UNDERSTANDING THE IMPACT OF GLOBAL CHANGE ON EAST AFRICA'S SAVANNA ECOSYSTEMS

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As the "birthplace" of humankind, the East African landscape almost universally touches a chord within the human heart. Vast savannas, expansive skies and plains teeming with primordial herds captivate the attention, inspire the mind and intimate a sense of connectedness with our ancient origins. Unfortunately, like many of the world's wild areas, these extraordinary landscapes are increasingly imperiled. Human activities are rapidly transforming East Africa's wild areas, and work in our lab is focused on understanding the consequences of these changes for ecological communities and processes.

Our research is staged in Laikipia, Kenya, and currently encompasses three broad themes – the consequences of large mammal declines and extinctions for African rangelands, the impact of biological invasions on savanna communities, and the ecology and evolution of cooperative interactions among species—called "mutualisms"—and the consequences of their disruption. In this report we discuss our work on the effects of mammal extinction on African savannas; we'll be back in future years to talk more about the other two research themes.

In contemporary time, thousands of species have gone extinct and tens of thousands of local populations have been extirpated as a consequence of human activities. Although we sometimes possess detailed knowledge about their causes, we know much less about the consequences of these extinctions for ecological systems. Even in cases where extinctions result from the targeting of particular species (e.g., through trophy hunting), the effects of these extinctions can reverberate through food webs, yielding surprising consequences for community structure and ecosystem function.

At the Mpala Research Centre in central Kenya, our work centers on a long-term experiment, established in 2008 by Jake Goheen, Rob Pringle and Todd Palmer. Dubbed UHURU, for "Ungulate Herbivory Under Rainfall Uncertainty," the experiment comprises four treatments, each applied to nine replicate 1-ha plots. The treatments exclude successively smaller-bodied subsets of the large-herbivore fauna using electrified fencing, thereby simulating a process of size-biased extinction. Megaherbivore-exclusion fences exclude only elephants and giraffes; mesoherbivore-exclusion fences exclude all species larger than ~40kg (including eight species of bovids and equids, along with elephants and giraffes); total-exclusion fences exclude all herbivores larger than ~5kg (the diminutive dik-dik, along with all larger species). For comparison with these fenced plots, we have a set of unfenced control plots that is accessible to all species. The 36 total plots are distributed across a natural rainfall gradient, enabling us to study how the strength and direction of herbivores' effects depend on climate; similarly, the longitudinal dataset from this experiment will enable us to assess the impacts of droughts and other environmental fluctuations.

From these studies, we have learned (among other things) that herbivores of different sizes play important and complementary functional roles in controlling invasive woody shrubs; that climatic stress (and drought in particular) mediates the strength of herbivore impacts on plant populations; and that large carnivores like leopards and African wild dogs make savanna tree communities less thorny by altering the foraging patterns of impala. Ongoing projects include research by M.Sc. student Travis Guy, who has been investigating how the loss of large mammals indirectly influences communities of pollinators by affecting the composition and abundance of flowering plants. University of Florida undergraduate students have also participated in this research during Summer A session through the "Field Ecology in Africa" program, run through the UF International Center and directed by Todd Palmer.

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