18th INTERNATIONAL ELEPHANT CONSERVATION & RESEARCH SYMPOSIUM

August 15-19, 2022

INTERNATIONAL ELEPHANT FOUNDATION.ORG

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18th INTERNATIONAL ELEPHANT CONSERVATION AND RESEARCH SYMPOSIUM
AUGUST 15-19, 2022
PROGRAM

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MONDAY - August 15, 2022

4:45 am – 5:05 am Entry into Zoom, morning "housekeeping" notes

5:05 am – 5:50 am Keynote Address – If it's not about elephants, it's irrelephant!
Dennis Schmitt DVM, PhD

5:50 am – 6:00 am IEF Welcome

The Ancestors of Modern Day Elephants

6:00 am – 6:15 am Exploring the evolutionary history of mammoths using a million-year genomic transect
Patricia Chrzanova Pecnerova
6:15 am – 6:30 am Reconstructing proboscidean migratory behaviour using strontium isotopes
Wouter Bonhof *
6:30 am – 6:45 am Extinction of the woolly mammoth – a lesson from the past?
Adrian M. Lister*
6:45 am – 7:00 am Pioneering Proboscidean Paleoendocrinology: Quantifying steroid hormones in elephant and mammoth tusks with mass spectrometry
Michael Cherney*
7:00 am – 7:15 am Sourcing elephant ivory from a sixteenth-century Portuguese shipwreck
Alida De Flamingh*
7:15 am – 7:30 am Questions & Answers

New Technologies – Colossal Biosciences

7:30 am – 7:45 am An introduction to species conservation and restoration efforts of Colossal Biosciences
Matt James*
7:45 am – 8:00 am Preserving the genetic code of all extant elephant species
Sara Ord*
8:00 am – 8:15 am Advanced Assisted Reproduction Technologies as an Elephant Conservation Tool
Wendy Kiso
8:15 am – 8:30 am iPSCs in conservation
Eriona Hysolli*
8:30 am – 8:45 am Industrialized Approach Toward EEHV Intervention
Justin Quinn*

8:45 am – 9:00 am Questions & Answers

TUESDAY - August 16, 2022

4:45 am – 5:00 am Entry into Zoom, morning "housekeeping" notes

Human Impact on Elephants and Habitat

5:00 am – 5:15 am Population status, feeding patter and anthropogenic disturbances of Forest elephants (*Loxodonta cyclotis*) in the Nki National Park, East Region, Cameroon
Fai Collins Ndi*

5:15 am – 5:30 am Protect elephants in the Wildlife Reserve from Development Projects
Benjamin Sock*

5:30 am – 5:45 am Conservation of the last wet zone elephants in Sri Lanka
Ravi Corea

5:45 am – 6:00 am Assessment of train elephant collisions in Sri Lanka
Mukti Roy

6:00 am – 6:15 am Landscape predictors of human elephant conflicts in Chure Terai Madhesh landscape of Nepal
Ashok Kumar Ram

6:15 am – 6:30 am Pre-assessment to action approach for effective conservation of African elephant habitat in Tanzania
Angelus Runji*

6:30 am – 6:45 am Making space for Asian elephants: Reviving degraded elephant habitat in Assam, India
Rubul Tanti*

6:45 am – 7:00 am Questions & Answers

Understanding Human Elephant Conflict

7:00 am – 7:15 am Roaming elephants in Epe, Lagos, Nigeria
Olajumoke Morenikeji*

7:15 am – 7:30 am Elephants and sustainable agriculture in Kenya (ESAK): Deterrent fences, habitat quality, food security, and education
Bruce Schulte

7:30 am – 7:45 am Elephants, bees & humans coexistence
Bright Geofrey Kata*

7:45 am – 8:00 am Assessing spatial distribution of human elephant conflict based on the issue of thunder flashes in Wasgamuwa, Sri Lanka
Chandima Fernando

8:00 am – 8:15 am Evaluating elephant presence around agricultural land in relation to lunar phase and crop season progression
Sophia Corde

8:15 am – 8:30 am Human-elephant conflict: A perspective from Zimbabwe
Sandra Toma & Newton Matandirotya*

8:30 am – 8:45 am Problem of elephants in the Itombwe Nature Reserve (RNI) in DR Congo
Paul Bulambo*

8:45 am – 9:00 am Environmental leadership of conservation of elephants
Steven Makumba*
9:00 am – 9:15 am Questions & Answers

WEDNESDAY - August 17, 2022

4:45 am – 5:00 am Entry into Zoom, morning "housekeeping" notes

Veterinary Medicine and EEHV
5:00 am – 5:15 am Contaminated food aversion in captive Asian elephants
Cécile Sarabian*
5:15 am – 5:30 am Prevalence of antimicrobial resistant fecal pathogens of elephants in Ghana
Emmanuel Odartel Armah*
5:30 am – 5:45 am Platelet counts in African elephants, a method comparison
Laura Keener*, Melanie Ammersbach*
5:45 am – 6:00 am Identification of African elephant polyomavirus in wild elephants and the creation of a vector expressing its viral tumor antigens to transform elephant primary cells
Virginia Pearson
6:00 am – 6:15 am The role of neutrophil extracellular traps in Elephant Endotheliotropic Herpesvirus (EEHV) hemorrhagic disease (HD)
Lisa Abegglen, Joshua Schiffman
6:15 am – 6:30 am Elephants' breath analysis for early-stage diagnosis of Elephant Endotheliotropic Herpesvirus (EEHV)
Charles Harb*
6:30 am – 6:45 am Substrate specificity of Elephant Endotheliotropic Herpesvirus Thymidine Kinase and Conserved Protein Kinase homologues for nucleoside analogs Penciclovir, Acyclovir, and Ganciclovir
Paul D. Ling, PhD
6:45 am – 7:00 am Generating an immunogenic Elephant Endotheliotropic Herpesvirus (EEHV) vaccine
Paul D. Ling, PhD
7:00 am – 7:15 am Questions & Answers

Captive Management and Welfare
7:15 am – 7:30 am Raising a calf in an era of EEHV awareness
Evan Miracle*
7:30 am – 7:45 am I greet you how I smell you: Olfactory tests in Loxodonta Africana predict the outcome of the introduction
Franziska Hörner*
7:45 am – 8:00 am Using self-directed behaviours and Faecal glutocorticoid metabolite concentrations to assess the impact of tourism on semi-captive African elephants' welfare
Primrose Manning
8:00 am – 8:15 am Assessing the welfare of the two semi-captive herd of African elephants using tail hair cortisol and self-directed behaviors
Maud Bonato

8:15 am – 8:30 am Physical activity and thermoregulation of captive Asian elephants participating in ecotourism activities
Hannah Tilley*
8:30 am – 8:45 am Steps taken to release captive elephants into Nam Pouy National Protected Area, Laos
Ana Belen Lopez Perez*, Michael Falshaw*
8:45 am – 9:00 am Questions & Answers

THURSDAY - August 18, 2022

4:45 am – 5:00 am Entry into Zoom, morning "housekeeping" notes

Trafficking and Technology
5:00 am – 5:15 am The four pillars for effective conservation of African savanna elephant
Amos Gwema*
5:15 am – 5:30 am Mitigating elephant tusk trafficking in the Deng Deng National Park
Nukia Fouego*
5:30 am – 5:45 am New and newly-affordable technologies that when combined with conservation dogs, will help stop poaching and disrupt trafficking
Pete Coppolillo*
5:45 am – 6:00 am Design and installation of low-cost indigenous electronic elephant signage for human-wildlife-conflict management
Sanjoy Deb
6:00 am – 6:15 am Questions & Answers

Community Engagement in Conservation
6:15 am – 6:30 am Private, public & community partnership (PPCP) for conservation of elephant, biological habitat corridor/ and conservation of water bodies
Prakash Chandra Mardaraj*
6:30 am – 6:45 am Sharing resources with elephants: Role of community-based Elephant Response Teams (ERTs) in human-elephant conflict (HEC) mitigating in and around Sheikh Jamal Inani National Park (SJINP), Cox's Bazar, Bangladesh
Ashis Kumar Datta*
6:45 am – 7:00 am Role of local communities in elephant conservation: A case study from North Kanara Landscape, Karnataka, India
Bismay Ranjan Tripathy
7:00 am – 7:15 am Participatory modeling across Kenyan villages facilitates greater understanding of human-elephant interactions
Lynn Von Hagen
7:15 am – 7:30 am SICOCABU – Simanjiro community capacity building project on human elephant conflict
Alamnyak Thaddeus Ole Orpiay*
7:30 am – 7:45 am Introducing our Elephant Guard Program and our One-day women and goat herders conflict mitigation trainings
Shannon Diener

Human-Elephant Conflict Mitigation

7:45 am – 8:00 am Human-elephant conflict mitigation and coexistence at Bwindi Impenetrable National Park, Uganda
Isaac Twinomuhangi*

8:00 am – 8:15 am Mitigate the impact of elephants on the livelihoods of community
Sarah Onani Milunga*

8:15 am – 8:30 am Human-elephant interaction and strategies for mitigating conflict in northern Botswana
Gaseitsiwe Masunga*

8:30 am – 8:45 am Human-elephant conflict mitigation: A key to conservation and livelihood development in rural communities
Gerubin Liberath Msaki*

8:45 am – 9:00 am Questions & Answers

FRIDAY - August 19, 2022

4:45 am – 5:00 am Entry into Zoom, morning "housekeeping" notes

Human-Elephant Coexistence

5:00 am – 5:15 am A shift from human elephant conflict to coexistence
Fidelicy Nyamukondiwa*

5:15 am – 5:30 am Human-elephant struggle for survival: Adopting acoustic deterrents to minimize human-elephant conflict around Chebera Churchura National Park, Ethiopia
Abebayehu Aticho*

5:30 am – 5:45 am Assessment towards human-elephant coexistence and poaching in Serengeti ecosystem, Tanzania
Nuhu Jacob*

5:45 am – 6:00 am Elephant conservation education around Pendjari and W. Parks in Benin
Ganso Rockis Gérovenso Sèdodjitché*

6:00 am – 6:15 am What makes living with free-roaming elephants OK? A case study and a summary of 20 years of applying co-existence strategies in Namibia
Christin Winter

6:15 am – 6:30 am Human elephant conflict mitigation: community empowerment through beekeeping project
Jenister John*

6:30 am – 6:45 am Questions & Answers

Conservation Partners

6:45 am – 7:00 am Asian Elephant Support 2022 Update on care and conservation efforts in Asia
Liz Beem, Mindy Ussrey

7:00 am – 7:15 am Youth living close to protected areas accessibility to tourism industry & conservation using wildlife arts in Tanzania
David Kabambo*
7:15 am – 7:30 am Conservation Art Exchange: From conflict to coexistence (Using art as a bridge from conflict to coexistence)
Lou Barreda*, Julia Braren*, Kellen Braren*
7:30 am – 7:45 am Is your NGO financially sustainable? Lessons I have learnt – The hard way!
Rachel Harris
7:45 am – 8:00 am Conservation Elephant Units in Way Kambas National Park, Sumatra, Indonesia
Christopher Stremme
8:00 am – 8:45 am Recovery of Murchison Falls Conservation Area
Mike Keigwin
8:45 am – 9:00 am Questions & Answers

Closing Ceremony
9:00 am – 9:15 am Bridging the Gap: Connecting humans & elephants
Sarah Conley

***New Presenters at the International Elephant Conservation and Research Symposium**

Keynote Address: Dennis Schmitt DVM, PhD

Although Dennis Schmitt, DVM, Ph.D., says that he is now retired, he is just as busy as ever consulting near and far on elephant veterinary and reproductive issues. Over the years, Dennis contributed to a number of different organizations from instructing his students in advanced assisted reproduction as a professor at Southwest Missouri State University to serving as a consulting veterinarian at some of the premiere elephant holding facilities in North America to specializing in elephant medical and reproductive management to being the owner of Reproductive Resources an assisted reproduction program for the domestic animal industry to serving as a founding board of directors member of the International Elephant Foundation for over twenty years.

Dennis is the leading elephant reproductive physiologist in North America and serves as a Research and Reproductive Advisor for the AZA Elephant TAG/SSP Management Group. He announced the first successful conception by artificial insemination of an elephant, an Asian, in June of 1998 and was involved in the subsequent first two successful artificial inseminations of African elephants in North America in 1998. Schmitt continues to perform inseminations with numerous additional conceptions to date. Dr. Schmitt was the veterinarian of record for the world's first survivor of Elephant Endotheliotropic Herpesvirus (EEHV). He has been active in conducting workshops internationally to train veterinarians and wildlife specialists in the technology of ultrasonography and semen collection, conservation projects in Sri Lanka, and domestically in the US caring for the largest breeding herd of Asian elephants in the Western Hemisphere.

Monday – August 15, 2022

Ancestors of Modern-Day Elephants

Exploring the Evolutionary History of Mammoths Using a Million-Year Genomic Transect

Tom van der Valk, Patrícia Pečnerová, David Díez-del-Molino, Anders Bergström, Jonas Oppenheimer, Stefanie Hartmann, Georgios Xenikoudakis, Jessica A. Thomas, Marianne Dehasque, Ekin Sağlıcan, Fatma Rabia Fidan, Ian Barnes, Shanlin Liu, Mehmet Somel, Peter D. Heintzman, Pavel Nikolskiy, Beth Shapiro, Pontus Skoglund, Michael Hofreiter, Adrian M. Lister, Anders Götherström, Love Dalén

Centre for Palaeogenetics, Stockholm, Sweden, Department of Bioinformatics and Genetics, Swedish Museum of Natural History, Stockholm, Sweden, Department of Cell and Molecular Biology, National Bioinformatics Infrastructure Sweden, Science for Life Laboratory, Uppsala University, Uppsala, Sweden, Department of Zoology, Stockholm University, Stockholm, Sweden, Section for Computational and RNA Biology, Department of Biology, University of Copenhagen, Copenhagen, Denmark, The Francis Crick Institute, London, UK, Department of Biomolecular Engineering, University of California Santa Cruz, Santa Cruz, CA, USA, Institute for Biochemistry and Biology, University of Potsdam, Potsdam, Germany, Department of Biological Sciences, Middle East Technical University, Ankara, Turkey, Department of Earth Sciences, Natural History Museum, London, UK, College of Plant Protection, China Agricultural University, Beijing, China, The Arctic University Museum of Norway, UiT – The Arctic University of Norway, Tromsø, Norway, Geological Institute, Russian Academy of Sciences, Moscow, Russia, Department of Ecology and Evolutionary Biology, University of California Santa Cruz, Santa Cruz, CA, USA, Howard Hughes Medical Institute, University of California Santa Cruz, Santa Cruz, CA, USA, Department of Archaeology and Classical Studies, Stockholm University, Stockholm, Sweden

Ancient DNA research brought the possibility to study evolutionary processes in real time by opening a direct window into the past. While theoretical models of DNA degradation predicted that DNA molecules might survive for a million years, the oldest DNA recovered was from a 780-560 thousand years old horse specimen. In addition, the challenges of working with degraded DNA led ancient DNA researchers to focus primarily on the last 50,000 years of evolutionary history. Here, we present genomic data from three mammoth specimen from Siberia, which lived between 1.2 million and 6500-thousand years ago. We show that it is technically possible to retrieve DNA that is more than a million years old using the currently available methods and protocols. Furthermore, this data provides new key insights into the evolutionary history of mammoths. Our results revise the idea that only one kind of mammoth lived in Siberia a million years ago, the steppe mammoth, by identifying two genetically distinct lineages. One of the lineages represents the ancestors of the woolly mammoth, and the other represents a previously unknown lineage. The third of the samples is an early woolly mammoth, and thus, we could study the process of speciation and when did the key mammoth traits for living in the cold environment develop. Our findings open a new chapter of deep-time studies that will focus on analysing an evolutionary time period, when many present-day mammal species originate.

Reconstructing Proboscidean Migratory Behaviour Using Strontium Isotopes

Wouter Bonhof, Alex Pryor
Department of Archaeology, University of Exeter, UK

Elephants are the largest terrestrial animals in the world and daily require vast quantities of food and water to sustain themselves. It is therefore not surprising that elephants in regions with (seasonally) low food availability generally have larger home ranges than conspecifics in more productive regions. What we know about the mobility of modern elephants, however, is of course only a proxy for the behaviour of woolly mammoths.

The migratory behaviour of woolly mammoths is relatively understudied even though it is an important aspect of their ecology and could have large implications for the reconstruction of human-mammoth interactions during the Upper Palaeolithic. Woolly mammoths were the largest herbivores on the so-called 'Mammoth Steppe', which also hosted, amongst others, bison, horses, and reindeer. While the Mammoth Steppe is thought to have a had higher plant productivity than modern ecosystems in the same regions, there was also much more competition for resources than there is today. Particularly in the Arctic, where Polar winters limit plant growth for nearly half of the year, competition between herbivores may have been especially severe, forcing animals to either migrate or adapt to long periods of starvation.

To reconstruct the migratory behaviour of woolly mammoths and coeval large herbivores, molars from Yana—the oldest archaeological site in the Siberian Arctic at about 32.000-years old—were analysed for intra-tooth variations in strontium isotope ratios ($^{87}Sr/^{86}Sr$). Strontium isotope ratios exhibit spatial variation and changes in $^{87}Sr/^{86}Sr$ ratios along molar growth therefore reflect temporal movements between different foraging regions. The data reveals that there were substantial inter-individual differences in movement patterns of the woolly mammoths and that, unlike modern reindeer and caribou, Arctic mammoths may not have had strong site fidelity.

Extinction of the Woolly Mammoth – A Lesson from the Past?

Adrian M Lister
The Natural History Museum, London

The woolly mammoth (*Mammuthus primigenius*) was the most recent proboscidean species to go extinct. It died out some 4000 years ago in northern Siberia, at around the time its closest living relative, the Asian elephant, began to be domesticated further south. Radiocarbon records of woolly mammoth across its vast northern hemisphere range show how its distribution waxed and waned with climate change through the last glacial period. Palaeobotanical and modelling evidence suggests this was largely mediated through the impact of climate on the nature and productivity of regional vegetation. Eventually the species was reduced to fragmented refugial populations before finally dying out altogether. The role of early human hunters is disputed, with some models simulating extinction by climatic/vegetational change alone, others suggesting a significant contributing effect of humans, probably on already-stressed refugial populations. A synergistic effect of multiple factors is likely, and has clear parallels with the modern situation.

Pioneering Proboscidean Paleoendocrinology: Quantifying Steroid Hormones in Elephant and Mammoth Tusks with Mass Spectrometry

Michael Cherney
U-M Michigan Medicine Metabolism, Endocrinology, and Diabetes, USA

Steroid hormones incorporated into continuously growing tissues provide a record of endocrine activity during the life of an animal. Numerous studies have reported cortisol concentrations in hair, nails, and other proteinaceous materials as evidence of long-term stress levels in modern animals. Recent reports of preservation of steroid hormones over long time spans, even thousands of years, make this avenue of inquiry a potentially valuable tool even in paleontological studies. In our first attempt to explore the potential of tusks as long-term repositories of steroid hormones in 2014, we identified cortisol in mammoth tusk samples using an enzyme-linked immunosorbent assay (ELISA) designed for saliva. However, knowing the potential for false positives due to cross-reactivity in ELISA, we subsequently embarked on a more rigorous investigation using liquid chromatography with tandem mass spectrometry (LC-MS/MS) to confirm the presence of cortisol and see if other steroids could also be detected. Initial LC-MS/MS results reveal testosterone, progesterone, androstenedione, cortisol, and trace amounts of other steroids preserved in modern elephant and late Pleistocene (permafrost-derived) woolly mammoth ivory. Consistent with results from serum samples obtained from one male and one female African elephant (*Loxodonta africana*), testosterone is abundant in bulk samples from male tusks but is only present in trace amounts in female tusks. Sex differences in tusk progesterone, androstenedione, and cortisol are also consistent with serum results. Ongoing analyses are already starting to reveal patterns that suggest tusks could be used to investigate retrospectively aspects of elephant life history with strong endocrine signatures. These results will not only provide insights into the palaeobiology of mammoths, they will also set the stage for wide-ranging studies of dentin-bound hormones in palaeontology, zoology, ecology, and wildlife conservation to investigate development, reproduction, behavior, and stress in modern and extinct mammals.

Sourcing Elephant Ivory from a Sixteenth-Century Portuguese Shipwreck

Alida de Flamingh[1], Ashley Coutu[2], Judith Sealy[3], Shadreck Chirikure[3], Armanda Bastos[4], Nzila Libanda-Mubusisi[5], Ripan Malhi[6], Alfred Roca[6]
[1,6] University of Illinois, [2]University of Oxford, [3]University of Cape Town, [4]University of Pretoria, [5]National Museum of Namibia

The oldest known shipwreck in southern Africa was found in Namibia in 2008. Forty tons of cargo, including gold and silver coins, helped identify the ship as the *Bom Jesus*, a Portuguese nau (trading vessel) lost in 1533 while headed to India. The cargo included >100 elephant tusks, which we examined using paleogenomic and stable isotope analyses. Nuclear DNA identified the ivory source as African forest (*Loxodonta cyclotis*) rather than savanna (*Loxodonta africana*) elephants. Mitochondrial sequences traced them to West and not Central Africa and from ≥17 herds with distinct haplotypes. Four of the haplotypes are known from modern populations; others were potentially lost to subsequent hunting of elephants for ivory. Stable isotope analyses (δ13C and δ15N) indicated that the elephants were not from deep rainforests but from savanna and mixed habitats. Such habitats surround the Guinean forest block of West Africa and accord with the locations of major historic Portuguese trading ports. West African forest elephants currently range

into savanna habitats; our findings suggest that this was not consequent to regional decimation of savanna elephants for their ivory in the 19th and 20th centuries. During the time of the *Bom Jesus*, ivory was a central driver in the formation of maritime trading systems connecting Europe, Africa, and Asia. Our integration of paleogenomic, archeological, and historical methods to analyze the *Bom Jesus* ivory provides a framework for examining vast collections of archaeological ivories around the world, in shipwrecks and other contexts.

New Technologies – Colossal Biosciences

An Introduction to Species Conservation and Restoration Efforts of Colossal Biosciences
Matt James
Colossal Biosciences

For the first time in the history of humankind, we are in control of a science with the power to reverse and prevent biodiversity loss on a large scale. We can heal a hurting planet. We can protect the species living on it. We can ethically decipher and protect genetic codes. And we can begin to turn the clock back to a time when Earth lived and breathed more cleanly and naturally. This is not an option for us. It is an obligation known as thoughtful disruptive conservation. Here, we will share an overview of Colossal's technologies, mission, and conservation efforts while highlighting current conservation and research partners.

Preserving the Genetic Code of all Extant Elephant Species
Sara Ord
Colossal Biosciences

The world is experiencing an unprecedented rate of loss of biodiversity. With over 7,000 species listed as critically endangered by the IUCN, and over 1 million plant and animal species at risk of extinction in the coming decades, the call to action to preserve and restore these species has never been greater. Generating high-quality reference genomes for all critically endangered species is instrumental in laying the foundation for future research and conservation efforts that may save these species. Reference genomes provide the basis for genetic preservation of a species. Generating a high-quality reference genome serves as the basis for population genomics. With a high-quality reference genome, individuals from that species can be sequenced quickly and at a low coverage as they are mapped to the reference genome allowing for cheaper methods and a higher throughput of individuals. Having a reference genome allows for Genome-wide association studies within a given species, leading to key findings in mechanisms involved in disease resistance, genetic diversity, population structures and introgression. Colossal is in collaboration with the Vertebrate Genomes Project to generate high quality, near error-free, fully annotated, open-source reference genomes for critically endangered species, starting with one of Earth's last megafauna species: the elephant. Through this collaboration, Colossal has generated one of the highest-quality mammalian reference genomes for the Asian elephant and is in progress on generating reference genomes for the African and Forest elephant. Through these efforts we aim to lay the foundation for genomic preservation for all extant elephant species.

Advanced Assisteed Reproduction Technologies as an Elephant Conservation Tool
Wendy Kiso
Colossal Biosciences

Assisted reproduction technologies (ARTs) provide a valuable array of tools for species conservation, especially for those species that are on the brink of or threatened with extinction, including both Asian and African elephants. Advanced ARTs can increase reproduction opportunities, enhance genetic diversity, increase the number of offspring produced per generation, and preserve and pass on genetics that may otherwise be lost forever. Although ARTs such as artificial insemination (AI) has been utilized in elephants, other avenues of advanced ARTs such as ovum pick up (OPU) in vitro fertilization (IVF) and embryo transfer (ET) in elephants require further attention and investigation. We are currently in the midst of the sixth mass extinction, thus establishing the fundamentals to advance ARTs in current extant elephant species is important now, before we get to an irreversible trajectory of geographic extinction.

iPSCs in Conservation
Eriona Hysolli
Colossal Biosciences

Induced pluripotent stem cells (iPSCs) hold great potential for conservation and returning keystone species to their ever-degrading ecosystems when their numbers are dwindling in the wild. iPSCs have been generated for a multitude of species, but not elephants. We aim to generate these powerful pluripotent stem cells for all extant elephant species, as well as derive gametes that can eliminate the need to harvest from endangered species where this reproductive work has not been done before. Stem cell technologies that are revolutionizing human health can also revolutionize conservation and provide the key to species restoration.

Industrialized Approach Toward EEHV Intervention
Justin Quinn
Colossal Biosciences

Elephant Endotheliotropic Herpes Virus Hemorrhagic Disease (EEHV-HD) is the single largest cause of death for captive juvenile Asian elephants in North America and Europe. Furthermore, EEHV-associated deaths have been documented in wild elephants in their natural range countries in both Africa and Asia, adding yet another threat to this endangered species. A great deal of work has been done to detect and care for sick elephants, but little is known about the immune response and more is needed in order to win this battle with EEHV-HD. Advanced tools exist for protecting humans from various threats, but animal health is sadly lacking many of these technologies. For the conservation of elephants, we need to approach treating these animals with the full strength of industrial efforts, by comprehensively interrogating and understanding the immune response to EEHV and using the best tools therapeutically/prophylactically against hemorrhagic disease. Here, we look at advances in treating human pathologies and propose a process by which elephant infection can yield the information needed to design effective vaccines and T- and B-cell

therapeutics. With these tools we can better manage viral transmission and response to infection, while also gaining a more meaningful understanding of the elephant immune response to EEHV.

Tuesday – August 16, 2022

Human Impact on Elephants and Habitat

Population Status, Feeding Pattern and Anthropogenic Disturbances of Forest Elephants (*Loxodonta cyclotis*) in the Nki National Park, East Region, Cameroon

Fai Collins Ndi, Nguedem Sylvie Fonkwo and Tonjock Rosemary Kinge
Department of Biological Sciences, Faculty of Science, the University of Bamenda, Cameroon.

Loxodonta cyclotis play important roles in both the natural and human worlds: ecologically as a keystone species, economically as drivers of tourism and culturally as icons of the African continent, though its population keeps reducing due to human threats. Specifically, this study was to estimate the population of forest elephants, identify the different wild and cultivated plants fed upon by elephants and human threats to their population. Eleven 2Km line transects, reconnaissance walk of approximately 40.16 Km, as well as administration of open-ended questionnaires to 107 participants in 9 villages around the Park were used to collect these data. Analyses was done using the software Distance v7.3 to determine elephant population density, inventory of plants species identified, and mean scores on a four-point Likert scale with a cut-off point of 2.50 to determine the threats. Results obtained indicated that mean dung pile was 6.0boli/Km^2. Elephant density, thus, was 0.14 elephant/km^2, translated to 428 (217-897) individual elephants. Based on the feeding ecology, 25 wild plants and 18 cultivated plants from 24 families were identified to be consumed by elephants in the Park and along its peripheries with their diet preference of mainly fruits and seeds (62%) and least being stems (6%), the most abundant consumed plant family being Poaceae and least being Pandaceae among other families. The main threats on elephant population with their percentage acceptance were identified to be non-respect of law enforcement (94.4%), hunting for bushmeat (92.5%), hunting for ivory (91.6%), lack of management plan (73.8%), logging (68.2%) and road construction (43.0%). In conclusion, elephant population of the Nki National Park has reduced compared to previous survey of 2015. Thus, surveillance and the setting up of a long-term monitoring program should be carried out in the Park.

Protect Elephants in the Wildlife Reserve from Development Projects

Benjamin Sock[1], Ménélik Ii Prince Zengle Ntouh Richard[2]
[1]Ngoyla Wildlife Reserve, Cameroon, [2]ALEDD, Cameroon

Forest elephants need large habitats to thrive, so proper management at the landscape level and close cooperation with local communities are essential to conserve the declining populations of the species. It is currently estimated that there are about 250 forest elephants in the Ngoyla Faunal Reserve (RFNg) which is a strategic area (a migration corridor) for elephants from the Cameroon component of the Tri National Dja, Odzala and Minkebe (TriDOM) that transit from the Dja Faunal Reserve (Cameroon) to Congo and vice versa. This protected area is one of the last bastions

of large mammals in Central Africa due to its biological diversity and its ecological role as a migration corridor for local and sub-regional mammalian fauna. This protected area is located in the centre of the Ngoyla-Mintom forest massif and shares with the Dja Biosphere Reserve and the Nki Park the Cameroonian component of the Tri-DOM landscape, which is in the process of obtaining the status of a transboundary biosphere reserve.

However, a predominance in terms of activities impacting this area is given to logging in the neighbouring Forestry Units (FMUs) and a hunting area. Although these activities are the source of many impacts on biodiversity, the balance of this protected area remained relatively guaranteed until the announcement of the launch of the construction site of the Mballam-Kribi railway, with a start in the immediate periphery and the imminent launch of a mining operation in the south-west of the reserve. The asphalting of the Mballam - Ngoyla road, also announced for this year, further reinforces the fears of the conservation service. Despite the direct impact of some of these activities on the reserve's forest ecosystem and its peripheral zone, these construction sites will contribute to accelerate poaching in the wildlife reserve and increase the pressure on the elephants that are already threatened in this area. In addition, other threats to the protected area have increased, including gold washing and illegal logging in the reserve.

It is with this in mind that, in order to avoid encroachment into the reserve by these structuring projects and to stop those caused by activities already taking place clandestinely within the protected area, we plan to open up and materialise the boundaries of the reserve on the one hand, which will make it possible to fight against intrusions by neighbouring concessionaires who hold mining and timber extraction titles in the periphery of the RFNg. Then we will sensitize the communities on the importance of the reserve and the need to keep this forest massif intact in order to block the way to the gold panners while setting up a network of informers whose role will be to provide valuable information to the conservation service in case of the presence of poachers or suspicion of illegal activities in the reserve and its peripheral zone. Finally, to allow elephants to flourish and frequent the Mbango clearing, we will develop the clearing by destroying the Pandanus sp which is an invasive plant. In addition, we will set up a conservation committee to ensure the survival of the elephants through the planning and implementation of adaptive strategies as part of the implementation of this project. The committee will bring together three stakeholders (conservation department, non-governmental organisations and local people's representatives) so that government and non-government wildlife managers act together. This group will meet every two months in the presence of the local administrative authority, the conservation department of the reserve and the non-governmental organisations operating in the area.

Conservation of the Last Wet Zone Elephants of Sri Lanka

Ravi Corea, Chinthaka Weerasinghe, Chandima Fernando
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The Adam’s Peak Mountain and Peak Wilderness Sanctuary is the last intact Wet Zone forests in Sri Lanka and is home to a rich endemic biodiversity making it one of Sri Lanka’s most important conservation areas. It is also significant that this sanctuary supports the last remnant Wet Zone elephant population in the country following its separation from the lowland populations in the Dry Zone jungles over one hundred and fifty years ago. For over 150 years the Wet Zone elephants

in the Adam's Peak and Peak Wilderness Sanctuary led a tranquil and undisturbed life. The only disturbance to their lives is the annual pilgrim season to the Adam's Peak Mountain which is from December to the first week of May when the season concludes with the Wesak full moon. Due to population growth over the past seven decades the number of pilgrims ascending the mountain has increased leading to rebuilding and improving the access routes to the peak. Recent construction work carried out on the access route from the town of Ratnapura totally disregarded the elephants or most likely were not aware of them. As a result, metal barriers were erected on either side of the steps effectively preventing the elephants from moving across one of their migratory routes. This is an example of how the lack of information on these elephants resulted in such an outcome. And there are similar plans to improve all the access routes to the peak and all of them could have disastrous impact on these elephants. It is imperative to gather information on the movement of these elephant to prevent further activities that would disrupt the natural ranging of the last Wet Zone elephants of Sri Lanka. Therefore, the Sri Lanka Wildlife Conservation Society is aiming for policy changes to ensure all development in an around the Peak Wilderness is done in a manner not to disrupt the natural ranging of these elephants, establish a conservation management plan for this entire area, and to develop a landscape level conservation paradigm for elephant conservation. In order to achieve these outcomes, we will establish a preliminarily Wet Zone elephant information Data-Hub by gathering primary and secondary information that is available including meeting with wildlife department personnel and villagers who have firsthand information on these elephants. Secondly, we will conduct habitat surveys by using drones specifically to identify and map the foraging areas of the elephants in the bamboo dominated habitats. Once the activity locations are confirmed the project team will set up Spypoint solar powered remote cameras to monitor their movement patterns, social behavior and resources use. The project will provide much needed baseline information on the abundance and ecological need of these elephants and to develop and implement a coexistence conservation model integrating cultural, symbolic, and economic values of the Wet Zone elephants and a better understanding of tolerance determinants.

Assessment of Train Elephant Collisions in Sri Lanka

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The population of Sri Lanka is projected to be 25.0 million people by 2050. Sri Lanka has been upgrading its rail network to increase domestic trade, alleviate the growing pressure on the road network, and mitigate the negative economic impacts of congestion. Asian Development Bank (ADB) is helping Sri Lanka to upgrade its transport network by giving soft loans. It is essential while upgrading a transport network it impacts wildlife migration and corridor areas. It is important to identify hotspot section/segment areas for free wildlife movement. This will help the transport department to develop a mitigation plan like overpass, underpass, viaduct tunnels and others in order to have less impact on wildlife migration/corridors areas while upgrading the railway network.

Elephants hold a central position in Sri Lanka's two main religions, Buddhism and Hinduism; as well as in Sri Lankan culture. Sri Lanka (62,710 Km^2) has an important position with regard to

elephant conservation and the country has 10% of the global Asian elephant population (Leimgruber *et al*. 2003). The Department of Wildlife Conservation (DWC) in Sri Lanka states that there were a total of 5879 elephants in 2011. The elephant population is presently divided into south (Udawalawe National Park, Yala, Lunugamvehera and Bundala), East (mainly outside protected area), North central, (the reservoir beds of Minneriya and Kaudul, Hurulu Forest Reserve and Eco-park), Northwest (reservoirs Kala Wewa), North. Currently, there are around 112 captive elephants also found in Sri Lanka with temples and private owners.

The major danger to elephants in Sri Lanka is habitat loss, fragmentation, conversion to settlements, and mortality due to train-elephant collision. Due to this ADB called for "A literature study about the status of Asian elephants and the impact of railways on elephants in Sri Lanka". Dr. Mukti Roy qualified for this project and got the contract through ANCF. The present paper is part of this report.

The railway tracks in Sri Lanka are divided into Coast/Matara, Kalayani valley, Kandy, Talai Mannar, Northern/Jaffna, Mattale, Badulla, Mihintale, Batticaloa, Balliata, Trincomalee, Puttam, Arukkawil. Most of the train-elephant collisions occur on the Northern/Jaffna, Trincomalee, Batticaqloa and Talai Mannar railway line and a few in the Puttlam railway line. We initially received two sets of data on train-elephant collisions in Sri Lanka from ADB which have been called ADB01 and ADB02. Additional data about train-elephant collisions were also found by searching newspaper clippings, videos, research papers, journals, and reports, and the data set is called ANCF03. We compared the ADB01 and ADB02 data sets (which were in the form of Excel spreadsheets) and corrected any duplicated entries and typological data errors and arrived at the final database for ADB01 and ADB02. New data entries from ANCF03 were then added to this final database to create an updated version that included ADB01, ADB02, and ANCF03 for data analysis and GIS analysis. The updated database (in the form of an excel spreadsheet) was made uniformly and entirely analyzed taking all the data available from 2008 – 2013 and 2014 – 2020. The study was done during the period from Apr 2020 to September 2020.

3.1.2008-2013: Out of 51 train-elephant collisions occurring between two stations, during the period 2008-2013, the most number of incidents/collisions occurred between Gal Oya-Kantale (Gal Oya-Trincomalee segment, Trincomalee line) and had 13 collisions /incidents (25%) followed by Palugaswewa-Gal Oya stations (Maho-Gal Oya segment, Trincomalee Line) and had 11collisions /incidents (22% out of total incidents occurred during this time) and then by Mannampitiya-Welikanda station and had 8 incidents (16%)**.** (Fig.1)

Out of a total of 67 elephant casualties (deaths and injured), during the period 2008-2013, the most number of casualties were between Gal Oya-Kantale stations (Gal Oya-Trincomalee segment, Trincomalee Line) with 20 casualties (30%) followed by the Pulugaswewa-Gal Oya (Maho-Gal Oya segment, Trincomalee Line) with 11 casualties (16%) and lastly, Ambanpola-Galgamuwa (Maho-Anuradhapura segment, Northern line) with 9 casualties (13%).

3.2.2014-2020: Out of 63 train-elephant collisions occurring between two stations, during the period 2014-2020, the most number of incidents occurred between Palugaswewa-Gal Oya stations (Maho-Gal Oya segment, Trincomalee Line) and had 11 collisions /incidents occurred during this time (17% out of total incidents occurred during this time) and followed by Cheddikulam-Madhu

Road (Medawachchiya - Madhu Road, Talaimannar line) and Mannampitiya-Welikanda station (Gal Oya-Batticaloa, Batticaloa line) and had 7 incidents each (11%), then by Welikanda-Punani (Gal Oya- Batticaloa, Batticaloa line) , Gal Oya -Hingurakgoda (Gal Oya- Batticaloa, Batticaloa line), Ambanpola-Galgamuwa (Maho-Anuradhapura , Northern line) and had 6 incidents each (9%). (Fig.1)

Out of a total of 79 elephant casualties (deaths and injured), during the period 2014-2020, the most number of casualties were between Pulugaswewa-Gal Oya (Maho-Gal Oya segment, Trincomalee Line) with a total of 15 casualties (19%), followed by Cheddikulam-Madhu Road, (Madawachchi - Madhu Road, Talaimannar line) with a total of 13 casualties (17%) and then by Welikanda-Punani (Gal Oya-Batticaloa segment eastern line) with a total of 9 casualties (11%)

There is an increasing trend found in a train-elephant collision by incident wise at the Cheddikulam-Madhu Road (+7) of the Talai Mannar line, Mankulam-Murukandi (+4) of the Northern line Whereas decreasing trend is found at the Gal Oya-Kantale, (-10), of the Trincomalee line. Post-2013, i.e. 2014-2020 Northern line and the Talai Mannar line have the most number of the incident, as well as the elephant of the causalities, have happened found increasing trend and Gal Oya- Kantale section incident, as well as casualties, had found a decreasing trend.

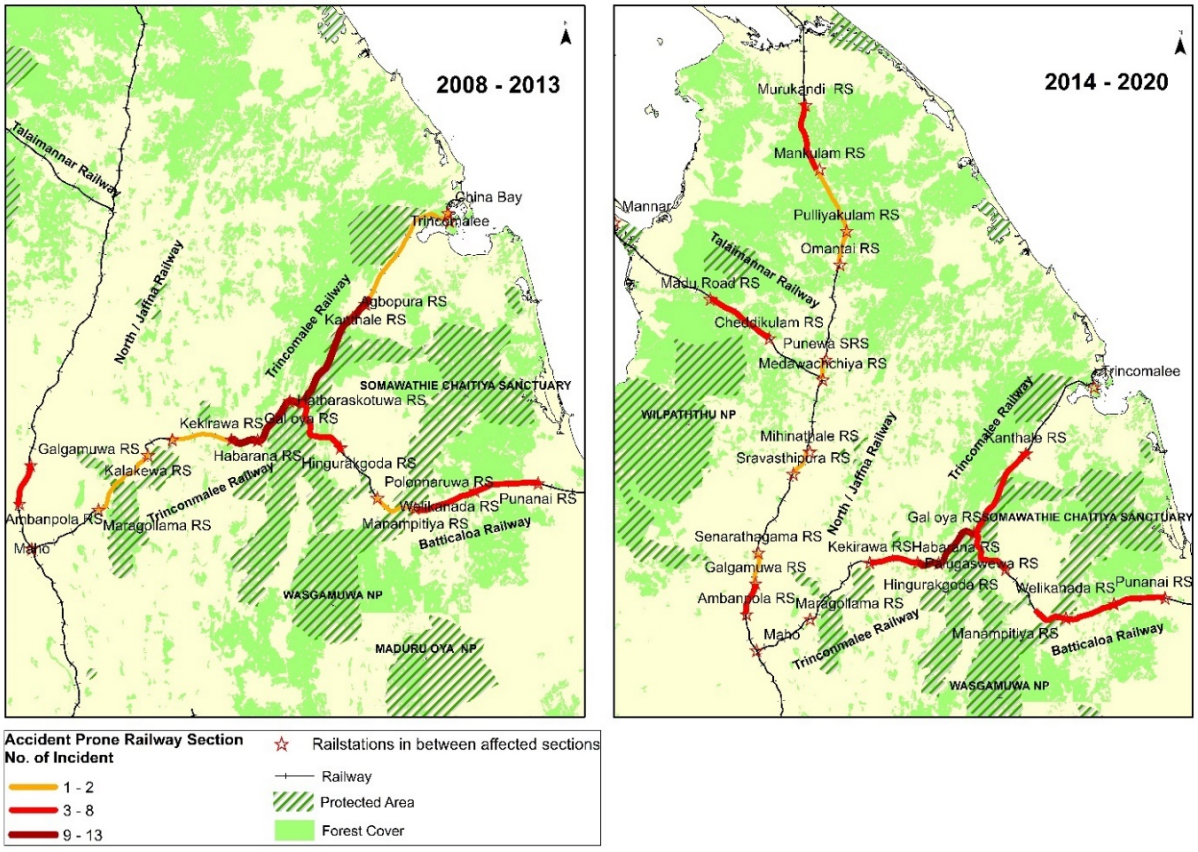

Fig 1 Comparisons of Incidents occurring from 2008-2013 and from 2014-2020

The above maps show the differences in the location and number of incidents occurring from two different periods, from 2008-2013 and from 2014-2020. Between 2008-2013 and from 2014-2020, the most number of incidents occurred on the Trincomalee Railway Network. However, this accident prone railway section with 9-13 incidents from 2008-2013 extended from Agbopura RS to Habarana RS but from 2014-to 2020 extended only from Gal Oya RS to Habarana RS.

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Acknowledgments:

We extend our gratitude to the Asian Development Bank team, especially Kirsty Rowan Marcus (Transport Specialist South Asia Department, ADB) , Karma Yangzom (Principal Environment Specialist,ADB) , Marco Sprong (South Asia Department's Environment Staff Consultant, ADB), and Maheeni Samarakoon (Environmental Safeguard Specialist, Colombo Suburban Railway Project) for going out of their way to collect questionnaires and elephant train collisions data from Sri Lanka. We thank to Mr. Asela Kulatunga for sharing his expertise and Dr. S. Wijeyamohan for sharing expertise and maps of Sri Lanka. Sincere thanks to Sri Lanka Railways for sharing data about train-elephant collisions.

Landscape Predictors of Human Elephant Conflicts in Chure Terai Madhesh Landscape of Nepal

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Human elephant conflict (HEC) is rapidly increasing throughout the Asian elephant range countries including Nepal. HEC occurs in the form of human deaths and injuries, and crop as well as property losses. We compiled 10,798 incidents of HEC including attacks on humans, crop and property losses caused by elephants in the Chure Terai Madhesh Landscape, Nepal, between January 2001 and June 2020. We interviewed 10.3% of the total households affected by HEC using structured questionnaire. We used multivariate analysis to identify landscape predictors associated with HEC. The intensity of HEC was high in the areas with higher forest fragmentation, vicinity to forests, protected areas, and larger coverage of seasonal surface water. Landscape heterogeneity, effective mesh size and altitude also contributed in HEC. Socio-economically marginalized communities living close to forests are more vulnerable to HEC. The spatial risk map of HEC identified Jhapa and Koshi in the eastern region; Parsa and Chitwan in the central region, Bardiya and Kanchanpur in the western region as HEC hotspots. Restoration of forests and corridor functionality in these hotspots could reduce HEC. The comprehensive under-standing of HEC

from this study provides important insights to devise strategies and actions for mitigating the HEC at the landscape level.

Pre-Assessment of Deterioration of African Elephant's Habitat in Mikumi National Parks, Tanzania.

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The ongoing destruction of elephants' habitat in Mikumi national park is no longer tolerable since it is revealed to contribute to poaching and continued human-elephants conflicts and other related challenges. Encroachment is contributed by anthropogenic factors including overgrazing, shifting cultivation, tree clearing for both social and commercial purposes which eventually have resulted into significant loss of the plant species that are suitable for maintaining ecology in Mikumi National Park.

The goal of the pre-assessment study was to generate and triangulate perception and thoughts among the stakeholders on the protection and management of the elephants' habitat in Mikumi National Park for assessment to action study. Our study has revealed that anthropogenic factors are directly linked to adjacent communities' needs and demands especially for social and economic gains including agriculture activities for food production and income generation, also, excessive dependence from forest products as a source of energy at household and charcoal making for income raising. Yet there is a gap in terms of information and actions among the stakeholders on how anthropogenic activities which contribute to deterioration of habitat are communicated to adjacent communities and other actors and no joint planning for conservation actions is being carried out to rescue the situation.

The pre-assessment study has generated significant and useful data that informed the research team to carry out Assessment to Action study. This will require more participatory methodologies which involves modelling best practices to address the challenges contributing to the deterioration of elephant habitat in the selected park area.

Making Space for Asian Elephants: Reviving Degraded Elephant Habitat in Assam, India

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Degradation and loss of elephant habitat in Assam have led to increased human-elephant confrontation, which are mostly negative, and thus escalated Human elephant conflict (HEC). To safeguard the elephants as well as human well-being, conservation attention must be directed towards long–term approaches like habitat restoration. With an aim to understand and improve the habitat quality we collated HEC data from secondary sources, used land use land cover change detection analysis to detect the change in elephant habitat, and eventually facilitated habitat recovery. The study was conducted from 2019-2021. Our initial analyses indicated that Baksa and Nagaon Forest divisions are high HEC zones in Assam, measured by the number of elephant and human deaths. We further used multi temporal satellite data of 44 years for Baksa and Nagaon

Forest Divisions (satellite data used: 1977, 1987, 1999, 2008 and 2019) to assess the change in habitat. We found that in both the divisions, the elephant habitat declined in the last 44 years; and the existing habitat is degraded. Invasive alien plants (IAPs) such as the *Lantana camara* and *Chromolaena odorata* were found in abundance in Baksa-habitats, while in Nagaon *Diplazium esculentum* were dominant. We identified and prioritized sites in both the Baksa and Nagaon division for habitat enrichment which will facilitate the elephants. We collected baseline information on the vegetation using quadrate method (10x10 m) to monitor change. The three priority sites were cleared of weeds and IAPs by engaging local communities. The sites selected in Nagaon division were two wetlands, which were desilted and we could revive 8 ha area. This was followed by plantation of elephant fodder plants. While in Baksa division, we undertook a habitat enrichment initiative and planted around 7000 tree saplings. Although habitat restoration is crucial to reduce HEC and increase habitat availability for the elephants, the process is resource-hungry, requires long-term commitment and efforts. Our initiative to restore elephant habitats will aid in achieving long-term solution to reduce HEC and facilitate elephant movement.

Understanding Human Elephant Conflict

Roaming Elephants in Epe, Lagos Nigeria

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The critically endangered elephant has had an 86% population decline in the last 30 years. The African elephant population was estimated at 415,000 by the IUCN in September 2016. Despite the international ban on trade in ivory and Nigeria's Endangered Species Act of 2016 which criminalizes trade in elephant products, Nigeria remains the hub for the illegal trade in ivory for Asian countries. Also conflicts between elephants and the growing human population are a major issue in elephant conservation. This often results in serious animal/human conflict.

The Omo Forest Reserve is a preserved area of 130,500 hectares of tropical rainforest located in Ogun State Southwest Nigeria. Vegetation consists of a dry evergreen mixed deciduous forest northward while in the south, it is more of a mixed moist deciduous forest and at the heart of the reserve, a plot of 640 hectares is designated as a Strict Nature habitat that belongs to the UNESCO Biosphere Reserve. The reserve has attracted thousands of small farmers seeking fertile land and respite from poverty. Consequently, the increasing farming activities have forced herds of elephants to migrate out of the reserve to areas around the border of Ogun State and Lagos State where the Imobi-Itasin-Epe Lagoon communities are situated. These herds are now the largest and most endangered in Nigeria as the farmers have sighted several elephant individuals. The elephants have been raiding crops, destroying farmlands, and causing large economic losses to the farmers with many of the farmers lamenting the negative impact of the elephant invasion on their livelihood. The situation will only get worse if not abated as there will be more damage leading to the harming of the elephants by frustrated farmers of the Epe waterside. Most farmers are only being restrained from retaliation because they are aware that the elephants belong to the government and so are appealing to the government to help them so they could return to their farms. Presently, four herds numbering about 40 forest elephants are currently roaming and

causing havoc in between the Omo Forest Reserve and Epe town. Farmers continue to pay a hefty price as each elephant eats up to 450 kg of food and a single elephant can run through one hectare of a farm in a very short time.

One of the most urgent steps should be a nationwide survey to establish the population of elephants in Nigeria to be able to design and develop suitable conservation strategies. Two methods have worked successfully to manage human-elephant conflict in many countries, Pure Conservative Measures and Touristic Measures. The former would provide an enabling environment for the animals and the villagers through established management actions such as habitat management, use of artificial barriers, training of villagers on elephant repelling farming operations and methods, the use of chili peppers, and tobacco-based deterrents, etc. Playback of recorded sounds of angry honeybees has also been found to be remarkably effective, prompting the animals to flee an area. The touristic measure however has high economic and recreational potential to transform Lagos State into a giant tourism hub, if necessary management action is taken to simulate natural barriers in turning the area into an Elephant Island.

Elephants and Sustainable Agriculture in Kenya (ESAK): Deterrent Fences, Habitat Quality, Food Security, and Education

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In 2016, the *Elephants and Sustainable Agriculture in Kenya* (ESAK) project was initiated with three major goals: (1) enhancing food security for smallholder farmers; (2) improving the conservation and status of elephants, sympatric species, and their habitat; and (3) ultimately, mitigate the impacts of climate change through the associated activities. A consortium comprising of ecologists, wildlife biologists, conservation practitioners, and agricultural engineers was formed to implement the project. ESAK was established with support from the IEF, the Earthwatch Institute, respective institutions included in the consortium, and other external sources.

The challenge ESAK strives to overcome is improving food security while conserving the endangered African elephant, which competes with people for resources such as food, water, and space. Our study site is located within the Kasigau Wildlife Corridor (KWC) where one of the consortium partners, Wildlife Works, implements the Kasigau Corridor REDD+ Project (KCRP)[1]. The KCRP comprises dryland forest habitat covering half million acres (200,000 ha) of land that forms a corridor between Tsavo East and West National Parks; over 100,000 people reside in this region and regularly interact with elephants and other wildlife, often in a detrimental way to both the people (their crops, property and welfare) and the elephants. The larger Tsavo Conservation Area has an estimated population of 14,000 elephants. From 1995-2017 elephants were involved in 61.6% (24,032) of the reported human-wildlife conflicts in the Greater Tsavo Ecosystem. The ESAK project aims to improve food security through reducing negative human-elephant

interactions and modifying agricultural practices, and by enhancing wildlife conservation through community educational programs.

Crop raiding by elephants remains a major food security issue in many places, and creates a highly negative perception of elephants by affected farmers; they are less likely to be supportive of conservation of wild habitats, and are more likely to retaliate against elephants and other wildlife. ESAK has experimentally tested numerous deterrent fence designs to reduce crop raiding, focusing on multimodal fences to improve effectiveness while also emphasizing affordability and practicality.

Elephants are ecosystem engineers that significantly modify their habitat, especially by altering vegetation structure, cover, diversity, and growth. High and sustained elephant densities can lead to excessive and extensive tree damage, resulting in a transition from forest to early successional habitat. For species that depend on forested areas, including humans, this modification could cause widespread trophic changes, leading to resource scarcity and declines for some species. Under ESAK, we seek to better understand the effects of elephant habitat modification on wildlife species and ecosystem function.

Climate Smart Agriculture (CSA) introduces techniques to bolster crop productivity through improved soil and water conservation, and use of crops and crop varieties that both reduce time to harvest and enhance protection from crop raiding. Through experimental testing, ecological monitoring, demonstrations, and educational programs, we hope to spread the use of viable CSA practices in tandem with affordable, practical, and effective deterrent fences and sustainable habitat management. In sum, these diverse but interconnected actions under ESAK will improve food security, aid elephant and wildlife conservation, and moderate the impacts of climate change.

[1]*REDD+ (Reducing Emissions from Deforestation and Degradation plus the sustainable management of forests, and the conservation and enhancement of forest carbon stocks) is a climate change mitigation strategy introduced under the UNFCCC framework to help stop destruction of the world's tropical forests by providing financial alternatives. The idea surmises that countries willing and able to reduce emissions from deforestation and forest degradation should be financially compensated and their actions will benefit local communities.*

Elephants, Bees & Human Coexistence

Bright Geofrey Kata, Manuela Hesse
Eco Hub Africa

We are working on a community project of bee fences to enable farmers close to the Queen Elizabeth National Park, in the Kyondo Community, to be able to grow crops and have an alternative income. Our community, like many, happens to be neighboring the Queen Elizabeth National Park. This means that in the evenings, elephants, hippos and sometimes buffaloes come into the community mostly during the rainy season and part of the dry season when it is peak harvest time. Since there is no timetable as to when the elephants, hippos and buffaloes come into the Community's farms, farmers have to stay awake all night to guard their crops from being destroyed. One night of sleep in most cases means waking up to a flat field where there stood an

almost ready to harvest farm the previous night. In 2017, we set up a Demonstration Fruit Farm for the Kyondo Community as we wished to focus on permaculture practices that would enable farmers to have multiple sources of livelihoods. In 2018, one-year after the farm was set up, a herd of 12 Elephants raided that night and the whole farm was completely destroyed. The same has been going on to date not only at the Eco Hub Africa Demonstration Farm but in all the communities' farms too.

To better understand the scope of the problem we were dealing with, we hired a team onsite to specifically spend the nights out together with the rest of the community to not only protect the Hub's demonstration farm, but to also continue learning about all the different methods being used by the community to keep the elephants away. These included game rangers shooting bullets in the sky to scare elephants off though our team said this happened about only twice a month. Meaning farmers were left to fend for themselves most of the time. Kids and adults stand in doorways all night hitting drums, wood, metal, plastic tins and anything that can make noise to let the elephants know they are being watched, unfortunately one at a time they all end up sleeping. Fires are lit in different sections of farms though this proves impossible when it is raining. Since there is no electricity in the community, Torch lamps are utilized to spot elephants in the dark, but battery running out may result in one running into a herd of elephants and hence risking their life. The government is doing their best to fence the Park with an electric fence. This has been going on for ages but our community being swampy close to the Park makes installing an electric fence even more difficult. Electrocution could be a huge problem. We researched more effective methods and realized bee fences were a solution being used in Botswana, Kenya and other communities around the world that were faced with the same challenge.

We then established our first 50 bee hives onsite. For the time that they were placed in the Lemon Orchard with a couple of them colonized with bees, no more Elephants walked through the orchard but more to the other sections with bananas and other fruit trees. Realizing this, we have since then moved them to another section in the farm with a lot of shade to ensure they multiply before we can put them around the whole property as a fence. And hence scaling the project to other community farms.

To ensure that farmers can continue to grow crops and have an alternative source of income in communities close to National Parks, Beekeeping is a project that can not only foster co-existence of humans with Elephants, but also enable farmers to have a revenue despite their low or high crop harvests. This ensures too that land is not transformed from Agroforestry practices to destructive activities like clay brick making in our community which has left the land more exposed to erosion, flooding and nutrients depletion all which continues to contribute to climate change.

Assessing Spatial Distribution of Human Elephant Conflict Based on the Issue of Thunder Flashes in Wasgamuwa, Sri Lanka

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In Sri Lanka, a larger proportion of elephants have home ranges that lie outside protected areas. As a consequence, negative interactions between humans and elephants are frequent. Among the mitigation measures for human-elephant conflict (HEC), one of the most widely used is the distribution of thunder flashes – a large firecracker approximately 30cm long and 2.5cm diameter. Farmers protect their crops, by lighting the fuse of the thunder flash and throwing it at elephants to chase them away. The explosion of the thunder flash works as a deterrent to the elephants. Thunder flashes are given free of charge to the community by the Department of Wildlife Conservation (DWC). On average farmers are given two thunder flashes per request. Depending on the severity they may make multiple requests. As thunder flash use is widespread, it could be used an indicator of the intensity of the HEC. We collected data on the issue of thunder flashes by the DWC for five years from 2015 to 2019, in the Wasgamuwa area in the dry zone of Sri Lanka. Each issue of thunder flashes was assigned to the relevant Grama Niladari Division (GND), which is the village level administrative unit. We analysed the data in a GIS environment to identify the spatial intensity of thunder flash use. We analysed it for the total period of five years and analysed it in relation to the location of the electric fences of two types (enclosure – village fences and linear- DWC fences), effort invested in crop guarding, cropping seasons, and favourable habitats of elephants such as occurrence of man- made lakes and day time refuges of elephants.

Our results reveal that thunder flash use was clustered, there were clusters of high (hot spots) and low (cool spots) thunder flash use. The farmers in GNDs with village electric fences utilized a lesser number of thunder flashes when compared with those bordered by linear electric fences on the boundary of protected areas. Areas with year- round agriculture with daily crop guarding had lower thunder flash use compared to areas with lesser crop guarding. GNDs that had isolated forest patches in the GNDs had higher thunder flash use than those without forest patches. GNDs with man-made lakes with surrounding forest and scrubland utilized a higher number of thunder flashes than areas with man-made lake surrounding human dominated landscapes such as home gardens. Our findings reveal that the intensity of the HEC varies spatially and is driven ecological and anthropogenic factors that are site specific. Such knowledge facilitates the prioritization of locations for HEC mitigation and also to identify appropriate site-specific mitigation measures, thus enabling more effective management of HEC.

Evaluating Elephant Presence Around Agricultural Land in Relation to Lunar Phase and Crop Season Progression

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Changes in the environment can have strong influences on animal behavior. Understanding how these changes impact interactions between wildlife and their environment is necessary for determining successful mitigation strategies for human-wildlife conflicts. As part of the Elephants and Sustainable Agriculture in Kenya (ESAK) project, over four years of study have been dedicated to mitigating a form of human-wildlife conflict, human-elephant conflict, in the Kasigau Wildlife Corridor (KWC) in southeastern Kenya. ESAK started by focusing on the construction of deterrent fences to help prevent elephant crop raiding, including the collection of environmental (moon phase) and agricultural (crop season) data around the Rukinga Wildlife Sanctuary. These data are components of a developing ecological prediction system for elephant crop raiding events. Moon phase and crop season progression were chosen because of the nocturnal crop raiding behavior of elephants and the inverse relationship between crop growth and the availability of natural forage in the KWC. This study examined two hypotheses: 1) there would be higher elephant presence around crop fields at the end of the crop season, when natural forage quality is decreasing, and 2) elephant presence would have a negative relationship with lunar light levels; as light levels increased, elephant presence would decrease.

Stage within the lunar cycle and progression of the crop season data were compared to elephant presence within 12 m of experimental crop fields along the boundary of wild habitat and human agricultural land to provide an indicator for potential crop raiding events. Data on elephant presence, lunar cycle, and crop season progression were collected and analyzed from 2017-2019, and 2021 using camera trap images, local reports, footprints/damage, and online NASA databases for lunar cycle.

Through statistical analyses using linear regression and mixed effect logistic regression models, we found that there was a significant positive relationship between elephant presence within 12 m of the experimental fields and the progression of the growing season. The highest number of elephants present was at the end of the growing season, when farmers were harvesting their crops and natural forage was dwindling. Elephants were present around crop fields significantly less during the full and gibbous moon phases, when lunar light levels were high, when compared to the new moon phase, when light lunar light levels were low. Elephants were also present significantly more during the waning moon phases when light levels were decreasing. These easily collected environmental data have strong relationships with elephant presence that can be used to predict potential elephant crop raiding events.

Discerning the way that changes in crop status and moon phase impact elephant behaviors around human settlements will help farmers and researchers better prepare peaceful mitigation practices that consider the wellbeing of people and elephants. Further understanding of the impacts of these

factors, as well as the consideration of other environmental factors, on animal behavior may have broader applications in the mitigation of human-wildlife conflict both in Kenya and globally.

Human-Elephant Conflict: A Perspective from Zimbabwe

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The expansion of human settlements into former elephant migratory paths has led to increased human-elephant conflict across Zimbabwe. The purpose of our paper was to the drivers and effects of human-elephant conflicts across different regions of Zimbabwe using a desk review approach. Human-Elephant conflicts often occur around the boundaries between wildlife parks and human settlements mostly being driven by the high interaction levels between humans and elephants in those areas. Such is the case with the Save valley, Southern Zimbabwe, where reports of human-elephant conflicts are increasing. Such human-elephant conflicts have resulted in the loss of human life, disruption of agricultural activities and in some instances loss of infrastructure by communities. Our paper proposes several mitigation strategies for example traditional deterrents and the use of non-electric fences.

Elephant-human conflict refers to" any interaction between humans and elephants that results in negative impacts for both parties". Human-Elephant conflicts often occur when the needs of elephants negatively affect humans. Human-Elephant conflicts can be considered inevitable in all communities where humans and elephants co-exist and share the same habitat (Cumming and Jones, 2007). It's important to note that human-elephant conflicts not only affect rural areas, but they have an international magnitude even in urban areas (Breteinmoser et al., 2005). In Africa human-elephant conflicts occur when elephants and human co-exist at an area with limited resources. The February 2020 meeting of the Southern African Development Community (SADC) announced that human-elephant conflicts was one of the main problems for Africa's problem of personal security and economic loss. Between 2002 and 2006 more human-elephant conflicts were recorded in Zimbabwe which resulted in the killing of 774 elephants during subsequent PAC operations (CAMPFIRE 2007). Recorded incidents of elephant-human conflicts increased from 74 in 2006 to more than 300 by 2010 (Le Bel et al., 2011). In 2020, there were more than 50 injuries and 60 deaths due to growing human-elephant conflicts in Zimbabwe (www.zimparks.org.zw). Zimbabwe's human wildlife conflict statistics are showing a gradual increase in the number of people being killed and injured by elephants from the year 2014, to 2021 (Mangwana, 2021). In 2021 a total of 72 people had been killed due to human-wildlife conflict across Zimbabwe of which 90% was a result of elephants and crocodiles (Herald,30 December 2021).

The intensive competition for food and water is one of the main drivers to the human-elephant conflicts in Zimbabwe. The Hwange national park is the biggest wildlife reserve in the Southern African Nation (Bennet, 2016). In Hwange, during the dry season, the competition between elephants and other animals increases

Problem of Elephants in the Itombwe Nature Reserve (RNI) in Dr. Congo

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The Nature Reserves (RN) of the DR. Congo in general and that of Itombwe (RNI) in particular have problems and difficulties related to armed poaching of elephants, gorillas, chimpanzees, buffaloes and other animal species. Some for the reason of the ivories and the others for the meats.

The Itombwe Nature Reserve (RNI) is located in the province of South Kivu, in the Democratic Republic of Congo (DRC), is renowned for its incredible biodiversity. Several expeditions have indeed made it possible to discover that this forest massif located on the high plateaus of Fizi and Uvira, in the territory of Mwenga. The latter is a large forest block of the Albertine Rift which is an important habitat for forest elephants and other. It is the largest and most isolated intact mountain forest in Africa. It has many families of elephants, gorillas, chimpanzees but also important endemic species. These areas are currently highly threatened. Since 2021, the Hauts Plateaux of the Fizi and Mwenga territories in South Kivu have experienced a resurgence of violence due to the activism of armed groups and inter-community conflicts leading to the massive displacement of local populations in and around this reserve, according to certain reports by organizations national and international at least 13,672 households (approximately 82,032 people) fled these clashes. These displaced people are with host families in the localities of this Itombwe nature reserve, among others Kipupu, Kiseke, Tumungu, Nabindi, Aboke, Lubunga, Mikenge.

Elephants, mountain gorillas and chimpanzees are the animals most threatened by traditional illicit hunting, the activities of foreign and local armed groups, artisanal mining of minerals (cassiterites, gold, coltant, etc.), bush fires, pastures, the installation of human dwellings in the reserve also the weak local governance make a danger of extinction of these animals in this reserve. But also the rural activities carried out by these people are a higher danger and a threat to biodiversity and their regular attendance. Apart from the threats of extinction of these animals in the reserve by men, but also attacked by different diseases not diagnosed or investigated by specialists (veterinarians). They reproduce but in danger fearing to be attacked during the put down. This is why, following these problems, these animal species flee the reserve to other uncontrolled and unsecured places.

Recognizing this situation, we recommend the following:

1. Support civil society organizations in the field to raise awareness and mobilize communities for the free movement, survival, safety and protection of elephants, gorillas and chimpanzees,
2. Support local organizations in advocacy with environmental and tourism services to raise their awareness of animal rights and the importance of protecting elephants and other wild animals,
3. Make veterinary specialists available at the local level to ensure the care of elephants and other wild animals,
4. Create income-generating activities for victims of atrocities and vulnerable populations in order to help them meet the needs of their households.

The protection of elephants and other wild animals will only be possible with the involvement of all of us and all social strata living at the local, national and international level.

Environmental Leadership of Conservation of Elephants

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We are a youth led organization that nurtures youths into passionate environmental leaders by mentoring them on environmental conservation and management. The ultimate goal is for them to take a critical role in providing environmental conservation awareness and advocacy in their communities, schools and homes. We aim to create a future with youths that have relevant knowledge and understanding about environmental conservation and management, so that they become nature guardians, actively protecting and preserving nature for ourselves and future generations. We aim to ensure that youths and communities have sufficient knowledge, understanding and experience on biodiversity and ecosystems to enhance behavior and attitude change towards environmental conservation.

Our youth mentorship program provides an insight into conservation of endangered mammals of Malawi, which normally takes place at Kasungu National Park for a week long camping. Mentees are given a chance to go on tours at the park to see different animal species including the elephants. The tours act as complementary sessions while main sessions cover elephant conservation in areas of; ecology, threats, behaviour, impacts of loss and how to conserve them. The youths are then trained on how they can provide education, awareness and community meetings to their fellows and community members.

It is evident that lack of community participation, youth involvement, misconceptions and dissemination of conservation information make it hard for community members and youths to participate in the conservation efforts leading to loss of wildlife through human driven threats. Through early exposure to leaners in elephant' conservation, it will significantly contribute to creation of interest and impact their adulthood. Both communities and leaners will develop interest, passion, skills, knowledge and understanding in protection and caring for wildlife. Through this program, leaders in conservation will be built since their minds will be pre-exposed to conservation and their perception on wildlife will positively change. The communities will also bare a different perception about elephants than what they had prior to the education, hence impacting elephants' conservation efforts.

The next step in our efforts is to provide community development strategies that will enable community members to have access to different livelihood needs to reduce their dependency on natural resources for their survival. NatureKit would like to implement a bee keeping project that will support community members as well facilitate reduction of human wildlife conflict and enhance co-existence. Besides that, NatureKit would like to facilitate construction of efficiency cooking stoves to reduce deforestation rate through reduction of amount of firewood used by each household, thereby reducing carbon emission.

Wednesday – August 17, 2022

<u>Veterinary Medicine and Elephant Endotheliotropic Herpesvirus (EEHV)</u>

Contaminated Food Aversion in Captive Asian Elephants

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Animals' perception of disease risk can translate into different behavioral responses depending on the level of pathogen threat, the context, and other potential costs and benefits at stake. Despite being crucial for survival and fitness, the behavioral immune system (i.e. the behavioral manifestations of parasite and pathogen avoidance) has been seldom investigated in elephants. Their olfactory-driven foraging behaviors could nonetheless confer them a selective advantage in detecting contamination at a low level. In this study, we investigated whether Asian elephants (*Elephas maximus*) can detect food contaminated with conspecific feces or soil and whether they would avoid it. We conducted binary choice experiments with 4 adults (2 males and 2 females) at Seoul Zoo, South Korea. We presented pieces of bananas either rolled within feces, soil or left uncontaminated (control). We video-recorded whether each individual fed or not on the presented food items as well as whether they smelt, touched, shaked and/or washed the food to a nearby pool with their trunk. Our results show that individuals fed significantly more on control food than on food contaminated with soil or feces. All individuals smelt and touched the different food items as part of an assessment process. However, only two individuals on four tasted foods contaminated with conspecific feces. Processing (shaking and washing) mainly concerned soiled and feces-contaminated food. These results converge with similar findings in primates, ungulates, marsupials and rodents, and constitute a preliminary basis for further investigating behavioral immunity in elephants. Our next studies aim to assess individual variability and the different trade-offs involved in the behavioral responses to risk perception. Finally, we argue that contamination and contaminant aversion should be integrated into the assessment of elephant welfare in captivity.

Prevalence of Antimicrobial Resistant Fecal Pathogens of Elephants in Ghana

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Although *Loxodonta Africana*, the African elephant is the largest living terrestrial mammal and occurs widely across Africa, their population has faced major decline in recent past. In Ghana, the Mole National Park (MNP) is home to the largest population of elephants in the Savannah habitat zone of Ghana. A major factor hindering the conservation of elephants at the Mole National Park is the lack of fine-scale data on the distribution of and factors affecting the occurrence of antimicrobial resistance among the elephants. For the purpose of conservation and planning, basic information on occurrence of antimicrobial distribution amongst the elephant and their environment would help take critical measures to reduce infection due to resistance and appropriately monitor the administering of drugs to them. It would also inform the officers and other workers of the park on proper ethics to avoid the possible transferability of these resistant bacteria from the elephant or their environment to humans. The goal of this project is to identify the prevalence of *E.coli* in the elephants and their environment (food and water). It is to also determine the antibiogram of these bacteria and detect the resistance genes responsible for these resistances. A total of 200 samples would be collected; these would include rectal swap,

food(foliage) and drinking water of the elephants and sent to the microbiology laboratory of the Water Research Institute of CSIR-Ghana for analysis. Qualitative data that would be collected would include the age, sex and weight. Sample collection would be done within three months. Based on Bacterial Analytical Manual (BAM), Escherichia coli (*E.coli*) would be isolated from these samples. Antimicrobial susceptibility testing would be performed on all E. coli isolates using the Kirby-Beaur method with guideline from the Clinical and Laboratory Standard Institute (CLSI). Double disc diffusion test would be performed to phenotypically determine the ESBL carriers amongst the *E.coli* isolates. The DNAs of the *E.coli* isolates the harbors the Extended Spectrum Beta-Lactamase (ESBL) genes would be extracted by use of extraction kit based on manufacturer's protocol. By use of Polymerase chain reaction, all ESBL producers would be screen for the presence of ESBL genes they may harbor. Significant differences amongst the prevalence of antimicrobial resistance of fecal E. coli isolated from male and female, juvenile and adult, food and water would be determined using Fisher's exact test using StatXact 4.0.1 and Statistical Parkage for Social Sciences (SPSS).Selected ESBL producers would be sequenced and comparative analysis would be made (isolated from male and female, juvenile and adult, food and water) comparing using haplotype network by POPART 4.1 and phylogenic tree by MEGA X. Knowledge on the prevalence of *E.coli* would inform the policy makers of this sector as to the health status of these animals and help in diagnosis of infections. The awareness that the antibiogram would create would help make the appropriate choices of antibiotics to administer to these animals. Based on the risk factors that influenced the resistance, handlers and guides (local people) would be careful if they want they treat the food/water so as to avoid the transferability of the resistance genes.

Platelet Counts in African Elephants (Loxodonta Africana), a Method Comparison Study

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Thrombocytopenia has been demonstrated to be an important diagnostic hematologic finding when evaluating possible EEHV disease in elephants. However, the reliability of the various platelet counting techniques have not been assessed in African elephants. In particular, automated hematology analyzers are suspected to not detect the majority of platelets due to their small size, thereby leading to inaccurate counts. The objective of this study was to compare three methods of total platelet counting in African elephants.

A repeated sampling method comparison study was designed on 16 individual elephants. Serial blood sampling over 2.5 years was performed and over 600 blood samples were collected on EDTA. Platelet counting methods were performed within 2 hours post collection and within similar time frames by one trained observer. Methods included an automated hematology analyzer (Horiba Pentra DX120), a platelet estimate from a stained blood smear, and a manual platelet count (Whi-pette, Exotic Animal Solutions) considered the reference method. Precision of the methods was obtained by running 10 replicates on each technique from 3 elephants. Agreement between the methods was assessed using differential plots with the constant bias, proportional bias, and limits of agreement obtained from linear mixed modelling. Agreement was interpreted within the

inherent imprecision of the 3 techniques and within total allowable error limits for platelets defined at 25%.

Precision of the techniques was 3% for the automated analyzer, 7% for estimated counts, and 8% for manual counts. The automated analyzer significantly underestimated platelet counts by a considerable margin. It also had a significant constant and proportional bias. However, the limits of agreement were low (10%) and below total allowable error limits and a corrective formula could be used. The estimates from the smear were also unreliable with significant constant and proportional biases with wide limits of agreement (47%) beyond allowable error limits.

This study demonstrated that the automated analyzer drastically underestimated platelet counts in African elephants, which is suspected to hold true in other automated analyzers uncalibrated for elephants. The high precision of the automated analyzer coupled to low limits of agreement and the possible use of a corrective formula suggest that it may be possible to calibrate or modify these analyzers for use in elephants. The estimates from the smear were found to be unreliable with significant biases, large limits of agreement and no clear disagreement pattern. This suggest that they should not be used in elephants until further standardization allows to increase accuracy and decrease variability. In conclusion, until other platelet counting techniques are optimized for elephants, it is recommended to use a manual hemacytometer-based technique to obtain total platelet counts in elephants.

Identification of African Elephant Polyomavirus in Wild Elephants and the Creation of a Vector Expressing Its Viral Tumor Antigens to Transform Elephant Primary Cells

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Wild elephant populations are declining rapidly due to rampant killing for ivory and body parts, range fragmentation, and human-elephant conflict. Wild and captive elephants are further impacted by viruses, including highly pathogenic elephant endotheliotropic herpesviruses. Moreover, while the rich genetic diversity of the ancient elephant lineage is disappearing, elephants, with their low incidence of cancer, have emerged as a surprising resource in human cancer research for understanding the intrinsic cellular response to DNA damage. However, studies on cellular resistance to transformation and herpesvirus repro- duction have been severely limited, in part due to the lack of established elephant cell lines to enable *in vitro* experiments. This report describes creation of a recombinant plasmid, pAelPyV-1-Tag, derived from a wild isolate of African Elephant Polyomavirus (AelPyV-1), that can be used to create immortalized lines of elephant cells. This isolate was extracted from a trunk nodule biopsy isolated from a wild African elephant, *Loxodonta africana*, in Botswana. The AelPyV-1 genome contains open-reading frames encoding the canonical large (LTag) and small (STag) tumor antigens. We cloned the entire

early region spanning the LTag and overlapping STag genes from this isolate into a high-copy vector to construct a recombinant plasmid, pAelPyV-1-Tag, which effectively transformed primary elephant endothelial cells. We expect that the potential of this reagent to transform elephant primary cells will, at a minimum, facilitate study of elephant-specific herpesviruses.

The Role of Neutrophil Extracellular Traps in Elephant Endotheliotropic Herpesvirus (EEHV) Hemorrhagic Disease (HD)

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Neutrophil extracellular traps (NETs) are web-like structures released by neutrophils to capture pathogens.[1] Dysregulated NET release is associated with disease pathology, including as a consequence of immunothrombosis.[2,3] Elephant endotheliotropic herpes virus hemorrhagic disease (EEHV-HD) causes widespread coagulopathy with increased thrombosis, suggestive of NET pathology.[4] Documenting NETs in EEHV-HD will increase knowledge and potential to improve outcomes for affected elephants through NET blocking medications.

We previously described NETs in human patients with COVID-19 sepsis and recognized similarities with EEHV-HD sepsis.[5] We hypothesized that NETs contribute to immunothrombosis in EEHV-HD, leading to fatal hemorrhage through a consumptive coagulopathy with microthrombi. To determine if elephant neutrophils (heterophils) form NETs, we isolated and stimulated elephant neutrophils with NET agonists *in vitro*. We observed profound NET formation in elephant heterophils in a dose dependent manner.

To determine if NETs occur in tissues from elephants with EEHV-HD, we obtained lung, liver, and heart samples previously collected at necropsy from elephants who succumbed to EEHV-HD. We also obtained control necropsy samples from elephants with non-EEHV-HD causes of death. All collected tissues were stained for NETs and results compared between affected vs. unaffected samples. We documented a significant increase in NETs in EEHV-HD heart and liver tissues ($p<0.0001$), as well as evidence of microthrombi throughout the affected tissues. These results suggest that NETs with associated immunothrombosis contribute to EEHV-HD organ failure and may be causative of the very poor outcomes for young elephants with this disease.

Blocking NET release in mouse models of sepsis leads to a dramatic increase in survival with reduction of organ failure.[6] This approach could also improve outcomes for elephants affected with EEHV-HD.[6,7] New medications to prevent NET release in human diseases are being developed. These NET inhibitors hold promise to prevent organ failure caused by immunothrombosis and could increase survival in elephants with EEHV-HD.

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Acknowledgements:

We acknowledge Hogle Zoo, Houston Zoo, Rosamond Gifford Zoo, Denver Zoo, and Santa Barbara Zoo for kindly providing samples. We also acknowledge Aaron Bretones, Niraja Bhachech, Mallory Wilmot, and Ryan Kennington for sample receiving, processing, and documentation. Research reported in this publication utilized the Biorepository and Molecular Pathology Shared Resource at Huntsman Cancer Institute at the University of Utah.

Viral Genotype Analysis of the 12 Most Recent Cases of Lethal EEHV HD in Asian and African Elephants in North America.

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Over the past five years there have been eight deaths from hemorrhagic disease (HD) caused by Elephant Endotheliotropic Herpesvirus (EEHV) in North America among six different Asian elephant housing facilities and four deaths of African elephants involving three facilities. These viruses have all been partially characterized, as well as several others from surviving cases of symptomatic EEHV viremic infections. The goals were to catalogue and analyze the viral species, subtypes and strains involved for comparison with the numerous previous cases that have been evaluated by conventional PCR DNA sequencing approaches worldwide. All six of the Asian elephant facilities had cases of fatal or survived symptomatic EEHV1A viremia previously, but not the African elephant facilities. In summary, these new *Elephas maximus* HD cases involved three novel never-before-seen EEHV1A strains, whereas three proved to match known EEHV1A

strains identified previously. As described before, whenever there were two or more elephants afflicted at close to the same time at the same facility they always involved identical strains, but when occurring multiple years apart at the same facility they were most often distinct strains.

Among the African elephant lethal cases there were three different virus species involved, EEHV3A, EEHV3B and EEHV2. Both of the first two episodes also involved one or more herdmates with the exact same virus strains that survived infection. Surprisingly, just a few months later, three herdmates at the first facility that were found to be shedding the same prototype EEHV3A(Nyah) strain in trunk wash samples as were present in the necropsy tissues from the two lethal cases there were also carrying another different strain of EEHV3A in their blood (collected at essentially the same time). This additional new strain (designated EEHV3A(Kedar1), proved to encode novel hugely diverged versions of the U48.5(TK) protein in CD-II, as well as of U81(UDG), U82(gL) and E37(ORF-O) within CD-III. A different highly diverged CD-III chimeric domain region (subtype-E) has also been observed in strain EEHV3A(Hansa). More recently, two of those herdmates were also found to be mildly viremic with the first known example of EEHV7-associated viremia within the USA (designated EEHV7A(Zahara3). Although we only have DNA sequence data for up to 6-kb so far for about ten EEHV7 strains, those segments differ from their EEHV3 and EEHV4 counterparts by about twice as far as do EEHV3 versions themselves differ from EEHV4 versions.

In comparison to the strains detected at the first facility, the two HD cases at the second facility (one a survivor) were infected with the same identical strain of another novel virus type designated EEHV3B(MB3), with considerable similarities to the original prototype EEHV3B(Samson) identified in 2013. We have previously argued that all known strains of EEHV3B are so different from those of the numerous EEHV3A strains evaluated (ave 9% at the nucleotide level, including many conserved genes not just the CD-II and CD-III segments) that we consider them to be worthy of being designated as distinct species that may have originally evolved separately for about 4.5 million years within *Loxodonta cyclotis* and *Loxodonta africana*, but are now found in the wild within both host species, with EEHV3B evidently being present at a higher frequency in *L. cyclotis* than in *L. africana* hosts. As additional evidence in support of this concept, we cite the nucleotide comparison data for the intact highly conserved "captured" host E4(vGCNT1) acetyl transferase enzyme gene, which differs by 8.6% for EEHV3A versus EEHV3B, but by only 1.5% for EEHV1A versus EEHV1B, by 1.7% for EEHV5A versus EEHV5B and just 1.0% for EEHV4A versus EEHV4B, with the EEHV1 versus EEHV6 versions differing by 9% and the EEHV2 versus EEHV5 versions by 13%.

Finally, from the data at ten PCR loci so far analyzed, the novel new EEHV2(Lucas) genome (only the fourth EEHV2 analyzed) differs sufficiently (about 20%) at three hypervariable loci U48.5/TK, U51/vGPCR1 and U81/UDG from the equivalent segments of the prototype complete genome strain of EEHV2A (Kijana) or EEHV2A(AfrLng#54) that we will probably designate it as subtype EEHV2B(Lucas). Note that complete 178 to 206-kb genome DNA sequences from one or more strains of all known EEHV species except EEHV7 have been submitted to GenBank.

Elephants' Breath Analysis for Early-Stage Diagnosis of Elephant Endotheliotropic Herpesviruses (EEHV)

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Elephant endotheliotropic herpesviruses (EEHV) is the main cause of mortality of captive Asian elephants (Elephas maximus) in North America, Canada and Europe. EEHV is also a leading cause for highly fatal hemorrhagic disease (HD). Young elephants at 1-8 years old are most susceptible to fatal EEHV-HD. HD could cause deaths within 24 hours of initial symptoms. The acute form of the disease reported 80 to 90% fatality rate. The main issue of this fulminant disease is that it spreads widely and rapidly among young elephants within a very short period of time without leaving time for veterinary treatments. Due to the severity and rapidness of this disease there are limited ways that veterinarian or elephant care team could detect or provide adequate treatments to infected elephants at early stage.

Human exhaled breath provides a great platform for noninvasive disease diagnosis. Exhaled breath carries more than a thousand small VOCs which are excellent sources of information and show great potential as a next generation screening tool of an individual's health. The composition of breath VOCs differ from person to person and are related to their health conditions and metabolism. This is the same for mammalian animals and hence elephant's breath also could be used as a measure of an elephant's health. VOC profiles in exhaled breath are expected to change during an infection and during EEHV, VOC profile of elephants' breath should be changed compared to a normal healthy elephant. Therefore, analysis of VOCs provides non-invasive, fast diagnosis of disease progression and early information of the infection process. Based on that notion our effort is to use elephants' breath samples for diagnosis of EEHV. RingIR patented gas tracking technology, runtime cavity ringdown spectroscopy (rtCRDS) is a laser-based optical absorption method which measures photon loss due to interaction of gas molecules inside an optical cavity as light passes through. This cavity enhanced absorption method is effective for measuring ultratrace concentrations of analytes. This method has a longer effective optical path compared with regular absorption spectroscopic methods and hence provides high sensitivity and selectivity for chemical detection.

Our preliminary results indicate the potential of detecting VOC biomarkers in elephants' breath. The breath profile of an elephant clearly shows presence of lots of VOCs compared to a human breath profile. The observed breath spectrum of an elephant was compared with the RingIR chemical library and VOCs such as hexane, methane, and carbon dioxide were identified. Our preliminary results suggest that there is great potential of developing a breath-based rapid test for early-stage diagnostic of EEHV.

Figure 1: Breath sample collection, On-site Sample analysis, Elephant's Breath spectrum and some VOC spectra

Substrate Specificity of Elephant Endotheliotropic Herpesvirus Thymidine Kinase and Conserved Protein Kinase Homologues for Nucleoside Analogs Penciclovir, Acyclovir, and Ganciclovir

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EEHV infection, particularly in young Asian elephants, can cause lethal hemorrhagic disease. The sensitivity of EEHV species endemic within Asian elephants to nucleoside analogs famciclovir (FCV), acyclovir (ACV) and ganciclovir (GCV), which are commonly used to treat infection, has not been established. Sensitivity to these drugs is dependent on virally encoded protein kinases that catalyze their initial phosphorylation. Analysis of prototype genomes from EEHV 1A, 1B, 4 and 5 identified two candidate protein kinases in each species: proteins encoded by open reading frame 48.5 (U48.5), with homology to the herpesvirus thymidine kinase (TK), and U69, with homology to the conserved herpesvirus protein kinases (CPK). Since no tissue culture system exists to test whether viral replication can be inhibited by these drugs, we instead expressed the TK and CPK homologs in mammalian cells to see if they could sensitize them to killing in the presence of each of the three commonly used nucleoside analogs or their active metabolites. EEHV1A, and 1B were unable to sensitize cells to PCV, ACV, or GCV-mediated killing while EEHV4 and EEHV5 TK had modest activity for PCV and GCV, particularly when overexpressed. The CPKs from EEHV1A and 1B also were unable to sensitize 293T cells to killing, while the homologs encoded by EEHV4 and 5 had detectable but low activity for all three drugs relative to the HSV TK. The results suggest that antiviral agents often used to treat EEHV HD, which is most often caused by EEHV1A or 1B, may have limited benefit for those EEHV types, although there may be somewhat greater relative benefit for treating infections caused by EEHV 4 or 5.

Generating immunogenic Elephant Endotheliotropic Herpesvirus (EEHV) vaccines

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Asian elephants are an endangered species facing many threats, including severe hemorrhagic disease (HD) caused by the elephant endotheliotropic herpesvirus (EEHV). EEHV-HD is the leading cause of death in captive juvenile Asian elephants in North America and Europe, and also affects elephants in their natural range countries. Significant challenges exist for successful treatment of EEHV-HD, which include timely recognition of disease onset and limited availability of highly effective treatment options. To address this problem, our goal is to prevent lethal disease in young elephants by developing a vaccine that elicits robust and durable humoral and cell-mediated immunity against EEHV. EEHV glycoproteins B (gB), gH and gL are major targets for cellular and humoral immunity in elephants previously exposed to EEHV. Therefore, we generated vaccines containing recombinant EEHV1A gB or gH and gL together with a liposome formulated TLR-4 and saponin combination adjuvant (SLA-LSQ). CD-1 mice that received one or two

vaccinations with these vaccines elicited significant antibody and polyfunctional $CD4^+$ and $CD8^+$ T cell responses, while no adverse effects of vaccination were observed. Overall, our findings demonstrate that adjuvanted gB and gH/gL protein subunit vaccines stimulate robust humoral and cell-mediated immune responses and supports their potential use in elephants.

Captive Management and Welfare

Raising a Calf in an Era of EEHV Awareness

Evan Miracle
San Diego Zoo Safari Park, CA, USA

With an average of 2 African elephant calves born in the North American population every year, the knowledge base for care and training of neonates in 100% protected contact from birth is quite small. In addition, the threat of EEHV to the youngest animals in our populations has become more apparent in recent years. An elephant calf born at this time in managed-care history presents a unique challenge in trying to balance solid behavioral foundations that will last a lifetime with the need for medical intervention capabilities. We believe that by sharing our experiences in a methodical and comprehensive way from birth to the age of 4 with Mkhaya, we can help enhance that knowledge base and provide a healthy framework for others in the future who will be training and caring for elephant calves in an era of EEHV awareness.

I Greet You How I Smell You: Olfactory Tests in *Loxodonta Africana* Predict the Outcome of an Introduction

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Introductions of elephants into new groups are regular parts of breeding programmes. However, empirical data on the behaviour of the animals during first encounter are missing. This ethological study monitored the reaction of African elephant females during the unification of related (2 mother-daughter pairs = 4 females in 2 facilities) and unrelated (6 females in 2 facilities) elephants. Prior to the reunifications of the mother-daughter pairs an olfactory test was performed, using faecal samples from the related but absent family member, a known member of the present group and a completely unknown female. Family members clearly recognised the sample of their relative, even though the elephants had been separated for 2 and 12 years, respectively. Mothers reacted stronger than daughters. During the following reunifications, related elephants showed all signs of the characteristic greeting ceremony described for free-ranging African elephants, even though the first encounters were performed with a separating fence. Unrelated females by contrast hesitated much longer to approach the separating fence, kept a wider distance to it, expressed more agonistic behaviour and even signs of fear and only performed a minor greeting. These results demonstrate

the significance of family bonds in elephants, which need to be considered in all breeding programmes. The ability to distinguish kin from non-kin in the olfactory test confirms the extremely good memory of elephants and gives first empirical proof that African elephants have an olfactory memory longer than 1 year. It is also first proof that elephants can distinguish kin from non-kin just by scent of faeces. These findings help to explain how the animals maintain the strong family bonds of the herds. Related zoo elephants expressed the same greeting ceremony as described for African elephants in the wild. The significant differences between the greeting behaviour of related and unrelated animals are important for future introductions of elephants in captivity and can be of practical use to organise first encounters as smooth as possible. It also testifies the immense significance of matrilines for breeding programmes in the zoos.

Using Self-Directed Behaviours and Faecal Glucocorticoid Metabolite Concentrations to Assess the Impact of Tourism on Semi-Captive African Elephants' Welfare

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Captive African elephants (*Loxodonta Africana*) can perceive human-animal interactions and/or unrelated intraspecific social relationships as stressful. The implementation of different non-invasive assessments is therefore crucial to understanding the impact of these factors on their welfare. Measuring levels of faecal glucocorticoid metabolite (fGCM) concentrations is considered a reliable and well-validated tool for assessing stress in African elephants and is typically favoured to avoid the stressful act of capture and restraint for sampling. Additionally, self-directed behaviours (SDBs), a form of displacement activity, are a novel behavioural indicator of anxiety and uncertainty in elephants. Hence, the present study sought to assess semi-captive elephant welfare using these two parameters. A group of 10 African elephants (8 females, 2 males; ages 13-31 yrs) housed at the Knysna Elephant Park, South Africa were each individually focal followed for a period of 30 mins, twice daily. SDBs were recorded as they were observed, along with the numbers of tourists present in the field. Faecal samples were collected prior to the first behavioural observation to provide a baseline sample (T0). The next day following observations, an additional two faecal samples were obtained at 24 hours (T24), and at 36 hours (T36) after observation. To assess the impact of tourism, numbers of tourists in the field were considered either low (< 9) or high (≥ 9). To ascertain the implications of unrelated social relationships, hierarchical rank was also included, starting with the highest ranked individual "SY" (matriarch, rank 1), and lowest ranked individual "SU" (rank 10). A mixed model analysis was run using Minitab. No significant effect of tourist numbers or social rank was observed on fGCM concentrations (all $p > 0.05$). However, high tourist numbers significantly increased SDB rates ($p = 0.014$), which demonstrates that elephants perceive elevated tourist pressure as stressful. Additionally, rank had a significant effect on SDBs ($p = 0.028$), indicating an element of apprehension due to potential social conflict. SDBs also significantly positively correlated with fGCM concentrations ($p = 0.024$), which further demonstrates SDBs are related to stress/ anxiety. Overall, this research shows evidence of the stressful effect of tourism on captive elephants, as well as social factors that can cause apprehension. It is also the first study to show a relationship

with the novel behaviour set (SDBs) and a physiological measurement of stress, further demonstrating its usefulness in captive elephant welfare assessments.

Assessing the welfare of two semi-captive herds of African elephants using tail-hair cortisol and self-directed behaviours

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Captive African elephants face numerous welfare issues through their use in the tourism industry. As these issues are often stress-related and linked to management practices, as well as the number of tourists present around them, it is crucial to find reliable and practical ways to accurately measure the animal's behaviour and physiological responses to any potential stressors. We thus aimed to determine the effect of two management systems on hair cortisol (hC) concentration, a novel and non-invasive physiological measure of chronic stress in African Elephants. We also explored several trunk and tail related self-directed behaviours (SDBs), a subset of displacement activities validated as anxiety indicators, and attempted to link this behaviour set with hC concentration. Tail-hair samples consisting of 5 strands of hair collected from 17 individuals maintained at the Knysna Elephant Park (KEP) and Plettenberg Game Reserve (PGR), South Africa, in March 2021. They were then sectioned, powdered, and incubated overnight to extract cortisol. A commercially available cortisol ELISA kit was used to interpolate cortisol concentration from each elephant. In addition, each elephant of the KEP herd (7 females, 2 males; 13-31 years) was followed as focal animals for a period of 30 mins, twice daily from February 2020 to March 2021. SDBs were recorded as they occurred, together with the numbers of tourists present in the field. The number of tourists present in the field at KEP during the observation period was also included in the model to investigate whether this factor influenced the rate of SDBs observed. The general linear mixed model procedure of R version 4.0.5 was used to determine the effect of management system (KEP: semi-captive with close interaction with tourists; PGR: free roaming during the day, with no close interaction with tourists) on hC as well as of hC on the expression of SDBs. Individuals from KEP and PGR observed to have similar average hC concentration (9.68±0.58 pg/mg and 8.13±0.56 pg/mg, respectively; $F_{1,17} = 0.58$, $P = 0.49$), indicating a lack of difference between the two management systems. The average umber of SDBs displayed per month by an individual of the KEP herd was 59.69 ± 5.54. Interestingly, hC had a significant inverse relationship with the expression of SDBs ($F_{1,7} = 7.29$, $P = 0.03$), with lowest concentrations of cortisol occurring with highest frequencies of SDBs. Also, whilst the number of tourists present in the field did not affect the expression of SDBs ($P>0.05$), higher hC concentrations were found with higher numbers of tourists ($t = -2.75$, $df = 1$, $P = 0.04$). These findings may suggest that the expression of SDBs acts as an adaptive coping mechanism for individuals under anxiety. Further studies should continue to investigate whether SDBs and hC levels differ between different management systems of African elephants (i.e free-roaming/wild vs. captive) to establish these measures as effective and non-invasive methods to assess elephants' welfare.

Physical Activity and Thermoregulation of Captive Asian Elephants Participating in Ecotourism Activities

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Thermoregulation is vital for mammals during periods of activity to regulate core temperature at a level which maintains bodily functions. In this study, we used infra-red thermographs from ten adult female Asian elephants (*Elephas maximus*) taken during a 6-day elephant polo tournament in Nepal to identify changes in surface body temperature after an intensive period of activity. To analyse elephant body temperature before and after polo matches, we measured separate regions of the body of each elephant (the axilla, foreleg, ear pinnae and shoulder, taken at the same time points) and calculated an average body temperature (Tab). We compared the average and body region temperatures of polo playing elephants with a control group that did not compete, but engaged in other eco-tourism activities (e.g. walking in forest with tourists). We hypothesised that large and significant changes to average body temperature could indicate the activity went beyond the thermoregulatory capacities of the animals and would represent a welfare issue, whereas small changes in distal regions could represent normal thermoregulatory processes. Our results show no significant average body temperature differences between the polo and the control group. However, by investigating the different body regions to further examine how elephants thermoregulated under exercise, we found significant temperature differences for the regions sampled. Our results show the ear's pinnae has significantly greater differences in temperature after polo compared to the other body regions. These findings were in line with our expectations, as due to the more strenuous physical exertion of the polo, we assumed that elephants would be more reliant on distal bodily regions for heat dissipation, than the control elephants. Our findings highlight the importance of the pinnae in the thermoregulation of elephants undergoing physical activity. In addition, we suggest that as no difference was found between average body temperature in the polo and control groups that in this case, thermoregulatory mechanisms could counteract the effects of physical activity.

Steps Taken to Release Captive Elephants into Nam Pouy National Protected Area, Laos

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Elephant Conservation Center, Laos

The Asian elephant (*Elephas maximus*) is categorized as endangered by the International Union for Conservation of Nature (IUCN, 2008) and listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) since 1973. In Laos, elephants are under significant pressure and there are currently only two viable populations remaining in the country; one population in Nakai Nam Thuen National Park (100 individuals; unstable) and one population in Nam Poui National Protected Area (NPNPA) (30-60 individuals; stable). Outside of these two protected areas every other population of elephants is assumed to be too small to sustain itself. Without a significant increase in national conservation efforts these two populations could face local extinction as has happened with other elephant populations in Laos. To address this challenge, the Elephant Conservation Center (ECC) is developing national elephant conservation efforts that advance four main strategies:

1. Creating socially coherent groups of elephants, mimicking as close as possible a natural herd structure
2. Protecting critical elephant habitat for wild populations
3. Augmenting wild populations through the release of captive elephants
4. Breeding captive populations

In March 2019, these efforts have culminated in the successful release of a group of 3 females (30-40 years) and 1 juvenile male (9-years) in the NPNPA in an effort to better understand the effectiveness of their socialization and to form protocols on how mahouts (elephant handlers) can be used to aid success. The introduction of captive elephants into natural forests is not only beneficial in terms of ecosystem services provided but can also facilitate a more nature-focused tourism system for Laos initially, with potential for other range countries hopefully following suit. Creating opportunities for captive elephants to be released into protected areas also reduces the temptation to elephant owners to illegally traffic these animals abroad and can provide employment for traditional mahouts. The objective of this presentation is to highlight the different steps that the ECC has undertaken from rescue to release, the ongoing activities to monitor the released group, and the combination of a scientific approach with mahout knowledge in the process.

Thursday – August 18, 2022

Trafficking and Technology

The Four Pillars for Effective Conservation of African Savanna Elephants

Amos Gwema
Community Action for Wildlife Conservation Trust T/A Bejane Trust

The above Photographs explains the four pillars for effective conservation of African Savanna elephants. The Pillars are:

1. **Community** which is the first line of defence, community leave alongside African Savanna Elephants, Communities can harbor the poachers or buy ivory from and consume meat from poached elephants. If engaged the community can supply information leading to the arrest and recovery of wildlife products, firearms as shown on the Photographs above.

2. Intelligence wildlife intelligence officers are the ones who should interface with communities and obtain information about those involved in poaching. The intelligence will come from the communities and the Intelligence Officers will pass the intelligence to Uniformed Wildlife law enforcement agencies who will then react to the intelligence supplied and make arrest, recover the wildlife products and then take the accused persons to court.

3. Law the legal provisions for wildlife should be fair and should give powers to wildlife law enforcement to search, arrest and recover the illegal wildlife product in possession of the offender without a warrant. The law should be flexible and to cover the interests of both parties. The law should be punitive enough to deter would be offenders from committing wildlife crime.

4. Justice/Judiciary is the last line of defence for effective wildlife conservation. If the judiciary is corrupt or is ailing it means there is no justice. An ailing judiciary demotivate wildlife stakeholders this includes wildlife law enforcement officials who will not perform their duties leaving wildlife offenders to do as they please. *It's like leaving a maize field to the mercy of baboons*.

In conclusion the above is summarized by my conservation slogan "If you see something say something and do something. The slogan is applicable to the Community, Intelligence Officers, Law enforcement Officers and Judiciary officials should all take corrective action all the time.

Mitigating Elephant Tusk Trafficking in the Deng Deng National Park

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Conservation efforts made to address the problem of African elephant's extinction is being slowed down by human activities. In Cameroon, the Deng-Deng national park has savanna and forest ecosystem found at the northern and southern regions and is home to a myriad of endangered wildlife species including pangolins, apes, elephants and many more keystone species of international concern. (Maisels et al, 2010). Unfortunately, the Park has long been faced with human-induced pressure as the livelihood, of the indigenous population revolve closely around the natural resources as they, depend solely on the forest for survival. Worse, the project site is exceptionally rich in natural resources, which have attracted a lot of external actors. At least four economic operators have installed in the park, creating avenue for severe illegal poaching/hunting. In the same line, the construction of the Lom Pangar Dam has led to the destruction of hectares of natural habitats and an increase in water levels, drawing fishermen from the North and other neigbouring countries. It has also facilitated access to remote areas and increased influx of labour population, hence increasing pressure on the remaining forest and its resources. The Cameroon railway which passes through the peripheral areas of the Park has facilitated access to remote areas

and also increased transportation of elephant bush meat and ivory to urban markets. All these threats have made the Deng-Deng National Park the most threatened in Cameroon. The illegal use of natural resources; poaching and uncontrolled logging have all been blamed on lack of effective patrols. To solve this problem, the following strategy has been established:

- create community conservation groups, the Village Forest Management committees (VFMCs) that will actively assist the eco guards and protect their forest from intruders.
- Capacity building of eco-guards and VFCMs by organizing workshops to introduce advance-monitoring approaches that will minimize human efforts, time and finance.
- Support the conservation service by supplying equipment for improved patrols; camera traps to monitor human activities and detect the presence/distribution of terrestrial wildlife and GPS will inform accurately on routes take by Ecoguards and where trafficking observations were made for more patrol emphasis.

This strategy offers a new opportunity to fight against the illegal killing and trafficking of wildlife especially elephants in the Deng Deng National Park. It also offers a new perspective to local communities to become primary custodians of their own forest.

New and Newly-Affordable Technologies That When Combined with Conservation Dogs, Will Help Stop Poaching and Disrupt Trafficking

Pete Coppolillo
Working Dogs for Conservation, Bozeman, Montana, USA

Dogs have long been involved in anti-poaching and anti-trafficking activities, but two new technological developments will significantly expand their use and effectiveness stopping wildlife crime.

The first is the widespread production and reduced cost of satellite and artificial intelligence enabled remote cameras. These cameras can interpret the digital images they acquire and when they detect a human, alert law enforcement. The utility of these cameras is increased enormously when combined with a tracking dog team, which can be deployed quickly to apprehend illegal entrants into protected areas before they kill an elephant.

The second development is a drastic cost reduction for an older technology: RASCO. Remote Air Sampling for Canine Olfaction (RASCO) has been around for over two decades, but has been prohibitively expensive. WD4C will share a new method which reduces the cost of RASCO (exclusive of dogs and handlers) from tens of thousands of US dollars to under $100 to set up, and less than $1per sample. RASCO technology can then be used to sample air from within shipping containers or any enclosed space to infer whether wildlife contraband is inside.

We discuss the value, risks, and challenges, of both approaches and offer suggestions for future deployments.

Design and Installation of Low-Cost Indigenous Electronic Elephant Signage for Human-Wildlife-Conflict Management Abstract

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The Sathyamangalam Tiger Reserve (STR) is a hotspot on the Human-Elephant-Conflict (HEC) map of India. Every year good numbers of elephant and human deaths or fatal injuries are recorded in and around STR due to this conflict. One of the major causes of human death is their accidental encounter with elephants at elephant corridors on a forest road or at the boundary of forest and human settlement during the night. There is no clear demarcation of those high elephant activity zone, especially during the night and thus they virtually work as a death trap for the locals**.** Along with the financial losses due to elephant crop raids, such fatal incidents fuel anger and tension among locals which leads to the killing of an elephant by elocution or poisoning**.** Such an undesirable chain of events can be disrupted significantly by demarking the high elephant activity zone**.**

With 'elephant activity zone demarcation', we are trying to indicate the exact location of elephant corridors on forest roadways and at the boundary of forest & human habitation to make people and vehicles aware. In this regard, the elephant signage, especially Electronic Elephant Signage (EES, a glowing elephant shape light) is an effective tool since it catches the attention of people and vehicles. When precisely installed on a larger scale, the EES may play an efficient role in HEC management**.** But the high cost of a reasonable-sized EES limits their wide-scale deployment in the field as of date.

Recently, we have developed our own indigenous EES with staggeringly low cost and successfully verified the design through several field trials. Our EES is a remote SMS-operated glowing 1ft×1ft elephant shape display unit with an integrated battery, solar panel, daylight sensor, and a buzzer. It can be mounted on a plane and carved surface and it's fully waterproof. Being our design, the glowing pattern, blinking duration, buzzer sound pattern, and day-night glowing modes can be adjusted as per the location-specific requirements. The making cost for each such unit of EES is approximately $45 only.

The operation of the EES is a collaborative effort among the villagers, the forest department, and our group. The EES accepts on/off command only from selective numbers of forest officials and village administrative officials. The display switches on remotely once elephant activity is reported at a particular location and a buzzer is also on to make the elephant warning more prominent. Different SMS codes are created to initiate different modes of warning to specify the intensity levels of the elephant activity.

The SMS operated EES:



EES module with integrated solar panel (on top) with battery + circuit box (bottom)	A test EES installed on NH-209, STR near Bannari temple site	Night time glowing of EES, clearly visible from 40-50m Operation of EES with SMS https://www.youtube.com/watch?v=YjtZwk0rBmA)

As of date two test units of EES are designed and installed on a busy national highway-209 near to Bannari Temple, STR. In association with forest guards and local villagers, a field survey was conducted with passing vehicles to understand the driver reaction, display visibility, warning sound intensity etc. System performance is found to be satisfactory in every aspect hence EES technology needs to be scaled up on a larger scale for better HEC management.

Community Engagement in Conservation

Private, Public & Community Partnership (PPCP) for Conservation of Elephant, Biological Habitat Corridor/and Conservation of Water Bodies

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Paribartan team has taken concerted effort for peaceful co-existence of Human & Elephants. Innovation & action research trials are going on in Odisha state of Indian sub-continent, in partnering with tribal and forest dependent community and stakeholders for conservation of Asian elephants, management of habitat and biological corridors. Since a decade Paribartan team successfully mobilized the support of conservationists, researchers, technical institutions and community to save lives of Asian elephants from extinction. The approach Public Private & Community Partnership (PPCP) seems to be one of the most feasible and acceptable strategies to ensure community participation for conservation of elephants, protection of their habitat and management of biological corridor.

Challenges:

- According to the latest census, India is home to 27,312 elephants range in 29 elephant reserves spread over 10 elephant landscapes in 14 states, covering about 65,814 sq kms and of them, Odisha is home to 1976 Asian elephants.
- Man-Elephant conflicts has been raging there is 106 human deaths and 119 injuries during April *2014 to January, 2022 (Odisha state)*
- 80 per cent of India's elephant population is in eastern region of India and elephants in Odisha constitute 74% of the total elephant of the eastern region of India. Since 1990, nearly 1,400 elephants have died, from an average mortality of 33 per year between 1990 and 2000, the number grew sharply to 784 elephant deaths in the period 2010 to 2020 while Odisha now with 1976 remaining elephants.

The goal of the action research /project how Public Private & Community Partnership (PPCP) ensure & foster participation of tribal & forest dependent community, forest department, government and conservationist's in protecting elephants in the pursuit of management of their habitat elephant corridor furthering mitigation of human elephant conflict thus protect elephant form extinction.

How PPCP facilitates to secure a future for wild elephants it is essential to improve the habitat/corridor health which is degraded day by day and reduced the roaming over forestland for enough food and water for sustenance. It is the findings, the farther an elephant herd has to roam in search of food and water the more chances of conflicts & human casualties in elephant encounters. One possible way to address the food and forage issue is to increase the forest cover in the already existing corridor that will leverage sheltered and food resources for them. Elephants depend on its tropical trees—consuming twigs, branches, stems, root, flowers, fruit (56%), shrubs (20%), herbs (14%) and climbers (10%). The identified indigenous fruit trees species in particular have added benefit as it naturally adapted to local soils and climates, wild trees often survive environmental stresses better than introduced species.

This apart using the approach –PPCP that increases access to water during hot days through building sand/check dams- a low-cost, multi-use rainwater harvesting solution built over perennial river beds by using local materials thus accommodate elephant herd inside habitat/corridor and less occurrences of encounters and trespassing to settlement.

Mapping and identification of conflict hotspots and strengthening community patrolling to zero down poaching and causality. How this approach enhanced community engagement:

1. Dissemination of identified site and sharing to avoid confrontation
2. Village wise enforcement team and sharing how to work in tandem with forest administration and police (early information in suspect of poaching, encroachment of habitat, early detection of sick elephant and distress situation)
3. Regular vigilant work in close coordination with trained community-based elephant trackers

Public-private community partnership initiative creates openings for policy enactment on conservation of elephant and their habitat in Eastern Ghats mountain region and less occurrence of man elephant conflict & wild changes on civilization and community participation in controlling, checking poaching.

Sharing Resources with Elephants: Role of Community-Based Elephant Response Teams (Erts) in Human-Elephant Conflict (HEC) Mitigating in and Around Sheikh Jamal Inani National Park (SJINP), Cox's Bazar, Bangladesh

Ashis Kumar Datta, Krishna Kumar Gupta
Arannayk Foundation

The forests in Cox's Bazar South Forest Division of Bangladesh harbour one of the last remaining viable Asian Elephant populations yet most intensely threatened by different anthropogenic activities. To mitigate the uprising trend of HEC, four community-involved Elephant response teams (ERTs) were mobilized by Arannayk Foundation & financed by USAID in March 2021. A total of 40 people from four ERTs received hands-on training and logistics support (hand mike, dress, whistle, torch etc). Since the formation of ERTs in March 2021, 88 elephant raids were stopped in and around SJINP till June 2022. The average group size of elephants was 2.4±3.3 (n=46). No elephant casualties were observed during this intervention, although one human died and two become injured due to HEC. A total of six houses, two nurseries of the local forest department, 11 vegetable beds, five betel leaf gardens, 460 bamboos and 1856 fruit (Mango,

Jackfruit, Banana, Coconut, Betel nut) yielding and 95 other trees were destroyed by elephant raids during this period. In addition to short-term measures like additional ERT formation, long-term pragmatic solutions e.g. habitat improvement & management, clearing of already blocked elephant corridors and crossing points, improved compensation systems, and research on elephant movement patterns are direly needed to conserve this megafauna of this region

The largest land mammal of the Asian continent, the Asian Elephant (Elephas Maximus) has been listed as Critically Endangered in Bangladesh. A nationwide survey found 268 resident wild elephants, of which 93 are migratory, and 96 are in captive conditions in Bangladesh (IUCN Bangladesh 2016). Cox's Bazar Forest Division & Chattogram forest ranges in Bangladesh are a few of the country's last remaining elephant range areas where at least 153 elephants have been killed in the last two decades by electrocution (70 elephants) and indiscriminate shooting. The existing HEC has increased manifold with the arrival of forcefully displaced Myanmar nationals in the Cox's Bazar region in 2017. About 38 elephants are entrapped in this area as the Ghumdhum corridor (for transboundary movement between Bangladesh and Myanmar) is blocked due to the Rohingya refugee makeshift settlements. Of all entrapped elephants, 18 were reported from the SJINP. The main goal of the project is to minimize HEC by forming four community-based Elephant Response Teams (ERTs) at SJINP and building community capacity building for the conservation of Asian Elephant in the region. Enrichment' (GREEN LIFE) project has formed four ERTs from March-June 2021, comprising 10 members in each group under four forest beats in the Inani range (Sowankhali, Inani Sadar, Jaliapalong beat) & Ukhiya range (Dochori beat) of SJINP. Team members were trained in the methods of how to stop elephant raids without causing any injury to the elephants; for example, the method to chase elephants from villages or crop fields. Quarterly team coordination meetings were also conducted with ERTs and local forest department staff.

The ERTs received ~ 300 phone calls related to potential elephant raids and subsequently handled 88 incidents. Elephants did potential crop and property damage to people and most of the raids took place during the nights in April-June (29 cases in 2021 & 30 cases in 2022) (Fig.1). This is the most fruit-yielding season in Bangladesh. Among all raids, tree damages (mostly fruit yielding) were higher (59%) compare to other damages. In 11 cases, ERTs successfully diverted the elephants back to the forest without any damage to crops, property, or injuries from either side (Fig.2). Four awareness campaigns were organized with the involvement of ERTs, the local forest department, school children, religious leaders and other community people. Monthly elephant raids seem unchanged over the project period. No elephants were injured or killed during the project period, however one human died and two become wounded by sudden elephant intrusion. Between 1997-2002, about 162 people were killed and more than 600 were injured in HEC, while humans in turn retaliated by killing 22 elephants in this region. The ERTs also rescued other wildlife like pythons & other snakes, monitor lizards, birds etc from time to time. Coordination, monitoring, and sustainable financial mechanisms are still required for the functioning of these community-based teams in long run.

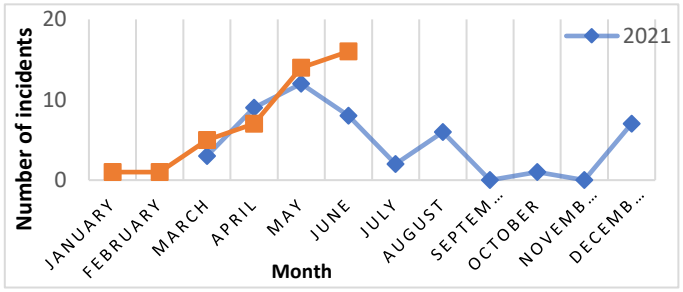

Fig 1. Monthly elephant raids during 2021 & 2022

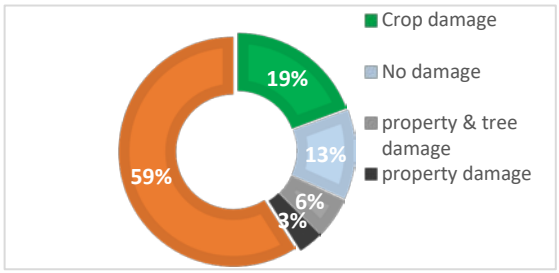

Fig 2. Crop and property damage scenarios

1 IUCN Bangladesh. 2015. Red List of Bangladesh Volume 2: Mammals. IUCN, International Union for Conservation of Nature, Bangladesh Country Office, Dhaka, Bangladesh, pp. xvi+232.
1 https://www.thedailystar.net/environment/natural-resources/wildlife/news/no-country-elephants-2974456
3 Survey Report on Elephant Movement, Human-Elephant Conflict Situation, and Possible Intervention Sites in and around Kutupalong Camp, Cox's Bazar. 2018. IUCN & UNHCR
1 https://www.tbsnews.net/features/panorama/extraordinary-giant-its-last-legs-287101

Role of Local Communities in Elephant Conservation: A Case Study from North Kanara Landscape, Karnatak, India

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Managing human-Elephant Conflict (HEC) is a complex issue involving a balance between conservation of the endangered Asian elephant and safeguarding the economy and lives of local communities. The Uttar Kannada District in Karnataka State of India supports a population of about 80 to 100 elephants. The landscape consists mainly of interspersion of forests and agriculture. Crop damage by elephants is an annual phenomenon occurring mainly in the postmonsoon season when the agricultural crops ripen. Since 2010, we are implementing a community-based conflict management (CBCM) model in Karnataka State for protection crops from damage by elephants. The project is being implemented in partnership with the joint forest management committees in the project villages, which are the local self-governance bodies established by the Forest Department. Our work focuses on empowering the farmers in protecting their crops using a combination of simple low-cost techniques. The techniques practiced include regular night guarding of crops and vigilance, supported by installation of trip alarms to alert farmers about the presence of elephants, installing farm-based deterrents, bee-hive fences and SMS alerts. Since 2018, these measures have been implemented in three forest divisions of the study area, where farmers are practising crop protection using some or all of these measures. We compared the results of crop damage between project villages where the farmers are actively guarding their crops, supported by simple project interventions, and non-project villages where farmers are not actively guarding their crops. The project interventions have increased the effectiveness of the farmers in protecting their agricultural crops and made a significant reduction in the crop damage. During 2015 and 2017, there were almost 1050 elephant crop raiding cases with an average of 350 cases per year, which was reduced to only 520 crop raiding cases (49%) with the average of 260 cases. It was found that in the guarded villages, 43% elephant raids were unsuccessful while in the unguarded village, only 3% raids were reported unsuccessful indicating elephants could access the crops easily in the unguarded villages. The average area of crop damage was only 5.6 acres in the project villages compared to 33.4 acres in the non-project villages. The low-cost and low maintenance interventions like trip alarm (USD 8,45) have motivated the farmers to protect their own crop fields. Apart from preventing crop loss, we are also working towards

creating a positive profile for the elephants among local communities. We have been training local women in preparing elephant-themed handicraft which can provide them a supplementary livelihood and they become willing conservation partners. Therefore, it was observed that, active participation of farmers and institutionalising the interventions in the local self-governance bodies, can significantly control the negative interactions of elephants with humans and ultimately change local people's perception towards elephant for a sustainable coexistence.

Participatory Modeling Across Kenyan Villages Facilitates Greater Understanding of Human-Elephant Interactions

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Negative human-wildlife interactions are a growing problem, particularly near protected areas and wildlife refuges. In Kenya, African elephants (*Loxodonta africana*) are threatening food security for subsistence farmers due to crop raiding, which also jeopardizes elephant conservation priorities if farmers retaliate. With the goal of developing a systems view of human-elephant interactions amongst stakeholders to inform policy and management, our objectives were to: 1) evaluate stakeholder mental models of human-elephant interactions, and 2) identify biocultural indicators for assessing the success of mitigation programs. To achieve our objectives, we conducted participatory modeling sessions in 6 rural Kenyan villages using Fuzzy Cognitive Mapping. Each village co-created visual models of variables that impact or are results of negative interactions with elephants. A total of 14 variables were common across all models, with the 2 highest centrality scores belonging to the variables of income levels and feelings of security, suggesting that elephants affect both the economic and the health of stakeholder's wellbeing. Furthermore, multiple novel variables, such as infrastructure, child labor, and soil compaction, were present in the models. Such variables represent opportunities for improving local conditions, signify the extent of the economic and social impacts of conflict, and showcase the advanced local ecological knowledge of farmers. These novel drivers and consequences can be used to inform management priorities by including unknown or under-represented impacts of human-elephant interactions in mitigation initiatives. System components that can be used as biocultural indicators provide useful metrics for assessing the success of such interventions across social and cultural dimensions. Taken together, these findings provide a more holistic approach for agencies addressing negative elephant interactions to promote coexistence.

Simanjiro Community Capacity Building Project: SICOCABU Project

Alamnyak Thaddeus Ole Orpiax
LIRDO Organization, Arusha, Tanzania

SICOCABU is based in Simanjiro area bordering Tarangire National Park working under (LIRDO) a Non-Governmental organization in Tanzania which is registered under Non-Governmental act of 2002 with registration No. No./NGO/R000556, Simanjiro Community Capacity Building (SICOCUBU) Project guarantees information on resources, sustainable

management of resources and resource sharing in the ecosystem together with resolve [HEC] – Human Elephant conflict to the local community and other associates in the vicinity of Tarangire National park. SICOCUBU Project practices various strategies developed by LIRDO experts to start resolve Human Elephant Conflict through introducing difference [PAC]- Problem Animal Control Toolkit like: Anti-poaching Unit of (Volunteer Village Game Scout), also Elephant pepper and Beekeeping programs in settlements with high elephant invasion. SICOCUBU Project helps to conserve elephants since there are many incidences reported of elephants being wounded, and sometimes being killed by indigenous people when elephants invade their farms. SICOCABU Project's goal is to solve human–elephant conflict in Simanjiro area by improving conservation and management method to Tarangire Elephant population, which are over 4,000 by introducing a combined sustainable community-based approach. Another prospect is to deliver scientific confirmation which will lead in a way of wide-ranging management plans in combating Human Elephant Conflict - HEC. SICOCABU Project Objective: To monitor and mitigate Human Elephant Conflict incidences and to promote development and implementation of participatory Land Use Planning in Elephant ranges taking into version Elephant movement patterns. The key Project accomplishments: to Launch Volunteer Anti-Poaching Unit (Volunteer Village game scouts (VVGS)), introducing Elephant chill pepper, establishing bee keeping program as a live fence and introducing community capacity building programs to reduce Human Elephant Conflict - HEC.

Introducing Our Elephant Guard Program and Our One-Day Women and Goat Herders Conflict Mitigation Trainings

Christin Winter, Rachel Harris, Shannon Diener
Elephant-Human Relations Aid (EHRA), Namibia

In Namibia's North-Western regions, conflict with elephants is an everyday reality for the rural communities living there. EHRA's PEACE (People and Elephants Amicably Co-Existing) Project has been working since 2009 to educate people on how to protect themselves and their property from damage caused by free-roaming elephants. The PEACE Project aims to improve people's livelihoods through education and to secure the long-term survival of Namibia's desert-adapted elephants by alleviating human-wildlife conflict and promoting a mutually beneficial relationship between people living in communal areas and their elephants. Over the years, the PEACE project has engaged rural communities through its successful three-day community seminars. Through these seminars we were able to teach people basic elephant behavior, elephant biology, safety around elephants, and how to mitigate conflict with elephants. The participants then took a practical field excursion to observe the elephants in their natural habitat and to experience what peaceful animals they are, when treated with respect. However, over the years, we realized that women and goat herders are unable to attend the three-day seminars. This is because women in rural areas carry the majority of household chores on their shoulders. While goat herders, herd livestock every day between 8am and 5pm. Their busy schedule makes it impossible to attend the three-day seminar even though they are some of the most important people who need the training. This encouraged us to start the one-day seminars which are specifically tailored for women in rural areas and goat herder, teaching them practical ways to keep themselves and their homes safe from elephant damage. In addition to this, we also kicked off our second elephant guard program this year and have now employed 7 elephant guards from 6 different conservancies/constituencies. The

Elephant Guards are local people from conservancies in our expanded project area who receive special training and equipment to lead efforts in combating conflict between humans and elephants on communal land. The elephant guard program is key to sustainable human-elephant conflict management as it empowers communities to take charge of conflict solutions themselves.

Human Elephant Conflict Mitigation

Human-Elephant Conflict Mitigation and Coexistence at Bwindi Impenetrable National Park, Uganda

Isaac Twinomuhangi, Dennis Babaasa and Robert Mujuni
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Bwindi Impenetrable National Park (BINP) is surrounded by one of the highest rural human population density in Africa that depend mainly on subsistence agriculture. Elephant crop-raiding is therefore the main concern to these communities and a major challenge to elephant conservation. Numerous human-elephant conflict mitigation measures have been implemented but a few are effective. Local people are knowledgeable about these interventions and are aware of why some are more effective than others. Based on their knowledge, it is possible to design effective and sustainable mitigation interventions. We will accomplish this by engaging the affected communities and key stakeholders using a mixed-method approach that includes Community Focus Group Discussions, household surveys using semi-structured interviews, Key Informant Interviews, participant observation and documentary review. It is anticipated that the results will contribute to elephant conservation by designing cost-effective, community-based human-elephant conflict mitigation interventions that will lead to reduction in crop losses to elephants and thus improve food security and local people's perception towards the African forest elephants.

Mitigating the Impact of Elephants on Community Livelihoods

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Human wildlife Conflict is a global conservation challenge, it is a complex phenomenon. The coexistence between people and elephants (*Loxodonta africana*) is a significant conservation challenge in Tanzania, and the African continent. Elephant is a keystone species of conservation in Tanzania, recognized for their contribution to the national economy through wildlife-based tourism. Despite their social, ecological and economic roles, they are still several factors threatening their survival, among the threat are ivory poaching crisis, bush-meat hunting, these have reduced the country's elephant population from 109,000 in 2009 to an estimated of 60,000 individuals. The increased conflicts between people and elephant, pose the increased threat to elephants through reduced range and retaliatory killing and or elephant being killed as problem animals.

Thus, ensuring long-term human-elephant coexistence in Tanzania requires mitigation of the negative impacts of elephants on people's livelihood. We intend to conduct our study in Naalarami Ward of Monduli -Arusha Region in Tanzania where HEC is highly pronounced. Most of the rampaging elephants normally stray off from Tarangire and Manyara national parks in pursuit of food and water, resulting into crop damages, people injuries, death and property damages.

TAFONEGO will conduct project meetings with Maasai tribe leaders, village leaders, community members and the local Government leaders. Through the semi-structured questionnaires 261 households in Naalarami Engorika, and Lengroliti will be interviewd. Site visits will be done in each village to assess the corridors/elephant pathway, raided crops will be recorded. The project will also train the affected communities in elephant conflict mitigation measures that will both protect the elephants and improve community livelihoods of Maasai community. Participatory village plan and strategies will be set.

The project will help in validating the scale and magnitude of the problems, exact elephant population density as well as the conservation, conflict management approach and strategies necessities to both people and elephants. Increased awareness and understanding of the urgent need for elephant conservation among local people affected by Human Elephant Conflict, reduction in intensity and severity of crop-raiding through early warning systems and community based elephant management tools.

Human-Elephant Interaction and Strategies for Mitigating Conflict in Northern Botswana

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Human-elephant conflict is a major source of negative human perspective towards wildlife, especially in countries experiencing a concurrent expansion of the elephant and human populations. Elephants interact regularly with humans as they share and compete for the space that provides life-supporting resources such as forage and water. As these resources become limited over space and time the conflict escalates resulting in loss of livelihood strategies, increase in human and elephant death and injuries, and subsequently an entrenchment of negative perceptions towards elephants. We conducted studies in the Okavango and Chobe region of Botswana from 2013-2022 to understand the dynamics of the human-elephant conflict, associated costs and benefits, and mitigation measures used or could be explored to promote co-existence. The studies used gathered quantitative and qualitative data through field surveys, interviews with local farmers and key informants, and focus group discussions. The respondents ranked elephant as the frequent crop-raider and estimated the crop damage to range from 0-100% of the total area planted with a total loss around US$53,000 in one year. In southern Okavango over 84% of the farmers indicated to have abandoned their fields due to damage by elephant. The elephant was also ranked third after crocodile and hippopotamus as the wild animal that killed most people in the Okavango, killing at

least 2 people per year. The number of human deaths due to elephants increased sharply after 2014 when a hunting ban of all wild animals was introduced in the country. During the hunting ban there was an increase in the elephant numbers in the Okavango from 61,621 in 2011 to 75,714 animals in 2018. As a deterrent measure, farmers used a combination of elephant deterrents such as traditionally made scarecrows, shiny tin-plates, and chilli-pepper (*Capsicum*). Chilli-pepper was reported to be effective as a deterrent by a majority of the farmers, but issues of supply, cost and labour intensiveness limited its adoption and use. The planting of leguminous crops in the field was also found to reduce field incursions and crop-damage by elephant. Payment of monetary compensation by government to the farmers whose crops and property were damaged by wildlife was believed to mitigate economic hardships brought by wildlife but was reported to be to be lower than the market value of the damaged crops or predated livestock. About 82% of the farmers interviewed in Chobe supported wildlife-based tourism projects as an alternative livelihood strategy to crop production which is vulnerable to damage by elephant. However, in mixed agro-ecosystems exclusion of agriculture may not be possible, hence the need to explore a give-and-take strategy that will allow limited crop production for household consumption. For crop production to be sustainable there will be a need to explore and strengthen mitigation measures that are climate smart, adaptive to local conditions, and can generate greater benefits to the local farmers.

Human-elephant Conflict Mitigation: A Key to Conservation and Livelihood Development in Rural Communities

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Human-elephant conflict (HEC) endangers both humans and animals' well-being. Crop raiding by elephants in Africa can devastate small farmers, causing food insecurity, lost opportunity costs, and even death. For improved livelihood development and the conservation of elephants and other wildlife in ecosystems, efforts must be made to maximize human-elephant coexistence. This project will be carried out in the Enduimet division, in 11 villages that comprise the Enduimet wildlife management area. The overall goal of this project is to protect community farms from elephant raiding while also conserving elephants through enhancing habitat protection and anti-poaching awareness, and reduced retaliatory killings. Specifically, this project seeks to i) provide toolkits and training to communities on the use of various methods, such as chilli and beehive fences (by establish satellite pilots scales), to reduce HEC and agricultural loss; ii) identify the most prominent HEC location and collect data on HEC incidences in order to develop long-term solution strategies and plans and iii) raise community awareness about elephant conservation,anti-poaching, habitat management as well as policies and regulations governing the protection of elephants and other wildlife.

Under the supervision of the project coordinator, the project officer will conduct training on HEC management and the use of various methods and toolkits in the Enduimet division's villages practicing crops farming activities. Furthermore, HEC monitoring personnel will distribute HEC

Toolkits to the community identified by the village government. Moreover, the project team will hold several Community meetings on HEC to raise awareness of HEC prevention techniques and approaches that can be used in the field. In addition, data on HEC's prominent area will be collected in the project area using ODK software. Additionally, the project will use village meetings, symposiums, and workshops to reach out to communities and stakeholders in order to advocate for conservation laws and regulations governing elephants protection, anti-poaching, habitat management and other wildlife protection. This project, on the other hand, will be carried out in primary and secondary schools, where visits will be made, video shows on elephant conservation will be shown, and brochures with elephant conservation messages will be distributed to students; this will help to impart knowledge on wildlife conservation to this vibrant and young group, thereby reducing future costs of anti-poaching operations within the WMA.

This project is expected to reduce HEC and improve food security by reducing crop raiding incidences. Additionally, the project is expected to build positive community support for elephant conservation in the Enduimet community, reducing retaliatory killings, habitat destruction, and poaching incidences.

Friday – August 19, 2022

Human Elephant Coexistence

A Shift from Human Elephant Conflict to Coexistence
Fidelicy Nyamukondiwa
Fauna and Flora Zimbabwe (FaFloZim)

Human elephant conflict is a serious cause for concern in Zimbabwe and many other African countries. On 12 May 2022, the Zimbabwe Government spokesperson reported that a total of 60 people had been killed by elephants since the beginning of the year. Besides trampling humans to death, elephants have been raiding and destroying crops in many areas surrounding national parks and wildlife conservancies. Zimbabwe's wildlife legislation classifies elephants as "dangerous animals" and it has become policy that whenever a human is killed by an elephant, the Wildlife authority reacts by shooting down the elephants. Elephants are sometimes shot in cases in which they did not attacked a human. This means that more that 60 elephants have been killed by humans between January and May 2022 in Zimbabwe. It has been scientifically proven that elephants are afraid of bees. To this end, what are known as beehive fences have been successfully used to deter elephants from human settlements. The beehive fencing is based of Dr Lucy. King's research and has been tried and tested. Beehive fencing is a non lethal method of mitigating human elephant conflict. The fence consists of beehives spaced at lease every 10 metres. The hives are tied by a wire and if elephants disturb the fence, the bees feel provoked and attack the elephants This scares away elephants from straying into beehive fenced communities. There is a need for an urgent shift from conflict to coexistence between humans and elephants. The beehive fencing initiative is one of the most successful methods which can be used to bring peace between humans and elephants. Besides promoting coexistences between the two conflicting species, the produced honey is also a source of livelihoods for communities.

Human-Elephant Struggle for Survival: Adopting Acoustic Deterrents to Minimize Human-Elephant Conflict Around Chebera Churchura National Park, Ethiopia

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[1]Threatened Species Conservation, Ethiopia; [2]Jimma University, Ethiopia

African savanna elephant (*Loxodonta africana*) is one of the three threatened elephant species in the world. Following rapid population decline for several decades, the species is listed as endangered on the IUCN Red List. A recent continent-wide survey reported about 352,271 elephants. The population is continued declining by 8% per year due to the continued human-elephant conflict, poaching for ivory, habitat loss and fragmentation, and isolation of populations. In Ethiopia, Chebera Churchura National Park (CCNP) is a distinct park that hosts the largest population of African savanna elephant. The park is home of 400 - 1000 elephants with different herds. As a generalist mega-herbivore, they consume about 150 - 450 kg of forage and 190 L of water daily. To fulfill this demand, they travel to the surrounding villages of the park and, eat and trample crops, damage local food stores, damage village infrastructure and sometimes kill people. The local communities have been using warning gunfire, chilly fencing, fire smoking, and guarding to minimize these conflicts, however, the problems of crop damage, life loss, and injuries continued as challenges. This could threaten biodiversity conservation efforts in the park by aggravating the community's negative attitude development toward the elephant, the park, and park staff. Therefore, the presented conservation project is aimed to introduce acoustic deterrents (i.e., loud noises of lion, cheetah, leopard, buzzing bees) in conflict zones to keep elephants away from villages, and to identify effective acoustic deterrents for future expansion.

Assessment Towards Human-Elephant Coexistence and Poaching in Serengeti Ecosystem, Tanzania

Nuhu Jacob, Robert Modest Byamungu, Baraka Mbise
Voluntary Education and Relief Initiative for Tanzanian Society (VERITAS)

This is 1-year (2023/2024) community-based project aims at promoting human–elephant conflict in Mara and Simiyu regions through awareness of recognizing elephants as sentient beings. The awareness to be promoted goes with adopting appropriate methods which can either alert villagers or limit elephants from interfering the farms or villagers' residences. Our research will cover two phases, firstly is to undertake a research work on analyzing the appropriateness and setbacks of local repellent methods used by villagers to drive away elephants around Serengeti National Park and the secondly is rescuing elephants from poachers' attack. A total sample of 440 households located in Mara and Simiyu regions bordered to the park will be interviewed in this study. The structured questionnaire and discussions will be used to get information relevant to the study. Descriptive statistics such as frequency and percentage analysis will be used to accomplish the objectives and presentation of results of the study. VERITAS will work with the local communities to expand poaching operations through the use of motorcycles and to increase capacity for integrating patrols and surveillance data into intelligence-led ranger mobilizations. The research aims to escalate food security, enhancing more income sources and eliminate human and elephant deaths, leading to increased tolerance of elephants among the local communities in Mara and Simiyu regions, thereby facilitating a drop of poaching.

Elephant Conservation Education Around Pendjari and W. Parks in Benin

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African Savannah Elephant an important component of the mammalian fauna, is an endangered and strictly protected species. Despite this status, the species' conservation remains a great challenge in "Pendjari" and "W" Biosphere Reserve in Benin mainly due to the poaching and the frequent recorded conflicts between humans and elephants around the reserves. The present project to be conducted in the riparian zones of the Pendjari and W parks in northern Benin aims to increase communities education on the conservation status of African savannah elephants in Pendjari and W Biosphere Reserves, give environmental education sessions at schools around each biosphere reserve, create African savannah elephant's conservation school library and establish groups of stakeholders for elephant-human conflict prevention and resolution in villages around the reserves. The activities to be carried consist in organizing awareness sessions for local communities in close collaboration with the Village Associations for the Management of Wildlife Reserves (AVIGREF). The sessions will include documentary film screenings on the role of elephants in forest ecosystems, the risk and dangers to humanity if the species disappears, and the importance of conserving the species and its habitat. Environmental education sessions will be conducted in the schools bordering the two biosphere reserves on several topic based on elephant and biodiversity conservation. Local committees of elephant-human conflict mitigation will be established in each village. These committees will work closely with population, local authorities, NGO and managers in order to promote sensitization as pacific collaboration tools between humans and elephants. With the implementation of the project, the local populations will understand that they are the guarantors of the security and protection of elephants in particular and of all wildlife species in general in the two biosphere reserves of northern Benin. Once they become more involved in the decision making and implementation of reserve management activities through this project, the population will do everything possible to protect the elephant population at all costs, seeing the importance of the latter for the good of their environment and future generations. Living synergy of elephant species with the riparian populations will reduce poaching and human-elephant conflicts for which they are increasingly threatened. These pressures on the species will be eliminated and it will be better protected.

What Makes Living with Elephants OK? A Case Study and a Summary of 20 Years of Applying Practical Co-Existence Strategies in Namibia

Christin Winter, Rachel Harris
Elephant-Human Relations Aid (EHRA), Namibia

In Namibia's northwest, free-roaming elephants live outside of National Parks and navigate complex landscapes including human settlements, rural and commercial farmland, and arid wilderness. Elephants, in search of water and food, often destroy human infrastructure, such as water tanks and pipes, fences, vegetable gardens, and fences that keep farmed animals on designated properties. Further, in their quest to adapt to ever-changing environmental conditions,

elephants have shifted their home ranges and appeared in places they were absent from for decades. As a result of an increase in conflicts, elephants get shot or otherwise removed, which does not seem to result in a decrease in conflict intensity. If free-roaming elephants are to survive long into the future, holistic co-existence strategies must be community-based and embraced by all relevant stakeholders.

Elephant-Human Relations Aid (EHRA) has worked to improve the relationship between people and elephants since 2003. We are identifying all elements that make living with elephants difficult and strive to strategically remove them or lessen their impact. Our aim is to make living with elephants as bearable as possible so that elephants can still exist and thrive, side-by-side people, whose quality of life isn't impacted negatively by their presence anymore. We are going to present a summary of 20 years of applying a multitude of practical co-existence strategies, and what elements need to be addressed to make living with wild elephants OK.

Human Elephant Conflict Mitigation: Community Empowerment Through Beekeeping Project

Jenister P John, Hillary T Mrosso
Lessons in Conservation, Tanzania Research and Conservation Organization (TRCO)

Human population growth and expansion into wildlife protected areas has been altering wildlife habitats, thereby causing negative interaction between the African Savannah elephants (*Loxodonta Africana*) and local communities in NALIKA WMA-Tunduru district. With that, there is a need to develop projects that will empower the local communities and mitigate human elephant conflicts (HEC), to ensure elephant conservation and community well-being. The use of beehives fences as a mitigation strategy against elephants have shown good outcomes and approved by Tanzania Wildlife Research Institute as nonlethal methods in reducing human elephant conflicts. In some places this method proves to provide an alternative source of income for local people, improving their socio-cultural and economic welfare. Therefore, it is an engagement of local people in conservation efforts while considerably mitigating HEC to achieve long-term conservation of elephants in their natural habitats.

Due to this fact, this project aimed at first to identify and map human-elephant conflict hotspots through direct observation to observe animal presence and their signs adjacent to protected areas. Local wildlife managers (Tanzania Wildlife Authority) in the protected areas and the interested local people from the respected villages will be involved in addressing this objective. Secondly, to develop and establish beehive fences for HEC mitigation and community beekeeping. Beehive fences will be built in identified human-elephant conflict hotspots, with the interested communities' members heavily involved in beehive construction and beehive fence construction, as well as fence maintenance and bee product harvesting. Third, to examine the response of elephants to beehive fences. This objective will be addressed by deploying camera traps in major HEC hotspots to determine the dynamic movement of elephants and their response towards beehive fences. Fourthly, to develop education programs for African elephants based on local beliefs and values in order to improve broader knowledge and understanding of elephant ecology, behavior, and human elephant conflicts, this will aid in the development of effective educational and training materials that will help increase awareness, knowledge, and skills related to elephant

conflict mitigation through beekeeping. This project will help in developing understanding, capacity, strategies to deal with human elephant conflicts and means of benefits from implementation of beehives fences in the communities adjacent to protected areas.

Conservation Partners

Asian Elephant Support 2022 Update on Care and Conservation Efforts in Asia
Liz Beem, Mindy Ussrey
Asian Elephant Support

Founded in 2006, Asian Elephant Support is an all volunteer-run not for profit organization that is dedicated to the care and conservation of elephants in Asia - by providing financial support for those that are working to help captive elephants and protect wild populations, creating awareness around the needs of elephants for the future and providing educational opportunities for those working and living in the regions of the 13 range countries in which Asian elephants exist. The ongoing struggle to help Asia elephants remains.

Asian Elephant Support would like to share our history, our recent achievements and our future goals with the delegates of the 2022 International Elephant Foundation Virtual Conference. We will share the story of the elephants and our partners in the field in Asia, how the world-wide elephant community can become active participants in their conservation alongside us and our appreciation for those that have already stepped-up to be a part of the path forward to save this species.

Youth Living Close to Protected Areas Accessibility to Tourism Industry & Conservation Using Wildlife Arts in Tanzania.
David Kabambo
Peace for Conservation

Inadequate source of income for youth living close to protected areas, western corridor of the Serengeti national park & Kijereshi game reserve tempt to engage in wildlife poaching to earn income. Not because they lack of wildlife illegally hutting, and the important of conservation of wildlife species, but because they lack of alternative source of income, they hunt wildlife and sell bush meat as a source of income to support their family livelihood. From 2016-2019 Approximately 100 youth arrested in Kijereshi game reserve processed wildlife species such as bush meat, and about 20 youth are imprisoned related issues of wildlife poaching in western corridor of Serengeti ecosystem (Serengeti National Park and Kijereshi game reserve) Data source from Ranger working Kijereshi game reserve. In order to rescue a number of youth for arrested in the park and imprisoner with cases of wildlife poaching, we need to create an opportunity of employment, youth living close to protected areas to be trainers on conservation entrepreneurship opportunity including Arts painting as alternative source of income through selling Arts painting to tourist visiting Serengeti national park & Kijereshi game reserve.

Peace for conservation, a nonprofit organization, based Tanzania, initiated the Arts4wildlife project to promote accessibility tourism, conservation education using arts painting. The ARTS4wildlife program, was designed to prepare youth living close to protected areas for future employment outside of wildlife poaching through bush meet business. The program also has an education components concerning elephant poaching in the park and promote conservation & tourism accessibility in Tanzania, painting Tanzania wildlife and natural landscapes in the modern Tinga Tinga style, each painting is unique, some painting include an ant- poaching, message, accessibility tourism in Tanzania, and other conservation theme.

The program teach youth in school and out of school, how to sketch and paint wildlife- based Art. Every month an Arts teacher visit schools & and Invite youth from street for identification arts talents painting, teach them drawing arts, drawing wildlife pictures and through peace for conservation, are supported to sell them to international organization including the U.S based international elephant foundation and the North West spirit rotary club in Canada. The arts painted pictures are mainly used for fundraising abroad and let the available funds be allocated to the fight of elephant poaching and address issue of unemployment of youth living in protected areas.- Tanzania.

After 3 years of implementation of the project we have observed the following

a) Create self-employment opportunities to children out of wildlife poaching, children sell Arts to tourist visiting Serengeti National Park and Kijereshi game reserve,
b) Promote cultural exchange between Tanzania and foreign artists through selling Arts work to foreigners, PFC participated for Arts Exhibition Sweden
c) Children, developed and grow their artistic skills and craftsmanship talents

More support both financially or material support is needed to construct, Painting Arts Vocational Training Center to enroll more children and teach children Arts work and prepare them for self-employment through selling Arts work to tourist visiting Serengeti National park and neighboring cities. Our goal to use elephant's dugs to show community elephant has value to have it in Tanzania. Increase more connections & network where we can sell Arts created by youth. This helps to promote youth to sell more arts and earn income, promote tourism in Tanzania and support conservation project in Africa.

Tanzania with Challenge of Inclusion of People with Physical Disability in Promoting Wildlife Based Nature Tourism.

David Kabambo
Peace for Conservation

Tanzania is a rich haven for a wildlife, with millions of wild animals representing 430 different species. Tanzania therefore offers countless opportunities for tourism, with 6 world heritage sites and numerous national parks and game reserves. However, with a population of about 45million, as per 2012 National census, approximately 8% of people (3.6 million) have physical disability and cannot experience the wonders of this landscape as many others do, let alone be gainfully employed in tourism. Indeed it is rare to find a Tanzanian with physical disability inside a National Park or Game Reserve watching wildlife or participating in other outdoor adventures. And while

wildlife tourism is a major employer in the country, and plays a significant role in the economy. In 2014, tourism generated around 2billion US$ which constitute 25% of Tanzania's foreign exchange. This includes directly employing around 600,000 people and up to 2 million people indirectly. However there is little data documenting the number of people with physical disabilities working in this sector. Though some tourism hotels and companies offer programming that provides free safari tours for people living close to protected areas, there is little attempt to include people with physical disabilities. This means they cannot so experience or learn about wildlife conservation from a professional tour guide and enjoy the outdoors.

Peace for Conservation is implementing a special program for people with physically disabilities to experience a free safari tour at Serengeti national park and Kijereshi game reserve. We will give those with disabilities a feeling of Tanzania’s heartbeat, to let them discover magical sights, and add smiles to their faces. They should be able to experience the big five animals found in Tanzania while riding a wheelchair/ tricycle inside Tanzania’s prize natural areas. Additionally, we will talk with these people about the opportunities they could pursue to be employed in wildlife tourism, and will help those that express interest. People with physical disability are happy to be included in tourism and learn about conservation activities, and are interested in seeing the program to be implemented annually. We encourage and work with tour companies to seek employing people with physical disability in their sector. We also work with these companies to coordinate free safari tours for people with physical disability.

We are proposing the program expand to engage more people with physical disability, and provide more information sessions and training of people so that they can get employment in the tourism sector. Peace for Conservation is looking financial support to implement the expanded program.
Peace for Conservation is also recommending Tanzania Tourism have a NATIONAL PARKS DISABILITY DAY. On this day, parks would be freely available for people with physical disability across the country to visit, and their transportation and tour guide would be who would be funded and hosted by government and tourism stake holders including tourism companies. This program also have the benefit of reducing or eliminating the fiction stories about wildlife that people with physical disability hear in the street and will supplement the President of Tanzania Samia Suluhu with Royal tour campaign, by inclusion of disability in Tanzania to overcome

Conservation Art Exchange: From Conflict to Coexistence: Using Art as a Bridge from Conflict to Coexistence

Lou Barreda, Julia Braren, Kellen Braren
Myakka Elephant Ranch

We are Myakka Elephant Ranch, a U.S. based non-profit focused on aiding elephant conservation, using hands on experiences and programs to raise funds and awareness benefiting global elephant conservation efforts. Located in Myakka City, Florida, we care for a unique herd, Lou (female) an African savanna, and Patti and Carol, mainland Asian elephants. These girls spend their days grazing lush Florida acreage while educating the public as ambassadors for elephants in the wild. Currently our foundational programs are action oriented and in person educational encounters. We believe that education combined with experiences will reach the public on a deeper more personal level enable them to leave our conservation center with a greater knowledge, understanding, and

passion for these animals and the importance of conservation. With the majority of our projects focusing on educating the local community we saw a need for a far-reaching application that can bring people together, united for a common cause. Just as a herd functions as a connected unit, we too must connect, across continents and oceans to aid and inspire any way we can. Influenced by our annual MER elephant conservation drawing contest and the numerous IEF funded education programs abroad, we created the Conservation Art Exchange. This initiative uses art for expression, healing, inspiration, and as a tool for change. The Conservation Art Exchange enables children here in the U.S. to share their love for elephants in the form of art with children abroad, especially those in communities affected by human elephant conflict. Participants can easily print out our template, create fun elephant focused art, with an area to write a few reasons why the love elephants and support conservation. These can then be electrically scanned and emailed or mailed in, where we create copies and send them abroad to be used in education-based programs in communities in the heart of elephant territory and used as instrument to educate and inspire. Together we can create a future of lasting conservation and coexistence.

Is Your NGO Financially Sustainable? Lessons I Have Learnt – The Hard Way!

Rachel Harris
Elephant-Human Relations Aid (EHRA)

Sharing my experience of surviving COVID and remodeling our financial strategy to ensure sustainability. When EHRA first presented to IEF in 2018, we were full of confidence about the sustainability of our organization which at that point was mostly funded through tourism ventures. This had allowed EHRA to upscale it's conservation work, and importantly allowed us autotomy in decision making. It also streamlined the administrative burden, as complicated report writing was not necessary. There was a lot of merit in this structure until COVID hit in March 2020, overnight tourism was gone and EHRA was left with less money in the account to cover one month's cost.

I will share what we did really well and in retrospect, badly before and now after COVID, and how we restructured financially to ensure EHRA is as sustainable as we can be!

	DAILY CHAT		
	DAY 1		
	0:23:07	Andreas Buberl:	hört man schon etwas?
	0:23:52	Ann-Kathrin Oerke:	Ja!!!
	0:24:44	Ashok Ram:	Hello, Good morning to every one
	0:26:50	Fidelicy Nyamukondiwa:	Good morning all
	0:27:13	Leanne Henry:	When we be able to replay the conference? will we receive links?
	0:27:21	Aleksandra Grubin:	good afternoon to all
	0:29:01	PAUL BULAMBO:	Hello, everyone
	0:29:40	Leanne Henry:	what's the dial in number? I have no sound.
	0:29:59	Sery Gonedele, Université Félix Houphouët Boigny:	Good morning to all
	0:32:51	Emmanuel Armah:	Hi everyone
	0:33:17	Emmanuel Armah:	This is Emmanuel Armah from Ghana, Hi everyone
	0:34:41	Vyalengerera:	Bonjour chers tous,
			Je suis Monsieur Magloire Vyalengerera from DRC
	0:44:40	Vyalengerera:	no sound
	0:49:20	pearsov:	Good morning from Philadelphia, Pennsylvania USA from Virginia R. Pearson
	1:09:04	Ann-Kathrin Oerke:	By which parameters do you assume elephants have an embryonic diapause? When do you think that it happens?
	1:11:51	Samantha Blair:	Thank you!
	1:15:36	Paul Ling:	Thanks Dennis—great talk. You mentioned a number of elephant specific diagnostic tests that would be useful. I assume all of them are important, but are there one or two specifically that you think would have the most impact? BTW-I consider you a mentor, can't thank you enough!
	1:18:58	Chase LaDue:	Thanks Dennis for a great talk!
	1:19:58	MUKTI ROY:	Good Morning to all I am Dr. Mukti Roy from India.
	1:21:11	MUKTI ROY:	Thank you Dennis for your nice and elaborate talk .
	1:29:46	Deborah:	Thank you Dennis! It has been a pleasure to work with you for all these years. You are indeed my hero!
	1:30:07	Julie Pellman:	Good morning from NYC
	2:05:22	Leanne Henry:	How similar genetically are the mammoths to the modern day African and Asian elephants?
	2:12:25	Sarah Florian:	Hi!
			Here in Tanzania is evening! Good evening everybody!!! I am Sarah Milunga from Tanzania!!! Love you all!!!
	2:15:17	Alamnyak Thaddeus Ole Orpiay:	Hi! to everyone ...Okay Madam Sarah Milunga please I will be happy to have your phone number please. I am Alamnyak Orpiay from Tanzania also.
	2:16:50	Sarah Florian:	Ooo GREAT to hear that! Am from Arusha 0757 483 744

	2:17:59	Alamnyak Thaddeus Ole Orpiay:	thanks madam I will find you after this Symposium meeting
	2:18:12	Leanne Henry:	What percent of mammoth DNA is known?
	2:20:00	PAUL BULAMBO:	Hi! Here in DR Congo is evening! Good evening everyone! Am Paul Bulambo from DRC/South-Kivu
	2:21:02	Bonhof, Wouter:	To Prof Lister: In the central part of Russia, roughly 70 to 110 eastern longitude, you apparently have hardly any radiocarbon dated mammoths, while there are plenty from the northern coast and the southern border of Russia at the same longitudes. Why do you think there are so few radiocarbon dated mammoths from that region?
	2:25:43	Adrian Lister:	Thanks Wouter, I think it's probably collecting bias - these are forested regions today rather than the open tundra where it is easy to find fossils. Of course, it's hard to know if it *might* have been a real absence!
	2:29:31	Bonhof, Wouter:	Thank you for your answer. It would be interesting to see if there is there is also a lack of fossils for other species/ archaeological sites in the region to confirm collecting/ preservation bias.
	2:30:43	Adrian Lister:	Correct. I can say that there's a broadly similar gap for woolly rhinos that we've mapped.
	2:36:01	Adrian Lister:	Terrific work Michael :)
	2:36:34	Michael Cherney:	Thank you Adrian!
	2:38:12	Nachiketha sharma:	Excellent work, Dr Cherney. Did you also measure progesterone using tusks?
	2:38:25	Alida de Flamingh (she/her):	Dr. Cherney - I'm looking forward to seeing the final paper, such interesting & exciting results!
	2:39:59	Michael Cherney:	Hi Nachiketha--Yes, progesterone is one that shows up, although we're still working to get consistent results and that work is ongoing. There will be some preliminary results in the paper we are submitting soon.
	2:41:15	Nachiketha sharma:	Thank you for the reply. Looking forward to reading the paper soon.
	2:41:28	Michael Cherney:	Hi Alida--I hope it gets published soon!
	2:49:03	Lizzie McLean:	To Michael Cherney: Are you able to look at other hormones than those for reproduction? Eg hormones that might show stressful events related to conflict, fighting, hunger, dehydration etc?
	2:49:59	Alamnyak Thaddeus Ole Orpiay:	poaching incidence of Elephants Ivory can be measured through DN thus will be easy to discover areas where the incidence occurred much more
	3:17:52	Nancy Kauffman - NC Zoo:	What is Colossal's plan for getting society buy in? Especially in a world that has films like Jurassic Park/World, where bringing animals back from extinction doesn't often turn out well for humans and the fact that there is a large population of people (or atleast "powerful" people) that don't think global warming is a thing.
	3:49:35	Julie Pellman:	Very interesting. Question

	3:49:42	Adrian Lister:	To restore a "Pleistocene steppe" in the far north you have to replace the present forest and tundra ecosystem. How many facsimile "mammoths" would be needed, and how many sq km of land would they take up, to significantly reduce global warming? And given the slow reproductive cycle of elephants, how long would it take to get there?
	3:56:14	Adrian Lister:	Has Colossal's bioethicist approved the attempted creation of arctic-adapted Asian elephants as fundamentally ethical?
	3:56:37	Paul Ling:	Eriona, do you have any insights or opinion about whether or not the novel “p53” system in elephants, might provide a more sensitive trigger for apoptosis and therefore make it more difficult to grow out and manipulate elephant iPCs? Or will it be just a matter of time to identify elephant specific factors and conditions and elephant IPCs will behave similarly to other species?
	3:58:11	Nancy Kauffman - NC Zoo:	Besides genetic modification how are current HEC issues going to be addressed with the introduction of a new species especially with interaction of indigenous people? Are there any threats that this would pose to current animal populations in the same region (ie, resource depletion), since it will take some time for plant growth in the area once they are introduced?
	3:58:57	Leanne Henry:	How long would an antibody cocktail for EEHV take to develop?
	3:59:14	Paul Ling:	Quick comment. As you know, the older African elephant genome sequence and annotation was of relative low quality. We therefore had to sequence a handful of immune markers and cytokine genes individually for the Asian elephant for some of our studies. While it’s certainly anecdotal, we just looked at these genes compared to your newly published high coverage Asian elephant genome and all of the half dozen or so genes we sequenced before matched up 100%!! This reference genome will be massively useful for all kinds of research activities.
	3:59:40	Leanne Henry:	What would be the timeline for development of an antibody cocktail?
	4:00:30	Alamnyak Thaddeus Ole Orpiay:	technologies are very important on Elephant Conservation sure you're right
	4:01:08	Leanne Henry:	Has anyone attempted to separate male sperm from female sperm? What is the technology for doing this?
	4:04:58	Alamnyak Thaddeus Ole Orpiay:	human wildlife contact contribute to HEC and some time disease transmission
	4:08:23	Sery Gonedele, Université Félix Houphouët Boigny:	Does these technologies include ethical concerns?
	4:08:29	Sara Ord:	Thats wonderful to hear Paul, thank you for sharing! :)
	4:11:04	Alamnyak Thaddeus Ole Orpiay:	there are funds available for technologies Lab. on Elephant Conservation Projects?
	4:11:12	Paul Ling:	Follow up for Eriona—so perhaps looking into IPCs in elephants may have potential broader insights into cancer or anti-cancer mechanisms?
	4:13:08	Roshan Kumar Thakur:	Hi Roshan from Nepal...….Exciting things to know here. Really enlightened....We are still doing population demography...so we are so behind.....
	4:14:38	Roshan Kumar Thakur:	Roshan (But still got one question, can we see rewilded elephants in other parts of world?

	4:15:33	International Elephant Foundation:	Thank you everyone, this was an amazing first day. WE look forward to seeing you tomorrow where the sessions will deal with field conservation.
	4:15:39	Roshan Kumar Thakur:	apert from elephant range countries?
	4:15:59	Chatchote Thitaram:	HEC has existed for several decades, and seems to be more severe. how colossal can mitigate this problems?
	4:17:25	Leanne Henry:	When will the links for restreaming after the conference be released?
	DAY 2		
	0:23:38	Isaac Twinomuhangi:	Good morning everyone
	0:24:37	Gerubin Liberath Msaki-Tanzania:	Greetings everyone, I am Gerubin from Arusha Tanzania
	0:25:14	Kristi Burtis :	Good morning
	0:25:35	Abebayehu:	hi good moring, good afternoon (for those who are form most Africa contries) I'm Aticho from Ethiopia
	0:27:20	AMOS GWEMA:	Greetings everyone am Amos Gwema from Zimbabwe
	0:27:42	pearsov:	Good morning from Virginia Pearson, Fox Chase Cancer Center, in Philadelphia Pa USA
	0:28:05	Ashok Ram:	Good morning every one.
	0:28:27	PRINCE ZENGLE NTOUH RICHARD Menelik II:	Good morning everybody body from Benjamin Sock and Prince Menelik, Cameroun
	0:29:15	iPhone Nukia Fouego:	Good morning everybody ; Nukia Fouego , Cameroon
	0:32:26	Julie Pellman:	Hard to hear
	0:32:46	Aleksandra Grubin:	volume is very low
	0:32:51	Sandra Toma:	can't hear anything
	0:33:05	Lizzie:	Volume too low
	0:33:08	Leanne Henry:	can't discern what he is saying.
	0:33:09	iPhone Nukia Fouego:	Very low volume
	0:35:46	Julie Bates - IEF:	The volume the presenter submitted was low and we are trying our best to enhance the volume.
	0:36:47	Julie Bates - IEF:	Subsequent videos will be better.
	1:06:11	Andreas Buberl:	How much influence the last politics Events have on the elephants conservation?
	1:10:27	Lizzie:	Thanks Ravi for a compelling presentation about the wet zone elephants. Can you explain how this effort fits in with Sri Lanka elephant conservation more widely?
	1:11:10	Alamnyak Thaddeus Ole Orpiay:	a nice presentation, can you explain the population of you Elephant a little bit
	1:13:07	Chandima Fernando:	Hi all, Ravi will join us a little later, if not I will answer during Q & A session
	1:13:42	Tom Conley:	I believe Sundance Resources Ltd. is owned by Sichuan Hanson Group of Chengdu, China. Not concerned in any way with conservation, or political stability of African countries. Just my opinion.
	1:23:51	Alamnyak Thaddeus Ole Orpiay:	thank Deborah

	1:24:03	Chandima Fernando:	Why did you divide the time period in to two time frames? any logical explanation please
	1:24:39	Wendy Kiso:	Where can we find and purchase this refreshing sparkling elephant tea?
	1:25:00	Julie Bates - IEF:	Elephantea.com
	1:27:49	Zabe HO:	Appreciate the talk and I'd like to know about Sri Lanka's elephant conservation actions despite the current crisis. Thanks
	1:30:17	Chandima Fernando:	the elephants that was injured due to train accidents in Sri Lanka subsequently died even though our vets did their best.
	1:53:09	iPad:	Mikumi NP: I am missing the very busy highway running through the NP and where a lot of collisions with wildlife (with elephant seen by myself) happen on an almost daily basis. is it a topic for the TZ government they are willing to tackle? is there any solution in the long term to reduce this incidents?
	1:58:31	Angelu Runji:	Thank you so much for the raised question. To date there is no a clear long term strategy to close the highway crossing Mikumi NP. It needs a political will from decision makers which is an area that need engagement at national level.
	2:10:49	Lizzie:	To Rabul: A lovely heartwarming presentation. Congratulations!
	2:11:08	Samantha Blair:	Thanks!
	2:11:59	Rubul Tanti:	Thank You Lizzie
	2:20:39	Chandima Fernando:	Ram, I have a question! could you take hec mitigation measures that people take in your study area with your landscape factors? for me these two are not independent
	2:31:00	iPad:	to Angelu: thanks a lot for getting into it. Since I strongly believe that every problem "with" animals starts with the encroachment of humans ..... do you see a path on which non TZ people could become active in the fight for a safe Mikumi NP for animals, e.g. elephants?
	2:32:00	Ashok Ram:	Thank you all for listening me passionately and commenting on my presentation.
	2:32:51	Olajumoke Morenikeji:	Good afternoon. I am Olajumoke
	2:43:42	Chandima Fernando:	Here in Sri Lanka, I guess we are the one who introduced "orange" as a mitigation measure to reduce HEC. We found that eles do not eat citrus fruits including oranges. But it does not work as a deterrent , I mean smell of citrus would not work as deterrent
	2:44:22	Chandima Fernando:	but its economic buffer for farmers who are subjected to crop raiding
	2:49:38	Olajumoke Morenikeji:	Great to know the Sri Lanka experience. This is well noted.
	2:50:48	Chandima Fernando:	More than happy to share our experiences and knowledge
	2:54:06	Alamnyak Thaddeus Ole Orpiay:	did your try to make 🐝 bee hive fence in your Ranch boundary?
	2:56:37	Olajumoke Morenikeji:	we are in the process of teaching locals how to do this.
	2:56:56	Lynn Von Hagen:	Hi Alamnyak, not sure if that question was for Bruce (I'm his colleague) but we did test beehive fences as well which performed very well for us.
	2:59:23	Alamnyak Thaddeus Ole Orpiay:	the question is for Bruce okay thanks Lynn
	3:28:43	Andreas Buberl:	It is possible to use the bees in Asia as it is used in Africa?

	3:30:05	Chandima Fernando:	we did use bee fences, it did not work, so we do not encourage people to use bee fences in sri lanka
	3:30:27	Ashoka Ranjeewa:	Nice work Chandima. Well done.
	3:30:56	Chandima Fernando:	no farmer get any benefits from bee fences and our elephant are not scared of bees
	3:31:17	International Elephant Foundation:	www.IEFStore.org
	3:32:48	Lynn Von Hagen:	The bee species in Africa, apis melifera scutellata is known to be more aggressive than their Asian counterparts
	3:33:33	Chandima Fernando:	Yes, ours are less aggressive but we can not bring them here
	3:34:13	Chandima Fernando:	I mean African species
	3:34:51	Lynn Von Hagen:	Yes, certainly wouldn't bring them there, just saying that may be one of the reasons they are sometimes less effective than in Africa
	3:37:27	Chandima Fernando:	well, how effective bee fences is at landscape level even in Africa questionable
	3:39:11	Chandima Fernando:	and in dry areas keeping bees in boxes is challenging even in Africa, so farmers do not get economic benefits as we expected,
	3:41:08	Chandima Fernando:	Just want to share with every one we did to check movement of elephants in relation to moon phases
	3:41:10	Chandima Fernando:	https://www.cambridge.org/core/journals/oryx/article/asian-elephant-movements-between-natural-and-humandominated-landscapes-mirror-patterns-of-crop-damage-in-sri-lanka/E9AAA10BA4459D084B25A7BB1A193D4D
	3:58:29	Perry Becker Design:	Its fascinating to hear all the different language dialects during these presentations. I love it
	4:04:05	Sery Gonedele, Université Félix Houphouët Boigny:	To Newton: It seems to me that since the population of elephant continue to increase in the area HEC will also increase as a consequence of resource rarefaction. Don't you think that the regulation of elephant population could part of the solution?
	4:06:21	342569:	my country with many threats, that's needs so fort help for sauvegaurds all these phares on critical endangered
	4:09:00	Sandra Toma:	this is Sandra Toma co-author to Newton's paper regulation of elephant population could be part of the solutions if enough funds are generated for relocation purposes
	4:19:21	Agatha Tumwine:	Great presentation
	4:20:30	Pete Coppolillo (WD4C- he/him):	Great talks— THANK YOU ALL!
	4:25:09	PAUL BULAMBO:	thank
	DAY 3		
	0:25:05	Zabe HO:	Hi from Burma
	0:25:27	Lauren Howard:	Good morning from California USA!
	0:25:50	pearsov:	Good morning Lauren, from Virginia
	0:25:54	Cécile Sarabian:	Good evening from Hong Kong!

	0:26:34	Charles's iPad:	Good morning from New Mexico USA
	0:29:23	International Elephant Foundation:	Good morning, good afternoon, good evening everyone! We are so happy you are all here, from around the world
	0:30:06	PAUL BULAMBO:	Good afternoon from DRC
	0:50:13	Chatchote Thitaram:	Do you think this behavior is inherited or acquired behaviors
	0:50:20	Zabe HO:	Merci Cécile.
	0:53:03	Cécile Sarabian:	The behavioral immune system is composed of both innate and learnt behaviors depending on the risk. For feces and soil, it is likely learnt. Juveniles also need to build their physiological immune system and get exposed to these contaminants. This remains to be empirically tested though. Lots to do!
	0:59:39	Sarah Florian:	no sound Please CORDINATOR,help me.
			Sarah Milunga from ARUSHA TANZANIA
	1:00:01	Julie Bates-IEF:	Sponsor websites:
	1:00:18	Julie Bates-IEF:	Elephantea.com
	1:00:38	Julie Bates-IEF:	Holbrooktravel.com
	1:01:06	Julie Bates-IEF:	Colossal.com
	1:01:53	Brian Aucone, Denver Zoo:	Sarah, I'm not sure how to help you. The sound is working so it must be something on your end.
	1:02:32	AMOS GWEMA:	Good afternoon I can hear you
	1:02:33	Sarah Florian:	it's okay now, thanks
	1:17:49	Paul Ling:	Dr. Ammersbach—nice talk. Can you comment on whether manual counts on blood smears might provide insights over automated methods, such as identification of band cells or other morphological changes (e.g., presence of plasma cells etc etc) and so even if eventually not useful for platelet counts might still be a good adjunct when assessing a potential illness in elephants?
	1:19:20	Ann-Kathrin Oerke:	Can you please make louder?
	1:21:15	Brian Aucone, Denver Zoo:	We have no way to make it louder on your end. It does appear that the sound on the recording is low, thus likely to be low on everyone's computer, as it is also low on mine at full volume.
	1:21:48	Ann-Kathrin Oerke:	Okay thanks :-(
	1:23:04	Julie Bates-IEF:	Presentations have varying degrees of sound quality. We have done what we can to optimize but it will fluctuate. Sometimes using headphones on quiet talks can help.
	1:32:28	Dennis Schmitt:	Virginia, Great news and presentation. Very important information.
	1:48:38	Paul Ling:	Josh, Lisa, nice talk. As Josh mentioned, some NET formation might be good, but too much may be bad. In the EEHV HD tissues, can you comment on whether levels of NETs you are observing are in the “good” range or “bad” range. Is there a way of measuring beneficial versus detrimental levels of NETs?

	1:48:42	Lauren Howard -San Diego Zoo Wildlife Alliance:	I advocate because you guys are awesome! Thanks for all of your work on elephant health!!!
	1:49:00	Dennis Schmitt:	How would you propose to treat an EEHS-HD patient with nNIF's?
	1:49:02	Alamnyak Thaddeus Ole Orpiay:	Lisa I like your presentation
	1:49:32	Joshua Schiffman:	Thanks @Lauren Howard and others - working with elephant community has been a very amazing and scientifically rewarding experience!
	1:49:33	Dennis Schmitt:	Thank you Lisa, Josh, Lauren and Virginia!
	1:50:36	Alamnyak Thaddeus Ole Orpiay:	You said you describe this NET are web like to humans who have COVID -19? how
	1:50:58	Joshua Schiffman:	@Dennis: we would propose to dose any elephant who shows symptoms of EEHV (or confirmed diagnosis) with NTPs to block the release of NETs in response to EEHV.
	1:51:58	Lisa Abegglen:	Thanks! It was great to share this project with all of you.
	1:52:00	Joshua Schiffman:	@Alamnyak: in COVID-19 (we think very similar to EEHV-HD in elephants), the virus triggers neutrophils to release multiple NETs throughout the body leading to DIC/clotting/bleeding, and death.
	1:52:40	Joshua Schiffman:	https://ashpublications.org/blood/article/136/10/1169/461219/Neutrophil-extracellular-traps-contribute-to
	1:55:45	Alamnyak Thaddeus Ole Orpiay:	okay JS
	1:55:49	International Elephant Foundation:	@Josh and @Liza, given the similarities of the NETs to cause inflammation in chronic diseases (like Chrons and UC) in humans and the extensive treatments developed for that, are there any ongoing human treatments being used to regulate NETs that may be used as a model to treat elephants? Perhaps as low-dose prophylactic treatments to prevent the inflammation from taking hold in elephants?
	1:55:59	Joshua Schiffman:	@paul: great question about good vs. bad NETs! The level of NETs is higher than expected in EEHV-HD affected tissues. We also see the NETs in the center of clots (immunothrombosis) further supporting the fact that NETs in EEHV is most likely pathogenic and contributing to clot formation (these neutrophil webs rapidly form the scaffolding for clot formation and clotting factor consumption).
	1:56:15	Alamnyak Thaddeus Ole Orpiay:	Okay Joshua

	2:00:53	Joshua Schiffman:	Great question from @IEF about other anti-NET therapies. In acute human diseases: Steroids can reduce NETs by contributing to decreased neutrophil function (in fact, dexamethasone is one of the first and only treatments that work for COVID-19 infections with excess NETosis). There are other drugs in development, although everything is still somewhat experimental. We do know that DNase, also called Pulmozyme, is very good at breaking down NETs in the lungs in cystic fibrosis. This potentially could be tried in elephants with lung involvement from EEHV-HD. In Chronic Diseases: many of known drugs have some effect on reducing NETs, like JAK inhibitors or hydroxychloroquine. But there are no specific NET inhibitors being used yet for chronic diseases in human of which I am aware.
	2:02:01	International Elephant Foundation:	Thank you! So much to think about!
	2:02:38	Joshua Schiffman:	
	2:05:27	Lauren Howard -San Diego Zoo Wildlife Alliance:	@Charles Harb, thanks so much for sharing your work!! Very interesting! Question for you: most elephants shed EEHV from their trunks naturally, when healthy. Do you think you can identify VOC's from ill elephants that are sick from EEHV Hemorrhagic disease, versus shedding EEHV normally? Is it that specific?
	2:07:12	Charles's iPad:	Hi Lauren,
			It is possible. We could look into that during our next round of testing.
	2:09:48	Lauren Howard -San Diego Zoo Wildlife Alliance:	good luck! my email is lhoward@sdzwa.org if you need help brainstorming on how to get samples from sick EEHV HD elephants!
	2:10:52	Charles's iPad:	Thank you. My email is charles.harb@ring-ir.com. Let's talk when you have time.
	2:15:39	Alamnyak Thaddeus Ole Orpiay:	I will be happy to know thus! How long passed away after relocate those Elephants from Africa? Asia? to America! took and when did you discover or know that they are ready affected by those Viruses. Those Viruses are from Africa? Asia? or America?
	2:17:18	Alamnyak Thaddeus Ole Orpiay:	how long took
	2:27:58	Lauren Howard -San Diego Zoo Wildlife Alliance:	@Alamnyak, thank you for your questions about elephant herpesvirus, or EEHV! The EEHV Virus is found in Asian and African elephants worldwide, and is a natural infection that, like many herpesviruses, can often be quiet and never cause illness. Unfortunately, it causes severe hemorrhagic disease in some young elephants, we believe this is due to low antibody levels in the elephants. We are still learning a lot about the virus and how to protect elephants.
	2:30:23	Leanne Henry:	For Paul, how does the genetic variability of the different EEHV 1A strains affect vaccine development?
	2:32:19	Leanne Henry:	For Paul, do you think that elephants will behave the same way toward a vaccine as a mouse? Also, will the dose of the vaccine in an elephant have to be scaled for weight?
	2:40:17	Julie Pellman:	Is there a relationship between these clots and cancer

	2:42:21	Julie Pellman:	Many thanks
	2:47:48	Leanne Henry:	What is the percentage variability between the different 1A strains?
	3:06:39	Brian Aucone, Denver Zoo:	Sorry, we are having some technical difficulties.
	3:14:28	Lauren Howard -San Diego Zoo Wildlife Alliance:	Excellent presentation, Evan! Your work with Mkhaya has paid off, and I am grateful to have such a great elephant team to partner with on all things EEHV!
	3:14:39	Paul Ling:	Hi Leanne, good question. I'll have to look up specifics, but in general, 1A strains are mostly identical except for a few clusters of hyper variable loci. One of them, in and around glycoprotein H (gH) can vary by up to 30% at the nucleotide level. How this translates to protein divergence, I'll have to check. Even so, the difference between 1A strains versus 1B strains is much greater than the intra-strain variability of the 1A's, if that makes sense.
	3:26:52	Nancy Kauffman - NC Zoo:	@Franziska. Have you thought about doing this with elephants in managed care with elephant fecals of former herd mates? For instance an elephant who was raised for several years within a herd with unrelated females but then moves to a different facility.
	3:28:49	Franziska Hörner:	We considered this, but have concerns as the scents had quite an impact on the elephants and in our project the elephants were re-united after the olfactory test
	3:28:51	Sam:	to: Franziska Such a good presentation, thank you. The references at the end were only briefly visible though. Could you possible send them to me at drlizziemclean@gmail.com thanks so much
	3:29:14	Franziska Hörner:	Sure, I'm happy to share them with you!
	3:29:52	Sam:	Thanks, that's wonderful. I really enjoyed your videos and your enthusiasm!
	3:30:06	Franziska Hörner:	Thank you so much!
	3:31:48	Nancy Kauffman - NC Zoo:	@Franziska would it be possible to reach out to you via email. I have an interesting interaction for you to discuss from a young bull elephant raised around a female and after about 18 years those elephants were reunited and we have noticed some interesting interactions during pre introduction meetings. My email is nancy.kauffman@nczoo.org.
	3:32:10	Nancy Kauffman - NC Zoo:	these elephants are unrelated
	3:33:38	Franziska Hörner:	@Nancy Yes, that sounds very interesting! Let's talk soon. My email is franziska.hoerner@uni-wuppertal.de
	4:33:04	Julie Pellman:	Many thanks for a very interesting morning here from NYC
	4:33:28	International Elephant Foundation:	thank you everyone for your wonderful presentations, questions, and commitment to elephants!
	4:33:31	Kristi Burtis San Diego Zoo Safari Park:	Great day of incredible learning. Thank you everyone!
	4:34:28	Zabe HO:	Thanks. Big hugs from Burma.
	4:34:42	Hannah Tilley:	Such an incredibly diverse array of talks! Thanks so much
	4:35:14	Perry Becker Design:	Thank you everyone for another really awesome day of educational sessions!!!! I Love Elephants!

	4:35:34	Maud Bonato:	Thank you very much! Greetings from South Africa
	4:35:34	PAUL BULAMBO:	thank u
	4:37:10	Julie Bates-IEF:	Elephantea.com
	DAY 4		
	0:22:25	Fidelicy Nyamukondiwa:	Goodmorning to you and everyone
	0:22:51	PAUL BULAMBO:	Hello
	0:22:59	Ashok Ram:	Good morning and namaste everyone from Nepal
	0:23:14	Sarah Florian:	GOOD AFTERNOON FROM ARUSHA TANZANIA-TAFONEGO
	0:23:32	Fidelicy Nyamukondiwa:	Fidelicy Nyamukondiwq
	0:23:59	Fidelicy Nyamukondiwa:	Fauna and Flora Zimbabwe
	0:24:36	Isaac Twinomuhangi:	Hello everyone
	0:24:56	iPad:	are we on air already, I have no more sound
	0:25:23	Leanne Henry:	I don't hear anyone either.
	0:25:32	Wendy Kiso:	Good morning, from Florida, USA. We have not started yet... so no sound yet!!
	0:28:44	International Elephant Foundation:	can you all hear now?
	0:28:54	Pete (WD4C- he/him):	yes!
	0:29:04	International Elephant Foundation:	Wonderful
	0:29:43	PAUL BULAMBO:	yes
	0:30:17	Fidelicy Nyamukondiwa:	loud and clear
	0:36:29	Julie Pellman:	Better
	0:37:16	iPad:	yes can hear but hear more aircraft noise than from presentator
	0:42:05	Ashok Ram:	Thank you so much for your presentation. What is success rate of legal actions. Would you please describe bit more about the elephant poaching from your area?
	0:45:07	PRAKASH MARDARAJ:	My Q is for Nukia: lovely presentation, great work. what is the maximum punishment for the poachers.
	0:46:50	Julie Bates- IEF:	holbrooktravel.com
	0:47:19	PRAKASH MARDARAJ:	Amos: Do the forest/wildlife officials compensate for the community towards elephant conflicts (Death of human/Crop damage/Livestock)
	0:47:46	Julie Bates- IEF:	colossal.com
	0:49:00	Julie Bates- IEF:	elephantea.com
	1:01:39	Perry Becker Design:	Is it possible to find more videos of the dog trainings? That was too cool and I would love to share that with friends and colleagues.
	1:16:49	AMOS GWEMA:	Can you please repeat the question for Amos
	1:17:06	International Elephant Foundation:	Hi Amos: Amos: Do the forest/wildlife officials compensate for the community towards elephant conflicts (Death of human/Crop damage/Livestock)
	1:17:12	Pete (WD4C- he/him):	https://www.instagram.com/WORKINGDOGSFORCONSERVATION/
	1:17:22	PRAKASH MARDARAJ:	Amos: Do the forest/wildlife officials compensate for the community towards elephant conflicts (Death of human/Crop damage/Livestock)

	1:17:32	Pete (WD4C- he/him):	https://drive.google.com/file/d/1jcb56zuSYuo4NTgWOTxOZqABBPELgWYP/view?usp=sharing
			https://www.youtube.com/c/WorkingdogsforconservationOrg/videos
			https://www.facebook.com/WorkingDogsForConservation/
			https://www.instagram.com/WORKINGDOGSFORCONSERVATION/
	1:18:08	AMOS GWEMA:	There is no compensation towards human wildlife conflict. However in case of death or injury the Government will assist under the Civil grant
	1:22:59	Wendy Kiso:	@Pete—thank you for sharing the WD4C video. Fantastic video! As an owner of 2 labs myself, its truly inspirational! Keep up the great work!
	1:25:45	Alamnyak Thaddeus Ole Orpiay:	Network is not good today IEF Video not working good today I don't know why?
	1:26:39	International Elephant Foundation:	Currently it is just an image with no video or sound. The videos will start again at the top of the hour
	1:27:20	Alamnyak Thaddeus Ole Orpiay:	okay thanks
	1:28:00	Kate-Lynne Allan:	Thank you for the fascinating Working dogs for conservation links! Do you have any articles or papers on your methodologies and implementation of training techniques? Thanks so much.
	1:33:29	Zabe HO:	Sorry. A BIt late to ask but I have a question for DOG training. Dear Pete, Can you please share us more protocol or guidelines? my email sabielwin@gmail.com
	1:36:09	Kate-Lynne Allan:	My question was also very late - sorry. If it would be possible to get more information that would be fantastic. My e-mail is 2bekatelynne@gmail.com Thank you so much.
	1:57:15	Gas Masunga:	To: Ashis: I didn't get the explanation for having plantations of preferred crops as a mitigation measure
	2:07:51	Ashis Datta_AF:	@Gas Masunga, Thanks for the question. Regarding preferred species, I meant plantation of fodder species in degraded lands inside core national park areas.
	2:08:35	PAUL BULAMBO:	thank u
	2:09:56	Gas Masunga:	@Ashis, will that be equivalent to artificial feeding of elephants, and how cost-effective or sustainable that will be?
	2:46:22	Gas Masunga:	@Shannon..Are the elephant Guards armed. How do they defend themselves from aggressive elephants?
	2:46:47	Julie Pellman:	Very interesting with regards for behavioral norms for women. Has the empowerment through training changed those norms?
	2:49:01	PRAKASH MARDARAJ:	Thank you Chase for moderating the session.
	2:49:57	Chase LaDue, OKC Zoo:	Of course! It's wonderful to hear about all of the interesting and important work happening around the world for elephants.
	2:50:00	Julie Bates- IEF:	You can purchase this wonderful tea at: Elephantea.com
	2:51:15	Julie Bates- IEF:	holbrooktravel.com
	2:51:48	Julie Bates- IEF:	Thank you! Colossal.com

	3:14:37	Rachel:	Apologies EHRA was offline and we see now the presentations are running ahead of time, if anyone has any questions regarding Shannon's presentation please ask away! Or email us Rachel@ehranamibia.org
	3:15:03	Chase LaDue, OKC Zoo:	Hi Rachel, here are a few questions for Shannon that the audience posed:
	3:15:03	Chase LaDue, OKC Zoo:	Are the elephant Guards armed. How do they defend themselves from aggressive elephants?
	3:15:12	Chase LaDue, OKC Zoo:	Very interesting with regards for behavioral norms for women. Has the empowerment through training changed those norms?
	3:16:21	Roshan Kumar Thakur:	conference ethics...? IEF...
	3:19:18	Rachel:	The elephant guards are not armed, none of our field staff are. The guards go through extensive training and would not be expected to go so close to the elephants. Through their training they would also be able to understand elephant behavior. The guards are not 'rangers' who are patrolling and actively looking for elephants, rather they are helping at homes and villages.
	3:20:36	International Elephant Foundation:	@Rachel if you can stay on until the next Q&A we'll do your questions live then
	3:21:09	Rachel:	With regards to women, these are very traditional tribal communities we work with and so I can not say that through these one day trainings we would change that, but at least the women feel comfortable to access and participate.
	3:23:33	Pete (WD4C- he/him):	Thank you all for great talks!
	3:28:54	Jenister Parsalaw:	Thank you all for your great presentations on HEC mitigation efforts and communities engagement in conservation 👏. This is incredible and inspiring
	3:29:42	International Elephant Foundation:	thank you everyone! We are so proud to be able to give a platform to dedicated conservationists all around the world with varying resources and capacities
	3:37:28	PAUL BULAMBO:	Thanks
	3:49:28	International Elephant Foundation:	Rachel, i'm sorry we were running early
	3:51:17	Jenister Parsalaw:	@Gerubin Msaki- the last presenter. I am really impressed with your study. I wish to learn more from you. Can you please share your contact details!?.
	3:51:31	Sarah Florian:	Thanks so much everybody!!!
			Welcome in ARUSHA TANZANIA to see natural resources WONDERS + ANIMALS & ELEPHANTS IN NATIONAL PACKS!!
			BE BLESSED SO MUCH 🙏🙏🙏
	3:52:13	Julie Pellman:	I agree with Rachel, but perhaps over time norms may change?
	3:52:49	Deborah:	will the government expand tet program to other areas of Botswana
	3:53:06	Deborah:	no the
	3:54:00	Gerubin Liberath Msaki (Tanzania):	@Jenister. Great Thanks. You can reach me through my Emails:msakig@nm-aist.ac.tz or call +255786873047
	3:55:10	Jenister Parsalaw:	Thank you Gerubin..
	3:55:38	Gerubin Liberath Msaki (Tanzania):	Your welcome@Jenister
	3:58:32	PAUL BULAMBO:	Thank you very much for this given opportunity

			you are welcome in the Democratic Republic of Congo
	DAY 5		
	0:26:03	Ashok Ram:	Good morning and Namaste to everyone
	0:26:31	Fidelicy Nyamukondiwa:	goodmorning to you all
	0:26:36	875 2120 1765:	Greting from Tanzania, By Davd kabambo
	0:27:28	PAUL BULAMBO:	Good Morning from DR.Congo
	0:27:57	Isaac Twinomuhangi:	Hello everyone
	0:28:05	AMOS GWEMA:	Good afternoon from Zimbabwe
	0:28:12	pearsov:	A beautiful morning here in Philadelphia PA USA from Virginia Pearson
	0:28:35	GANSO Rockis G. S., SOS Savane-ONG, Bénin, West:	Good morning, GANSO Rockis G. S from Benin
	0:29:43	MUKTI ROY:	Good Morning to everyone .
	0:32:09	International Elephant Foundation:	Good Morning, Good Afternoon, and Good Evening everyone! We've got a great day of talks!
	0:35:44	Sery Gonedele, Université Félix Houphouët Boigny:	Good Morning everyone. Sery from Côte d'Ivoire
	0:38:42	Wendy Kiso:	Despite trying to improve the sound, the volume is still low. Wearing headphones may help with the sound. Thank you for your patience!
	0:50:36	Prakash Mardaraj:	Hi Fedelicy: Great work. I wanted to know that if the bee fence is ever disturb by livestock then how u people avoid that?. 2nd question is Do the Forest authority help financially in bee farming?
	0:51:31	Julie Pellman:	Great description of the origin of the beehive fence and how it is used
	0:54:32	Bakari Shokala:	Hi, I am Nuhu Jacob from Voluntary Education and Relief Initiative for Tanzanian Society (VERITAS) -Tanzania. I had just used my staff's ID to join as am facing internet hardship now so not to miss this crucial conference I use this alternative.
			Nice to connect with you all.
	0:59:18	Wendy Kiso:	Thank Nuhu! Glad you can join us! You are coming next---but we will wait for questions at the end of the session.
	1:00:53	Fidelicy Nyamukondiwa:	thank you for the feedback .
	1:02:13	Julie Pellman:	Great ideas.
	1:04:43	GANSO Rockis G. S., SOS Savane-ONG, Bénin, West:	phrase increase the sound
	1:04:55	GANSO Rockis G. S., SOS Savane-ONG, Bénin, West:	*please
	1:05:51	Wendy Kiso:	We apologize. We have tried to improve the quality of the sound. Wearing headsets may help enhance sound quality. Thank you very much for your patience and understanding.

	1:09:23	Fidelicy Nyamukondiwa:	responce to Prakash : There should be a team which regularly monitorw and inspects the fence in view of repairing it in case of livestock disturbances , theft and or vandalism. The Forestry Commission and also the wildlife authorities dont financially support but more often they help in doing awareness campaigns. The Forestry Commission of Zimbabwe actually sells beehives as a way of fundraising for their projects since they also lack adequate funding.
	1:11:18	Bakari Shokala:	Thanks, Wendy
	1:39:25	Bakari Shokala:	EHRA, presenter I would really appreciate if I can connect with you. I am Nuhu Jacob from VERITAS
	1:40:15	Christin Winter:	Hi Nuhu, you are very welcome to do so: christin@ehranamibia.org :-)
	1:46:57	Fidelicy Nyamukondiwa:	Coexistence at its best
	1:47:18	Jenister Parsalaw:	@Christin what your doing is amazing. I will also love to connect with you!.
	1:47:28	Gerubin Liberath Msaki (Tanzania):	A great Presentation from EHRA
	1:48:27	Julie Pellman:	Amazing work
	1:49:19	MUKTI ROY:	Thank you for your nice presentation EHRA.
	1:49:32	Christin Winter:	Thank you very much! @Jenister, we would love to connect! Please do get in touch!
	1:50:08	Patryk Pyciński:	Great work Christin!
	1:51:06	Christin Winter:	Thank you, Patryk!
	1:51:12	Jenister Parsalaw:	@Christin thank you so much
	1:55:19	Meline Klopfenstein:	Thank you for all the presentations, they are all so inspiring. I have a more general question to all speakers: What would be your advice to a young graduate (Msc and an internship in HEC data analysis in Namibia) to start a career in HEC research?
	2:08:55	Meline Klopfenstein:	Thank you so much for your answers. I have volunteered for EHRA last year and it was amazing !
	2:09:17	Julie Bates- IEF:	Holbrooktravel.com
	2:10:45	Julie Bates- IEF:	Colossal.com
	2:11:18	Julie Bates- IEF:	Elephantea.com
	2:12:33	Fidelicy Nyamukondiwa:	nice T shirts
	2:14:35	International Elephant Foundation:	www.IEFstore.org
	2:17:14	Bakari Shokala:	Voluntary Education and Relief Initiative for Tanzanian Society (VERITAS) - Tanzaniaveritasorgtz@gmail.com
			Shokala99@gmail.com
	2:18:42	Fidelicy Nyamukondiwa:	Fidelicy Nyamukondiwa +263773975244 (Whatsapp)
	2:19:01	Fidelicy Nyamukondiwa:	Fauna and Fli
	2:19:02	Julie Pellman:	I have a friend who is a Maasai in Kenya. He needs to find funds for educating his community about beehives and HEC. Can you help me find funding for him or tell him how to go about finding funding?

	2:20:24	Bakari Shokala:	NGO: Voluntary Education and Relief Initiative for Tanzanian Society (VERITAS) - Tanzania
			Title: Assessment towards Human – Elephant Coexistence and Poaching in Serengeti National Park
			We can connect via:
			veritasorgtz@gmail.com
			Shokala99@gmail.com
			nuhujacob01@gmail.com
	2:20:35	Mindy Ussrey:	If there are questions for Asian Elephant Support , please email us at elephants@asianelephantsupport.org.
	2:21:01	PAUL BULAMBO:	Thank
	2:21:35	Fidelicy Nyamukondiwa:	Fidelicy Nyamukondiwa Fauna and Flora Zimbabwe(FaFlozim) directorfaflozim.gmail.com or fidelnyams@faflozim.org.zw @fidelnyams on Twitter
	2:24:13	Fidelicy Nyamukondiwa:	Amazing work by Asian Elephant Support
	2:25:27	pearsov:	Wonderful work. We are all very proud of you all at Asian Elephant Support. Virginia R. Pearson
	2:25:48	Mindy Ussrey:	Thanks everyone!
	2:26:13	Zabe HO:	Thank you so much AES. Hugs from Myanmar.
	2:27:14	875 2120 1765:	Enjoy watching my presentation By David kabambo, from Peace for conservation
	2:27:38	875 2120 1765:	any one interested Arts drop your email to dkabambo@gmail.com
	2:37:54	Fidelicy Nyamukondiwa:	Hello David. you are doing great. research about Larry Norton in Zimbabwe. He is an artist who has internationally exhibited a lot of artwork and has fundraised for many organisations through conservation Art. You can get in touch with me so that i can link you up
	2:38:17	Fidelicy Nyamukondiwa:	my contacts attached above
	2:38:50	875 2120 1765:	please email via dkabambo@gmail.com
	2:40:10	PAUL BULAMBO:	thank u David for presentation
	2:40:56	875 2120 1765:	larry please share contact
	2:41:47	998749:	thank you so much about highly idea Mr David
	2:43:12	875 2120 1765:	please larry drop your email
	2:44:53	PAUL BULAMBO:	my mail is:apadecasbl@yahoo.fr
	2:50:47	Lou Barreda:	https://www.myakkaelephantranch.org/conservation
	2:51:20	Fidelicy Nyamukondiwa:	Larry is not attending the symposium. im fidelicy from Zimbabwe my email is directorfaflozim@gmail.com . i personally know him. lets connect. have taken note of emails
	2:51:51	Julie Pellman:	Can my college students be involved in the Conservation Art Exchange in NYC? If so how? Is it on your website?

	2:54:00	pearsov:	Truly inspired. Thank you for making your ranch and elephants available to so many people. Virginia R. Pearson
	2:55:21	Perry Becker Design:	Can I please get the contact info for the team at Myakka Elephant Ranch? Id love to come visit and maybe schedule a volunteer day for our firm
	2:56:01	Wendy Kiso:	https://www.myakkaelephantranch.org/conservation
	2:56:41	875 2120 1765:	JP, YES WE HOST VOLUNTEER CONSERVATION ARTS , drop your email to dkabambo@gmail.com or share yur email i will send a more information
	2:57:21	Myakka Elephant Ranch:	Absolutely Julie we are just starting to get more schools involved. https://www.myakkaelephantranch.org/conservation you can visit our website for the templates. And then they can be mailed or emailed back to us. Then we will distribute and share them to inspire others.
	3:04:10	HUAWEI Y MAX:	https://www.facebook.com/lifeinoozievillageecohut/
	3:04:40	Abebayehu:	Hi everyone
	3:05:14	875 2120 1765:	Covid -19 was disaster in my life I lost my wife for COVID-19, Her name Beatrice james salu, She was working the nature conservancy Africa as operations manager Africa.
	3:06:07	Fidelicy Nyamukondiwa:	oh Sorry for your lose. Please be comforted
	3:06:26	Julie Pellman:	So sorry as well
	3:06:41	Bakari Shokala:	So sorry
	3:06:44	PAUL BULAMBO:	OOOh Sorry dear
	3:06:50	Wendy Kiso:	I am so sorry for you. Much sympathy to you and your family. What a huge loss to your family and community.
	3:06:58	875 2120 1765:	Thanks By David
	3:07:09	Abebayehu:	I miss most of the presntion due to problem in internet connection
	3:07:21	Abebayehu:	sorry
	3:08:00	Wendy Kiso:	IEF is recording each session. You can watch the videos later via IEF website if you would like to catch up on talks that you may have missed.
	3:09:01	PAUL BULAMBO:	Thanks
	3:11:10	Ashoka Ranjeewa:	Excellent talk. Thank you
	3:11:11	Deborah:	Excellent presentation with many lessons we all need to pay attention to. Yes I took away some ideas and inspiration!
	3:11:29	MUKTI ROY:	Thank you for great talk and suggestion for NGO .
	3:11:34	Gerubin Liberath Msaki (Tanzania):	Very interesting talk@Rachel
	3:11:47	Zabe HO:	Thanks Rachel for sharing your experience.I'm operating a sustainable tourism project called Life in Oozie Village Ecohut (L.O.V.E.)in Myanmar.
	3:12:57	Rachel Harris:	Thank you! very welcome to contact me rachel@ehranamibia.org
	3:13:18	Rachel Harris:	@Zabe I will check it out! thanks!
	3:14:52	Zabe HO:	Yes, Please @Rachel.You inspire me!

	3:18:32	Fidelicy Nyamukondiwa:	inspiring journey. great insights. its been very difficult for us to fundraise in Zimbabwe. We get many volunteers interested in working with US at Fauna aand Flora Zimbabwe but some of them disappear as soon as they realise that we dont have any funding. im inspired. will definitely get in touch for more
	3:22:22	Rachel Harris:	You are welcome to get in touch @Fidelicy happy to chat!
	3:22:57	Sam:	To Christopher: Fantastic presentation and novel ideas, thank you! I wonder, with the elephant patrol units, how do the captive and wild elephants interact? What are the benefits and drawbacks of using elephants to protect the the wild elephants?
	3:30:30	Wendy Kiso:	Unfortunately, Christopher was not able to attend this session. You can email IEF your questions and they can forward them onto Dr. Stremme. Thank you.
	3:51:41	Fidelicy Nyamukondiwa:	what is the penalty got setting snares in Uganda.
	3:53:17	Fidelicy Nyamukondiwa:	or altenatively, the penalty for illegal hunting or killing of elephants. Could you be in a position to tell?
	4:19:20	Julie Pellman:	Does the IEF fund small projects like my friend who is a Maasai in Kenya?
	4:20:18	Julia Braren Myakka Elephant Ranch:	Thank you wonderful information
	4:20:38	International Elephant Foundation:	Yes, IEF funds a variety of projects, of all sizes, anywhere there are elephants. Our 2023 funding proposal deadline has passed but you are welcome to apply or have him apply in the spring for 2024
	4:20:45	International Elephant Foundation:	www.elephantconservation.org
	4:22:51	Zabe HO:	IEF did lots of good funds in Myanmar too. Thanks and hope to get continuous support to Myanmar elephants.
	4:23:18	International Elephant Foundation:	Thank you, Zabe! we are so proud to support the work in Myanmar
	4:23:58	Fidelicy Nyamukondiwa:	it was an exciting session. thank you IEF , speakers and everyone who participated
	4:25:01	Zabe HO:	Yes. After Covid and especially unlawful Coup, elephants became victims. They deserve our supports.
	4:26:48	PAUL BULAMBO:	It is was a mazing sypasium
	4:30:57	Cora Musial:	Thank you to all. I learned a lot. Inspirational!
	4:31:26	Julie Pellman:	I learned a lot as well
	4:32:40	Ashoka Ranjeewa:	Great work. Thanks everyone.
	4:33:05	PRAKASH MARDARAJ:	Thank you all IEF team making this wonderful symposium successful. with all my good wishes. lets save the Jumbos.
	4:33:07	Aleksandra Grubin:	Thank you! It was very instructive, informative and excellently organized!
	4:33:08	Isaac Twinomuhangi:	It was a good experience to learn more about HEC and possible solutions around the world.
	4:33:19	PRAKASH MARDARAJ:	Prakash Mardaraj, Paribartan
	4:34:29	Gerubin Liberath Msaki-Tanzania:	Many thanks to IEF for the wonderful opportunity to learn different issues on HEC and elephants Conservation.

	4:36:04	MUKTI ROY:	Thank you IEF giving us opportunity to present out work on Train elephant collision in Sri Lanka.
	4:36:23	Ashok Ram:	Thank you so much to IEF for providing this platform to share, and gain wonderful knowledge from this symposium
	4:37:09	Julia Braren Myakka Elephant Ranch:	Thank you so much to IEF for an informative enlightening symposium.
	4:37:12	PAUL BULAMBO:	Thank you very much to IEF for giving me this amazing opportunity
	4:37:29	Julie Pellman:	Thanks fora great conference
	4:38:03	Wendy Kiso:	Thank you everyone for a great IEF conference! I look forward to meeting everyone in person next year! ☺
	4:38:10	pearsov:	Thank you IEF
	4:38:13	International Elephant Foundation:	@Sam, the symposium is usually in person and held in different places around the world
	4:38:21	International Elephant Foundation:	the last two in person ones were SIngapore and South Africa
	4:38:37	Isaac Twinomuhangi:	🙏🙏
	4:38:44	International Elephant Foundation:	Thank you so much, everyone! YOU are the ones who make this conference so wonderful <3
	4:38:48	Sarah Florian:	Thanks so much SARAH ♡💝🙏🤲👏
			THANKS DEBORA, JULIE, DIRECTOR AND ALL IEF STAFF AND ALL IEF MEMBERS ON EARTH
	4:39:09	Julie Pellman:	I hope there can be an online component next year. Many thanks for thinking of hybrid.
	4:39:21	Wendy Kiso:	Thank you to Debbie, Sarah and Julie for all your hard work! We all appreciate you!!
	4:39:28	Sarah Florian:	🔥🔥🌷🌷🍁🏵️🌸🌸🌸🌸🌸🌸🌸🌻🌻⛵⛵🏵️🏵️🌸🌸🏵️🏵️🌿🌿🙏🙏🙏🛩️🛩️🛩️🛩️be BLESSED SO MUCH 💝
			love you so much
	4:39:44	Julie Pellman:	Also by fall, those of us who are teaching are in class. I cannot travel at that time.
	4:39:51	Leanne Henry:	when do you think that the links will be available to replay the meeting?
	4:40:18	Christina Tholander:	Thank you so much for an awesome symposium. Good luck to everyone
	4:40:24	Dorothy:	when do you think that the links will be available to replay the meeting?
	4:41:40	Gas Masunga:	I thank IEF for affording me the opportunity to attend this symposium. I learned a lot and now up to date with many research studies and conservation efforts on elephants going on around the world.
	4:42:09	Rachel Harris:	Thank you everyone we look forward to meeting in person!

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4	Adam Felts	adam.felts@columbuszoo.org	
5	Adrian M. Lister	a.lister@nhm.ac.uk	Extinction of the woolly mammoth – a lesson from the past?
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7	Alamnyak Thaddeus Ole Orpiay	alamnyakthaddeus@gmail.com	SICOCABU-Simanjro Community Capacity Building Project on HEC
8	Aleksandra Grubin	pasavetnici@gmail.com	
9	Alida De Flamingh	adeflamingh@gmail.com	Sourcing elephant Ivory from a Sixteenth-Century Portuguese shipwreck
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14	Amos Gwema	amosigwema@gmail.com	The four pillars for effective conservation of African Savanna Elephant
15	Amy Roberts	aroberts@rwpzoo.org	
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22	April Yoder	ayoder9@gmail.com	
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183	Paul D. Ling	pling@bcm.edu	Generating an immunogenic Elephant Endotheliotropic Herpesvirus (EEHV) vaccine
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245	Wouter Bonhof	w.bonhof@exeter.ac.uk	Reconstructing proboscidean migratory behaviour using strontium isotopes

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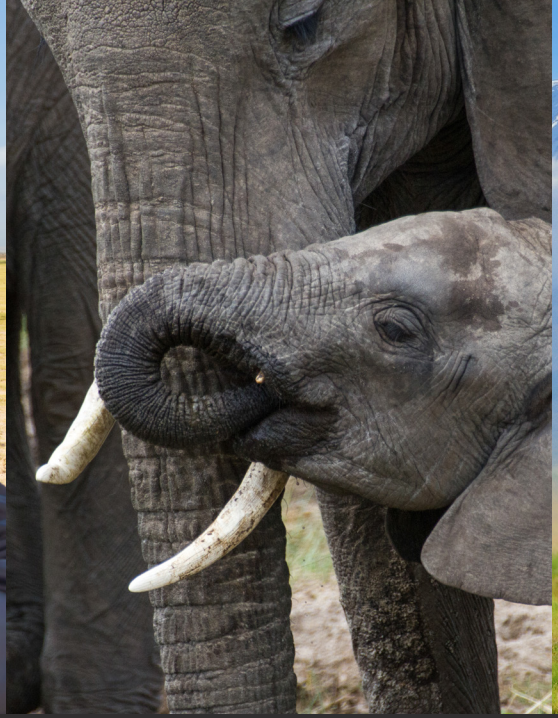

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