Conservation - Community - Research

Mpala Memos

news from Mpala

The Prickly Pear Problem

Anne-Marie Hodge discusses her PhD work on the spread of the invasive prickly pear cactus, and the efforts undertaken to halt its invasion.

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For time-strapped zebras, communication is a full-body activity

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The Prickly Pear Problem: Dispatch from the Front Lines of an Invasion

Anne-Marie Hodge

Research

Although the term "alien" is often applied to non-native species, for the prickly pear cactus (*Opuntia spp.*) the label seems particularly apt: this plant hitches rides across the landscape inside animals, clones itself, can "come back to life" by sprouting from seeds that have been dormant in the soil for up to 20 years, and has rapidly overwhelmed native vegetation after introduction to new environments across the globe. This "alien" species is hastily spreading across Laikipia, much to the consternation of scientists, ranch managers, and local community members.

A large Opuntia (prickly pear) sits atop a rock formation on Mpala. The rocks are popular hangout spots for baboon troops.

The effects of this invasion are problematic on many levels. Goats and sheep can die from consuming the cactus in large quantities (as they are wont to do during the dry season, when *Opuntia* is the one of the few green components of the landscape), yet higher and higher volumes of cactus can mean less and less space for grass and other forage. In addition, managers who rely on income from tourists are understandably unhappy about a non-native species becoming the most noticeable aspect of Laikipia's breath-taking vistas. The conservation impacts of the invasion—such as its effects on species diversity of native animals and plants, and the effects on soil properties in infested areas—are another significant cause for concern, and need to be evaluated.

For my dissertation research, I am investigating several aspects of *Opuntia*'s spread throughout this region, including the degree to which baboons facilitate germination rates and seedling establishment, several different environmental and management factors that may accelerate encroachment across the landscape, the effects of the *Opuntia* infestation on species richness and activity of wild mammals, and the economic effects of the invasion on ranches, conservancies, and community lands. Ultimately, I am interested in identifying whether conservancies are especially vulnerable to invasion by the cactus, due to their relatively healthy and diverse populations of seed dispersers.

There is a new twist on the story of the *Opuntia* invasion this year: the biocontrol cochineal insect (Dactylopius opuntiae) - selected to help reduce *Opuntia* density - has made it to Mpala from surrounding properties.

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The Prickly Pear Problem

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Although the insect has not yet dramatically reduced cactus densities on Mpala, it appears to be spreading on its own, and the effects on seedling recruitment should become apparent within the next few months.

Baboons eat and play on rocks inhabited by many invasive Opuntia

In the meantime, I am continuing to census cactus in plots on a variety of properties across Laikipia (conservancies, private ranches, and community lands), as well as collecting baboon scats for seed counts, running seed germination experiments in the lab, interviewing managers and other stakeholders about the plant's economic impacts, and now also monitoring rates of cochineal infestation. Now that the rains have come this season, I will be working on comparing mammal activity in cactus-infested versus control plots between the wet and dry seasons. It is a busy and exciting time, as the cactus continues to ratchet up its presence, but the upcoming months should be especially interesting as we begin to observe the effects of the cochineal insect on all of these components of *Opuntia*'s ecology. Stay tuned! •

The latest from Mpala Live!

Check out the live cams from the bush, take your own snapshots like these, and more at Mpala Live!, powered by explore.org.

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For time-strapped zebras, communication is a full-body activity Andy Gersick

Research

This year and next at Mpala and the nearby Ol Pejeta conservancy, the Princeton Zebra Research Project is trying to enhance our understanding of how zebras socialize by looking closely at the signals they use in different social contexts. Many evolutionary theorists believe that social challenges exert strong selective pressure on the cognitive abilities of social animals. Figuring out how to create and maintain social bonds, and how to simultaneously cooperate and compete with groupmates, is so difficult that it may have required creatures like our hominid ancestors to evolve greater capacities for things like abstract thinking, problem solving, or inferring the emotions and intentions of others. Much of the evidence supporting this idea comes from primate societies, wherein animal behaviorists have documented complex, flexible social strategies and sophisticated communication in a wide variety of species. But if complicated social life requires complicated social cognition, the pattern should show up in all kinds of animal societies, not just those of our close phylogenetic relatives. That's one of the reasons we're interested in looking at social communication in plains zebras: though they live in undeniably complex networks of harems, bachelor groups and herds, zebras' lives are vastly different from those of apes and monkeys. Will we see them using comparably sophisticated social behaviors to succeed?

Spotted hyenas greet one another during a long midday rest at the den.

A male curls back his lips to take in scents produced by a member of his harem. This "flehmen" behavior is an important part of zebras' olfactory communication.

I came to the zebra project from a grad-school career spent watching spotted hyenas, social carnivores that are more like monkeys than most people know. Like monkeys, hyenas often seem to spend their days doing nothing but socializing. Hyenas hunt mainly from dusk to dawn. During the days, mothers try to nap at communal dens while their young cubs alternately nurse and play. Some adult males – low-ranked and always hungry – band together in twos and threes to explore the breadth of a clan's territory, searching and sniffing for an old carcass that might yield a few bites of food or a waterhole to bathe in. Other males may doggedly follow a preferred female and her older offspring through a day of wandering, perhaps tending relationships that might one day yield mating opportunities. In all of these activities, whenever two or more hyenas are together, they interact constantly. Using their voices, faces, ears and body postures they perform elaborate greeting rituals, subtly threaten and humbly submit, groom andharass one another, giggle and whoop. Mating, hunting and fighting – the obvious

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For time-strapped zebras, communication is a full-body activity

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business of survival – are rarer events that punctuate days composed mainly of social communication.

Equid lives invert this routine. All day long, they eat - heads to the ground, jaws working. To the casual observer, zebras often appear calmly oblivious to the other animals around them. In this animal society, the steady work of fueling large ungulate bodies fills the days, and the days are quiet. A gathering of hyenas produces such a cacophony that even two individuals feeding together on a kill will soon draw in other carnivores from kilometers around. A herd of zebras drinking or grazing together may be nearly silent, and communication that is easy for a human observer to read happens infrequently. Two males may escalate through a succession of threats and counter-threats as rivals assess each other's strength. A harem stallion may call to a straying female with a loud, harsh *quagga quagga*. Mostly, though, zebras are silent and we are left to wonder how they form and maintain their social relationships. Yet we know that social life matters tremendously to a zebra's survival and reproductive success. Work by Princeton's Dan Rubenstein and others, using techniques such as Social Network Analysis (SNA) has shown that strong social bonds are vital to equid survival and reproductive success, just as such bonds help determine the fitness of more demonstratively communicative creatures like group-living primates and social carnivores. The question, then, is what makes up those bonds?

Communication – the production, reception and interpretation of signals and cues – is the medium of social life. So our research will closely examine how zebras use and combine signals in multiple modes, as social contexts shift. We know that, in addition to vocal signals, zebras use visual, tactile and olfactory signals when they interact. We'll be looking at the ways that individuals combine those signals in conditions of greater or lesser conflict. A greeting between two harem stallions can be low- or high- conflict depending on how well the males know one another and how clearly their dominance relationship has been established. An exchange between mare and stallion around the decision to stop drinking and move can be low- or high-conflict depending on whether she is nursing and needs more water, or whether the presence of a bachelor group has him needing to move on. Can zebras vary their signaling to enhance the subtlety or urgency of their communication as contexts change? We hope to find out. By doing so, we will be closer to understanding how these creatures manage their often cryptic social lives. By extension, we will know more about whatever universal principles govern the influence of social environments on the evolution of social animals. •

Just prior to mating, a harem stallion rests his head on a mare's back; she regards him with ears held back against her skull

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Burning Issues:
does size matter? Duncan Kimuyu

Research

Earth is a fire planet. Although the history of fire in our planet predates our existence, its role as a key ecosystem process has, until recently, been ignored. Humans in many ways have altered natural fire regimes, sometimes with severe implications for biodiversity. For example, decades of fire suppression in many grassland and savanna ecosystems are now being blamed for expansion of woody species cover, a phenomenon that has been dubbed "bush thickening". Fire also plays important roles in controlling pest infestation, influencing wildlife distribution, and manipulating pasture heterogeneity in space and time.

Most mammalian herbivores in savanna ecosystems are attracted to the burned areas mainly because; (i) burned areas offer more nutritious pastures after it rains, and (ii) there is better visibility in burned areas than unburned areas, hence better chances of detecting predators from a 'safe distance'. By preferentially foraging in burned areas, herbivores may continue to reinforce this 'magnet effect' of fires; hence burned areas may persist in landscape as short-cropped grazing lawns for a long period after the fire. However, the size of the burn and the level of patchiness (grain) have important implications for the number and different species of herbivores that are attracted to the burns.

In collaboration with Ryan Sensenig (Goshen College, Indiana), we have been monitoring experimentally burned plots to understand how preference of burned areas proceeds through time. In 2004 and 2005, Ryan implemented a series of replicated burns of different sizes (1-, 9- and 81-ha) and grain (patchy and continuous). Using dung counts, Ryan monitored herbivore visitation of the burned plots for up to 2 years after fire. In 2011 (6 to 7 years after fire), we conducted yet another dung survey to examine which burns were still attractive to herbivores. Results from the second survey indicate that size and grain have strong influence on persistence of burned areas as grazing hotspots. While the magnet effect of small (1-ha) and large (81-ha) burns had faded during the second survey, intermediate size burns (9-ha) were still attractive to herbivores. For large size burns, grain was also a significant predictor of changes in preference, with patchy burns being more attractive than continuous burns.

A controlled burn on Mpala

This study emphasizes the importance of considering spatial scales in developing fire prescriptions to increase habitat heterogeneity and influence herbivore distributions in the landscape. We recommend intermediate size burns or large scale-patchy burns to land owners interested in achieving higher biodiversity goals at less frequent fire return intervals. •

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Picking up the SCRAPS: Laikipia's Small Carnivore Research and Parasite Study

Adam Ferguson

Kenya hosts a diverse assemblage of small carnivores (species of the order Carnivora < 15 kg), with over 25 species representing seven families. In spite of this spectacular diversity, a majority of carnivore research in Kenya (and in Africa in general) focuses on the larger, more charismatic species such as lions, hyenas, and African wild dogs. Mpala is no exception; minimal research has been conducted on the many small carnivores found at this site. Our project seeks to help fill in this knowledge gap by examining how the interplay between anthropogenic disturbance, behavior, and immunity influences parasite dynamics in several species of small carnivores.

The SCRAPS, or Small Carnivore Research and Parasite Study, applies a suite of methodologies including live-trap gird surveys (Figure 1), GPS radio telemetry, and wet lab work including fecal egg-counts of intestinal parasites and traditional immunoassays to examine how the presence of humans influences space use, survival, and overall health of several small carnivore species. Four species in particular appear most frequently in the traps and thus have become the major focus of the project. These include the common or small-spotted genet (*Genetta genetta*), the white-tailed mongoose (*Ichneumia albicauda*), the slender mongoose (*Galerella sanguinea*), and the skunk-like zorrilla or striped polecat (*Ictonyx striatus*). Other small carnivores captured to date include the bat-eared fox (*Otocyon megalotis*), black-backed jackal (*Canis mesomelas*), and the dwarf mongoose (*Helogale parvula*).

In order to examine the effects of human disturbance on the community dynamics, spatial ecology, and overall health of these species, we are conducting paired surveys between a 'pristine' site (Mpala Ranch) and 'disturbed' site (Il Motiok/Koija Community Ranches). We use Tomahawk live traps baited with raw chicken and beef to capture small carnivores (Figure 2). Following capture, animals are anesthetized and a series of over 10 biological samples are collected (e.g., blood, ear biopsy, feces, and ectoparasites), animals are marked

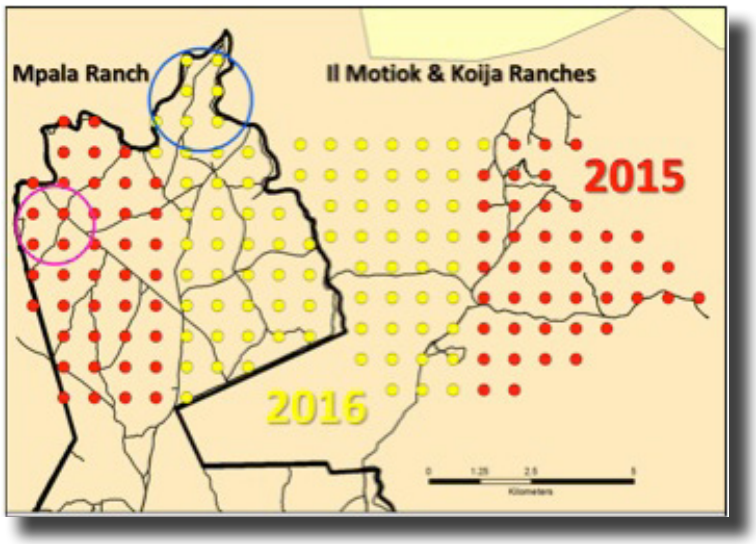

Figure 1. Live trap grid sampling for northern Mpala Ranch and the adjacent community ranches of Il Motiok and Koija. Each dot represents a trap station consisting of a Tomahawk live trap (Figure 2). The blue circle represents the average home range size of a male common genet, the pink circle represents the same for a female common genet.

with small ear tags or Passive Integrated Transponders (PIT tags), and then released at the point of capture. Common genets that are large enough are fitted with GPS collars (Figure 3) to allow for fine-scale monitoring of their movement patterns. To date we have 22 collared genets, 12 individuals on Mpala and 10 individuals on Il Motiok/Koija. In addition, we are using new data logger technologies to make homemade GPS collars for other species, like the white-tailed mongoose. These technologies will allow us to examine space use patterns in relation to human presence in order to understand how contact with humans and their domestic animals (e.g., domestic dogs and cats) might influence small carnivore immunodynamics and parasite loads.

Understanding the relationship between behavior, physiology, and parasite communities is vital to improving knowledge of disease transmission dynamics

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Picking up the scraps

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Figure 2. Tomahawk live trap with small spotted genet (Genetta genetta) captured on Mpala Ranch

for wildlife species that can affect zoonoses (diseases communicable between animals and humans) in multiple ways. Growing evidence suggests that small carnivores may prove to be one of the most important biological players in disease dynamics across Africa's human-wildlife interface, yet little is known about most of these species. This study will provide one of the first explicit investigations into these topics. Ultimately, this project will help elucidate how mesocarnivores 1) link humans, livestock, and wildlife at the local and landscape scales; 2) regulate host reservoirs (i.e. rodent control); and 3) act as reservoirs for diseases of zoonotic and conservation concern. Along these lines, the project has expanded to include studies of parasite and movement patterns of domestic dogs inhabiting surrounding communities, to be discussed by Karatina University Master's student, Dedan Ngatia, in a future Mpala Memos! •

Figure 3. Adam holding an anesthetized small spotted genet that has just had a GPS collar affixed around its neck

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Cooking Up Change Sally Goodman

In an effort to locally curb cooking fuel (largely firewood and charcoal) use and reduce time spent on cooking and related activities, Mpala has subsidized the cost of 25 heat retention cookers for staff. The cookers, called Wonderbags, are produced by the Zeitz Foundation in collaboration with the social enterprise, Nature Balance.

The traditional method of cooking over an open fire, as is done across Africa and much of the developing world, is a significant contributor to greenhouse gas emissions, deadly respiratory infections, and is highly time-consuming for women, who are usually responsible for cooking. According to the Global Alliance for Clean Cookstoves, residential solid fuel burning in developing countries is the cause of 21 percent of global black carbon emissions. Prior to receiving Wonderbags, the families surveyed in Mpala's staff village burned an average of 9 kg of wood and 0.75 kg of charcoal per day, yielding roughly 18.5 kg of CO_2 emissions, and nearly 10 g of black carbon emissions (based on FAO estimation of 1 g black carbon per kg fuel for wood and charcoal combustion).

The climate change-causing particulate emissions also contribute significantly to illnesses such as stroke, pneumonia, ischaemic heart disease, chronic obstructive pulmonary disease, and lung cancer, leading to more than 4 million premature deaths annually, as reported by the World Health Organization. Women and children compose a substantial proportion of these deaths. Nine of 25 Mpala village members surveyed reported negative health effects from cooking, including chest congestion, cough, and eye irritation.

Lastly, in many instances women must devote huge quantities of time and children sacrifice education in order to collect enough firewood or other forms of biomass for cooking. Clean cookstove projects not only have the potential to significantly reduce greenhouse gas emissions and preventable deaths, but also can improve overall quality of life for up to 3 billion people worldwide who cook and heat their homes using open fires.

Nearly all staff members who received Wonderbags reported that the bags were very effective for cooking. Daily fuel use measurements performed immediately before and two months after receipt of the jikos, as the Wonderbags are known in the village, showed an average 31% decrease in firewood use and a 22% decrease in charcoal, or an emissions savings of roughly 5.5 kg CO_2 per family per day (equivalent to driving 24 fewer kilometers in the average passenger car). Further, recipients reported health benefits from less smoke inhalation, and an average of slightly more than two hours saved daily through use of the Wonderbag for cooking. Most recipients use their Wonderbag only once or twice daily, so there is potential for further fuel and time savings with increased use. The greatest obstacle to higher use is belief by some users that the Wonderbags are not suitable for cooking certain traditional dishes that they are used to, specifically ugali (staple starch made with maize flour) and githeri (dish with beans and maize). However, many users have had success cooking both of these dishes.

In order to eliminate any doubts about the jikos' practicality and increase their use by villagers, the next possible steps include holding demonstrations of the Wonderbag's potential uses, organizing sharing of cooking techniques between users, and distributing recipes and cooking times. Additionally, we hope to be able to provide more Wonderbags to others in the Research Centre and Ranch villages! •

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Mpala At A Glance

On January 31, nine undergraduate students from Princeton and Columbia Universities arrived at Mpala for a semester-long program that has taken them to Lewa, Ol Pejeta, Nairobi, Kisumu, and Amboseli National Park. The students are studying ecology and conservation, sustainable development, energy, and water.

In February, Mpala hosted a two-week Rhino Crime Scene Course run by wildlife investigators Rod Potter and Wayne Evans. Nine individuals from Kenya Wildlife Service, Lewa, Ol Pejeta, and elsewhere learned strategies for dealing with wildlife crime, including staging investigations, and collecting and presenting evidence.

Instructors and participants in the Rhino Crime Scene Course

Munira Bashir speaks with a student at Daraja Academy

On March 13, Munira Bashir, of The Nature Conservancy in Nairobi, spoke to students at Daraja Academy as part of Mpala's Women in Conservation Lecture Series. She led the girls in a discussion about empowering women in conservation and other fields.

On March 24, 18 Masters and undergraduate students from the University of Leeds arrived at Mpala for a two-week African Ecology field course.

In late March, Mpala hosted students from Kenya's Karatina University for three days. Among the highlights of the trip was a visit to the Kenya Long-term Exclosure Experiment (KLEE) plots, which manipulate the presence of different combinations herbivores in order to better understand the nature of interactions between different herbivore guilds and their impacts on the habitat. The students also heard from Mpala researchers Adam Ferguson, Dedan Ngatia, George Wang, Sandy Oduor, and Solomon Kipkoech, who introduced them to some of the opportunities in various fields of biology. Visits like this one help to foster the culture of conservation within Kenya's new generation of leaders.

Karatina students conduct a dung survey – one of the techniques used to quantify habitat use

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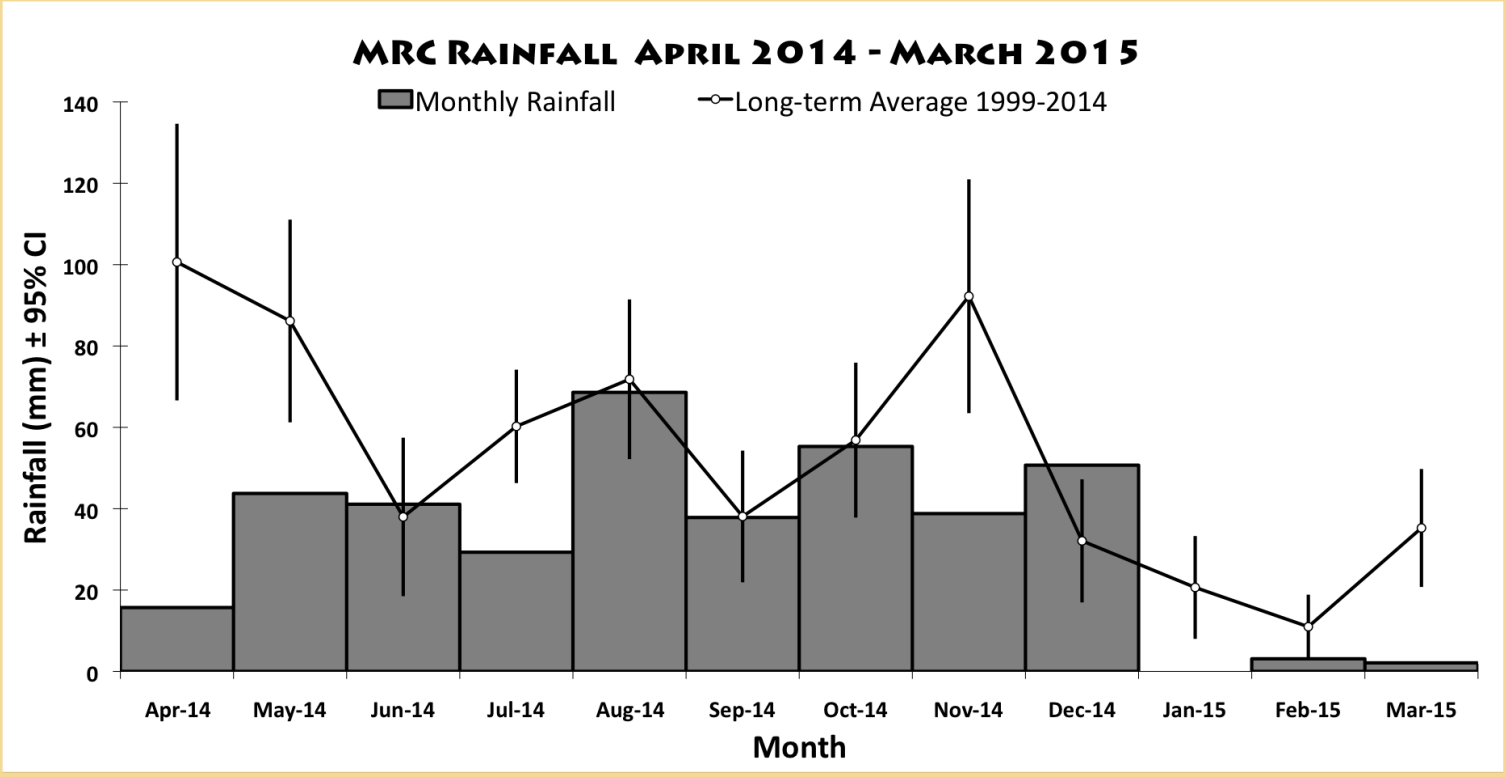
Mpala Weather Corner



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Shannon Wreford-Smith
shanni@wananchi.com

Newsletter Editing and Design
Sally Goodman
piaf@mpala.org

Contact Information
(USA)
Kay Berney
kberney@aol.com

Mpala Wildlife Foundation
PO Box 137
Riderwood, MD 21139-0137
USA

(Kenya)
Tel: 254-62-32758

Mpala Research Trust
P.O. Box 555, Nanyuki
Kenya

www.mpala.org

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