ZSL
LET'S WORK FOR WILDLIFE

EDGE

EVOLUTIONARILLY DISTINCT & GLOBALLY ENDANGERED

Survival Blueprint

Sunda pangolin, Manis javanica

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1. STATUS REVIEW

1.1 Taxonomy: Mammalia > Pholidota > Manidae > *Manis* > *javanica*
(Although Palawan in the Philippines was previously thought to be a stronghold for this species, here the species has since been re-categorized as the Philippine pangolin under the name Manis culionensis by Feiler (1998) and subsequently by Gaubert and Antunes (2005)).

English: Sunda Pangolin, Malayan Pangolin
French: Pangolin Javanais, Pangolin Malais
Spanish: Pangolín Malayo

1.2 Distribution and population status:

1.2.1 Global distribution: ***"The highlighted text has been reproduced with permission from the IUCN Red List of Threatened Species account for the Sunda Pangolin, as available June 2018" (Challender et al. 2014).*** The species is widely distributed geographically, occurring across Southeast East Asia, from southern China and Myanmar through to lowland Lao PDR and including much of Thailand, central and southern Viet Nam, Cambodia, Peninsular Malaysia, Sumatra, Java and adjacent islands (Indonesia) and Borneo (Malaysia, Indonesia, Brunei). However, the northern and western limits of its range are poorly known (Schlitter 2005, Wu et al. 2005). It has been recorded from sea level up to 1,700 m above sea level.

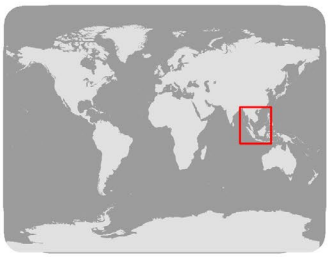
Manis javanica

Range

Extant (resident)

Compiled by:
IUCN (International Union for Conservation of Nature)

NE DD LC NT VU EN **CR** CRITICALLY ENDANGERED EW EX



The boundaries and names shown and the designations used on this map do not imply any official endorsement, acceptance or opinion by IUCN.

Country	Population estimate (plus references)	Distribution	Population trend (plus references)	Notes
Myanmar	There is virtually no information available on population levels of any species of Asian pangolin and no comprehensive population estimates.	This species is distributed in central and southern Myanmar (Corbet and Hill 1992, Salter 1983), but has apparently been eradicated widely from lowland areas due to human agricultural expansion and hunting (J.W. Duckworth pers. comm. 2006).	There is no recent data on the status of this species in Myanmar. However seizures involving the Sunda pangolin in China in recent years infer that the trade originated in Myanmar, suggesting populations of this species here are under threat (Challender et al. in prep).	This species is rarely observed, principally because of its increasing rarity, but also because it is secretive, elusive and primarily nocturnal. There is a paucity of research on population densities at local, national and global scales (WCMC et al. 1999, CITES 2000). This species is now extremely rare in the northern part of its range (J.W. Duckworth pers. comm. 2006) where there have been massive declines, especially in Lao PDR (Nooren and Claridge 2001).
Lao PDR	Not available	Historically this species waswidespread in Lao PDR. There are records of varying reliability from a wide range of areas below c. 600 m asl altitude, though it is possible that in Lao PDR the species is restricted to the Mekong plain and adjacent foothills up to c. 900 m asl, with a possible occurrence on the Bolaven Plateau, north from Xe Pian National Biodiversity Conservation Area in the south at least as far north as Nam Kading (Duckworth et al. 1999, J.W. Duckworth pers. comm. 2006).	Nooren and Claridge (2001) reported that populations in Lao PDR have been severely reduced as a result of hunting for consumption and trade. In three separate areas within the range of *Manis javanica* in Lao PDR (Xe Pian, Dong Phou Veng and Khammouan Limestone NBCA), villagers reported in the late 1990's that pangolin populations had declined due to hunting, in some areas to as little as one percent of the level 30 years ago (Duckworth et al. 1999; Nooren & Claridge 2001).	
Thailand	Not available	The species historically occurred throughout Thailand (Lekagul and McNeely 1977, Bain and Humphrey 1982,	*M. javanica* is considered threatened and becoming increasingly rare in	

		WCMC et al. 1999), but has since been lost from much of the lowland areas due to human agricultural expansion and hunting (J.W. Duckworth and R. Steinmitz pers. comms. 2006). Camera trap data confirms the presence of the species in Khao Yai National Park (Lynam et al. 2006 in Newton et al. 2008), south-eastern Western Forest Complex (sWEFCOM), and Khlong Nakha Wildlife Sanctuary (W. Sodsai pers. Comms, 2018).	Thailand (Bain and Humphrey 1982, Steinmitz pers. comm. 2006)	
Viet Nam	Not available	In Viet Nam, there are records which vary in reliability throughout the central and southern parts of the country. There are older records from Kon Tum Province, Tay Ninh Province and Quang Nam Province (Bourret 1942). There are more recent records (summarised by Newton 2007) from: Ha Tinh Province (Timmins and Cuong 1999); Kien Giang and Ca Mau Provinces (in U Minh Thuong National Park) (CARE 2004); Dong Nai, Bin Phuoc and Lam Dong Provinces (Cat Tien National Park) (Murphy and Phan 2001); Quang Binh (Le et al. 1997b) and Dak Lak (Le et al. 1997a). Recent research suggests the species is present but rare in central and southern Viet Nam (MacMillan and Nguyen 2013, Nuwer and Bell 2013). However, it is understood to be present in Cat Tien National Park and recent enforcement activity suggests the species is still present in Dak Nong, Kon Tum,	In three areas of Viet Nam where interviews were conducted (Khe Net Protected Area, Ke Go Nature Reserve and Song Thanh National Park), 95% of hunters here believed pangolins populations have declined severely, which is a consequence of hunting pressure (Newton et al. 2008). Hunters reported that populations had massively declined in the last few decades, but particularly since about 1990, when the commercial trade in pangolins began to escalate (Newton 2007). In all three areas, the species was described as now being extremely rare. The intense biodiversity survey effort and extremely limited number of confirmed records of pangolins throughout Viet Nam's protected areas adds weight to this observation (P. Newton pers. comm. 2008). The rarity of the species was highlighted in more	The species is listed as Endangered in Viet Nam (Viet Nam Red Data Book 2007),

		Quang Binh and Gia Lai provinces as well as U Minh Thuong National Park (L. Fletcher & A. Nguyen, pers. comms. 2013). Based on camera trap data it is also present in U Minh Ha National Park (Willcox et al. in prep.).	recent research in U Minh Thuong National Park (Nuwer and Bell 2013) and Quang Nam Province (MacMillan and Nguyen 2013).	
Cambodia	Not available	In Cambodia, *M. javanica* has been recorded as present from 150 m to 800 m asl (A. Olsson pers. comm. 2012). According to hunters in Cambodia, its distribution is concentrated around water bodies in the dry season, though in the wet season it is present throughout deciduous forest, lowland and mountainous evergreen forest and secondary forest. Although it is widely distributed in Cambodia, hunters infer that it now only occurs in low numbers.	This species is present in a number of reserves in the Cardomom Mountains, Cambodia (the Elephant mountains, Central Cambodian Lowland Forests (Prey Long), Eastern Plains Landscape, Northern Plains and Northeast Cambodia) but populations are declining. Interviews with hunters suggest the species is absent in some of these areas, which is attributed to hunting (A. Olsson pers. comm. 2013).	Rare in Cambodia (2003).
Peninsular Malaysia	Not available	The species is widely distributed geographically in Peninsular Malaysia, primarily in forest, but also in gardens and plantations, including oil palm and rubber plantations (Medway 1977; Numata et al. 2005). It is also found on the island in Penang. Numata et al. (2005) and Ickes and Thomas (2003) note its presence in oil palm and regenerating lowland dipterocarp forest in and around Pasoh Forest Reserve where it was previously considered common. *Manis javanica* remains present within oil palm plantations in Selangor and Negri Sembilan, Peninsular Malaysia, based on interviews	This species is present in Peninsular Malaysia, where it has previously been described as common in some areas, at least up until 1999 (Ickes and Thomas 2003). Azhar et al. (2013) report its presence in oil palm plantations in Selangor and Negri Sembilan though it is subject to very heavy hunting pressure there. According to Numata et al. (2005) the species is present in Pasoh Forest Reserve. Based on recent camera trap data, the species is also present in the Kenyir Wildlife Corridor (D.W.S. Challender, pers. comms. 2013).	Vulnerable in Peninsular Malaysia (2012).

		with plantation workers (Azhar et al. 2013). However, Azhar et al. (2013) report that in areas where interviews have been conducted it is in decline from hunting for trade.	However, interviews with hunters and villagers in 2007 and 2011 indicate populations in Peninsular Malaysia are decreasing as a result of hunting pressure for trade (D.W.S. Challender pers. comm. 2013).	
Borneo	Not available	This species is widely distributed in Borneo, from sea level to 1,700 m asl on Mount Kinabalu in Sabah (Payne et al. 1985). It has been recorded in mixed dipterocarp forest, riverine forest (Azlan and Engkamat 2013) as well as remnant forests (Giman et al. 2007). It is rarely seen in Sabah, especially compared to ten years ago (Panjang, E. pers. comms. 2013), although it is evidently widely distributed, being known by local people throughout the state (Davies and Payne 1982). The species is reportedly still found in Kebun Cina Forest Reserve (Sabah; Damit 2009) while data from Sabah Wildlife Department suggest the species is mainly distributed in central Sabah (E. Panjang pers. comm. 2013). Surveys conducted in 2005 report the presence of the species at Bintulu, Sarawak (Wilson et al. 2006) though it appears to be absent from the extensive peat swamp forests in this state (CITES 2000). The species is presumably present in Brunei, which was reported by Medway (1977), and which is supported by the rescue of a small number of individuals here in 2013. The	In Sabah, *Manis javanica* has previously been considered relatively common (Han and Giman pers. comms. 2008 assessment), and though there is little recent data on the species' status here, populations are under pressure from collection for both local use and international trade, which seems to have intensified in recent years based on available evidence, and which could well be having a detrimental impact on population levels (Pantel and Anak 2010). For example, Pantel and Anak (2010) report that >22,000 pangolins were collected for trade in an 18-month period here between 2007 and 2009.	

		abundance of this species is understood to be low in the peat-swamp forests of east and central Kalimantan (Indonesian Borneo; S. Cheyne pers. comm. 2012) but otherwise has a widespread distribution in Indonesia on Sumatra, Java, Borneo, Kiau and Lingga archipelago, Bangka and Belitung, Nias and Pagi islands, Bali and adjacent islands (Corbet and Hill 1992).		The populations appear stable in Singapore (B. Lee pers. comm. 2013). Here, Lim and Ng (2007) estimated the range size of one individual, but made no estimate of total population size or density. Recent revision of the national Red List assessment in Singapore lists the species as Critically Endangered (Singapore Red Data Book 2008).
Singapore and adjacent islands	Not available	The species is still found in the wild in Singapore and adjacent islands, including Pulau Tekong, and potentially Pulau Ubin (CITES 2000, Lim and Ng 2007).		

1.2.2 Local distribution: ***This information is based on studies on the Sunda pangolin in Thailand.***

Country	Region / province	Site	Level of Protection	Population size	Reference(s)	Notes
Thailand	The southern end of the Thanon Thong Chai Mountain Range in Lamphun, Tak, and Chiang Mai Provinces in northern Thailand.	Mae Ping National Park	National Park	Unknown	Local news: https://www.sanook.com/news/1173443/	Many research studies with camera traps and local news in Thailand still confirm the presence of the species in many protected areas

Thailand	Uthai Thani and Tak Provinces. The park, along with the Thungyai Naresuan Wildlife Sanctuary, is declared a World Heritage Site by UNESCO, and is part of the Thailand's Western Forest Complex (WEFCOM)	Huai Kha Khaeng Wildlife Sanctuary	Wildlife Sanctuary / World Heritage Site	Unknown	Local news: "เสือโคร่งไทยถูกยิงตายในประเทศพม่า" by WCS Thailand, 2017.	throughout Thailand (W. Sodsai pers. Comms, 2018).
Thailand	Southeastern Western Forest Complex (sWEFCOM) in the west of Thailand, in Kanchanaburi Province.	Southeastern Western Forest Complex (sWEFCOM) including Salakpra Wildlife Sanctuary, Srinakharin National Park, Chareomrattanakhosin National Park, Erawan National Park, and Srisawat No Hunting Zone.	National Park / Wildlife Sanctuary	Unknown	Research: Pangolin Conservation Project by ZSL Thailand, 2016-2017.	
Thailand	The park is in Ranong Province, part of the Khlong Saeng-Khao Sok Forest Complex in the south of Thailand.	Khlong Nakha Wildlife Sanctuary	Wildlife sanctuary	Unknown	Research: Pangolin Conservation Project by ZSL Thailand, 2016-2017.	
Thailand	The park lies on the Sankamphaeng Mountain Range in eastern Thailand and covers Nakhon Ratchasima, Saraburi,	Khao Yai National Park	National Park / World Heritage Site	Unknown	(Lynam et al. 2006 in Newton et al. 2008)	

	Prachinburi, and Nakhon Nayok Provinces.					
Thailand	Phetchaburi and Prachuap Khiri Khan Provinces in the south of Thailand.	Kaeng Krachan National Park	National Park	Unknown	Local news: Sunda Pangolin by Wildlife & National Parks of Thailand, 2015; https://wildlifethailand.com/blog-posts/mammals/268-sunda-pangolin-manis-javanica	
Thailand	The park is situated at the Thailand-Malaysia border in southern Thailand, in Yala and Narathiwat Provinces.	Hala-bala Wildlife Sanctuary	Wildlife Sanctuary	Unknown	Local news: "รวบ 2 หนุ่มคาป่าฮาลา-บาลา ลอบจับตัวนิ่มขนาดใหญ่ ไปขายโลละพัน" by Thairath, a daily newspaper, in April 2017.	

1.3 Protection status: The Sunda pangolin is currently considered as critically endangered species on the IUCN Red List (Challender et al. 2014). In 2017, the species was listed by CITES in its Appendix I. Also the Sunda pangolin has full legal protection in Thailand under the Wild Animal Reservation and Protection Act, B.E. 2535.

1.4 Habitat and resource assessment: This species is found in primary and secondary forest, including lowland dipterocarp forest, and cultivated areas including gardens and oil palm and rubber plantations and near other human settlements (Azhar et al. 2013, Nowak 1999). Hunters interviewed in Viet Nam reported that the species is found in a variety of habitats, though areas with primary forest support more pangolins, probably because they contain older, larger trees with hollows suitable for sleeping and for use as den sites (P. Newton pers. comm. 2008) and have lower levels of human activity. However, the population in Singapore is in very low quality forest in which they have been able to

survive for decades without an obvious decline (J.W. Duckworth pers. comm. 2006). Therefore further research is required to determine habitat utilization and the ability of this species to persist outside primary forest.

1.5 Biology and ecology: As with other pangolins, this species is primarily nocturnal, solitary and a specialized feeder on ants and termites. Inference from other species indicates that one young is born at a time, after a gestation period of a minimum of 130 days. Hunters in Viet Nam have consistently reported that *Manis javanica* is a more arboreal species than *Manis pentadactyla*, and that they are adept climbers with prehensile tails. They often climb to access ants nests in trees. They sleep in hollows either in or at the base of trees, but have also been known to dig burrows in soil. Lim and Ng (2007) recorded the activity budget of a radio-tracked individual with the following results: maternal care followed the birth of a single offspring for approximately three to four months - Challenger et al. (2011) witnessed behaviour in captivity concurring with this. Three natal dens were used, all associated with hollows in large trees (50 cm DBH) and home-range size was estimated as being 6.97 ha. Daily activity was 127 ± 13.1 minutes, with peak activity between 03hr00 and 06hr00.

1.6 Threat analysis: ***This information is based on studies on the Sunda pangolin in Thailand.*** Historically, the Sunda Pangolins are consumed for subsistence, and used in traditional medicine by locals residing around the species' habitat. According to questionnaire distribution carried out in 2017 by ZSL-Thailand's pangolin conservation project, Sunda pangolins were eaten in rural areas as bushmeat and were widely available in local markets. Also, their scales were used as jewellery to protect against diseases in children in some parts of Thailand in the past (W. Sodsai pers. comm. 2017). Now, due to its high value in the illegal wildlife trade (Challender et al. 2015) resulting from a significant rise in international demand for pangolin meat and scales, many of the locals have opted to sell the Sunda Pangolins instead (MacMillan & Quoc Anh Nguyen 2013; Nuwer & Bell 2013). The demand is particularly strong in China and Vietnam, where the meat is consumed as a luxury dish and the scales are used in traditional medicine (Challender et al. 2015; Shairp et al. 2016; Xu et al. 2016). As demand increases and the species becomes rarer, its price is expected to grow even higher (Drury 2011). Therefore, direct hunting is not the only activity that pose a serious threat to the species, but other activities like non-timber forest product (NTFP) collection and free cattle ranging around PAs' boundaries also pose a major threat to pangolins because whenever people encounter pangolins (quite easy to do so when they are with domestic dogs), they will likely attempt to capture and sell them.

Although habitat destruction is not likely to be a direct threat to Sunda Pangolins since they are quite resilient to high levels of human-induced habitat change in a wide variety of habitats, including grasslands, peatswamp forest, primary and secondary forests, palm oil plantations, and urban areas (Payne et al. 1985; Lim 2007; Lim and Ng 2008; Azhar et al. 2013; Wearn 2015; Fletcher 2016; Willcox et al. 2017), forest degradation for the expansion of roads and commercial concessions (e.g. mining, hydro-power dams, logging, plantations) eventually make the pangolins more susceptible to hunting activities. With my personal experiences working on this species in the south of Thailand, pangolins are

frequently caught in rubber plantations, especially in the ones that are adjoined PAs' boundaries. Rubber collection activities are conducted during the night which is the active time of the predominantly nocturnal Sunda pangolins (e.g. Lim 2007).

Sunda pangolin has full legal protection in Thailand, but unfortunately with relatively low enforcement attention for small- and medium-sized wildlife hunting in rural villages, pangolin poaching and smuggling are likely to continue. This potentially makes Thailand still the source and transit country for pangolin trade.

1.7 Stakeholder analysis: ***This information is based on studies on the Sunda pangolin in Thailand.***

Country	**Stakeholder**	**Interest**	**Current activities**	**Impact** *(positive, negative or both)*	**Intensity of impact** *(low, medium, high or critical)*	**Proposed activities**
International	SOS (SAVE OUR SPECIES)	Conservation	Funders	+	Critical	Financial support to protect the species from extinction
International	Fondation Segre'	Conservation	Funders	+	Critical	Financial support to protect the species from extinction
International	The United States Fish and Wildlife Service (USFWS or FWS)	Conservation	Funders	+	Critical	Financial support to protect the species from extinction
International NGO	Zoology Society of London (ZSL)	Conservation	Partners	+	Critical	Funding and advising the project
Thailand	Zoology Society of London, Thailand Programme (ZSL-Thailand)	Conservation	Practitioners (monitoring population, strengthening law enforcement, and community engagement in two study sites	+	Critical	To project the species in research sites

			(sWEFCOM and Khlong Nakha Wildlife Sanctuary) in Thailand)			
Thailand	Department of National Parks, Wildlife and Plant Conservation (DNP)	Government	PA Managers	+	Critical	Permission to work in protected areas
Thailand	National Research Council of Thailand	Government	Administrators	+	Low	Permission to support international researchers working in Thailand
Thailand	Kasetsart University	Research & conservation	Partners	+	High	Serve as project adviser and to provide student volunteers for field surveys
Thailand	Mahidol University (Livestock and Wildlife Hospital)	Research & conservation	A captive centre for confiscated population	+	High	Captive husbandry for confiscated population of Sunda pangolin including recovery and release in some cases
Thailand	Communities surrounding the PAs	Commercial	Agriculture, rubber & palm oil plantation, illegal logging, wildlife poaching, non-timber forest product collecting and tourism.	-	Critical	Making income for a living

1.8 Context and background information that will affect the success of any conservation action for this species: ***This information is based on studies on the Sunda pangolin in Thailand.***

	Description	Threats	Opportunities
Socio-cultural effects	Throughout history this species, like other wild animals, is domestically consumed as bushmeat, and its scales are used in traditional medicines. The trend changed when the species became very high value because of a high demand from China and Vietnam. According to local interviews by ZSL-Thailand, pangolins have been excessively hunted since the last decade to supply the illegal international wildlife trade.	Most of the PAs in Thailand are surrounded by communities which makes forests easily accessible for hunters.	The Sunda pangolin is a nocturnal and elusive mammal. From local interviews, pangolins are very hard to find without hunting dogs. Therefore, targeting the use of hunting dogs offers an opportunity for effective conservation action.
Economic implications	Most of the communities are agriculturists with low income. Locals still rely on forests as food sources. Non-timber forest products like mushrooms, bamboo shoots, fire wood, etc. are widely collected. The relative value of one pangolin is very high.	Although non-timber forest product gathering inside any PAs is illegal by law, many communities are originally settled inside the parks before they were established, which makes restricting their activity very challenging. Whenever people encounter pangolins, they will likely attempt to capture and sell them because of their high value in the illegal wildlife trade.	Many research studies using camera traps show that pangolins are still present in some PAs that are well-protected, like in World Heritage Sites or in habitats with tough terrains.

Existing conservation measures	Currently, ZSL-Thailand is the only international NGO to study the wild population of Sunda pangolins to determine the population status in the study areas. This is being done through the development of an effective surveying methodology, collection of baseline data to inform patrol-based monitoring, improvement of law enforcement efficiency, and engagement of local communities in the protection of the species.	Populations are very difficult to estimate due to the species' ecology. The project needs continuous support from donors since it is a long term study. Although the species is protected under the law, the very high price of pangolins can be considered as a main factor for poaching activities, especially since locals are low income.	The species' assessment for the IUCN Red List of Threatened Species for 2018 is being developed by IUCN SSC Pangolin Specialist Group. Sunda Pangolin (*Manis javanica)* monitoring protocol is being developed by ZSL.
Administrative/political set-up	The management of natural resources by government is not effective.	The value of pangolins is often higher than its fine since penalties are very small. Law enforcement is weak. Corruption is widespread and ongoing.	ZSL-Thailand has a plan to arrange a stakeholder workshop with Department of National Parks, Wildlife and Plant Conservation (DNP) to discuss Sunda pangolin conservation in Thailand.
Local expertise and interest	Pangolins provide a significant extra income. In many communities that hunt pangolins, conservation activities potentially bring a conflict between locals and conservationists.	Despite pangolins becoming rare and more difficult to find, some poachers still hunt pangolins for a living.	There is optimism that school students are likely to enjoy awareness raising activities on pangolin conservation.
Cultural attitudes	Some local people believe that pangolin meat and scales contain many medicinal properties.	The species is consumed both domestically and internationally.	

Appeal of species	Pangolins are the only mammal in the world with bodies covered in strong scales. They feed on ants and termites. Rolling their bodies up into a ball is the only protection mechanism from predators.	Hunters can catch pangolins with their bare hands.	The popularity and international interest in pangolins has dramatically increased in recent years.
Resources	Insufficient manpower and weak law enforcement play an important role in the lack of protection of the species in many PAs.	The species is easily hunted along the PAs' boundaries by opportunistic poaching, especially during a non-timber forest product gathering season (normally in rainy season). An insufficient number of park rangers is always a main factor that restricts the PAs' protection in Thailand.	Increasing global support for pangolin conservation will hopefully provide new sources of funding, coordination and support.

2. ACTION PROGRAMME

Vision (30-50 years)	
A population of Sunda pangolins in Thailand thriving again throughout its range, with full protection in the healthy ecosystem.	
Goal(s) (5-10 years)	
To assess the population status of the Sunda pangolin in the country, and ensure the effective protection of the populations with strict patrolling and efficient law enforcement. Engage local communities located near to the species' habitats in the protection of the species.	
Objectives	**Prioritisation** *(low, medium, high or critical)*
1. Population status is assessed across the country.	Critical
2. The whole pangolin population in the country is secure and fully protected.	Critical
3. Local communities are engaged in the protection of the species.	Critical
4. Efficient management of confiscated and rehabilitated populations.	High
5. All checkpoints on the illegal wildlife trade routes in Thailand are more strictly enforced.	Medium
6. The Sunda pangolin conservation programme is supported by all stakeholders in Thailand.	High

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
1. Population status is assessed across the country								
1.1 Identify distribution of the species across the country	Thailand	Critical	Over 30 million baht	By 2020	Government agencies (DNP), NGOs, researchers	Reports, distribution data	Habitats of the species are identified and protected	Improving knowledge & supporting protection activities
1.2 Develop a standard protocol for surveying and monitoring	Thailand	High	500000 baht	2018	DNP, NGOs, researchers	A monitoring protocol	…An effective survey methodology since pangolins are elusive mammal and difficult to monitor	Improving knowledge
1.3 Establish long-term monitoring programmes	Thailand	High	10 million baht	From 2015	DNP, NGOs, researchers, universities	Long-term pangolin conservation programmes	Data from the studies can be used to inform protection activities	Improving knowledge & supporting protection activities
2. A whole population in the country is secure and fully protected								
2.1 Strengthen law enforcement (penalty and fine)	Thailand	Critical	Over 50 million baht	From 2018	Government	New Act for wild animal conservation and protection	Increase pressure on pangolin poaching	Law & Policy

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
2.2 Employ more rangers to maintain sufficient manpower	Thailand	High	Over 50 million baht	By 2020	DNP	More rangers in PAs	More efforts to protect the species	PAs' management & protection
2.3 Improve park rangers' skills through regular training	Thailand	High	20 million baht	From 2015	DNP, NGOs	Number of training and participants, reports	Effective patrolling and efficient protection	PAs' management & protection
3. Local communities are engaged in protection of the species								
3.1 Support locals on how to manage their agricultural land to produce the optimal amount of crops without using chemicals or expanding their land into the forests	Thailand	Medium	1 million baht each community	From 2018	Thailand Ministry of Agriculture and Cooperatives, DNP, NGOs	Amount of the agricultural products	Higher income may lead to reduced local hunting	Livelihoods, economic, and other incentives

Activities	**Country / region**	**Priority** *(low, medium, high or critical)*	**Associated Cost**	**Time scale**	**Responsible stakeholders**	**Indicators**	**Opportunities and threats**	**Activity type**
3.2 Introduce alternative ways for communities to gain extra income (eco-tourism, selling local products, organic farming)	Thailand	Medium	Over 10 million baht	From 2018	DNP, NGOs	Amount of the communities' income	Extra income potentially halts local hunting	Livelihoods, economic, and other incentives
3.3 Share knowledge about pangolins with local communities and alter perceptions of pangolin consumption	Thailand	Critical	10 million baht	From 2016	DNP, NGOs, universities	Changes in communities' attitudes of pangolin consumption as assessed by questionnaires and interviews	Reduction in pangolin consumption	Improving knowledge, raising awareness

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
3.4 Raise awareness of pangolin conservation through recreational activities conducted with the public and local schools	Thailand	High	20000 baht per school	From 2016	NDP, NGOs	Number of activities, materials, and participants, pre and post surveys to demonstrate increased knowledge about pangolins among participants.	Increased pressure on pangolin poaching	Improving knowledge, raising awareness
4. Efficient management of confiscated and rehabilitated populations.								
4.1 Develop a protocol for rehabilitated populations	Thailand	High	Over 5 million baht	By 2020	DNP, international & national NGOs, universities	A protocol or an action plan for rehabilitated populations is needed because most of the confiscated pangolins in Thailand hardly survive after being released back to the wild.	Increase wild population	Population management

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
4.2 Establish husbandry and breeding programmes for captive populations to store genetic diversity	Thailand	High	Over 10 million baht	By 2025	DNP	Husbandry and breeding programmes	Captive/stored populations available for conservation programmes	Population management
5. All checkpoints on the illegal wildlife trade routes in Thailand are more strictly enforced.								
5.1 Identify illegal wildlife trade routes over the country	Thailand	Medium	20 million baht	By 2020	DNP, NGOs, customs, universities	Database/reports on the wildlife trade routes in Thailand		Improving knowledge & supporting protection activities
5.2 Collaborate with the police, customs authority and military at all checkpoints on the illegal wildlife trade routes	Thailand	Medium	Over 10 million baht	From 2020	DNP, police, customs	Action plans (i.e. having some officials from DNP working at the checkpoints with police and military for illegal wildlife trade inspection)	Increased pressure on illegal wildlife trade	Law enforcement

Activities	Country / region	Priority *(low, medium, high or critical)*	Associated Cost	Time scale	Responsible stakeholders	Indicators	Opportunities and threats	Activity type
6. The Sunda pangolin conservation programme is supported by all stakeholders in Thailand								
6.1 Organise the stakeholder workshop to review and assess the progress of the conservation programmes annually	Thailand	High	2 million baht each year	From 2018	DNP, ZSL Thailand, Kasetsart University (KU), NGOs	Workshops, conferences, meetings		Species & its habitat management, community livelihoods, economic, and other incentives for conservation

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