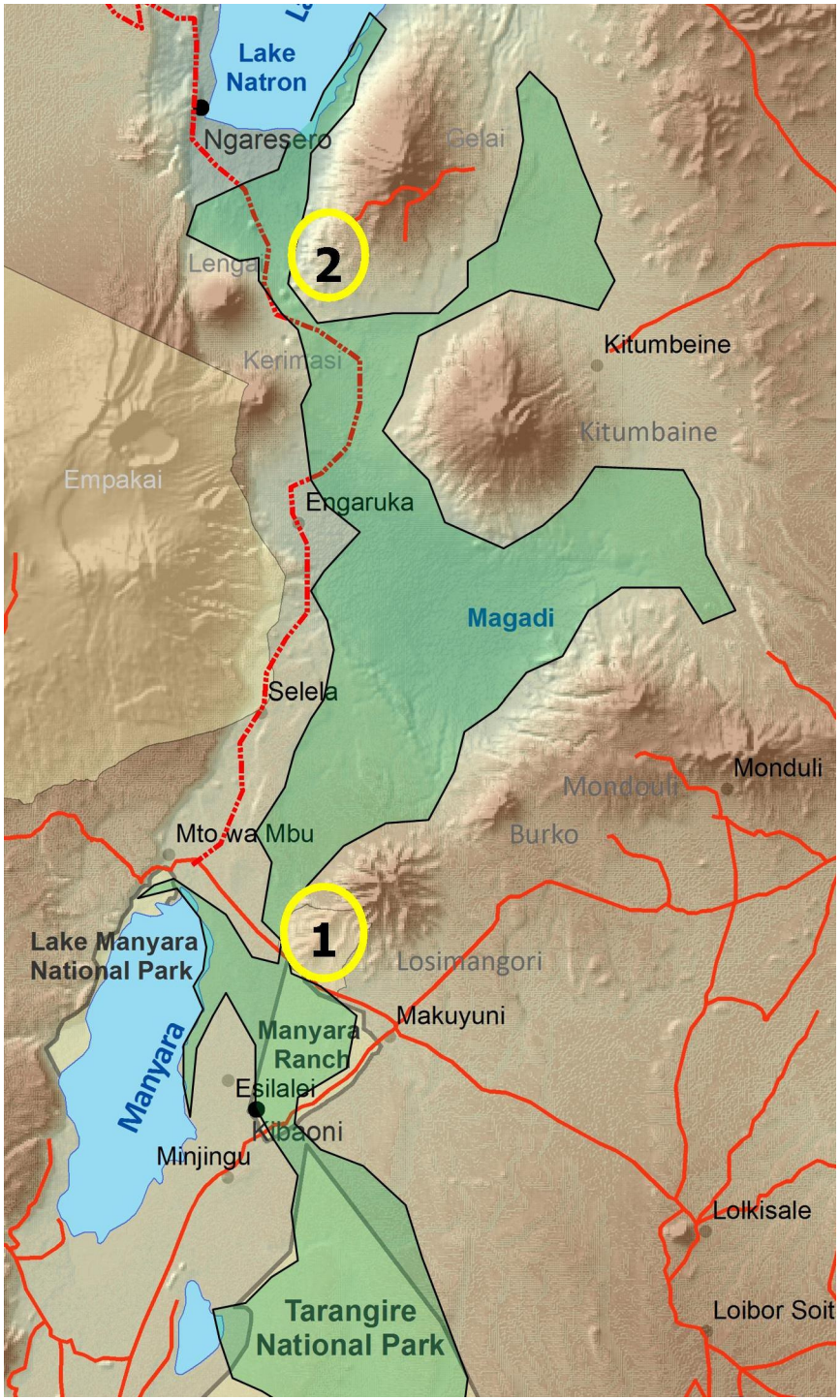
Wild Nature Institute Research in the Tarangire-Manyara Ecosystem

Currently our research focus is the dry savanna habitat of the Tarangire-Manyara Ecosystem of northern Tanzania. Savannas are tropical ecosystems with grassland and scattered trees and pronounced wet and dry seasons. The Tarangire -Manyara Ecosystem is among the richest areas on the planet for large mammal diversity and abundance, and is a world hotspot for ungulate diversity. Ungulates are mammals with hooves.

Here is a map of our study area in the Tarangire-Manyara Ecosystem. The green area is the land used by migrating ungulates like wildebeests, zebras, gazelles, elands, and oryxes. The "1" and "2" are pinch points in the migration routes.

Map courtesy of Dr. Tom Morrison



Hoofed Mammals: Ungulates in the Tarangire-Manyara Ecosystem

Artiodactyla (related to whales!)
Even-toed

Ruminants
- Bovids
- Giraffes

Non-ruminants
- Warthogs
- Hippos

Perissodactyla (related to carnivores!)
Odd-toed

All non-ruminants
- Zebras
- Rhinoceroses

Number of Ungulate Species in the U.S.A. = 11

Number of Ungulate Species in Tanzania = 42

Number of Ungulate Species in the Tarangire-Manyara Ecosystem = 22
(but one, the rhinoceros, is recently extinct due to poaching)

We will walk you through some slides of the 19 different species of ungulates that we monitor in the Tarangire-Manyara Ecosystem, and then we'll explain about the evolution of ungulates and why they are so important in the savanna ecosystem.

Hoofed Mammals: Non-ruminants

Four species of non-ruminants occur in the Tarangire-Manyara Ecosystem, but we are only counting one, the zebra.

Family Equidae

- Genus Equus evolved only 2 million years ago in North America, but spread to the old world and the Burchell's zebra is now one of Africa's most adaptable and successful grazers .
- Pioneer that crops the taller vegetation and prepares it for wildebeests, gazelles, and others.
- Migratory.

Burchell's zebra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Why Do Zebras Have Stripes?
THREE HYPOTHESES
1. Confuse predators 2. Repel tsetse flies 3. Communicate with each other

Hoofed Mammals: Ruminants

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The rumen has a superior ability to convert cellulose into digestible carbohydrates. This is accomplished by symbiotic microorganisms (bacteria, protozoans, yeast) that digest cellulose by fermentation in the multi-chambered stomach. Ruminants also re-masticate, or "chew their cud" to further break down plant fibers. Dung consists of hard pellets with little plant material.

There are two families of ruminants in the Tarangire-Manyara Ecosystem: the Bovidae and Giraffidae.

Family Bovidae, the antelopes and buffaloes, is divided into many tribes. There are 8 tribes of Bovidae, consisting of 17 different species, in our study area of the Tarangire-Manyara Ecosystem.

Family Bovidae

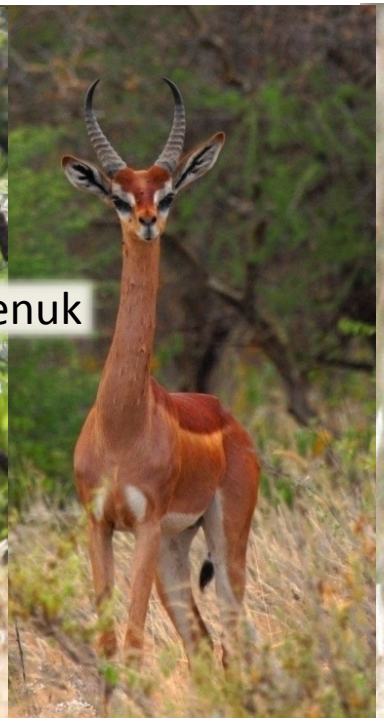
Dwarf Antelopes – tribe Neotragini

- World's smallest antelopes.
- Highly selective feeders: mostly browsers.
- Sedentary (non-migratory).

Family Bovidae

Tribe Antilopini

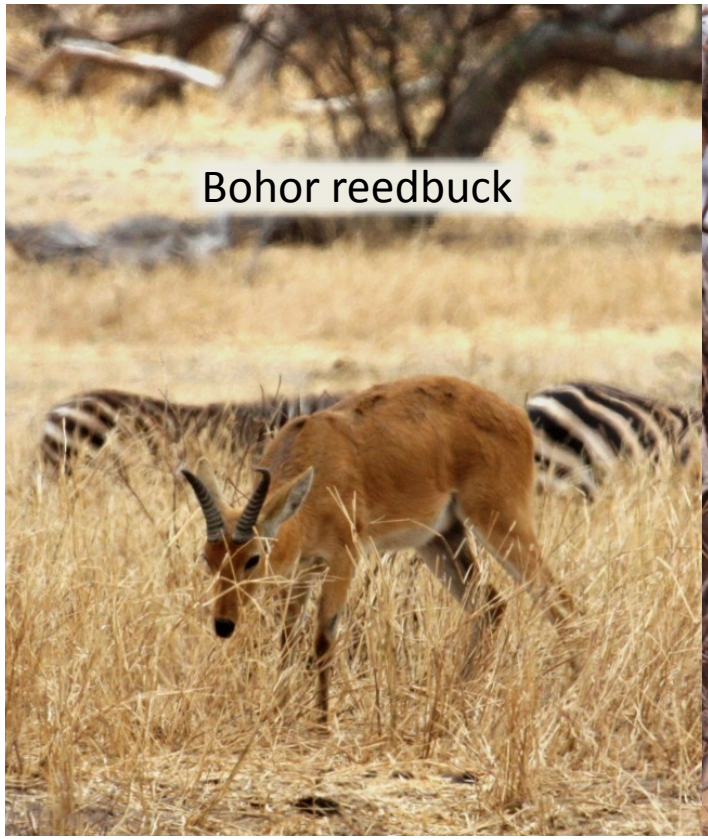
- The greatest number of species and most widely distributed tribe of antelopes (from South Africa to China!)
- Highly selective feeders: browsers and grazers.
- Sedentary and migratory.



Family Bovidae

Tribe Reducini

- Most water-dependent tribe of antelopes, invariably found within a few kilometers of water.
- All are grazers.
- Sedentary.



Family Bovidae

Tribe Hippotragini

- Ecologically diverse tribe; oryx adapted for subdesert conditions, built for long-distance travel, and able to gain water from plants without drinking.
- All are mostly grazers, but browse to gain water and protein.
- Sedentary or migratory; oryx is migratory.

Photo from AWF website

Family Bovidae

Tribe Alcelaphini

- Archetypal plains antelopes, preferring the most open available landscapes with the shortest grasses.
- All are grazers.
- Migratory (especially wildebeests!).

Eastern white-bearded wildebeest

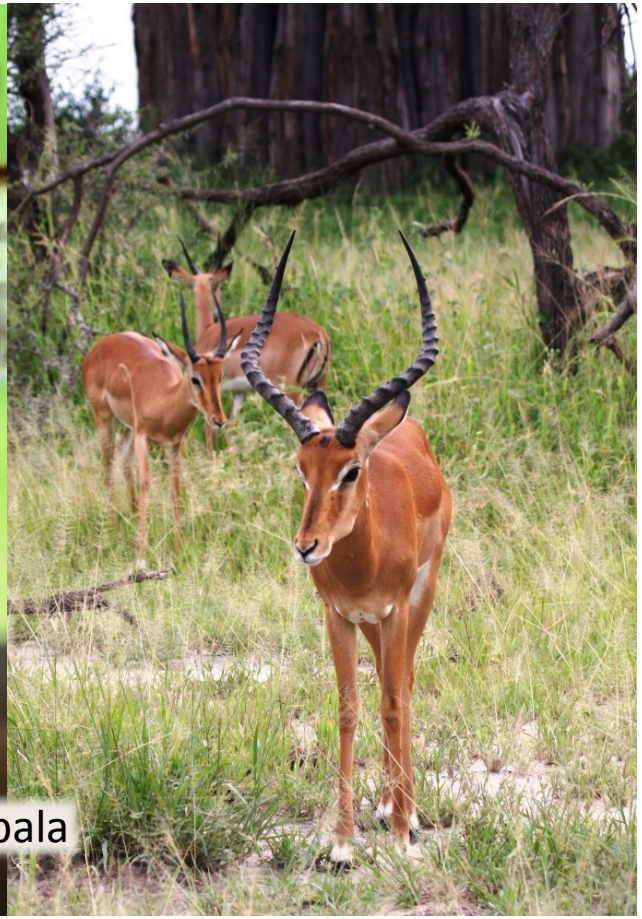

Coke's hartebeest

One species in tribe: Impala

Family Bovidae

Tribe Aepycerotini

- Edge (ecotone) species, preferring light woodland with little undergrowth and grassland of low to medium height; needs free water, but only in dry season.
- Individuals both graze and browse: highly adaptable diet in different habitats and seasons, allowing impalas to be sedentary and reach high densities.

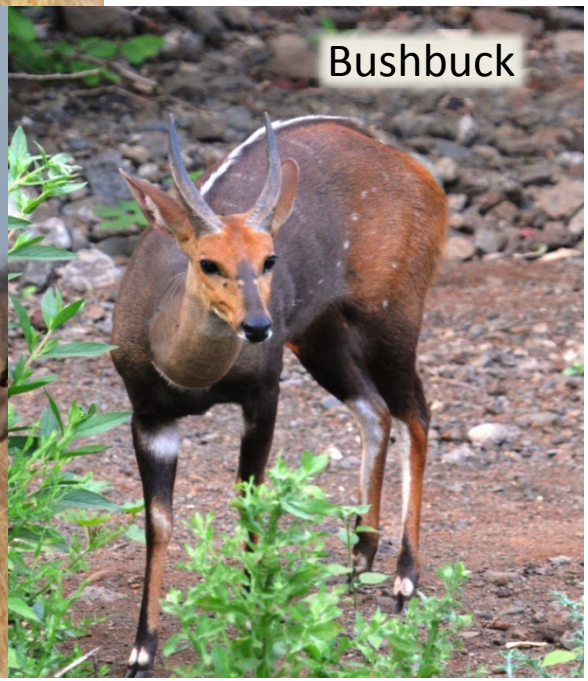


Impala

Family Bovidae

Tribe Tragelaphini

- Beautiful patterns and spiral horns.
- Mostly browsers dependent upon heavy shrub cover, and are solitary and sedentary (except eland).



Family Bovidae

Tribe Bovini

- Largest, most massive bovids.
- Graze on tall, coarse, rough grass and depend upon free water. Seasonal movements but not “migratory.”
- Inhabit wooded or forested country interspersed with glades. Highly gregarious.

African buffalo

Family Giraffidae

- Only two members of this family in the world: Giraffes and Okapi.
- Tallest animal in the world. Selective browser that feeds high in the tree canopies.
- Sedentary but large home ranges.

Maasai giraffe

Ungulate Evolution and Diversification

~ 65 mya – Dinosaurs disappear, opening up the world for mammal radiation.

~ 55 mya – First ungulates appear (browsers) in North America and Eurasia.

~ 37 mya – Global climate cools. Artiodactyls radiate while perissodactyls decline.

~ 25 mya – Temperatures warm. Grassland habitats begin to spread in Northern Hemisphere. Land bridge forms between Eurasia and Africa. Ungulates spread into Africa. First pure grazers evolve 10 mya.

~ 7-5 mya – Massive invasions of Eurasian genera into Africa, causing "faunal revolution." Modern forms of giraffe, warthog, and bovids appear. Polar ice caps form.

~ 2.5 mya – Isthmus of Panama forms, disrupting circum-equatorial circulation. Aridification of East Africa and establishment of extensive grasslands/savanna here. Modern Equus appears. Ice ages begin.

~ 1 mya – Sahara Desert forms a barrier to inter-continental movement. Most Eurasian ungulates become extinct in Ice Ages but animals cannot re-colonize Eurasia due to barrier.

RESULT = Sub-Saharan Africa is final refuge of Plio-Pleistocene mammals

Why are ungulates so important?

In the Masai Steppe Ecosystem alone, there are 22 species of ungulates! Ungulates are very important grazers (of grasses and herbs) and browsers (of trees and shrubs). By eating vegetation and processing it through their digestive system, and because they are important prey for a whole host of predators and scavengers, ungulates are key animals in the shaping and maintaining of the ecosystems where they live.

Every day, millions of herbivores eat tons of grass, excreting vast amounts of seed-filled dung. Dung beetles feast upon and live within these droppings, which also provide a nutrient-rich food source for the beetles’ larvae. Entomologists believe the savannah and many of its plants and animals depend upon the ecosystem services provided by dung beetles. More than 100 species of dung beetle have been recorded in Serengeti National Park alone, with different strategies in how they utilize the dung. “Roller” beetles create a ball of dung up to 40 times their body weight and can transport it up to 70 meters away, thus spreading nutrients over a large area. “Tunneller” beetles bury their balls of dung, helping the plant seeds within to germinate.

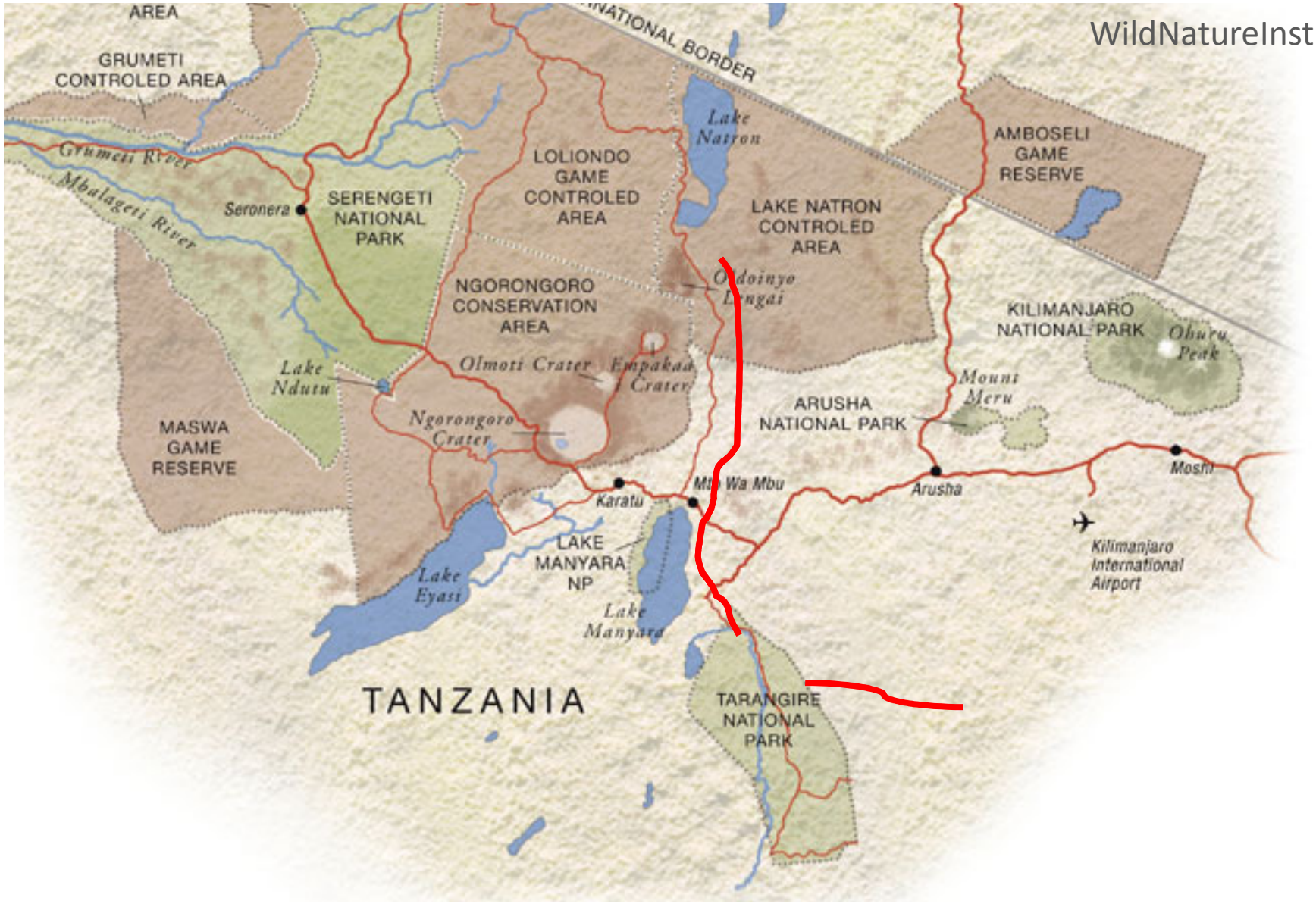
Wild grazing ungulates also provide an important ecosystem service for humans: less selective feeders like buffaloes and zebras reduce tall grasses to the height preferred by selective feeders, including domestic cows and goats. The shorter grasses are more nutritious.

Because there are so many different species of ungulates in the Tarangire-Manyara Ecosystem, there are also many different kinds of predators and scavengers that depend upon them for food.

The region's wildlife is not only ecologically priceless but is a critical part of Tanzania's economy. Ungulates figure prominently in photographic tourism as icons of wild nature and symbols of a nomadic existence that has been lost in much of the rest of the world. Wildlife-based tourism represents an important long-term source of income because these animals are an infinitely renewable resource – but only as long as wildlife populations are managed sustainably.

Tarangire: A Critical Dry-season Refuge

Ungulates range widely through the Tarangire-Manyara Ecosystem, and some, like zebras and wildebeests, have long seasonal migrations in search of forage and water. The animals migrate because they need water from Tarangire River during the dry season (the only place in the whole region with reliable water), and volcanically enriched calcium and phosphorus-rich grass for healthy milk during the breeding season – but that grass only grows outside the park.



Just 50 years ago, there used to be more than 10 different migration routes in and out of Tarangire National Park but **now only two remain**. The others have all been lost due to human settlements. Large areas are effectively unprotected from poaching or habitat conversion, which poses a particular problem for those migratory species.


Unfortunately, the Tarangire-Manyara Ecosystem is now experiencing severe losses of wildlife due to rampant poaching of wild animals for bushmeat and continuing habitat loss from a rapidly growing human population.
PHOENIX
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The Tarangire-Manyara Ecosystem has no monitoring of ungulate populations except sporadic and non-standardized aerial surveys, so authorities cannot scientifically manage habitat, identify poaching-induced declining populations, establish proper hunting quotas, or judge whether conservation efforts are succeeding. Our project goal is to develop and implement an effective, long-term monitoring program of the region's ungulate populations to enable conservation and sustainable management of this critical natural resource, with a detailed focus on demography of giraffe, an indicator of the overall health of savanna ecosystems.

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Our Ungulate Research

Our Ungulate Research Objectives

- **Determine the seasonal spatial distribution of 19 ungulate species during wet and dry seasons and identify movement corridors of migratory species.**
- **Estimate seasonal densities for all ungulate species using distance sampling.**
- **Estimate site-specific population size, seasonal survival, reproduction, and movement rates of giraffe using photographic capture-mark-recapture methods (see giraffe slideshow).**

We are conducting systematic road surveys for19 species of ungulates. Road-based distance sampling surveys are useful because they are less expensive than aerial surveys, find small and hard-to-detect species that are unobservable from the air, and can be easily repeated to estimate population trends. We drive established routes counting every ungulate and measuring the distance from the road. This allows us to account for differences in detectability of different species in different habitats and seasons. Using this information we can then obtain precise estimates of the densities of each of these species during each of our surveys. We are conducting these ungulate surveys 3 times per year.

Our ungulate monitoring data will help wildlife authorities to identify poaching-induced declining populations, establish proper hunting quotas, and evaluate conservation efforts. We also offer training to interested management authorities so they can understand our protocols and potentially use them in monitoring efforts for other regions. With our research and conservation efforts, we hope to provide effective conservation measures to ensure a safe future for ungulates – and all life that depends upon them – in the spectacular Tarangire-Manyara Ecosystem.