



# EXPEDITION REPORT

Expedition dates: 12 – 20 November 2018

Report published: October 2019

**Elephant encounters:  
Studying Asian elephants in the hills of  
northern Thailand to increase their  
welfare and conservation**







มูลนิธิหัวใจรักช้าง  
Kindred Spirit Elephant Sanctuary  
Love. Care. Rescue.



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## Elephant encounters: Studying Asian elephants in the hills of northern Thailand to increase their welfare and conservation

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Authors:

Talia Gale  
Kindred Spirit Elephant Sanctuary

Matthias Hammer (editor)  
Biosphere Expeditions

## Abstract

This study was a collaboration between Biosphere Expeditions and Kindred Spirit Elephant Sanctuary. It used direct observations of five free-roaming captive Asian elephants. Their activity budgeting, foraging habits and social-association behaviour were observed using instantaneous, all-occurrence focal and scan-sampling methods respectively, with the aim for three separate data sets to be collected simultaneously.

Sixteen hours of activity budget data collected on each of the five elephants showed that, like wild Asian elephants, the study subjects spent the majority of their time foraging, followed by walking. There was no significant difference between the behaviours displayed by the five study subjects.

The foraging data collected during the expedition showed a high variety of plant species foraged on (31 species from 20 different families). The study subjects were characterised as a browse species. There was no significant difference in the plant species that the five study subjects foraged on.

The elephant association data set used the proximity of the study subjects to examine social affiliation and closeness among the elephants. The elephants separated themselves into two separate groups during data collection. Similar to wild elephants, the family unit of females along with a juvenile were separate from the older males.

Overall, the data collected are the first of their type on semi-wild free-roaming captive Asian elephants. There is much room for improvement in regards to management of captive elephant populations. The differences in behaviours exhibited by the study subjects when compared to other captive populations highlight this. Further research on the five study elephants will ensure data precision, with the intention of publication and the creation of an elephant management guide to be distributed to elephant venues in Thailand and around the world.

## บทคัดย่อ

การศึกษานี้เป็นความร่วมมือระหว่าง Biosphere Expeditions

และมูลนิธิหัวใจช้างซึ่งทำการสังเกตโดยครบบ้างเลี้ยงสายพันธุ์เอเชียที่มีอิสระในการหาอาหารจำนวน 5 เชือก ได้ทำการสังเกตกิจกรรม

นิสัยการออกหาอาหาร และพฤติกรรมทางสังคมของช้างด้วยวิธีการสังเกตทางตรง แบบภาพรวมและการสุ่มตัวอย่างตามลำดับ

และการสุ่มตัวอย่างตามลำดับ โดยมีเป้าหมายที่จะเก็บรวบรวมข้อมูลสามชุดไปพร้อม ๆ กัน

การเก็บข้อมูลกิจกรรมของช้างแต่ละเชือกเป็นเวลา 16 ชั่วโมง แสดงให้เห็นว่าตัวอย่างศึกษาใช้เวลาส่วนใหญ่ไปกับการออกหาอาหาร ดื่มน้ำ

และเดินไปมา เช่นเดียวกับช้างป่าสายพันธุ์เอเชียทั่วไป

ไม่พบความแตกต่างอย่างมีนัยสำคัญระหว่างพฤติกรรมของช้างทั้งห้าเชือกที่ทำการศึกษา

ข้อมูลเกี่ยวกับการกินอาหารที่เก็บรวบรวมระหว่างการสำรวจแสดงให้เห็นถึงความหลากหลายของสายพันธุ์พืชที่ช้างกิน (31 สายพันธุ์จาก 20

วงศ์) ตัวอย่างศึกษาถูกจัดให้อยู่ในประเภทสัตว์แทะเล็ม ไม่พบความแตกต่างอย่างมีนัยสำคัญของสายพันธุ์พืชที่ช้างทั้งห้าเชือกเลือกกิน

ชุดข้อมูลเกี่ยวกับการรวมกลุ่มของช้างใช้ระยะห่างของตัวอย่างทดลองเพื่อศึกษาความสัมพันธ์ทางสังคม

และความใกล้ชิดระหว่างช้างแต่ละเชือก ช้างแยกตัวออกเป็นสองกลุ่มระหว่างการรวบรวมข้อมูล เช่นเดียวกับพฤติกรรมของช้างป่า

ครอบครัวที่ประกอบไปด้วยกลุ่มช้างเพศเมียกับลูกช้างวัยเด็กจะแยกออกจากกลุ่มช้างเพศผู้ที่มีอายุมากกว่า

โดยรวมแล้ว การศึกษานี้เป็นการเก็บรวบรวมข้อมูลของช้างเลี้ยงสายพันธุ์เอเชีย

ที่เดินหาอาหารได้อย่างอิสระในสภาพแวดล้อมกึ่งป่าเป็นครั้งแรก

ยังมีสิ่งที่จะต้องศึกษาพัฒนาเพิ่มเติมอีกมากเกี่ยวกับการจัดการประชากรช้างเลี้ยง ความแตกต่างของพฤติกรรมเหล่านี้

ในตัวอย่างศึกษาจะเห็นได้อย่างชัดเจน เมื่อเปรียบเทียบกับประชากรช้างเลี้ยงอื่นๆ

การวิจัยต่ออยู่กับช้างห้าเชือกที่ทำการศึกษายังช่วยรับรองความเที่ยงตรงของข้อมูล โดยมุ่งที่จะตีพิมพ์และสร้างแนวทางการจัดการช้าง

เพื่อเผยแพร่ไปยังสถานที่เลี้ยงช้างในประเทศไทยและทั่วโลก

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# 1. Expedition Review

Matthias Hammer (editor)  
Biosphere Expeditions

## 1.1. Background

Biosphere Expeditions runs wildlife conservation research expeditions to all corners of the Earth. Our projects are not tours, photographic safaris or excursions, but genuine research expeditions placing ordinary people with no research experience alongside scientists who are at the forefront of conservation work. Our expeditions are open to all and there are no special skills (biological or otherwise) required to join. Our expedition team members are people from all walks of life, of all ages, looking for an adventure with a conscience and a sense of purpose. More information about Biosphere Expeditions and its research expeditions can be found at [www.biosphere-expeditions.org](http://www.biosphere-expeditions.org).

This project report deals with an expedition to the hills in Northern Thailand that ran from 12 – 20 November 2018 with the aim of conducting close-encounter behavioural, diet and other studies on Asian elephants.

Asian elephants are the largest living mammals in Asia and can be split into three subspecies; *Elephas maximus maximus* (Sri Lanka), *Elephas maximus sumatranus* (Sumatra) and *Elephas maximus indicus* (mainland Asia). They are listed as Endangered by the IUCN as the total population has declined by over 50% in the last 65-70 years (Choudhury et al. 2008). Asian elephants are threatened by poaching and habitat degradation, as well as habitat fragmentation leading to human-elephant conflict (Sukumar 2006). There are approximately 40,000 – 50,000 wild Asian elephants left worldwide, found in 13 countries in South and South East Asia (Sukumar 2006).

The wild elephant population in Thailand is around 3,000 and there is a domestic population of approximately 3,500 (Sukumar 2006, “Most Elephants” 2017). In Thailand the elephant is a highly revered species. Captive elephants have been part of Thai culture for hundreds of years, both as work animals and sacred beings. After a ban on logging in 1989, many elephants in Thailand were out of work. Elephant owners turned to the tourism industry to continue to earn a living from their elephants. However, elephants in the tourism industry are often kept in inadequate conditions, worked to exhaustion and offered little or no veterinary care. Kindred Spirit Elephant Sanctuary (KSES) returns elephants from the tourism industry back to the forest to live in semi-wild conditions and studies them in order to create more opportunities and strategies to re-wild more elephants in the future.

It is only one of a handful of projects to do so and due to the dense forest habitat wild elephants live in, there are also very few studies on natural Asian elephant behaviour and social structure. KSES’s elephant herd presents an ideal opportunity to study the natural behaviour of semi-wild Asian elephants in safe and natural surroundings.

## 1.2. Research area

Thailand, officially the Kingdom of Thailand, is a country at the centre of the Indochinese peninsula. It is comprised of several distinct geographic regions. The north of the country is a mountainous area, the Thai highlands, with the highest point being Doi Inthanon in the Thanon Thong Chai Range at 2,565 m. The expedition took place in the foothills of this mountain range (Fig. 1.2a).



**Figure 1.2a.** Map and flag of Thailand with study site (red dot).

An overview of Biosphere Expeditions' research sites, assembly points, base camp and office locations is at [Google Maps](#).

Most of Thailand, including the expedition study site, has a tropical savannah climate. The south and the eastern tip of the east have a tropical monsoon climate. Thailand is the only country in South East Asia to have escaped colonial rule. Buddhist religion, the monarchy and the military have helped to shape the country's society and politics.

The diversity of animals and plants in Thailand is remarkable. This is partly due to Thailand's geography: a land between two oceans on the Malaysian Peninsula, numerous islands, plains in the central part of the country, the vast Mekong river and mountains covered by jungles in the north.

It has been estimated that Thailand supports 18,000 species of plant, 6,000 insect species, 1,000 kinds of bird, and 300 species of mammal<sup>1</sup>. Even so, it is difficult not to escape the conclusion that the kingdom's flora and fauna are heavily depleted, mainly due to logging of forests. As recently as 1950, over half the country's land area was forested<sup>2</sup>. Today forest cover has been reduced by as much as 90% and barely a day goes by before yet another scandal with an environmental tinge is revealed in the newspapers. This concern for the environment though is comparatively recent, dating back to 1973. In that year, an army helicopter crashed, and as investigators picked over the wreckage they discovered not just the bodies of the crew and passengers, but also the corpses of several protected wild animals. It became clear that the human victims - prominent army officers - had been illegally hunting in the Thung Yai Naresuan Wildlife Sanctuary. A public scandal ensued and the environmental movement in Thailand was born.

KSES, the expedition's study site, was established in 2016 and comprises highland and mountain tropical rainforest ecosystems. Slopes vary between 25% - 100% and the highest elevation is 1,100 m. There are four elephants in the study site who roam in an area of around 14 square kilometres. The flora consists of sphagnum bog, moist and dense evergreen cloud forest, dry evergreen, pine, mixed deciduous teak and dipterocarp forests. The fauna includes lar gibbons (*Hylobates lar*), red muntjac (*Muntiacus muntjak*), Indian civets (*Viverricula indica* and *Viverra zibetha*), Indian giant flying squirrel (*Petaurista philippensis*), as well as a plethora of bird, reptile and amphibian species. The area is based around a Karen hilltribe village with a population of 450 people. The Karen people are well known for their close relationship with elephants, their traditional clothing weaving and corn and rice agriculture.

### 1.3. Dates

The project ran from 12 – 20 November 2018. This period was chosen to coincide with the mildest climate in terms of temperature extremes. It is also a good time of the year to collect data as the forest food for the elephants, as well as forest biodiversity, was still thriving after the rainy season.

### 1.4. Local conditions & support

#### Expedition base

The expedition was based in a traditional Karen hill tribe village in a rural area. Sleeping was in homestays in single, twin or double (for couples) accommodation and there was a central dining and meeting area for the expedition team in one of the local houses. Overall conditions were rustic with simple living quarters, squat toilets and bucket showers. There was electricity (220 V) and also mobile phone coverage, including 3G internet services.

All meals were prepared by local community cooks and special diets were catered for.

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<sup>1</sup> <https://www.nationsencyclopedia.com/Asia-and-Oceania/Thailand-FLORA-AND-FAUNA.html>

<sup>2</sup> [https://en.wikipedia.org/wiki/Deforestation\\_in\\_Thailand](https://en.wikipedia.org/wiki/Deforestation_in_Thailand)

## Weather

The Thai climate is controlled by tropical monsoons and the weather in Thailand is generally warm and humid across most of the country throughout most of the year. The weather in northern Thailand (where the expedition took place) is determined by three seasons: Between November and May the weather is mostly dry and the cool season and hot season occur from November to February and March to May respectively. The rainy season lasts from May to November and is dominated by the southwest monsoon, during which time rainfall in most of Thailand is at its heaviest. The expedition took place towards the end of the rainy and the beginning of the cool season with daytime highs of about 30°C, night time lows of about 10°C and some rainfall in October, decreasing to very little in November.

## Field communications

There was a patchy 3G mobile phone network connection (Thai phone provider AIS 1-2-call) at base and in the study site. The expedition leader posted a [diary with multimedia content on Wordpress](#) and excerpts of this were mirrored on [Biosphere Expeditions' social media](#) sites.

## Transport & vehicles

Team members made their own way to the Chiang Mai assembly point. From there onwards and back to the assembly point all transport and vehicles were provided for the expedition team. After meeting at the Chiang Mai assembly point, the team travelled for about five hours to the study site and base camp by vehicle.

## Medical support and incidences

The expedition leader was a trained first aider, and the expedition carried a comprehensive medical kit. Further medical support was provided by a clinic in Pang Un (about 35 minutes drive) or a hospital in Khun Yuam (about 1.5 hour drive). All team members were required to carry adequate travel insurance covering emergency medical evacuation and repatriation. Safety and emergency procedures were in place, but did not have to be invoked as there were no emergencies.

### 1.5. Expedition scientists

Talia Gale was born in Vancouver, Canada where she studied Zoology at the University of British Columbia. Talia first came to Thailand in 2011 to study Asian elephant foraging behaviour. After working in Canada for 2 years in the field of veterinary science, she returned to Thailand again to work with and study Asian elephants on a project near Chiang Mai. Talia has been working in Thailand for over 4 years, both in the north studying elephants and in the south studying sea turtles and general biodiversity. In May 2016 Talia began working with KSES where her main focus has been designing and carrying out studies on their elephants' social structure and behaviours.



Kerri McCrea was born in Co. Tyrone, Northern Ireland and studied Zoology at Queen's University Belfast. Having already worked on conservation projects in Australia and Sri Lanka, Kerri first came to Thailand in 2013 to help an elephant project with their community and research efforts. In May 2016, Kerri and her local partner Sombat founded KSES and brought home the first 4 elephants to live in the surrounding forests. Kerri's main focus is to oversee all projects, including but not limited to, research, community, teaching, admin, project expansion and maintenance.

## **1.6. Expedition leader**

Malika Fettak is half Algerian, but was born and educated in Germany. She majored in Marketing & Communications and worked for more than a decade in both the creative field, and in PR & marketing of a publishing company. Her love of nature, travelling and the outdoors (and taking part in a couple of Biosphere expeditions) showed her that a change of direction was in order. Joining Biosphere Expeditions in 2008, she runs the German-speaking operations and the German office and leads expeditions all over the world whenever she can. She has travelled extensively, is multilingual, a qualified off-road driver, diver, outdoor first aider, and a keen sportswoman.

## **1.7. Expedition team**

The expedition team was recruited by Biosphere Expeditions and consisted of a mixture of ages, nationalities and backgrounds. They were (in alphabetical order and with country of residence): Wayne Curley (USA), Barbara Felitti (USA), Neil Goodall (UK), Melanie Hitchcock (USA), Kuntusangpo Ling (Canada), Bruce Loughbridge (USA), Lindsay Osborne (USA), Henning Scharpff (Germany).

## **1.8. Partners**

On this expedition Biosphere Expeditions' main partner was Kindred Spirit Elephant Sanctuary & Foundation (KSES). Their mission is to bring as many elephants as possible back to their natural environment to live in semi-wild conditions and provide an alternative and sustainable livelihood for the human communities with which they share a living space. One of KSES's ultimate goals is to stop and eventually reverse the effects of the illegal elephant trade, as well as provide some much-needed research to give insights into natural elephant behaviour.

## **1.9. Acknowledgements**

The expedition provided labour and funding, and permitted data collection to occur throughout the day, allowing for full data sets on KSES's elephants to be collected. We are grateful to the citizen scientist volunteers, who not only dedicated their spare time to helping but also, through their expedition contributions, funded the research. A big thank you to all the members of the local community, especially those who welcomed expedition participants into their homes with open arms, who guided us through the forest, who helped with transportation and who cooked amazing meals. Biosphere Expeditions would also like to thank members of the Friends of Biosphere Expeditions and donors for their support.

## 1.10. Further information & enquiries

More background information on Biosphere Expeditions in general and on this expedition in particular including pictures, diary excerpts and a copy of this report can be found on the Biosphere Expeditions website [www.biosphere-expeditions.org](http://www.biosphere-expeditions.org). Enquiries should be addressed to Biosphere Expeditions at the address given on the website.

## 1.11. Expedition budget

Each team member paid a contribution of €1,880 per person per nine-day slot towards expedition costs. The contribution covered accommodation and meals, supervision and induction, special research equipment and all transport from and to the team assembly point. It did not cover excess luggage charges, travel insurance, personal expenses such as telephone bills, souvenirs etc., or visa and other travel expenses to and from the assembly point (e.g. international flights). Details on how this contribution was spent are given below.

<b>Income</b>	<b>€</b>
Expedition contributions	18,700
<b>Expenditure</b>	
<b>Staff</b> includes local and Biosphere Expeditions staff salaries and travel expenses	4,326
<b>Research</b> includes equipment and other research expenses	227
<b>Transport</b> includes fuel, taxis and other local transport	404
<b>Expedition base</b> includes board & lodging and community support	2,392
<b>Administration</b> includes miscellaneous fees & sundries	285
<b>Team recruitment Thailand</b> as estimated % of annual PR costs for Biosphere Expeditions	8,676
<b>Income – Expenditure</b>	<b>2,390</b>
<b>Total percentage spent directly on project</b>	<b>87%</b>

Please note: Each expedition report is written as a stand-alone document that can be read without having to refer back to previous reports. As such, much of this section, which remains valid and relevant, is a repetition from previous reports, copied here to provide the reader with an uninterrupted flow of argument and rationale.

## 2. Activity budgeting, foraging and social behaviour of free-roaming semi-wild Asian elephants

Talia Gale  
Kindred Spirit Elephant Sanctuary

### 2.1. Introduction

#### Activity budget data

Activity budgets are defined as the different activities an animal partakes in, in a given unit of time. The activity budgeting of elephants can be used to compare wild and captive populations. Differences, if found, can highlight areas in need of improvement in regards to captive elephant management (Baskaran et al. 2010, Ahamed 2015). Most studies on captive Asian elephants have had discrepancies in the activity budgeting of their elephants from wild populations (Elzanowski and Sergiel 2006, Varma et al. 2008, Mackey 2014, Samarasignhe and Ahamed 2016). This study investigates the activity budgeting of Kindred Spirit Elephant Sanctuary's (KSES's) semi-wild elephants, the first of its kind looking at captive elephant behaviour while living the most natural life possible. It is hypothesized that the activity budgets will closely mimic that of wild elephants.

#### Elephant foraging data

As a mega-herbivore, eating approximately 200 kg of food each day, Asian elephants are generalist feeders, eating a vast selection of plant species (Sukumar 2003, Sukumar 2006). Studies (Baskaran et al. 2010, Roy and Chowdhury 2014, Koirala et al. 2016) have shown that different wild populations have strong feeding preferences and even differ in being characterised as a browse or graze species. For most elephants in captivity, only a handful of plant species make up the bulk of their diet, supplemented by vast amounts of high-sugar treats. There is a great need for a research-based guideline regarding fodder provided for captive elephants. Our first-hand observational study of free-foraging elephants in their natural environment will help to provide this.

#### Elephant association data

Over six million years of divergence, African and Asian elephants have developed different social structures due to different social, ecological and predation pressures (de Silva and Wittemyer 2011). For years, research has focused on African elephant social networks. It is well established that they live in large multilevel family groups with strong social ties, led by a matriarch. Males leave their maternal herd between the ages of 9–18 to form small, male-only herds (Lee and Moss 1999). Knowledge of the structure of Asian elephant societies is less detailed, but it is believed that they live in much smaller herds with less association between individuals (de Silva and Wittemyer 2011, de Silva et al. 2011).

Due to the dense-forest mountainous habitat Thailand's elephants inhabit, there are few first-hand observational studies on their social preferences. The work with KSES's semi-wild herd will provide valuable insight into Asian elephant social behaviour.



## 2.2. Materials and methods

Study site: The study site is described in chapter 1.2. and a topographic map of the site is shown in Fig. 2.2a.



**Figure 2.2a.** Topographic map of study site, located inside the yellow line.  
For location of site in Thailand, see Fig. 1.2a.

## Study subjects



**Figure 2.2b.** Too Meh is the oldest elephant in the herd. She is in her late 50s and spent her younger days working in the logging industry. When logging was banned in 1989, due to the lack of forest and food available, she was brought to work in the tourist camps where she spent her life entertaining tourists. She spent about 20 years giving elephant rides with a howdah, the iron saddle that is put on their back to carry tourists and gives many elephants back problems. These days she is free to spend her days in the forest, roaming, foraging and interacting with her daughter & grandsons.





**Figure 2.2c.** Mae Doom, in her early 20s, is the daughter of Too Meh & aunt of Dodo and Gen Thong. Before she was brought to KSES, she was living and working in elephant camps, away from her family. At KSES she has been reunited with her mother and nephew and has the freedom to learn from her mother and the other elephants.





**Figure 2.2d.** Gen Thong is the youngest elephant of the herd at six years old. When Gen Thong was young, he tragically lost his mother at the age of two. His mother was chained to a tree below a wasp nest in a tourist camp. The wasp nest fell on her head and she was stung many times. Gen Thong was with his mother and because he was not chained, he was able to run away. His mother succumbed to the wasp stings. Gen Thong then spent several years on a chain being fed bananas by tourists and giving elephant rides. Now back in the forest, he learns natural behaviours from his aunt, grandmother, brother and best friend Boon Rott.





**Figure 2.2e.** Boon Rott is a 13 year old male elephant, who had also lived his life in tourist camps giving rides and performing tricks. When he was born, he suffered from malnutrition as his mother was unable to produce enough milk. His mother had given birth a few times, but Boon Rott was the first of her offspring to survive, due to the combination of her care and their hard working mahouts. The name “Boon Rott” translates to the “Lucky One” in Thai. He is now able to roam free in the forest, choosing when and how to interact.





**Figure 2.2f.** Dodo is a 13 year old elephant who spent ten years living in and out of tourist camps giving rides. Dodo can be unpredictable and due to this, he spent most of his life before KSES in confinement. He is the most recent elephant to join the study herd, in September 2018 after his owner approached KSES asking for help. He is the brother of Gen Thong, nephew of Mae Doom and grandson of Too Meh and is now able to spend his days roaming, socialising and foraging with his family.

Elephant owners are given a monthly compensation in order for them to help provide for their families. Kindred Spirit does not purchase elephants, as this has the potential to lead to illegal trafficking and capture from the wild. Currently KSES only has the funding to support these five elephants, but hopes to bring more elephants to join them in the near future.



During the day, the elephants are free to roam in the forest surrounding the hilltribe village and base location of Ban Naklang in the district of Mae Chaem, Chiang Mai province, Thailand. The mahouts (elephant caretakers), who act as forest guides for KSES, closely watch over the elephants to ensure they stay within the forest boundaries and do not enter any fields or cross any main roads. During observations the mahouts may interact with the elephants to guide them away from agricultural land; direction is primarily given with vocal commands. During data collection days the expedition participants solely observed the elephants.

Data collection started at 8:00 and ended at 16:00, and was split into one hour periods, with the aim of collecting data sets (activity budget, elephant foraging and elephant association) simultaneously.

### Activity budget

Throughout the expedition, two full data sets (8:00–16:00) were collected for each elephant. Data were collected via instantaneous sampling at five minute intervals. At each interval, the observer noted the behaviour exhibited by the individual elephant using the behavioural ethogram (Table 2.2a). Cloud cover (0, 25, 50 or 100%) and ambient temperature were also recorded at each five minute interval.

**Table 2.2a.** Behavioural ethogram used in the field.

<b>Behaviour</b>	<b>Description</b>
Bathing	Standing/laying in water or mud; spraying water or mud over body with trunk
Digging	Digging in soil using the foot (but not as part of a dusting behaviour)
Drinking	Collecting water in the trunk and spraying it into the mouth
Dusting	Collecting soil and throwing it over the body/rubbing it into the skin (while standing still or walking), including digging in soil for this purpose
Exploring	Exploring any area of the environment; includes raising trunk to smell environment, using trunk on ground to explore substrate or other objects; does not include exploring forage
Foraging	Collecting solid food with the trunk and placing it in the mouth while standing or walking; includes tearing down tree and branches and exploring forage
Mahout interaction	Any interaction with a mahout
Rolling	Rolling in soil or mud (but not as part of playing with another individual)
Scratching	Scratching or rubbing any body part with another part of the body, or with an inanimate object
Socializing	Interacting with other individuals via touch of any body part (not as part of courtship)
Social Bathing	Interacting with other individuals via touch of any body part while bathing
Social Foraging	Interacting with other individuals via touch of any body part while foraging
Sex	Courting or being courted or mounting another elephant or being mounted by another elephant of either sex
Standing	Standing motionless
Walking	Walking (except while feeding)
Other	Any other behaviour
Cannot see	Elephant behaviour is not visible or not distinguishable





**Figure 2.2g.** Pictures of the expedition participants trekking through forests and crossing rivers to reach the elephants each day.



## Elephant association

The elephant association data set used proximity to examine social affiliation among the herd. Data were collected via scan sampling at five minute intervals. At each interval the identity of an elephants' nearest neighbour and next nearest neighbour, and the approximate distance between them, were recorded. The distance between two elephants was split into 4 categories: (1) touching, (2) two trunks reach apart - approximately 3m, (3) one elephant length apart – approximately 6m, or (4) over 6m apart.

## Elephant foraging

Data were collected via all occurrence focal sampling. As the elephant selected plants to forage, the observer recorded the start and end time of the foraging bout, the name of the plant (if known by the mahouts or found in the field guide) and the part eaten by the elephant (bark, fruit, leaf, root, twig or stem). If the plant was not already in the field guide, a description of the plant and detailed photos of the entire specimen were taken. The GPS coordinates as well as the elevation were recorded at the start of the observation period.

## Statistical analysis

Activity budget: At each interval, if only one behaviour was observed in a given elephant, it was given a value of 1; if two behaviours were occurring simultaneously, they were both given a value of 0.5. Incidences where the elephant was recorded as 'Cannot See' were omitted from analysis. A one-way ANOVA (Microsoft Excel) was performed across all behaviours for the five elephants.

Foraging: A one-way ANOVA (Microsoft Excel) was performed across all five elephants and the species of plants consumed.

## Training of expedition participants

In this study, data collection was performed by volunteer citizen scientists with no previous knowledge of wildlife research and conservation, or elephant research and behaviour. Training included an introduction to differentiating elephant behaviours and individual elephants. Expedition members had to pass an elephant identification and behaviour test prior to collecting data to ensure accurate data collection and quality.

A training hike and training data collection period was conducted in the forest to allow the participants to adjust to the hardships of collecting field data (e.g. walking on steep rocky slopes while recording elephant behaviour) prior to recorded data collection periods.



### 2.3. Results

#### Activity budget

During the study, 192 incidences of behaviours were recorded for each elephant, totalling 960. For 96 incidences, the animal was out of sight (recorded as 'cannot see'). Out of the 16 behaviours listed on the behavioural ethogram (Table 2.2a), the elephants displayed 13 behaviours. Digging, rolling and sex were never observed. For the purpose of data analysis, social bathing and social foraging were added to the socialising category and drinking was added to other. Foraging was the most dominant behaviour observed, with an average of 63% of the time spent foraging. This was followed by walking at an average of 12%, standing at 8%, socialising at 4% and dusting, exploring and scratching, all at 3%. (Figure 2.3a). There was no significant difference in the behaviours observed by the five individual elephants (one-way ANOVA  $F= 1.56E-15$ ,  $p=1$ ). Mean temperature for each hour-interval of data collection ranged from 23°C to 32°C.

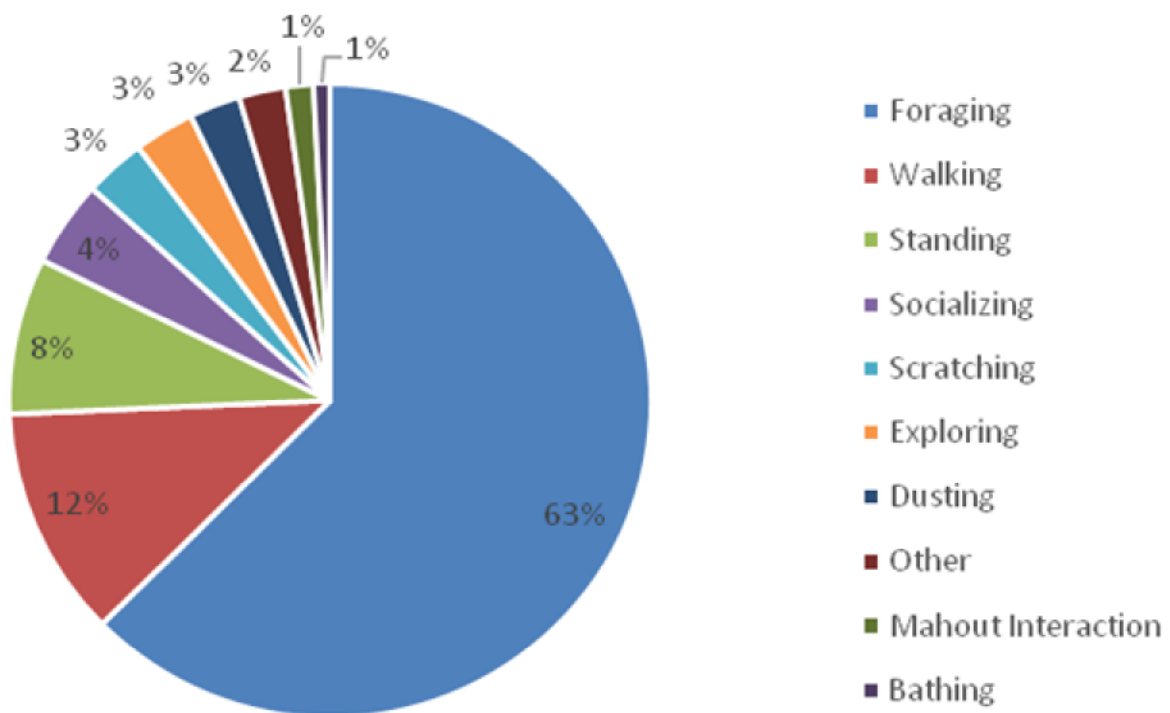


Figure 2.3a. Pooled behaviours displayed by the elephants (n=5).

#### Elephant Association

During every observation period, the elephants separated themselves into two groups, with Dodo and Boon Rott staying together and Gen Thong, Mae Doom and Too Meh staying together. The two groups only crossed paths for one recorded data point that has been eliminated from data analysis. As such, data analysis looks at the two groups separately.

Looking at Gen Thong, there were 149 data points collected where the association to at least one other individual could be determined. Gen Thong was found touching both of the other elephants (Mae Doom and Too Meh) for 1.3% of the observed encounters. He was within a trunk's reach of at least one other individual for 40.9% of the time. He was over 6 m apart from another individual for 43.0% of the observed encounters.

For Mae Doom, 149 data points where the association to at least one other individual could be determined were collected. Mae Doom was touching two other individuals 2.0%, within a trunk's reach of at least one other elephant 53.0%, and over 6 m away from another individual 32.9% of the observed encounters.

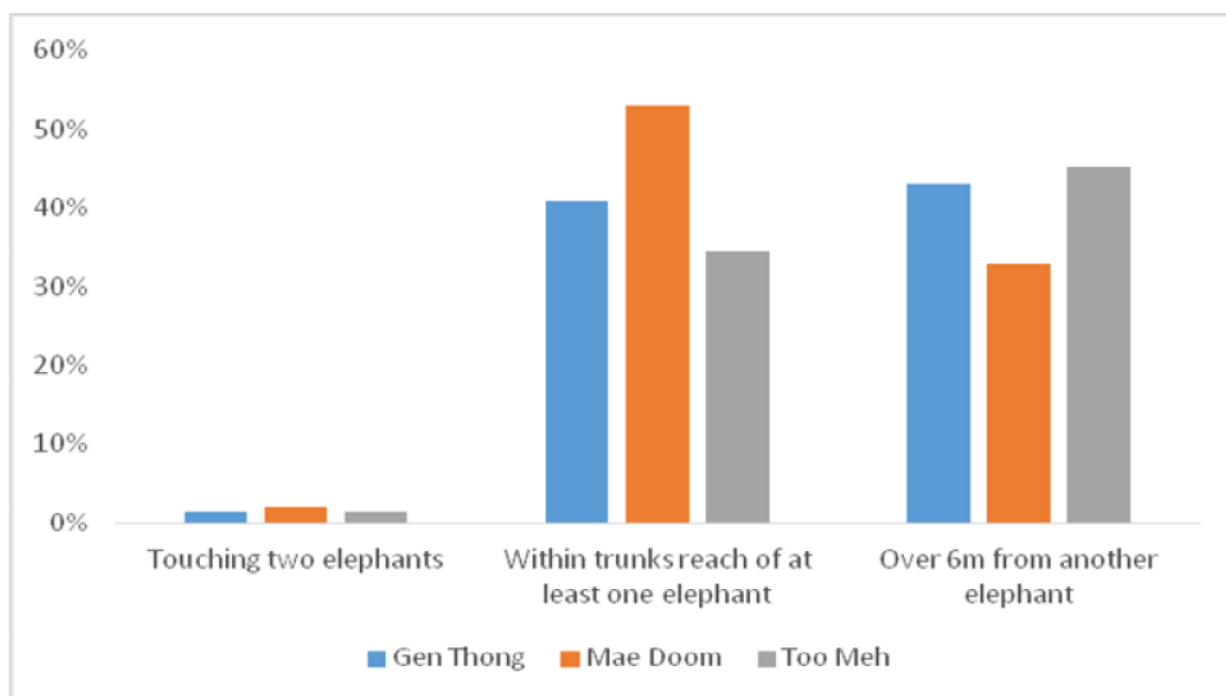
For Too Meh, 148 data points where the association to at least one other individual could be determined were collected. She was touching two other individuals 1.4%, within a trunk's reach of at least one other elephant 34.5%, and over 6 m away from another individual 45.3% of the observed encounters (Figure 2.3b).

Looking at Gen Thong and Mae Doom as a pair, they were touching 8.2% of their encounters, within a trunk's reach 28.6%, one elephant length apart 12.2% and over 6 m apart 51.0% of their observed encounters.

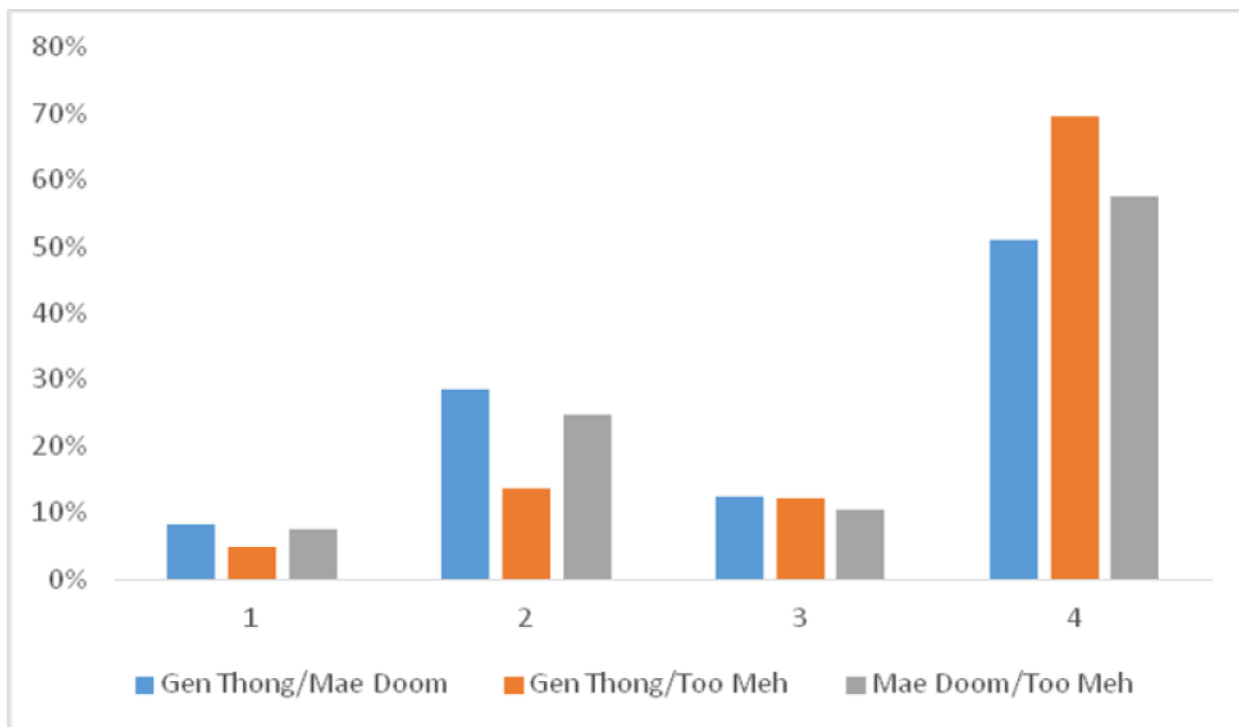
Gen Thong and Too Meh were touching 4.7%, with a trunk's reach 13.5%, one elephant length apart 12.2% and over 6 m apart 69.9% of their encounters.

Mae Doom and Too Meh were touching 7.5%, within a trunk's reach 24.7%, one elephant length apart 10.3% and over 6 m apart 57.5% of their encounters (Figure 2.3c).

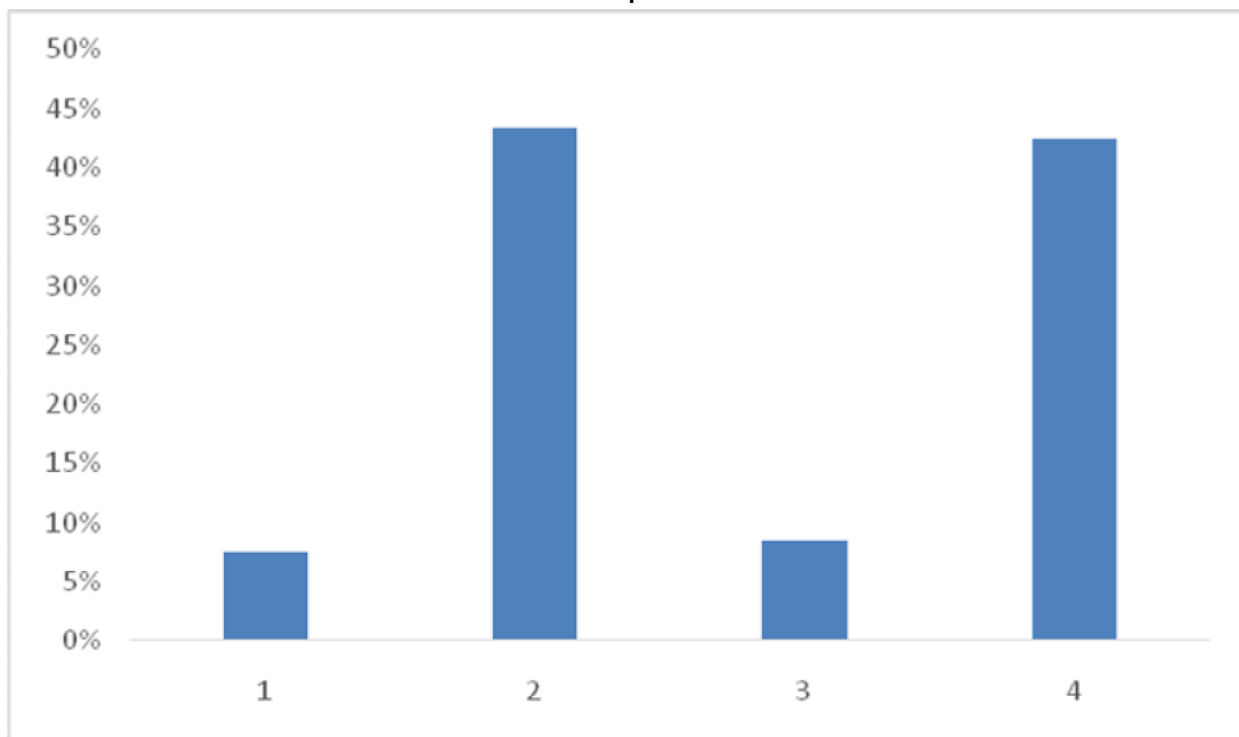
Boon Rott and Dodo's association was recorded on 107 occasions. They were touching 7.5% of the observed association occurrences, within a trunk's reach 43.3%, one elephant length apart 8.5% and over 6 m apart 42.5% of the observed association occurrences (Figure 2.3d).



**Figure 2.3b.** Individual elephants' percentage of observed associations spent among the herd.



**Figure 2.3c.** Percentage of observed associations at different distances for each elephant pair - (1) touching, (2) two trunks reach apart – approximately 3 m, (3) one elephant length apart – approximately 6 m, (4) over 6 m apart.



**Figure 2.3d.** Percentage of association occurrences between Boon Rott and Dodo at different distances - (1) touching, (2) two trunks reach apart – approximately 3 m, (3) one elephant length apart – approximately 6 m, (4) over 6 m apart.

## Foraging

During the expedition, surveys were conducted for 1320 minutes; 649 minutes of foraging data were recorded, with 34 different species consumed, 25 of which have been identified to the genus level, and another six to the family. The plants consumed and identified come from 20 different families: Anacardiaceae (3 species), Apocynaceae (1 species), Arecaceae (1 species), Clusiaceae (1 species), Cucurbitaceae (1 species), Dicotyledonous (1 species), Dioscoreaceae (1 species), Dipterocarpaceae (1 species), Fabaceae (5 species), Fagaceae (2 species), Lamiaceae (1 species), Menispermaceae (1 species), Moraceae (1 species), Myrtaceae (1 species), Orchidaceae (1 species), Poaceae (5 species), Primulaceae (1 species), Rubiaceae (1 species), Solanaceae (1 species), Zingiberaceae (1 species).

The elephants consumed 91.8% browse species (bamboos, trees, shrubs and herbs). Grasses, including corn, only made up 8.2% of the foraged food. Aside from two species of bamboo that made up 37.1% of the species consumed, the most commonly consumed species were *Spatholobus* sp. (13.6%), *Gluta usitata* (8.0%), *Embelia* sp. (7.9%), *Shorea obtusa* (7.1%) and *Pennisetum purpureum* (6.2%) (Table 2.3a).

There was no significant difference in the species foraged on by the five individual elephants (one-way ANOVA  $F=0.099$ ,  $p=0.987$ ).

**Table 2.3a.** All consumed plant species recorded during the 2018 expedition.

Species	Type	Part(s) consumed	% of foraging encounters
Bamboo (Vami) Poaceae family	Bamboo	Leaves	19.9%
Akar malam <i>Spatholobus</i> sp.	Climber	Leaves	13.6%
Bamboo (Vasu) Poaceae family	Bamboo	Leaves	11.9%
Burmese varnish tree <i>Gluta usitata</i>	Tree	Bark	8.0%
<i>Embelia</i> sp.	Tree	Leaves	7.9%
Balan/Taengwood <i>Shorea obtusa</i>	Tree	Leaves, stem	7.1%
Elephant grass <i>Pennisetum purpureum</i>	Grass	Whole plant	6.2%
Ring-cupped oak <i>Quercus kerrii</i>	Tree	Fruit	4.0%
Mountain date palm <i>Phoenix loureiroi</i>	Tree	Whole plant	3.1%
Bean <i>Mucuna</i> sp.	Climber	Stem	2.2%
Golden gardenia <i>Gardenia sootepensis</i>	Tree	Bark	1.8%
Cashew family <i>Spondias pinnata</i>	Tree	Bark	1.8%
Unidentified (Gammay) Poaceae family	Grass	Whole plant	1.5%
Cluster fig tree <i>Ficus racemosa</i>	Tree	Leaves, stem	1.5%



**Table 2.3a (continued).** All consumed plant species recorded during the 2018 expedition.

Species	Type	Part(s) consumed	% of foraging encounters
Deciduous climber <i>Tinospora crispa</i>	Climber	Leaves, stem	1.2%
Cuddapah almond <i>Buchanania lanzan</i>	Tree	Leaves	0.8%
Unidentified (Sah lay dah)	Tree	Leaves	0.8%
Mampat <i>Cratoxylum formosum</i>	Tree	Roots, stem	0.6%
Turkey Berry <i>Solanum torvum</i>	Shrub	Whole plant	0.6%
Orchid <i>Dendrobium</i> sp.	Shrub	Whole plant	0.6%
Unidentified (Nuway Say) Dicotyledonous family	Shrub	Stem	0.6%
Unidentified (T106)	Tree	Leaves	0.6%
African dream herb <i>Entada rheedii</i>	Climber	Stem	0.6%
Corn <i>Zea mays</i>	Grass	Whole plant	0.5%
<i>Dioscorea</i> sp.	Climber	Stem	0.5%
<i>Pachyrhizus</i> sp.	Climber	Stem	0.3%
<i>Quercus</i> sp.	Tree	Fruit	0.3%
Lemon Guava <i>Syzygium megacarpum</i>	Tree	Fruit	0.3%
Unidentified (Saykato) Apocynaceae family	Tree	Bark	0.3%
Unidentified (Puh) Zingiberaceae family	Herb	Whole plant	0.3%
Teak <i>Tectona grandis</i>	Tree	Leaves	0.2%
<i>Albizia</i> sp.	Tree	Leaves	0.2%
Unidentified (Sah Koh Bley)	Tree	Stem	0.2%
Pumpkin <i>Cucurbita maxima</i>	Climber	Fruit	0.2%

\*NOTE: Not all of the collected plant samples have been identified yet. Remaining unidentified samples are currently with Dr. Prachaya of Queen Sirikit Botanical Gardens.

## 2.4. Discussion and conclusions

### Activity budgets

Comparing our results from the 2018 expedition to those from the 2017 expedition, we see only minor differences. The main similarity is that the majority of time – 59% (2017) and 63% (2018) – was spent foraging (Gale and Hammer 2018). The behaviour of KSES's elephants appears to more closely match those of wild elephants, with many studies concluding that wild Asian elephants spend a majority of their time feeding (Baskaran et al. 2010, Ahamed 2015). When looking at captive elephants, there is more variation in which behaviours are dominant: Elzanowski and Sergiel (2006) concluded that an elephant at Municipal Zoo (Poland) spent 52% of its time in stereotypic behaviour (bouts of rhythmically repeated movements including swaying and head-bobbing). A study examining captive elephants in India (Varma et al. 2008), comparing forest camp elephants, temple elephants and zoo elephants, when pooled together, found that the elephants fed only 29% of the time. Mackey (2014) found elephants at San Diego Zoo spent the majority of their time feeding and standing. Samarasignhe and Ahamed (2016), looking at captive orphaned elephants in Sri Lanka, found their behaviours were dominated by feeding.

### Social association

The present study showed a social preference that matched that of wild elephants; a closely related female herd, and solitary males (Santiapillai et al. 1984, de Silva et al 2011). Long-term anecdotal evidence of KSES's elephant herd suggests this is not always the case. Often Boon Rott, a young male elephant (13 years old), will associate and interact with the core female herd (Too Meh and Mae Doom), and interact with the juvenile (Gen Thong). During the present study, Boon Rott only crossed paths with the females very briefly. The discrepancy between the collected data and previous anecdotal reports displays the need for long-term, repeat data collection in order to have a full picture of the social preferences of those elephants.

Among both the females and males, touch and being within touching distance of another elephant was commonly recorded, touching being something that is significant in Asian elephant societies (Makecha et al. 2012).

Dodo, the newest member of Kindred Spirit's herd, was only introduced to the project two months prior to the expedition. It will be interesting to watch the herd dynamics over time to see the changes that occur with new members.

## Diet analysis

The present study recorded over 30 species foraged on by the five study elephants during 1320 survey minutes and 649 minutes of observed foraging. When comparing this to the findings of the 2017 expedition (Gale and Hammer 2018), 162 species consumed during 8184 foraging minutes, we see an over 500% increase in the number of species recorded, presumably due to a significant increase in observation time spanning seasonal changes as well as changes in the location of the elephants in the forest. Given this, the need for long-term studies on elephant foraging is obvious.

Our analysis of plant species foraged shows utilization of a large selection of species within the study area. Browse dominated the diet of our study elephants and this result is similar to elephants in dense-mixed and open-mixed forests in Northern West Bengal, India (Roy and Chowdhury 2014). By contrast, grass dominated the diet of elephants in deciduous and dry thorn forests of Nilgiri Biosphere Reserve in southern India (Baskaran et al. 2010). In Nepal, seasonal changes dictated whether the elephants preferred browse or graze food sources (Koirala et al. 2016). The significant differences in diets of Asian elephants from different areas shows the need for more research into the preferred diet of individual elephants in captivity. The American Zoo Association Guidelines for Elephant Management and Care (2012) suggest elephant diet should “include hay (e.g. meadow or timothy) supplemented with fruits, vegetables, a pelleted supplement or grain” and that “fresh browse should be made available daily, if possible.” This type of diet, however, would only be suitable for elephants originating from grassland habitats, where graze makes up a majority of their diet. For captive elephants in Thailand, there are no standards for elephant dietary requirements, but anecdotal evidence suggests that at many tourist venues graze species, including on grass and corn, make up the majority of the diet.

## Natural behaviour and the implications for captive elephants

An expedition such as this enabled observations of captive Asian elephants displaying natural elephant behaviours while living in semi-wild conditions. The data collected showed that KSES’s elephants’ behaviours more closely mimic those of wild Asian elephants, than of elephants in captivity.

The expedition also highlighted some areas for improvement in regards to management of captive elephant populations. For example, the discrepancies in the amount of time an elephant dedicates to feeding in captivity vs. KSES’s elephants vs. those in the wild demonstrate the importance of feeding as part of natural behaviour.

There is a need to improve captive conditions so that the behaviour of elephants in captivity can mimic those in the wild. This is possible, as demonstrated in this study by the lack of stereotypic behaviours observed in KSES’s elephants compared to other captive elephant studies.



## This study's contribution to elephant welfare and conservation

Understanding the diet, foraging ecology and behaviour of captive elephants living in semi-wild conditions can also contribute to wild elephant conservation efforts. Knowing diet composition and foraging ecology of Thailand's elephants will help conservationists and wildlife managers in developing effective strategies to improve wildlife management.

This study highlighted the need for long term studies of Asian elephant behaviour, social preferences and diet.

## Outlook

As this was the second Biosphere Expeditions project in conjunction with KSES in Thailand, further research is needed to ensure precision of collected data. This was also the first study investigating social association of semi-wild Asian elephants. As such, the study needs to be replicated in order to have a full picture of the situation.

As the elephants move to different areas of the forest throughout the study site, the forest composition differs, opening up new foraging opportunities, potentially adding species to the list of foraged plants. In this expedition alone, two new plant samples were added to the species list of plants consumed by the elephants. Furthermore, in years to come, as the number of elephants under KSES's care expands, the data sets can be expanded to incorporate more individual elephants in different age/sex classes.

## Summary and action points for next expedition

### Key findings of this expedition:

- A continuing detailed description of the diets of elephants free-roaming in the forests of Northern Thailand; two new plant samples (potential species that had not been recorded to be consumed before) were added to the species list
- A description of the behavioural patterns of five captive elephants free-roaming in the forest
- A description of the social association of five captive elephants free-roaming in the forest

### Actions for the next expedition and future research work:

- Continue to record observations for the elephant association and elephant activity data sets to ensure data quantity and quality
- Publish foraging and activity budget data in a peer-reviewed journal and once published, create an elephant management guide to be distributed to elephant venues in Thailand and around the world
- A beehive fencing project is in its early stages. Once underway, a new data set using camera trapping to monitor the effectiveness of the fences will be created

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## Appendix I: Expedition diary, reports and resources



A multimedia expedition diary is available on <https://blog.biosphere-expeditions.org/category/expedition-blogs/thailand-2018/>.



All expedition reports, including this and previous expedition reports, are available on [www.biosphere-expeditions.org/reports](http://www.biosphere-expeditions.org/reports).

More pictures, videos, media coverage of the expedition are available via [www.biosphere-expeditions.org/thailand](http://www.biosphere-expeditions.org/thailand).