SUN BEARS:
Global Status Review & Conservation Action Plan

2019-2028

Bear Specialist Group

CONSERVATION PLANNING SPECIALIST GROUP

FREE THE BEARS

IUCN SSC Species Survival Commission

TRAFFIC the wildlife trade monitoring network

For further information about this strategy and its implementation, please contact the Sun Bear Action Plan Implementation Coordinator: sunbearactionplan@gmail.com

Cover photo: Sun bear, ***Helarctos malayanus***. Credit: Free the Bears

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A collaboration between Free the Bears, TRAFFIC Southeast Asia, the IUCN Species Survival Commission (SSC) Bear Specialist Group and the IUCN SSC Conservation Planning Specialist Group.

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Resources:

- *Proceedings from the 1st International Symposium on Sun Bear Conservation & Management*
- *Abridged version of Sun bears: Global status review and conservation action plan, 2019-2028*
- *Unabridged version of Sun bears: Global status review and conservation action plan, 2019-2028*

Available from:

- *Free the Bears https://freethebears.org/pages/publications-press-resources*
- *IUCN SSC Conservation Planning Specialist Group http://www.cpsg.org/document-repository*
- *IUCN SSC Bear Specialist Group http://www.globalbearconservation.org/*

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Free the Bears is an international animal welfare and wildlife conservation charity headquartered in Australia. Free the Bears works with governments and non-governmental partners to build, manage and sustain bear sanctuaries and field programmes aimed at ending the suffering of captive bears whilst protecting wild bears across Southeast Asia and India. As part of its mission to protect, preserve and enrich the lives of bears throughout the world Free the Bears has supported the rescue of over 900 bears and currently provides care for over 200 bears in Southeast Asia, including 80 rescued sun bears in the Cambodian Bear Sanctuary, the world's largest sanctuary for sun bears.

The IUCN SSC **Bear Specialist Group** (BSG) is one of more than 140 Specialist Groups established by the Species Survival Commission (SSC), within the International Union for the Conservation of Nature (IUCN). The goal of the BSG is to promote the conservation of bears and their natural habitats across their distribution worldwide. The BSG is comprised of ~180 members including professional biologists and conservationists from governments, non-governmental organisations (NGOs), universities, museums, zoos and other captive facilities. The BSG is not an advocacy or animal welfare organisation. The purpose of the BSG is to pursue science-based conservation of bears.

The IUCN SSC **Conservation Planning Specialist Group** (CPSG) is a global network of conservation professionals dedicated to saving threatened species by increasing the effectiveness of conservation efforts worldwide. For over 30 years, CPSG has accomplished this using scientifically sound, collaborative planning processes that bring together people with diverse perspectives and knowledge to catalyse positive conservation change. CPSG provides species conservation planning expertise to governments, other SSC Specialist Groups, zoos and aquariums, and other wildlife organisations.

TRAFFIC, the wildlife trade monitoring network, is the leading non-governmental organisation working globally on trade in wild animals and plants in the context of both biodiversity conservation and sustainable development. TRAFFIC is a strategic alliance of WWF and IUCN. By co-operating with government departments, industry and civil society organisations, TRAFFIC is helping to bring about transformative change across both wildlife legislation and consumer attitudes.

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We are grateful to all donors for their support of sun bear conservation in Southeast Asia and beyond, and for helping to shine a light on sun bears.

#savesunbears

Wildlife Reserves Singapore Group

Jurong Bird Park · Night Safari · River Safari · Singapore Zoo

Perth Zoo · Wildlife Conservation Action · Taronga Conservation Society Australia – For the Wild

Bornean Sun Bear Conservation Centre – BSBCC

Hauser Bears

FOREWORD

By Jon Paul Rodríguez,

Chair of the IUCN Species Survival Commission

Biodiversity is critical to the functioning of ecosystems and the health of the planet, but it is facing unprecedented threats –– from habitat destruction, invasive species, overexploitation, pollution and climate change. The IUCN Species Survival Commission (SSC) is a global network of over 8,500 experts working together to halt the decline in biodiversity and ensuring that SSC is an unmatched source of information and advice to influence conservation outcomes. In addition to assessing the status of species across the globe and the drivers of biodiversity loss, taxa-specific Specialist Groups within the SSC work to identify the conservation actions required to reduce or prevent species extinctions. Most conservation actions occur at a local or country level, but for species with wide geographical ranges, the strategic design and coordination of actions must occur at a range-wide scale. Strategic conservation planning is a key priority for the SSC as it allows us to invest our limited resources wisely for the greatest impact. The Conservation Planning Specialist Group (CPSG) has a mandate to increase the quantity and effectiveness of planning across the SSC network, which we also see as helping to deliver on Target 12 (on preventing the extinction of threatened species) of the Convention on Biological Diversity. By taking a collaborative, inclusive and science-based approach to planning, we can deliver the most effective conservation action to protect future generations of threatened species.

The challenge is to ensure that conservation planning translates into action. Participation of all relevant stakeholders –– government, academia, civil society and the private sector –– is key to achieving successful conservation outcomes. This is of particular importance for species whose range spans across several countries, where the threats, socio-economic factors, and the political context vary. Moreover, the inclusion of diverse stakeholders in the planning process is more likely to yield innovative and workable ideas, as well as support during implementation.

Southeast Asia is a recognised hotspot for species declines. The sun bear *(Helarctos malayanus)* is an endemic, forest-dependent umbrella species of Southeast Asia, whose populations are under increasing threats from forest loss and poaching: conservation strategies to aid this species are likely to benefit many others in the region. Hence, the development of a conservation action plan for sun bears, detailed here, should be relevant to many conservation activities in the region.

This plan was developed following the 1st International Symposium on Sun Bear Conservation & Management, and a subsequent action planning workshop, facilitated by the CPSG in collaboration with the IUCN SSC Bear Specialist Group. The symposium and planning workshop brought together sun bear experts, field researchers, conservationists and government representatives from throughout the sun bear's range and beyond, to share the latest information on this threatened species, and to determine which actions are most urgently needed and most likely to achieve its long-term conservation.

The result of those efforts is a comprehensive strategy that will guide conservation of this species throughout the next ten years. In a world where resources for conservation are severely limited, creative and intelligent strategies will determine our success in averting biodiversity loss. I encourage all responsible government agencies, researchers, donors and practitioners to examine the recommended actions summarised in this document and put them to practice.

ABBREVIATIONS

AAF	Animals Asia Foundation
ASEAN	Association of Southeast Asian Nations
AZA	Association of Zoos and Aquariums, North America
BOS	Bornean Orangutan Survival
BSBCC	Bornean Sun Bear Conservation Centre
BSG	Bear Specialist Group (IUCN SSC)
CIFOR	Center for International Forestry Research
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CPSG	Conservation Planning Specialist Group (IUCN SSC)
CZA	Central Zoo Authority, India
DNA	Deoxyribonucleic acid
EAZA	European Association of Zoos & Aquaria
EIA	Environmental Investigation Agency
ENV	Education for Nature-Vietnam
FSC	Forest Stewardship Council
FTB	Free the Bears
GC-MS	Gas Chromatography-Mass Spectrometry
GFW	Global Forest Watch
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
HCV	High Conservation Value (Forest)
ID	Indonesia/Republic of Indonesia
IN	India/Republic of India
ISPO	Indonesian Sustainable Palm Oil
IUCN	International Union for the Conservation of Nature
IUCN SSC	IUCN Species Survival Commission
IWT	Illegal Wildlife Trade
JAZA	Japanese Association of Zoos and Aquaria
KH	Cambodia/Kingdom of Cambodia
KPH	Kesatuan Pengelolaan Hutan - Forest Management Unit (Indonesia)
KWPLH	Kawasan Wisata Pendidikan Lingkungan Hidup
LA	Laos/Lao People's Democratic Republic
LiDAR	Light Detection and Ranging
MSPO	Malaysian Sustainable Palm Oil
MM	Myanmar/Republic of the Union of Myanmar
MY	Malaysia
NGO	Non-government Organisation
NWRC	National Wildlife Rescue Centre, Sungkai, Malaysia
PCR	Polymerase Chain Reaction
PERHILITAN	Department of Wildlife and National Parks Peninsular Malaysia (DWNP)
RIL	Reduced-Impact Logging
RSPO	Roundtable on Sustainable Palm Oil
RTE	Rare, threatened, endangered
SDZG	San Diego Zoo Global
SEAZA	South East Asian Zoo Association
SFC	Sarawak Forestry Corporation
SFM	Sustainable Forest Management
SMART	Spatial Monitoring And Reporting Tool
SSC	Species Survival Commission
SSP	Species Survival Plan
TAG	Taxon Advisory Group
TCDCA	Taurochenodeoxycholic acid
TCM	Traditional Chinese Medicine
TUDCA	Tauroursodeoxycholic acid
TH	Thailand/Kingdom of Thailand
TM	Traditional Medicine
UDCA	Ursodeoxycholic acid
UNODC	United Nations Office on Drugs and Crime
VN	Vietnam/Socialist Republic of Vietnam
WAP	World Animal Protection
WARN	Wild Animal Rescue Network Asia
WAZA	World Association of Zoos and Aquariums
WCS	Wildlife Conservation Society
WG	Working Group
WFSRU	Wildland Fire Special Research Unit
WWF	World Wide Fund for Nature
ZAA	Zoo and Aquarium Association, Australasia
ZIMS	Zoological Information Management System

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EXECUTIVE SUMMARY

Need for a Conservation Action Plan for Sun Bears

Of the eight species of bears in the world, six (75%) are globally threatened with extinction (listed as Vulnerable on the IUCN Red List of Threatened Species™). It is not coincidental that four of these threatened species range into the tropics, where the threats are particularly severe. The chief threats to bears in the tropics include forest clearing and conversion, road building, poaching, and conflict with people. These threats are amplified because they act synergistically: for example, roads and shrinking forest patches provide greater access to poachers; additionally, diminished or degraded habitat reduces food availability for bears and increases the interface with humans and agriculture, which together prompt bears to seek human-related foods and increase their likelihood of being killed as a consequence.

Participants in the 1st International Symposium on Sun Bear Conservation & Management, held in Kuala Lumpur, Malaysia from the 4th – 6th September 2017. Credit: Free the Bears/Lim Thona

Where should we start in addressing these threats? Which are most consequential, which are most practical to solve, and what process should we use to set priorities for the conservation of these species? What do we want the future to look like?

Here we answer these questions for the sun bear *(Helarctos malayanus).* This species has been the focus of only a handful of studies in the wild –– beginning just 20 years ago –– and has attracted little world attention in terms of its conservation, despite being a charismatic bear. Yet it is believed to be in steep decline in many parts of its range due to loss, degradation and fragmentation of its forested habitat, combined with direct killing. The species ranges only through Southeast Asia, in 10 or 11 countries, from northeastern India east to Vietnam, and south through the Malaysian Peninsula and into Sumatra and Borneo. Within this range there are still many areas with suitable habitat where its existence is uncertain; it was thought to be extirpated in Bangladesh, but was recently rediscovered in a small patch in the south; it is unknown whether any populations persist in southern China.

Not only is the status uncertain, but many looming questions about the main drivers of this species' decline remain unanswered or confusing. This obviously complicates formulation of a conservation strategy. For example, whereas some studies have indicated that sun bears are reliant on primary forest, a number of recent camera trapping studies (not directed at sun bears) have detected them at relatively high rates in secondary (regenerating) forests. In the southern parts of their range, widespread forest conversion to oil palm *(Elaeis guineensis)* has been a paramount concern. Whereas these expansive plantations have clear adverse effects on sun bears insofar as reduced availability of useable space, shade, cover, and food diversity, it has been shown that bears consuming abundant oil palm fruits along plantation edges are often atypically heavy; conversely, in these open areas, they are also more vulnerable to being killed by people. Some direct killing of sun bears may occur incidentally while hunters are seeking other species, with guns or snares, but targeted killing also occurs. Sun bear cubs are sold as pets, and the gallbladder/bile of this species is a valuable commodity that is illegally traded on a global scale.

Sun bear, Helarctos malayanus, at the Bornean Sun Bear Conservation Centre. Credit: BSBCC/Chiew Lin May

Ironically, though, whereas Asiatic black bears *(Ursus thibetanus)* possess a unique compound in the bile with proven medicinal benefits for humans, sun bear bile is dominated by a different bile acid, which is not unique to bears.

Further complicating these issues is the fact that monitoring of sun bear populations is almost nonexistent. A few efforts have been made to assess density, relative density, or presence/absence from camera trapping, sign surveys, and interviews of local people. But no real monitoring programme has been implemented. Therefore, evaluations of population trend have generally been gleaned from expert opinions and interviews with local people, or a subjective assessment of the threats and how they must be affecting the bears. Consequently, even if conservation programmes were implemented, it would be difficult to ascertain their effectiveness with such sparse baseline data.

Process of Plan Development

With this as a backdrop, the IUCN SSC Bear Specialist Group, Free the Bears, and TRAFFIC Southeast Asia organised the 1st International Symposium on Sun Bear Conservation & Management to gather the collective knowledge and opinions from sun bear experts relevant to the conservation of this species. The 3-day symposium, which was held in Kuala Lumpur, Malaysia, September 4–6, 2017, brought together 100 delegates from over 50 organisations, including researchers in the field (although there are very few), conservationists, people working in captive care centres with sun bears, and governmental representatives.

Building on the work from the Symposium, 25 delegates worked collaboratively over the following 2 days to draft a 10-year range-wide conservation action plan. In accordance with IUCN guidelines, as many country-specific representatives were included in this process as possible, within budgetary and logistical constraints. Moreover, we followed the One Plan Approach of the IUCN SSC Conservation Planning Specialist Group (CPSG) in terms of integrating *in situ* and *ex situ* components. A small team of editors, with later input from the wider group of symposium participants, worked for over a year to develop the final document.

The document includes an extensive but not exhaustive status review. This is meant to provide justification for the conservation actions, including research needs, especially where information is lacking or conflicting. We cited work that seemed to be useful for the purposes here, relying mainly on peer-reviewed literature; we did not attempt to find or cite every paper relevant to every point.

Components of the Plan

The range-wide conservation action plan outlines a strategic approach for priority actions over the period 2019–2028. These actions will lay the groundwork to help achieve a long-term vision for the future of sun bears in which: wild bears are an ecologically functioning component of natural ecosystems, present in all 11 range countries, coexisting with and appreciated by people, and no longer threatened; captive bears are maintained under high standards and contributing to conservation; and the conservation of this species aids in conservation of other species and ecosystems.

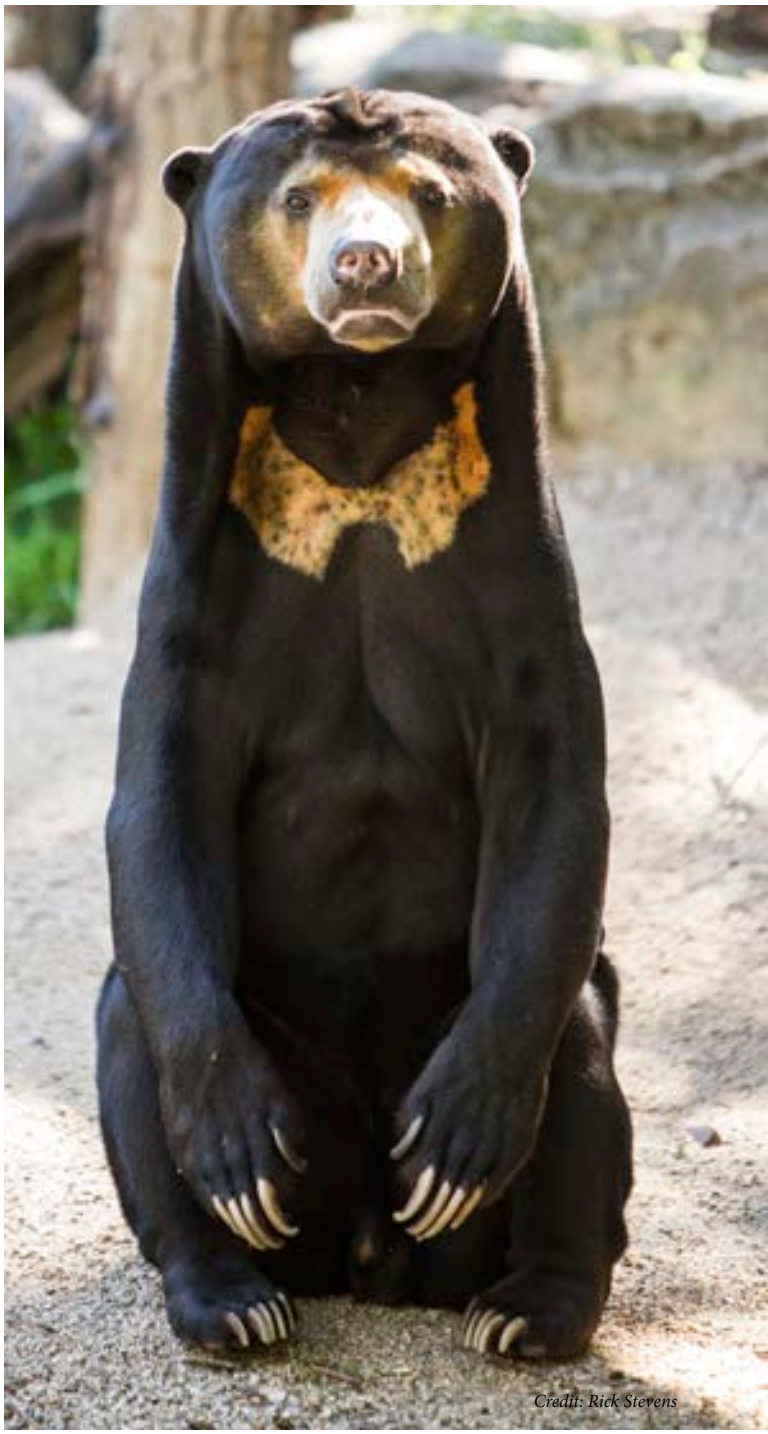
The plan details 19 objectives and 63 actions aimed at attaining 5 overarching goals: (1) eliminating illegal exploitation; (2) protecting and restoring habitats and populations; (3) devising and employing reliable monitoring methods; (4) maximising *ex situ* contributions to conservation; and (5) increasing cross-sectoral support and collaboration for sun bear conservation.

Many of the objectives (14) involve reviewing, compiling, and interpreting existing data, or conducting research to obtain new data (7), so as to better understand the issues and the likelihood of success of the possible solutions. Alongside filling these knowledge gaps, the plan proposes a series of direct actions (6), prioritisation of actions (4), or initiatives to motivate actions by others (15). Each action in the plan has an associated list of people, organisations, or types of organisations responsible for carrying it out, a general timeline, a list of what we already have to aid in performing the action and what we need, and indicators of progress.

Implementation of the Plan

Implementation of this plan over the next ten years is the initial step in reaching the long-term vision for the conservation of this species. The plan will be coordinated by a Sun Bear Action Plan Implementation Task Force, which will be housed under the Sun Bear Expert Team of the IUCN SSC Bear Specialist Group. The task force will comprise both issue (goal)-based and range-country focal points who will serve as contacts for anyone wishing to conduct or assist with recommended actions. The Task Force will have an appointed coordinator, supported for the first two years by Free the Bears.

This is the first global conservation action plan for a terrestrial species of bear. Inevitably, implementation of this plan will require adoption by range countries, and some range countries may develop companion country-specific plans. Some countries in Asia have already adopted country-specific conservation action plans for other species of bears (Taiwan and India, both in 2012), but thus far these have spurred few actual actions. It is our hope that by starting globally, with a comprehensive plan, and with the commitment of a dedicated group to implement this plan, we can coordinate a set of actions that will drastically improve the status of this species as well as our understanding of it.



Credit: Rick Stevens

SECTION 1

INTRODUCTION

Background

Sun bears *(Helarctos malayanus)* are often referred to as the least-known or most 'forgotten' of all bear species. The first field studies on this species were only started in 1997. In part, this can be attributed to the relative difficulty in conducting ecological field research on this rather rare and elusive forest-dwelling species, which lives in areas that are tough to work in and often hard to get to. Many field techniques used for other bear species have shown limited success with sun bears because they are hard to capture (they are wary of traps and the remoteness of field sites restricts safe placement

Rescued sun bear at the Cambodian Bear Sanctuary. Credit: Free the Bears

of traps), they are difficult to radio-collar, and no reliable technique has yet been developed to snag their short hair (for DNA-based population estimates). Sign surveys have been confounded because much of their range overlaps with Asiatic black bears (*Ursus thibetanus)*, and often the sign of these two species cannot be reliably distinguished (unless very fresh). Although sign transects can be used to quickly confirm sun bear presence in the Sundaic part of their range (i.e., Malay Peninsula, Borneo, and Sumatra), where other bear species do not occur. Sun bears are rarely seen, and even then are confused with Asiatic black bears, so interviews with local people have rarely yielded definitive information. Recently, camera-trapping has provided more reliable information on presence (sometimes in places they were thought to have been extirpated), occupancy, density, habitat selection, response to human activities, and use of plantations. However, because this species is rarely the direct focus of camera trapping studies, the data are commonly "by-catch" results from studies of more high-profile species, such as tigers *(Panthera tigris)* and elephants (*Elephas maximus*). Likewise, conservation efforts for sun bears often tend to derive as by-products of initiatives directed primarily at these other species.

In September 2017, sun bears were front and centre when one hundred researchers, conservationists, government representatives, population managers, and managers of captive facilities from across the globe convened in Kuala Lumpur, Malaysia, for the 1st International Symposium on Sun Bear Conservation & Management. The three-day symposium was co-hosted by Free the Bears, the IUCN SSC Bear Specialist Group, and TRAFFIC in Southeast Asia.

Although sun bears remain the least-studied bear species, research and conservation efforts have advanced greatly in the past few years and the symposium achieved what would have been inconceivable ten years ago: over 30 presentations and more than 20 hour-long panel discussions and workshop sessions dedicated solely to the conservation and management of sun bears. A diverse array of topics was covered, including: updates to the IUCN Red List Assessment and range map; genetic analyses; assessing wild sun bear populations; health and welfare; thermoregulation and metabolic rates in captive sun bears; trade and use of sun bears in traditional medicine; education and behaviour change; status review and threat assessment of *ex situ* sun bear populations; and habitat requirements of *in situ* populations.

Among the participants were representatives from, or those knowledgeable about, all sun bear range states, except China, which has just one recent record of an individual barely over the border from Myanmar (Li et al. 2017). Sixty percent of participants are currently involved in sun bear conservation projects, while 43% are involved in sun bear research. Participants represented both *in situ* and *ex situ* sun bear populations and were affiliated with several international conservation and management bodies, including: the IUCN SSC Bear Specialist Group (BSG); BSG Sun Bear Expert Team; BSG Captive Bears Expert Team; regional zoological associations (EAZA, AZA and ZAA); and regional Bear Taxon Advisory Groups.

The symposium was designed to capture the collective knowledge and expertise of those in attendance in order to inform the development of this conservation strategy. A two-day conservation planning workshop was held immediately after the symposium, facilitated by the IUCN SSC Conservation Planning Specialist Group (CPSG). The planning process followed the CPSG's One Plan Approach, which promotes integrated *in situ* and *ex situ* species conservation planning. The approach considers all populations of the species, inside and outside their natural range, under all conditions of management, and engages all responsible parties from the very start of any species conservation planning process (Byers et al. 2013).

The 25 participants of the planning workshop were divided into thematic working groups tasked with developing conservation actions related to: Trade and consumption; Habitat protection and improvement; Population monitoring; *Ex situ* management; and cross-sector collaboration. First, each group listed key threats related to their topic, which were informed by the discussions during the symposium. Then, each group made a list of objectives that would reduce these threats, over the next 5–10 years. Finally, specific actions required to achieve the objectives were identified. For each action, working groups detailed what we had available to start, what we still needed, and who would likely do the work.

Results of the planning workshop were extensively fleshed out to create a draft document, which underwent a series of reviews and editing over several months, first by a core editing team, then each themed section was reviewed by the members of the relevant working group, and finally the draft action plan was reviewed by participants of the symposium plus other sun bear biologists and conservationists who were unable to attend the symposium.

This action plan for sun bears is the first range-wide conservation action plan for any of the world's terrestrial bear species. It is intended to guide targeted conservation interventions, as recommended by the IUCN Species Survival Commission, and serve as a guide for development of national or local sun bear conservation action plans. Despite the diversity of threats, and the variety of opinions and solutions that existed amongst participants, everyone was united by a common desire to see the sun bear survive and thrive in its natural environment as an important part of the forest ecosystem.

In addition to recommended actions, this document contains comprehensive information on the status of and threats to *in situ* and *ex situ* sun bear populations, details of national focal points for the implementation of the action plan, and a map of current sun bear-related projects. It is intended to be used as a freely available resource and reference document for all those interested in the conservation of sun bears.

Audience

The sun bear's range stretches across eleven countries. Sun bears live in a host of different protected areas, in forested areas under varying management levels outside protected areas, and along the borders of plantations. It was not possible to involve all relevant local stakeholders (e.g., all national governments, protected area staff, industry representatives, non-governmental organisations, community groups, *ex situ* facility representatives) in the planning workshop. However, it is intended that this initial broad-based planning process will trigger further national and local planning in which key locally-based stakeholders will have an opportunity to define local actions that align with the overall strategy presented here. With this in mind, this range-wide plan includes both broad action recommendations designed for further consideration and delegation by in-country agencies as well as more specific action recommendations already committed to by those present at the workshop.

This document is intended as a resource to be used by:

- workshop participants, as a record of the actions, initiatives and collaborations discussed;
- range state governmental agencies, to help guide and inform the development of national or local action plans and initiatives;
- individuals, institutions and *ex situ* facilities working with sun bears, to help inform their priorities;
- non-governmental conservation organisations and community groups, to guide and inform their priorities and work plans;
- the IUCN SSC Bear Specialist Group, to help in directing conservation-related research and actions, and tracking and supporting progress with the directions and priorities agreed for sun bears;
- donor organisations, to guide priority actions for funding support.

Implementation

The implementation of actions in this plan will be monitored and coordinated by an Implementation Task Force comprised of Focal Point persons for each range state and each of the five working groups from the conservation planning workshop. The Focal Points will serve as contacts for anyone conducting or wishing to conduct recommended actions within range states or working group themes. The Focal Points will report annually to the Action Plan Implementation Coordinator for the duration of the action plan (2019 – 2028).

The Implementation Coordinator will be recruited from within the IUCN SSC Bear Specialist Group's Sun Bear Expert Team which has a mandate to coordinate global sun bear conservation. The coordinator will serve a term coinciding with that of the Specialist Group membership and will report annually to the Bear Specialist Group Co-chair(s). An implementation progress report will be submitted annually by the Implementation Coordinator for publication in International Bear News, the newsletter of the Bear Specialist Group and the International Association for Bear Research and Management (https://www.bearbiology.com/publications/iba-newsletter/).

The various actions in the plan relate to both wild and captive sun bears and will be implemented by a wide range of people and organisations, including students, university departments and researchers, government departments, and non-government organisations. The Implementation Task Force will act as a central hub for this diverse array of activities, keeping track of current and past projects conducted under the umbrella of the action plan.

Individuals and organisations carrying out projects and actions are encouraged to notify and communicate their progress to the Implementation Task Force. The Sun Bear Expert Team has representatives in most sun bear range countries, and these representatives along with other Focal Points will be responsible for monitoring and maintaining communication with projects occurring in their respective countries.

Credit: Wildlife Reserves Singapore

SUN BEAR ACTION PLAN IMPLEMENTATION TASK FORCE (2019 – 2020)

Bear sign, Northeast Cambodia
Credit: Roth Vichet / Free the Bears

SECTION 2

SUN BEAR STATUS REVIEW

KINGDOM	PHYLUM	CLASS	ORDER	FAMILY
Animalia	**Chordata**	**Mammalia**	**Carnivora**	**Ursidae**

Scientific Name: *Helarctos malayanus* (Raffles, 1821)

Synonym: *Ursus malayanus* (Raffles, 1821)

English name: Sun bear, Malayan sun bear

Language	Common Name	Romanised spelling	Direct translation
Arunachali (Lissu)	Wublu	-	Dog bear (Wu = Dog; blu=bhalu=Bear)
Assamese	Gos Bhaluk	-	Tree-climbing bear (Gos = Tree; Bhaluk = Bear)
Bahasa Indonesia	Beruang madu	-	
Czeck & Slovakian	Medvěd malajský	-	Malayan bear
Dutch	Maleise beer	-	Malayan bear
English 1	Sun Bear	-	-
English 2	Malayan Sun Bear	-	-
French 1	Ours des cocotiers	-	Coconut palm bear
French 2	Ours Malais	-	Malayan bear
German	Malaienbär	-	Malayan bear
Italian	Orso malese	-	Malayan bear
Khmer	ខ្លាឃ្មុំតូច	khlakhmoum tauch	Small Bear (khlakhmoum = bear; tauch = small)
Lao 1	ເໝີຂ	Meuay	-
Lao 2	ໝີໝາ	mī mā	Dog bear (ໝາ = mā = dog; ໝີ = mī = bear)
Malay (Bahasa Melayu)1	Beruang matahari	-	Sun bear
Malay (Bahasa Melayu)2	Beruang madu	-	Honey bear
Mandarin1	马来熊	Ma Lai Xiung	Malay bear (Xiung = bear)
Mandarin2	狗熊	Gou Xiung	Dog bear (Xiung = bear)
Manipuri	Sawon	-	Sa=phu=
Mizoram 1	Samang	-	Samang = Golden (Golden color U shape) Bear
Mizoram 2	Mangtir		Small Bear
Myanmar national language	မလေးဝက်ပိ	Malay at wan	Malay pig bear
Polish	Niedźwiedź malajski	-	Malayan bear
Rakhine language	ဝံနီးတိုး	wan nee toe	-
Spanish 1	Oso de Sol	-	Sun bear
Spanish 2	Oso Malayo	-	Malayan bear
Thai 1	หมีหมา	mī mā-	Dog bear (mā = dog; mī = bear)
Thai 2	หมีคน	mī khon	human bear (khon = human; ; mī = bear)
Vietnamese	Gấu chó	Gau cho	Dog Bear (Gau = Bear; Cho = Dog)

1. HISTORY & TAXONOMY

In 1819, Thomas Stamford Raffles, then Governor-General of Bencoolen, a province in southern Sumatra, received a pet sun bear, purchased for him from a villager. Although these bears were then common on the island, and common as village pets, the species had not yet been described to science. That pet bear became the basis for the first scientific description of the species. "He was brought up in the nursery with the children; and, when admitted to my table, as was frequently the case, gave proof of his taste by refusing to eat any fruit but mangosteens, or to drink any wine but Champaign" (Raffles 1821).

Raffles provided the scientific name *Ursus malayanus*, but did not suggest a common name other than "Bruang", the local name of the species. Horsfield (1824) provided a fuller description of this species, based on a specimen from Sumatra that Raffles had forwarded to a museum in England.

A year later, Horsfield (1825) distinguished what he called the "Malayan bear" from a newly acquired, similar-looking specimen of a "Bear from Borneo". He named this bear *Helarctos euryspilus*, literally meaning "sun bear with wide birthmark". It is clear from Horsfield's account that the Helarctos generic name referred to the animal living near the "hot sun" of the equator. Hence the common name, sun bear, does not derive (as often thought) from the shape of the mark on the chest, which sometimes looks like a sun, and is distinct from that of the crescent-shaped white marking on the Asiatic black bear *(Ursus thibetanus)*, which in some areas is called the "moon bear".


Sun bear sketch (Horsfield, 1825)

Presently only one species of sun bear is recognised, under the name *Helarctos malayanus,* with the Bornean form considered a subspecies *(H. m. euryspilus)*, having some distinct morphological characteristics (Meijaard 2004). Some taxonomists consider the mono-specific generic name to be erroneous, and have suggested that it should be Ursus. Genetic studies have been insufficient to resolve either the generic name, or specific/sub-specific name of the Bornean sun bear.

2. MORPHOLOGY & PHYSIOLOGY

Sun bear conservation and management is informed by the distinctive morphology and physiology of this species. Sun bears are the smallest extant member of Ursidae, and the Bornean subspecies is generally considered to be smaller than the nominal form. Weights among sun bears also vary by the availability of foods: wild bears with access to oil palm fruits tend to be heavier (Table 1), whereas those subsisting on wild foods during periods of fruiting failure are very thin, and may even die of starvation (Wong et al. 2005, Fredriksson 2012). The heaviest wild sun bears for which there are data were males on the mainland with access to oil palm fruits (average ~75–80 kg). Males in Borneo consuming only wild foods averaged ~40 kg while Bornean females averaged only ~25 kg when weighed mainly during lean fruiting periods (Table 1). Healthy adults in captivity at a rescue facility in Cambodia are typically ~70 kg for males, and 10 kg less for females (Free the Bears, unpublished data, 2018). Weights of these bears recorded throughout the year over the course of 13 years (>5,600 weight measurements) revealed that adult females varied little seasonally, whereas males exhibited a pronounced (but as yet unexplained) fluctuation, with a decline (~12%) during March–May (J.P. Whiteman/Free the Bears, unpublished data, 2018).

Sun bear making use of teeth and claws.
Credit: BSBCC/Seng Yen Wah

Table 1. Weights (kg) of wild adult sun bears captured and radio-collared in research studies, comparing those that used (and fed in) oil palm plantations, versus that did not use oil palm (natural diet), in Borneo and Peninsular Malaysia, 1999–2014. The weights of bears feeding exclusively on wild foods may be biased low because bears in poor condition (e.g., during times of food failure) may have been easier to attract to baited traps.

Area	Used oil palm			Did not use oil palm		
	Male	**Female**	**Source**	**Male**	**Female**	**Source**
Sabah, Malaysia	47	35	Nomura	30[b]	20	Wong
(Borneo)	59	39	Nomura	34	28	Wong
	53		Guharajan	40	30	Wong
				40		Wong
				44		Wong
				45		Wong
				56[c]		Wong
East Kalimantan, ID					23	Fredriksson
(Borneo)					25	Fredriksson
					30	Fredriksson
Borneo range	**47–59**	**35–39**		**34–45[d]**	**20–30**	
Peninsular Malaysia	72		Cheah			
	77		Cheah			
	77		Cheah			
	80		Cheah			
	87		Cheah			
Peninsular Malaysia range	**72–87**					

[a] Sources: Nomura et al. (2004), Wong et al.(2005), Wong (2005–2006, unpublished data), Fredriksson (2012), Cheah (2013), Guharajan (2014, unpublished data).
[b] Subadult.
[c] Bear had access to other human-related sources of food.
[d] Excluding subadult and bear that consumed human-related foods

Morphology of the sun bear skull and teeth is generally consistent with an omnivorous diet. However, among Ursidae, sun bears exhibit a unique combination of a heavily domed skull, short and robust lower jaw, short nose, and low position of the eyes, giving them a stout appearance (Figueirido et al. 2009). Sun bears also have the longest canine teeth relative to skull size among bears; in fact, their canines do not differ in size from those of polar bears *(Ursus maritimus)* despite their body mass being 5–10 times smaller (Christiansen 2008). Sun bears also have an unusually high bite force (Christiansen 2008). The robustness of the sun bear skull and dentition are adaptations for tearing into hard substrates for food, such as logs and termite mounds, and especially stingless bees, whose nests are excavated by chewing through the wood of living trees (Fredriksson 2012). Their exceptionally long tongues (Pastor et al. 2011) is another adaptation for feeding on insects, particularly stingless bees. The hind limb musculature and tendon structure of sun bears is uniquely well-suited for climbing trees (Sasaki et al. 2005), and probably for holding onto the trunk while chewing into the wood.

Sun bears inhabit a warm, humid climate, which is characterised by low seasonal and diurnal temperature fluctuations ranging from 23°C to 30°C (Fredriksson et al. 2006). They have shorter guard hairs than other bears throughout the year (De and Chakraborty 2006) and do not develop insulative fat layers. However, no data are available regarding their body temperature and metabolic rate. Thermographic measurements obtained in European zoos revealed that the thermoneutral zone of sun bears lies between 24°C and 28°C (Schneider 2015). Above 28°C sun bears avoid direct solar radiation (Schneider 2015). This may be one reason that in the wild, when using open areas, like plantations, they do so mainly at night (Nomura et al. 2004, Cheah 2013). There are no reports of sun bears hibernating.

Similar to several other members of Ursidae, females appear to be spontaneous ovulators capable of multiple estrus periods in a year and of embryonic diapause and delayed implantation (Spady et al. 2007; Frederick et al. 2010, 2013; although see Frederick et al. 2012 for a pregnancy without delayed implantation). Sun bears are the only species in Ursidae capable of reproducing at any point during the year (Schwarzenberger et al. 2004; Spady et al. 2007), although wild populations may exhibit some seasonality in reproductive activity (Hesterman et al. 2005).

Relatively little is known about disease threats to sun bears, with a small number of published case reports arising from captive individuals (e.g., Ursid herpesvirus, neoplastic disease, reproductive tract pathology; Blake and Collins 2002, Goeritz et al. 2006, Lam et al. 2013). There is a paucity of data pertaining to disease occurrence in wild sun bears, with no published reports in the literature. Starvation and predation of wild sun bears have been encountered by researchers in Borneo (Wong et al. 2005, Fredriksson 2005a, Fredriksson et al. 2007). Given the lack of information on naturally occurring diseases in wild sun bears, and the challenges of accessing and collecting data for this cryptic species, biosurveillance and baseline data collection using captive populations are useful for understanding pathogen diversity and disease-related risks in this species.

Credit: Giles Clark

3. DISTRIBUTION

RESIDENT RANGE STATES:

Bangladesh; Brunei Darussalam; Cambodia; India; Indonesia; Laos; Malaysia; Myanmar; Thailand; Vietnam

PRESENCE DETECTED BUT RESIDENCY UNCERTAIN:

China

EXTIRPATED:

Singapore

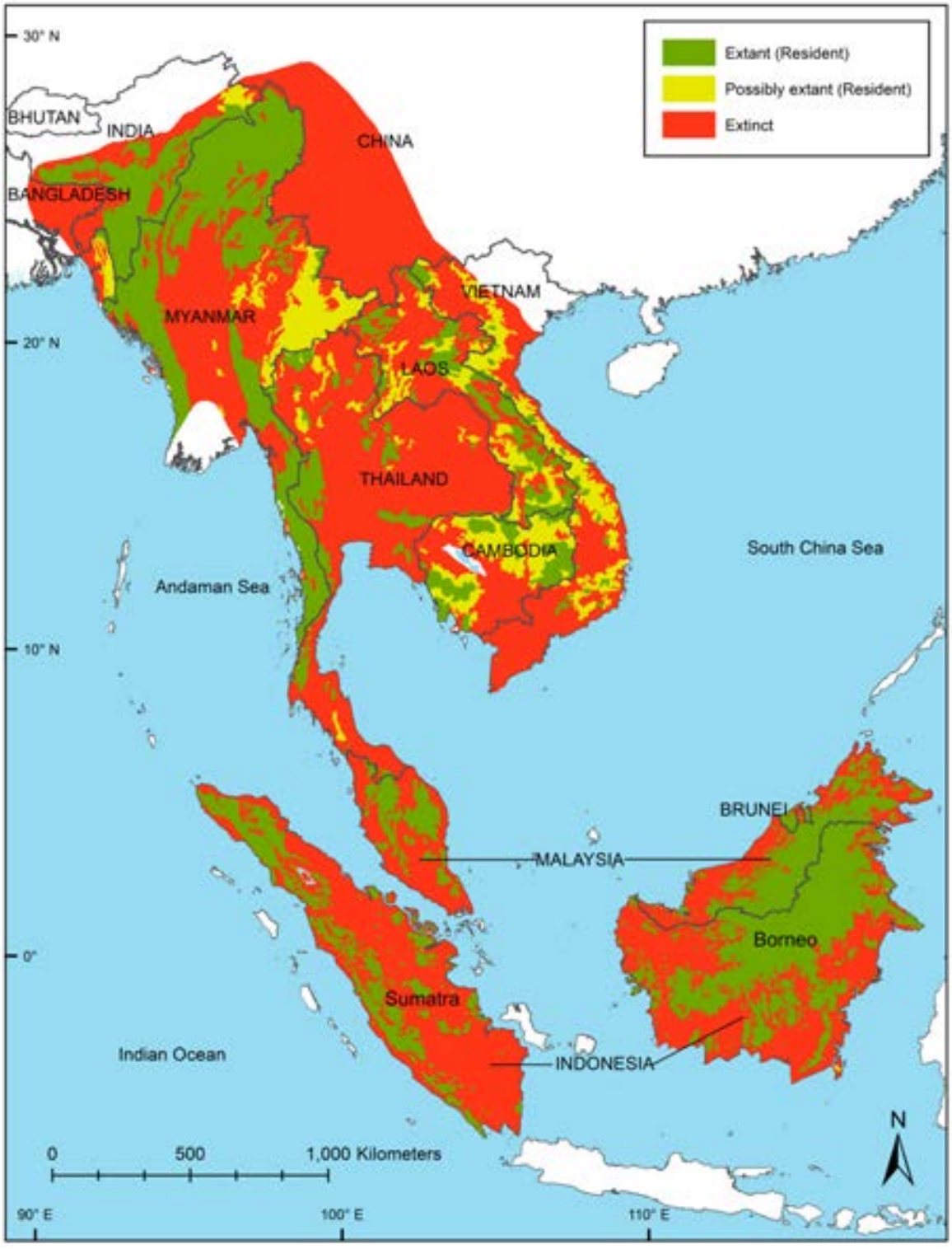


Figure 1. Range map of sun bears derived by country experts from presence data and extrapolations to surrounding suitable habitat. Possible range was defined as suitable habitat without confirmed presence. The relative amounts of range categorised as present versus possible varies by country in part due to differing amounts of presence data and in part to the degree to which country experts extrapolated those data based on their assumptions of habitat and threats. Extirpated range was defined as unsuitable range and no recorded presence.

Historic range (within 500 years) of sun bears extended across much of Southeast Asia, from Borneo and Sumatra north across Southeast Asia to at least Yunnan Province, in southern China. Fossil records from the Pleistocene have been found much farther north (Erdbrink 1953). Assam, in northeast India, marks the north-western confirmed historic range limit (Wroughton 1916, Higgins 1932). Reports of sun bears formerly occupying the Terai of Nepal (Hodgson 1844) appear to be erroneous. The southern-most range limit is Indonesia; there are no records of sun bears ever occurring farther east than Borneo. Records of sun bears exist from the Island of Java from middle-late Pleistocene (Erdbrink 1953) but there is no evidence of occurrence there within historic times.

Table 2. Sun bear geographic range divided by country, region (mainland versus Sundaic = Borneo and Sumatra), and subspecies *(H. m. euryspilus* only on Borneo). Areas were calculated from a range map drawn by in-country experts (Fig. 1); these values and corresponding percentages are thus less accurate than portrayed by the (rounded) values on the table. Areas were categorised as likely present, possibly present, or extirpated. Relative areas may not reflect population size.

Country or Region	Area of sun bear range (km²)		Percent of area in total sun bear range[a]		Percent of former (historical) range in this country or region that sun bears likely do not occupy[c]
	Present range (known or assumed)[b]	Possible range[b]	Present range (known or assumed)	Present plus possible range	
			1.13 million km²	1.41 million km²	2.17 million km²
Bangladesh	2,300	7,600	<0.5%	<1%	83–96%
Brunei	4,900	0	<0.5%	<0.5%	17%
Cambodia	43,000	61,100	4%	7%	40–75%
China	400	400	0%	<0.1%	>99%
India	88,800	6,100	8%	7%	39–43%
Indonesia	388,500	300	34%	28%	60%
Laos	68,700	46,700	6%	8%	50–70%
Malaysia	148,000	0	13%	11%	55%
Myanmar	303,300	67,100	27%	26%	40–51%
Thailand	66,100	18,300	6%	6%	84–87%
Vietnam	15,600	72,400	1%	6%	67–94%
Total	**1,129,600**	**280,000**			
Mainland	633,000	280,000	56%	65%	62–74%
Sundaic	496,000	0	44%	35%	58%
H. m. malayanus	752,000	280,000	67%	73%	64–74%
H. m. euryspilus	378,000	0	33%	27%	49%

[a] The best estimates of occupied range are likely between the values for "present range" and "present plus possible range" (some of the possible range is occupied).
[b] Criteria for differentiating present versus possible range was likely different among different country experts, explaining why in some countries, all range was categorised as either presently occupied or extirpated (none classified as possible).
[c] Extirpated range based on lack of presence data and habitat thought to be unsuitable. Percent of former range extirpated in each country is based on comparison to a historic range map (~500 years ago), largely from Erdbrink (1953). The span of values excludes or includes the possible range as being extirpated.

Camera trap image of sun bear mother and cub. Credit: Borneo Nature Foundation

Presently, sun bears occur patchily across 32–40% (1.1–1.4 million km^2) of their former range; the higher estimate includes all areas where no data exist but where country experts indicated they could possibly occur, based on possible suitability of habitat (Figure 1; Appendix IV; Table 2). Sun bears once occurred in what is now Singapore, but were extirpated due to the widespread deforestation in the 1800s and early 1900s (Corlett 1992, Brook et al. 2003). The continued existence of this species in China remains uncertain. Surveys in the most likely regions (remnant lowland natural forests) of Yunnan Province detected no evidence of sun bears, although one small border area (<600 km^2) could not be surveyed (Wen and Wang 2013). In 2016, video footage of a sun bear was obtained from a camera trap in this area, indicating the presence of at least one bear, <1 km from the Myanmar border (Li et al. 2017). It is unknown whether there is a transboundary population, or just a few individuals living near the border. Nevertheless, this represents the first confirmed record of the species in China in 45 years. Other recent reports of sun bears in China (Zhou et al. 2017, Bai et al. 2018) were misidentifications of Asiatic black bears.

Sun bears were thought to be extirpated in Bangladesh, with the exception of a few vagrants from neighboring countries (Islam et al. 2013), until confirmed records (dead animals and camera-trap photos) were obtained in the Chittagong Hill Tracts during 2014–2016, including a female and cub (Anwarul Islam, WildTeam, personal communication 2015; Creative Conservation Alliance 2016; Hasan Rahman, personal communication, 2017). It is possible that a population in southeastern Bangladesh is maintained through immigration from core areas in western Myanmar.

Elsewhere, they have been locally extirpated from many areas (Figure 1; Table 2). This is particularly evident in Thailand, where bears are mainly limited to a patchwork of protected areas separated by expanses of agriculture (Kanchanasakha et al. 2010), comprising only ~15% of the historic range. The range extends westward to northeastern India, where isolated populations have been confirmed in portions of five states (Arunachal Pradesh, Assam, Manipur, Mizoram, and Nagaland) and suspected in one other (Meghalaya) (Chauhan 2006, Chauhan and Jagdish Singh 2006, Choudhury 2011, Sathyakumar et al. 2012, Sethy and Chauhan 2012, 2013, 2016). There are no records of sun bears north of the Brahmaputra River in Assam (Choudhury 2011), but they extend northeastward into Arunachal Pradesh and northern Myanmar. Eastward on the mainland they extend into Vietnam.

The sun bear's range is sympatric with Asiatic black bears across mainland Southeast Asia to about 9°N latitude (in peninsular Thailand), south of which Asiatic black bears do not occur. Sun bears occur southward in Peninsular Malaysia, and then into the Sundaic region of Sumatra and Borneo. About 35–44% of the range occurs in the Sundaic region (Table 2). Indonesia comprises about one-third of the total range area; Myanmar is second in terms of range area (Table 2).

Baited camera trap station in Khao Yai National Park, Thailand, allowing individual identification. Credit: Dusit Ngoprasert

4. ABUNDANCE

In mainland Southeast Asia sun bears appear to exhibit a natural population gradient, increasing from the north to south across Southeast Asia (Steinmetz 2011). Population density and abundance appears to be highest in the Sundaic region. This gradient of abundance was apparent in historical times (Higgins 1932) and is also reflected by the relative frequency of fossil records (Tougard 2001, Meijaard 2004).

Very few rigorous population or density estimates exist for this species. A camera-based mark-recapture survey in Thailand estimated population densities of 4.3 (95% CI 1.6–11.6) and 5.9 (95% CI 2.3–15.4) sun bears per 100 km^2 in two sites within Khao Yai National Park (Ngoprasert et al. 2012). In southern Sumatra, in Harapan Rainforest, a camera-based study estimated a density of 26 bears per 100 km^2, 4–5 times higher than density estimates from Thailand (Lee 2014, unpublished data, cited in Scotson et al. 2017a). However, the methods used to estimate density in Thailand and Sumatra differed (capture-recapture versus "ideal gas"-model, respectively), so it is unclear whether results are truly comparable. It is also unclear whether the Sumatra estimate met the restrictive assumptions of the gas model (Hutchinson and Waser 2007, Rowcliff et al. 2008, Nakashima et al. 2017).

5. STATUS & POPULATION TREND

IUCN RED LIST CATEGORY: Vulnerable (assessed 2008, 2016)

IUCN RED LIST CRITERIA: A2cd+3cd+4cd

Sun bears are believed to be declining across most of their range. Although lacking direct empirical estimates of population trends, country experts from the Bear Specialist Group made subjective estimates of rates of population decline over three time periods (30 years in the past, a 30-year window overlapping the present, and 30 years into the future) based on dwindling geographic ranges, loss and degradation of habitat, and high levels of exploitation. Weighting each country's estimate of population change by the country's areal proportion of the geographic range yielded an overall estimated decline of ~35% for the past 30 years, and ~40% or more for time periods including the future (Scotson et al. 2017a). These rates of decline meet the IUCN Red List criteria for a classification of Vulnerable.

Assessments of rates of decline for this species have been based mainly on expert opinion. Some empirical estimates support these assessments. In Thailand's Khao Yai National Park camera trap photo encounter rates for sun bears declined by over 60% from 0.73 per 100 days (1999–2003) to 0.27 (2003–2007) (Jenks et al. 2011). But other populations seem to be doing better: photo encounter rates were stable in Kuiburi National Park and Thung Yai Naresuan Wildlife Sanctuary (R. Steinmetz, unpublished data). An earlier systematic mammal status assessment survey of local people in Thung Yai Naresuan Wildlife Sanctuary, Thailand, estimated that sun bear numbers declined by more than 40% in a 20-year period (1984–2004), but improved protection and community engagement since then appear to have had a positive effect (Steinmetz et al. 2006). Conversely, interview surveys in 22 protected areas in Vietnam indicate drastic population declines throughout this country during 1995–2005, with no subsequent recovery (Crudge et al. 2016).

Sun bear populations can recover in previously extirpated areas, given a nearby source population. In Indonesian Borneo (Kalimantan), sign transects were used to monitor relative abundance of sun bears in a burned forest during 2000–2010. In an adjacent unburned forest, sun bear sign density remained stable. In the burned forest, sun bear sign density was near zero post fires, but within 10 years reached 65% of the sign densities in the unburned forest (Fredriksson 2012).

DATA GAPS on sun bear populations:

There are no reliable population estimates for any range country, and also no empirically-based estimates of rates of population change. All current estimates of rates of decline are based on expert opinion.

Because populations are not actively monitored, it is difficult to assess the real effects of threats or of conservation actions designed to reduce threats.

Population surveys have been conducted using sign, camera traps, and interviews in a number of sites in almost all of the range countries (see section on Population Monitoring), but differences in the ways the data have been collected have hampered a thorough assessment of spatial differences in population size/density (but see Steinmetz 2011) or population trend.

6. HABITAT USE

Sun bears are recognised as a forest-dependent species; however, there remains a lack of understanding as to the relationship between habitat (types and age of forest and understory) and sun bear density. Two broadly distinct categories of tropical forest comprise their natural range, distinguished by differences in climate, phenology, and floristic composition: (i) seasonal evergreen and deciduous forests with generally a 4–5 month dry season on mainland Southeast Asia north of the Isthmus of Kra; and (ii) aseasonal evergreen rainforests in Malaysia, Sumatra and Borneo. A principal distinction is that the aseasonal rainforests experience synchronised masting events, followed by inter-mast periods with little fruiting. During these inter-mast periods, sun bears rely largely on insects. However, they seem unable to maintain body mass for extended periods on a diet of insects, and some die of starvation (Wong et al.

2005, Fredriksson et al. 2007). Such large swings in fruit availability do not occur north of the Isthmus of Kra, and sun bears there are less reliant on insects (Steinmetz et al. 2011, 2013). In Bornean lowland forests, fruits of the families Moraceae, Burseraceae and Myrtaceae make up more than 50% of the fruit diet (Fredriksson et al. 2006), whereas in western Thailand fruits of Lauraceae, Fagaceae, Leguminosae, Labiatae, and Sapindaceae are the most commonly consumed (Vinitpornsawan et al. 2006, Steinmetz et al. 2013). North of the Isthmus of Kra, sun bears and Asiatic black bears co-occupy many of the same habitats on a fine scale, and consume many of the same fruits (based on claw marks on fruit-bearing trees; Steinmetz et al. 2013). Sun bears seem to avoid montane forests occupied by Asiatic black bears, although sun bears have been observed at elevations over 2,000 m in Myanmar and Indonesia (Augeri 2005, Htun 2006, Wong and Linkie 2012) and up to 3,000 m in India (Choudhury 2011).

Data on sun bear use of disturbed habitats remains equivocal, and views on this topic appear to be evolving as more information becomes available. There is good evidence that sun bears attempt to avoid roads, settlements, and other sources of human activities (Augeri 2005, Linkie et al. 2007, Nazeri et al. 2012, Wong et al. 2013, Guharajan et al. 2018), and their use of newly-logged areas is low (Brodie et al. 2015). Augeri (2005) found significantly more sun bear sign in primary forests than in logged forests, even after 20+ years of regeneration. Augeri (2005: 219) also noted that, in Borneo and Sumatra, "despite thousands of hours of effort with extensive geographic coverage in a wide variety of habitat types, no [camera trap] photographs or genetic samples were observed in secondary forests of any age." Scotson (2017), conducted sign surveys on the mainland (which thus included both sun bears and Asiatic black bears) and found that bears selected for areas of high elevation, high tree density and for sites at greater distance from roads, but proximity to villages had little association with bear occurrence. Based on accumulated camera trapping data from various sites, Scotson et al. (2017b) found sun bear detection rates at camera trap stations to be positively correlated with percent tree cover and used tree cover as the sole variable (with caveats) in a mathematical model which projected severe declines in sun bear populations with declining tree cover.

However, ground-based data from a number of individual sites indicate that this species is adaptive and resilient to certain types and amounts of forest change. In Malaysian Borneo, Imai et al. (2009) reported that sun bears were camera-trapped at significantly higher rates in a forest logged under sustainable forest management (SFM) and reduced-impact logging (RIL) than at an adjacent site subjected to conventional logging practices. Unexpectedly though, within the SFM–RIL site, sun bears were camera-trapped at a higher rate at sites that were logged 2–8 years before than at sites not logged for 20 years (Samejima et al. 2012). In a forest in Indonesian Borneo, 1–3 years after switching from conventional to RIL logging, sun bears selected sites with more intact forest (defined by a low extent of pioneer tree species that tend to grow in forest openings); but in a forest converted to RIL logging 6–8 years before, they were camera-trapped at a much higher rate overall, and showed no significant selection for more intact forest sites (Jati et al. 2018). In Malaysian Borneo, camera traps in more intact lowland forest tended to obtain more sun bear photos, but occupancy was only negligibly higher in the section of forest where logging had been controlled under RIL and certified under the Forest Stewardship Council (FSC) than two adjacent forest blocks that had been more aggressively logged (Sollmann et al. 2017).

Brodie et al. (2015) indicated that sun bear abundance was significantly reduced after logging in Malaysian Borneo, but rebounded after 10+ years of regeneration. Also in Malaysian Borneo, Wearn et al. (2017) reported that sun bear abundance was similar or slightly higher in a previously-logged forest than in old-growth forest. Adila et al. (2017) observed high species abundance, with sun bears being one of the most-commonly photographed large mammals, in a previously-logged peat swamp forest in Peninsular Malaysia that was not logged for ~20 years, even though much of the area continued to be burned and some was converted to oil palm *(Elaeis guineensis)*. In a degraded, previously logged site in Sumatra, sun bears were camera-trapped at rates equivalent to unlogged sites, and within the logged site they showed no preference for parts of the forest that were less degraded (Lindsell et al. 2015). At another site in Sumatra, Linkie et al. (2007) observed higher occupancy of sun bears in a degraded hill-forest than in primary forest; 4–6 years later, occupancy in the degraded area precipitously declined, possibly due to continued high rates of deforestation, whereas occupancy in primary forest increased despite that site undergoing deforestation (Wong et al. 2013).

Sun bears have been observed in plantations (oil palm, sugar palm), agricultural lands (sweetcorn, cucumber, pumpkin, sesame), orchards (coconut, durian, banana, jackfruit, snakefruit, pineapple, apple), narrow remnant

riparian forests surrounded by a deforested landscape, and near forest edges (Nomura et al. 2004, Augeri 2005, Fredriksson 2005b, Cheah 2013, Sethy and Chauhan 2013, Yaap et al. 2016, Guharajan et al. 2017). Some bears may benefit nutritionally from supplementing their diets with human-related foods (Nomura et al. 2004, Cheah 2013; Table 1), especially when fruits are scarce in the forest. However, sun bears using plantations and croplands typically do so mainly at night, avoiding both people and the hot sun, and returning to the adjacent forest for cover and shade by day (Nomura et al. 2004, Fredriksson 2005b, Cheah 2013, Sethy and Chauhan 2013). Despite this seemingly tenuous existence, sun bears seem to be able to persist in small strips of forest bordered by plantations as long as human-caused mortality is low (Yaap et al. 2016; Guharajan et al. 2017, 2018).

DATA GAPS on sun bear habitat needs:

Some data suggest that sun bear occurrence declines with reduced tree cover after logging, and is not restored for many decades. Other recent camera trapping data indicate that the species is more adaptable than once thought to certain kinds of forest alteration. Most camera trapping studies, though, are not targeted to sun bears, so there may be specifics to each case that are important but not understood.

Sun bears evidently use the edges of oil palm plantations, and benefit nutritionally from eating the fruit, while doing little damage to the trees. However, plantations remove necessary cover and thermal protection, and reduce what is normally a diverse diet to just this singular fruit. Also, bears are more vulnerable to being killed in a plantation. It is unknown to what extent plantations can be made more bear friendly, without creating a mortality trap.

7. MAJOR THREATS

Sun bears are threatened primarily by deforestation and commercial hunting, both of which occur to various degrees, and affect many species throughout the region (Scotson et al. 2017a, Duckworth et al. 2012). Killing due to human–bear conflict is an additional threat in some areas. However, at a site in Sabah, Malaysian Borneo, Guharajan et al. (2017) found that few oil palm plantation farmers or operators considered sun bears destructive to their crop, and therefore had no motivation to kill them. In other sites, though, there are records of crop-raiding sun bears being killed either out of fear (they sometimes attack people: Sethy and Chauhan 2013, Wong et al. 2015), retribution for crop damage (Fredriksson 2005b), or because they are targeted for their parts, and are readily hunted in cropfields or plantations (Shepherd and Shepherd 2010; Sethy and Chauhan 2012, 2013; Scotson et al. 2014; G. Fredriksson, personal communication, 2017). Sun bears are also vulnerable to snares set for other species, as evidenced by plantation-visiting bears with missing paws (Cheah 2013). Notably, wild boar *(Sus scrofa)*, bearded pigs *(Sus barbatus)* and porcupines *(Hystrix brachyura)* are attracted to oil palm and other food-producing plantations, so these areas have become ideal places to hunt these species; some of that hunting involves snares that indiscriminately capture other species, including sun bears (Luskin et al. 2014).

Sun bear with apparent snare injury, captured near the Vietnam-Laos border. Credit: Centre for Environment and Rural Development, Vinh University

Illegal road & logging in sun bear habitat. Credit: Dewi Kurnia

Poaching for consumption and commercial use of sun bears is a much greater threat than retaliatory killing: it was reported by regional members of the IUCN SSC Bear Specialist Group to be a moderate to major threat in all range countries except Brunei (where there are no records of international trade, but some local hunting of bears for medicinal purposes; Cheema 2015). Trade in sun bear parts has been reported in a host of studies (Meijaard 1999, Nea and Nong 2006, Nguyen 2006, Htun 2006, Tumbelaka and Fredriksson 2006, Wong 2006, Foley et al. 2011, Sethy and Chauhan 2011, Burgess et al. 2014, Krishnasamy and Shepherd 2014, Lee et al. 2015, Willcox et al. 2016). Sun bears are valued primarily for their gallbladder (see next section on Use & Trade) and paws; live cubs are also sold as pets or, to a lesser extent, to stock bear bile farms. It is widely believed that the extent of killing and trade is much larger than indicated by the actual records of dead bears. Snaring is widespread across Southeast Asia (Gray et al. 2017), which impacts sun bears either indiscriminately or through targeted poaching. This is evidenced by individuals missing paws, typical of snare injuries, in both high priority conservation areas and in plantations (Scotson and Hunt 2012, Cheah 2013, Krishnasamy and Or 2014, Or et al. 2017). Moreover, the prevalence of snaring is often significantly underestimated, effectiveness of anti-poaching patrols overestimated, and the factors associated with the extent of snaring in any particular area not well understood (Steinmetz et al. 2014; O'Kelly et al. 2018a,b).

Harrison et al. (2016), in a recent review paper, described what they called "a wave of unsustainable hunting that has spread across Southeast Asia over the past 20–30 years." They asserted that government agencies and the international conservation community "fail to appreciate the scale and extent of overhunting, much less respond appropriately." Whereas in many other parts of the world, human-dominated landscapes can support thriving populations of wildlife, including bears, this is not usually the case in Southeast Asia because of extreme over-exploitation and poaching. In part, this over-exploitation is due to the commercial value of some of the wildlife, including bears. Nevertheless, Steinmetz et al. (2010, 2014) showed in one area that if poaching can be alleviated, as via a thoughtful, locally-adapted community outreach programme or an enhanced patrolling effort, wildlife populations can quickly bounce back (as recently documented for tigers *(Panthera tigris)* in some areas; Pusparini et al. 2018, Lamichhane et al. 2018).

Deforestation compounds the effects of poaching, partly because logging is associated with increased roads and access. Highlighting this point, Gaveau et al. (2014) used a map of logging roads to estimate the extent of logging impacts on Borneo. Bryan et al. (2013) calculated that the combined length of new logging roads built just in Malaysian Borneo and Brunei during 1990–2009 would circle the earth nine times. These roads increase access for poachers, and also add human disturbance, which the bears attempt to shun. Deforestation also increases edge, which increases human access (Meijaard et al. 2005). Further, with reduced size of forest patches, bears become more vulnerable to human encounters as they move among patches of forest that are increasingly separated by agriculture. Moreover, when forests become degraded and produce less food per area, bears may travel more, and feed more on human-related food sources. Even during selective logging, where only certain types and sizes of trees are harvested, there is considerable damage to other trees, the understory, and the soil (Bryan et al. 2013).

Southeast Asia has the highest rate of forest loss in the world, and has the lowest remaining proportion of natural tropical forest (Sodhi et al. 2004, 2010; Miettinen et al. 2011; Margono et al. 2012, 2014; Dong et al. 2014). This loss is driven by logging, fires, expansion of oil palm, rubber, and fiber (e.g., Acacia) plantations, and mining activity.

Within sun bear range, the Sundaic region has had the highest rate of deforestation (Miettinen et al. 2011; Margono 2012, 2014), where logging and conversion to fiber and oil palm are the chief drivers (Stibig et al. 2013, Abood et al. 2015). Gaveau et al. (2016) estimated that one-third of the forested area on Borneo was deforested during the period of industrial plantation expansion, 1973–2015; by 2015, half of the deforested area of Borneo was in oil palm or timber plantations. Margono et al. (2012) estimated that nearly half the remaining primary forests of Sumatra were cleared or degraded during 1990–2010. Indonesia was second only to Brazil in terms of area of net forest lost, with Myanmar third (FAO 2016). However, whereas forest loss rates have diminished in Brazil, the opposite occurred in Indonesia. By 2012, the rate of primary forest loss in Indonesia was estimated to be nearly double that of Brazil (Margono et al. 2014). Cushman et al. (2017) estimated a loss of 23% of forested area of Malaysian Borneo and 15% of Kalimantan (Indonesian Borneo) during the decade 2000–2010, and predicted that these same rates of loss would continue through the next decade. Moreover, forest loss in Brunei, which has historically been less (6% for 2000–2010) would increase to 16% during 2010–2020. Conversion of natural habitat to oil palm plantations is particularly extensive on Borneo and Sumatra (Miettinen et al. 2011; Wicke et al. 2011; Margono et al. 2012, 2014). Protected areas have not been exempt from deforestation: 40% of the forest lost in Indonesia during 2000–2012 occurred in protected areas where logging is restricted (Margano et al. 2014).

Indonesia and Malaysia, countries considered to be the remaining strongholds for sun bears (Figure 1; Table 2), are the top two producers of palm oil in the world, providing 85% of the global supply; Thailand, another sun bear range country, is (a distant) third in world production (https://www.indexmundi.com/agriculture/?commodity=palm-oil). Thailand, Indonesia, and Malaysia (in that order) are also the world's top-three rubber *(Hevea brasiliensis)* producing nations. Monoculture rubber plantations that provide little or no nutrition for sun bears are rapidly spreading in mainland Southeast Asia (Fox and Castella 2013, Ahrends et al. 2015), whereas the common rubber agroforestry systems of insular Southeast Asia, which often include fruiting trees conducive to use by bears, are being replaced by more lucrative oil palm. Sun bears living adjacent to oil palm plantations may feed upon the fruits (judged by their use of the plantations and their scats containing oil palm seeds; Nomura et al. 2004, Cheah 2013, Yue et al. 2015, Guharajan et al. 2017, Wearn et al. 2017).

Paradoxically (given the high rate of forest loss in Southeast Asia), three sun bear range states (Laos, Vietnam, and India) are among the top ten countries in the world reporting the greatest annual net gain in forest area (FAO 2016). This shift, from a net loss to a net gain in forest area, called a forest transition, involved a number of factors, including protection of natural forest and planting of primarily fiber and rubber plantations. Keenan et al. (2015: Supplementary Materials, Table S3) separated natural forests from plantations of fast-growing monocultures and found that, among these three range states with forest gain, Laos and Vietnam had real gains in natural forest, whereas the gains in India were nearly all in plantations. In Vietnam, about half of the forest area increase was from plantations. Common species used in these plantations, like Eucalyptus (*Eucalyptus sp.)* and Acacia *(Acacia sp.)* (Hurni et al. 2017, Phompila et al. 2017) are thought to offer little benefit to bears, although sun bears do use Acacia if near other forest (McShea et al. 2009).

Human-caused fires throughout the Sundaic region, mainly set to clear land for agriculture, are also diminishing habitat quality and quantity for sun bears. In one study, sun bears totally vacated an area for 2+ years after a fire (but slowly returned from an adjacent unburned area, and reoccupied the burned area over the ensuing years; Fredriksson 2012). These fires are more prevalent and extensive during El Niño-related droughts, which compounds the effects of fruit failures and tree mortality caused by these droughts in unburned forests (Fredriksson et al. 2006). During 1997–2006, over 20% of the total land surface area of this region was affected by fires (Langner and Siegert 2009). During 2015, fires burned over 2.6 million hectares in Indonesia, especially the peatlands of Sumatra and Kalimantan (World Bank Group 2016). Once the forest has burned, there is a higher propensity for it to burn again (Hoscilo et al. 2011). Because much of the seed bank is destroyed by fires, ultimately, many such repeatedly-burned forests become degraded scrublands.

Given the diversity of fruits in the diet of sun bears in forests that have not been disturbed by humans (Steinmetz 2011, Steinmetz et al. 2013), it is expected that the extensive loss, degradation, and fragmentation of lowland forests, including removal of many fruit-producing trees, will negatively impact this species. Much of what is considered prime sun bear range is outside protected areas, and thus susceptible to human intrusion.

Slash and burn, North Sumatra
Credit: Nanang Sujana

DATA GAPS on threats to sun bears:

Whereas there is little doubt that sun bears are threatened both by habitat pressures and poaching, the relative impact of these two forces is difficult to ascertain for this species. Recently, such an assessment was conducted for Bornean orangutans *(Pongo pygmaeus)*, and the results were not as normally assumed: between 1999 and 2015, half of the orangutan population was affected by logging, deforestation, or industrialised plantations, and this loss and degradation of forest caused precipitous local declines in orangutan numbers; however, the largest overall decline in numbers occurred in selectively-logged and primary forests (where most orangutans live), apparently due to poaching (Voight et al. 2018). This analysis was possible because estimates exist of orangutan numbers through time; such population information is lacking for sun bears.

Habitat alteration is much easier to measure than poaching pressure. Remote sensing has enabled large-scale, verifiable quantification of loss (or sometimes gain, or conversion to other types) of tree cover, as well as measures of increased human development and road access. Poaching is much more elusive by its very nature. What we know of sun bear poaching stems from accumulated confiscation records (although these often include a mixture of Asiatic black bears and sun bears –– see next section on Use and Trade), abundance of snares and other sign of poachers, and evidence of significant population declines of sun bears in areas where forests remain largely intact (Crudge et al. 2016).

Whereas every range country has laws prohibiting the killing of sun bears (Appendix III), and CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) prohibits international trade, the country-specific regulations of logging, burning, forest conversion, and road building and other infrastructure development, and how these may impact sun bears, are less clear. The extent to which these regulations are violated, and how often violators are prosecuted, are also unknown.

There is disagreement as to what habitat features are most important for sun bears (in terms of their use, reproduction, and survival), and what patches of forest are still occupied by sun bears (Nazeri et al. 2012, 2014). Even at a very large scale, there are many areas within the broad sun bear range where their presence is uncertain (see Figure 1 and Table 2). This greatly complicates assessment of the state of this species, and prioritisation of sites to reduce threats.

8. USE & TRADE

Bear bile has been a component of Traditional Medicine (TM) in Eastern Asia for millennia. The first written account of such use was recorded in the first pharmacopeia of China in 659 A.D. (Feng et al. 2009). Bear bile is used in TM for reducing fever and inflammation, detoxifying the liver, dissolving gall stones, arresting convulsions, diminishing swelling and pain, and healing sprains, fractures, hemorrhoids, as well conjunctivitis and other eye ailments (Feng et al. 2009, Li et al. 2017). The medicinally active ingredient of bear bile is ursodeoxycholic acid (UDCA). In controlled, clinical trials, this compound (and its associated conjugates) has been shown to have many of the medicinal properties claimed in TM, as well as some medical benefits beyond those of TM (Feng et al. 2009, Gamboa 2011). In western societies, synthetically produced UDCA has been approved as a drug to treat certain liver diseases. More recently it has been shown to prevent retinal degeneration (Boatright et al. 2006), protect against Type I diabetes (Engin et al. 2013), and to have therapeutic effects for a number of neurodegenerative diseases, including amyotrophic lateral sclerosis, Alzheimer's disease, Parkinson's disease, and Huntington's disease (Vang et al. 2014). A number of herbal alternatives to bear bile exist in the Chinese pharmacopeia, and are often prescribed by TM practitioners in combination with bear bile, and could be viable substitutes for bear bile (Appiah et al. 2017).

Evidence suggests that UDCA in bear bile, which is a potent inhibitor of cell death (apoptosis) (Rivard et al. 2007), may serve to protect bears during hibernation (Solá et al. 2006). Asiatic black bears produce especially high levels of TUDCA (tauroursodeoxycholic acid), a conjugated form of UDCA which is rare in the bile of species other than bears (Hagey et al. 1993). Historically, the Asiatic black bear has been sought after for its bile more than any other bear species, possibly because of the high levels (Wang et al. 2011) and medicinal benefits

of TUDCA. By contrast, sun bears, which do not hibernate, have low levels of TUDCA but high levels of a different bile acid, TCDCA (taurochenodeoxycholic acid) (Hagey et al. 1993); this compound may also have some medicinal (anti-inflammatory) benefits (Mao et al. 2018), but is found in other animal species besides bears. One study found that Asiatic black bear bile did not contain TCDCA (Wang et al. 2011).

Sun bears, which historically had a marginal extent in China, have not had the same long history of exploitation for bile as Asiatic black bears. Accordingly, when the farming of bears to extract bile to produce medicine commenced in China, sun bears were not included in the industry (and presently it is not legal to farm sun bears in China). Nevertheless, more recently, sun bears have become involved in the commercial trade in gallbladders and bile, despite no studies confirming the medicinal effectiveness of sun bear bile. Sun bears were also included in bear bile farming in Southeast Asia, specifically in Vietnam, Laos, and Myanmar, although they composed just 2-4 % of the farmed bears in this region (Foley et al. 2011, Livingstone and Shepherd 2014, Livingstone et al. 2018, Crudge et al. 2018). Nevertheless, there is no indication among the bear farming countries of Southeast Asia that sun bear populations have fared any better than Asiatic black bears (the main target for bear farms) (Crudge et al. 2018).

Increased demand, stemming from burgeoning human populations and increasing wealth, coupled with more efficient hunting of wild bears and increased ability to sell and transport products has led to the over-exploitation of these Asian bears, mainly for their bile. Bear bile is sold in various forms including whole gallbladders, raw bile, pills, powders, flakes, and ointments (Foley et al. 2011). Trade in bears is further fuelled by increasing demand for bear parts for the consumption of wild meat, particularly its paws in the form of an expensive soup; having nothing to do with TM (Burgess et al. 2014, Anon. 2015, Willcox et al. 2016). Bear paws are considered a delicacy and health tonic when soaked in wine and are reportedly in high demand in countries like China and Vietnam (Burgess et al. 2014, Willcox et al. 2016). Other bear parts (claws, teeth, skin, skull) are also coveted as trophies or souvenirs.

All international trade in bears, their parts or derivatives, including bile (whether wild or farmed) is regulated under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Despite this, a wide and complex network of international bear bile trading exists, with much cross-border trade within Southeast Asia, and exports to China and to non-Asian countries (Foley et al. 2011, Burgess et al. 2014). The actual extent of this illegal trade is difficult to judge, given that seizure data are an unknown fraction of the total trade, and because gallbladders and bile are not easily differentiated to species (not just among bear species, but also other species whose parts are traded as imitation bear parts (Peppin et al. 2008).

Dried gallbladders for sale in a Lao market.
Credit: Free the Bears

Domestic hunting and trade in sun bears is illegal throughout its range states. The highest protection by law is generally afforded for the species across its range, except in Sarawak, where hunting is permitted under license, though no permission has been issued for hunting or trade (Krishnasamy and Shepherd 2014). Enforcement of domestic and international wildlife laws is severely lacking in most sun bear range countries and is failing to deter illegal bear trade (Shepherd and Nijman 2008, Foley et al. 2011, Burgess et al. 2014, Livingstone et al. 2018). Low risk of being prosecuted and high potential profits mean that the incentive to poach bears is very high.

Nijman et al. (2017) interviewed self-declared bear poachers in Myanmar, and learned that poaching was almost always a side-occupation, bears were mainly poached using snares set for a variety of species, and poachers typically took about one bear per year and consumed some of it but sold the valuable parts (gallbladder, paws, skin); most respondents said that selling the gallbladder was the prime reason to poach bears, with little fear of being caught, and most thought that hunting pressure reduced bear density over the past 5 years. In one area, targeted bear poaching, involving long lines of iron traps, started after a Chinese logging operation became active. Poachers indicated, though, that most bears caught were Asiatic black bears, and in a separate survey in Myanmar, it was found that <1% of bear parts being traded were from sun bears (Shepherd and Nijman 2008). Nijman et al. (2017) recommended not just better law enforcement efforts but also a concerted attempt to disrupt trade networks that foster and fulfill demand for bear parts.

In the state of Arunachal Pradesh in northeast India, Asiatic black bear parts (gallbladders, skulls, teeth, claws, paws, skins) were likewise sought and traded more than those of sun bears, based on interviews with local people and parts found for sale (Sethy and Chauhan 2011). However, sun bears comprised a larger portion (11–15%) of the bear parts found or bears poached than in neighbouring Myanmar. The study site in India marks the northern limit of sun bears, where they would be expected to be less common than Asiatic black bears, whereas the Myanmar data were from throughout the country, which includes places where sun bears were more common than black bears (based on camera-trapping data: Steinmetz 2011). Hence, the difference in results between these adjacent countries may reflect differences in hunter selectivity or hunting methods.

TRAFFIC and other organisations have attempted to ascertain the levels of trade in bears and their parts through surveys of TM outlets and bear bile farms. In Vietnam there was a decline in open availability of bear parts in physical outlets between surveys in 2012 and 2016, but commercial trade in bear bile and gallbladders remained prevalent (Willcox et al. 2016). A survey of online outlets such as Facebook, found that bear products were openly advertised in Vietnam (Nguyen 2016).

A survey in Malaysia, where only sun bears are native, reported that nearly 50% of TM shops sold bear gallbladders or bile (in the form of pills, liquid, or powder) in 2012; even though most acknowledged that it was illegal, the sale of bear parts remained widespread (Lee et al. 2015). Some of the bile in Peninsular Malaysia was sourced from other countries (including farmed bile), so was likely predominantly Asiatic black bears. However, almost all traders interviewed in Sabah and Sarawak (on Borneo) claimed that they sourced their gallbladders locally, meaning that if they were indeed bear gallbladders (and not some other species that traders sold as bear) they were all sun bears. There are reports of increasing poaching of sun bears in Malaysian Borneo (Or et al. 2017).

Tom-tom, wild-born hybrid sun-moon bear rescued from illegal wildlife trade in Cambodia.
Credit: Free the Bears

Sun bears are also involved in the exotic pet trade (Burgess et al. 2014). For example, in Cambodia, 141 sun bears (plus 51 Asiatic black bears and one hybrid (Galbreath et al. 2008)) were confiscated or relinquished during 1998 – 2017, an average of 7 sun bears per year. In the first five years of this period, the majority of confiscated bears had been kept as pets or in restaurants and tourist attractions in and around Phnom Penh, the capital city. In subsequent years, confiscations increasingly occurred in the rural provinces, often directly from hunters and traders (Nev Broadis, Free the Bears, unpublished data). Confiscation rates have decreased in recent years, although given the prevalent high value of bears, this may be due to declining bear populations and trade becoming more secretive, as opposed to reduced demand.

DATA GAPS on sun bear trade:

Gallbladders and bile from different bear species cannot be differentiated, except through genetic analysis. Therefore, trade data on bear parts from Southeast Asia is mainly an undefinable mixture of Asiatic black bears and sun bears, unless it is known for certain that the origin is wild bears from Malaysia or Indonesia, where only sun bears occur.

Trends in seizure data are very hard to interpret: increased seizures may mean more trade or, conversely, better enforcement; decreased seizures may indicate less trade or that the traders have become better at eluding authorities. Large seizures have large effects on the data, making it difficult to interpret.

Total number of seizures, body parts, or bears gives no indication on the effect on the wild population. Every wild population can sustain some offtake without declining, but estimation of the sustainable offtake requires a reliable population estimate, which does not exist for any sun bear range country. Also, it is not known what fraction of the total human-caused mortality ends up being seized.

Unlike Asiatic black bears, where the medicinal effects of bile are proven, it is unclear whether sun bear bile has significant medicinal effects. It is possible that sun bear bile is akin to rhino horn in having no pharmacological benefit, but trade is sustained through cultural beliefs (Cheung et al. 2018). However, whereas use of Asiatic black bear bile in Traditional Medicine traces back over 1000 years (Feng et al. 2009), widespread use and trade in sun bear bile as a medicinal product is much more recent. It is unclear whether bile users know the difference, or if traders simply substituted a look-alike wild bear bile from the same geographic region. Notably, sun bears were rarely used in bear farms, suggesting that those selling farmed bile perceived a difference.

9. *EX SITU* STATUS

Sun bears have been held in captivity under a wide range of circumstances, conditions and motivations for at least 200 years. For the purpose of this review the *ex situ* sun bear population has been assigned to three separate categories, and the population status for each category will be assessed separately:

- **Category 1:** coordinated *ex situ* populations held outside of the bears' natural range-states.
- **Category 2:** bears held within natural range-states as part of legally recognised *ex situ* populations, including recognised sanctuaries, government wildlife rescue centres, and zoos recognised by regional/global organisations (SEAZA, WAZA, ZIMS).
- **Category 3:** bears held within range states and outside of government programmes (e.g., pets, illegally held captive bears, roadside zoos, tourist attractions, bear bile farms etc.).

CATEGORY 1 POPULATIONS

Four separate programmes have been established to coordinate *ex situ* sun bear populations outside of their natural range. They are managed within the framework of the following regional zoo associations:

- Association of Zoos & Aquariums (AZA) in North America
- European Association of Zoos and Aquaria (EAZA)
- Japanese Association of Zoos and Aquaria (JAZA)
- Zoo and Aquarium Association (ZAA) in Australasia

In EAZA, JAZA and ZAA studbooks are kept for the species, while in North America the population was managed more intensively in a Species Survival Plan (SSP) until 2012 when, following poor breeding results and a discouraging population viability analysis, the species was no longer recommended for cooperative management within AZA. The roles currently assigned by the population managers to these individual programmes differ between regions but in all regions,

the species should play a role for education and conservation education. In Europe, North America and Australasia the populations should also contribute to conservation related research (see Table 3).

Sun Bears at the San Diego Zoo, North America. Credit: SDZG

Sun bears have been kept in North American zoos since 1874. However, successful breeding did not start in any region until the 1960s. Studbook management of these populations was initiated decades later in the 1990s (Table 3), when the numbers of sun bears were already beginning to decline. Among the Category 1 populations, the biggest drop in population size – from a maximum of 88 to 26 sun bears currently - was observed in the North American population. Declines of a lesser degree are also seen in the populations held in Europe and Japan (see Table 4).

The decline in populations in the two regions with the longest breeding history is attributed to the relatively low reproductive output, which was outweighed by the death rate associated with the aging of the populations (Table 4).

Table 3. Management level for captive sun bears managed by regional zoological associations, and roles currently assigned by regions.

	EAZA	AZA	ZAA	JAZA
Level of management	Regional studbook	Regional studbook	Regional studbook	Regional studbook
Since	1996	1992	1999	1985
Start of regular breeding	1960	1967	1996	2000
Roles of the population by region				
Education	X	X	X	X
Conservation education	X	X	X	X
Fundraising	X		X	
Maintaining husbandry and breeding expertise	X			
Basic research	X	X	X	
Conservation related research	X	X	X	
Re-homing bears from sanctuaries	X		X	
Contributing to a managed *ex situ* global population			X	

Several factors are believed to have contributed to the low recruitment rate and decline in the Category 1 populations:

- Sex bias of captive-born young – particularly in Europe, resulting in surplus of females and shortage of males.
- Inappropriate social grouping (Fredrick et al 2013).
- Some evidence of infertility within the captive population, impacting breeding results.
- Inappropriate denning facilities contributing to high infant mortality historically.
- Limited capacity for housing of the species, sometimes leading to restrictions on breeding.

Table 4. Demographics of the sun bear populations currently managed by regional zoo associations, as of end 2017. Numbers represent males.females.unknown sex (total number)

	EAZA	AZA	ZAA	JAZA	total
Maximum population size	23.50.0 (73)	9.14.0 (23)[a]	9.9.2 (20)	15.22.0 (37)	**153**
Current population size (2018)	13.25.0 (38)	10.16.0 (26)	5.5.0 (10)	12.13.0 (25)	**99**
Bears of known origin	10.14.0 (24)	7.11.0 (18)	5.5.0 (10)	7.8.0 (15)	**67**
Births 1997-2017	6.13.3 (22)	5.7.0 (12)	5.4.4 (13)	12.9.0 (21)	**68**
Bears survived > 6 months	3.11.0 (14)	4.4.0 (8)	2.3.0 (5)	??	**27**
Deaths 1997 - 2017	23.25.3 (51)	21.34.1 (56)	6.9.4 (19)	10.13.1 (24)	**150**

The global sun bear population outside of its geographic range today comprises around 100 captive animals living in four regions geographically separated and managed independently of each other (Table 4). The capacity - currently 50 institutions - is very limited and even decreasing in North America and Europe. Considering the spaces available, none of these regional populations is, or will be, self-sustainable, despite the fact that a few new, high standard facilities for sun bears are planned in Europe and Australasia.

Sun bear cub born in Perth Zoo, Australia, to bears rescued from illegal wildlife trade in Cambodia. Credit: Perth Zoo

The annual growth rate is negative in all four populations (Table 5). Theoretically the proportion of animals in breeding age is still sufficient to correct that. However, to give the wild-born sun bears the chance to reproduce, several new pairings are recommended for the population. In order to ensure new pairs are reproductively viable, it has been recommended that reproductive health examinations are carried out on animals prior to transfers.

Table 5. Dynamics of managed sun bear populations per sex (based on studbook data of the regional populations).

	EAZA		AZA		ZAA		JAZA	
	M	F	M	F	M	F	M	F
Lambda (1997-2017)[a]	0.96	0.94	0.93	0.90	0.84	0.863	?	?
Generation time (years)	15.4	13.5	14.1	14	9.3	11.9	?	?
Age at first reproduction (years)	4	3	~4	~4	6	5	6	6
Latest age at first reproduction (years)	16	16	~ 21	~23	10	7	?	?
Latest age at last reproduction (years)	27	23	~26	~27	12	18	21	21
% of animals in or prior to breeding age	92	68	78	79	80	100	58	69

[a]Lambda: The proportional change in population size from one year to the next. Lambda can be based on life-table calculations (the expected lambda) or from observed changes in population size from year to year. A lambda of 1.11 means an 11% per year increase; lambda of .97 means a 3% decline in size per year.

The numbers of sun bears actually founding the *ex situ* populations were small with 14 wild-born founders in Europe, 7 wild-born founders in both the AZA and ZAA populations, and 6 in Japan. The latter were imported from China and it is not known whether these were captive- or wild-born individuals. Wild-born animals from Vietnam, Thailand, Cambodia and Sumatra (Indonesia) contribute to the EAZA population. All are currently still assigned to the *H. m. malayanus* sub-species. Only part of the Category 1 sun bear population, comprising individuals in North America, belongs to *H. m. euryspilus* from Borneo. In all populations a certain percentage of ancestry is unknown.

CATEGORY 2 POPULATIONS

Category 2 populations are sun bears held within recognised sanctuaries, wildlife rescue centres, zoos or similar facilities in their natural range states. Often these centres are owned by local governments and may have external support from non-governmental organisations. These animals make up a significant population of around 300 individuals, many of which are wild-born (Table 6).

Rescued sun bear at the Bornean Sun Bear Conservation Centre.
Credit: BSBCC/Chiew Lin May

Table 6. Demographics of *ex situ* populations in range-countries according to organisation/zoo region. Numbers represent males.females.unknown sex (total number)

	Population size	Known origin	Locations	Role of bears
Cat Tien Bear Sanctuary, Vietnam (Free the Bears)	4.6.0 (10)	10	1	Conservation education & research, wildlife law enforcement
Cambodian Bear Sanctuary, Phnom Tamao Wildlife Rescue Centre, Cambodia (Free the Bears)	29.58.0 (87)	87	1	Conservation education & research, wildlife law enforcement
Vietnam Bear Rescue Centre, Vietnam (Animals Asia)	5.6.0 (11)	11?	1	Wildlife law enforcement, conservation education
National Wildlife Rescue Centre (NWRC), Sungkai, Malaysia	(no data)	(no data)	1	(no data)
Bornean Sun Bear Conservation Centre, Malaysia	(44)	30	1	Reintroduction, ecotourism, captive breeding (in future)
KWPLH, East Kalimantan, Indonesia	4.2.0 (6)	4.2.(6)	1	Conservation education
Pasir Panjang Orangutan Rescue Centre, Central Kalimantan, Indonesia	8	???	1	Wildlife law enforcement
Banlamung Wildlife Breeding Centre, Thailand	(no data)	(no data)	1	Wildlife law enforcement
Wildlife Friends Foundation Wildlife Rescue Centre, Petchaburi, Thailand	6.15.0 (21)	(no data)	1	Wildlife law enforcement
Samboja Lestari Sun Bear Sanctuary, East Kalimantan, Indonesia	45		1	Wildlife law enforcement
Nyaru Menteng, Indonesia	16		1	Wildlife law enforcement
Nehru Zoological Park, India[a]	0.2.0	??	1	Research, education
Total	> 280			
SEAZA zoos in z	27.25.1 (53)	11.5.1 (17)	11	Unknown

[a] data provided by Dr. Brij Kishor Gupta, Central Zoo Authority, India, accurate as of 31.03.18

Some of the organisations supporting the facilities housing this population include:

- Free the Bears – Cambodia, Vietnam & Laos
- Bornean Sun Bear Conservation Centre (BSBCC) – Sabah, Malaysia
- Pro Natura Foundation – KWPLH, East Kalimantan, Indonesia
- Animals Asia - Vietnam
- Wildlife Friends Foundation Thailand - Thailand
- Bornean Orangutan Survival (BOS) and Sun Bear Outreach – East Kalimantan, Indonesia
- Orangutan Foundation International - Central Kalimantan, Indonesia

Numbers of sun bears held in government/NGO partnered sanctuaries have increased dramatically over the past 20 years and will most probably rise further with improved law enforcement against illegal hunting and trading of bears , and hence more confiscations of live bears (K. Krishnasamy, TRAFFIC Southeast Asia, personal communication, 2018). These populations fulfil a number of roles including support for wildlife law enforcement efforts, conservation education for local communities to reduce demand for bears and poaching as well as awareness raising about the situation of sun bears in the wild and their threatened ecosystems. With the exception of the Bornean Sun Bear Conservation Centre (BSBCC) captive breeding is not one of the goals of these sanctuaries due to populations growing via the receipt of confiscated and relinquished bears.

CATEGORY 3 POPULATIONS

An unknown number of sun bears are held in captivity across their natural range outside the coordinated programmes – this includes animals held as pets, illegally held captive bears, roadside zoos, tourist attractions, and bear bile farms. Despite legal protection aimed at preventing the capture of wild bears, large numbers of sun bears continue to be held in a variety of exploitative situations that do not contribute to, and almost certainly have a negative impact on, the conservation of the species. Sun bear cubs, often captured as a by-product of illegal killing of adult bears, remain popular as pets in many range countries. Since before the time of Raffles (1821), local people have had a particular fascination with keeping cubs of this bear species as pets. Sadly, once the cubs have outgrown their owners' attention they are often confined to small, unsuitable cages that do not allow for a full range of natural behaviours, or are sold into the trade to be killed and butchered for their body parts. It is highly likely that the number of sun bears being kept in roadside zoos, temples or as tourist attractions greatly outnumber the populations being held in managed breeding programmes or government-affiliated sanctuaries. Due to the illicit nature of this form of captivity the true numbers of bears being held across their range are impossible to know. However, experts estimate that within each range country there may be anywhere between a few individuals (Cambodia and Laos) to several hundred such captive sun bears (Indonesia and Thailand).

CURRENT STATUS OF BIOBANKS

Biobanks have not yet been established for sun bears and this science remains in its infancy with regards to this species. Some semen collection has taken place during reproductive tract exams, but it is believed that to date few attempts at cryo-preservation have been initiated or properly tested for this species. Some work is currently being trialed in Thailand using Artificial Insemination (Khao Kheow Open Zoo, ZPO).

Bear rescue centres can play a role in raising local awareness. Credit: KWPLH/Pro Natura Foundation

10. CONSERVATION ACTIONS & IMPLICATIONS

Figure 2. Map of sun bear project locations. In preparation for the 1st International Symposium on Sun Bear Conservation & Management, an announcement was made requesting information on the details and locations of all sun bear related projects. This map is a compilation of the information provided. The online version of the map provides the name of each project as well as a brief description and contact details.
Ctrl + Click on the Map to link to the live online version.
Or follow the link https://goo.gl/zuQmZ4

REDUCTION IN ILLEGAL EXPLOITATION

Sun bears are legally protected domestically and internationally from hunting and trade throughout most of their range (Appendix III). However, deficiencies in law enforcement are recognised as major ongoing weaknesses (Burgess et al. 2014). Efforts to reduce mortality by clearing of snares from bear habitat are underway in several protected areas throughout Southeast Asia by park authorities, often in collaboration with international NGOs. However, these projects have limited geographic scope and can face difficulties in maintaining long-term funding, political support, and most importantly, cooperation by local communities. In one study in Cambodia, looking at anti-poaching effectiveness, it was suspected that most snares were never found (O'Kelly et al. 2018b). It has long been assumed that snaring pressure corresponds directly with forest access: more in the dry season, more in small patches of degraded forest with increased road access, and closer to villages. O'Kelly et al. (2018b), though, indicated that these assumptions are not necessarily correct –– poachers attempting to avoid being caught worked during the wet season, used thick forests for cover, and often set snares away from their village, looking for places with high animal densities, and hence high returns (O'Kelly et al. 2018b). No clear relationship between anti-snaring efforts and poaching was found in this study.

The challenges to effective wildlife law enforcement have prompted some to advocate for increased demand-side interventions. However, recent studies have shown that such efforts also commonly fail, especially if the drivers of demand and consumer preferences are not well understood, and methods for reaching and influencing the public are not appropriately targeted (Drury 2011, Davis et al. 2016, Harrison et al. 2016, Veríssimo et al. 2018). It is perplexing that, whereas killing sun bears for their gallbladders is a chief threat, there is as yet no direct evidence that their bile (unlike that of Asiatic black bears) is medicinally effective.

PROTECTION AND RESTORATION OF HABITAT

Significant efforts have been made to reduce the rate of tropical forest loss, a necessity for the conservation of sun bears. The most recent Global Forest Resources Assessment of the Food and Agricultural Organisation of the United Nations (FAO 2016) indicated that the rate of tropical forest loss since 2010 was only half that of the 1990s (Keenan et al. 2015). Likewise, the rate of planting forests in the tropics has nearly doubled since the 1990s, although Southeast Asia has lagged behind (Payn et al. 2015). Additionally, there are now more inventories (and these inventories are far more accurate because they can be checked with satellite imagery; Romijn et al. 2015), management plans, national targets, and international as well as stakeholder pressure to conserve forests, for a variety of reasons (MacDicken et al. 2015). Indeed, at least on paper, the area of protected forest has increased in Southeast Asia (Morales-Hidalgo et al. 2015), and forest area in this region is projected to increase significantly by 2030, according to some estimates (d'Annunzio et al. 2015). This is not to say that significant forest conversion to agriculture is not still a major issue. Additionally, it is clear that in Southeast Asia, primary forests are still being degraded (as from fire) at an alarming rate (van Lierop et al. 2015), likely diminishing habitat quality for sun bears.

Whereas conservation efforts should certainly focus on saving sun bear habitat, there is still much uncertainty as to what "prime" sun bear habitat is, and also how much effort should be invested in protecting logged, burned, scrubby, small, or severely fragmented habitat. We know that sun bears consume a diversity of fruits when they exist in dense, old-growth forests, but this species also has evolved to persist through inter-mast periods with a paucity of fruits. Likewise, recent studies have shown them to occur in recovering logged or burned forests. Linkie et al. (2007) recommended that such sites "should therefore not be considered as having limited conservation value and assigned to other uses, such as oil palm production."

Expansion of oil palm plantations is currently the most pressing conservation issue facing this species in the Sundaic region, specifically where this involves further clearing of forest habitats. Many initiatives are ongoing to try to improve the palm oil sector (e.g., Roundtable on Sustainable Palm Oil [RSPO], Indonesian Sustainable Palm Oil [ISPO], Malaysian Sustainable Palm Oil [MSPO]) and progress has been made in developing guidelines for more sustainable practices that apply to large companies. A large challenge lies ahead to develop and implement more sustainable practices for smallholder oil palm, which in Indonesia is estimated to account for up to 40% of oil plantation area. But it is not clear what exactly should be done to make these monoculture plantations more sun bear friendly. Establishing "set-asides" or plantings of new forest patches may be encouraged within plantations. However, embedded "bear-friendly" habitats may entice bears to use the plantation more, and thereby increase their potential as a hunting-mortality trap.

POPULATION MONITORING

There have been few efforts to monitor changes in sun bear populations or even to assess relative spatial differences in sun bear population size and density. It is difficult to know if conservation efforts are effective if there is no reliable measure of the response of sun bear populations. Likewise, it is difficult to prioritise where conservation actions are most needed if sites cannot be distinguished in terms of a quantifiable measure of status or threat (e.g., rate of population decline, population size and connectivity, type and extent of threat and whether it is increasing or decreasing, prospects for long-term viability). Ideally, some baseline population estimate or index would be established, and population changes tracked through time in a number of sites. An alternative or additional approach would be to compare an index of population size/density across sites and identify attributes of these sites that explain high versus low sun bear populations.

Nevertheless, data exist from a number of surveys that were designed to gauge some aspect of population status. Three principal methods have been used –– sign surveys, camera trapping and local interviews –– although comprehensive recommendations on when to apply which method, or how to best implement or interpret each method, do not presently exist. Sign surveys have been conducted at sites in Indonesia, Malaysia, Vietnam, Thailand, Cambodia, Laos, India, and Bangladesh (Augeri 2005, Scotson et al. 2008, 2009, Namyi 2009, Powell 2011, Teo et al. 2011, Fredriksson 2012, Ngoprasert et al. 2011, Islam et al. 2013, Steinmetz et al. 2011, 2013, Sethy and Chauhan 2016, Guharajan et al. 2018). The basic design is for a group of two or more people to walk a straight line (transect) through a forest, and search for bear sign within a certain distance (typically 2-5 m, but up to 10 m) either side of that line, yielding an index of sign density (which presumably relates to bear density). Each tree is inspected for claw marks and ripped or chewed wood (from sun bear excavation of stingless bees), and the ground is

searched for insect digging (and occasional scats or tracks). Chief difficulties include: (a) inaccuracies in distinguishing bear sign from that of other species, especially for species that dig for insects or roots; (b) ambiguities in distinguishing sign of sun bears and Asiatic black bears (Steinmetz and Garshelis 2008), where the two species co-occur; (c) decay rates that vary by type of sign, weather, growth rates of trees, etc.; (d) untested or inconsistently applied methods used to age sign (Fredriksson 2012, Steinmetz and Garshelis 2010); (e) inconsistent methods for quantifying sign when it occurs in clumps (e.g., series of closely-spaced diggings); (f) uncertain procedures for summing the amount of sign encountered when there are multiple types of sign (e.g., adding the number of claw marked trees and number of diggings); (g) lack of methods for dealing with inter-observer differences in sign detection; (h) lack of methods for assessing the proportion of sign not detected; and (i) lack of understanding of how sign density relates to bear density, and factors that may confound this relationship (e.g., density of fruiting trees, amount of fruit and distribution among tree species). For these reasons, there have been few attempts to compare sign density of sun bears over a broad geographic scale. However, Fredriksson (2012) used consistent methods to monitor re-use of a burned, recovering forest by sun bears over time. Guharajan et al. (2018) used sign density to compare amount of sun bear use of small patches of forest adjacent to oil palm plantations. Since sun bear sign is generally related to feeding, sign surveys not only provide an indication of presence, but also use (i.e., not just passing through). Additional ecological information about fine scale habitat features (e.g., types of trees climbed) and signs of human presence are also informative for assessing risks and developing conservation strategies.

Camera trapping has become common in Southeast Asia, focussed especially on tigers or general biodiversity. Sun bear photos are often obtained as "by-catch". A chief difficulty of using such by-catch data is that camera placement may not be ideal for monitoring bears (Guharajan et al. 2018). However, camera traps are now so commonly-used and widespread across this region that enormous amounts of data are available on presence, relative abundance (photos per hundred trap-nights; e.g., Steinmetz 2011), and potentially occupancy (although this is strongly related to camera spacing, which varies among studies). Additionally, sun bear (or sun bear and Asiatic black bear)-focussed camera trapping studies have been conducted or are in progress in a number of the range countries (India, Bangladesh, Myanmar, Thailand, Malaysia, Indonesia) to assess relative density or occupancy by habitat (Linkie et al. 2007, Ngoprasert et al. 2012, Sethy and Chauhan 2016, L. Gaffi, R. Guharajan, H. Rahman, personal communication, 2017), and when repeated, may indicate change in distribution or population density (Wong et al. 2013).

Interviews of local people are a particularly useful way of assessing population change over time, and perceived drivers of population change. In a study of Asiatic black bears in China, Liu et al. (2009, 2011) showed that a combination of village interviews and sign surveys reliably indicated bear presence or absence, and was useful in gleaning opinions of population trends (comparing past and present) and reasons for these trends (e.g., changes in habitat, extent of poaching). Sethy and Chauhan (2011, 2012, 2013) interviewed villagers in northeastern India to gain information about sun bear presence, crop damage, attacks on people, and trade in bear parts. Recently, Crudge et al. (2016) employed village interviews around protected areas in Vietnam to gauge presence, relative density, and population trends of bears, and related this to bear farming. An important caveat of interviews, though, is that often local people are unable to reliably differentiate sun bears from Asiatic black bears. Also, their perceptions of population change may be linked more to their perception of the presumed drivers (e.g., improved habitat leads to increased population; observed cases of poaching leads to a decrease) than to actual encounter rates with bears.

CONTRIBUTIONS OF *EX SITU* FACILITIES

Non-governmental organisations (NGOs) have established rescue centres in partnership with government authorities in Cambodia, Vietnam, Laos, Thailand, Malaysia, Indonesia, and China with the primary aim of providing sanctuary to bears confiscated from the illegal wildlife trade (Table 6). For example, since 2002 in Cambodia, a dedicated Wildlife Rapid Rescue Team, made up of Forestry Officials and Military Police and funded by international NGOs, has confiscated more than 200 sun bears and Asiatic black bears that were previously kept illegally as pets, tourist attractions or destined for restaurant trade or bear farms (M. Hunt, Free the Bears, personal communication, 2018). An argument can be

Camera trap image of a sun bear. Credit: Roshan Guharajan

made that without a place for these bears to go after confiscation, less effort would be dedicated toward law enforcement, and hence there would be more opportunity for the trade in live bears to flourish.

Rehabilitation of ex-captive sun bears to restock depleted populations is another potential conservation role. However, this is rare and fraught with challenges, as most potential release sites are still threatened by forest loss and poaching, and most good forest habitats still retain sun bear populations. Few rehabilitation attempts have been monitored over a sufficient period to judge success (or the reasons for failure) –– the aim being that released sun bears become functioning parts of a viable population. In most rehabilitation attempts that have been monitored so far, sun bears were either killed by resident bears, found starved, or moved out of the forest and have been killed after coming too close to settlements or orchards. In Cambodia, a pilot project to rehabilitate two sun bears that were confiscated from the illegal wildlife trade ended after both bears were trapped in snares within two months, despite over two years of intensive snare-patrolling in the area prior to the release (M. Hunt, Free the Bears, personal communication, 2018). Efforts are now underway in Sabah to assess the fate of sun bears released after a prolonged period of rehabilitation (S.T. Wong, Bornean Sun Bear Conservation Centre, personal communication, 2018).

Bear rescue centres can also play a key role in raising local awareness of the threats to sun bears, their conservation value, and the ecosystem services provided by bear habitat. In Malaysia public awareness of the conservation implications and illegal nature of the bear bile trade was found to be quite low (Ipsos Malaysia 2013). Awareness campaigns in Southeast Asia resonate differently with different ethnic groups, even in the same country, as people may feel quite differently and also have a different knowledge base about conservation, animal welfare, and the efficacy of different types of bear bile (Davis et al. 2016). Some centres operate outreach teams, providing structured learning programmes that can reach tens of thousands of people each year. Likewise, centres support capacity building of local conservationists, and facilitate *in situ* and *ex situ* research and conservation (Table 6).

INCREASING CROSS-SECTORAL SUPPORT

Throughout their range sun bears face a multitude of direct and indirect threats, each with its own complex set of drivers and contributors. Their forest habitat is destroyed or degraded in many ways, including legal and illegal logging, forest fire, agricultural conversion, and infrastructure development, motivated by livelihood development or economic growth. Hunting of sun bears may be driven by demand from urban centres for high value parts, by livelihood needs of rural hunters, or may be the result of indiscriminate hunting methods such as snaring. Threats are compounded by low levels of wildlife law enforcement. Efforts to mitigate these threats are hampered by: (a) lack of empirical data on which to base recommendations for improved polices; (b) the immensity of the challenge versus the limited resources available to address all threats across the range; and (c) general lack of awareness among the public and policy makers as to the conservation importance of sun bears and the steps that can be taken. Overcoming these constraints will require a strategic approach to increasing efficiencies in the application of limited resources, as well as increased understanding and collaboration across all relevant sectors and stakeholders.

STRATEGIC PLANNING

The plan outlined here delves into the complexities of sun bear conservation. Some actions are direct, based on what we know, or what we think we know. Other actions involve data-compiling or even full-fledged research efforts, to better guide later conservation efforts, with the aim of achieving the overarching vision for sun bear conservation.

As highlighted in the status review above, there remain many data gaps for this species. In some cases conservation actions can proceed under the assumption that enough is known to get started. But it is clear that effectiveness would be enhanced if conservation can be more precise in terms of targeting the most pressing threat(s), which may be poaching in some areas and habitat loss or degradation in other areas, or some interaction between the two (e.g., increased access due to logging promotes greater poaching). Additionally, even these two broad threats may be best solved in different ways in different areas, depending on the specific problem (e.g., whether the habitat alteration is due to logging or conversion to oil palm; whether the poaching is indiscriminate or targeted to bears), and the willingness and capacity to solve it.

Ex situ sun bears.
Credit: Wildlife Reserves Singapore

Credit: Wildlife Reserves Singapore

SECTION 3

THE SUN BEAR CONSERVATION ACTION PLAN

Rescued sun bear at the Cambodian Bear Sanctuary.
Credit: Free the Bears

OVERVIEW

The following section outlines a range-wide conservation strategy and action plan for sun bears, for the period 2019 – 2028. This brings together the results of targeted discussions by workshop participants (Appendix I) at the 2017 Sun Bear Conservation Planning Workshop and the recommendations for actions that arose from those discussions. These discussions were informed by outputs from the preceding International Symposium on Sun Bear Conservation & Management, where an initial vision and operational goals were drafted, and where discussions of threats and conservation opportunities were captured and summarised (see Appendix II).

Over the two-day planning workshop, and following a series of scene-setting presentations, participants worked collaboratively on:

- **A VISION for the long-term future of sun bears;**
- **Operational GOALS which, if achieved, would realise the vision;**
- **The nature and dimensions of the ISSUES currently impacting the viability of the species across its range;**
- **A series of OBJECTIVES aimed at addressing these issues;**
- **ACTIONS to be taken in pursuit of these objectives, including recommendations on where and how each action should be taken and who would be best placed to take it.**

After discussing as a group all of the potential issues impacting on the viability of the species across its range, working groups were formed around the themes of: Trade and consumption; Habitat protection and improvement; Population monitoring; *Ex situ* management; and cross-sectoral collaboration. These themes ultimately became aligned with five operational goals. Working groups discussed the issues relevant to their theme with the aim of linking each issue to sun bear viability in the wild. Additionally, groups identified the underlying causes or exacerbating factors of each issue, wherever possible citing supporting evidence, clarifying assumptions and noting important information gaps.

Once issues were described, objectives aimed at addressing them were developed and brought to the wider group for discussion and prioritisation. Action steps were developed and recommended for 1, 5 and 10-year time-frames.

Results of the planning workshop were extensively fleshed out to create a draft document, which underwent a series of reviews and editing over several months, first by a core editing team, then each themed section was reviewed by the members of the relevant working group. Finally, the draft action plan was reviewed by participants of the symposium plus other sun bear biologists and conservationists who had been unable to attend the symposium.

The following summarises the outputs of these discussions and the agreed-upon Vision, Goals, Objectives and Actions.

Participants developed the following 25-year vision and goals for sun bear conservation:

Vision

Sun bears thrive as a functional component of all natural ecosystems in which they occur in each of the eleven range countries. Human societies coexist with wild sun bears throughout the range with political and cultural appreciation of their intrinsic value as living beings. Wild sun bear populations are no longer threatened. Captive sun bears are maintained under high welfare standards and contribute to conservation through advocacy, education, research, and where appropriate, release back to the wild. Conservation of sun bears aids in the conservation of other species and ecosystems in Southeast Asia.

Goals

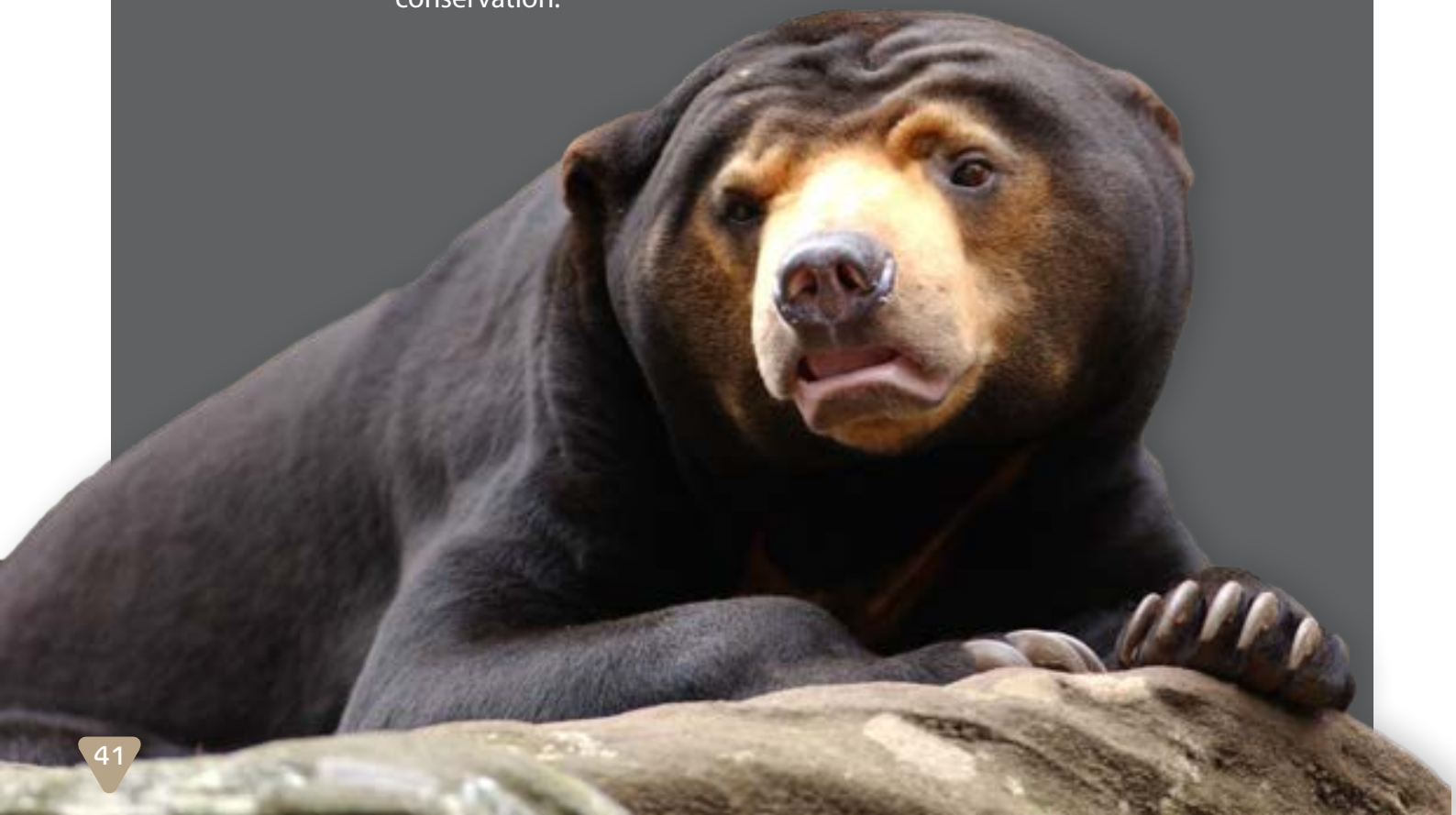
Goal 1. Eliminate illegal exploitation of sun bears.

Goal 2. Protect and restore sun bear habitats and populations across the species' natural range.

Goal 3. Devise and employ methods to reliably monitor trends in sun bear populations.

Goal 4. Maximise the contribution of *ex situ* sun bear populations to conservation.

Goal 5. Increase cross-sectoral support and collaboration for sun bear conservation.



ISSUES OF POTENTIAL RELEVANCE TO THE EFFECTIVE CONSERVATION OF SUN BEARS

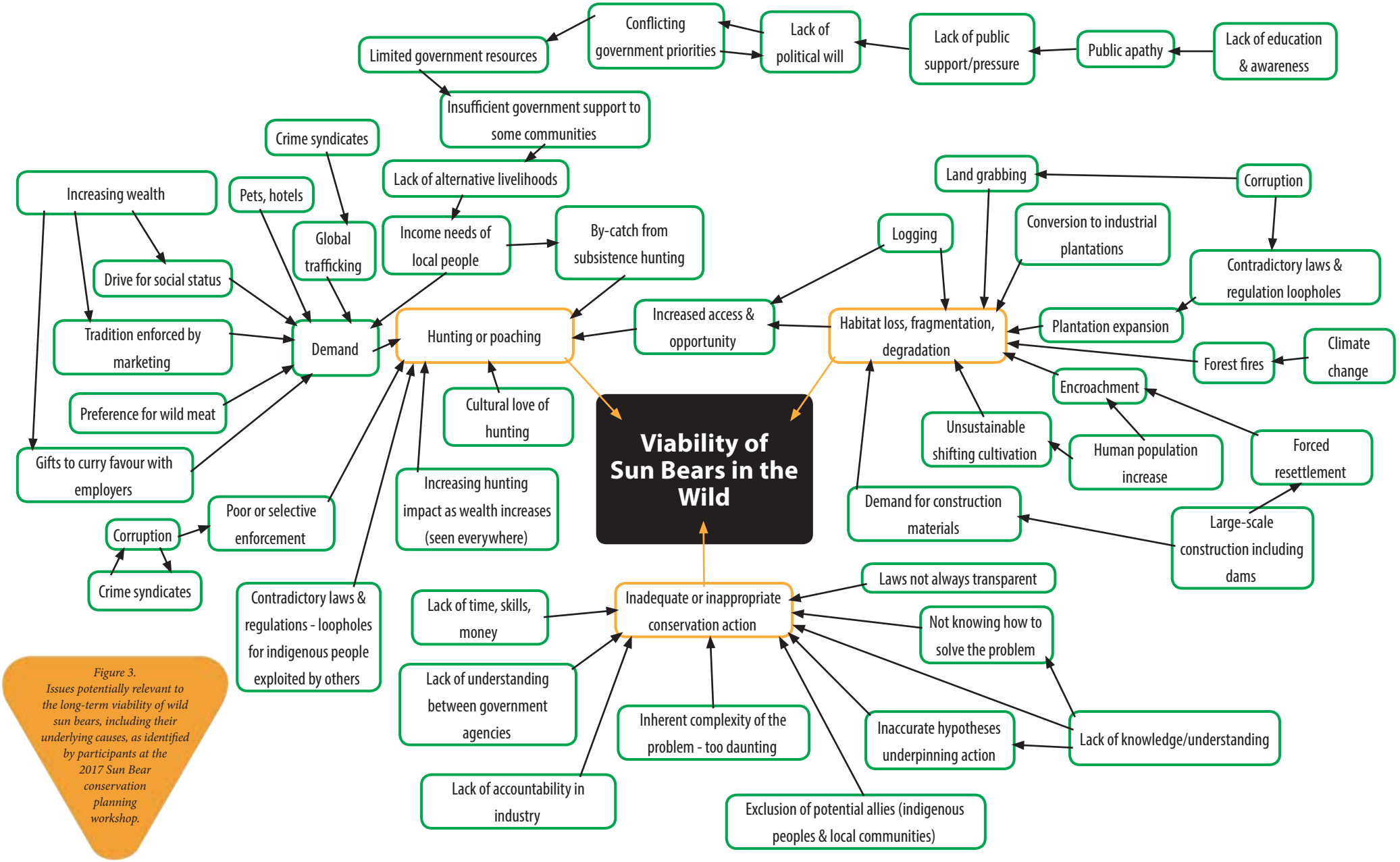


Figure 3. Issues potentially relevant to the long-term viability of wild sun bears, including their underlying causes, as identified by participants at the 2017 Sun Bear conservation planning workshop.

GOALS, OBJECTIVES AND ACTIONS (ABRIDGED)

GOAL 1. ELIMINATE ILLEGAL EXPLOITATION OF SUN BEARS

OBJECTIVE 1. REDUCE DEMAND FOR SUN BEARS, THEIR PARTS AND PRODUCTS	
1.1	Conduct research to determine the main targets for, and design of, behaviour change and demand reduction interventions.
1.2	Design, implement, monitor and evaluate behaviour change and demand reduction interventions targeting key audiences and sources of demand.
1.3	Conduct research on the motivation for hunting sun bears.
OBJECTIVE 2. IMPROVE LAW ENFORCEMENT EFFECTIVENESS FOR LAWS PERTAINING TO HUNTING, TRADE AND USE OF SUN BEARS AND THEIR PARTS	
2.1	Advocate improvements to legislation and policies based on a review of the existing legal and policy regimes governing sun bears in all range states.
2.2	Monitor and investigate availability of sun bear parts and products along the trade chain to enable law enforcement action.
2.3	Raise awareness with law enforcement authorities and judiciary through a combination of training and outreach.
2.4	Monitor and investigate the illegal hunting of sun bears to enable law enforcement actions.
2.5	Develop non-PCR based forensic methods to detect illegal bear parts and derivatives in Traditional Medicine.
2.6	Collect baseline information to evaluate action taken to reduce hunting and trade of sun bears.

GOAL 2. PROTECT AND RESTORE SUN BEAR HABITATS AND POPULATIONS ACROSS THE SPECIES' NATURAL RANGE

OBJECTIVE 3. REVIEW DATA ON FOREST COVER AND ECOSYSTEM SERVICES TO PRIORITISE AREAS AND GALVANISE SUPPORT FOR CONSERVATION INTERVENTIONS	
3.1	Review existing policies in order to identify national targets and commitments pertaining to forest cover (loss/gain).
3.2	Quantify and compile current rates of forest loss by range state in order to identify and prioritise areas needing protection.
3.3	Identify and map ecosystem services beneficial to people derived from conservation of sun bear habitat.
3.4	Disseminate information about forest loss and ecosystem services losses to authorities and the public in order to stimulate interest in maintaining intact forest.
OBJECTIVE 4. IMPROVE ENFORCEMENT OF EXISTING LOGGING REGULATIONS	
4.1	Review existing regulations and identify parties responsible for enforcing regulations pertaining to logging.
4.2	Gain better understanding of site-specific violations of logging regulations, including who is violating these regulations and why.
4.3	Identify areas within sun bear range where illegal logging is having the greatest negative impact and effectively communicate findings related to where enforcement and capacity building is needed.
OBJECTIVE 5. IMPLEMENT EFFORTS TO SIGNIFICANTLY REDUCE HUMAN-CAUSED FIRES THAT DEGRADE SUN BEAR HABITAT	
5.1	Identify the locations, causes and timing of fire threats to sun bear habitat by country and area.
5.2	Identify gaps in enforcement that result in violators not being prosecuted for illegal burning, and build capacity to enable successful prosecution of violators.
5.3	Disseminate information on fire threat and damage to wider public.

OBJECTIVE 6. MAKE PLANTATIONS MORE BEAR-FRIENDLY HABITAT	
6.1	Examine regulations for plantations that relate to how bear-friendly they can be.
6.2	Implement small-scale pilot projects to test/monitor methods for improving sun bear habitat in and near plantations while monitoring changes in hunting/poaching resulting from habitat improvements in and near plantations.
6.3	Provide recommendations for more bear-friendly habitat guidelines to agricultural (oil palm, pulpwood, etc.) certification bodies for inclusion in their standards and expand implementation and further testing (adaptive management).
OBJECTIVE 7. RESTRICT ROAD AND OTHER INFRASTRUCTURE DEVELOPMENT INTO PRIORITY AREAS OF NATURAL SUN BEAR HABITAT AND MITIGATE EFFECTS OF EXISTING INFRASTRUCTURE	
7.1	Obtain all large scale development plans that could impact sun bear habitat in each range state.
7.2	Communicate with relevant donors and stakeholders regarding the effects of proposed development projects on sun bear habitat and lobby stakeholders to restrict development in target areas of sun bear habitat.
7.3	Monitor and evaluate strategies for reducing impacts of infrastructure development on sun bear habitat to determine which are most effective and why.
7.4	Assess the impacts of infrastructure development on sun bears and evaluate the efficacy of current mitigation measures in order to inform development of more effective mitigation measures (e.g. increased checkpoints, speed breakers, road signage, etc) in consultation with the development companies/operators.
OBJECTIVE 8. IMPROVE UNDERSTANDING OF WHAT CONSTITUTES HIGH QUALITY SUN BEAR HABITAT, AND HOW VARIOUS HABITAT COMPONENTS AFFECT SUN BEAR POPULATIONS	
8.1	Gather existing relevant information from published and unpublished sources regarding the sun bear's use of various natural and altered habitats.
8.2	Conduct research to fill gaps in information about assessing the quality of sun bear habitat, and defining highest quality sun bear habitats.
OBJECTIVE 9. PRIORITISE SITES FOR THE CONSERVATION OF SUN BEARS, AND ESTABLISH CONSERVATION TARGETS	
9.1	Identify where sun bear populations exist.
9.2	Develop criteria for the prioritisation of sites in terms of importance for conservation of sun bears.
9.3	Quantify and map protected forests and how they overlap with current sun bear distribution.
9.4	Identify portions of sun bear range overlapping with existing action plans and ongoing conservation actions for other species.
9.5	Identify priority areas that are most important to protect sun bears and establish targets for their protection.
OBJECTIVE 10. RECONNECT SMALL ISOLATED SUN BEAR POPULATIONS WITH HABITAT CORRIDORS	
10.1	Identify where habitat corridors are needed to connect small isolated sun bear populations.
10.2	Examine sun bear use of already existing potential corridors or degraded habitats between forest patches.
10.3	Prioritise need for corridors based on sun bear population status, threats, conservation value, feasibility, etc.
10.4	Consult with stakeholders to create site-specific spatial action plans; implement small-scale corridor development; and monitor sun bear use to inform recommendations for larger-scale implementation.

GOAL 3. DEVISE AND EMPLOY METHODS TO RELIABLY MONITOR TRENDS IN SUN BEAR POPULATIONS

OBJECTIVE 11. DEVELOP PROTOCOLS FOR MONITORING TECHNIQUES THAT RELIABLY DETECT POPULATION CHANGES FOR SUN BEARS	
11.1	Collect existing data to examine whether protocols can be established.
11.2	Establish test sites to compare various survey methods.
11.3	Explore use of camera trap by-catch data for monitoring sun bears.
OBJECTIVE 12. IDENTIFY KEY AREAS WHERE SUN BEAR POPULATION MONITORING AND TRAINING ARE NEEDED	
12.1	Identify areas where sun bear populations are likely declining or where conditions are changing.
12.2	Identify within each country the capacity to implement a monitoring programme.
OBJECTIVE 13. IMPLEMENT MONITORING PROGRAMMES AND EVALUATE RESULTS TO IDENTIFY WHERE CONSERVATION OF SUN BEARS IS SUCCEEDING AND WHERE IT IS NOT, AND WHY	
13.1	Provide recommended monitoring protocols to each range country.
13.2	Increase capacity for monitoring through training workshops.

GOAL 4. MAXIMISE THE CONTRIBUTION OF *EX SITU* SUN BEAR POPULATIONS TO CONSERVATION

OBJECTIVE 14. IN RANGE COUNTRIES, ENSURE LEGISLATION PERTAINING TO KEEPING SUN BEARS IS CLEAR, UNAMBIGUOUS AND SUPPORTS EFFECTIVE LAW ENFORCEMENT	
14.1	Conduct a comprehensive review of all existing laws pertaining to keeping sun bears in captivity, in all range states.
14.2	Conduct baseline surveys of captive sun bear populations in range states, highlighting regulatory violations and gathering additional evidence from published and unpublished sources.
14.3	Develop evidence-based recommendations for strengthening laws, regulations and enforcement with regard to captive sun bears.
14.4	Secure commitments from range state governments to improve laws and enforcement pertaining to captive sun bears, where needed.
14.5	Assess existing captive sun bear facilities to ensure these are compliant with laws and introduce ongoing monitoring programmes.
OBJECTIVE 15. IMPROVE THE QUALITY AND QUANTITY OF CONSERVATION-DIRECTED RESEARCH CONDUCTED USING *EX SITU* SUN BEARS	
15.1	Review past and current *ex situ* sun bear research projects to provide a baseline from which to identify conservation-relevant gaps and priorities.
15.2	Identify, assess the feasibility of, and prioritise, conservation-directed research needs for *ex situ* sun bears.
15.3	Develop a formal network of academic institutions and captive care facilities willing to collaborate on applied research programmes to improve cooperation, reduce duplication and address agreed priorities.
OBJECTIVE 16. ENSURE SUN BEAR RELEASE INITIATIVES ADHERE TO INTERNATIONALLY RECOGNISED GUIDELINES	
16.1	Develop methods for determining the conservation impact, and risk, of sun bear release projects.
16.2	Develop and publish guidelines for sun bear releases to provide advice on when and how to conduct a release project, and how to monitor, evaluate, adapt and where necessary terminate it.
OBJECTIVE 17. INCREASE EFFICIENCIES WITHIN *EX SITU* PROGRAMMES	
17.1	Clearly define roles and priorities of the regionally managed programmes for sun bears.
17.2	Evaluate, agree and implement the best format for international collaborative programmes for captive sun bears.
17.3	Build on existing collaborative networks to improve best practice sharing between sanctuaries, rescue centres, and good zoos.
17.4	Utilise *ex situ* facilities to provide information about sun bear ecology, populations, threats, and conservation measures.

GOAL 5. INCREASE CROSS-SECTORAL SUPPORT AND COLLABORATION FOR SUN BEAR CONSERVATION

OBJECTIVE 18. RAISE AWARENESS OF SUN BEAR CONSERVATION NEEDS AND THE ROLES THAT CAN BE PLAYED BY INDIVIDUALS, SOCIETY, AND THE PRIVATE SECTOR	
18.1	Engage with media to raise the profile of sun bear conservation.
18.2	Engage with industry, e.g. transport sector, Traditional Medicine community, logging and plantation companies, to increase the effectiveness of sun bear conservation efforts.
18.3	Engage with private sector and social influencers to ensure the use of sun bears, their parts and products is no longer considered socially, personally, or culturally acceptable.
OBJECTIVE 19. INCREASE EFFICIENCIES IN SUN BEAR CONSERVATION RESEARCH	
19.1	Identify priority *in situ* and *ex situ* research projects which would contribute to sun bear conservation.
19.2	Explore methods of facilitating research on identified priority projects which would contribute to sun bear conservation.

Sun bear in tree. Credit: David Garshelis

GOALS, OBJECTIVES AND ACTIONS (UNABRIDGED)

GOAL 1. ELIMINATE ILLEGAL EXPLOITATION OF SUN BEARS

Ensuring that:

- illegal hunting and trade are prevented
- there is no longer consumer demand for sun bears
- governments and local communities are empowered to protect their sun bear populations from illegal activities

Sun bear held in captivity. Credit: Free the Bears

GOAL 1. ELIMINATE ILLEGAL EXPLOITATION OF SUN BEARS

OBJECTIVE 1. REDUCE DEMAND FOR SUN BEARS, THEIR PARTS AND PRODUCTS

Rationale:
We know demand exists and we are assuming that this demand has negative impacts on wild sun bear populations. Well designed and targeted behaviour change interventions have the potential to reduce demand for bears and bear parts. (Action 1.2)
To set these in place we need to understand: target audiences' implicit and explicit motivations for using bears, their parts and products; the full range of sun bear uses in trade; and which use of sun bear parts is the greatest driver of poaching/hunting for trade. (Action 1.1)
Currently we do not understand to what extent demand is driving hunting pressure or how much hunting is targeted at sun bears versus other reasons for hunting/poaching. Better information could support law enforcement efforts as well as behaviour change interventions. (Action 1.3)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
1.1	Conduct research to determine the main targets for, and design of, behaviour change and demand reduction interventions.	1-5 years	Free the Bears; TRAFFIC; San Diego Zoo Global; Animals Asia; BSBCC; PERHILITAN	Funds and surveys completed: Year 1: LA, KH Year 2: VN, MY Year 3: MM	Expertise. Tools/methods for conducting consumer behaviour or demand research, adaptable to different cultural contexts.	Funding and well-trained survey teams. Tried and tested survey designs.
1.2	Design, implement, monitor and evaluate behaviour change and demand reduction interventions targeting key audiences and sources of demand.	3-10 years	Free the Bears; TRAFFIC; San Diego Zoo Global; Animals Asia; BSBCC; PERHILITAN	Interventions implemented in all key identified consumer markets. Changes from the baseline data.	Expertise. In-country capacity.	Baseline to monitor and evaluate. Clear understanding of the full range of bear products and uses. Funds. Collaborators /partners.
1.3	Conduct research on the motivation for hunting sun bears.	1-5 years	Free the Bears; TRAFFIC; San Diego Zoo Global; Animals Asia; BSBCC; PERHILITAN; Oikos	Surveys conducted in at least three key source countries.	Some information on use and hunting reasons. Tools/methods to conduct research on hunting. Expertise.	Information on key areas where sun bears are hunted. Information on the extent to which poaching is resulting in sun bear population decline. Funds, collaborators, partners.

OBJECTIVE 2. IMPROVE ENFORCEMENT EFFECTIVENESS FOR LAWS PERTAINING TO HUNTING, TRADE AND USE OF SUN BEARS AND THEIR PARTS

Rationale:

Uncontrolled hunting of sun bears is considered a major threat to the survival of the species. In most instances it is illegal, and it is necessary to address this issue in order to improve the conservation status of the species.

Weak laws and policies (e.g. low penalties, insufficient regulation for trade, loopholes, etc.) enable the illegal trade and hunting of sun bears to persist and limits the effectiveness of law enforcement actions. Successful law enforcement requires data by which to monitor and evaluate success, and on which to base management strategies and set targets for future interventions. (Action 2.1)

Most TM samples that potentially containing bear bile are mixed with essential oils or plant derivatives. PCR (polymerase chain reaction) can be used to analyse a short sequence of DNA even in samples containing only minute quantities. However, the presence of other substances can hinder the PCR from working and the process for their removal introduces uncertainty to the results. Therefore, wildlife law enforcement may benefit from having alternative methods, such as antibody tests or gas chromatography-mass spectrometry (GC-MS), to detect if a sample contains bear bile. (Action 2.5)

It is assumed that having knowledge and information on the severity of sun bear crimes will motivate law enforcement and the judiciary to strengthen convictions (higher frequency and severity of penalties imposed). This requires documenting the extent of the illegal trade in sun bears, their parts and products that is occurring in physical and online markets in order to identify key traders and trade routes, and monitor trends. (Actions 2.2, 2.3, 2.4, 2.6)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
2.1	Advocate improvements to legislation and policies based on a review of the existing legal and policy regimes governing sun bears in all range states.	1-2 years	TRAFFIC & Collaborators.	Completed assessment report published.	In-country expertise.	Funds for human resources and translations. Collaborators for follow-up advocacy.
2.2	Monitor and investigate availability of sun bear parts and products along the trade chain to enable law enforcement action.	1-10 years	TRAFFIC; Free the Bears; BSBCC; PERHILITAN.	Information leads to action taken. Action taken leads to successful conviction.	Existing information for some range states. Expertise to monitor and investigate.	Resources (human, funds, equipment, motivation).
2.3	Raise awareness with law enforcement authorities and judiciary through a combination of training and outreach.	Ongoing and continuous.	Regional law enforcement agencies; TRAFFIC; Free the Bears; BSBCC; PERHILITAN; Oikos	The number of training and outreach efforts with judiciary and law enforcement agencies in all range states.	A collection of case studies where this has been effectively implemented in some places in the region. Regional platforms between law enforcement agencies and judiciary.	Funds. Political will. Human resources.
2.4	Monitor and investigate the illegal hunting of sun bears to enable law enforcement actions.	1 year	Protected Area staff; NGOs; field researchers in sun bear habitats; law enforcement agencies.	Monitoring and investigation in key areas – MY, ID, MM, IN, VN, TH.	Some information on where hunting is taking place. Sun bears are protected species in all range states. SMART conservation software. Existing patrolling/ surveillance tactics e.g. techniques developed by Panthera/Freeland for site security.	Resources (human, funds, equipment, motivation). Comprehensive information where hunting is taking place/ priority areas. High quality investigations to build a solid case. Skilled investigators/ informants.
2.5	Develop non-PCR based forensic methods to detect illegal bear parts and derivatives in Traditional Medicine.	1-2 years	Danau Girang Field Center, in collaboration with: AnimalsAsia; Free the Bears; CITES; IZW	Complete report published.	Access to bears, laboratory facilities and expertise.	Funding, TM samples for analysis, reference database.
2.6	Collect baseline information to evaluate action taken to reduce hunting and trade of sun bears.	1-2 years	Free the Bears; TRAFFIC; field researchers in sun bear habitats; law enforcement agencies.	Baseline information documented.	Information on actions taken in some range states. National and regional law enforcement agencies have information.	Comprehensive information on actions taken in all range states. Baseline information from Actions 2.2 and 2.4.

GOAL 2. PROTECT AND RESTORE SUN BEAR HABITATS AND POPULATIONS ACROSS THE SPECIES' NATURAL RANGE

Ensuring that:

- habitat patches are large enough and sufficiently inter-connected to ensure long-term viability;
- sun bears thrive both inside and outside of protected areas in each range state;
- protection is effective, sustained and long-term.

Hydrodam development in primary forest habitat, North Sumatra. Credit: Nanang Sujana

GOAL 2. PROTECT AND RESTORE SUN BEAR HABITATS AND POPULATIONS ACROSS THE SPECIES' NATURAL RANGE

OBJECTIVE 3. REVIEW DATA ON FOREST COVER AND ECOSYSTEM SERVICES TO PRIORITISE AREAS AND GALVANISE SUPPORT FOR CONSERVATION INTERVENTIONS

Rationale:

Forest cover is declining rapidly in Southeast Asia. This poses a major threat to sun bears because it reduces the area of habitat and increases fragmentation, creating smaller, disconnected patches that are more susceptible to additional threats like poaching, climate change, and fire. Some countries have established national targets for forest cover. A review of existing national policies and standards is needed to highlight areas for improvements that would ultimately benefit wild sun bear populations. (Action 3.1)

Forest loss varies by country within the range of sun bears. Compiling current rates of forest loss for each range state will help to identify areas within each country most at risk and therefore help prioritise conservation interventions. Additionally, comparison of forest data against national targets will indicate which countries are most apt to intervene. (Action 3.2)

People may derive benefits from saving rather than cutting forests. Identification of such benefits may increase political and public will, as well as financial resources through payment for ecosystem services, for protecting sun bear habitat. (Action 3.3)

Greater awareness of forest loss among the authorities and the public may lead to increased interest in maintaining intact forest and greater protection of sun bear habitat. (Action 3.4)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
3.1	Review existing policies in order to identify national targets and commitments pertaining to forest cover (loss/gain).	1 year	Student, consultant, contractor, or volunteer.	Information compiled, with policy review and analyses of forest cover targets, for all sun bear range countries.	National forest cover targets (most countries).	Dedicated person to collate available data for all range states. Understanding of what constitutes high quality sun bear habitat, and how various habitat components affect sun bear populations (Objective 8).
3.2	Quantify and compile current rates of forest loss by range state in order to identify and prioritise areas needing protection.	1 year	Student, consultant, contractor, or volunteer.	Information compiled.	National forest cover targets (most countries). Arial forest cover, rates of forest loss (or gain), and hotspots of forest change. Satellite-based alert system to detect fine-scale deforestation in near-real time, created by the Global Land Analysis & Discovery (GLAD) lab at the University of Maryland, through Global Forest Watch (GFW).	Dedicated person to collate available data. Understanding of what constitutes high quality sun bear habitat, and how various habitat components affect sun bear populations (Objective 8).
3.3	Identify and map ecosystem services beneficial to people derived from conservation of sun bear habitat.	1 year	Student, consultant, contractor, or volunteer.	List and map of priority sites in each range state where forest loss is highest.	Existing action plans for other species in some range states, which may identify forest-related services to people. Existing studies of ecosystem services.	Dedicated person to collate available data.
3.4	Disseminate information about forest loss and ecosystem services losses to authorities and the public in order to stimulate interest in maintaining intact forest.	2 years	IUCN/BSG & country nationals, to take forward policy recommendations.	Recommendations and solutions proposed to relevant decision-makers.	National forest cover targets (most countries). Areal coverage of forest and rates of forest change. Existing studies of ecosystem services. Charismatic flagship species (sun bears).	Results from Action 3.2 and 3.3 A plan and process to use the information effectively to stimulate change in forest use Connection to existing networks and institutions working on advocacy regarding forest loss and ecosystem services (i.e. ALERT Network at Univ Queensland; NGOs, government departments, and Universities in various countries)

OBJECTIVE 4. IMPROVE ENFORCEMENT OF EXISTING LOGGING REGULATIONS

Rationale:
Legal and illegal logging have both direct and indirect impacts on sun bear populations, through habitat degradation and loss, and increased accessibility leading to increased poaching and disturbance, etc. Logging regulations exist but are often not fully enforced. A review of existing regulations would identify the agencies responsible for enforcement and point to the strengths and weaknesses in the current system, which would indicate opportunities for improvement. (Action 4.1)
A better understanding of the factors driving illegal timber trade, including who is violating logging regulations and why, may aid in efforts to change the behaviour of illegal loggers and traders, and help identify areas for targeted law enforcement. Ultimately this will help protect bear habitat. (Action 4.2)
Logging regulations exist, which would benefit sun bears (by protecting their habitat) if implemented, but the regulations are not enforced. Identifying areas where illegal logging is having the greatest negative impact on sun bear status will allow for the targeted allocation of resources and interventions. (Action 4.3)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
4.1	Review existing regulations and identify parties responsible for enforcing regulations pertaining to logging.	5 years	Relevant NGOs; Government departments; Logging companies.	List of regulations and enforcement responsibilities.	Existing information on logging regulations. Knowledge of responsible parties regarding enforcement. EIA (Environmental Investigation Agency) has done such studies for some countries (i.e. Cambodia).	Identification of existing studies (if available). Communication with logging companies and relevant government enforcement agencies.
4.2	Gain better understanding of site-specific violations of logging regulations, including who is violating these regulations and why.	5 years	Relevant NGOs; Government departments; Logging companies.	Agreements with logging companies and government enforcement agencies.		Identification of existing studies (if available). List of priority areas where improved enforcement is most needed (Action 4.3.).
4.3	Identify areas within sun bear range where illegal logging is having the greatest negative impact and effectively communicate findings related to where enforcement and capacity building is needed.	5 years	Relevant NGOs; Government departments; Logging companies.	3-5 priority areas chosen at which to focus efforts to improve logging enforcement. Work at those sites launched and monitored.		Identification of existing studies (if available). Dialog with logging companies and relevant government enforcement agencies.


Credit: Brian Crudge

Credit: Wildlife Reserves Singapore

OBJECTIVE 5. IMPLEMENT EFFORTS TO SIGNIFICANTLY REDUCE HUMAN-CAUSED FIRES THAT DEGRADE SUN BEAR HABITAT

Rationale:

Fires degrade sun bear habitat by destroying trees, eliminating food sources (fruit trees, insects), and reducing cover and shelter sites. Some fires are started by people, so fires can potentially be reduced if the motivations and actors responsible are identified and addressed.

Determining the locations, causes and timing of fire threats to sun bear habitat will identify areas most at risk and help to determine potential mitigating measures. (Action 5.1). Illegal burning degrades sun bear habitat, and will increase if not prosecuted. It is therefore important to identify gaps in enforcement and capacity needs within enforcement agencies, to increase successful prosecution rates of violators and reduce the incidence of illegal human-caused fire in sun bear habitat. (Action 5.2)

Unlike logging and forest conversion to plantations there is little recognition of the negative effects of fires among the wider public. Greater recognition of this source of habitat deterioration is necessary to spur actions to reduce it. (Action 5.3)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
5.1	Identify the locations, causes and timing of fire threats to sun bear habitat by country and area.	1-3 years	Bear Specialist Group; CIFOR	Contacts made with CIFOR and others.	Existing studies and monitoring systems focused on fires (i.e., from CIFOR in Indonesia, GIZ). Upper ASEAN Wildland Fire Special Research Unit (WFSRU) in Kasetsart University, Thailand. Existing studies on the negative impact of forest fires on air quality and human health.	Collaboration with other institutions already working on this issue (i.e. CIFOR, GIZ).
5.2	Identify gaps in enforcement that result in violators not being prosecuted for illegal burning, and build capacity to enable successful prosecution of violators.	5 years	Bear Specialist Group; NGOs; EIA; CIFOR; GIZ; FoE	Opportunities for collaboration assessed.		Collaboration with other institutions already working on this issue. Collaboration with range state forestry departments. Compilation of laws and regulations relating to fires/ burning for key countries in sun bear range where fire damage seriously affects sun bear habitat.
5.3	Disseminate information on fire threat and damage to wider public.	5 years	Bear Specialist Group; CIFOR; NGOs and agencies involved in education and public outreach.	Contacts made with CIFOR and others.		Collaboration with other institutions already working on this issue (i.e., CIFOR). Collaboration with conservation awareness groups to improve and extend messaging on the effects and scope of fires on sun bear habitat.

OBJECTIVE 6. MAKE PLANTATIONS MORE BEAR-FRIENDLY HABITAT

Rationale:
Plantations are rapidly expanding across the range of the sun bear. Bears sometimes enter plantations from adjacent forest to eat oil palm and other plantation crops. But they also suffer heightened risk of mortality from snaring or hunting in plantations. Improving plantation management may help sustain nearby bear populations. In many places, sun bears have been relegated to small forest patches near plantations. In these conditions, sun bears are known to make feeding forays from the forest to adjacent plantations, which provide rich, concentrated sources of food (e.g., palm oil fruit). In so doing, these bears are subjected to mortality risks. It is not known whether habitat manipulations in and around plantations could provide more security for sun bears seeking food in plantations and at the same time (1) not entice more hunting, (2) not increase agricultural losses (from sun bears and other species), and (3) not adversely affect other wildlife species.
Small-scale pilot projects will help to improve understanding of the costs and benefits of plantation regimes. Most present plantations are expansive, with ready access to people (including hunters) and little cover for bears. If a more bear-friendly design can be developed (including habitat manipulations and hunt-free zones), it could be promoted through a certification programme, so buyers could select products that have had less detrimental impacts on bears, and thereby put pressure on the industry to use more bear-friendly techniques. (Actions 6.1, 6.2, 6.3).

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
6.1	Examine regulations for plantations that relate to how bear-friendly they can be.	1-3 years	Students. Plantation managers.	2-3 research projects initiated	A few studies have investigated sun bear use of plantations. Some local action plans for other species (e.g. Bornean elephants). Effort by some larger plantation companies to implement high conservation value recommendations (e.g. riparian buffers, forested slopes, etc.). Sun bears are listed as one of the Rare, Threatened or Endangered (RTE) species in the RSPO certification process. Some studies on land sharing vs land sparing (Phalan et al. 2011). Some general studies of other species living in forest patches adjacent to plantations. General recognition of the potential benefits and problems with making plantations more attractive to wildlife.	Collation of existing plantation rules. Results from Objective 8. Brainstorming ideas, methods or approaches to improving safety of plantations for bears. Identified researchers/students. Dialogue with other species experts. Dialogue with plantation managers and certification bodies.
6.2	Implement small-scale pilot projects to test/ monitor methods for improving sun bear habitat in and near plantations while monitoring changes in hunting/poaching resulting from habitat improvements in and near plantations.	5 years	Students; NGOs; Plantation managers.	2-3 research projects initiated. Discussion with plantation managers initiated		
6.3	Provide recommendations for more bear-friendly habitat guidelines to agricultural (oil palm, pulpwood, etc.) certification bodies for inclusion in their standards and expand implementation and further testing (adaptive management).	5 years	Students; Academics working on remote sensing in range state countries; BSG; Local communities (eventually).	Discussion with plantation managers and certification bodies initiated.		

OBJECTIVE 7. RESTRICT ROAD AND OTHER INFRASTRUCTURE DEVELOPMENT INTO PRIORITY AREAS OF NATURAL SUN BEAR HABITAT AND MITIGATE EFFECTS OF EXISTING INFRASTRUCTURE

Rationale:
Collating information on all large scale development projects that could negatively impact sun bear habitat in each range state will help to identify projects with the greatest potential impact on sun bear habitat and those with the greatest potential for successful mitigation. (Action 7.1)
Communicating with relevant donors and stakeholders regarding the effects (or potential effects) of a proposed development project on sun bear habitat may result in the incorporation of suitable mitigation measures in the development plan, or may result in a reduced public or political support for the project and consideration of more sustainable alternatives. (Action 7.2)
Monitoring and evaluation of lobbying efforts will provide information on which strategies are most effective at restricting or mitigating development. This will inform future lobbying strategies in order to restrict development that negatively impacts sun bear habitat. (Action 7.3)
Infrastructure development diminishes and fragments sun bear habitat, threatening populations through habitat loss and degradation, and by increasing access for poachers. Assessing the impact of such infrastructure development.

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
7.1	Obtain all large scale development plans that could impact sun bear habitat in each range state.	1-2 years	IUCN; existing institutions and networks (ie, ALERT).	Existing networks identified and institutions connected with Information compiled and assessed in relation to bear conservation.	Road assessment and recommendations for mitigation, for some areas of Sabah (i.e. Abram et al. 2014; see also work by James Cook University in relation to the Pan-Borneo Highway and other roads and infrastructure development). Threat assessment for proposed roads in SE Asia (7 countries), based on threat to large mammals (in general, not bear specific) (Clements et al 2014). Publications about road and infrastructure plans from World Bank and Asian Development Bank. Other species of conservation importance (e.g. Tigers) sharing habitat with sun bear, with which to leverage further support. Some studies on the efficacy of mitigation measures (e.g. Road signs as a deterrent to encroachment: Mahfuzatul Izyan, University Malaysia Terengganu).	Connection to existing networks and institutions working on advocacy regarding infrastructure and roads (ie, ALERT Network at Univ Queensland). Documentation of all current and planned major infrastructure projects that may affect forested habitats in sun bear range. List of priority areas of natural sun bear habitat (Objective 9).
7.2	Communicate with relevant donors and stakeholders regarding the effects of proposed development projects on sun bear habitat and lobby stakeholders to restrict development in target areas of sun bear habitat.	2-3 years	IUCN; Existing institutions and networks (i.e., ALERT).	Mitigation measures incorporated into development plans Potentially destructive development projects avoided.		A process to engage policy makers. A link to policy at national and regional scale. Connection to existing networks and institutions working on advocacy regarding infrastructure and roads (ie, ALERT Network at Univ Queensland). Results from Objective 9.
7.3	Monitor and evaluate strategies for reducing impacts of infrastructure development on sun bear habitat to determine which are most effective and why.	5 years	IUCN; Existing institutions and networks.	Information compiled and assessed in relation to bear conservation. Compilation of previous lobbying experiences.		Evaluation of what works and what does not work, in previous lobbying efforts to curtail infrastructure. Assessment of effectiveness of various mitigation measures.
7.4	Assess the impacts of infrastructure development on sun bears and evaluate the efficacy of current mitigation measures in order to inform development of more effective mitigation measures (e.g., increased checkpoints, speed breakers, road signage, etc.) in consultation with the development companies/operators.	5 years	BSG; Existing institutions and networks.	The impact on sun bears of several development projects is assessed and reported.		Some quantified measure of the effects of various kinds of infrastructure projects on sun bear populations.

OBJECTIVE 8. IMPROVE UNDERSTANDING OF WHAT CONSTITUTES HIGH QUALITY SUN BEAR HABITAT, AND HOW VARIOUS HABITAT COMPONENTS AFFECT SUN BEAR POPULATIONS

Rationale:
Sun bears rely on forests, but factors influencing the quality of forests for sun bears are not well understood (e.g., forest age and density, forest type, understory, patch size and shape, disturbance, human access). It is also not clearly understood how various configurations of forest and agriculture, or forest and plantation, affect sun bear occurrence, density, survival and reproduction. Answering these questions will help to conserve bears by (1) revealing the extent to which different types of land use change can be expected to impact bear populations, and (2) informing land use plans or agricultural development plans to protect and improve habitat for sun bears. (Actions 8.1, 8.2)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
8.1	Gather existing relevant information from published and unpublished sources regarding the sun bear's use of various natural and altered habitats.	1-3 years	NGOs/Institutes working on sun bears; Students	Review paper on what is known about sun bear habitat quality in different parts of the range.	A few existing studies about sun bear habitat use, behaviour, and feeding ecology, within different types of forests and at forest-plantation edges.	Compilation and critical evaluation of current data.
8.2	Conduct research to fill gaps in information about assessing the quality of sun bear habitat, and defining highest quality sun bear habitats.	10	BSG; NGOs; Universities	Long term field projects implemented. Published papers on sun bear habitat use. Recommendations for highest quality sun bear habitats.	Some existing information, some on-going studies, and some field-tested techniques for assessing habitat quality.	Hypotheses and predictions (based on current knowledge). Long term field projects to understand demographic effects of different habitats and habitat components. A network of people to conduct studies over broad area with varying conditions.

Oil palm and mining in North Sumatra.
Credit: Nanang Sujana

OBJECTIVE 9. PRIORITISE SITES FOR THE CONSERVATION OF SUN BEARS, AND ESTABLISH CONSERVATION TARGETS

Rationale:

Sun bears occur in a range of landscapes that vary in habitat quality, size, protected status, physical geography, human threats and disturbance, sun bear population density, etc. Their occurrence and status in parts of their range is uncertain (Fig. 1), due to lack of confirmed presence data and uncertainty about the quality of habitats and degree of threats in areas without presence data. Improved knowledge of where sun bears exist (Action 9.1) would enhance the targeting of conservation actions and allow for measuring effectiveness of those actions.

A set of criteria with which to objectively assess sites would facilitate their prioritisation and the allocation of resources. (Action 9.2). In order to make recommendations for protecting more forests for sun bears, we need to know where sun bears are present, what areas are currently protected and determine how much of the sun bear's distribution falls within designated protected areas. (Action 9.1 and 9.3)

Sun bears occur in habitats used by other species of high conservation priority (e.g. tigers, elephants, orangutans) in some portions of their range. Sun bear conservation may benefit from the resources allocated to areas with other high priority species (e.g., anti-poaching), thereby freeing resources for other places important for sun bears but ignored by other conservation projects. (Action 9.4)

Sun bears exist in different habitats, of different quality, with different threats, and different levels of protection. Some areas warrant or need more attention than others in terms of restoring this species. Highest priority sites need to be identified, and targets established for conserving them. (Action 9.5)

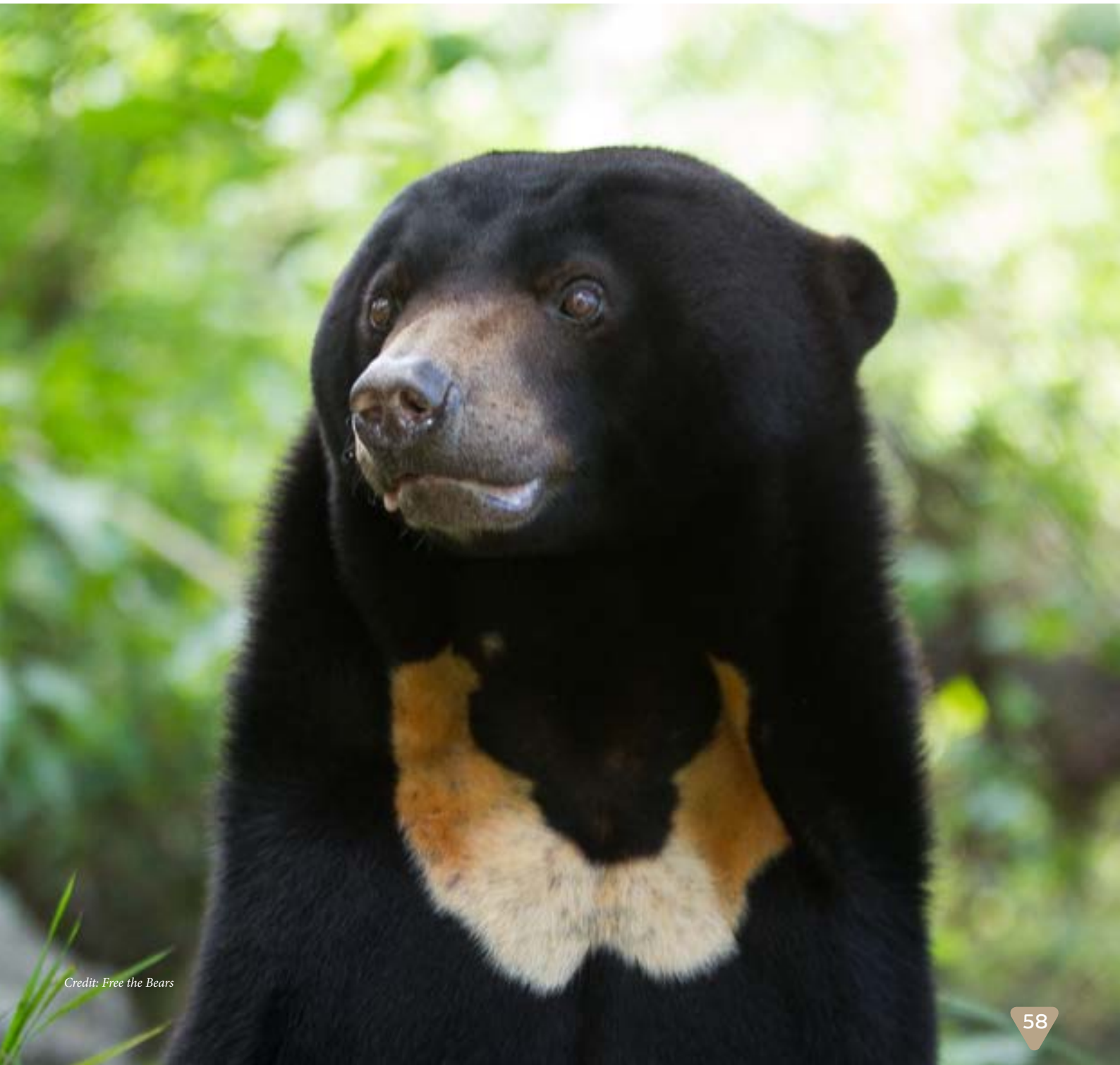
No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
9.1	Identify where sun bear populations exist.	1-2 years	Students; Academics working in range state countries; BSG; NGOs, Protected Area staff	Reduction in the area of uncertain distribution (possible range, Fig. 1). More presence points of sun bears, and greater certainty in extrapolating sun bear range from presence data.	General range map for sun bears, including areas of uncertain distribution. Some site-based assessments of sun bear population status. Methods for rapidly assessing bear presence (Interview surveys, sign surveys, camera traps).	Funding, human resources.
9.2	Develop criteria for the prioritisation of sites in terms of importance for conservation of sun bears.	1-2 years	BSG; NGOs; IUCN	Criteria developed (and published) and applied across the sun bear's range.	General range map for sun bears Some site-based assessments of sun bear population status. Some information available on the size, location and status of protected areas (www.protectedplanet.net; opendevelopmentcambodia.net/) Some information on habitat quality.	A better understanding of status of individual sun bear populations. A better understanding of threats impacting individual sun bear populations. A better understanding of habitat connectivity (Objective 10). A better understanding of how habitat quality impacts sun bear populations. More site-based assessments of sun bear populations.
9.3	Quantify and map protected forests and how they overlap with current sun bear distribution.	3 years	Student; Free the Bears	Information compiled.	Some data on protected areas freely available (www.protectedplanet.net; opendevelopmentcambodia.net/). IUCN Species Range Map.	Better understanding of the occurrence and status of sun bear populations which are uncertain (Probably Extant) in portions of its range.
9.4	Identify portions of sun bear range overlapping with existing action plans and ongoing conservation actions for other species.	1 year	MSc/PhD Student; consultant/contractor	Information compiled.	Existing action plans for other species. Ongoing conservation actions directed at other species within the range of sun bears.	Dedicated person to collate available data. Establishment of network with conservationists working on other species in sun bear range.
9.5	Identify priority areas that are most important to protect sun bears and establish targets for their protection.	2 years	Relevant NGOs; Government departments; Local stockholders; BSG	3-5 priority sites per range state (except Brunei and China) chosen at which to focus efforts to reduce threats and improve conservation status.	Some existing information on threats (logging, conversion to plantations, poaching, small populations fragmented), but rarely quantified or specific to individual populations. Existing information about current levels of habitat protection. Knowledge of responsible parties regarding enforcement.	Better information on site-specific threats. Better information on current status of individual populations. Protocols for setting priorities to conserve sun bears. Establishment of a network of conservation organisations working in SE Asia

OBJECTIVE 10. RECONNECT SMALL ISOLATED SUN BEAR POPULATIONS WITH HABITAT CORRIDORS

Rationale:
Small populations are more likely to be extirpated, either due to over-hunting or to stochastic events; keeping them connected increases likelihood of persistence, allows for rescue of declining populations through immigration, and promotes long-term genetic interchange. (Action 10.1).
Corridors connecting core areas will promote persistence of sun bears in regions where their forested habitat is fragmented. Presently we do not know where such potential corridors are already being used by sun bears. There may be degraded habitats, or narrow swaths of forest that are used by sun bears, and could be protected so as to prevent them from being destroyed. (Action 10.2)
The efficacy and feasibility of corridors connecting core sun bear populations varies across the range in relation to the habitat, land use, human density in the corridor, size and distance between core areas, threats to the core areas, and political will to protect and possibly enhance the corridor. Prioritising the need for corridors based on threats, presence of roads, human settlements, plantations, sun bear population size, likelihood of success, etc., will inform the allocation of resources. (Action 10.3)
Before generalising to a large-scale, there is a need to test corridors on a small-scale, to make sure all attributes are considered. This will involve establishing test sites with appropriate monitoring. Implementation of small-scale corridor development projects will provide the evidence on which to base recommendations for large-scale projects to increase the connectivity and this demographic resilience of sun bear populations. (Action 10.4)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
10.1	Identify where habitat corridors are needed to connect small isolated sun bear populations.	2 years	Students; Academics working on remote sensing in range state countries; BSG; Local communities (eventually).	Identification of priority corridors. 1-2 corridor projects initiated.	Fine-scale forest cover maps for range countries. LiDAR and Landsat data. A few studies of sun bear habitat patches (Nazeri et al. (2012) in Peninsular Malaysia). Studies of other bear species that have been shown to use corridors connecting core areas. Studies of other species (e.g. Elephants in Sabah; Banteng in Borneo; Brodie et al. (2015). Evaluating multispecies landscape connectivity). Existing methodologies and tools (e.g. Linkage Mapper).	A desk study of the locations of sun bear core areas, habitat patches and potential corridors. Synthesis of expert knowledge (in BSG) to identify potentially important corridors. Compilation of lessons learned from other corridor projects in the region (i.e. Kinabatangan area in Sabah; Pench corridor in India; Terai community forest corridors in Nepal; others).
10.2	Examine sun bear use of already existing potential corridors or degraded habitats between forest patches.	2 years	Students; Academics working on remote sensing in range state countries; BSG; Local communities (eventually).	Identification of priority corridors. 1-2 corridor projects initiated.	Fine-scale forest cover maps for range countries. A few studies of sun bear habitat patches (Nazeri et al. (2012), in Peninsular Malaysia). General knowledge of habitats used by sun bears (from sign surveys and camera trapping). Existing data from camera trapping on occurrence of sun bears. Studies of other species (e.g. Elephants in Sabah; Banteng in Borneo; Brodie et al. (2015) Evaluating multispecies landscape connectivity).	A desk study of the locations of sun bear habitat patches and corridors. Synthesis of expert knowledge (in BSG) to identify potentially important corridors. Identification of lessons learned from other corridor projects in the region (i.e., Kinabatangan area in Sabah; Pench corridor in India; Terai community forest corridors in Nepal; others). Compilation of existing data for evidence of use of areas by sun bears (plus results of Action 9.1). Genetic studies to examine connectivity of sun bear populations.
10.3	Prioritise need for corridors based on sun bear population status, threats, conservation value, feasibility, etc.	2 years	Students; Academics working on remote sensing in range state countries; BSG; Local communities (eventually).	Identification of priority corridors.	Fine-scale forest cover maps for range countries. A few studies of sun bear habitat patches (Nazeri et al. (2012) in Peninsular Malaysia). Existing data from camera trapping on occurrence of sun bears. Information on wildlife corridor efforts already initiated for other species (e.g. elephants, tigers). LiDAR and Landsat data. Studies of other species (e.g. Elephants in Sabah; Banteng in Borneo; Brodie et al. (2015) Evaluating multispecies landscape connectivity). Existing methodologies .	Synthesis of expert knowledge (in BSG) to identify potentially important corridors. Agreed prioritisation approach to designate which corridors are most important. Dialogue with government authorities about potential importance of corridors. Results of 9.1.

OBJECTIVE 10. Cont. RECONNECT SMALL ISOLATED SUN BEAR POPULATIONS WITH HABITAT CORRIDORS						
No.	**Action**	**Priority**	**Responsibility**	**Indicators of progress**	**What we have**	**What we need**
10.4	Consult with stakeholders to create site-specific spatial action plans; implement small-scale corridor development; and monitor sun bear use to inform recommendations for larger-scale implementation.	2 years	Students; Academics working on remote sensing in range state countries; BSG; Local communities (eventually).	1-2 corridor projects initiated.	Fine-scale forest cover maps for range countries. A few studies of sun bear habitat patches (Nazeri et al. (2012) in Peninsular Malaysia). Existing data from camera trapping on occurrence of sun bears. Potential to incorporate actions specific to sun bears into multi-species landscape plans.	A desk study of the locations of sun bear habitat patches and corridors Synthesis of expert knowledge (in BSG) to identify potentially important corridors. Agreed prioritisation approach to designate which corridors are most important. Identification of lessons learned from other corridor projects in the region (ie, Kinabatangan area in Sabah; Pench corridor in India; Terai community forest corridors in Nepal; others).



Credit: Free the Bears

GOAL 3. DEVISE AND EMPLOY METHODS TO RELIABLY MONITOR TRENDS IN SUN BEAR POPULATIONS

Ensuring that:

- population declines can be detected with sufficient time to enact conservation measures;
- population responses to conservation measures can be detected;
- countries implement monitoring of key populations, coordinated across the geographic range.

Sun bears at baited camera trap station allowing individual identification. Credit: Dusit Ngoprasert

GOAL 3. DEVISE AND EMPLOY METHODS TO RELIABLY MONITOR TRENDS IN SUN BEAR POPULATIONS

OBJECTIVE 11. DEVELOP PROTOCOLS FOR MONITORING TECHNIQUES THAT RELIABLY DETECT POPULATION CHANGES FOR SUN BEARS

Rationale:
Population trend estimates of sun bears tend to be based on the opinions of professionals, who may consider forest loss and poaching. Some monitoring also involves interviews with local people. Monitoring methods using quantifiable data, such as sign surveys and camera trapping, are becoming more common, but are not coordinated or conducted in a comparable manner across the range. More rigorous assessments of population change are needed to (1) target areas most in need of conservation interventions, and (2) assess and identify which interventions are most effective and efficient, thereby enabling management strategies to be adapted to benefit sun bear conservation. (Action 11.1, 11.2)
Southeast Asia is a global biodiversity hotspot with several species of conservation interest throughout the sun bear's range. Studies that utilise camera traps to monitor other species, or terrestrial biodiversity in general, may also detect sun bears as by-catch. Such by-catch data may be useful for monitoring sun bear population trends, thereby reducing the need for sun bear-specific surveys. (Action 11.3)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
11.1	Collect existing data to examine whether protocols can be established.	5 years	Brian Crudge, BSG; Bear Specialist Group; Students; Relevant NGOs/agencies; Universities and academics.	Most relevant data compiled and examined.	Numerous field projects in the region using various monitoring techniques, some using multiple techniques on the same area (e.g., camera trap surveys with and without individual identification of bears, bear sign surveys, interview-based surveys, collection of DNA from hair or scats). Remote-sensing data; forest loss data. Confiscation records. Surveys of expert opinion of changes in sun bear populations.	Dedicated person to collate available data for all range states. Understanding of what constitutes high quality sun bear habitat, and how various habitat components affect sun bear populations (Objective 8).
11.2	Establish test sites to compare various survey methods.	5 years	Brian Crudge, BSG; Bear Specialist Group; Students; Relevant NGOs/agencies; Universities and academics.	1-2 sites completed.	People with expertise in various types of survey methodology (local interviews, sign surveys, camera trapping, DNA, remote sensing).	Dedicated person to collate available data. Understanding of what constitutes high quality sun bear habitat, and how various habitat components affect sun bear populations (Objective 8).
11.3	Explore use of camera trap by-catch data for monitoring sun bears.	5 years	Brian Crudge, BSG; Bear Specialist Group; Students; Relevant NGOs/agencies; Universities and academics.	1-2 studies completed that investigate reliability and efficacy of camera trap data as a reflection of bear abundance/ occupancy. A network of camera trappers created.	Numerous field projects in the region using camera traps (though not focused on bears, they capture photos of bears).	Dedicated person to collate available data.

OBJECTIVE 12. IDENTIFY KEY AREAS WHERE SUN BEAR POPULATION MONITORING AND TRAINING ARE NEEDED

Rationale:

Sun bears are distributed throughout much of Southeast Asia but it is not feasible to monitor population trends throughout their entire range. Identification of key areas where it is most important/useful to monitor sun bear population trends will be more efficient and will inform the allocation of conservation resources. (Action 12.1)

Conducting monitoring surveys throughout the sun bear's range, at a scale and frequency necessary to evaluate and adapt management strategies, will require in-country capacity. Assessment of the capacity of relevant government agencies, university departments, and NGO's within each range state will identify potential collaborators and training needs for the implementation of a long-term monitoring programme. (Action 12.2)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
12.1	Identify areas where sun bear populations are likely declining or where conditions are changing.	5 years	Bear Specialist Group; Relevant NGOs/agencies; Universities and academics.	Key areas identified throughout sun bear range.	IUCN Red List Assessment range map with Extant and Probably Extant populations	Criteria for choosing and prioritising monitoring sites (Action 9.2).
12.2	Identify within each country the capacity to implement a monitoring programme.	5 years	Bear Specialist Group; Relevant NGOs/agencies; Universities and academics.	Capacity needs assessment conducted for 6 sun bear range states.	Expert opinions on key monitoring areas, based on poaching or habitat issues.	List of priority sites important for monitoring bear population trends (Actions 9.2 and 12.1). New partnerships with potential for long-term site-based monitoring. Training workshops (e.g. for long term camera trap projects) to build capacity in each country (Action 13.2).

OBJECTIVE 13. IMPLEMENT MONITORING PROGRAMMES AND EVALUATE RESULTS TO IDENTIFY WHERE CONSERVATION OF SUN BEARS IS SUCCEEDING AND WHERE IT IS NOT, AND WHY

Rationale:

Population trends of sun bears are unknown, which constrains conservation management. Implementation of a well-designed monitoring programme will enable us to evaluate the effectiveness of conservation interventions such as wildlife law enforcement, livelihood development etc., and identify and replicate the most effective management strategies. (Action 13.1, 13.2)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
13.1	Provide recommended monitoring protocols to each range country.	5 – 10 years	Bear Specialist Group; Relevant NGOs/agencies; Universities and academics; Range state governments	Site based monitoring of sun bear population trends underway.	Some existing field projects and interested stakeholders in range states. Results of sign surveys, camera trapping, and local interviews in some areas (i.e., baseline data). Spatial Monitoring and Reporting Tool (SMART) conservation tool in use in some sun bear habitats, to monitor the threats. Can provide data that can help us understand what is influencing sun bear population trends.	Monitoring protocols (Objective 11). Repeated surveys over many years. List of priority sites important for monitoring bear population trends (Objective 12). Identify new partnerships with potential for long-term site-based monitoring.
13.2	Increase capacity for monitoring through training workshops.	5 – 10 years	Bear Specialist Group; Relevant NGOs	Range countries can conduct their own surveys.	People with expertise in population monitoring. In-country staff interested in monitoring.	Data to make decisions about best monitoring protocols.

Credit: Free the Bears/Peter Yuen

GOAL 4. MAXIMISE THE CONTRIBUTION OF *EX SITU* SUN BEAR POPULATIONS TO CONSERVATION

Ensuring that:

- all *ex situ* sun bears are well cared for and contribute to, rather than detract from, the conservation of wild sun bear populations;
- the potential for *ex situ* populations to contribute to advocacy, awareness and education programmes, is realised;
- use of *ex situ* sun bears to restore or support wild populations is carried out in accordance with internationally-recognised best practices.

Expert care provided to rescued sun bear cub at the Cambodian Bear Sanctuary. Credit: Free the Bears

GOAL 4. MAXIMISE THE CONTRIBUTION OF *EX SITU* SUN BEAR POPULATIONS TO CONSERVATION

OBJECTIVE 14. IN RANGE COUNTRIES, ENSURE LEGISLATION PERTAINING TO KEEPING SUN BEARS IS CLEAR, UNAMBIGUOUS AND SUPPORTS EFFECTIVE LAW ENFORCEMENT

Rationale:
Sun bears are a protected species throughout their range and regulations exist regarding the conditions and circumstances under which sun bears can be kept in captivity. Despite this, large numbers of sun bears continue to be taken illegally from the wild and kept as pets (particularly cubs), status symbols, tourist attractions and occasionally for use in bile farms. This represents an ongoing threat to the conservation of the species.
Weak or poorly enforced legislation pertaining to keeping bears in captivity creates opportunities for laundering of wild-caught bears, may contribute to the black market trade, and impedes wildlife law enforcement. It is therefore necessary to address the issue of illegally held captive sun bears. Wherever possible efforts should be made to engage with other stakeholders such as United Nations Office on Drugs and Crime (UNODC), World Bank and bilateral aid programmes to incorporate sun bear positive reforms within broader reviews of local legislation. (Actions 14.1 – 14.5)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
14.1	Conduct a comprehensive review of all existing laws pertaining to keeping sun bears in captivity, in all range states.	1 year	Matt Hunt to source/ engage legal expert on a consultancy basis to work with existing networks – e.g. NGO network – to obtain existing laws and regulations.	List of relevant laws in all range states Existing strengths, weaknesses and loopholes identified.	Existing government and NGO connections and networks. Incomplete list of relevant legislation.	Qualified person to conduct review. Funds to carry out review.
14.2	Conduct baseline surveys of captive sun bear populations in range states, highlighting regulatory violations and gathering additional evidence from published and unpublished sources.	2-3 yrs	TRAFFIC	National level report on status of illegal and/or captive sun bears produced for all range states.	Existing and historical data for select countries (Cambodia, Laos, Vietnam, Malaysia). Skills in investigative surveys by TRAFFIC.	Funding support to conduct surveys of captive sun bear populations. Information on locations and numbers of captive sun bears in key countries (Indonesia, Myanmar).
14.3	Develop evidence-based recommendations for strengthening laws, regulations and enforcement with regard to captive sun bears.	10 years	TRAFFIC; Free the Bears; BSBCC	National level report on status of illegal and/or captive sun bears produced for all range states.	Technical support and experience from select stakeholders in identifying legal loopholes.	Legal expertise to draft legislative reform as required. Results from Action 14.2.
14.4	Secure commitments from range state governments to improve laws and enforcement pertaining to captive sun bears, where needed.	10 years	TRAFFIC or World Bank Environmental Protection Fund or other bilateral aid agencies.	Laws pertaining to captive sun bears are robust. Numbers of illegally-held captive bears shown to decline.	Cooperative links with select range country governments. Broad support from international community for strengthened wildlife law enforcement (e.g. IWT conferences, climate change reform).	Full cooperative links with the designated authorities throughout all range countries.
14.5	Assess existing captive sun bear facilities to ensure these are compliant with laws and introduce ongoing monitoring programmes.	10 years	National government agencies with support from Free the Bears/ AAF/WAP (or local NGO networks).	Government-approved audit of captive sun bears completed for each range state. Training workshops conducted for designated authorities in key countries. Ongoing monitoring programmes in place for all countries with captive sun bears.	Some existing monitoring taking place, and monitoring guidelines already developed for Asiatic black bears.	Relevant authorities lack training and resources required for ongoing monitoring of captive bears.

OBJECTIVE 15. IMPROVE THE QUALITY AND QUANTITY OF CONSERVATION-DIRECTED RESEARCH CONDUCTED USING *EX SITU* SUN BEARS

Rationale:

Sun bears are kept in *ex situ* environments by zoological institutes, government and non-government organisations, and by private individuals. They are held in facilities throughout their range, as well as in non-range states across Europe, North America, and Australasia. These bears are a valuable resource for research and are the focus of a growing number of research projects. However, often individual research projects do not contribute towards our collective understanding or to the conservation of sun bears, resulting in lost resources and the unfulfilled potential of the ex situ population. Conservation-directed research needs should be identified and given priority. (Actions 15.1 – 15.3) (See also Objective 19)

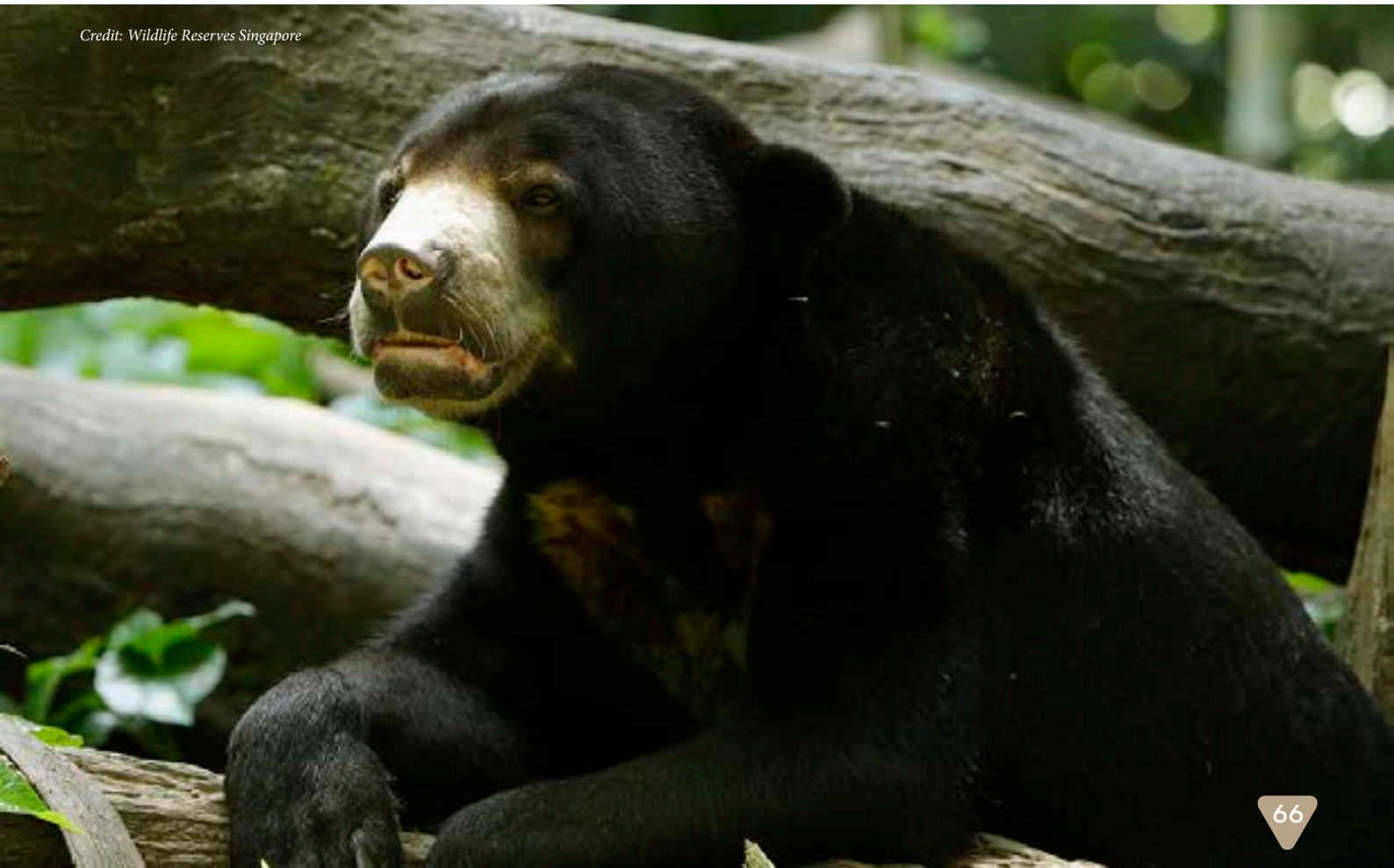
No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
15.1	Review past and current *ex situ* sun bear research projects to provide a baseline from which to identify conservation-relevant gaps and priorities.	1 years	Research consultant (Marion Schneider)	List compiled, including abstracts or summaries (in English).	Extant published literature. Resources for accessing published literature (e.g. Google Scholar, Web of Science).	Overview of grey literature and research projects underway but not yet published.
15.2	Identify, assess the feasibility of, and prioritise, conservation -directed research needs for *ex situ* sun bears.	1-2 years	Marion Schneider, Lydia Kolter, Kirsty Officer, Dave Garshelis, Brian Crudge, Siew Te Wong, AAF research rep., San Diego Zoo Global (SDZG), BSG Captive Bears Expert Team.	Effective feasibility assessment method developed. A working list of priority research questions and potential projects and how they might be carried out.	Contacts in *ex situ* programmes. Contacts within academia and *in situ* community. A working list of questions which can be answered by *ex situ* sun bear research. Extant model for assessing project feasibility for other ursids/taxa. Some collaboration between *ex situ*, academia and field researchers.	Comprehensive list of sun bear related research projects (Action 15.1). Method to assess the feasibility of identified projects to ensure that projects are possible and aligned with resource availability.
15.3	Develop a formal network of academic institutions and captive care facilities willing to collaborate on applied research programmes to improve cooperation, reduce duplication and address agreed priorities.	5 years	Academic institutions; Sun bear field researchers; captive care facilities with sufficient resources to undertake research.	Working list of academics and field researchers. Central point of contact within the *ex situ* community for academics and field researchers. Formal meeting of interested parties to take place either before or during the planned 2nd International Symposium on Sun Bear Conservation & Management.	Contacts in *ex situ* sun bear programmes. Contacts within academia and field researchers.	List of academics and field researchers working in sun bear research and potentially interested in collaborating.

OBJECTIVE 16. ENSURE SUN BEAR RELEASE INITIATIVES ADHERE TO INTERNATIONALLY RECOGNISED GUIDELINES

Rationale:

Sun bears are kept in *ex situ* environments by zoological institutes, government and non-government organisations, and by private individuals. They are held in facilities throughout their range, as well as in non-range states across Europe, North America, and Australasia. These bears are a valuable resource for research and are the focus of a growing number of research projects. However, often individual research projects do not contribute towards our collective understanding or to the conservation of sun bears, resulting in lost resources and the unfulfilled potential of the *ex situ* population. Conservation-directed research needs should be identified and given priority. (Actions 15.1 – 15.3) (see also Objective 19)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
16.1	Develop methods for determining the conservation impact, and risk, of sun bear release projects.	5 years	Siew Te Wong/BSBCC (Sabah); SDZG; Wildlife Alliance (Cambodia); Malaysian Nature Society (Peninsular Malaysia); Free the Bears (Vietnam)	The successes, failures and impacts of sun bear releases are documented and results are available.	*Ex situ* sun bear population. Documented previous experience with sun bear release. Existing IUCN Guidelines for reintroduction and other conservation.	Method of measuring the conservation, social and welfare impact of release strategies. Guidelines and results for release from all facilities which have released sun bears.
16.2	Develop and publish guidelines for sun bear releases to provide advice on when and how to conduct a release project, and how to monitor, evaluate, adapt and where necessary terminate it.	5 years	Siew Te Wong/BSBCC (Sabah); SDZG, Wildlife Alliance (Cambodia); Malaysian Nature Society (Peninsular Malaysia); Bear Specialist Group members	Guidelines are produced and published.	Documented previous experience with sun bear release. Guidelines for the release of other bear species. Guidelines for the release of other taxa.	Information on the ontogeny of the species to help form guidelines. Published information on disease risks. Effective monitoring of releases. Information on the conservation, social and welfare impact of sun bear release. Methods for determining the impact of sun bear release on conservation (Action 16.1). Information on range-state regulations to ensure that release guidelines consider local regulatory compliance.



Credit: Wildlife Reserves Singapore

OBJECTIVE 17. INCREASE EFFICIENCIES WITHIN *EX SITU* PROGRAMMES

Rationale:

Existing regionally-managed breeding programmes for sun bears are not sustainable in isolation and are not fulfilling their conservation potential. Clearly defining regional roles and priorities, and improving coordination and cooperation between key programmes (e.g. AZA, EAZA, SEAZA, ZAA and JAZA), will be essential for the long-term success of the *ex situ* population in meeting conservation goals. (Actions 17.1, 17.2)

Within range states there are no standardised welfare programmes and little communication and collaboration between facilities housing sun bears, which may result in inefficiencies and lost resources, for example when establishing new rescue centres. (Action 17.3)

Ex situ sun bears are accessible sources of education and communication. Awareness of sun bears and their conservation is low. Increased awareness may lead to increased financial and political support of conservation of sun bears. (Action 17.4) (See also Objective 19)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
17.1	Clearly define roles and priorities of the regionally managed programmes for sun bears.	1 year	Kay Bradfield (Clive Barwick/Lydia Kolter EAZA; Gaylene Thomas – AZA Bear TAG).	International Studbook for sun bears is established. Improved long-term population viability via increased gene-flow between regions.	Appointed regional programme managers . Long history of successfully maintaining the species. Wide pool of skills sets available within the global zoo community (captive husbandry, population management, veterinary science).	Agreed plan to encompass the population of sun bears within regionally-managed populations. Increased commitment for a long-term strategy to maintain sun bears as a flagship species for Southeast Asian wildlife/ wildlife trade/tropical forest lost/unique ecological/ fundraising values.
17.2	Evaluate, agree and implement the best format for international collaborative programmes for captive sun bears.	5 years	Kay Bradfield (Clive Barwick/Lydia Kolter EAZA, Gaylene Thomas – AZA Bear TAG).	1st International Studbook for sun bears approved and published.	Established regional studbooks for key regions.	Links with SEAZA and range-state sanctuaries/ rescue centres are not formally established.
17.3	Build on existing collaborative networks to improve best practice sharing between sanctuaries, rescue centres, and good zoos.	2 years	All *ex situ* sun bear managers in range countries (including head keepers, vets, etc.).	Increased communication and cross knowledge about other rescue centre practices and projects.	Existing formal networks (eg. WARN, SEAZA) and informal networks (eg. Vietnam Bear Working Group). Existing link between range-state facilities and *ex situ* managed breeding programmes .	Funding for regional workshops and symposia. Online hub or social networks to improve communication and information sharing.
17.4	Utilise *ex situ* facilities to provide information about sun bear ecology, populations, threats, and conservation measures.	1 year (and then indefinitely)	All *ex situ* sun bear centres in range countries.	Increased positive values and attitudes towards sun bears.	*Ex situ* sun bear populations. Captive audience. Charismatic species.	Understanding of the educational messages that will resonate among the public.

GOAL 5. INCREASE CROSS-SECTORAL SUPPORT AND COLLABORATION FOR SUN BEAR CONSERVATION

Ensuring that:

- population status, distribution, habitat needs, biology, ecology and taxonomy are well understood by all relevant stakeholders;
- mechanisms for inter-agency collaboration and data sharing are in place;
- the potential for conservation-related research involving *ex situ* sun bears, field programmes and academic institutions is realised efficiently and effectively.

Ex situ student research at the Cambodian Bear Sanctuary. Credit: Free the Bears

GOAL 5. INCREASE CROSS-SECTORAL SUPPORT AND COLLABORATION FOR SUN BEAR CONSERVATION

OBJECTIVE 18. RAISE AWARENESS OF SUN BEAR CONSERVATION NEEDS AND THE ROLES THAT CAN BE PLAYED BY INDIVIDUALS, SOCIETY, AND THE PRIVATE SECTOR

Rationale:

Lack of information communicated to the media about actions undertaken by sun bear conservationists is leading to a lack of awareness about sun bear conservation among the general public which may be contributing to negative conservation values, attitudes, and behaviours. (Action 18.1)

Industry is affecting sun bear populations, often negatively, so it's necessary to understand the motivations driving the behaviours that negatively affect sun bears. Lack of knowledge and information about sun bear conservation may be contributing to social, cultural and personal acceptability of using bears, their parts and products, which in turn contributes to continued poaching and trade of sun bears. (Action 18.2)

The continued widespread and sometimes open hunting, trade and use of sun bears is, in part, enabled by societal apathy and lack of political will. Personal and social changes are required to ensure that the cruel, unsustainable and illegal behaviours of others towards sun bears are no longer acceptable nor tolerated. (Action 18.3)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
18.1	Engage with media to raise the profile of sun bear conservation.	1 year (then indefinitely)	All managers of sun bear-conservation-focused organisations.	Increased press and media coverage of sun bears in local and international media. Increased conservation-positive values, attitudes, and behaviours in the public for sun bears and their welfare measured by evaluative methods.	Engaging stories; engaging individuals. Baseline data on values, attitudes, and behaviours.	Agreed plan to encompass the population of sun bears within regionally-managed populations. Increased commitment for a long-term strategy to maintain sun bears as a flagship species for Southeast Asian wildlife/wildlife trade/tropical forest lost/unique ecological/fundraising values.
18.2	Engage with industry, e.g. transport sector, Traditional Medicine community, logging and plantation companies, to increase the effectiveness of sun bear conservation efforts.	1 year (then indefinitely)	All managers of sun bear conservation-focused organisations.	Increase in policy statements, mitigation measure and concessions related to sun bears.	Baseline data from Vietnam about TM practitioner beliefs and behaviours. Positive relationships between TM practitioners and certain sun bear conservation organisations in Vietnam.	Links with SEAZA and range-state sanctuaries/rescue centres are not formally established
18.3	Engage with private sector and social influencers to ensure the use of sun bears, their parts and products is no longer considered socially, personally, or culturally acceptable.	5 years	Animals Asia; ENV; Free the Bears; All Zoos; Rescue Centres.	Increased publicity. Pledges/commitments made by private sector and social influencers.	Partnerships with private sectors and social influencers to carry communication messages. Charismatic species. Information to justify communication messages. Rescue centres as platforms.	More information about trade routes, key consumers, effective social change campaign methods. Funds. Human Resources.

OBJECTIVE 19. INCREASE EFFICIENCIES IN SUN BEAR CONSERVATION RESEARCH

Rationale:

The need for research and conservation of sun bears is urgent, but resources are limited. To make sure that we aren't duplicating efforts and maximising collaboration and communication between existing projects it is necessary to explore methods of facilitating academic research on identified priority projects which would contribute to the conservation of sun bears. (Action 19.1, 19.2) (See also Objectives 15 and 17)

No.	Action	Priority	Responsibility	Indicators of progress	What we have	What we need
19.1	Identify priority *in situ* and *ex situ* research projects which would contribute to sun bear conservation.	1 year	Bear Specialist Group, Captive Bears Expert Team	10 – 20 priority projects identified, described and disseminated.	Relevant BSG Expert Teams. Cursory list of previous projects.	Review of past and current *ex situ* sun bear research projects (Action 15.1).
19.2	Explore methods of facilitating research on identified priority projects which would contribute to sun bear conservation.	1 year (and then indefinitely)	Research managers at sun bear-oriented centres	Communication and collaboration between geographically-close projects. Research students finding their research subjects/areas/ supervisors with minimal communication and time.	Current academic projects. Map of sun bear related projects (Figure 2).	A collaborative network of projects.

Sun bear at rest. Credit: BSBCC/Seng Yen Wah

SECTION 4

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Sun bear mosaic. Credit: Free the Bears

APPENDIX I. PLANNING PARTICIPANTS

Table 1. Sun Bear Expert Team of the IUCN SSC Bear Specialist Group

Surname	First Name	Affiliation
Fredriksson	Gabriella	PanEco/Pro Natura Foundation
Steinmetz	Rob	WWF-Thailand
Augeri	Dave	Colorado State University
Bendixsen	Tuan	Animals Asia Foundation, Vietnam Director
Choudhury	Anwaruddin	The Rhino Foundation for Nature in NE India
Crudge	Brian	Free the Bears
Galbreath	Gary	Northwestern University
Gaffi	Lorenzo	Istituto OIKOS Myanmar
Gomez	Lalita	TRAFFIC in Southeast Asia
Guharajan	Roshan	Leibniz Institute for Zoo and Wildlife Research
Htun	Saw	Wildlife Conservation Society, Deputy Country Program Director
Islam	Md. Anwarul	Department of Zoology, University of Dhaka, and Chief Executive, WildTeam
Long	Barney	Director, Species Conservation, Global Wildlife Conservation
Ngoprasert	Dusit	King Mongkut's University of Technology Thonburi
O'Connor	David	San Diego Zoo Institute for Conservation Research
Sethy	Janmejay	P.G.Department of Zoology, North Orissa University, Baripada
Shepherd	Chris	Monitor
Wong	Siew Te	Bornean Sun Bear Conservation Centre
Wong	Wai-Ming	Panthera

Table 2. Participants of the Sun Bear Action Planning Workshop

Surname	First Name	Affiliation
Abu Hashim	Abdul Kadir	PERHILITAN
Bach Thanh	Hai	Cat Tien National Park, Vietnam
Barwick	Clive	Colchester Zoo
Boonsanong	Sompong	Dept. of National Parks, Wildlife and Plant Conservation, Thailand
Chhin	Sophea	Mininstry of Environment, Cambodia
Chiew	Lin May	Bornean Sun Bear Conservation Centre (BSBCC)
Crudge	Brian	Free the Bears
Davis	Elizabeth	San Diego Zoo Global
Fredriksson	Gabriella	Sun Bear Expert Team
Gaffi	Lorenzo	Istituto Oikos
Garshelis	Dave	Minnesota Dept. Natural Resources/IUCN Bear Specialist Group
Gomez	Lalita	TRAFFIC in Southeast Asia
Guharajan	Roshan	Leibniz Institute for Zoo and Wildlife Research
Hunt	Matt	Free the Bears
Kolter	Lydia	AG Zoologischer Garten Koeln
Krishnasamy	Kanitha	TRAFFIC in Southeast Asia
Lees	Caroline	Conservation Planning Specialist Group
Officer	Kirsty	Free the Bears
Peov	Somanak	Ministry of Environment, Cambodia
Quine	Heidi	Vietnam Bear Rescue Centre, Animals Asia
Savath	Bounmy	Provincal Agriculture and Forestry Office, Lao PDR
Sethy	Janmejay	Amity University
Steinmetz	Robert	IUCN Bear Specialist Group
Tee	Thye Lim	Bornean Sun Bear Conservation Centre (BSBCC)
Thomas	Gaylene	San Diego Zoo
Tran Duc	Viet	Tam Dao National Park, Vietnam
Win	San Win	Nature and Wildlife Conservation Division, Forest Department, Myanmar

Table 3. Participants of the Sun Bear Symposium

Surname	First Name	Affiliation
Abu Hashim	Abdul Kadir	PERHILITAN
Bach Thanh	Hai	Cat Tien National Park, Vietnam
Barwick	Clive	Colchester Zoo
Beastall	Claire	TRAFFIC in Southeast Asia
bin Adnan	Muhammad Hafizuddin	Singapore Zoological Gardens
Boonsanong	Sompong	Department of National Parks, Wildlife and Plant Conservation, Thailand
Bouhuys	Jamie	TRAFFIC in Southeast Asia
Boyd	Alex	Kamo Wildlife Sanctuary
Bradfield	Kay	Perth Zoo
Chanthapanya	Keophounong	Dept. of Forest Inspection, Lao PDR
Chew	Jactty	Sunway University, Malaysia
Chhin	Sophea	Ministry of Environment, Cambodia
Chiew	Lin May	Bornean Sun Bear Conservation Centre
Chotiwatphongchai	Phasawat	Dept. of National Parks, Wildlife and Plant Conservation, Thailand
Chuon	Vuthy	Free the Bears
Crudge	Brian	Free the Bears
Davis	Elizabeth	San Diego Zoo Global (Institute for Conservation Research)
Day	Charlotte	N/A
Dunn	Jonathan	N/A
Elphinstone	Andrew	Taronga Conservation Society Australia
Fraser	Peter	Wellington Zoo Trust
Fredriksson	Gabriella	Sun Bear Expert Team
Gaffi	Lorenzo	Istituto Oikos
Ganang	Gloria	Bornean Sun Bear Conservation Centre
Garshelis	Dave	Minnesota Dept. Natural Resources/IUCN Bear Specialist Group
Gartland	Annette	Changing Times Media
Gomez	Lalita	TRAFFIC in Southeast Asia
Goossens	Benoit	Danau Girang Field Centre
Grady	Elizabeth	On behalf of Sun Bear Outreach
Gueli	Leonardo	Istituto Oikos
Guharajan	Roshan	Leibniz Institute for Zoo and Wildlife Research
Hasdi	Hasdi Hassan	PERHILITAN
Hassan	Nur Hazwani	TRAFFIC in Southeast Asia
Hunt	Matt	Free the Bears
Indenbaum	Rosa	TRAFFIC
Jailan	Thaqifah Syaza	Universiti Malaysia Sarawak (UNIMAS)
Kanapathy	Uma	TRAFFIC in Southeast Asia
Kolter	Lydia	AG Zoologischer Garten Koeln
Krishnasamy	Kanitha	TRAFFIC in Southeast Asia
Kumar	Anand	Singapore Zoological Gardens
Kunde	Miriam	Leibniz Institute for Zoo and Wildlife Research (IZW)
Lai	Wai Ling	Sunway University
Lees	Caroline	Conservation Planning Specialist Group
Lewis	Kate	Manchester Metropolitan University
Lim	Thona	Free the Bears
Loyma	Sutee	Dept. of National Parks, Wildlife and Plant Conservation, Thailand
Muis	Sumira	APE Malaysia
Narayanasamy	Sai Sanggkeeth	RIMBA

Surname	First Name	Affiliation
Newing	Luke	Perth Zoo
Ng	Wai Pak	Sunway University
Nguyen Van	Dien	Cat Tien National Park, Vietnam
Nguyen Van	Dung	Free the Bears
O'Dwyer	Jen	N/A
Officer	Kirsty	Free the Bears
Padgett	Jennifer	Free the Bears
Peake	Sheila	University of the Sunshine Coast
PEOV	SOMANAK	Ministry of Environment, Cambodia
Perumal	Balu	Malaysian Nature Society
Preap	Socheat	Forestry Administration, Cambodia
Pye	Sarah	University of the Sunshine Coast
Quine	Heidi	Vietnam Bear Rescue Centre, Animals Asia
Rahman	Shahriar Caesar	Creative Conservation Alliance
Ramirez	Diana	Sabah Wildlife Rescue
Ratnayeke	Shyamala	Sunway University
Romer	Elizabeth	Sydney Zoo
Rowe	Vanessa	Stay Wild
Ryan	Fiona	Melbourne Zoo
Sahu	Hemanta Kumar	North Orissa University, India
Savath	Bounmy	Provincial Agriculture and Forestry Office, Lao PDR
Schenk	Jarrod	Wildlife HQ (Queenslands Zoo)
Schneider	Marion	Cologne Zoo / Free the Bears
Scotson	Lorraine	N/A
Seng	Yen Wah	Bornean Sun Bear Conservation Centre
Sethy	Janmejay	Amity University
Sim	Sovannarun	Royal University of Phnom Penh
Sivayogam	Charina	Sunway University
Small	Lesley	Sumatran Sun Bear Team
Sophorn	Phan	Ministry of Environment, Cambodia
Sounyvong	Bounthan	Dept. of Forest Resource Management, Laos
Steinmetz	Robert	IUCN Bear Specialist Group
Strang	Kathryn	Stay Wild
Tee	Thye Lim	Bornean Sun Bear Conservation Centre
Thomas	Gaylene	San Diego Zoo
Thompson-Morrison	Hadee	Massey University
Tien Trung	Cao	Vinh University
Toombes	Rebecca	Wildlife HQ (Queenslands Zoo)
Topani	Rahmat	Wildlife dept. Malaysia
Tran Duc	Viet	Tam Dao National Park, Vietnam
Turnock	Suzanne	Borneo Nature Foundation
Vilarketh	Air	Dept. of Forest Inspection, Lao PDR
Wahab	Azhari	PERHILITAN
Weegenaar	Annemarie	Bears in Mind
Whiteman	John	San Diego Zoo Global (Institute for Conservation Research)
Win	San Win	Nature and Wildlife Conservation Division, Forest Department, Myanmar
Wong	Siew Te	Bornean Sun Bear Conservation Centre
Woo	Chee Yoong	University Malaysia Sarawak
Zawawi	Abdullah	PERHILITAN

APPENDIX II. SYMPOSIUM PROCEEDINGS

The 1st International Symposium on Sun Bear Conservation & Management was designed to capture the collective knowledge and expertise of those in attendance in order to inform the development of a range-wide conservation strategy. Group discussions and workshops were framed around specific SWOT Analyses in order to identify facts, assumptions and information gaps in current understanding. As well as the Strengths, Weaknesses, Opportunities and Threats (SWOT) associated with each topic.

The Proceedings of the 1st International Symposium on Sun Bear Conservation & Management contain the presentation abstracts as well as the unedited SWOT Analysis summaries for each workshop and panel discussion.

For more information see:

Crudge, B. (Ed.) 2018. Proceedings of the 1st International Symposium on Sun Bear Conservation & Management, Kuala Lumpur, Malaysia, September 2017. Free the Bears, Phnom Penh, Cambodia.

https://freethebears.org/pages/publications-press-resources

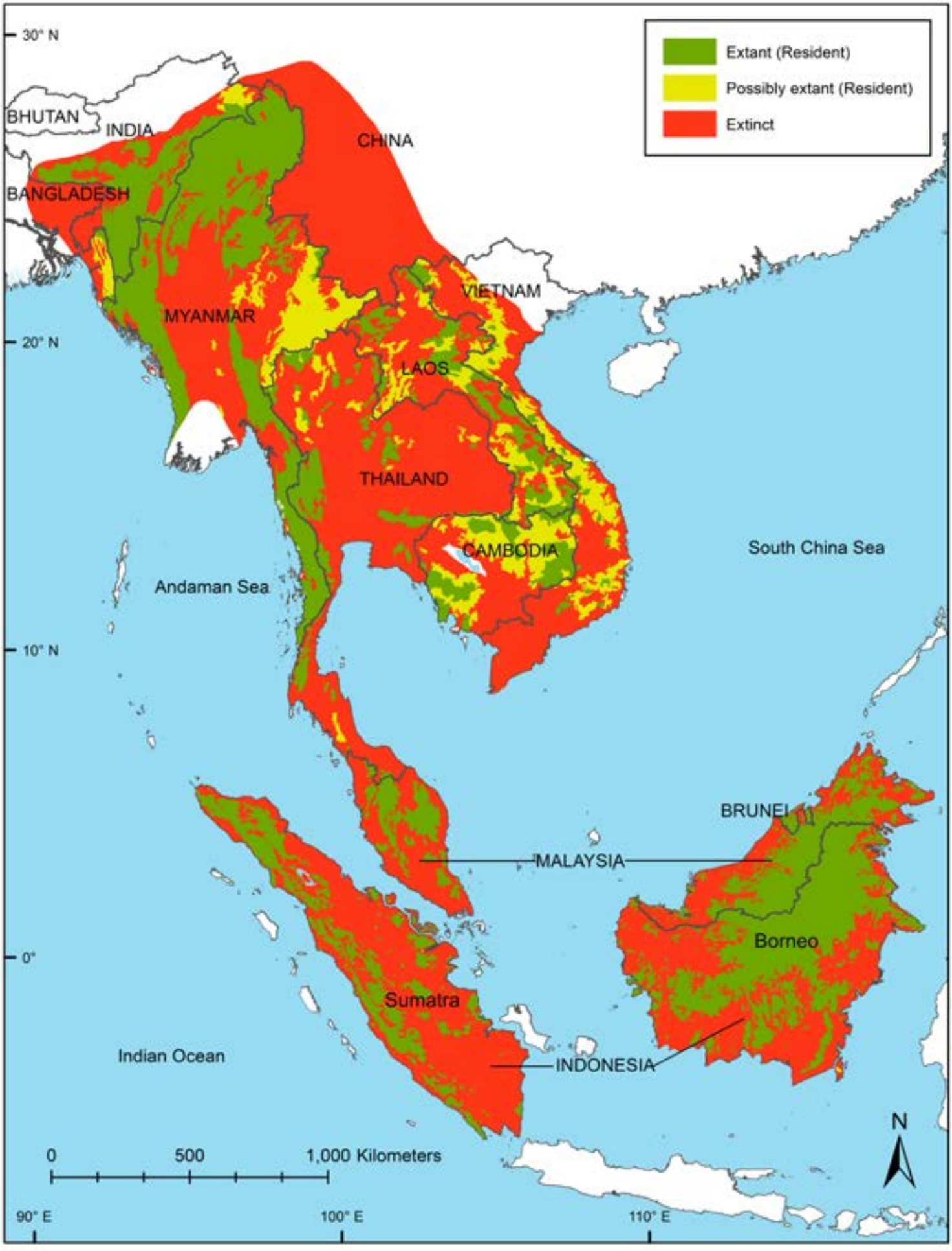
APPENDIX III. BEAR TRADE REGULATIONS IN SUN BEAR RANGE STATES (as of December 2017).

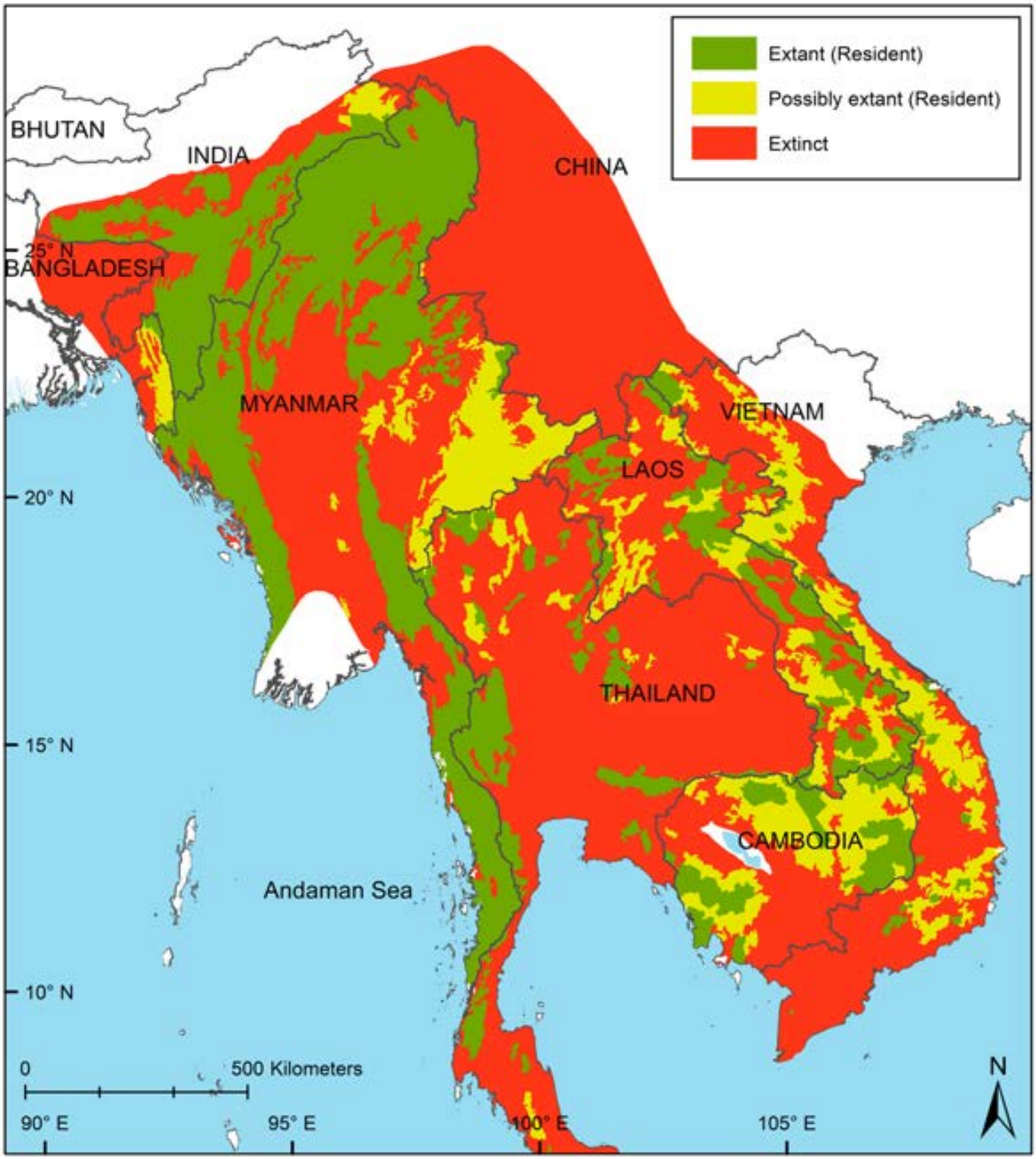
RANGE STATES	CURRENT TRADE DATA	LEGISLATION
Bangladesh	Specific trade data on Sun bears unknown	**Wildlife (Conservation and Security) Act, 2012** • Protected under Schedule IV - purchases, sells, imports or exports any wild animal or parts thereof, meat, trophy or any derivative thereof from any other person without license or permit • Imprisonment of up to 1yr or a fine of up to BDT50,000 (USD620) or both
Brunei	Specific trade data on Sun bears unknown	**Wild Life Protection Act (Laws of Brunei Chapter 102)** • Protected under First Schedule - the export of which is forbidden without a license • Imprisonment of 1yr and a fine of BND2,000 (USD1475)
Cambodia	• Recent seizures: July 2016, woman caught with bear gallbladders and paws which reportedly originated from Thailand. • A reported preference and willingness to pay more for the gallbladders of Sun bears than Asiatic black bears (Lim et al. 2017). • Highest number of bear-related seizures in Asia between 2000 and 2011-included live bears (mostly Sun bears), as well as bones, claws, teeth and paws (Burgess et al 2014). • Cross border trade - supply China and Viet Nam with 'wild sourced' products (Foley et al 2011). • Commonly poached for their gallbladders (i.e., bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy (Fredriksson et al 2008).	**Law of Forestry (2003)** • Protected as Rare on the Protected Species List (2007) – prohibited to possess, process, transport, import and engage in trade of listed species or their parts and derivatives. • Imprisonment of up to 5yrs and KHR10mil-100mil (USD2400-25,000)
China	• Recent seizures: Between 2000-2011, there were 145 seizure cases, involving an estimated minimum of 682 bears, mostly of skins, gallbladders, paws and bear bile products and derivatives (Burgess et al., 2014). • Bear bile trade is generally prevalent, significant consumer and producer country (Foley et al 2011). Much of this is suspected to originate from the Asiatic Black Bear. • Majority of trade is domestic and legal under Chinese Law; however, the biggest illicit source of bear bile products to countries around the world (Foley et al., 2011). • Also cross-border trade of bears from Lao PDR and Myanmar into China (Burgess et al., 2014). • Specific trade data on Sun bears unknown.	**Chinese Wild Animal Protection Law** • Illegal to hunt or capture wild bears for farming Regulation for the Implementation of the People's Republic of China on the Protection of Terrestrial Wildlife (1992) • Regulates the breeding of bears through licensing. Violations can result in revocation of the license, animals and fine of up to CNY3000 (USD456) • There is no legal farming of sun bears
India	• Recent seizures: September 2017, two arrested with 2 bear gallbladders; October 2017, in a joint operation conducted by the Assam forest department with the wildlife crime control bureau, a major international racket of smuggling animal parts was busted and at least 45 bear gallbladders were seized; August 2016, a huge consignment of animal parts was seized from the northeastern state of Assam, including a bear head and skin. • Poaching of bears, including Sun Bears for parts, meat and as pets (Sethy and Chauhan, 2011) • Trade of bear parts with China and Myanmar (Sethy and Chauhan 2011). • Specific trade data on Sun bears unknown	**The Wildlife (Protection) Act, 1972** • Scheduled I listed species – prohibits hunting or trade or commerce in trophies, animal articles, etc. derived from certain animals • Imprisonment between 1-7yrs and/or fines of up to INR25,000 (USD390)

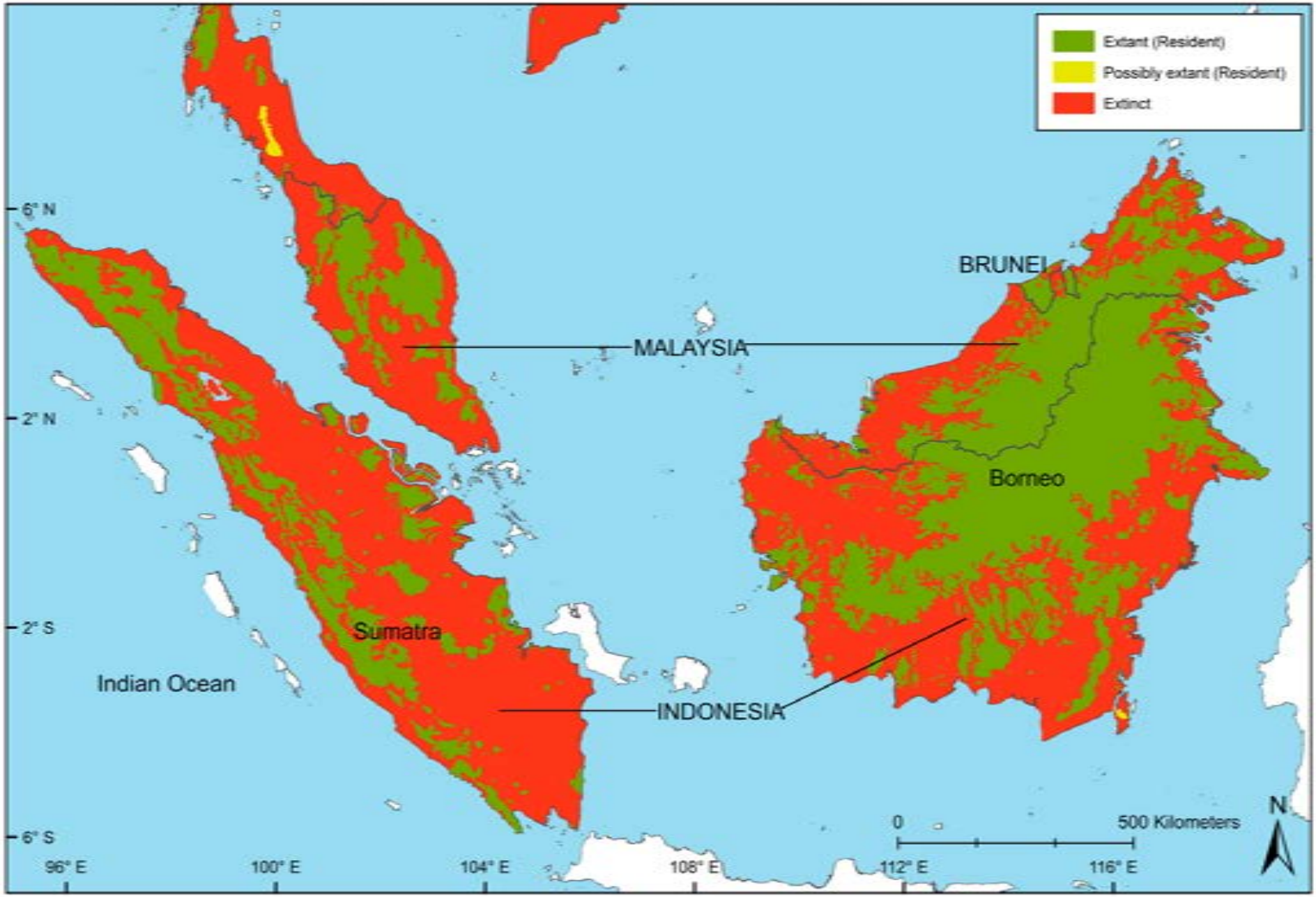
RANGE STATES	CURRENT TRADE DATA	LEGISLATION
Indonesia	• Recent seizures: July 2017, Indonesian authorities seized hundreds of bear bone fragments, over 1000 bear claws and 67 gallbladders in a single package from the Sultan Aji Muhammad Sulaiman airport in Balikpapan (East Kalimantan) heading to Viet Nam; April 2016, bear bones were seized from the home of a known wildlife trader in Riau, while bear teeth were found in the possession of a souvenir seller in West Kalimantan. • Unknown level of trade however i.e. current trends such hunting locations and methods, trade trends, national and international trade routes, destinations, availability, prices, turnover, enforcement, etc. • Widely hunted and traded for parts (bear skins, teeth, skull, claws), for consumption of its meat, for its bile and gallbladder prized in traditional medicine, and kept as pets • Evidence of illegal cross border trade i.e. export of bear bile products from Indonesia to Malaysia, Thailand and Singapore (Ng and Tan 2006; Burgess et al, 2014).	**Act of the Republic of Indonesia No.5 of 1990 concerning Conservation of Living Resources and their Ecosystems** • Protected species - not allowed to be caught, injured, killed, kept, possessed, cared for, transported, or traded whether alive or dead • Imprisonment for a maximum of five years and a fine of up to IDR100 million (USD7519) **Government Regulation No. 8, 1999 Concerning the utilization of wild plants and animals of this Act,** • Allows the trade of a Protected species if captive-bred-only second and subsequent generations
Lao PDR	• Recent seizures: September 2016, enforcement officers in Lao PDR seized bear limbs, gallbladders, claws, fur, teeth and bile from several roadside market stalls surrounding the city of Vang Vieng; at least 41 bear seizure/surrender records between 2010 and 2016 in which Lao PDR was indicated as either a source/ seizure, transit or destination country; involving seizures of live bears and parts including teeth, paws, claws, head, body, gallbladders and skins (Gomez and Shepherd, in prep). • Both the US and Viet Nam were implicated in the international trade of bears with Lao PDR in clear violation of CITES, in which the US was mostly a destination country for medicinal products and gallbladders, and Viet Nam a destination country for live bears and bear paws (Gomez and Shepherd, in prep). • Recent market survey in Lao PDR (2016), bear parts and derivatives were observed for sale in more than half of locations surveyed; at least nine different types of items sourced from bears were recorded mostly for traditional medicinal (packages of powder, bottles of fat/grease, bottles of pills, raw gallbladders and bottles of wine) followed by trophy/ornamental (teeth, claws, jaw and skins) purposes (Gomez and Shepherd, in prep). • Cross-border trade of bears (including cubs) and bear parts – Vietnam, China, Myanmar (Livingstone et al., in prep; Free the Bears, 2012; Livingstone and Shepherd, 2014) although not specific to Sun Bears. • In Myanmar, cross border sourced gallbladders were reported to be entirely from Lao PDR (Foley et al., 2011). • Commonly poached for their gallbladders (i.e. bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy (Fredriksson et al 2008). • Specific trade data on Sun bears unknown	**Wildlife and Aquatic Law, 2007** • Listed as Category 1 (Prohibition) Species - catching, hunting (including removal of carcasses, organs and parts), trading and possession of animals under this Category is prohibited unless authorized by the government for necessary circumstances e.g. educational research or breeding purposes. This Law also prohibits the trade of Category I species unless they are second or third generation captive-bred. The establishment of farms (for business purpose) is allowed for animals under the Prohibition Category upon authorisation by the Government following a recommendation made by the Ministry of Agriculture and Forestry. • Imprisonment of three months to five years depending on the crime or a penalty of approximately 'double the damage' (if this amounts to KIP200 000 and over, ~USD24) or triple for repeat offenders and/ or a prison sentence of between. • The law is being amended however to incorporate higher fines and criminal liability where lack of compliance with CITES is concerned
Malaysia	• Recent seizures: August 2017, officers stopped a Vietnamese national with over 200 suspected wildlife parts of protected species - included 188 pieces claws and 21 teeth belonging to Sun bears; in August 2016, dozens of bear parts including gallbladders, teeth and claws were found in a series of raids in Peninsular Malaysia while the Sabah Wildlife Department (East Malaysia) arrested four men and seized eight bear paws and other bear parts in two back-to-back cases. • Incidences of poaching/ snaring of Sun bears is high throughout the country – gallbladder and bile for traditional medicine, paws and meat, etc (Or et al., 2017; Krishnasamy and Or, 2014) • Between 2015 – July 2017 at least six cases have been reported involving an estimated minimum of 10 sun bears in east Malaysia (Sabah), all of them slaughtered for their parts (Or et al, 2017). • Emerging pet trade: seizure of cubs/ cubs offered for sale on FB (Krishnasamy & Stoner 2016) • Significant consumer, producer and source country (Foley et al 2011); TM products mostly imported from China. High local consumer demand for wild bear products e.g. gallbladder, bile, meat, etc. Domestic wild bears parts mostly sourced from Sabah and Sarawak. Imported bear parts e.g. gallbladder from China, Indonesia and Russia	**Wildlife Conservation Act, 2010** • Totally Protected • Imprisonment of not more than 10yrs and fines of up to MYR 300 000 (USD 70 000) **Sabah Wildlife Conservation Enactment 1997** • Totally Protected • imprisonment of between 1 – 5yrs and fines of between MYR 50 000 (USD 11 680) and MYR 250 000 (USD 58 400) **Sarawak Wild Life Protection Ordinance, 1998** • Protected •• Imprisonment of up to 1yr and fines of up to MYR 10 000 (USD 2336)

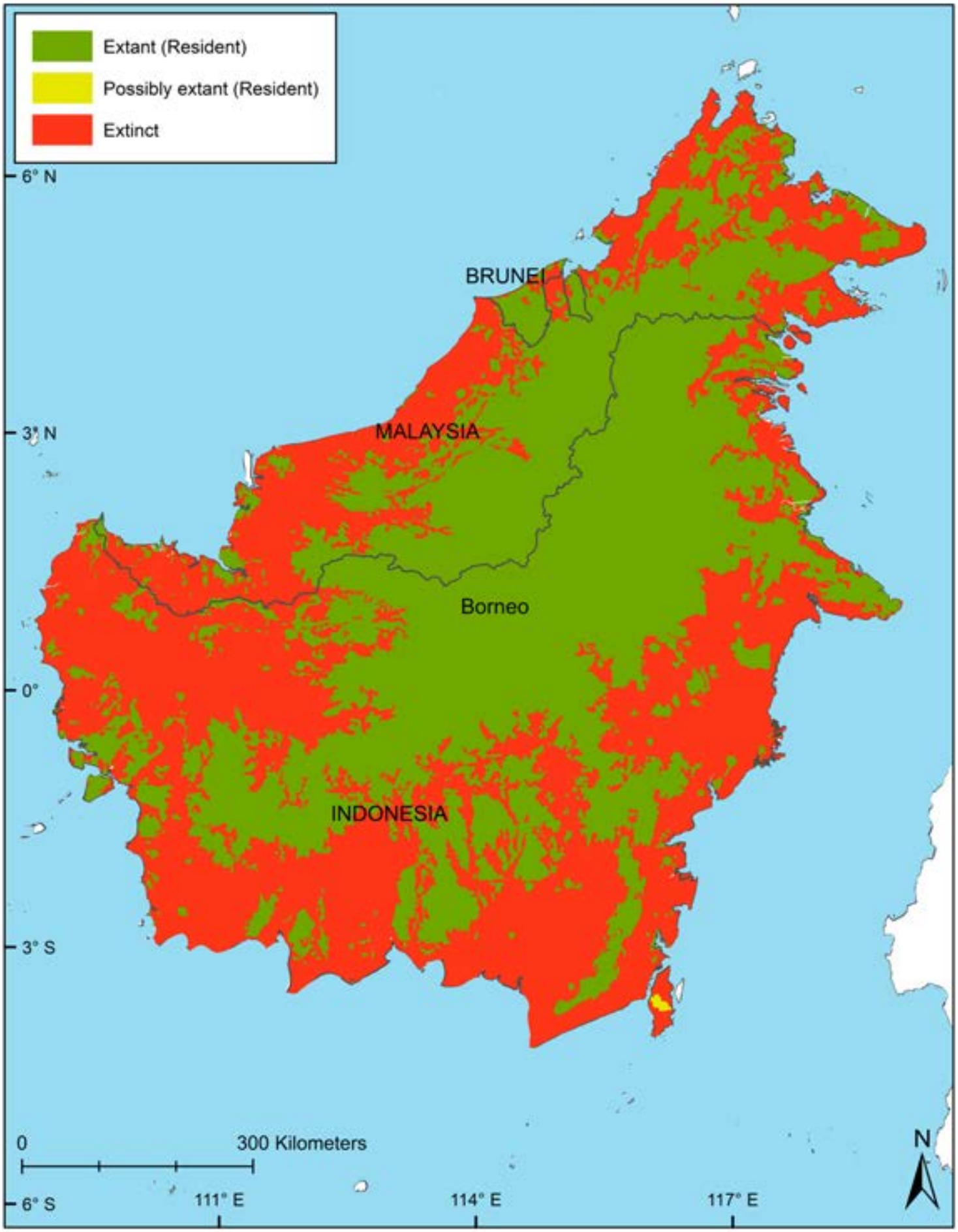
RANGE STATES	CURRENT TRADE DATA	LEGISLATION
Myanmar	• An increasing number of bears, particularly Asiatic Black Bears, are being killed for their bile, or to supply bear farms; the price of bear bile is relatively high compared to other products from bears such as claws, paws, teeth, and meat (BANCA, 2016). • From hunter interviews - the prime reason for poaching bears is to obtain the gallbladder so it can be sold to traders; although bear meat is often consumed when a bear is killed, more commercial valuable parts, including the gallbladder, paws, and skins, are to supply the demand from traders to Chinese nationals or Burmese of Chinese descent (Nijman et al 2017). • Some bear farms present with bears reportedly wild caught from China, Lao PDR and Myanmar (Foley et al 2011). • Mostly Asiatic Black bear observed in trade (Shepherd and Nijman 2007) • Cross border trade with China and Thailand, and Taiwan (Shepherd and Nijman 2007; BANCA, 2016); and Lao PDR (Foley et al 2011; Livingstone et al., in prep). • Commonly poached for their gallbladders (i.e., bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy (Fredriksson et al 2008).	**Protection of Wild Life and Wild Plants and Conservation of Natural Areas Law (1994)** • Totally Protected - illegal to hunt or sell Sun Bear and its parts • Imprisonment of up to 7yrs or a fine of up to USD1490
Thailand	• Seizures: Between 2000-2011, 29 seizures involving live bears and parts (e.g. paws, gallbladders, claws, skull) and derivatives - estimated to amount to over 50 bears (Burgess et al 2014); uncertain to what extent this involves Sun bears. • Thailand is primarily a consumer, bear bile products sourced from countries bordering Thailand (Foley et al 2011) • Commonly poached for their gallbladders (i.e., bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy (Fredriksson et al 2008). • Trade in bear gallbladder across border – Myanmar and China (Shepherd 2007)	**Wild Animal Reservation and Protection Act, 1992** • Protected – prohibits possession and trade • Imprisonment of up to 4 years and/or fines of up to THB40,000 (USD1200)
Viet Nam	• Recent seizures: June 2016, man arrested with 60kg of bear paws reportedly destined to China; July 2016, police in Thanh Hoa province seized 18 frozen bear legs that originated from Lao PDR; August and September 2016, two Sun bears seized respectively, kept as pets. • Sourcing of bears and bear parts from neighbouring countries to meet demand in Viet Nam e.g. Cambodia, Lao PDR and Thailand (although how much this involves Sun Bears is unclear) (Willcox et al 2016; Livingstone et al., in prep) • Trade in wild-sourced bear parts and bear gallbladder is lucrative in comparison to farmed bear products (Willcox et al 2016) • Bears are removed from the wild to stock or restock small farms (Fredriksson et al 2008; Animals Asia, 2017); both Sun bears and Asiatic black bears have been recorded in farms, although the latter is more common. • Consumer preference for wild caught bears; farms likely used to launder wild caught bears (Willcox et al 2016) • Commonly poached for their gallbladders (i.e., bile) and bear-paws; the former is used as a Traditional Chinese Medicine, and the latter as an expensive delicacy (Fredriksson et al 2008). • Specific trade data on Sun bears unknown	**Decree 32/2006/ND-CP** • Totally Protected - illegal to hunt, transport, keep, advertise, sell, purchase and consume either bear species or their parts and derivatives. • In 2006 - a government ban on live bile extraction • In 2017, the Vietnam Administration of Forestry and animal welfare group Animals Asia signed an MoU agreeing to rescue all remaining bears from Vietnamese farms

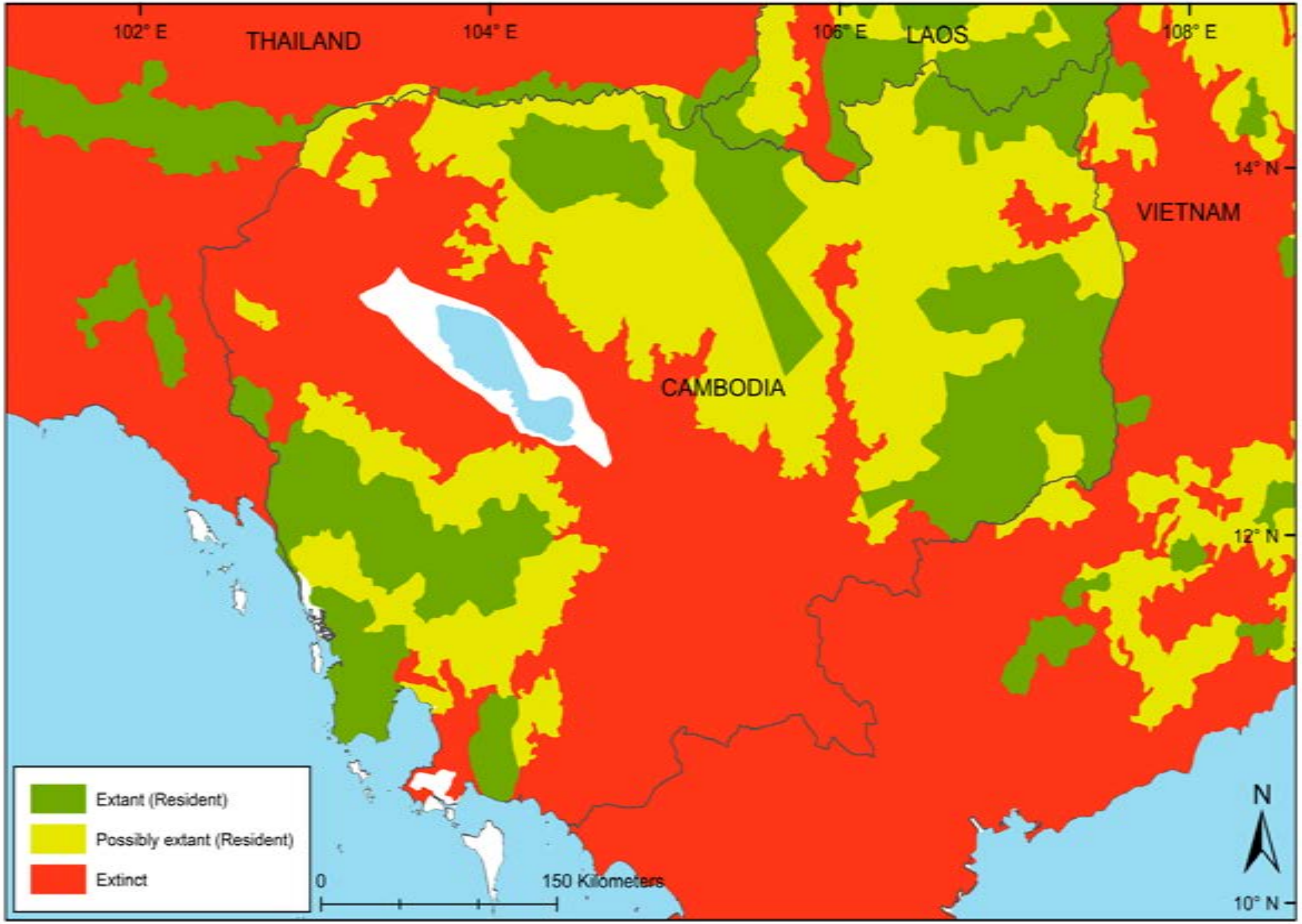
APPENDIX IV: SUN BEAR RANGE MAPS

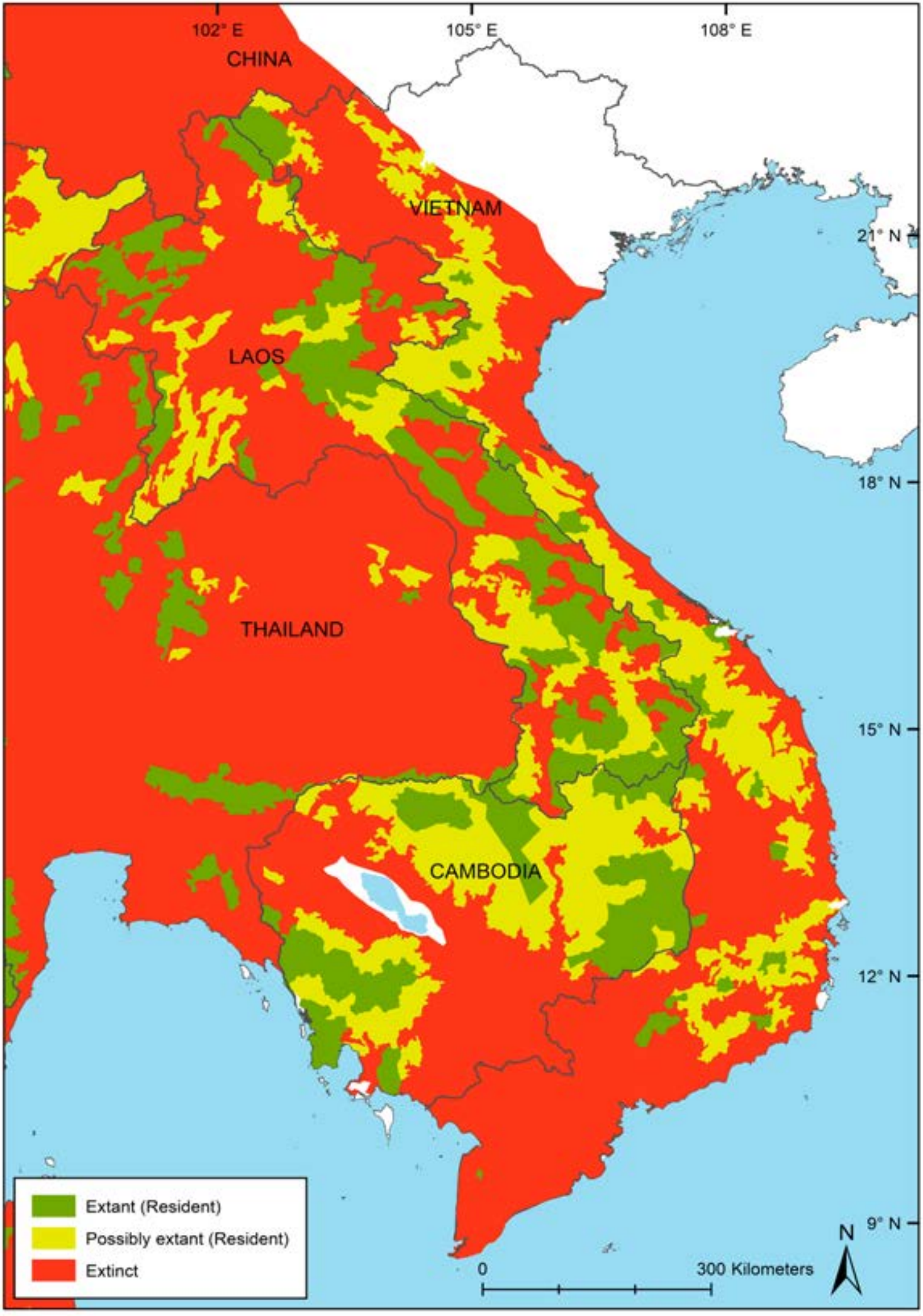


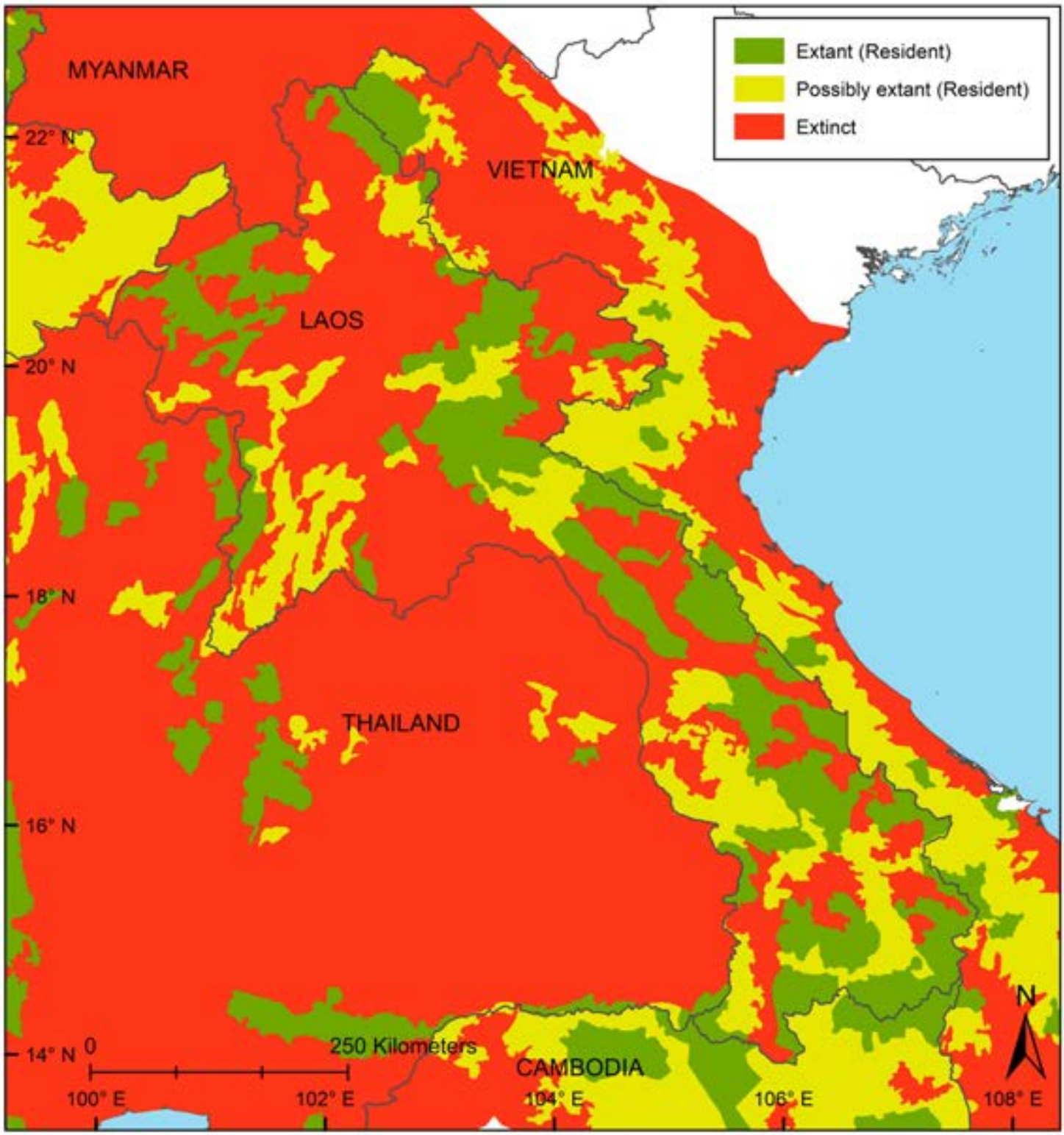

Extant (Resident)
Possibly extant (Resident)
Extinct
BHUTAN
INDIA
CHINA
BANGLADESH
MYANMAR
VIETNAM
LAOS
THAILAND
CAMBODIA
Andaman Sea
25° N
20° N
15° N
10° N
0
500 Kilometers
90° E
95° E
100° E
105° E
N

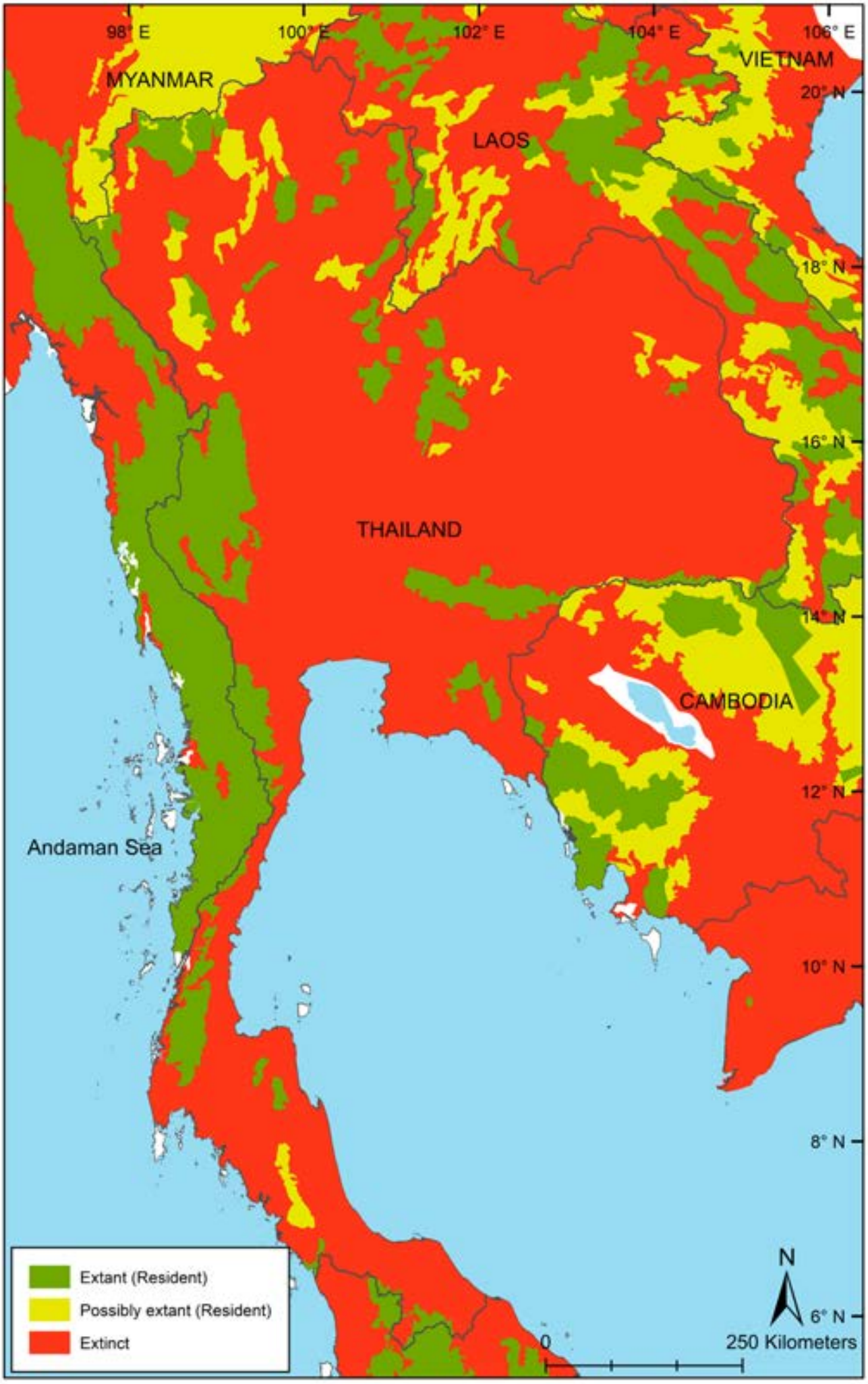

Extant (Resident)
Possibly extant (Resident)
Extinct
6° N
2° N
2° S
6° S
96° E
100° E
104° E
108° E
112° E
116° E
BRUNEI
MALAYSIA
Borneo
Sumatra
Indian Ocean
INDONESIA
0
500 Kilometers
N

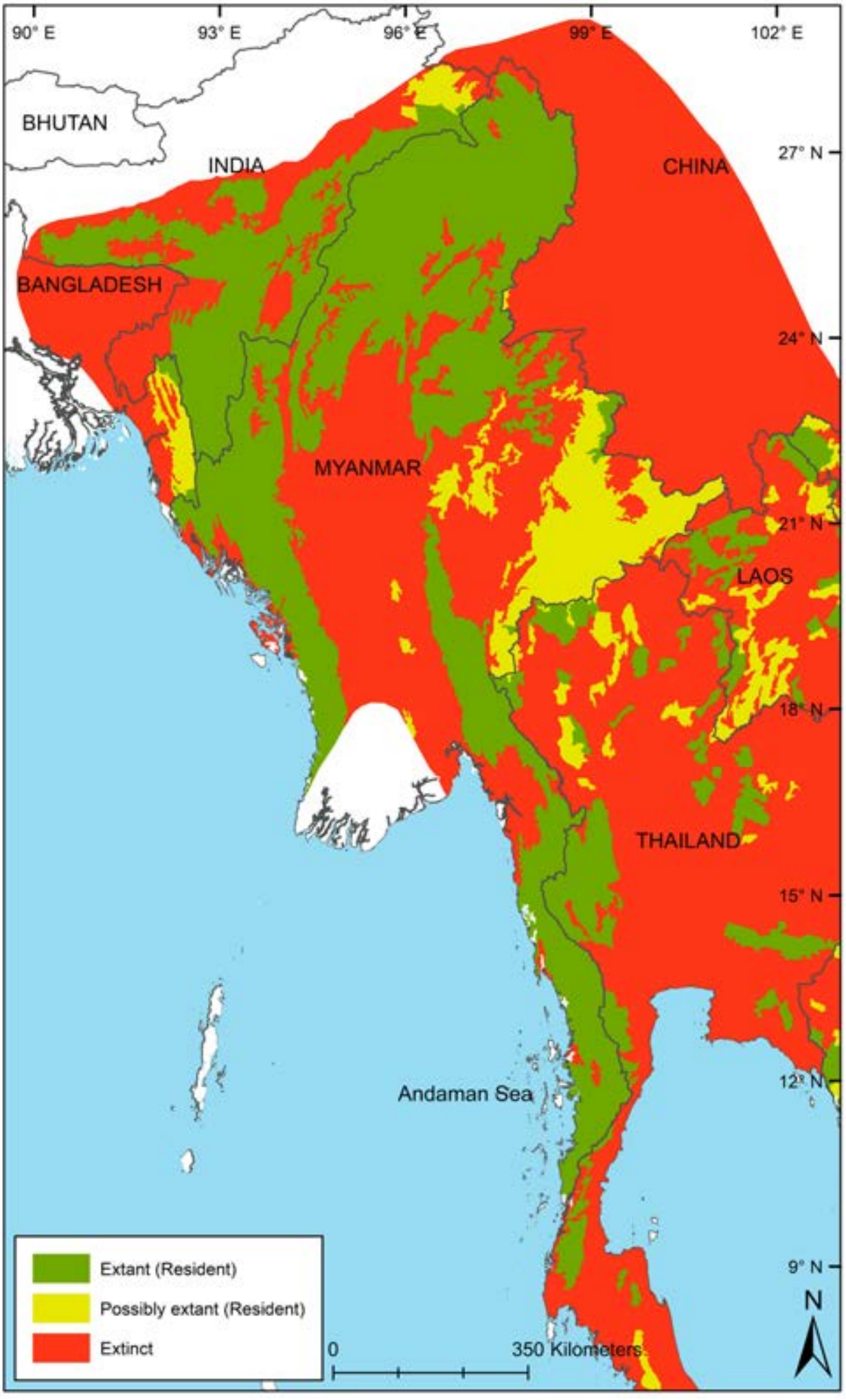

Extant (Resident)
Possibly extant (Resident)
Extinct
6° N
3° N
0°
3° S
6° S
111° E
114° E
117° E
BRUNEI
MALAYSIA
Borneo
INDONESIA
0
300 Kilometers
N


102° E
THAILAND
104° E
106° E
LAOS
108° E
14° N
VIETNAM
CAMBODIA
12° N
10° N
Extant (Resident)
Possibly extant (Resident)
Extinct
0
150 Kilometers
N


102° E
105° E
108° E
CHINA
VIETNAM
21° N
LAOS
18° N
THAILAND
15° N
CAMBODIA
12° N
9° N
Extant (Resident)
Possibly extant (Resident)
Extinct
0
300 Kilometers
N


Extant (Resident)
Possibly extant (Resident)
Extinct
MYANMAR
VIETNAM
LAOS
THAILAND
CAMBODIA
22° N
20° N
18° N
16° N
14° N
100° E
102° E
104° E
106° E
108° E
0
250 Kilometers
N


98° E
100° E
102° E
104° E
106° E
MYANMAR
VIETNAM
LAOS
20° N
18° N
16° N
THAILAND
14° N
CAMBODIA
12° N
Andaman Sea
10° N
8° N
6° N
Extant (Resident)
Possibly extant (Resident)
Extinct
N
0
250 Kilometers


90° E
93° E
96° E
99° E
102° E
27° N
24° N
21° N
18° N
15° N
12° N
9° N
BHUTAN
INDIA
CHINA
BANGLADESH
MYANMAR
LAOS
THAILAND
Andaman Sea
Extant (Resident)
Possibly extant (Resident)
Extinct
0
350 Kilometers
N