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LIONS AND GREVY'S ZEBRA: WHEN ONE ENDANGERED SPECIES EATS ANOTHER



Laurence Frank, Margaret Kinnaird, Tim O'Brien



Stefanie Siller

Chessie, the second lioness collared on Mpala as part of the 'Fangs and Stripes: African Lions, Wild dogs, Grevy's Zebra and Conservation Education' project.

Everyone knows what lions eat – lots of zebras, lots of antelope, the odd buffalo or giraffe, the occasional cow. In ecology, however, the details matter: how often do lions kill Grevy's zebras, one of Laikipia's poster species that is nearly extinct elsewhere, as opposed to the abundant plains zebra? Is lion predation a factor in the declines of Laikipia's hartebeest, eland and gazelle populations, or are those a response to long term habitat changes (e.g. increase of bush cover at the expense of open grassland), and/or increasing livestock numbers, and/or bushmeat poaching in communal areas? We have excellent data on Laikipia prey numbers from the annual aerial censuses conducted by Mpala Research Centre and Kenya's Department of Resource Surveys and Remote Sensing, but our understanding of local lion diet lacks detail.

In national parks where lions are tame and easy to find, it is relatively simple to accurately document their diet by finding fresh kills.

However, kills are found infrequently in the dense bush that covers most of Laikipia. Until this century, people could find fresh kills by following vultures (no doubt a key survival technique to our distant ancestors), but widespread predator poisoning in Kenya has drastically reduced vulture numbers and the sight of birds spiraling down to a carcass is now rare. The biologist's traditional tool for carnivore diet studies, analyzing hair in droppings, is not an option either, as lion scats disappear quickly; they are surprisingly attractive to many other animals, eaten fresh by specialized dung beetles, jackals and even tortoises.

MRC and Living With Lions are using a new high tech approach to document lion impact on Laikipia's prey populations, supported by grants and donations from the Disney Worldwide Conservation Fund, Chester Zoo, the Banovich Wildscapes Foundation, Frank Levinson, Cindy Calderon, Segera Ranch, and Mpala's new neighbour Bruce Ludwig.

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Michael Brown

A territorial male Grevy's Zebra

LIONS AND GREVY'S ZEBRA: WHEN ONE ENDANGERED SPECIES EATS ANOTHER



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We are fitting females in six prides on and around Mpala Ranch with GPS collars that accurately document their movements and send hourly fixes every morning via a satellite phone link. When the data show the lions spending several hours in one spot during the night, we go out that day and search for a kill. Tooth wear indicates the age of the prey animal, and the amount of fat in the marrow of leg bones reflects its nutritional condition. The collars will automatically drop off after a year, allowing us to deploy them on another lioness, yielding information on diet and movements of twelve different prides. Tim O'Brien will use the resulting data on lion predation and the population data from the aerial counts to model the impact of lions on species of concern.



Researchers Laurence Frank [above] and Margaret Kinnaird [above right] collar and take measurements from lioness Chessie.

'Virtual Fencing', as in Max Graham's work with crop raiding elephants in southern Laikipia. Although most Laikipia ranchers are first rate conservationists and carefully manage their cattle to minimize losses to predators, a small minority still shoot lions, hyenas and leopards rather than invest in predator proof bomas and good herding practices. Lions also run into trouble when they move from commercial ranches onto community areas where there are great numbers of livestock but little natural prey. We can program the collars to send an email or text message when they cross onto areas where lions are likely to be killed, allowing the conservation ranches to 'herd' them back to safety.

Because these collars report real time data on lion locations, they can also be used for

We are still developing the full potential of this powerful new technology, and will report on progress in future Mpala Memos. ■

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INVASIVE ANT THREATENS TREE COVER



Corinna Riginos

You've probably noticed them around. Little black ants that swarm to anything oily or fatty you may have left out. Columns of them, streaming up from the ground. In and among all the little ones, an occasional larger one with an unusually big head.



Megan Karande

Big-headed ants devour an acacia ant

This is the big-headed ant, *Pheidole megacephala*, one of the world's most invasive ants, and unfortunately, they are here in Laikipia. You have probably noticed them around houses, gardens, and other inhabited areas, where they form extensive colonies and devour pretty much anything in their path. Many invasive ants never spread beyond such disturbed areas, but our recent research suggests that these diminutive creatures may be wreaking havoc on the Laikipia landscape.

My irritation with these household pests turned to fascination (and alarm)

when I noticed them streaming up and down the trunks of nearby whistling thorn acacias. There was no sign of the acacia ants that used to live there, and it got me thinking: had the big-headed ants pushed out the acacia ants? And if so, wouldn't there be major consequences for the trees?

Through my research (with student Megan Karande and acacia ant expert Todd Palmer), I can now say "yes": the big-headed ants are able to obliterate the acacia ants, with devastating consequences for the trees.

We surveyed whistling thorn trees at three different sites in Laikipia and found that, where the big-headed ant was present, three of the four acacia ant species were completely absent. The fourth species, *Tetraponera penzigi*, was present at low densities on many of the acacias. Now, here's the thing: the three *Crematogaster* ant species defend trees fiercely against browsing herbivores like elephants, but *T. penzigi* is not a very good defender, and the big-headed ants do not appear to defend trees at all.

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Douglas Kamaru

Big-headed ant-occupied tree destroyed by elephants



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The consequences of this became clear when we started looking at the trees themselves. Where the big-headed ant had invaded, one in five whistling thorn trees had been completely destroyed by elephants. Where there were no big-headed ants, only one in twenty trees had been pushed over by elephants.

What does this mean? In a nutshell, it means that if the big-headed ant invasion spreads widely, we might expect to see far fewer whistling thorn trees on the Laikipia landscape. Should we be alarmed? Perhaps; right now we do not know how fast the invasion is spreading or how far it has already spread. Is there anything that can be done about it? Maybe; certain chemicals have been effective elsewhere for eliminating colonies that have spread over limited areas of land. These are questions we hope to address in the near future.

Laikipia has remained relatively free of invasive pests, and it is sad to see one gaining a toe-hold here. Our preliminary research suggests that the big-headed ants are about to become a big problem. But in this case, I hope that our findings prove wrong. ■

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Stefanie Siller

WORKSHOPPING WITH WALIMU

Care and protection
Our duty is to defend
the environment

-Alice Njeru, Ngabolo Primary School

From January 10 to January 12, the Northern Kenya Conservation Clubs hosted their second annual teacher's workshop for the teachers ('walimu' in Kiswahili) of the Laikipia clubs. 21 teachers attended the workshop, which was co-hosted by Education Beyond Borders and the Laikipia Wildlife Forum. Together, NKCC, EBB, and LWF worked with teachers to expand their understanding of experiential learning and environmental education in order to make them experts at implementing experiential learning in their clubs and classrooms. Teachers learned new ways to present lessons and discovered how to address different learning styles amongst students. From demonstrations on soil erosion to playing games about the interconnectedness of humans, resources, and their environment, crafting Haiku poems based on observations about the surrounding wildlife to an educational game drive through Ol Pejeta, the teachers were challenged to think about learning in a new way. At the end of the workshop, the teachers worked together in groups to use what they had discovered to make new lesson plans for the upcoming year, striving to present knowledge not through lectures but through stories, games, and activities. In the upcoming year, we look forward to a new club-wide competition based on endangered species, as well as exciting new projects from each club to present at the next Community Conservation Day!

-Stefanie Siller

THE DRONES ARE COMING!



Dan Rubenstein



Researchers Katelyn Wolfenberger, Nick Roberts, Tyler Coverdale, and Jen Guyton pose with a drone

Gathering data on the structure of landscapes, animal locations and movements as well as their associations is always a challenge on a landscape like Mpala's that is covered with thick bush. Bouncing around on roads or going off them is a jarring adventure and ultimately limits what ecologists and animal behaviorists can 'see'. The use of Unmanned Aerial Vehicles (UAVs)—drones in the vernacular—will help overcome many of these problems and help make much of the invisible, visible.

This winter, students in Princeton University's 'Tropical Ecology' class were the first to deploy one of Princeton professor Dr. Kelly Caylor's octocopters (an 8-winged drone) to map the pattern of termite mounds on the black cotton landscape. In doing so, they were testing some hydrological models on how termite mounds change vegetation productivity not only on the mounds themselves, but in the neighboring landscape as well. During the course, I and my team of computer scientists and engineers (Tanya Berger-Wolf of the University of Illinois-Chicago, Chuck Stewart

of Rensselaer Polytechnic Institute, Sai Ravela of MIT and Lucas Joppa of Microsoft) also embarked on a feasibility study for flying fixed wing drones to follow zebras and take pictures of their stripes. We hope to explore the associations and movements of a large fraction of the population of plains and Grevy's zebras to learn what makes them tick and to see how they organize their use of the landscape. As we build our new Image Based Ecological Information System (IBEIS) tools such as drones will bring muddy boot ecology face to face with the new world of 'Big Data'. Iain Couzing of Princeton and Fritz Vollrath of Oxford and Save the Elephants are planning to float helium filled blimps above watering points and critical habitats in Samburu and on Mpala to study the collective behavior of elephants and other large ungulates. They will transform the way data are gathered and used at Mpala and are likely to reveal much about the private lives of animals. So stay tuned, drones and dirigibles will join the vultures and eagles flying high over Mpala. ■

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CONGRATULATIONS TO: ALEX MURIITHI GATHONI



Stefanie Siller



the Mpala Research Centre are delighted to announce that the 2014 scholarship has been awarded to Alex Muriithi Gathoni, who achieved the top KCPE marks of all Mpala students, an astonishing 83% (416 out of possible 500 marks), which has secured him a place at Lenana High School, Nairobi, one of the top ten schools in the country.

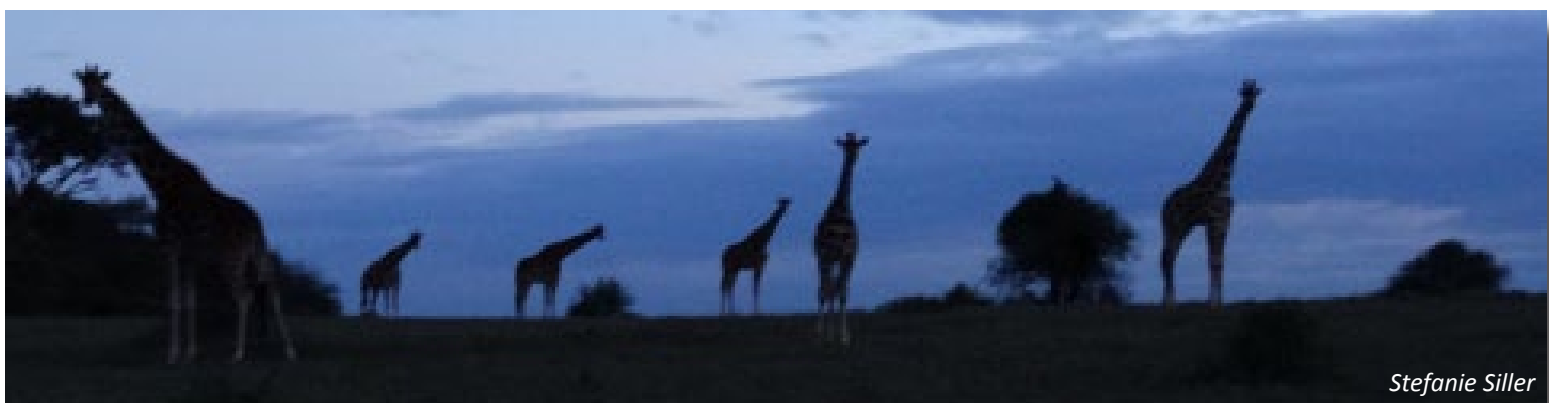
Alex, 14 years old, grew up on Mpala, where his mother, Doris, works as a cook and room steward. Alex attended the Mpala Primary School from nursery class through Standard 5. He then transitioned to the Nanyuki Boarding Academy. Alex's favorite subjects in school are science and math, especially algebra. Not only does Alex excel in school, but he is also skilled at football! His favorite team is Barcelona, though his favorite player is Argentine footballer Messi. In his free time, Alex enjoys going on game drives and seeing rhinos, his favorite animal.

The recently established Smithsonian UK Charitable Trust Mpala Scholarship, a full scholarship that will be granted once every four years, is intended to support the child of a lower-income Mpala employee throughout Form 1 to Form 4 of a Kenyan National Secondary School. The scholarship will be awarded to the pupil who has achieved the highest mark on the KCPE National Exam and has secured a place at a National Secondary School.

When Alex found out about the award, he explained that he felt 'Good, excited!' He is particularly excited because Lenana High School is, in his own words, his 'dream school'. Alex looks up to his uncle, an accountant, for going to university and working hard to pursue his career. When he grows up, Alex hopes to be a civil engineer. We wish Alex the best at Lenana, and can't wait to hear about all he does! ■

The Trustees of the Smithsonian UK Charitable Trust, together with the Director of

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Jen Guyton, Ian Warrington

Jen Guyton and Ian Warrington are the previous and current managers of the hippo project at Mpala. They sat down to talk about some of the discoveries and pitfalls encountered while trying to bait hippos on Mpala.

Why are you baiting hippos?

JEN: We started thinking about how we could bait hippos for a couple of reasons. First, we wanted to use baits to establish one location that we could count on for tagging hippos. Second, we were planning on eventually transfusing the bait with an isotope tracer, a high concentration of nitrogen 15. The hippo would eat the isotope tracer and poop it out in the river. That isotope tracer would then show up in an analysis of whatever organism ate the poop directly, or ate the things that ate the poop.

So how do you bait a hippo?

JEN: To do this we had to figure out what we could get wild hippos to eat, so Doug [McCauley - project leader] went to some local conservancies where they had semi-tame hippos and asked what they were feeding them. Pretty consistently he was getting the response that hippos love cabbages.

So we started buying cabbages in bulk, 20 cabbages at a time, and taking them out to various places where the hippos were grazing. Then we'd set camera traps on them. We got a lot of weird things happening in front of those cameras. If we left the cabbages out for too long in the morning the baboons came and tore them apart. On various occasions we got pictures of white-tailed mongooses anal-marking them, and a lot of dik dik



A wild hippo caught on camera!

sniffing them. A couple of times, elephants actually did eat them, but the hippos were generally totally uninterested. You'd kind of see them walk by in the background but they never really came close to the cabbage. We tried a couple of other things, like slicing the cabbages up into pieces or tearing them apart. We did this for 2 months, and in all that time just never managed to make it happen.

The hippos never even touched the cabbages?

JEN: We had one small success once where a hippo did kind of pick up a cabbage in its mouth and spit it back out onto the ground and then walk away, but that was about the closest we got.

IAN: I had that a second time, I had a hippo pick one up, and move it and then put it down somewhere else, and then continue walking.

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So why does everyone say that hippos like cabbages?



IAN: Hippos crop raid and get into a lot of human-wildlife conflict as a consequence, and two of the biggest things they eat are green maize and cabbage fields. A lot of hippos go out of their way to break fences to eat cabbages, but these ones just don't. They'll actually go the opposite direction.

Did you ever figure out something that they would eat?

JEN: We were told that hippos really like sweet things, so the first thing we tried was hay with molasses on it. That just turned into a baboon party the next morning. They just demolished it. We then started trying cabbages with molasses on it, which was hard because the molasses made the cabbages rot a lot faster. That didn't work either.

IAN: We moved onto lettuce because it got some positive results.

JEN: When we switched to lettuce we tried multiple different kinds of lettuce. We were buying romaine, you know the dark leafy stuff, and that didn't seem to be working. We switched to iceberg lettuce, and we had a little bit of success with that but it's super hard to get. We had to start special ordering iceberg because it seemed to be the only thing that got us any kind of success. I never expected hippos to be picky about what kind of lettuce they eat!

How have cabbages continued to factor into your research?

IAN: For this last round of tagging, I purposefully put cabbages out to alter their behavior. There are places where the hippos bask during the day, so normally you will find 11 hippos laying stretched across one beach for, say, 5 days in a row. But when you put the cabbages out, you'll find 11 hippos laying on top of each other, squeezed into one 2-meter section of beach because they don't want to use the part that has cabbages. They don't want to sit beside a cabbage, they aren't willing to walk between cabbages, they all pile onto the tiny corner that I hadn't put a cabbage in. So I laid those out to shift them so I could take better shots with the tagging.

It's mind boggling how many people tell me that hippos eat cabbages, and I'm not disagreeing, there are crop raiding papers about them eating cabbages.

JEN: Just not these hippos.

IAN: And the cabbages aren't novel anymore, they should be used to it, but they still go the other way. Zero answers, nothing, not a clue.

JEN: It's a mystery. ■

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AN MPALA HOLIDAY REUNION!



The long lasting bonds forged while working in the Mpala environment were again on display this past holiday season. In a gathering of researchers from the 2011-2012 field terms, nine former project managers, Princeton-in-Africa fellows, extended student attachments, and a mechanic all from Mpala converged on snowy Vermont for the New Years holiday. Despite being a world apart from the Laikipia Plateau, the gathering brimmed with a fun energy of shared experiences, humor, academic curiosity, and cooperation that marked their time spent at Mpala. Those present included David Kimiti, Cara Brooks, Theresa Laverty, Grace Charles, Katie Worsley-Tonks, Laura Budd, Aaron Kinoti, EB Tupper, and Matt Snider. They stayed at the family homes of Laura and Matt, who were excited to share the wonders of the frozen north with all of their guests, including cheese and cider tasting, sledding/skiing, and a visit to the Ben and Jerry's Ice Cream factory. With the success of this reunion, the impetus for more Mpala rooted reunions in the future remains high!

-Matt Snider



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MPALA-AT-A-GLANCE

Courses & Groups

- Cornell University hosted a course in January by Irby Lovette on Tropical Biology and Animal Behavior for 29 students
- 10 graduate students from Princeton University visited Mpala in early January to conduct research on their own individual projects
- The technical team for the Mpala Live! project, Tim and Tiffany Sears and Kurt Wastell, were assisted by George Mwangi and Valerie May for 3 weeks in January in setting up the complex infrastructure and webcams for the project. We expect the live streaming and associated website to be functional by March!
- Prof. Tanya Berger-Wolf, along with interns

Nick Roberts and Katelyn Wolfenberger, began developing an image based ecological information system in January at the center.

Events

- From October 7 to October 9, the MWF hosted the Boma Project, a US and Kenyan NGO focused on livelihood diversification and poverty alleviation, while they undertook a strategic planning workshop.
- The Northern Kenya Conservation Clubs held their second annual Teacher's Workshop from January 10 to 12. The workshop was co-hosted by Education Beyond Borders and the Laikipia Wildlife Forum, and was attended by 21 teachers.

This list is comprised of the publications related to Mpala Research Centre released within the second half of 2013:

Beauquier, J., P. Blanchard, J. Burman, et al. 2013. Tight complexity analysis of population protocols with cover times - The ZebraNet example. *Theoretical Computer Science* 512:15-27.

Creel, S., B. Dantzer, W. Goymann, and D. Rubenstein. 2013. The Ecology of Stress: Effects of the Social Environment. *Functional Ecology* 27: 66-80.

Keesing, F., B.F. Allan, T.P. Young, and R.S. Ostfeld. 2013. Effects of wildlife and cattle on tick abundance in central Kenya. *Ecological Applications* 23: 1410–1418.

Kimuyu, D.K., R.L. Sensenig, C. Riginos, K.E. Veblen and T.P. Young. 2014. Wild and domestic browsers and grazers reduce fuels, fire temperatures, and acacia ant mortality in an African savanna. *Ecological Applications*, online early.

Kirigia, A., J.T. Njoka, P.D Kinyua & T.P. Young. 2013. Characterizations of livestock manure marketing chain and the annual income contribution of manure trade in Mukogodo, Laikipia, Kenya. *African Journal of Agricultural Research* 8:5864-5871.

Lane, P.J. 2013. Trajectories to pastoralism in northern and central Kenya: an overview of the archaeological and environmental evidence. Pp. 104-144 in: M. Bollig and Hans-Peter Wotzka (eds.), *Pastoralism in Africa: Past, Present and Future*. Oxford: Berghahn.

Martins, D.J. and S.D. Johnson. 2013. Interactions between hawkmoths and flowering plants in East Africa: polyphagy and evolutionary specialization in an ecological context. *Biological Journal of the Linnean Society* 110:199-213 DOI: 10.1111/bij.12107

Martins, D.J. 2013. *People, Plants and Pollinators: Uniting Conservation, Food Security, and Sustainable Agriculture in East Africa*. Conservation Biology: Voices from the Tropics, First Edition. Navjot S. Sodhi, Luke Gibson, and Peter H. Raven. John Wiley & Sons, Ltd. Published 2013 by John Wiley & Sons, Ltd.

Rota, J. and S. Miller. 2013. A new genus of metalmark moths (Lepidoptera, Choreutidae) with Afrotropical and Australasian distribution. *ZooKeys* 355 (2013) : 29-47 doi: 10.3897/zookeys.355.6158

Sankaran, S., D.J. Augustine and J. Ratnam. 2014 Native ungulates of diverse body sizes collectively regulate long-term woody plant demography and structure of a semi-arid savanna. *Journal of Ecology*, in press.

Soderberg, K., S.P. Good, M. O'Connor, L. Wang, K. Ryan, and K.K. Caylor. 2013. Using atmospheric trajectories to model the isotopic composition of rainfall in central Kenya. *Ecosphere* 4:art33.

Veiga, J.P., Wamiti, W., Polo, V. and Muchai, M. 2013. Interaction between distant taxa in the use of tree cavities in African ecosystems: a study using nest-boxes. *Journal of Tropical Ecology* 29:187-197.

Wilkerson, M.L., L. Roche & T.P. Young. Indirect effects of domestic and native herbivores on butterflies in an African savanna. *Ecology and Evolution* 3:3672-3682.

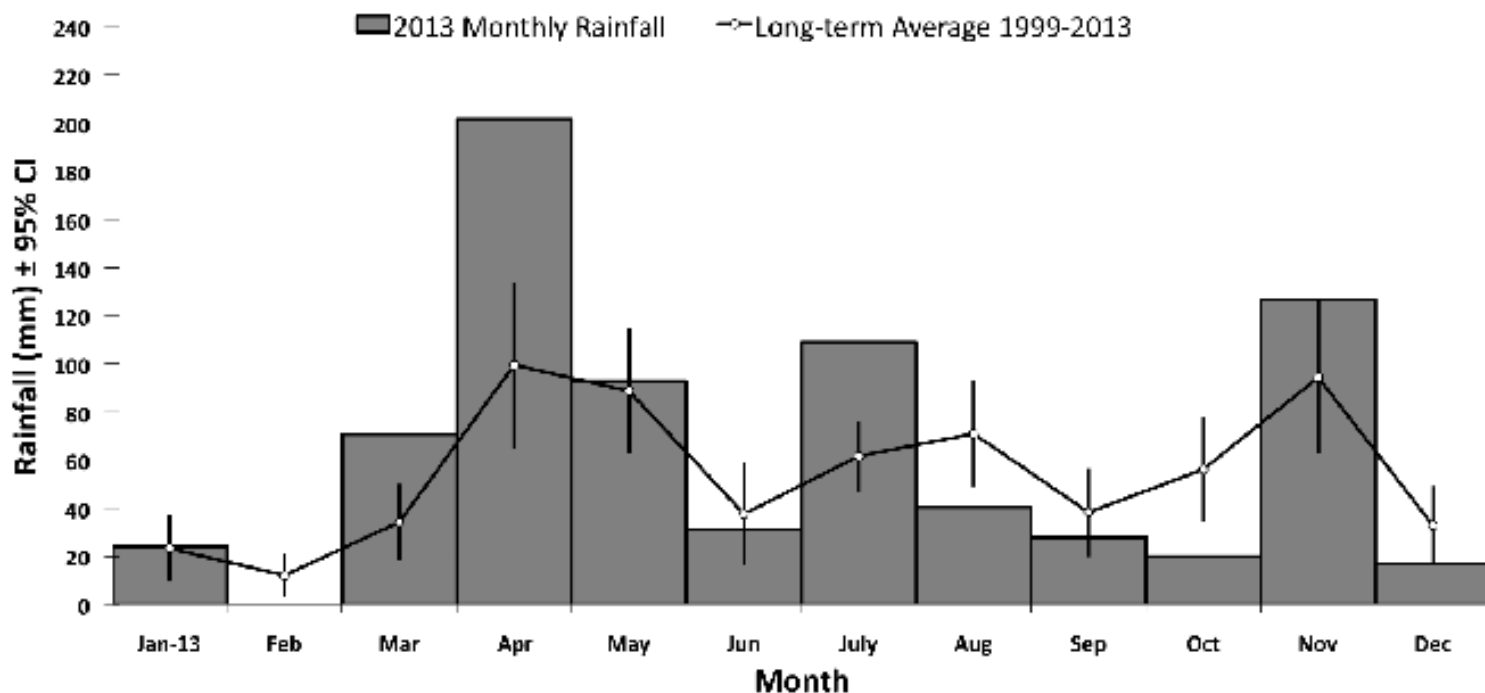
Zero, V.H., S.R. Sundaesan, T.G. O'Brien and M.F. Kinnaird. 2013. Monitoring an Endangered savannah ungulate, Grevy's *Equus grevyi*: choosing a method for estimating population densities. *Oryx* 47: 410-419.

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Michael Brown

MRC RAINFALL 2013



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