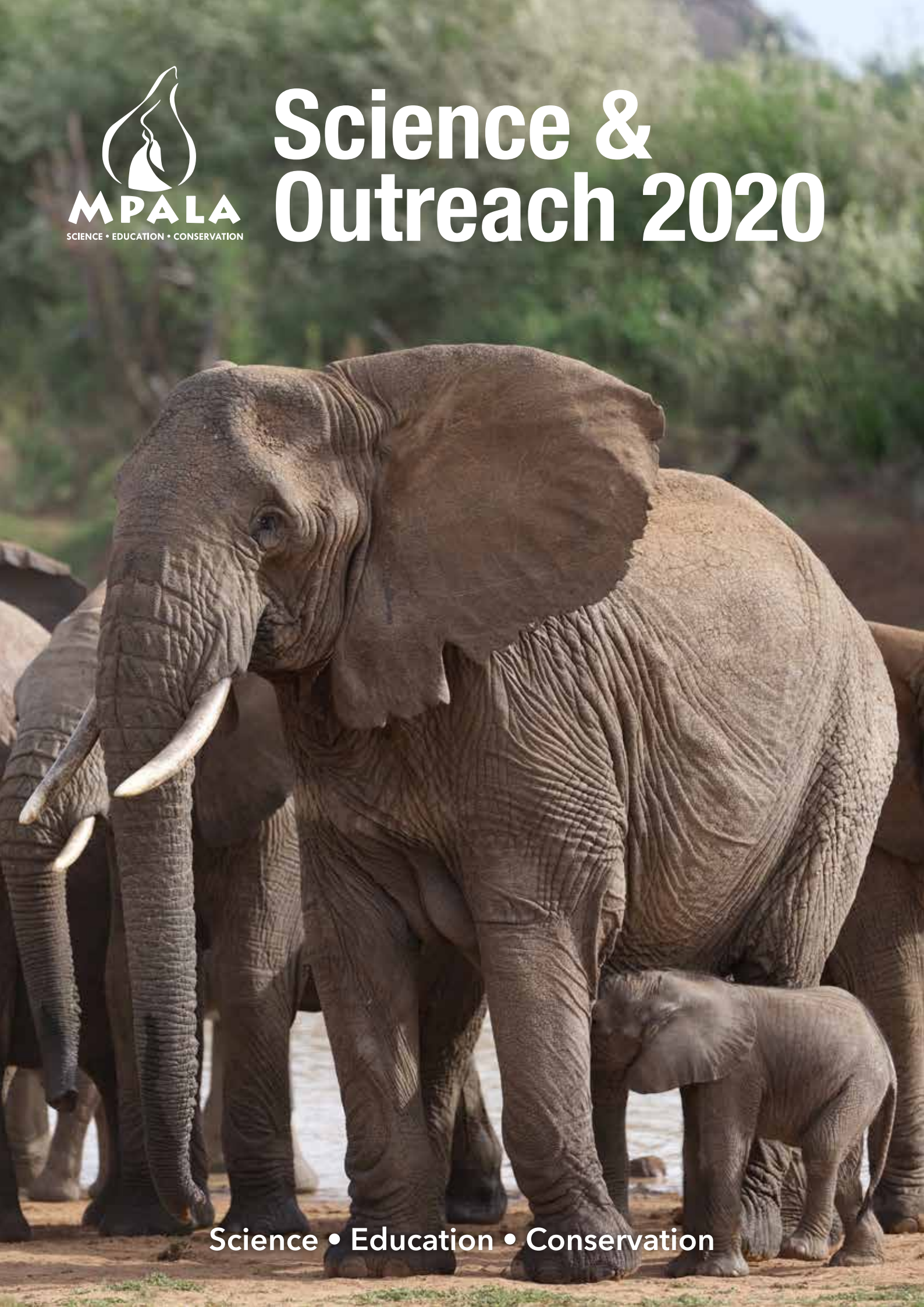
MPALA
SCIENCE • EDUCATION • CONSERVATION

Science & Outreach 2020



Science • Education • Conservation

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Director's Letter

Dear Friends and Supporters of Mpala,

Many greetings and it is my great pleasure to share our 2020 Science and Outreach report with you. Like many communities and institutions across Laikipia and the wider world, Mpala has faced some challenges this year. Despite these challenges, Mpala remains relevant, active and fully engaged in our mission of Science, Education and Conservation.

Throughout this year, Mpala has managed to keep most of our research running. We are also playing our small part in contributing to the wider scientific effort around the Covid-19 pandemic.

Thanks to the investments we have made in developing Kenyan talent, capacity and collaboration, we have kept all long-term projects up and running. We have also been able to develop some new projects, including in the areas of 'One Health' and better understanding how viruses evolve, behave and move between hosts and within populations.

There are many milestones to celebrate. I am especially pleased that in terms of scientific output, collaborations between Kenyan and international scientists have seen original discoveries published in

the world's leading journals.These discoveries, insights and additions to our knowledge of ecology are made possible by the incredible passion, dedication and energy of all the Mpala staff, scientists and students.

I would like to note the important discoveries of Dr Judith Sitters, working with Professor Truman Young, and our own Dr Duncan Kimuyu, who showed that elephants, as ecosystem engineers who produce lots of dung (!), can help land recover from the effects of cattle grazing. Sandy Odour has combined fieldwork and making use of cutting-edge lab analyses to provide new non-invasive ways of understanding elephant biology and the Turkana Genome Project, based out of the Mpala Genomics Lab, has it's first key paper out recently in *Science Advances,* led by Amanda Lea and Professor Julien Ayroles at Princeton, and Dr Joseph Kamau at the Institute of Primate Research in Kenya.

Our team have risen gallantly to implement all the necessary changes around social distancing, hygiene and basically being more present, aware and caring for everyone at Mpala and around us. We have also worked with Laikipia County Government and neighbours to provide support to vulnerable communities.

As we have all had more time to reflect and take pause, I am constantly reminded on the many things to be grateful for here daily. Thriving wildlife, and the promise of new discovery and adding to knowledge, and most importantly the continued energy and passion of our students and scientists, keep us all inspired and motivated.

All of these successful projects and discoveries are thanks to your support.

On behalf of the students, scientists, staff and Mpala family, Asante!

Dino J. Martins

The incredible rains this year have brought us so much grass, I've been working on a book about East African grasses, and below are some of my sketches of these beautiful plants.

Glimpses of wildlife from Mpala

Facing page, top rows: **Butterflies and moths have been abundant this year at Mpala.** Bottom: **The Greater Kudu have also been doing well and have lots of young as well.**

This page, Top left: **A White-Bellied Go Away Bird and Brown Parrot stop by for a drink, top right: a lone bull buffalo watches from a thicket.** Left and below: **the 'Big Cats' have done really well this year too, with lots of sightings of lion, cheetah and leopard at Mpala.**

About Mpala

The Mpala Research Centre was established in November 1994 at the core of the Ewaso Ecosystem, a large, geographically diverse region of central Kenya, defined by the Ewaso Ng'iro River and its tributaries. The region is part of Kenya's 80% land that is arid and semi-arid. It's characterised by savannas and woodlands, home to an estimated 550 bird species and 100 mammal species. This includes, large populations of elephants and rare species like the Grevy's Zebra, reticulated giraffe, African wild dog and black rhino. The region is unique in that little of it is formally protected yet, wildlife abundance rivals the renowned Maasai Mara and Serengeti ecosystems. The Mpala property is located on the Laikipia Plateau and covers 48,000 acres of land. The land provides a hub for experimental and manipulative research open to scientists and students. Mpala provides a 'living laboratory' without the restrictions of a national park. This allows scientists to manipulate the environment and conduct landscape-level controlled experiments, to explore basic science, address real-world problems, and ensure that sustainable livelihoods and economic advancement are synonymous with wildlife conservation.

Mpala's Institutional Mission, is to support research that improves ecosystem functions, conserves biodiversity, and enhances the livelihoods of employees and their families who are predominantly traditional pastoralists. In conjunction with this mission, Mpala works to advance the understanding and conservation of natural and human-occupied ecosystems. This is through basic research, education, outreach,creating new scientific knowledge and developing science-based solutions to guide conservation actions for the benefit of nature and human welfare.

MPALA'S MISSION

- Operate an enduring facility for research and education in environmental, biological and conservation sciences at local, national, and international levels.
- Sustain a long-term environmental monitoring program, to measure changes in climate, landuse, vegetation, ivestock and wildlife numbers. To enable the understanding of biotic processes at the landscape level, and to identify mechanisms for maintaining the integrity of the expansive savanna ecosystem.
- Develop an informed approach to conserving the natural resources of the greater Ewaso ecosystem and,lead as an example, for other 'non-protected' areas of Kenya.
- Promote human and wildlife co-existence in the greater Ewaso ecosystem and provide information to help resolve conflicts.
- Provide educational opportunities via experiential learning in research and monitoring skills for students and professionals from Kenya and around the world.

Partners

Mpala is a Trust of the Mpala Wildlife Foundation, Princeton University, the Smithsonian Institution, the Kenya Wildlife Service, and the National Museums of Kenya. Mpala hosts interdisciplinary research and training programs in ecology, evolution, geology, and resource management to scientists from Kenya and around the world. Researchers representing all our partners, are drawn to Mpala to study our remarkable ecosystems, making Mpala a hub for collaborative research.

In 1989 George Small created the Mpala Wildlife Foundation to fund the activities necessary to achieve his vision. The foundation supports the wildlife conservancy, a primary school for employees' children, community outreach, a Mobile Clinic and a livestock ranch that successfully coexists with an abundance of wildlife.

Princeton University serves as the managing partner for Mpala. Through Princeton University, Mpala has been awarded several NSF grants to improve facilities and rebuild the campsite. Most recently, NSF funded the construction of a cutting-edge genomics and stable isotope laboratory. Throughout the year, Princeton faculty members researchers, graduate and undergraduate students visit the research facility to undertake research and expand their knowledge of the savannah landscape.

The Smithsonian Institution is a Trust Instrumentality of the United States, administering several Museums and Research Centres. Mpala is the Smithsonian Institution's first, permanent research facility in Africa. The Smithsonian Institution offers multiple fellowship opportunities with Mpala to promote the study of biology, anthropology, geology, hydrology, material science, social science, soil science, and related areas. The Smithsonian also collaborates with Mpala, on long-term research and monitoring on the greater Ewaso ecosystem.

The Kenya Wildlife Service is the government agency tasked to protect and manage the fauna, flora, and ecosystems of Kenya. KWS undertakes and coordinates biodiversity research and monitoring. We have research projects that collaborate with the KWS especially when collaring wildlife. More recently, the Smithsonian-Mpala Veterinary Fellow has been working with KWS veterinarians to treat injureda and sick wildlife on Mpala and surrounding conservancies.

The National Museums of Kenya is a state organization that manages museums, sites, and monuments in Kenya. The NMK carries out heritage research and has expertise in subjects ranging from paleontology, ethnography, biodiversity research and conservation. A number of our researchers are affiliated with NMK and collaborate with NMK scientists, use their facilities, equipment and expertise.

A Mission to Wipe Out Rabies

By **Dedan Ngatia**, Co-Founder, Laikipia Rabies Vaccination Campaign

Science for a Cause

The Laikipia Rabies Vaccination Campaign was started in 2015 by Dedan Ngatia and Dr. Adam Ferguson. The two researchers continue their work at Mpala Research Centre, studying wild dogs and the small carnivores. LRVC is a unque pilot study bringing mass vaccination to rural communities, where achieving widespread vaccination is more challenging, and access to veterinary and health services is limited. Every Friday and Saturday from early October to the second weekend of November, teams of volunteer veterinarians and students have been visit rural communities around Laikipia, offering free rabies vaccinations to domestic dogs and cats.

In its first year, the campaign vaccinated 821 domestic dogs and cats in five pastoralist communities around Mpala. The following year, 2016, the campaign expanded to additional communities, vaccinating 4530 animals. In 2017, a total of 9313 dogs were vaccinated and the number almost doubled in 2018, where 15300 dogs and cats were vaccinated.

The Laikipia Rabies Vaccination Campaign (LRVC) completed its 2019 campaign to immunize domestic dogs and cats around Laikipia against rabies. The campaign attracted collaboration with Veterinarian International and similarly managed to gather support from surrounding conservancies and donors including Ludwig Foundation, Ol Jogi conservancy, Ol Pejeta Conservancy, Laikipia Wilderness Camp and many others. The Laikipia County Government and the Kenya Zoonotic Disease Unit (ZDU) supported the LRVC as part of the nation-wide effort to eradicate rabies in Kenya by the year 2030.

Over five weekends, the 2019 LRVC vaccinated a record-breaking 13,185 domestic dogs and cats across the county, almost achieving the total number of dogs vaccinated in 2018. The LRVC's ultimate goal is to eradicate the fatal disease from Laikipia County.

The campaign is based at Mpala Research Centre, where students, community partners, and researchers have come together to support the campaign, using science to benefit humans, domestic animals, and wildlife alike. The team continues to receive huge support from Mpala Research Centre through Dr. Dino Martins.

First Paper on LRVC

The paper titled, *Effectiveness of grassroots dog and cats vaccination to eradicate Rabies* was published in the prestigious open access journal PLoS (Public Library of Science) Neglected Tropical Diseases.

According to the World Health Organization, rabies kills tens of thousands of people every year, mainly in Asia and Africa. Globally, rabies causes an estimated cost of US$ 8.6 billion per year. Dog bites are responsible for 99% of all cases of human rabies. Therefore, vaccinating dogs is the most cost-effective way to prevent rabies in people.

As the world currently battles a pandemic also caused by a virus, the success of the LRVC can serve as an example of how to tackle the challenge of diseases using an integrated and grassroots-led approach.

The research study found that while grassroots volunteer-based dog vaccination campaigns against rabies can be useful, these efforts need to be supported at a larger scale by county and national governments for a more sustainable approach towards eradicating the disease.

Facing page: **Dr. Adam Ferguson and Dedan Ngatia the co-founders of LRVC.**

Above: **2019 LRVC volunteers in the field.** Left: **2 recently vaccinated dogs.** Right: **2 Veterinarian Volunteers at the 2019 LRVC.**

Community Outreach

In collaboration with the Laikipia County Government, we have continued to reach out to the communities around Laikipia County. In May, Mpala 'adopted' the villages of Lekiji and Ilmotiok who are our immediate neighbors. This initiative supported 209 families with food stuffs. In addition to this, 11 elderly and vulnerable families around Mpala were supported.

Visit to One More Day for Children Foundation

One More Day for Children, is an institution that takes care of young girls from the Samburu and Maasai community, who are rescued from early marriages, beading and FGM. During this visit, 20 families were supported with food stuffs.

Visit to The Sang'ida Foundation

Sang'inda Foundation, is an institution that support disabled children, from the pastoralist communities of Laikipia North Sub-County. A total of 20 families were supported.

Left: **Everlyn Ndinda reading a storybook to NKCC students at Ol Jogi Primary.** Right: **Nancy Rubenstein during the teachers' workshop in January at Mpala.**

Northern Kenya Conservation Clubs (NKCC)

By **Everlynne Ndinda**

The Northern Kenya Conservation Clubs were started in the year 2008. They were an outreach program, for Proffessor Dan Rubenstein's research on Grevy's zebra in Samburu. By 2009, there were conservation clubs in four primary schools namely, Mpala, Il Motiok, Naiperere, and Ewaso. Proffessor Dan, Nancy Rubeinstein, NKCC teachers, educators from Saint Louis and San Diego zoos held a workshop with members from group ranches to develop a curriculum for the clubs.

Every year, Proffessor Dan and his colleagues would go to the communities and share their research findings. In the local primary schools, the proffessor would teach a lesson in conservation biology. Bearing in mind that one day the Grevy research would come to an end, the idea of the conservation clubs was conceived to ensure that Dan's lessons in schools, would continue in his absence.

NKCC program currently has 16 schools.Below are the program's ongoing activities in member schools. However,with schools closed they have been disrupted.

- Opuntia elimination project.
- Soil restoration project.
- Afforestation
- Farming
- Camera traps/mammal project.
- Bee keeping
- Schools trips

In January 2020, an annual teacher's workshop was held. It's aim was to help teachers understand experiential hands-on learning and how to carry out the pre-designed curriculum. During the workshop teachers assummed the role of students. This enabled them to experience a students' perspective. They were able to give feedback, on what would make the activities more fun and engaging.

COVID-19 has affected the program plans in many ways. Due to restrictions imposed by the Ministry of Health to curb the spread of COVID-19, the annual community Conservation Day, held every 2nd Saturday of July was not held.

Princeton University students, who help teach conservation to students in preparation for the event, could not travel to Kenya and were greatly missed. All was not lost as we embarked on e-learning to enable them to help with this. The interns carried out storytelling available on the MpalaLive! Website www.mpalalive.org which educators can access freely.

The NKCC Program evaluation was set for this year. This being our 12th year, we wanted to get feedback from our stakeholders on how to best improve the club's operations. We have been able to meet with the community member and also the club students at their homes. When schools open, we plan to provide each school with a pedal operated hand washing machine, and also make plans for the following year's workshop.

Through our WhatsApp groups, we have kept in touch with the conservation teachers. We remind them conserving our environment is a process and a journey that we should all support.

Zebra Project

By **Rosemary Warungu**, Project Manager

The Mpala Zebra Project is multifaceted. Not only does it examine the basic ecology, behaviour and demography of both plains and Grevy's zebras on Mpala and neighbouring conservancies and group ranches, it also examines issues of human-wildlife interaction, especially with respect to cattle and human economic and social well being.

Zebra Demography, Habitat Choice and Movement Ecology

To determine the demographic structure and stability of zebra populations, we record the individual identity and habitat locations of Grevy's and Plain zebras across seasons in Laikipia, mainly on Ol Jogi, Mpala and Ol Pejeta Conservancies. We drive predetermined loops taking photos of all individual zebras, recording reproductive status and habitat within the group. Individual identities are determined from these images using the Detection and Hotspotter algorithms of WILDBOOK which we have been instrumental in helping develop. From repeated sightings we can assess seasonal ranging, habitat preferences as well as demographic features associated with survival and reproduction.

Grevy's zebra is an endangered species whose numbers are increasing in Laikipia and Samburu areas.

The use and importance of WILDBOOK in Kenya made news this year in Daily Mail and The Kenya Standard newspaper following an interview with the zebra project manager Rosemary Warungu. WILDBOOK being the fastest and accurate software for identification will help combat the Grevy zebra extinction.

Even though 2020 has been a tough year due to COVID-19 pandemic, we have achieved several activities that include:

GGR 2020

We helped organize the third national census of Grevy zebra on the 25th and 26th of January 2020 where tens of thousands of photos were taken within the 25,000km^2 area of the Grevy's zebras Kenya range. GGR brings together scientists, landowners, conservancies and members of the public in driving through designated areas and photographing the right side of each individual Grevy's zebra observed with a provided GPS enabled digital camera. Each Grevy's zebra has a unique stripe pattern which allows WILDBOOK to identify individuals from photographs taken on two consecutive days. From these sight-resightings we can estimate the size of the Grevy's zebra population nationally, by county and even by property. The population size estimates are highly accurate and are used by national and county officials to shape future conservation and management initiatives.

Grevy's Zebra Genetics

To better understand the genetic structure of the entire population of Grevy's zebras throughout Kenya, we have begun collecting the dung of

as many Grevy's zebras as possible along with a photograph, from which we will determine identity using WILDBOOK, GPS location and date. As the database grows we will determine the degree of population mixing, sub structuring and possible inbreeding. The total genomic analysis of the population using Mpala's new molecular lab will also reveal which traits are undergoing selection and what genetic bottlenecks have existed throughout the population in the past.

Princeton Students Course Work

In January 2020, Princeton University's Graduate course on 'Tropical Ecology' took place at Mpala. The Mpala Zebra Team assisted one of the student projects which focused on the diets and microbiome of the hybrid zebras and compared them to the parental species (GZ and PZ) at OPC. This helped to assess the degree of foraging competition between the two parental zebra species and examine for the first time the degree to which genetic differentiation or socialization

As part of the Great Grevy's Rally in January this year, Mpala hosted the USAID, Wildlife Direct and journalists.

influences how the hybrids process vegetation and their physiological similarity to the parental species.

In addition the team is assisting Sara Beery, a graduate student from Cal Tech, in monitoring the 100 camera traps she has positioned at Mpala waterholes, roads and random points on the landscape to capture photos of the animals to assess habitat preferences and the different biases that are associated with different camera positioning's.

PEI Summer Internship Program

Due to COVID-19 pandemic, for the first time we conducted an online- rather than the usual onsite-intern program for summer students. In past years students would reside at the research facility and would be attached to various research projects. This would enlightenand help them understand on the various savana interactions.

Our project interns focused on how intensive cattle grazing affected zebra habitat choice by examining home range changes before, during and after cattle use an area. Photos captured by driving new loops, demos and tutorials were shared online. Preliminary results reported at a closing 'Discovery Day' suggest that both zebra species change their feeding locations when cattle arrive and intensively use and change the grassland. While plains zebras tend to avoid these area when cattle are present, returning after the cattle are subsequently moved away, Grevy's zebras move the center of their ranges more judiciously, preferring to continue grazing with the cattle, but on the fringes of areas where they are not densely aggregated.

Cattle project

In order to better understand why cattle typically lose weight when they switch from 'green' to 'brown' forage and vice versa, experiments involving

pre-feeding with supplements of future forage were begun. In February 2020 four treatment groups were created:

i) one served as a control and received no supplements;
ii) one received both silage before wet seasons or hay before dry seasons as well as phosphorous for 3 weeks before the season was expected to change;
iii) one received only the vegetation supplements and was deployed as described in (ii) above, but without additional phosphorous; and
iv) one received only phosphorous.

Three cows in each treatment ware collared with small GPS tags to record movements on the land scape. In this way habitat choice and movement routes could be determined as well as distance traveled and velocity could be recorded.

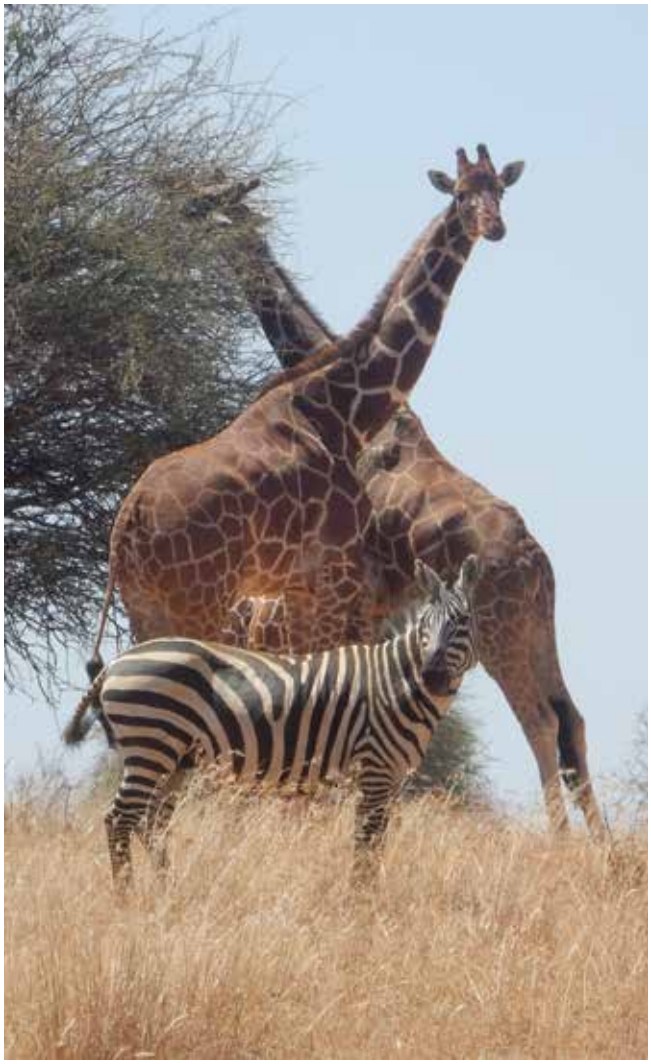
Weight was also taken at two weeks intervals to assess growth performance. At the time of weighing, dung was collected to determine the gut microbial community associated with each diet which will be a mixture of the natural one chosen by the individual cows daily and the supplement treatment Tracks of 3 cows in each treatment group were determined from the GPS tags and will be correlated with vegetation sampling and scan sampling of activity along the movement tracks.

Farm Project

While much of Laikipia is too dry for farming, lands along the Nanyuki River are plowed and draw water from the river to grow crops. Traditionally, the fields are flooded with thousands of liters of water weekly which dries the river and leads to conflict with cattle ranchers and herders downstream. It is also wasteful since 50% of the water is lost via evaporation. To better understand crop farming we have begun experiments on the effectiveness of alternative irrigation schemes, in particular flood vs drip irrigation. In this way, we hope to determine the degree to which better water stewardship affects farm productivity, incomes and human-human conflict.

While water limitation represents one challenge to crop farming, free-ranging wildlife represents another. To better understand what impact baboons and elephants, in particular, have on crop yields and quality, camera traps have been deployed on 3 different farms to examine how wildlife refuges and different farming practices together influence crop yield, loss to wildlife raiders and thus overall farm productivity. Via these comparisons we hope to identify economically effective ways to attenuate human-wildlife tensions.

From Left: **Rosemary Warungu the project manager Princeton Zebra project. Dr. Paula Kahumbu, CEO Wildlife Direct with the kids during the 2020 GGR.**



Sandy Oduor in the field and working in the lab.

Elephant Research

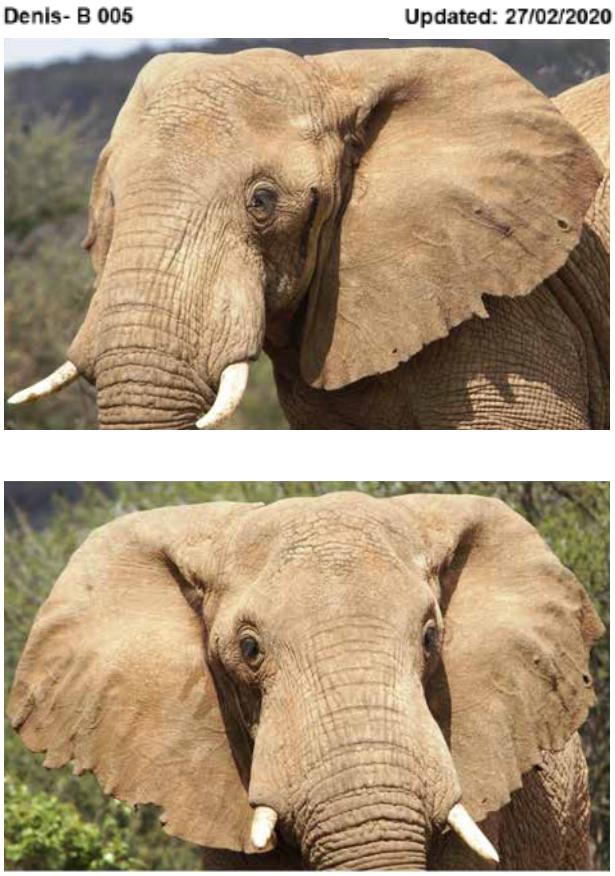
By **Sandy Oduor**

In the year 2019, Sandy was fortunate to be awarded an early career explorer grant by the National Geographic Society to undertake a study on the effects of human activities on the stress hormone levels of African elephants at Mpala Research Centre. In the same year, he was also awarded a Rufford Small grant to understand how land use system and the anthropogenic disturbance therein affects both their physiological and nutritional stress across space and time.

Together, these two studies will generate new data towards our understanding on how behavioral spatial structuring of elephants across private and communal ranches is motivated by a tradeoff between anthropogenic activities, access to vegetation quality and if physiological stress responses are adaptive or maladaptive.

The National Geographic Society project has been completed. A manuscript has also been submitted to PeerJ journal for publication. The manuscript seeks to understand, how elephant's ranging behavior (resident vs. non-resident), their reactivity to vehicle presence and vegetation quality affects their physiological state.

Progress has also been made on the study supported by the Rufford Small grant. As at March 2020, a total of 124 elephants were observed in Koija group ranch. From these, only 65 individuals have been captured in the catalogue recognition file, used for monitoring elephants in the community ranches. The elephants identified will be targeted for sample collection in the next phase of the project.



The Vulturine Guinea Fowl

By **Brendah Nyaguthii,** Project Manager

The vulturine guineafowl project is headed by Dr.Damien Farine, started in 2016 at Mpala Research Centre. The team has so far developed invaluable skills in the field.

Danai Papageorgiou, a PhD student published a paper on the vulturine guineafowl in November 2019 at *Current Biology* focusing on the multilevel society of a small-brained bird.

Brendah Nyaguthii, the Project manager oversees and participates in all activities carried out by the field team. The team has been carrying out daily observations from over 600 marked individuals from their 18 study groups, with each group containing 15-60 individuals. They have also been conducting interactions among the birds, a task led by Wismer Cherono including working to identify parasites in the Vulturine guinea fowls, a task led by our very able intern, Mary Waithira.

New PhD and postdoc students

Our team continues to grow. This year we have a new PhD and postdoc students in the projects too. Two new interns (Mary and Janet) and a field assistant (John Wanjala) have been a great addition to the project.

Covid-19 has had an impact on the project. Some of the PhD students were not able to travel for their field work within the required time. The field team in Kenya has continued with the projects work, i.e. data collection even during the pandemic.

The team plans to trap several groups of vulturine guinea fowls and deploy GPS tags on them as they continue with other daily project activities to add to their database.

The Vulturine Guinea Fowl team at Mpala (from left: Janet Wangare, Wismer Cherono, Brendah Nyaguthii, John Wanjala and Mary Waithera).

Fellowships

Dr. Geoffrey M. Wambugu

Dr. Wambugu joins Mpala for a 2-year postdoc fellowship by the Smithsonian Institution. The research focuses on land use and climate change impacts, on hydro-ecology of rivers in Arid Lands in the Upper Ewaso Ng'iro Basin, Kenya.

The research seeks to;

- Determine the influence of land use activities, in the upper sub watersheds of River Ewaso Ng'iro, on river metabolism
- Determine the influence of land use activities, in the upper sub watersheds of River Ewaso Ng'iro, on macro-invertebrate species richness, and biomarker response
- Determine the combined effects of land use and climate change on macro-invertebrate species composition and diversity on the upper sub watersheds of River Ewaso Ng'iro River.

Dr. Maureen Kamau

Dr. Maureen Kamau is a research fellow with the Smithsonian Global health program. Undertaking a veterinary research fellowship for one year.

Some of the most devastating global zoonotic diseases (e.g. Ebola, Yellow fever, Zika) have their origins in African vertebrates. They spread to new regions and/or countries through large scale animal, human or vector interactions, causing dramatic impacts on human health. An approach to informed, actionable intelligence on the distribution, prevalence and diversity of circulating vector borne pathogens, at the human-wildlife interface in the Laikipia region, with the anticipation of the discovery characterization and early detection of the next potentially global epizootic pathogens is required.

Dr. Kamau's overall objective during this fellowship is to;

- Leverage this opportunity towards a career goal of understanding landscape epidemiology of vector borne diseases, at the human wildlife livestock interface
- Organize an expansive vector borne disease sampling project in Laikipia
- Organize scientific grant administration across multiple funding entities

Ivy Wanjiku Ng'iru

Ivy is a masters student at the University of Nairobi. She currently studies insect-plant interactions and invasive species ecology. She is the project manager in the Insect-plant interactions lab, led by the Executive Director, Dr. Dino J. Martins.

She organizes the day-to day tasks of the lab, collects and analyses data as well as develops project protocols. Being at the Insect-plant interactions lab, she says, offered her the very first exposure into ecology as a career. She credits all her current skills on insect breeding, rearing and collection, basic genetic analysis, plant pressing among others, to the guidance and support of her PI's and the Mpala fraternity.

Ivy appreciates the fact that she has grown her managerial skills by being at Mpala. The diversity that Mpala bears has challenged Ivy to understand different cultures and find common grounds that enhance harmony. She has been featured on various platforms, where she has tackled topics such as Women in Science, and Locust invasion in Kenya.

Khasoha Leo Malingati

Leo is a PhD student in the Department of Zoology and Physiology at the University of Wyoming, USA under a 5-year NSF scholarship starting in 2020.

He is currently studying a diverse community of approximately 15 species of rodents and shrews in an African savannah at Mpala.

He makes use of long-term data from repeated sampling of small mammals on UHURU experiment, to field test theorized hypothetical explanations for abundance-occupancy relationships.

Leo is currently applying DNA metabarcoding technique, in identifying constitutes of the diet of these small mammals. From this, he aims to tell how resource selectivity, shapes abundance and occupancy of Mpala small mammals community. Additionally, he is testing the role of emigration in sustaining the populations of rare species that might be endangered.

Albanus Musyoka

Albanus Musyoka is a Masters student with the University of Nairobi. He has been awarded a 2 year Msc Fellowship that will support and facilitate his fieldwork activities in Laikipia and Samburu counties. The fellowship is a collaboration between Mpala and British Army Training Unit in Kenya (BATUK).

He will be joining a very strong Rangeland rehabilitation team lead by the project's principal investigator Dr. Kimuyu who will also be his advisor.

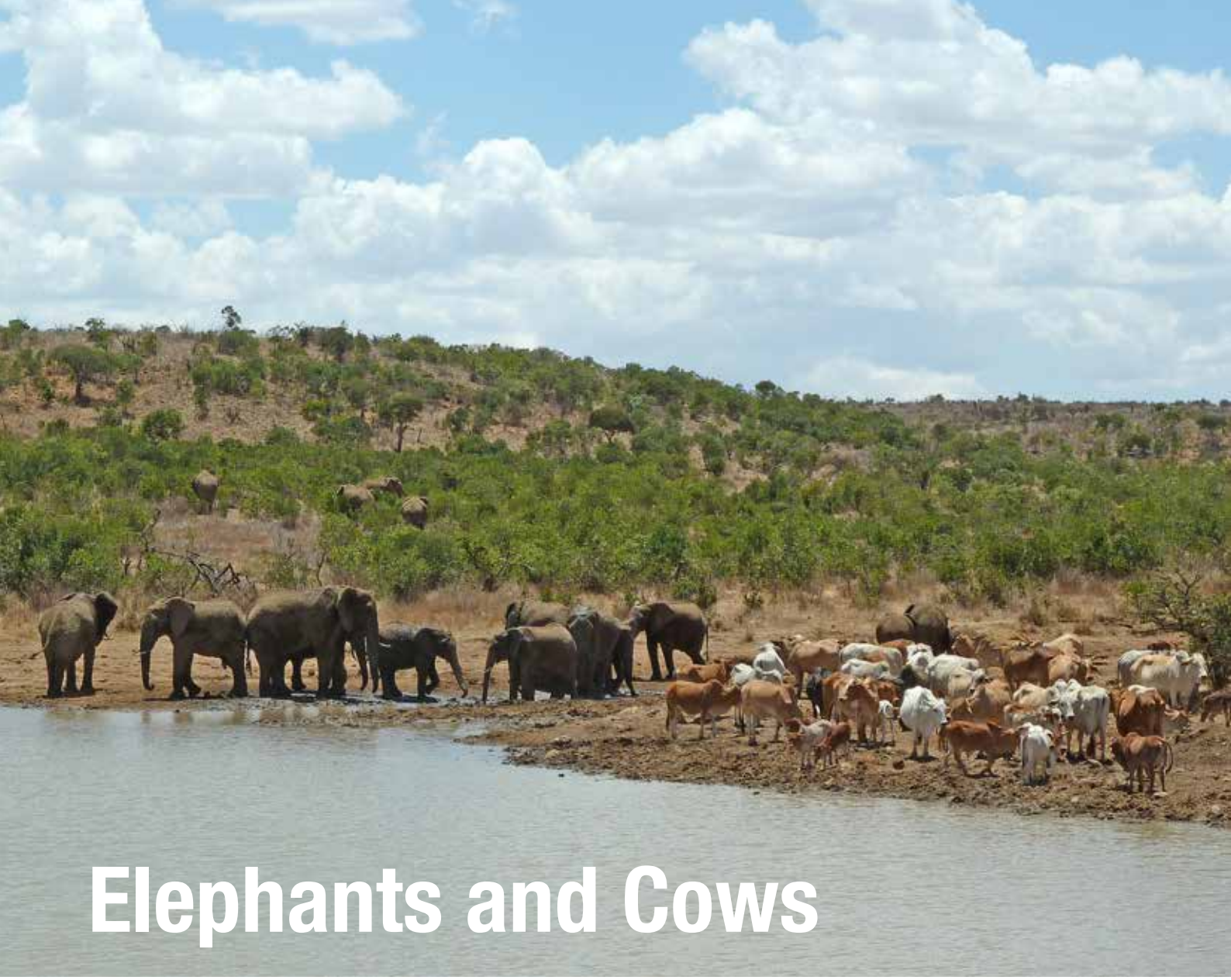
The research aims to achieve the following:

- To understand the nature of military disturbance and design ways to minimize the disturbance to allow for recovery and maintaining an intermediate level of disturbance.
- Through ecologically sound rangeland rehabilitation methods tested at Mpala, Promote the sustainable management of the ranges in Laikipia and Samburu.
- Communicate the outcomes of the research to all stakeholders and the Ranch Owners for long term monitoring and to support assessments of their land.
- To produce a Range Management Tool Kit, a set of recommendations from the study for BATUK, Mpala and Ranch Owners detailing a range of techniques that could be used to restore the impacts of military training

Dr. Duncan Kimuyu

Dr. Duncan Kimuyu is a lecturer at Karatina University. He received a 2-year extension to his Smithsonian Mpala Postdoctoral Fellowship to study mammalian herbivores' abundance and browsing within the Mpala CTFS-ForestGEO plot.

Dr Kimuyu has been studying interactions between fire and herbivory, by both domestic and wild ungulates, in the Kenya Long-term Exclosure Experiment (KLEE Project) at Mpala Research Centre. His research has opened up new ways of thinking about livestock, wildlife, and fire management in savannas.



Elephants and Cows

Water is one of the critical shared resources for wildlife and livestock in Laikipia.

On wildlife and landscape, a paper based on a study of over 20 years of experimental work by Kenya Long-term Exclosure Experiment (KLEE) was published in Nature Sustainability was part of a commentary feature in Science magazine. This included the measuring of several indicators of savannah productivity.

The study involves the following outstanding scientists, Professor Truman Young (University of California), Dr. Dancun Kimuyu (Karatina University) and Dr. Judith Sitters (Vrije Universiteit Brussel). It shows that it may be possible for humans and their livestock to co-exist and sustain productivity outside protected areas.

The elephants are able to reverse the negative effects of the livestock, that is the decreased total soil carbon and nitrogen pools. The results suggest that a mix of cattle at moderate densities and wild herbivores can be sustainable, provided that the assemblage of wild herbivores includes the largest species.

Using different types of fences, the experiment created areas that included six treatments: no large herbivores; only moderate densities of cattle; cattle mixed with smaller (<1,000 kg) wildlife; cattle mixed with all wildlife including megaherbivores; only smaller wild herbivores; and only wildlife of all sizes. They found that over the years, as expected, cattle alone or with smaller wild herbivores reduced potential soil fertility by transferring carbon and nitrogen from the plants they consumed across the landscape during the day to dung deposited in their corrals at night. This reduced the carbon and nitrogen found in the soil and was associated with plant forage of poorer nutritional quality.

Surprisingly, when megaherbivores, mainly elephants, cohabited with cattle these negative effects were reversed, with soil carbon and nitrogen restored to levels found when cattle were absent. This result suggests that if humans, their livestock, and large herds of wildlife are to coexist, the megaherbivores must join the mix.

This study advance the knowledge base for finding future working solutions to conserving the iconic large animals of Africa, and demonstrated the inter-connectedness of wildlife and livestock in Laikipia.

Wildlife Trends in Laikipia

Dr. Ramiro Crego, a post-doctoral fellow at the Smithsonian's National Zoo and Conservation Biology Institute, working in collaboration with scientists at Kenya's Directorate of Resource Surveys and Remote Sensing (DRSRS) among other institutions, published a paper in *Biological Conservation* earlier this year. The study looks at connectivity in the landscape on species richness and trends across Laikipia in recent times. This is based on over 20 years of herbivore population data from the aerial surveys . The results of this study have actionable implications for translating science into public and private land management to conserve wildlife and ecosystems in Laikipia and beyond

The detection data was analyzed on 15 species of wild herbivores found in Laikipia rangelands, including African buffalo, Grevy's zebra, plains zebra, hartebeest, Defassa waterbuck, Grant's gazelle, Thomson's gazelle, common warthog, ostrich, reticulated giraffe, gerenuk, Savannah elephant, eland, impala and Beisa oryx. The study area included "wildlife only" properties dedicated to conservation, "ranching and wildlife" private lands with dedicated conservation areas for tourism and livestock managed at moderate stocking levels, commercial ranching areas that generally do not tolerate wildlife and private and communal pastoralist lands where livestock is the primary economic driver.

Findings showed that the number of wild herbivore species decreased drastically as livestock numbers increased. At higher stocking rates, livestock outcompetes wildlife for space, forage and water. However, ecosystem benefits, such as maintaining pasture quality and vegetation diversity, have been shown to increase when livestock are kept at moderate densities.

The wildlife-friendly private properties are crucial for conservation in Laikipia, as they provide the necessary space for wild species to thrive. Landscape connectivity is the key, allowing wildlife to move between different areas in different years and environmental conditions. The movement of wildlife across multiple land-use systems is what sustains the rich diversity of wildlife in Laikipia.

With demonstrated conservation success on private lands where wildlife, people and livestock co-exist, Laikipia County is uniquely positioned to lead the way in how private and communal land can play a critical role in wildlife conservation across global rangelands.

Above: **Grevy's Zebra and Impala are two of the species included in the analysis of the wildlife trends and species richness.**

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Spatiotemporal dynamics of wild herbivore species richness and occupancy across a savannah rangeland: Implications for conservation

Ramiro D. Crego [a], Joseph O. Ogutu [b], Harry B.M. Wells [c, d], Gordon O. Ojwang [e, f], Dino J. Martins [g, h], Peter Leimgruber [a], Jared A. Stabach [a]

Turkana Genome Project

By **Benjamin Mbau & Charles Waigwa**

The Turkana Health and Genomics Project (THGP) started in April of 2018. It is a collaborative and interdisciplinary study of the Turkana people. The Turkana inhabit an extremely arid environment in northern Kenya where they practice nomadic pastoralism; this means that they herd livestock and rely on these animals for subsistence. As a result, their diet is extremely high in protein and they are physically active.

However, as infrastructure has improved in northwest Kenya in the last few decades, many of the Turkana people have stopped practicing nomadic pastoralism and have moved to urban areas in central Kenya. Our project's main goals seek to understand;

(i) How the genomes of the Turkana people have adapted through evolutionary time to a high-protein diet and an extreme desert lifestyle.
(ii) What happens, when people of this genetic background move to cities and live a dramatically different, "Western" lifestyle?

Because the Turkana people are currently transitioning from their ancestral way of life to an urban, industrialized lifestyle, they provide a unique opportunity to test a key idea in evolutionary medicine known as the "evolutionary mismatch" hypothesis. This hypothesis posits that traits that evolved in one type of environment may no longer be advantageous if the environment radically shifts.

Most famously, this idea has been proposed to explanation the high rates of cardio-metabolic disease in Western, industrialized countries; however, it is very difficult to test in practice. Using biomedical data collected from traditional, pastoralist Turkana as well as Turkana living in cities, we have shown that Turkana individuals who experience strong "evolutionary mismatch" and live highly urban, modern lifestyles exhibit the worst cardio-metabolic health – namely high BMI, blood pressure, cholesterol, and body fat levels – relative to traditional, pastoralist Turkana. This work provides evolutionary insight into the origins of cardio-metabolic disease

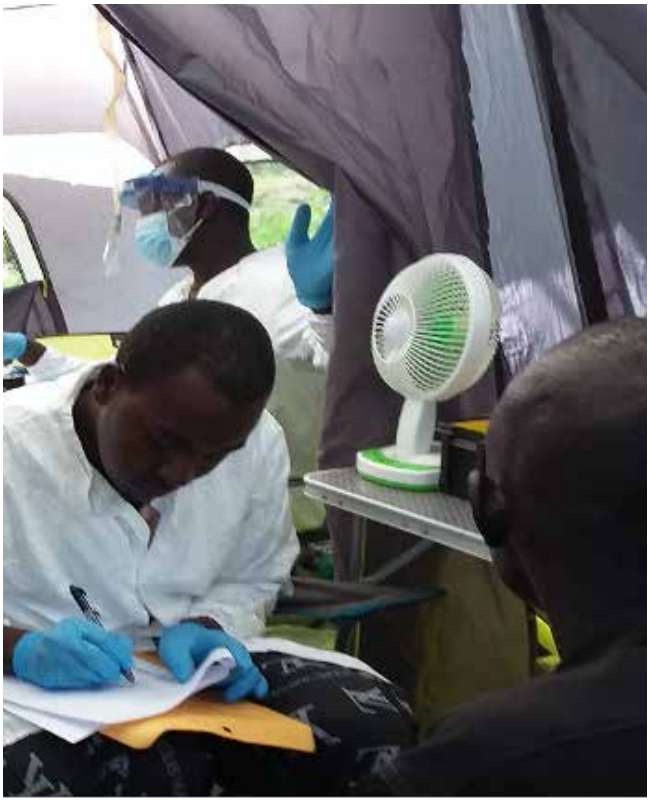
and can help guide health policies not only in northern Kenya but around the world. A paper detailing these discoveries in currently in press at *Science Advances*. A second paper detailing the Turkana's evolutionary history and genes under natural selection (using a whole genome sequence dataset) is in preparation. There are many discoveries ahead of us, to follow the progress of the THGP, please visit our website at http://turkanahgp.com/.

While we have had our fair share of accomplishments this year, it hasn't been without challenges.

The recent COVID-19 pandemic has been another major challenge to our science and has resulted in a standstill in fieldwork. Hopefully, things will settle down soon and we will be able to return to the field in a manner that is safe for the Turkana people as well as ourselves.

Currently, our focus has been to expand our sample sizes and to continue building partnerships with Turkana communities. The biggest challenges has been the logistics of sampling in remote locations in northern Kenya. Some of these locations are very difficult to access by vehicle, hence it takes considerable effort to get a team of scientists to the study regions.

Moving forward, it is clear that there is much to learn from the Turkana people. This is both in human evolutionary history and the contribution of lifestyle changes to modern diseases. We look forward to making more discoveries that will enhance our understanding of evolution and also guide future health policies.



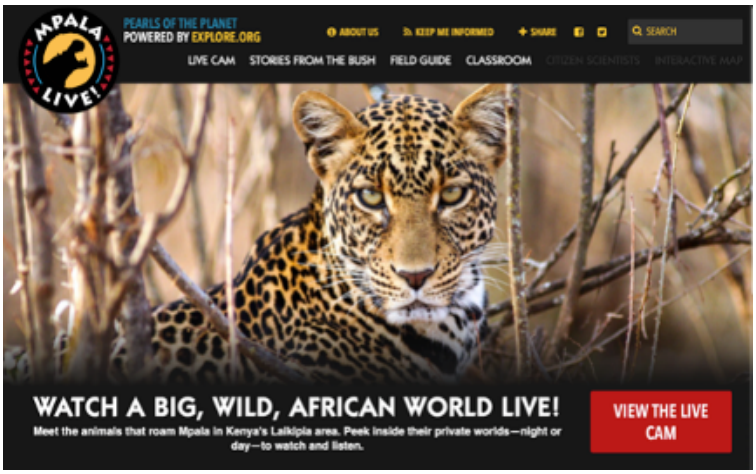
Above: **Collecting data for the Turkana Genome Project**
Below: **Members of the Turkana community at Lokiriama, Lodwar in Turkana County.**

MpalaLive!

MpalaLive! aims to excite and educate viewers around the world about animals, culture and the ongoing scientific research conducted at Mpala Research Centre.

MpalaLive! Is a part of Pearls of the Planet, a project of explore.org that aims to inspire global learning and preservation of species through the creation of an online virtual classroom. Live camera feeds from around the world are selected to document fragile species and wonders of nature.

The live video is supplemented with educational information, including related films from the library and fun facts about the animals and creatures.



53 million Views

Traffic to Mpala's live cams on Explore.org (which broadcast simultaneously on MpalaLive.org) remains robust. The daily visitors ranging from 750 per day to 1,000 per day, with lifetime views of the live cams on all platforms (YouTube, Facebook Live, Explore.org) exceeding 53 million with more than 1.6 million hours of viewing on You Tube alone.

The upgrade made in 2019 provides a 24-hour (night vision) viewing of the wildlife that frequent the hippo pool. The high-definition resolution and night viewing on the cams is outstanding and has given us a peak into the nocturnal habits of our wildlife.

88 species

The interactive field Guide features 88 species (possibly the most complete resource for East African animals available online).

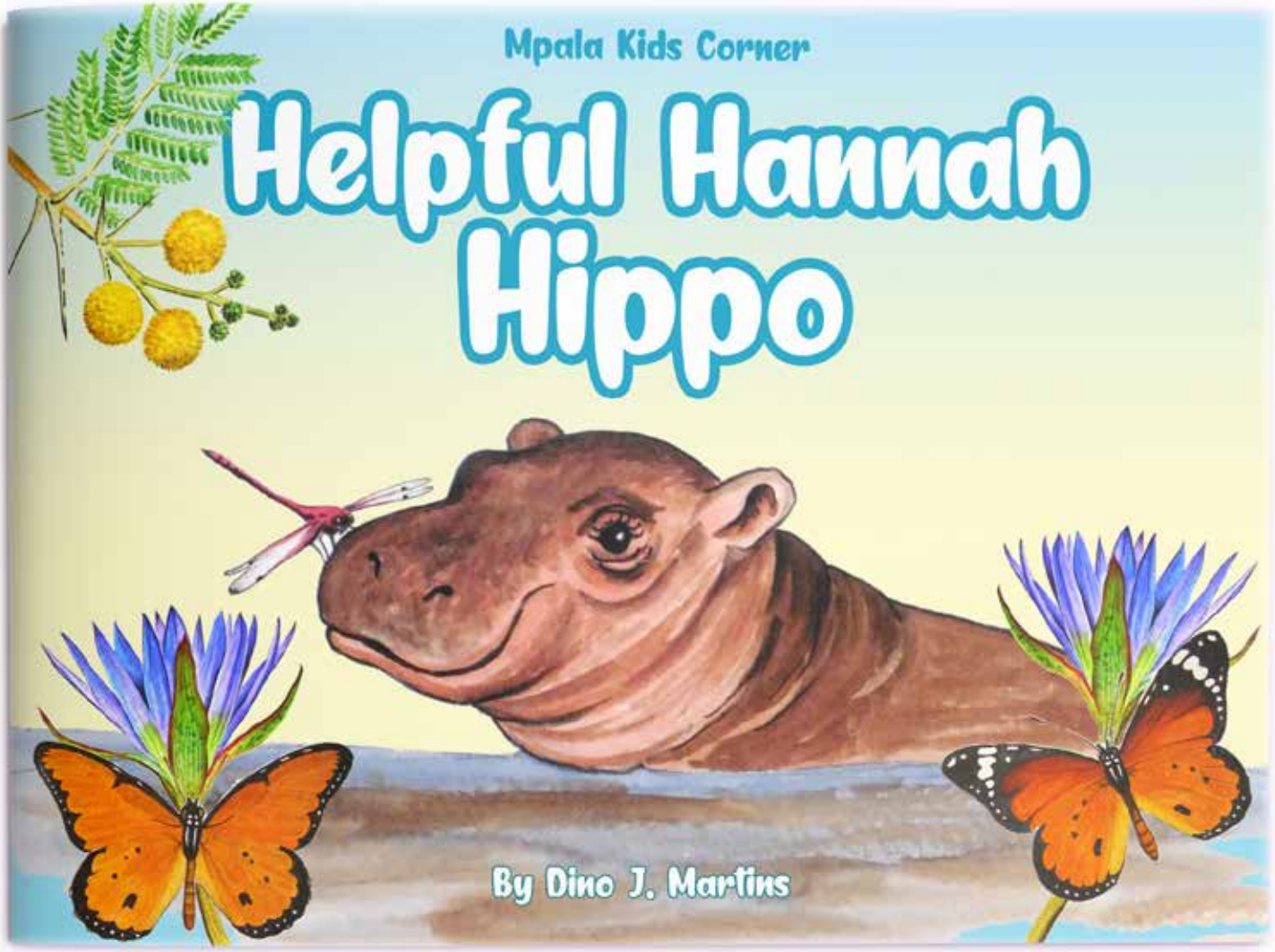
OFFICIAL HONOREE THE WEBBY AWARDS

MpalaLive! Showcases 25 live chats and short videos describing the research and wildlife of Mpala (includes Lions, People, and Prey a Webby honoree).

25 live chats

65% visitors

65% of the visitors check out the Classroom section featuring downloadable lesson plans and classroom activities geared to US and Kenyan students from grades 1 through 12.



Kids Corner

In honor of World Environment Day, we hosted a special reading and chat with our own Executive Director Dr. Dino J. Martins on 5th June 2020.

Dr. Martins Shared his children's book on entomology he engaged kids of all ages on what it means to explore the world around us.

The second kid's corner event was held on 25th June 2020 on 'Helpful Hannah hippo' which was hosted by our Executive Director, Dr. Dino J. Martins and Dr. Paula Kahumbu CEO of Wildlife Direct.

The story was about a hippo named Hannah who sets out to help a friend who is lost, and on the way learns about the world around her. She meets lots of different creatures while on a journey at the hippo pools. Dr. Martins also launched his book on 'Helpful Hannah Hippo'.This is available on our Mpala website on www.mpala.org and kids are encouraged to complete coloring the sketched images on the book.

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P.O. Box 555 - 10400, Nanyuki, Kenya
Tel: +254 2025 97401
info@mpala.org
www.mpala.org

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