HERPETOFAUNA DIVERSITY OF SURANAREE UNIVERSITY OF TECHNOLOGY, NAKHON RATCHASIMA PROVINCE

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A Thesis Submitted in Partial Fulfillment of the Requirements for the
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ความหลากหลายของสัตว์เลื้อยคลานและสัตว์สะเทินน้ำสะเทินบก ของมหาวิทยาลัยเทคโนโลยีสุรนารี จังหวัดนครราชสีมา

นางสาวโซ ทันดาร์ ออง

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิทยาศาสตรมหาบัณฑิต

สาขาวิชาชีววิทยา

มหาวิทยาลัยเทคโนโลยีสุรนารี

ปีการศึกษา 2567

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โซ ทันดาร์ ออง: ความหลากหลายของสัตว์เลื้อยคลานและสัตว์สะเทินน้ำสะเทินบกของมหาวิทยาลัยเทคโนโลยีสุรนารี จังหวัดนครราชสีมา (HERPETOFAUNA DIVERSITY OF SURANAREE UNIVERSITY OF TECHNOLOGY, NAKHON RATCHASIMA PROVINCE) อาจารย์ที่ปรึกษา : ผู้ช่วยศาสตราจารย์ ดร.พงศ์เทพ สุวรรณวารี, 70 หน้า.

คำสำคัญ : สัตว์สะเทินน้ำสะเทินบก, ความหลากหลายทางชีวภาพ, การอนุรักษ์, สัตว์เลื้อยคลาน

สัตว์เลื้อยคลานและสัตว์สะเทินน้ำสะเทินบกเป็นองค์ประกอบที่สำคัญของระบบนิเวศบนบก โดยมีบทบาทในการรักษาสมดุลของสิ่งแวดล้อมผ่านกระบวนการหมุนเวียนธาตุอาหาร การควบคุมแมลงศัตรูพืช และการเป็นทั้งผู้ล่าและเหยื่อในห่วงโซ่อาหาร นอกจากนี้ยังสามารถใช้เป็นดัชนีชี้วัดการเปลี่ยนแปลงของสิ่งแวดล้อมได้อย่างมีประสิทธิภาพ งานวิจัยนี้มีวัตถุประสงค์เพื่อประเมินความหลากหลาย ความชุกชุม และรูปแบบการใช้ถิ่นอาศัยของสัตว์เลื้อยคลานและสัตว์สะเทินน้ำสะเทินบกในถิ่นอาศัย 5 ประเภท ได้แก่ บริเวณรอบอาคาร พื้นที่เกษตรกรรม แหล่งน้ำ ป่าปลูก และป่าที่ถูกรบกวนโดยมนุษย์ ภายในพื้นที่มหาวิทยาลัยเทคโนโลยีสุรนารี จังหวัดนครราชสีมา โดยใช้วิธีการสำรวจการพบเห็นด้วยสายตาในเวลากลางคืนระหว่างเดือนมีนาคมถึงธันวาคม พ.ศ. 2567

จากการสำรวจพบสัตว์เลื้อยคลานทั้งหมด 33 ชนิด คิดเป็นจำนวนการพบรวม 2,917 ครั้ง โดยพบว่าป่ารบกวนจากมนุษย์มีความหลากหลายของชนิดสูงสุด (22 ชนิด) รองลงมาคือบริเวณรอบอาคาร (18 ชนิด) แปลงป่าปลูก (16 ชนิด) แหล่งน้ำ (16 ชนิด) และพื้นที่เกษตรกรรม (12 ชนิด) ตามลำดับ พื้นที่รอบอาคารมีจำนวนการพบสูงที่สุด (954 ครั้ง) ซึ่งส่วนใหญ่เป็นชนิดที่ปรับตัวให้อยู่ร่วมกับมนุษย์ได้ เช่น จิ้งจกบ้านหางหนาม และ จิ้งจกดินสยาม นอกจากนี้ยังพบชนิดที่มีสถานภาพอนุรักษ์ ได้แก่ เต่าหับ (ใกล้สูญพันธุ์) งูหลาม และ งูเห่าสยามพ่นพิษ (เสี่ยงต่อการสูญพันธุ์) และ งูสิงธรรมดา (ใกล้ถูกคุกคาม)

ในส่วนของสัตว์สะเทินน้ำสะเทินบก พบทั้งหมด 18 ชนิด รวมจำนวนการพบ 5,790 ครั้ง โดยมีความหลากหลายสูงสุดในป่าที่ถูกรบกวนจากมนุษย์ (17 ชนิด) รองลงมาคือพื้นที่เกษตรกรรม (15 ชนิด) บริเวณรอบอาคาร (14 ชนิด) และป่าปลูกกับแหล่งน้ำ (พื้นที่ละ 13 ชนิด) ตามลำดับ พื้นที่รอบแหล่งน้ำพบชนิดที่ปรับตัวกับสภาพแวดล้อมแหล่งน้ำได้ดี เช่น เขียดทราย ขณะที่ชนิดทั่วไป เช่น คางคกบ้าน และ อึ่งอ่างบ้าน พบได้ในทุกถิ่นอาศัย นอกจากนี้ยังพบชนิดที่มีสถานภาพใกล้ถูกคุกคาม ได้แก่ อึ่งเพ้า และ อึ่งอ่างก้นขีด ซึ่งพบมากในป่าที่ถูกรบกวนและป่าปลูก อย่างไรก็ตาม สัตว์กลุ่มนี้กำลังเผชิญแรงกดดันจากการถูกเก็บจับโดยชุมชนท้องถิ่น โดยเฉพาะหลังฝนตก

ผลการศึกษานี้แสดงให้เห็นถึงความสำคัญทางนิเวศของการรักษาความหลากหลายของถิ่นอาศัยภายในภูมิทัศน์เมือง และเน้นย้ำถึงความจำเป็นในการดำเนินมาตรการอนุรักษ์แบบบูรณาการ การคุ้มครองที่เข้มงวดยิ่งขึ้น รวมถึงการส่งเสริมความตระหนักรู้ของประชาชน เพื่อรักษาความหลากหลายของสัตว์เลื้อยคลานและสัตว์สะเทินน้ำสะเทินบกในพื้นที่สีเขียวของสถาบันการศึกษา

สาขาวิชาชีววิทยา ลายมือชื่อนักศึกษา ____________

ปีการศึกษา 2567 ลายมือชื่ออาจารย์ที่ปรึกษา ____________

SOE THANDAR AUNG : HERPETOFAUNA DIVERSITY OF SURANAREE UNIVERSITY OF TECHNOLOGY, NAKHON RATCHASIMA PROVINCE.
THESIS ADVISOR : ASST. PROF. PONGTHEP SUWANWAREE, Ph.D. 70 PP.

Keyword: Amphibian, Biodiversity, Conservation, Herpetofauna, Reptile.

Reptiles and amphibians are integral components of terrestrial ecosystems, contributing to ecological balance through nutrient cycling, pest control, and functioning as both predators and prey. They also serve as sensitive indicators of environmental change. This study assessed the diversity, abundance, and habitat use of herpetofauna across five habitat types around buildings, agricultural areas, reservoirs, plantations, and human-disturbed forests of the Suranaree University of Technology campus in Nakhon Ratchasima Province, Thailand. Nocturnal visual encounter surveys were conducted from March to December 2024.

A total of 33 reptile species were recorded, with 2,917 individual detections. Species richness was highest in human-disturbed forests (22 species), followed by around buildings (18), plantations (16), reservoirs (16), and agricultural areas (12), respectively. The highest reptile abundance was found around buildings (954 detections), primarily due to synanthropic species such as *Hemidactylus frenatus* and *Dixonius siamensis*. Several species of conservation concern were observed, including *Cuora cuora kamaroma* (Endangered), *Python bivittatus* and *Naja siamensis* (Vulnerable), and *Ptyas korros* (Near Threatened).

For amphibians, 18 species were recorded, totaling 5,790 individual detections. Species richness was highest in human-disturbed forests (17 species), followed by agricultural areas (15), around buildings (14), and both plantations and reservoirs (13 species each), respectively. Aquatic specialists such as *Hylarana erythraea* and *Occidozyga martensii* were found mainly in reservoirs, while generalist species like *Duttaphrynus melanostictus* and *Kaloula pulchra* were common across all habitat types. Two Near Threatened species, *Glyphoglossus molossus* and *Kaloula mediolineata*, were mostly found in human-disturbed forests and plantations.

However, these species face increasing pressure from overharvesting, particularly after rainfall, when local communities collect amphibians on campus.

These findings highlight the ecological importance of maintaining heterogeneous habitats within urban landscapes and emphasize the need for integrative conservation strategies, stronger protective measures, and increased public awareness to safeguard herpetofauna diversity in institutional environments.

School of Biology
Academic Year 2024

Student's Signature ______
Advisor's Signature ______

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CHAPTER I
INTRODUCTION

1.1 Introduction

Herpetofauna, collectively encompassing reptiles and amphibians, are vital components of ecosystems, playing crucial roles as predators, prey, and bioindicators. They help maintain ecological balance by regulating populations of pests and other small animals, contributing to nutrient cycling, and acting as indicators of environmental health. Globally, there are approximately 12,440 species of reptiles (The Reptile Database, 2025) and 8,887 species of amphibians (AmphibiaWeb, 2025). Thailand is particularly rich in herpetofauna, with 512 reptile species, including 114 endemic species, and 194 amphibian species, of which 29 are endemic (Poyarkov et al., 2021, 2023). These statistics highlight the significance of Thailand as a biodiversity hotspot for herpetofauna.

Despite their ecological importance, herpetofauna face numerous threats, including habitat loss, urbanization, climate change, pollution, and overexploitation. Urban areas, in particular, present unique challenges for these species due to habitat fragmentation, human activities, and altered landscapes. While biodiversity surveys have traditionally focused on natural habitats such as forests and wetlands, there is a growing need to study herpetofauna in human-modified environments, such as university campuses.

University campuses often comprise a mix of natural and semi-natural habitats, including green spaces, water reservoirs, and plantations, making them ideal settings for studying the diversity and adaptability of herpetofauna. These environments offer important refuges for wildlife amid urban development and serve as microcosms for examining how human activities influence biodiversity. Research in such areas can provide insights into species' responses to anthropogenic pressures such as land-use change, habitat fragmentation, and infrastructure development. For instance, previous studies have shown that roads and urban structures can negatively affect reptile abundance by reducing habitat connectivity and increasing mortality (Andrews et al., 2008).

Globally, urbanization is recognized as a major driver of biodiversity loss (McKinney, 2002). However, urban green spaces including university campuses have emerged as key components of urban ecological networks, helping to conserve species in human-dominated landscapes (Colding, 2007; Cox and Gaston, 2018). In particular, campuses in rapidly developing regions often contain a variety of habitat types, some of which may remain relatively undisturbed compared to the surrounding urban matrix. These campus environments can support species-rich communities and offer practical opportunities for biodiversity research, monitoring, and education (Liu et al., 2017; Zhang et al., 2018). Although most studies on campus biodiversity have focused on flora, birds, or insects, recent efforts have highlighted the importance of documenting and conserving herpetofauna in these environments. Amphibians and reptiles are especially sensitive to environmental change due to their physiological and ecological traits, making them valuable indicators of habitat quality and ecosystem health (Gibbons et al., 2000; Cushman, 2006). Monitoring their presence, abundance, and habitat use on university campuses not only contributes to urban conservation goals but also enhances understanding of species resilience and the potential of semi-natural spaces to support wildlife in urban areas.

The Suranaree University of Technology (SUT) campus, located on the outskirts of Nakhon Ratchasima city in northeastern Thailand, offers an excellent opportunity for such research. Spanning a vast area, 95% of the campus is covered by green spaces, including natural and planted forests, as well as a water reservoir. The university is committed to ecological conservation, with efforts to replenish deforested areas by planting trees and preserving existing vegetation. Beyond the campus boundaries, the surrounding agricultural landscape, dominated by crops like cassava, maize, and sugarcane, adds to the ecological complexity (Naithani et al., 2018).

Despite these favorable conditions, no comprehensive study has been conducted on the herpetofauna diversity of the SUT campus. This represents a significant gap in understanding the biodiversity of semi-urban environments in

Thailand. Addressing this gap is crucial for documenting species richness, understanding habitat preferences, and assessing the impacts of urbanization on herpetofauna.

Herpetofauna research on campuses is also important for its educational and conservation implications. University campuses provide opportunities for students and researchers to engage in biodiversity studies, fostering a deeper understanding of ecological processes and conservation needs. Findings from such research can promote environmental awareness among the university community, encouraging sustainable practices and habitat restoration efforts.

Moreover, campus-based studies contribute to the global effort to document biodiversity in human-modified landscapes. These investigations reveal how herpetofauna respond to anthropogenic pressures, providing insights into their resilience and adaptability. Such information is essential for developing conservation strategies that address the challenges posed by urbanization and climate change.

In a broader context, this study aligns with global biodiversity conservation priorities, emphasizing the need for integrated approaches to land-use planning and wildlife protection. By documenting herpetofauna diversity in a semi-urban environment, this research contributes to scientific knowledge, informs conservation practices, and highlights the pivotal role of academic institutions in biodiversity preservation.

Ultimately, this research underscores the interconnectedness of ecological systems and the importance of conserving herpetofauna, not only for their intrinsic value but also for their role in maintaining environmental health and stability. By focusing on the SUT campus, this study provides a foundation for future research and conservation efforts, ensuring that the rich biodiversity of herpetofauna is protected for generations to come information on the diversity of herpetofauna. Consequently, the primary objectives of this study are to compile a comprehensive species checklist, detailing habitat specifics, relative abundance, Shannon-Wiener's diversity metrics, evenness indices, and conservation statuses. The overarching goal is to establish an area identification key for the herpetofauna inhabiting the SUT campus.

1.2 Research objectives

1.2.1 To assess the abundance and diversity of reptile and amphibian species within the SUT.

1.2.2 To investigate and report on how different land uses and habitat types on the campus influence the variety of herpetofauna species.

1.3 Scope and limitations

The study of herpetofauna was conducted at the SUT campus from February 2024 to December 2024. The research area was divided into five habitat types: (a) around buildings (AB), (b) human-disturbed forests (HDF), (c) near reservoirs (RES), (d) plantations (PLT), and (e) agricultural areas (AG).

The survey methods were limited to the Visual Encounter Survey (VES) and snake rescue operations. Surveys were conducted 3-4 days per week during the study period. Daytime surveys primarily focused on snake's rescue, particularly those encountered during rescue calls requiring immediate attention. The reliance on the VES method may have resulted in underreporting of nocturnal. Additionally, the survey frequency of 2 to 3 days per week may have limited the detection of rare or elusive species. Seasonal variations in weather and the activity patterns of herpetofauna also influenced the results, as the study spanned both the dry and rainy seasons. External factors, such as human disturbances, restricted access to certain areas, and unforeseen environmental conditions, occasionally impacted the comprehensiveness of the surveys. Despite these challenges, the study successfully documented the diversity, abundance, and habitat preferences of herpetofauna on the SUT campus, contributing valuable data to herpetological research and conservation efforts.

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CHAPTER II
LITERATURE REVIEW

Reptiles and amphibians, collectively referred to as herpetofauna, were integral components of ecosystems, playing pivotal ecological roles that extended far beyond their charismatic appearances. These roles included regulating prey populations, cycling nutrients, and maintaining the balance of food webs. The study of herpetofauna was essential for understanding and preserving ecosystem dynamics and biodiversity. Reptiles, such as snakes, lizards, turtles, and crocodiles, significantly contributed to biodiversity regulation by controlling prey populations and serving as indicators of habitat quality (Gibbons et al., 2000). For example, in agricultural landscapes, snakes played a critical role in controlling rodent populations, which aided in protecting crops and public health. These roles underscored their importance in ecosystem stability and sustainability.

The ability of reptiles to thrive in diverse environments highlighted their value as bioindicators of ecosystem health. Variations in reptile populations signaled changes in habitat quality, climate conditions, and overall ecological balance (Dorcas et al., 2011). Their interactions within food webs, both as predators and prey, were essential for the balance of energy flow and nutrient cycling (Brose et al., 2006). Some reptiles acted as keystone species, profoundly influencing the structure and dynamics of their ecosystems (Perry and Garland Jr, 2002).

Thailand was recognized as a global biodiversity hotspot, with 512 documented species of reptiles, 22.3% of which were endemic to the country (Poyarkov et al., 2023). Amphibians, which included frogs, toads, and salamanders, also contributed significantly to ecosystem health by controlling insect populations and serving as bioindicators of environmental quality (Blaustein et al., 2010). The country hosted 194 species of amphibians, 29 of which were endemic (Poyarkov et al., 2021). Amphibians played a pivotal role in pest control, as their diet consisted predominantly of insects, including agricultural pests and disease vectors. This contribution not only aided in crop protection but also enhanced agricultural sustainability (Duellman and Trueb, 1994).

In addition to their ecological roles, amphibians occupied critical positions in food webs, acting as both predators of insects and prey for various vertebrates. Their population dynamics directly affected the stability and functioning of ecosystems (Petranka, 1998). Unfortunately, global amphibian populations declined due to habitat loss, pollution, and diseases such as chytridiomycosis, which caused significant mortality among amphibian species worldwide (Stuart et al., 2004).

2.1 Herpetofauna research in university campuses of Thailand

Research on herpetofauna has gained increasing attention in Thailand, particularly within university campuses, which often serve as microcosms of broader ecosystems (Table 2.1). At Kasetsart University, for instance, a study conducted in a secondary mixed-deciduous forest documented 10 amphibian species and 13 reptile species (Duengkae, 2011). Likewise, surveys at Prince of Songkhla University reported 11 frog species across a variety of habitats, including artificial canals, agricultural areas, building zones, freshwater ponds, temporary ponds, and yard zones demonstrating notable diversity within a compact landscape (Sangrueng et al., 2021). At Suan Sunandha Rajabhat University, 2 amphibian and 20 reptile species were recorded in habitats such as stagnant drains, roadside ditches, lawns, weedy patches, and waste material sites (Chanate and Pattaraporn, 2017).

Table 2.1 Recorded amphibian and reptile species in university campuses in Thailand.

University	Amphibian	Reptile	References
Kasetsart University	10	13	Duengkae (2011)
Prince of Songkla University	11		Sangrueng et al. (2021)
Prince of Songkla University (Kho Hong Hill)	16	7	Wangkulkul et al. (2008)
Suan Sunandha Rajabhat University	2	20	Chanate and Pattaraporn (2017)
Mahidol University		41	Prasopsin and Aksornneam (2014)
Ubon Ratchathani University	17		Wanchai et al. (2023)
Walailak University		21	Barnes et al. (2024)

In contrast, Mahidol University with its mixed deciduous forest and bamboo stands on limestone karst terrain documented 41 reptile species spanning 30 genera and 10 families (Prasopsin and Aksornneam, 2014). Research at Ubon Ratchathani University added further depth to this growing body of knowledge, identifying 17 amphibian species from 6 families across locations including the botanical garden, campus grounds, and surrounding agricultural areas (Wanchai et al., 2023). Additionally, the protected Kho Hong Hill area affiliated with Prince of Songkla University supported 16 amphibian and 7 reptile species, highlighting the biodiversity potential of semi-managed natural reserves linked to academic institutions (Wangkulkul et al., 2008). Moreover, Walailak University recorded 21 reptile species within its campus environment, further underscoring the biodiversity potential of institutional green spaces (Barnes et al., 2024).

2.2 Herpetofauna in university campuses around the world

Herpetofauna assessments from university campuses around the world further highlight the vital role these institutions play in biodiversity conservation and ecological research (Table 2.2). At Central Luzon State University (CLSU) in the Philippines, 6 amphibians and 11 reptiles were recorded across grasslands, ponds, and forest patches (Fernando et al., 2021). In India, Fergusson College campus documented 5 amphibian and 26 reptile species (Nerlekar et al., 2016), while the Indian Institute of Technology Bombay recorded 4 amphibians and 10 reptiles (Quadros et al., 2009). Amravati University contributed 19 reptile species, including both venomous and non-venomous taxa (Wadatkar, 2004). Universidad Militar Nueva Granada in Colombia reported 1 amphibian and 1 reptile (Sánchez et al., 2015), and Vilnius University in Lithuania recorded 6 amphibians and 1 reptile (Starodubaite, 1999).

In Southeast Asia, Universitas Gadjah Mada in Indonesia recorded 8 amphibians and 24 reptiles (Qurniawan, 2015), while Universitas Sebelas Maret documented 3 amphibians and 4 reptiles as part of its baseline monitoring (Muhtianda et al., 2022). Mizoram University in India reported 24 reptiles (Laltanpuia et al., 2008), and Universiti Malaysia Terengganu (UMT) recorded 5 amphibians and 19 reptiles in its green zones (Badli-Sham et al., 2019). At Shivaji University in Maharashtra, 14 amphibians and 20 reptiles were reported (Yadav et al., 2014), while Barkatullah University documented 4 amphibians and 16 reptiles over a two-year period (Manhas et al., 2015). The University of Jember supported 6 amphibians and 13 reptiles in its landscaped and forested areas (Wijaya et al., 2024), and the University of Palangka Raya recorded 6 amphibians and 6 reptiles in its tropical forest setting (Maulidi et al., 2020). Similarly, Nusa Cendana University in Indonesia reported 4 amphibians and 8 reptiles (Pramatana et al., 2025).

Table 2.2 Recorded amphibian and reptile species in university campuses worldwide.

University	Amphibian	Reptile	References
Fergusson College campus, India	5	26	Nerlekar et al. (2016)
Indian Institute of Technology, Bombay Campus, India	4	10	Quadros et al. (2009)
Mizoram University, India		24	Laltanpuia et al. (2008)
Amravati University Campus, India		19	Wadatkar (2004)
Shivaji University, India	14	20	Yadav et al. (2014)
Barkatullah University, India	4	16	Manhas et al. (2015)
Kalpakkam Nuclear campus, India	14	30	Ramesh et al. (2013)
North Orissa University, India	15	27	Boruah et al. (2016)
Assam University, India	14		Roy and Dey (2014)
Universitas Gadjah Mada, Indonesia	8	24	Qurniawan (2015)
Universitas Sebelas Maret, Indonesia	3	4	Muhtianda et al. (2022)
University of Jember, Indonesia	6	13	Wijaya et al. (2024)
University of Palangka Raya, Indonesia	6	6	Maulidi et al. (2020).
Nusa Cendana University, Indonesia	4	8	Pramatana et al. (2025)
Universidad Militar Nueva, Colombia	1	1	Sa´nchez et al. (2015)
University of Magdalena, Colombia	7	32	Montes-Correa et al. (2015)
Vilnius University, Lithuania	6	1	Starodubaite (1999)
Universiti Malaysia Terengganu, Malaysia	5	19	Badli-Sham et al. (2019)
Central Luzon State University, Philippines	6	11	Fernando et al. (2021)
University of Cape Coast, Ghana	10	22	Deikumah et al. (2024)
Georgia Southern University, United State	20	22	Curlis et al. (2022)

In southern India, the Kalpakkam Nuclear Campus yielded one of the highest records with 14 amphibians and 30 reptiles across varied man-made and natural habitats (Ramesh et al., 2013). North Orissa University reported 15 amphibians and 27 reptiles through pitfall trapping and habitat surveys (Boruah et al., 2016). In the Americas, the University of Magdalena in Colombia documented 7 amphibians and 32 reptiles (Montes-Correa et al., 2015), and Georgia Southern University (GSU) in the United States hosted 20 amphibians and 22 reptiles across semi-natural green spaces (Curlis et al., 2022). In West Africa, the University of Cape Coast in Ghana recorded 10 amphibians and 22 reptiles using visual surveys and pitfall traps (Deikumah et al., 2024). Lastly, Assam University in northeast India reported 14 amphibians from a mix of eco-forests and degraded landscapes surrounding the campus (Roy and Dey, 2014).

These findings collectively affirm that university campuses worldwide act as important reservoirs of herpetofauna diversity and offer valuable platforms for long-term ecological monitoring, student engagement, and localized conservation initiatives.

2.3 Herpetofauna diversity in Thailand's wildlife sanctuaries and national parks

Studies in wildlife sanctuaries and national parks also highlighted the richness of herpetofauna diversity. Yoddom Wildlife Sanctuary, for instance, housed 28 amphibian species (Thongproh et al., 2019), while Khao Ang Rui Ni Wildlife Sanctuary boasted 121 species, including 34 amphibians and 87 reptiles (Inthara et al., 2004). Similarly, Eastern Thungyai Naresuan Wildlife Sanctuary and Phu Laung Wildlife Sanctuary supported 92 species and 24 amphibian species, respectively (Phochayavanich et al., 2008), while Yao Islands in Phang-nga Province documented 32 species of herpetofauna (Visoot et al., 2023).

In northeastern Thailand, the "Amphibians of Northeastern Thailand" guide reported 69 species of amphibians (Makchai et al., 2023). National parks such as Khao Yai National Park (90 reptile species and 28 amphibian species (Thai National Park, 2025), Kaeng Krachan National Park (63 species of reptiles and amphibians; Pauwels and Chan-ard, 2006), and Namtok Phliu National Park (22 amphibian species and 57 reptiles; Sukprakarn and Nabhitabhata, 2002) further emphasized the importance of preserving Thailand's herpetofauna diversity.

While traditional biodiversity surveys primarily focused on natural habitats, university campuses provided unique opportunities to study herpetofauna in anthropogenically altered and urbanized environments. These settings often involved significant human-induced modifications, such as the construction of roads and buildings, which impacted herpetofauna abundance and distribution (Andrews et al., 2008). Studies showed that university campuses acted as refuges for various species, offering a mix of natural and modified habitats.

Suranaree University of Technology (SUT) was situated on the outskirts of Nakhon Ratchasima city and encompassed diverse habitats, including forests, agricultural areas, and plantations. Despite its ecological potential, no comprehensive studies on the herpetofauna diversity of SUT had been conducted. This gap underscored the need for focused research to document species diversity, assess population dynamics, and explore how land use influenced herpetofauna within the campus.

The study aimed to address this knowledge gap by compiling a detailed species checklist, including habitat preferences, abundance metrics, and conservation statuses. By doing so, it contributed to the broader understanding of biodiversity within human-modified landscapes and provided valuable insights for conservation planning and environmental management.

The research aligned with global efforts to understand the impacts of urbanization on wildlife, offering a unique perspective on the adaptability of reptiles and amphibians to altered environments. The outcomes informed policies for habitat restoration, biodiversity conservation, and sustainable development, emphasizing the ecological importance of preserving herpetofauna diversity.

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CHAPTER III

REPTILE DIVERSITY OF SURANAREE UNIVERSITY OF TECHNOLOGY, NAKHON RATCHASIMA PROVINCE, THAILAND

3.1 Abstract

Reptiles, important components of terrestrial ecosystems, contributing to ecological balance as both prey and predator in addition to serving as indicators of environmental change. This study evaluated the species diversity and distribution of reptiles across five habitat types on the Suranaree University of Technology campus in Nakhon Ratchasima Province, Thailand. Field surveys were conducted from March to December 2024 using visual encounter survey. A total of 33 reptile species were observed with 2,917 detections. Species richness was highest in human-disturbed forests (22 species), followed by around buildings (18), plantations (16), reservoirs (16), and agricultural areas (12), respectively. The human-disturbed forest also recorded the highest species diversity, as indicated by the Shannon-Wiener index (H' = 2.75) and exhibited the highest Pielou's evenness index (J' = 0.82). Despite lower diversity scores, around buildings supported high reptile abundance (954 detections), particularly synanthropic species such as *Hemidactylus frenatus* and *Dixonius siamensis*. Several species of conservation concern were documented, including *Cuora cuora kamaroma* (Endangered), *Python bivittatus* and *Naja siamensis* (Vulnerable), and *Ptyas korros* (Near threatened). These findings highlight the ecological value of mixed-use urban landscapes and support the need for integrative biodiversity conservation strategies within institutional settings.

3.2 Introduction

Reptiles play critical roles in ecosystem function regulating pest populations, contributing to nutrient cycling, and structuring food webs while also serving as sensitive bioindicators of habitat change (Gibbons et al., 2000; Perry and Garland, 2002).

In agricultural landscapes, snakes suppress rodent outbreaks that threaten crops and human health (Perry and Garland, 2002).

Thailand is a recognized biodiversity hotspot, harboring over 512 reptile species, of which 22.3% are endemic (Poyarkov et al., 2023). Despite this richness, many reptile populations are declining due to habitat loss, pollution, invasive species, and climate change pressures that are especially acute in urban and peri-urban areas (Stuart et al., 2004; Andrews et al., 2008).

While most Thai reptile research has centered on protected areas, recent campus surveys (e.g., Duengkae, 2011; Prasopsin and Aksornneam, 2014) reveal that university grounds can support surprisingly diverse and even rare reptile assemblages, providing green spaces, water bodies, and low disturbance refugia.

Suranaree University of Technology (SUT) in Nakhon Ratchasima province, Thailand encompasses a mosaic of dry dipterocarp forest fragments, plantations, reservoirs, agricultural fields, and man-made environments. Although SUT maintains extensive green-space conservation efforts, only one short time study has evaluated its reptile community before.

The aim of this study was to provide an updated and comprehensive checklist of reptile species while quantifying abundance, diversity, and assessing the conservation status of the documented species. Results will inform campus biodiversity monitoring, conservation planning, and environmental education.

3.3 Methods

Surveys took place on the 1,120-ha campus of Suranaree University of Technology, Nakhon Ratchasima province, Thailand (14.8729° N, 102.0237° E; 251 m asl), which comprises dry dipterocarp forest fragment, plantation, botanical garden, agricultural field, reservoir, and built zone (Thammathaworn et al., 1996; Naithani et al., 2018). Vegetation includes 383 species (1 cycad, 308 dicots, and 74 monocots), dominated by Leguminosae and Gramineae families. Five habitat types were chosen to represent an urban–natural gradient (Figures 3.1 and 3.2), including around buildings (AB), agriculture zones (AG), riparian zones near reservoirs (RES), plantations (PLT), and human-disturbed forest fragments (HDF).

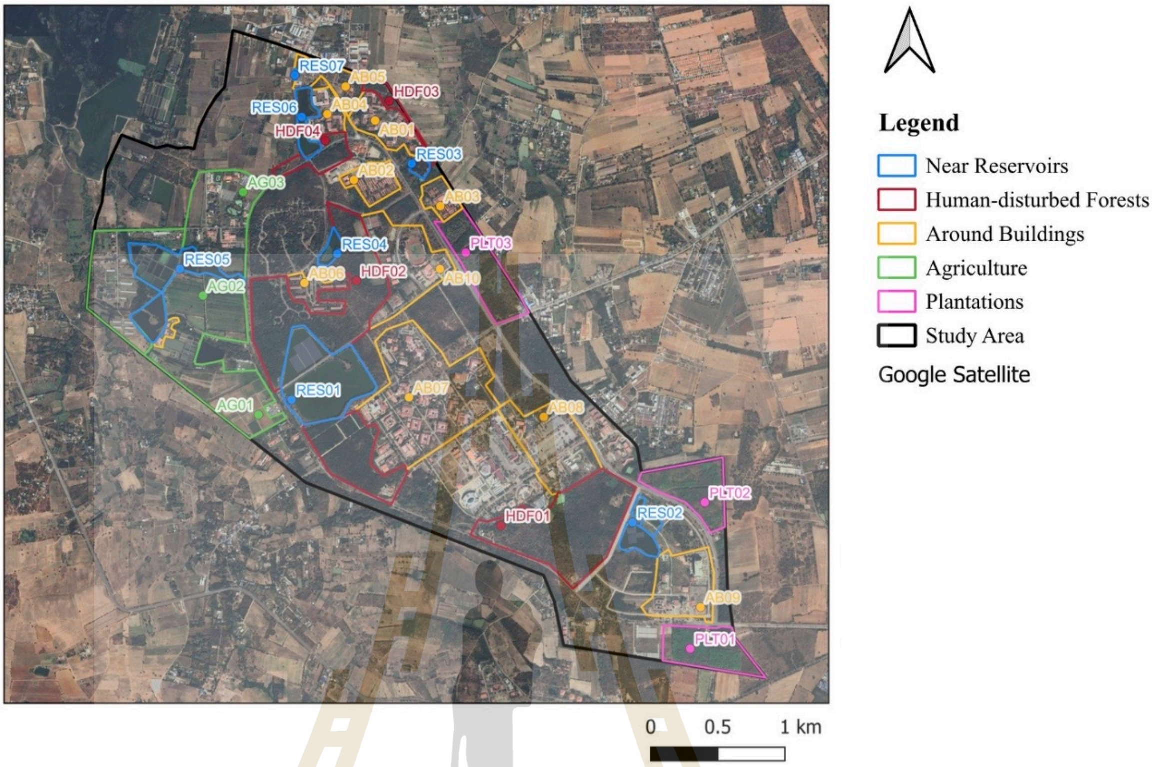

Figure 3.1 Map of five research habitats in Suranaree University of Technology, Nakhon Ratchasima, Thailand.

Figure 3.2 Five study habitats at Suranaree University of Technology. (A) Around Buildings, (B) agriculture, (C) near reservoirs, (D) plantation, (E) human-disturbed forest.

From March to December 2024, nocturnal visual encounter surveys (VES) were conducted two to three nights per week (20:00 – 01:00). Surveyors walked fixed transects in each habitat, actively searching for all reptile taxa. Opportunistic captures and specimens reported via the campus snake removal service supplemented VES records.

Each animal was identified to species by consulting the Reptile Database (https://reptile-database.reptarium.cz/), its GPS location noted, and assigned to one of the five habitat types. Threatened or protected species were flagged according to the IUCN Red List and Thai wildlife protection laws. At the start of each transect, ambient and ground temperature and humidity were recorded to explore their influence on reptile activity patterns. These variables were later correlated with monthly detection rates.

Reptile community structure in each habitat was characterized using Shannon-Wiener index (H′) for overall diversity (Krebs, 1978), Simpson's diversity index (1–D) to assess dominance patterns (Simpson, 1949), and Pielou's evenness (J′) to measure distribution equity among species (Pielou, 1966). Indices were computed and compared across the five habitat types to identify areas of high diversity and potential conservation importance.

We assessed normality of our data, using Shapiro – Wilk test (Freedman et al., 2007). Then, we assessed the linear relationship between environmental variables (temperature and humidity) and total reptile detections using Pearson's product-moment correlation coefficient and Spearman's rank test. We also used Kruskal – Walli's test with *post hoc* Dunn tests to compare monthly detection among habitats. All calculations were carried out in R Statistical Software (version 4.3.0; R Core Team, 2023).

3.4 Results and discussion

A total of 33 reptile species (2,917 detections) were recorded across five habitat types on campus (Tabel 3.1). Species richness was highest in human-disturbed forests (22 species), followed by around buildings (18), reservoir edges (16), plantations (16), and agricultural zones (12), respectively. Overall abundance peaked around buildings

(954 detections), but all habitats supported substantial reptile populations. These findings highlight the ecological heterogeneity within a university campus and reinforce the role of semi-urban environments in supporting reptile diversity.

The most frequently recorded species during the survey were *Hemidactylus frenatus*, with a total of 1,073 detections, and *Dixonius siamensis*, with 782 detections (Table 3.1 and Figure 3.3). These high counts suggest that both species are well adapted to human especially AB areas. *Calotes irawadi* was also commonly encountered, with a total of 464 detections, most of which were observed in RES, AG, and PLT. The venomous pit viper *Trimeresurus albolabris* was recorded 311 detections, with the highest number found in AG and RES.

Table 3.1 Reptile detection by species around buildings (AB), agriculture (AG), near reservoirs (RES), plantations (PLT), and human-disturbed forest (HDF).

Family	Species	AB	AG	RES	PLT	HDF	Total
Agamidae	Calotes irawadi	80	100	116	94	74	464
Agamidae	Leiolepis belliana	0	0	0	1	0	1
Agamidae	Calotes goetzi	0	0	1	1	2	4
Colubridae	Ahaetulla prasina	0	1	1	0	0	2
Colubridae	Ahaetulla fusca	1	1	12	1	1	16
Colubridae	Fowlea flavipunctatus	16	2	1	2	1	22
Colubridae	Chrysopelea ornata	0	1	1	4	3	9
Colubridae	Dendrelaphis pictus	2	8	3	18	12	43
Colubridae	Ptyas korros*	0	0	0	1	2	3
Colubridae	Coelognathus radiatus	0	0	0	0	1	1
Colubridae	Oligodon fasciolatus	15	0	0	2	2	19
Colubridae	Ptyas mucosa	1	0	0	0	0	1
Colubridae	Oligodon taeniatus	1	0	0	0	0	1
Colubridae	Cylindrophis jodiae	1	0	0	0	0	1
Colubridae	Lycodon capucinus	0	0	0	0	1	1
Elapidae	Bungarus Candidus	1	0	0	0	0	1
Elapidae	Naja siamensis**	1	0	0	0	0	1
Gekkonidae	Gekko gecko	32	9	11	5	3	60

Table 3.1 (Continued).

Family	Species	AB	AG	RES	PLT	HDF	Total
Gekkonidae	Dixonius siamensis	226	103	105	205	143	782
Gekkonidae	Hemidactylus frenatus	532	115	140	167	119	1073
Geoemydida	Malayemys khoratensis	0	0	1	0	1	2
Geoemydida	Cuora cuora kamaroma***	0	0	0	0	1	1
Homalopsidae	Hypsiscopus murphyi	14	8	1	1	49	73
Homalopsidae	Enhydris enhydris	0	0	1	0	0	1
Pythonidae	Python bivittatus**	2	0	0	0	0	2
Pythonidae	Malayopython reticulatus	0	0	0	0	1	1
Scincidae	Eutropis macularia	0	0	0	0	1	1
Scincidae	Subdoluseps bowringii	0	0	2	1	4	7
Scincidae	Eutropis multifasciata	0	1	0	0	0	1
Typhlopidae	Indotyphlops braminus	1	0	0	0	0	1
Varanidae	Varanus salvator macromaculatus	0	0	0	0	1	1
Viperidae	Trimeresurus albolabris	26	85	84	63	53	311
Xenopeltidae	Xenopeltis unicolor	2	0	1	3	4	10
	Grand Total	954	434	481	569	479	2918
	Species	18	12	16	16	22	33

* IUCN Near threatened, ** Vulnerable, *** Endangered species

In this study, four species of conservation concern were documented (Table 3.1 and Figure 3.4). *Cuora cuora kamaroma,* listed as Endangered by the IUCN, was recorded only once in a human-disturbed forest patch, highlighting both its rarity and sensitivity to habitat modification. *Python bivittatus* and *Naja siamensis*, both classified as Vulnerable, were observed two times and once, respectively. These individuals were encountered in areas adjacent to student dormitories, categorized as "around building" habitats, suggesting that habitat fragmentation and increased human-wildlife interactions may pose significant threats to their survival. *Ptyas korros*, listed as Near Threatened, was recorded twice in human-disturbed forest and once in plantation habitat during the survey. Additionally, *Ptyas korros*, *Ptyas mucosa*, *Python bivittatus*, *Malayopython reticulatus,* and *Xenopeltis unicolor* were identified as protected species under Thai law. The limited occurrence of these species, particularly within human-influenced environments, underscores the ecological significance of the study area and highlights the urgent need for targeted conservation measures within and around the university camp.

Figure 3.3 Common species of reptiles in Suranaree University of Technology. (A) *He midactylus frenatus*, (B) *Dixonius siamensis*, (C) *Calotes irawadi,* (D) *Trimeresurus albo labris.*

Shannon-Weiner index (Table 3.2) was lowest in agriculture (H′=1.92) and highest in human disturbed forest (H′=2.75), reflecting that intensive cropping supports few species and is dominated by generalists, whereas moderately disturbed forests maintain both high richness and relatively balanced abundances. Simpson's diversity index also supports this finding. Once again, HDF ranked the highest (0.884), indicating low dominance, with around buildings (AB = 0.817) and plantations (PLT = 0.810) intermediate, while reservoir margins (RES = 0.784) and AG (0.761) were lower, showing stronger skew towards fewer taxa. Pielou's evenness peaked in HDF (J′=0.82), intermediate in PLT (0.79), AB (0.78) and RES (0.76), and dropped lowest in AG (0.72), confirming that moderate disturbance fosters relatively equitable communities whereas intensive land use yields an uneven assortment of species.

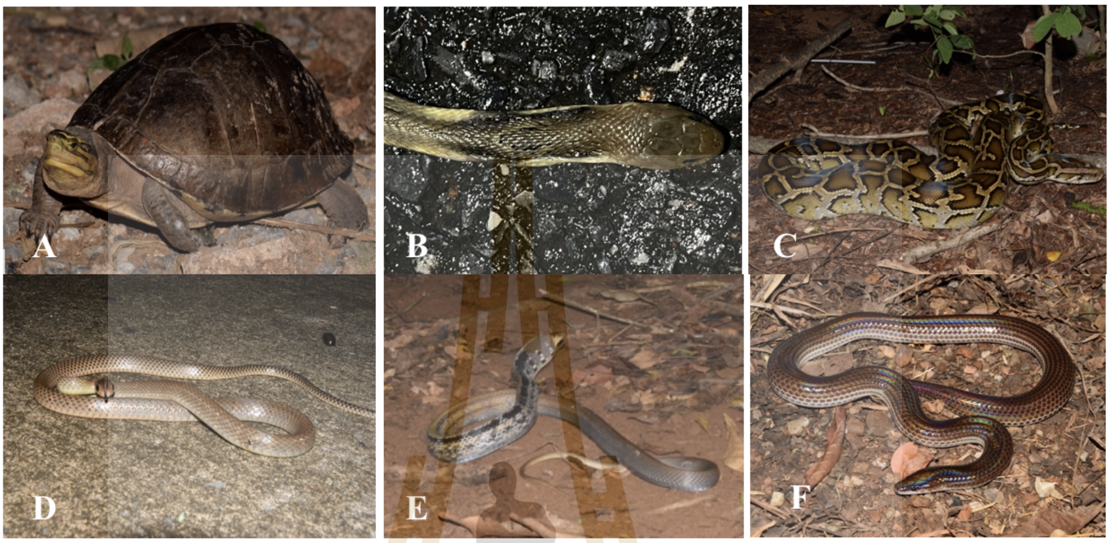

Figure 3.4 Examples of reptile species of conservation concern and legally protected species recorded at Suranaree University of Technology. (A) *Cuora cuora kamaroma*, (B) *Naja siamensis*, (C) *Python bivittatus*, (D) *Ptyas korros*, (E) *Coelognathus radiatus*, (F) *Xenopeltis unicolor*.

Table 3.2 Diversity indices of reptiles of five habitats in Suranaree University of Technology.

Habitat	Species	Shannon-Weiner	Simpson diversity	Pielou J′
AB	18	2.31	0.817	0.78
AG	12	1.92	0.761	0.72
RES	16	2.15	0.784	0.76
PLT	16	2.21	0.810	0.79
HDF	22	2.75	0.884	0.82

Collectively, these indices demonstrate that semi-natural habitats (HDF, PLT, RES) support the greatest diversity and evenness, whereas highly modified areas (AB, AG) exhibit high encounter rates driven by a handful of synanthropic species. Taken together, these indices confirm that seminatural habitats (disturbed forest, plantations, reservoir margins) tend to support both higher richness and more equitable species abundances, while urban edges see strong dominance by a handful of generalists.

We used the Pearson correlation test (Table 3.3) to examine any positive associations between the average monthly temperature and detection. A moderate, positive association but not statistically significant between mean monthly temperature and total reptile detections ($r = 0.60$, $p = 0.056$) was shown. However, no significant correlation between detections and humidity ($p = 0.905$) was found. Although this trend indicates that warmer months tend to have higher detection counts, it falls just shy of conventional statistical significance suggesting a primarily exploratory pattern rather than a definitive climate–activity link.

The monthly reptile detection data reveal some seasonal and habitat-related trends (Figure 3.5), with total detections peaking in September (541) and October (481), corresponding with the highest humidity levels and moderate temperatures during the wet season. Reptile detection was lowest in December (106), when temperature was low (18.2°C) marking the onset of the dry cool season. Among habitat types, areas around buildings (AB) consistently recorded the highest detections, particularly in July, September, and October. Human-disturbed forests (HDF) also showed substantial activity, particularly in the early wet season, aligning with this habitat's overall high diversity observed in the study. In contrast, detections in agricultural (AG), plantation (PLT), and reservoir edge (RES) habitats were lower and more variable, with slight increases during the rainy months. These results underscore the strong influence of climatic factors particularly humidity on reptile detectability and emphasize the importance of preserving seminatural habitat fragments alongside managed landscapes for sustaining campus herpetofauna.

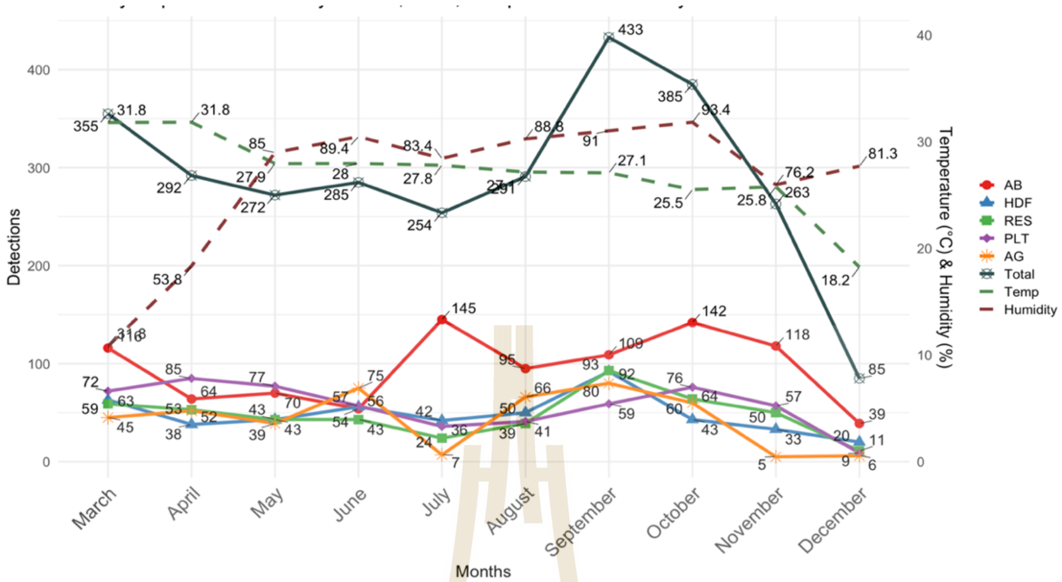

Figure 3.5 Monthly temperature, humidity, and reptile detection by habitat. Around buildings (AB), agriculture (AG), near reservoirs (RES), plantations (PLT), human-disturbed forest (HDF), air temperature (AT), air humidity (AH).

We assessed normality of our weather covariates using the Shapiro–Wilk test: (Table 3.3) mean monthly temperature was marginally non-significant (W = 0.848, p = 0.055), while humidity clearly violated normality (W = 0.763, p = 0.005). Accordingly, we used Pearson's correlation to test temperature–detection associations and Spearman's rank correlation for humidity. There was a close but not significant linear relationship between mean monthly temperature and total reptile detections (r = 0.62, p = 0.054); however, humidity showed a significant, positive rank-order association with detections (ρ = 0.35, p = 0.331). Monthly detection rates also differed by habitat (Kruskal–Wallis H = 12.41, p = 0.014). The unadjusted pairwise Wilcoxon tests indicated differences between AB and AG (p = 0.023), AB and HDF (p = 0.005) and AB and RES (p = 0.016), but none of these survived Benjamin–Hochberg correction (all p adj. > 0.05) which revealed no significant differences between any two habitats (Figure 3.6).

Table 3.3. Results of Normality and Correlation Analyses for Environmental Influences on Reptile Detection.

Test	Statistic	p-value
Shapiro–Wilk Test (Temperature)	0.848	0.055
Shapiro–Wilk Test (Humidity)	0.763	0.005
Pearson Correlation	0.62	0.054
Spearman Correlation	0.35	0.331
Kruskal–Wallis Test	12.41	0.014

When compared to SUT previous surveys, this study has less than 40 species reported by Suwanwaree et al. (2011), reaffirming the campus as a reptile diversity hotspot in northeast Thailand. SUT exhibits one of the highest reptile richness values among Thai academic institutions. For instance, Mahidol University in Bangkok recorded 41 species (Prasopsin and Aksornneam, 2014), and Suan Sunandha Rajabhat University, Samut Songkhram province reported 20 species (Chanate and Pattaraporn, 2017), while Kasetsart University, Siracha campus, Chonburi province documented 13 species (Duengkae, 2011). These differences may be attributed to SUT's diverse habitat types, including relatively undisturbed forest patches and water bodies, as well as extended survey duration and effort.

In comparison to nearby protected areas, SUT supports a moderately high level of reptile species richness. Sakaerat Environmental Research Station located approximately 65 km from SUT, harbors 90 species of reptiles (Thailand Institute of Scientific and Technological Research, 2025), 18 of which are also recorded at SUT. Khao Yai National Park supports 96 species (Thai National Park, 2025), while Pang Sida National Park is home to 42 species (Chuaynkern, 2001). Although protected areas typically sustain higher biodiversity due to their ecological integrity and lower levels of human disturbance, the presence of 33 reptile species within the urbanized campus of SUT underscores the adaptability of many reptilian taxa to modified landscapes and highlights the ecological value of seminatural habitats within academic environments.

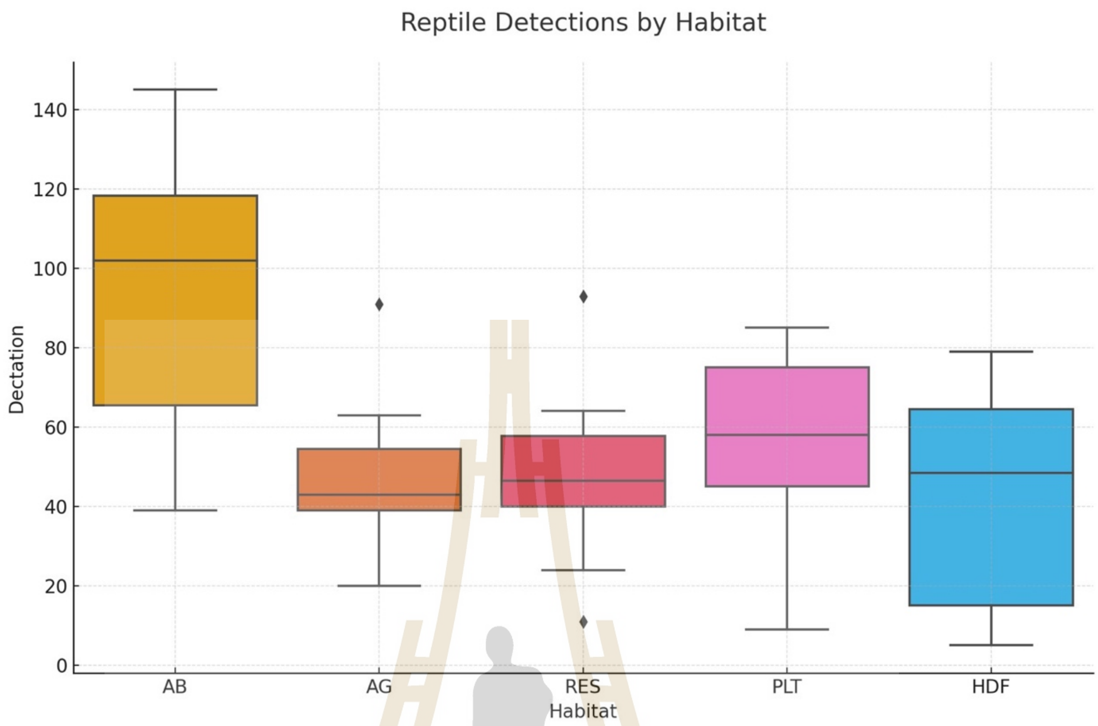

Figure 3.6 Monthly reptile detection comparison among habitats. Around buildings (AB), agriculture (AG), near reservoirs (RES), plantations (PLT), human-disturbed forest (HDF).

This study underscores the value of university campuses as alternative conservation spaces in anthropogenically influenced environments. Previous studies have emphasized that anthropogenic disturbances, including landscape modifications and land-use changes, can significantly affect herpetofauna diversity on university campuses (Prasopsin and Aksornneam, 2014; Maulidi et al., 2020). The reptile diversity observed at SUT is comparable to that of larger protected areas and exceeds many other campus-based inventories across Thailand. This affirms the role of academic institutions not only as centers for learning but also as important contributors to biodiversity conservation in rapidly urbanizing regions.

3.5 Conclusion

Our study recorded 33 species of reptiles on Suranaree University of Technology campus, with the highest diversity and species richness observed in human-disturbed forests, underscoring the conservation value of maintaining seminatural habitat fragments within the campus landscape. Synanthropic gecko species dominated reptile assemblages in urban-edge habitats around buildings, resulting in lower overall diversity but high local abundance. Seasonal variation was pronounced, with reptile detections peaking during the wet months (March, September, and October) and declining during the drier months. Notably, several rare and conservation-concern species were recorded, including *Cuora cuora kamaroma* (Endangered), *Python bivittatus* (Vulnerable), *Naja siamensis* (Vulnerable), and *Ptyas korros* (Near Threatened) according to the IUCN Red List. In addition, *Ptyas korros*, *Ptyas mucosa*, *Python bivittatus*, *Malayopython reticulatus*, and *Xenopeltis unicolor* were identified as protected species under Thai law. This survey provides a valuable baseline for long-term monitoring and supports biodiversity-informed campus planning, infrastructure development, and environmental education initiatives.

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CHAPTER IV

AMPHIBIAN DIVERSITY OF SURANAREE UNIVERSITY OF TECHNOLOGY NAKHON RATCHASIMA PROVINCE

4.1 Abstract

Amphibians are essential components of ecosystems, contributing to nutrient cycling, pest control, and serving as sensitive indicators of environmental change. This study evaluated amphibian species diversity and habitat use across five habitat types on the Suranaree University of Technology campus in Nakhon Ratchasima Province, Thailand. Visual encounter surveys were conducted from March to December 2024, recording 18 amphibian species with 5,790 detections. Species richness was highest in human-disturbed forests (17 species), followed by agricultural areas (15), around buildings (14), and both plantations and reservoirs (13 species each). The human-disturbed forest also recorded the highest species diversity, with a Shannon–Wiener index (H′) of 2.33, Simpson diversity of 0.88, and Pielou's evenness (J′) of 0.82. Despite lower richness, reservoirs supported aquatic specialists such as Hylarana erythraea and Occidozyga martensii, enhancing overall habitat diversity. Generalist species like Duttaphrynus melanostictus and Kaloula pulchra were widespread across all habitats. Notably, two Near Threatened species, Glyphoglossus molossus and Kaloula mediolineata, were primarily found in human-disturbed forest and plantation areas. However, these species face increasing pressure from overharvesting, as local communities frequently collect amphibians on campus after rainfall. These findings highlight the ecological importance of maintaining habitat heterogeneity within urban landscapes and underscore the need for targeted conservation actions, stricter protection, and enhanced public awareness to safeguard amphibian biodiversity.

4.2 Introduction

Amphibians play vital roles in ecosystems as insect predators, prey for higher trophic levels, and indicators of environmental health due to their physiological sensitivity to pollutants and climate variation (Duellman and Trueb, 1994; Blaustein et al., 2010). Their dual aquatic-terrestrial life cycle and permeable skin make them especially vulnerable to habitat disturbance, positioning them as valuable bioindicators of environmental change (Petranka, 1998). Globally, 8,892 amphibian species are currently recognized (AmphibiaWeb, 2025), yet many faces alarming declines. Widespread population crashes and extinctions have been driven by habitat loss, environmental contamination, and emerging infectious diseases most notably chytridiomycosis, caused by the fungal pathogen *Batrachochytrium dendrobatidis* (Berger et al., 1998; Fisher and Garner, 2020).

Thailand is considered a biodiversity hotspot for amphibians, harboring 194 known species, including 29 endemics (Poyarkov et al., 2021). While much of the country's herpetological research has focused on protected areas, amphibian assemblages in semi-urban landscapes zones that exist between natural habitats and fully urbanized areas are receiving increasing attention. University campuses, which often contain remnant natural features such as wetlands, forest patches, and artificial ponds, may serve as important refuges for amphibians amidst rapid land-use change (Duengkae, 2011; Wanchai et al., 2023).

Suranaree University of Technology (SUT), located on the semi-urban outskirts of Nakhon Ratchasima in northeastern Thailand, encompasses a heterogeneous landscape of dry dipterocarp forest fragments, tree plantations, seasonal wetlands, a large reservoir, and anthropogenic environments including roads and built-up zones (Naithani et al., 2018). Although the campus has implemented green space restoration and conservation initiatives, pressures such as habitat fragmentation and frog harvesting after rainfall events continue to pose threats to local amphibian populations.

This study aimed to fill that gap by documenting the diversity, abundance, habitat associations, and conservation statuses of amphibians on the SUT campus. By evaluating species presence across five distinct land-use types around buildings, human-disturbed forest (HDF), reservoirs, plantations, and agricultural areas it provided essential baseline data for future conservation planning, ecological education, and biodiversity monitoring in semi-urban university environments.

4.3 Methods

Surveys took place on the 1,120-ha campus of Suranaree University of Technology, Nakhon Ratchasima province, Thailand (14.8729° N, 102.0237° E; 251 m asl), which comprises dry dipterocarp forest fragment, plantation, botanical garden, agricultural field, reservoir, and built zone (Thammathaworn et al., 1996; Naithani et al., 2018). Vegetation includes 383 species (1 cycad, 308 dicots, and 74 monocots), dominated by Leguminosae and Gramineae families. Five habitat types were chosen to represent an urban–natural gradient (Figures 4.1 and 4.2), including around buildings (AB), agriculture zones (AG), riparian zones near reservoirs (RES), plantations (PLT), and human-disturbed forest fragments (HDF).

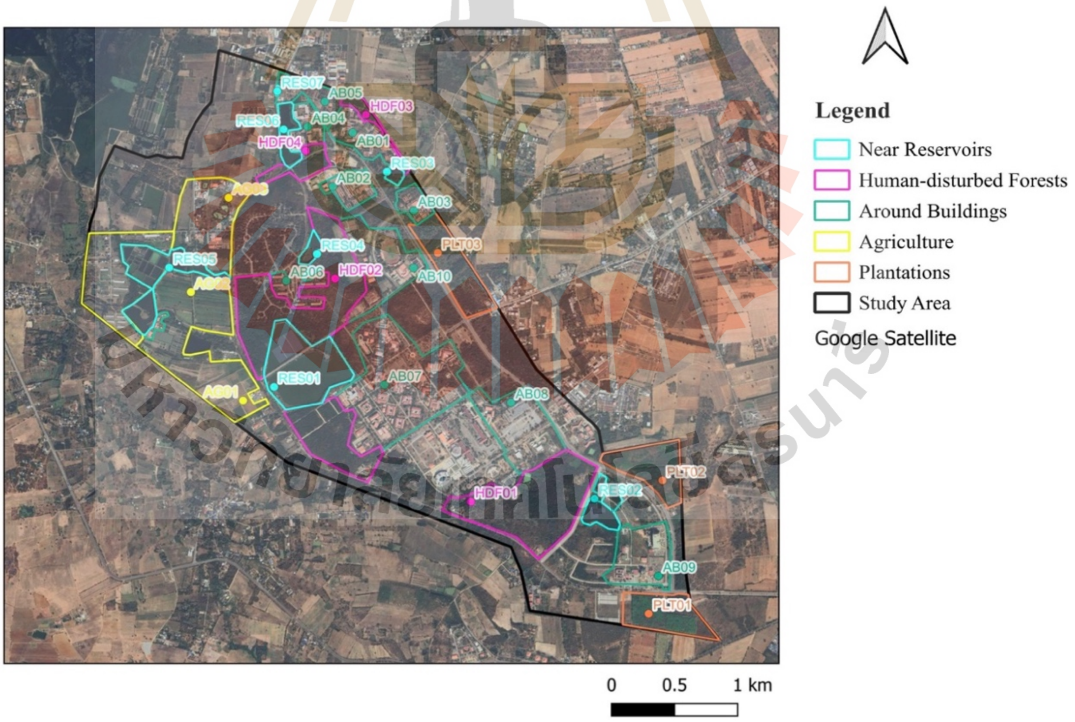

Figure 4.1 Location map showing five surveyed habitats within Suranaree University of Technology, Nakhon Ratchasima, Thailand.

Figure 4.2 Five study habitats at Suranaree University of Technology. (A) Around buildings, (B) agriculture, (C) near reservoirs, (D) plantation, (E) human-disturbed forest.

From March to December 2024, nocturnal visual encounter surveys (VES) were conducted two to three nights per week between 20:00 and 01:00. Each amphibian encountered was identified to species level using standard field guides and photographed for documentation. The GPS location of each individual was recorded, and observations were assigned to one of four primary habitat types: around buildings (AB), agriculture (AG), plantations (PLT), and reservoirs (RES). Species listed as threatened or protected were flagged according to the IUCN Red List and Thai wildlife protection laws.

At the beginning of each transect, ambient temperature, ground temperature, and humidity were measured to examine their relationship with amphibian activity patterns. These environmental variables were later correlated with monthly detection rates using Pearson's product-moment correlation coefficient (Freedman et al., 2007).

Frog identification followed established morphological protocols outlined by Leong et al. (2003), Rujirawan et al. (2013), Garg et al. (2018), Alhadi et al. (2019), Thongproh et al. (2019), and Yodthong et al. (2019), with further reference to *Amphibians of Northeastern Thailand* (Makchai et al., 2023). Where possible, measurements including snout–urostyle length, head length, and head width were taken to support species identification.

Community structure in each habitat was characterized using the Shannon–Wiener diversity index (H′) to evaluate overall diversity (Krebs, 1978), Simpson's diversity index (1–D) to assess species dominance (Simpson, 1949), and Pielou's evenness index (J′) to determine the evenness of species distribution (Pielou, 1966). Diversity indices were compared across habitat types to identify areas of high biodiversity and conservation priority.

4.4 Results and discussion

A total of 18 amphibian species, representing six families and comprising 5,790 individual detections (Table 4.1), were recorded across five habitat types around buildings (AB), human-disturbed forest (HDF), reservoir edges (RES), plantations (PLT), and agricultural areas (AG) on the SUT campus from March to December 2024. Species richness was highest in HDF (17 species), followed by AG (15), AB (14), and both PLT and RES (13 each), respectively. In terms of abundance, HDF yielded the highest number of detections (1,598 individuals), followed by AB (1,403), PLT (1,000), AG (911), and RES (878), respectively. These results underscore the ecological importance of fragmented and semi-natural habitats within semi-urban university landscapes in supporting diverse amphibian communities. Several species showed wide habitat tolerance and high overall abundance. *Microhyla mukhlesuri* was the most frequently recorded species, with 1,168 detections across all habitat types, demonstrating a high degree of adaptability. Other common generalists included *Occidozyga martensii* (684 detections), *Kaloula pulchra* (673), *Fejervarya limnocharis* (637), *Duttaphrynus melanostictus* (569), and *Microhyla heymonsi* (512), all of which were distributed broadly and associated with both natural and human-altered environments (Figure 4.3).

Table 4.1 Amphibian species observed across five habitat types: around buildings (AB), agricultural areas (AG), reservoir edges (RES), plantations (PLT), and human-disturbed forests (HDF).

Family	Species	AB	AG	RES	PLT	HDF	Total
Bufonidae	Duttaphrynus melanostictus	206	89	85	85	104	569
Dicroglossidae	Fejervarya limnocharis	116	110	98	84	229	637
Dicroglossidae	Hoplobatrachus rugulosus	2	2	2	0	8	14
Dicroglossidae	Occidozyga lima	81	24	33	0	113	251
Dicroglossidae	Occidozyga martensii	234	132	105	23	190	684
Ichthyophiidae	Ichthyophis kohtaoensis	1	0	0	0	1	2
Microhylidae	Glyphoglossus guttulatus	0	8	0	21	3	32
Microhylidae	Glyphoglossus molossus*	11	20	5	86	73	195
Microhylidae	Kaloula mediolineata*	0	7	0	38	2	47
Microhylidae	Kaloula pulchra	153	103	77	203	137	673
Microhylidae	Microhyla butleri	9	50	15	17	31	122
Microhylidae	Microhyla heymonsi	101	118	57	115	121	512
Microhylidae	Microhyla mukhlesuri	343	164	98	201	362	1168
Microhylidae	Microhyla pulchra	0	0	0	0	11	11
Microhylidae	Micryletta erythropoda	113	54	43	46	129	385
Microhylidae	Polypedates megacephalus	31	15	17	80	20	163
Microhylidae	Rohanixalus vittatus	0	0	0	1	0	1
Ranidae	Hylarana erythraea	2	15	243	0	64	324
	Grand Total	1403	911	878	1000	1598	5790
	Species	14	15	13	13	17	18

* IUCN Near threatened.

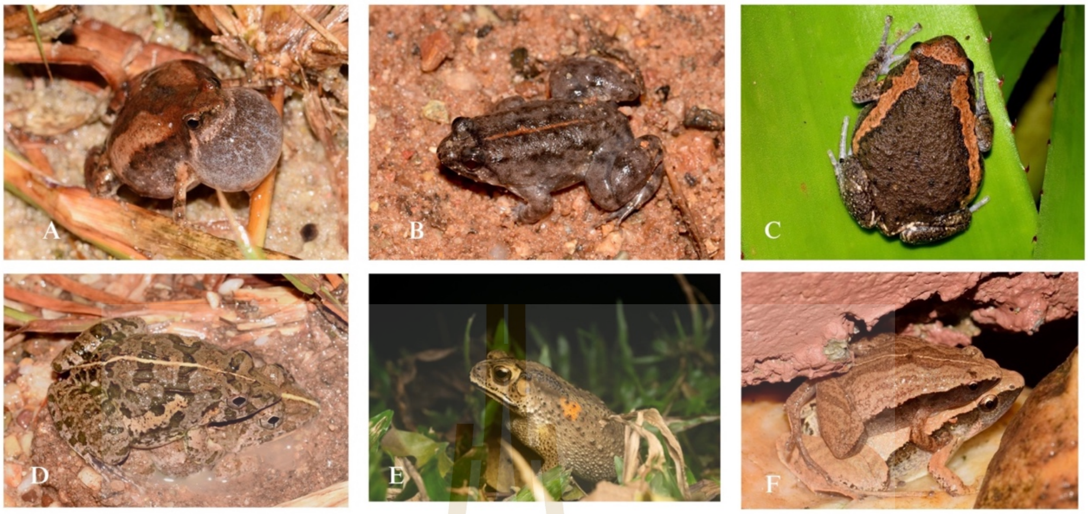

Figure 4.3 Common species of amphibians in Suranaree University of Technology. (A) *Microhyla mukhlesuri*, (B) *Occidozyga martensii*, (C) *Kaloula pulchra,* (D) *Fejervarya limnocharis*, (E) *Duttaphrynus melanostictus*, (F) *Microhyla heymonsi*.

Conversely, certain species exhibited habitat preferences or restricted distributions. For instance, *Hylarana erythraea* was mostly recorded near the reservoir (243 out of 324 detections), reflecting its reliance on permanent aquatic habitats. Plantation areas supported notable populations of *Kaloula mediolineata* and *Glyphoglossus guttulatus*, likely due to the soft, well-drained soil favorable for burrowing. *Ichthyophis kohtaoensis*, a fossorial caecilian, was detected only twice once in AB and once in HDF suggesting its rarity or cryptic behavior. Two species of conservation concern were observed during the survey: *Glyphoglossus molossus* and *Kaloula mediolineata*, both listed as Near Threatened on the IUCN Red List (Figure 4.4). The former was detected 195 times, primarily in plantation and forest habitats, while the latter was found 47 times, almost exclusively in plantations. Their presence indicates that modified environments such as plantations can still provide important refuges for declining species, especially where soil and vegetation conditions are favorable.

Figure 4.4 Examples of amphibian species of conservation concern species recorded at Suranaree University of Technology. (A) *Glyphoglossus molossus*, (B) *Kaloula mediolineata*.

The amphibian assemblage at SUT thus reflects a blend of habitat generalists and specialists, demonstrating the biodiversity value of semi-urban campuses. Conservation efforts should aim to preserve wetland integrity, maintain forest patches, reduce pesticide use in agriculture, and discourage frog harvesting, particularly during the rainy season. Continued monitoring is recommended to track population trends, habitat use, and potential emerging threats such as disease or urban expansion.

Ichthyophis kohtaoensis, the only caecilian recorded in this study, was detected only twice—once in the around-building (AB) area and once in human-disturbed forest (HDF) (Figure 4.5). As a fossorial and subterranean amphibian, it spends most of its life underground, which likely contributed to its low detectability. Its presence in both semi-natural and human-altered environments with moist, soft soil suggests these areas may serve as important microhabitats, particularly during or after heavy rainfall when caecilians are more likely to surface. Similarly, *Rohanixalus vittatus* was observed just once, in a plantation area. While not considered rare, this arboreal species may have been under-detected due to its canopy-dwelling behavior, small size, and seasonal breeding, which limit its visibility during standard ground-based nocturnal surveys.

Figure 4.5 Amphibian species with low detection frequency during the survey. (A) *Ichthyophis kohtaoensis*, (B) *Rohanixalus vittatus*.

The Human-Disturbed Forest (HDF) exhibited the highest species richness (17 species) and the greatest Shannon–Weiner diversity index (2.33), reflecting a well-balanced and diverse community (Table 4.2). The Agricultural (AG) habitat followed closely, with a Shannon–Weiner index of 2.32 and the highest Simpson diversity value (0.89), suggesting a community structure with minimal species dominance. Plantation (PLT) and Reservoir (RES) habitats also showed comparable diversity levels, with Shannon–Weiner indices of 2.24 and 2.18, and Simpson indices of 0.87 and 0.86, respectively. In contrast, the Around-Buildings (AB) habitat had the lowest diversity (Shannon–Weiner = 2.11) and evenness (Pielou's J′ = 0.80), although still within a moderately even range. These findings highlight that species diversity remains relatively high across all habitat types, including modified environments such as agriculture and plantation areas, while human-disturbed forests (HDF) continue to function as key areas supporting both richness and evenness.

Normality testing using the Shapiro–Wilk test (Table 4.3) revealed that temperature was approximately normally distributed ($W = 0.8486$, $p = 0.0594$), while humidity deviated significantly from normality ($W = 0.7963$, $p = 0.0166$).

To examine environmental influences on amphibian detection, both Pearson and Spearman correlation analyses were conducted. The Pearson correlation between ambient temperature and amphibian detection (Table 4.3) yielded a weak positive association ($r = 0.2532$), which was not statistically significant ($p = 0.4803$). This suggests that temperature alone does not have a strong linear relationship with detection rates.

Table 4.2. Diversity indices for amphibian species observed in five different habitats within Suranaree University of Technology.

Habitat	Species	Shannon-Weiner	Simpson diversity	Pielou J'
B	14	2.11	0.86	0.80
AG	15	2.32	0.89	0.86
RES	13	2.18	0.86	0.85
PLT	13	2.24	0.87	0.87
HDF	17	2.33	0.88	0.82

In contrast, Spearman's rank correlation between ambient humidity and amphibian detection produced a moderate and statistically significant positive correlation (ρ = 0.661, p = 0.038) (Table 4.3), indicating that amphibian detection increases with higher humidity levels in a monotonic but potentially non-linear manner.

Table 4.3. Summary of Normality and Correlation Tests Examining Environmental Influences on Amphibian Detection.

Test	Statistic	p-value
Shapiro–Wilk	0.8486	0.0594
Shapiro–Wilk	0.7963	0.0166
Pearson Correlation	0.2532	0.4803
Spearman Correlation	0.661	0.038

Monthly amphibian detections (Figure 4.6) showed marked variation across habitats and environmental conditions. A sharp peak in total detections was observed in September (1410 detections), coinciding with high humidity (91.0%) and moderate temperature (27.1°C). This suggests that amphibian activity and detectability may be strongly influenced by elevated moisture levels, which are essential for hydration, skin respiration, and breeding. Among habitat types, HDF (human-disturbed forest) and AB (areas around buildings) consistently recorded higher detection counts across months, particularly in the wet season, likely due to the presence of water-retaining structures, shade, and vegetation. In contrast, AG (agriculture) and RES (reservoirs) showed lower and more variable detections, possibly reflecting habitat disturbance or fewer suitable microhabitats. The lowest overall detections occurred in December (66 detections), when temperature dropped to 18.2°C and humidity fell to 81.3%, indicating that cooler and drier conditions reduce amphibian surface activity or calling behavior. The data suggest that amphibian abundance and detectability are seasonally influenced, with peaks during warm, humid periods and declines in colder, drier months, with habitat-specific responses influenced by microclimatic buffering and anthropogenic features.

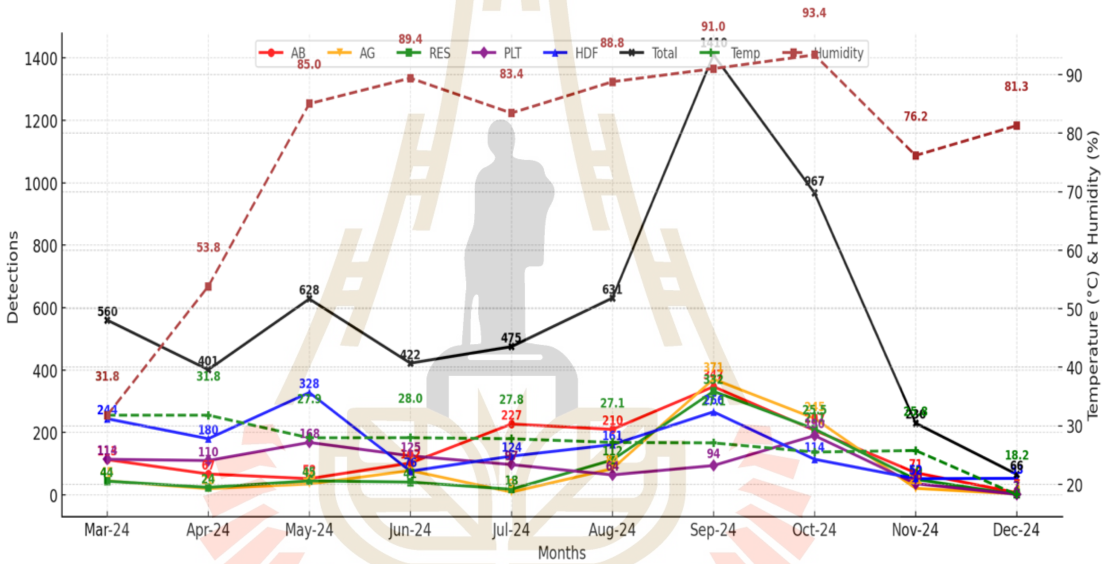

Figure 4.6. Monthly changes in temperature, humidity, and amphibian detections across different habitat types: AB (around buildings), AG (Agriculture), RES (reservoirs), PLT (plantations), and HDF (human-disturbed forests).

To assess differences in amphibian detection across habitat types (AB, AG, RES, PLT, HDF), a Kruskal–Wallis H test was conducted. The test produced a statistic of $H = 7.78$ with $p = 0.100$, indicating no statistically significant difference in detection counts among habitats.

Amphibian detections varied among habitat types (Figure 4.7), with the highest median and overall detection counts observed in human-disturbed forest (HDF) and areas around buildings (AB). HDF showed the greatest range and upper quartile of detections, reaching up to nearly 330 individuals, indicating high amphibian presence in these partially modified environments. The AB habitat also exhibited a wide detection range and high interquartile spread, suggesting that these environments may offer suitable microhabitats such as shaded areas, water sources, or refuge sites. In contrast, agricultural land (AG) and reservoir (RES) habitats showed the lowest medians and more constrained distributions, with several outliers present, suggesting inconsistent or localized amphibian presence. Plantation (PLT) habitats had intermediate values with a relatively balanced distribution. These patterns suggest that semi-disturbed or edge environments (e.g., HDF and AB) may support greater amphibian diversity or abundance, possibly due to higher structural heterogeneity and microclimatic variation, while more exposed or homogeneous environments (like AG and RES) may offer fewer suitable conditions for amphibian persistence.

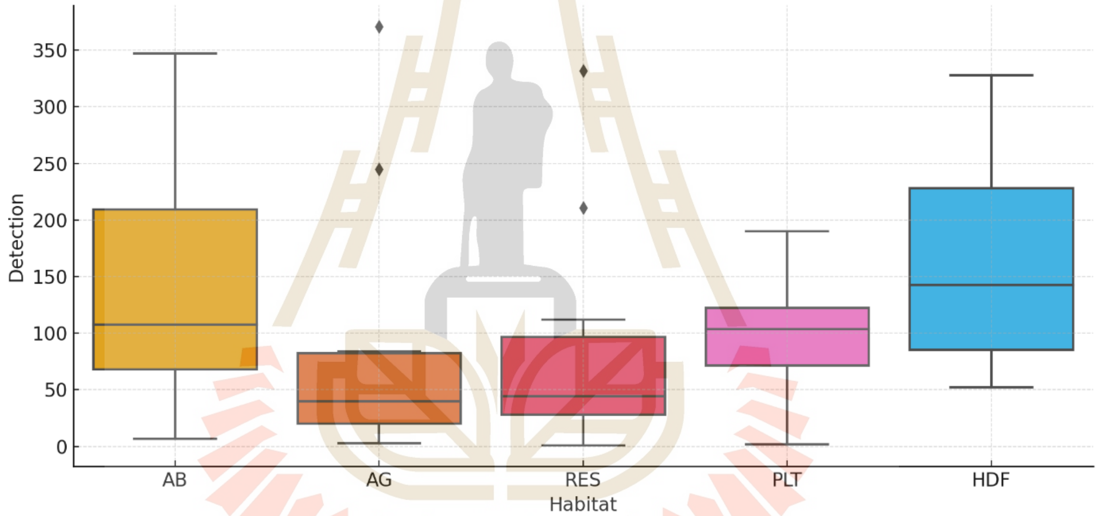

Figure 4.7. Monthly amphibian detection comparison among habitats. Around buildings (AB), agriculture (AG), near reservoirs (RES), plantations (PLT), human-disturbed forest (HDF).

Recent research at various sites in Thailand has reported diverse amphibian assemblages across a range of habitats. For example, Kasetsart University recorded 10 amphibian species in a secondary mixed-deciduous forest (Duengkae, 2011), while Prince of Songkla University found 11 frog species across habitats such as artificial canals, agricultural zones, building zones, freshwater ponds, and temporary ponds (Sangrueng et al., 2021). Suan Sunandha Rajabhat University reported two amphibian species from habitats including stagnant drains, roadside ditches, and lawns (Chanate and Pattaraporn, 2017), and Ubon Ratchathani University documented 17 amphibian species from six families across its botanical garden, campus grounds, and nearby agricultural areas (Wanchai et al., 2023).

In comparison, my study recorded 18 amphibian species across five habitat types: around buildings (AB), agricultural areas (AG), near reservoirs (RES), plantations (PLT), and human-disturbed forest (HDF). The human-disturbed forest had the highest species richness (17 species), followed by agriculture (15 species), around buildings (14 species), plantations (13 species), and near reservoirs (13 species). Notably, species such as *Microhyla mukhlesuri* and *Fejervarya limnocharis* showed high detection rates, with over 600 individuals each. Additionally, *Glyphoglossus molossus* and *Kaloula mediolineata*, both listed as Near Threatened on the IUCN Red List, were recorded, highlighting the conservation value of the area.

In relation to nearby protected areas, SUT shows a fairly high level of amphibian diversity. The Sakaerat Environmental Research Station, located approximately 65 km from SUT, has recorded 29 amphibian species (Thailand Institute of Scientific and Technological Research), 13 of which are also present at SUT. Khao Yai National Park is home to 28 amphibian species (Thai National Park, 2025), with 10 species overlapping with those found at SUT. Namtok Phliu National Park supports 22 amphibian species (Sukprakarn and Nabhitabhata, 2002), while Kaeng Krachan National Park has reported a total of 63 amphibian and reptile species combined, although separate amphibian counts are not provided (Pauwels and Chan-ard, 2006). Despite the fact that protected areas typically support richer biodiversity due to intact habitats and lower levels of human impact, the documentation of 18 amphibian species within the urbanized landscape of SUT highlights the resilience of several amphibian taxa and underscores the ecological importance of seminatural spaces on university campuses.

4.5 Conclusion

This study recorded 18 amphibian species from six families, totaling 5,790 detections across five distinct habitat types on the Suranaree University of Technology (SUT) campus. Species richness and abundance were highest in human-disturbed forests, followed by areas around buildings, plantations, agricultural zones, and reservoirs. These findings emphasize the ecological importance of preserving semi-natural and mosaic habitats within university landscapes, which can support a wide range of amphibian species even amid ongoing land-use changes.

Generalist species such as *Microhyla mukhlesuri*, *Occidozyga martensii*, *Kaloula pulchra*, and *Fejervarya limnocharis*were widely distributed and highly abundant, indicating strong adaptability to both natural and human-modified environments. Conversely, more specialized species like *Glyphoglossus molossus* and *Kaloula mediolineata*, both listed as Near Threatened on the IUCN Red List, showed stronger associations with specific microhabitats—particularly loose soils in plantations ideal for burrowing. Their presence in these localized habitats, along with their popularity as edible frogs in Thailand, raises concerns about overharvesting, especially following heavy rains when they become more active and easier to catch.

The detection of *Ichthyophis kohtaoensis*, a fossorial caecilian, in the area around buildings further highlights the hidden amphibian diversity that persists in semi-urban zones. As urbanization increases across the country, this study underscores the need for continued amphibian monitoring, responsible land management, and the inclusion of biodiversity considerations in university campus development. SUT's green spaces serve not only as refuges for wildlife but also as living laboratories for conservation research and education.

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CHAPTER V

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

This study documented 33 reptile species and 18 amphibian species from a range of ecological guilds across five habitat types within the Suranaree University of Technology (SUT) campus in Nakhon Ratchasima Province, Thailand. Among all habitats surveyed, human-disturbed forests consistently supported the highest levels of species richness and detections for both groups, highlighting the critical role of semi-natural green spaces in conserving herpetofauna diversity in urbanizing landscapes. These areas function not only as biodiversity refuges but also as important ecological corridors within the campus matrix.

For reptiles, urban-edge habitats such as areas around buildings were dominated by highly adaptable, synanthropic species most notably *Hemidactylus frenatus* and *Dixonius siamensis* which contributed to high local abundance but lower species evenness. In contrast, forested and more structurally complex habitats supported a broader spectrum of taxa, including elusive or conservation-priority species such as *Cuora cuora kamaroma* (Endangered), *Python bivittatus* and *Naja siamensis* (Vulnerable), and *Ptyas korros* (Near Threatened), several of which are also protected under Thai law. Reptile activity also showed a strong seasonal pattern, with detection rates increasing notably during the wet months (March, September, and October).

Amphibian communities exhibited both wide-ranging generalists—such as *Microhyla mukhlesuri*, *Kaloula pulchra*, and *Fejervarya limnocharis*—as well as habitat specialists like *Glyphoglossus molossus* and *Kaloula mediolineata* (both Near Threatened), which were strongly associated with specific environmental conditions such as loose, moist soils in plantation and forest habitats. The detection of *Ichthyophis kohtaoensis*, a fossorial caecilian species, in areas around buildings further revealed that significant amphibian diversity can persist even in semi-urban environments. However, the presence of species with economic and cultural value also exposes them to risk, as post-rainfall harvesting by local residents was observed, raising conservation concerns related to unsustainable exploitation.

The high abundance of reptiles and amphibians around buildings may be attributed to the presence of water resources associated with student dormitories. Numerous drainage ditches and water channels around these areas provide essential microhabitats that support the hydration and breeding requirements of many amphibian species. These semi-permanent water bodies not only retain moisture during dry periods but also create humid microclimates that benefit both amphibians and reptiles, allowing them to persist and even thrive throughout the hot Thai summer.

In addition, the abundance of *Hemidactylus frenatus* around buildings can be explained by their behavioral adaptation to artificial lighting. As nocturnal insectivores, these geckos benefit from the dormitory lights, which attract a steady supply of insects—an easy and consistent food source. The ability to forage under lights with minimal energy expenditure, coupled with the gecko's tolerance to human-modified environments, has likely contributed to its dominance in the around-building habitat. This synergistic relationship between anthropogenic features and ecological adaptations demonstrates how some species have successfully adjusted to urban living.

Taken together, these findings underscore the ecological importance of maintaining habitat heterogeneity ranging from minimally disturbed forest patches to modified urban areas within university campuses. They also demonstrate that even anthropogenically influenced landscapes can support considerable biodiversity if managed thoughtfully. The results of this study provide a valuable baseline for future herpetofaua monitoring, and they reinforce the need for integrated conservation actions, such as strengthening environmental regulations, promoting community awareness, and incorporating biodiversity into institutional land-use planning. Ultimately, SUT's green spaces serve not only as vital refuges for native wildlife but also as living laboratories for education, research, and the promotion of urban ecological resilience.

5.2 Recommendation

This study was conducted over a 10-month period, from March to December 2024, providing valuable baseline data on herpetofauna diversity and habitat use on campus. However, since the research did not fully cover all three seasons particularly the cool season future studies should aim to include a complete annual cycle. Doing so would allow for more accurate comparisons of species activity, diversity, and abundance across the hot, rainy, and cool seasons.

Although roadkill was not a focus of this research, several roadkill incidents involving reptiles and amphibians were observed during fieldwork. These findings indicate a potential threat to local herpetofauna that warrants further investigation. Future research should include systematic roadkill monitoring to assess the extent of the issue. Identifying roadkill hotspots, recording affected species, and tracking patterns can help inform conservation strategies, such as the implementation of traffic calming measures or signage in high-risk areas.

In addition, land use changes on campus should be addressed in future studies. Over the past few years, many new buildings have been constructed, likely contributing to habitat loss and fragmentation. A comparative analysis of land use changes over the past 10 years using satellite imagery and mapping tools could reveal important trends in habitat reduction and their effects on herpetofauna populations. Understanding how urban expansion impacts biodiversity is essential for long-term campus conservation planning.

APPENDICES

APPENDIX A

ENVIRONMENTAL DATA

Appendix A-1 Monthly ambient temperature, ambient humidity, ground, temperature, and ground humidity.

MONTH	AT	AH	GT	GH
Mar-24	31.7912752	53.45%	31.7912752	31.7912752
Apr-24	31.8174312	53.8247706	31.2724771	54.5522936
May-24	27.9393258	85.0432584	28.4966292	84.7837079
Jun-24	27.9578947	89.4	28.5684211	88.8842105
Jul-24	27.778125	83.4296875	28.4375	81.4265625
Aug-24	27.1495798	88.7907563	27.2411765	91.8731092
Sep-24	27.0740741	91.0176955	27.3995885	93.2333333
Oct-24	25.5016216	93.3756757	25.8778378	95.6772973
Nov-24	25.7676056	76.1830986	26.328169	76.3338028
Dec-24	18.2428571	81.2857143	19.3666667	84.0571429

APPENDIX B

HABITAT TRANSECT PHOTOS

Appendix B-1 Photographs of AB-1, AB-2, AB-3, AB-4, AB-5 and AB-6.

Appendix B-2 Photographs of AB-7, AB-8, AB-9, AB-10, AG-1, AG-2, AG-3, and RES.

Appendix B-3 Photographs of RES-2, RES-3, RES-4, RES-5, RES-6, and RES-7.

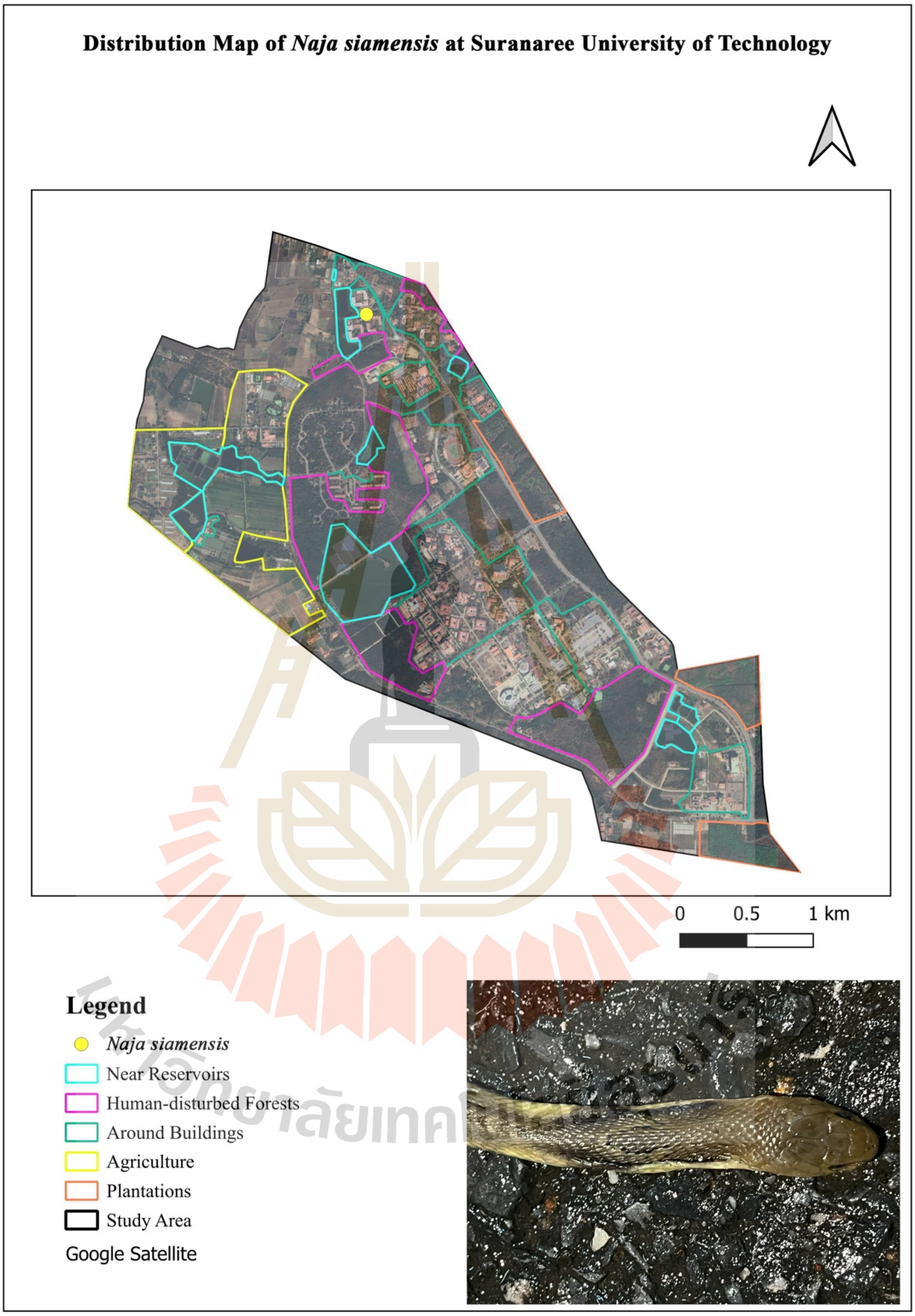
Appendix B-4 Photographs of PLT-1, PLT-2, PLT-3, HDF-1, HDF-2, HDF-3, HDF-4, and HDF-5.

APPENDIX C

DISTRIBUTION MAPS OF CONCERNED SPECIES

Appendix C-1 Distribution map and photo of *Cuora cuora kamaroma*.

Appendix C-2 Distribution map and photo of *Python bivittatus*.

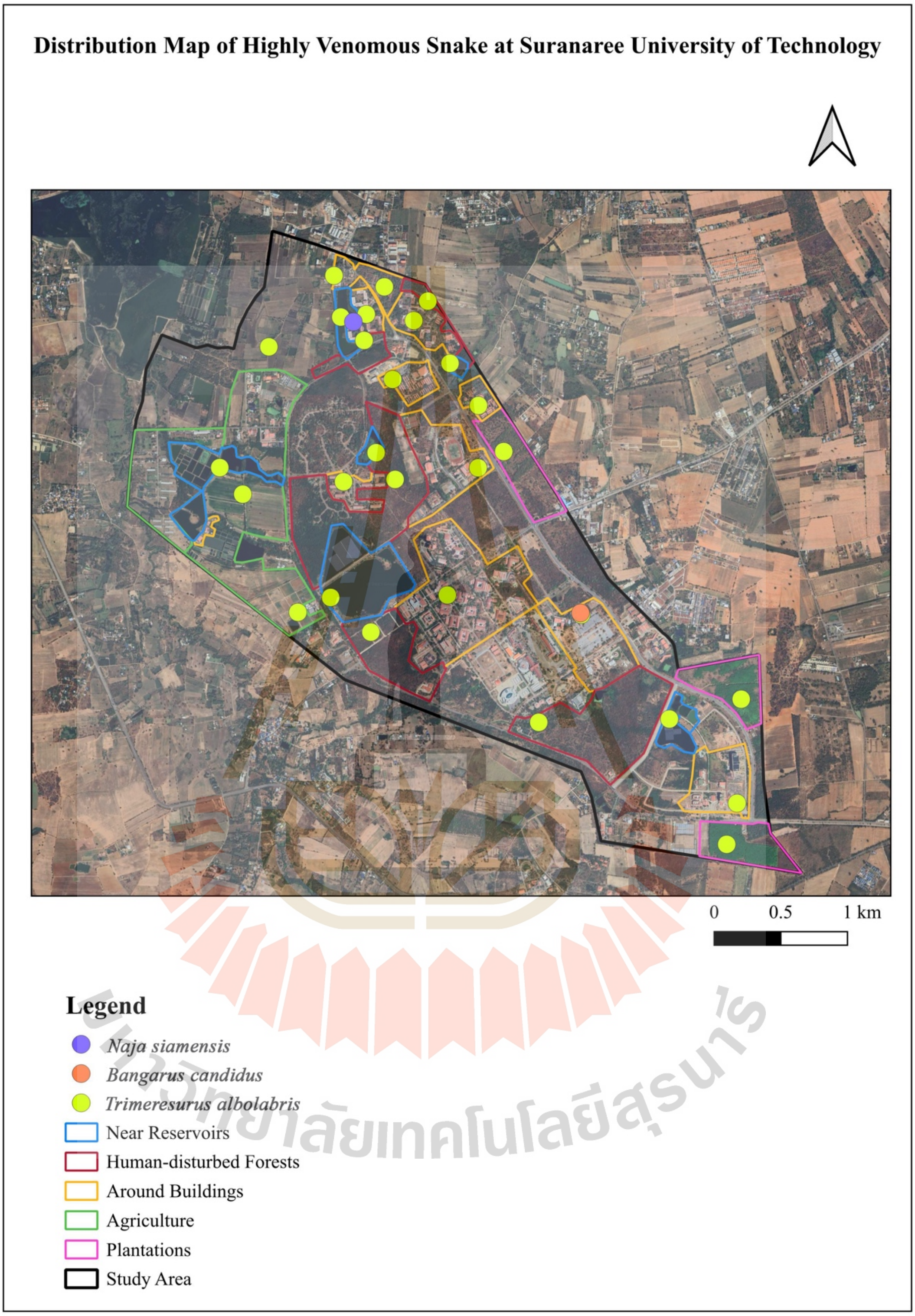


Appendix C-3 Distribution map and photo of *Naja siamensis*.

Appendix C-4 Distribution map and photo of *Ptyas korros*.

Appendix C-5 Distribution map and photo of *Kaloula mediolineata*.

Appendix C-6 Distribution map and photo of *Glyphoglossus molossus*.



Appendix C-7 Distribution map of venomous snakes.

CURRICULUM VITAE

Name: Soe Thandar Aung

Date of Birth: July 4, 1997

Nationality: Myanmar

Education: Bachelor of Science (Industrial Chemistry), West Yangon University, Myanmar

Professional experience and Research interests

I have been actively involved in snakebite awareness, snake conservation, and environmental education projects for over seven years. My work focuses on community-based conservation efforts, wildlife rescue, and ecological research particularly related to snakes in Myanmar. I have collaborated with various researchers, conservationists, and local communities to promote the importance of snake conservation and reduce human-wildlife conflict.