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The journal is intended as a medium of communication on issues that concern the management and conservation of Asian elephants both in the wild and in captivity. It is a means by which everyone concerned with the Asian elephant (*Elephas maximus*), whether members of the Asian Elephant Specialist Group or not, can communicate their research results, experiences, ideas and perceptions freely, so that the conservation of Asian elephants can benefit. All articles published in *Gajah* reflect the individual views of the authors and not necessarily that of the editorial board or the Asian Elephant Specialist Group.

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Editorial Note

Gajah will be published as both a hard copy and an on-line version accessible from the AsESG web site (www.asesg.org/gajah.htm). If you would like to be informed when a new issue comes out, please provide your e-mail address. If you need to have a hardcopy, please send a request with your name and postal address by e-mail to <jenny@aim.uzh.ch>.

Cover

Elephant Awang Sg Kedah, a local resident, walking along the Gerik-Jeli Highway also known as East-West Highway in Gerik, Perak (Malaysia)
Photo by Alicia Solana Mena
(See article on page 4)

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Editorial

Jennifer Pastorini (Editor)

E-mail: jenny@aim.uzh.ch

Gajah 48 presents two research articles, six short communications and three meeting reports. The publications are about wild elephants in India, Malaysia, Bangladesh and captive elephants in Australia, Europe and Myanmar.

The *Peer-Reviewed Research Article* by E.P. Wong *et al*. monitored hormones of a GPS-collared translocated elephant in Malaysia. They found that hormone levels changed after the elephant gave birth and crossed a road. The *Research Article* presents the results from a survey in Northern Bangladesh. A. Palash *et al*. found people to be tolerant towards elephants, as long as human lives were not threatened.

In *Short Communications*, A. Saklani *et al*. present an elephant fence constructed with railway track sections which was more successful than other fences used in the area. H. Dutta *et al*. looked into human-elephant conflict issues in the Patheria Hills Reserve Forest along the Indo-Bangladesh border. A. Hazarika & H. Dutta conducted an interview survey to study people's perceptions of human-elephant conflict around the Abhaypur Reserve Forest in northeast India. C. Schiffmann *et al*. filmed the resting behaviour of an old captive elephant. She rested lying down for nearly eight hours per night, which is unusual for old elephants. C. Holland trained an elephant at Perth Zoo to search for a particular scent. When he found it he was rewarded with food. Z.M. Oo *et al*. describe how they successfully treated an elephant whose throat got completely blocked by food.

In the *News and Briefs* section S.K. Tiwari & V. Menon give a detailed overview on the AsESG meeting held in Bangkok this year. A. Sadaula *et al*. report on the regional Tiger, Asian Rhino and Elephant Veterinary Workshop held in Chitwan, Nepal. There is also a brief summary of the sixth workshop from the Elephant Conservation Group held in Bangkok. Abstracts from 54 publications can be read in "Recent Publications on Asian Elephants" and newspaper clippings about elephants are given in the "News Briefs".

Vivek Menon, the chair of the Asian Elephant Specialist Group, gives a vote of thanks for the last AsESG meeting, informs us about the progress of the working groups and mentions the China-ASEAN Wildlife Conservation Training Workshop he attended.

During the AsESG meeting in Bangkok we also held a short *Gajah* editorial board meeting. It is the first time all of us could meet in person (see photo). Alex Rübel has resigned from the editorial board and I would like to thank him for his contributions for *Gajah* in the last 11 years.

I am grateful to all the authors for taking the time to write up articles about their work for us to read in *Gajah*. I very much appreciate the editorial team's help with paper editing and working with the authors to improve their manuscripts. Thanks to the financial support from the Wildlife Reserves Singapore Group we can print hard copies of *Gajah* and mail them out for free to readers across the globe.

A. Campos-Arceiz, P. Fernando, J. Pastorini, V.R. Goswami, H. Riddle, T.N.C. Vidya

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Notes from the Chair IUCN SSC Asian Elephant Specialist Group

Vivek Menon

Chair's e-mail: vivek@wti.org.in

Dear members

I am happy to connect with all of you again and also extremely pleased to inform you that the IUCN SSC Asian Elephant Specialist Group is now a strong team of 112 likeminded specialists from across the globe. Recently, in July 2018, 22 new members have joined our group allowing us to score our century in membership.

Also, now that we have had a very successful 9th meeting of the Asian Elephant Specialist Group at the Avani Riverside Hotel in Bangkok, Thailand from April 25 to 27, 2018 (please read the report of this on pages 40–45) and that many of you could attend that meeting, I am confident that the group is going from strength to strength.

For the smooth conduct of the meet I have several sets of people to thank. First of course all of you who took part and made it the largest meet of our group ever. Secondly, I wish to thank the Thai Government (Department of National Parks, Wildlife and Plant Conservation) for hosting the meet so graciously. Thirdly our donors; majorly Elephant Family and International Fund for Animal Welfare (IFAW) who were the principal sponsors but equally MIKE Asia (for partially supporting the travel and stay of officials for the AsESG meeting), Mr. John Edwards (for the support from Golden Triangle Asian Elephant Foundation), Dr. A. Christy Williams (for support from WWF International), The Wildlife Practice and Dr. Sonja Luz (for support from Wildlife Reserves Singapore). It was a fun and productive meeting.

Based on the recommendations of AsESG meeting in Bangkok, I have constituted three more working groups i.e. the working group to manage the Rohingya elephant crisis in Bangladesh, the working group to assist in developing the National Action Plan for Bhutan and the working group on emerging diseases affecting Asian elephants.

I know that a few more working groups have been suggested but I am hoping that with a few others ending by December, we can initiate new ones. Currently I would want the secretariat to focus on winding up existing ones after achieving the desired outcomes. It is when we start publishing the reports, guidelines, action plans and protocols coming out of these groups that I think the work of the AsESG will achieve a more permanent footing. I would request all the members of the

Group photo of the AsESG meeting in Bangkok.

AsESG Chair Mr. Vivek Menon addressing the meeting.

The Hon'ble Minister of Natural Resources Wildlife and Plant Conservation, Thailand.

groups especially the facilitators and convenors to please focus on getting as many of these done before we meet again.

We are now currently in discussion with the four members who had verbally suggested hosting the meet in their countries. Sri Lanka, Bangladesh, Malaysia (Sabah) and China were proposed but we would look to see what is convenient for most members in terms of logistics as well as what hosting support we would get from the host government and our members in situ. I hope that by the end of the year we can decide on the venue and dates for the next meet.

Soon after the Bangkok meet, I also had the privilege of attending the China-ASEAN Wildlife Conservation Training Workshop from 19th – 23rd June 2018 at Chengdu, China on the invitation of the Chinese government. Apart from presenting an overview of Asian elephant conservation and the role of AsESG, I also discussed the elephant conservation challenges with senior officials of the Chinese Forestry Department and offered the support of AsESG experts for the conservation of elephants in China. I also gave a talk on the Asian elephant at the Beijing Normal University.

Meanwhile the AsESG Secretariat has also been working hard in helping some of the working groups but also in helping the CITES in providing information on "Asian elephants (*Elephas maximus*): Status, threat and conservation actions" for their report for the 70th meeting of the Standing Committee submitted in June 2018. The Secretariat also provided information for the SSC Annual Reports for the years 2016 and 2017. The website should also go live in a few weeks.

Vivek Menon
Chair AsESG, IUCN SSC

Vivek Menon
Chair AsESG, IUCN SS

Ex-officio members with the AsESG Secretariat.

Paying attention to the Chair's report.

Peer-Reviewed Research Article *Gajah 48 (2018) 4-11*

The Elephant who Finally Crossed the Road – Significant Life Events Reflected in Faecal Hormone Metabolites of a Wild Asian Elephant

Ee Phin Wong[1,2,*], Lisa Yon[2], Susan L. Walker[3], Alicia Solana Mena[1], Jamie Wadey[1], Nasharuddin Othman[4], Salman Saaban[4] and Ahimsa Campos-Arceiz[1,5]

[1]*School of Environmental and Geographical Sciences, Faculty of Science, The University of Nottingham Malaysia, Jalan Broga, Semenyih, Selangor, Malaysia*
[2]*School of Veterinary Medicine and Science, Faculty of Medical & Health Sciences, The University of Nottingham, Sutton Bonington, Leicestershire, UK*
[3]*Chester Zoo, Upton-by Chester, Chester, UK*
[4]*Department of Wildlife and National Parks Peninsular Malaysia, Kuala Lumpur, Malaysia*
[5]*Mindset Interdisciplinary Centre for Environmental Studies, The University of Nottingham Malaysia, Jalan Broga, Semenyih, Selangor, Malaysia*
**Corresponding author's e-mail: eephin@gmail.com*

Abstract. We used GPS-telemetry and faecal glucocorticoid metabolites (fGCM) to monitor a wild translocated female elephant in rainforests of Peninsular Malaysia. The elephant was GPS-tagged at translocation and her fGCM monitored within 11–22 months after translocation. The lowest fGCM concentrations were observed at the beginning of hormone monitoring, when she exhibited unusual movement patterns, moving repetitively alongside a major road without crossing it. Around the 16th month after translocation, the elephant delivered a calf and in the 18th month she crossed the road. In this period, she exhibited increased fGCM concentrations, presumably indicating response to challenging life events.

Introduction

It is challenging to study elusive Asian elephants (*Elephas maximus*) in the rainforest due to the dense foliage and limited sightings (Blake & Hedges 2004). Recent technological developments, such as GPS-telemetry and non-invasive molecular techniques, have considerably improved the wildlife ecologist toolbox and our capacity to study forest elephants. Similarly, ability to measure hormone metabolites from faeces, allows the physiological monitoring of free-ranging wildlife without the need to capture the animal.

Glucocorticoid hormones play a role in modulating daily energy needs and in helping to prepare the body to cope with challenges, managing the period of stress and in recovering after the challenge has passed (Sapolsky *et al*. 2000). Wildlife biologists can now use faecal glucocorticoid metabolites to gauge wildlife responses towards anthropogenic impacts such as tourism, logging, and translocation (Wasser *et al*. 1997; Thiel *et al*. 2008; Dickens *et al*. 2010; Wong 2017). In addition, it is considerably easier to obtain faecal samples in the field than saliva, urine, or blood (Palme *et al*. 2005), as wild Asian elephants are known to defecate up to 18 times per day (Hedges *et al*. 2005).

Furthermore, faecal glucocorticoid metabolites (fGCM) patterns are reflective of free glucocorticoid concentrations in the blood, after taking into account the gastrointestinal transit time (Touma & Palme 2005; Sheriff *et al*. 2010a), and are therefore a reasonable method to evaluate adrenal activity. However, the use of fGCM, requires various validation tests to ensure we are measuring actual adrenal responses instead of environmental or sampling artefacts (see reviews by Millspaugh & Washburn 2004; Goymann 2012). In previous studies, we have validated the use of fGCM in Asian elephants (Watson *et*

al. 2013) and that fGCM samples are stable up to eight hours after defecation in a tropical rain forest environment (Wong *et al*. 2016).

In 1950, Selye introduced his theory of "General Adaptation Syndrome" outlining the adrenal glands' role in secreting glucocorticoids as response to stimulants (stressors). Since then, more researchers have identified links between glucocorticoid concentrations and health. In a "fight or flight" scenario when faced with a dangerous situation (e.g., zebra chased by a lion; Sapolsky 2004), within seconds to minutes, the body will release a cascade of hormones, including catecholamines and corticotropin-releasing hormone (CRH), into the blood stream; these effect a number of physiological changes in the body (Sapolsky *et al*. 2000; Sheriff *et al*. 2011). The CRH, secreted by the hypothalamus, stimulates the pituitary's secretion of adrenocorticotropic hormone (ACTH), which in turn, will stimulate the adrenal glands to release glucocorticoids minutes after the stressful encounter (Chrousos 1998; Sapolsky *et al*. 2000; Sheriff *et al*. 2011).

Glucocorticoids are steroid hormones that will exert a physiological effect on the body over a few hours, and will act through a negative feedback loop to receptors in the brain, to reduce the production of CRH and ACTH after the stressor ends (Sapolsky *et al*. 2000). In an acute stress scenario, glucocorticoids play a vital role in managing stress and assisting in recovery from stressors (Sapolsky *et al*. 2000), which includes mediating immune responses to prevent overshooting or autoimmunity, enhancing cardiovascular activation during stress, and maintaining the sensitivity of β-adrenergic receptors to catecholamines at vital locations in the body, including the heart (McEwen 1998; Sapolsky *et al*. 2000; Silverman *et al*. 2005).

Although glucocorticoids are often termed as "stress hormones", they have important functions outside the "fight and flight" stress response. Basal glucocorticoids have a circadian cycle in our body and play an important role in energy regulation. At low to moderate levels, glucocorticoids stimulate appetite; and appetite normally peaks when basal glucocorticoid concentrations are at their highest early in the morning (Sapolsky *et al*. 2000). When acute stress occurs, appetite is suppressed temporarily (less than an hour) and afterwards glucocorticoids may help build appetite to encourage metabolic intake and prepare the body for subsequent stressors (Sapolsky *et al*. 2000). If the timing and secretion pattern for glucocorticoids are disrupted (McEwen *et al*. 2015), the adrenal response is impaired (Dickens *et al*. 2009), or the body reaches exhaustion due to chronic stress (Selye 1950; Sapolsky 1999), then there could be negative impacts on health. Elevated glucocorticoids can have adverse effects on memory, learning, and cognitive function (Sapolsky 1999; McEwen *et al*. 2015). Although not so well known, low concentration of glucocorticoids is linked to acute adrenal crisis (a potentially life-threatening condition; Lee & Ho 2013), chronic fatigue syndrome (Edwards *et al*. 2011), and post-traumatic stress disorder (Raison & Miller 2003; Yehuda & Seckl 2011), amongst other health problems (Heim *et al*. 2000; Cicchetti & Walker 2001). Therefore, the ability to maintain an adequate concentration of basal glucocorticoids is vital for the body in managing daily activities (Sapolsky *et al*. 2000; Busch & Hayward 2009; Madliger & Love 2014), as well as in facing stressors or energy-intensive life-history stages such as migration (Sapolsky *et al*. 2000; Wingweld & Kitaysky 2002; McEwen & Wingweld 2003).

Peninsular Malaysia is home to an estimated population of 1223–1677 wild Asian elephants (Saaban *et al*. 2011) that, like elsewhere in the species range (Fernando & Pastorini 2011), are endangered due to the combined effect of habitat loss and human-elephant conflict (HEC). Translocation, moving elephants from conflict zones to protected areas, has been one of the main strategies to mitigate HEC in Peninsular Malaysia in recent decades, with approximately 10 to 25 wild elephants translocated every year since 1974 (Saaban *et al*. 2011; pers. comm. Nasharuddin Othman). Not much is known about the impact of translocation on elephants, nor how they fare after their release. The work presented here is part of the activity of the Management and Ecology of Malaysian Elephants (MEME)

project, a collaboration between university researchers and local wildlife authorities that aims to move towards an evidence-based conservation of elephants in Peninsular Malaysia (http://www.meme-elephants.org). Among other activities, MEME is using GPS-telemetry and fGCM monitoring to study elephant response to translocation, comparing the movement patterns (e.g. Wadey *et al*. 2018) and hormone profiles (Wong 2017) of translocated and local resident elephants at release sites. Here we present a case study that uses movement tracking and hormone profiles to gain insights into the physiological condition of a wild elephant.

Methods

Study site

The Belum-Temengor Landscape (BTL) is located in the northwest of Peninsular Malaysia (Fig. 1), and is mainly comprised of hill dipterocarp and upper dipterocarp forest. It covers the Royal Belum State Park (1175 km^2), Temengor Forest Reserve (1489 km^2), state land (131 km^2), indigenous villages, plantations, rivers and a large dam (Rayan & Linkie 2015). This landscape is bisected by the Gerik-Jeli East-West highway, of about 121 km in length (Wadey *et al*. 2018).

Study subject

The elephant in this case study is a female (named Mek Jalong) from the south of Perak that was translocated 94 km to BTL on the 20th May 2012 (day 0). Jalong was fitted with a GPS-satellite collar (~17 kg, Africa Wildlife Tracking, South Africa), which tracked her movements every two hours from day 0 to day 669. We started monitoring Jalong's fGCM in the 11th month (day 341) after her translocation and stopped in the 22nd month (day 669), when her GPS-collar failed. During this latter period (days 341–669), Jalong underwent two presumably challenging (in terms of stimulation of the HPA axis) events. The first event was the birth of her calf (Fig. 2), which took place around the 16th month after translocation. This indicates that Jalong was four to six months pregnant when she was translocated. The second event was when she crossed the East-West highway for the first time during the study period, 18 months (day 537) after translocation.

Field sample collection

We tracked Jalong on the ground by first using the GPS collar's location coordinates to know where she had been in the previous few hours and, then, using the strength of the collar's VHF signal and forest signs (e.g. footprints, disturbed

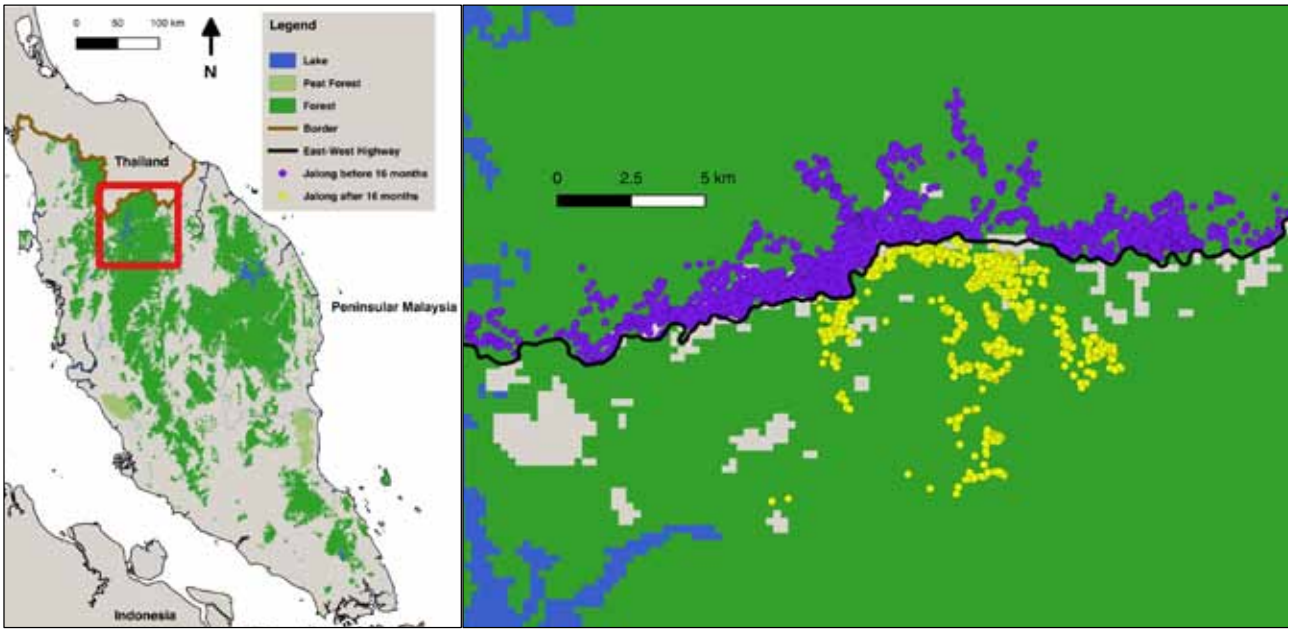

Figure 1. Combined tracklog (days 0–660) of Mek Jalong's movement before (blue dots) and after (yellow dots) crossing a major highway (black line) in the Belum-Temengor landscape for the first time on day 537 after translocation.

vegetation, and the sound of flapping ears and feeding) to narrow down Jalong's position. Once the tracking team was at close distance from the elephant (within visual or auditory range), we closely tracked her movements to look for fresh dung assumed to have been produced by her. Since the elephant never joined any other elephant (except her calf) and we were tracking her at very close range, it is highly unlikely that the dung samples we collected could have been produced by any other elephant. Once we found a dung pile, we recorded the GPS location and environmental variables associated.

The faecal samples were collected using clean surgical gloves and stored in a zip-lock bag; approximately 100 g of faecal material was removed from the middle of the bolus from an average of three intact boli. The fGCM samples were mixed thoroughly in the zip-lock bag and placed immediately in a cooler bag with ice packs, before transferring it to a portable car compressor freezer (–15°C to –18°C; Mobicool CF18C and CDF-11, Germany, powered by car AC socket) or chest freezer (–20°C) at our field station. Following Wong *et al*. (2016), only samples stored in the freezer within eight hours after defecation were used in the analysis.

In the 11 months in which we monitored Jalong's fGCM, we obtained a total 13 dung samples from nine different sampling occasions.

Laboratory analysis

We used a wet-weight extraction technique (Watson *et al*. 2013), whereby 5 ml of 90% methanol were used to extract fGCM overnight from 0.5 g (± 0.003) of a well-mixed dung sample. Extracts were dried and reconstituted in 1 ml of 100% methanol, and stored at –20°C until being analysed with a corticosterone enzyme immunoassay (CJM006, Coralie Munro, UC Davis). The biological and biochemical validation for the assay was previously carried out by Watson *et al*. (2013). Only data with an intra-assay coefficient of variation (CoV) of less than 10% and inter-assay CoV less than 15% were used for subsequent analyses.

Figure 2. Mek Jalong and her newborn calf.

Results

In the approximately 16 months after her translocation, Jalong remained solitary although there were other elephant groups in the area. She moved up and down repetitively along the northern side of the East-West highway, always close to the road but never crossing it (Fig. 1). When Jalong's fGCM monitoring started on day 341 post-translocation, for 4.5 months, Jalong's mean fGCM was 7.3 ± 1.2 ng/g (SD; Fig. 3).

Jalong was first noticed to be with her calf on day 481 post-translocation during a field track. Soon after that (day 536), Jalong crossed the East-West highway for the first time (Fig. 1). In the period between these two events, Jalong's fGCM fluctuated (mean±SD fGCM = 10.9 ± 3.9 ng/g; Fig. 3). We recorded Jalong's highest fGCM value shortly before she crossed the highway (15.9 ng/g, highest concentration throughout the monitoring period of 11 months). After crossing the highway, Jalong's movement changed and she began exploring new areas away from the road (see Fig. 1), while her fGCM concentration persisted around 11.2 ± 1.4 ng/g for the remaining four months (Fig. 3) until monitoring terminated at day 669 post-release, when the GPS satellite housing detached from the collar.

Discussion

At the beginning of the study, Jalong roamed alone and showed repetitive movements alongside the highway (i.e. she seemed attracted to the highway

but avoided crossing it). This is a very unusual movement pattern compared to other elephants monitored in this landscape (Wadey *et al*. 2018). Jalong's initial fGCM concentration was similar to fGCM concentrations found in other translocated elephants in the year immediately after translocation (8.5 ± 1.9 ng/g, N = 5; all males; Wong 2017) but lower in comparison to local resident elephants in the same landscape (11.4 ± 2.8 ng/g, N = 4, 3 males and 1 female; Wong 2017). Although the East-West highway has a negative impact on elephant movements in the area, the elephants in the landscape are still able to cross it. Wadey *et al*. (2018) found that translocated elephants in this landscape were 14 times less likely to cross the road than local ones, suggesting that road crossing is particularly challenging to elephants not familiar with the road. In separate studies, we have found that wild elephants are attracted to this highway due to the availability of grasses and other early succession plants, mainly monocots, in the area (Yamamoto-Ebina *et al*. 2016; Terborgh *et al*. 2017).

Before Jalong crossed the highway for the first time, we detected an increase in fGCM concentrations. The time of the road crossing event, however, also coincided with Jalong's delivery of her calf, which also may result in an increase in fGCM concentrations (Brown 2000). Jalong's fGCM concentration remained elevated after crossing the road; this could be related to the challenges of exploring a new environment

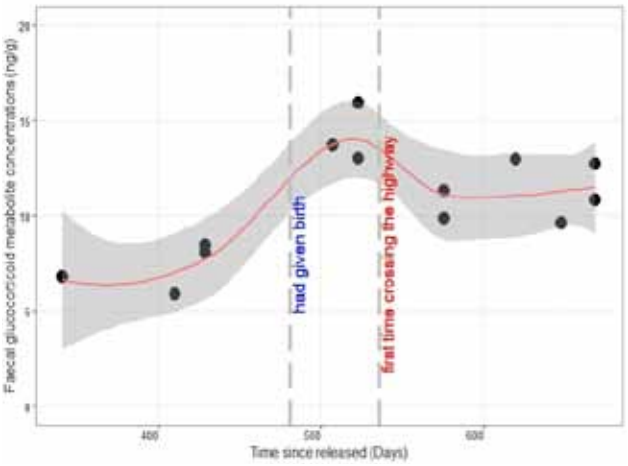

Figure 3. Faecal glucocorticoid metabolites profile for Mek Jalong. The red line was drawn using loess smoothing (span 0.75) and the shaded grey area represents standard error 95%.

(there was a change in movement patterns and Jalong was exploring areas further away from the road) and the need to be vigilant when caring for offspring (Rees *et al*. 2004). Jalong's fGCM concentration values, which persisted after crossing the highway, however, were within the usual fGCM range for local elephants in the area who crossed the highway regularly (Wong 2017). In retrospect, the increase in fGCM in Jalong's case could be due to many other reasons, but we speculate it is a positive indication that she was actively coping with challenges in her surroundings and in caring for her young calf. Although there could be innate fGCM differences between male and female elephants, both will respond to challenging situations in the field and show an increase in fGCM (Vijayakrishnan *et al*. 2018).

The unusual nature of Jalong's movements before crossing the road and her relatively low fGCM concentration compared with local elephants in the landscape (Wong 2017) could be of concern, since prolonged periods of low glucocorticoid concentrations can be associated with health problems (e.g. Dickens *et al*. 2009; Linklater *et al*. 2010; Pawluski *et al*. 2017). In future studies, researchers should investigate the importance of having an adequate amount of basal glucocorticoids in helping humans and animals to manage challenges in their surrounding (Sapolsky *et al*. 2000; McEwen & Wingweld 2003).

Alteration of the mother's glucocorticoid concentrations during pregnancy can exert influence on her offspring's (F1) and grandchildren's (F2) stress response, physiology, and health (Franklin *et al*. 2010; Sheriff *et al*. 2010b; Matthews & Phillips 2012; Khan *et al*. 2016). This also means that Jalong's translocation could potentially affect her calf's health and behaviour.

This case study demonstrates that (1) GPS-tracking can be successfully combined with fGCM to monitor the physiological condition of wild Asian elephants in tropical rainforest and (2) significant life events can be reflected in wild elephants' fGCM concentrations. Although our sample size is too small to draw conclusions, our

results and those in Wong (2017) suggest that translocation could affect elephants' health and behaviour. More research is needed to understand the relationship between elephant exposure to prolonged stress and changes in glucocorticoid concentrations, and when these hormonal changes can be harmful for the elephants. In this context, we call for the precautionary principle in managing wild elephant populations.

Acknowledgements

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Research Article *Gajah 48 (2018) 12-19*

Sociological Dimensions of Human-Elephant Conflict with Trans-boundary Herds in Northern Bangladesh

Anwar Palash[1]*, Muntasir Akash[1] and Md. Anwarul Islam[1,2]

[1]*Department of Zoology, University of Dhaka, Dhaka, Bangladesh*
[2]*WildTeam, Dhaka, Bangladesh*
**Corresponding author's e-mail: smahp97@gmail.com*

Abstract. Bangladesh is a tenacious frontier of human-elephant conflict (HEC), with conflict in the country escalating over the last 20 years. HEC in the northern region involves trans-boundary herds and the sociological dimension of HEC there is under-studied. We, therefore, conducted a simple randomized household survey (n = 234) in 22 borderline villages of the Central North that is subject to intense HEC. The respondents showed a mixed response. Most of the respondents were tolerant towards elephants. Our results suggested that people tend to be retaliatory and want to kill elephants only if human life is threatened by direct elephant attack.

Introduction

Human-wildlife conflict is a global issue often resulting in human death, staggeringly high transaction and opportunity cost, loss of wildlife resources, and disruption of ecological balance (Dublin & Hoare 2004; Anthony *et al*. 2010). As people encroach into natural habitats, contact between people and wildlife is inevitable, subsequently leading to conflict (Woodroffe *et al*. 2005). This poses an increasing challenge to wildlife for space and resources (Pimm *et al*. 1995).

Being a large mammal, this challenge is particularly large for elephants. Though the Asian elephant (*Elephas maximus*) is spread across 13 countries, is revered as an integral part of certain cultures, and plays a significant ecological role, it is globally endangered owing to the rapid decline of populations and habitat loss (Sukumar 1992; Barua *et al*. 2010; Fernando & Pastorini 2011).

Like elsewhere, elephants in Bangladesh have become confined to small patches occupied by a single or a few small herds and are deemed Critically Endangered (Islam 2006; IUCN Bangladesh 2015). According to IUCN Bangladesh (2004), areas with high human-elephant conflict (HEC) strongly correspond to elephant corridors, as human settlement, agricultural practices and other developmental works have been carried out along these corridors. Protected by the Bangladesh Wildlife (Conservation and Security) Act (2012), the number of total elephants is thought to be 457 by IUCN Bangladesh (2016), of which resident herds comprise 268 individuals and captive elephants comprise 96 individuals. Migratory herds or trans-boundary herds, whose home ranges include areas in India, Bangladesh, or Myanmar, include 93 elephants.

Northern Bangladesh has a sizeable trans-boundary elephant population, found in Mymensingh Forest Division and in Sylhet Forest Division (Sunamganj and Moulvibazar). The number of migratory elephants found in Mymensingh Forest Division, Sunamganj, and Moulvibazar are estimated to be 51, 7 and 5, respectively (IUCN Bangladesh 2016).

These trans-boundary elephants in northern Bangladesh move between the wet deciduous forests and crop mosaics located in the districts of Kurigram, Mymensingh, Sherpur, Jamalpur and Netrokona of Bangladesh and the neighbouring state of Meghalaya, India (Islam 2006; IUCN Bangladesh 2011). Movement of these particular elephants between India and Bangladesh is

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subject to the structure, nature and opening of the border fence, as well as to diversity of cultivated crop, availability of food sources, salt licks etc (Aziz *et al*. 2016). Owing to human-made barriers, HEC in these remote northern regions is multi-faceted, ranging from crop raiding and infrastructural damage to disruption of normal activities such as commuting to work and school and, in extreme cases, injury or death of people and elephants (Hoare 2000). The issue is more severe and unpredictable than expected because of restricted elephant routes and corridors. In addition, while HEC incidents were limited to a few localities in the past (Islam *et al*. 2011), it has now expanded to all the districts of the Central North (Aziz *et al*. 2016).

In this context, appropriate HEC mitigation is a dire necessity for Bangladesh. However, we have very little information on how human communities are reacting to elephants. Therefore, before attempting to involve the locals in any mitigation or conservation strategy, we wanted to understand their approach towards the 'conflict species'. Here, a sociological study is presented to understand the anthropogenic dimensions of HEC in northern Bangladesh.

The specific objectives of the study were to (a) understand people's perception towards elephants, (b) assess people's tolerance and (c) understand the factors that motivate people to kill elephants.

Methods

Study area

Of the five upazilas or sub-districts of Sherpur District, trans-boundary elephants are present in three. These are Jhenigati, Nalitabari and Sreebardi. The total area of the district is 1364.67 km^2 of which 78.80 km^2 (only 0.06% of the total area) is under forest cover (BBS 2015). The forest of the study area falls under the jurisdiction of Mymensingh Forest Division (IUCN Bangladesh 2016). The study took place in 22 border villages situated in these trans-boundary sub-districts (Fig. 1). These villages are characterized by an agricultural mosaic of primarily paddy and maize crops. The vegetation also includes acacia plantations and remnants of secondary sal forests (Shorea robusta), typical of the South Asian wet deciduous forests, managed by the Department of Forest, Bangladesh (Islam *et al*. 2011).

Questionnaire design

An initial pilot survey was carried out where 20 people were interviewed and an average time of two hours was spent per interview to design the questionnaire. Two focus group discussions (FGD) were carried out to provide additional context. Each FGD comprised eight respondents. A focus group discussion is a good way to gather together people from similar backgrounds or experiences to discuss a specific topic of interest. The group of participants is guided by a moderator who introduces topics for discussion and helps the group to participate in a lively and natural discussion amongst themselves (Krueger 2014). A further pilot with 17 respondents was conducted targeting more direct responses to the questions. Upon reviewing these initial survey results, the questionnaire was modified to alleviate the difficulties in understanding the questions.

The final questionnaire had four general sections. These were: Demographic information, perception towards elephants, level of tolerance, and assessment of factors that lead to retaliatory behaviour towards elephants. There was an additional section in which respondents were asked about their positive and negative meaningful experiences to support the information they provided.

Data collection

By following Morrison *et al*. (2008), simple randomized household survey technique was carried out during both the pilot (n = 20 respondents) and the final survey (n = 243 respondents). The data were collected from April 2016 to January 2017. People of different age groups were interviewed. Most of the respondents were from 20 to 40 years of age. A male or female adult from each household was approached and questioned depending on whether they were available and

willing to complete the survey. Interviews were arranged in a communal space; in the yard in front of the houses. The family members of the interviewees were present during the interview. Nine respondents were not able to complete answering the full questionnaire.

All the data were collected using a structured questionnaire. The interview followed the format of the questionnaire and each question was asked as was designed. The questionnaire was filled by the researcher. If the respondent chose to provide additional anecdotal information, they were encouraged until it was comfortable to return to the set survey structure. This was done to make them comfortable and understand their feeling, and also to get some additional information that could support the survey. The respondents' attitude to the survey was given maximum priority. In terms of accuracy of responses, particular actions displayed by villagers such as shouting or emotions towards elephants were often witnessed and noted in the field and anecdotally matched answers received during interviews.

Data analysis

All the data were qualitative data except those related to demography. The data analyses were carried out using IBM SPSS 23 (IBM Corp., Chicago, USA). The data were analyzed by means of simple descriptive statistics. The rigour and accuracy of our descriptions and interpretations were tested by going through the data and the information from different interviewees several times, and examining them to find common threads and patterns (Newing *et al*. 2011).

Results

Demographics

The respondents of the study site comprised 63.9% Muslims, and 19.7% and 16.3%, ethnic tribal Christians and ethnic tribal Hindus,

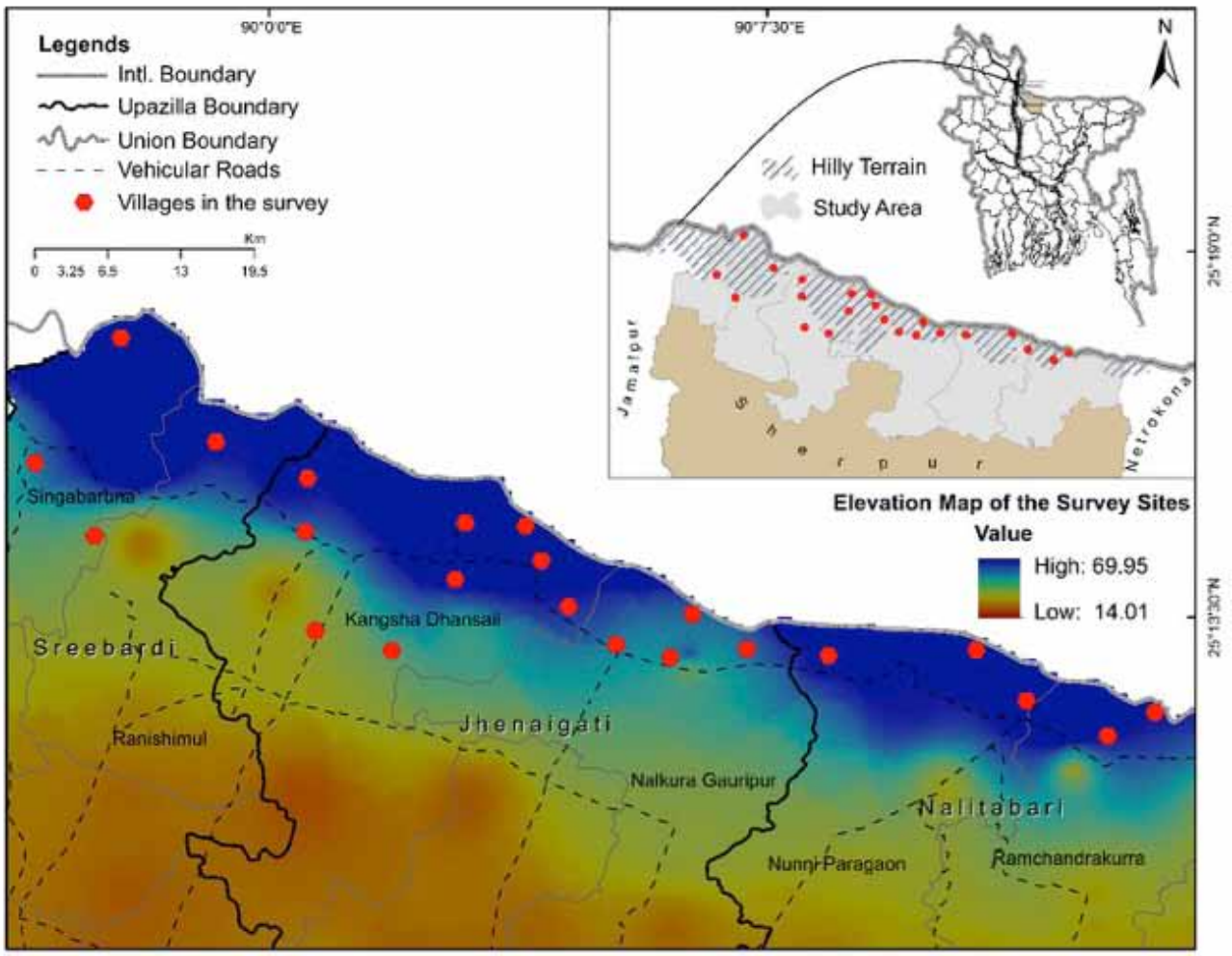

Figure 1. Study area, showing villages, unions and upazilas.

respectively. The ethnic groups living in the area are the Garo, the Koch and the Hajong. The average price of a property (households and agricultural lands) owned by a respondent was found to be BDT 239,201.13 (US$ 3,056). The average annual income of a respondent was BDT 156,000 (US$ 1,998). We considered people with an annual income less than BDT 180,000 as poor based on local context.

A total of 146 respondents owned agricultural land and 73 respondents had rented agricultural land, while we did not know the status for 15. A total of 168 respondents owned a house, 51 rented a house, and we did not know the status for 15 of them. In both cases, 15 female respondents were unable to clearly state ownership or lack thereof of agricultural land or their house. The average land size owned by a respondent was 1.51 acres.

From a religious perspective, Muslim women were initially found to be less inclined to consent to research teams interviewing them without a male household member present. One issue from interviewing female respondents was obtaining answers to questions on damage, mitigation measures etc. Female household members are less exposed to elephants and rarely engage in mitigation practices, except for tribal women. The latter actively participated in mitigation practices alongside the men. They were equally exposed to the elephants too.

Perception and attitude towards elephants

The respondents showed a combination of positive and negative attitude towards elephants depending on the context they were provided. Seventy one percent (71%) of the interviewees believed that elephants could understand what was being said to them. They also believed that elephants generally listened to them if the elephants were called "mama" ("uncle" in Bengali) or "babu" ("land lord" in Bengali).

The survey also revealed other important aspects of people's belief regarding elephants. The majority (67.5%) of the respondents liked elephants while 19.2% disliked them (Table 1). The survey revealed that a vast majority of people

Table 1. Perception and attitude towards the elephants.

Factors / Answers	Very negative	Negative	Neutral	Positive	Very positive
Liking elephants	9.8%	9.4%	13.2%	29.5%	38.0%
How elephants behave	2.1%	5.1%	6.4%	13.7%	72.7%
	Not at all beneficial	Somewhat beneficial	Moderately beneficial	Quite beneficial	Very beneficial
To respondents	84.2%	2.6%	6.4%	1.3%	5.6%
To the community	85.5%	2.6%	6.4%	5.6%	0%
To nature	71.4%	2.6%	6.0%	17.9%	2.1%
	Not at all dangerous	Somewhat dangerous	Moderately dangerous	Quite dangerous	Very dangerous
Elephants being dangerous	0%	0%	4.3%	6.4%	89.3%
	Not at all afraid	Somewhat afraid	Moderately afraid	Quite afraid	Very afraid
Respondents being frightened	15.4%	8.5%	8.1%	9.0%	59.0%
	Very rare	Quite rare	Medium	Quite common	Very common
Presence of elephants	0%	0%	0%	85%	15%
	Decrease a lot	Decrease a little	Stay same	Increase a little	Increase a lot
Elephant population	34.2%	32.9%	16.2%	16.9%	0%

Table 2. Tolerance of crop damage.

Crop damage	Very sad	A little sad	Would not mind
20%	23.5%	62.8%	13.7%
40%	85.0%	12.8%	2.2%
60%	100%	0%	0%

(86.4%) thought the behaviour of elephants to be attractive (Table 1). This indicates a positive emotion towards elephants, which is important to engage local people in conservation.

On the contrary, respondents (71.4–85.5%) thought that elephants were not beneficial to them in any form. People were asked how dangerous the elephants were and how afraid they were. Less people were afraid of elephants (84.6%) than they thought of elephants as being dangerous (100%). Two thirds (67.1%) of the respondents wanted the population of elephants to decrease (Table 1).

Tolerance

The survey found that almost half (50.4%) of the respondents' crop fields were not raided by the elephants in the last two harvesting seasons. These people were victims of crop raiding earlier (before 2016). They appeared to be more tolerant than others whose crop fields were raided once (23.9%) or twice (25.7%) in 2016.

To what extant people can tolerate the crop damage was surveyed. It was found that people can accept 5–10% of crop damage. When there is a damage of 20% of the crop, people get upset or they feel sad because it costs them more money to compensate their loss (Table 2).

Table 3. Tolerance of the elephant presence.

Elephants in the area	Yes (%)	No (%)
Once in three months	60.7	39.3
Once in two months	34.6	65.4
Once in one month	26.1	73.9
Twice in one month	20.1	79.9
Two – four times/week	14.1	85.9

The survey revealed that 60.7% of the respondents were okay with elephants visiting once in three months and only 11.1% of them are tolerant if elephants visit 5–7 times a week (Table 3). The real scenario is that sometimes elephants visit 10–20 times a month, sometimes not a single time for two to four months probably because of seasonal availability of food in the forest.

Motivation to kill elephants

To understand the factors that drive people to kill the elephants, people were provided with seven conditions or scenarios. The objective was to find out under what conditions people would want to kill elephants. None of the respondents wanted to kill elephants in the first six given scenarios. However, 70.1% of the respondents wanted to kill the elephants, if a child or adult person was killed by the elephants (Table 4).

Discussion

The existing belief of people on various aspects related to elephants, plays a very important role in further shaping their perceptions towards the elephants. The results of the survey and narratives of the interviewees gave insights into people's feeling regarding elephants. The results showed an overall positive reaction of people

Table 4. Motivation to kill the elephants.

Motivators to kill elephants	Yes (%)	No (%)
When elephants are seen in the forest far away from the village or houses	0	100
When elephants are seen in the vicinity of the agricultural land or houses	0	100
When elephants raid the houses or agricultural land	0	100
When elephants injured or killed the livestock animals	0	100
When elephants threatened a child or adult	0	100
When elephants injured a child or adult	0	100
When elephants killed a child or adult	70.1	29.9

towards elephants. Either due to fear or due to liking the elephants, people do not want to harm elephants. They think that they are not capable of causing any harm to the elephants because they do not have the tools and elephants are larger and stronger than them.

Though most of the respondents like the elephants, this does not guarantee the protection of the elephants. The positive attitude to the statement that they like the elephant and their behaviour might not always imply in case of the elephants as they are subjected to the economic well-being. Though most of the people think elephants are not beneficial, some of the interviewees think that elephants are beneficial because of the ecological role they play. These people can be useful asset for elephant conservation.

Some interesting narratives about people's belief regarding elephants were revealed. Some of these narratives are very hard to interpret. For instance, people believe that the elephants can hear them or understand them and can communicate accordingly. This belief was strengthened by various incidents they experienced during elephant raids and attacks, even through dreams. A place named "Amzadmara" (meaning Amzad got killed) was named after the incident when a guy named Amzad was killed by elephants. People believe that it was Amzad's fault to get himself killed and all of the respondents believed it surprisingly.

There are some people who think that the elephants are dangerous but they are not afraid of them. Other people also consider them to be brave and these people are always in the front line while chasing elephants. Though most of the people want the elephant population to decease, there are some people who have a strong feeling for the elephants and want elephant number to stay same or increase a little.

Many of the aspects of people's perception regarding the elephants can be understood by the level of tolerance they showed. The intensity of HEC depends on the people's ability to tolerate elephants. The level of tolerance also depends on other factors like whether the elephants entered their crop field; if they entered, how many times they entered and the percentage of crop damage.

As most of the people in the region are poor, they cannot afford great economic loss. These crops are the source of their foods. In a situation like this, people facing crop damage have to borrow money from other people, which in many cases they might not be able to repay soon. This ultimately results in hostility toward elephants. We think that if people were rich and did not have to depend on agriculture, they would not be so hostile.

Research done in the tropics suggests that wildlife-associated costs reduce tolerance and support for conservation and vice versa (Newmark *et al*. 1993; de Boer & Baquete 1998). Almost 85% of the respondents have an alternative means of income. In most cases, they work as day labourers. But, this job is not available all year round. We assume from the narrative of the people that they become more intolerant when there is no other way of income and the HEC situation is at its peak. This situation drives them to attack the elephants more or even kill them.

There is another reason for which people tolerate elephants. There is no electricity in most areas in that region. So, there is no television in most of the houses and they cannot afford a television being poor. There is a scarcity of games and sports too. People have no or a very limited access to entertainment. So, watching elephants is a form

Figure 2. A herd of elephants in the forest of the study area.

of entertainment to them. Anyone would love to watch them in the forest. These people are no exception though they are the sufferer of the HEC. Sometimes, while watching, people start throwing stones at the elephants or they make fun of them for their weird or interesting behaviour. At times, the elephants start chasing them and other times, they chase elephants back too. It seemed to be fun to the people and they enjoyed doing it. The information was obtained when people were asked about positive meaningful events with elephants.

Such incidents also occurred at night when the elephants roamed around the human settlements, but there was no possibility of an elephant attack on people and there was no crop in the field. People from the nearby settlements would come just to watch the elephants and not to help people of that particular residence. This entertainment value lets people tolerate elephants or like them.

The responses regarding people's behaviour of retaliation suggested that people are tolerant in most scenarios. People become intolerant enough to kill the elephants only when human life was threatened. They did not think that the other six scenarios would provoke them to kill elephants although all of the drivers mentioned in Table 4 have the potential to initiate incidents of HEC. The narratives of the respondents also suggest that sometime they feel like killing elephants but they would not kill the elephants if nobody gets killed by the elephants. One should keep in mind that killing of elephants is prohibited by law and people had been sentenced to jail for such action previously. This also motivated them not to kill elephants.

Though people are expected to show retaliatory behaviour, there were some exceptions. Eight respondents did not want to kill elephants despite losing a close family member or relatives. Their response was "I am not going to get my relative back. So, why should I kill the elephants?" Others said that it was the victim's fault for getting killed. Respondents who did not want to kill elephants believed that killing them would not solve the problem. It could evoke retaliatory behaviour from the elephants making the problem worse. They also believed that the elephants have to live too. People have sympathy for elephants when they see them starving or if there is a calf in the herd. In the article "Baby elephant rescued from well in Garo Hills" (Daily Star 2016) it was reported that the local people rescued a calf, which fell into a well. It was found that people are more compassionate to the elephants than they are thought to be.

The pattern of HEC is integrally connected with harvesting season and practices Aziz *et al*. (2016). We think the still persisting hospitable attitude of the local people should be utilized before they become completely hostile. As seen and proven in many human-wildlife conflicts scenario (Zimmermann *et al*. 2005; Inskip & Zimmermann 2009), the majority of the locals always have a friendly attitude toward the concerned 'conflict species'. To seal a secure future for the existing wild elephants, conservation strategies should monopolize the local perception and use the drivers of such reverence.

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The Railway-Line Fence: A New Passive Elephant Barrier at Bannerghatta National Park, Southern India

Arjun Saklani[1], Dilip Kumar[2], Aaranya Gayathri[3] and Avinash Krishnan[2]*

[1]*School of Environment & Natural Resources, Doon University, Dehradun, Uttarakhand, India*
[2]*A Rocha India, Anekal (Taluk), Bengaluru South, India*
[3]*Wildlife Institute of India, Mehu Wala Mafi, Dehradun, Uttarakhand, India*
**Corresponding author's e-mail: avinash.krishnan@arocha.org*

Introduction

India holds 60% of the population of Asian elephants (*Elephas maximus*) (Baskaran *et al*. 2011) with about 28,000 elephants distributed in approximately 3% of the land area of India (Lenin 2011). The southern population is the largest and represents 48% of the total population, of which the State of Karnataka harbours an estimated 6049 elephants (MOEF 2017). In Karnataka, about 60% of the elephants utilize areas outside protected areas (Malhotra 2015). Human-elephant conflict (HEC) is a major concern and to address this issue, many physical barriers have been set up on the boundaries of protected areas to prevent elephants moving out.

In Bannerghatta National Park (BNP), Karnataka, eight types of physical barriers namely, solar electric fences, elephant proof trenches, rubble walls, concrete walls, concrete moats, spike pillars, spike gates and mesh barriers have been constructed (Gayathri *et al*. 2016). These barriers border 200 km (70.42% of the BNP boundary) of BNP, with single barriers or multiple types of barriers located parallel to each other in sections of the boundary.

These efforts however did not alleviate HEC, either due to man-made breaches such as on paths created for grazing cattle, natural causes such as soil erosion impeding the effectiveness of elephant proof trenches, and elephants overcoming the barriers (Varma *et al*. 2009). A field survey conducted along the BNP boundary revealed that there was an average of 6 breakages per km along all types of barriers (Gayathri *et al*. 2016). In 2015, another physical barrier, the 'railway line barrier' was constructed by the Karnataka government, using steel rails from old railway tracks. This was constructed parallel to the existing barriers. Such barriers have been implemented in South Africa at Addo National Park since 1951 (Studer 2014) and at Veeranahosahalli Range (33 km) in Nagarhole Tiger Reserve, India since 2015 (Kumar 2015).

The costs of some of the barriers per km are, elephant proof trenches – 6,777 US$ (Tamil Nadu Forest Department 2013), solar electric fences – 5,911 US$ (NABARD 2017), rubble walls – 194,047 US$ (Nameer 2015) and railway line barriers – 90,312 US$ (Nameer 2015). Considering the installation costs, though elephant proof trenches and solar electric fences are cheaper in comparison to railway line barriers, the trenches are ineffective near streams and sloping terrain, and fences require continual maintenance. This makes railway line barriers more economical in the long term and they are also more environmentally friendly compared to some of the other barriers (Nameer 2015).

We carried out a survey in the BNP from 8th July to 7th August 2017 to map land use patterns around the boundary, assess the efficacy of the railway line barriers and identify factors that potentially reduce their effectiveness.

Methods

BNP consists of 260 km^2 of fragmented tropical thorn and scrub forests located at the northern tip of Eastern Ghats. The railway barriers were implemented in the Bannerghatta and Kodihalli wildlife ranges of BNP. The assessment was

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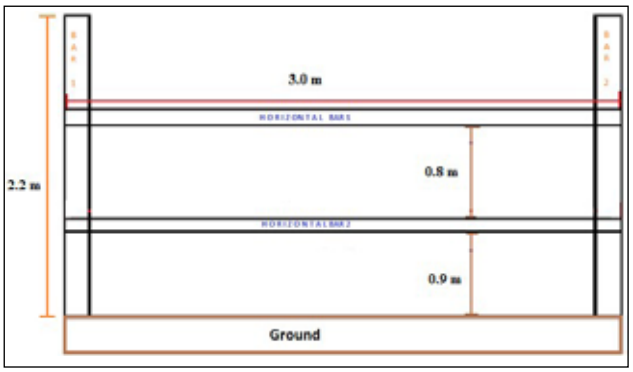

Figure 1. Structure of the railway line barrier.

conducted at Thattuguppe administrative beat of Bannerghatta wildlife range and Hanchuguli and Gowdahalli beats of Kodihalli wildlife range. Foot surveys were carried out along the railway line barriers and presence of human settlements, agricultural land, other vegetation and water bodies were documented every 100 m, within a visual range of 200 m. In addition, water channels and cattle trails across the fence were recorded to identify breakages or weak spots. Measurement of rail segments (Fig. 1) and other barriers that were alongside railway line barriers were conducted every 100 m, using a 15 m tape.

Results and Discussion

Specifications of the railway barrier system

Horizontal and vertical bars were connected by four nuts and bolts (Fig. 2), and vertical bars were buried about a metre in the ground. The total length of the barrier was 9.953 km (Fig. 3), with 7.585 km in the Thattaguppe beat of Bannerghatta Range and 2.249 km in and Kodihalli Range of

Figure 2. Horizontal bars are connected to the vertical bars with nuts and bolts.

which 0.119 km was in the Gowdahalli beat and remaining 2.130 km in the Hanchuguli beat. The fence was continuous in Thattaguppe and Hanchuguli, however, in the Gowdahalli beat, the barriers were placed to supplement other barriers where there were water channels (Fig. 4). It was implemented as 4 different segments of 12 m, 30 m, 32 m and 45 m lengths.

Land use patterns

There were approximately 320 houses without agricultural land, inside the protected area in Bannerghatta Range in the first km of the railway line barrier. Along the remaining extent, it was forested with no other land-use. Outside the fence there were no houses and 3/4th of the land-use

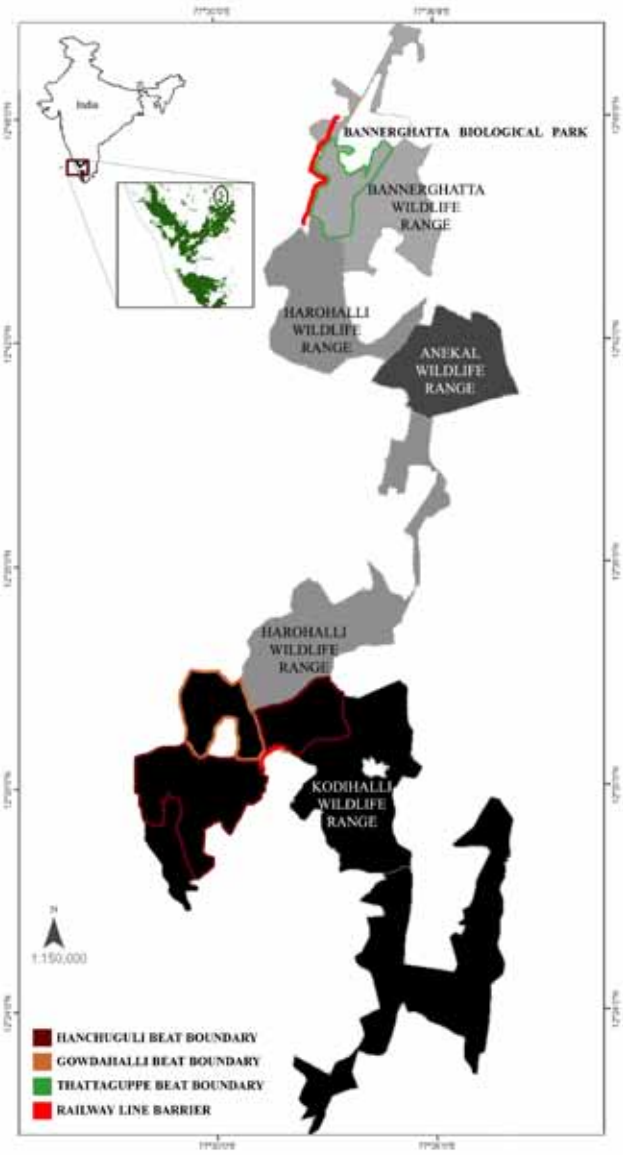

Figure 3. Position of the railway line barrier along the BNP boundary.

Figure 4. Railway line barrier used for supplementing solar electric fence along water channels in Gowdahalli Beat, Kodihalli Range.

was agriculture with other vegetation and bare land consisting of the remaining. In Kodihalli Range, there were no houses on either side of the railway line barrier. Inside the protected area, it was completely forested. Outside the barrier half of the land-use was agriculture with the remaining being covered by other natural vegetation or bare land. Twelve water bodies were found along the railway line barrier in BNP out of which 3 were in Hanchuguli beat and one was in Gowdahalli beat of Kodihalli Range, and the other 8 were in Thattaguppe beat of Bannerghatta Range. All the water bodies were on the protected area side along the railway line barrier except for one in Thattaguppe beat.

Effectiveness of the railway barrier system in comparison to other barriers

Elephant-proof trenches were found along 7.6 km of the rail barrier and had 14 breaches amounting to a length of 0.971 km. Most (85%, n = 12) of the breaches were due to natural causes such as sludge, silt or debris deposition that reduced the depth of the trench. There was one breach from elephant breakage and another from communities laying bamboo sticks across the trench.

Solar electric fencing was found along 6 km of the rail barrier. We recorded a total of 11 breakages in solar electric fencing (10 in Kodihalli Range and 1 in Bannerghatta Range). In Kodihalli, fencing was broken by elephants, amounting to a damage extent of 1.0 km. The fence was broken by humans at 9 locations, for facilitating the movement of cattle and fuel wood collection. A 5 km length of the rail barrier had an integrated solar electric fence, which did not have any breakages (Fig. 5).

Rubble walls and concrete walls parallel to the constructed railway line barrier were observed in an extent of 2 km and 0.4 km, respectively. They were found to be frequently broken, with 13 breaches in the rubble wall and 4 in the concrete wall.

There were 2 damages in the railway line barrier. One was caused by elephants in Gowdahalli beat extending to about 22 m. According to the field staff, the breakage had occurred in one of the vertical bars that had two segments welded to a single pole. The other was in Thattaguppe beat where one of the horizontal bars was slightly bent as it was challenged by an elephant but was not breached.

Errors in construction of the rail barrier seemed to be considerably high. A total of 43 bolts connecting horizontal and vertical bars were missing, with 37 in Bannerghatta Range and 6 in Kodihalli Range. The soil below vertical bars

Figure 5. Railway line barrier with integrated electric fencing.

Figure 6. A boulder that possibly decreases the effectiveness of the railway line barrier.

was found to be eroded extending to about 15 to 40 cm, at 5 places, 4 in Bannerghatta Range and 1 in Kodihalli. Boulders were found at the barrier on 5 locations in Bannerghatta Range (Fig. 6).

The damages in the railway line barrier were considerably low in comparison to the other barriers. Construction errors such as welding two segments and, missing nuts and bolts, could make the barrier susceptible to breakage by elephants. There were no breakages in the railway line barrier for a continuous stretch of 7.58 km in Thattaguppe, suggesting that the railway line barrier is effective against elephant breakage. However, elephants have been seen by the locals to have crossed over the railway line barrier once and to have passed between the horizontal bars once, in 2018, both in Thattaguppe beat.

A structure constructed with 3 horizontal rails fixed at 0.6 m, 1.35 m and 2.1 m from the ground supported by 3 m tall vertical bars every 1.8 m as per the proposal of the Kerala State Forest Department (Nameer 2015), could prevent elephants from crossing over, between or under the horizontal bars. Alternatively, we strongly recommend the use of solar fence integrated with the railway line barrier in order to maximize the efficacy of these physical barriers and make it completely elephant-proof.

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Human-Elephant Conflict in Patheria Hills Reserve Forest along the Indo-Bangladesh Border in Northeast India

Himangshu Dutta[1], Hilloljyoti Singha[2]*, Biman Kumar Dutta[1] and Panna Deb[2]

[1]*Department of Ecology and Environmental Science, Assam University, Silchar, Assam, India*
[2]*Centre for Biodiversity and Natural Resource Conservation, Department of Ecology and Environmental Science, Assam University, Silchar, Assam, India*
**Corresponding author's e-mail: hilloljyoti.singha@gmail.com*

Introduction

Negative interaction between human and wildlife is an extensive and complex challenge to conservation (Fenta 2014). The Asian elephant (*Elephas maximus*) is a species that causes severe damage to crops and human lives in India (Gubbi 2012).

Patheria Hills Reserve Forest, located at the Indo-Bangladesh Border in the Karimganj District of Assam has been a site of human-elephant conflict for decades. The forest falls under the jurisdiction of Patherkandi Range of Karimganj Forest Division, Assam. Although the majority of human-elephant conflict cases are undocumented, as per the records of Karimganj Forest Division, there were 112 cases of elephant depredation in the area between 2000 and 2013. However, the issue has not been studied in the area, except for a preliminary documentation by Talukdar & Choudhury (2017).

Methods

The most prominent sites of conflict in the area are Bhubrighat and Sepinjuri tea estates (Fig. 1) and adjoining paddy fields, located in the fringe areas of the Patheria Hills Reserve Forest at the Indo-Bangladesh Border. The estates consist of tea gardens spread over hillocks, interspersed with narrow roads. The paddy fields are located in the adjacent plains.

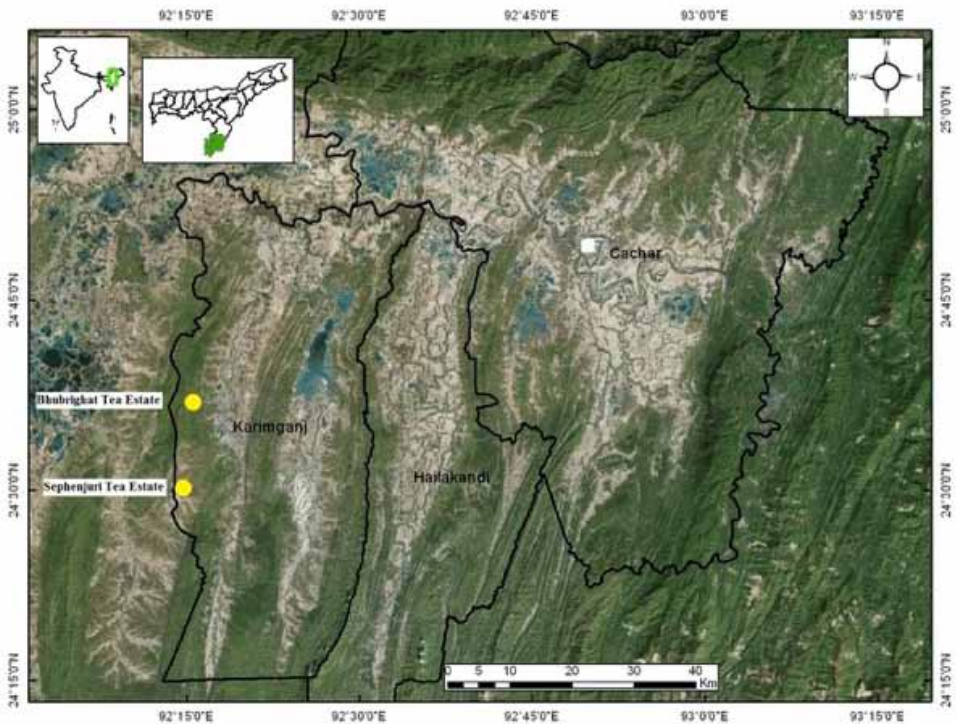

Figure 1. Location of Sephenjuri Tea Estate and Bhubrighat Tea Estate.

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Figure 2. Elephants foraging inside a forested hillock (Tilla No. 6) in Sephenjuri Tea Estate during day time.

Discussions were undertaken with Forest Department officials, tea estate authorities and employees, local people and officers of the Indian Border Security Force to collect qualitative information. In addition, observations were made in the field.

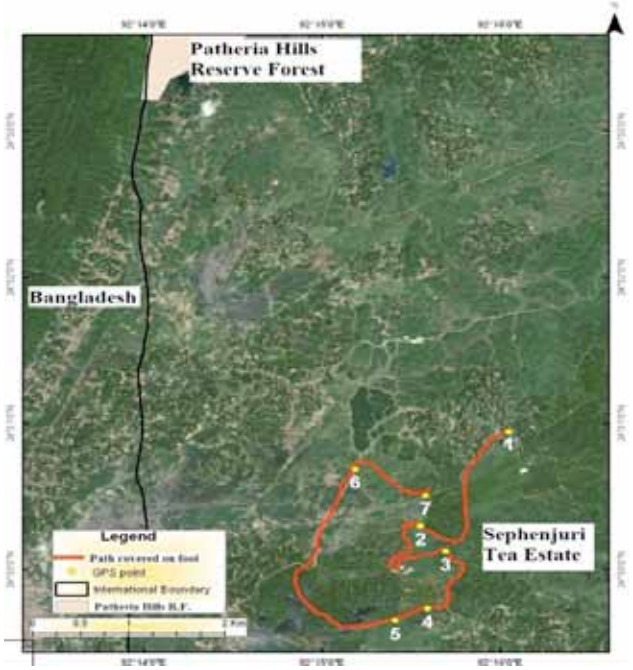

Figure 3. Human-elephant conflict locations in Sephenjuri Tea Estate. 1 = tea factory; 2 = Tilla No. 6 used by elephants for foraging; 3 = Mooli Jungle hillock used by elephants for foraging where they were sighted in November 2014; 4 = site where one person was killed by elephants in 1998; 5 = Kalabeel, a site of rampant paddy depredation; 6 = Kukirthal bamboo plantation occasionally visited by elephants for feeding; 7 = North Kuchi Hillock used by elephants for foraging (sighted in November 2015).

Results and discussion

Seven elephants were said to raid paddy fields in the fringes of the Reserve Forest. These were the only elephants in the area. Crop raiding and depredations have been taking place approximately for the past 25 years during the months of October to December every year, which was also stated by Talukdar *et al*. (2017). Crop depredation was most rampant in Kalabeel adjacent to Sephenjuri Tea Estate. In addition, the elephants also raided paddy fields adjoining Kalabeel and Sephenjuri Tea Estate. This resulted in heavy economic losses to local farmers.

During daytime, the elephants foraged in the hillocks of the tea estates (Fig. 2). Within the tea estates, there are unplanted areas, which give refuge to elephants, as these are covered by thick natural vegetation. The daytime behaviour of the elephants was said to be calm and they did not pay any attention to people who passed by. The elephants most frequently foraged at North Kuchi hillock (point 7 in Fig. 3) and Mooli

Figure 4. Human-elephant conflict in Bhubrighat Tea Estate. 1 = site of human death due to elephant attack; 2 = Adamtilla Hillock frequently used by elephants for foraging; 3 = Genai Hill, where a soldier of the Indian Border Security Force was attacked by elephants in 2012.

Jungle hillock (point 3 in Fig. 3) in Sephenjuri Tea Estate. These two sites, along with Tilla No. 6 (point 2 in Fig. 3) and Adamtilla (point 2 in Fig. 4) hillocks, were the main foraging grounds of the elephants. The elephants usually remained divided into two groups of four and three in daytime, but united together to raid paddy fields in the evening. From this time onwards, they became aggressive towards humans.

There have been a few cases of attacks on humans. For instance, in Genai Hill in Bhubrighat Tea Estate (point 3 in Fig. 4), a Border Security Force soldier was attacked in 2012, he however escaped. At another site within Sephenjuri Tea Estate (point 4 in Fig. 3), a labourer was killed in 1998. In this case, the victim was drunk and the villagers thought that the scent of liquor had attracted the elephant. In addition, elephants incurred infrastructural damage. The nursery for raising tea saplings, located within Bhubrighat Tea Estate was completely destroyed in 2015. These were only a few prominent incidents that could be recalled by the locals within the period of discussions in field. It was likely that a number of such incidences had occurred in the past that had been unrecorded or forgotten. Border Security Force officials stated that the elephants also frequently caused damages to the fences and light posts located at the international border.

Displacement of villagers had occurred and the abandoned land was later converted to tea gardens. Large areas of agricultural land had been abandoned by farmers in Kalabeel. This was because Kalabeel was raided by elephants to the extent that farmers were unable to cultivate. Displacement and abandonment were gradual and could not be traced back to any specific point of time. People were not compelled to move but they themselves preferred to move to sites where there was no conflict rather than continue to contend with elephant riding.

Crop raiding occurs when conservation areas are surrounded by traditional or rural farmland (Eden *et al*. 2016). Such a situation is prevalent in the fringe areas of the Patheria Hills Reserve Forest, leading to elephant depredation. Deterrents of raiding used included fire crackers and setting up of campfires, which were not very effective.

Except for the period from October to December when conflict was highest, elephants ranged inside the Patheria Hills Reserve Forest in Assam and adjoining forested areas of Bangladesh, indicating the trans-boundary nature of their movements.

Acknowledgements

The help and cooperation received from the General Managers of Bhubrighat and Sephenjuri tea estates, Karimganj, Assam as well as the staff of Patherkandi Forest Range, Karimganj Forest Division, Assam are highly acknowledged. The authors are also thankful to Mr. Arup Kumar Das from Geospatial Technology and Application Programme, Aaranyak, Guwahati, Assam for providing his expertise in preparing the maps.

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Perceptions of Human-Elephant Conflict around Abhaypur Reserve Forest in Northeast India

Animekh Hazarika and Himangshu Dutta*

Department of Ecology and Environmental Science, Assam University, Silchar, Assam, India
**Corresponding author's e-mail: himangshu.dibru@gmail.com*

Introduction

Conflicts occur when wildlife requirements or behaviour has negative consequences on human livelihoods or when the human activities intersect with the needs of wildlife (Makindi *et al*. 2014). Such occurrences must be studied and mitigation measures devised, as human-wildlife conflicts can hamper community support for long-term species conservation (Barua *et al*. 2010). Human-elephant conflict is a case in point.

Conflict between people and Asian elephants (*Elephas maximus*) is prevalent in the fringes of the Abhaypur Reserve Forest (Fig. 1) located at the inter-state border between Assam and Nagaland in Northeast India. Here we report on the first study of human-elephant conflict in the area.

Methodology

Qualitative information was collected through participatory techniques. Focal group discussions were held in two affected villages; Gowala Pothar No. 4 and Honalipam (Fig. 2), located in the fringes of Abhaypur. There were 848 and 483 people respectively in Gowala Pothar No. 4 and Honalipam. Ten residents were selected from each village to participate in discussions in consultation with the headmen, based on the ability to provide reliable and relevant information on human-elephant conflict. The headmen and the participants were assembled together for discussions. The focal group discussions were conducted for about two hours. Issues discussed included types of economic losses due to elephants, human attacks, historical cases of human-elephant conflict, impacts of elephant depredation on the socio-economic conditions and control measures used.

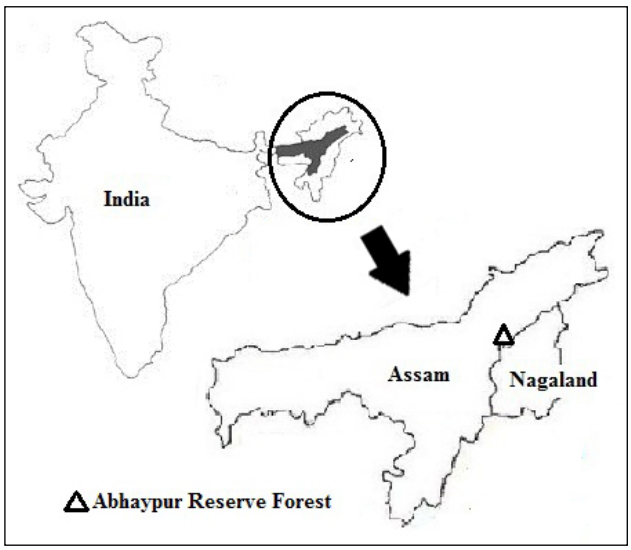

Figure 1. Location of Abhaypur Reserve Forest.

Results and discussion

The villagers stated the occurrence of elephant attacks on humans as well as damage to home gardens, property and paddy fields throughout the year. The most severe incident was traced back to 2006, when about 35 elephants caused widespread issues. Elephant deaths due to electrocution occurred in 2003 in Sonari Tea Estate located in the forest fringe. In low-income situations, human-wildlife conflict adversely affects the well being of communities (Barua *et al*. 2013). Such a situation occurred in Abhaypur as the villagers were economically poor and consequently elephant depredations exerted a severe economic impact on them.

Depredations were less during the rainy season, possibly because of ample availability of fodder in the Reserve Forest. During this season, elephants occasionally moved out of the Reserve Forest, but the Forest Department successfully

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drove them back. Conflicts intensified during winter. The main reasons mentioned were lower availability of elephant food in the forest and paddy cultivation in its fringes, which attracted elephants. In response, the villagers abandoned agricultural land. Some people switched to other means of income such as wage labour. As a result paddy production decreased, which exerted additional negative impacts on the local economy because agriculture was the chief means of livelihood.

The level of education was low and the villagers could not find better employment. Some converted paddy fields into tea gardens. However, all villagers were not financially capable of investing the capital required for conversion. The consequent reduction of agriculture near the Forest caused elephants to stray further (up to 15 km from the forest) in search of paddy, through human settlements. The result was greater property loss and attacks on people. The elephants followed no specific route and dispersed all around in small herds (usually 3–5 individuals).

Habitat destruction was identified as the main reason for human-elephant conflict in the area. Habitat destruction is more likely to occur in the fringes of protected areas because local communities obtain resources for consumption or commercial purposes from forest-fringe areas

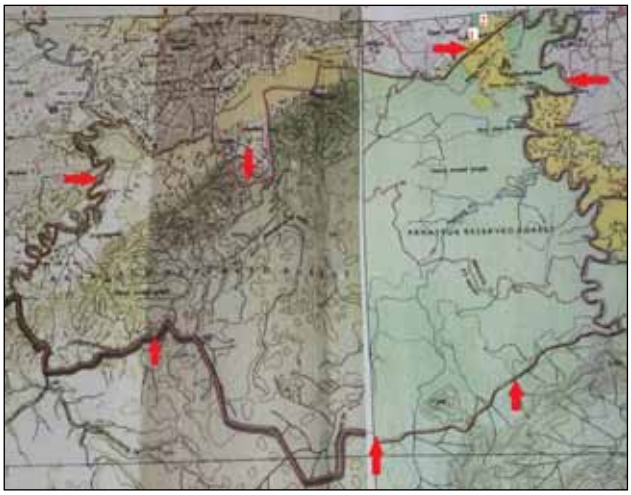

Figure 2. Map of Abhaypur Reserve Forest showing the locations of the study villages (1 = Hunalipam; 2 = Gowala Pothar No. 4). Red arrows indicate the forest border. Map obtained from the Charaideo Forest Division, India.

(Davidar *et al*. 2010; Banerjee & Chowdhury 2013; Ministry of Environment and Forests 2014). In our study, the villagers stated that human-elephant conflict had first occurred in 1996 and intensified with ongoing habitat destruction. Widespread forest clearing and removal of earth from forested hillocks had been increasing around Abhaypur due to human population growth in the fringe villages and developmental activities. Population of the fringe villages had also increased because of immigration of flood-displaced rural people from other parts of Assam.

It was also mentioned that an elephant corridor existed between the Abhaypur Reserve Forest and Sola Reserve Forest, situated at a distance of about 30 km from Abhaypur to the northwest. However, human settlements have increased in this corridor, hindering elephant movement and causing conflict with humans. Protected areas may play an important role in preventing and reducing poverty by supporting livelihoods and providing social and cultural governance and subsistence values (SCBD 2009). But in Abhaypur, accelerated population growth was leading to the overexploitation of forest resources.

The Forest Department and local people used fire and firecrackers as control measures, which were not fully effective. Nocturnal fires were set around paddy fields and at times ignited balls of fire were thrown at conflict elephants. Fires and firecrackers are also used as control measures against elephant depredation in the fringes of Manas National Park, another protected area in Assam (Nath *et al*. 2009). In addition, stones were also pelted. Some residents guarded their paddy fields at the peak season of crop raiding. As a whole, the villagers were not financially capable of bearing greater expenditures on control measures. It was also mentioned that when authorities in Assam drove the conflict elephants into the forest, they moved towards Nagaland. However, Naga authorities chased the elephants back into the forest to protect their own lands. As a result, the animals returned to resume depredations.

Elephant depredation has given rise to severe negative socio-economic and administrative

consequences around Abhaypur. As human population and development continue to expand, certain wildlife species adapt themselves to newer landscapes whereas others suffer consequences due to negative interactions (Bateman & Fleming 2012; Northrup *et al*. 2012). In Abhaypur, it appears that elephants are adapting to human induced landscape changes, creating increasing conflict. Negative attitudes towards elephants and their conservation were evident in Abhayapur. This is a conservation issue because the success of wildlife conservation in protected areas is dependent upon the support and positive attitudes of local people (Rao *et al*. 2002).

In managing conflict, the aspirations of local people should be taken into account as attitudes and perceptions of local residents towards nature conservation should be integrated with conservation policies for it to be effective (Szell & Hallett 2013). As the elephants maybe ranging between the two States, inter-state initiatives are required for mitigation. Ideally management would enable Abhaypur to develop into a site of peaceful coexistence between humans and elephants.

Acknowledgements

The authors are grateful for the co-operation received from the local villagers and the Forest Department.

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Unexpected Resting Behaviour in a Geriatric Zoo Elephant

Christian Schiffmann[1,2]*, Kevin Knibbs[3], Marcus Clauss[1], Jon Merrington[3] and Darren Beasley[3]

[1]*Clinic for Zoo Animals, Exotic Pets and Wildlife, Vetsuisse Faculty, University of Zurich, Zurich, Switzerland*
[2]*Elefantenhof Platschow, Platschow, Germany*
[3]*Longleat Safari Park, Warminster, United Kingdom*
**Corresponding author's e-mail: c.schiffmann.elephantproject@gmail.com*

Introduction

Although observational data on natural resting behaviour in free-ranging Asian elephants (*Elephas maximus*) are lacking, lying rest is considered essential and may be used as a welfare indicator under captive conditions (Asher *et al*. 2015). Actual requirements of lying rest in elephants have not been determined, but the expression of this behaviour seems to decrease with age (Fig. 1a). Due to impaired musculoskeletal strength and degenerative joint disease, geriatric elephants are often observed to avoid lying rest completely (Wuestenhagen *et al*. 2000; Roocroft 2005; Kandler 2010; Braidwood 2013). Instead, they express a higher amount of standing rest possibly as a substitute for lying rest (Fig. 1b).

Considering the scarcity of quantitative data, each additional case report may enhance our understanding of restorative sleeping behaviour in elephants. Within the scope of a welfare assessment, we were able to investigate the nocturnal resting behaviour of a geriatric zoo elephant. It was the aim of our observations to quantitatively evaluate this individual's resting behaviour.

Material and methods

The subject of our study was a female Asian elephant born in Sri Lanka in 1952 and living in a Safari Park in the UK (van Wees & Damen 2016). Before this single kept elephant was moved to her current location in 2011, she had travelled with a performing circus for more than 50 years without any contact to further elephants during the last 20 years (Ellicott 2016). Due to the elephant's age and presumed severe arthritis mainly in both knee joints, it was decided not to bring another elephant in (Ellicott 2016). The elephant shares her exhibit, consisting of a sand-floored indoor and a greened outdoor exhibit, with three Anglo-Nubian goats. During observation nights, access was mostly restricted to the indoor area due to low ambient temperatures.

A video monitoring system was in place and provided data for our observations. Indirect observation by camera recordings was conducted between the 27th of November 2016 and the 19th of April 2017 for a total of 20 nights (18:00–8:00). Observations took place on a cluster of consecutive nights (on average 6.67 ± 4.16 nights) with several weeks between such clusters. Data were collected by continuous sampling (Altmann 1974) accurate to the minute. Lying rest was defined as lying motionless on the ground in a recumbent position. For each lying bout, the side on which the elephant lay was recorded. Total duration of lying rest was calculated for each night, as well as the average duration of lying bouts.

Results

On the video recordings the elephant was visible at all times and image quality allowed unambiguous identification of the behaviour. The elephant had one or two bouts of lying rest during each night, ranging in duration between 50 and 535 minutes. In total, 30 bouts of lying rest were observed with a mean duration of 314.3 ± 152.3 minutes. In 15 bouts the elephant chose her left side to lie on, i.e. exactly 50% of

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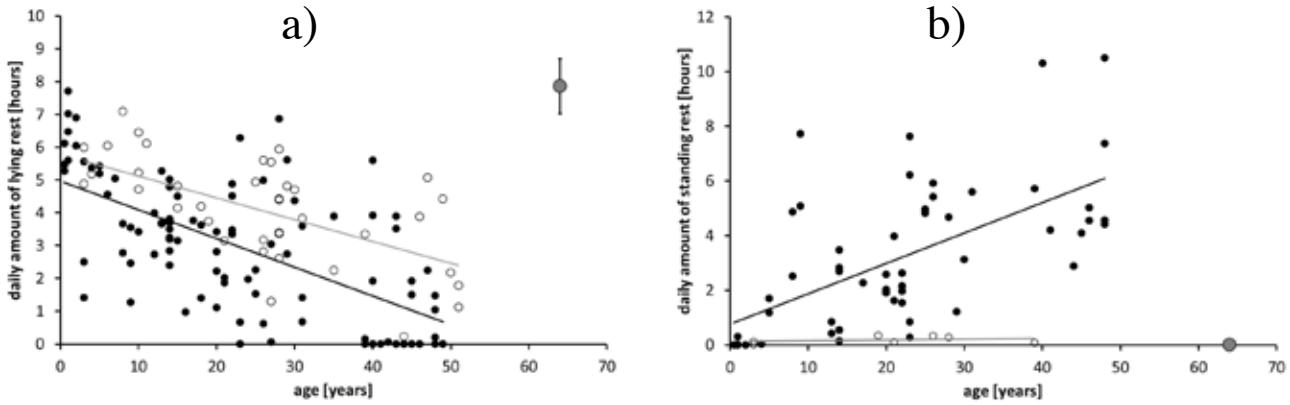

Figure 1. Correlation between daily amount of (a) lying and (b) standing rest and age in circus (circles and regression line in grey) and zoo (filled circles and regression line in black) elephants (*Elephas maximus* and *Loxodonta africana*) and the outstanding position of the observed elephant (grey circle) (literature data reviewed in Schiffmann *et al*. (2018)).

the cases (Table 1). On average the animal slept for 471.6 ± 49.9 minutes each night. She had her lying rest exclusively on the moderate slopes of sand piles provided in her indoor exhibit (Fig. 2). The majority of the elephant's lying rest activity occurred between 21:00 and 7:00 (Table 1).

According to her keepers, very short lying or leaning bouts during daytime (8:00–18.00) were observed on rare occasions. During the study period no measurable time of inactively standing still, which might be classified standing rest, occurred (see also Fig. 1b).

Discussion

Although quantitative data regarding lying rest in Asian elephants are scarce and restricted to observations under captive conditions, its duration seems to decrease with increasing age (Fig. 1a). According to her year of birth indicated in the EEP-studbook, the observed female is one of the oldest elephants living in Europe (van Wees & Damen 2016). Thus, very short bouts or even absence of lying rest was expected, especially with respect to the elephant's reduced mobility due to severe arthritis. Under these premises, the extended bouts of lying rest documented here were completely unexpected. To date, no comparable amount of lying rest has been reported in elderly zoo elephants in either species (Fig. 1a).

The absence of a side preference for lying rest corroborates findings reported in the literature (Gebbing 1959; Kurt 1960; Tobler 1992; Weisz *et al*. 2000; Wuestenhagen *et al*. 2000; Laws *et al*. 2007; Kandler 2010), as does the expression of major sleeping activity in the early hours of the morning (Kurt 1960; Tobler 1992; Friend 1999; Friend & Parker 1999; Weisz *et al*. 2000; Wuestenhagen *et al*. 2000; Kandler 2010; Ibler & Pankow 2012; Boyle *et al*. 2015; Williams *et al*. 2015; Holdgate *et al*. 2016). However, the female observed here expressed an additional peak of lying rest between 21:00 and midnight (Table 1).

It can only be speculated which factors led to the extensive lying resting behaviour in the observed elephant. Sand-flooring with slopes and mounds represents a key factor to facilitate lying rest in elephants (Roocroft 2005; Holdgate *et al*. 2016; Walsh 2017). Thus the observed pattern may be related to the availability of such features in the enclosure. Extended lying bouts might also be explained by a desire to avoid getting up

Figure 2. The elephant exclusively chose the slopes of sand piles for lying rest.

Table 1. Compilation of 30 bouts of lying rest observed during 20 nights (18:00–8.00).

Night	Lying side	Time start	Time end	Rest per bout [min]	Total rest per night [min]
1	right	21:24	5:34	490	490
2	right	20:31	5:11	520	520
3	left	21:25	23:08	103	440
	right	0:21	5:58	337	
4	left	20:08	22:27	139	526
	right	0:07	6:34	387	
5	left	20:59	0:38	219	545
	right	1:42	7:08	326	
6	right	22:22	5:37	435	435
7	left	21:03	23:06	123	437
	left	0:16	5:30	314	
8	right	21:28	5:25	477	477
9	left	22:36	23:38	62	408
	right	0:46	6:29	344	
10	right	21:32	6:01	509	509
11	right	21:30	0:45	195	457
	left	2:58	7:20	262	
12	left	23:43	6:30	407	407
13	left	22:16	7:11	535	535
14	left	22:35	0:25	110	451
	right	1:32	7:13	341	
15	right	21:52	3:27	335	496
	left	4:00	6:41	161	
16	left	22:47	7:01	494	494
17	right	22:13	6:41	508	508
18	left	22:16	23:06	50	349
	left	2:07	7:06	299	
19	right	22:18	6:33	495	495
20	left	22:14	2:01	227	452
	right	2:41	6:26	225	

and down, due to musculoskeletal alterations, although this is generally considered to cause the opposite behaviour of not lying down at all (Wuestenhagen *et al*. 2000; Roocroft 2005; Kandler 2010; Braidwood 2013). The observed female did not show evidence of problems getting back up after rest: From her lying position on the sand pile, she easily changed to sternal recumbency, pushed herself up on her front legs, and then the hind legs.

Analysis of data from the literature revealed increased lying behaviour in circus compared to zoo elephants (Benedict 1936; Gebbing 1959; Kurt 1960; Friend 1999; Friend & Parker 1999) (Fig. 1a; Schiffmann *et al*. 2018) possibly related to the structured daily routine of circus life. Although, having lived for many years at a circus, this alone might not explain the outstanding resting behaviour of this elephant. The observed pattern might rather be considered an idiosyncratic behaviour of this individual. Alternatively it can be speculated whether geriatric elephants would usually express such an extended lying rest if they were provided with a more conducive environment. Unfortunately quantitative data on lying rest in free-ranging Asian elephants is lacking as well as data for captive individuals of a similar age (reviewed in Schiffmann *et al*. 2018). Whatever the reason, extended daily lying bouts with complete weight relief of all four limbs are likely to be highly beneficial for an elephant suffering severe degenerative joint disease.

In conclusion, this case report provides evidence of extended bouts of lying rest in a geriatric zoo elephant. We consider this behaviour beneficial for an elephant's well-being and health. Installation of malleable sand-flooring for captive elephants may encourage lying rest and is strongly recommended.

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Olfactory Cognitive Enrichment Training for a Male Asian Elephant

Clair Holland

Perth Zoo, South Perth, Australia
Author's -email: clair.holland@dbca.wa.gov.au

Introduction

There are mixed views in the literature on the merits of cognitive enrichment training projects for elephants. Some reviews on 'controlled experiments' on elephant cognition argue that while these experiments have not supported widespread positive human understandings of elephant intelligence (Nissani 2008; Plotnik *et al*. 2009), this may be because new ways of investigating elephant cognition need to be found. Some authors argue that researchers have only made a small start in investigating elephant cognition in appropriate ways (Bates *et al*. 2008). They also argue that there has been a bias in past research on animal cognition, that has viewed those animals able to perform similar tasks (e.g. such as tool-making) to humans, as more intelligent (Bates *et al*. 2008) than animals with different kinds of 'higher order brain functions' (Hart *et al*. 2008).

This paper describes a behavioural enrichment project conducted with a male Asian elephant (*Elephas maximus*) at Perth Zoo, Australia. This project aimed to provide increased opportunity within enrichment training projects for the utilization of elephants' natural sensory and cognitive abilities. The World Association for Zoos and Aquariums notes that "enrichment projects in zoos and aquariums need to provide species-appropriate challenges, opportunities and stimulation for animals in human care" (Mellor *et al*. 2015).

This project utilizes the elephant's olfactory abilities to provide cognitive stimulation and problem solving situations as well as increased opportunities for physical exercise and investigation of the elephant's environment. This paper provides detailed description of the project in order to share this information and to provide assistance for others in trialling this form of behavioural enrichment.

Recent research suggests that elephants have twice as many olfactory receptor genes as dogs and five times that of humans (Niimura *et al*. 2014). As these authors note, olfaction is essential for the survival of most mammals, and is used for 'finding food, avoiding dangers, identifying mates and offspring, and identifying marked territory'. When olfactory receptor genes were classified and compared between 13 placental mammal species including African elephants (*Loxodonta africana*), the elephants were found to have the largest repertoire yet reported. It was suggested that this might be attributed to elephants' reliance on olfaction in contexts such as 'foraging, social communication and reproduction' (Niimura *et al*. 2014).

These findings correspond with neuro-anatomical studies on elephants having 'well-developed olfactory systems that include large olfactory bulbs and large olfactory areas in the brain'. In addition, research testing whether African elephants can detect the explosive TNT using olfaction, suggests that their 'well-developed cognitive processes … and memory retention … often act to support this ability' (Miller *et al*. 2015; Steyn 2015).

Other studies with Asian elephants have assessed their olfactory ability to distinguish between different odours (Arvidsson *et al*. 2012; Rizanovic *et al*. 2013). Research conducted at the Kolmarden Wildlife Park in Sweden demonstrated that Asian elephants could successfully be trained to cooperate in olfactory discrimination tests, and that they were capable of distinguishing between structurally related

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odour stimuli (Arvidsson *et al*. 2012). The authors noted that the results provide support for smell playing an 'important role in regulating the behaviour of Asian elephants' (Rizanovic *et al*. 2013). In addition, earlier studies suggest that African elephants may be able to distinguish between different local human ethnic groups, and can also possibly recognize 'up to 30 individual elephant family members from olfactory cues in mixtures of urine and earth' (Bates *et al*. 2008 quoted in Niimura *et al*. 2014).

The importance of olfaction in the lives of elephants in natural environments and the olfactory abilities identified in the above studies provide a solid basis for environmental and behavioural enrichment projects using olfactory cues for elephants in human care. The following project was developed with this in mind.

Materials and methods

Details of the elephant

The male Asian elephant Putra Mas is 28 years of age (Fig. 1). He was born in the wild in approximately 1989 and came to Perth Zoo from Malaysia with two female elephants of similar age in 1992. He was originally housed with the female elephants and handled in free contact until 1999. He was then moved to an adjacent enclosure in open protected contact when he reached sexual maturity. The olfactory training project was commenced with Putra Mas in 2014.

Details of the keeper

The Technical Officer Zoology (who is referred to in this paper as the 'keeper') is female and has worked at Perth Zoo in the elephant section for eight years. Previously, her work has been with marine mammals for 19 years, and she has been involved in behavioural enrichment training projects and observation research projects.

Description of training stages

Initially, the elephant Putra Mas was familiar with, and understood the retrieval concept. Thus the described enrichment behaviour originated as an extension of this already established retrieval behaviour.

The keeper began the project in 2014, and it has evolved through a number of stages. Firstly, the project involved the elephant searching for and finding objects with the aid of visual and audible prompts, and then later without those prompts. Then different scents were introduced with verbal cues, and the project evolved to the elephant searching for and finding these varied scents. Initially, the scents were placed closer to the elephant's location, and then the project was extended to involve larger search areas. Further work on the project can continue the extension of the opportunities and challenges of identifying, discriminating, searching and finding scents. Training was undertaken with the aim that Putra Mas would be able to indicate vocally when he had searched for and found a requested scent.

The first training session aimed at pairing his smelling of a vanilla scent with his 'hello' vocalization, which is a chirp sound. Repetitions were done using a vanilla scented tea strainer while the trainer asked him to do the 'hello' vocalization. This pairing training was conducted at the elephant barn drinker window.

Initially, Putra Mas was not providing the vocalization in association with the scent. The trainer allowed time to give him the opportunity to anticipate the association. When he did offer a 'hello' vocal after being presented with the scent,

Figure 1. Elephant "Putra Mas" at Perth Zoo.

this was then food reinforced with hay. Following repetitions, Putra Mas then began offering a vocalization when the scent was presented. It was then necessary for the trainer to quickly separate the 'smell' behaviour and 'find scent' behaviour indicators in order for Putra Mas to only indicate vocally when he had been searching for the scent and had found it, rather than on first smelling the scent. When Putra Mas gave a perfect response in the barn he was given hay. He picked up the pairing quickly.

By December 2016, if the scent was something that Putra Mas couldn't physically pick up and bring back to the trainer (e.g. liquid or a smear of paste), he vocalized to indicate the location of the scent straight away. If the scent was contained in an object that could be readily picked up, Putra Mas also vocalized, but not as consistently as when dealing with scents that could not be picked up.

Introduction of a variety of new smells

Different smells were trialled. As well as the already mentioned vanilla essence, other smells included Promite®, zebra faeces, echidna bedding, and the urine of two female Asian elephants at Perth Zoo. Also trialled were a lemongrass and ginger paste, perfume, human scented material and coffee grinds. Scents and foods that an elephant would find desirable to eat were not used.

The scents were initially placed on a material such as gauze. Later, other objects were used to hold the scented gauze. In one case, the gauze was placed in-between two circular interlocking plumbing discs made of wire mesh. Other objects used were a plastic fishing bait holder and strong poly-piping with a scented towel inside. For the coffee grinds, a tealeaf holder was initially used. Later, liquid coffee was poured onto the ground (Fig. 2). The urine scent was also poured direct onto sand. The elephant was very successful at finding this scent (Fig. 3). However, it was difficult to remove the scent.

The keeper found that when she used the stronger smelling scents, even when she removed the sand

Figure 2. Pouring liquid scent onto the ground.

from that area or covered it with fresh sand Putra Mas could still smell it there. So in later training sessions, even if he was searching for a different scent, he would naturally also go to the area with the lingering earlier scent. Learning from this, if using several scents in a training session, the keeper now begins with the weaker scents and works towards the stronger ones.

Discussion

This project was commenced in early 2014 and by late 2016 it had reached a stage where the elephant could successfully find a scent without visual or audible prompts. He had also learnt to give a vocal response upon identifying a scent. This project continues to provide the elephant with behavioural enrichment. The project has provided good physical exercise and mental stimulation in the process of the enrichment

Figure 3. Putra Mas searching the scent.

training, with the elephant responding well to the behavioural enrichment training.

The capacity for animals to be able to make choices within their environments has been a popular theme in recent discussions on the care and health of intelligent species. Challenges such as these deliver the ability for choice to Putra Mas, and therefore complement understandings of the 'Five Domains of Animal Welfare' in a fun, physical, and challenging program.

This project provided not only sensory and cognitive stimulation for this male elephant but presented him with problem solving challenges and encouraged investigation of the full extent of his enclosure. The level of success of this Asian elephant in performing tasks of odour-learning and long-term odour memory suggests that the sense of smell plays an important role in their behaviour. Behavioural and environmental enrichment projects that utilize these abilities can help to provide species-appropriate cognitive and physical opportunities for elephants in human care.

Conclusion

This enrichment training project has been successful in providing sense and mental stimulation as well as physical exercise for the elephant and in addressing needs as set out within the 'Five Domains of Animal Welfare' (Mellor & Beausoleil 2015). It follows pathways of natural sense and cognitive abilities of elephants in order to provide enhanced opportunities for Putra Mas to use and demonstrate these abilities.

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Esophageal Blockage in a Captive Asian Elephant

Zaw Min Oo[1]*, Tin Tun Aung[1], Myo Min Aung[1], Nin Nada[1] and Myo Than[2]

[1]*Myanma Timber Enterprise, Department of Extraction, Yangon, Myanmar*
[2]*Myanma Timber Enterprise, Mandalay, Myanmar*
**Corresponding author's e-mail: zawminoomte@gmail.com*

Introduction

There are more than 5000 captives elephants in Myanmar of which over 3000 are owned by Myanma Timber Enterprise, a state owned enterprise. In 2016, the Myanmar government imposed an embargo on timber extraction. Before stopping timber extraction, most captive elephants were used for logging, some for carrying baggage and a very few for tourism.

Currently a few captive elephants are used in tourism business but most are out of work. Consequently the owners need help to provide health care for their elephants. Therefore, Myanma Timber Enterprise collaborated with international NGOs to set up Mobile Elephant Clinic. There are three mobile elephant clinics in Myanma Timber Enterprise, which provide care for state owned as well as private elephants. The Mobile Elephant Clinic teams do regular trips to elephant camps to conduct health checkups, provide medication to sick and injurious elephants, de-worming and vaccination. Additionally training of mahouts in foot care of elephants is also done.

Here we report on a case of esophageal blockage of a Forest Department owned elephant used for transportation at a famous pagoda within the Alawdakathapa National Park.

Case history

On 5th February 2018 an emergency telephone call was received from Dr. Myo Min Aung, the veterinarian in charge of the Sagaing region, indicating the problem. The elephant concerned was a male named Ye' Aung, 15 years old. According to the elephant classification of Myanma Timber Enterprise based on ages, he was a 'trained calf', which means he could only be used for transportation.

Clinical signs

- Elephant vomited whatever he drank or ate.
- He appeared to want to eat and tried to swallow. However he could not swallow and it resulted in vomiting.
- The oral colour was pale and the body weight was decreasing based on body condition score.

Cause and treatment

On 6th February 2018, we went to the Alontawkathpa National Park. When we arrived there, it was dark and we were only able to check the general condition, body temperature and behaviour of the elephant. The body temperature was nearly normal (around 34.5ºC) and he vomited every 2–3 minutes after eating or drinking.

Based on our experience, we thought that it could be due to esophageal blockage with food. He could not eat for 3 days, so the body condition was poor and we decided to give supportive treatment consisting of dextrose saline (1000 ml) every 5 h for his water and electrolyte loss and multivitamin (80 ml).

The next day at 7:00 am, we again did a general check up (Fig. 1) and put in a mouth-gap instrument made by us, into the elephant's mouth (Fig. 2) and examined the upper alimentary tract by palpation (Fig. 3). A very hard mass was felt inside the throat. We removed the mass and found it to be a bolus consisting of a mixture of sugarcane and rice, weighing 1.6 kg (Fig. 4).

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Figure 1. Mobile Elephant Clinic team observing the behaviour of the sick elephant.

After removal of the bolus, Ye Aung started drinking water and eating. After 2–3 hrs, defecation, and urination was observed and his behaviour became normal.

Anazin C (vit C+ diplone+ analgesic) 30 CC per day was given for 4 days intramuscularly (diplone for increasing peristaltic movement). In addition, the local veterinarians gave antibiotics (Pen Strep – 50 ml twice a day intramuscularly) and supportive treatment (multivitamin – 50 ml twice a day intramuscularly) for 4 days.

The pagoda is situated within the Alontawkathpa National Park and is visited by many pilgrims. The elephants receive food from the pilgrims. During the summer, the elephants at Alontawkathpa

Figure 2. Mouth-gap instrument fitted to the elephant's mouth.

Figure 3. Examination using the mouth-gap instrument.

National Park have to walk in the morning and afternoon, transporting pilgrims to and fro from the festival at the pagoda. As a result they cannot eat properly and are very hungry. When they finish working, they go to the pasture and consume food very fast.

As it was the dry season the sick elephant was probably dehydrated and there was very little water content in the food. The food probably became obstructed due to the dryness and rapid ingestion.

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Figure 4. Old digester removed from elephant's throat.

9th Meeting of the Asian Elephant Specialist Group

Sandeep K. Tiwari* and Vivek Menon

Asian Elephant Specialist Group, Noida, India
**Corresponding author's e-mail: sandeep@wti.org.in*

Introduction

The 9th Meeting of the Asian Elephant Specialist Group (AsESG) was held at the Avani Riverside Hotel in Bangkok, Thailand from April 25 to 27, 2018. Discussions on priorities and strategies for Asian elephant (*Elephas maximus*) conservation took centre stage during the three-day meeting, which was attended by about 131 people including 53 AsESG members, 13 government officials from all Asian elephant range countries, 19 potential AsESG members and 46 invitees from across the globe. The Department of National Parks, Wildlife and Plant Conservation (DNP), Government of Thailand provided the local support to organise the meeting.

Addressing the members, the Hon'ble Minister of Natural Resources and Environment, Kingdom of Thailand General Surasak Karnjanarat said that the meeting provides a good opportunity for experts on Asian elephants to look at various aspects of wild and captive populations and to provide technical support to governments and others on long-term conservation of Asian elephants. Welcoming the guests, the Deputy Regional Director of IUCN Asia, Dr. T. P. Singh said that the uniqueness and value of the IUCN Species Survival Commission and its Specialist Groups like the AsESG is that it embodies the spirit of IUCN's 'One Programme Approach'. Through this approach IUCN continues to play a convening role and bring together governments, civil society, research organisations, universities and other stakeholders to address emerging challenges in the long-term conservation and management of Asian elephants. Chairing the meeting, Mr. Vivek Menon, Chair AsESG spoke about the importance of the AsESG to save the flagship species and said that it was greatly heartening to see such an assemblage of skill and passion among the members of the AsESG. As a group of scientists and experts, it is our duty to use these attributes to ensure the survival of the Asian elephants for generations to come. The Deputy Director General, Department of National Parks, Wildlife and Plant Conservation, Thailand, Dr. Pinsak Suraswadi said that he believes that the meeting will be a platform not only for discussing the action taken, identifying the priorities needed to tackle the Asian elephant conservation issues but also strengthen our collaboration to protect the Asian elephant in the future.

Chair's report

Presenting the Chair's report, Mr. Vivek Menon informed that the AsESG consist of 90 members from 18 countries as well as ex-officio Government representatives from all 13 countries. He also spoke about the 2nd Elephant Range States Meeting in Jakarta, Indonesia in April 2017 and the Jakarta declaration, meetings attended by the Chair at various forums in Indonesia, Malaysia, Thailand and United Kingdom and the constitution of the 12 working groups on diverse elephant conservation issues. As part of the report, the financial overview and the AsESG Action Plan were also presented. The main component of the AsESG plan till 2020 includes:

- Facilitate National Action Plans (NAP) on elephant conservation for 13 range countries in Asia.
- Ensure membership from all 13 range countries with diverse skills.
- Organise meetings of the AsESG members in 2019/2020.
- Mapping the distribution of elephants in all the 13 range states in Asia.
- Assist the Vietnam government in arresting

the decline of elephant population in Vietnam.

- Developing guidelines/protocols for the conservation of Asian elephants by relevant working group.
- Facilitating MIKE in effective data collection and reporting.
- Developing Asian elephant database.
- Effective communications of AsESG activities through website and Gajah journal and fund raising to facilitate AsESG activities.
- Identifying elephant conservation emergencies and to plan mitigation measures with technical support from AsESG.

Rohingya crisis

The Chair also informed the group about the Rohingya crisis that has gripped the world both from a humanitarian point of view as well as a wildlife point of view and offered AsESG assistance to Bangladesh Government and IUCN Bangladesh in undertaking HEC mitigation initiatives in the area. Mr. Raquibul Amin, Country Representative, IUCN Bangladesh said that his office with support from UNHCR and assistance of AsESG members from Bangladesh has surveyed the area to understand elephant movement, number of elephants and seasonality of movement based on direct survey and interaction with fringe villages.

The main challenge is how to address the increasing human-elephant conflict (HEC) in the region. Based on an initial survey by IUCN Bangladesh, elephant response teams (20 member teams) have been formed in the camp area and watch towers have also been installed along the western periphery of the refugee camp. The Chair has formed an AsESG working group to assist the Bangladesh government and IUCN Bangladesh team in preparing the mitigation plan.

2nd Range State Meeting

Dr. Wahdi Azmi and Ms. Heidi Riddle briefed the meeting on the outcomes of 2nd Range State Meeting and the follow up activities by range countries. They also briefed the meeting about the Jakarta declaration for Asian elephant conservation. The main priorities of the AsESG as outlined in the declaration were to maintain landscapes for elephant populations, work collaboratively on transboundary issues, address the root causes of HEC and develop long term solutions, ensure effective enforcement to prevent illegal killing and trade, strengthen international collaboration, coordination, and communication; cooperatively develop captive Asian elephant registration programs, ensure the welfare of captive elephants and develop where necessary National Asian Elephant Action Plan and its timely implementation.

Range country contributions

The government officials from all 13 countries presented the status of elephants in their respective countries, conservation challenges and the conservation initiatives undertaken and proposed plans.

Working group reports

The conveners of the 12 working groups presented the outcomes of their group.

Preparation of National Action Plans

The working groups for the preparation of the National Action Plans for the conservation of elephants in Indonesia and Malaysia (Borneo) – the Sumatra draft NAP was presented by Dr. Wahdi Azmi and Mr. Donny Gunaryadi on behalf of the Indonesia Environment and Forest Department and the Borneo draft NAP was presented by Dr. Bennoit Gossens and Dr. Nurzhafarina Othman. The final plans are expected to be published by end 2018.

Arrest the decline of the elephant population of Vietnam

Mr. Ajay Desai presenting the outcome of the working group to arrest the decline of the elephant population of Vietnam suggested short-term and long-term interventions and recommended listing the Vietnam population as "critically endangered". The group also aims to provide technical inputs to the Vietnam government and advise them on decision making, assist in drafting guidelines and manuals on HEC mitigation measures, translocation, captive breeding, reintroduction, etc. and also to advise on expertise available within the AsESG and outside.

Develop guidelines for the welfare and use of elephants in tourism

Dr. Sonja Luz and Dr. Janine Brown presenting the outcome of the working group to develop guidelines for the welfare and use of elephants in tourism said that there are no real guidelines in place for the care of captive elephants being used in tourism. The new guidelines for the welfare of captive elephants used in tourism were drafted based on research implemented by the ACEWG. The need for the guidelines and the key challenges faced for captive elephant welfare were explained and that the group will prioritize the development of specific protocols (e.g. for humane taming, training and managing elephants) once the guidelines are finalized.

Mapping the distribution of Asian elephants

The working group for mapping the distribution of Asian elephant range states was presented by

Dr. Varun Goswami and Dr. A. Christy Williams who described the data need and ways to map the populations. The working group presented on the need to map the distribution of Asian elephant ranges and how it is needed for landscape level planning to conserve the species. They briefed on occupancy model and data requirements from range states.

Developing guidelines for rehabilitation of captive elephants in the wild

The working group for developing guidelines for rehabilitation of captive elephants in the wild as a possible restocking option was presented by Dr. Chatchote Thitaram. The group presented the broad plan of action for rehabilitation of captive elephants back to the wild as a restocking program and why reintroduction is required from a conservation point of view.

Management and care of captive elephants in musth

Introducing the term "musth", Dr. Janine Brown informed its impact on male elephants and the signs and behavioural changes observed in wild elephants when in musth and compared the difference to that of captive elephants. Due to the abnormal behavioural changes displayed in captive elephants, they are subject to harsher management methods. She also briefed on the behavioural stereotypes displayed by captive elephants in musth and the aggression among the bulls, at time leading to accidents. Following the management criteria, she briefed on the musth control protocol that the group has drafted including use of short acting drugs that reduce aggression (suggested avoiding repeated use) and emphasised on the importance of training mahouts and also the use of the right tools to manage an elephant in musth.

Developing guidelines for creating artificial water holes

Giving a background, Prof. R. Sukumar presented on past studies implemented in Africa on water holes installed there and mentioned that this is a critical debate which has been going

on in Africa and is now emerging in Asia as well. Water holes cause changes in home range/ movement/distribution, have a localized impact on vegetation, impacts population growth and also has implications for other biodiversity. The impact of water holes on elephants and their habitats were presented in details.

Involving AsESG members to strengthen MIKE

Dr. N. M. Ishwar informed that MIKE Asia has been revived in 2017 and listed the MIKE sites in South East Asia (14 sites in 8 countries) and in South Asia (14 sites in 5 countries). He presented key learnings from AsESG members on MIKE carcass data sheet and reporting, MIKE site selection, Proportion of Illegally Killed Elephants (PIKE) and on population estimation and sought assistance of AsESG. The group felt that it will be good to integrate the MIKE carcass data template into the national action plans so the range state governments consider the same as part of their mandate.

Human-elephant conflict guidelines

Dr. Alexandra Zimmermann introducing the concept of IUCN guidelines explained that the guideline will be that of a guiding framework for principles and processes in all aspects of managing HEC across the range states. The guideline is formed around the three key aspects – principles of HEC, process for best practices in HEC mitigation and mitigation methods. A final revised version will be submitted to IUCN for formal approval process by early 2019 and the HEC guidelines were to be launched at the next AsESG meeting in late 2019.

Communications

The communications working group was presented by Dr. Sandeep K. Tiwari and Ms. Nilanga Jayasinghe. Dr. Tiwari presented the new AsESG website, which was approved by the members with some suggestions, which are being incorporated. The new website will be hosted by early September 2018. Ms. Jayasinghe emphasised the need of AsESG communications strategy and spoke on branding, visuals, blog, media and coverage.

Way forward with the working groups

All the working groups (except the one on HEC) will be modifying their reports based on feedback and comment by members during the AsESG meeting and plan to finalise their output by October 2018.

Dr. Sandeep K. Tiwari updated the group on the status of NAP's. He said that in the last few months, Myanmar and Bangladesh have prepared their NAP. Three countries (India, Bhutan and Lao PDR) that do not have a plan have assured to draft the National Action Plan and AsESG has offered support to help them in drafting the NAP.

Based on feedback of the members, the Chair also agreed to have working groups on minimizing impact of Rohingya refugees on elephants in Bangladesh, minimising the impact of linear infrastructures on elephant habitat, assisting with drafting the National Action Plans for elephant conservation for India, Lao PDR and Bhutan, on emerging diseases and nutrition in elephants and on invasive species in elephant habitats.

Other presentations

Presentations were also made on important elephant conservation issues by invited speakers.

CITES DNA database requirement: Options available and lessons learned

Dr. Ross McEwing from TRACE Wildlife Forensics Network presented on DNA registration system which is currently being used in Thailand and presented a conceptual framework on the use of DNA in the field of wildlife enforcement and its advantages. Informing the advantages of this system, he said that it will form a single calibrated system across south east Asian range states. The system will also avoid use of duplication and allow outsourcing to a single appropriate genetic service provider.

Wildlife forensic science laboratory in Thailand

Dr. Kanitha Ouithaven from the Department of National Parks, Wildlife and Plant conservation, Thailand informed that the Wildlife Forensic Science Unit Laboratory (WIFOS) was established in December 2010 with aim of using forensic techniques in wildlife crime and confiscated animal investigations. The lab also aims to establish a DNA database and DNA bank for wildlife in Thailand. Said that the key challenge faced is that in Thailand many wild elephants are brought in to captivity illegally. As a solution to this, the DNP established the captive elephant database and an Asian elephant DNA parentage system. Each elephant in captivity has a legal document known as the elephant passport. This along with the captive elephant genetic database is helping the DNP keep a check on illegal capture of wild elephants for captivity.

Research and progress for managing elephant endotheliotropic herpes virus (EEFV)-HD globally in captive and wild elephant populations

Dr. Sonja Luz, Chairman, Asia EEHV Working Group and members AsESH informed about the EEFV virus and its resulting Hemorrhagic disease including the symptoms and its impacts on elephants, individuals and populations. She said that in Asia the disease is being recorded with increasing frequency both in captive and wild elephants. Dr. Luz stressed on the importance and need to raise more awareness and inform regional stakeholders about the currently available knowledge and best practices to better coordinate research on this disease. The EEHV working group was set up to help facilitate the same. The recommendations of the first Asia EEHV strategic meeting have been published as an information brochure. An EEHV task force has also been formed in Thailand in 2015. The working group's collaborations with other institutes were also presented. The working group also recommends training for mahouts and veterinary trainings for doctors and assistants to help treat EEHV-HD in captive elephants.

Influencing international transportation policy and practice for more wildlife-friendly roads challenges in the 21st century

Mr. Rob Ament from the Western Transportation Institute, Montana State University, USA introduced about the Connectivity Conservation Specialist Group (CCSG) and their role. He emphasised on the importance of landscape level conservation, especially the need to connect habitats and also spoke about the challenges faced (existence of multiple jurisdictions, authorities, organizations, cultures, spatial scales and multiple time frames to work with). Mr. Ament gave a brief introduction to the Transport Working Group under CCSG that aims on improving transport systems for species and ecosystems. He informed on the challenges faced by the working group and the mitigation strategies like change in behaviour of animals (using deterrents), change in driver behaviour and means to separate drivers from animals using underpasses, bridges, animal corridors etc. He included proven solutions like underpasses and corridors, which have helped in mitigation threats posed by roads and railways. However, some of these like wildlife corridors are expensive. Mr. Ament presented a few case studies / examples of these solutions including tunnels for salamanders in Waterton Lakes National Park Canada, signage and early warning systems along railway tracks, elevated railways in the Tibetan plateau etc.

Illegal trade in live Asian elephants: A review of current legislative, regulatory, enforcement, and other measures across range states

Ms. Heidi Riddle informed that the CITES resolution recommends that all elephant range States have in place legislative, regulatory, enforcement, or other measures to prevent illegal trade in live elephants. She spoke about the project goal and objectives based on the CITES recommendations. The team conducted questionnaire surveys to help with their research on illegal trade of elephants in the area. Ms. Riddle also presented the key findings of the survey.

Threat of elephant poaching for skin in Myanmar

Dr. A. Christy Williams told the gathering on survey in Mong La, Myanmar by WWF Myanmar that was able to highlight the emerging trade on elephant parts (skin) in the region. Based on their recent records, 7 out of 19 elephants poached had collars. Of these 20 were poached from a single site in March 2017. Based on market survey in 2014–2015, the team found 700 pieces of skin available for sale in 16 shops largely being sold to Chinese buyers. Dr. Williams presented the response to this threat taken by organizations in Myanmar. The teams worked towards responding at three levels – immediate response in the field, fixing national policy to fix this threat, increasing awareness and support to close markets which deal in trade of elephant parts. They also trained Forest Department staff and local communities on patrolling.

Report on elephant killing and carcass processing at Rakhine Yoma elephant range

Dr. Martin Tyson from Wildlife Conservation Society (WCS), Myanmar presented the background of the Rakhine Yoma elephant range in Myanmar and informed that the threats to elephants come from the Ayeyarwady villages on the east of the range. He informed of the indicators of hunting in the area, based on anecdotal evidence from rangers, confiscated items from poachers, confiscated wildlife products from poachers and also spoke about the challenges faced and the need to help address this threat to elephants in the region. WCS in Myanmar is working with the department and has pressed for a 7-year jail sentence on convictions. He also informed on the lack of proper weapons by the patrolling team compared to the poachers and raised doubt that the local police may be involved in the trade. Hence, need of good informer system in field. He suggested having multi-agency armed patrolling teams, additional captive elephant unit in northern Rakhine Yoma elephant range and satellite collaring of elephants for protection and research.

Skinned – an investigative report from Elephant Family

Ms. Belinda Stewart-Cox presented on Elephant Family's investigation in to the recently emerged trade in elephant skin and their work on addressing this threat to Asia's elephants. Elaborating the report "Skinned: The growing appetite for Asian elephants" she briefed the group on the history of Elephant Family's work on the above issue, and their contribution which resulted in addition of 'live elephant trade' to resolution 10.10 in CITES CoP 16. The findings of the research indicate that since 2014, there has been increase in poaching and trade / sales with main source of elephant skin being Myanmar and the products being produced are beads / pendants, skin pieces, powder. These are manufactured in Myanmar, Laos, China and the by-products being elephant trunks, a delicacy. The main market is China and the trade could result in indiscriminate killing of elephants of both sexes, threatening the fragile elephant population.

Next meeting

The next AsESG meeting is planned for late 2019. Four verbal offers were received from members (Sri Lanka, Malaysia-Borneo, Bangladesh and China) and the venue will be finalised in consultation with members based on support available for meeting from the local government and other agencies.

Regional Tiger, Asian Rhino and Elephant Veterinary Workshop in Chitwan, Nepal

Amir Sadaula[1]*, Sharada Thapaliya[2] & Heidi S. Riddle[3]

[1]*National Trust for Nature Conservation, Lalitpur, Nepal*
[2]*Agriculture and Forestry University, Khumaltar, Lalitpur, Nepal*
[3]*Asian Elephant Support, Missouri, USA*
**Corresponding author's e-mail: naturalamir@gmail.com*

The National Trust for Nature Conservation (NTNC) in collaboration with the Department of National Parks and Wildlife Conservation, Government of Nepal, and the Agriculture and Forestry University hosted the Regional Tiger, Asian Rhino and Elephant Veterinary Workshop in Chitwan National Park, from February 5–8, 2018.

Chitwan National Park has populations of tigers, one-horned Indian rhinos, and Asian elephants. This was the first wildlife veterinary workshop to focus on three highly endangered species that share habitat. The workshop addressed wildlife health from an ecosystem perspective.

The workshop included oral presentations from the various Asian range countries as well as practical activities. The workshop addressed veterinary topics such as disease surveillance in wild populations, the role of veterinarians in translocation, rescue and rehabilitation of wildlife, and disease case studies. The workshop hosted 75 participating wildlife veterinarians, including representatives from several Asian wildlife range countries: China, India, Indonesia, Mongolia, Myanmar, Nepal, Russia, Thailand, Vietnam, as well as veterinarians from the United Kingdom and USA.

Wildlife health is an important priority for wildlife conservation in Nepal, and the recent confirmation of *Mycobacterium orygis* in the wild rhino population has increased this importance. NTNC, in collaboration with the government of Nepal, recently established a molecular laboratory, which prioritizes wildlife disease surveillance as an important component of its work. NTNC assists in rhino and tiger rescue and relocation and developed a surveillance program for canine

distemper in domestic dogs and tuberculosis in livestock within the buffer zone of Chitwan National Park. These monitoring programs were discussed during the workshop, which served as a catalyst for networking with the broader regional community of wildlife health experts in Asia. During the workshop, delegates from Nepal presented and discussed with participants a National Wildlife Health Management Strategy that the country is endorsing.

The workshop included visits to the Molecular Laboratory of NTNC, which has been recently constructed. During the lab visit the veterinarians were asked to assess a female elephant with tooth issues. Workshop participants also visited the Elephant Breeding Center which manages 17 elephants, with 6 calves, and enjoyed a drive through Chitwan National Park where local wildlife such as rhino, different deer species, sloth bear, gharial and mugger crocodiles were observed.

This workshop follows up on three earlier regional veterinary workshops to develop the capacity of Asian wildlife veterinarians. These activities are instrumental in developing needed veterinary skills; they helped to identify a critical disease (elephant endotheliotropic herpes virus or EEHV) in additional elephant populations in Asia including in Nepal, for the first time, and improved networking among wildlife veterinarians in Asia.

These regional wildlife veterinary workshops underscore the importance of veterinary science for keystone wildlife conservation in Asian range countries. As a result of these ongoing meetings, there is better communication amongst wildlife veterinarians in Asia, and the sharing of information and experiences has increased. Thanks to the network created by these workshops, wildlife veterinarians working in Asian range countries are now better equipped to support conservation initiatives for endangered species such as the Asian elephant.

Report on the Sixth Elephant Conservation Group Workshop

Jennifer Pastorini

Centre for Conservation and Research, Tissamaharama, Sri Lanka
Author's e-mail: jenny@aim.uzh.ch

Background

The Elephant Conservation Group (ECG) was founded in 2011 to conduct common projects across the Asian elephant range and to exchange ideas and experiences regarding elephant conservation.

The sixth workshop was attended by 13 participants from nine countries. The meeting was held in Bangkok, Thailand from 22nd to 24th April 2018 preceding the Asian Elephant Specialist Group (AsESG) meeting. As eight ECG members are also AsESG members, this arrangement saved travel costs and time. The meeting was held in a house rented through Airbnb where the participants also stayed.

Summary of activities presented by each team

Jackson Frechette (**Cambodia**, FFI) informed us that landscape management was the most important issue for them to better conserve elephants. Studies using camera traps and line transects were undertaken. Dung samples were collected for a genetic study, and the bush meat market and ivory trade routes were investigated.

Becky Shu Chen (**China**, ZSL) told us about last year's elephant stakeholder meeting. Studies were done on human-elephant conflict (HEC), individual elephant identification, distribution, population estimates using DNA, plants consumed and landuse. An alarm system using camera traps around the village was tried and elephant-friendly rice and tea was promoted.

Ananda Kumar (**India**, NCF) informed us about the translocation efforts in Hassan and a study on elephant and people deaths at four sites. We got an update on the SMS alerts in Valparai, which have now also been introduced in Hassan. Having a Forest Department quick response team on duty was found to be useful for mitigating HEC.

Ahimsa Campos-Arceiz (**Malaysia**, MEME) talked about the elephant distribution survey conducted by them, a study on social organisation using camera traps and 50 elephants that were collared in the last six years. The seed dispersal study continued, with DNA being used to identify plant species in dung. MEME was also involved in developing policies, and focused on communication with the general public.

From John McEvoy (**Myanmar**, Smithsonian) we heard about the collaring efforts of 28 elephants and new habitat maps. HEC was studied and electric fencing was introduced. A new poaching crisis came to light as seven collared elephants got killed for their skin.

Narendra Pradhan (**Nepal**, IUCN) reported on a study of HEC, which showed that 75% of human deaths due to HEC were due to negligence. An awareness program would help to avoid deaths.

Prithiviraj Fernando (**Sri Lanka**, CCR) reported about their collaring program, a study of elephants at garbage dumps, collaboration with a hotel to give tourists a better experience when observing elephants, ongoing electric fence work, distribution survey results, awareness programs and updating the national elephant policy.

Eileen Larney (**Thailand**, ZSL) talked about their camera trapping and elephant sign surveys in the Western Forest Complex. HEC incidents were investigated and new mitigation techniques tried. Main threats to elephants were found to be agricultural encroachment, cattle, logging and poaching.

Research activities

Ananda Kumar gave an overview on dung counts. He pointed out that visibility and climate are key factors and that defecation and dung decay rates need to be specific for the study area. They are currently studying dung decay rates at Valparai.

Sreedhar Vijayakrishnan (India, NCF) presented his PhD project on the response of elephants to drives. He studied distribution in different seasons with dung line transects and used camera traps to ID individual elephants in Valparai in agricultural and forest landscapes. He also monitored FGM hormone levels and body condition of elephants.

Ee Phin Wong (Malaysia, MEME) presented her study, which evaluated hormone levels from collared elephants, combining the results with the elephants' actual movement data. Parasites were also investigated. The goal was to compare translocated elephants with resident ones.

ECG Projects

Three years ago ECG started a study on elephant and human mortality due to HEC. All teams collected data but as the numbers were still low, it was decided to collect data for another year.

The second ongoing project is to study elephant body condition from photographs. All teams brought photographs to the workshop, which we scored as a group, providing training to the less experienced. We discussed how such data can be used to compare males and females, different sites or different seasons. As we also want to compare countries, it was decided to keep collecting data.

The distribution survey has now been completed at all sites. We discussed the status of data analysis for each team. Three teams are preparing a publication. Others have not started analysis yet but were motivated to do it soon.

Discussions

We held an open discussion on sustainable solutions to address HEC. Confrontational methods were found not to be very useful as elephants get used to them and respond aggressively. Compensation was difficult as damage value is difficult to determine and payment of compensation reinforces the idea that the payee is responsible for elephants. For crop insurance to be viable, all farmers and not only those affected would need to be involved. Electric fences can work but maintenance is a big issue and also elephants with tusks can break them. Alternative crops may work but most people do not want to change for socio-cultural and economic reasons. Overall we agreed that proper studies on HEC mitigation methods across sites would be very useful.

Nilanga Jayasinghe (WWF) gave us further insights into the poaching crisis in Myanmar. An impressive campaign was launched called "Voices for Momos". They put up life-sized elephant sculptures and invited people to come and take selfies – which 50,000 did in the first week. A touching movie was produced and a music festival with famous artists organized. The sale of ivory souvenirs at the Shvedagon pagoda in Yangon already stopped as a result.

In the last session we discussed the future of ECG. Our common projects have not worked as well as expected. Most teams already have a lot going on and it is difficult to add new activities. However, we all agreed that we are open for new projects if something interesting comes up that can be managed beside the ongoing work. All participants felt that the ECG meetings are worthwhile to exchange experiences and build a personal network. This allows data sharing on a personal basis and facilitates visits to other team members' sites to learn at first hand.

Recent Publications on Asian Elephants

Compiled by Jennifer Pastorini

Anthropologisches Institut, Universität Zürich, Zürich, Switzerland
Centre for Conservation and Research, Tissamaharama, Sri Lanka
E-mail: jenny@aim.uzh.ch

If you need additional information on any of the articles, please feel free to contact me. You can also let me know about new (2018) publications on Asian elephants.

N. Abeysekara, R.P.V.J. Rajapakse & R.S. Rajakaruna
Comparative cross-sectional survey on gastrointestinal parasites of captive, semi-captive, and wild elephants of Sri Lanka
J. of Threatened Taxa 10 (2018) 11583-11594
Abstract. Parasites can influence the fitness of individuals particularly of small populations of endangered species. An island-wide, cross sectional, coprological survey was carried out from 03 January to 30 October 2015, to determine the gastrointestinal (GI) parasites of the Sri Lankan elephant *Elephas maximus maximus*. Fresh fecal samples from wild, captive and semi-captive elephants were collected and analyzed using a modified salt floatation, Sheather's sucrose floatation, direct iodine smears, and sedimentation methods. Species identification was done morphologically. Intensity of parasite infections was determined using McMaster technique. A total of 85 fecal samples (wild = 45, semi-captive = 20, captive = 20) were analysed; 58 (68.2%) samples were positive for GI parasites. Overall, helminth infections (60.0%) were more common than protozoan (37.6%) infections (Chi square test, $\chi^2 = 8.499$; $p < 0.001$). In the captive elephants, however, more protozoan infections were observed than helminthes, which could be due to anthelminthic treatment. A significantly higher prevalence of infection was observed in the wild elephants (93.3%) compared to semi-captive elephants (55.0%; $\chi^2 = 13.516$; $p < 0.001$) and captive elephants (25.0%; $\chi^2 = 32.289$; $p < 0.001$) but there was no significant difference in the prevalence between captive and semi-captive elephants ($\chi^2 = 3.750$; $p = 0.053$). Ten types of GI parasites were observed, nine of which were recorded in wild elephants. Among them the most common infection was strongyles (34.1%) with high intensity (440.1±295.2 EPG). Semi-captive elephants harbored five types of GI parasites, while captive elephants had only three types. One captive elephant at the Temple of the Tooth was infected with the tapeworm Anoplocephala sp. at low intensity of 50 EPG. Some of the GI parasites recorded are highly pathogenic while others are incidental.

R. Amin, H.S. Baral, B.R. Lamichhane, L.P. Poudyal, S. Lee, S.R. Jnawali, K.P. Acharya, G.P. Upadhyaya, M.B. Pandey, R. Shrestha, D. Joshi, J. Griffiths, A.P. Khatiwada & N. Subedi
The status of Nepal's mammals
J. of Threatened Taxa 10 (2018) 11361-11378
Abstract. The main objectives of the Nepal National Mammal Red Data Book (RDB) were to provide comprehensive and up-to-date accounts of 212 mammal species recorded in Nepal, assess their status applying the IUCN Guidelines at Regional Levels, identify threats and recommend the most practical measures for their conservation. It is hoped that the Mammal RDB will help Nepal achieve the Convention on Biological Diversity target of preventing the extinction of known threatened species and improving their conservation status. Of the 212 mammal species assessed, 49 species (23%) were listed as nationally threatened. These comprise nine (18%) Critically Endangered species, 26 (53%) Endangered species and 14 (29%) Vulnerable species. One species was considered regionally Extinct. A total of seven species (3%) were considered Near Threatened and 83 species (39%) were Data Deficient. Over sixty percent of Nepal's ungulates are threatened and

almost half of Nepal's carnivores face extinction (45% threatened). Bats and small mammals are the least known groups with 60 species being Data Deficient. Habitat loss, degradation and fragmentation are the most significant threats. Other significant threats include illegal hunting, small and fragmented populations, reduction of prey base, human wildlife conflict and persecution, climate change, invasive species, disease and inadequate knowledge and research. Adequate measures to address these threats are described. It was also concluded that re-assessments of the status of certain mammal groups be carried out every five years and the setting up of a national online species database and mapping system would also greatly help in land-use planning and policies. © 2018 The Authors.

James J. Anderson
The relationship of mammal survivorship and body mass modeled by metabolic and vitality theories
Population Ecology 60 (2018) 111-125
Abstract. A model describes the relationship between mammal body mass and survivorship by combining replicative senescence theory postulating a cellular basis of aging, metabolic theory relating metabolism to body mass, and vitality theory relating survival to vitality loss and extrinsic mortality. In the combined framework, intrinsic mortality results from replicative senescence of the hematopoietic stem cells and extrinsic mortality results from environmental challenges. Because the model expresses the intrinsic and extrinsic rates with different powers of body mass, across the spectrum of mammals, survivorship changes from Type I to Type II curve shapes with decreasing body mass. Fitting the model to body mass and maximum lifespan data of 494 nonvolant mammals yields allometric relationships of body mass to the vitality parameters, from which full survivor- ship pro les were generated from body mass alone. Because maximum lifespan data is predominantly derived from captive populations, the generated survivorship curves were dominated by intrinsic mortality. Comparison of the mass-derived and observed survivorship curves provides insights into how specific populations deviate from the aggregate of populations observed under captivity. © 2018 Society of Population Ecology and Springer Nature.

A. Aryal, C.G. Morley & I.G. McLean
Conserving elephants depend on a total ban of ivory trade globally
Biodiversity and Conserv. 27 (2018) 2767-2775
Abstract. Despite the Convention on International Trade in Endangered Species (CITES) 1989 ban on trading ivory internationally, poaching for ivory has intensified in both Africa and Asia. Populations of African elephant (*Loxodonta* spp.) and Asian elephant (*Elephas maximus*) have declined drastically. In response to the rapid decline, the USA and some other CITES countries have banned commercial ivory trading in ivory. The country with the highest ivory consumption, the People's Republic of China, recently shut down its legal ivory trade at the end of 2017. Nepal has turned the tide of elephant poaching, with no loss of elephants in the last 4 years. This remarkable success has been achieved by imposing a total ban on trade in ivory, supported by strict national legislation that includes significant fines and incarceration for poachers, traders and officials. Elsewhere, elephant poaching continues to increase despite the numerous disincentives already in place. Thus, we propose a global ban on trade in ivory as the only realistic solution to the current unsustainable rate of loss of elephants. The ban should be extended to trade in all products from endangered wildlife. © 2018 Springer Nature.

W. Azab, A.M. Damiani, A. Ochs & N. Osterrieder
Subclinical infection of a young captive Asian elephant with elephant endotheliotropic herpesvirus 1
Archives of Virology 163 (2018) 495-500
Abstract. Elephant endotheliotropic herpesviruses (EEHVs) are a continuous threat for young Asian elephants. We report a laboratory-confirmed infection of a 5-year-old female Asian elephant (AZ_2016) in the Berlin Zoologischer Garten. Initially, high EEHV-1 loads were detected in trunk swabs obtained from the young elephant during routine screening. The animal showed no clinical signs except for slight irritability. EEHV-1 was continuously shed for

almost one year, with fluctuations in viral load from time to time. Our investigations highlight the continuous threat of EEHV-1 to young captive Asian elephants and stress the importance of routine monitoring of captive elephants to allow early detection of infection. © 2018 Reprinted with permission from Springer-Verlag.

M. Bonaparte-Saller & J.A. Mench
Assessing the dyadic social relationships of female African (*Loxodonta africana*) and Asian (*Elephas maximus*) zoo elephants using proximity, tactile contact, and keeper surveys
Applied Animal Behaviour Science 199 (2018) 45-51
Abstract. Understanding the affiliative social relationships, or bonds, between zoo elephants has implications for both their welfare and management, yet there is limited work assessing and describing these bonds. Consequently, there is a need for the development of a reliable assessment tool. We used multiple metrics of proximity and tactile contact, as well as keeper surveys, to assess the social bond strength of 41 elephant dyads from 22 different zoos. Survey descriptions of social bond strength were based on previous research and included proximity and separation-reunion behaviors between individuals in a dyad. Approximately half of the elephant dyads in our study were rated as having a "strong" or "strongest" bond by keepers, who showed excellent agreement in their ratings of elephant bond strength (ICC(1,k) = 0.82). Elephant dyads that spent more time in proximity (within two elephant body lengths), and those that were more consistent in this behavior across time had an increased predicted probability of being rated as having a "strong or strongest bond" by keepers ($p < 0.001$; $p = 0.002$; respectively). Affiliative tactile contact within dyads, described using duration, diversity, symmetry, and variability metrics, was not significantly related to keeper assessments of dyad bond strength. On average, proximity within dyads occurred more often and was less variable than dyads' tactile behaviors. Our results suggest that tactile contact may play a more limited role in the maintenance of zoo elephant social bonds than proximity; however, additional research is needed to confirm this. Additionally, this study suggests that keepers are accurately assessing the proximity behavior of their elephants, highlighting the potential of this survey tool to reliably measure the social bond strength of zoo elephant dyads. © 2017 Reprinted with permission from Elsevier.

K. Boonsri, C. Somgird, P. Noinafai, K. Pringproa, T. Janyamethakul, T. Angkawanish, J.L. Brown, P. Tankaew, S. Srivorakul & C. Thitaram
Elephant endotheliotropic herpesvirus associated with *Clostridium perfringens* infection in two Asian elephant (*Elephas maximus*) calves
Journal of Zoo and Wildlife Medicine 49 (2018) 178-182
Abstract. Elephant endotheliotropic herpesvirus (EEHV) is an infection associated with fatal hemorrhagic disease in young Asian elephants (*Elephas maximus*). This brief communication describes the postmortem evaluation of two Asian elephant calves diagnosed with EEHV4 and EEHV1A in conjunction with *Clostridium perfringens* infection. Case 1 was a 7-mo-old, male captive-born Asian elephant that developed diarrhea and died 2 days after clinical presentation. Examination of the heart, lungs, liver, and spleen revealed predominantly basophilic intranuclear inclusion bodies in the endothelial cells of the blood vessels. Case 2 was a 3-mo-old, female wild-born Asian elephant that showed signs of lethargy, anorexia, and convulsions and died 6 hr after clinical presentation. No intranuclear inclusion bodies were observed. The heart, lung, liver, and spleen of both calves tested positive for EEHV by polymerase chain reaction. Phylogenetic analysis identified EEHV4 and EEHV1A in Case 1 and 2, respectively. Additionally, liver, spleen, and hemorrhagic intestinal tissue samples tested positive for *C. perfringens* α, β, and ε toxins. This is the first reported case to describe coinfection of EEHV and *C. perfringens* in Asian elephant calves. © 2018 American Association of Zoo Veterinarians.

Janine L. Brown
Comparative ovarian function and reproductive monitoring of endangered mammals
Theriogenology 109 (2018) 2-13
Abstract. The ability to track gonadal function is facilitated by the use of endocrine and ultrasound techniques, both of which are important tools

for optimizing reproduction and ensuring sustainability of fragile populations. With so many species now endangered, captive breeding is increasingly viewed as a means to sustain important insurance populations. As reproduction is key to species survival, understanding how to control and monitor ovarian function is vital. Through decades of study, we now have a greater understanding of the diversity, and plasticity, of reproductive mechanisms across taxa. Even within related species, there are marked differences in seasonal, environmental and social influences on ovarian cycle dynamics, ovulatory mechanisms, and responses to assisted reproductive/ovulation induction protocols. For most wildlife species, endocrine function is assessed noninvasively through analyses of hormones or their metabolites excreted in urine or feces. Perhaps it should not be surprising then, that major differences in metabolism and routes of excretion exist, not only between species, but also among hormone types within a species. This means that a species by species, and sometimes hormone by hormone, approach is essential for developing effective reproductive monitoring and control strategies. Over the past 30 years, our laboratory has developed and validated a number of reproductive assay techniques, which has led to our amassing a database of ovarian cycle dynamics on over 100 species. This paper presents an overview of ovarian physiology, and summarizes comparative ovarian function research on some of our most well-studied species: felids, elephants, rhinos, tapirs and the giant panda, and how that information has been used to aid ex situ management. Each of these species represents a range of reproductive strategies, from the highly seasonal, monestrus giant panda to the aseasonal, polyestrus elephant. Some species exhibit spontaneous ovulations, while others are induced ovulators or both, with variations in ovarian cycle lengths that range from a few days to several months. These differences reinforce the need for studies of species basic biology to optimize breeding strategies.

M. Camoin, A. Kocher, P. Chalermwong, S. Yangtarra, N. Thongtip, S. Jittapalapong & M. Desquesnes

Adaptation and evaluation of an ELISA for *Trypanosoma evansi* infection (surra) in elephants and its application to a serological survey in Thailand

Parasitology 145 (2018) 371-377

Abstract. *Trypanosoma evansi*, the causative agent of surra, is widespread in domestic livestock and wildlife in South East Asia. Surra can affect cattle, buffaloes, horses and also Asian elephants (*Elephas maximus*). Despite the 'threatened to extinction' CITES status of elephant, surra's impact has not been thoroughly assessed yet in this species. This work offers to adapt an antibody enzyme-linked immunosorbent assay (ELISA) protocol, to detect *Trypanosoma evansi* antibodies in elephant serum. The test was validated with 365 negative-reference samples, which allowed the determination of a 16% positive threshold. The test was applied to a serological survey including 375 individuals. The estimated global seroprevalence was 2.1% (95% CI 1.1–4.2%). Therefore, surra does not appear to be endemic in Thai domestic elephants, but occasional outbreaks were reported to our laboratory during the survey period. These outbreaks seemed to be linked to close proximity to cattle or buffaloes, and led to severe clinical signs in elephants. Frequent relapses were observed after treatment with diminazene aceturate, the only trypanocide drug currently available in Thailand. Therefore, care should be taken to keep elephants away from bovine reservoirs, and to monitor the disease in this endangered species. ELISA proved to be reliable for screening purposes as well as for post-treatment monitoring. © 2017 Cambridge University Press.

S. Chaichanathong, K. Taya, G. Watanabe, K. Nagaoka, W. Wajjwalku, A. Sudsukh & N. Thongtip

Immunohistochemical localization of inhibin/activin subunits in adult Asian elephant (*Elephas maximus*) testes

Journal of Veterinary Medical Science 80 (2018) 549-552

Abstract. Immunolocalization of inhibin-α and inhibin/activin βA and βB subunits in the testes of Asian elephant was determined. Testicular sections were immunostained with polyclonal antisera against inhibin subunit-α

and inhibin/activin βA and βB using the avidin-biotin-peroxidase complex method. Positive immunostaining against inhibin-α subunit was strongly present in Sertoli cells, and positive immunostaining for the inhibin/activin βA and βB subunits was observed in both Sertoli and Leydig cells. These results indicated that while Sertoli cells are the predominant source of inhibin and activin secretions in the testes of adult male Asian elephant, Leydig cells are a source of activin but not inhibin. © 2018 Japanese Society of Veterinary Science.

W.G.D. Chathuranga & K.B. Ranawana

A preliminary investigation of seed dispersal by elephants (*Elephas maximus maximus*) in Kumaragala Forest Reserve, Matale District, Sri Lanka

Ceylon Journal of Science 46 (2017) 39-46

Abstract. Elephants are capable of dispersing seeds in the wild and hence, have the potential to affect the vegetation dynamics of forests. Only few studies have been conducted in Sri Lanka to study the seed dispersal capability of wild elephants. Thus, this study was initiated to determine the diversity of plant species that are dispersed by the elephants in Kumaragala forest reserve, Central Sri Lanka. Dung piles were searched twice a month and three dung boli were collected randomly from each dung pile. Visible seeds were identified by comparing with a reference seed collection. A total of 84 dung piles were recorded from September 2014 to February 2015. Fifty three dung piles out of 84 (63.1%) contained seeds or seedlings of one or more plant species. Most of the dung piles were found in relatively undisturbed areas of the study site. Twenty two plant species; 15 cultivated (68.2%) and seven non-cultivated (31.8%) plants belonging to nine families were identified from dung boli. *Careya arborea*, *Megathyrsus maximus* and *Mimosa pudica* were the most commonly noted seedlings. The findings of this study prove that elephants assist in dispersing seeds of some plant species in Kumaragala forest reserve area.

S. Debata & K.K. Swain

Estimating mammalian diversity and relative abundance using camera traps in a tropical deciduous forest of Kuldiha Wildlife Sanctuary, eastern India

Mammal Study 43 (2018) 45-53

Abstract. Information on the status and distribution of species within a geographical region is vital for designing effective conservation plans. We assessed the diversity and abundance of medium to large sized mammals in Kuldiha Wildlife Sanctuary, eastern India by using remotely triggered camera traps from January 2013 to August 2013. A total 916 camera trap days at 65 trap stations were deployed. We recorded 912 independent photographs and identified 20 species of mammals. Based on photographic rate of each mammalian species, the small Indian civet *Viverricula indica* represented high relative abundance (RAI = 2.07) among the carnivore while the Asian elephant *Elephas maximus* among the herbivores (RAI = 9.72) and the sloth bear *Melursus ursinus* among the omnivores (RAI = 2.51). Large carnivores like the leopard *Panthera pardus* (RAI = 0.55) and the Asiatic wild dog *Cuon alpinus* (RAI = 0.11) were represented by a relatively low abundance. Frequency of various anthropogenic activities from movement of livestock, feral dogs and human traffic accounted for maximum photo capture (combined RAI = 30.7) and found to be negatively correlated with mammalian relative abundance. So an effective intervention incorporating the social and ecological components is desirable for wildlife conservation in Kuldiha Wildlife Sanctuary. © 2018 Mammal Society of Japan.

L.J. Evans, G.P. Asner & B. Goossens

Protected area management priorities crucial for the future of Bornean elephants

Biological Conservation 221 (2018) 365-373

Abstract. Tropical protected area management strategies have traditionally been heavily skewed towards high carbon, primary forests. This focus can result in areas, such as heavily logged forests, being viewed as low quality and thus offered up for conversion. We assessed the importance of intact to heavily logged forests for the Bornean elephant in the Malaysian state of Sabah. By modelling distributions of elephants throughout Sabah based on GPS telemetry tracking of 29 individuals and airborne three-dimensional forest mapping, we present the most wide-scale

analysis of forest use by Bornean elephants to date. Forests of 13 m in stature were found to be of highest suitability for elephants, especially when these areas were flat and low lying. Forest statures of this order are consistent with degraded landscapes, often viewed as suitable for oil palm conversion. Less than a quarter of fully protected intact forests in Sabah were of suitable stature for elephants, whereas disturbed commercial forest reserves were found to be highly suitable. We suggest that the importance of degraded landscapes for the future of elephants is currently underestimated, and thus, the need for the preservation of such habitats is not seen as a priority. The loss of these landscapes to large-scale agriculture could prove detrimental to the longevity of the species in Borneo.

F. French, C. Mancini & H. Sharp

High tech cognitive and acoustic enrichment for captive elephants

Journal of Neuroscience Methods 300 (2018) 173-183

Abstract. This paper investigates the potential for using technology to support the development of sensory and cognitive enrichment activities for captive elephants. It explores the usefulness of applying conceptual frameworks from interaction design and game design to the problem of developing species-specific smart toys that promote natural behaviours and provide stimulation. We adopted a Research through Design approach, and describe how scientific inquiry supported our design process, while the creation of artefacts guided our investigations into possible future solutions. Our fieldwork resulted in the development of an interactive prototype of an acoustic toy that elephants are able to control using interface elements constructed from a range of natural materials. © 2017 Reprinted with permission from Elsevier.

Herve Fritz

Long-term field studies of elephants: Understanding the ecology and conservation of a long-lived ecosystem engineer

Journal of Mammalogy 98 (2017) 603-611

Abstract. No permission to print abstract.

L. Girdland-Flink, E. Albayrak & A.M. Lister

Genetic insight into an extinct population of Asian elephants (*Elephas maximus*) in the Near East

Open Quaternary 4 (2018) 2, 1-9

Abstract. The current range of the Asian elephant is fragmented and restricted to southern Asia. Its historical range was far wider and extended from Anatolia and the Levant to Central China. The fossil record from these peripheral populations is scant and we know little of their relationship to modern Asian elephants. To gain a first insight to the genetic affinity of an *E. maximus* population that once inhabited Turkey we sequenced ca. 570 bp mtDNA from four individuals dating to ~3500 cal. BP. We show that these elephants carried a rare haplotype previously only observed in one modern elephant from Thailand. These results clarify the taxonomic identity of specimens with indeterminate morphologies and show that this ancient population groups within extant genetic variation. By placing the age of the common ancestor of this haplotype in the interval 3.7–58.7 kya (mean = 23.5 kya) we show that range-wide connectivity occurred at some time or times since the start of MIS 3, ~57 kya, probably reflecting range and population expansion during a favourable climatic episode. The genetic data do not distinguish natural versus anthropogenic origin of the Near Eastern Bronze Age population, but together with archaeological and paleoclimatic data they allow the possibility of a natural westward expansion around that time. © 2018 The Authors.

T.N.E. Gray, A.C. Hughes, W.F. Laurance, B. Long, A.J. Lynam, H. O'Kelly, W.J. Ripple, T. Seng, L. Scotson & N.M. Wilkinson

The wildlife snaring crisis: An insidious and pervasive threat to biodiversity in Southeast Asia

Biodiversity and Conserv. 27 (2018) 1031-1037

Abstract. Southeast Asia, a region supporting more threatened species than any other comparable continental area, is in the midst of a conservation crisis. Hunting constitutes the greatest current threat to the region's threatened vertebrates and has resulted in many areas of largely intact forest losing much of their former vertebrate diversity and abundance. Though numerous hunting

methods are used, capture with homemade snares is a major driver of this defaunation. Snares are cheaply constructed and easy to set but can be difficult to detect and are highly damaging to vertebrate populations due to their indiscriminate and wasteful nature. The primary response to snaring is the removal of snares by patrol teams: more than 200,000 snares were removed from just five of the region's protected areas between 2010 and 2015. However due to the low opportunity costs of replacing snares, removal alone is largely ineffective. Without the proactive search, arrest and prosecution of snare-setters, along with incentives not to hunt, snares will continue to be replaced. Legislative reform that criminalises the possession of snares, and the materials used for their construction, inside and immediately adjacent to protected areas is also required. Consistent enforcement of such legislation is essential. This must be combined with longer-term demand reduction activities aimed at changing cultural attitudes and behaviors related to the consumption of wildlife products in Southeast Asia.

E.M. Gross, B.P. Lahkar, N. Subedi, V.R. Nyirenda, L.L. Lichtenfeld & O. Jakoby

Seasonality, crop type and crop phenology influence crop damage by wildlife herbivores in Africa and Asia

Biodiversity and Conserv. 27 (2018) 2029-2050

Abstract. Wildlife species damaging crops can cause substantial losses to farmers and at the same time create negative attitudes against wildlife and conservation efforts that may result in negative interactions against wildlife and lead to human-wildlife conflicts (HWCs). For the analysis of negative interactions between humans and terrestrial wildlife species, a globally applicable scheme for monitoring was developed and applied over 6 years in study areas of two Asian (Nepal and India) and two African (Zambia and Tanzania) countries. Factors influencing crop consumption by eight different groups of herbivores were monitored and analyzed using generalized linear models. Seasonality, crop availability, type and the phenological stage of the crop seem to play an important role in the crop damaging behavior of herbivores. Crop consumers such as elephants (*Loxodonta africana* and *Elephas maximus*), zebra (*Equus quagga* spp.) and boars/hogs (*Sus scrofa*, *Potamocherus larvatus* and *Phacochoerus africanus*) show preferences for harvested and/or maturing crops. Rhinos (*Rhinoceros unicornis*) and antelopes/deer (*Taurotragus oryx*, *Aepyceros melampus*, *Boselaphus tragocamelus* and *Axis axis*) damage the highest numbers of fields with crops at an intermediate growth stage. The findings of this study can inform management of HWCs in areas where people and wildlife coexist. Furthermore, this study demonstrates the benefits of standardized HWC assessments in order to compare data from different continents and between different species to be able to draw generalized conclusions for the management of HWC. © 2018 Reprinted by permission from Springer Nature.

R. Hermes, J. Saragusty, I. Moser, S. Holtze, J. Nieter, K. Sachse, T. Voracek, A. Bernhard, T. Bouts, F. Göritz & T.B. Hildebrandt

Bronchoalveolar lavage for diagnosis of tuberculosis infection in elephants

Epidemiology and Infection 146 (2018) 481-488

Abstract. Tuberculosis (TB) has been known to affect elephants for thousands of years. It was put into spotlight when few circus elephants were diagnosed carrying *Mycobacterium tuberculosis*. Because of the zoonotic risk and high susceptibility to *M. tuberculosis*, periodic testing was enacted since, in captive breeding programmes. Presently, trunk wash is the recommended diagnostic procedure for TB. Trunk wash, however, puts the operator at risk, has low sensitivity, and is prone to contamination. Here, bronchoalveolar lavage is described for the first time for TB diagnosis in elephants. Bronchial, trunk and mouth fluids were investigated using bacterial culture, *M. tuberculosis* complex (MTC)-specific real-time quantitative PCR (qPCR) and mycobacterial genus-specific qPCR for overall presence of mycobacteria or mycobacterial DNA including bacteria or DNA of closely related genera, respectively, in 14 elephants. Neither bacteria of the MTC nor their DNA were identified in any of the elephants. Yet, 25% of the cultures grew non-tuberculous mycobacteria (NTM) or closely related bacterial species. Furthermore, 85% of the samples contained DNA of NTM

or closely related bacterial genera. This finding might explain continued false-positive results from various serological tests. From a zoonotic point of view, bronchoalveolar lavage is safer for the testing personal, has higher probability of capturing MTC and, through PCR, identifies DNA NTM in elephants. Yet, necessary endoscopic equipment, animal sedation and access to a TB reference laboratory might pose challenging requirements in remote conditions in some elephant range countries. © 2018 Cambridge University Press.

K. Islam, M.F. Rahman & M. Jashimuddin

Modeling land use change using Cellular Automata and Artificial Neural Network: The case of Chunati Wildlife Sanctuary, Bangladesh

Ecological Indicators 88 (2018) 439-453

Abstract. Land use changes generally affect the integrity of an ecosystem. The effect of this change can be very severe if the conversion disrupts a crucial habitat of major plants and animals. The degraded Chunati Wildlife Sanctuary is one such area of Bangladesh, which is facing a serious problem of rapid land use change. In this study, the future trend of land use change of the area was modelled using Artificial Neural Network. Several driver variables were also incorporated to determine their effect on land use change. Binary logistic regression was used to assess the significance of the drivers of land use change for this region. The analysis shows that nearly 76% of the total land area (8258 ha) was covered by vegetation during 2005. After 2005, that was reduced to 61% (6637 ha) in 2015, a 15% decline from 2005. On the other hand, the coverage of vacant land increased from nearly 10% in 2005 to 22% in 2015. This is indeed a matter of real concern. The critical analysis suggests that Cellular Automata is not a good fit to simulate the future land uses as it misdirects the analysis both spatially and numerically. The incorporation of driver variables gives strength to the Artificial Neural Network to predict the future. The chi-square value for the prediction of land use of the area found from the neural network was 7.815, which was greater than the critical value (3.316). The neural network was found to be a good fit for future land use prediction. The kappa index of variation shows that the overall accuracy of the prediction using neural network was above 90%. Elevation, slope, and distance to the road were the three driver variables, which were found statistically significant while predicting the probability of forest land use change. The accuracy of the binary logistic regression was about 61%, which was quite satisfactory. The simulation result shows that almost 5732 ha of the total land will be in the forest category of land use during 2020 and it will be further decreased to 5128 ha in 2025. The vacant area will increase from 24% to 31% from 2020 to 2025. Based on the findings and simulated land use map of 2020–2025, the study will help the management authority of this critical habitat to take proper action before further degradation occurs. © 2018 Reprinted with permission from Elsevier.

G. Johnson, J. Smith, J. Peddie, L. Peddie, J. DeMarco & E. Wiedner

Use of glue-on shoes to improve conformational abnormalities in two Asian elephants (*Elephas maximus*)

Journal of Zoo and Wildlife Medicine 49 (2018) 183-188

Abstract. This report describes the use of custom-made, glue-on shoes for the front feet of two female adult Asian elephants (*Elephas maximus*) with conformational abnormalities. Both elephants had unequal leg lengths. The first elephant also had bilateral fetlock varus causing recurrent nail infections of the fourth digits of the front feet. The second elephant displayed weight shifting. Over several years, multiple shoe prototypes were tested. The current version is made of two types of shoe rubber, glued together and attached to the pad of the shorter leg with a liquid adhesive. The first elephant also has bilateral wedge pads to offload pressure from the fourth nails. The shoes are removed each month for foot care, then replaced. Within several months of wearing shoes, the first elephant's nail infections healed and the second elephant stopped weight shifting. Both elephants' gaits became smoother. This is the first description of corrective shoeing in elephants. © 2018 American Association of Zoo Veterinarians.

K. Karenina, A. Giljov, S. de Silva & Y. Malashichev

Social lateralization in wild Asian elephants: Visual preferences of mothers and offspring
Behavioral Ecology and Sociobiol. 72 (2018) e21
Abstract. Theoretical and empirical evidence suggest that socio-biological factors determine the expression of behavioural lateralization across species. One would expect the same association at the intraspecific level, that is, that the differences in social strategies of the two sexes entail the sex differences in the lateralized social processing. This study aimed to test whether this hypothesis applies to the lateralized behaviour of offspring towards a mother. The preferences in the use of the lateral visual field of the left and right eye were assessed in wild Asian elephant, *Elephas maximus* mothers and their young sons and daughters. The spatial positioning relative to a social partner during approach was used as a behavioural indicator of visual lateralization. At the population level, elephant mothers preferred to keep the young in their left visual field during slow travelling. In contrast, young did not display a one-sided bias for the whole sample. The lateralization, however, was pronounced in a sex-specific manner—sons preferentially kept their mothers in the right visual field, while daughters preferred to keep mothers in the left visual field. Intriguingly, both sons and daughters preferentially kept the familiar older young in the left visual field. Sons, thus, showed oppositely directed lateral preferences towards mother and non-mother companion. Presumably, sons aim to approach the mother from her left side (rather than to keep her in the right visual field) and benefit from optimized maternal perception, while daughters facilitate their own perception of the mother by keeping her in the left visual field. These sex-related differences in lateralized behaviour may result from strikingly different social strategies of two sexes. © 2018 Reprinted by permission from Springer-Verlag.

L. King, M. Pardo, S. Weerathunga, T.V. Kumara, N. Jayasena, J. Soltis & S. de Silva
Wild Sri Lankan elephants retreat from the sound of disturbed Asian honey bees
Current Biology 28 (2018) R51-R65
Abstract. Asian elephants (*Elephas maximus*) are threatened primarily by habitat loss and human–elephant conflict. In addition to establishing protected areas and corridors for wildlife, empowering farmers to protect their crops is crucial for Asian elephant conservation. Elephants can habituate to artificial deterrents, hence natural biological alternatives are of great interest. African elephants (*Loxodonta africana*) avoid African honey bees (*Apis mellifera scutellata*), inspiring 'beehive fences' as a successful means of small-scale crop protection. Here, we used a recording of a disturbed hive of cavity-dwelling Asian honey bees (*Apis cerana indica*) and conducted sound playbacks to 120 wild elephants in 28 different groups resting under trees in Uda Walawe National Park in Sri Lanka. Elephants responded by moving significantly further away from their resting site in bee playback trials compared to controls. Elephants also increased vocalization rates, as well as investigative and reassurance behaviours in response to bee sounds, but did not display dusting or headshaking behaviour. © 2018 Reprinted with permission from Elsevier.

V. Kochagul, S. Srivorakul, K. Boonsri, C. Somgird, N. Sthitmatee, C. Thitaram & K. Pringproa
Production of antibody against elephant endotheliotropic herpesvirus (EEHV) unveils tissue tropisms and routes of viral transmission in EEHV-infected Asian elephants
Scientific Reports 8 (2018) e4675
Abstract. Elephant endotheliotropic herpesvirus (EEHV) is one of the most devastating viral infectious diseases in elephants worldwide. To date, it remains unclear how elephants get infected by the virus, where the virus persists, and what mechanisms drive the pathogenesis of the disease. The present study was aimed to develop an antibody against glycoprotein B (gB) of EEHV, investigate the EEHV tissue tropisms, and provide the possible routes of EEHV transmission in Asian elephants. Samples from elephant organs that had died from EEHV1A and EEHV4 infections, peripheral blood mononuclear cells (PBMC) from EEHV4- and non-EEHV-infected calves were used in this study. The results of western immunoblotting indicated that the antibody can be used for detection of gB antigens in both EEHV1A- and EEHV4-infected samples. Immunohistochemical detection indicated that the EEHV gB antigens

were distributed mainly in the epithelial cells of the salivary glands, stomach and intestines. Immunofluorescence test of PBMC for EEHV gB in the EEHV4-infected calf indicated that the virus was observed predominantly in the mononuclear phagocytic cells. The findings in the present study unveil tissue tropisms in the EEHV1A- and EEHV4-infected calves and point out that saliva and intestinal content are likely sources for virus transmission in EEHV-infected Asian elephants. © 2018 The Authors.

C.A. LaDue, T.E. Goodwin & B.A. Schulte
Concentration-dependent chemosensory responses towards pheromones are influenced by receiver attributes in Asian elephants
Ethology 124 (2018) 387-399
Abstract. The physical structure of a signal is not sufficient to determine its meaning. For chemical signals between conspecifics, this concept is termed "pheromonal parsimony." The function of a compound depends not only on its molecular structure but also on its context, which can include signal concentration and various receiver at- tributes. We sought to investigate the contextual flexibility of chemosensory responses through bioassays with Asian elephant (*Elephas maximus*) sex pheromones of various concentrations (frontalin, from males, and (Z)-7-dodecenyl acetate [Z7-12:Ac], from females). We hypothesized that elephants would respond stronger to higher concentrations, especially towards the opposite-sex pheromone, and that receiver age and sexual experience would modify responses. We examined responses of 73 captive elephants to both compounds. Pheromone concentration impacted the rate of chemosensory response, which was further modified by the sex, age and/or sexual experience of the receiver. Response rates increased with concentration for each compound across both sexes. Experience shaped male responses with older, physiologically primed males responding more often. The interaction between experience and age affected female response to frontalin, but not to Z7-12:Ac. Furthermore, response thresholds were modified by sexual experience in most cases: experienced animals generally had lower thresholds than inexperienced animals. Elephants responded to each solution according to its perceived relevance, including concentration. These results also indicate that receiver attributes (e.g., sex, age and sexual experience) may modify seemingly fixed chemosensory responses and further emphasize the flexibility of vertebrate communication systems. © 2018 Blackwell Verlag GmbH.

Nicolas Lainé
Elephant tuberculosis as a reverse zoonosis
Medicine Anthropology Theory 5 (2018) 157-176
Abstract. In the last twenty years, a growing number of captive elephants have tested positive for tuberculosis (TB) in various institutions worldwide, causing public health concerns. This article discusses two localities where this concern has produced significant mobilizations to ask about the postcolonial resonances of this global response. The first case focuses on epidemiological studies of elephant TB in Laos launched by international organizations involved in conservation, and on the role of traditional elephant workers (mahouts) in the daily care for elephants. The second describes the finding by veterinarians of two elephants suspected of TB infection in a French zoo and the mobilization of animal rights activists against the euthanasia of the pachyderms. The article shows that while, in the recent past, in France elephants were considered markers of exoticism and in Laos as coworkers in the timber industry, they are now considered to be endangered subjects in need of care, compassion, and conservation. This analysis contributes to the anthropology of relations between humans and elephants through the study of a rare but fascinating zoonosis. © 2018 The Author.

B.R. Lamichhane, N. Subedi, C.P. Pokheral, M. Dhakal, K.P. Acharya, N.M.B. Pradhan, J.L.D. Smith, S. Malla, B.S. Thakuri & C.B. Yackulic
Using interviews and biological sign surveys to infer seasonal use of forested and agricultural portions of a human-dominated landscape by Asian elephants in Nepal
Ethology Ecology & Evol. 30 (2018) 331-347
Abstract. Understanding how wide-ranging animals use landscapes in which human use is highly heterogeneous is important for determining patterns of human–wildlife conflict

and designing mitigation strategies. Here, we show how biological sign surveys in forested components of a human-dominated landscape can be combined with human interviews in agricultural portions of a landscape to provide a full picture of seasonal use of different landscape components by wide-ranging animals and resulting human–wildlife conflict. We selected Asian elephants (*Elephas maximus*) in Nepal to illustrate this approach. Asian elephants are threatened throughout their geographic range, and there are large gaps in our understanding of their landscape-scale habitat use. We identified all potential elephant habitat in Nepal and divided the potential habitat into sampling units based on a 10 km by 10 km grid. Forested areas within grids were surveyed for signs of elephant use, and local villagers were interviewed regarding elephant use of agricultural areas and instances of conflict. Data were analyzed using single-season and multi-season (dynamic) occupancy models. A single-season occupancy model applied to data from 139 partially or wholly forested grid cells estimated that 0.57 of grid cells were used by elephants. Dynamic occupancy models fit to data from interviews across 158 grid cells estimated that monthly use of non-forested, human-dominated areas over the preceding year varied between 0.43 and 0.82 with a minimum in February and maximum in October. Seasonal patterns of crop raiding by elephants coincided with monthly elephant use of human-dominated areas, and serious instances of human–wildlife conflict were common. Efforts to mitigate human–elephant conflict in Nepal are likely to be most effective if they are concentrated during August through December when elephant use of human-dominated landscapes and human–elephant conflict are most common.

L. Lin & L. Zhang

The impact on local forest ecosystem by elephants

Acta Theriologica Sinica 38 (2018) 411-419

Abstract. Current taxonomy recognizes three extant species of elephants (Elephantidae), the African bush elephant *Lodonta africana*, the African forest elephant *Loxodonta cyclotis* and the Asian elephant *Elephas maximus*. As large herbivores and an excellent keystone species, elephants can cause positive and / or negative impacts on their surrounding environments and these impacts can vary in both temporal and spatial scales. The positive impacts include: improved seed dispersal and germination; creating forest gaps and maintaining community diversity; and enriching food resources and habitat for other animals. The negative impacts include: causing biodiversity loss by reducing locally vulnerable species, and causing habitat degradation by transforming local plant communities from woodlands to shrub lands or grass lands. Population over-abundance by confinement to habitat islands due to habitat loss is mainly responsible for the negative impacts caused by elephants. Simply culling off elephants would not be an effective mitigation strategy to offset their negative impacts and is strongly discouraged. Rigorous scientific information on effective ways to evaluate and alleviate the negative impact of elephants and to guide proper management plans still is lacking. Local environmental conditions and site-specific objectives should be considered when developing management actions to curb the negative impact of elephants on woody vegetation. All elephant species, including African bush elephant, African forest elephant and Asian elephants, are currently facing severe population declines and habit loss. In order to save them from extinction, it is imperative to conduct more comprehensive research to better understand the relationship between elephants and the ecosystems in which they live. [MAIN TEXT IN CHINESE].

S. Liu, Y. Yin, J. Li, F. Cheng, S. Dong & Y. Zhang

Using cross-scale landscape connectivity indices to identify key habitat resource patches for Asian elephants in Xishuangbanna, China

Landscape and Urban Planning 171 (2018) 80-87

Abstract. The landscape connectivity of natural habitats serves an important role in the migration and survival of animals. In southwestern China, the rapid decline of the Asian elephant (*Elephas maximus*) population has been attributed to habitat loss and fragmentation due to recent land-

use changes. Despite efforts to protect the Asian elephants' habitats, an analysis on the cross-scale landscape connectivity within and among these habitats has rarely been documented. In this study, we focused in Xishuangbanna, China and first identified the key patches for the Asian elephant in Xishuangbanna, China. We then evaluated the landscape connectivity and compared scenarios for eight dispersal distances of the resource patches. Levels of importance for each individual patch were evaluated by calculating the probability of connectivity (dPC) and betweenness centrality (dBC). Results showed that habitats with high suitability occupied 29% of the studied area. The distribution of patch importance levels was determined separately by dPC and dBC, and these two indices corresponded with each other via the connector fraction of dPC ($dPC_{connector}$) index. The final total area of the priority patches was 2478 km^2, or approximately 76% of the suitable habitat area. Our study indicated that the cross-scale landscape connectivity analysis is an effective approach to characterize the key patches, and the priority patches for Asian elephants can be selected by using both dBC and dPC in Xishuangbanna.

K.P. Lyashchenko, C. Gortázar, M.A. Miller & W.R. Waters

Spectrum of antibody profiles in tuberculous elephants, cervids, and cattle

Veterinary Microbiology 214 (2018) 89-92

Abstract. Using multi-antigen print immuno-assay and DPP® VetTB Assay approved in the United States for testing captive cervids and elephants, we analyzed antibody recognition of MPB83 and CFP10/ESAT-6 antigens in Asian elephants (*Elephas maximus*) infected with Mycobacterium tuberculosis and in white-tailed deer (*Odocoileus virginianus*), fallow deer (*Dama dama*), elk (*Cervus elaphus*), and cattle (*Bos taurus*) infected with *Mycobacterium bovis*. Serum IgG reactivity to MPB83 was found in the vast majority of tuberculous cattle and cervid species among which white-tailed deer and elk also showed significant CFP10/ESAT-6 recognition rates with added serodiagnostic value. In contrast, the infected elephants developed antibody responses mainly to CFP10/ESAT-6 with MPB83 reactivity being relatively low. The findings demonstrate distinct patterns of predominant antigen recognition by different animal hosts in tuberculosis. © 2017 Reprinted with permission from Elsevier.

S.S.B. Moo, G.Z.L. Froese & T.N.E. Gray

First structured camera-trap surveys in Karen State, Myanmar, reveal high diversity of globally threatened mammals

Oryx 52 (2018) 537-543

Abstract. The hill forests of Karen State, Myanmar, were previously inaccessible to biologists and conservationists for security and political reasons. We have, however, now been able to conduct six surveys across the area, using camera traps, for a total of 9,511 trap-nights, to ascertain the presence of threatened mammal species. We obtained 4,191 records of at least 31 mammal species, including 17 categorized as Near Threatened, Vulnerable or Endangered on the IUCN Red List. Carnivores were especially diverse, with 19 species recorded, indicating a globally significant community, including the tiger *Panthera tigris*, leopard *Panthera pardus* and dhole *Cuon alpinus*. Our methodology was not appropriate for estimating relative abundance or occupancy but the species richness of the mammal community, the number of records and the number of locations where species were detected suggest the area is important for the conservation of a globally threatened mammal community that is in decline across the majority of its range. Despite long-standing conservation efforts undertaken by the Karen people, their forests are threatened by hunting and habitat loss. These threats are likely to be exacerbated as political change brings rapid development. Urgent action is thus needed to assist the Karen people to protect one of South-east Asia's last intact rich and diverse ecosystems.

S. Nandini, P. Keerthipriya & T.N.C. Vidya

Group size differences may mask underlying similarities in social structure: A comparison of female elephant societies

Behavioral Ecology 29 (2018) 145-159

Abstract. No permission to print abstract.

T. Nguyen & J.L. Frechette

The market for elephant ivory in Cambodia

Traffic Bulletin 29 (2017) 65-72

Abstract. This study aimed to evaluate the potentially important and under- studied market for ivory in Cambodia. Market surveys were conducted in June 2015 and January 2016 to assess the number of ivory items for sale, the price of items, and the demographics of the customer base in three Cambodian cities (Phnom Penh, Siem Reap, Sihanoukville). Each city was systematically surveyed to identify ivory vendors. In 2015, 10 retail outlets in Phnom Penh and five retail outlets in Siem Reap were identified as selling elephant ivory, offering a total of 502 and 282 ivory items, respectively. Surveys in January 2016 showed that the number of shops offering ivory had increased to 16 (670 items) in Phnom Penh and eight shops (446 items) in Siem Reap. No elephant ivory was found during either survey in Sihanoukville. Vendors reported that the main consumers of ivory were foreign, particularly Chinese nationals. This study shows that there is a persistent market for ivory in Cambodia, which may be driven largely by foreign buyers from China.

A. Pérez-Manrique & A. Gomila

The comparative study of empathy: Sympathetic concern and empathic perspective-taking in non-human animals

Biological Reviews 93 (2018) 248-269

Abstract. While empathy is a century-old psychological concept, its study in non-human animals has become the focus of much recent scientific interest, as it promises to provide the clues to understand the evolutionary origins of our social and moral nature. A review of the comparative study of empathy is thus timely to complement and constrain anthropocentric views, and to integrate current findings. However, this is not an easy task. The study of animal empathy has developed using different paradigms, different concepts of the phenomena involved, and the absence of a systematic program. Herein, we carry out a comprehensive review of the literature on complex forms of empathy in non-human animals: sympathetic concern and empathic perspective-taking. In particular, we focus on consolation and targeted helping, as the best examples of each category. In so doing, we try to shed light on the current debate concerning whether these phenomena are exclusively human traits. First, we try to clarify the terminology and taxonomy of forms of empathy, providing operative criteria for these phenomena that are applicable to both human and non-human animals. Second, we discuss whether the available evidence qualifies such behaviour as empathic. Third, we aim to provide an integrative view of the field, clarifying the challenges and conditions to satisfy. We also hope to highlight the importance of the study of these processes for elucidating the evolutionary history of this capacity across the animal kingdom.

K.L. Perrin, A.K. Krogh, M. Kjelgaard-Hansen, L. Howard, L. Bochsen, W.K. Kiso, D. Schmitt, A.T. Kristensen & M.F. Bertelsen

Thromboelastography in the healthy Asian elephant (*Elephas maximus*): Reference intervals and effects of storage

Journal of Zoo and Wildlife Medicine 49 (2018) 54-63

Abstract. Hemorrhagic disease associated with elephant endotheliotropic herpesvirus infection is the most-frequent cause of mortality in captive Asian elephants (*Elephas maximus*). Survival relies on intensive monitoring of hemostatic status. Thromboelastography (TEG) utilizes whole blood samples containing all the blood components of hemostasis and is therefore a sensitive indicator of the clinical status in the patient. This study was performed to assess the practicability of TEG in Asian elephants in a zoo environment. Citrated stabilized whole blood samples were obtained from 44 healthy Asian elephants. Kaolin-activated TEG was performed on whole blood at 60 min and 24 hr postsampling (to replicate shipment to an external laboratory) as well as on freeze–thawed plasma samples, 12–14 mo postsampling. Reference intervals were calculated for fresh whole blood and freeze–thawed plasma samples. In the 24-hr analysis, storage artifacts, likely due to cellular degeneration, resulted in a hypercoagulable thromboelastogram and thus reduced sensitivity for detecting coagulopathies. Therefore, delayed analysis of whole blood samples is not

recommended. © 2018 American Association of Zoo Veterinarians.

A. Pinyopummin, S. Mahasawangkul, G. Nunklang, K. Kornkaewrat, S. Laopiem, S. Koonjaenak & P. Wattananit

Supplemented stallion seminal plasma can improve impaired motility due to the dilution effect in chilled Asian elephant sperm

Reproduction in Domestic Animals 53 (2018) 525-533

Abstract. The dilution effect and effect of restoring seminal plasma (SP) proportion in diluted semen were determined in chilled Asian elephant sperm. Semen was collected from eight males, and samples with ≥30% motile sperm were used in the study. Tris - glucose - egg yolk extender (TE) was used for cooled storage at 4°C for 48 hr. In experiment 1 (n = 18), semen was diluted to 1:1, 1:3, 1:7 and 1:15 with TE (volume per volume). There were no significant changes in sperm viability and sperm with normal acrosome integrity among dilutions, but sperm motility and motility velocities were greater ($p < .05$) in the 1:1 dilution than those of the 1:7 and 1:15 dilutions at 48 hr of storage. In experiment 2, supplemented SP was derived from elephants and stallions. In experiment 2.1, diluted semen (1:7 dilution) was restored with SP to obtain a 1:2 proportion (n = 8). Sperm motility, viability and sperm with normal acrosome integrity were similar among treatments, but motility velocities were greater ($p < .05$) with stallion SP at 48 hr of storage. In experiment 2.2, diluted semen (1:15 dilution) was restored with SP to obtain a 1:3 proportion (n = 10). Sperm viability and sperm with normal acrosome integrity were similar among treatments at 48 hr of storage. However, sperm motility and motility velocities were greater ($p < .05$) with stallion SP than those of others. In conclusion, elephant sperm motility was affected by a dilution effect and restoration of SP proportion with stallion SP, but not with elephant SP, could improve motility in chilled highly diluted sperm. © 2018 Blackwell Verlag.

J. Podani, A. Kun & A. Szilágyi

How fast does Darwin's elephant population grow?

J. of the History of Biology 51 (2018) 259-281

Abstract. In "The Origin of Species," Darwin describes a hypothetical example illustrating that large, slowly reproducing mammals such as the elephant can reach very large numbers if population growth is not affected by regulating factors. The elephant example has since been cited in various forms in a wide variety of books, ranging from educational material to encyclopedias. However, Darwin's text was changed over the six editions of the book, although some errors in the mathematics persisted throughout. In addition, full details of the problem remained hidden in his correspondence with readers of the Origin. As a result, Darwin's example is very often misinterpreted, misunderstood or presented as if it were a fact. We show that the population growth of Darwin's elephant population can be modeled by the Leslie matrix method, which we generalize here to males as well. Darwin's most often cited figure, about 19 million elephants after 750 years is not a typical outcome, actually a very unlikely result under more realistic, although still hypothetical situations. We provide a recursion formula suggesting that Darwin's original model corresponds to a tribonacci series, a proof showing that sex ratio is constant over all age classes, and a derivation of a generating function of the sequence. © 2017 reprinted by permission from Springer Science+Business Media.

A.D.G. Ranjeewa, J. Pastorini, K. Isler, D.K. Weerakoon, H.D. Kottage & P. Fernando

Decreasing reservoir water levels improve habitat quality for Asian elephants

Mammalian Biology 88 (2018) 130-137

Population health and habitat quality are intimately related and seasonal changes in habitat quality are likely to be reflected in the body condition of animals. We studied seasonal variation of body condition in free ranging Asian elephants (*Elephas maximus*) in Udawalawe National Park, Sri Lanka based on visual scoring of individually identified elephants. We assessed the body condition of 218 adult females and 329 adult males from January 2008 to November 2012 and examined its relation to monthly rainfall and water level of the Udawalawe reservoir. Contrary to expectations, body condition of elephants was higher in the dry season, when primary

productivity decreases due to lack of rainfall. However, the body condition showed both a seasonal and inter-annual negative co-relation with reservoir water level. A possible explanation for improved body condition in the dry season is the greater availability of fresh grass due to the emergence of reservoir bed grasslands with the drawdown of water. Our results underscore the importance of water management of large irrigation reservoirs in elephant conservation in Sri Lanka. © 2017 Deutsche Gesellschaft für Säugetierkunde. Reprinted with permission from Elsevier.

C. Sampson, P. Leimgruber, D. Tonkyn, J. Pastorini, H.K. Janaka, E. Sotherden & P. Fernando

Effects of illegal grazing and invasive *Lantana camara* on Asian elephant habitat use

Biological Conservation 220 (2018) 50-59

Abstract. Protected areas provide some of the last refuges for Asian elephants in the wild. Managing these areas for elephants will be critical for elephant conservation. Scientists know little about elephant habitat use in Asia and how invasive species or livestock grazing influence habitat use. We studied these issues in two protected areas in Sri Lanka, Udawalawe National Park and Hurulu Eco-Park. These areas contain some of Sri Lanka's largest remaining grasslands. These grasslands are threatened by the invasive and toxic shrub, *Lantana camara*, and are used for illegal livestock grazing. To measure habitat use by elephants and livestock, we conducted dung surveys along over 50 km of transects stratified across grassland, scrub, and forest. We surveyed 159 vegetation plots along these transects to assess plant composition, and mapped habitat types based on satellite images. We used mixed-effect models to determine the relative importance of habitats, livestock presence, and plant associations for elephant use. Elephant presence was greatest in scrub and grassland habitats, positively associated with both livestock presence and short graminoids, and unaffected by *L. camara*, which was widespread but at low densities. Given the importance of these areas to elephants, we recommend a precautionary management approach that focuses on curbing both illegal grazing and the spread of *L. camara*. © 2018 Reprinted with permission from Elsevier.

C. Sampson, J. McEvoy, Z.M. Oo, A.M. Chit, A.N. Chan, D. Tonkyn, P. Soe, M. Songer, A.C. Williams, K. Reisinger, G. Wittemyer & P. Leimgruber

New elephant crisis in Asia — Early warning signs from Myanmar

PLoS ONE 13 (2018) e0194113

Abstract. In the southern Bago Yoma mountain range in Myanmar, Asian elephants are being killed at a disturbing rate. This emerging crisis was identified initially through a telemetry study when 7 of 19 of collared elephants were poached within a year of being fitted with a satellite-GPS collar. Subsequent follow up of ground teams confirmed the human caused death or disappearance of at least 19 elephants, including the seven collared individuals, within a 35 km2 area in less than two years. The carcasses of 40 additional elephants were found in areas located across south-central Myanmar once systematic surveys began by our team and collaborators. In addition to the extreme rate of loss, this study documents the targeting of elephants for their skin instead of the more common ivory, an increasing trend in Myanmar. Intensive research programs focused on other conservation problems identified this issue and are now encouraging local authorities to prioritize anti-poaching efforts and improve conservation policies within the country. Myanmar represents one of the last remaining countries in Asia with substantial wildlands suitable for elephants. Increasing rates of human-elephant conflict and poaching events in this country pose a dire threat to the global population.

C. Schiffmann, S. Hoby, C. Wenker, T. Hard, R. Scholz, M. Clauss & J.-M. Hatt

When elephants fall asleep: A literature review on elephant rest with case studies on elephant falling bouts, and practical solutions for zoo elephants

Zoo Biology 37 (2018) 133-145

Abstract. Little attention has been paid to the resting and sleeping behavior of zoo elephants so far. An important concern is when elephants avoid lying down, due to degenerative joint

and foot disease, social structure, or stressful environmental changes. Inability or unwillingness to lie down for resting is an important welfare issue, as it may impair sleep. We emphasize the importance of satisfying rest in elephants by reviewing the literature on resting behavior in elephants (*Loxodonta africana* and *Elephas maximus*) as well as the documentation of four cases from European zoos and our own direct observations in a zoo group of four female African elephants during 12 entire days. The common denominator in the case reports is the occurrence of a falling bout out of a standing position subsequently to a cessation of lying rest for different periods of time. Although well-known in horses as "episodic collapse" or "excessive drowsiness," this syndrome has not been described in elephants before. To enable its detection, we recommend nocturnal video monitoring for elephant-keeping institutions. The literature evaluation as well as own observational data suggest an inverse relationship between lying rest and standing rest. Preventative measures consist of enclosure modifications that facilitate lying rest (e.g., sand hills) or standing rest in a leaning position as a substitute. Anecdotal observations suggest that the provision of appropriate horizontal environmental structures may encourage safe, sleep-conducive standing rest. We provide drawings on how to install such structures. Effects of providing such structures should be evaluated in the future. © 2018 Wiley Periodicals.

M.W. Seltmann, S. Helle, M.J. Adams, K.U Mar & M. Lahdenperä

Evaluating the personality structure of semi-captive Asian elephants living in their natural habitat

Royal Society Open Science 5 (2018) e172026

Abstract. Data on personality for long-lived, highly social wild mammals with high cognitive abilities are rare. We investigated the personality structure of Asian elephants (*Elephas maximus*) by using a large sample of semi-captive timber elephants in Myanmar. Data were collected during 2014–2017 using questionnaires, for which elephant riders (mahouts) rated 28 behavioural adjectives of elephants. Repeated questionnaires were obtained for each elephant from several raters whenever possible, resulting in 690 ratings of 150 female and 107 male elephants. We started by performing a confirmatory factor analysis to compare the fit of our data to a previously published captive elephant personality structure. Owing to a poor fit of this model to our data, we proceeded by performing explanatory factor analysis to determine the personality structure in our study population. This model suggested that personality in these elephants was manifested as three factors that we labelled as Attentiveness, Sociability and Aggressiveness. This structure did not differ between the sexes. These results provide the basis for future research on the link between personality and reproductive success in this endangered species and more generally, help to resolve the selective pressures on personalities in long-lived, highly social species. © 2018 The Authors.

R. Sharma, B. Goossens, R. Heller, R. Rasteiro, N. Othman, M.W. Bruford & L. Chikhi

Genetic analyses favour an ancient and natural origin of elephants on Borneo

Scientific Reports 8 (2018) e880

Abstract. The origin of the elephant on the island of Borneo remains elusive. Research has suggested two alternative hypotheses: the Bornean elephant stems either from a recent introduction in the 17th century or from an ancient colonization several hundreds of thousands years ago. Lack of elephant fossils has been interpreted as evidence for a very recent introduction, whereas mtDNA divergence from other Asian elephants has been argued to favor an ancient colonization. We investigated the demographic history of Bornean elephants using full-likelihood and approximate Bayesian computation analyses. Our results are at odds with both the recent and ancient colonization hypotheses, and favour a third intermediate scenario. We find that genetic data favour a scenario in which Bornean elephants experienced a bottleneck during the last glacial period, possibly as a consequence of the colonization of Borneo, and from which it has slowly recovered since. Altogether the data support a natural colonization of Bornean elephants at a time when large terrestrial mammals could colonise from the Sunda shelf when sea levels were much lower. Our results are important

not only in understanding the unique history of the colonization of Borneo by elephants, but also for their long-term conservation. © 2018 The Authors.

P. Siengdee, S. Klinhom, C. Thitaram & K. Nganvongpanit

Isolation and culture of primary adult skin fibroblasts from the Asian elephant (*Elephas maximus*)

PeerJ 6 (2018) e4302

Abstract. Primary cultures from Asian elephants (*Elephas maximus*) allow scientists to obtain representative cells that have conserved most of their original characteristics, function, physiology and biochemistry. This technique has thus gained significant importance as a foundation for further cellular, cell biology and molecular research. Therefore, the aim of this study was to describe conditions for the successful establishment of primary adult fibroblasts from Asian elephant carcasses. Ear tissue sample collection from Asian elephant carcasses and our recommendations are given. We describe here a simple modified protocol for successful isolation and maintenance of primary adult fibroblasts from elephant ear skin. Ear samples from each individual (five 3 × 3 cm^2 pieces) were brought to the laboratory within 3 h after collection, kept in transportation medium at 0–4ºC. The ear tissues were prepared by a combination of 10% collagenase type II digestion procedure together with a simple explant procedure. Primary fibroblasts were cultured at 37ºC in Dulbecco's modified Eagle's medium (DMEM) with 20% fetal calf serum (FCS) in a humidified atmosphere containing 5% CO_2. After the third passage, fibroblasts were routinely trypsinized with 0.25% trypsin/EDTA and cultured in DMEM with 10% FCS at 37ºC and 5% CO_2. Traditional cell counting method was used to measure cell viability and growth curve. Long-term storage of cells used freezing medium consisting of 40% FCS (v/v). We explored the most suitable conditions during sample collection (post- mortem storage time and sample storage temperature), which is the most important step in determining primary outgrowth. Our study successfully established and cultured primary adult skin fibroblasts obtained from post-mortem *E. maximus* ear skin tissues from six carcasses, with a success rate of around 83.3%. Outgrowth could be seen 4–12 days after explantation, and epithelial-like cells were found after 4–7 days of culture, while fibroblasts appeared at around day 7–10. The fibroblasts had viability and post-freezing recovery rates of around 97.3 ± 4.3% and 95.5 ± 7.3%, respectively, and doubling time was about 25 h (passage 6). To our knowledge, this report is the first to describe primary cell cultures derived from adult Asian elephant skin. Future studies should benefit from the information and useful suggestions herein, which may be used as a standard method for establishing primary skin fibroblast cultures in future experiments. © 2018 The Authors.

S. de Silva, V. Schmid & G. Wittemyer

Fission–fusion processes weaken dominance networks of female Asian elephants in a productive habitat

Behavioral Ecology 28 (2017) 243-252

Abstract. No permission to print abstract.

R.B. Suba, N.G.P. Beveridge, W. Kustiawan, G.R. de Snoo & H.H. de Iongh

Foraging ecology and diet of Bornean elephants (*Elephas maximus borneensis*) in the Sebuku forest area, North Kalimantan Province of Indonesia: Do the choices matter?

Integrative Zoology 13 (2018) 219-223

Abstract. none.

K. Suraprasit, H. Bocherens, Y. Chaimanee, S. Panha & J.-J. Jaeger

Late Middle Pleistocene ecology and climate in Northeastern Thailand inferred from the stable isotope analysis of Khok Sung herbivore tooth enamel and the land mammal cenogram

Quaternary Science Reviews 193 (2018) 24-42

Abstract. Paleoecological and paleoclimatic records based on the stable isotopes of mammalian tooth enamel are poorly known in mainland Southeast Asia during the Pleistocene. Khok Sung in Northeastern Thailand is a late Middle Pleistocene terrace deposit, tentatively dated either as 213 ka or 188 ka, yielding 15 described mammalian taxa with especially abundant and complete fossil remains. To investigate paleodiets and habitats of these ancient mammals and to understand the corresponding regional

climate, we performed an analysis of stable carbon and oxygen isotopes extracted from tooth enamel carbonate of various mammalian taxa, coupled with the cenogram method. The enamel $\delta^{13}C$ values of Khok Sung mammals indicate a variety of diets, ranging from pure C_3 to C_4 plants, suggesting that C_4 grasses were a major component of local Thai ecosystems during the late Middle Pleistocene. The stable isotopic distinction between C_3 and C_4 plants suggests that the Pleistocene wildlife habitats ranged from closed forests to open grasslands for the Khok Sung area. Moreover, differences within sympatric Pleistocene herbivores such as proboscideans, rhinoceroses, and cervids characterize possible niche partitioning by minimizing interspecific overlap. Paleoclimatic interpretations based on the intra-tooth variability in enamel $\delta^{18}O$ values from large mammals and on the cenogram analysis reflect significant seasonal variations in precipitation and temperature, and humid conditions, for the Khok Sung locality. Compared to modern environments in Thailand, it is apparent that C_4-dominated grasslands were more widespread at that time when anthropic impacts on the ecosystems were presumably absent or minimal. © 2018 Reprinted with permission from Elsevier

K. Takehana, K. Hatate & N. Yamagishi

Serum activities of two bone markers in captive Asian elephants (*Elephas maximus*) at different ages

J. of Veterinary Medical Science 80 (2018) 63-67

Abstract. The blood biochemical analysis of bone markers could have a role in the early diagnosis of metabolic bone disease in animals; however, there is limited information on bone markers in captive Asian elephants (*Elephas maximus*). Serum samples from ten captive Asian elephants were obtained to clarify the relationship between age and the blood bone markers tartrate-resistant acid phosphatase isoform 5b (TRAP5b) and bone specific alkaline phosphatase (BALP). Serum TRAP5b and BALP activities were negatively correlated with age. A positive correlation was observed between TRAP5b activity and BALP activity. These results may contribute to the health management of captive Asian elephants. © 2018 The Japanese Society of Veterinary Science.

J. Terborgh, L.C. Davenport, L. Ong & A. Campos-Arceiz

Foraging impacts of Asian megafauna on tropical rain forest structure and biodiversity

Biotropica 50 (2018) 84-89

Abstract. Megaherbivores are known to influence the structure, composition, and diversity of vegetation. In Central Africa, forest elephants act as ecological filters by breaking tree saplings and stripping them of foliage. Much less is known about impacts of megafauna on Southeast Asian rain forests. Here, we ask whether herbivory by Asian megafauna has impacts analogous to those of African forest elephants. To answer this, we studied forest (1) structure, (2) composition, (3) diversity, and (4) tree scars in Belum and Krau, two protected areas of Peninsular Malaysia, and compared the results with those obtained in African forests. Elephants are abundant in Belum but have been absent in Krau since 1993. We found that stem density and diversity, especially of tree saplings, were higher in Krau than in Belum. Palms and other monocots were also more abundant in Krau. In Belum, however, small monocots (<1 m tall) were very abundant but larger ones (>1 m tall) were virtually absent, suggesting size-selective removal. The frequency of stem-break scars was equal at Belum and Krau but less than in Central Africa and greater than in the Peruvian Amazon where tapirs are the only megafauna. Pigs and tapirs could also contribute to the high frequency of tree scars recorded in Malaysian forests. Forest-dwelling elephants in Asia seem to have a reduced impact on tree saplings compared to African forest elephants, but a very strong impact on monocots. © 2017 Association for Tropical Biology and Conservation.

C. Thitaram & J.L. Brown

Monitoring and controlling ovarian activity in elephants

Theriogenology 109 (2018) 42-47

Abstract. Both Asian (*Elephas maximus*) and African (*Loxodonta africana*) elephants are important keystone, umbrella and flagship species. Paradoxically, world population numbers of both species are declining in many of their natural ranges due mainly to poaching, while over population of elephants in some

areas is resulting in serious human-elephant conflict, and modifications of natural habitats that impact biodiversity. Understanding mechanisms of reproductive control is vital to effective population management, and for that reason significant advances have been made in endocrine and ultrasonographic monitoring techniques, particularly in studies of elephants ex situ. However, there remains a need to develop new methods to control ovarian activity, both for enhancing and inhibiting reproduction, to maintain population numbers at levels that ensure species survival and their ability to safely cohabitate with humans and other species. We present an overview of reproductive monitoring methods and how they have contributed to our knowledge of elephant reproductive biology, as well as their application for in situ and ex situ conservation purposes. © 2017 Reprinted with permission from Elsevier.

C. Thitaram, P. Matchimakul, W. Pongkan, W. Tangphokhanon, R. Maktrirat, J. Khonmee, A. Sathanawongs, P. Kongtueng & K. Nganvongpani
Histology of 24 organs from Asian elephant calves (*Elephas maximus*)
PeerJ 6 (2018) e4947
Abstract. Elephants are the largest and heaviest living terrestrial animals, but information on their histology is still lacking. This study provides a unique insight into the elephant's organs and also provides a comparison between juvenile Asian elephants and adult Asian elephants or other species. Here we report on the histological structure of 24 organs, including the skin, brain (cerebrum, cerebellar hemisphere, vermis, thalamus, midbrain), spinal cord, sciatic nerve, striated skeletal muscle, cardiac muscle, bone (flat bone and long bone), cartilage (hyaline cartilage and fibrocartilage), heart (right atrium, right ventricle), blood vessels (aorta, pulmonary artery and caudal vena cava), trunk, trachea, lung, tongue, esophagus, stomach, small intestine (duodenum, jejunum, ileum), large intestine (cecum, colon, rectum), liver and pancreas, kidney, ovary, uterus (body and horn) and spleen of two juvenile Asian elephants. Tissue sections were stained with Harris's hematoxylin and eosin Y. While almost all structures were similar to those of other species or adult elephants, some structures were different from other mammalian species, such as: plexiform bone was found in flat bone only; a thin trachealismuscle was observed in the trachea; and no serous or mucinous glands were found in the submucosa of the trachea. Histological information from various organs can serve as an important foundation of basal data for future microanatomical studies, and help in the diagnosis and pathogenesis in sick elephants or those with an unknown cause of death. © 2018 The Authors.

C. Udomtanakunchai, S. Lawongwan, S. Tasomkan, P. Pongsopawijit & W. Langkaphin
The diagnostic X-ray exposure technique guidelines for elephants' limbs in Elephant Hospital, Thai Elephant Conservation Center, Thailand
Journal of Associated Medical Sciences 51 (2018) 45-50
Abstract. Radiographic image is the first of choice for diagnosing complications involving elephants' limbs. The extreme thickness of their limbs causes inaccurate image quality. Therefore, an appropriate procedure is hereby investigated as a matter concerned. Because of difference of X-ray absorption in elephant tissue from human tissue, the Sante's rule cannot be directly applied. This study sought to acquire the appropriate equation by modifying the Sante's rule with a tissue factor for calculating the exposure technique for Asian elephants' limbs. Firstly, capacity of a mobile X-ray machine was evaluated in terms of dose rate, precision, and accuracy of radiation. The exposure techniques were then designed using the modified Sante's rule and tested with the hind limbs of 10 live elephants. Output of X-ray machine revealed the dose rate in milli-Rontgen per mAs equal to 4×10^{-4} of kVp^2, and the machine factor equal to 6.4. The radiographic images taken using the calculated exposure techniques showed good quality, and so, it is possible to differentiate between the medullar and the cortex of the bone. Equations suitable for designing the exposure technique are kVp equal to two times of sample thickness in cm plus source image distance in inch and the tissue correcting factor 5, and mAs equal to two-fifths of the sample thickness in cm. © 2018 Journal of Associated Medical Sciences.

A. van de Water & K. Matteson

Human-elephant conflict in western Thailand: Socio-economic drivers and potential mitigation strategies

PLoS ONE 13 (2018) e0194736

Abstract. Understanding human-wildlife conflict is an important first step in the conservation of highly endangered species that can have adverse effects on human communities, such as elephants. To gain insights into variables that shape attitudes toward elephant conservation in Asia, we surveyed 410 households and 46 plantation owners in seven villages around the Salakpra Wildlife Sanctuary in western Thailand, an area of high human-elephant conflict. We sought to evaluate how past experiences with elephants (positive or negative), as well as socio-economic variables (age, income level, gender, and employment type) affect attitudes toward elephant conservation and coexistence in this area. In addition, we quantified deterrence methods currently used and identify potential mitigation strategies supported by community members. In general, less supportive attitudes toward elephant conservation and coexistence were held by individuals older than 35 years of age, those who had previously had experienced negative interactions with elephants, those with lower incomes, and those working in the agricultural sector. Conversely, those who had received benefits from living near elephants (e.g., supplemental income or feelings of pride from hosting volunteers or participating in conservation work) had more supportive views of elephant coexistence. Plantation owners reported using a variety of deterrence methods with varying success, with firecrackers being the most commonly utilized method. Community members identified several potentially beneficial mitigation strategies including forest restorations and patrol teams, adding water sources to wild elephant habitat, and education of local school and community groups. Overall, our results highlight the value of community members receiving benefits from living near elephants and suggest that special incentives may be needed for demographic groups disproportionately affected by elephants (e.g. those at lower income levels, those working in agriculture). A combination of these and other approaches will be required if human-elephant coexistence in western Thailand is to be realized.

J. Wadey, H.L. Beyer, S. Saaban, N. Othman, P. Leimgruber & A. Campos-Arceiz

Why did the elephant cross the road? The complex response of wild elephants to a major road in Peninsular Malaysia

Biological Conservation 218 (2018) 91-98

Abstract. Roads cause negative impacts on wildlife by directly and indirectly facilitating habitat destruction and wildlife mortality. We used GPS telemetry to study the movements of 17 wild Asian elephants (*Elephas maximus*) and a mechanistic modelling framework to analyse elephant response to a road bisecting their habitat in Belum-Temengor, northern Peninsular Malaysia. Our objectives were to (1) describe patterns of road crossing, (2) quantify road effects on movement patterns and habitat preference, and (3) quantify individual variation in elephant responses to the road. Elephants crossed the road on average 3.9 ± 0.6 times a month, mostly (81% of times) at night, and crossing was not evenly distributed in space. The road caused a strong and consistent barrier effect for elephants, reducing permeability an average of 79.5%. Elephants, however, were attracted to the proximity to the road, where secondary forest and open habitats are more abundant and contain more food resources for elephants. Although the road acts as a strong barrier to movement (a direct effect), local changes to vegetation communities near roads attract elephants (an indirect effect). Given that risk of mortality (from poaching and vehicle collisions) increases near roads, roads may, therefore, create attractive sinks for elephants. To mitigate the impact of this road we recommend avoiding further road expansion, reducing and enforcing speed limits, limiting traffic volume at night, managing habitat near the road and, importantly, enhancing pa- trolling and other anti-poaching efforts. Our results are relevant for landscapes throughout Asia and Africa, where existing or planned roads fragment elephant habitats.

News Briefs

Compiled by Jayantha Jayewardene

Biodiversity and Elephant Conservation Trust, Rajagiriya, Sri Lanka
E-mail: romalijj@eureka.lk

1. Straying Thai elephant found (Cambodia)

Khmer Times – 11.1.2018

A wild elephant that strayed into Cambodia from Thailand's Sa Kaeo province was found yesterday morning. Yim Ly, provincial environment department chief, said the six-tonne female elephant had strayed into a forest in Banteay Meanchey province's Malai district after crossing the border in Battamang province's Sampov Loun district on Wednesday night.

"The elephant is now staying in the surroundings of Yeay Sam Mountain, about 3 km from the border," Mr. Ly said. He added his department dispatched officers to work in collaboration with local police to track down the elephant after learning of the animal's presence. Thai officers asked to join the operation in cooperation with the Cambodian side to observe the animal.

According to Thai authorities, the elephant broke loose from an electric fence enclosure for behaviour-adjustment in a forest conservation project area in Sa Kaeo province. The wild animal previously attacked Thai residents and destroyed farms.

2. Workshop stresses on birth control of wild elephants (India)

Times of India – 11.1.2018

Raising serious concerns over the increasing instances of human-elephant conflict (HEC), a regional workshop on elephant conservation in south Indian states has stressed the need for birth control of wild elephants through immunocontraception method and other effective strategies to stabilize the rising population of elephants.

When the workshop was inaugurated Wildlife Institute of India (WII) director V B Mathur said the ministry had already approved a project to research on birth control measures to be initiated in four species, including Asian elephant, nilgai, wild pigs and rhesus macaques.

"The challenge before us is getting the right kind of drug and to find the right way of administering it. The management of elephant population has become vital as the country is witnessing 350 – 400 deaths of people, damages to 10,000 – 12,000 houses and crop loss for 30,000 – 40,000 farmers every year due to HEC," he said.

3. Dak Lak province moves to conserve elephants (Vietnam)

Vietnam News Agency – 11.1.2018

The Central Highlands province of Dak Lak has taken a number of measures to manage, monitor and care for elephants so as to help conserve and develop the animals, said Director of the province's centre for elephant conservation Huynh Trung Luan.

He said relevant agencies have guided elephant owners how to care for the animals and reduce the number of days and the load elephants have to carry when they serve tourists in order to ensure their health and lifespan.

Recently, the Dak Lak Elephant Conservation Centre implanted microchips in local tame elephants. Data on each elephant such as height, weight, sex and previous diseases are also recorded to make it easier for managing, caring for and studying tame elephants.

Dak Lak currently has 45 tame elephants, mostly in Buon Don and Lak districts. It is also home to five wild herds with about 80 – 100 elephants in total, and most of them live in Buon Don, Ea Sup and Cu M'gar districts.

4. Sensors to curb elephant death on tracks (India)

Times of India – 17.1.2018

The forest department has installed eight sensors with infrared facilities on both sides of a railway track at Madukkarai to reduce the incidents of wild elephants being hit by speeding trains. The sensors fixed on 6 m poles would alert the forest department staff if elephants cross the track.

The staff would get SMS and immediately a team of anti-depredation watchers would visit the spot and chase away the elephant from the railway track.

The forest department has been taking many steps to prevent wild elephant deaths while crossing the railway track on the B (Palakkad - Coimbatore) and A (Coimbatore - Palakkad) railway lanes. While the train traverses through the reserve forest for 3.5 km on B-lane, it chugs through 1.5 km stretch of reserve forest on A-lane.

As many as 12 wild elephants were killed by speeding trains on the two lanes since 2006. The forest department fixed the sensors last week. The forest department has deputed 12 anti-depredation watchers (ADW) at the watchtower round the clock.

5. Critically endangered Sumatran elephant gives birth in Indonesia

Outlook India – 17.1.2018

A critically endangered Sumatran elephant has given birth to a new calf in Indonesia, the country's conservation agency said today. Sumatran elephants are a protected species, but rampant deforestation for plantations has reduced their natural habitat and brought them into conflict with humans.

The newborn was found with its 40-year old mother Seruni, who was being closely monitored by the agency in anticipation of the birth inside a conservation forest in Riau on the island of Sumatra.

Dozens of elephants were found dead in Sumatra last year, including an adult without tusks in Aceh, along with its abandoned 11-month-old calf. Most were killed by humans, according to conservationists.

6. Elephants terrorizing locals of Damak (Nepal)

My Republica – 22.1.2018

Elephants have been terrorizing the locals of ward no 2 and 3 since the last few months. Chairperson Baral informed that a herd of elephants has entered their villages from India. These wild tuskers have thrown their normal life out of gear especially after 7 pm. In last 22 days, elephants have destroyed 27 houses and ruined the fields of numerous farmers of both the wards. According to Baral, locals are facing a great torture due to the wild elephants.

In lack of effective measures, locals have been obliged to stay awake all night for protecting their lives and properties. On Thursday, an elephant smashed the wall of Surendra Dulal of Damak-2. His whole family had to beat plates and utensils to chase away the elephant.

Blowing conch shells in the evening has been a regular routine for the locals here. However, this is not the first time elephant rampage has taken a toll on the lives of locals of Damak-3. But it is the first time that they have caused so much loss and damage in Damak-2. Som Dhungana, secretary at the DFO, informed that elephants spend their days in the community forests and head toward the human settlements at night in search of food.

Some of the victims have already been provided relief while some are yet to get. "We are just provided with Rs 10,000 to 15,000 but that won't cover our loss," said Baral.

7. Sri Lanka police lose gun as elephants charge during stake-out

Daily Nation – 21.1.2018

Sri Lankan police who were charged by elephants as they staked out a cannabis farm dropped an automatic rifle as they ran for their lives, sparking a hunt on Sunday for the missing weapon.

Policemen who had been camping out near the plantation in a bid to catch crooks turned tail and scampered after the huge creatures started hurtling after them. The constables dropped their weapons and fled to save their lives when the elephants charged. Officers were now looking for the T56 automatic assault rifle in the bush at Lunugamvehera, 225 km south of Colombo.

Sri Lanka has strict laws protecting elephants, which are considered sacred. However, about 200 jumbos are killed annually by farmers who say wild elephants stray onto their land and destroy their crops. About 50 people are killed in wild elephant attacks annually.

8. Jumbo job awaits Bengal mahouts (India)

Telegraph India – 23.1.2018

Forest Department officials in Seraikela contacted a group of trained mahouts from Bankura district in Bengal to drive away a herd of rampaging elephants in Seraikela-Kharsawan, about 35 km from here, after local drivers failed to accomplish the task.

The mahouts from Bengal would be camping at Seraikela till their job is done unlike their locals counterparts from places such as Kuchai and Chandil who would stay in Seraikela for a couple of days and head back home, leaving their job midway. The trained mahouts are expected to reach Seraikela in 2-3 days. The herd from Odisha, comprising 18 elephants, including four calves, had entered Seraikela-Kharsawan after crossing Rajnagar jungle. The DFO said the elephants were not returning to Odisha as they had deviated from the route because of the digging of canals at two local dams.

9. Here is a device to alert people about elephant movement in their area (India)

NYOOOZ – 24.1.2018

Wouldn't it be possible to avoid man-elephant conflicts if there were an early warning system to alert people about the movement of wild elephants in their area? And that's what exactly city-based N Parthiparajan, 33, and S Suresh, 29, have done.

The device would be now used at Thadagam area and Periyanaickenpalayam forest range on a pilot basis to curb man-animal conflicts. Forest department officials said if the trials were a success, the device would be installed in many places of Coimbatore forest division.

Parthiparajan, president, Western Ghats Wildlife Conservation Trust, and Suresh, proprietor of 3Q technologies, said they developed the GSM-based device to alert the people residing along the forest fringes about the movement of elephants.

The device has a SIM card with more than 250 – 300 mobile numbers of villagers fed to it. The SIM card details would be shared with two villagers and three field staff of the forest department. If the designated villagers and field staff were to spot wild elephant(s) near the village, they would dial the mobile number of the device by using their mobile phone. Immediately, the villagers would get an alert about the elephant movement.

10. Nghe An residents in conflict with wild elephants (Vietnam)

VietNamNet Bridge – 24.1.2018

Together with Dak Lak and Dong Nai, Nghe An is one of three localities in Vietnam with the highest wild elephant populations. However, their natural habitat is shrinking. A survey found that there are 13 – 15 wild elephants in Nghe An, including 11 – 13 living in Pu Mat National Park. There are two groups of elephants, one in Khe Thoi in the national park's core area, and another in the buffer zone.

In recent years, the second group of elephants has entered cultivated areas and residential quarters, damaging crops and houses and threatening people's lives. Pu Mat National Park is classified by MARD (the Ministry of Agriculture and Rural Development) as one of three elephant conservation centres in Vietnam.

11. Innovative scare gun a hit among farmers (India)

Times of India – 4.2.2018

Farmers in Wayanad district are now a happy lot. Hundreds of them have deployed an innovative low-cost carbide gun in order to ward off crop-raiding jumbos and other stray animals. The gun, made by a Wayanad-based farmer, doesn't pose any harm to the animals.

Vinu A A (38), who lives at Chethalayam on the fringes of forests under the Wayanad Wildlife Sanctuary, has sold around 1000 PVC "guns" to farmers in the district, which is the epicentre of human-wildlife conflict in the state. The machine uses a mix of calcium carbide and water to produce a powerful bang. He said that even forest officials in Wayanad had been seeking his help to drive wild jumbos back to the forests using the sound gun as a replacement to fire crackers.

The carbide gun is basically two PVC pipes of varying diameters joint together and has a triggering apparatus made from gas-stove lighters. A piece of calcium carbide dipped in water is dropped down the muzzle. The acetylene gas produced in the reaction is ignited using a triggering mechanism connected to the device to produce a loud bang. One kg calcium carbide, which costs around Rs. 85, is enough to make 400 'explosions'.

12. Plastic waste kills elephant near Pamba (India)

Times of India – 7.2.2018

On January 27, a week after the conclusion of the Makaravilakku festival at Sabarimala, a 20-year old female elephant was found dead near Valiyanavattom. The post-mortem examination of the carcass revealed that it died after large quantity of plastic blocked its alimentary canal, resulting in internal bleeding and failure of the vital organs. Forest officials have found that plastic is a key content in the dung of the mammal all over forest region covering the hill shrine.

The forest department in 2016 had filed an affidavit before the high court after a sambhar deer died after consuming plastic, on the basis of which the high court imposed a total plastic ban in Sabarimala. But despite this, loads of plastic bottles and packets are still dumped in and around the shrine, after the pilgrimage season.

13. Rohingya influx deals blow to Bangladesh's wild elephant population

Dhaka Tribune – 9.2.2018

The influx of the displaced Rohingya has a dealt a double blow to the wild elephant population inhabiting Bangladesh's Chittagong region. Shortage of food and destruction of habitat forced the elephants to venture out, leading to clashes with humans. Five elephants have been killed between November 21 last year and January 22 – three of them from electrocution and landmine-related injuries.

Since the latest spell of Rohingya crisis, Myanmar security forces planted landmines and erected barbed wire fence along its border with Bangladesh, obstructing the trans-boundary migratory routes of the giant mammals.

On the other hand, shelters set up for the Rohingya – which led to the destruction of 4000 acres of forestland – also blocked the wild elephants' routes. The Rohingya are destroying forest resources to meet their daily demand of firewood of 800 tons. Nearly 690,000 Rohingya escaped to Bangladesh from Myanmar last August. Another 100,000 Rohingya had crossed the border earlier.

Deforestation and changing patterns in forestry created a severe shortage of food for elephants and other animals.

14. Villagers learn to keep Borneo pygmy elephants away using PVC 'cannons' (Malaysia)

New Straits Times – 18.2.2018

Some young villagers here have been consulting with Sabah Wildlife Department's Wildlife Rescue Unit (WRU) and resorting to google online to find ways to keep the Borneo pygmy elephants away effectively.

As human-elephant conflict grows in this area where the huge mammal has been trespassing into village settlements, they took the initiative to make 'cannons' from polyvinyl chloride (PVC) pipe, locally known as 'ladum', which is believed to scare the herd and prevent them from destroying crops and properties.

The step was taken following a shortage of staff in the department as well as WRU staff to fully manage the situation at six locations which have this problem. Syaiful Anthony Stephen, 32, from Kampung Gambaron, said the villagers involved normally moved in groups of three to eight every night on patrol duty since a herd of elephants trespassed their village early this year.

The home-made 'sound bomb' made from PVC pipe, plastic bottle and gas lighter, uses spirit as explosive and a safety cone instead of a loud speaker to chase the wildlife back into the forest.

15. Elephants have unique personalities just like humans: Study (Myanmar)

Deccan Chronicle – 22.2.2018

Elephants have unique personalities just like humans. Researchers of the University of Turku in Finland studied a timber elephant population in Myanmar and discovered that the Asian elephant personality manifests through three different factors - attentiveness, sociability and aggressiveness. "These kinds of consistent differences in behaviour are called personality."

Besides humans, personality studies on other long-lived species living in their natural habitat are rare. Researchers found that male and female elephants do not differ in these three personality factors. Attentiveness is related to how an elephant acts in and perceives its environment. Sociability describes how an elephant seeks closeness to other elephants and humans.

Aggressiveness shows how aggressively an elephant acts towards other elephants and how much it interferes in their social interaction. The researchers studied the personality of over 250 timber elephants living in their natural habitat in Myanmar. The elephants work in the timber industry, pulling logs from one place to another. This is a very unique research environment, enabling us to study several hundreds of elephants.

16. Myanmar, conservationists collaborating to save wild elephants

Voice of America – 23.2.2018

For centuries, elephants have had a rich and proud history in Myanmar. Throughout the country's past, the animals have been used for everything, including transportation, agriculture, construction and even warfare.

But its survival is under threat. There are about 2000 wild elephants left in Myanmar today, plus an estimated 5000 that are captive. But conservationists warn that the loss of their habitat, increased conflict with humans, and the illegal trafficking of elephants and their parts could result in the extinction of the Asian elephant in Myanmar.

Earlier this month, the Ministry of Natural Resources and Environmental Conservation published the Myanmar Elephant Conservation Plan (MECAP). The plan, produced in collaboration with several prominent wildlife groups, aims to guide policies on the survival of elephants in Myanmar for the next 100 years and beyond.

"The Government of Myanmar decided to commission a review of the status, distribution and threats to elephants," Anthony Lynam, a senior advisor for the Wildlife Conservation Society told VOA by email.

"It is a visionary plan that will need bold action on the part of the government and supporting agencies for it to succeed. The MECAP is a plan that requires action on the part of multiple stakeholders for it to work. The challenge is to see how the Government can coordinate the plan to see this happen," he said.

17. Herbalist fights to save last of the elephants (Vietnam)

Viet Nam News – 25.2.2018

In Lắk Commune in the Central Highlands province of Đắk Lắk, elephant doctor Đàng Đăng Long is fighting a desperate battle to not only keep overworked beasts alive, but to provide the right conditions for them to mate so that they do not die out.

We visited the doctor as he was about to leave for a trip to Cambodia to treat an elephant. "I have only 30 minutes. I'm in a hurry," Long said. "I'm actually a normal herbal doctor and hold no secrets," he said. "I have many years of experience caring for my herd of elephants and I have drawn some experience in treating them. I inherited knowledge from my father as well. In recent years, elephants tend to have more tumours in their bodies. The tumours stem from polluted food and water, which leads to lack of nutrition and resistance in their bodies."

18. A rescue centre for old, injured and ailing jumbos (India)

Times of India – 26.2.2018

Remember Sidda, the wild elephant which died in December 2016 after sustaining a fracture in its leg? Even today, wildlife activists feel timely treatment could have saved the jumbo. Sidda is not alone. Tens of wild elephants stray out of Karnataka's forests, sustaining injuries in the process and die an agonising death in the absence of timely medical help. There are elephants rescued from temples, circus etc, which could be disease prone and cannot be sent to camps directly without proper treatment.

To rescue and rehabilitate such jumbos, the Forest Department will open a dedicated elephant rescue centre at Doddaharive Reserve Forest off Periyapatna in Mysuru District. Spread over more than 100 acres, the campus will be equipped to provide medical aid to injured elephants and rehabilitate rescued ones.

Manoj Kumar, chief conservator of forests (Project Elephant), said the long-pending project is awaiting final approval from the Central Zoo Authority (CZA). "As we have received in-principal approval from the CZA, basic infrastructure like solar fencing, crawls for elephants and accommodation for mahouts have been readied. Five rescued elephants, including three from a circus and two from Hassan, which were victims of conflict, have been housed there for the time being," he added.

19. Will Dak Lak have elephants in the future? (Vietnam)

VietnamNet Bridge – 28.2.2018

After two years of waiting, in October 2017, Ban Nang, the female elephant in Lak district, gave birth to a baby elephant but it had died in the womb. Huynh Trung Luan, director of the Dak Lak Elephant Conservation Center, said Pac On possibly died because the mother elephant was too old to give birth.

Dak Lak's people have been spending big money and time, and making every effort to protect and develop the local herd of elephants. Since the Dak Lak Elephant Conservation Center doesn't have modern facilities, its veterinary surgeons sometimes consult with foreign experts or invite Thai specialists to Vietnam to help elephants.

20. Elephant breaks into Malaysian school, creates panic; Borneo forest needs better deal?

International Business Times – 1.3.2018

An elephant broke into a school in the Malaysian province of Sabah on Thursday, forcing the eviction of teachers and students. The elephant appeared to be foraging for food at the SMK

school in Telupid, a small town in the region, and stomped through several classrooms in the building while people were still inside, as seen in a video published on the Facebook profile of the Sabah Police.

So far they were able to capture four aggressive elephants, which would be translocated soon, she said. It is estimated that there are 20 elephants in the herd which is entering the Malay villages and destroying plantations.

Rapid deforestation affecting the ecosystems of Borneo island is threatening the survival of elephants in the region with an estimated population between 500 and 2000. Borneo forest is fast losing its green cover with a current deforestation rate of 1.3 million hectares per year. A 2012 study by WWF projected that at this rate, 21.5 million hectares will be lost by 2020.

21. Plan launched to check human-elephant conflict in Rohingya settlement (Bangladesh)

Dhaka Tribune – 2.3.2018

There have been at least 10 deaths resulting from human-elephant incidents in the main Kutupalong-Balukhali refugee settlement, including one casualty in the past week involving a 12-year-old boy.

The highly congested refugee site, which houses around 560,000 refugees who fled Myanmar, used to be forest land but is now crowded with tens of thousands of refugee shelters and services. The site lies along one of elephants' main migratory routes between Myanmar and Bangladesh.

"Behaviourally, elephants always follow their traditional routes and corridors for regular movement. If they find any obstacles within it, they try to break it," said IUCN in the survey report. It estimated that as many as 45 elephants could currently be active around the site.

The study also warned there could be spike in the numbers of elephants appearing in the coming days as elephants, often travelling in groups, are forced to forage for food and water during the dry season. "This partnership is critical not only to ensure the conservation of elephants, but to protect refugees, a number of whom have tragically already lost their lives," said Kevin Allen, UNHCR's head of emergency operations in Cox's Bazar.

22. Group of 50 wild Asian elephants spotted in SW China

XinhuaNet – 5.3.2018

A group of more than 50 wild Asian elephants have been spotted in a nature reserve in southwest China's Yunnan Province. Of the elephant group, seven were cubs, with the youngest only about two weeks old. They were spotted Saturday in the valley, which boasts sufficient water and plants and is a natural passage for a variety of animals.

Adult Asian elephants have just entered mating season and their peak period for births. Wild Asian elephants are often spotted there, but it is rare to see them in such large numbers, according to the group.

23. Solar-powered detector to tackle jumbo menace in Nilgiris border (India)

Deccan Chronicle – 6.3.2018

A new early warning system which has been designed with help of an NGO with sensor, solar-powered battery and alarm facilities is ready to be in place within Pandalur limits in Nilgiris border to tackle the rising man-animal conflicts. This is an improved version than its predecessor.

While the jungle-rich Pandalur taluk is known for frequent instances of man-elephant conflicts in particular, the Forest range office in Pandalur was looking for a devise with state-of-art technology to act as an early warning system.

"The device consists of a sensor to detect the movement of elephants due to the vibrations caused by the jumbos' movement. Once the sensor is activated by the jumbos' movement within an area of 20 – 40 ft circumference, a bulb in the device will burn and the alarm attached to

the device will ring," he said. This would give enough warning to the people nearby to take necessary precautionary measures to take shelter and keep themselves safe, besides alerting the officers and others too.

24. Bengal jumbos set to be collared to ease conflict (India)

Times of India – 12.3.2018

After more than a decade, elephants in Bengal are set to get radio collars. The state forest department with technical help from Indian Institute of Science (IISc), Bangalore will radio-collar two elephants in south Bengal next week.

Wildlife warden Ravi Kant Sinha said: "To start with, we are planning to radio-collar two elephants in Midnapore Division. Earlier, such exercises were taken up mostly for solitary elephants, commonly known as loners. But this time, we will radio-collar elephants from herds. The move will help us get an idea about an entire herd's movement."

The GPS collars, a source said, have been indigenously designed in collaboration with a French organisation and its signals can be accessed from a computer or a smart phone.

25. Elephant dies of lung infection (India)

Times of India – 23.3.2018

A nine-year-old makna, a male elephant without tusks, was found dead in Singara range of forests in the Nilgiris, allegedly due to lung infection. The carcass of the elephant was found in a private land at Bokkapuram. "The carcass might be a day old," said forest range officer Kanthan.

Government veterinarian attached to Gudalur taluk performed the postmortem operation and the preliminary autopsy report suggested that the animal had breathing difficulties as it had been suffering from lung infection. "Samples of vital organs have been collected for lab test," the official said. Later, the carcass was buried inside the forest area.

26. Trained jumbos drive away the wild ones (India)

The Hindu – 31.3.2018

Forest officials heaved a sigh of relief as they could successfully send back wild elephants into thick forest area on Friday night. Two well trained elephants (kumkis) which came from Chittoor provided much needed relief to the department as wild elephants followed those two animals into Palakonda forest range.

Currently, there are near Karagandi village of Sarubujjili mandal, according to Chief Conservator of Forest Rahul Pandey and Srikakulam District Forest Officer Ch. Santhi Swaroop. "Finally, we could send them back to forest area from plains without giving any scope for damage to properties and crops. Fortunately, all the eight elephants are safe.

The animals are able to move almost 60 to 70 km per hour but human's capacity is not beyond 20 km. In spite of the hurdles, the officials continued their operation to control the animals. They also decided to keep kumkis for a couple of weeks as part of their operations.The officials are expected to seek suggestions from senior officials as the total number of elephants has gone to 12 in the district. Earlier, there was only one herd of four elephants.

27. Smartphones help tame giant forest threat (China)

Ecns.cn – 11.4.2018

Unlike smartphone addicts who spend hours a day on social media, playing games or watching videos, residents of Basan village are using smartphones to save lives and local incomes. The safety alerts about wild elephants they spread help prevent injuries and economic losses that can be caused by the roaming rainforest giants.

The village, in southwestern China's Yunnan province, has witnessed frequent visits by wild Asian elephants in recent years as their numbers have grown. The giant animals, searching for

food, sometimes pose a threat to safety. The villagers' options for dealing with the safety threat are limited because the wild Asian elephant is listed as one of China's top-level protected wild animals due to its limited population – an estimated 300 – all living in Yunnan.

An elephant alert alliance was later formed voluntarily in the village. Through text messages, phone calls and social media, a report system has been established. Anyone who notices a wild elephant nearby will spread the alert.

28. Bago to get massive elephant sanctuary (Myanmar)

The Myanmar Times – 3.5.2018

One of Myanmar's biggest elephant sanctuaries will be established in Bago region to preserve endangered elephants in the country. Elephant Lake Sanctuary, named Four Paws, has initiated a long-term project, which aims to protect elephants, both wild and captive, on a 17,000-hectare area in Bago region, according to the Forest Department.

Here, people are not allowed to ride elephants. Elephants will be released in nature and not tied with a chain. The Asian elephants population has dramatically decreased in Myanmar due to loss of habitat, territorial fragmentation and poaching.

29. Anthrax fear in elephant death (India)

The Telegraph India – 13.5.2018

The death of an adult female elephant, suspected to be caused by anthrax, at a forest-side village in the district has spread panic among local residents. The carcass of the 20-year-old elephant was recovered from near Pitaspala village in Hadagada forest range on Thursday. Preliminary diagnosis by veterinary surgeons suggest that it was a case of anthrax.

As a precautionary measure, the forest department has undertaken a sensitisation drive and urged farmers to avoid using the spot from where the elephant's carcass was recovered. "The villagers have been asked to stop grazing their cattle in the area for at least a week," said Anandpur forest division divisional forest officer Ajit Kumar Satpathy. The forest department has started an immunisation drive to vaccinate domesticated animals in the village.

The animal was buried after applying chemicals for quick decay of the body. "Cremation of the infected body was a better option to check the possible spread of the anthrax bacteria. However, going by local tradition, the forest department opted to bury it," Satpathy said. Anthrax is an air-borne disease.

30. SF withdraws his order to remove Sinharaja elephants (Sri Lanka)

Daily Mirror – 17.6.2018

Minister of Wildlife Field Marshal Sarath Fonseka today revoked his original decision to remove two elephants from World Heritage site Sinharaja Forest Reserve. Director General of Wildlife M.G.C. Suriyabandara said the Minister ordered to temporarily halt removing the elephants.

Despite President Maithripala Sirisena's order not to remove the two elephants, Wildlife officers continued search operations to find the two elephants in order to relocate them to some other place under Minister Fonseka's guidance. A special team of Wildlife officers was deployed to Sinharaja forest with necessary tools like ropes, chains and other tools to load the elephants. Instead of Wildlife veterinary surgeons, Air Force veterinary surgeons were deployed to the place with anesthetics to sedate the elephants. Minister's stance was to remove the elephants for the safety of the people of the area despite the order of the President. According to the Minister's order, the operation to catch the elephants was underway this morning.

Meanwhile, a protest organized against the removal of elephants was held in Rambuka village near the Sinharaja Forest today with the participation of professionals, environmentalists and residents of the area.

Instructions for Contributors

Gajah welcomes articles related to Asian elephants, including their conservation, management, and research, and those of general interest such as cultural or religious associations. Manuscripts may present research findings, opinions, commentaries, anecdotal accounts, reviews etc. but should not be mainly promotional.

All articles will be evaluated by the editorial board of *Gajah*. Peer-reviewed articles will be sent out for review. Word limits for submitted articles are for the entire article (title, authors, abstract, text, tables, figure legends, acknowledgements and references).

Correspondence: Readers are encouraged to submit comments, opinions and criticisms of articles published in *Gajah*. Such correspondence should be a maximum of 500 words, and will be edited and published at the discretion of the editorial board.

News and Briefs: Manuscripts on anecdotal accounts and commentaries on any aspect of Asian elephants, information about organizations, and workshop or symposium reports with a maximum of 1000 words are accepted for the "**News and Briefs**" section.

Research papers: Manuscripts reporting original research with a maximum of 5000 words are accepted for the "**Research Article**" section. They should also include an abstract (100 words max.). A second abstract in the local language of the authors is optional (100 words max.). *Gajah* also publishes "**Peer-Reviewed Research Articles**". Peer-reviewed papers will carry a notation to that effect. Authors are requested to specify that they are submitting their paper to the peer-reviewed section. Shorter manuscipts (2000 words max.) will be published as a "**Short Communication**" (no abstract).

Tables and figures should be kept to a minimum. Legends should be typed separately (not incorporated into the figure). Figures and tables should be numbered consecutively and referred to in the text as (Fig. 2) and (Table 4). The lettering on figures must be large enough to be legible after reduction to final print size. Include tables and line drawings in the MS Word document you submit. In addition, all figures must be provided as separate files in JPEG or TIFF format.

References should be indicated in the text by the surnames(s) of the author(s) with the year of publication as in this example: (Olivier 1978 ; Baskaran & Desai 1996; Rajapaksha *et al*. 2004) Avoid if possible, citing references which are hard to access (e.g. reports, unpublished theses). Format citations in the 'References' section as in the following examples, writing out journal titles in full.

Baskaran N & Desai AA (1996) Ranging behavior of the Asian elephant (*Elephas maximus*) in the Nilgiri biosphere reserve, South India. *Gajah* **15:** 41-57.

Olivier RCD (1978) *On the Ecology of the Asian Elephant*. Ph.D. thesis, University of Cambridge, Cambridge, UK.

Rajapaksha RC, Mendis GUSP & Wijesinghe CG (2004) Management of Pinnawela elephants in musth period. In: *Endangered Elephants, Past Present and Future*. Jayewardene J (ed) Biodiversity & Elephant Conservation Trust, Colombo, Sri Lanka. pp 182-183.

Sukumar R (1989) *The Asian Elephant: Ecology and Management*. Cambridge University Press, Cambridge, UK.

Manuscripts should be submitted by e-mail to the editor <jenny@aim.uzh.ch>. Submission of an article to *Gajah* is taken to indicate that ethical standards of scientific publication have been followed, including obtaining concurrence of all co-authors. Authors are encouraged to read an article such as: Benos *et al*. (2005) Ethics and scientific publication. *Advances in Physiology Education* **29:** 59-74.

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