



University of Minnesota Lion Center

An update to supporters about new and ongoing research and conservation initiatives



Photo: Daniel Rosengren

A most unusual year

Research moved forward at a slower pace, but there were bright spots in our work to inform wildlife management practices.

The COVID-19 pandemic has been challenging for us all, as we each faced extended periods of isolation and many of our friends and families were personally touched by tragedy. Vaccines remain scarce in Africa, and waves of infection are still crashing in many of the countries where the Lion Center works. The Delta variant adds more uncertainty.

As seen in the following pages, we all managed to carry on even though the pandemic seriously curtailed our field research in 2020. Jessica Burkhart (p. 4), Abby Guthmann (p. 6) and John Heydinger (p. 2) returned to South Africa, Kenya and Namibia, respectively. Sarah Huebner's (p. 3) collaborators in Mozambique, South Africa and Tanzania maintained their camera-trap grids, feeding ever more imagery into Snapshot Safari while record numbers of Zooniverse volunteers classified camera-trap photos, and Natalia Borrego's (p. 5) team of trackers continued to retrace the paths of hunting lions in the Kalahari.

After evacuating from Nairobi in March 2020, I came back to the United States and took stock. Zoom calls made it easy to remain in contact with all the Lion Center team as well as with our partners in Africa and Europe. All that time at home also helped ensure I would finally complete several long-standing projects.

The first centered around an Africa-wide map of the highest-risk areas for human-lion conflict. By bringing together fine-scale data on human population densities, crop production and livestock abundance, my team of geographers and conservationists identified sites where the financial losses suffered by local people from lost livestock (to lion predation) and crop destruction (to elephant raids) were sufficiently high to cover the full costs of building and maintaining wildlife-proof perimeter fences. These are areas where human populations utterly dominate the landscape, so the addition of a permanent barrier would have no further

impact on wildlife movements — instead protecting people from dangerous animals and, in turn, protecting lions and elephants from retaliatory killings. Though largely a measure of last resort, we know from our earlier work that lions thrive when they are separated from local people by a strong fence — and as Africa's human population is still growing fast, the human-dominated areas will expand ever closer to the remaining lion strongholds.

Earlier this summer I also finished my new book, tentatively titled *The Lion: Behavior, ecology and conservation of an iconic species*. Unlike *Into Africa* and *Lions in the Balance*, in which the narratives alternated between descriptions of lion behavior and the challenges of studying these animals in the wild, this book points the spotlight solely on the lions themselves and is lavishly illustrated with hundreds of full-color photographs by my former Serengeti field assistant, Daniel Rosengren, who is now the staff photographer for the Frankfurt Zoological Society. The Serengeti and Ngorongoro lion studies ran continuously from the 1960s to 2015, and we studied virtually every aspect of lion life. We also established a number of conservation efforts aimed at protecting the lions for future generations, all of which are covered in the 12 chapters of the new book. *The Lion* will be published by Princeton Press in 2022.

In summary, the Lion Center has managed to thrive despite the pandemic, and we are all eager to get back to full capacity in the coming months. We're optimistic about 2022, and we greatly appreciate the past help of our supporters and hope you will consider supporting our work by donating to Abby, Jessica, John, Natalia and Sarah's ongoing projects. — Craig Packer

Considered the world's foremost expert on African lions, Dr. Craig Packer is a Distinguished McKnight Professor of Ecology, Evolution and Behavior at the University of Minnesota. He established the world's first research center dedicated to the study of lions in 1986.

Conserving desert-adapted lions

Maintaining a unique lion population through community conservation

In Africa's second-youngest country, communal conservancies ensure rural residents benefit from living alongside wildlife. Community-based natural resource management (CBNRM) in Namibia is a shining light in African wildlife conservation. This success brings new challenges, chiefly increasing levels of human-wildlife conflict.

Desert-adapted lions in northwest Namibia primarily inhabit communal land, which is also home to cattle and other livestock. These animals are the chief source of income for the region's residents. Drought conditions are depressing wildlife numbers. When desert-adapted lions destroy livestock, it threatens farmers' livelihoods and lion survival. Since 2000, retaliatory killings of lions following human-lion conflict events are responsible for 89 percent of adult lion mortalities in northwest Namibia.

As a member of the Lion Center, I co-founded the Lion Ranger Program to address this issue. I am partnering with the Namibian government on an intensive lion-monitoring study. Using inclusive, community-centered methods, I am aligning CBNRM and lion conservation to ensure evidence-based management of this largely unstudied desert-adapted population.

I completed my doctorate (University of Minnesota/Macquarie University) in 2020. My dissertation, "Humans, Livestock, and Lions in Northwest Namibia" is an



environmental micro-history examining the apartheid-era drivers and contemporary manifestations of human-lion conflict. Portions have been published in *Biological Conservation*, *Environment and History*, and the *Journal of Southern African Studies*.

In coming years, I plan to deepen this data collection on the desert-adapted lions and continue to scale up the activities of the Lion Rangers. I am working closely with the Namibian government toward developing a first-ever comprehensive regional lion-monitoring plan. I live and am based out of a remote field camp at Wêreldsend (World's End) in northwest Namibia. – John Heydinger

Learn more about Dr. Heydinger's work and the Lion Rangers at lionrangers.org or on Instagram @lionrangers.

Picture this ...

Lion Center and Snapshot Safari researchers use cameras and artificial intelligence.

Together with Microsoft AI for Earth and numerous partners around the globe, I am working to develop technology to extract important information about wild animal populations from “camera-trap” images. Snapshot Safari, the network created by the Lion Center to combine efforts of academic researchers and conservation organizations, deploys grids of cameras to monitor large mammals such as lions and elephants in African nature reserves. The millions of images captured annually provide unique insights into animal behavior and how wildlife populations are faring in these protected areas. By running the cameras continuously, we can address pressing questions related to the welfare of animals subject to pressures from poaching, loss of habitat, and climate change.

The massive image dataset generated by this project led to the development of artificial intelligence (AI) algorithms that can rapidly and accurately detect whether animals are present in images and identify the species observed within them. We are currently training the AI to accurately count the number of animals, tell us whether young are present, and annotate behaviors like feeding and vigilance. This approach provides a powerful new tool to quickly adapt conservation strategies to meet new challenges on the ground.

This would not have been possible without the nearly 200,000 volunteers who have helped to classify more than 18 million images to date on our website, [snapshot safari.org](https://www.snapshot safari.org). These citizen scientists, hailing from 77 countries, have made a significant contribution to the field of conservation through their efforts, while also learning about and enjoying the beauty of African wildlife and habitats. We continue to welcome and make good use of their contributions as we produce more data that can be used to train increasingly sophisticated AI algorithms.

The resulting labeled image data help wildlife managers adjust conservation tactics by giving them valuable information on where animals are hunting, resting, and migrating, among



other things. This includes documenting animals — such as brown hyenas and leopards — that have been found outside of their known ranges, as well as tracking rare and cryptic species like servals and honey badgers that are rarely seen except by camera traps.

Snapshot Safari is part of a new era in monitoring the health of Africa’s ecosystems. Conservation managers must balance the needs of iconic species like lions and elephants with protecting other threatened megaherbivores like rhinoceros and giraffes, diverse ungulate guilds, endemic plant populations, and mature trees that are economically and culturally significant. These dilemmas are further compounded by the demands of international ecotourism, increasingly limited space due to ongoing human development, and the infrastructure designed to minimize human-wildlife conflict.

My hope is that Snapshot Safari will help us learn and disseminate the wildlife management strategies that work best to protect all of these threatened species and their habitats.
– Sarah Huebner

Sarah Huebner is the Research Manager of Snapshot Safari and a Ph.D. candidate in conservation sciences who studies the role of megaherbivores, particularly elephants, in mitigating the “landscape of fear” created by African lions.

Oxytocin to the rescue?

A new approach being tested by Jessica Burkhart could relieve social stress for captive lions and aid in future conservation.

I recently returned to South Africa to continue my work investigating neurological mechanisms of social behavior in African carnivores. I work with a naturally occurring hormone called oxytocin, which is present in all mammals. I administer oxytocin to animals to test whether it can be used as a noninvasive management tool.

My studies have shown that oxytocin increases prosocial behavior in lions within familiar group contexts, and that it decreases vigilance towards out-group “intruders.” This is exciting because it has led to the next chapter of my work testing whether oxytocin can help ease the experience of introducing lions.

Lions rescued from circuses, private owners, etc., that were badly abused and neglected show heightened fear and aggression to their environment, and especially to potential companions. Oxytocin helps ease these negative effects in the animals, making them more relaxed and willing to bond with other individuals. Given that lions are social animals, it is best to house them in pairs or groups, but their innate territoriality makes it difficult to match them up with others, especially after a lifetime of abuse. My preliminary findings suggest that twice-weekly intranasal administration of oxytocin assists these animals to bond with each other, enabling them to live a less stressful, more companionable life in better welfare conditions.

Additionally, reserves build fences to prevent lions from harming people in neighboring communities, but these

barriers prevent genetic transfer between populations.

Current management practices often involve creating new prides to maintain genetic diversity. However, this process is stressful to the animals. They often fail to bond, and the introductions can even be fatal. Rather than continuing to use Prozac or tranquilizers to reduce aggression, oxytocin would be a much more natural and less invasive strategy that I will soon be implementing to assist in the conservation of wild lions in South Africa.

This year, I will also start working with captive populations of tigers and wild dogs. Not only will I implement the use of oxytocin to aid in the welfare, quality of life and safety of all of these species, but cross-species comparisons will also help clarify how social behavior has evolved across different species.

My research has been partly funded by the Academic Health Center for its implications in understanding human autism. This aspect of my work focuses on the cellular structures in the brain that are responsible for social decisions. Because lions and tigers are so closely related yet have opposite social behaviors (lions being highly social and tigers being solitary), they provide an excellent model for comparison. – Jessica Burkhart

Jessica Burkhart is a Ph.D. candidate working for the Lion Research Center. She is examining the link between oxytocin and social behavior in lions, to see if this can be used to help bonding during lion relocation.



Maasai Mara in focus

Abby Guthmann describes her work studying the impact of cattle in the Mara reserve in southern Kenya.

The savannas of East Africa support a greater diversity of large herbivores across a wider body size range than anywhere else on earth — from the diminutive dikdik antelope to the iconic African elephant. In addition to this abundance of wild species, the grasslands of Kenya's Maasai Mara have supported nomadic pastoralists and their cattle for thousands of years! Because of this history, the relationship between domestic and wild species is complex. Cattle can act as competitors when drought or seasonal variations in rainfall limit food availability, but when resources are abundant, increased herbivory can stimulate grass growth and facilitate the grazing of smaller herbivores. This may in part inform why, despite relatively high densities of livestock, pastoral areas remain important and even preferred habitat for migratory grazers such as wildebeest and gazelle.

Today, changes in traditional land use threatens this incredible and diverse ecosystem. Human and livestock density has rapidly increased along the edges of protected habitat, and agricultural development within this ecosystem further increases human-wildlife conflict by reducing available habitat for wildlife. To counter these effects, a network of community-led conservancies has formed as a buffer between Kenya's Maasai-Mara National Reserve and intensifying land pressures to the north. By forming community trusts with Maasai pastoralists, conservancies aim to diversify sources of income through wildlife tourism, improve land management to maximize livestock revenue, and conserve critical spillover habitat for wildlife.

Investigating how cattle may impact wildlife in the species-rich habitat of Kenya's Maasai Mara is essential for the long-term sustainability of this region. I established my research at the northern edge of the Mara conservancy system where wildlife from Kenya's Maasai Mara National



Reserve and cattle from Maasai herds live and graze on the same landscape.

In collaboration with surrounding community members, I have deployed remote camera traps to characterize “when” and “where” wildlife move and forage in intensive cattle-use areas, which can indicate the potential long-term success of these pastoral areas as bastions of biodiversity in an increasingly cultivated landscape. We are additionally examining the driving mechanisms of species distributions by manipulating cattle presence to measure changes in plant communities. We will also collect and analyze dung samples using DNA barcoding to investigate how wildlife and livestock species may overlap in their diet. This research will offer insight into how resource competition with cattle may drive wildlife spatial-temporal patterns within this critical habitat. – Abby Guthmann

Abby Guthmann is a Ph.D. student and a member of the Lion Center team. She studies how livestock grazing impacts ecosystem functioning and food-web dynamics in Kenyan conservancies.

Interested in supporting the work of the Lion Center? **Go to z.umn.edu/lioncenter**, where you can donate to the Center's overall activities. Or If you'd like to support a specific researcher, just note their name under Special Options > Add Special Instructions!

Fieldwork from afar

Unable to do field work, Natalia Borrego launched new collaborations and communicated her science.



Over the past year, I have been busy with data from our Lessons of the San project. The Lion Center researchers work with the San peoples of Botswana to investigate factors that influence lion predation behavior.

The San people have lived in the Kalahari for ~20,000 years and are well known for their outstanding animal-tracking abilities. San trackers spend most of their lives as hunters and gathers, following a tradition of tracking and interpreting wildlife spoor (e.g., lion footprints). By employing San trackers, I could gather data on African lion hunting behavior at an otherwise impossible level of detail and build on the traditional field craft skills of the San people.

I received the Max Planck Institute of Animal Behavior's Collaborative Research Grant, which will support new initiatives in my research with the Lion Center, Leopard Ecology and Conservation (LEC), and the San trackers.

One such initiative is a collaboration with WildTrack, an organization that developed a "Footprint Identification Technology" (FIT) tool. The FIT tool can be used to infer species, age-class, sex and individual identification of an animal from footprints. Fortunately, LEC and the San trackers in Botswana have been able to carry on with data collection amidst the pandemic, and they've been busy collecting the footprint data that we need to begin identifying individual lions

from their tracks. By integrating the FIT tool (to identify who is who) with the San trackers' abilities to infer behavior and social interactions, scientists will be allowed unprecedented "observation" into the social dynamics of hunting behaviors among the Khutse lion groups.

Although unable to travel to the field this year, I continued my research in local zoological facilities. I am working with Beni-Suef University and Giza Zoo to investigate the impact of pandemic-related lockdowns on captive carnivores. My co-PI, Dr. Hamada Mahmoud, and I have been overseeing student collection of lion, tiger and hyena fecal samples during and after lockdowns from zoos around Egypt. Once analyzed, the fecal samples will give a snapshot of animals' stress levels around the time of collection and provide insights into factors such as zoo visitor density, which likely affect zoo animal welfare.

Over the past year, I continued communicating about science to broad audiences and was involved in several popular press productions. I served as scientific consultant for the PBS documentary *Nature's Fear Factor* and for the Apple TV series *Earth at Night*. I also co-hosted a web series titled *Animal IQ*. The series aired spring 2021 on PBS Terra. – Natalia Borrego

Dr. Natalia Borrego's work focuses on the evolutionary links among social, ecological and cognitive complexity in lions.

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The Lion Center's mission is to tackle the complicated issues around lion conservation through advocacy for direct international funding for African wildlife reserves and development of innovative strategies to protect both lions and vulnerable human communities in an ever-evolving landscape.

Support evidence-based conservation.

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