EDUCATION | OUTREACH | RESEARCH | FACILITIES

MPALA MEMOS

NEWS FROM MPALA
MAY 2016

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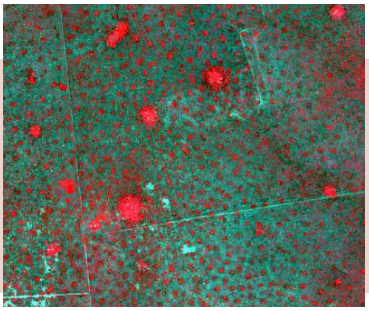
The Problem of the Polka Dot Pattern



Learn more about the regular distribution of termites on Mpala landscape and how dispersal mechanisms may explain these patterns.

see more on research from page 2

Danielle Martin

Citizen Science: Science Not Just for Scientists

Read about Mpala's participation in the Great Grevys Rally and the Kid's Twiga Tally

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Laikipia Rabies Vaccination Campaign

Read about the campaign from this past August and the plans for this years's campaign and the years to come.

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DRSRS Aerial Survey

Mpala worked with Laikipia Wildlife Forum to sponsor an aerial survey of both wildlife and landscape in Laikipia.

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Mpala Termites: The Problem of the Polka Dot Pattern

Chris Baker

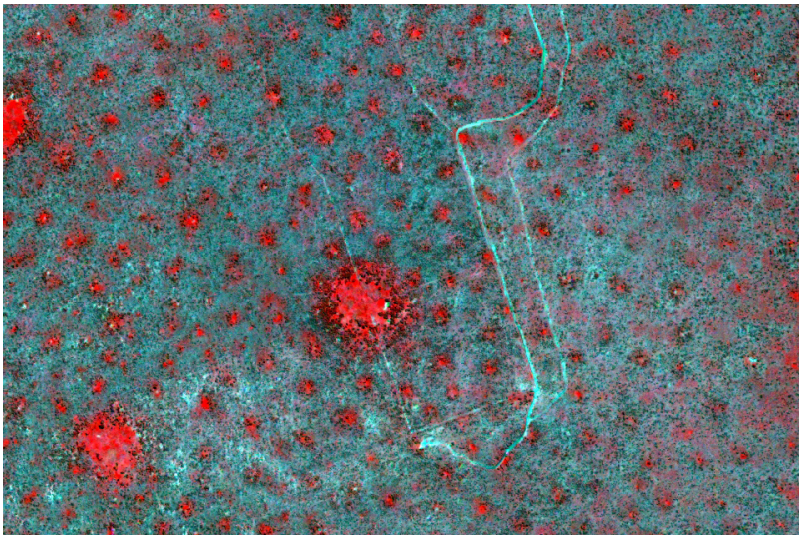

Figure 1. False colour infrared satellite imagery shows the highly regular spacing of Odontotermes termite mounds, visible as small red dots; the large red patches are abandoned cattle bomas.

Wherever you go on Mpala's black cotton soils, you're never very far from a termite mound. In fact, on average, an Odontotermes termite mound will be just 30 metres away. The highly regular spacing of these mounds throughout the black cotton is hard to see from the ground – they are mostly subterranean and Odontotermes doesn't build tall chimneys like some termites do. But from the air the polka dot pattern of mounds across the landscape is clear (Fig 1).

The regular spacing of the termite mounds means the whole savannah can benefit from the activities of the termites: termite effects are strongest close to termite mounds, but nowhere is very far from a mound. Odontotermes mounds retain water better than the surrounding soil, providing critical reservoirs of moisture in the dry season. At the same time, the termites raise soil nutrient levels at the mound, by bringing back plant material from the surrounding area and feeding it to the Termitomyces fungus they farm in their underground chambers (Fig 2). The fungus breaks down the plant material, providing food for the termites, and playing a key part in the savannah nutrient cycle.

But how does the regular spacing of the mounds arise in the first place?

Jessica Castillo Vardaro and I recently joined forces with Rob Pringle and Corina Tarnita at Princeton University to tackle this question. We suspected that mound spacing was likely to depend in part on the distance that termites disperse when mating and establishing new colonies in the wet season. While dispersal distance was unknown, we knew we could infer this and other important information by examining genetic variation within the

Figure 2. An Odontotermes fungal comb, showing white nodules of Termitomyces fungus that serve as food for the termites.

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population.

We visited Mpala in October 2015 to collect samples, along with collaborator Dan Doak from the University of Colorado, Boulder. Our goal was to collect Odontotermes termites over a range of sampling distances – from one end of Mpala's black cotton plateau to the other, right down to neighbouring mounds. This sampling would reveal how genetic variation relates to distance, whether the termites turn out to disperse 10 kilometres or just 10 metres.

Figure 3. The team from Mpala dig into an Odontotermes mound: (L to R) Robert, Mohamed, Junior, Julius, John and Patrick. Inset: Jessica Castillo Vardaro holds up a piece of fungal comb from an Odontotermes mound.

Collecting termites from each mound involved digging down through the hard packed clay to reach the fungal chambers. It was hot, dusty work that was only possible on such a large scale with the help of Mpala's research and field assistants (Fig 3). After finding a fungal chamber, we would collect a couple of dozen termites before moving onto the next mound in our sampling scheme. Back in the lab facilities at the Mpala Research Centre, each sample of termites was carefully sorted, stored in ethanol and kept in the freezer to preserve the termite DNA until we could return to the United States.

Now back at Princeton University with hundreds of samples, we are working to sequence the termites' DNA to obtain the information we need about termite dispersal. But these termite samples are just the beginning. We also have samples of the Termitomyces fungus from Mpala and want to understand how that fits into the termite story: how do termites get the fungus they need when they disperse to establish a new mound? We are eager to return for another fun and productive visit to Mpala, armed with new results and ideas, to further expand our understanding of this fascinating system.

Mount Kenya Roosevelt Resurvey: Insights from the Field

Molly McDonough

Hiking boots frozen and stuck to the ground and tents covered in frost were how scientists woke up most mornings at what was dubbed 'Upper Crusty Camp' during the more than 100-year anniversary of Smithsonian-Roosevelt African Expedition. Historically, biologists Alden Loring and Edmund Heller spent only three nights surveying fauna at this high elevation site—approximately 4,100 meters above sea level. This time around, a collaborative team of Kenyan and United States scientists would spend three weeks at this site and close to five weeks at two lower camps during the months of September and October. Goals were set on documenting how distributions of small mammals previously recorded by Theodore Roosevelt's team have shifted in response to a century of climate change. Smithsonian scientist Darrin Lunde recalls burning through three pairs of hiking boots while scrambling Mt. Kenya's volcanic rock on the daily trek along his rodent trapline, passing giant lobelias and rock hyraxes along the way. Lunde and the upper camp team would be rewarded with new elevational records for several species of small mammals.

At the middle camp, myself and several other biologists were tasked with documenting small mammals—some of which have not been recorded since the original survey (1909)—across several diverse habitats, including bamboo forests, meadows, and heath forests spanning elevations 2,700-3,600 meters. We were given the name 'Pirate Camp' early on in the expedition, due to a bottleneck in supplies failing to reach Upper Crusty Camp. Here, we were armed with Bernard Risky Agwanda, Curator of Mammals at the National Museums of Kenya, who has conducted bioinventories such as this in East Africa for the past several decades. Each camp used a variety of different trapping methods, including pitfall arrays—or a series of 5-gallon plastic buckets placed in the ground about ten meters apart and connected by drift fences that help to guide terrestrial mammals, insects, and reptiles into the buckets. Using this technique, we caught an incredible diversity of shrews at Pirate Camp.

Camps Unite! Midway through the expedition some of the team members join up for a trip to Point Lenana (4,985 meters). Enjoying breakfast near a tarn, left to right: Esther Langan, Kaylyn Patitucci, Georgia Titcomb, Matthew Snyder, Douglas Branch, Sara Weinstein, and Roland Kays.

The lower camp (2,400-2,700 meters), which was dubbed 'Camp Cupcake' because, according to Smithsonian scientist, Esther Langan, "we didn't have hail and freezing temperatures, we didn't have seven hour daily walks up steep parts of the mountain to check traps and, most importantly, we had a steady supply of toilet paper". However, each camp had it's own set of challenges and for those at Camp Cupcake, it may have

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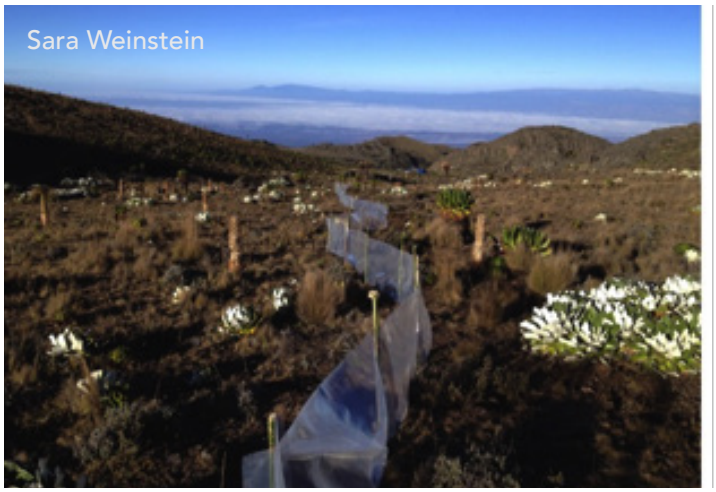
been the large numbers of individuals that they had to process each day. A single animal must be photographed, measured, examined for external and internal parasites, and finally prepared as a museum voucher specimen, including harvesting tissue samples in liquid nitrogen for future genomic studies. This series will allow us to make direct comparisons to the historical collections from Mt. Kenya housed at the Smithsonian, which have been well preserved for more than 100 years.



Pitfall array at upper camp. Sheets of plastic attached to bamboo were used to guide rodents and shrews into bucket traps sunken in the ground.

While Theodore Roosevelt was busy collecting mammals in East Africa, a like-minded naturalist from California, Joseph Grinnell (Museum of Vertebrate Zoology, Berkeley from 1908-1939), had the foresight to collect large series of small mammals across comparative transects for scientists to utilize more than a century later. In fact, Joseph Grinnell wrote about the MVZ collection in 1909 that "[the greatest value of the museum] will not, however, be realized until the lapse of many years, possibly a century, assuming that our material is safely preserved." Modern scientists are now equipped with the ability to examine genetic changes, stable isotopes, morphological changes, and parasite communities, among others. With this type of data, scientists that have resurveyed Grinnell's historical California transects have discovered that increases in temperature over just one century can result in significant reductions in distributions for certain taxa that are sensitive to climate change. We are hopeful that the data resulting from the 2015 Mount Kenya expedition will be useful for comparison to 1909 Smithsonian-Roosevelt African Expedition and for the scientists of the future.

Weaving in and out of all of the camps was a team led by Roland Kays of North Carolina State University that set more than 70 camera traps spanning lower to upper camps to document carnivore activity along the mountain

Principle Investigators Hillary Young (University of California Santa Barbara), Kristofer Helgen (Smithsonian Institution), Roland Kays (North Carolina State University), and Bernard Risky Agwanda, are now in the process of compiling the vast amount of data collected on this expedition and look forward to updating you with our results in future Mpala Memos!

A Study on the Aquatic Community in Laikipia County

Ray Schmidt

Oreochromis spilurus

Is the aquatic community being affected by land use changes and population growth within Laikipia County? A research project by Smithsonian Mpala Postdoctoral Fellow, Ray C. Schmidt, is looking into these questions throughout the Ewaso Ng'iro basin. The Ewaso Ng'iro and Ewaso Narok rivers are a lifeline for the people and animals of Laikipia County. Current land use practices and water abstraction in the upstream reaches of these rivers have dramatically affected the amount and quality of water that is available for Mpala and further downstream. These changes also negatively affected the aquatic community throughout the basin. As the aquatic community serves as an indicator for the overall health of the environment, it is important to understand what is occurring within the community and how this affects the people and wildlife that rely on these aquatic systems for survival.

There are currently 24 species of fishes recorded from the Ewaso Ng'iro basin. Eight species are known to occur upstream from Crocodile Jaws, including the rivers within Mpala. The fish community within the basin is quite unique. Most of the species are endemic to the basin (meaning that they occur nowhere else in the world). Troubling signs were noted in the late 2000's when the species richness in the rivers at Mpala crashed and only one or two species, where once there were seven to eight species. This species decline coincided with an increased amount of unauthorized water abstractions and agricultural activity in the upstream areas. Since that time, an increase in richness has occurred within Mpala following the formation of community groups tasked with managing the water resources of the area.

Garra hindii, the most common fish on upstream sites

This project is collecting fish, macroinvertebrates, and water quality data throughout the Ewaso Ng'iro basin. Though the situation has improved within Mpala, many upstream sites only contain one species of fish (Garra hindii) or none at all. Extirpations are likely a natural phenomenon within the basin, but increased abstactions and climate change are exacerbating this issue. Is ecosystem functioning affected by these community changes? This project will also allow us to better understand the life history of these

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fishes. What do these species eat, when do they breed? Little is known about these fishes within Kenya and East Africa more broadly. This project is also helping to resolve many of the taxonomic issues within the basin. Though many of these fishes are unique, most are currently lumped in with other wide ranging East African species. Ray and his colleagues at the National Museum of Kenya recently described a new species of suckermouth catfish that is only found in the Ewaso Ng'iro below Chandlers Falls. Sampling these communities monthly over the next year will allow us to better understand these communities and mitigate the effects of future development within the basin.

A. grandis.

Mpala At A Glance

Mpala Rallies for the Endangered Grevy's Zebra

Mpala was thrilled to participate in the Great Grevy's Rally (GGR) in January. This rally was a wonderful feat of citizen science. It brought people together to more accurately estimate the population of the endangered Grevy's Zebra. During the GGR, scientists, land owners, conservancy managers and members of the public traveled to Laikipia, Samburu and Isiolo in northern Kenya in groups to take as many photographs of Grevy's zebras as they can. Then using a software called 'Hotspotter' embedded in an Image Based Ecological Information System (IBEIS) unique zebras were differentiated based on their stripes. These identifications will not only be used to estimate the population of Grevy's zebra but also determine sex ratios and age structure of the population, giving insight into the future of the species.

Mpala was honoured to host the US ambassador to Kenya H.E. Bob Godec, pictured on the right, as he participated in the GGR. Overall the event was a huge success with over 200 participants. It has been featured in The Star, Daily Nation (see below), Agency France-Presse, CNN, Citizen TV and NTV. Mpala looks foward to being a part of more events like these.

DAILY NATION | Monday February 1, 2016

US envoy clicks away

US Ambassador to Kenya Robert Godec (centre) WildlifeDirect chief executive Paula Kahumbu (right) and Prof Daniel Rubenstein of Princeton University take pictures of Grevy zebras at the Mpala Research Centre in Laikipia during a count of the endangered animals on Saturday.

JOSEPH KANYI | NATION

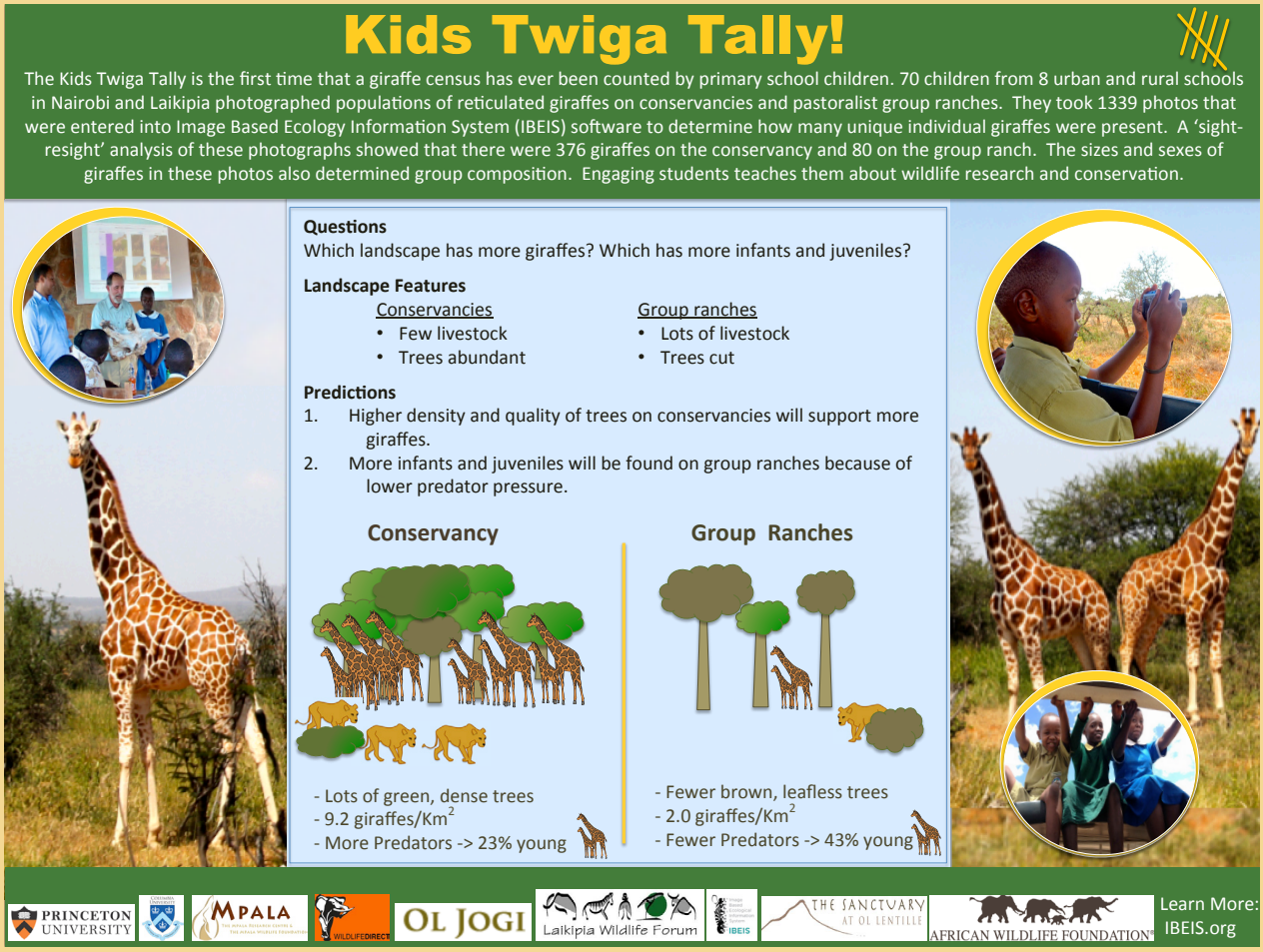
Kid's Twiga Tally

Student try to differentiate giraffes using photos in order to understand how the IBEIS software works.

This event was done as a citizen science data collection activity within Professor Dan Rubenstein Princeton field course on African mammals. The students were broken up into small groups led by the Columbia/Princeton undergrads. The kids were tasked with taking photos of giraffes and using the same IBEIS software from the GGR, unique giraffes were identified. Very useful data was collected on the distribution of giraffes on conservancies vs. group ranches (see results on page 10). There is a larger population of giraffes on conservancies but they have a lower proportion of juveniles because there are more predators.

As a follow up to the Grevy's Zebra Rally, Mpala hosted another citizen science event for kids centered around reticulated giraffes. Seven schools participated. There were three Conservation Club Schools including Kimanjo Primary, Ng'abolo Primary and Mpala Academy. In addition there were four other schools from Nairobi - Brookhouse School, Kibera Girl's School - and Nanyuki - St. Christopher's and Ndururi Primary School. Some of the students even had the opportunity to stay at Mpala for the whole weekend.

Prof. Dan Rubestein shows the students a giraffe skull.



The above poster, displaying the results, was distributed to the participating schools and institutions.

Laikipia Rabies Vaccination Campaign

In August 2015, Mpala participated in the Laikipia Rabies Vaccination Campaign. This campaign was initiated by Dedan Ngatia and Dr. Adam Ferguson as they were working on Dedan's project on domestic dogs. The campaign aimed to vaccinate domestic dogs for rabies in the communities that surround Mpala. LRVC was so well received that another weekend of vaccinations was added in September due to the demand from the community. Over 800 dogs and cats were vaccinated during the campaign in the neighbouring communities that included Koija, Il Motiok, Naibor, Jua Kali, Lekiji and many others.

This campaign does not end just at vaccinating dogs and cats but will be followed by an education campaign in the Conservation Club. Despite the highly preventable nature of the disease in humans, many Kenyans continue to contract rabies often because of a lack of understanding of the disease and how it should be treated. The Conservation Clubs will be serve as conduit to share vital information about rabies with the community and start creating the momentum for next year's campaign, during which is expected to reach more communities over a longer period of time.

Mpala plans to continue this campaign annually with the 2016 campaign taking place in August and September. During this year's campaign we plan to vaccinate 2000 dogs and cats and continue to expand the reach of the campaign.

Annual Visit of the First Year Daraja Students

Recently, Form 1 students from Daraja Academy for girls visited Mpala and had a chance to see the wildlife and interesting research here. Before lunch, they enjoyed a morning game drive and a talk in the field about vegetation from Kimani Ndung'u. After, they learned about the ant-acacia mutualism on the whistling thorn acacia from Executive Director, Dr Dino J. Martins before sitting down to a delicious lunch. After lunch, they broke up into smaller groups and accompanied different researchers to the field.

All About Ticks!

Mpala and University of Illinois held Tick Day at the research centre on December 5, 2015. The event strove to share cutting edge research on ticks with members of the surrounding communities. Ticks are constant presence in most of the landscape in Laikipia. They not only affect humans but also the livestock. Therefore it is hugely important that increasing information about them be shared not only within the research community but also the local communities.

Tick Day succeeded greatly in doing just that. There was a big turnout from local ranch owners and members of the community ranches. The event was even featured in the local press. A large part of the day was devoted to the University of Illinois' Laikipia Tick Project run by members of Dr. Brian Allen's lab. Dr. Allan presented on the basic biology of ticks and the diseases they transmit, especially in Laikipia. Dr. Sharon Okanga discussed the distribution of ticks and how this is affected by the presence of cattle and more specifically dipped cattle. Dr. Steven Huckett shared his findings on ticks and their economic impact.

Finally we also had some presentations from Mpala researchers. PhD candidate Georgia Titcomb presented her findings on the tick populations found near watering holes. Dr. Adam Ferguson head of the Small Carnivores Research and Parasite Study (SCRAPS) described the tick population found on the small carnivores he is trapping. Karatina Masters student Dedan Ngatia shared some results from his Domestic Dog Project and the highly successful Laikipia Rabies Vaccination Campaign. Overall the event was a huge success and Mpala hopes to continue our efforts to share the research being done at Mpala and to use these findings to help the community in any way we can.

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DRSRS Aerial Survey

This past April Mpala together with the Laikipia Wildlife Forum helped support a Department of Resource Surveys and Remote Sensing (DRSRS) aerial survey of Laikipia. Mpala served as the main base of operations for the the survey, with the DRSRS spending about a week at Mpala and two planes lifting off from the airstrip every day for the duration of the survey. Two surveys, one looking at the animal population and the other just taking photos to document landscape and landuse in Laikipia.

March 2016 Issue No. 6 CONSERVATION IN ACTION 7

LWF and MRC to Sponsor Aerial Sample Survey of Wildlife

For years, the Mpala Research Centre (MRC) and LWF have worked together on conservation and rangeland issues in Laikipia. But over time, the connection between the two organizations has become weakened as the relationship became less defined.

That's now changing. Through each organization's new directors, the future looks better for applied research, citizen science and public information about research projects important to Laikipia.

Director of the MRC, Dr. Dino Martins, and Peter Herz, LWF Executive Director, recently met to discuss how to strengthen their collaboration. MRC hosts a number of recent and long-term research projects that are not well known to LWF membership. Yet the results of some of the research work can help management decision-making in Laikipia.

Recent cooperation has focused on "TICK" Day - the presentation to farmers and communities of the results of tick research being done in Laikipia. The costs related to tick control and tick diseases have a big

There will be more accessible information on the results of the tick study as results emerge.

More recently, the collaboration extended to the Great Grevy's Rally, where scientists at MRC made internet and software available to help with the great rally to identify and count the endangered Grevy's Zebras in Kenya. MRC and LWF were partners on this big event.

LWF and MRC will soon jointly sponsor an aerial sample survey of wildlife, livestock, land types and settlements in Laikipia, Laroji, and Lewa. Working with NRT, we will extend the survey work into NRT conservancies in Isiolo, Marsabit and Samburu Counties. The aerial count will be conducted with the GOK, and takes place in early April 2016. The results of the survey will be shared with the public in efforts to help with wildlife conservation, and

"As we move forward, watch for more collaboration between us on social, economic and ecological research that affects our members in Laikipia"

livestock/rangelands management. The last survey was conducted in 2012.

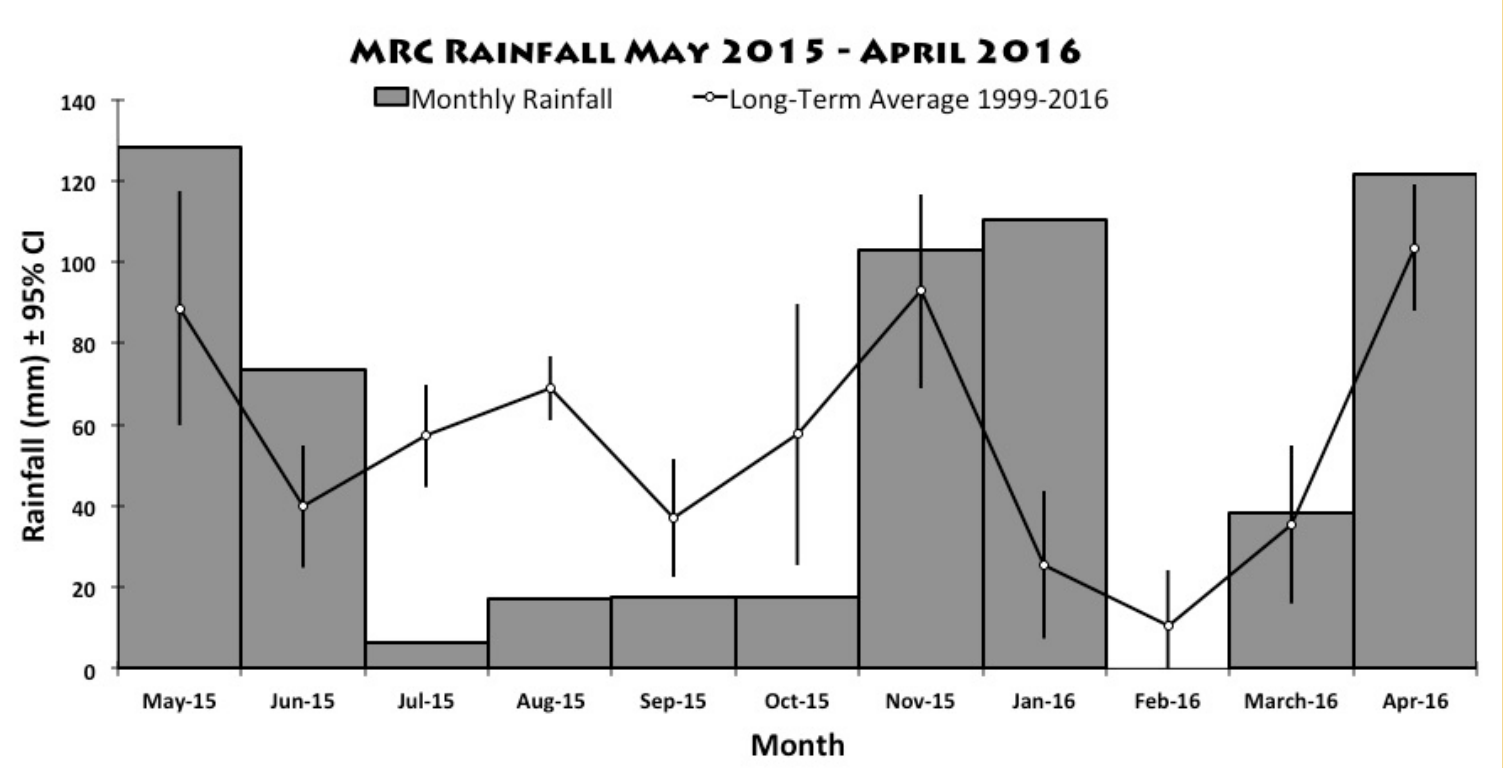
"I see the future of Mpala Research Centre to be the focus of all types of research that are needed in Laikipia," says Dr. Martins. "We take this role very seriously, as it's called for in the Kenya Constitution. We are an important source of information for the public and the County. We must support all forms of information that contribute to improvements in our social, economic, and natural systems. We see the role of LWF in helping us to identify these research topics, and to help in popularizing the progress of these projects and their results."

"As we move forward, watch for more collaboration between us on social, economic and ecological research that affects our members in Laikipia!" says Peter Herz. LWF and MRC will soon host a series of meetings to discuss these research priorities - with ranches in March, with community groups in April, and with Government officials in May. Stay tuned for more information on locations and dates.

Mpala held a meeting before the start of the survey with county government officials, Laikipia Wildlife Forum, Kenya Wildlife Service and DRSRS to discuss how this information can be used to benefit Laikipia and how it will be shared. This is a part of ongoing efforts ensure that data collected in Laikipia about Laikipia is shared with the necessary stakeholders. It is also a part of a continued effort to ensure that there is research that looks at the primary issues that affect Laikipia.

The Trumpeteers perform on the Mpala lawn. A huge thank you goes to Bruce Ludwig for bringing them over and also that to the trumpeters for a wonderful performance.

Mpala Weather Corner



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