BIODIVERSITY ASSESSMENT OF PREY LANG

Kratie, Kampong Thom, Stung Treng and Preah Vihear Provinces

May 2015

Benjamin Hayes, Eang Hourt Khou, Neang Thy, Neil Furey, Chhin Sophea, Jeremy Holden, Hun Seiha, Phen Sarith, La Pengly and Virginia Simpson

USAID FROM THE AMERICAN PEOPLE

WINROCK INTERNATIONAL

CONSERVATION INTERNATIONAL

Table of contents

List of Maps

List of Tables

List of Figures

Appendices

EXECUTIVE SUMMARY

Conservation International, in cooperation with the Forestry Administration of Cambodia, undertook biodiversity surveys of Prey Lang between June 2014 and February 2015. The objectives of the survey were to determine the biodiversity values and conservation priorities within Prey Lang, identify threats, and produce recommendations for the alleviation of these threats. The survey covered vegetation, mammals (including a specific study of bats), birds, amphibians and reptiles. The survey teams recorded evidence of the presence of species, using camera trapping, mist netting, harp traps, direct observation and captures. Sign surveys and interviews were also undertaken. The field surveys aimed to build on existing research undertaken in the area, and the results sections present the aggregation of both primary and secondary data. The results are as follows:

Vegetation:

Eight distinct forest/habitat types are present in the landscape. The majority of the forest cover is made up of evergreen, deciduous dipterocarp and semi-evergreen forest, but mixed deciduous forest, mixed pine broadleaf forest, evergreen swamp forest, riparian forest and open grasslands were also identified. The total botanical record for Prey Lang accounts for 530 species, including the orchid *Peristylus goodyeroides,* a new record for Cambodia. Eleven species are listed on the IUCN Red List of Threatened Species.

The swamp forests are considered a unique forest type for the region and contain several rare, endemic and endangered species.

There is a small area of isolated karst pinnacles in the north of Prey Lang, which should be given special attention and focus due to their biological uniqueness.

There is large scale habitat degradation occurring; this is largely caused by forest conversion to agriculture in the forms of economic land concessions, and small-scale agricultural land use, logging and gold mining.

Mammals:

A total of 60 mammal species were identified by either direct observation, specimens or by camera trap picture. Twenty-four of these species were bats. Eighteen Key Species of international concern were confirmed for Prey Lang, the most significant of which are Pileated Gibbon, Banteng and Asian Elephant.

Bats:

Twenty-four bat species, arranged in six families, were recorded at Prey Lang, representing at least one-third (24/71) of the known bat fauna of Cambodia. Despite a suggested inventory completeness of 86–92%, continued sampling will undoubtedly reveal additional bat species at the site.

Bat species richness and abundance was significantly greater in the northern sector, with 15 species and 74% of total captures, followed by the central sector with eight species and 14.9% of captures and the southern sector with eight species and 11.1% of captures.

All of the bat species presently recorded at Prey Lang are currently considered to be of Least Concern by the IUCN (2014). This is somewhat misleading however, as population trends (whose quantification underlies the Red List categories) are currently unknown for most of these species.

One bat, *R. marshalli,* found in the northern karst area of Prey Lang, is a new country record for Cambodia.

Birds:

A total of 266 species of birds were recorded during the survey, representing approximately 44% of the total bird species known in Cambodia. Fifteen Key Species were confirmed for the area. The most significant of these are the Orange-necked partridge *Arborophila davidi*, Green Peafowl *Pavo muticus*, Great Slaty Woodpecker *Mulleripicus pulverulentus,* Great Hornbill *Buceros bicornis*, Greater Adjutant *Leptoptilos dubius* and Lesser Adjutant *Leptoptilos javanicus*. The seasonal pools and grasslands around both evergreen and deciduous dipterocarp forest habitats were found to support several regionally and globally threatened species such as Lesser Adjutant and Woolly-necked Stork. These habitats are likely to be of high importance to other globally threatened large water birds, and deserve more detailed investigation.

Regional endemics/near-endemics are well represented in Prey Lang, including the Siamese Fireback *Lophura diardi*, Bar-bellied Pitta *Pitta elliottii*, and Black-browed Fulvetta *Alcippe grotei*, while regionally threatened species present include the Great Hornbill *Buceros bicornis*, Wreathed Hornbill *Aceros undulatus* and Woolly-necked Stork *Ciconia episcopus*.

Amphibians and Reptiles:

A total of 67 species of herpetofauna, comprising 22 amphibians (arranged by five families and 14 genera) and 45 reptiles (arranged by 14 families and 35 genera) were recorded. One reptile found in Prey Lang, *Gekko petricolus,* is a new country record for Cambodia.

In total, 11 Key Species were found, the most severely threatened species known to occur in Prey Lang being the five turtle species recorded.

Overall:

The Prey Lang Landscape contains some of Cambodia's largest remaining areas of forest that are not under official government protection. It could also rank as one of the more significant areas of lowland evergreen forest in the Indo-Burma region, one

of the world's top ten biodiversity 'hotspots' - the planet's most biologically rich and threatened regions.

In total, Prey Lang supports nationally and regionally important populations of 55 globally threatened animals. In particular it is a hugely important place for the conservation of Cambodia's birds, home to 44% of all species.

Prey Lang has considerable potential to support sustainable livelihoods for the forests' dependent communities, and also contributes to the national economy through the export of non-timber forest products (NTFPs) and provision of important ecosystem services. The forest is a watershed for the Tonle Sap Lake, upon which millions of Cambodians and a significant proportion of the national economy are dependent.

Threats and recommendations:

There is a lack of effective patrolling and law enforcement in Prey Lang, which is leading to increased encroachment, settlement, logging and hunting. These trends, added to infrastructure development and conversion of forest to agricultural land are fragmenting the forest, the main threat to most of the Key Species of large mammals, amphibians, reptiles and several of the Key Species of birds. The survey team recommend the Government of Cambodia:

- Initiate the protection of Prey Lang as a protected area with the highest status possible under Cambodian law and ensure that every effort is made to give the landscape a high priority in the international, and national conservation agenda.

- Immediately start training and equipping patrol staff so that they are able to commence law enforcement for the protection of wildlife and habitats. Immediately stop all illegal logging activities and land clearance taking place throughout Prey Lang.

- Prevent any further immigration of people into the landscape, especially with regards to the gold miners moving in to the southern area of Prey Lang and around Phnom Chi and along the Stung Treng to Tbaeng Meachey road.

- Prevent any further Economic Land Concessions (ELC) being issued within Prey Lang and monitor activities of all present ELCs and Mining Concessions.

- Undertake further detailed research to more accurately assess the status and distribution, and threats to, the Key Species and to develop appropriate conservation and monitoring strategies; especially with regards to any possible human-elephant conflicts.

- Create better dialogue with all partners concerned with the conservation of Prey Lang, involving a wider base of expertise. This will avoid a single NGO-led conservation effort and allow greater capacity to be directed towards Prey Lang.

- Create local community and social media networking campaigns to promote the urgent need for protection of Prey Lang.

- Undertake further broad-based surveys for those areas not visited under the present survey, especially to the western part of the evergreen central area of forest. The contiguity of habitat and wildlife corridors with Prey Vihear Protected Forest should be assessed and geographical features important for wildlife should be mapped, including rivers, streams, seasonal pools and salt licks.

- Conduct a full assessment on the watershed values of Prey Lang and its economic value to Cambodia.

ACKNOWLEDGEMENTS

We gratefully acknowledge the support of H.E. Dr Chheng Kimsun, Delegate of the Royal Government of Cambodia and Head of the Forestry Administration; Dr. Keo Omaliss, Director of Wildlife Protection and Biodiversity Department; Mr. Sao Vanny, Chief of Sadan Forestry Administration Division, Kampong Thom.

Fieldwork was made possible thanks to the help of local authorities and the villagers of Prey Srea Pring Forestry Community, Sochet Commune, Sandan District, Kampong Thom Province; Krain Village, Tomring Commune, Sandan District, Kompong Thom Province; Siem Bouk Village, Stung Treng Province; Chhvang Village, Thala Barivat District, Stung Treng Province; Mr. Long Som Phat, Thmear Commune Chief, Chey Sen District, Preah Vihear Province; Pnheak Roluek Village, Thmear Commune, Chey Sen District, Preah Vihear Province; Spong Village, Anlong Phe Commune, Thala Barivat District, Stung Treng Province; and Ms. Phok Hong, Prey Lang Facilitation Committee, Pnheak Roluek, Thmear Commune, Chey Sen District, Preah Vihear Province.

Special thanks go to the field team, Pengly La and supporting CI staff, Eang Hourt Khou, Chhin Sophea, Neang Thy, Ben Hayes, Jeremy Holden, Neil Furey. For editorial assistance and general advice, Ida Theilade, Marcus Hardtke, David Ashewell, Joe Walston, Alex Diment, Fredric Goes, Howie Neilson, David Ware and Winrock International staff.

USAID are gratefully acknowledged as funders of the Supporting Forests and Biodiversity Project.

All photos by Jeremy Holden unless otherwise credited.

ABBREVIATIONS & ACRONYMS

Asl	above sea level
c.	approximately
CITES	Convention on International Trade in Endangered Species
CI	Conservation International
CR	Critically Endangered (IUCN Red List category of threat)
dbh	diameter at breast height
DAFF	Department of Agriculture, Forestry and Fisheries (MAFF)
DD	Data Deficient (IUCN Red List category of threat)
EN	Endangered (IUCN Red List category of threat)
FFI	Fauna & Flora International
GPS	Global Positioning System
GT	Globally Threatened (IUCN Red List category of threat)
GNT	Globally Near-threatened (IUCN Red List category of threat)
IUCN	World Conservation Union
Lao PDR	Lao People's Democratic Republic
LC	Least Concern (IUCN Red List category of threat)
MAFF	Ministry of Agriculture, Forestry and Fisheries
MoE	Ministry of Environment
NE	Not Evaluated (IUCN Red List category of threat)
NP	National Park
NTFP	Non-timber forest product
PVPF	Preah Vihear Protected Forest
REDD+	Reducing Emissions from Deforestation and Forest Degradation
UTM	Universal Transverse Mercator
VU	Vulnerable (IUCN Red List category of threat)
WCS	Wildlife Conservation Society
WWF	World Wildlife Fund

CONVENTIONS

Names and spellings of villages, places in the study area generally follow those on the 1: 50'000 topographical map series. Literal translations of local names are used if no name is shown on the maps.

Key Species are species judged to be Globally Endangered, Globally Critically Endangered, Globally Vulnerable, Globally Near-Threatened or Data Deficient following the definitions of the IUCN 2015. (http://jr.iucnredlist.org/documents/redlist_cats_crit_en.pdf)

1.INTRODUCTION

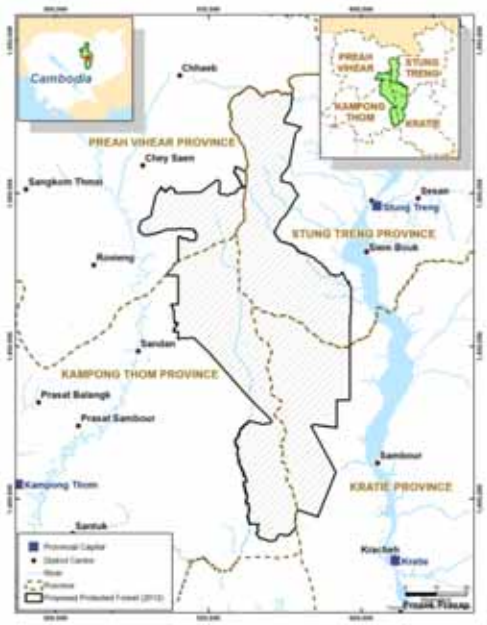
Prey Lang is situated to the west of the Mekong River in north-central Cambodia and stretches over four Provinces: Kratie, Kampong Thom, Stung Treng and Preah Vihear (See Map 1.). It lies within three watersheds, the Stung Sen, Stung Chinit and Siem Bok and traverses the hydrological divide between the Tonle Sap and Mekong Basins (Map 2.). This region contains one of the largest areas of wet lowland evergreen forest in Cambodia and forms part of the Indo-Burma Hotspot, one of the world's 34 biodiversity hotspots (Mittermeier, et al., 2004). McDonald (2004) describes the greater Prey Lang area as follows:

> Remnants of Cambodia's once vast lowland forests are now restricted to the northern reaches of Kampong Thom Province, the more significant pieces of which extend southward from the small village of Spong (13º 30' latitude; due West of Stung Treng on the Mekong River) in the Sandan and Mien Rith Districts. People in this region refer to the uppermost portions of this forest as 'Prey Lang', and those more than 20 km to the South of Spong as 'Prey Tlong.'

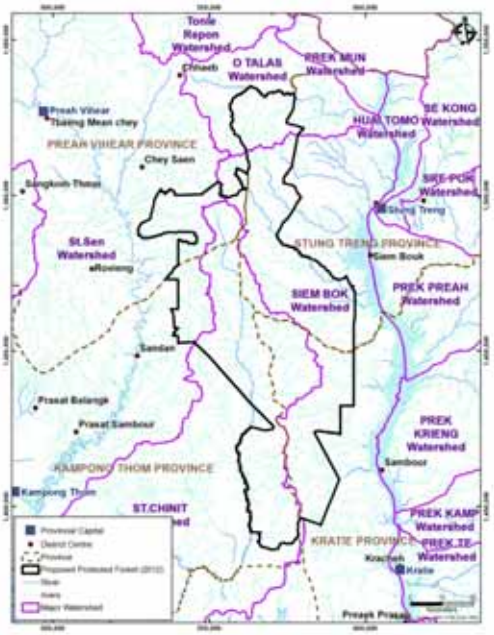
These forests will be referred to in the present report as Prey Lang, but this term will also incorporate forests and habitats stretching to the south and north.

The forest landscape is not officially protected and the exact definition of the Prey Lang boundaries are therefore unclear. A sub-decree was prepared by the Cambodian Forestry Administration (FA) in 2008, which proposed boundaries showing Prey Lang covering an area of approximately 480,000ha. The broadest definition of Prey Lang covers about 520,000ha (Ashwell *et al*., 2004). However Prey Lang has changed drastically in recent years. Across all areas of Prey Lang there has been considerable habitat degradation and there is no longer full connectivity of forest cover or suitable habitats within the originally proposed boundaries. This is most noticeable south and north of the central evergreen forest region (see Map 3.). Already habitat connectivity with Beng Per Wildlife Sanctuary has been lost.

Along the eastern border of Prey Lang and in the south there are multiple Economic Land Concessions (see Map 4.), many of which are for rubber plantations

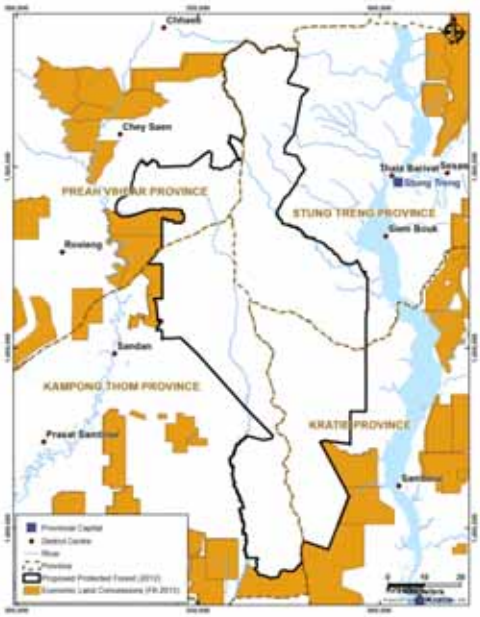


Map 1 Location of Prey Lang



Map 2 Watersheds sharing Prey Lang

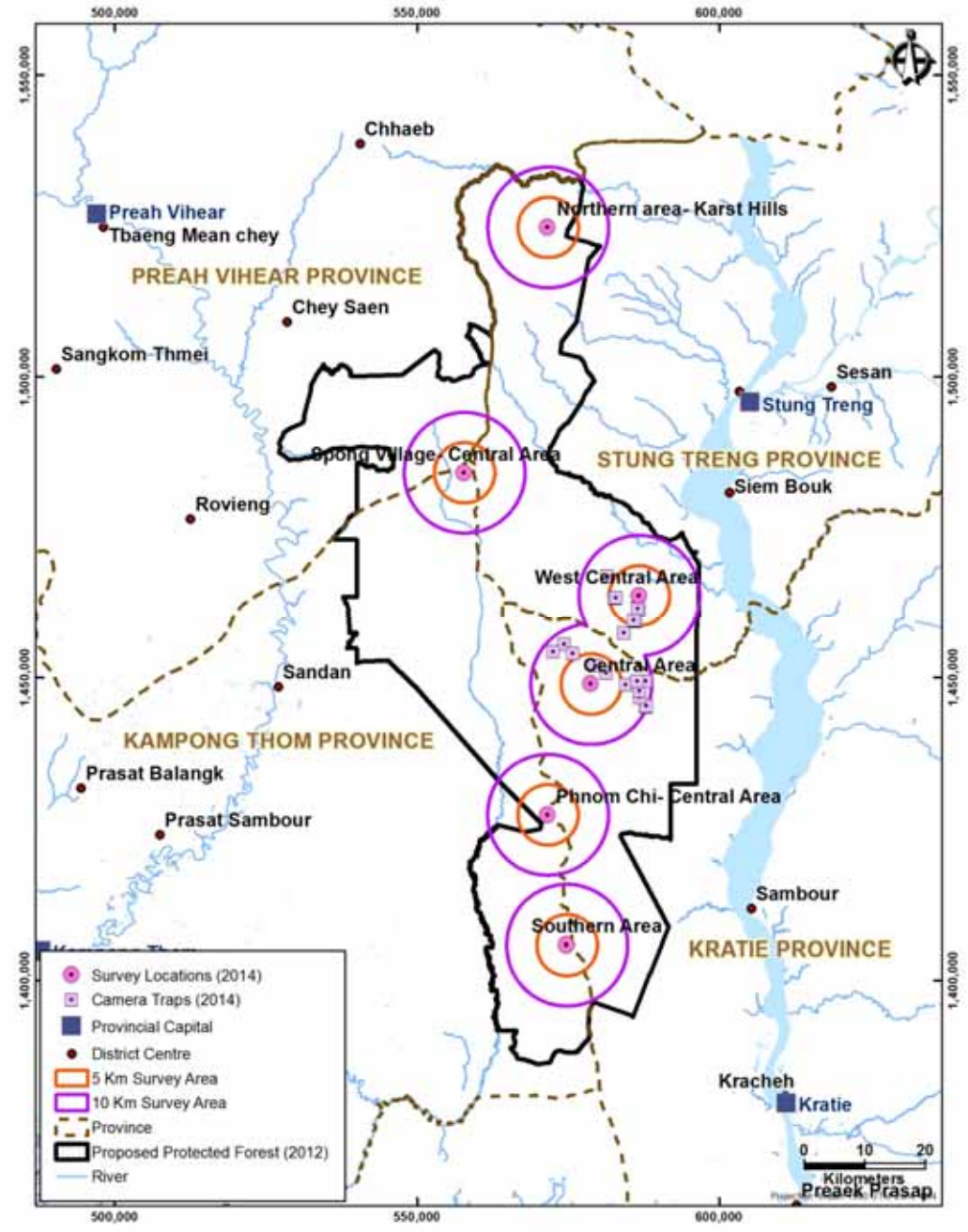
Map 3 Deforestation in Prey Lang between 2001-2011



Map 4 Economic Land Concessions around Prey Lang 2013

Survey aim and objectives:

Prior to this assessment several biodiversity surveys had been undertaken within Prey Lang. For the most part these were very rapid and were conducted between 2002 -2008 (see Olsson & Emmett, 2007). The present survey was conducted between June 2014 and February 2015. Fieldwork largely concentrated in the core evergreen area with a lesser effort directed towards the north and south (see Map 5.).



Map 5 Survey Areas

The aim of the survey was to review the biodiversity and conservation concerns and values within Prey Lang with the goal of obtaining official government protection of this landscape. For this purpose vegetation, mammals (including a specific study of bats), birds, amphibians and reptiles were selected as suitable focal taxa, with biologists working together towards the following objectives:

- Conduct baseline surveys of the vegetation, mammal (including a specific study of bat), bird, amphibian and reptile communities in all relevant habitats within the Prey Lang Landscape and build on the previous knowledge of the ecology of the landscape.
- Collect more in-depth information on species of global conservation concern;
- Recommend and identify priorities for conservation within the Prey Lang landscape;
- Evaluate and highlight the ongoing threats within the survey area and provide recommendations for their redress.

As methodological approaches differed depending on the taxa, the authors have described their specific survey methodologies in each of the chapters.

Survey limitations

This research was conducted in the form of a rapid assessment of the forest ecosystems of Prey Lang. Due to limited survey time over a large area, this survey was undertaken at sites known or suspected to have high biodiversity value. The species lists in this document are still relatively short compared to the number of species the diversity of the habitats and natural features of this landscape suggest the area supports. There are also some information gaps regarding the plants, such as phenology, their utilization and ecological preferences. Therefore, findings in this document are regarded as preliminary. However, names of visited sites and forest habitats could assist subsequent researchers to conduct more in-depth studies. Further floristic study efforts are necessary to document the integrity of species variety of Prey Lang to support policy making, and understanding the potential economic value of the area, such as through the study of plant-derived pharmaceuticals, and eco-friendly product development from NTFPs.

Since birds were surveyed only during the rainy season (June and October) and once in the early dry season (December), when most of the studied areas were still wet, it is not possible to draw conclusions about the bird populations in the dry season in the area. Many areas in Prey Lang were disturbed by human activity before proper bird surveys were conducted, so longer-term studies are necessary to detect lags in responses to changes from disturbance or habituation.

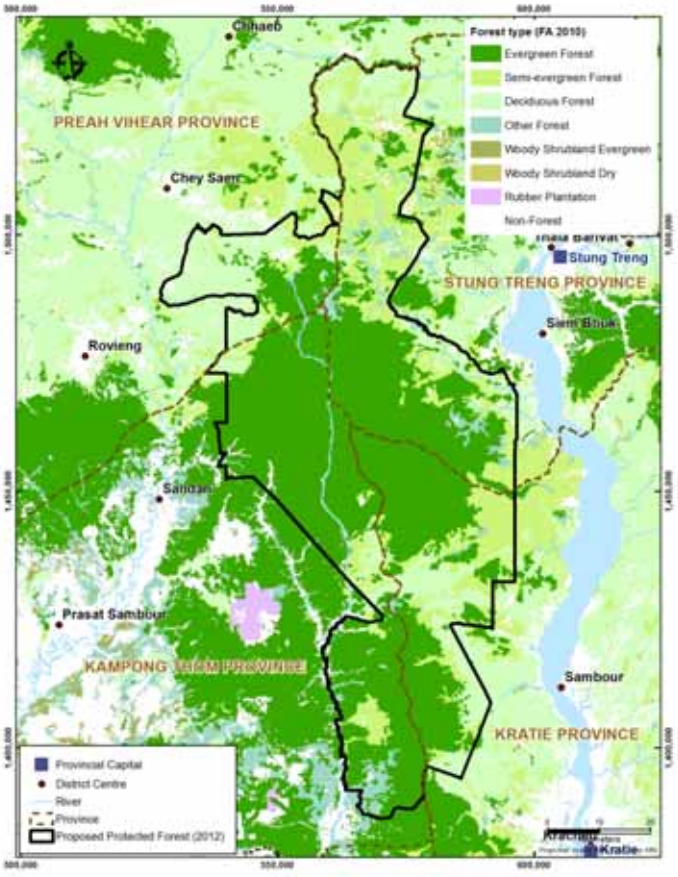
2. VEGETATION

Eang Hourt Khou

Introduction

Botanical research in Cambodia was started by French botanists in 1907 (Le Compte 1907 – 1942). Later, the publication of *Flore du Cambodge, du Laos et du Viêt Nam* in 1960 provided family accounts for Cambodia, Lao PDR and Vietnam (ibid). Between 1970 and 1972, a Cambodian taxonomist, Dy Phon, conducted comprehensive botanical research in many areas, mainly in the Elephant Mountain range and Kirirom National Park. The vegetation and floristic study stopped between 1975 and 1992 due to local unrest. Botanical research has been revitalized since 1993, however, study has been carried out periodically, based on short-term projects (typically 3-5 years).

One of the constraints in sustained botanical study in Cambodia is the lack of a national herbarium and trained botanists. In recent years, research on vegetation, fauna and flora has been carried out by international institutions in collaboration with researchers from the Forestry Administration. The leading international institutions have been the University of Copenhagen, Denmark; the University of Texas, Pan American, USA; and Chiang Mai University, Thailand. A number of conservation NGOs such as Conservation International (CI), Birdlife International and donor agencies have also invested in understanding the last remaining lowland evergreen forests of Prey Lang. In addition, the carbon stock of Prey Lang has been calculated for consideration in the REDD+ initiative. This research has produced significant results on the diversity of forest habitats, and of floristic diversity, however it is expected that many more species remain undiscovered. The coverage of different forest types as they were understood by the Forestry Administration in 2010 is depicted in Map 6.



Map 6 Forest types in Prey Lang, Forestry Administration 2010 data

Methods

To gather more comprehensive and accurate information, the following steps were employed:

- ➢ Study of the secondary data and development of an inventory of species recorded within Prey Lang and other areas of similar forest type(s);
- ➢ Based on previous studies which mapped forest types within Prey Lang, particularly Aruna (2009) and Theilade et al (2011b), selection of sites for vegetation and flora studies;
- ➢ Telephone interviews with community members living inside Prey Lang to:
  - Determine ease of access to selected survey sites
  - Verify the existence of various habitat types in the selected survey sites.
- ➢ Visits by the authors to the field sites listed in Table 1.

Table 1 Vegetation survey sites

Study site	Geography	UTM	Alt (m)	Forest type
Boeung Pes (Pes Lake)	Spong Village, Anlong Phe Commune, Thalaboriwat, Stung Treng Province	0554733-1486690	90 m	Evergreen Swamp Forest
Transitional zone of swamp forest and evergreen forest	Spong Village, Anlong Phe Commune, Thalaboriwat, Stung Treng Province	0557774-1486625	118m	Dwarf evergreen Forest
Evergreen forest	Spong Village, Anlong Phe Commune, Thalaboriwat, Stung Treng Province	0555028-1486586	126m	Evergreen Forest
Choam Thom	Boundary of Spong Village and Pnheak Roloek Village, Thmea Commune, Chey Sen District Preah Vihear Province	0553820-1587457	129m	Evergreen Swamp Forest (ESF)
O Porong (Porong seasonal stream)	Pnheak Roloek Village, Thmea Commune, Chey Sen District Preah Vihear Province	0553570-1488025	110m	Riparian Vegetation (RV)
Prey Phnom Soseth	Pnheak Roloek Village, Thmea Commune, Chey Sen District Preah Vihear Province	0553032-1492796	123m	Semi-Evergreen Forest
Prey Phnom Soseth	Pnheak Roloek Village, Thmea Commune, Chey Sen District Preah Vihear Province	0552582-1493709	124m	Deciduous Dipterocarp Forest (DDF)
Prey Totoeng	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0549901-1500992 0549506-1500907	145m	Mixed Deciduous Forest
Prey Totoeng hill	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0549413-1500751	117m	DDF dominated by *Shorea siamensis*
O Traim Dom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0549517-1500764	103m	RV
O Traim Dom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0548218-1501136	116m	DDF
Kon Damrey hill	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0550584-1504608	156m	DDF
Tompaing Ropok (Ropok pond)	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	0552470-1504563	145m	Aquatic pond with DDF environs
Chinese gold mining well	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	600953-1447287	71 m	MDF
Veal Phnom Dambok Khpos (Dambok Khpos open grassland area)	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	598510-1448122	74 m	Open Grassland Area
O Russey	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	597322-1447850	66 m	RV, periodic stream

Close to Veal Hluong	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	596535-1448069	68 m	Open Grassland Area
Veal Hluong	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	595864-1448246	64 m	Open Grassland Area
Boundary of Open grassland and SEF	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	595646-1448252	71 m	Open Grassland Area
On the way to O kraik	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	590084-1449645	85 m	SEF
O Kraik	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	589746-1449181	92 m	RV
Office of Chinese gold mining company at Dambok Sor	Kampong Damrey Village, Boeng Char Commune, Sambo District, Kratie Province	601341-1446702	77 m	MDF
O Chuntol	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	545741-1490979	106 m	RV
O Veay Laing	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	545692-1489883	99 m	RV
Clearance site of Trapaing Roim	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	545948-1489059	124 m	SEF
Chamcar of Trapaing Roim	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	546134-1488836	128 m	Farm
Trapaing Roim	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	546615-1488483	127 m	Grassland Area, pond
Prey Trapaing Roim	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	548754-1487880	134 m	Mixed Pine Broad Leaf Forest
Prey Trapaing Roim	Sreveal Village, Thmea Commune, Chey Sen District, Preah Vihear Province	548934-1488157	136 m	Mixed Pine Broad Leaf Forest
Pralay Chroeuk, Phnom 100	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	550120-1498479	134 m	DDF with S. siamensis dominance
Phnom Khleng Tom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	556247-1504536	153 m	SEF
Phnom Khleng Tom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	556195-1504878	159 m	SEF
Toek Chenh Pralay Damrey Tok	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	556104-1504972	152 m	SEF
Phnom Khleng Tom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	555934-1504835	161 m	SEF
Adjacent area of Phnom Khleng Tom	Thmea Village, Thmea Commune, Chey Sen District Preah Vihear Province	555293-1505238	144 m	SEF

The sites selected included representative areas of each of the eight different habitat types identified in the results section.

- ➢ Creation and utilization of an ecological assessment form, and the classification of forest types encountered using this form.

- ➢ Collaboration with para-taxonomists who accompanied the authors to each site to verify the local names of species identified. In the instances where species were known to the para-taxonomist, but not the author, only the local name for the species was recorded.

The rapid nature of the survey did not allow for the collection of samples for further analysis.

Results

Overall Findings

Significant contributions to the knowledge base of Prey Lang's flora have been made by McDonald (2004), Olsson & Emmett (2007), Francke et al (unpublished), Schmidt and Theilade (2010) and Theilade et al (2011). This findings section draws on all of their previous studies.

The total species account derived from existing literature is 153 species, including some for which botanical names are unknown. The current survey has built on this list through local interviews and field surveys to arrive at a total account of 530 species: 198 tree species, 87 treelet species, 69 liana species, 68 herbaceous species, 37 shrub and subshrub species, 20 vine species, 15 palm species, 12 fern species, seven fungi species, seven hemi-epiphyte species, three bamboo species, three parasite species, two pandan species, one cycase species and one epiphyte species (see Figure 1).

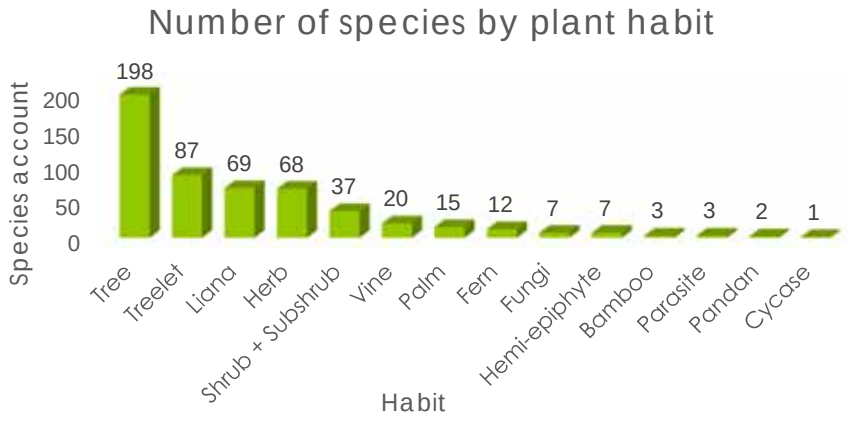


Figure 1 Number of species identified in Prey Lang by plant habit

One orchid found during the survey, *Peristylus goodyeroides,* is a new record for Cambodia.

Figure 2 Peristylus goodyeroides on limestone, Prey Lang

Prey Lang was found to be composed of eight forest types, consisting of Deciduous Dipterocarp Forest (DDF), Mixed Deciduous Forest (MDF), Mixed Pine Broad Leaf Forest (MPBF), Semi-Evergreen Forest (SEF), Evergreen Forest (EF), Evergreen Swamp Forest (ESF), Riparian Forest (RV) and Open Grassland (OG). The terminology of the forest habitat description to be applied in this document follows Rundel's forest classification system of 1998. However, forest classification terms used by previous researchers in Prey Lang will be noted as appropriate.

The following sections describe each of these habitat types individually.

- ➢ Deciduous Dipterocarp Forest (DDF)

DDF in Prey Lang is defined based on the unique structure of open canopy layers, a deciduous character in the dry season, and a dominance of deciduous dipterocarp tree species and seasonal herbaceous plants, with a preponderance of the two main grass species of thatch (*Imperata cylindirca*, Graminae) and dwarf bamboo (*Vietnamosasa pusilla*, Gramineae). Five deciduous dipterocarp species, consisting of *D. obtusifolius*, *D. tuberculatus*, *D. intricatus*, *Shorea obtusa* and *S. siamensis* are distributed randomly throughout this forest type. Termite hills and ponds are sparsely scattered throughout this forest type, and support different species. Termite hills usually do not have grasses on the ground, but hold many evergreen tree species and lianas. Most of the ponds are seasonal, containing water only in the rainy season and start to dry from November, but some large ponds hold water permanently, and so serve as water

resources for wildlife in the dry season. All ponds are home to many amphibious herbs. Based on previous and current study, there are 191 species, 18 of which are evergreen species (see Appendix I).

Based on plant habit, by exclusion of the emergent crown layer, DDF can be categorized into three layers: a canopy layer, an understory and a ground story.

- The upper or canopy story includes all tree species inhabiting this forest type. The average maximum height of these trees is around 15 meters, whereas average minimum height ranges from around eight meters to 12 meters. Typical deciduous tree species recorded in this forest type include Raing Phnom (*Shorea siamensis*, Dipterocarpaceae), Chhlik (*Terminalia alata,* Combretaceae), Khvav (*Haldina cordifolia,* Rubiaceae), Phchoek (*Shorea obtuse,* Dipterocarpaceae), Praim Damloeung (*Terminalia mucronata,* Combretaceae), Roka (*Bombax anceps,* Malvaceae), Samrang - Veng Khsae (*Sterculia villosa,* Malvaceae), Sokram (*Xylia xylocarpa,* Mimosoideae), Phlou Thom (*Dillenia ovate,* Dilleniaceae), Roleay Toch (*Lasianthus hirsutus,* Rubiaceae), and Trach (*Dipterocarpus intricatus,* Dipterocarpaceae). Some of the evergreen tree species that grow in association with other deciduous tree species of this forest type include Laing Chey Sloek Thom (*Buchanania reticulate,* Anacardiaceae), Sdok Sdol (*Petes thorelii,* Euphorbiaceae), Chambak (*Irvingia malayana,* Irvingiaceae), Pring Bay (*Syzygium fruticosa,* Myrtaceae), Sdok Sdol (*Walsura robusta,* Meliaceae), Thlok (*Parinari anamensis,* Chrysobalanaceae) and Trayoeng (*Diospyros pilosanthera,* Ebenaceae). The heights of some tree species are greatly variable and are dependent on soil conditions. It is noted that most large trees are host to many epiphytic plants, such as orchids and ferns.
- The understory is composed of small trees/treelets, palms and shrubs of variable height, from approximately two meters to six meters, rarely exceeding this height; most of them are deciduous. Deciduous species commonly inhabiting this forest type are Baikdang (*Gardenia philastrei,* Rubiaceae), Ach Sait (*Brownlowia emarginata,* Malvaceae), Krumpouk (*Randia uliginosa,* Rubiaceae), Kandoal (*Careya arborea,* Lecythidaceae), Krung Samot (*Aporosa octandra,* Phyllanthaceae), Nho Toch (*Morinda coreia,* Rubiaceae), Kantuot Prey (*Phyllanthus emblica,* Phyllanthaceae), Phlou (*Dillenia parviflora,* Dilleniaceae), Ampok Phleung (*Dioecrescis erythroclada,* Rubiaceae), Ampok Sor (*Tamilnadia uliginosa,* Rubiaceae), Pika (*Oroxylum indicum,* Bignoniaceae) and Roveang (*Randia tomentosa,* Rubiaceae).
- The ground story refers to all plants attached to the ground to a height of approximately two meters above ground level. Species of this layer are represented by a number of deciduous species of herb, sub-shrubs, shrubs, ground ferns, cycases, palms and seedlings. Species representing this layer include Sbov (*Imperata cylindrical,* Gramineae) and Prich (*Vietnamosasa pusilla*, Gramineae). Other common species occurring across this forest type are Bay Nhenh Chhmol (*Melastoma villosum,* Melastomataceae), Tundai (*Droogmansia godefroyana,* Papilionoideae), Phlou bat (*Dillenia hookeri,* Dilleniaceae), Dong Preah/Dong Tonsay (*Phoenix loureiri,* Palmae), Chahuoy (*Curcuma petiolata,* Zingiberaceae), Proh (mem) (*Kaempferia galangal,* Zingiberaceae), Tathok (*Costus speciosus,* Zingiberaceae), Toil

(*Amorphophallus harmandii,* Araceae), and Prang Prey (*Cycas siamensis,* Cycadaceae).

Climbing species commonly seen in this forest type include Khlen Tea (*Harrisonia perforate,* Simaroubaceae), Ang Krong (*Ziziphus cambodiana,* Rhamnaceae), Char (Voir) (*Butea superba,* Papilionoideae), Sang Kheur (*Ziziphus oenopolia,* Rhamnaceae), Voir Doh Kun (*Tetracera loureiri,* Dilleniaceae) and Voir Thnoeng (*Aganonerion polymorphum,* Apocynaceae).

Different deciduous tree species start to shed their leaves from December to March, and all exposed parts of herbaceous plant species subsequently begin to die off during the same period. After shedding their leaves, certain tree species start to flush new leaves immediately, but others remain dormant. The dead parts of herbaceous plants, fallen leaves and branches of plants on the ground create a large biomass, which is prone to forest fire in the dry season. With regular annual forest fires, the DDF may be tolerant of fire and maintain its structure. Such fires do not kill mature trees, shrubs or lianas, because they have thick bark that is resistant to fire. However, if more biomass is accumulated over successive years, and is suddenly affected by large fires, mature trees may be severely affected by stronger fire intensity, which may result in their deaths. Seedlings regenerated from roots, stumps and seeds are usually severely affected by any fire, making it difficult for them to grow into larger plants. This may explain why the DDF usually has sparse numbers of trees and shrubs.

All herbaceous plants start their growth by their rootstock, and most trees/small trees, shrubs and herbs are in full bloom at the start of rainy season, from April to June. Therefore the DDF attracts wildlife to its abundance of food in the rainy season, especially large mammals. It is noted that not only grasses serve as food for wild mammals, but also the fruits of some tree species - *Phyllanthus emblica*, *Terminalia chebula* and *Irvingia malayana* are important food sources, in particular for deer species.

As most of the DDFs are located in lowlands of Prey Lang and surrounded by residential areas, they are usually subject to the threat of land clearance for farming by either villagers or larger scale agricultural projects. In addition, this forest type also contains a number of valuable timber species, which are subject to extensive logging. Currently, rosewood species, such as *D. cochinchinensis*, *D. olivery*, *P. macrocarpus*, *Sindora. siamensis* and *Afzelia xylocarpa* are overharvested for commercial trade. They are listed as endangered to critically endangered on the IUCN Red List. The majority of these species are coppiced by stumps and roots, and so, with proper maintenance of the remaining stumps, new sprouts can be regenerated from the stumps.

- ➢ Mixed Deciduous Forest (MDF)

Mixed Deciduous Forest is characterised by diverse deciduous trees with a very low percentage or a complete lack of deciduous dipterocarp tree species in some areas. Rollet (1952, 1962, 1972) studied this forest type near Siem Reap and Buplok, and applied a French term to it: *forêst denses décidues*. Martin (1973) studied vegetation on the lower hill slopes in the northern Cardamom Mountains and termed it *dry*

deciduous forest. Plant species of the understory and ground story layers are dominated by deciduous species, which shed their leaves in the dry season. Climber species are less common and are represented by few species. The herbaceous plants are similar to those present in the DDF, but less abundant. Therefore, forest fires usually occur in this forest type at a low intensity. Based on field observations conducted in a number of areas, MDF usually occurs in low lying areas of Prey Lang, or areas with a deep and moderate, rich soil of loamy sand or clay. The two sites composed of Prey Totoeng and O Traimkang and their environs, located to the south of Thmea village, Thmea commune, Chey Sen District, Preah Vihear Province, represent the MDF well. The two community forests (CF) of Kroam and Kralapeas and their environs, located in Preah Rumkel commune, Thalaboriwath District, in the northeast of Prey Lang, are also dominated by this forest type and are similar to those in Thmea village in terms of both species compositions and forest structure. The author has also observed MDF within the Poukroch CF in Mondulkiri Province. This forest type occurs in variable sizes from small to large patches, and in association with DDF, though it sometimes occurs in transitional zones between DDF and Semi-Evergreen Forest (SEF), or DDF and Riparian Forest (RF). The structure of this forest type is also intermediate between the DDF and SEF, and thus hard to distinguish precisely. Therefore, mapped delineation of this forest type cannot be precise unless thorough ground research is conducted and cross-checked with aerial photos or satellite images. This may be the reason for the absence of this forest type in the national forest cover map produced by the Forestry Administration (FA) in 2010 (Map 6). A total account of 205 species recorded during this and past surveys includes 22 evergreen species, representing about 10.7 percent of all species in this forest type (see Appendix I). MDF is composed of three layers – the canopy layer, understory and ground story. Certain trees grow taller and become an emergent layer. Many mature trees and certain unhealthy trees are usually intermediate between the canopy and understory, and thus occasionally create indistinct layers.

- The canopy layer has the average height of approximately 17 meters. The canopy cover is variable from approximately 60 percent to 80 percent, which allows sunlight to penetrate to the ground. Trees account for 80 percent of species. Some Key Species representing this layer consist of Sralao Kanhchhreab (*Lagerstroemiaduperreana,* Lythraceae), Lve (*Dillenia pentagyna,* Dilleniaceae), Trach (*Dipterocarpus intricatus*, Dipterocarpaceae), Khvav (*Haldina cordifolia,* Rubiaceae), Chambak (*Irvingia malayana,* Irvingiaceae), Svay Prey (*Mangifera duperreana,* Anacardiaceae), Sma Krabei Thom/Doh Krabei (*Miliusa velutina,* Annonaceae), Popel (*Shorea roxburghii,* Dipterocarpaceae), Sangkuot Tmart (*Stereospermum cylindricum,* Bignoniaceae) and Sokram (*Xylia xylocarpa,* Mimosoideae).
- The understory layer refers to all treelets, shrubs and juvenile trees, ranging from three to seven meters in height. Most of these species are deciduous, which shed leaves in December, and produce young leaves and flowers in April and May. Species representing in this layer are Chhkae Sreng (*Cananga latifolia,* Annonaceae), Romduol (*Melodorum fruticosum,* Annonaceae), Khleng Kung (*Wrightia pubescens,* Apocynaceae), Dork Po (*Markhamia stipulacea,* Bignoniaceae), Haisan (*Senna garrettiana,* Caesalpinioideae) and Dai Khla (*Gardenia angkoreansis*, Rubiaceae). *Gardenia angkoreansis* is very

common along the road to Veal Hluong, in Kampong Damrey village of Boeng Char commune.

- The ground layer is usually less dense, and thus forest fire is not as intense as in the DDF. In some areas, where the ground has exposure to sunlight, a greater number of thatches (*Imperata cylindrical*) and sometimes dwarf bamboo/Russey Prich (*Vietnamosasa pusilla*) and sedges of the family Cyperaceae are encountered, whereas in areas with less sunlight penetrating to the ground, for instance O Traim Dom which is closer to a stream, thatches and dwarf bamboo are absent and have been replaced by seedlings. Certain species recorded included Toel Tom (*Amorphophallus paeoniifolius,* Araceae), Spey Kok (*Synedrella nodiflora,* Compositae), Tathok (*Costus speciosus,* Zingiberaceae), Phtuok Sar (*Globba cambodgensis,* Zingiberaceae), Proh (mem) (*Kaempferia galangal,* Zingiberaceae) and Khteu (*Zingiber zerumbet,* Zingiberaceae).

Climber species are less common in this forest type, and most of them represent deciduous species, which also frequently grow in DDF areas. Examples include Voir Char (*Butea superba,* Papilionoideae), Khlaeng Poir (*Bauhiniabracteata,* Caesalpinioideae), Khlen Tea (*Harrisonia perforate,* Simaroubaceae), Khsuos (*Getonia floribunda,* Combretaceae), Phdao Kraek (*Calamus viminalis,* Palmae), Tumpaing Baychou Prey (*Ampelocissus martini,* Vitaceae) and Voir Sleng (*Strychnos rupicola,* Loganiaceae).

Epiphytic and hemi-epiphytic species are represented by orchids, Suot Damrey (*Hydnophytum formicarium*, Rubiaceae), Pokmoat Preah Ream (*Platycerium wallichii*, Polypodiaceae), Trachek Damrey (*Hoya diversifolia*, Asclepiadaceae) and *Panheu Ka-aek* (*Dendrophthoe pentandra*, Loranthaceae).

Economically, this forest type is rich in populations of the four rosewood species of *Dalbergia olivery*, *D. cochinchinensis*, *Pterocarpus macrocarpus* and *Afzelia xylocarpa*, and other highly-valued timber species, mainly belonging to dipterocarp, lagerstroemia and other legume families. Small patches of paddy rice fields of approximately 0.5 to one hectare in size are randomly scattered within this forest in Prey Lang, in particular in low lying areas where there is both more water and richer soil as a result of the accumulation of biomass.

➢ Mixed Pine Broad Leaf Forest (MPDF)

A large patch of Mixed Pine Broad Leaf Forest is located at Veal Amoul of Trapaing Prei area, Sre Veal village, Thmea commune, Chey Sen District, Preah Vihear Province, at the elevation of 136 meters a.s.l. Another patch of pine forest was also reported to be present at O Lang area in Stung Treng Province, or around 2 km northeast of upper stream of O Kraik, extending to O Khsach (Kou Veurn, Kampong Kbeurng villager, Kratie Province, pers comm.). Previous studies reported pine forest in many areas, ranging from the south to north of Tonle Sap to the northern lowland of Cambodia (Dy Phone 1970, Legris and Blasco, 1972; Martin 1973, and Rollet, 1972), randomly scattered in between Siem Reap and Kampong Thom Province, and to a limited degree near Siem Bok, in the west of Mekong River (Legris and Blasco, 1972). MPDF was also recorded in Boeung Per Wildlife Sanctuary, Kampong Thom

Province (Eanghourt K. 2014). Based on these findings, it can be concluded that the two-needle pine forest is widespread in the southwest and central regions of Cambodia.

This forest type is characterized by a mix of two-needle pine tree species and other broad leaf tree types. Tree species occurring in this forest type are a mix of evergreen and deciduous trees. The canopy layer of this forest type is variable from more open to moderately dense depending on the majority of counterpart tree species. For an area with pine tree dominance and more deciduous counterpart, the canopy is more open which allows sunlight to reach the ground, and encourages the growth of herbaceous plants, especially grasses. Only 57 species in total were recorded in Prey Lang's MPDF, and 45.6 percent were evergreen species (see Appendix I). In general, the crown layers can be categorized in three distinct layers including canopy layer, understory and ground composition.

- The canopy layer of this forest type is made up of evergreen pine tree species of two needle leave pine trees, and other counterpart broadleaf tree species such as Popel (*Shorea roxburghii*), Phdeak (*Anisoptera costata*), Trach (*Dipterocarpus intricatus*), Chramas (Vatica odorata), Chheuteal Kreus (*Dipterocarpus costatus*), Thlok (*Parinari anamensis, Chrysobalanaceae*), Thnong (*Pterocarpus macrocapus, Papilionoideae*) and Angkort Khmao *(Diospyros bejaudii*, Ebenaceae).
- The understory is composed of species such as Kray Krahorm (*Xylopia vielana*, Annonaceae), Kray Sor (*Xylopia pierrei*, Annonaceae), Popoul Thmor (*Vitex pinnata*, Labiatae), Lngieng Kon Nga (*Cratoxylum formosum*, Hypericaceae), Tbeng (*Dipterocarpus obtusifolius*, Dipterocarpaceae), Mrech Tansaiy (*Baeckea frutescens*, Myrtaceae), Krung Samot (*Aporosa octandra*, Phyllanthaceae) and Roveang (*Randia tomentosa*, Rubiaceae).
- Ground herbaceous plants are dominated by grasses, with sparse clumps of Bay Nhenh (*Melastoma saigonense*, Melastomataceae) and Tathok (*Costus speciosus*, Zingiberaceae). The former Thmear Commune Council of Chey Sen District has reported that communities living in Sandan District, Kampong Thom Province, tapped oleoresin from pine trees in 2006, but resin collection activity was abandoned due to the deaths of a number of pine trees after tapping (pers comm.).

➢ Semi-evergreen Forest (SEF)

Due to the variation of the forest structure and species diversity, Semi-evergreen Forest has been termed variously by different researchers visiting different forests. Lagris and Blasco (1972) termed it in French as *forêt dense semi-decidue*, and used the term *dry evergreen forest*, whereas Maxwell (2006-2007) suggested a more specific term - *Mixed Evergreen + Deciduous Hard Wood Forest* (MXF). Rundel (1999) preferred the term Semi-evergreen Forest due to the variable proportions of evergreen and deciduous trees. The SEF is characterized by more diverse floral species, a tall and multi-layered forest structure, and is located in lower areas with more seasonal rainfall regimes (Rundel, 1999). McDonald explained that this forest type is a transition zone between deciduous and evergreen forests, and varies considerably in terms of stature, species composition and vertical layered structure

(McDonald, 2004). Stands of 40 meters in height and more than one meter in diameter were reported to be common in this type of forest in the past (Rollet, 1972). Some SEF areas are dominated by populations of *Lagerstroemia* spp, accompanied by counterpart species of *Dipteroarpus costatus*, *Xylia xylocarpa*, *Anisoptera costata* and *Irvingia malayana*. Because of tall stands with larger diameters, local communities usually refer to this forest type as '*Prey Sroang*' or in technical Khmer terms, '*Prey Paik Kandal Sroang*'. Due to the fact that most species are on the ground level and that there are many large evergreen trees, this forest type is usually not affected by fire in the dry season. It consists of diverse plant species, but only 152 species have been recorded by researchers, of which 77 are evergreen, representing 50.65% of species in this forest type.

McDonald observed two SEF sites located near the upper stream of O Lang (Kbal O Lang) in 2004, and encountered two intact SEF areas with stands ranging from 25 to 35 meters in height and 40-80 centimeters in diameter. With such broad variable forest structure and plant communities, this forest type is difficult to describe based on observations at a few sites. Moreover, height of individual stands are continuous from the ground to the emergent layers, making it hard to distinguish layers. If based on plant life forms, three crown layers can be divided as follows:

- Emergent and canopy layers are composed of a number of key evergreen tree species, for instance the dipterocarp tree species of Chramas (*Vatica odorata)* and Chheuteal Bangkuoy/Chheuteal Kreus/Chheuteal Chhngor (*Dipterocarpus costatus*); Thlok (*Parinari annamensis*, Chrysobalanaceae), Chambak (*Irvingia malayana*, Irvingiaceae), Chheu Sor/Chia (*Alstonia spatulacea*, Apocynaceae); and Trasek (*Peltophorum dasyrrachis*, Caesalpinioideae). Many large trees are home to epiphytic orchids and ferns.
- The understory layer is comprised of a number of tree communities of certain Myrtaceae species like Smach/Smach Doam/Pring Krahorm (*Syzygium zeylanica*) and Pring (*Syzygium* spp.); species of Guttiferae - Pha-ong (*Calophyllum saigonense*) and Tromoung (*Garcinia oliveri*, Guttiferae); and species of Sapindaceae - Mien Prey (*Dimocarpus longan*) and Semoan Sach (*Nephelium hypoleucum*), Trorb Tum (*Crypteronia paniculata*, Crypteroniaceae), Neang Pha-aek/Atit (*Dehaasia cuneata*, Lauraceae), and Popoul Thmor (*Vitex pinnata*, Verbenaceae).
- The ground floor contains many evergreen, woody and herbaceous plants and seedlings. In the dry season, the ground vegetation remains green but very dry. In areas with larger stands and denser canopy, the ground cover is sparse and easy to walk through. In more disturbed areas, Krakoa (*Amomum ovoidium*, Zingiberaceae) and other members of the ginger family are abundant. The notable hemi-epiphytic plants are represented by Voir Ka-aep (*Rhaphidophora peepla* and *Rhaphidophora Montana*, Araceae), Mrech Prey (*Piper* sp., Piperaceae) and Phka Kandoeng (*Hoya oblongacutifolia*, Asclepiadaceae).

Larger woody climbing species are represented by Khanma (*Ancistrocladus cochinchinensis*, Ancistrocladaceae), Voir Khlot (*Gnetum gnemon*, Gnetaceae), Angkunh Sva (*Archidendron lucidum*, Mimosoideae), Voir Ankunh (*Entada phaseoloides*, Mimosoideae), Voir Chek Tum (*Artabotrys hexapetalus*, Annonaceae),

Kandap Chang-E (*Salacia typhina*, Celastraceae), Kuy (*Willughbeia edulis*, Apocynaceae), Voir Taling *(Coptosapelta flavescens*, Rubiaceae), Voir Dek (*Dendrotrophe varians*, Santalaceae), and rattan (*Calamus* spp., *Plectocomia pierreana*, *Myrialepis paradoxa* and *Korthalia laciniosa*).

➢ Evergreen Forest (EF)

Evergreen forest refers to forests with a dominance of evergreen species, from the canopy to the ground layer, and herbaceous plants in combination with a rich variety of epiphytic orchids, ferns, *Hoya*, *Araceae* and creeping species. The literature from the French period did not report the study of EF within Prey Lang. Similarly, recent studies have not precisely described this forest type within this landscape. Most of the studies on this forest type were conducted within the Elephant Ranges of the Bokor National Park in the south of Cambodia, through the Central Cardamom Mountain ranges in the southwest of the country (Rundel 1999). In Prey Lang, the surveyed sites of this forest type were in the environs of Boeng Pes and O Kraik. The record of plant species up to date has accounted for only 111 species, 91 (about 82%) of which are evergreen species. Based on the description of EF given in Rundel's book, *Forest Habitat and Flora in Lao PDR, Cambodia, and Vietnam*, large patches of the forest adjacent to the Evergreen Swamp Forest in Prey Lang can be classified as Evergreen Forest. The vertical stuture of the crown layers is continuous, again making it difficult to define its layers properly. However on the basis of plant life form, (for instance tree, treelet, shrub, herb and climber), four crown layers can be defined as follows.

- The canopy layer is uneven, and the stands are usually 15-20m high, but sometimes reach 30-35m. Local guides reported that the average lower height of trees is natural, not a result of logging. Chheuteal Kreus (*Dipterocarpus costatus*), Chheuteal Toek (*D. alatus*), Trach (*D. intricartus*), Koki Msao (*Hopea odorata*), Phdeak (*Anisoptera costata*), and Chambork (*Irvingia malayana*) represent this layer. The counterpart species like Thlok (*Parinari anamensis*, Chrysobalanaceae), Bangkuv Hobphlae (*Aglaia cambodiana,* Meliaceae), Bangkuv Sva (*Aglaia elaeagnoidea,* Meliaceae), Kamping Reach (*Sandoricum koetjape,* Meliaceae), Tatrao (*Fagraea fragrans,* Loganiaceae) and Trasek (*Peltophorum dasyrrhachis,* Caesalpinioideae) are also seen in this forest type. Most of the trees are cylindrical with small buttresses, grey bark and one to two thirds of vertical crown. Because of their sparse distribution throughout the forest, the canopy is relatively open, allowing sunlight to penetrate to the lower layers. The upper part of the trees are frequently host to epiphytic orchids and ferns, and their crown layers are sometimes host to large bird species. Trees with diameters of greater than one meter are rarely seen, except in the case of dipterocarp trees.
- The subcanopy layer is denser. Most of these trees are cylindrical in shape, and reach between 14 to 17 meters in height and 30 to 40 cm in diameter. Tree species include a number of Ebenaceae species like Angkort Khmao (*Diospyros bejaudii*), Chheu Khmao (*Diospyros crumenata*) and Chheu Phleung (*Diospyros undulata var. cratericalyx*); certain species of Guttiferae - Tromoung (*Garcinia oliveri*), Prohout (*Garcinia vilersiana*); Khos (*Lithocarpus polystachyus,* Fagaceae); Chramas (*Vatica odorata,* Dipterocarpaceae); two species of Annonceae - Kray Krahorm (*Xylopia*

vielana) and Kray Sor (*Xylopia pierrei*), and Phlong (*Memecylon laevigalum,* Melastomataceae).

- The understory layer includes all treelet species and shrubs with maximum ranges from one to six metres in height. These species grow well under shade. A number of species representing this story include Angkea Bath (*Gomphia serrate,* Ochnaceae), Angrae Daek (*Dracaena cambodiana,* Asparagaceae), Kon Khmom (*Dracaena fragrans,* Asparagaceae), Chunlos (*Lepisanthes rubiginosa,* Sapindaceae), Phlov Neang (*Cleistanthus tomentosus,* Phyllanthaceae), Slang (*Ardisia sanguinolenta,* Primulaceae), Snay (*Streblus asper,* Moraceae), Pha-av (*Licuala spinosa,* Palmae) and Chumpou Prey/Chhnok Thmatbat (*Ardisia helferiana,* Primulaceae).
- The ground layer accounts for all herbaceous species, certain treelets and sub-shrubs, and all seedlings. Its height is counted from the surface layer to a height of approximately one meter. This layer receives little sunlight, so grasses and thatches are very rare. A number of species representing this layer are species of Primulaceae - Sakou Phnom (*Ardisia smaragdina*) and Seda Prey (*Ardisia villosa*); and species of Zingiberaceae - Krakei (*Alpinia oxymitra*) and Krakoa (*Amomum ovoideum,* Zingiberaceae), Romchek Phnom (*Pandanus capusii,* Pandanaceae) and Snaeng Ton (*Aglaonema modestum,* Araceae).

The climbing species are diverse, but their populations are low in this forest type, mainly occuring in canopy gaps. These species include many rattan species - Phdao chvaing (*Calamus palustris*), Phdao Sno (*Plectocomia pierreana*), Ph'dao Soam (*Daemonorops jenkinsiana*), Sesoeng (*Calamus tetradactylus*); many legume species such as Angkonh Sva/Chondeu Sva (*Archidendron lucidum*), Angkunh (*Entada phaseoloides*), Voir Antong (*Derris elliptica*); Khanma (*Ancistrocladus cochinchinensis,* Ancistrocladaceae); Voir Khlot (*Gnetum gnemon,* Gnetaceae), and Voir Thlok (*Toxocarpus lagenifer,* Apocynaceae). Hemi-epyphytes are dominated by Changkeh Angkrang (*Pothos scandens,* Araceae), Mrech Tansay (*Piper* sp., Piperaceae), Voir Ka-aeb (*Rhaphidophora peepla,* Araceae), and *Hoya* spp.

➢ Evergreen Swamp Forest (ESF)

The Evergreen Swamp Forest (ESF) has been coined as such probably due to the fact that the central area of Prey Lang is covered by large patches of water in the rainy season, which are then reduced to smaller patches in the dry season. Floristically, species compositions inhabiting this landscape represent evergreen forest, but are not associated with the swamp forest surrounding the Tonle Sap/Great Lake (McDonald 2004). Due to large intact forest areas in the past, the extensive underground water of this landscape was stored and released. Therefore many spring areas, permanent ponds or lakes (locally called *Boeng*) and permanent swamp/boggy areas mainly dominated by grasses occur randomly across the landscape. These special landscape features play a vital role in either storing water in the rainy season or maintaining water in the dry season for wildlife. They may also provide a significant underground water source to support agricultural crops and people living in the low lying areas by means of well construction for water consumption (McDonald 2004).

Figure 3 Evergreen Swamp Forest, Prey Lang

The study of the inland Evergreen Swamp Forest was conducted by McDonald (2004), and later, more extensive studies were carried out in 2008, 2009 and 2010 by a research team from Copenhagen University (Denmark), Texas University (USA), and the Forestry Administration (FA) of Cambodia. Many inland swamp areas have been reported, scattered between the Porong and O Lang rivers at altitudes ranging from 50-100 meters asl., of which five sites, including Choam, north of Spong, Choam Spong, Choam Takong, Choam west of Takong, and Choam Svay, had studies conducted on either botanical or ecological species diversity and hydrology. Choam Takong, with a size of 2km by 1km, was reported as being the largest swamp (McDonald 2004). Although there are some differences in species composition in the swamp areas, the characteristics of the Evergreen Swamp Forests are generally represented by hydrophytic trees with aerial and stilt roots on the ground, dense understories that may be more open in places, an irregular canopy of 8-35 meters in height, and a sparse emergent layer of trees and palms (*Livistona saribus)* with heights ranging from around 30-35 meters (McDonald 2014). Some species are confined to the swamp areas, though many of them can also be found on upland areas (Theilade et al., 2011). Based on floristic compositions, three layers can be defined as follows:

- The canopy layer is represented by Kuok (*Myristica iners*, Myristicaceae), two unknown species of the genus *Litsea* spp., Pring Angkaim (*Syzygium* sp., Myrtaceae), Prolop (*Mastixia pentandra*, Nyssaceae), Sreung (*Ploiarium alternifolium*, Bonnetiaceae), Deum Tronum Kamphem (*Archidendron clypearia*, Mimosoideae) and some fig trees (*Ficus* spp., Moraceae).
- The understory trees are represented by Slapang Sloek Chhaek (*Macaranga triloba*, Euphorbiaceae), Changkort Praik (*Pternandra caerulescens*,

Melastomataceae), Phnheav Toek (*Baccaurea bracteata*, Euphorbiaceae), Sralork (*Euonymus glaber*, Celastraceae), *Memecylon umbellatum* (Melastomataceae), Pring Krahorm/Smach Doam (*Syzygium zeylanicum*, Myrtaceae) and Pha-ong Chorm (*Calophyllum spectabile*, Guttiferae). The clumpy species are represented by Sla Prey (*Areca triandra*, Palmae), Pha-av (*Licuala spinosa*, Palmae), Soam (*Daemonorops jenkinsiana*, Palmae) and the tree fern, (*Cibotium barometz*, Cibotiaceae). A few small trees and climbers like Angredek (*Dracaena gracilis*, Asparagaceae) and *Nepenthes* species are confined to the swamp's border.

- The ground cover is dominated by two species of Cyperaceae – Traset Choim (*Mapania macrocephala*) and *Hypolythrum nemorum*. Other aquatic species inhabiting the open water areas or adjacent ponds include Kork Moul (*Isolepis crassiuscula*, Cyperaceae), Sarai (*Najas indica*, Najadaceae), and *Utricularia aurea*, Lenthibulariaceae (local name unknown). Based on a comparision of species compositon with other Swamp Forests in the region, it is clear that the inland Evergreen Swamp Forest is endemic to the central lowlands of Cambodia (Theilade, 2010).

The transitional zone between swamp forest and mainland evergreen forest is known as '*Prey Sail*' or 'dwarf forest' in the indigenous Kuy language. Similar to swamp forest, the forest of this area is short, with an average maximum height of around eight meters and a 50 cm diameter breast height (dbh). The forest ecosystem of Boeng Pes (Pes Lake) is a good example of this forest type. The trees are mainly represented by evergreen species, with few deciduous species. Tree species occurring in this zone include a number of dipterocarp species - Phdeak (*Anisoptera glabra*), Trach (*Dipterocarpus intricatus*) and Chramas *(Vatica odorata*); two species of Annonaceae - Kray Krahorm (*Xylopia vielana*) and Kray Sor (*Xylopia pierrei*); Kokoh (*Sindora siamensis*, Caesalpinioidae); and three species of Ebenaceae – Chheu Phleung (*Diospyros undulata* var. *cratericalyx*), Angkort Khmao (*Diospyros bejaudii*) and Chheu Khmao (*Diospyros crumenata*).

➢ Riparian Forest (RF)

The term riparian vegetation is applied to vegetation located along small and large streams, which functions as erosion protection. The species compositions along the streams running though different forest types largely reflects the forest types it is adjacent to. However certain species such as Raing Toek (*Barringtonia acutangula*, Lecythidaceae), Khtum Toek (*Nauclea officinalis*, Rubiaceae), Kum Phneang (*Hymenocardia punctata*, Phyllanthaceae), Phdao Toek (*Calamus siamensis*, Palmae), Ampong Traing (*Lasia spinosa*, Araceae), Phdao Sva (*Flagellaria indica*, Flagellariaceae) are much more common on stream banks.

Figure 4 Riparian Forest, Stung Treng, Prey Lang

This vegetation type plays a dominant role in protecting soil from erosion and keeping water clear, and is also an important habitat for wild animals in the dry season. The soil of this forest type is usually wet and loamy as a result of the accumulation of decayed plant materials.

➢ Open Grassland Area

Open areas are characterized by an area covered with grasses and sparse clumps of shrubs and dwarf trees. Veal Hluong, along the road to O Kraik, represents this habitat well. This area is surrounded by a mosaic of dwarf MDF and SEF. The substrate is poor, sandy with fine grains, making it difficult for plants to grow. Grasses are dominant, usually reaching 0.3m in height, and are associated with other counterparts, such as herb, vine and shrub species. The local names of a number of herbaceous members inhabiting this grassland area are unknown, including *Rhynchospora rubra*, *Ischaemum indicum*, *Mnesithea mollicoma*, *Eremochloa ciliaris*, *Fimbristylis distycha*, *Burmannia wallichii*, *Burmannia coelestis*, *Eriocaulon truncatum*. Other herbaceous plants and herbs are represented by Chahuoy (*Curcuma petiolata*, Zingiberaceae) and Voir Chuy (*Streptocaulon juventas*, Asclepiadaceae). Some shrubs, treelets and trees, growing sparsely in small colonies, include Toek Doh Khla Toch (*Holarrhena curtissii*, Apocynaceae), Phlou Bat (*Dillenia hookeri*, Dilleniaceae), Preal Chunlos (*Corona auriculata*, Malvaceae), Lngeang Ach Konnga (*Cratoxylon formosum*, Hypericaceae), Dai Khla (*Gardenia angkorensis*, Rubiaceae), Trach (*D. intricatus*, Dipterocarpaceae), Trasek (*Peltophorum dasyrrhachis*, Caesalpinioideae). These trees rarely reach adulthood, as this grassland area suffers from annual forest fires caused by humans.

Figure 5 Elephant footprints through grassland, Prey Lang

Key Species

A total of 13 out of the total record of 530 species have been listed in the IUCN Red List (see Table 2.). These species include Beng (*Afzelia xylocarpa*), Phdeak (*Anisoptera costata*), Prang (*Cycas siamensis*), Neang Nuon (*Dalbergia olivery*), Kranhuong (*Dalbergia cochinchinsis*), Chheuteal Toek (*Dipterocarpus alatus*), Yieng Daeng (*Dipterocarpus costatus*), Koki Thmor (*Hopea ferrea*) Koki Msao (*Hopea odorata*), Chramass Trang/Popel (*Hopea recopei*), Sral Sloek Pee (*Pinus merkusii*), Thnong (*Pterocarpus macrocarpus*), and Popel (*Shorea roxburghii*). *Shorea guiso* has become very rare due to over-extraction during the past 10-15 years, but has not been placed on the IUCN Red List, and *Sindora siamensis* has also recently come under threat as a result of over-extraction. At present, the most common species, *Lagerstroemia calyculata*, is seriously over-logged, and may face threats in the near future. The other five species present in the Prey Lang - *Anisoptera costata, Cycas siamensis, Dipterocarpus alatus, Dipterocarpus costatus* and *Shorea roxburghii* - are still moderately common. *Pinus murkusii* is still abundant in the mixed pine broadleaf forest.

A total of 12 out of the 21 national priority species for conservation concern determined by the Forestry Administration of the Ministry of Agriculture, Forestry and Fisheries (FA's Tree Monographs 2004) are present in Prey Lang. These species include Beng *(Afzelia xylocarpa),* Chress *(Albizia lebbeck),* Chhkae Sreng *(Canang latifolia),* Kranhoung *(Dalbergia cochinchinensis),* Neang Nuon *(Dalbergia oliveri),* Angkort Khmao *(Diospyros bejaudii),* Chheu Khmao *(Diospyros crumenata),* Tatrao *(Fagraea fragrans),* Dai Khla *(Gardenia angkorensis),* Koki Msao *(Hopea odorata),* Sral sleukpi *(Pinus merkusii),* and Popel *(Shorea roxburghii).* Around 75% of the 20 high-priority tree species determined by FA's Cambodia Tree Seed Project in 2003 are also found in Prey Lang.

Table 2 Status of Cambodia's Key Plant Species Within Prey Lang

Plants		IUCN Red List			Status in Prey Lang				
Botanical name	Vernacular name	Critically Endangered	Endangered	Vulnerable	Absent	Very rare	Rare	Moderate	Common
Afzelia xylocarpa	Beng		EN			x			
Aglaia pleuropteris	n/a	CR			x				
Anisoptera costata	Phdeak		EN					x	
Aquilaria crassna	Chankrassna	CR			x				
Cycas siamensis	Prang			VU				x	
Dalbergia olivery	Neang Nuon		EN			x			

Dalbergia cambodiana	n/a		EN		x				
Dalbergia cochinchinsis	Kranhuong			VU				x	
Dipterocarpus alatus	Chheuteal Toek		EN					x	
Dipterocarpus baudii	n/a	CR			x				
Dipterocarpus costatus	Yieng Daeng		EN					x	
Dipterocarpus dyeri	Chheuteal Chngor		EN		x				
Dipterocarpus turbinatus	Chheuteal Dang / Chheuteal Ko	CR			x				
Hopea ferrea	Koki Thmor		EN				x		
Hopea helferi	Koki Daek	CR			x				
Hopea latifolia	n/a	CR			x				
Hopea odorata	Koki Msao			VU		x			
Hopea pedicellata	n/a		EN		x				
Hopea pierrei	Koki Khsach		EN		x				
Hopea recopei	Chramass Trang/Popel		EN					x	
Hopea siamensis	n/a	CR			x				
Intsia bijuga	Kokoh Prek			VU	x				
Mangifera flava	n/a			VU	x				
Pinus merkusii	Sral Sloek Pee			VU					x
Pterocarpus macrocarpus	Thnong			VU		x			
Shorea henryana	n/a		EN		x				
Shorea hypochra	Koki Phnang / Kamnhan	CR			x				
Shorea roxburghii	Popel		EN					x	
Shorea thorelii	Khchov / Phchoek Odorm	CR			x				
Vatica cinerea	n/a		EN		x				
Sindora siamensis	Kokoh	n/a	n/a	n/a			x		
Sindora siamensis	Kokoh	n/a	n/a	n/a			x		
Shorea guiso	Chor Chong	n/a	n/a	n/a		x			

The Evergreen Swamp Forest of Prey Lang is a unique and very special natural feature, which is host to many aquatic and terrestrial species in terms of refuge and food sources, and provides a valuable ecological function. Based on previous studies

by ecologists and botanists, this Evergreen Swamp Forest is distinct from the swamp forests of Tonle Sap/Great Lake and Stung Sen in terms of floristic composition and vegetation structure (McDonald, 2004).

Ecologically, the forest ecosystems of Prey Lang are a vital refuge for fauna and flora, and are home to large wild mammals such as elephant, banteng, gaur and bear and other key faunal species (Olsson and Emmett, 2007). The author observed on this survey that individual old and tall stands in the forest provide significant habitat for other species such as orchids, ferns, *Hoya* spp., mosses, lichen and animals such as lizards, nesting birds and insects. These species in turn provide food sources for other, larger organisms. Any reduction in these stands, regardless of other remaining forest, degrades biodiversity.

Prey Lang is rich in biological resources that support the livelihood of the forests' dependent communities, and also contributes to the national economy through the export of non-timber forest products (NTFPs) and other ecosystem services. It is notable that five dipterocarp species are significant for the community living in and reliant on the forest. These species include the three liquid-resin producing species of *Dipterocarpus costatus*, *D. alatus* and *D. intricatus*, and two solid resin producing species, *Shorea obtusa* and *S. siamensis*. One of the main sources of liquid resin derived from *D. costatus*, *D. intricatus* and *D. alatu* is taken from this landscape. Local traders told the authors that more than 10,000 Karn (one Karn is 30 litres, or 28 kg, of liquid resin), were supplied annually by just four villages (Spong, Padevoat, Pnheak Roloek, Sre Veal) to four middlemen in two villages, Pnheak Roloek and Sre Veal. This resin is transported to the main depot in Chhaep District of Preah Vihear Province for further processing and export to Vietnam and Thailand (local resin trader in Pnheak Roloek, pers comm. 11 Dec., 2014). Oleoresin derived from *Pinus murkusii* had in the past also been tapped by local community from Kampong Thom Province, but this practice was abandoned when the tapping resulted in the death of the pine trees (Former Head of Tmea Commune Council, pers comm, 12 Dec., 2014).

A vast variety of other NTFPs, for instance green cardamom, honey, rattan, bamboo, solid resin, wild fruits, etc. could provide substantial sources for either subsistence utilization or commercial trade. There is currently no local market demand for these NTFPs, but there is internationally. Prey Lang is also home to medicinal plants, and therefore very important for future scientific research in this field.

Hydrologically, the Prey Lang forest serves as significant watershed for the Tonle Sap/Great Lake and the Mekong River, and contributes to flood control in the peak rainy season between August and September (Thailade & Schmidt, 2010), vital ecosystem services. It also makes a major contribution to the regulation of underground water in the dry season.

Overall, it is clear that Prey Lang provides multiple benefits for both economic development and local climate balance.

Figure 6 Cutting a new resin tree, Prey Lang

Figure 7 Resin drops, Prey Lang

Figure 8 Rattan-rich swamp habitat, Prey Lang

Discussion

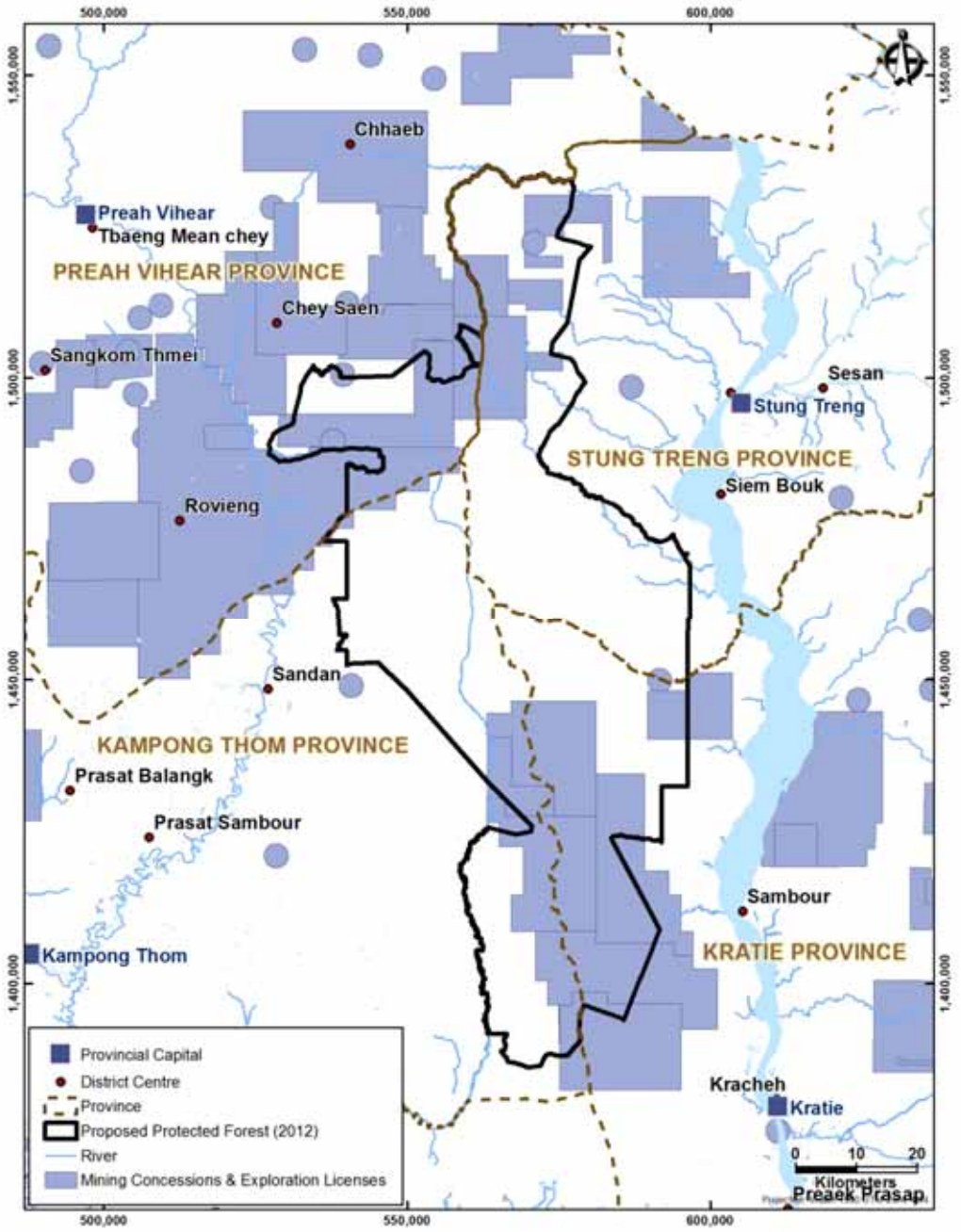
Threats

Based on the research team's observation, there are several main drivers of deforestation in Prey Lang, including forest conversion to agriculture in the form of economic land concessions including rubber and gold mining; inefficient small scale agriculture by local communities and migrants; and substantial uncontrolled logging by individuals from outside and inside the community.

A number of economic land concessions within and adjacent to this area have been granted to foreign and local companies for mining and agro-industry (Aruna 2009 & Michaud 2013), adding pressure to the degraded ecosystems. Some of these concessions are in areas with high biodiversity value (NGO Forum, 2013). A large area located in Damkambet commune of Sandan District has been completely cleared for rubber tree plantation (ibid). As is common across other parts of Cambodia, security staff and workers employed by the company also contribute to poaching, logging and illegal fishing.

Gold mining excavations have been operated by both individual households and companies who have received exploration licenses from the government (direct observation and community members, pers comm., 30 Dec. 2014). Phnom Chi, located in Sandann District, is well known for gold mining excavations operated by its local community, and is also under exploration by a Chinese company (Aruna 2009). There is a further small mining excavation area at Dambok Sor, an annex village of Kampong Damrey village, Boeng Char commune, Sambo District, being

explored by either individual households or a Chinese company (direct observation and community members, pers comm., 30 Dec., 2014). This area is adjacent to Prey Lang. Rocks are pounded and sifted to extract gold. The use of chemical substances has been reported in extracting gold in this area (Local Community members, Boeng Char commune, pers comm, 30 Dec., 2014). An estimate of mining concessions is presented in Map 7, as sourced from Open Development 2015.



Map 7 Mining concessions and exploration licenses year

Members of all the villages visited by the survey team are presently engaged in logging operations related to house construction and local market supply (pers obs.). Timber is cut and sawn into planks, square-shaped logs and poles by chainsaw, and then transported from the forest to the villages. Tillers and sometimes local-made trucks have been used as means of transporting this wood, rather than ox carts. One tiller can carry 2-3 cubic meters of wood, and one truck is capable of carrying 10-12 cubic meters of wood (Local community members, pers comm, Thmea commune, 18 Feb., 2015). Logging is mainly conducted in the dry season because conditions are more conducive to transporting wood from the forest. Reports are that Thmea Village of Thmea commune, located in Prey Lang, logs approximately 70 cubic meters daily in the dry season (Commune Consul Thmea Commune, pers comm., 18 Feb., 2015). Small-scale logging by individual households becomes larger in scale if all villages of the four Provinces across Prey Lang are taken into account. Logging causes the loss not only of trees themselves but also the destruction of surrounding vegetation, such as seedlings, saplings and other small plants and opens gaps in the forest, which are easily colonized by invasive species. In addition, forest fires may result if substantial cutting is undertaken in one large area. Most of the valuable timber species, such as rosewood, are already very scarce, and loggers are moving to the next most valuable species. *Largestroemia calyculata,* which grows in colonies in both the Semi-Evergreen Forest and Mixed Deciduous Forest will likely be heavily logged (ibid). This forest type will be susceptible to forest fire in the near future due to the large amount of debris left behind after logging operations. Forest fires occurring in the SEF will destroy entire ecosystems and alter vegetation compositions because of the ensuing domination of deciduous pioneer species.

Small-scale agricultural fields were also encountered by the team in some areas of Prey Lang. These small-scale farming areas are mainly located within the DDF, MDF and SEF, rich in highly valuable trees. A few small patches of evergreen swamp forest in the core of Prey Lang, located in Pnheak Roloek village, on the trail to Spong village, appeared to have been newly cleared for unknown purposes.

The team observed that at present, many landless households or households holding small plots of land for agriculture migrate to forested areas, which still have low populations, in order to search for land to plant rice, rubber, beans, cassava, cashew trees and other crops to support their livelihoods. In other areas of Cambodia a common practice is for migrants to buy land from the local community, who then need to open new areas for their own farming, and this is suspected to be also occurring in Prey Lang. Similarly, poor families who migrate from other Districts or Provinces are expected to be seeking forest areas and clearing them themselves for housing and farming. Indications are that land clearing will continue for as long as it is not controlled.

Electro-fishing poses a further threat. When fish populations in the area are depleted, local livelihoods begin to rely on farming and logging. In Thmear village, electro-fishing gear is used by almost every household, as well as by local police (local community members, Thmear Village, pers comm, 12 Dec., 2014). Every day fish are transported by motorcycle from Preah Vihear Province to Thmear and other villages, extending to Spong Village, and passing through Prey Lang's core zone, to sell to forest dwellers, who used to rely upon plentiful fish in their areas (ibid).

Figure 9 Deforestation and burning, Prey Lang

Figure 10 Deforestation and burning, Prey Lang

Recommendations

- ➢ Promote the sub-decree on Establishing Protected Forest and Biodiversity Conservation 'Prey Lang' over an area of 480,000 ha to have it passed by the Royal Government of Cambodia, and effectively applied in Prey Lang.

- ➢ Enforce the law on illegal logging, poaching and fishing immediately, to reduce increasing pressure on natural resources.

- ➢ Raise awareness on the sub-decree and Forestry Law, and the significant value of Prey Lang Landscape ecosystems to the environment and the local economy across the communities of the four Provinces. Provide schools with an environmental education programme through lectures, posters and/or short films, to educate children on the value of the forest, wildlife and environment within their area.

- ➢ Engage key stakeholders, especially Village Chiefs, Commune Councils, Commune police, the military and the community on the protection and management of Prey Lang. They should be engaged in every activity, from awareness-raising to forest patrols, regardless of the cost and their current level of willingness. This strategic approach will result in long-term outcomes for Prey Lang's protection.

- ➢ Take into account land use requirements by villages and communes within Prey Lang, to demarcate zones for agricultural land, settlement areas, and forest reserves. Establish more Community Forests (CFs), to secure abrupt land use change in areas near villages, sustainable usage of the natural landscape and to buffer Prey Lang.

- ➢ Diversify the livelihoods of forest reliant communities within Prey Lang through improvement of farming practices, eco-friendly, intensive agriculture and the introduction of agro-forestry systems with commercial value rather than just for household subsistence. Promote NTFP development through different approaches, such as through sustainable collection techniques, vocational training on product development and market development.

- ➢ Undertake ongoing botanical study in Prey Lang. Some examples of the species that are very diverse but less known are in the families of the higher plants of *Orchidaceae, Graminae, Cyperaceae, Compositae, Leguminosae, Rubiaceae, Lauraceae* and *Myrtaceae* to the lower plants of fern, fungi and mosses. These species require long-term research, and long-term collaboration with other institutions abroad or in-country are needed to compile a checklist for this landscape.

- ➢ Incorporate the REDD+ scheme, which was studied in 2011, into management plans for the area.

- ➢ Commit sufficient funds to support the above activities effectively and protect this unique landscape.

3. MAMMALS

Ben Hayes

Introduction

Historically mammal research and surveys in Cambodia were limited to a few early expeditions between the 1930s -1960s with more of an emphasis on larger species such as the Kouprey (Wharton, 1957; Osgood, 1932.). However due to civil conflict, foreign occupation and instability, no further research was conducted until the 1990s. Prior to this survey, there has been little research undertaken on the mammal fauna of Prey Lang. Some ad hoc localized camera trapping, general observations and a few species specific surveys were conducted by Conservation International, World Wide Fund for Nature, Fauna and Flora International and the Wildlife Conservation Society between 2002 and 2008 (see Olssen and Emmett, 2007). However, these tended to be very rapid in nature with little overall field time.

Methods

The following methodology was employed in the mammal survey:

- Camera Trapping
  Up to 17 Automatic Bushnell camera traps were utilized and these were set between July 2014-February 2015. Camera trap locations were concentrated in the central area of evergreen forest (see Map 6.), and set at 'optimal' locations such as animal trails, water sources and salt licks. Special attention was paid to locations where mammal signs were detected. Traps were left in the forest for 4-8 weeks and set for operation day and night, and then rotated to other locations. A total of 3,555 Camera Trap Days were undertaken. Additional survey work was undertaken in the northern area of Prey Lang in and around the karst hills bordering Prey Vihear Protected Forest, as well as a short visit to the southern area of Prey Lang.

- Night Spotting
  Routes were walked in suitable areas such as paths, forest fringes and dry riverbeds at different times of the night. Species were found by looking for eye shine using red spectrum filtered head torches and a 2000 lumen spotlight.

- Signs
  Forest paths and streambeds were walked in the daytime in suitable habitats looking for opportunistic signs such as mammal tracks and droppings. Some early mornings were spent listening for vocalizations of gibbons.

- Interviews
  Interviews with local villagers and hunters were conducted regarding specific information about certain Key Species, wildlife trade and localities of saltlicks, caves and other geographical features.

Results

Overall findings

In total 36 mammal species were recorded through camera trapping, night spotting and diurnal observation work looking for signs/tracks. Eighteen of these are IUCN listed species of conservation concern. A full list of species recorded is provided in Appendix II.

Key Species

Banteng (*Bos javanicus)* IUCN: Endangered
Banteng were recorded by camera traps, from several locations in the central evergreen forest area of Prey Lang. This species typically occurs in open Dry Deciduous forest in rocky or hilly country. Although naturally diurnal, human disturbance has caused it to become nocturnal as well as occupying less preferential habitat such as mixed/evergreen forest (Timmins et al., 2008C). The species is found throughout South-East Asia including Myanmar, Thailand, Laos, Vietnam and Cambodia as well as South China, Java and Borneo (Francis, 2008). In Cambodia the species is found sporadically throughout the north and east, as well as in the Cardamoms, although the most significant population is found in Mondulkiri Province (Timmins et al., 2008C). It is believed that the population in Cambodia has declined by more than 90% since the 1960's due to continued hunting, as well as habitat disturbance and fragmentation due to agricultural expansion and infrastructure developments (Timmins *et al*., 2008C).

Figure 11 Bos javanicus, camera trapped during survey, Prey Lang

Gaur (*Bos gaurus*) IUCN: Vulnerable
Two Gaur were recorded during the present survey from camera trap images at one salt lick. It has also been confirmed in low numbers by camera traps and signs from previous surveys (Olssen and Emmett, 2007). All these records were from the central evergreen area of Prey Lang. In Cambodia, Gaur probably declined by 90% or more in the period from the late 1960s to the early 1990s and the most significant populations are thought to be in the Siema Biodiversity Conservation Area and the Srepok Wilderness Area, and to a lesser degree in the northern plains and central Cardamoms (Duckworth *et al,* 2008). Hunting is the major threat to this species, compounded by loss of suitable habitat: large tracts of suitable habitat hold few or no Guar. Ongoing habitat degradation and conversion is continually reducing the potential populations. In addition, there is a large trade in Gaur parts for decorative and medicinal purposes. (Duckworth *et al,* 2008). Its known range is through South-East Asia, including Nepal, India, and extreme Southern China (Francis, 2008).

Asian Elephant (*Elephas maximus)* IUCN: Endangered
Elephants were recorded by camera traps in several locations throughout the central evergreen forest of Prey Lang. Most records were from several salt licks in the western part of this forest in Stung Treng Province. Several other individuals were documented along an old logging concession road in Kratie Province. Based on initial analysis of the photographs and videos there are at least 13 identifiable individuals with one video alone showing six elephants passing the camera. From past surveys there has been no accurate data on the actual numbers of elephants in the Prey Lang and the only reference is Maltby & Bourchier (2010), which gave an estimate of 20 elephants based on interview data. The most recent estimate for the number of elephants in Cambodia range from 250-600, with the Eastern Plains Landscape in Mondulkiri Province and the Cardamom Mountains holding the most significant populations (Maltby & Bourchier, 2010). The nearest connecting protected area to Prey Lang that has a population of elephants is in Prey Vihear Protected Forest, where estimates range from 4-16 elephants remaining (Brook et al., 2012). The greatest threats to the Asian elephant today are habitat loss, degradation and fragmentation, which are driven by an expanding human population, in turn lead to escalating conflicts between humans and elephants when elephants eat or trample crops (Choudhury et al., 2008). Other major threats include poaching for ivory and body parts. The species occurs in Bangladesh, Bhutan, India, Nepal, and Sri Lanka in South Asia and Cambodia, China, Indonesia (Kalimantan and Sumatra), Lao PDR, Malaysia (Peninsular Malaysia and Sabah), Myanmar, Thailand and Viet Nam in South-East Asia. Feral populations occur on some of the Andaman Islands (Choudhury et al., 2008).

Figure 12 Elephas maximus camera trapped during survey, Prey Lang

Dhole (*Cuon alpinus)* IUCN: Endangered
During this survey three individuals were reported to have been seen by one of the local guides. This was in DDF forest in the northern area of Prey Lang close to the boundary of Prey Vihear Protected Forest. A single individual was also recorded from the central evergreen area during the 2005 WWF camera trapping survey of Prey Lang. Depletion of natural prey base and habitat loss and transformation are the main threats to Dholes (Durbin, et al., 2008). Their known range extends throughout South-East Asia including from Southern Siberia to India, Sumatra and Java (Francis, 2008).

Sambar (*Rusa unicolor)* IUCN: Vulnerable
No Sambar were recorded during the present survey. However, it has been confirmed by camera trapping from previous surveys (Olssen and Emmett, 2007). All these records were from the central evergreen forest area of Prey Lang. Local guides and hunters interviewed during this survey reported Sambar to be in low numbers and seldom caught. This species occurs in a wide variety of habitat types across its range including: evergreen, semi-evergreen and deciduous forests (Timmins *et al*., 2008B). Its distribution within South-East Asia includes: Myanmar, Thailand, Laos, Vietnam, Cambodia and Peninsular Malaysia (Francis et al., 2008). Tolerant of forest degradation, this species is typically found in highest numbers in regions of broken habitat, which include opens areas in contrast to pristine forests (Timmins et al., 2008B). Hunting is the predominant threat to this species in South-East Asia (Francis, 2008).

Large Indian Civet (*Viverra zibetha)* IUCN: Near-threatened
This species was regularly photographed by camera traps from the central evergreen forest area. Considered reasonably common throughout its range, habitat loss and degradation are a threat to this species as well as hunting for food and medicinal purposes (Duckworth et al, 2008). Its known range is through South-East Asia including Nepal, North-East India, and southern China (Francis, 2008).

Large Spotted Civet (*Viverra megaspila)* IUCN- Near-threatened
This species was not documented during the present survey. However, it has previously been recorded once on camera trap from the central evergreen forest area of Prey Lang (Olssen and Emmett, 2007). The population status of this species is poorly known and there are few records across its range (Duckworth et al, 2008). The main threats are habitat loss and hunting. Its known range is through South-East Asia including southern China (Francis, 2008).

Clouded Leopard (*Neofelis nebulosa) IUCN*- Vulnerable
This species was not documented during the present survey. However it was recorded in the central evergreen forest area of Prey Lang during a WWF 2002 camera trapping survey. It is reasonably well documented from other protected areas in Cambodia, most noticeably in the Cardamom Mountains, though like other large cat species it is elusive and rare across its range. The clouded leopard is hunted for the illegal wildlife trade - large numbers of skins have been seen in market surveys, and there is also trade in bones for medicines, meat for exotic dishes and live animals for the pet trade (Sanderson et al*,* 2008). It's known range is through South-East Asia including southern China, Nepal, North-East India, Sumatra and Borneo (Francis, 2008).

Smooth–coated Otter *(Lutrogale perspicillata)* IUCN: Vulnerable
This species was not documented during this present survey. However, it was recorded in the central evergreen forest area of Prey Lang during a 2008 CI camera trapping survey. An earlier otter-focused survey also recorded several otter pelts and body parts in local villages, with interviewees stating that they had recently seen otters. They stated that when they are in the forest to collect NTFPs or hunt they often see otters either swimming or on the riverbanks, typically in groups of two to ten animals. They stated that otters are most abundant near the streams of Olung, Ochoam, Osiembok, Stung Pongrong and Okrak (Olssen and Emmett, 2007). The main threats to Asian otter populations are loss of wetland habitats due to construction of large-scale hydroelectric projects, reclamation of wetlands for settlements and agriculture, reduction in prey biomass, poaching and contamination of waterways by pesticides (Hussain., et al. 2008). The Smooth Coated Otter's known range is through South-East Asia and South Asia (Francis, 2008).

Black Giant Squirrel (*Ratufa bicolor)* IUCN: Near-threatened
This species was commonly observed throughout the survey area. It is easily distinguished as the largest tree squirrel in the region and was regularly seen in the high canopy. This species, although widespread throughout South-East Asia (Myanmar, Thailand, Laos, Vietnam, Cambodia and Peninsular Malaysia), has declined considerably in many areas due to loss and fragmentation of tall forest, as well as hunting (Francis, 2008). Human induced habitat degradation due to shifting agriculture practices, small-scale logging, clear-cutting, forest fires, expansion of

human settlement and harvesting for local consumption have been observed to be major threats for this species in South Asia (Waltson et al., 2008).

Figure 13 Ratufa bicolor, camera trapped during survey, Prey Lang

Bengal Slow Loris (*Nycticebus bengalensis*) IUCN: Vulnerable
This species was observed once during night spotting along DDF forest trails in the northern part of Prey Lang near Prey Vihear Protected Forest. One other recently caught specimen was seen at a hunter's camp in the central evergreen forest area of Prey Lang. Several dried specimens for sale were also observed in villages just outside the Prey Lang boundaries. It occurs throughout South-East Asia and also North-East India, Bangladesh and South China. Populations are declining due to loss of forest habitat as well as hunting and trapping for the pet trade (Francis, 2008). This species is found in a large number of protected areas throughout its range, but at low densities (Streicher *et al*., 2008).

Northern Pig-tailed Macaque (*Macaca leonina*) IUCN: Vulnerable
This species was observed on very few occasions during the survey area, all sightings were from the central evergreen forest area in Prey Lang. However, local hunters and guides reported this species as relatively common. It is assumed to be restricted to small areas of forest with the lowest levels of human disturbance, where it is known to forage predominantly on the ground but readily climbs trees to forage if disturbed. In Cambodia the primary threat to this species is hunting for food and the wildlife trade (Boonratana et al., 2008). Its known range is through South-East Asia: Myanmar, Thailand (South to about 8ºN), Laos, Vietnam and Cambodia (Francis, 2008).

Pileated Gibbon (*Hylobates pileatus*) IUCN: Endangered
During the survey this species was commonly heard calling throughout the central evergreen area of Prey Lang and several groups were heard from the karst area in the northern area of Prey Lang. Arboreal, found typically in tall forest canopy, this species occurs in small family groups. In Cambodia, the primary area of importance is the Cardamom Mountains, in the southwestern region, which is relatively intact, where densities are on the order of 1-2 groups/km^2 (Brockelman et al.,2008). Their distribution is restricted to South-East Thailand, South-West Laos and in Cambodia West of the Mekong River (Francis, 2008). Populations in Cambodia are in severe decline due to habitat destruction through logging and agricultural intensification in remote areas (Brockelman et al., 2008).

Indochinese Silvered Langur (*Trachypithecus germaini)* IUCN- Endangered
This species was recorded by camera trap, while visiting several salt licks in the western part of the central evergreen forest. Sizeable groups were documented on camera traps, though no observations were made during this or past surveys. Local guides and hunters reported the Indochinese Silvered Langur to be relatively common throughout the central evergreen forest area of Prey Lang. This is mainly a lowland species, with a preference for evergreen and semi-evergreen, mixed deciduous, riverine and gallery forest (Nadler et al., 2008). Cambodia is considered the stronghold for this species (Moody et al., 2011). The major threats to this species are hunting, mainly for subsistence use and traditional 'medicine', the pet trade and habitat loss (Nadler et al., 2008). Their known range extends from South-East Thailand, southern Lao PDR, Cambodia and Vietnam west of the Mekong (Francis, 2008).

Bear spp. *(Helarctos malayanus*. */Ursus thibetanus.)* IUCN: Vulnerable
During this survey one individual was recorded by camera trap from the central evergreen forest area. However, the quality of the imagery meant it could not be identified to species level. Previous surveys have recorded *Helarctos malayanus* from camera trapping. *Ursus thibetanus* was also recorded in Prey Lang based on size of claw marks on trees by Olssen and Emmett (2007). The two major threats to both species are habitat loss and commercial hunting (Fredriksson et al*.,* 2008). Both species of bear range throughout South-East Asia (Francis, 2008).

Hog-badger (*Arctonyx collaris*) IUCN Near-threatened
This species was recorded three times during the survey, twice from camera trap images and once from a hunter's specimen. All records were from the central evergreen forest area. The Hog-badger is known from forested areas as high as 3,500 meters, and it feeds on 'tubers, roots, earthworms, insects, and other small living creatures' (Lekagul and McNeely 1977). It is distributed throughout South-East Asia and also North-East India, China and Sumatra (Francis, 2008). In Cambodia this species occurs in level lowlands, in mosaics of deciduous and semi-evergreen forests. In southwestern and eastern Cambodia it is considered to be quite common (Timmins et.al., 2008).

Discussion

Thirty-six mammal species have been confirmed in Prey Lang. Eighteen of these are IUCN listed as species of global conservation concern.

The overall field observations of mammals during the survey was considered quite low when compared to other protected areas in Cambodia. This was especially the case for primates, with very few sightings apart from vocalisations of Pileated Gibbon groups. However, camera traps frequently recorded certain species such as the Common Palm Civet, Wild Pig, Muntjac, Leopard Cat, Yellow-throated Marten and Malayan Porcupine, and there are certain species, namely Sunda Pangolin (IUCN-CR) and Leopard (IUCN-NT), not sighted in this survey but accurately described in interviews as being present in the central evergreen area of Prey Lang. The overall mammal list is thus likely to be proven higher than this initial list, with further research. More extensive surveys would also be required to determine individual species populations.

Certain species, such as the Tiger, which were confirmed in a WCS 2003 survey of Prey Lang, have been taken off the species list since there is no recent evidence of their existence.

While further survey work is required to assess the full significance of the area for mammals and with a sizeable area of Prey Lang still un-surveyed, the presence of certain regional endemic and near endemic species highlight that the Prey Lang is an area of high conservation priority for mammal conservation in Cambodia. Of particular importance is the presence of Banteng, Pileated Gibbon, Indochinese Silvered Langur and Asian Elephants, of which Prey Lang could habor significant national populations and thus should be considered of regional importance for the conservation of these species.

Threats

Hunting, habitat fragmentation, clearing for agriculture, immigration, logging and lack of enforcement and protection appear to be the main threats to the mammal communities in Prey Lang. Hunters were observed in considerable numbers during the survey and especially prevalent in the central evergreen forest area of Prey Lang. Most observed hunting was undertaken by snaring and the use of crossbows and dogs. Gun shots were heard only once during the survey and no firearms were seen on any of the hunters encountered. Local guides also reported the historical use of poison at salt licks, water holes and poisoned bait and mentioned large numbers of banteng being killed by this method. However, they said this practice had been stopped and there was no evidence seen during the survey of this taking place.

Recommendations

- Undertake specific surveys concentrating on the Key Species, in particular a focus on the status and distribution of wild cattle species and elephants.

- Conduct further research on the status and distribution of primates within Prey Lang, especially with regards to Bengal Slow Loris, Pileated Gibbon and the Indochinese Silvered Langur.
- Undertake surveys on the small mammal communities with emphasis on rodents.
- Commission further camera trapping throughout Prey Lang, particularly in areas that were not surveyed during this assessment.
- Conduct a focused habitat assessment and ground survey on whether there are any feasible wildlife corridors that can be created for movement of wildlife between Prey Lang and other suitable habitats, in particular with regards to linking Prey Lang to Prey Vihear Protected Forest in the North.

4. BATS

Neil Furey

Introduction

Bats are divided into two suborders: the Yinpterochiroptera (Rhinolophoid bats and old world fruit bats) and Yangochiroptera (all other bats), whose ability to perceive their surroundings using echolocation, together with powered flight, has allowed them to master the night skies and exploit a wide range of niches worldwide (Schnitzler et al., 2001; Jones and Teeling, 2006). Over 1,259 bat species are currently recognized (Fenton 2012), many of which feed on nectar and fruit, and this figure continues to grow each year with the discovery of new species. Fruit bats are the main pollinators of many economically and ecologically important plants (Fujita and Tuttle, 1991; Bumrungsri et al., 2013), and as many species carry seeds over long distances, they make a significant contribution to reforestation of cleared areas (Sritongchuay et al., 2014). Most echolocating bats are insectivorous and these are the primary consumers of nocturnal insects (Nowak 1994), including economically significant quantities of major agricultural pests in Thailand (Wanger et al., 2014) and important vectors of human disease e.g. mosquitoes.

Bats form a critical component of Southeast Asia's mammal fauna, as the group constitutes approximately 30% of the region's mammal species, and can comprise as many as half of all mammal species in tropical rainforests (Kingston et al., 2006). Southeast Asia is also a pivotal area for global bat conservation as it supports over 25% of the world's bat fauna and at least 197 of the 342 species known from the region are endemic (Kingston 2010, 2013). Despite the economic and conservation importance of bats (Kunz et al., 2011), the composition and biogeography of the Cambodian fauna is poorly known. Though knowledge has increased in recent years, only 70 bat species are currently documented in the scientific literature for the country (Chheang et al. 2013), a figure which lags far behind that for neighboring Laos (92 species: Douangboubpha et al., 2014), Vietnam (approximately 120 species: Kruskop, 2013) and Thailand (119 species: Bumrungsri et al., 2006). Correspondingly little is known about the natural history of Cambodian bats, despite their being the most diverse mammal order in the Kingdom.

The aim of the chiropteran survey at Prey Lang was to complete a first inventory of bat species at the site, evaluate the site's importance for Cambodian bats and recommend actions to promote effective conservation.

Methods

Three field surveys were undertaken, the first in the southern 'Srae Pring' sector from June 16–25, 2014, and the second and third in the northern 'Chhep' and central 'Spung' sectors from October 20–30 and December 22–30, 2014 (see Appendix III for more detail). These periods represent the beginning and end of the wet season in Cambodia.

➢ Live-trapping

Bat species vary in their relative susceptibility to capture with mist nets and harp traps (Francis 1989, Berry et al., 2004). As our aim was to maximize inventory completeness, both capture devices were employed in sampling. An assortment of mist net sizes were used depending on local topography (e.g. 3x3m, 7x3m, 10x3m, 12x2.5m), all of which were 70 denier nets. Four-bank harp traps with a capture surface of 2.4 m^2 were employed. To standardize units of sampling effort between these traps, sampling effort for mist nets was calculated as m^2 of net multiplied by the number of hours for which they were set (m^2mnh), while harp trap effort was similarly calculated as m^2 of harp trap multiplied by the number of hours of use (m^2hth).

Harp traps were used overnight during the survey and checked hourly from 1730–2100 hours and then again the following morning, while mist nets were employed from 1730–2100 hours each night, except where rain prohibited live trapping. Nets were attended constantly while in use and disabled after each session. Selection of sampling locations largely focused on flyways within the forest understory, such as trails, watercourses and natural linear breaks in the vegetation, and trapping was avoided on consecutive nights at the same location.

➢ Roost searches

Daytime searches were undertaken to locate and assess bat roosts. These were mostly confined to caves located in the northern sector of Prey Lang. As many bat species use caves on a transient basis, either seasonally as maternity roosts or nocturnally as feeding roosts, their absence during a single visit does not necessarily mean that the site is unused or abandoned. Use of caves by bats and people was therefore determined by initially entering each cave to:

1. Directly observe and census the bats at roost. While many bat species prefer to roost in clusters, some species roost singly while others prefer to roost in crevices, which can be easily overlooked. Ultrasound detectors (below) were used to detect the latter species.
2. Search for guano. Fresh guano is the most obvious evidence of recent use by bats and the size of guano deposits can provide a rough idea of population size and length of occupancy (provided it has not been harvested). Fruit bats and insectivorous bats also produce different guano and this was used to determine which were present.
3. Assess past bat use. This was determined by searching for remains of bats on floors and stains on walls and ceilings from bat skin oils and urine.
4. Assess human use. Evidence typically includes footprints, garbage, graffiti, rock scratches, fire pits and religious items such as burnt incense and other offerings. The presence of long sticks and fragments of fishing nets usually indicates that bat hunting has occurred.

Following initial assessments, live trapping was undertaken at selected cave colonies to determine their species composition. This was undertaken using mist nets of varying size during evening emergence (typically 1730–1930 hours).

➢ Acoustic sampling

An ultrasound (bat) detector (D240x, Pettersson Electronik AB) was employed to assess nightly bat activity and record species echolocation calls following Furey et al. (2009) and Phauk et al. (2013). All signals registered were stored using an Edirol HR09 digital recorder (Roland) and analyzed using Batsound Standard vers. 3.31 (Pettersson Electronik AB).

➢ Species identification

Bats were measured, photographed and identified in the field using Francis (2008) and released as close as possible to their capture site. Reproductive condition was also recorded following Furey et al. (2011). Species representing less than 0.5% of total captures were defined as locally rare. Where required to confirm species identifications, a minimum number of non-reproductively active adults were retained as voucher specimens in 80% ethanol. Voucher specimen skulls and bacula (where taxonomically important) were subsequently extracted for measurement and comparative examination. Specimens collected are deposited in the zoological collections of the Centre for Biodiversity Conservation at the Royal University of Phnom Penh. Accession numbers are available from the first author. Taxonomy follows Simmons (2005) with recent modifications (Bates et al. 2007, Soisook et al. 2008, Csorba et al. 2011).

➢ Statistical procedures

To determine the completeness of sampling effort at Prey Lang, true species richness (*Smax*) was estimated using abundance data and multinomial methods developed by Solow and Polasky (1999) and Shen et al. (2003). To create upper and lower bound estimates of species richness, predictions were based upon a quadrupling of sampling effort and inventory completeness was calculated as the ratio of species observed (*Sobs*) to those estimated i.e. Sobs/Smax x 100.

Assemblage evenness ($E_{1/D}$) was calculated by dividing the reciprocal form of Simpson's Index values by S (number of species). Values for $E_{1/D}$ range from 0–1, reflecting increasing evenness in the relative abundances of species. Species composition between sectors was compared using the Chao-Jaccard Abundance-based Similarity Index (CJ-SI) and Estimator (CJ-SE) (Chao et al. 2005). Values for CJ-SI and CJ-SE range from 0–1 and reflect increasing similarity in shared species composition.

➢ Sampling effort

Over the course of the three field surveys, a total of 18 trapping nights representing 3,296.3 m^2mnh (mist-net-hours) and 789.6 m^2hth (harp-trap-hours) were achieved at 84 locations in Prey Lang, including 11 caves and 73 forest interior locations (Table 3.). Geo-coordinates for these are provided in Appendix III.

Table 3 Sampling effort during the bat survey at Prey Lang

Area	Sampling Nights	Sampling Points	m^2mnh	m^2hth	Notes
Northern sector	8 (22–29.10.14)	40	1,063.5	340.8	11 caves, 19 trails & 10 rivers in forest
Central sector	5 (24–28.12.14)	27	1,538.3	247.2	26 trails & 1 river in forest
Southern sector	5 (18–22.06.14)	17	694.5	201.6	14 trails & 3 rivers in forest
Total	**18**	**84**	**3,296.3**	**789.6**	

Of the 40 points sampled in the northern sector, 26 (including seven caves and 19 forest interior locations) were located at Phnom Thom (central UTM 0579500, 1525400), a forested limestone karst outcrop, whereas the remaining 14 (including four caves and 10 forest interior locations) were located at Phnom Chhngauk (central UTM 0580900, 1523300), a discrete karst outcrop situated approximately 2km to the southeast. Both outcrops were vegetated in closed-canopy semi-evergreen forest (including areas of *Lagerstroemia* spp. around their base) and situated in a landscape dominated by dry deciduous forest, grassland and chamkar. Sampling locations ranged between 100–170m asl and sampling effort was partially influenced by rain, which occurred on four nights after 2100 hours.

Figure 14 Southern face of Phnom Thom in the northern sector of Prey Lang.

Figure 15 Lagerstroemia forest at base of Phnom Thom in northern sector, Prey Lang

Of the 27 locations sampled in the central sector, all but one (a forested river) were trails within tall closed-canopy semi- to fully-evergreen forest in a seasonally inundated area including numerous chamkar in early stages of regrowth (UTM 0559830, 1473800). Sampling effort ranged between 80–140m asl and was uninfluenced by rain. Of the 17 locations sampled in the southern sector, 14 were on trails and three on rivers in an area of heavily disturbed semi-evergreen forest (UTM 0575595, 1454128), which had been intensively logged by the Pheaphimex concession prior to 2002 and more selectively afterwards. Sampling effort ranged between 100–130m asl and was heavily affected by rain, which occurred on all but one of the five sampling nights.

Results

Overall findings

Twenty-four species arranged in six families were recorded at Prey Lang (Table 4). Estimates of true bat species richness (*Smax*) ranged from 25.0 to 26.9, suggesting an overall inventory completeness ratio of 86–92%. Evening bats (Vespertilionidae) were best represented in terms of species richness with seven species, though they accounted for significantly fewer captures (9.1% of total captures) compared to horseshoe bats (Rhinolophidae, 67.9%) of which six species were recorded. Leaf-nosed bats were also represented by six species but only 10.1% of captures, followed by sheath-tailed bats (Emballonuridae: 2 species, 6.4%), false vampire bats (Megadermatidae: 2 species, 2.7%) and Old world fruit bats (Pteropodidae: 1 species, 3.7%).

Assemblage evenness was low at 0.21 due to the hyper abundance of Shamel's horseshoe bat *Rhinolophus shameli* in the northern sector, which represented 41.6% of total captures. The second most abundant species was acuminate horseshoe bat *R. acuminatus* (11.1%), whereas four taxa were locally rare, being represented by a single individual for each: ashy leaf-nosed bat *Hipposideros cineraceus,,* diadem leaf-nosed bat *H. diadema ,* black-bearded tomb bat *Taphozous melanopogon* and Walston's tube-nosed bat *Murina walstoni*. One species, Marshall's horseshoe bat *R. marshalli*, constitutes the first country record for Cambodia, whereas the record of *M. walstoni* is the fourth known locality for the species nationally.

Figure 16 Rhinolophus shameli, Prey Lang

Figure 17 Rhinolophus acuminatus, Prey Lang

Figure 18 R. marshalli, Prey Lang

Figure 19 Murina walstoni, Prey Lang

Table 4 Bat species recorded in three sectors at Prey Lang

#	Family / Species	Northern Sector	Central Sector	Southern Sector
	Old world fruit bats, Pteropodidae			
1	Greater short-nosed fruit bat, Cynopterus sphinx			11
	False vampire bats, Megadermatidae			
2	Greater false vampire bat, Megaderma lyra	2		
3	Lesser false vampire bat, Megaderma spasma	2		4
	Horseshoe bats, Rhinolophidae			
4	Acuminate horseshoe bat, Rhinolophus acuminatus		24	9
5	Malayan horseshoe bat, Rhinolophus malayanus	25		
6	Marshall's horseshoe bat, Rhinolophus marshalli [2]	3		
7	Lesser brown horseshoe bat, Rhinolophus microglobosus	13		
8	Least horseshoe bat, Rhinolophus pusillus	4		
9	Shamel's horseshoe bat, Rhinolophus shameli	123		
	Leaf-nosed bats, Hipposideridae			
10	Great leaf-nosed bat, Hipposideros armiger [3]			
11	Ashy leaf-nosed bat, Hipposideros cineraceus [1]	1		
12	Diadem leaf-nosed bat, Hipposideros diadema [1]			1
13	Cantor's leaf-nosed bat, Hipposideros galeritus	8	1	1
14	Intermediate leaf-nosed bat, Hipposideros larvatus [3]	13		
15	Large-eared leaf-nosed bat, Hipposideros pomona	5		
	Sheath-tailed bats, Emballonuridae			
16	Black-bearded tomb bat, Taphozous melanopogon [1]	1		
17	Theobald's tomb bat, Taphozous theobaldi [3]	18		
	Evening bats, Vespertilionidae			
18	Titania's woolly bat, Kerivoula titania		2	
19	Hardwicke's woolly bat, Kerivoula hardwickii		3	3
20	Round-eared tube-nosed bat, Murina cyclotis			2
21	Walston's tube-nosed bat, Murina walstoni [1]		1	
22	Peter's myotis, Myotis ater		7	
23	Least pipistrelle, Pipistrellus tenuis	1	1	
24	Blanford's bat, Hesperoptenus blanfordi		5	2
	Total	**219**	**44**	**33**

Key: 1 = Locally rare species (<0.5% of total captures), 2 = New country record, 3 = Large cave colonies of these species were encountered in the northern sector (see below) – the figures on the right do not include these colonies.

Bat species richness and abundance was significantly greater in the northern sector with 15 species and 74% of total captures, followed by the central sector with eight species and 14.9% of captures and the southern sector with eight species and 11.1% of captures. Estimates of true bat species richness (*Smax*) ranged from 16.2–17.6 in the north and 12.2–13.2 in the center to 9.0–10.0 in the south, suggesting inventory completeness ratios of 80–86%, 61–66% and 80–89% respectively. Assemblage evenness was low to moderately high at 0.21 (north), 0.38 (central) and 0.65 (south). Pair-wise similarity in shared species composition was low between all the three sectors (CJ-SI values: 0.023–0.338) and increased only marginally when the effects of unseen shared species were incorporated (CJ-SE values: 0.037–0.352).

➢ Cave bat colonies

Eleven caves were explored during survey of the northern sector at Prey Lang. Of the seven caves explored at Phnom Thom, all but one (C4: located in the eastern interior of the site) was located on the southern face of the hill and only one (C6) did not contain bats or evidence of past occupancy. All four caves investigated at Phnom Chhngauk supported bat colonies, though only one (C8) was of elevated interest in supporting several thousand Theobald's tomb bats *T. theobaldi*. Survey results for each cave are provided in Table 5 below.

Table 5 Caves surveyed in the northern sector of Prey Lang

#	Survey Date	Summary Characteristics
C1	22.10.14	Phnom Thom, above floodplain (UTM: 0579103, 1525235). Consists of a porch with left and right leads. Right lead extends a few meters only, whereas the left lead descends for ≈50m, steeply initially and gently thereafter. Left lead includes a small shrine, several large erosion domes and one skylight. Extensive bat staining, though only 4-5 insectivorous bats (including *H. armiger*) were observed, as was old insectivorous bat guano above the seasonal water line.
C2	22.10.14	Phnom Thom, above floodplain (UTM: 0579089, 1525251). Single large and roughly circular chamber ≈10m in diameter, dominated by central flowstone column. Large erosion dome at rear with extensive bat stains and 3-4' deep carpet of insectivorous bat guano. Guide reported a 'thousand' bats were present five years previously, though only ≈20 were observed. Clear evidence of hunting also noted and two species were recorded: *H. larvatus* and *T. melanopogon*.
C3	23.10.14	Phnom Thom, above floodplain (UTM: 0579500, 1525281). Large overhang with two vertical crevices on cliff face, which were not accessible. Approximately 150 *H. larvatus* , were observed in these.
C4	23.10.14	Phnom Thom, higher elevation cave (UTM: 0580539, 1525120). Consists of a wider-than-deep porch (ca. 7x5m) with overhang at centre-rear, behind which the upper portion of erosion dome leads to a passage which was not accessible. Extensive bat staining and hunting evidence was observed in the porch where *R. shameli*, *R. malayanus* and *H. larvatus* were recorded.
C5	25.10.14	Phnom Thom (UTM: 0577543, 1525882). Low entrance cave located in karst foothills above floodplain with an initial steep descent and many breccias. Approximately 1,000 *H. armiger* and *H. larvatus* were observed at roost. Unequivocal evidence of hunting and guano harvesting (small store of full rice sacks) were also observed, although the latter may not have been recent as thick deposits of undisturbed/fresh guano were present in several areas.
C6	26.10.14	Phnom Thom (UTM: 0577734, 1525747). Consists of a rock overhang that forms a shallow porch area (ca. 4m deep). A single descending lead to right of porch was explored, which terminated after several meters. No bats or evidence of their past occupation was observed.
C7	26.10.14	Phnom Thom (UTM: 0577735, 1525713). Nearby and similar to C6 in that entrance is a porch area overhung by a cliff face. Main lead is to right and descends for a few meters to a level passage, which leads to a large chamber (≈10–15m diameter and height) containing a roost of 3–400 *H. armiger* and *H. larvatus* (*H. armiger* being dominant). This continues via two leads, the lower of which was accessible and ended after ≈40m. No evidence of disturbance was observed.
C8	27.10.14	Phnom Chhngauk (UTM: 0580878, 1523241). Set at base of hill with small entrance shrine. Consists of an overhung porch beyond which a large chamber subsequently narrows into a massive chamber heavily stained with guano and bat skin oils that has a rear skylight. Abundant evidence of guano harvesting and bat hunting was noted and several thousand *T. theobaldi* were recorded in the rear chamber. Two smaller caves are located to the left of the entrance, the nearer also heavily stained, though no bats were recorded in either cave.
C9	28.10.14	Phnom Chhngauk (UTM: 0580388, 1523087). Located at hill base in heavily disturbed forest and easily accessed via one gently-descending and ≈15m long passage beyond the overhung porch area. This includes a series of variably-sized erosion domes and is under water at its rear. Extensive staining was observed, yet only a handful of tomb bats *Taphozous* spp. were noted at the entrance. Abundant evidence of disturbance of hunting was also recorded.

C10	28.10.14	Phnom Chhngauk (UTM: 0580881, 1523138). A steeply-ascending and high-vaulted cave with a single lower entrance ≈10m above hill base on cliff face and at least five skylights towards upper rear. Main chamber is strewn with boulders and stepped flowstones and is ≈20–30m in height and ≈40–50m in diameter. Only ≈100 tomb bats *Taphozous* spp were observed, though staining was noted in several unoccupied erosion domes. Abundant evidence of use was also observed in the form of hunting sticks, guano harvesting, burnt incense and guard-rail at entrance.
C11	28.10.14	Phnom Chhngauk (UTM: 0580933, 1523138). A descending cave with two entrances set ≈25m above hill base, only the left of which was explored (the right being inaccessible). It comprises three chambers: the second includes a small skylight and the last is relatively level. ≈20 *H. armiger* and two *H. galeritus* were recorded and wall staining was less abundant compared to other caves. Evidence of cave use included graffiti, hunting and guano collection.

Key Species

All of the bat species presently recorded at Prey Lang are currently considered Least Concern by the IUCN (2014). This may be misleading however, as population trends (whose quantification underlies the Red List categories) are currently unknown for most of these species. Further, given the very large extent of intact habitat and limited sampling to date, it is highly probable that future studies will reveal the presence of additional bat species at the site. As such, the conservation significance of Prey Lang for bats is in all likelihood considerably greater than presently documented. Nevertheless, in supporting at least a third of the national fauna, the area is clearly important for Cambodian bat conservation.

Marshall's horseshoe bat *R. marshalli*
Two individuals were caught in a mist net on a forest trail (F13, Appendix III) in the early evening of October 26, 2014 in the northern sector, while a third was caught overnight in a harp trap on a forest trail (F12, Appendix III) later that same night. The external, craniodental and acoustic characteristics and measurements of all three bats match *R. marshalli*. The species is relatively uncommon and is a cave-dwelling forest-interior specialist known only from scattered localities in Thailand, northern Laos, Vietnam and Peninsular Malaysia (Francis, 2008). The records from Prey Lang are the first for Cambodia.

Walston's tube-nosed bat *Murina walstoni*
A single bat was caught in a harp trap on a forest trail (F31, Appendix III) in the early evening of December 25, 2014 in the central sector of Prey Lang. This individual matches well the diagnoses of Csorba et al. (2011), who recently described the species from Veun Sai in Ratanakiri Province, including specimens from Koh Kong Province and Dak Lak Province (Vietnam). Since then, additional records have emerged from Preah Vihear Province (Furey, unpublished data), Laos and Vietnam (Francis and Eger 2012). Though all *Murina* dwell in foliage and are typically considered forest-interior specialists (Furey et al. 2010, Kingston 2013), *M. walstoni* appears to use more open and drier habitats than other members of the genus.

Discussion

Prey Lang supports at least one-third (24/71) of the known bat fauna of Cambodia and in all likelihood somewhat more. Despite a suggested inventory completeness of 86–92%, continued sampling will undoubtedly reveal additional bat species at the site. Field experience strongly supports this, as many genera and species typically

encountered in Cambodian forests have yet to be recorded e.g. *Megaerops* spp., *Myotis* spp. and *Tylonycteris* spp. This is particularly true for the central and southern sectors where sampling effort was comparatively limited.

It should be noted that the importance of caves in these isolated hills is not confined to bats but also includes the subterranean invertebrates that depend on their guano. As a result of these diverse assemblages, caves now rank among the hottest of biodiversity hotspots (*sensu* Myers et al. 2000) worldwide in terms of their levels of species endemism and threat (Whitten 2009). It should be noted that the importance of caves in these isolated hills is not confined to bats but also includes the subterranean invertebrates that depend on their guano. As a result of these diverse assemblages, caves now rank among the hottest of biodiversity hotspots (*sensu* Myers et al. 2000) worldwide in terms of their levels of species endemism and threat (Whitten 2009).

Threats

Unequivocal evidence of bat hunting was encountered at seven of the ten caves supporting bat colonies in the northern sector of Prey Lang. Evidence of population declines was also encountered in several caves. This poses a major concern as the large aggregations of bats typically attracted to such sites can represent a sizeable proportion of local populations and are highly vulnerable to human disturbance (Furey and Racey in press). Guano collection and other cave uses were also observed at several sites and have strong adverse potential, particularly during critical breeding periods such as late pregnancy, lactation and weaning (Furey et al. 2011). In contrast, only one instance of bat hunting was encountered in the central sector and no evidence was encountered in the southern sector. In these sectors, it is helpful from a conservation perspective that no (or at least less) caves seemingly exist locally as bat populations will be more evenly distributed and consequently less vulnerable to human depredations.

The widespread continuation of illegal timber logging at Prey Lang is well documented and also poses a major concern. Studies in Vietnam have demonstrated dramatic declines in bat abundance between areas with natural forest compared to those with secondary cover (Furey et al., 2010). The removal of older, larger trees presents a particular concern as these tend to provide more cavities and crevices for foliage-dwelling species. Allied to this, a sizeable proportion of the known bat fauna of Prey Lang (14 of 24 species) comprises forest-interior specialists (e.g. members of the Rhinolophidae and Hipposideridae and most taxa within the Murininae and Kerivoulinae subfamilies) which are poorly adapted to foraging in open areas (Kingston 2013). Internal habitat fragmentation is therefore likely to erode their foraging effectiveness and consequently increase local extinction risks. Such concerns are all the more relevant due to species range shifts anticipated as a result of global climate change (Jones and Rebelo 2013).

Recommendations

- ➢ Undertake further surveys to fully document the conservation significance of Prey Lang for bats, particularly in the northern sector, where many more karst

hills and caves have yet to be assessed.

- Protect all caves supporting bat colonies at Prey Lang from hunting. This prohibition need not extend to guano collection, as this could be encouraged to support local livelihoods and conservation objectives through the promotion of sustainable harvesting techniques (e.g. IUCN SSC 2014).

- Accord priority to protection of forest habitat, with particular emphasis on maintaining forest connectivity and protecting forest areas encompassing surface water, such as the interior swamp forests in the central sector.

5. BIRDS

Chhin Sophea

Introduction

Birds are considered an ideal taxon for studying the impacts of habitat changes on biodiversity in tropical forests, as bird community composition can be strongly influenced by disturbance to forest vegetation structure. Birds also perform vital ecological functions in tropical forests and have roles as pollinators, seed dispersers and predators (Felton et al., 2008). Furthermore, quantitative assessment of the IUCN Red List shows that the threat status of the world's birds has steadily worsened since 1988 (Butchart et al., 2004), with 93% of threatened forest avifauna found in tropical forests (BirdLife International, 2004).

The earliest ornithological literature relating to Cambodia dates from the end of the 19th century; however, for most of the following one hundred years, the ornithological fauna of Cambodia remained little studied (certainly in comparison to neighbouring countries). According to Delacour (Eames et al., 2001), up until the mid-1990s, the only significant ornithological literature about Cambodia came from three sources. The first was from the 4th Franco-British Expedition to Indochina from 1927-28 by Jean Delacour, Pierre Jabouille and Willoughby Lowe, who conducted the earliest research in the Cardamom Mountains. This research was published by Delacour in 1929 and summarized again in 1931 in four volumes of *Les Oiseaux de Indochine Francaise*. The second source of information is from Paul Englebach, a French doctor who lived in Cambodia between the 1930s and 1940s and published several papers on bird status and identification. The final literature is an unpublished manuscript entitled 'A Preliminary Checklist of the Birds of Cambodia' written in 1964 by William W. Thomas, an American diplomat who lived in Phnom Penh from 1959 to 1961. This last manuscript remained the most reliable summary of Cambodian ornithological fauna until 2003.

In 1992, the first foreign ornithologist returned to Cambodia, but the security situation as a result of civil war severely restricted fieldwork. The subsequent arrival of international conservation NGOs such as the World Conservation Union (IUCN), the Worldwide Fund for Nature (WWF) and the Wildlife Conservation Society (WCS), allowed comprehensive fieldwork and publication to begin (Daltry & Momberg, 2000). In 2003 Tan Setha, a Cambodian conservationist, and Colin Pool, an ornithologist, collaboratively produced a Field Guide to the Birds of Cambodia, which categorized 535 species (Setha & Poole, 2003). Until December 2012, a total of 599 bird species had been recorded and confirmed in Cambodia, of which about two-thirds are resident and a quarter are winter visitors. This indicates remarkably high diversity for a country with a topography that consists mostly of lowlands. Indeed, the whole of Western Europe supports about 650 bird species in a range 20 times larger than that of Cambodia (Goes, 2013). However, Cambodia hosts only two strictly endemic species (Cambodian laughing thrush *Garrulax ferrarius* and Cambodian tailorbird *Orthotomus chaktomuk*); and two near-endemic species (Chestnut-headed Partridge *Arborophila cambodiana* and Mekong Wagtail *Motacilla samveasnae*), whose ranges marginally extend into adjacent countries. Another 13 highly distinctive subspecies are also endemic to the Cardamom Mountains.

Methods

The total bird species listed in this report have been compiled from a combination of secondary sources such as relevant wildlife surveys, information gained through local interviews and field sampling (Table 6).

Table 6 Date and location of ornithological field sampling

Date	Survey Areas
16-25 June, 2014	Field work started in Sre Pring Village, where the team stayed for one night; headed up to the first base camp located in central Prey Lang, Kampong Thom Province for one night; shifted to the second camp, 2,252meters away from the first camp; and concluded the last three days at Phnom Chi in the south.
20-30 November, 2014	Two nights were spent at Chhvarng village Along Chrey Commune, Chheb District, Preah Vihear Province. Four nights were spent at Phnom Thom and three nights at Phnom Chhngorck.
22-30 December, 2014	The survey started at Pnheak Rolouek, Thmear Commune, Chey Sen District, Preah Vihear Province, and moved to Spong village the location of three provincial boundaries (Preah Vihear, Kampong Thom and Stueng Treng Province). The base camp was set in the swamp forest 18km from Spong village.

Birds were sampled using a combination of transect lines, mist-netting surveys and opportunity search. The combined methods are useful for studying bird presence and richness (Blake & Loiselle, 2001; Wang & Finch, 2002) and may complement each other in terms of species encountered. Birds were surveyed along meandering transects (existing trails) from 0500-1130hours and 1500-1800hours daily.

Mist-nets were used just a few days before the end of the trips and when most areas of each base camp had been observed. Mist-nets were used to detect small and shy bird species in the forest understory. Three sizes (12m × 2.5m x 3 sets, 15m × 2.5m x 4 sets and 10m x3m x 1 set) of 70-denier passerine mist-nets (mesh size of 16 × 16mm and 19 × 19mm) were used depending on the habitat structure at the site. Mist-nets were deployed only at camp 2, where nets were opened from 0530-1700hours, and checked hourly.

Opportunity searches were conducted to record targeted bird species, colonies and nest sites, where the locations were outside the trail; especially when surveyors saw fruit trees or heard birds call. Binoculars were used to aid observation and a digital recorder (Edirol R-09HR) recorded bird calls where needed to later confirm identifications.

Birds were mainly identified through sightings or calls; captures were only used for identification confirmation when required. Bird identifications were made based upon field guides (Robson, 2008; Setha & Poole, 2003; Goes, 2013) and a bird songs webpage (www.xeno-canto.org). The conservation status and importance of birds were based on Goes (2013).

Results

Overall findings

A total of 266 bird species representing 61 families were recorded in Prey Lang using the combination of transects, mist-nets, camera trap records and opportunity search techniques employed by the researchers. When added to the observations from other bird records (Olsson & Emmett, 2007) including locals interviewed, the bird list exceeds 266 species of 61 families (see Appendix IV).

Of those, 15 species are listed by the IUCN, 56 species are Regionally Threatened in Laos and Thailand, while 38 species have been listed as Threatened in Cambodia. More information is needed for these species (see Appendix IV).

Key Species

White Shoulder Ibis *Pseudibis davisoni* (IUCN-Critically Endangered)
White Shoulder Ibis is a very localized resident in dry deciduous forest, grasslands and undisturbed rivers in lowlands. It forages mainly at livestock-grazing pools, meadows, rice fields and river channels (Goes, 2013). Based on observations, there is a lot of available habitat that looks suitable for this species in Prey Lang (eg Site 2 and 3). No individuals were recorded during the survey but several local people described them and assured us that the species is present. The population declined dramatically during the 20th century due to habitat loss (largely land conversion for agriculture) and human hunting of adult birds, eggs and chicks for food (Birdlife International Cambodia Programme, 2012).

Giant Ibis *Pseudibis gigantean* (IUCN-Critically Endangered)
The Giant Ibis is the national bird of Cambodia. In Prey Lang, Site 2 is likely a very good habitat for this species due to the several seasonal ponds, which are far enough from human disturbance to afford some protection. The surveyors did not encounter any individuals on account of the seasonal pools being full of water. The Giant Ibis is extinct in Thailand and now confined and largely endemic to Cambodia, being only occasionally found in Laos and Vietnam. The global population is estimated at less than 400 birds (BirdLife International, 2015).

Green Peafowl *Pavo muticus* (IUCN-Endangered)
One group of Green Peafowl was heard at Site 1 in the semi-evergreen forest and another at Site 2, where the habitat mostly consists of DDF forest with less semi-evergreen forest close to the foot of Thnom Thom and Phnom Chhngorck Mountains. The species is extinct in part of India and in Bangladesh, and is now confined to Myanmar, China, Thailand, Indonesia, Cambodia, Vietnam and Laos (BirdLife International, 2015). The major threat to this species is persecution for food and trade driven by the high market value of live birds and feathers (Goes, 2013).

Figure 20 Pavo muticus

Greater Adjutant *Leptoptilos dubius* (IUCN-Endangered)
An adult Greater Adjutant was found in a seasonal pond at Site 2 more than 5km away from base camp. Another was feeding with a Woolly-necked Stork in an uncompleted dried seasonal pond, approximately 100m from the main stream in Site 3. The species is easily confused with the Lesser Adjutant (Birdlife International Cambodia Programme, 2012). This species prefers mainly lowland freshwater wetland. In Cambodia, the main populations are found in the Tonle Sap swamp forest, grassland and dry deciduous forest landscapes. Habitat loss, hunting for food, and direct and indirect poisoning from agricultural practice are the threats to the species (Goes, 2013).

Lesser Adjutant *Leptoptilos javanicus* (IUCN-Vulnerable)
Several Lesser Adjutant individuals were found. At Site 1, one was found perched on a tree close to the main road to Sre Pring village and three individuals were found foraging in grassland close to a big seasonal pond between Kamnob and Phnom Chi Mountain. At Site 2, two individuals were found flying over a seasonal pond and

grassland about 5km from the base camp, and remains of wings and a head left by a hunter were found at a bank stream connected to a larger lake near by. At Site 3, four individuals were found foraging mixed with Woolly-necked Storks and two individuals were flying over a seasonal pond and old grass. The species is distributed across South and Southeast Asia and Indonesia, with the global population estimated at 6,500-8,000 birds, of which as many as 2,500-4,000 individuals are believed to occur in Cambodia (BirdLife International, 2015). Habitat loss, hunting, chicks and egg collection are considered the major threats to this species (Birdlife International Cambodia Programme, 2012).

Figure 21 Leptoptilos javanicus, Prey Lang

Great Slaty Woodpecker *Mulleripicus pulverulentus* (IUCN-Vulnerable)
At Site 1, two Great Slaty Woodpeckers were found, one in DDF on the road close to Srekass, and another was heard about 3km from camp. At Site 2, five individuals were found singing and alarming with White-bellied Woodpeckers in DDF. Site 2 represents very good habitat for this species and other woodpeckers, and should be considered as a main site for woodpecker watching and a potentially important area for long-term conservation of the species. A previous study strongly suggests that this species prefers large mature trees (Lammertink *et al*., 2009), so to support the population of this species, the dominant vegetation in Site 2 should be conserved. Like the White-bellied Woodpecker, it may be heavily affected by the loss of large trees and riverine forest.

Yellow-breasted Bunting *Emberiza aureola* (IUCN-Vulnerable)
Only two Yellow-breasted Bunting individuals were spotted in grassland in open habitat surrounded by DDF in Site 2. This species is a non-breeding winter visitor and spring passage migrant in rice fields, scrub, grasslands and marshes in lowlands. The species was formerly globally Near Threatened in 2004 and upgraded to globally Vulnerable in 2008 due to declines noted in breeding areas and high levels of trapping for food and merit release at migration and wintering sites (BirdLife International 2015; Gilbert et al., 2012).

Indian Spotted Eagle *Aquila hastate* (IUCN-Vulnerable)
One individual was spotted on a tree of DDF forest close to three connected seasonal pools approximately 5km from the base camp at Site 2. The species looks similar to the Serpent-crested Eagle, with white spots on its underside and no tail bar as the keys to distinguish it. It was historically recorded at Chep District in Preah Vihear in 2009 (Goes, 2013). That record could help to confirm the species identification.

Sarus Crane *Grus antigone* (IUCN-Vulnerable)
No individuals were found during the survey; yet the information from interviewing with local people from three studied areas indicate that the locals are aware that Sarus Crane is the tallest bird with a distinct red head. The surveyors take this knowledge as confirmation that Sarus Crane is present in the area. Sarus Crane is a rare resident of grasslands in plains and lowlands, including meadows and the grassy margins of pools in DDF and undertakes seasonal movement (Goes, 2013). In Cambodia the largest population is found at Ang Tropeang Thmor, Banteay Meanchy Province. BirdLife International in 2015 stated that this species is facing risk in Laos, and is extinct in Thailand. The major threats to this species are the loss of wetland habitats and human persecution (direct and indirect poisoning and hunting for food) (BirdLife International, 2015).

Figure 22 Grus antigone

Pale-capped Pigeon *Columba punicea* (IUCN-Vulnerable)
One Pale-capped Pigeon was found in a DDF at the foot of Mount Thom (Phnom Thom) of Site 2. In Cambodia, most records of this species come from Mondolkiri and Thmar Baeuy in Preah Vihear Province (Goes, 2013). Its conservation status in Cambodia is difficult to assess as the species is not known to face any specific threats, although it might be incidentally affected by the widespread practice of hunting and poisoning pigeons (Goes, 2013).

Orange-necked Partridge *Arborophila davidi* (IUCN-Near Threatened)
One individual was heard and sighted between semi-evergreen and evergreen forest in Site 2. To try and confirm the identification, mist-nets and opportunity search were deployed; they were not successful however. The species is quite rare in Prey Lang; most records were made in Mondulkiri Province, especially in Seima Protected Forest

(Goes, 2013). Orange-necked Partridge is reported as endemic to Southern Annamese lowland forest. The finding of this species in Prey Lang fills the biogeographical gap in the center Cambodia, suggesting that this species may not be endemic to Annanmese; however, further study of the species distribution in that area is recommended to confirm this. The abundance of this species is difficult to assess, as the species is particularly unobtrusive, rarely vocal, and has an inexplicably patchy distribution (BirdLife International, 2015), suggesting a small population, perhaps in the low to mid-hundreds range.

Painted Stork *Mycteria leucocephala* (IUCN-Near Threatened)
The species is widespread in various lowland wetlands such as swamp forest, grassland and marshes, as well as coastal mudflats, reservoirs, rivers and wet fields (Goes, 2013). Along the survey in Prey Lang, two groups with three and five individuals were found, one in a swamp forest and another in a seasonal pool in DDF of Site 2. Hunting for human food consumption is the major threat to the species (Goes, 2013).

Oriental Darter *Anhinga melanogaster* (IUCN-Near Threatened)
This species has been confirmed to occur in various freshwater wetlands including swamp forest, lakes, rivers, reservoirs, floodplain marshes and the upper Mekong channels (Robson, 2008; Goes, 2013). In Prey Lang, one individual was found perching on a tree above a seasonal pool approximately 5km from Site 2's camp, and another was feeding mixed with Little Cormorants in a swamp forest along the road up to base camp of Site 3. Egg and chick collection are the most significant threats to this species (Goes, 2013).

White-rumped Pygmy Falcon *Polihierax insignis* (IUCN-Near Threatened)
Several individuals were sighted along a trail from base camp of Site 1 to Phnom Chi. This species is usually found in DDF and lower hills. The extensive dry deciduous forests in Cambodia support the largest part of the global population. Its unobtrusiveness may result in impressions of low density. However, there was until recently no reason to believe the species was declining or at risk due to its widespread occurrence and consistent records at all regularly watched sites. The recent wave of economic land concessions, especially across the north and northeast lowland forest landscape, including within protected areas, present major concerns for the near future. Although present in other wooded habitats, these are sub-optimal for this dry deciduous forest specialist. Fragmentation and severe degradation of dry deciduous forest may severely affect the species and its status requires regular monitoring (Goes 2013).

Great Hornbill *Buceros bicornis* (IUCN-Near Threatened)
The species seems to be fairly common in Prey Lang as they were in all surveyed sites. This may be due to the fact that Prey Lang still has a high density of large and tall trees that provide safety, shelter and a food source for this species. In Cambodia, the species has undergone historical and recent declines in parts of its range. Other surveys have concluded that the Cardamom and Elephant mountains are the strongholds for the species, with a second healthy population in central-southern Mondolkiri. Other populations are increasingly fragmented. The species is threatened

by hunting for food and trophies, habitat loss and degradation, particularly logging of the large trees that it requires for nesting (Goes, 2013).

Discussion

Even though the fieldwork was undertaken during a short time period, mostly during the rainy season, and covered a relatively small area, the species represented in this preliminary report represent approximately 44% of the total birds recorded throughout Cambodia. There was previously little known about the biogeography and status of birds in Prey Lang, even though this forest has been confirmed as being the biggest remaining lowland forest in the region. It was interesting to note the presence of species such as the Orange-Necked Partridge, which was mostly recorded in the north-east region of the country and is now confirmed in Prey Lang; and the Green Peafowl which, we now know, has a large available habitat in Prey Lang. Although globally and nationally significant species such as Giant Ibis, White-Shouldered Ibis and Sarus Crane were not spotted during the survey, the information from local communities and direct site surveying strongly indicate that those species are present, and may be found during the dry season when the waters narrow into the specific seasonal ponds.

The survey was too brief to draw final conclusions regarding the relative importance of different habitats, because the survey was undertaken in just a few habitat types. These were mostly in dry deciduous forest because they were easily accessed in wet weather, but surveying was harder in the evergreen and semi-evergreen forest found mostly in the north central region (Site 1). In addition, there was significant potential for survey bias in evergreen and semi-evergreen forest because the forests are secondary old growth with very dense understory and forest floor layer, which caused difficulty in sighting and hearing birds.

Threats

According to the survey, the major threats to birds in Prey Lang are:

- Habitat loss and degradation: birds are threatened by habitat loss and fragmentation caused mainly by logging (found everywhere in Prey Lang) and clearing forest for local agriculture use. Local agricultural clearings were found not only in the areas close to the villages but also in the areas where solid and liquid resin tree species were found. Increased access into the region via logging roads may also promote higher hunting pressure on birds.
- Hunting for local consumption: Evidence of hunting was found such as remaining feathers, dead birds being carried by hunters and live birds in nets set in the swamp forest. These nets may capture not only birds but any flying animal. Several people, old and young, who accessed the forest were carrying sling shots and/or locally invented air guns. There is little discrimination in birds hunted because the surveyors found evidence of small-bodied birds such as Drongos to big birds such as Lesser Adjutant being hunted.

Figure 23 Wings of Leptoptilos javanicus (lesser Adjutant) abandoned by hunters, Prey Lang

Recommendations

- ➢ Protect Prey Lang under the national forestry laws.
- ➢ Significantly improve current law enforcement activities, not only for logging but also for forest clearing and hunting.
- ➢ Deliver educational programmes on the importance of birds, especially at the local communities level. Young villagers should be the first targeted group.
- ➢ Carry out longer bird surveys at the surveyed areas and expand to other parts of Prey Lang.
- ➢ Teach birding techniques to enforcement individuals who regularly access the forest, so they can record the bird data.
- ➢ Create bird watching sites at the potential bird areas such as at the DDF of Site 2, not just for tourists but also to encourage local researchers.

6. AMPHIBIANS AND REPTILES

Neang Thy

Introduction

Herpetofauna are cold-blooded amphibians and reptiles with body temperature fluctuating according to the surrounding environment in which they live. Amphibians include frogs, caecilians and salamanders, although the latter are absent in Cambodia (Neang & Holden, 2008). Reptiles include crocodile, turtles, lizards, snakes and tuatara (Cox et al., 1999; Das, 2010), and again the latter is not present in Cambodia.

Herpetological studies in Cambodia have been few. The first herpetofauna studies in Cambodia were initiated by Günther (1861, 1864) and Bourret (1936, 1941, 1942), followed by Smith (1943), Shibata (1967) and Saint Girons (1972) prior to the start of the civil war in 1975. Due to the prolonged conflict lasting for almost three decades, and the resulting inaccessibility of many areas, knowledge of Cambodia's herpetofauna remained poor and lagged far behind that generated in Cambodia's neighbouring countries of Thailand (Taylor, 1962, 1963, 1965), Laos (Stuart, 1999, 2005) and Vietnam (Inger et al. 1999; Orlov et al., 2002).

Post-conflict herpetological field resurgence mainly concentrated on the Cardamom Mountains of southwest Cambodia (Grismer et al., 2008; Neang et al., 2014; Ohler et al., 2002; Stuart & Emmett, 2006) and north-eastern Cambodia (Rowley et al., 2010; Stuart et al., 2006, 2010). Some sporadic surveys were also carried out along the Mekong River (Bezuijen et al., 2009), Tonle Sap Lake (Brook et al., 2007a, 2007, 2009) and around Siem Reap (Hartmann et al., 2013). Brook et al. (2007a, 2007b, 2009) also assessed the impact of hunting and trade on the reproductive and trophy ecology of water snakes of Tonle Sap. These surveys were carried out in the vicinity of Prey Lang. however Prey Lang itself was almost unvisited by biologists.

The exception to this is, a single survey on amphibians and reptiles conducted by Rowley (2007) and turtle survey conducted in the central evergreen forest of Prey Lang by Olsson & Emmett (2007).

This survey is therefore the first comprehensive herpetological study of Prey Lang, aiming at justifying the importance of herpetofauna as part of the area's biodiversity value, identifying the threats to Prey Lang's herpetofauna, and recommending practical conservation actions to save the last remaining lowland forest block of Prey Lang.

Figure 24 Hylarana erythraea, Prey Lang

Methods

The first fieldwork was conducted between June 16 and 22, 2014 around C1 and C2 (see Table 7 for localities). A brief search after rain at night was also carried out in Sreping Village on June 17, 2014. The second field survey was undertaken between July 20 and 27, 2014 around the Phnom Thom karst at C3. Additional scattered surveys were also carried out in Srekhas and O'Krak at Prey Lang (see Table 7). Most surveyed areas were felled under the past logging concessions of Pheaphimex Company. The two main large tree species *Dipterocarpus costatus* and *Anisoptera costata*, which dominated the semi-evergreen forest, were removed during the 1990s and early 2000s. Meandering logging roads in Prey Lang remain in use by illegal loggers, hunters and NTFP collectors. All survey dates and efforts are shown in Table 7.

Table 7 Dates and sites and herpetofauna surveys

Survey Date	Survey sites	UTM (WG84)		Elevation	Habitat types
17-Jun-14	Srepring village (SPV)	0563859	1431573	58m	Dry deciduous dipterocarp forest with pools, ponds and puddles at road side
18-21-Jun-14	Camp1 (C1)	0575570	1454149	101m	Lowland semi-evergreen forest, disturbed by logging in 1990s and 2000s.
22-24-Jun-14	Phnom Chi (C2)	0571918	1430036	320m	Hilly semi-evergreen forest with large resin trees remaining
20-27-Jul-14	Thnom Thom, Karst (C3)	0579149	1524759	120m	Thnom Thom, karst surrounded semi-evergreen forest and dry dipterocarp forest
10-Oct-14	Srekhas (C4)	0584807	1464460	89m	Seasonal rice field surrounded by semi-evergreen forest
19-Nov-14	O'Krak (C5)	0588174	1449162	-	Semi-evergreen forest

Opportunistic searches for amphibians and reptiles were undertaken both day and night in most macro and microhabitats around the studied sites. These included searches along shallow, slow and fast moving streams, along forest trails, in swampy areas, around ponds, pools, puddles, tree trunks, caves and karst. Logs were overturned in some places. As far as possible, species encountered were caught, photographed and released unharmed. Amphibians and reptiles were identified by using *Field Guide to Amphibians of Cambodia* (Neang & Holden, 2008), *Reptiles of Southeast Asia* (Cox et al. 1999; Das 2010) and *Turtles of Thailand, Laos, Vietnam and Cambodia* (Stuart et al. 2001).

Results

Overall Findings

A total of 67 herpetofaunal species is confirmed for the first time from the herpetological field survey and literature review for Prey Lang.. The species comprise 22 amphibians (arranged by five families and 14 genera) and 45 reptiles (arranged by 14 families and 35 genera). Olsson & Emmett (2007) also reported two frogs, four turtles and two snakes that were not found by the current study. Additionally, the author observed a king and a monocellate cobra during his field work in Prey Lang in Kampong Thom Province in 1999 and 2001 respectively. The present survey yielded 57 herpetofaunal species (20 amphibians and 37 reptiles). However, it is believed that the number of amphibian and reptile species found at Prey Lang remains incomplete, as any additional field effort resulted in more species discoveries. Species which were expected to be found, but which remain missing from the current list include the Butterfly Lizard, Burmese Python and many other snakes. A list of all herpetofaunal species confirmed for Prey Lang are presented Appendix V.

The majority of the species found (85%) are the representatives of anthropogenically modified habitats and they can be found in the lowlands throughout Cambodia. Six species, including *Ingerophrynus macrotis*, *Hylarana mortenseni*, *Theloderma stellatum*, *Siebenrockiella crassicolis*, *Calotes mystaceus* and *Sphenomorphus stellatus* had previously been recorded in the Cardamom Mountains (Emmett & Olsson 2005; Grismer et al. 2008; Ohler et al. 2000; Stuart & Emmett, 2006) and Siem Reap (Hartmann et al. 2013). Two frogs (*Limnonectes dabanus*, *Pelochylax lateralis*) and two turtles (*Cyclemys oldhemii*, *Heosemys grandis*) had been recorded in Kratie, and Mekong River (Benzuijen et al. 2007; Neang & Holden 2008; Stuart & Platt 2004), and the latter three species were also identified in Siem Reap (Hartmann et al. 2013). This result provides further range extension from the extreme easternmost boundary of those species reported from the Cardamom Mountains and the extreme westernmost boundary of those reported from eastern Cambodia (east of the Mekong). The record of *Limnonectes dabanus* at Prey Lang is interesting because we can now confirm its presence on both the western and eastern sides of the Mekong River; likely a result of the geographical allopatric formation of the Mekong River about 5,000 years ago (Woodruff 2010). *Hylarana morternseni* from Prey Lang was incorrectly identified as *H. nigrovittata* by Rowley (2007), therefore its occurrence remains confirmed only in western Cambodia (not eastern, as this species occurs in the Cardamoms and Siem Reap.

More importantly, one reptile found in Prey Lang, *Gekko petricolus*, is confirmed for Cambodia for the first time. The record of this species in the Prakas dated January 25, 2007 by the Ministry of Agriculture, Forestry and Fishery was premature because there were no other papers, reports, photographs or specimens confirming its presence in Cambodia at that time *Scincella rupicola* was found for the second time after it was first discovered in Siem Reap (Hartmann et al. in prep.). The two reptile species are highly likely to occur only in the areas around Prey Lang and north to the border of Thailand, being biogeographically isolated from the Cardamom Mountains and eastern Cambodia.

One species of skink (*Lygosoma* sp.) that has been found in the Cardamom Mountains in recent years (Neang, unpublished data) and Prey Lang from the present survey is potentially new to science. The genetic analysis of this species is being checked.

Pelochelys cantorii, a giant soft-shell turtle is a large and deep aquatic reptile that has only been confirmed in the Mekong River (Benzuijen et al. 2007; Stuart & Platt, 2004). Although to some extent it may intrude to the vicinity of Prey Lang's area (Olsson & Emmett 2007), there may not be large and deep enough water bodies at Prey Lang for this species. Hence it has been excluded from the present record. Siamese crocodile was reported to inhabit the deep river near the karst area by local communities from Chavang village. Based on local guide reports, Sok & Sin (2003) and Sok & Prum (2003) believed that crocodiles were present at Prey Lang. According to the reports, the highest potential area for Siamese crocodiles is Pong Barang at UTM 0558785, 1449585, Mean Rith Commune, Sandan District, Kampong Thom Province. In a recent interview by Chhin Sophea with experienced local forest guide, Mr. Sy from Chhvang Village, Sam-ang District, indicated that crocodiles were present in the large river (O'Thom) about 5 km north of Phnom Thom. He claimed that ten years ago he alone caught more than 200 crocodile individuals. He claimed that combined with those caught by others, about 2000 crocodiles were sold to middlemen. In the early dry season last year (2013), he spotted two crocodiles while revisiting his fishing net setting in the river. As there was no confirmation by either sighting or dung record of Siamese crocodiles by the survey team, the present report has excluded the reptile from the list. However, it would be worthwhile to invest additional efforts to resurvey the areas in the dry season to confirm its presence or otherwise.

Key Species

Of the 22 amphibians, one frog is listed by IUCN (2014) as Data Deficient (DD), two listed as Near Threatened (NT) and 18 as Least Concern (LC). Of the 47 reptiles, one terrestrial turtle is listed as Endangered (EN), six as Vulnerable (VU), 13 as LC and 26 have not been evaluated yet (NE). The details of distribution and status of species listed in the IUCN threatened category is provided below in Table 9.

Table 8 Summary of Prey Lang's Herpetofauna species listed by IUCN

IUCN red list of threatened category	Amphibians	Reptiles	Total
EN	0	1	1
VU	0	6	7
DD	1	0	1
NT	2	0	2
LC	19	12	31
NE		26	26
Total	22	45	67

➢ **Amphibians**

Annam Wart Frog *Limnonectes dabanus* (Smith, 1922), IUCN-DD:
This species has been previously recorded in eastern Cambodia (Neang & Holden, 2008; Stuart et al., 2006) and Vietnam (Nguyen et al., 2009). The record of this species in Prey Lang extends its range to the west in the lowland at 101 meters above sea level (asl.). This is perhaps the lowest altitude recorded for this frog as Stuart et al., (2006) reported it above 450 meters asl. Its population in Prey Lang seems to be low as only a few individuals were observed during the survey time. Due to its localized distribution this frog is listed by IUCN as Data Deficient (DD).

Mortensen's Frog *Hylarana mortenseni* Boulenger, 1903, IUCN-NT:
This species has been previously recorded in Cambodia's Cardamom Mountains (Ohler et al., 2000; Stuart & Emmett, 2006; Neang et al., 2010) and south-eastern Thailand (Chan-ard, 2003). The record of this species in Prey Lang extends it range to the east, probably to the lowest altitude of 101 meters asl. Due to its localized distribution and habitat degradation, this species is listed as Near Threatened (NT). This medium sized frog is also reportedly hunted for local consumption in all its ranges in Cambodia.

Spotted Warty Tree Frog *Theloderma stellatum* (Taylor, 1962), IUCN-NT:
This species was previously recorded in both the Cardamom Mountains and northeastern Cambodia (Neang & Holden 2008), and Vietnam (Nguyen et al. 2009). The finding of this species in Prey Lang fills the biogeographical gap in the center of Cambodia, suggesting that this species occurs throughout the country. This species is not impacted by hunting but is affected by removal of large trees with holes, especially resin trees (*Dipterocarpus costatus* and *D. alatus*) and bamboo. Localized occurrence and habitat degradation prompted IUCN to list it as Near Threatened (NT).

➢ **Reptiles**

Asian Box Turtle *Cuora amboinensis* (Daudin, 1802), IUCN-VU:
This species is known throughout most of Southeast Asia (Cox et al., 1999; Das, 2010). The species was previously reported in most western parts of Cambodia (Daltry & Chheang, 2000; Hartmann et al., 2013; Olsson & Emmett, 2007; Stuart & Platt, 2004) and is likely to be relatively common in most of its range. But its population in Prey Lang seems to be becoming rare due to heavy harvesting for both consumption and trade. Due to over exploitation and habitat degradation, it is listed as Vulnerable (VU).

Asian Giant Terrapin *Heosemys grandis* (Gray, 1860), IUCN-VU:
This species has been recorded in most Southeast Asian countries (Das 2010; Stuart et al., 2001). In Cambodia it has been reported from most parts of the country (Hartmann et al., 2013). The finding of this turtle in Prey Lang fills a gap between the east and west, suggesting it occurs throughout Cambodia. As with other turtle species, this species has been harvested all over its range, thus it is listed by IUCN as Vulnerable (VU).

Black Marsh Turtle *Siebenrockiella crassicollis* (Gray, 1830), IUCN-VU:
This species is recorded in Cambodia, Vietnam, Thailand, Indonesia and Malaysia (Das, 2010; Stuart et al. 2001). In Cambodia, this species was previously recorded in the Cardamom Mountains and Kampong Thom Province (Stuart & Platt, 2004; Som et al., 2005) and Kulen Prom Pep National in Siem Reap (Hartmann et al., 2013). The record of this species in Prey Lang extends its range to Cambodia's central lowland. Two juvenile individuals were observed during the survey, suggesting that an adult population remains viable for breeding but may have declined due to hunting (Olsson & Emmett, 2007). Due to overexploitation and habitat loss in most of their ranges, this species is listed by IUCN as Vulnerable (VU).

Figure 25 Siebenrockiella crassicolis (Vulnerable), Prey Lang

Asian Soft-shell Turtle *Amyda cartilaginea* (Boddaert, 1770), IUCN-VU:
The turtle occurs in most of Southeast Asia (Das 2010; Stuart et al., 2001). This species is commonly found nationwide (Hartmann et al., 2013), but its population has declined throughout its range due to overharvesting. Because of high demand for consumption and trade, it is listed by IUCN as Vulnerable (VU).

Elongated Tortoise *Indotestudo elongata* (Blyth, 1853), IUCN-EN:
This terrestrial tortoise species has been recorded in most Southeast Asian countries (Das, 2010; Stuart et al., 2001). It has been reported to occur all over Cambodia (Bezuijen et al., 2009; Emmett & Olsson, 2005; Hartmann et al., 2013; Stuart and Platt, 2004). The presence of this species in Prey Lang fills the biogeographical gap between the Cardamom Mountains and eastern plain. Because of its terrestrial nature, the population has been severely impacted throughout its range by forest clearing and especially by local hunters and dogs. It has been listed by IUCN as Endangered (EN) to address its conservation importance.

Spitting Cobra *Naja siamensis* Laurenti, 1768, IUCN-VU:
This species was previously reported to occur in the Indo-Burmese region (Cox et al., 1999; Das, 2010). The spitting cobra has been recorded throughout Cambodia (Grismer et al., 2008; Wüster & Thorpe, 1994). This fatally venomous species has been severely affected by overexploitation for traditional medicine and local consumption and trade, prompting IUCN to list it as Vulnerable (VU).

King Cobra *Ophiophagus hannah* (Cantor, 1836), IUCN-VU:
This is the largest, longest and most venomous species of snake in the world. It was reported throughout Southeast Asia (except the Philippines) to Nepal and India (Cox et al., 1999; Das, 2010). It has been recorded throughout Cambodia (Daltry & Chheang, 2000; Saint Girons, 1972; Stuart et al., 2006). Due to overharvesting for traditional medicine, local consumption and trade, and habitat loss, this species is listed by IUCN as Vulnerable (VU). In July 2014, the author observed indigenous people in Siem Pang District, Stung Treng Province, selling one kilogram of King Cobra for 40USD.

Discussion

The result indicates that Prey Lang supports high diversity with a high rate of regionally and globally threatened species, as at least 10 herpetofaunal species (or 15%) are listed by IUCN in the threatened category. Although 26 species are yet to be evaluated, the current discoveries and their distribution ranges reported here could be useful for future IUCN assessment.

Threats

The high diversity and relatively high proportion of globally threatened herpetofaunal species in Prey Lang are critically important as they are the indicators of a healthy environment (Hartwell et al. 1998). Currently, herpetofauna at Prey Lang appears to be being severely threatened by many unsustainable activities. Observed threats include the conversion of forest for settlement, agriculture and development, and habitat fragmentation by the construction of infrastructure. Past and current selective logging have changed the forest composition and structure, which alters the microclimate, and increases sedimentation in hydrological systems leading to shallower water regimes, and unfavorable conditions for breeding and shelters for water dependent species.

Beside professional poachers, loggers around development sites hunt all kinds of wildlife to supplement their diet. Many groups of hunters and many snares were observed and reported during the surveyed period, suggesting that the daily subsistence income of many community members living around Prey Lang relies largely on hunting. Large-bodied amphibians and reptiles were reported to be collected for food, such as *Hylarana mortenseni*, *Hoblobatrachus rugulosus* and *Kaloula pulchra,* while reptiles are collected for both bush meat and trade. Land monitor lizards (*Varanus bengalensis*) were observed hanging in stores for sale in Boeung village at Prey Lang. A number of water dragons (*Physignathus cocincinus*) were seen being carried by local hunters during August 2014 in the survey area.

Figure 26, Physignathus cocincinus, Prey Lang

The Reticulate Python and all turtle species are reportedly hunted for both local consumption and trade, according to people in (community members, Siem Bok, Srepring and Chhvang pers comm.). Two turtle traders, one in Sandan District and another in O'Lang Village in Siem Bok District, were reported as buying all wild turtle species caught from Prey Lang and adjacent areas (ibid).

Figure 27 Herpestes urva (Crab-Eating Mongoose) in a turtle trap, Prey Lang

Figure 28 Turtles collected by poachers, Prey Lang

In summary, reduction of critical habitats by forest conversion for logging and agriculture, and hunting for consumption and trade, have reduced the range and distribution of certain herpetofaunal species.

Recommendations

- ➢ Undertake law enforcement to stop illegal logging and land conversion for settlement and agriculture. These unsustainable activities will severely affect herpetofauna in the longer term.
- ➢ Stop newcomers migrating to Prey Lang, as this trend is leading to forest conversion for settlement and agriculture, and wildlife poaching.
- ➢ Ensure protection for Phnom Chi, which is covered by rock boulders and cloaked in evergreen forest, which are important habitats for many reptiles. Phnom Chi is surrounded by dry dipterocarp forest, so it is important for other animals to seek shelter during fires in the dry season.
- ➢ Preserve wetlands, major streams and rivers for water dependent species, including the Tonle Sap endemic Water snake (*Enhydris* longicauda), all turtle species and the Annam wart frog (*Limnonectes dabanus*).
- ➢ Identify local community needs and provide support for agricultural improvement to reduce dependency on limited forest and wildlife resources in the area.
- ➢ Provide education and awareness to people, to mainstream the importance of wildlife and relevant laws to sustain Prey Lang ecosystems.
- ➢ Undertake further herpetological fieldwork to obtain a more complete species inventory.
- ➢ Resurvey the Siamese crocodile in the dry season to confirm its status at Prey Lang. If the population remains viable, there should be a good area conserved to recover its population, using it as a flagship species to protect Prey Lang.
- ➢ Identify and stop turtle and other threatened herpetofauna poaching and trade around Prey Lang.

7. SUMMARY

Regional and global significance

Prey Lang contains some of Cambodia's largest remaining areas of forest that are not under official government protection. It also ranks as one of the more significant areas of lowland evergreen forest in the Indo-Burma region, one of the world's top ten biodiversity 'hotspots' - the planet's most biologically rich and threatened regions. The Indo-Burma Hotspot includes all non-marine regions of Cambodia, Lao PDR, Myanmar, Thailand and Vietnam, plus parts of southern China.

Biologically, the fauna of Prey Lang should be considered favorably diverse and to date 55 species under the IUCN Red List of Threatened Species have been confirmed. The landscape supports nationally and regionally important populations of several globally threatened animals. In addition, interview and previous survey data indicates the possible presence of several species in Prey Lang that, if confirmed, would further elevate the conservation importance of the landscape. These include the Hairy-nosed Otter *Lutra sumatrana* (IUCN-EN), Siamese Crocodile *Crocodylus siamensis* (IUCN-CR) and the Giant Ibis *Thaumatibis gigantea* (IUCN-CR). Taking into consideration the rapid nature of most of the surveys conducted, as well as the large areas still unsurveyed, it is very likely that further species will be added to this list by any further research, as well as the overall biodiversity knowledge of Prey Lang.

Botanically, there is a diverse mosaic of eight distinct habitats with the central area of evergreen forest being the largest contiguous section. This area also includes the evergreen swamp forests, which preliminary documentation indicates is endemic to central Cambodia. This is based on stature, species composition, structure, species dominance and phenology (McDonald, 2004).

The small area of isolated karst pinnacles in the northern section of Prey Lang is worthy of special note. Karst is often associated with outstanding biodiversity, above and below ground, with markedly different species assemblages in different parts of the world (Vermeulen and Whitten 1999). Endemicity and diversity are the rule especially in isolated karsts in the tropics (Clements et al.2006). Karst landscapes are rare in Cambodia and particularly under-represented in Cambodia's protected areas network.

Prey Lang is enormously important to the Kuy people, who rely on the forest's NTFP, and cherish their resin trees in particular as a critical livelihood base. As described earlier in this report, Prey Lang is home to many other NTFPs with strong international markets which warrant exploration rather than destruction.

Figure 29 Resin collector, Prey Lang

Considering Prey Lang's many distinctive biodiversity values, the importance of the landscapes water catchment, and REDD+ potential, the area certainly justifies protection at the highest level. However, as mentioned, the landscape is detrimentally changing and at an ever increasing rate (see threats below) and if action is not taken soon to protect this area then many of the biodiversity values will vanish

Threats

- Logging

  Historically much of Prey Lang has been logged and three logging concessions belonging to Pheapimex Fuchan, Everbright CIG Wood Co. Ltd., and Colexim Forest Concession were active in the area until 2002 (Schmidt and Theilade, 2010). Today, logging is taking place at an alarming rate (survey team, *pers obs*). This is largely concentrated in the central evergreen forest area and, as witnessed during the present survey, there seems to be a continuous flow of timber being taken out by any means of transport. To date this is totally unhindered.

Figure 30 Removal of timber by ox-cart, Prey Lang

- Hunting and wildlife trade

  As with logging, there seems to be uncontrolled hunting throughout the landscape (survey team, *pers obs*). Previous surveys reported there being an organized system of illegal hunting and trade in Prey Lang and wildlife is apparently transported to Stung Treng, Kratie and Kampong Thom towns for sale (Olssen and Emmett, 2007). There is also specific hunting for bats taking place in the karst caves in the north and this is likely to have severe impacts on bat populations there.

- Land clearance and access

  Due to the flat topography of Prey Lang, there is ease of access from all directions, and as with hunting and logging there seems to be unhindered land clearance taking place throughout the landscape. This is especially prevalent in the southern and northern areas of Prey Lang. Small local scale clearing was commonly observed as well as much larger clearing of land for plantations or general clear felling. Recent infrastructure development and especially the new road running from Stung Treng town to Tbeng Meanchey has accelerated immigration of people, all of whom have started to clear land for agricultural purposes. Around Phnom Chi there has also been a large immigration of people involved with gold mining (survey team, *pers obs*), largely dealing with rubber (Seiha, H. *pers obs*). This has created new access roads and thus further increased pressure on the landscape's natural resources. Overall, this has created a much more fragmented landscape.

Recommendations and management considerations

- Prioritize clear demarcation and definition of the boundaries of Prey Lang with possible conservation zoning of the key areas, such as the central evergreen forest, the karst hills and potential linkage with Preah Vihear Protected Forest.

- Initiate the protection of Prey Lang as a protected area with the highest status possible under Cambodian law and ensure that every effort is made to give the landscape a high priority in the international, and national conservation agenda.

- Immediately start training and equipping of patrol staff so that they are able to commence law enforcement for the protection of wildlife and habitats. Immediately stop all illegal logging activities and land clearance taking place throughout Prey Lang.

- Prevent any further immigration of people into the landscape, especially with regards to the gold miners moving in to the southern area of Prey Lang and around Phnom Chi and along the Stung Treng to Tbaeng Meachey road.
- Prevent any further Economic Land Concessions (ELC) being issued within Prey Lang and monitor activities of all present ELCs and Mining Concessions.

- Undertake more detailed research to more accurately assess the status and distribution, and threats to, the Key Species and to develop appropriate

conservation and monitoring strategies; especially with regards to any possible human-elephant conflicts.

- ➢ Create better dialogue with all partners concerned with the conservation of Prey Lang, involving a wider base of expertise. This will avoid a single NGO-led conservation effort and allow greater capacity to be directed towards Prey Lang.

- ➢ Create local community and social media networking campaigns to promote the urgent need for protection of Prey Lang.

- ➢ Undertake further broad-based surveys for those areas not visited under the present survey, especially to the western part of the evergreen central area of forest. The contiguity of habitat and wildlife corridors with PVPF should be assessed and geographical features important for wildlife should be mapped, including rivers, streams, seasonal pools and salt licks.

REFERENCES

Aruna technology, (2009). *Rapid Assessment of Prey Lang Forest*. Downloaded from Open Development. http://data.opendevelopmentmekong.net/dataset/5b387e04-7b40-5b9d-b1b5-7755cf145dc7

Ashwell, AD. (1997). *Cambodia: A National Biodiversity Prospectus*. IUCN, Phnom Penh.

Bates, P.J.J. (2008) A taxonomic review of *Rhinolophus stheno* and *R. malayanus* (Chiroptera: Rhinolophidae) from continental Southeast Asia: an evaluation of echolocation call frequency in discriminating between cryptic species. *Acta Chiropterologica* 10: 221–242.

Bates, P.J.J., Struebig, M.J., Hayes, B., Furey, N.M., Khin Mya Mya, Vu D.T., Pham D.T., Nguyen T.S., Harrison, D.L., Francis, C.M., Csorba, G. (2007). A new species of *Kerivoula* (Chiroptera: Vespertilionidae) from South-East Asia. *Acta Chiropterologica* 9: 323–338

Berry, N., O'Connor, W., Holderied, M. W., Jones, G. (2004) Detection and avoidance of harp traps by echolocating bats. *Acta Chiropterologica* 6: 335–346.

Birdlife International (2005). Ecosystem profile, Indo-Burma hotspot, Indochina Region. Critical Ecosystem Partnership Fund.

BirdLife International. (2004). *State of the world's birds 2004 : indicators for our changing world*. Cambridge UK: BirdLife International.

BirdLife International. (2015). IUCN Red List for birds. Downloaded from http://www.birdlife.org

Birdlife International Cambodia Programme. (2012). *The biodiversity of the proposed Western Siem Pang Protected Forest, Stung Treng Province, Cambodia*. Phnom Penh, Cambodia: BirdLife International Cambodia Programme.

Bezuijen, M. R., Timmin, R., Seng, T. (ed.). (2007) Biological surveys of the Mekong River between Kratie and Stung Treng Towns, northeast Cambodia, 2006-2007, 220pp.

Bezuijen, M.R., Bunna V. & Lieng S. (2009) A collection of amphibians and reptiles from the Mekong River, north-eastern Cambodia. *Hamadryad,* 34, 134–164.

Blake, G. J., & Loiselle, A. B. (2001). Bird Assemblages in Second-Growth and Old-Growth Forest, Costa Rica: Perspectives from Mist nets and Point Counts. *The Auk*, *118*(2), 304–326.

Boonratana, R., Das, J., Yongcheng, L., Htun, S. & Timmins, R.J 2008. *Macaca leonina*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Bourret, R. (1936) *Les Serpents de L'Indochine. Volumes I and II.* Imprimerie Henri Basuyau & Cie., Toulouse, France.

Bourret, R. (1941) Les tortues de l'Indochine. *Institut Océanographique de l'Indochine*, 38, 1–235.

Bourret, R. (1942) Les batrachiens de l'Indochine. *Mémoires de l'Institut Océanographique de l'Indochine,* 6, 1–547.

Boyce, P. Khou Eanghourt, & Ma Sophal M. (2002). Higher Plants, *in*: *Social and Ecological Surveys of Phnom Aural Wildlife Sanctuary, Cardamom Mountains, Cambodia*. Fauna & Flora International, Phnom Penh.

Brockelman, W., Geissmann, T., Timmins, T. & Traeholt, C. 2008. *Hylobates pileatus*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Brook, S. E., Allison, E. H., Gill, J. A., Reynolds, J. D. (2009) Reproductive and Trophic Ecology of an Assemblage of Aquatic and Semi-Aquatic Snakes in Tonle Sap, Cambodia. *Copeia* 2009, No. 1, 7–20.

Brook, S.E., Neang.T, Daltry.J,. (2012). National Elephant Workshop: Summary of proceedings. August 2012, Phnom Penh Cambodia, FFI

Brooks, S. E., E. H. Allison, and J. D. Reynolds. (2007a). Vulnerability of Cambodian water snakes: initial assessment of the impact of hunting at Tonle Sap Lake. *Biological Conservation* 139:401–414.

Brooks, S. E., J. D. Reynolds, E. H. Allison, and B. Touch. (2007b). The exploitation of homalopsid water snakes at Tonle Sap Lake, Cambodia, p. 31–38. In: *Homalopsid Snakes: Evolution in the Mud*. J. C. Murphy (ed.). Krieger Publishing Company

Bumrungsri, S., Harrison, D.L., Satasook, C., Prajukjitar, A., Thong-Aree, S., Bates, P.J. (2006) A review of bat research in Thailand with eight new species records for the country. *Acta Chiropterologica* 8: 325–359.

Bumrungsri, S., Lang, D., Harrower, C., Sripaoraya, E., Kitpipit, K., Racey, P.A. (2013) The dawn bat, *Eonycteris spelaea* Dobson (Chiroptera: Pteropodidae) feeds mainly on pollen of economically important food plants in Thailand. *Acta Chiropterologica* 15: 95–104.

Burgess, S. & I. Theilade, (2003). *Forest Gene Conservation Strategy, Part A: Conservation of forest genetic resources*. Cambodia Tree Seed Project, Danida, Phnom Penh.

Butchart S.H.M., Stattersfield AJ, Bennun LA, Shutes SM, Akçakaya HR, et al. (2004) Measuring Global Trends in the Status of Biodiversity: Red List Indices for Birds. *PLoS Biol* 2(12): e383. doi:10.1371/journal.pbio.0020383

Chan-ard, T. (2003). *A photographic guide to amphibians of Thailand.* Darnsutha Press Co., Ltd., Bangkok. 175 pp.

Chao, A., Chazdon, R. L., Colwell, R. K., Shen, T.-J. (2005) A new statistical approach for assessing similarity of species composition with incidence and abundance data. *Ecology Letters* 8: 148–159.

Chheang, S., Bates, P.J.J., Boughey, K., Csorba, G., Hayes, B., Ith, S., Mould, A., Phauk, S., Furey, N.M. (2013) Further new country records of four bat species (Chiroptera: Mammalia) from Cambodia and a call for information. *Cambodian Journal of Natural History* 2013(2): 73–82.

Choudhury, A., Lahiri Choudhury, D.K., Desai, A., Duckworth, J.W., Easa, P.S., Johnsingh, A.J.T., Fernando, P., Hedges, S., Gunawardena, M., Kurt, F., Karanth, U., Lister, A., Menon, V., Riddle, H., Rübel, A. & Wikramanayake, E. (IUCN SSC Asian Elephant Specialist Group) (2008). *Elephas maximus*. The IUCN Red

List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 09 February 2015.

Clements, R., Sodhi, N.S., Schilthuizen, M. and Ng, P.K.L.(2006) Limestone karsts of Southeast Asia: imperiled arks of biodiversity. BioScience 56(9), p. 733-742.

Conservation International, (2011). REDD+ in the Prey Lang Area.

Cox, J.M., Dijk, v. P.P., Nabhaitabhata, J., Thirakhupt, K. (1999). *A photographic guide to snakes and other reptiles of Peninisular Malaysia, Singapore and Thailand*.

Csorba, G., Son N.T., Saveng, I. & Furey, N.M. (2011) Revealing cryptic bat diversity: three new *Murina* and redescription of *M. tubinaris* from Southeast Asia. *Journal of Mammalogy* 92(4): 891–904.

CTSP (Cambodia Tree Seed Project), (2003). *Gene-Ecological Zonation of Cambodia*. Institutional Capacity Building of the Tree Seed Sector. Forestry Administration, Danida, and German Development Service.

Daltry, J. C., & Momberg, F. (2000). Cardamom Mountains Biodiversity Survey 2000. Fauna & Flora International. Phnom Penh, Cambodia.

Daltry, J.C. & Chheang D. (2000) Reptiles. In *Cardamom Mountains Biodiversity Survey 2000* (eds J.C. Daltry & F. Momberg), pp. 99–110. Fauna & Flora International, Cambridge, UK.

Das, I. (2010) A *field guide to the Reptiles of South-east Asia*. New Holland Publishers (UK) Ltd, London-Cape Town-Sydney- Auckland, 376 pp.

Deharveng, L., Bedos, A. (2012) Diversity patterns in the tropics. In: White, W.B., Culver, D.C. (eds) Encyclopedia of Caves. Academic Press, Chennai, p. 238–250.

Douangboubpha, B., Xayaphet, V., Sanamxay, D., Thomas, N., Bumrungsri, S., Bates, P.J.J. (2014) First confirmed records of *Taphozous longimanus* and *Myotis annamiticus* (Chiroptera) from Lao PDR. *Tropical Natural History* 14(1): 27–34.

Duckworth, J.W., Wozencraft, C., Wang Yin-xiang, Kanchanasaka, B. & Long, B. (2008a). *Viverra zibetha*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 07 February 2015.

Duckworth, J.W., Timmins, R.J., Olsson, A., Roberton, S., Kanchanasaka, B., Than Zaw, Jennings, A. & Veron, G. (2008b). *Viverra megaspila*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 07 February 2015.

Duckworth, J.W., Steinmetz, R., Timmins, R.J., Pattanavibool, A., Than Zaw, Do Tuoc & Hedges, S. (2008c). *Bos gaurus*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Durbin, L.S., Hedges, S., Duckworth, J.W., Tyson, M., Lyenga, A. & Venkataraman, A. (IUCN SSC Canid Specialist Group - Dhole Working Group) (2008). *Cuon alpinus*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 09 February 2015.

Dy Phon, P. (1970). *La Vegetation du Sud-Oeast du Cambodge: Secteur Baie de Kompong Som, Chaine de l'Elephant et Plateau de Kirirom*. Ann. Fac. Sc. Phnom Penh. 3:1-136.

Dy Phon, P. & B. Rollet. (2002). *Lexique des Arbres Forestiers du Cambodge*. ONF: Les dossiers forestiers, no. 5.

Eames, J. C., Steinheimer, F. D., & Bansok, R. (2002). A collection of birds from the Cardamom Mountains, Cambodia, including a new subspecies of Arborophila cambodiana. *Forktail*, 67–86.

Eanghourt, K (2014). Identification of potential indigenous plant and fruit tree species for forest restoration and agroforestry in Chiork Boeung Prey community protected area. In *Enhancing climate changes resilience of rural communities living in protected area in Cambodia.* Ministry of Environment, Royel Government of Cambodia.

Emmett, D.A. & Olsson, A. (Editors) (2005). Biological Surveys in the Central Cardamom Mountains. Conservation International Cambodia Program and Forestry Administration, Phnom Penh

Everbright, (2003a). *Forest Management Plan for Kratie/Stung Treng Forest Concession*. Phnom Penh, Cambodia.

Felton, A., Wood, J., Felton, A. M., Hennessey, B., & Lindenmayer, D. B. (2008). Bird community responses to reduced-impact logging in a certified forestry concession in lowland Bolivia. *Biological Conservation*, *141*(2), 545–555. doi:16/j.biocon.2007.11.009

Fenton, M.B. (2012) Bats and white-nose syndrome. *Proceedings of the National Academy of Sciences* 109(18): 6794–6795.

Francis, C.M. (1989) A comparison of mist nets and two types of harp traps for capturing bats. *Journal of Mammology* 70: 865–870.

Francis, C.M. (2008) *A guide to the mammals of Southeast Asia*. Princeton University Press, USA.

Francis, C.M., Eger, J.L (2012) A review of tube-nosed bats (Murina) from Laos with a description of two new species. Acta Chiropterologica 14: 15–38.

Francke, M.S., Ith, S, Theilade, I., and Schmidt, L. (2007) Deciduous trees of Prey Lang: Appendix 14 in Olsson, A., & Emmett, D. E. (2007). A Floral and Fuanal Biodiversity Assessment of Prey Lang. Conservation Internatioinal, Forest & Landscape, University of Copenhagen, and Forestry Administration. Phnom Penh, Cambodia.

Fredriksson, G., Steinmetz, R., Wong, S. & Garshelis, D.L. (IUCN SSC Bear Specialist Group) (2008). *Helarctos malayanus*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Fujita, M.S., Tuttle, M.D. (1991) Flying foxes (Chiroptera: Pteropodidae): threatened animalsof key ecological and economic importance. *Conservation Biology* 5: 455–463.

Furey, N.M., Mackie, I.J., Racey, P.A. (2009) The role of ultrasonic bat detectors in improving inventory and monitoring surveys in Vietnamese karst bat assemblages. *Current Zoology* 55: 327–341.

Furey, N.M., Mackie, I.J., Racey, P.A. (2010) Bat diversity in Vietnamese limestone karst areas and the implications of forest degradation. *Biodiversity and Conservation* 19: 1821–1838.

Furey, N.M., Mackie, I.J., Racey, P.A. (2011) Reproductive phenology of bat assemblages in Vietnamese karst and its conservation implications. *Acta Chiropterologica* 13(2): 341–354.

Furey, N.M., Racey, P.A.(in press). Conservation ecology of cave bats. In: Kingston, T., Voigt, C. (eds.) *Bats in the Anthropocene: Conservation of bats in a changing world*. Springer, USA.

Gilbert M., Chear Sokha, Joyner P., Thomson R. & Pool C.(2012) Characterizing the trade of wild birds for merit release in Phnom Penh, Cambodia and associated risks to health and ecology. *Biological Conservation* , 153, 10-16

Goes, F. (2013). *The Birds of Cambodia: An Annotated Checklist.* Centre for Biodiversity Conservation, Fauna & Flora International Cambodia Programme and Royal Unversity of Phnom Penh, Cambodia.

Grismer, L.L., Neang, T., Chav, T. & Grismer, J.L. (2008) Checklist of the amphibians and reptiles of the Cardamom region of Southwestern Cambodia. *Cambodian Journal of Natural History*, 2008 (1), 12–28.

Günther, A. (1861) Second list of Siamese reptiles. *Proceedings of the Zoological Society of London,* 1861, 187–189.

Günther, A.C.L.G. (1864) *The Reptiles of British India.* Taylor and Francis, London, UK.

Hartmann, T., Ihlow, F., Edwards, S., Sovath, S., Handschuh, M. & Böhme, W. (2013) A preliminary annotated checklist of the amphibians and reptiles of the Kulen Promtep Wildlife Sanctuary in northern Cambodia. *Asian Herpetological Research* 4(1): 36-55.

Hartwell, H., J. R. Welsh, and L. M. Oliver. (1998). Stream Amphibians as Indicators of Ecosystem Stress: A Case Study from California Redwoods. *Ecological Applications* 8: 1118-1132.

Hussain, S.A., de Silva, P.K. & Mostafa Feeroz, M. (2008). *Lutrogale perspicillata*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 07 February 2015

Inger, R. F. Orlov, N. & Daresky, I. (1999) Frogs of Vietnam: a report on new

collections. *Fieldiana: Zoology* (New series) 92:1–46.

IUCN (2014) IUCN Red List of Threatened Species. Version 2010.4. <www.iucnredlist.org>.

IUCN SSC (2014) IUCN SSC guidelines for minimizing the negative impact to bats and other cave organisms from guano harvesting. Ver. 1.0. IUCN, Gland.

Jones, G., Teeling, E.C. (2006) The evolution of echolocation in bats. *Trends in Ecology and Evolution* 21: 149–156.

Jones, G., Rebelo, H. (2013) Responses of bats to climate change: learning from the past and predicting the future. In: Adams, R.A., Pedersen, S.C. (eds) *Bat Evolution, Ecology, and Conservation.* Springer, New York, p. 457–478.

Johns, A.D., 1985. Selective logging and wildlife conservation in tropical rain-forest: Problems and recommendations. *Biological Conservation* 31:355-375.

Kingston, T. (2010) Research priorities for bat conservation in Southeast Asia: a consensus approach. *Biodiversity Conservation* 19: 471–484.

Kingston, T. (2013) Response of bat diversity to forest disturbance in Southeast Asia: insights from long-term research in Malaysia. In: Adams, R.A., Pedersen, S.C. (eds) *Bat Evolution, Ecology, and Conservation*. Springer, New York, p. 169–185.

Kingston, T., Liat, L.B., Akbar, Z. (2006) *Bats of Krau Wildlife Reserve*. Penerbit Universiti Kabangsaan Malaysia Bangi, Malaysia.

Kruskop, S.V. (2013) *Bats of Vietnam, checklist and an identification manual*. Joint Russian Vietnamese Science and Technological Tropical Centre, Hanoi, Vietnam.

Kunz, T.H., Braun de Torrez, E., Bauer, D., Lobova, T. and Fleming, T.H. (2011) Ecosystem services provided by bats. Annual. N. Y. Acad. Sci. Doi: 10.1111/j.1749-6632.2011.06004.x

Lammertink, M., Setiorini, U., Thet Zaw Naing, Duckworth, J. W., & Menken, S. B. J. (2009). Globall population decline of the Great slaty woodpecker (Mulleripicus pulverulentus). *Biological Conservation*, *142*, 166–179.

LeCompte, H. (1907-1942). *Flore Generale de l'Indochine,* (9 vols.) Paris.

Legris, P. & F. Blasco. (1972). Notice *de la Carte: Carte Internationale de Tapis Vegetal*. Etraits des travaux de la Scetion Scientifique et Technique de l'Institut Francaise de Pondichery: hors serie No. 1, Toulouse, France.

Maltby, M. & Bourchier (2010) Current Status of Asian elephants in Cambodia. *Gajah* 35 (2011) 35-41

Maxwell, JF., Eanghourt, K., Palee, P., Van de Bult, M., Ngundahn, SJ., and Narith, CH. (2007). Biological surveys of the Mekong River between Kratie and Stung Treng towns, Northeast Cambodia. *Vegetation And Flora*. Page 42-52.

McDonald, J. A. (2004). Ecological survey of Prey Lang, Kampong Thom. Plant Resources Center, Univ. of Texas, Austin.

McDonald, J.A. & Sam Veasna, (1996). *Floristic and Biotic Resource Reconnaissance of Prek Sramaoch lake and Vicinity, Tonle Sap*. FAO, Participatory Natural Resource Management in the Tonle Sap Region, Cambodia.

Martin, M.A. (1973). Notes on the vegetation of the Cardamom Mountains, Cambodia. *Garden's Bulletin* 26: 213-222.

Michaud A, (2013). Prey Lang development case: Do people benefit from its development? The NGO Forum on Cambodia.

Moody.J, An Dara, Camille N Z Coudrat, Tom Evans, Tom Gray, Matt Maltby, Men Soriyun, Nut Meng Hor, Hannah O Kelly, Pech Bunnat, Phan Channa, Edward Pollard, Hugo J Rainey, Benjamin M Rawson, Rours Vann, Song Chansocheat, Tan Setha, Thong Sokha. (2011). A summary of the conservation status, taxonomic assignment and distribution of the Indochinese Silvered Langur *Trachypithecus germaini* (sensu lato) in Cambodia. *Asian Primate Journal* 12/2012; 2(1):21-28.

Myers, N., Mittermeier, R.A., Mittermeier, C.G. (2000) Biodiversity hotspots for conservation priorities. *Nature* 403: 853–858.

Nadler, T., Timmins, R.J. & Richardson, M. 2008. *Trachypithecus germaini*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 12 February 2015.

Neang, T. Grismer, L. L, Onn, K. C. Grismer, J. L., Wood, P. L. Jr., Youmans, T. M. (2010) First report on the herpetofauna of Dalai Mountain in Phnom Samkos Wildlife Sanctuary, southwestern Cardamom Mountains, Cambodia. *Cambodian Journal of Natural History*, 2, 127-143.

Neang, T., Hartmann, T., Hun, S. Souter, N. J. & Furey, N. M. (2014) A new species of wolf snake (Colubridae: Lycodon Fitzinger, 1826) from Phnom Samkos Wildlife Sanctuary, Cardamom Mountains, southwest Cambodia. *Zootaxa* 3814 (1): 068–080.

Neang T. & Holden, J. (2008) *A Field Guide to the Amphibians of Cambodia.* Fauna & Flora International, Phnom Penh, Cambodia. pp. 132.

NGO Forum on Cambodia, (2013). 'Prey Lang development case do people benefit from its development?' Unpublished, Phnom Penh, Cambodia.

Nguyen, V.S., Ho, T.C. & Nguyen, T.Q. (2009) *Herpetofauna of Vietnam*. Edition Chimaira, Frankfurt am Main, 768 pp.

Nowak, R.M. (1994) *Walker's bats of the world.* John Hopkins University Press, Baltimore and London.

Ohler, A., Swan, S.R. & Daltry, J.C. (2002) A recent survey of the amphibian fauna of the Cardamom Mountains, southwest Cambodia with descriptions of three new species. *Raffles Bulletin of Zoology,* 50, 465–481.

Olsson, A., & Emmett, D. E. (2007). *A Floral and Fuanal Biodiversity Assessment of Prey Lang*. Conservation Internatioinal, Forest & Landscape, University of Copenhagen, and Forestry Administration. Phnom Penh, Cambodia.

Orlov, N. L., Murphy R. W., Ananjeva N. B., Ryabov S. A., and Ho T. C. (2002), 'Herpetofauna of Vietnam. A checklist. Part I. Amphibia,' *Russ. J. Herpetol*., 9(2), 81 – 104

Osgood, W.H. (1932). Mammals of the Kelley-Roosevelts and Delacour Asiatic Expeditions. *Publ. Field Mus. Nat. Hist., Zool. Ser.* 18: 193-339.

Phauk, S., Phen, S., Furey, N.M. (2013) Cambodian bat echolocation: A first description of assemblage call parameters and assessment of their utility for species identification. *Cambodian Journal of Natural History* 2013(1): 16–26.

Robson, C. (2008). *A Field Guide to The Birds of South-East Asia*. London, Cape Town, Sydney, Auckland: New Holland.

Rollet, B. 1972. La Vegetation du Cambodge. *Rev. Bois et For. des Trop*. 144:3-16; 145:23-38; 146:3-20.

Rowley, J. (2007) 'Amphibians, Snakes & Lizards' In Olsson, A. and Emmett, D. E. (Eds). *A Faunal Biodiversity Assessment of Prey Lang.* Conservation International and Forestry Administration, Phnom Penh, Cambodia.

Rowley, J.J.L., Stuart, B.L., Neang T. & Emmett, D.A. (2010) A new species of *Leptolalax* (Anura: Megophryidae) from northeastern Cambodia. *Zootaxa,* 2567, 57–68.

Rundel, P.W. (1999). *Forest Habitats and Flora in Lao PDR, Cambodia, and Vietnam*. WWF Desk Study, Indochina Programme Office, Hanoi.

Saint Girons, H. (1972). Les serpents du Cambodge. *Me´moires du Muse´um National d'Histoire Naturelle, Paris*, 74:1–170.

Sanderson, J., Khan, J.A., Grassman, L. & Mallon, D.P. (2008). *Neofelis nebulosa*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 07 February 2015.

Schmidt, L. and Theilade, I. (2010). Conservation of Prey Lang Forest Complex, Cambodia Working papers nr.50-2010. Forest & Landscape.

Schnitzler, H-U., Kalko, E.K.V., Denzinger, A. (2001) Evolution of echolocation and foraging behaviour in bats. In: Thomas, J. A., Moss, C. F., Vater, M. (eds). *Echolocation in bats and dolphins*. The University of Chicago Press, Chicago and London, pp. 330–338.

Setha, T., & Poole, C. M. (2003). *The Field Guide to Birds of Cambodia*. Phnom Penh: JSRC.

Shen, T-J., Chao, A., Lin, C-F. (2003) Predicting the number of new species in further taxonomic sampling. *Ecology* 84: 798–804.

Shibata, Y. (1967) A small collection of amphibians from Cambodia collected by the Osaka City University Expedition 1962-65. *Bull. Osaka Mus. nat. Hist.,* No. 20, 11-12.

Simmons, N.B. (2005) Order Chiroptera. Pp. 312–529, in Wilson D. E.and. Reeder D. M (eds), *Mammal species of the World: a taxonomic and geographic reference*, 3rd edition Johns Hopkins University Press, Baltimore, USA.

Smith, J. (2001). *Biodiversity, the Life of Cambodia - Cambodia's Biodiversity Status Report-2001*. Cambodia Biodiversity Enabling Activities, Phnom Penh, Cambodia.

Smith, M.A. (1943) The Fauna of British India, Ceylon and Burma, including the whole of the Indo-Chinese Sub-region. Reptilia and Amphibia. Vol. III. - Serpentes. Taylor and Francis, London, xii + 583pp.

Soisook, P., Bumrungsri, S., Satasook, C., Thong, V.D., Bu, S.S.H., Harrison, D.L., Solow, A.R., Polasky, S. (1999) A quick estimator for taxonomic surveys. *Ecology* 80: 2799–2803.

Sok, K. & Prum, S. (2003) Short report about crocodile in Colexim forest concession in Kampong Thom Province from 17 to September 24, 2003

Sok, K. & Sin, P. (2003) Short report about crocodile in Colexim forest concession in Kampong Thom Province from May 27 to June 22, 2003.

Som, S., Chey, C., & Sun, Y. (2005). Tortoise and Freshwater Turtle Conservation in the Cardamom Mountains. Cambodian Turtle Conservation Project, Phnom Penh, Cambodia.

Sritongchuay, T., Gale, G. A. Stewart, A., Kerdkaew, T., Bumrungsri, S. (2014) Seed rain in abandoned clearings in a lowland evergreen rain forest in southern Thailand. *Tropical Conservation Science* 7(3): 572–585.

Strange, N., Theilade, I., Thea, S., Sloth, A., Helle, F., (2007). Integration of species persistence, costs and conflicts: An evaluation of tree conservation strategies in Cambodia.

Streicher, U., Singh, M., Timmins, R.J. & Brockelman, W. 2008. *Nycticebus bengalensis*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Stuart, B. L. (1999) Amphibians and reptiles. pp:43–67. In: Wildlife in Lao PDR: 1999 Status Report. J. W. Duckworth, R. E. Salter & K. Khounboline (compilers). IUCN–The World Conservation Union / Wildlife Conservation Society / Centre for Protected Areas and Watershed Management, Vientiane. 275 pp.

Stuart, B. L. (2005) New Frog Records from Laos. *Herpetological Review*, 2005, 36(4), 473–479.

Stuart, B.L. & Emmett, A.E. (2006) A collection of amphibians and reptiles from the Cardamom Mountains, southwestern Cambodia. *Fieldiana Zoology,* 109, 1–27.

Stuart, B.L. & Platt, S.G. (2004) Recent records of turtles and tortoises from Laos, Cambodia and Vietnam. *Asiatic Herpetological Research,* 10, 129–150.

Stuart, B.L., Rowley, J.J.L., Neang, T., Emmett , D.A. & Som S. (2010) Significant new records of amphibians and reptiles from Virachey National Park, northeastern Cambodia. *Cambodian Journal of Natural History*, 2010, 38–47.

Stuart B.L., Sok, K. & Neang, T. (2006) A collection of amphibians and reptiles from hilly eastern Cambodia. *The Raffles Bulletin of Zoology,* 54, 129–155.

Stuart, B. L., Van Dijk, P. P., & Hendrie, D. B. (2001) *A photographic guide to the turtles of Thailand, Laos, Vietnam and Cambodia.*

Taylor, E. H. (1962) The amphibian fauna of Thailand. University of Kansas Science Bulletin 43(8):265–599.

Taylor, E. H. (1963) The lizards of Thailand. University of Kansas Science Bulletin 44(14):687–1077.

Taylor, E.H. (1965) The serpents of Thailand and adjacent waters. University of Kansas Science Bulletin, 45, 609–1096.

Theilade, I and Schmidt, L, (2011). *REDD+ and Conservation of Prey Lang Forest, Cambodia: Summary of Scientific Findings 2007-2010*. Faculty of Life Sciences, University of Copenhagen.

Theilade, I., Schmidt, L, Chhang, P and McDonald AJ, (2011). Evergreen swamp forest in Cambodia: floristic composition, ecological characteristics, and conservation status. *Nordic Journal of Botany* Volume 29, Issue 1, pages 71–80

Timmins, R.J., Duckworth, J.W., Hedges, S., Steinmetz, R. & Pattanavibool, A. (2008). *Bos javanicus*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 04 February 2015.

Timmins, R.J., Long, B., Duckworth, J.W., Wang Ying-Xiang & Than Zaw (2008). *Arctonyx collaris*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Timmins, R.J., Steinmetz, R., Sagar Baral, H., Samba Kumar, N., Duckworth, J.W., Anwarul Islam, Md., Giman, B., Hedges, S., Lynam, A.J., Fellowes, J., Chan, B.P.L. & Evans, T. (2008). *Rusa unicolor*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Traeholt, C., Bonthoeun, R., Rawson, B., Samuth, M., Virak, C. and Sok Vuthin (2005). Status review of pileated gibbon, *Hylobates pileatus* and yellow-cheeked crested gibbon, *Nomascus gabriellae*, in Cambodia.

Vermeulen, J. and Whitten, T. (eds) (1999) Biodiversity and cultural property in the management of limestone resources: lessons from East Asia. Directions in Development Series, The World Bank, Washington D.C., 120 pp.

Walston, J., Duckworth, J.W. & Molur, S. 2008. *Ratufa bicolor*. The IUCN Red List of Threatened Species. Version 2014.3. <www.iucnredlist.org>. Downloaded on 08 February 2015.

Wang, Y., & Finch, D. M. (2002). Consistency of mist netting and point counts in assessing landbird species richness and relative abundance during migration. *The Condor*, *104*(1), 59–72.

Wanger, T.C., Darras, K., Bumrungsri, S., Tscharntke, T., Klien, A-M. (2014) Bat pest control contributes to food security in Thailand. *Biological Conservation* 171: 220–223.

Wharton, C.H. (1957) *An ecological study of the Kouprey,* Novibos sauveli (*Urbain*). Manilla: Institute of Science and Technology.

Whitten, T. (2009) Applying ecology for cave management in China and neighbouring countries. *Journal of Applied Ecology* 46: 520–523.

Wüster, W. & Thorpe, R.S. (1994) *Naja siamensis*, a cryptic species of venomous snake revealed by mtDNA sequencing. *Experientia*, **50,** 75–79.

Woodruff, D. S. (2010) Biogeography and conservation in Southeast Asia: how 2.7 million years of repeated environmental fluctuations affect today's patterns and the future of the remaining refugial-phase biodiversity. *Biodivers Conserv* (2010) 19:919–941.

Appendices

Appendix I: Plants Species of Prey Lang.

Genus	Species	Family	Khmer Name
Unknown	*Unknown*	Unknown	*Phset Pork*
Unknown	*Unknown*	Unknown	*Phset Sokram*
Unknown	*Unknown*	Unknown	*Phset Raing/Phchoen*
Unknown	*Unknown*	Unknown	*Phset Rongea*
Unknown	*Unknown*	Unknown	*Phset Kanh-chor*
Unknown	*Unknown*	Unknown	*Phset Kngoak*
Unknown	*Unknown*	Meliaceae	*Sdao Khmoach*
Unknown	*Unknown*	Vitaceae	*Voir Mchou Sna*
Abrus	*precatorius*	Papilionoideae	*Angkrem Angkrorm*
Abrus	*pulchellus*	Papilionoideae	*Voir Ampil*
Acacia	*megaladena*	Mimosoideae	*Voir Aem*
Acacia	*pennata*	Mimosoideae	*Thmor Toib (dem)*
Acacia	*intsia*	Mimosoideae	*Thmea*
Acacia	*concinna*	Mimosoideae	*Bay Damneub*
Acronychia	*pedunculata*	Rutaceae	*Prangorl*
Adinandra	*integerrima*	Theaceae	*Srakom*
Afzelia	*xylocarpa*	Caesalpinioideae	*Beng*
Aganonerion	*polymorphum*	Apocynaceae	*Voir Thnoeng*
Ageratum	*conyzoides*	Compositae	*tuntrean khet nhi/Phka Hoy*
Aglaia	*cambodiana*	Meliaceae	*Bangkuv (Hobphlae)*
Aglaia	*elaeagnoidea*	Meliaceae	*Bangkuv Sva*
Aglaia	*lawii*	Meliaceae	*Bangkov Kengkang*
Aglaonema	*modestum*	Araceae	*Snaeng Ton*
Albizia	*millettii*	Mimosoideae	*Voir Ampil*
Albizia	*myriophylla*	Mimosoideae	*Voir Aem*
Albizia	*lebbeck*	Mimosoideae	*Chress*
Albizia	*corniculata*	Mimosoideae	*Chamriek*
Alpinia	*oxymitra*	Zingiberaceae	*krakei*
Alstonia	*scholaris*	Apocynaceae	*me chor, sait tba*
Amomum	*ovoideum*	Zingiberaceae	*Krakoa*
Amorphophallus	*harmandii*	Araceae	*Toil*
Amorphophallus	*paeoniifolius*	Araceae	*Toel Tom*
Ampelocissus	*arachnoidea*	Vitaceae	*Voir Tumpeang Bai Chou*
Ampelocissus	*martini*	Vitaceae	*Tumpaing Baychou Prey*
Amphineurion	*marginatum*	Apocynaceae	*Kraloam Pe*
Ancistrocladus	*cochinchinensis*	Ancistrocladaceae	*Khanma*
Ancistrocladus	*harmandii*	Ancistrocladaceae	*Khann Ma*
Andrographis	*paniculata*	Acanthaceae	*Pramat Monus (grass)*
Anisoptera	*costata*	Dipterocarpaceae	*Phdeak*

Anogeissus	*acuminata*	Combretaceae	*Suoy/Sev*
Anomianthus	*dulcis*	Annonaceae	*Treal Sva*
Antidesma	*montanum*	Phyllanthaceae	*Krachak andeuk*
Antidesma	*cambodianum*	Phyllanthaceae	*Kampung tra-oh*
Antidesma	*cochinchinensis*	Phyllanthaceae	*Dang keap kdam*
Antidesma	*japonicum*	Phyllanthaceae	*Tromuoch*
Aphanamixis	*polystachya*	Meliaceae	*Parker Bang keou*
Aporosa	*ficifolia*	Phyllanthaceae	*Krung*
Aporosa	*octandra*	Phyllanthaceae	*Krung Samot*
Aporosa	*villosa*	Phyllanthaceae	*Krung Momis*
Archidendron	*lucidum*	Mimosoideae	*Angkonh sva/Chondeu Sva*
Archidendron	*clypearia*	Mimosoideae	*Tranom Kamphem (deum)*
Archytaea	*vahlii*	Bonnetiaceae	*Stieng*
Ardisia	*helferiana*	Primulaceae	*Chumpou Prey/Chhnok Thmatbat*
Ardisia		Primulaceae	*Phnek Trei*
Ardisia	*crenata*	Primulaceae	*pong chap*
Ardisia	*sanguinolenta*	Primulaceae	*Slang*
Ardisia	*smaragdina*	Primulaceae	*Sakou Phnom*
Ardisia	*villosa*	Primulaceae	*Seda prey*
Areca	*triandra*	Palmae	*Sla Prey*
Artabotrys	*hexapetalus*	Annonaceae	*Chek Tom (Vol)*
Artocarpus	*nitidus*	Moraceae	*Sampor*
Artocarpus	*rigidus*	Moraceae	*Khnoa Prey*
Arytera	*Littoralis*	Sapindaceae	*Bei Sanloek(Drem)*
Asplenium	*nidus*	Aspleniaceae	*Sambok Satt*
Atalantia	*monophylla*	Rutaceae	*Kroch Prey*
Azadirachta	*indica*	Meliaceae	*Sdao*
Baccaurea	*ramiflora*	Euphorbiaceae	*Phnheav*
Baccaurea	*bracteata*	Euphorbiaceae	*Phneav toek*
Baeckea	*frutescens*	Myrtaceae	*Mrech Tansaiy*
Bambusa	*bambos*	Gramineae	*Russey Roleak*
Barringtonia	*acutangula*	Lecythidaceae	*Raing Toeuk*
Barringtonia	*racemosa*	Lecythidaceae	*Raing Phnom*
Bauhinia	*bassacensis*	Caesalpinioideae	*Angkunh Sva*
Bauhinia	*bracteata*	Caesalpinioideae	*Khlaeng Poir*
Bauhinia	*variegata*	Caesalpinioideae	*Cheung Ko*
Beaumontia	*murtonii*	Apocynaceae	*Choir Banh*
Berrya	mollis	Malvaceae	*Anseum/Taseum*
Berrya	*mollis*	Malvaceae	*An Seum*
Bhesa	*robusta (Roxb.) Ding Hou*	Centrolepidaceae	*Chambak Ka-aek*
Bolbitis	*copelandii*	Dryopteridaceae	*Pramoay Damrei*

Bombax	*anceps*	Malvaceae	*Roka*
Borreria	*alata*	Rubiaceae	*Ma-orm Phnom Nhi*
Bouea	*oppositifolia*	Anacardiaceae	*Mak Prang*
Brachiaria	*mutica*	Gramineae	*Smao Koo*
Brachiaria	*reptans*	Gramineae	*Smao Ko*
Breynia	*vitis-idaea*	Phyllantaceae	*Phnek Preab*
Bridelia	*retusa*	Phyllanthaceae	*Chhlik Pok*
Brownlowia	*emarginata*	Malvaceae	*Ach Sait*
Brucea	*amarissima*	Simaroubaceae	*Roliey smorng*
Brucea	*javanica*	Simaroubaceae	*Pramat Mnos (dem)*
Buchanania	*glabra*	Anacardiaceae	*Laing Chey Damrei*
Buchanania	*lanzan*	Anacardiaceae	*Kantuot Proang*
Buchanania	*reticulata*	Anacardiaceae	*Laing Chey Sloek Thom*
Buchanania	*siamensis*	Anacardiaceae	*Laing Chey Sloek Toch*
Bulbophyllum	*sect. sestoshilos*	Orchidaceae	
Burmannia	*disticha*	Burmanniaceae	*Bay Marn*
Butea	*superba*	Papilionoideae	*Char (Voir)*
Butea	*monosperma*	Papilionoideae	*Cha (Deum)*
Caesalpinia	*digyna*	Caesalpinioideae	*Khvav Banla*
Calamus	*palustris*	Palmae	*Phdao chvaing*
Calamus	*rudentum*	Palmae	*Phdao Dambang*
Calamus	*siamensis*	Palmae	*Ph'dao Toek*
Calamus	*tetradactylus*	Palmae	*Sesoeng*
Calamus	*viminalis*	Palmae	*Phdao Kraek*
Calophyllum	*soulattrii*	Guttiferae	*Pha-ong Slek Thom*
Calophyllum	*spectabile*	Guttiferae	*Pa ong chorm*
Calophyllum	*tetrapetalum*	Guttiferae	*Pha ong*
Calophyllum	*thorellii*	Guttiferae	*Pha-ong Toek*
Calophyllum	*pisiferum*	Guttiferae	*Pha-ong Toch*
Cananga	*latifolia*	Annonaceae	*Chhkae Sreng*
Canarium	*album*	Burseraceae	*Talait*
Canthium	*parviflorum*	Rubiaceae	*Chaik Kralik*
Capparis	*micracantha*	Capparaceae	*Kanhcheu Baydach*
Cardiospermum	*halicacabum*	Sapindaceae	*Peng Poh Sroam*
Careya	*arborea*	Lecythidaceae	*Kandoal*
Caryota	*urens*	Palmae	*Tunsae`*
Cassia	*tora*	Caesalpinioideae	*Danhet Chhneang/Danghet Khmoach*
Cassia	*sp.*	Caesalpinioideae	*Kal*
Cassia	*alata*	Caesalpinioideae	*Dang Het*
Cassytha	*filiformis*	Lauraceae	*voir meas*
Catunaregam	*tomentosa*	Rubiaceae	*Lveang*
Cayratia	*trifolia*	Vitaceae	*Tradet (voir)*

Cenolophon	*oxymitrum*	Zingiberaceae	*Krakei*
Centella	*asiatica*	Compositae	*Tracheak Kranh Srok*
Cephalacanthus	*angustifolius*	Rubiaceae	*Khtum Kok*
Cerbera	*manghas*	Apocynaceae	*Kralaim Per*
cf Mitragyna	*rotundifolia*	Rubiaceae	*Khtum,*
cf Vitex	*pinnata*	Labiatae	*Khnoeul**
Chisocheton	*cumingianus*	Meliaceae	*Bang Kuv Sva*
Chromolaena	*odorata*	Compositae	*Kantraing Khaet*
Chrozophora	*tinctoria*	Euphorbiaceae	*Tumpoung Phleung*
Chrysopogon	*aciculatus*	Gramineae	*Kantreuy*
Cibotium	*barometz*	Dicksoniaceae	*Promoay damrey*
Cinnamomum	*burmannii*	Lauraceae	*Kuntuy Ve*
Cladogynos	*orientalis*	Malvaceae	*Preal Chhmol*
Clausena	*excavata var. villosa*	Rutaceae	*Kantrop Kmoach*
Cleistanthus	*tomentosus*	Phyllanthaceae	*Phlov Neang*
Clerodendrum	*nutans*	Labiatae	*ronteah banh*
Clerodendrum	*paniculatum*	Labiatae	*Ronteash Banh*
Clitoria	*ternatea*	Papilionoideae	*Sandek Barang*
Coldenia	*procumbens*	Boraginaceae	*Cheung Tokae (grass)*
Colocasia	*esculenta*	Araceae	*Kdat*
Colona	*auriculata*	Malvaceae	*Preal*
Combretum	*latifolium*	Combretaceae	*Voir Romeat Sor*
Combretum	*quadrangulare*	Combretaceae	*Sang Kae*
Congea	tomentosa	Verbenaceae	
Connarus	*cochinchinensis*	Connaraceae	*Lom Posh/Chhkae Vong Veng*
Connarus	*semidecandrus*	Connaraceae	*Lunpos Daek*
Coptosapelta	*flavescens*	Rubiaceae	*Voir Taling*
Corypha	*lecomtei*	Palmae	*Traing*
Costus	*speciosus*	Zingiberaceae	*Tathok*
Cratoxylum	*cochinchinense*	Hypericaceae	*L'ngeang Thom*
Cratoxylum	*formosum*	Hypericaceae	*Lngieng Kon Nga*
Crotalaria	*Striata*	Papilionoideae	*Smao Changkrang Sva*
Crotalaria	*verrucosa*	Papilionoideae	*Changkrang Sva*
Croton	*joufra*	Euphorbiaceae	*Ta Poung*
Croton	*stellatopilosus*	Euphorbiaceae	*Tumpoung Phleung*
Curcuma	*gracillima*	Zingiberaceae	*Chahuoy, rumduol cheung phnom*
Curcuma	*alismatifolia*	Zingiberaceae	*Chahuoy Phka Krachak*
Curcuma	*petiolata*	Zingiberaceae	*Chahuoy*
Curcuma	*thorelii*	Zingiberaceae	*Chahuoy Baitang*
Cyanthillium	*cinereum*	Compositae	*Smao Roy*
Cyathostemma	*micranthum*	Annonaceae	*unknown*

Cycas	*siamensis*	Cycadaceae	*Prang Prey*
Cymbidium	*aloifolium*	Orchidaceae	*Lompeng Preahream*
Cymbidium	*poilanei*	Orchidaceae	*Bay Damneup*
Cynodon	*dactylon*	Gramineae	*Chen chean*
Cyperus	*rotundus*	Cyperaceae	*Kravanh Chrouk*
Dactyloctenium	*aegyptium*	Gramineae	
Daemonorops	*jenkinsiana*	Palmae	*Ph'dao Soam*
Dalbergia	*pinnata*	Papilionoideae	*Voir Ampel*
Dalbergia	*thorelii*	Papilionoideae	*Angkrem Angkram*
Dalbergia	*cultrata*	Papilionoideae	*Kranhoung Sva*
Dalbergia	*cochinchinensis*	Papilionoideae	*kranhoung*
Dalbergia	*oliveri*	Papilionoideae	*neang nuon*
Dalbrgia	*nigricans*	Papilonoideae	*Snoul*
Dasymaschalon	*tomentocum*	Annonaceae	*Cheung Chab*
Decaspermum	*montanum*	Myrtaceae	*Phlong Sor*
Dehaasia	*cuneata*	Lauraceae	*Neang Pha-aek*
Dendrobium	*delacourii*	Orchidaceae	
Dendrolobium	*lanceolatum*	Papilionoideae	*Tronum Bangkuoy*
Dendrolobium	*baccatum*	Papilionoideae	*Tronom Bangkuoy*
Dendrophthoe	*pentandra*	Loranthaceae	*Panheu ka-aek*
Dendrotrophe	*varians*	Santalaceae	*Voir Dek*
Derris	*elliptica*	Papilionoideae	*Voir Antong*
Derris	*scandens*	Papilionoideae	*Voir Preng Sor*
Derris	*trifoliata*	Papilionoideae	*Voir Preng krahorm*
Desmodium	*triquetrum*	Papilionoideae	*Changkeh Angkrang*
Desmodium	*rostratum*	Papilionoideae	*Tranung Bangkuoy*
Desmos	*chinensis*	Annonaceae	*Chek Tom*
Dialium	*cochinchinensis*	Caesalpinioideae	*Kralanh*
Dicranopteris	*linearis*	Gleicheniaceae	*vor thnanh*
Digitaria	*adscendens*	Gramineae	
Dillenia	*ovata*	Dilleniaceae	*Phlou Thom*
Dillenia	*pentagyna*	Dilleniaceae	*Lve*
Dillenia	*hookeri*	Dilleniaceae	*Phlou bat*
Dillenia	*parviflora*	Dilleniaceae	*Phlou*
Dimocarpus	*longan*	Sapindaceae	*Mean Prey*
Dioecrescis	*erythroclada*	Rubiaceae	*Ampok Phleung*
Dioscorea		Dioscoreaceae	*Damlong Chrang*
Dioscorea	*hispida*	Dioscoreaceae	*Kduoch*
Dioscorea	*brevipetiolata*	Dioscoreaceae	*Damlong Tean*
Dioscorea	*oryzetorum*	Dioscoreaceae	*Damlaung chrouk*
Dioscorea	*pentaphylla*	Dioscoreaceae	*Damlong Toeuk*
Diospyros	*bejaudii*	Ebenaceae	*Angkort Khmao*
Diospyros	*crumenata*	Ebenaceae	*Chheu Khmao*

Diospyros	*ehretioides*	Ebenaceae	*Lomaing/Ming Maing*
Diospyros	*filipendula*	Ebenaceae	*krachass*
Diospyros	*malabarica*	Ebenaceae	*Dang Koa*
Diospyros	*pilosanthera*	Ebenaceae	*Trayoeng*
Diospyros	*sp.*	Ebenaceae	*Krum*
Diospyros	*sylvatica*	Ebenaceae	*khchas*
Diospyros	*undulata var. cratericalyx (Craib) Bakh.*	Ebenaceae	*Chheu Phleung*
Diospyros	*venosa*	Ebenaceae	*Angkat Khmao*
Dipterocarpus	*alatus*	Dipterocarpaceae	*Chheuteal Toek*
Dipterocarpus	*costatus*	Dipterocarpaceae	*Chheuteal Neangdeng/Bangkuoy/Chheuteal Kreus*
Dipterocarpus	*intricatus*	Dipterocarpaceae	*Trach*
Dipterocarpus	*obtusifolius*	Dipterocarpaceae	*Tbeng*
Dipterocarpus	*retusus*	Dipterocarpaceae	*Chheuteal Preng*
Dipterocarpus	*tuberculatus*	Dipterocarpaceae	*Khlong*
Dipterocarpus	*tuberculatus var. tomentosus*	Dipterocarpaceae	*Khlong Momiss*
Donax	*grandis*	Marantaceae	*Ron*
Dracaena	*cambodiana*	asparagaceae	*Angrae Daek*
Dracaena	*fragrans*	asparagaceae	*Angredek*
Dracaena	*gracilis*	asparagaceae	*Angre Dek*
Droogmansia	*godefroyana*	Papilionoideae	*Tundai*
Drosera	*burmannii*	Droseraceae	*smao sanseumduoch*
Drosera	*indica*	Droseraceae	*smao sanseumduoch*
Ehretia	*laevis*	Boraginaceae	*Sangkae Phleung*
Eichhornia	*crassipes*	Pontederiaceae	*Kamphloak*
Elaeocarpus	*hygrophilus*	Elaeocarpaceae	*Chambak Prang*
Eleusine	*indica*	Gramineae	*Cheung Krass (grass)*
Enkleia	*siamensis*	Thymelaeaceae	*Khleay*
Entada	*phaseoloides*	Mimosoideae	*Angkunh*
Entada	*reticulata*	Mimosoideae	*Ampel*
Eriocaulon	*longifolium*	Eriocaulonacae	*Tumhou (Smao)*
Erythrophleum	*fordii*	Caesalpinioideae	*Traim Kang*
Erythrophleum	*succirubrum*	Caesalpinioideae	*Treas*
Euonymus	*glaber*	Celastraceae	*Sralork*
Eurycoma	*longifolia*	Simaroubaceae	*Antung sor-Antung Krahorm*
Fagraea	*fragrans*	Loganiaceae	*tatrao*
Fagraea	*racemosa*	Loganiaceae	*Prohout Toek*
Fernandoa	*adenophylla*	Bignoniaceae	*Ampor*
Ficus	*ischnopoda*	Moraceae	*Chrey Toek*
Ficus	*pumila*	Moraceae	*krabei chuldei*

Ficus	*fistulosa*	Moraceae	*Po Lvea*
Ficus	*hirta*	Moraceae	*Lvea Dei*
Ficus	*pisocarpa*	Moraceae	*Chrey Krem*
Ficus	*sp.*	Moraceae	*Chorm*
Ficus	*sp.*	Moraceae	*Trang Thom*
Flacourtia	*indica*	Salicaceae	*krakhop prey*
Flagellaria	*indica*	Flagellariaceae	*Phdao Sva/Phdao Andiek*
Gacinia	*cochinchinensis*	Guttiferae	*San dann*
Garcinia	*cambodgiensis*	Guttiferae	*Prohut Phnom*
Garcinia	*merguensis*	Guttiferae	*Kreh/Kre´*
Garcinia	*oliveri*	Guttiferae	*Tromoung*
Garcinia	*schefferi*	Guttiferae	*Prous*
Garcinia	*vilersiana*	Guttiferae	*Prohout*
Gardenia	*angkorensis*	Rubiaceae	*Dai Khla*
Gardenia	*obtusifolia*	Rubiaceae	*Chontol Pongmoan*
Gardenia	*philastrei*	Rubiaceae	*Baikdang*
Genus	*Species*	Family	*Khmer name*
Getonia	*floribunda*	Combretaceae	*Khsuos*
Gigantochloa	*albociliata*	Gramineae	*Russey Khley*
Globba	*cambodgensis*	Zingiberaceae	*Phtuok Sar*
Glochidion	*eriocarpum*	Euphorbiaceae	*Russey Sach*
Glochidion	*lanceolarium*	Euphorbiaceae	*Se Sach*
Gluta	*laccifera*	Anacardiaceae	*kreul*
Glycosmis	*pentaphylla*	Rutaceae	*Phling Phlaing*
Gmelina	*philippensis*	Labiatae	*Anchanh*
Gmelina	*villosa*	Labiatae	*Anh Chanh*
Gnetum	*gnemon*	Gnetaceae	*Khlot*
Gnetum	*leptostachyum*	Gnetaceae	*Voir Khlot*
Gomphia	*serrata*	Ochnaceae	*Angkea Bath*
Grewia	*asiatica*	Malvaceae	*Pophlea Preus*
Grewia	*eriocarpa*	Malvaceae	*Po Phlea*
Haldina	*cordifolia*	Rubiaceae	*Khvav*
Harrisonia	*perforata*	Simaroubaceae	*Khlen Tea*
Hegnera	*obcordata*	Papilionoideae	*Baek Phsaeng voir*
Helicteres	*angustifolia*	Malvaceae	*Sombok Chheas*
Helicteres	*hirsuta*	Malvaceae	*Priel Chhruk*
Heritiera	*javanica*	Malvaceae	*Duong Chaem*
Hewittia	*malabarica*	Convolvulaceae	
Hibiscus	*mutabilis*	Malvaceae	*Kabass Prey*
Hibiscus		Malvaceae	*Ach Chrouk*
Holarrhena	*curtissii*	Apocynaceae	*Toek Doh Khla Toch*
Holarrhena	*pubescens*	Apocynaceae	*Toek Doh Kha Thom*
Homonoia	*riparia*	Euphorbiaceae	*Rey Toek*

Hopea	*odorata*	Dipterocarpaceae	*Koki Msao*
Hoya	*diversifolia*	Asclepiadaceae	*Tracheak Damrei*
Hoya	*kerrii*	Asclepiadaceae	*Nom Damrei*
Hoya	*oblongacutifolia*	Asclepiadaceae	*Phka Kandoeng*
Hydnocarpus	*anthelminthica*	Salicaceae	*Krabao Tunle*
Hydnocarpus	*saigonensis*	Salicaceae	*Krabao Sva*
Hydnophytum	*formicarium*	Rubiaceae	*Suot Damrey*
Hymenocardia	*punctata*	Phyllanthaceae	*Kum Phneang*
Hymenocardia	*wallichii*	Phyllanthaceae	*Phling Phlaing*
Hymenodictyon	*excelsum*	Rubiaceae	*Aloak*
Hypolytrum	*nemorum*	Cyperaceae	
Hypserpa	*nitida*	Menispermaceae	*Voir Yeav*
Imperata	*cylindrica*	Gramineae	*Sbov*
Irvingia	*malayana*	Irvingiaceae	*Chambak*
Ixora	*chinensis*	Rubiaceae	*Kaimronteah*
Jasminum	*scandens*	Oleaceae	*Voir Chha-oeng Poh*
Kaempferia	*galanga*	Zingiberaceae	*Proh (mem)*
Lagerstroemia	*calyculata*	Lythraceae	*Sralao*
Lagerstroemia	*cochinchinensis*	Lythraceae	*srolao*
Lagerstroemia	*duperreana*	Lythraceae	*Sralao kanhchhreab*
Lagerstroemia	*floribunda*	Lythraceae	*Trabaek Prey*
Lagerstroemia	*macrocarpa*	Lythraceae	*Etanel Phlaethom/Kroal*
Lasia	*spinosa*	Araceae	*Ampong Treang/Trav Banla*
Lasianthus	*hirsutus*	Rubiaceae	*roleay toch*
Lasianthus	*lancifolius*	Rubiaceae	*roleay thom*
Leea	*asiatica*	Leeaceae	
Leea	*indica*	Leeaceae	*Bay K'daing*
Lentinus	*aquarrosulus*	Polyporaceae	*Phset Chheu*
Lepisanthes	*rubiginosa*	Sapindaceae	*Chunlos*
Lepisanthes	*sp.*	Sapindaceae	*Chonlos Toch*
Lepisanthes	*tetraphylla*	Sapindaceae	*Changkran*
Licuala	*spinosa*	Palmae	*pha-av*
Limnophila	*chinensis subsp. Aromaticum*	Plantaginaceae	*Maam Dei*
Lithocarpus	*polystachyus*	Fagaceae	*Khos*
Litsea	*glutinosa*	Lauraceae	*Krapul Bay*
Litsea	*sp.*	Lauraceae	
Litsea	*sp.1*	Lauraceae	
Litsea	*sp.1*	Lauraceae	
Livistona	*saribus*	Palmae	*Treak*
Lophopetalum	*wallichii*	Celastraceae	*Poan Talei*
Lygodium	*flexuosum*	Schizaeaceae	*Voir Khnanh*
Lygodium	*conforme*	Schizaeaceae	*Voi Laelor/Voir Alor*

Macaranga	*denticulata*	Euphorbiaceae	*Sla Pang*
Macaranga	*griffithiana*	Euphorbiaceae	*Pang*
Macaranga	*triloba*	Euphorbiaceae	*Slapang Sloek Chhaek*
Madhuca	*bejaudi*	Sapotaceae	*Srakum Si Phlae*
Madhuca	*butyrospermoides*	Sapotaceae	*Srakum Phnom*
Madhuca	*cochinchinensis*	Sapotaceae	*Srakum (Siphlae)*
Mallotus	*peltatus*	Euphorbiaceae	*Beus Phnom*
Mangifera	*duperreana*	Anacardiaceae	*Svay Prey*
Mapania	*macrocephala*	Cyperaceae	*Traset cheum*
Markhamia	*stipulacea*	Bignoniaceae	*Dork Po*
Mastixia	*pentandra*	Nyssaceae	*Prolop*
Melastoma	*saigonense*	Melastomataceae	*Bay Nhenh*
Melastoma	*sanguineum*	Melastomataceae	*Nhenh*
Melastoma	*villosum*	Melastomataceae	*Bay Nhenh chhmol*
Meliantha	*suavis*	Opiliaceae	*Prich*
Melmecylon	*acuminatum var. tenuis*	Melastomataceae	*Phlong-Phngiehs*
Melodorum	*siamensis*	Annonaceae	*Kreal*
Melodorum	*fruticosum*	Annonaceae	*Romduol*
Memecylon	*acuminatum*	Melastomataceae	*Phngeas*
Memecylon	*laevigalum*	Melastomataceae	*Phlong*
Memecylon	*umbellatum*	Melastomataceae	
Merremia	*vitifolia*	Convolvulaceae	
Miliusa	*velutina*	Annonaceae	*Sma krobei Thom/Doh Krabei*
Millingtonia	*hortensis*	Bignoniaceae	*Angkea Boss*
Mimosa	*pudica*	Mimosoideae	*Preah Khlorb*
Mimosa	*invisa*	Mimosoideae	*Preah Khlab Damrei*
Mischocarpus	*sundaicus*	Sapindaceae	*Sandek Prey*
Mitragyna	*parvifolia*	Rubiaceae	*Khtum Phnom*
Mitragyna	*speciosa*	Rubiaceae	*Khtum Toek*
Morinda	*pandurifolia*	Rubiaceae	*Nho Toek*
Morinda	*coreia*	Rubiaceae	*Nho Toch*
Mussaenda	*cambodiana*	Rubiaceae	*sattaba*
Myrialepis	*paradoxa*	Palmae	*phdao russei*
Myristica	*iners*	Myristicaceae	*Kouk*
Najas	*indica*	Najadaceae	*Sarai*
Nauclea	*officinalis*	Rubiaceae	*Khtom Toek*
Nauclea	*orientalis*	Rubiaceae	*Kdol*
Neolitsea	*zeylanica*	Lauraceae	*Kantuy Ve*
Neonauclea	*sessilifolia*	Rubiaceae	*Khtom Roleay/Roleay Thom*
Nepenthes	*geoffrayi*	Nepenthaceae	*Ampong Sramoach*
Nepenthes	*thorelii*	Nepenthaceae	*Bampong sromoch*

Nephelium	*hypoleucum*	Sapindaceae	*Semoan Sach*
Nephrolepis	*cordifolia*	Lomariopsidaceae	*Thnaing cheum*
Ochna	*integerrima*	Ochnaceae	*Angkea sel*
Ochrocarpus	*siamensis*	Guttiferae	*Sophi*
Olax	*obtusa*	Olacaceae	*Aphtok*
Olax	*scandens*	Olacaceae	*Kdor Kralet/Aphtok*
Oroxylum	*indicum*	Bignoniaceae	*Pika*
Oryza	*rufipogon*	Gramineae	*Sra Gnae*
Osbeckia	*cochinchinensis*	Melastomataceae	*unknown*
Oxyceros	*horridus*	Rubiaceae	*Yuthka*
Oxyceros	*horruda*	Rubiaceae	*Snaeng Ko*
Paederia	*scandens*	Rubiaceae	*Voir Phoam*
Pandanus	*capusii*	Pandanaceae	*Romchek Phnom*
Pandanus	*humilis*	Pandanaceae	*Romchek*
Parinari	*anamensis*	Chrysobalanaceae	*Thlok*
Passiflora	*foetida*	Passifloraceae	*Sav Mav Prey*
Pavonia	*rigida*	Malvaceae	*Kolap Phnom*
Peltophorum	*dasyrrhachis*	Caesalpinioideae	*Trasek*
Peperomia	*pellucida*	Piperaceae	*Krasaing Tieb*
petes	*thorelii*	Euphorbiaceae	*Sdok Sdol*
Phaleria		Euphorbiaceae	*Ngob Prey*
Phoenix	*loureiri*	Palmae	*Dong Preah/Dong Tonsay*
Phragmites	*vallatoria*	Gramineae	*Bo Bos*
Phyllanthus	*urinaria*	Phyllanthaceae	*Prork Phlae (dem)*
Phyllanthus	*lasiogynus*	Phyllanthaceae	*Praphenh Nhi*
Phyllanthus	*collinsiae*	Phyllanthaceae	*Ampet/Rompaot Sesh*
Phyllanthus	*emblica*	Phyllanthaceae	*Kantuot Prey*
Phyllodium	*pulchellum*	Papilionoideae	*Ang Prumbre Kroay*
Physalis	*angulata*	Solanaceae	*Peng Poah Sroam*
Pinus	*merkusii*	Pinaceae	*Sral sleukpi*
Piper	*sp*	Piperaceae	*Mrech Tansay*
Piper		Piperaceae	*Mrech Sva*
Piper	*lolot*	Piperaceae	*Chi Phlou*
Piper		Piperaceae	*Mlou Prey*
Pistia	*stratiotes*	Araceae	*Chork*
Platycerium	*wallichii*	Polypodiaceae	*Pokmoat Preah Ream/Kantoab Yeak*
Plectocomia	*pierreana*	Palmae	*Phdao Sno*
Polyalthia	*evecta*	Annonaceae	*Bat Phtel*
Polyalthia	*modesta*	Annonaceae	*Chek Tum*
Polyalthia	*cerasoides*	Annonaceae	*Snay Del/Mai Del (Ngai Del)*
Portulaca	*oleracea*	Portulacaceae	*Kbet Chuon*
Pothos	*scandens*	Araceae	*Changkeh Angkrang voir*

Prismatomeris	*sessiliflora*	Rubiaceae	*romdenh meas*
Prismatomeris	*tetrandra*	Rubiaceae	*Mdenh Meas*
Psychotria	*serpens*	Rubiaceae	*Voir Daek*
Psychotria	*asiatica*	Rubiaceae	*Sroam Dav*
Psydrax	*pergracilis*	Rubiaceae	*Mekang*
Pteridium	*aquilinum*	Dennstaedtiaceae	*vor thnanh/Khmanh*
Pternandra	*caerulescens*	Melastomataceae	*Changkat prak*
Pterocarpus	*macrocarpus*	Papilionoideae	*Thnung*
Pterospermum	*semisagittatum*	Malvaceae	*Preal Phnom*
Pyrrosia	*longifolia*	Polypodiaceae	*poprork baiy damneup*
Quisqualis	*conferta*	Combretaceae	*Dong Preah*
Randia	*tomentosa*	Rubiaceae	*Roveang*
Randia	*uliginosa*	Rubiaceae	*Krumpouk*
Rhaphidophora	*montana*	Araceae	*Voir Ka-ep*
Rhaphidophora	*peepla*	Araceae	*Voir Ka-aeb*
Rhodamnia	*cinerea*	Myrtaceae	*puoch uol*
Rhynchospora	*rubra*	Cyperaceae	*unknown*
Saccharum	*arundinaceum*	Gramineae	*Treng*
Salacia	*chinensis*	Celastraceae	*Viey*
Salacia	*macrophylla*	Celastraceae	*Kandapchang-E*
Sandoricum	*indicum*	Meliaceae	
Sandoricum	*koetjape*	Meliaceae	*Kamping Reach*
Sapium	*insigne*	Euphorbiaceae	*Chheu Romoas*
Schleichera	*oleosa*	Sapindaceae	*Pong Ro*
Scleropyrum	*pentandrum*	Santalaceae	*Lolok Kev*
Securinega	*virosa*	Euphorbiaceae	*Thmenh Trei*
Selaginella	*delicatula*	Selaginellaceae	*unknown*
Selaginella	*siamensis*	Selaginellaceae	*Cheung toekkae*
Senna	*garrettiana*	Caesalpinioideae	*Haisan*
Senna	*sp.*	Caesalpinioideae	*Ngaisan*
Sesbania	*javanica*	Papilionoideae	*Snoa*
Shorea	*guiso*	Dipterocarpaceae	*Choi chong*
Shorea	*hypochra*	Dipterocarpaceae	*Kamnhan*
Shorea	*obtusa*	Dipterocarpaceae	*Phchoek*
Shorea	*roxburghii*	Dipterocarpaceae	*popel*
Shorea	*siamensis*	Dipterocarpaceae	*Reang Phnom*
Sindora	*siamensis*	Caesalpinioideae	*kokoh*
Sorghum	*halepense*	Gramineae	*Treng*
Spatholobus	*acuminatus*	Papilionoideae	*Voir Ta An*
Spatholobus	*parviflorus*	Papilionoideae	*Voir Khnhae*
Spondias	*pinnata*	Anacardiaceae	*Mkaak Prey*
Spondias	*malayana*	Anacardiaceae	*Mkak Prey*
Spondias	*pinnata*	Anacardiaceae	*Pon Sva*

Stephania		Menispermaceae	*Krabei Choldei (Voir)*
Sterculia	*gilva*	Malvaceae	*Samrorng chorm*
Sterculia	*villosa*	Malvaceae	*Samrang - Veng Khsae*
Stereospermum	*cylindricum*	Bignoniaceae	*Sangkuot Tmart*
Streblus	*asper*	Moraceae	*Snay*
Strophanthus	*caudatus*	Apocynaceae	*Choir Banh*
Strychnos	*axillaris*	Loganiaceae	*Voir Yeav*
Strychnos	*polyantha*	Loganiaceae	*Voir Sleng*
Strychnos	*rupicola*	Loganiaceae	*Voir Sleng*
Strychnos	*urupieda*	Loganiaceae	*Voir Paprork*
Strychnos	*nux-vomica*	Loganiaceae	*Sleng*
Strychnos	*nux-blanda*	Loganiaceae	*Poveak*
Suregada	*multiflora*	Euphorbiaceae	*Tromoung Sek*
Synedrella	*nodiflora*	Compositae	*Spey Kok*
Syzygium	*albiflora*	Myrtaceae	*Pring chorm*
Syzygium	*bracteatum*	Myrtaceae	*Pring Uol*
Syzygium	*cochinchinense*	Myrtaceae	*Pring Kmom*
Syzygium	*cumini*	Myrtaceae	*Pring Doh Krabei*
Syzygium	*fruticosa*	Myrtaceae	*Pring Bay*
Syzygium	*grande*	Myrtaceae	*Pring Kbalta*
Syzygium	*laosense*	Myrtaceae	*Pring Chan*
Syzygium	*polyanthum*	Myrtaceae	*Pring Muoyroysratab*
Syzygium	*zeylanicum*	Myrtaceae	*Smach Deng*
Tabernaemontana	*bovina*	Apocynaceae	*Mtes prey*
Tamilnadia	*uliginosa*	Rubiaceae	*Ampok Sor*
Terminalia	*alata*	Combretaceae	*Chhlik*
Terminalia	*bellirica*	Combretaceae	*Talat*
Terminalia	*bialata*	Combretaceae	*Popeal Khae*
Terminalia	*chebula*	Combretaceae	*Sramor*
Terminalia	*corticosa*	Combretaceae	*Puntaley*
Terminalia	*darfeuillana*	Combretaceae	*Samor Prey*
Terminalia	*mucronata*	Combretaceae	*Praim Damloeung*
Terminalia	*nigrovenulosa*	Combretaceae	*Preah Phnov*
Terminalia	*triptera*	Combretaceae	*Preah Phnov*
Tetracera	*loureiri*	Dilleniaceae	*voir doh kun*
Tetrameles	*nudiflora*	Datiscaceae	*spong*
Tetrastigma	*planicaule*	Vitaceae	*Voir Trolenten*
Tetrastigma	*harmandii*	Vitaceae	*Voir Tradet*
Thunbergia	*laurifolia*	Acanthaceae	
Tinospora	*crispa*	Menispermaceae	*Bandol Pech*
Toddalia	*asiatica*	Rutaceae	*Rok Kait*
Toona	*surenii*	Meliaceae	*Chham Chha*
Toxocarpus	*lagenifer*	Apocynaceae	*Voir Thlok*

Trema	*orientalis*	Connabaceae	*Steav*
Trichosanthes	*tricuspidata*	Cucurbitaceae	*Pul Ek (dem)*
Tristaniopsis	*merguensis*	Myrtaceae	*Rumleang*
Tristaniopsis	*burmanica*	Myrtaceae	*Sra ngam*
Uncaria		Rubiaceae	*Antong (Voir)*
Uraria	*lagopodioides*	Papilionoideae	*Kantuy Kamprok*
Urena	*lobata*	Malvaceae	*Arch Chrouk*
Utricularia	*aurea*	Lentibulariaceae	*Saray*
Uvaria	*hahnii*	Annonaceae	*Treal Sva (voir)*
Vatica	*odorata*	Dipterocarpaceae	*Chramas*
Vetiveria	*zizanodies*	Gramineae	*Sbov Ronndahs*
Vietnamosasa	*pusilla*	Gramineae	*Russey Prich*
Viscum	*articulatum*	Viscaceae	*Panheu Ka-aek*
Vitex	*pinnata*	Labiatae	*popoul thmor*
Wallichia		Palmae	*Tonsae Bath*
Walsura	*sp.*	Meliaceae	*Eysei psam srach*
Walsura	*robusta*	Meliaceae	*Sdok Sdol*
Wrightia	*annamensis*	Apocynaceae	*Chheu Dai Khla*
Wrightia	*religiosa*	Apocynaceae	*Popich Changwa*
Wrightia	*pubescens*	Apocynaceae	*Khleng Kung*
Xanthophyllum	*virens*	Polygalaceae	*Prich*
Xerospermum	*noronhianum*	Sapindaceae	*Semoan Thmor*
Xylia	*xylocarpa*	Mimosoideae	*Sokram*
Xylopia	*pierrei*	Annonaceae	*Kray Sor*
Xylopia	*vielana*	Annonaceae	*Kray Krahorm*
Xyris	*indica*	Xyridaceae	*Thnork Toek (grass)*
Zanthoxylum	*nitidum*	Rutaceae	*Preah Kamchait*
Zingiber	*pellitum*	Zingiberaceae	*unknown*
Zingiber	*zerumbet*	Zingiberaceae	*Khteu*
Ziziphus	*cambodiana*	Rhamnaceae	*Ang Krong*
Ziziphus	*oenopolia*	Rhamnaceae	*Sang Kheur*
			Bay Arm

Appendix II: Mammal Species Prey Lang

Common Name	Scientific name	Evidence	IUCN
Bengal Slow Loris	*Nycticebus bengalensis*	HS, O	VU
Northern Pig-tailed Macaque	*Macaca leonina*	O	VU
Long-tailed Macaque	*Macaca fascicularis*	O, CT	
Pileated Gibbon	*Hylobates pileatus*	V	EN
Indochinese Silvered langur	*Trachypithecus germaini*	CT	EN
Malayan Sun Bear	*Helarctos malayanus*	CT, S	VU
Asiatic Bear	*Ursus thibetanus*	CT, S	VU
Dhole	*Cuon alpinus*	O	EN
Golden Jackal*	*Canis aureus*	CT	
Yellow-throated Marten	*Martes flavigula*	CT	
Hog Badger	*Arctonyx collaris*	HS, CT	NT
Smooth-coated Otter	*Lutrogale perspicillata*	CT	VU
Binturong*	*Arctictis binturong*	CT	VU
Large Indian Civet	*Viverra zibetha*	CT	NT
Small Indian Civet	*Viverricula indica*	CT	
Common Palm Civet	*Paradoxurus hermaphroditus*	CT	
Large Spotted Civet*	*Viverra megaspila*	CT	VU
Small Asian Mongoose	*Herpestes javanicus*	O	
Crab Eating Mongoose	*Herpestes urva*	CT	
Leopard Cat	*Prionailurus bengalensis*	CT	
Clouded Leopard*	*Neofelis nebulosa*	CT	VU
Asian Elephant	*Elephas maximus*	CT, S	EN
Eurasian Wild Pig	*Sus scrofa*	CT	
Lesser Mousedeer	*Tragulus kanchil*	CT, HS	
Red Muntjac	*Muntiacus muntjak*	CT	
Sambar*	*Rusa unicolor*	CT	VU
Banteng	*Bos javanicus*	CT	EN
Gaur	*Bos gaurus*	CT	VU
Black Giant Squirrel	*Ratufa bicolor*	O, CT	NT
Variable Squirrel	*Callosciurus finlaysonii*	O	
Cambodian Striped Squirrel	*Tamiops rodolphi*	O	
Indochinese Ground Squirrel	*Menetes berdmorei*	O	
Indian Giant Flying Squirrel	*Petaurista philippensis*	O	
Small Flying Squirrel	*Hylopetes sp*	O	
Northern Tree Shrew	*Tupaia belangeri*	O	
Malayan Porcupine	*Hystrix brachyura*	CT	
Malayan Colugo	Galeopterus variegatus	O	

HS= Hunters specimen, CT= Camera Trap, V= Vocilisation, O= Observation, S= Signs
* Past surveys

Appendix III: Locations sampled during the bat survey at Prey Lang

Date	Code	UTM
NORTHERN SECTOR		
22-Oct-14	C1	0579103, 1525235
22-Oct-14	C2	0579089, 1525251
23-Oct-14	C3	0579500, 1525281
23-Oct-14	C4	0580539, 1525120
25-Oct-14	C5	0577543, 1525882
26-Oct-14	C6	0577734, 1525747
26-Oct-14	C7	0577735, 1525713
27-Oct-14	C8	0580878, 1523241
28-Oct-14	C9	0580388, 1523087
28-Oct-14	C10	0580881, 1523098
28-Oct-14	C11	0580933, 1523138
22-Oct-14	F1	0579120, 1525005
22-Oct-14	F2	0579190, 1524783
23-Oct-14	F3	0579131, 1524980
23-Oct-14	F4	0579041, 1525137
23-Oct-14	F5	0580539, 1525120
23-Oct-14	F6	0579197, 1524814
24-Oct-14	F7	0579408, 1524869
24-Oct-14	F8	0579440, 1524857
24-Oct-14	F9	0579883, 1524640*
24-Oct-14	F10	0579883, 1524640*
24-Oct-14	F11	0579276, 1524962
25-Oct-14	F12	0579266, 1525085
25-Oct-14	F13	0579360, 1524896
25-Oct-14	F14	0579630, 1524470*
25-Oct-14	F15	0579630, 1524470*
26-Oct-14	F16	0579816, 1524608
26-Oct-14	F17	0579867, 1524611
26-Oct-14	F18	0579872, 1524620
26-Oct-14	F19	0579878, 1524579
27-Oct-14	F20	0580844, 1523319
27-Oct-14	F21	0580789, 1523367
28-Oct-14	F22	0580878, 1523241*
28-Oct-14	F23	0580878, 1523241*
28-Oct-14	F24	0580878, 1523241*
28-Oct-14	F25	0580878, 1523241*
29-Oct-14	F26	0581473, 1523515*
29-Oct-14	F27	0541473, 1523515*
29-Oct-14	F28	0581527, 1523437*
29-Oct-14	F29	0581527, 1523437*
CENTRAL SECTOR		
24-Dec-14	F30	0560049, 1473387

24-Dec-14	F31	0560311, 1473190
24-Dec-14	F32	0560029, 1473444
24-Dec-14	F33	0560319, 1473107
25-Dec-14	F34	0560349, 1473454
25-Dec-14	F35	0560315, 1473341
25-Dec-14	F36	0560320, 1473093
25-Dec-14	F37	0559528, 1474299
25-Dec-14	F38	0559366, 1474418
25-Dec-14	F39	0559280, 1474502
26-Dec-14	F40	0559878, 1472015
26-Dec-14	F41	0559916, 1472139
26-Dec-14	F42	0560353, 1473398
26-Dec-14	F43	0559317, 1474377
26-Dec-14	F44	0559444, 1474456*
26-Dec-14	F45	0559477, 1474376*
27-Dec-14	F46	0560330, 1473633
27-Dec-14	F47	0560234, 1473818
27-Dec-14	F48	0560150, 1474054
27-Dec-14	F49	0560060, 1474309
27-Dec-14	F50	0561003, 1475357*
27-Dec-14	F51	0561314, 1475437*
28-Dec-14	F52	0559929, 1473719
28-Dec-14	F53	0560092, 1473893
28-Dec-14	F54	0560083, 1474256
28-Dec-14	F55	0560096, 1474370
28-Dec-14	F56	0559963, 1474236
SOUTHERN SECTOR		
18-Jun-14	F57	0575595, 1454128*
18-Jun-14	F58	0575595, 1454128*
18-Jun-14	F59	0575595, 1454128*
19-Jun-14	F60	0574342, 1456366*
19-Jun-14	F61	0574342, 1456366*
19-Jun-14	F62	0574342, 1456366*
19-Jun-14	F63	0575595, 1454128*
20-Jun-14	F64	0575595, 1454128*
20-Jun-14	F65	0574119, 1454565*
20-Jun-14	F66	0574119, 1454565*
20-Jun-14	F67	0574119, 1454565*
20-Jun-14	F68	0579819, 1451808*
21-Jun-14	F69	0575595, 1454128*
21-Jun-14	F70	0575595, 1454128*
21-Jun-14	F71	0575595, 1454128*
22-Jun-14	F72	0576752, 1453909*
22-Jun-14	F73	0576752, 1453909*

Key: C=Cave, F=Forest, *=Approximate

Appendix IV: Bird Species of Prey Lang

Family	English Name	Latin Name	Khmer Name	Threat status			Prey Lang	Habitat	Dectection	Recorded
				Global	Regional	Cambodia	x,y,z		Method	Sources
Francolins, Quails, Partridges & Pheasants (Phasianidae)										p
	Chinese Francolin	*Francolinus pintadeanus*	ទទាគុកាតតតា				x, y,z	DDF,SE	H, S	Chhin 2014
	Rain Quail	*Coturnix coromandelica*	ក្រូចទ្រូងខ្មៅ			L Known	y	DDF	H, S	Chhin 2014
	Blue-breasted Quail	*Coturnix chinensis*	ក្រូចទ្រូងខៀវ		(Lao,Thai)	N-Thr.	z	DDF	H, S	Chhin 2014
	Orange-necked Partridge	*Arborophila davidi*	ទទាកទឹកក្រូច	GNT		R Range	x	EF,SE	H, S	Chhin 2014
	Scaly-breasted Partridge	*Arborophila chloropus*	ទទាជើងបៃតង				x,y,z	SE	H, S	Chhin 2014
	Red Junglefowl	*Gallus gallus*	មាន់ព្រៃ				x,y,z	EF, DDF,SE	H, S	Chhin 2014
	Siamese Fireback	*Lophura diardi*	ស្តេចកូលីត		(Lao), Thai		x,z	EF, SE, SW	H, S	Chhin 2014
	Grey Peacock Pheasant	*Polyplectron bicalcaratum*	មាន់ទោប្រជេះ			R Range	y	EF	H	Chhin 2014
	Green Peafowl	*Pavo muticus*	ក្ងោកបៃតង	GT-En	Lao, Thai	Threat.	x,y	SE, DDF	H	Chhin 2014
Whistling Ducks, Ducks & Pygmy-geese (Anatidae)										p
	Lesser Whistling Duck	*Dendrocygna javanica*	ប្រវឹក				z	SW, DDF	H	Chhin 2014
Storks (Ciconiidae)										p
	Painted Stork	*Mycteria leucocephala*	រនាលពណ៌	GNT	Lao, Thai	N-Thr.	z	SW, DDF	S	Chhin 2014

	Asian Openbill	*Anastomus oscitans*	ចង្រៀលខ្យង		Lao, (Thai)		z	SW, DDF	S	Chhin 2014
	Black Stork	*Ciconia nigra*	រនាលខ្មៅ		Lao, Thai		y,z	DDF ,SW	S	Chhin 2014
	Woolly-necked Stork	*Ciconia episcopus*	សត្វកស (គាត្រុំ)		Lao, Thai		x,y ,z	SE, DDF ,SW	H	Chhin 2014
	Lesser Adjutant	*Leptoptilos javanicus*	ត្រដក់តូច	GT-Vu	Lao, Thai	N-Thr.	x,y ,z	SE, DDF ,SW	S	Chhin 2014
	Greater Adjutant	*Leptoptilos dubius*	ត្រដក់ធំ	GT-En	Lao, Thai	Critical	y,z	SE, DDF ,SW	S	Chhin 2014
Ibises & Spoonbills (Threskiornithidae)										p
	White-shouldered Ibis	*Pseudibis davisoni*	កូខ្លួនខ្មៅ	GT-Cr	Lao, Thai	Critical	y,z	DDF	I	L.In 2014
	Giant Ibis	*Pseudibis gigantea*	កូយក្ស (ឌីឡឹក,ត្រយ៉ង់)	GT-Cr	Lao, Thai	Critical	y,z	DDF	I,O	L.In 2014, Olsson, A. & Emmett, D.E. 2007
Bitterns, Herons & Egrets (Ardeidae)										p
	Yellow Bittern	*Ixobrychus sinensis*	កុកសំបកត្រពាំងធម្មតា				z	SW	H, S	Chhin 2014
	Cinnamon Bittern	*Ixobrychus cinnamomeus*	កុកម្ទេសទុំ				z	SW	H	Chhin 2014
	Black-crowned Night Heron	*Nycticorax nycticorax*	ខ្វែកយប់ប្រផេះ		(Lao)		z	SW	S	Chhin 2014
	Little Heron	*Butorides striata*	ក្រាអាច់(ក្រសាស្វាយ)				z	SW	S	Chhin 2014
	Chinese Pond Heron	*Ardeola bacchus*	កុកក្រក ក្បាលត្នោតចាស់				x	DDF	S	Chhin 2014
	Javan Pond Heron	*Ardeola speciosa*	កុកក្រក				y,z	SW	S	Chhin 2014

			ក្បាលត្នោតខ្ចី							
	Eastern Cattle Egret	*Bubulcus coromandus*	កុកគោ				y	DDF	S	Chhin 2014
	Grey Heron	*Ardea cinerea*	ក្រសាប្រផេះ		(Lao), Thai		y,z	DDF,SW, SE	S	Chhin 2014
	Purple Heron	*Ardea purpurea*	ក្រសាធ្មុង់				y,z	DDF,SW	S, H	Chhin 2014
	Little Egret	*Egretta garzetta*	កុកគ្រោងតូច				y,z	DDF,SE, SW	S	Chhin 2014
Cormorants (Phalacrocoracidae) & Darters (Anhingidae)										p
	Little Cormorant	*Phalacrocorax niger*	ក្អែកទឹកទូច		Lao		y, z	DDF, SW	S	Chhin 2014
	Oriental Darter	*Anhinga melanogaster*	ស្មោញ	GNT	Lao, Thai	N-Thr.	y, z	DDF, SW	S	Chhin 2014
Ospreys (Pandionidae) and Hawks, Eagles & allies (Accipitridae)										p
	Black Baza	*Aviceda leuphotes*	ស្ទាំងស្លាបឆែកខ្មៅស				x,z	DDF	S	Chhin 2014
	Oriental Honey Buzzard	*Pernis ptilorhynchus*	រអាតឃ្មុំ				x,y	DDF	S	Chhin 2014
	Black-shouldered Kite	*Elanus caeruleus*	ស្ទាំងលលក				z	DDF	S	Chhin 2014
	Black Kite	*Milvus migrans*	ខ្លែងខ្មៅ		Lao, Thai	Threat.	z	DDF	S	Chhin 2014
	Black-eared Kite	*Milvus lineatus*	ខ្លែងត្រចៀកខ្មៅ				z	DDF	S	Chhin 2014
	Crested Serpent Eagle	*Spilornis cheela*	អកពស់ព្រៃ				x,y,z	DDF,SE	S, H	Chhin 2014
	Shikra	*Accipiter badius*	ស្ទាំងស្លាបឆែកស្រុក				x,z	DDF	S, H	Chhin 2014
	Japanese Sparrowhawk	*Accipiter gularis*	ស្ទាំងស្លាបឆែកតូច				y,z	DDF	S	Chhin 2014
	Besra	*Accipiter virgatus*	ស្ទាំងស្លាបឆែកព្រៃ				x,z	SE	S	Chhin 2014
	Indian	*Aquila*	ឥន្ទ្រីយ៍ព្រៃ	G		Thr	y	DDF	S	Chhin 2014

	Spotted Eagle	*hastata*		T-Vu		eat.				
Falcons and allies (Falconidae)										p
	White-rumped Pygmy Falcon	*Polihierax insignis*	ស្វាំងស្លាបស្រួចចុងខ្ចងស	GNT	Lao ,(Thai)		x	DDF	S	Chhin 2014
	Collared Falconet	*Microhierax caerulescens*	ស្វាំងស្លាបស្រួចតូច				x	DDF	S, H	Chhin 2014
	Oriental Hobby	*Falco severus*	ស្វាំងស្លាបស្រួចពោះពណ៌ាច្រេះ		(Thai)		y	SE	S	Chhin 2014
Rails, Crakes & Coots (Rallidae)										p
	Slaty-legged Crake	*Rallina eurizonoides*	ជុំដុរជើងក្រមៅ				z	SW	S	Chhin 2014
	Slaty-breasted Rail	*Gallirallus striatus*	កញ្ជ្រោះក្បាលត្នោត				y,z	DDF ,SW	S	Chhin 2014
	Baillon's Crake	*Porzana pusilla*	ជុំដុរតូច			L Known	z	SW	S	Chhin 2014
	Ruddy-breasted Crake	*Porzana fusca*	កាត្រែត(ជុំដុរក្រហម)				z	WS	S	Chhin 2014
	Watercock	*Gallicrex cinerea*	ក្លុំ		Lao ,(Thai)		z	WS	S	Chhin 2014
	Black-backed Swamphen	*Porphyrio indicus*	ទោម		Lao		z	OP	S	Chhin 2014
	Common Moorhen	*Gallinula chloropus*	មាន់ទឹកខ្មៅ				z	OP	S	Chhin 2014
Cranes (Gruidae)										p
	Sarus Crane	*Grus antigone*	ក្រៀលក្បាលក្រហម	GT-Vu	Lao ,Thai	Thr eat.	x,y ,z	DDF	I	L.In 2014
Buttonquails (Turnicidae)										p
	Small Buttonquail	*Turnix sylvaticus*	ក្រួចតូច		(Lao, Thai)	N-Thr.	y	DDF	S	Chhin 2014
Stilts (Recurvirostridae), Lapwings & Plovers										p

(Charadriidae)										
	River Lapwing	*Vanellus duvaucelii*	ត្រដេរវិចទន្លេ		Lao ,Thai	Threat.	y,z	DDF, SW	S, H	Chhin 2014
	Grey-headed Lapwing	*Vanellus cinereus*	ត្រដេរវិចក្បាលប្រផេះ		(Lao,Thai)		z	DDF	S	Chhin 2014
	Red-wattled Lapwing	*Vanellus indicus*	ត្រដេរវិចទូល				y,z	DDF, SW	S, H	Chhin 2014
	Little Ringed Plover	*Charadrius dubius*	សត្វក្បាលធំរ័ណ្តូងខ្មៅ				z	DDF,SW	S	Chhin 2014
Painted-snipes (Rostratulidae) & Jacanas (Jacanidae)										p
	Greater Painted-snipe	*Rostratula benghalensis*	ខ្វែកពណ៌				z	DDF, SW, Op	S	Chhin 2014
Pratincoles (Glareolidae)										p
	Small Pratincole	*Glareola lactea*	ទន្ត្រីតទន្លេ		(Lao,Thai)		z	DDF,SW, OP	S	Chhin 2014
Doves & Pigeons (Columbidae)										p
	Rock Dove	*Columba livia*	ព្រាបស្រុក				z	DDF,OP	S	Chhin 2014
	Pale-capped Pigeon	*Columba punicea*	ពពូលក្បាលព្រលែត	GT-Vu	(Lao), Thai	LKnown	y	DDF	S	Chhin 2014
	Red Collared Dove	*Streptopelia tranquebarica*	លលកទ្រាំង				x,y,z	DDF,SE	S, H	Chhin 2014
	Spotted Dove	*Streptopelia chinensis*	លលកបាយ				x,y,z	DDF,SE	S, H	Chhin 2014
	Emerald Dove	*Chalcophaps indica*	លលកស្លាបបៃតង				x	EF,SE	S, H	Chhin 2014
	Zebra Dove	*Geopelia striata*	លលកតូច				x,y,z	DDF, OP	S, H	Chhin 2014
	Orange-breasted Green Pigeon	*Treron bicincta*	ពពូលទ្រូងភ្លើងក្បាលបៃតង		(Lao,Thai)		y,z	SE,SW	S	Chhin 2014
	Thick-billed Green	*Treron curvirostra*	កំប្លុក (ពពូលចំពុះ				x,y,z	EF,SE,DDF,S	S, H	Chhin 2014

	Pigeon		ធំ)					W		
	Yellow-footed Green Pigeon	*Treron phoenicoptterus*	ពពូលជើងលឿង		Lao, Thai		y,z	DDF	S, H	Chhin 2014
	Green Imperial Pigeon	*Ducula aenea*	ព្រាបព្រៃ		Lao, Thai	N-Thr.	x,y	SW, DDF	S, H	Chhin 2014
	Ashy-headed Green-pigeon	Treron phayrei	ពពូលក្បាលប្រផេះ		Lao, Thai	N-Thr.	??	??	Ca. Tr	Camera trap 2014
	Mountain Imperial Pigeon	*Ducula badia*	ព្រាបភ្នំ				x,y.z	EF,SE,DDF	S, H	Chhin 2014
Parrots & Parakeets (Psittacidae)										p
	Vernal Hanging Parrot	*Loriculus vernalis*	សេកក្រិច				x,y	DDF	S	Chhin 2014
	Alexandrine Parakeet	*Psittacula eupatria*	សេកសោម		Lao, Thai	Threat.	x,y	DDF	S, H	Chhin 2014
	Grey-headed Parakeet	*Psittacula finschii*	សេកក្បាលប្រផេះ			N-Thr.	x,z	DDF,SW	H, S	Chhin 2014
	Blossom-headed Parakeet	*Psittacula roseata*	សេកអាត់		(Lao, Thai)		y	DDF	H, S	Chhin 2014
	Red-breasted Parakeet	*Psittacula alexandri*	សេកសក (សេកយី)				x,y	SE, DDF	S	Chhin 2014
Coucals, Malkohas & Cuckoos (Cuculidae)										p
	Greater Coucal	*Centropus sinensis*	ល្នតធំ				x,y,z	DDF,SW	H, S	Chhin 2014
	Lesser Coucal	*Centropus bengalensis*	ល្នតស្បូរ				y	DDF	H, S	Chhin 2014
	Coral-billed Ground Cuckoo	*Carpococcyx renauldi*	សត្វយំ		Thai		y	SE	H	Chhin 2014
	Green-billed Malkoha	*Rhopodytes tristis*	តុកកាគូ				x,y,z	DDF	S	Chhin 2014
	Chestnut-winged Cuckoo	*Clamator coromandus*	តារៅកំប៉ោយ				x,z	DDF	S	Chhin 2014
	Asian Koel	*Eudynamys*	តារៅស្រុក				x,y	DDF	S	Chhin 2014

		scolopaceus	ធំ							
	Violet Cuckoo	*Chrysococcyx xanthorhynchus*	តាវៅស្វាយ				x,y	DDF	S	Chhin 2014
	Banded Bay Cuckoo	*Cacomantis sonneratii*	តាវៅខ្លួនអន្ទន់ត្នោត				xy	DDF	H, S	Chhin 2014
	Plaintive Cuckoo	*Cacomantis merulinus*	តាវៅស្រុកតូច				x,y	DDF	H, S	Chhin 2014
	Drongo Cuckoo	*Surniculus lugubris*	តាវៅខ្មៅ				y	DDF	S, H	Chhin 2014
	Large Hawk Cuckoo	*Hierococcyx sparverioides*	តាវៅព្រៃធំ				z	DDF	S	Chhin 2014
	Indian Cuckoo	*Cuculus micropterus*	តាវៅព្រៃពោះត្នោត				x,y	DDF	H	Chhin 2014
Owls (Tytonidae & Strigidae)										p
	Common Barn Owl	*Tyto alba*	ខ្លែងស្រោកស្រុក		(Lao, Thai)	N-Thr.	x,y	DDF	H, S	Chhin 2014
	Oriental Bay Owl	*Phodilus badius*	ឌឌ្បក្របី				z	SW	H	Chhin 2014
	Collared Scops Owl	*Otus lettia*	ឌឌ្បឡឹក				x,z	DDF,SE	H, S, C	Chhin 2014
	Oriental Scops Owl	*Otus sunia*	ឌឌ្បពូប (លលកខ្មោច)				x,z	DDF,SW	H	Chhin 2014
	Spot-bellied Eagle Owl	Bubo nipalensis	ទីទុយធំព្រៃ		(Lao,Thai)	L Known	??	??	Ca. Tr	Camera trap 2014
	Brown Fish Owl	*Ketupa zeylonensis*	ទីទុយត្រីថ្ងាសត្នោត		(Lao,Thai)	N-Thr.	x,z	SE, DDF	H	Chhin 2014
	Spotted Wood Owl	*Strix seloputo*	មៀមធំរ៉ូ		(Lao), Thai		z	SW	H	Chhin 2014
	Collared Owlet	*Glaucidium brodiei*	មៀមតូចក្អែកបួន				x,y,z	DDF,SE, SW	S, H, C	Chhin 2014
	Spotted Owlet	*Athene brama*	មៀមតូចស្រុក				y	DDF	S, H	Chhin 2014
Frogmouths (Podargidae) & Nightjars (Caprimulgidae)										p

	Great Eared Nightjar	*Eurostopodus macrotis*	ពញ្ជាក់ធំ				x,y	DDF, SE	H, S	Chhin 2014
	Large-tailed Nightjar	*Caprimulgus macrurus*	ពញ្ជាក់ចង់				x,y	DDF	H	Chhin 2014
	Indian Nightjar	*Caprimulgus asiaticus*	ពញ្ជាក់តូច				x,y	DDF	H, S	Chhin 2014
	Savanna Nightjar	*Caprimulgus affinis*	ពញ្ជាក់ជូរិច				z	DDF	H, S	Chhin 2014
Treeswifts (Hemiprocnidae) & Swifts (Apodidae)										p
	Crested Treeswift	*Hemiprocne coronata*	ត្រចៀកកាំព្រៃ				x	SE	S	Chhin 2014
	[Germain's] Swiflet	*Aerodramus [germani]*	ត្រចៀកកាំតូចសំបុកសឮ			L Known	x	DDF	S	Chhin 2014
	White-throated Needletail	*Hirundapus caudacutus*	ត្រចៀកកាំធំបំពង់កស				x	DDF	S	Chhin 2014
	Silver-backed Needletail	*Hirundapus cochinchinensis*	ត្រចៀកកាំធំខ្នងព្រែក				y	DDF		Chhin 2014
	Brown-backed Needletail	*Hirundapus giganteus*	ត្រចៀកកាំធំខ្នងត្នោត				x	DDF	S	Chhin 2014
	Asian Palm Swift	*Cypsiurus balasiensis*	ត្រចៀកកាំខ្មៅដើមត្នោត				x,y,z	SE, DDF	S	Chhin 2014
	House Swift	*Apus affinis*	ត្រចៀកកាំខ្មៅចុងខ្នងស				x	DDF	S	Chhin 2014
Trogons (Trogonidae) & Rollers (Coraciidae)										p
	Orange-breasted Trogon	*Harpactes oreskios*	ត្រហ្គនពោះលឿង				x,y,z	SE, DDF,SW	S	Chhin 2014
	Indian Roller	*Coracias benghalensis*	ទាវខៀវ				x,y,z	DDF	H, S	Chhin 2014
	Dollarbird	*Eurystomus orientalis*	ទាវព្រៃ				y	SE	S, H	Chhin 2014
Kingfishers (Alcedinidae)										p
	Banded Kingfisher	*Lacedo pulchella*	កដបព្រៃ				x,z	SW, SE	S, H	Chhin 2014
	Stork-billed Kingfisher	*Pelargopsis capensis*	ងាវកក				z	SW	S, H	Chhin 2014

	White-throated Kingfisher	*Halcyon smyrnensis*	កដបទ្រូងស				x,y,z	DDF,SW	S	Chhin 2014
	Blue-eared Kingfisher	*Alcedo meninting*	ចចាតត្រចៀកខៀវ				x,z	DDF,SE	S	Chhin 2014
	Common Kingfisher	*Alcedo atthis*	ចចាតក្រឹម				z	SW	S	Chhin 2014
	Pied Kingfisher	*Ceryle rudis*	កដបខ្មៅស		Lao	N-Thr.	z	SW	S	Chhin 2014
Bee-eaters (Meropidae)										p
	Little Green Bee-eater	*Merops orientalis*	ត្រដេវតូច				x,y,z	DDF,SW	S	Chhin 2014
	Blue-tailed Bee-eater	*Merops philippinus*	ត្រដេវក្បាលបៃតង		(Lao)		x,y	DDF	S	Chhin 2014
	Chestnut-headed Bee-eater	*Merops leschenaulti*	ត្រដេវក្បាលត្នោត				x,y,z	DDF	S	Chhin 2014
Hoopoes (Upupidae) & Hornbills (Bucerotidae)										p
	Common Hoopoe	*Upupa epops*	បាគូ				x,y,z	DDF,SW	S,H	Chhin 2014
	Oriental Pied Hornbill	*Anthracoceros albirostris*	កេងកងតូចសខ្មៅ				x,z	SW, DDF	H,S	Chhin 2014
	Great Hornbill	*Buceros bicornis*	កេងកងធំ	GNT	Lao, (Thai)	Threat.	x,y,z	DDF,SE, EF,SW	H,S	Chhin 2014
	Wreathed Hornbill	*Aceros undulatus*	ញ៉ាំង		Lao, (Thai)	Threat.	x	EF	H,S	Chhin 2014
Barbets (Megalaimidae)										p
	Lineated Barbet	*Megalaima lineata*	ប៉ោលតោកក្បាលព្រលែត				x,y,z	DDF	S,H	Chhin 2014
	Blue-eared Barbet	*Megalaima australis*	ប៉ោលតោកថ្ងាសខ្មៅ				y	SE		Chhin 2014
	Coppersmith Barbet	*Megalaima haemacephala*	ប៉ោលតោកអំបុក				x,y,z	DDF,OP	H,S	Chhin 2014
Wrynecks, Piculets & Woodpeckers (Picidae)										p

	Eurasian Wryneck	*Jynx torquilla*	ត្រសេះកទន់				y	DDF	S	Chhin 2014
	Heart-spotted Woodpecker	*Hemicircus canente*	ត្រសេះតូចពពាលបំពងកស				y	DDF	S, H	Chhin 2014
	Rufous-bellied Woodpecker	*Hypopicus hyperythrus*	ត្រសេះពោះត្នោត		Thai	L Known	y	DDF	S, H	Chhin 2014
	Grey-capped Pygmy Woodpecker	*Dendrocopos canicapillus*	ត្រសេះខ្មៅសតូច				y	DDF,SE	S, H	Chhin 2014
	Spot-breasted Woodpecker	*Dendrocopos analis*	ត្រសេះខ្មៅសអង្កន់ពោះ		(Lao)		y	DDF	S	Chhin 2014
	Yellow-crowned Woodpecker	*Dendrocopos mahrattensis*	ត្រសេះខ្មៅសក្បាលលឿង		Lao,Thai	L Known	y	DDF	S	Chhin 2014
	White-bellied Woodpecker	*Dryocopus javensis*	ត្រសេះធំពោះស		(Lao,Thai)	N-Thr.	y	DDF	S, H	Chhin 2014
	Lesser Yellownape	*Picus chlorolophus*	ត្រសេះកំប៉ោយលឿងតូច				x,y	DDF	S, H	Chhin 2014
	Laced Woodpecker	*Picus vittatus*	ត្រសេះបៃតងក្បាលក្រហម				y	DDF,SE	S, H	Chhin 2014
	Streak-throated Woodpecker	*Picus xanthopygaeus*	ត្រសេះបៃតងកន្ធុត		(Lao), Thai		y	DDF	S, H	Chhin 2014
	Black-headed Woodpecker	*Picus erythropygius*	ត្រសេះបៃតងក្បាលខ្មៅ				y	DDF	S, H	Chhin 2014
	Grey-headed Woodpecker	*Picus canus*	ត្រសេះបៃតងក្បាលប្រផេះ				y	DDF	S, H	Chhin 2014
	Common	*Dinopium*	ត្រសេះភ្លើ				x,y	DDF	S,	Chhin 2014

	Flameback	*javanense*	ឯងធំ				,z	,SE	H	
	Greater Flameback	*Chrysocolaptes lucidus*	ត្រសេះភ្លើងតូច				y	DDF	S, H	Chhin 2014
	Rufous Woodpecker	*Micropternus brachyurus*	ត្រសេះត្នោតចំពុះខ្មៅ				x,y	DDF ,SE	S, H	Chhin 2014
	Great Slaty Woodpecker	*Mulleripicus pulverulentus*	ត្រសេះធំប្រផេះ	GT-Vu	(Thai)	N-Thr.	x,y	DDF	S, H	Chhin 2014
Broadbills (Eurylaimidae)										p
	Black-and-red Broadbill	*Cymbirhynchus macrorhynchos*	សត្វចំពុះធំខ្មៅក្រហម		Thai	N-Thr.	z	SE,SW	S	Chhin 2014
	Banded Broadbill	*Eurylaimus javanicus*	សត្វចំពុះធំលឿងក្រមៅ				y,z	SE	S	Chhin 2014
	Dusky Broadbill	*Corydon sumatranus*	សត្វចំពុះធំកស				y	DDF	S, H	Chhin 2014
Pittas (Pittidae)										p
	Blue-rumped Pitta	*Pitta soror*	ប៉ាក់ខ្មៀវចុងខ្ចងខៀវ		(Lao), Thai	L Known	z	SE	H	Chhin 2014
	Bar-bellied Pitta	*Pitta elliotii*	ប៉ាកខ្មៀវពោះបង្កង់		(Lao), Thai	L Known	x	SE	S	Chhin 2014
	Hooded Pitta	*Pitta sordida*	ប៉ាក់ខ្មៀវបន្ទុលក្បាលត្នោត				z	SE	S, H	Chhin 2014
	Blue-winged Pitta	*Pitta moluccensis*	ប៉ាក់ខ្មៀវស្លាបខៀវ				x,z	DDF	S, H	Chhin 2014
Gerygone (Acanthizidae), Flycatcher-shrike and Woodshrikes (Tephrodornithidae)										p
	Bar-winged Flycatcher-shrike	*Hemipus picatus*	អល់អែកស្លាបខ្មៅឆ្នូត				x		S	Chhin 2014
	Large Woodshrike	*Tephrodornis gularis*	អល់អែកមធ្យម				y	DDF	S	Chhin 2014
	Common Woodshrike	*Tephrodornis pondiceria*	អល់អែកតូច				y,z	DDF	S, H	Chhin 2014

		nus								
Woodswallows (Artamidae) & Ioras (Aegithinidae)										p
	Common Iora	*Aegithina tiphia*	ចេកចៅស្លាបខ្មៅស				x,y,z	DDF,SE,OF	S,H	Chhin 2014
	Great Iora	*Aegithina lafresnayei*	ចេកចៅស្លាបខ្មៅ				x		S	Chhin 2014
Cuckooshrikes & Minivets (Campephagidae)										p
	Large Cuckooshrike	*Coracina macei*	អល់អែកធំ				y	DDF	S	Chhin 2014
	Indochinese Cuckooshrike	*Coracina polioptera*	អល់អែកស្លាបប្រផេះ				x,y	EF,DDF	S,H	Chhin 2014
	Black-winged Cuckooshrike	*Coracina melaschistos*	អល់អែកស្លាបខ្មៅ				y	SE	S	Chhin 2014
	Swinhoe's Minivet	*Pericrocotus cantonensis*	ចេកទេសប្រផេះស				y	DDF	S	Chhin 2014
	Ashy Minivet	*Pericrocotus divaricatus*	ចេកទេសខ្មៅស				y	DDF	S	Chhin 2014
	Small Minivet	*Pericrocotus cinnamomeus*	ចេកទេសតូច				y	DDF	S	Chhin 2014
	Scarlet Minivet	*Pericrocotus speciosus*	ចេកទេសធំ				y	DDF	S	Chhin 2014
Whistlers (Pachycephalidae) & Shrikes (Laniidae)										p
	Brown Shrike	*Lanius cristatus*	ចាបដូនតាវាលត្នោត				y	DDF	S,H	Chhin 2014
	Burmese Shrike	*Lanius collurioides*	ចាបដូតាវាលខ្មែងត្នោតទុំ				y	DDF	S	Chhin 2014
	Long-tailed Shrike	*Lanius schach*	ចាបដូនតាវាលកន្ទុយវែង			L Known	y	DDF	S	Chhin 2014
Orioles (Oriolidae)										p
	Black-naped Oriole	*Oriolus chinensis*	ចេកទុំកញ្ឆឹងកខ្មៅ				y,z	DDF,SE	S,H	Chhin 2014
	Black-hooded	*Oriolus xanthornus*	ចេកទុំ				x,y,z	DDF,SE	S,H	Chhin 2014

	Oriole		ក្បាលខ្មៅ							
Drongos (Dicruridae)										p
	Black Drongo	*Dicrurus macrocercus*	អន្ទេបខ្មៅ				x,y,z	DDF	H, S	Chhin 2014
	Ashy Drongo	*Dicrurus leucophaeus*	អន្ទេបប្រផេះ				x	DDF	S, H	Chhin 2014
	Bronzed Drongo	*Dicrurus aeneus*	អន្ទេបខ្មៅផ្លែក				z	SE	S, H	Chhin 2014
	Lesser Racket-tailed Drongo	*Dicrurus remifer*	អន្ទេបរំយោលភ្នំ				x,y,z	DDF,SE	S, H	Chhin 2014
	Hair-crested Drongo	*Dicrurus hottentottus*	អន្ទេបកំប៉ោយខ្សែ				z	DDF	C	Chhin 2014
	Greater Racket-tailed Drongo	*Dicrurus paradiseus*	អន្ទេបទងកន្ត្រៃ				z	DDF	H	Chhin 2014
Fantails (Rhipiduridae)										p
	White-browed Fantail	*Rhipidura aureola*	កញ្ជាក់ស្លាចិញ្ចើមស		Thai		y,z	DDF	S, H	Chhin 2014
	Pied Fantail	*Rhipidura javanica*	កញ្ជាក់ខ្មៅស				x,z	DDF	H, S	Chhin 2014
Monarchs & Paradise Flycatchers (Monarchidae)										p
	Black-naped Monarch	*Hypothymis azurea*	សត្វសូគាខៀវ				x,y,z	DDF,SE	S, H, C	Chhin 2014
	Asian Paradise-flycatcher	*Terpsiphone paradisi*	សត្វសូគាអាស៊ី				x,z	SE,SW	S, H	Chhin 2014
Jays, Magpies, Treepies & Crows (Corvidae)										p
	Eurasian Jay	*Garrulus glandarius*	ឆ្នងឆ្នតខ្លួនត្នោត				y,z	DDF	S, H	Chhin 2014
	Red-billed Blue Magpie	*Urocissa erythrorhyncha*	ឆ្នងឆ្នតខៀវ				x,z	DDF	S, H	Chhin 2014
	Rufous Treepie	*Dendrocitta vagabunda*	ឆ្នងឆ្នតលឿង				y	DDF	S, H	Chhin 2014
	Racket-tailed Treepie	*Crypsirina temia*	ត្រមាក់ខ្លាព្រៃ				y,z	DDF,SW	S	Chhin 2014
	Southern Jungle	*Corvus macrorhyn*	ក្អែកគោក				x,z	DDF,SW	S	Chhin 2014

	Crow	*chos*								
Canary-flycatchers (Stenostiridae) & Typical Tits (Paridae)										p
	Grey-headed Canary-flycatcher	*Culicicapa ceylonensis*	ចាបស៊ីរុយ លឿង ក្បាល ប្រផេះ				y	SE	S, H	Chhin 2014
	Grey Tit	*Parus cinereus*	ចាបសំបក ឈើឆ្កួត ទ្រូងខ្មៅ				y	DDF	S, H	Chhin 2014
Larks (Alaudidae)										p
	Indochinese Bushlark	*Mirafra erythrocephala*	ក្រូចស្មៅ ស្លាបត្នោត				y,z	DDF	S	Chhin 2014
Bulbuls (Pycnonotidae)										p
	Black-headed Bulbul	*Pycnonotus atriceps*	ពពិចក្បាល ខ្មៅ				y,z	DDF ,SE	S, H	Chhin 2014
	Black-crested Bulbul	*Pycnonotus flaviventris*	ពពិចក្បាល កំប៉ោយខ្មៅ				x,y ,z	DDF ,SE	S, H	Chhin 2014
	Red-whiskered Bulbul	*Pycnonotus jocosus*	ពពិច ត្រចៀក ក្រហមស		(Thai)		z	SW	S	Chhin 2014
	Sooty-headed Bulbul	*Pycnonotus aurigaster*	ពពិចក្បាល ខ្មៅចុងខ្នង ស				y,z	DDF ,SE	S, H, C	Chhin 2014
	Stripe-throated Bulbul	*Pycnonotus finlaysoni*	ពពិច ពុកមាត់ លឿង				x	DDF	S, H, C	Chhin 2014
	Yellow-vented Bulbul	*Pycnonotus goiavier*	ពពិចក្រូច (ចាបក្រូច)				x,y ,z	DDF	S, H	Chhin 2014
	Streak-eared Bulbul	*Pycnonotus blanfordi*	ពពិច ត្រចៀកឆ្កួត				y,z	DDF ,SE	S, H, C	Chhin 2014
	Puff-throated Bulbul	*Alophoixus pallidus*	ពពិច បំពង់កស ទ្រូងលឿង ចាស់				x,y ,z	DDF ,SE	S, H	Chhin 2014
Martins & Swallows										p

(Hirundinidae)										
	Common/Pale Sand Martin	*Riparia riparia/diluta*	ត្រចៀកកាំប្រផេះវាលទំនាប				z	SW	S	Chhin 2014
	Barn Swallow	*Hirundo rustica*	ត្រចៀកកាំខ្មៅស្រុក				z	SW	S	Chhin 2014
	Red-rumped Swallow	*Cecropis daurica*	ត្រចៀកកាំខ្មៅត្នោតតូច				z	SW	S	Chhin 2014
Leaf Warblers & Seicercus Warblers (Phylloscopidae)										p
	Dusky Warbler	*Phylloscopus fuscatus*	ចាបដូនតាស្លឹកពណ៌ច្រេះតូច				y	DDF	S	Chhin 2014
	Radde's Warbler	*Phylloscopus schwarzi*	ចាបដូនតាស្លឹកពណ៌ច្រេះធំ				z	DDF	S	Chhin 2014
	Arctic Warbler	*Phylloscopus borealis*	ចាបដូនតាស្លឹកអាក់ទិក				y,z	SE,EF,DDF,SW	S, H	Chhin 2014
	Two-barred Warbler	*Phylloscopus plumbeitarsus*	ចាបដូនតាស្លឹកឆ្នូតស្លាបពីរ				z	SE,SW	S	Chhin 2014
	Pale-legged Leaf Warbler	*Phylloscopus tenellipes*	ចាបដូនតាស្លឹកជើងប្រលែត				z	SW	S	Chhin 2014
	Plain-tailed Warbler	*Seicercus soror*	ចាបដូនតាស្លឹកកន្ទុយតំរាប				y	SE	S	Chhin 2014
Acrocephalus warblers (Acrocephalidae)										p
	Oriental Reed Warbler	*Acrocephalus orientalis*	ចាបដូនតាស្មៅធំ				y,z	OP	S	Chhin 2014
	Thick-billed Warbler	*Acrocephalus aedon*	ចាបដូនតាស្មៅចំពុះធំ				y	DDF	S	Chhin 2014
Grasshopper Warblers & Grassbirds (Locustellidae)										p

	Lanceolated Warbler	*Locustella lanceolata*	ចាបដូនតាស្មៅឆ្នូតខ្នង				y,z	DDF	S	Chhin 2014
	Striated Grassbird	*Megalurus palustris*	ចាបក្រុក		(Thai)		y	DDF	S	Chhin 2014
Cisticolas, Prinias & Tailorbirds (Cisticolidae)										p
	Brown Prinia	*Prinia polychroa*	ចាបដង្កូវធំ				y,z	DDF,OP	S, H	Chhin 2014
	Rufescent Prinia	*Prinia rufescens*	ចាបដង្កូវស្លាបពណ៌ច្រេះ				y,z	DDF	S, H	Chhin 2014
	Grey-breasted Prinia	*Prinia hodgsonii*	ចាបដង្កូវទ្រូងប្រផេះ				y,z	DDF	S	Chhin 2014
	Plain Prinia	*Prinia inornata*	ចាបដង្កូវចិញ្ចើមស				y,z	DDF	S	Chhin 2014
	Common Tailorbird	*Orthotomus sutorius*	ចាបតេតស្រុក				x,y,z	DDF.OP	H, S	Chhin 2014
	Dark-necked Tailorbird	*Orthotomus atrogularis*	ចាបតេតព្រៃ				z	SW	S	Chhin 2014
Scimitar Babblers & allies (Timaliidae)										p
	White-browed Scimitar Babbler	*Pomatorhinus schisticeps*	ចាបដូនតាព្រៃចំពុះកោងលឿង				z	SE,SW	S	Chhin 2014
	Rufous-fronted Babbler	*Stachyridopsis rufifrons*	ចាបដូនតាព្រៃថ្ងាស់ច្រេះ			R Range	z	SE,SW	S	Chhin 2014
	Pin-striped Tit Babbler	*Macronous gularis*	ចាបដូនតាព្រៃបំពង់កលឿង				x,y,z	SE, DDF,SW	S, H, C	Chhin 2014
	Chestnut-capped Babbler	*Timalia pileata*	ចាបដូនតាព្រៃបំពង់កស				y,z	DDF,SW	S	Chhin 2014
Fulvettas, Wren-Babblers & allies (Pellorneidae)										p
	Black-browed Fulvetta	*Alcippe grotei*	ចានដូនតាព្រៃចិញ្ចើមវែង		(Thai)		z	SE	S	Chhin 2014

	Abbott's Babbler	*Malacocincla abbotti*	ចាបដូនតាព្រៃចំពុះធំ				z	SW	S, H, C	Chhin 2014
	Scaly-crowned Babbler	*Malacopteron cinereum*	ចាបដូនតាព្រៃបន្ទូលក្បាលស្រកា				x,y	SE, DDF	S, H, C	Chhin 2014
	Puff-throated Babbler	*Pellorneum ruficeps*	ចាបដូនតាព្រៃបំពង់កប៉ោង				x,y,z	SE, DDF	S, H, C	Chhin 2014
Laughingthrushes, Siva & Mesia (Leiothrichidae)										p
	White-crested Laughingthrush	*Garrulax leucolophus*	ចកវ៉ែកកំប៉ោយស				x,y	SE, DDF,SW	H, S	Chhin 2014
	Lesser Necklaced Laughingthrush	*Garrulax monileger*	ចកវ៉ែកវ័ណ្ឌទ្រូងខ្មៅ				z	SE	S	Chhin 2014
Fairy-bluebirds (Irenidae) & Nuthatches (Sittidae)										p
	Asian Fairy-bluebird	*Irena puella*	ចេកទុំខៀវ				x,y,z	SE	S, H, C	Chhin 2014
	Neglected Nuthatch	*Sitta neglecta*	ចាបសំបកឈើពោះច្រេះ				y,z	SE, DDF	S	Chhin 2014
	Velvet-fronted Nuthatch	*Sitta frontalis*	ចាបសំបកឈើចំពុះក្រហម				y,z	SE	S	Chhin 2014
Mynas & Starlings (Sturnidae)										p
	Golden-crested Myna	*Ampeliceps coronatus*	សារិកាកែវក្បាលលឿង		(Lao,Thai)		z	SE	S	Chhin 2014
	Common Hill Myna	*Gracula religiosa*	សារិកាកែវវង		(Thai)		y,z	SE, DDF	S, H	Chhin 2014
	White-vented Myna	*Acridotheres grandis*	សារិកាកែវក្របី(រាជក្របី)				y,z	DDF	S	Chhin 2014
	Common Myna	*Acridotheres tristis*	សារិកាកែវគោ(រាជ				x,y,z	DDF	S, H	Chhin 2014

			គោ)							
	Vinous-breasted Myna	*Acridotheres burmannicus*	កញ្ជ្រៀកទ្រូងត្នោត				y	DDF	S	Chhin 2014
	Black-collared Starling	*Gracupica nigricollis*	គ្រលឹងគ្រលោង(កញ្ជ្រៀចវណ្ណកខ្មៅ)				x,y,z	DDF	S	Chhin 2014
	Chestnut-tailed Starling	*Sturnus malabaricus*	កញ្ជ្រៀចកន្ទុយត្នោត				y,z	DDF	S	Chhin 2014
Thrushes, Cochoas & Shortwings (Turdidae)										p
	Dusky Thrush	*Turdus eunomus*	ពពិចថ្ម្រទ្រូងបន្តក់				y	DDF	S	Chhin 2014
Robins, Forktails, Chats & Rock Thrushes (Muscicapidae)										p
	Oriental Magpie Robin	*Copsychus saularis*	ស្វាចេកស្រុក				y	DDF	S, H	Chhin 2014
	White-rumped Shama	*Copsychus malabaricus*	ស្វាចេកព្រៃ				x,z	DDF	S, H, C	Chhin 2014
	Eastern Stonechat	*Saxicola maurus*	ពពិចស្មៅត្រចៀកស				y	DDF	S, H	Chhin 2014
	Pied Bushchat	*Saxicola caprata*	ពពិចស្មៅខ្នងស				z	DDF	S	Chhin 2014
	Blue Rock-thrush	*Monticola solitarius*	ពពិចថ្មខៀវ				y,z	SE, DDF,SW	S, H	Chhin 2014
	White-throated Rock-thrush	*Monticola gularis*	ពពិចថ្មបំពង់កស				z	SE	S	Chhin 2014
Flycatchers & allies (Muscicapidae)										p
	Asian Brown Flycatcher	*Muscicapa dauurica*	ចាបស៊ីរុយត្នោតព្រៃ				y,z	OP	S, H	Chhin 2014
	Yellow-rumped Flycatcher	*Ficedula zanthopygia*	ចាបស៊ីរុយចុងខ្នងលឿង				y,z	SE,SW	H	Chhin 2014
	Taiga Flycatcher	*Ficedula albicilla*	ចាបស៊ីរុយត្នោតស្រុក				y,z	DDF,SE	S, H	Chhin 2014

	Verditer Flycatcher	*Eumyias thalassinus*	ចាបស៊ីរុយពណ៌ទឹកសមុទ្រ				y	SE	S, C	Chhin 2014
	Hainan Blue Flycatcher	*Cyornis hainanus*	ចាបស៊ីរុយខៀវហៃណាន				y,z	SE	S, C	Chhin 2014
	Tickell's Blue Flycatcher	*Cyornis tickelliae*	ចាបស៊ីរុយខៀវវាលទំនាប				z	SE,SW	S	Chhin 2014
	Blue-throated Flycatcher	*Cyornis rubeculoides*	ចាបស៊ីរុយខៀវបំពង់កខៀវ				x,z	SE	S, H, C	Chhin 2014
Leafbirds (Chloropseidae)										p
	Blue-winged Leafbird	*Chloropsis cochinchinensis*	ចេកខ្ចីស្លាបខៀវ				y,z	SE	S	Chhin 2014
	Golden-fronted Leafbird	*Chloropsis aurifrons*	ចេកខ្ចីថ្ងាសភ្លើង				x,y	SE, DDF	S	Chhin 2014
Flowerpeckers (Dicaeidae)										p
	Thick-billed Flowerpecker	*Dicaeum agile*	ចាបកន្លង់ចំពុះធំ				z	SE	S, H	Chhin 2014
	Yellow-vented Flowerpecker	*Dicaeum chrysorrheum*	ចាបកន្លង់គូថលឿង				y,z	SE	S, H	Chhin 2014
	Scarlet-backed Flowerpecker	*Dicaeum cruentatum*	ចាបកន្លង់ចខ្នងក្រហម				x,y,z	DDF,OP	S	Chhin 2014
Sunbirds & Spiderhunters (Nectariniidae)										p
	Ruby-cheeked Sunbird	*Chalcoparia singalensis*	ចាបកន្លង់បំពង់ក្រហម				y,z	SE	S	Chhin 2014
	Brown-throated Sunbird	*Anthreptes malacensis*	ចាបកន្លង់បំពង់កត្នោតចាស់				x,z	DDF	S	Chhin 2014
	Van Hasselt's Sunbird	*Leptocoma brasiliana*	ចាបកន្លង់ទ្រូងក្រហម				z	SE	S	Chhin 2014

	Purple Sunbird	*Cinnyris asiaticus*	ចាបកន្លង់ខៀវចាស់				x	SE, DDF	S	Chhin 2014
	Olive-backed Sunbird	*Cinnyris jugularis*	ចាបកន្លង់ពណ៌អូលីវ				y,z	SE,SW	S, H	Chhin 2014
	Little Spiderhunter	*Arachnothera longirostra*	ចាបពីងពាងតូច				z	SE,SW	S	Chhin 2014
Sparrows (Passeridae)										p
	Plain-backed Sparrow	*Passer flaveolus*	ចាបស្រុក				y,z	DDF ,OP	S	Chhin 2014
	Eurasian Tree Sparrow	*Passer montanus*	ចាបផ្ទះ				y,z	OP	S	Chhin 2014
Weavers (Ploceidae)										p
	Baya Weaver	*Ploceus philippinus*	ចាបពូកទ្រូងត្នោតលាត		(Lao,Thai)	N-Thr.	y	DDF	S	Chhin 2014
Avadavat, Munias & Parrotfinches (Estrildidae)										p
	White-rumped Munia	*Lonchura striata*	ចាបចង្រៃង់ចុងខ្នងស				z	DDF ,OP	S	Chhin 2014
	Scaly-breasted Munia	*Lonchura punctulata*	ចាបចង្រៃង់ទ្រូងស្រកា				z	OP	S	Chhin 2014
Wagtails & Pipits (Motacillidae)										p
	Forest Wagtail	*Dendronanthus indicus*	ខ្ចប់ដីព្រៃ				y,z	DDF ,OP	S	Chhin 2014
	Eastern Yellow Wagtail	*Motacilla tschutschensis*	ខ្ចប់ដីពោះលឿង				y,z	SW	S	Chhin 2014
	Paddyfield Pipit	*Anthus rufulus*	ក្រូចអិនវាលស្រែតូច				y,z	OP	S	Chhin 2014
	Olive-backed Pipit	*Anthus hodgsoni*	ក្រូចអិនខ្នងពណ៌អូលីវ				y	DDF	S	Chhin 2014
Buntings (Emberizidae)										p
	Yellow-breasted Bunting	*Emberiza aureola*	ចាបព្រៃវែងពោះលឿង	GT-Vu	(Thai)	N-Thr.	y	DDF ,OP	S	Chhin 2014

Appendix V Herpetofauna species known to occur at Prey Lang

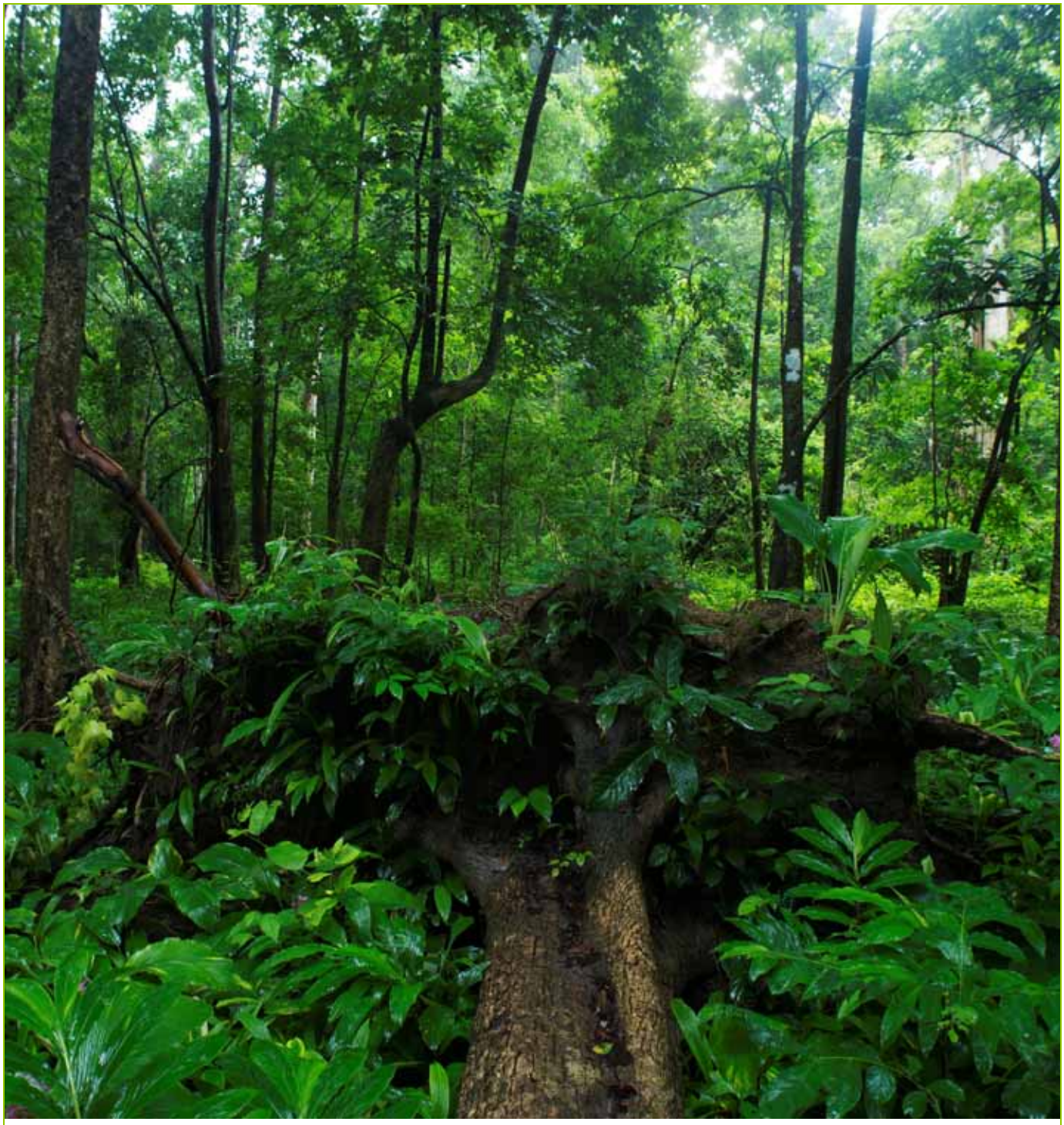
Scientific names	English name	IUCN status	Localities	Sources
Amphibians				
Bufonidae				
Duttaphrynus melanostictus	Common Asian toad	LC	C3	This survey
Ingerophrynus macrotis	Large-ear toad	LC	C2	This survey
Microhylidae				
Kalophrynus interlineatus	Striped sticky frog	LC	C4	This survey
Kaloula pulchra	Common Asian bullfrog	LC	SPV	This survey
Microhyla berdmorei	Berdmor's narrow mouth frog	LC	C3	This survey
Microhyla butleri	Painted narrow-mouth frog	LC		Olsson & Emmett (2007)
Microhyla fissipes	Ornate narrow mouth frog	LC	C1, C3	This survey
Microhyla heymonsi	Dark-side narrow mouth frog	LC	C1, C2	This survey
Microhyla pulchra	Beautiful narrow mouth frog	LC	C3	This survey
Micryletta inornata	Spotted narrow mouth frog	LC	C3	This survey
Ranidae				
Hylarana mortenseni	Mortensen's frog	NT	C1, C2	This survey
Hylarana erythraea	Red-eye frog	LC	C1	This survey
Pelochylax lateralis	Korakit frog	LC	C3	This survey
Dicroglossidae				
Fejervarya limnocharis	Paddy frog	LC	C1, C2	This survey
Hoplobatrachus rugulosus	Rugulose bullfrog	LC	C1	This survey
Limnonectes dabanus	Annam wart frog	DD	C1, C2, C5	This survey
Occidozyga lima	Green floating frog	LC	C1	This survey
Occidozyga martensii	Marten's floating frog	LC	C1	This survey
Rhacophoridae				

Chiromantis nongkhorensis	Nong khor'bush frog	LC	C1	This survey
Chiromantis vittatus	Striped bush frog	LC		Olsson & Emmett (2007)
Polypedates leucomystax	Common treefrog	LC	C1, C2	This survey
Theloderma stellatum	Spotted warty frogs	NT	C3	This survey
Subtotal=22 species				
Reptiles				
Turtles				
Bataguridae				
Cuora amboensis	Asian box turtle	VU		Olsson & Emmett (2007)
Cyclemys oldhemii	Black plastron leaf turtle	NE		This survey
Heosemys grandis	Asian giant pond turtle	VU		Olsson & Emmett (2007)
Indotestudo elongata	Elongated tortoise	EN		Olsson & Emmett (2007)
Geoemydidae				
Siebenrockiella crassicollis	Black marsh turtle	VU	C1	This survey
Trionychidae				
Amyda cartilaginea	Asiatic softshell turtle	VU		Olsson & Emmett (2007)
Lizard				
Agamidae				
Calotes versicolor	Common garden lizard	NE	C2, C3	This survey
Calotes mystaceus	Blue crested lizard	NE	C3	This survey
Draco maculatus	Spotted gliding lizard	LC	C2	This survey
Physignathus cocincinus	Water dragon	NE	C1	This survey
Gekkonidae				
Hemidactylus platyurus	Plat tailed gecko	NE	C1, C3	This survey
Dixonius siamensis	Siamese gecko	NE	C1, C3	This survey

Gekko gecko	Tockay gecko	NE	SPV,C1,C2, C3	This survey
Gekko petricolus	Sandstone gecko	NE	C2, C3	This survey
Hemidactylus frenatus	House gecko	NE	C2	This survey
Lacertidae				
Takydromus sexlineatus	Asian grass lizard	LC	C4	This survey
Scincidae				
Eutropis longicaudata	Long tailed sun skink	NE	SPV, C3	This survey
Eutropis macularia	Speckled forest skink	NE	C1, C4	This survey
Eutropis multifasciata	Common Asian skink	NE	C1	This survey
Lygosoma bowringii	Bowring's skink	NE	C3	This survey
Lygosoma sp.	Short limb supple skink	NE	C3	This survey
Scincella rupicola	Red tailed skink	NE	C2, C3	This survey
Sphenomorphus maculatus	Stream skink	NE	C1, C2	This survey
Sphenomorphus stellatus	Starry forest skink	NE	C2	This survey
Lipinia vittigera	Striped tree skink	NE	C2	This survey
Varanidae				
Varanus bengalensis	Land monitor lizard	LC	C1	This survey
Snakes				
Pythonidae				
Malayopython reticulatus	Reticulate python	NE	C1	This survey
Homalopsidae				
Enhydris bocourti	Bocourt's water snake	NE	C1	This survey
Enhydris plumbea	Yellow belly water snake	LC	SV	This survey
Homalopsis buccata	Puff-face water snake	NE	C1	This survey
Colubridae				
Ahaetulla prasina	Asian vine snake	LC	C4	This survey
Boiga cyanea	Green cat snake	NE	C3	This survey

Boiga siamensis	Siamese big eye snake	NE		Olsson & Emmett (2007)
Xenochrophis flavipunctatus	Chequerred keeled back snake	NE	C1	This survey
Dendrelaphis subocularis	Brown keeled back snake	LC	SPV, C3	This survey
Pareas margaritophorus	Slug snake	NE	C1	This survey
Psammodynastes pulverulentus	Mock viper	NE	C1	This survey
Elaphidae				
Bungarus candidus	Black-white banded krait	LC	C2	This survey
Bungarus fasciatus	Black yellow banded krait	LC	C5	This survey
Naja kaouthia	Monocellate cobra	LC		Sighting (2001), NT*
Naja siamensis	Spitting cobra	VU	C3	This survey
Ophiophagus hannah	King cobra	VU		Sighting (1999), NT*
Viperidae				
Calloselasma rhodostoma	Malayan pitviper	LC	C2	This survey
Trimeresurus macrops	Large eyed Pitviper	LC	C1	This survey
Xenopeltidae				
Xenopeltis unicolor	Sunbeam snake	LC		Olsson & Emmett (2007)
Subtotal of 45 species				

*Neang Thy *pers obs*



Conservation International, Greater Mekong
PO Box 1356
Phnom Penh, Cambodia
Tel: +855 (0)23 214 627
info-cicambodia@conservation.org
www.conservation.org

Winrock International
USAID Supporting Forests and Biodiversity Project
Room 588, Building F
Phnom Penh Center
Phnom Penh, Cambodia
Tel: +855 (0)23 220 714
infosfb@winrock.org