

Rapid Herpetofauna Assessment at Tumring REDD+ Community Forests in Kampong Thom Province, Cambodia

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នៅជុំវិញតំបន់ការពារដែនជម្រកសត្វព្រៃ-ព្រៃឡង់ មានព្រៃសហគមន៍ជាច្រើនកន្លែង ដែលបច្ចុប្បន្នកំពុងត្រូវបានគ្រប់គ្រងដោយសហគមន៍មូលដ្ឋានផ្ទាល់។ ក្នុងចំណោម ព្រៃសហគមន៍ទាំងនោះ មានព្រៃសហគមន៍ចំនួន ០៨ កន្លែងនៅក្នុងខេត្តកំពង់ធំ ត្រូវបានគេបញ្ចូលក្នុងគម្រោងសាកល្បង “អដបូក (REDD+)” នៅទីរឹង ដែលព្រៃសហគមន៍ទាំងនេះទំនងជាគាំទ្រដល់ភាពសម្បូរបែបនៃសត្វព្រៃ ប៉ុន្តែការស្រាវជ្រាវ និងតាមដានវត្តមានសត្វព្រៃនៅតំបន់ទាំងនេះហាក់នៅមានកម្រិតនៅឡើយ ជាពិសេស ការសិក្សាពីល្អន និងថលជលិកសត្វ។ ដើម្បីប្រមូលទិន្នន័យបឋមសម្រាប់គម្រោង “អដបូក (REDD+)” នៅទីរឹង ការសិក្សាស្រាវជ្រាវអំពីសត្វល្អន និងថលជលិកសត្វត្រូវបានធ្វើឡើងនៅទីតាំងព្រៃសហគមន៍គោលដៅចំនួន ០៨ កន្លែង។ វិធីសាស្ត្រស្រាវជ្រាវតាមរយៈការប្រើប្រាស់ឱកាសនៃការស្វែងរក និងការដាក់អន្ទាក់ជីកដី ត្រូវបានអនុវត្តចំពោះការសិក្សាអំពីវត្តមានប្រភេទល្អន និងថលជលិកសត្វ ហើយប្រភេទសត្វដែលចាប់បានត្រូវបានថតរូប ហើយដោះលែងទៅវិញ ដោយមិនបង្កគ្រោះថ្នាក់ដល់ពួកវាឡើយ។ ល្អនចំនួន ២០ ប្រភេទ និងថលជលិកចំនួន ១៦ ប្រភេទ (សរុបចំនួន ៣៦ ប្រភេទ) ត្រូវបានកត់ត្រាពីការសិក្សានៅព្រៃសហគមន៍ទាំង ០៨ ហើយប្រភេទទាំងនោះ ភាគច្រើនស្ថិតនៅក្នុងក្រុម “មានការព្រួយបារម្ភតិចបំផុត” នៅក្នុងបញ្ជីក្រហម IUCN។ ចំពោះថលជលិកសត្វដែលជួបប្រទះច្រើនជាងគេគឺ ប្រភេទហ្នឹងហ្នឹងស៊ីស ហើយចំពោះល្អនគឺប្រភេទប្លែងឆ្មួតខ្នងធំ។ ព្រៃសហគមន៍អូរក្រញ៉ាក់ជាទីតាំង ដែលមានល្អននិងថលជលិកសត្វច្រើនប្រភេទបំផុត ដោយសារទីតាំងនេះនៅមានអូរទឹកហូរ និងមានវាលកក់ ដែលជាទីជម្រកល្អប្រសើរសម្រាប់ល្អននិងថលជលិកទាំងនោះអាចរក្សាភាពសកម្មរបស់វាក្នុងរដូវប្រាំងបាន។ ព្រៃអង្កែនជាទីតាំងដែលមានភាពចម្រុះទាបជាងគេនៃវត្តមានល្អន និងថលជលិកសត្វ ដោយសារព្រៃនៅទីតាំងនោះមានភាពស្ងួតរហូតដល់ខ្លាំង ហើយនៅជាប់ឆ្ងាយពីព្រៃសហគមន៍

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ផ្សេងៗទៀត។ តាមរយៈការស្រាវជ្រាវនេះ យើងសង្កេតឃើញថា ការកាប់ឈើ និងការដាក់អន្ទាក់ចាប់សត្វខុសច្បាប់គឺជាកត្តាគំរាមកំហែងចម្បងនៅតំបន់ព្រៃសហគមន៍ទាំងនេះ។ របកគំហើញនៃការសិក្សាស្រាវជ្រាវនេះអាចផ្តល់ទិន្នន័យជាបញ្ជីឈ្មោះប្រភេទល្អិត និងថលជលិកសត្វ សម្រាប់ជួយគាំទ្រដល់ការអភិវឌ្ឍកម្មវិធីសិក្សាតាមដាន និងអភិរក្សនៅតំបន់ព្រៃសហគមន៍ទាំងនោះ។ ការសិក្សាស្រាវជ្រាវបន្ថែមអំពីល្អិតនិងថលជលិកសត្វ ការអភិរក្ស និងស្តារអេកូឡូស៊ីព្រៃឈើឡើងវិញ ជាពិសេស គឺការថែរក្សាការពារអុរ និងវាលភក់ធម្មជាតិ និងការទប់ស្កាត់ការកាប់បំផ្លាញព្រៃឈើនិងការដាក់អន្ទាក់ចាប់សត្វខុសច្បាប់នៅព្រៃសហគមន៍ទាំងនេះគួរតែត្រូវបានធ្វើជាប្រចាំ។

ABSTRACT

Many community forests are located in the area surrounding the Prey Lang Wildlife Sanctuary, which is currently managed by the local communities. Among those, eight community forests in Kampong Thom province have been included in the pilot project of Tumring REDD+. While these areas are likely to support a high diversity of wildlife, a limited amount of wildlife research and monitoring has been conducted for them, especially herpetofauna studies. To support Tumring REDD+-related work, research was conducted to collect information of herpetofauna species in the targeted eight community forests. Opportunistic searches for amphibians and reptiles and pitfall traps, were applied to collect data. Captured species were photographed and released back unharmed. A total of 36 herpetofauna species (16 amphibian and 20 reptile species) were recorded across all survey sites. Most of the recorded species from this survey are listed as of the Least Concern by the IUCN Red List. The most detected amphibian species were *Microhyla fissipes* and *Eutropis macularia* reptile species. In terms of diversity scores, the O’Kranhak community forest was identified as the site with the highest diversity for herpetofauna species, and this area was observed to contain more flowing streams and puddles than other studied sites. This good habitat condition supports more species and organisms’ ability to keep active even in the dry season. The lowest diversity score was at Prey Ang Taen Forest. This area was observed to be more degraded and isolated from other forest fragments. Illegal logging and wildlife hunting were observed as the main threats to these community forests. Our findings provide a species list of the herpetofauna in these studied community forests useful for supporting the development of long-term biodiversity monitoring and conservation. We recommend conducting further study and restoration of these community forests, preservation of swamps and streams, and tackling illegal logging and wildlife hunting in these areas.

1. Introduction

Herpetofauna is a term used to include both amphibians and reptiles (Megantara et al., 2022). They are cold-blooded, and their body temperature fluctuates according to the surrounding environment. This animal group serves as an important component in aquatic and terrestrial ecosystems because they fill a critical role as prey for birds, fish, and mammals, and as predators of terrestrial and aquatic insects (Do et al., 2022). Herpetofauna, especially the amphibians, are very sensitive to environmental changes and habitat disturbance, so they are often considered bio-indicators for environmental health and habitat quality (Saber et al., 2017). However, many populations of the herpetofauna species are in decline and even threatened with extinction due to the result of habitat loss, climate change, diseases, pet trade, introduced species, rapid urbanization, intensification of agriculture, and their over-exploitation for consumption (Valencia-Zuleta et al., 2014).

The herpetofauna are known to be the oldest extant animal group of terrestrial vertebrates, and they compose a vast amount of diversity, with more than 6800 amphibian species and 9700 reptile species currently recorded (Lesbarrères et al., 2014). Amphibians are classified into three orders, including Anura (the amphibians without tails: frogs, toads, tree frogs); Caudata (or Urodela, the amphibians with tails: salamanders and newts); and Gymnophiona (or Apoda, the legless amphibians: caecilians) (Neang & Holden, 2008). There are four main groups of reptiles, which include Crocodylia (crocodiles and alligators), Squamata (lizards & snakes), Testudines (turtles), and Sphenodontia (tuataras) (Pincheira-Donoso et al., 2013). As part of the Indo-Burma biodiversity hotspot, Cambodia is known to host an extremely

rich number of species of herpetofauna (Geissler et al., 2019). However, the herpetofauna studies in Cambodia are still unevenly distributed throughout the country. For the purpose of biodiversity conservation and scientific research, herpetofauna surveys have been conducted in several natural forest areas, mainly concentrated in the Cardamom Mountains of the southwest (Daltry & Wüster, 2002; Murdoch et al., 2019; Neang et al., 2014) and in northeastern Cambodia (Rowley et al., 2010). Other herpetofauna studies have been conducted in Phnom Kulen National Park, Siem Reap Province (Geissler et al., 2019) and Prey Lang Wildlife Sanctuary, located in Cambodia’s central lowlands (Hayes et al., 2015).

Prey Lang Wildlife Sanctuary (PLWS) covers an area of 431,683 hectares and lies within parts of the provinces of Kampong Thom, Preah Vihear, Stung Treng, and Kratie. Prey Lang Wildlife Sanctuary was established by Sub-Decree No.74, which was issued on 09 May 2016. In the herpetofauna survey Neang Thy led in 2015, 67 species of herpetofauna were recorded in PLWS. Among the 67 recorded species, there were 22 species of amphibians and 45 species of reptiles (Hayes et al., 2015). Recently, two new reptile species were found in PLWS (specifically at Phnom Chi). These two new reptile species were named the Prey Lang Forest Skink (*Spenomorphus preylangensis*), which was recorded in 2019, and the Phnom Chi Bent-toes Gecko (*Cyrtodactylus phnomchiensis*), which was recorded in 2020 (Grismer et al., 2019; Neang et al., 2020).

There are many community forests located in the areas surrounding the PLWS, which means that the forests are being managed by the local community. Among those, eight

community forests in Sandan and Santuk districts, Kampong Thom province, have been included in the pilot project of “Tumring REDD+,” which is being implemented and managed by the Forestry Administration of the Ministry of Agriculture, Forestry and Fisheries. The Tumring REDD+ project covers an area of 41,166 hectares and lies at the southwestern edge of PLWS; it is a multi-partner initiative designed to promote climate change mitigation and adaptation, restore and protect biodiversity, and improve local people’s livelihoods, under the UN scheme of Reducing Emissions from Deforestation and forest Degradation (REDD+). These community forests of the Tumring REDD+ project remain in good condition and are likely to support a high level of wildlife diversity, especially for species of significance for global conservation. However, there has been insufficient wildlife research and monitoring in these areas, especially herpetofauna studies.

To achieve better wildlife protection and conservation in the community forests under Tumring REDD+ related activities, collecting information and providing baseline data on wildlife species in these community forest areas is crucial. In December 2021, the Department of Wildlife and Biodiversity of the Forestry Administration cooperated with the Centre for Biodiversity Conservation of the Royal University of Phnom Penh (RUPP) to conduct a rapid assessment of herpetofauna in the community forest areas related to the Tumring REDD+ program. The objective of this assessment was to complete a scientific survey to collect information on herpetofauna species in the targeted community forest areas, with a specific focus on species ‘richness’ and ‘abundance’. A species list of the herpetofauna in those community forest areas is the logical first step in undertaking a long-term biodiversity monitoring project.

2. Research Methodology

The herpetofauna survey fieldwork was carried out from 06-15 December 2021 at eight community forest sites located in Sandan and Santuk districts, Kampong Thom province (Fig. 1). These community forests are included in the pilot implementation of the “Tumring REDD+” program, which covers a total area of 41,166 hectares. The eight community forests include the following: O’Kranhak, O’Ta Tey, O’Kranhoung, O’Das Skor, Bos Leav, Hong Chamtit, Water Cycle Forest Research Station (Prey Ang Taen), and Labos Sral. These eight studied community forests are located in lowland areas (with the elevation ranging from 41-107 m asl.), which are separated from the larger forest of Prey Lang Wildlife Sanctuary and are surrounded by cassava and cashew nut plantations.

The main habitat of these community forests can be described as semi-evergreen forests, and there are many dipterocarp tree species that remain dominant and distributed throughout each area. These community forests also maintain a high number of resin tree species, and local communities were observed practicing their traditional resin-tapping methods. Swamps and streams are the important forms of water storage found in these community forests, and they

provide suitable habitat conditions for amphibians and reptiles, as well as other wildlife species in the areas.

Due to the fact that some reptiles and amphibians are active during the day and others are active at night, a group of four or five surveyors conducted the search at different times. The opportunistic process of searching for amphibians and reptiles was undertaken by walking slowly and searching on the ground, in grasses, in vegetation, in puddles, in tree holes, in wood lodges, and in trees along forest trails and streams.

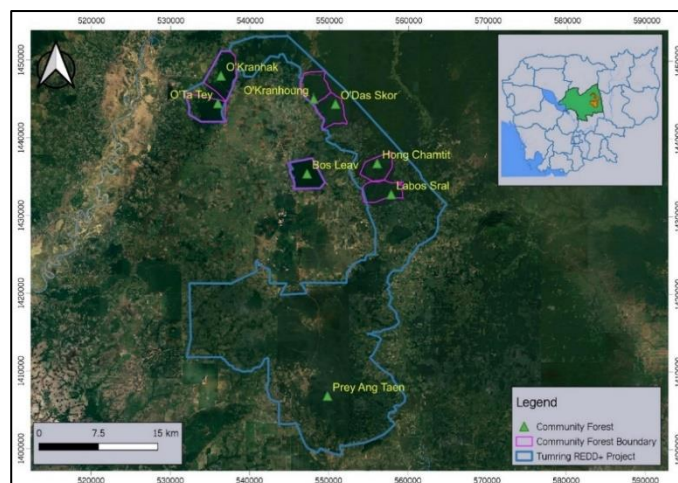


Fig. 1. Map showing the studied location of eight community forests (CFs) in Kampong Thom province.

During the daytime search, researchers walked along forest trails and looked for herpetofauna species on the ground, under leaf litter, and underwood lodges (seeking snakes, frogs, and skinks). We also looked in the trees for other species. At night, in each community forest area, researchers walked along the streams and forest trails to find nocturnal species. We deployed six pitfall traps of plastic buckets, with drift fences to prevent animals from passing, at “Bos Leav” in order to capture ground-dwelling species such as small snakes, skinks, and some other small frog species. Most species that we found were photographed, had their location recorded, and were kept in plastic bags with enough air so that we could photograph them the next morning and then release them unharmed. Amphibian and reptile species were identified by using field guides such as *Amphibians of Cambodia* (Neang & Holden, 2008), *Reptiles of Southeast Asia* (Das, 2015), and other online sources.

To analyze the herpetofauna from the eight community forests, four measurements were utilized, including taxonomic richness, Shannon-Wiener’s diversity, Pielou’s evenness, and abundance. Shannon-Wiener’s diversity (H') and Pielou’s evenness (J) were calculated using the vegan package of R (Oksanen et al., 2020). All statistical analyses were performed with the R software version 4.1.1 (R Core Team, 2021).

3. Results and Findings

3.1 Total species richness and abundance

A total of 36 herpetofauna species, comprised of 16 amphibian and 20 reptile species, were found in this study. They were recorded in the field research across the eight community forest areas (see Annex 1 for the full species list). The recorded 16 amphibian species (Annex 2) belonged to twelve genera and five families. The highest amphibian species richness was recorded in the Microhylidae family (7 species), followed by Dicroglossidae (4 species), Ranidae and Rhacophoridae (2 species each), and Bufonidae (1 species). The 20 recorded reptile species (Annex 3) belonged to 6 families: Colubridae (6 species), Gekkonidae (5), Scincidae (4), Agamidae (3), Elapidae (1), and Homalopsidae (1). Among the 36 herpetofauna species recorded in this study, only a single species, the Indochinese Water Dragon (*Physignathus cocincinus*), is listed as “Vulnerable”, while the rest are listed as “Least Concern” by the IUCN Red List (IUCN, 2021).

Among the recorded species of amphibians, some species were found to have a high number of individuals, while for others, a very low number was detected. Among the 16 species of amphibians, the Ornate Pigmy Frog (*Microhyla fissipes*) is the species that has the highest abundance, with a record of 86 individuals, followed by Paddy Frog (*Fejervarya limnocharis*) with an abundance of 66 individuals recorded. Some species were detected in very low numbers, such as the Burmese Squat Frog (*Calluella guttulata*) with only one detection, followed by Spotted Narrow-mouthed Frog (*Kalophrynus interlineatus*) and Mada Paddy Frog (*Micryletta erythropoda*) with two individuals detected (Fig. 2).

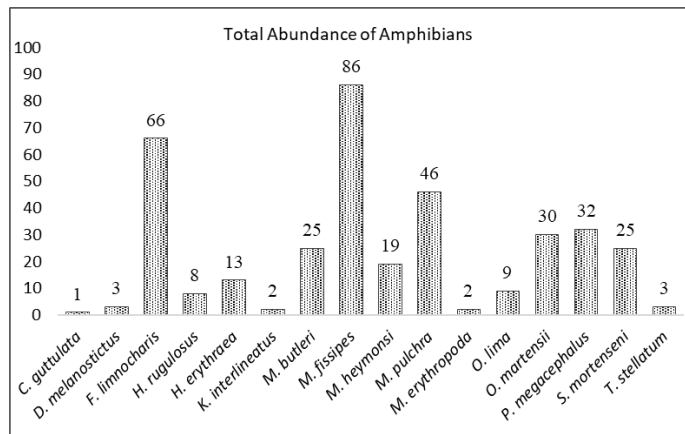


Fig. 2. Abundance of recorded amphibian species across all survey sites.

For reptiles, the most abundant species was the Speckled Forest Skink (*Eutropis macularia*), with 55 individuals detected, followed by Tokay Gecko (*Gekko gekko*), with an abundance of 24 individuals, while the rest were found in very low abundance. There was only one individual detected of the following species: Malayan Krait (*Bungarus candidus*), Green Cat Snake (*Boiga cyanea*), Many-spotted Cat Snake (*Boiga multomaculata*), Ornate Flying Snake (*Chrysopelea ornata*), Yellow Belly Water Snake (*Enhydryis cf. plumbea*), Stump-toed Gecko (*Gehyra mutilata*), Striped Tree Skink (*Lipinia vittigera*), Ashy Kukri Snake (*Oligodon cf. cinereus*), Indochinese Water Dragon (*Physignathus cocincinus*), and Common Mock Viper (*Psammodynastes pulverulentus*) (Fig. 3).

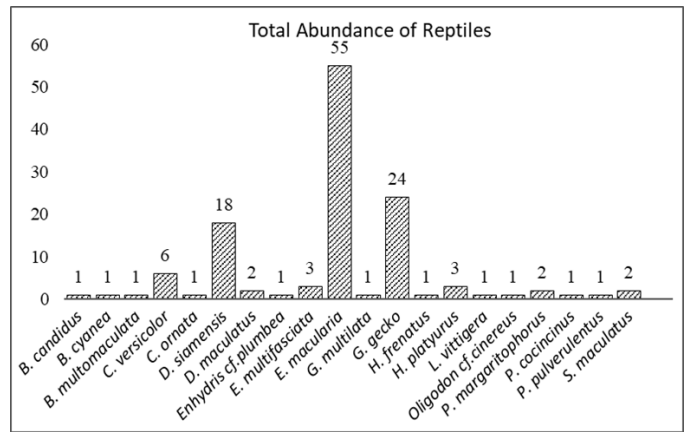


Fig. 3. Abundance of recorded reptile species across all survey sites.

3.2 Taxonomic richness, diversity & abundance at each site

The herpetofauna species richness and abundance recorded at each survey site of the eight community forests varied (see Annex 4 for the species list recorded at each community forest). The highest herpetofauna richness was recorded in Bos Leav (17 species), while the highest abundance was recorded in the O’Kranhoung community forest (117 individuals). The site with the lowest species richness and individual detections was in the O’Ta Tey community forest, where only 11 species and 23 individuals were recorded (Fig. 4). The Shannon diversity index showed that the highest and lowest herpetofauna diversity was at O’Kranhak (2.383) and Prey Ang Taen (1.873), respectively (Table 1).

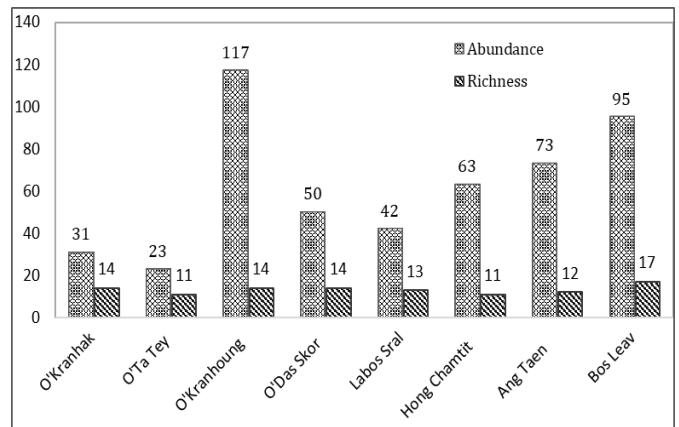


Fig. 4. Species richness and abundance at each community forest.

4. Discussion

Even though the survey was conducted relatively short and carried out in only eight community forest sites, 36 herpetofauna species (16 amphibian and 20 reptile species) were recorded from all survey sites. Most of them are listed as of the least concern by the IUCN Red List. This finding is approximately equal to 53.7% of the total recorded herpetofauna species (67 species) from the nearby Prey Lang Wildlife Sanctuary (Hayes et al., 2015).

Table 1. Herpetofauna diversity, species richness, and evenness at the survey site.

No.	Community Forests	H' Shannon	Richness	Evenness
1	O'Kranhak	2.38	14	0.90
2	O'Ta Tey	2.22	11	0.92
3	O'Kranhoung	1.93	14	0.73
4	O'Das Skor	2.30	14	0.87
5	Labos Sral	2.33	13	0.91
6	Hong Chamtit	2.00	11	0.83
7	Prey Ang Taen	1.87	12	0.75
8	Bos Leav	2.13	17	0.75

Fig. 4 describes the record of herpetofauna species richness and abundance at each community forest. Our survey records are equal to the 72.7% of amphibians and 44.4% of reptiles recorded in Prey Lang Wildlife Sanctuary (PLWS). Based on Hayes et al. (2015), the highest abundance among the amphibians recorded from the PLWS was found for the narrow-mouth frog *M. fissipes*. Similarly, it was also the most detected species in our studied community forests. The Speckled Forest skink (*E. macularia*) can be considered a common species in these community forests as it has the highest recorded abundance and was detected in every site surveyed.

Among the two applied techniques, the drift fences with pitfall traps were not good in providing results because the researchers had only a very short time to survey each site. So, it was only set up at one site along a stream in the "Bos Leav Community Forest". The stream was relatively dry, and only a single species of the skink (*E. macularia*) was caught. The opportunistic sampling and searching produced much better results due to the use of observers walking during the day along forest trails and at night along the streams and puddles. This gave researchers a greater chance to record species and individuals by exploring more areas in each site. It was a suitable method to collect herpetofauna counts in the areas, while the pitfall trap captured fewer animals. This conclusion is similar to the analysis of findings mentioned by Ali et al. (2018).

Among the eight survey sites, Bos Leav community forest was found to have the highest species richness and the second-highest abundance. This site is surrounded by cashew and cassava plantations and has swamps inside that can attract more species from surrounding areas into the site. The lowest numbers of species richness and abundance were recorded in the O'Ta Tey community forest. This site was found to be relatively dry, and researchers could not find a stream on this site, and only a few puddles were found along the trails. This condition likely contributes to the scarcity of herpetofauna diversity in the area, especially amphibians, as water availability can influence their reproduction and survival (Walls et al., 2013). In terms of diversity scores, the highest score was detected in O'Kranhak community forest, and this area has more flowing streams and puddles than other sites. This condition supports more species, even in the dry season. The lowest diversity score was recorded at Prey Ang Taen where the forest was observed to be more degraded and isolated from other sites.

The studied community forests might maintain more species of amphibians and reptiles, as some might not have been detected during the search due to the limited time frame spent for detection and the dryness of many areas, which is not preferable for some species as there is less prey available than during the wet season (De Oliveira & Haddad, 2015). Additionally, signs of illegal logging and hunting in the community forests were observed. A type of snare called "Duo" in Khmer was seen and was reported to be set up by the local people along the streams inside those survey forest areas to catch amphibian and reptile species, including snakes, frogs, and turtles. Based on Tohir et al. (2021), human disturbance activities such as illegal logging and hunting could degrade the richness and abundance of amphibian and reptile species.

5. Conclusions and Recommendations

A rapid assessment of the herpetofauna in the eight community forests under the Tumring REDD+ project was revealed. Through this assessment, 36 species of herpetofauna (16 amphibian species and 20 reptile species) were recorded. The results from this survey show that these community forests support a moderate level of diversity in the herpetofauna community, with a diversity index (H') ranging from 1.87 to 2.38. O'Kranhak community forest supports the highest diversity of herpetofauna (H' = 2.38), and this area contains more water (flowing streams and puddles) than other sites. Prey Ang Taen supports the lowest herpetofauna diversity (H' = 1.87), which is likely because this area's forest is degraded and isolated from other community forests. Regarding species richness by family, the families of Microhylidae and Colubridae represented the most abundant group for amphibians and reptiles, respectively. It was found that the Ornate pigmy frog (*M. fissipes*) was the most detected amphibian species, and the Speckled Forest skink (*E. macularia*) was the most detected reptile species in the studied community forests.

Based on the field observation and findings from our survey, the following recommendations can be made: (1) Conduct further study with more effort and expand the survey time to confirm the presence of other herpetofauna species in these community forests. Importantly, further surveys should be conducted during the wet season. (2) Provide awareness raising and education to local people about the importance and need for protecting and conserving herpetofauna and other wildlife species such as mammals and birds. (3) Improving and strengthening law enforcement to stop illegal logging and illegal wildlife hunting activities by local hunters. (4) Restoring the natural forests of these areas, especially for the sites that are degraded (e.g., Water Cycle Forest Research Station - Prey Ang Taen), which can provide a more suitable habitat for the herpetofauna in these targeted areas. (5) Preserve major streams, waterholes, and other swamp areas within these community forests, which are important habitats and shelters for water-dependent species, including amphibians, all turtle species, and other wildlife.

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Declaration of competing interest

The authors declare that they have no competing interests. All authors have read and approved the final, published version of the manuscript.

Credit authorship contribution statement

THI Sothearen: Experimental design, data collection, writing-original draft, reviewing and editing. **SAN Sovannary:** Data collection, reviewing & editing. **KRY Makphal:** Reviewing and editing. **Y Chaly:** Reviewing and editing. **MEAS Seanghun:** Reviewing and editing. **HUN Seiha:** Supervision, conceptualization, experimental design, data collection, data analysis and interpretation, visualization, writing-review & editing.

All authors have read and agreed to the published version of the manuscript.

References

Ali, W., Javid, A., Bhukhari, S. M., Hussain, A., Hussain, S. M., & Rafiue, H. (2018). Comparison of different trapping techniques used in herpetofaunal monitoring: A review. *Punjab University Journal of Zoology*, 33(1), 57-68. <https://doi.org/10.17582/pujz/2018.33.1.57.68>.

Bickford, D., Howard, S.D., Ng, D.J.J., & Sheridan, J. A. (2010). Impacts of climate change on the amphibians and reptiles of Southeast Asia. *Biodivers Conserv* (19) 1043-1062. <https://doi.org/10.1007/s10531-010-9782-4>.

Daltry, J. C., & Wüster, W. (2002). A New Species of Wolf Snake (Serpentes: Colubridae: Lycodon) from the Cardamom Mountains, Southwestern Cambodia. *Herpetologica*, 58(4), 498-504. [https://doi.org/10.1655/00180831\(2002\)058\[0498:ansows\]2.0.co;2](https://doi.org/10.1655/00180831(2002)058[0498:ansows]2.0.co;2).

De Oliveira, E. G., & Haddad, C. F. B. (2015). Diet Seasonality and Feeding Preferences of *Brachycephalus pitanga* (Anura: Brachycephalidae). *Journal of Herpetology*, 49(2), 252-256. <https://doi.org/10.1670/13-211>.

Do, M.S., Son, S.-J., Choi, G., Yoo, N., Kim, D.-K., Koo, K.-S. & Nam, H.-K. (2022). The establishment of ecological conservation for herpetofauna species in hotspot areas of South Korea. *Scientific Reports*, (2022) 12:14839. <https://doi.org/10.1038/s41598-022-19129-0>.

Geissler, P., Hartmann, T., Ihlow, F., Neang T., Seng R., Wagner, P. & Bohme, W. (2019). Herpetofauna of the Phnom Kulen National

Park, northern Cambodia—An annotated checklist. *Cambodian Journal of Natural History*, 2019, 40-63.

Grismer, L. L., Wood, P. L., Quah, E. S. H., Anuar, S., Poyarkov, N. A., Thy, N., Orlov, N. L., Thammachoti, P., & Seiha, H. (2019). Integrative taxonomy of the Asian skinks *Sphenomorphus stellatus* (Boulenger, 1900) and *S. praesignis* (Boulenger, 1900) with the resurrection of *S. annamiticus* (Boettger, 1901) and the description of a new species from Cambodia. *Zootaxa*, 4683(3), 381-411. <https://doi.org/10.11646/zootaxa.4683.3.4>

Hayes, B., Khou, H., Thy, N., Furey, N., Sophea, C., Holden, J., Seiha, H., Sarith, P., Pengly, L., & Simpson, V. (2015). BIODIVERSITY ASSESSMENT OF PREY LANG Kratie, Kampong Thom, Stung Treng and Preah Vihear Provinces. Technical Report published in May 2015 by the Conservation International (CI).

IUCN. (2021). The IUCN Red List of Threatened Species. Version 2021-3. <https://www.iucnredlist.org>

Lesbarrères, D., Ashpole, S.L., Bishop, C.A., Blouin-Demers, G., Brooks, R.J., Echaubard, P., Govindarajulu, P., Green, D.M., Hecnar, S.J., Herman, T., Houlihan, J., Litzgus, J.D., Mazerolle, M.J., Paszkowski, C.A., Rutherford, P., Schock, D.M, Storey, K.B. & Loughheed, S.C. (2014). Conservation of herpetofauna in northern landscapes: Threats and challenges from a Canadian perspective. *Biological Conservation*, 170 (2014) 48-55.

Megantara, E.N., Jauhan, J., Shanida, S.S., Husodo, T., Fauzi, D.A., Hendrawan, R., Wulandari, I. & Yuansah. (2022). Herpetofauna distribution in different land cover types of West Java, Indonesia. *Biodiversitas* 23: 2990-2999.

Murdoch, M. L., Lee Grismer, L., Wood, P. L., Neang, T., Poyarkov, N. A., Tri, N. V. A. N., Nazarov, R. A., Aowphol, A., Pauwels, O. S. G., Nguyen, H. N. & Grismer, J. L. (2019). Six new species of the *Cyrtodactylus intermedius* complex (Squamata: Gekkonidae) from the Cardamom Mountains and associated highlands of Southeast Asia. *Zootaxa*, 4554(1), 1-62. <https://doi.org/10.11646/zootaxa.4554.1.1>

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), 68-80. <https://doi.org/10.11646/zootaxa.3814.1.3>

Neang, T., Henson, A. & Stuart, B. L. (2020). A new species of cyrtodactylus (Squamata, gekkonidae) from cambodia's Prey Lang Wildlife Sanctuary. *ZooKeys*, 2020(926), 133-158. <https://doi.org/10.3897/zookeys.926.48671>.

Neang, T., & Holden, J. (2008). A field guide to the Amphibians of Cambodia. Fauna & Flora International, Cambodia Programme.

Oksanen, J.F., Blanchet, G., Friendly, M., Kindt, R., Legendre, P., McGlenn, D., Minchin, R.P, O'Hara, R. B., Simpson, L. G, Solymos, P., Stevens, M.H., Szoeocs, E. & Wagner, H. (2020). vegan: Community Ecology Package. R package version 2.5-7. <https://CRAN.R-project.org/package=vegan>.

Pincheira-Donoso, D., Bauer, A.M., Meiri, S. & Uetz, P. (2013). Global Taxonomic Diversity of Living Reptiles. *PLoS ONE*, 8(3): e59741. doi: 10.1371/journal.pone.0059741

Price, S.J., Grayson, K.L., Gartrell, B.D. & Nelson, N.J. (2020). Survival and growth of tuatara *Sphenodon punctatus* following translocation from the Cook Strait to warmer locations in their historic range. *Oryx*, 54(2). doi:10.1017/S003060531800008X.

R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL: <https://www.R-project.org/>.

Robinson, M. (2017). A Field Guide to the Reptiles of South-East Asia. In Reference Reviews (1st ed., Vol. 31, Issue 1). Bloomsbury Publishing Plc. <https://doi.org/10.1108/rr-08-2016-0210>.

Rowley, J. J. L., Stuart, B. L., Thy, N. & Emmett, D. A. (2010). A New Species of Leptolax (Anura: Megophryidae) From Northeastern Cambodia. *Zootaxa*, 68(June), 57-68. <https://doi.org/10.5281/zenodo.197318>.

- Saber, S., Tito, W., Said, R., Mengistou, S. & Alqahtani, A. (2017). Amphibians as Bioindicators of the Health of Some Wetlands in Ethiopia. *The Egyptian Journal of Hospital Medicine*, (66) 66-73.
- Tohir, R.K. & Siregar, D.I. (2021). Diversity and distribution of herpetofauna in INSTITUT TEKNOLOGI SUMATERA Campus Area. *Media Konservasi* 26 (1), 1-8. DOI: 10.29244/medkon.26.1.1-8.
- Valencia-Zuleta, A., Jaramillo-Martínez, A.F., Echeverry-Bocanegra, A., Viáfara-Vega, R., Hernández-Córdoba, O., Cardona-Botero, V.E., Gutiérrez-Zúñiga, J. & Castro-Herrera, F. (2014). Conservation status of the herpetofauna, protected areas, and current problems in Valle del Cauca, Colombia. *Amphibian & Reptile Conservation*, 8(2) [Special Section]: 1-18 (e87).
- Walls, S.C, Barichivich, W.J. & Brown, M.E. (2013). Drought, Deluge and Declines: The Impact of Precipitation Extremes on Amphibians in a Changing Climate. *Biology*, 2013, 2, 399-418. doi:10.3390/biology201039 9.

Supplementary Data

Annex 1. List of 36 amphibian and reptile species found across all surveyed community forests.

No.	Scientific Name	Common English Name	IUCN Status
Amphibians			
Bufonidae			
1	<i>Duttaphrynus melanostictus</i>	Asian common toad	LC
Dicroglossidae			
2	<i>Fejervarya limnocharis</i>	Paddy frog	LC
3	<i>Hoplobatrachus rugulosus</i>	Rugulose bullfrog	LC
4	<i>Occidozyga lima</i>	Green floating frog	LC
5	<i>Occidozyga martensii</i>	Marten's floating frog	LC
Microhylidae			
6	<i>Calluella guttulata</i>	Burmese squat frog	LC
7	<i>Kalophrynus interlineatus</i>	Spotted narrow-mouthed frog	LC
8	<i>Microhyla butleri</i>	Butler's pigmy frog	LC
9	<i>Microhyla fissipes</i>	Ornate pigmy frog	LC
10	<i>Microhyla heymonsi</i>	Dark-side narrow mouth frog	LC
11	<i>Microhyla pulchra</i>	Beautiful pygmy frog	LC
12	<i>Micryletta erythropoda</i>	Mada paddy frog	LC
Ranidae			
13	<i>Hylarana erythraea</i>	Common green frog	LC
14	<i>Sylvirana mortenseni</i>	Mortensen's frog	LC
Rhacophoridae			
15	<i>Polypedates megacephalus</i>	Hong Kong whipping frog	LC
16	<i>Theلودerma stellatum</i>	Spotted warty frogs	LC
Reptile-lizards			
Agamidae			
17	<i>Calotes versicolor</i>	Common garden lizard	LC
18	<i>Draco maculatus</i>	Spotted gliding lizard	LC
19	<i>Physignathus cocincinus</i>	Indochinese water dragon	VU
Gekkonidae			
20	<i>Dixonius siamensis</i>	Siamese leaf-toed gecko	LC
21	<i>Gehyra mutilata</i>	Stump-toed gecko	LC
22	<i>Gekko gekko</i>	Tokay gecko	LC
23	<i>Hemidactylus frenatus</i>	Common house gecko	LC
24	<i>Hemidactylus platyurus</i>	Flat-tailed house gecko	LC
Scincidae			
25	<i>Eutropis macularia</i>	Speckled forest skink	LC
26	<i>Eutropis multifasciata</i>	Common sun skink	LC
27	<i>Lipinia vittigera</i>	Striped tree skink	LC
28	<i>Sphenomorphus maculatus</i>	Streamside skink	LC
Reptile-snakes			
Colubridae			
29	<i>Boiga cyanea</i>	Green Cat Snake	LC
30	<i>Boiga multomaculata</i>	Many-spotted Cat Snake	LC
31	<i>Chrysopelea ornata</i>	Ornate Flying Snake	LC
32	<i>Oligodon cf. cinereus</i>	Ashy Kukri Snake	LC
33	<i>Pareas margaritophorus</i>	White-spotted Slug Snake	LC
34	<i>Psammodynastes pulverulentus</i>	Common Mock Viper	LC
Elapidae			

35	<i>Bungarus candidus</i>	Malayan Krait	LC
Homalopsidae			
36	<i>Enhydris cf. plumbea</i>	Yellow Belly Water Snake	LC

Annex 2. Record of amphibian species from the surveyed community forests (i: *Microhyla butleri*, j: *Micryletta erythropoda*, k: *Microhyla heymonsi*, l: *Occidozyga lima*, m: *Microhyla fissipes*, n: *Occidozyga martensii*, o: *Microhyla pulchra*, p: *Calluella guttulata*).



Annex 3. Reptile species recorded from the survey (a: *Oligodon cf. cinereus*, b: *Boiga cyanea*, c: *Psammodynastes pulverulentus*, d: *Boiga multomaculata*, e: *Pareas margaritophorus*, f: *Eutropis macularia*, g: *Bungarus candidus*, h: *Sphenomorphus maculatus*).



Annex 4. Record of amphibians and reptile species by number of detections from each community forest. 1. O’K: O’Kranhak, 2. O’T: O’Ta Tey, 3. O’Kr: O’Kranhoung, 4. O’D: O’Das Skor, 5. LS: Labos Sral, 6. HC: Hong Chamtit, 7. PAT: Prey Ang Taen, and 8. BL: Bos Leav.

No.	Scientific Name	O’K	O’T	O’Kr	O’D	LS	HC	PAT	BL
Amphibians									
Bufonidae									
1	<i>Duttaphrynus melanostictus</i>	0	2	0	0	1	0	0	0
Dicroglossidae									
2	<i>Fejervarya limnocharis</i>	6	1	32	10	4	6	7	0

3	<i>Hoplobatrachus rugulosus</i>	1	0	4	0	1	0	2	0
4	<i>Occidozyga lima</i>	0	0	0	1	3	5	0	0
5	<i>Occidozyga martensii</i>	0	1	0	0	4	0	0	25
Microhylidae									
6	<i>Calluella guttulata</i>	0	0	0	1	0	0	0	0
7	<i>Kalophrynus interlineatus</i>	0	0	0	0	0	1	1	0
8	<i>Microhyla butleri</i>	0	0	0	0	0	0	0	25
9	<i>Microhyla fissipes</i>	1	1	31	4	4	20	25	0
10	<i>Microhyla heymonsii</i>	1	0		1	0	2	2	13
11	<i>Microhyla pulchra</i>	0	2	4	0	9	10	20	1
12	<i>Micryletta erythropoda</i>	1	0	0	0	0	0	0	1
Ranidae									
13	<i>Hylarana erythraea</i>	2	0	3	7	0	0	0	1
14	<i>Sylvirana mortenseni</i>	0	4	4	7	2	0	7	1
Rhacophoridae									
15	<i>Polypedates megacephalus</i>	6	2	5	2	6	3	3	5
16	<i>Theلودerma stellatum</i>	0	0	1	0	0	0	0	0
Reptile-lizards									
Agamidae									
17	<i>Calotes versicolor</i>	2	0	4	0	0	0	0	0
18	<i>Draco maculatus</i>	0	0	0	2	0	0	0	0
19	<i>Physignathus cocincinus</i>	0	0	0	0	0	0	1	0
Gekkonidae									
20	<i>Dixonius siamensis</i>	4	5	1	1	2	1	1	3
21	<i>Gehyra mutilata</i>	0	0	0	0	0	0	0	1
22	<i>Gekko gekko</i>	0	3	1	5	4	4	2	5
23	<i>Hemidactylus frenatus</i>	0	0	0	0	0	0	0	1
24	<i>Hemidactylus platyurus</i>	2	0	0	1	0	0	0	0
Scincidae									
25	<i>Eutropis macularia</i>	2	1	25	7	1	10	2	7
26	<i>Eutropis multifasciata</i>	1	0	0	0	0	0	0	2
27	<i>Lipinia vittigera</i>	0	0	0	0	0	0	0	1
28	<i>Sphenomorphus maculatus</i>	1	0	1	0	0	0	0	0
Reptile-snakes									
Colubridae									
29	<i>Boiga cyanea</i>	1	0	0	0	0	0	0	0
30	<i>Boiga multomaculata</i>	0	0	1	0	0	0	0	0
31	<i>Chrysopelea ornata</i>	0	0	0	1	0	0	0	0
32	<i>Oligodon cf. cinereus</i>	0	0	0	0	1	0	0	0
33	<i>Pareas margaritophorus</i>	0	0	0	0	0	0	0	2
34	<i>Psammodynastes pulverulentus</i>	0	0	0	0	0	0	0	1
Elapidae									
35	<i>Bungarus candidus</i>	0	0	0	0	0	1	0	0
Homalopsidae									
36	<i>Enhydris cf. plumbea</i>	0	1	0	0	0	0	0	0