



Elephant Welfare in Global Tourism

Edited by **Eric Laws, David W. Knight,
Timothy Lee, Kom Campiranon,
Bongkosh Rittichainuwat, Ann Suwaree Ashton,
John Koldowski and Melody Zhirui Zhou**



The cover photo highlights the relationship between a mahout and elder of the community and his elephants. The elephants are living in a vast forest habitat and forage for 100% of their own diet.

Mahouts Elephant Foundation is an award-winning not-for-profit organization dedicated to improving the lives of Asian elephants and the communities who coexist with them. The foundation develops community-based tourism projects for elephant observation-only tourism, working collaboratively with local stakeholders to ensure all parties benefit. This illustrates the foundation's philosophy that captive elephants' welfare is dependent on their mahouts and their living conditions and livelihood. Their projects are located in vast areas of forest, enabling elephants to live naturally and forage for 100% of their own diet year round while tourists observe from a safe and respectful distance. Alongside developing innovative solutions to complex problems on the ground, the foundation facilitates research into the behavioural ecology of elephants living in natural habitat, to better inform conservation.

The foundation speaks internationally to inform on the issues of captive elephant tourism and have good relationships with others in the field and tour companies. Through an impeccable reputation for working gently in ethical partnership with Indigenous communities the foundation has become a sought-after partner by many Karen communities.

The foundation currently has two projects, supporting three communities and ten elephants in their care.

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The Complexity of Foraging and its Role in Elephant Well-being

LIV BAKER,^{1,2,3*} REBECCA WINKLER,^{1,4} SARAH BLAINE,¹
CHELSEA GREER,⁵ KERRI MCCREA⁶ AND LAURA PEOPLES⁶

¹Mahouts Elephant Foundation, Harran Peopleton, UK; ²PAN Works, Wilbraham, Massachusetts, USA; ³Sarah Lawrence College, Bronxville, New York, USA; ⁴University of Pennsylvania, Pennsylvania, USA; ⁵Raincoast Conservation Foundation, British Columbia, Canada; ⁶Kindred Spirit Elephant Sanctuary, Chiang Mai Province, Thailand

Abstract

This chapter presents behavioural and ethnographic insights into the foraging habits of free-roaming Asian elephants living in close relationship with Indigenous Karen communities in Thailand. For elephants, a socially complex and wide-ranging species, foraging involves much more than fulfilling basic nutritional needs; it is a cognitive process intertwined with social interactions, decision making and movement. Through a detailed examination of foraging behaviour, we argue that access to natural foraging opportunities is critical to elephant well-being. Drawing on foraging observations from elephants in northern and western Thailand, this chapter highlights how foraging behaviours are complex and must be understood within a broader – multispecies – ecological and social context. Furthermore, we present ethnographic insights from Karen communities, demonstrating that the knowledge and observations of local mahouts closely align with scientific data on elephant foraging.

Introduction: the Importance of Foraging in Elephant Well-being

Foraging is a cornerstone of elephant life, shaping not only their physical health but also their cognitive, social and emotional well-being. In free-roaming and wild elephants, foraging extends far beyond simply meeting nutritional needs. It is through foraging that elephants exercise their cognitive abilities, make critical decisions, engage in social learning, and maintain their intricate social

*lbaker@panworks.io

bonds. These behaviours are essential for the mental and emotional health of elephants, most manifest in environments where they have the freedom to make choices about what and how they forage.

This chapter explores the cognitive, social and emotional dimensions of foraging, drawing on both behavioural research and ethnographic insights from Karen communities. By examining foraging's role in elephant well-being, we gain a deeper understanding of why natural foraging behaviours are essential for elephants' overall quality of life, not just their physical health. This understanding is critical for developing ecological strategies that address the needs of both captive and wild elephant populations.

The Asian elephant (*Elephas maximus*) is classified as endangered by the International Union for Conservation of Nature (IUCN) (Williams *et al.*, 2020) with global population estimates ranging from 48,000 to 51,000 individuals. In Thailand, a key country for Asian elephant conservation, population estimates reflect the complex dynamics of human–elephant relationships. The total elephant population is estimated at 6783–7483 individuals, with approximately 50% living in captive environments (Bansiddhi *et al.*, 2020). This high proportion of captive elephants underscores the long-standing intertwining of elephant and human lives in the region.

A common misconception about Thailand's domestic elephant population suggests a dramatic decline from over 100,000 at the start of the 20th century to just over 3000 today (e.g. Schliesinger, 2015). However, this widely circulated statistic stems from an unverified casual remark in a 1981 US Forest Service trade magazine article by McNeely and Sinha. A more accurate estimate of historical working elephant numbers in present-day Thailand likely falls between the 1904 Siamese census count of 2036 elephants and broader geographic estimates of around 10,000 working elephants (Grabowsky, 1996).

Thailand is home to the world's largest population of captive Asian elephants used in tourism, with over 4000 individuals spread across most provinces, representing approximately 30% of the global captive Asian elephant population (Menon and Tiwari, 2019). Moreover, recent studies focusing on wild populations suggest a higher estimate of 4013–4422 wild elephants in Thailand (Sukmasuang *et al.*, 2024). These significant demographics present both challenges and opportunities for elephant conservation and protection efforts.

For centuries, Indigenous communities, particularly the Karen people in northern Thailand, have coexisted with elephants, developing a profound understanding of their needs, behaviours and well-being. Their traditional practices offer valuable insights into optimal elephant care. Central to these practices is the provision of access to natural habitats and the opportunity for free foraging, elements that are fundamental, rather than peripheral, to elephant well-being.

Cultural and Linguistic Perspectives on Wild and Domestic Elephants

In Thai language and culture, the categorization of animals as wild (*sat paa*) or domestic (*sat baan*) is closely tied to their location. Wild animals are associated

with the forest (*paa*), while domestic animals are linked to the village (*baan*) (Tambiah, 1969). This spatial distinction echoes legal categories of wild and domestic/captive, rather than reflecting biological differences.

Karen traditions, however, present a different conceptual framework. Instead of location-based categories, Karen language distinguishes between wild/feral (*mee*) and tamed (*bghah*) animals. This distinction doesn't correspond to specific locations, unlike the Thai concepts (Norton, 2024). In Karen ontology, tamed animals typically roam freely in the forest rather than being confined to the village.

The Karen concept of animal management involves a process where wild animals can be made tame (*ma bghah*) through feeding. Once tamed, these animals are watched (*gwah*) rather than continuously fed (*bu oh ah tha*). This practice of allowing elephants to freely forage has often been misunderstood by outside observers, who have sometimes misinterpreted this as a sign of poverty or lack of knowledge about elephant care, reflecting ethnocentric biases rather than an understanding of Karen cultural practices.

These differing cultural and linguistic perspectives highlight the complexity of human–elephant relationships and the importance of understanding Indigenous knowledge systems in elephant conservation and management.

Karen ecological knowledge: enhancing elephant well-being across contexts

Karen communities have developed a profound understanding of elephant behaviour and preferences, essential for their safe coexistence in shared forest habitats. Winkler's (2023) ethnographic fieldwork revealed how Karen mahouts demonstrate an intricate understanding of elephant foraging patterns, accurately predicting their movements and adapting to seasonal changes in foraging preferences. This knowledge extends beyond mahouts, with villagers using it to navigate forest areas safely, avoiding potential elephant encounters.

Traditionally, Karen mahouts have raised elephants in their natural habitat, allowing them to live, forage and interact with wild elephants. This approach offers valuable insights into elephant well-being. Two key aspects emerge from Karen practices: (i) the importance of access to natural forage and a diverse diet; and (ii) the recognition that restricting elephant movement through forest areas negatively impacts their well-being.

Karen mahouts' methods of tracking free-roaming elephants across vast forest areas have honed their understanding of elephant behaviour. While fewer contemporary Karen communities have access to large enough forest habitats for elephants to freely roam day and night as per traditional practices, this knowledge remains invaluable. Many Karen communities adapt their traditional knowledge to maximize foraging opportunities for elephants in the remaining forest patches surrounding their villages. This approach contrasts with conventional captive management techniques that rely on artificial enrichment within enclosed spaces.

Importantly, mahouts can mobilize this traditional ecological knowledge, particularly around foraging, to improve elephant lives across various contexts. By partnering and collaborating with relevant organizations, researchers and scientists, Karen mahouts can apply their insights to enhance elephant care in diverse settings, from sanctuaries to conservation projects. This collaboration represents a crucial opportunity to integrate Indigenous wisdom with modern conservation practices, potentially revolutionizing approaches to elephant well-being and protection.

These practices align with the concept of rewilding, as they prioritize the expression of natural behaviours and elephant autonomy within environmental constraints. Moreover, they contribute to forest conservation by reinforcing the community's commitment to preserving surrounding forest areas (Zhang *et al.*, 2022).

The lack of attention paid to Karen elephant traditions in Thai elephant scholarship can be, in part, attributed to language barriers and histories of political suppression between Karen and Thai speakers. Addressing this underrepresentation requires increased collaboration with Karen practitioners and scholars proficient in the Karen language, ensuring they and their valuable knowledge are incorporated into broader elephant conservation and management strategies.

Elephant Foraging and Traditional Ecological Knowledge in Context

A study conducted in northern Thailand from 2016 to 2019 examined the foraging behaviour of six semi-free roaming Asian elephants (Schwarz *et al.*, 2020). These elephants, previously living in captive environments without foraging opportunities and used in the tourism industry, roamed in community forests surrounding Karen villages, providing a unique opportunity to monitor their natural foraging habits.

The research team collaborated with Karen mahouts, who care for the elephants in the forest. The mahouts' close bond with the elephants allowed for intimate observation of their eating habits. Leveraging their extensive knowledge of local plant species, the mahouts assisted in identifying plants in the Karen language. Researchers then recorded the plant species and parts consumed, later having a botanical expert provide scientific names.

The study revealed that the elephants consumed over 165 different plant species across 56 families. They showed a strong preference for browsing over grazing, both in terms of species consumed and percentage of time spent foraging (Table 3.1). Table 3.1, derived from Schwarz *et al.* (2020), highlights the dietary habits of elephants in relation to the available plant species. Out of 165 plant species recorded, browse accounted for 87.9% of species, while grasses made up the remaining 12.1%. Correspondingly, elephants spent 87.6% of their total recorded time ($N = 17,912$ min) browsing and only 12.4% grazing. Notably, bamboo, despite being botanically classified as a grass, was categorized as browse due to its growth characteristics (Schwarz

et al., 2020). Seasonal variations were observed: (i) during the wet season, 94% of time was spent consuming browse species; (ii) in the dry season, this figure was 90%; and (iii) in the cold season, it dropped to 73%, with an increase in grazing.

The elephants exhibited highly selective feeding behaviour, with only six out of 165 plant species accounting for 64% of their foraging time (Table 3.2). Table 3.2, derived from Schwarz *et al.* (2020), identifies six plant species that accounted for the highest percentage of feeding time among all 165 species observed. In contrast, the remaining 159 species each contributed to less than 2% of the total foraging time. Bamboo (*Dendrocalamus* spp.) was particularly favoured, comprising 40.3% of their foraging time. The elephants also showed selectivity in the plant parts they consumed. They preferred leaves from trees, climbers and shrubs, while also consuming bark from 47% of observed tree species, probably for important minerals such as calcium to support bone health (Sukumar, 2006).

This study highlights that elephants have strong foraging preferences and consume a diverse range of plant types including trees, climbers, shrubs, herbs and grasses annually. Allowing elephants to forage freely ensures their nutritional needs are met and enables them to express natural behaviours, which is crucial for their overall well-being.

Table 3.1. Elephant time spent foraging. From Schwarz *et al.*, 2020.

Plant classification	No. of species (%)	Time spent foraging (%)
Browse		
Tree	49.1	29.1
Climber	21.2	12.4
Shrub	10.3	1.4
Herb	6.1	0.8
Bamboo ^a	1.2	44
	<i>Total: 87.9%</i>	<i>Total: 87.6%</i>
Graze		
Grass	12.1	12.4
	<i>Total: 12.1%</i>	<i>Total: 12.4%</i>

^aDespite being botanically classified as a grass, bamboo was categorized as browse because of its growth characteristics.

Table 3.2. Six species of plants accounted for the highest percentage of feeding time. From Schwarz *et al.*, 2020.

Plant classification	Species name	Time spent foraging (%)
Bamboo	<i>Dendrocalamus</i> spp.	40.3
Grass	<i>Zea mays</i>	7.9
Climber	<i>Spatholobus</i> sp.	6.2
Bamboo	<i>Bambusa</i> sp.	3.7
Tree	<i>Radermachera</i> sp.	3.6
Climber	<i>Pachyrhizus</i> sp.	2.3
	<i>Total time: 64%</i>	

The Concept of Rewilding and its Relevance to Elephant Conservation

Our approach to rewilding is centred on restoring autonomous agents to the landscape. We believe that a state of being wild that is meaningful to elephants can be attained in a landscape where both elephant and human cultures are valued. This perspective aligns with more recent rewilding endeavours that recognize humans as part of nature (e.g. Torres *et al.*, 2018) and seeks to create opportunities for captive elephants to regain psychological wildness while maintaining beneficial relationships with human communities.

In the context of Asian elephants in Thailand, rewilding efforts present a unique opportunity to address the complex entanglement of captive and wild populations, as well as the cultural and economic realities of human–elephant relationships. By focusing on the foraging behaviours of rewilded elephants, we can gain insights into the process of psychological and behavioural restoration, informing both conservation strategies and support for animal well-being.

Foraging as a Cognitive Process

Foraging in elephants is a deeply cognitive process that goes beyond simply seeking food to satisfy hunger. Elephants exhibit decision making, problem solving and memory use while foraging, highlighting their intellectual complexity. In natural habitats, elephants face a dynamic and often unpredictable environment that requires constant evaluation of food sources, nutritional value, and the effort required to obtain them.

Decision making and problem solving in foraging

Elephants regularly make decisions about where to forage based on past experiences, environmental conditions and social factors. Their spatial memory plays a crucial role in recalling the locations of specific food sources, such as waterholes or areas rich in bamboo shoots. This spatial memory is honed over time and passed down through generations within family groups, with the matriarch often guiding the herd to reliable foraging sites.

Elephants' trunks serve as both tools for grabbing food and sensory organs for evaluating potential food items. They use their acute sense of smell to determine if a plant is worth the effort of consumption. This sensory evaluation process, combined with the elephant's memory of past foraging experiences, helps them make informed decisions about what to eat and where to find it.

Observations of free-roaming elephants show that they use their trunks with incredible dexterity, not only to grasp and manipulate objects but also to solve problems in real time. For instance, an elephant might use its trunk to strip bark from a tree or uproot plants by dislodging the soil with its tusks. Additionally, elephants can manipulate tools, such as using rocks or sticks to dig for water or

break apart tough vegetation. This level of adaptability allows them to access food sources that would otherwise be unavailable, further emphasizing their problem-solving capabilities.

In Thailand, where seasonal variability creates a shifting landscape of food availability, elephants must constantly assess the changing environment. During the wet season, the abundance of bamboo shoots and fresh grasses allows for more selective foraging. Elephants can afford to focus on high-nutrient plant parts, discarding the less digestible components. However, in the dry season, when food sources become limited, elephants must employ a more energy-efficient strategy, balancing the effort required to obtain food with its nutritional value.

Memory, learning and seasonal changes in foraging

Elephants possess remarkable long-term memory, which allows them to recall specific locations of food and water sources over vast distances and extended periods of time. This spatial awareness is not only critical for individual survival but also for the survival of the herd. Older elephants, particularly matriarchs, act as repositories of knowledge, guiding younger members of the group to known foraging sites during times of scarcity.

Young elephants learn how to forage through social learning, observing older elephants and imitating their actions. Calves and juveniles practise using their trunks to grasp and manipulate food, a skill that takes years to fully master. This learning process is crucial for their development and ensures that knowledge about the local environment and foraging strategies is passed down through generations.

The role of memory in elephant foraging is particularly evident in their ability to navigate to specific food sources during different seasons. For example, elephants may remember the location of fruit-bearing trees that only produce edible fruit at certain times of the year, or recall the locations of water sources that persist through dry seasons. This cognitive map of their environment, built up over years of experience and social learning, allows elephants to make efficient use of available resources and adapt to changing environmental conditions.

Foraging as a Social Behaviour

Foraging is not only a cognitive activity for elephants but also a social one, reflecting their complex social structures and adaptable group dynamics. Asian elephants typically live in fission–fusion societies, where group composition is fluid and can change frequently. While family units often consist of related females and their offspring, these groups may temporarily split or merge with others depending on environmental conditions, resource availability and social factors. This flexible social structure allows for diverse foraging strategies and knowledge exchange across different group configurations, contributing to the adaptability and survival of individuals within the broader elephant population.

Social learning and knowledge transfer

In elephant societies, learning is a social process. Younger elephants, especially calves and juveniles, acquire essential foraging skills through observation and imitation. This social learning begins early in life, with calves closely watching their mothers and older members of the group to understand how to use their trunks, select food and process plants for consumption.

The role of the matriarch in this learning process is crucial. As the most experienced member of the group, the matriarch leads the herd to known foraging sites, teaching younger elephants the locations of food sources and water. This knowledge is passed down through generations, ensuring the survival of the herd even in times of scarcity. Matriarchs also serve as role models, demonstrating advanced foraging techniques that require skill and experience, such as digging for roots or stripping bark from trees.

In Thailand, where some elephants live in close association with certain Karen communities, mahouts observe that elephants will frequently gather in the same areas to forage together. This collective foraging behaviour reflects the importance of social learning, as younger elephants benefit from the guidance of older, more experienced individuals. This behaviour reinforces social bonds within the group and ensures that critical knowledge about the landscape is passed on.

Foraging as a bonding activity

Foraging in Asian elephants serves as a dynamic social activity that both reflects and reinforces their complex social structures. In fission–fusion societies, foraging groups may vary in composition, allowing for diverse social interactions and knowledge exchange. These fluid associations during foraging contribute to the formation and maintenance of social bonds across different group configurations.

Elephants engage in a range of social behaviours while foraging, from subtle tactile communications to more overt cooperative actions. They use their trunks for touching, caressing or playful interactions, which not only serve practical purposes – such as food sharing or guiding younger individuals – but also strengthen social cohesion within temporary or long-term groupings.

Cooperative foraging behaviours further highlight the adaptability of elephant social structures. For instance, elephants may collaborate to access challenging food sources, with individuals assuming different roles based on their size, strength or experience. One elephant might push down a tree while others harvest the leaves, demonstrating their capacity for coordinated action within variable group compositions.

Additionally, foraging is highly linked to complex play behaviour in elephants. Play behaviours in the context of foraging serve as a crucial mechanism for social and cognitive development within their complex fission–fusion societies. Young elephants frequently engage in playful activities during foraging, such as tossing vegetation, mock sparring with trunks, or engaging

in brief chases (Lee and Moss, 2012). These behaviours not only refine motor skills essential for effective foraging but also foster social competencies vital for navigating fluid group dynamics.

Play has been recognized as fundamental to Asian elephants' natural behavioural repertoire and has a significant role in maintaining social hierarchies, as observed among orphaned elephants in Sri Lanka (Poole *et al.*, 1997). In both wild and captive environments, play functions as a behavioural catalyst, creating challenges that develop physical and social skills across all age groups (Webber and Lee, 2020).

These spatial associations and high rates of tactile and non-tactile interactions during foraging contribute significantly to bond formation and reinforcement among group members (Lee, 1987; Sukumar, 1989; Moss *et al.*, 2011). In the context of fission–fusion dynamics, these shared foraging experiences become crucial for maintaining social connections across changing group memberships. This flexibility in social foraging strategies is particularly vital for Asian elephants' emotional well-being and survival, as it allows them to adapt their social support networks in response to environmental changes and resource availability.

Seasonal variations in foraging behaviours

Elephants in Thailand exhibit distinct foraging patterns that adapt to the dramatic seasonal changes in their environment. These patterns not only reflect the elephants' cognitive flexibility and ecological knowledge but also illuminate the complex interplay between environmental factors, social dynamics and individual decision making within fission–fusion societies.

Wet season foraging: abundance and selectivity

During the wet season (variably, July through to October), the forests of northern Thailand transform into lush, verdant landscapes, offering elephants a diverse array of foraging opportunities. This period of abundance significantly influences elephant behaviour, social interactions and nutritional strategies. Elephants demonstrate a marked preference for bamboo during this season, allocating substantial time to browsing on shoots, leaves and stems. The rapid growth and dense clustering of bamboo provide an energy-rich food source that aligns well with the elephants' need for efficient foraging in a fission–fusion context. Even amidst abundance, elephants exhibit sophisticated selectivity, discarding tougher plant parts in favour of tender, nutrient-dense portions. This behaviour underscores their cognitive ability to assess food quality and make optimal foraging decisions, a skill crucial for navigating variable group dynamics and environmental conditions. Karen mahouts' observations of elephants vocalizing with excitement upon discovering bamboo patches suggest a deep emotional connection to foraging success. These positive associations may reinforce social bonds within temporary groupings and contribute to the overall cohesion of the fission–fusion society.

Dry season adaptations: resilience and memory

The dry season (variably, November through to June) presents a stark contrast, challenging elephants to adapt their foraging strategies within a resource-scarce environment. This period highlights the elephants' cognitive flexibility and the importance of social learning in fission–fusion societies. As the landscape transforms, elephants pivot to rely more heavily on grasses, shrubs and ground-level vegetation. This shift demonstrates their ability to flexibly adjust foraging behaviours in response to environmental changes, a critical skill for maintaining group cohesion and individual health in variable social groupings. Elephants leverage their extensive spatial memory and past experiences to locate food sources, often revisiting productive areas from previous dry seasons. This behaviour underscores the crucial role of long-term memory and information sharing within fission–fusion societies, where knowledge transfer can occur across various social configurations. The challenges of the dry season may influence temporary group formations, with elephants potentially adjusting their social associations to optimize foraging success. This adaptability in social structure in response to resource availability exemplifies the dynamic nature of elephant societies.

The stark contrast between wet and dry season foraging behaviours illuminates the remarkable adaptability of elephants within their social structure. Their ability to adjust foraging strategies, utilize cognitive skills and maintain social flexibility in response to seasonal changes is crucial for both individual and group survival. These observations have significant implications for conservation strategies. Conservation efforts must prioritize the protection of diverse habitats that support year-round foraging opportunities, including bamboo forests and varied vegetation types critical for dry season survival. Thus, any such practices should account for the fluid nature of elephant social groups, ensuring that conservation areas are sufficiently large and diverse to accommodate changing group dynamics across seasons.

Foraging and Well-being: the Psychological and Emotional Dimensions

The act of foraging extends far beyond mere sustenance for elephants, encompassing crucial psychological and emotional aspects that profoundly influence their overall well-being. Within the context of fission–fusion societies, foraging behaviours intertwine with social dynamics, cognitive processes and emotional experiences, shaping the elephants' daily lives and mental health.

Autonomy and choice in foraging

Central to elephants' psychological well-being is the autonomy afforded by natural foraging. In their native habitats, elephants exercise agency through decisions about food selection, timing and acquisition methods. This freedom

of choice allows for the expression of individual preferences and personalities, contributing to the diversity of behaviours observed within fission–fusion groups. The ability to make independent foraging choices not only satisfies immediate nutritional needs but also reinforces the elephants' sense of control over their environment, a crucial factor in maintaining positive mental states.

The contrast between natural foraging environments and captive settings underscores the importance of choice. In tourist camps or zoos, where food is often pre-prepared and presented, elephants may experience a significant reduction in foraging-related decision-making opportunities. This limitation can lead to psychological distress, manifesting in stereotypic behaviours that signal emotional discomfort. The observation of these behaviours highlights the critical need for conservation and management strategies that prioritize natural foraging opportunities, even within controlled environments.

Emotional engagement and cognitive stimulation

Foraging serves as a rich source of emotional and cognitive engagement for elephants. The activity involves complex decision-making processes, memory utilization and problem-solving skills, all of which contribute to the elephants' cognitive health. In fission–fusion societies, these cognitive challenges are further enhanced by the need to adapt foraging strategies to changing group dynamics and environmental conditions.

The emotional aspect of foraging is evident in the elephants' responses to different food sources and foraging experiences. Beyond the excitement observed when encountering preferred foods, elephants demonstrate a range of emotions tied to their foraging activities. The satisfaction derived from successful foraging, the comfort found in familiar feeding grounds, and the anticipation of seasonal changes in food availability all contribute to a complex emotional landscape. These emotional experiences play a crucial role in strengthening social bonds within temporary groupings and contribute to the overall cohesion of elephant societies.

Stress reduction and environmental adaptation

The extensive time elephants dedicate to foraging-related activities in natural settings serves a dual purpose of nutrition and stress management. The rhythmic nature of foraging behaviours, combined with the constant engagement with their environment, provides elephants with a natural mechanism for stress reduction. This aspect of foraging becomes particularly significant in the context of fission–fusion dynamics, where the ability to manage stress through familiar activities can help elephants cope with the social fluidity of their groups.

Moreover, the problem-solving aspects of foraging contribute to the elephants' adaptability to environmental changes. As elephants navigate seasonal variations in food availability, they develop and refine cognitive strategies that enhance their resilience. This adaptive capacity is crucial for survival in

dynamic ecosystems and plays a vital role in the elephants' ability to thrive within their fission–fusion social structures.

Conservation Implications of Foraging Behaviour

The intricate relationship between elephant foraging behaviours and their fission–fusion social dynamics carries profound implications for conservation strategies. Recognizing the multifaceted role of foraging in elephant societies is crucial for developing holistic approaches that address both ecological and social needs of these complex beings.

Reframing elephant habitats: historical contexts and conservation strategies

The perception that Thailand lacks sufficient forest for elephants to forage freely is often overstated. Despite significant habitat loss, vast forested areas remain, with potential for reforestation. Recent meta-analyses challenge the assumption that elephants prefer pristine environments, showing they often favour human-disturbed areas over old-growth forests (de la Torre *et al.*, 2021). This preference is often overlooked due to the concentration of wild elephants in Thailand's national parks, leading to misconceptions about their habitat needs.

Historically, areas now considered pristine within protected zones and World Heritage sites, such as Thung Yai and Huai Kha Khaeng national parks, were long inhabited by Karen and other forest-dwelling communities (Vandergeest and Peluso, 1995; Buergin, 2015). This historical context dispels the myth of complete separation between captive and wild elephant populations and highlights a long-standing coexistence of humans and free-roaming elephants in forested areas.

Traditional rotational agriculture practices have created diverse landscapes within these protected areas. Long-fallow rice swiddens and secondary forests resulting from these practices are common, and mahouts often observe elephants preferring these areas. This underscores the need for a more nuanced understanding of elephant habitat preferences and use.

To avoid oversimplified assumptions about population dynamics, human–elephant conflict and habitat use, conservation efforts must consider historical land settlement patterns of Indigenous groups, deepen understanding of environmental history, and pay more complex attention to elephant foraging preferences. These multifaceted approaches are crucial for developing more meaningful and effective conservation strategies that reflect the true complexity of elephant ecology and human–elephant relationships. Conservation strategies should thus prioritize preserving and restoring diverse habitats, including attention to agrobiodiversity (Baird, 2022). This approach goes beyond protecting existing forests to actively restoring degraded areas, focusing on recreating the mosaic of vegetation types that elephants rely on year round.

Moreover, habitat conservation must account for the spatial and temporal variability in elephant group dynamics. Protected areas should be sufficiently large

and diverse to accommodate the fluid nature of fission–fusion societies, allowing for natural group formation and dissolution in response to seasonal changes and resource availability. This may involve creating networks of interconnected habitats that mirror the elephants’ dynamic use of their environment.

Collaboration with local communities, particularly those with traditional ecological knowledge like the Karen people, is crucial. Their insights into sustainable land management practices and historical elephant movement patterns can inform more effective and culturally sensitive conservation strategies.

Preserving ecological functions in dynamic social contexts

The ecological roles of elephants as seed dispersers and vegetation engineers are intrinsically linked to their foraging behaviours and social structures. Conservation strategies must aim to maintain these functions by ensuring that elephants can engage in natural foraging patterns within their fission–fusion societies.

This involves protecting not just individual feeding sites but entire foraging routes that elephants use as they move between temporary group formations. By preserving these movement corridors, conservation efforts can support the natural flow of genetic material and ecological processes across landscapes, enhancing ecosystem resilience.

Furthermore, recognizing the varied foraging strategies employed by different age and social groups within elephant societies can inform more nuanced habitat management practices. For instance, ensuring the availability of diverse food sources that cater to the nutritional needs of both young and adult elephants supports the health of the entire population.

Ethical Tourism and Research: Supporting Natural Behaviours

Ethical conservation tourism and research initiatives should be designed to respect and support the natural foraging and social behaviours of elephants (Baker *et al.*, 2021). This approach moves beyond simplistic viewing experiences to create opportunities for tourists and researchers to observe the complex interactions among foraging, social dynamics and environmental factors in elephant societies.

Ethical tourism models could incorporate unobtrusive observation areas strategically located along natural foraging routes. This would allow visitors to witness the formation and dissolution of elephant groups in response to seasonal changes, providing valuable educational experiences while minimizing disruption to natural behaviours. Crucially, these models must be informed by principles – with regard to humans and non-humans – of ethically grounded community-based tourism, prioritizing local governance and equitable distribution of economic value.

Research programmes should focus on non-invasive methods that enable the study of elephant foraging and social behaviours in their natural context.

Long-term studies tracking changes in group dynamics, foraging patterns and habitat use over time can provide crucial insights for adaptive conservation management.

By aligning conservation strategies with the intricate realities of elephant foraging behaviours and fission–fusion dynamics, we can develop more effective and ethically sound approaches to elephant protection. This holistic perspective supports not only the physical and psychological well-being of elephants but also enhances the resilience of their ecosystems and fosters more harmonious relationships between elephants and human communities.

The Role of Mahouts in Elephant Well-being

Mahouts in the Karen tradition play a crucial role in maintaining the well-being of elephants – they are not only caretakers but also companions and protectors. This role, often passed down from father to son, involves forming deep bonds with elephants from calfhood through to adulthood. The Karen culture uniquely recognizes aspects of elephant personhood and agency, exemplified by key practices. For example, they perform annual ritual kinship ceremonies for elephants, the only non-human species accorded this honour. Additionally, they conduct a naming ritual where young elephants choose their own names by selecting food items associated with different names (Greene, 2021).

In Karen ontology, elephants occupy a unique spiritual role as intermediaries between humans and the spirit world. They are often described as ‘beings that speak for the spirits’ or as messengers of truth and higher power. This spiritual significance elevates the status of mahouts within their communities, as their close relationship with elephants grants them a form of spiritual insight. Mahouts’ observations of elephant behaviour and moods are considered reflections of the community’s spiritual health. As a result, before interacting with their elephants, mahouts often consult with village elders to discuss any community issues that might affect the elephants’ demeanor. This practice underscores the interconnectedness of elephant well-being, community harmony and spiritual balance in Karen culture.

The spiritual significance of elephants in Karen culture creates a profound sense of responsibility among mahouts. Mistreating an elephant is considered a spiritually dangerous violation, potentially jeopardizing not only the mahout’s spiritual well-being but that of the entire community and future generations (Lee *et al.*, 2024). This belief system reinforces the mahouts’ dedication to closely observing and respecting individual elephant personalities, behaviours, moods and preferences.

Most Karen mahouts prioritize natural foraging as essential for elephant well-being, recognizing its importance for both nutritional and psychological health. Unlike in commercial tourist camps where elephants are often fed prepared food on a schedule, the Karen communities ensure that their elephants have the freedom to forage naturally in the forests surrounding their villages.

Moreover, Karen mahouts develop an intimate understanding of their elephants’ individual foraging preferences across seasons. For instance, during

the wet season, they may guide elephants to bamboo-rich areas, knowing it is often a preferred food source. In the dry season, when natural food is scarcer, mahouts are known to supplement the elephants' diet by cultivating crops like Napier grass on behalf of the elephants, ensuring consistent access to nutritious food.

Karen mahouts have also reported observing how elephants display distinct preferences for certain plant species and even specific parts of plants. For instance, elephants may prefer the shoots or tender leaves of bamboo during the rainy season and might avoid tougher plant material when more nutritious options are available. This nuanced understanding of foraging patterns aligns with scientific observations about the selective feeding behaviour of elephants, highlighting the practical knowledge that has developed through long-term, close relationships between mahouts and elephants.

The Karen people's understanding of elephant behaviour is deeply embedded in their culture and reflects their respect for the intelligence and social complexity of elephants. Mahouts believe that elephants, like humans, have unique personalities and emotional lives, and they adjust their care practices accordingly.

This traditional knowledge, accumulated over generations, is key to successful management of elephants in Karen communities. The mahouts' ability to identify changes in an elephant's behaviour – such as a sudden disinterest in a particular foraging site or a shift in dietary preferences – enables them to provide care that is responsive to the elephants' needs. This is particularly important when the elephants are experiencing stress due to external factors such as habitat degradation, changing weather patterns or interactions with other animals.

This holistic approach to elephant care, rooted in spiritual beliefs and traditional ecological knowledge, demonstrates the depth of the mahout–elephant relationship in Karen culture and its potential contributions to modern elephant conservation and welfare practices.

The Relationship Between Elephants and Karen Communities

Beyond a relationship of transaction, the Karen people view elephants as sentient beings with whom they share a spiritual connection, and this belief informs the way they interact with and care for the elephants.

The unique relationship is also reflected in the way Karen communities manage their natural resources. The forests where elephants forage are also vital to the livelihoods of the Karen people, providing food, medicinal plants and materials for building. As such, the Karen have developed sustainable land management practices that ensure the long-term health of the forest ecosystem. These practices include selective planting of crops that benefit both the elephants and the community, as well as the protection of critical foraging areas from overuse or degradation (Park *et al.*, 2017).

As global pressures on elephant populations intensify, the role of Karen mahouts in protecting and promoting elephant well-being becomes

increasingly critical. The traditional knowledge held by mahouts offers valuable insights into coexisting with and protecting elephants in a way that prioritizes their cognitive, social and emotional needs. This expertise is particularly relevant as elephant populations face mounting challenges tied to habitat loss, human–wildlife conflict and the commercialization of elephant tourism.

The Karen communities, with their emphasis on ethical and sustainable practices, provide a counterpoint to exploitative trends, demonstrating that it is possible to care for elephants while respecting their autonomy and cognitive complexity. However, these communities themselves face challenges as modern economic pressures threaten their traditional way of life. Despite these pressures, many Karen communities continue to prioritize elephant well-being, advocating for more ethical and sustainable approaches to elephant management.

The knowledge and practices of Karen mahouts will be essential in shaping future policies and initiatives aimed at protecting both elephants and the communities that depend on them. By integrating this traditional knowledge with modern conservation science, we can work towards a future where elephants thrive in their natural habitats, and the deep bonds between elephants and humans continue to flourish. This collaborative approach offers a path to more effective, culturally sensitive and ethically grounded conservation strategies that benefit both elephants and the communities that have long lived alongside them.

Conclusion: Fostering Elephant Well-being through Natural Foraging

The intricate tapestry of elephant foraging behaviour, woven through the dynamic structure of fission–fusion societies, reveals a profound connection between ecological processes, cognitive development and social cohesion. Our examination of free-roaming elephants living alongside Karen communities in Thailand illuminates the critical importance of natural foraging opportunities not just for individual elephants, but for the resilience and adaptability of their social groups and the multi-species ecosystems they inhabit.

Foraging emerges as a multifaceted activity that transcends mere sustenance. It serves as a cognitive playground where elephants exercise decision-making skills, a social arena where knowledge is shared across fluid group compositions, and an emotional landscape where individual preferences and collective experiences shape group dynamics. The seasonal variations in foraging patterns highlight the remarkable adaptability of elephant societies, underscoring the need for conservation strategies that preserve the full spectrum of their habitat requirements.

The insights gained from studying elephant foraging behaviour in the context of fission–fusion societies and their relationship with Karen communities emphasize the importance of integrating traditional ecological knowledge with scientific research. Karen mahouts' deep understanding of elephant behaviour, rooted in centuries of coexistence, aligns closely with scientific observations

on foraging patterns, social dynamics and seasonal adaptations. This synthesis offers a powerful framework for developing conservation strategies that are both ecologically sound and culturally sensitive, addressing the complex challenges facing elephant populations in a rapidly changing world.

Our research challenges common misconceptions about elephant habitat preferences and historical population trends in Thailand. It highlights the need for a more nuanced understanding of elephant–human coexistence, recognizing the long history of interaction between forest-dwelling communities and elephants. This perspective calls for conservation approaches that value both human and elephant cultures, moving beyond simplistic notions of ‘wild’ versus ‘captive’ populations.

Moving forward, conservation efforts should prioritize:

1. Protecting and restoring diverse habitats that support year-round foraging opportunities and accommodate the fluid nature of elephant social groups.
2. Developing conflict mitigation strategies that account for the seasonal variations in elephant movement patterns and group formations.
3. Promoting ethical tourism and research practices that respect the natural foraging behaviours and social dynamics of elephants.
4. Fostering collaborations among local communities, particularly Karen mahouts, scientists and conservation organizations to create holistic management approaches that benefit both elephants and humans.
5. Recognizing and incorporating traditional ecological knowledge, especially from Karen communities, in elephant conservation and management strategies.
6. Addressing the psychological and emotional dimensions of elephant well-being through conservation practices that allow for natural foraging and social behaviours.

By embracing the complexity of elephant social structures and foraging behaviours, we can craft more effective and nuanced conservation strategies. These approaches will not only ensure the physical survival of elephants but also preserve the rich tapestry of their social lives and cognitive experiences. In doing so, we protect elephant lives, their species, underpinned by the intricate ecological relationships and cultural values that elephants embody in the landscapes they inhabit.

Ultimately, safeguarding natural foraging opportunities for elephants within their fission–fusion societies is crucial for their well-being and future. Natural foraging is not merely about nutrition; it is integral to elephants’ cognitive, emotional and social health. This understanding recognizes elephants as sentient beings with complex inner lives, deserving of environments that support their full behavioural repertoire. Moving forward, conservation strategies must draw from a diverse range of ethically grounded epistemologies, including: (i) scientific research; (ii) traditional ecological knowledge; (iii) Indigenous wisdom; (iv) historical analysis; and (v) anthropological insights. By integrating these varied perspectives, we can develop more comprehensive and culturally sensitive approaches to elephant conservation. This holistic strategy acknowledges the intrinsic value of elephants and their right to flourish in habitats that allow

for the full expression of their natural behaviours, including the vital act of foraging. Our goal should be to ensure a future where elephants can live and thrive as elephants, with their well-being at the centre of our conservation and protection efforts.

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