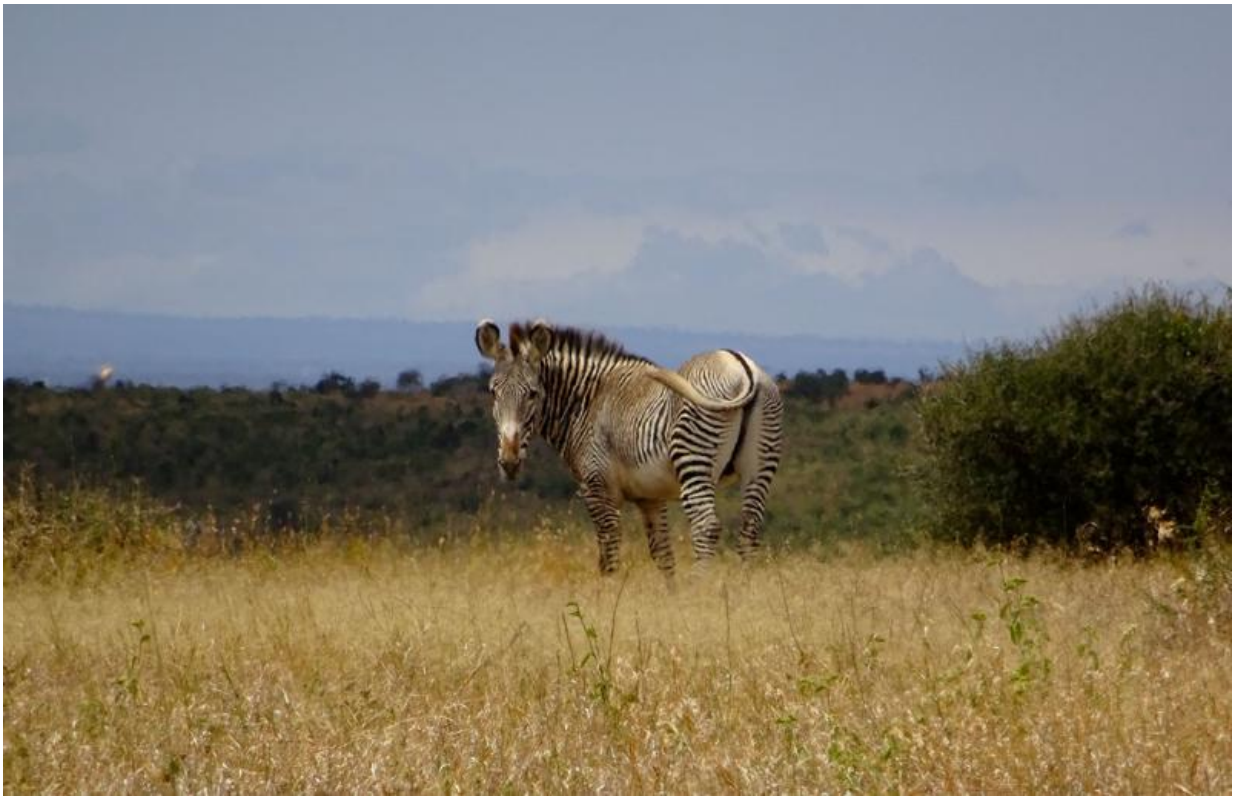
Bringing people together as scientists to save a zebra species

September 16 2016, by Morgan Kelly



On Sept. 3, results were announced for the Great Grévy's Rally held in Kenya in January. The Princeton-sponsored event used 40,000 photos collected by 500 volunteers to precisely quantify the remaining wild population of the world's largest and most imperiled wild horse species, the Grévy's zebra (pictured). The initiative was among the first to use "citizen scientists" to establish the population and range of an endangered mammal. Credit: Morgan Kelly, Office of Communications

For 30 long minutes, the two safari buses trundled across the dry bushland of northern Kenya. Rocks and a haze of red dust kicked up from the rough and pitted road. The sun seared through the cloudless sky and thin air of the high escarpment, illuminating the leaves and long blanched thorns of the acacia trees.

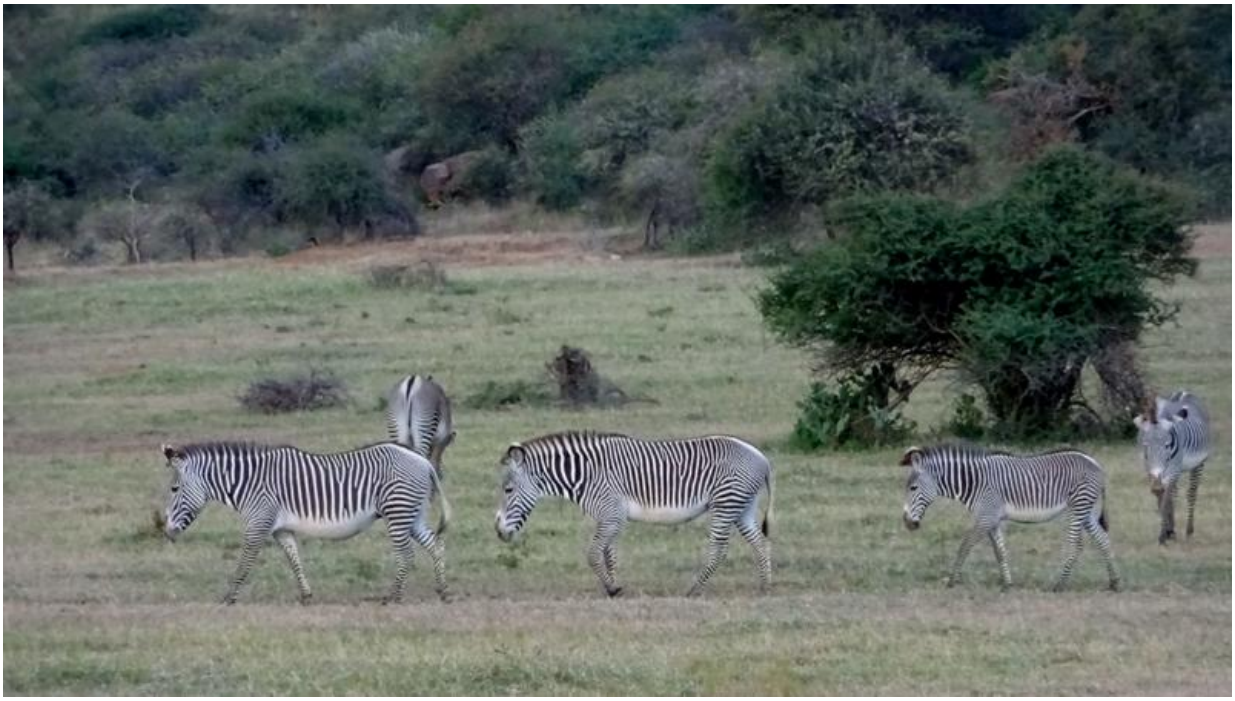
The roughly 40 people in the buses snapped photos of giraffes languidly plucking treetops clean, or of small families of elephants crushing and eating the dense and brittle vegetation mere feet from the road. But a specific animal had brought these people out in the midday heat and it had yet to appear.

Then, on the lead bus, a passenger called out, "Behind that tree—tell the driver to stop!" Everyone called out the instruction and the bus lurched to a halt. To the right, a herd of plains zebras, with their iconic stripes of white and black, milled about an open patch of grass. But from behind the tangled branches of an acacia, larger, leaner striped heads emerged—first one, then two more—stepping out until their white underbellies shimmered in the undulating lines of heat rising from the ground.

From his seat at the front of the bus, Dan Rubenstein, Princeton University's Class of 1877 Professor of Zoology and professor of ecology and evolutionary biology, and director of the Program in Environmental Studies, stood and turned toward the window, quickly raising his binoculars to his eyes. "There they are," he said. "Those are Grévys—aren't they incredible?"

In hushed awe, those aboard the buses busily photographed the three males belonging to the largest and most threatened species of wild horse—the Grévy's, or imperial, zebra. Many of these people had made a personal effort to save this creature, and now they reveled in its silent and stately stillness.

The excursion was one of several events held in Kenya on Sept. 3 to conclude a months-long effort known as the Great Grévy's Rally that was intended to find out precisely how many Grévy's zebras remain in the wild. Supported by Princeton and numerous Kenyan and American institutions, the initiative was among the first campaigns to use data collected by "citizen scientists"—members of the general public with little or no scientific training—to establish the population and range of an endangered mammal species.



Female Grévy's zebras traversing a grassland. The rally revealed that 2,350 Grévy's zebras remain in the wild, 95 percent of which live in just five counties in the arid bushland of northern Kenya. The Grévy's zebra is distinct from the smaller plains, or common, zebra for living in open societies where males continually compete for groups of females. Credit: Morgan Kelly, Office of Communications

At the end of January, roughly 120 teams made up of 500 volunteers from conservation groups, government agencies and the general public set out for two consecutive days to photograph Grévy's zebras in the five northern Kenya counties where the animals are known to exist.

Sporting GPS-enabled cameras purchased with support from the National Science Foundation, the teams covered the 9,650 square miles (25,000 square kilometers) of the animal's range and collected 40,000 photos of Grévy's zebras. The photos were analyzed using specially developed pattern-recognition software to identify individual animals.

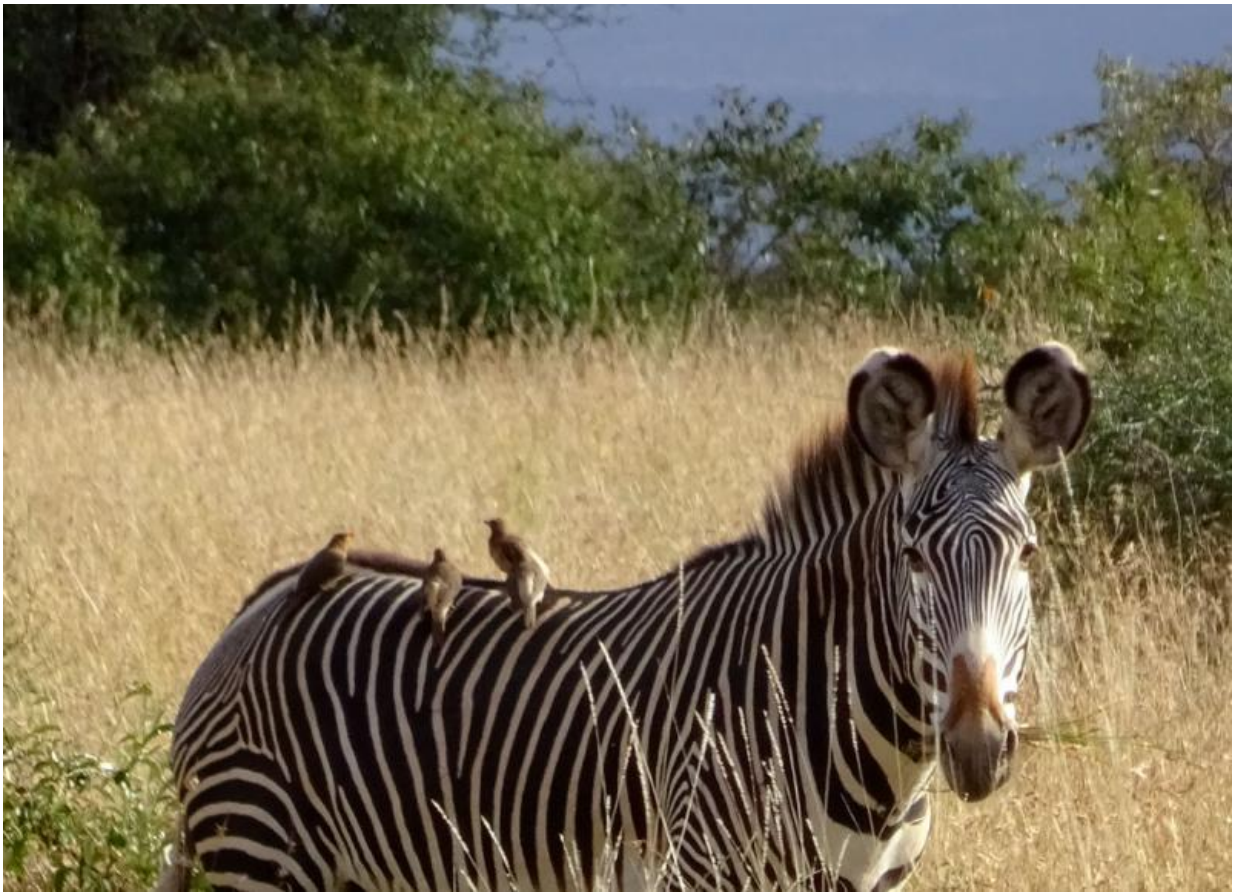
On Sept. 3, Rubenstein, the lead ecologist for the rally and one of its key architects, announced the results of the count to a packed room of rally volunteers, government representatives, conservationists and Grévy's enthusiasts at the Mpala Research Center, a multidisciplinary field laboratory that sits on a 50,000-acre reserve. (Princeton currently serves as the center's managing partner, working closely with co-partners the Smithsonian Institution, the Kenya Wildlife Service and the National Museums of Kenya.) Later that evening, many of those same people, plus many more, gathered for the Great Grévy's Ball fundraiser at the Fairmont Mount Kenya Safari Club in Nanyuki to hear once again the results of the rally and commend those who organized and participated in it.

Among those present at both events were rally participant and U.S. Ambassador to Kenya Robert Godec and the governors—or designates—of four of the five counties surveyed. After Rubenstein announced the results, the governors in attendance committed themselves to work to pursue policies that would sustain and strengthen the zebra's population—which is low but stable, as the rally revealed.

The Grévy's zebra's population in the wild stands at 2,350, Rubenstein said. Kenya contains 95 percent of the world's population, with the

highest numbers in Laikipia County where Mpala is located. The 150 Grévy's outside Kenya live in southern Ethiopia and are under the constant threat of being used for target practice and killed for bush meat, Rubenstein said.

"This is an iconic species of your counties—it lives nowhere else in the world," Rubenstein told the audience. "You are the worldwide global protectors of an amazing animal."



A Grévy's zebra with oxpeckers aboard. Rally participants sporting GPS-enabled cameras photographed the right side of the Grévy's zebras they saw. The photos were analyzed using pattern-recognition software that Rubenstein and his collaborators on a project called the Image Based Ecological Information System (IBEIS) developed to identify individual animals. Known as Hotspotter, the

software converts a zebra's unique stripe pattern into a digital identifier that can be quickly "read" from a field photograph, similar to scanning a bar code. Credit: Morgan Kelly, Office of Communications

Although the Grévy's zebra's population falls far short of the more than 15,000 that roamed Kenya in the 1970s—even though large-scale poaching ended 30 years ago —its decline has leveled off, Rubenstein said. The results of the rally showed that nearly 30 percent of Grévy's zebras are infants and juveniles, or "recruits," which indicates the population is producing new generations. The animal's greatest threat is human encroachment, overgrazing by livestock and poor land management, Rubenstein said. Less than 1 percent of the animal's territory is protected.

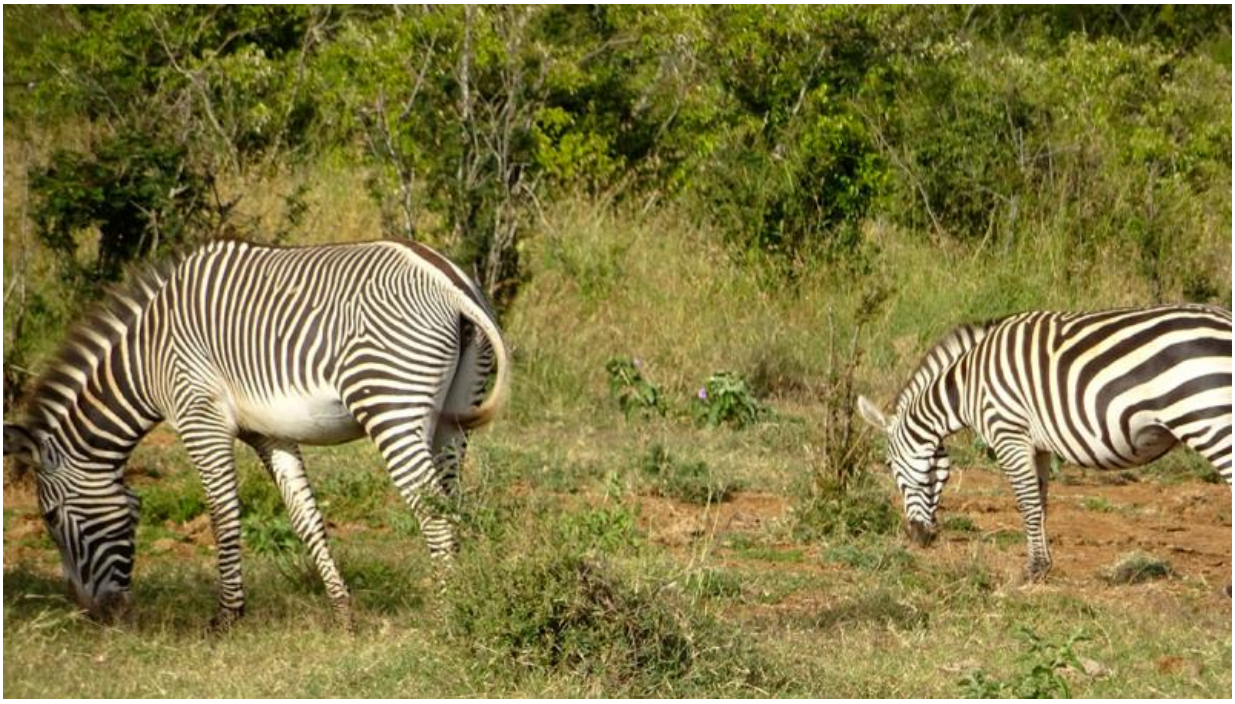
"The rest of the nation has sustainable populations. This was never known before—this is a new result," Rubenstein said. "Despite the fact that Grévy's have been assaulted by humans, they are a species that, when given a chance, can recover. We want to work with you to discuss ways we can keep this species moving forward."

An iconic species in a parched land

Grévy's zebras (Equus grevyi) are larger and leaner than the stout and ubiquitous plains, or common, zebra found in much of southern and eastern Africa. A Grévy's zebra's narrow black bands, ochre muzzle and white, stripe-less belly strike a regal presence on the dry sprawling scrub to which the animal is exclusive. Unlike plains zebras, which live in closed groups called harems, Grévy's zebras live in open societies where members cycle in and out, and males continually compete for groups of females.

The Grévy's zebra's range is just north of the equator, and consists of far-inland, high-elevation arid areas that host tough shrub and grass species. In this environment, Grévy's thrive. They eat fibrous grass stems and seeds, and most can amazingly survive for five days without water (lactating females must drink every day until foals are three months old). Herdsmen from the semi-nomadic Samburu tribe follow the trails blazed by the resilient zebra to find water and grazing areas for their livestock.

Yet the harsh land has worsened from overgrazing and runoff from settlements, said Peter Lalampaa, who works in Kenya's arid Marsabit and northern Samburu counties as field director for the Nairobi-based nonprofit Grévy's Zebra Trust, which works to preserve the animal's habitat and population in Kenya and Ethiopia. Pastoralist tribes that formally moved between grazing lands are increasingly staying put. Their livestock graze the same tracts of land until all that remains are annual grasses that "hardly last a month," he said.



Grévy's zebras (left) are larger and leaner than the plains zebra (right) found in much of southern and eastern Africa. A Grévy's zebra has narrower black bands, an ochre muzzle and a white, stripe-less belly. Also unlike plains zebras, Grévy's zebras prefer the shady cover of trees to lingering in the midday sun, which made previous population counts — typically done by airplane — potentially inaccurate. Credit: Morgan Kelly, Office of Communications

"We're losing our perennial grasses because of how we manage our land because we have gone from a pastoral lifestyle to being sedentary," Lalampaa said. "People want to share the land with wildlife, but the pasture as we know it is disappearing."

Actions to protect Grévy's zebras have been beleaguered by an uncertainty as to how many there are, Rubenstein said. Animal censuses typically take place from above using aerial counts. Unlike plains zebras, however, Grévy's zebras tend not to linger in the midday sun, instead preferring the shady cover of trees. That makes them hard to see from an airplane.

The primary triumph of the rally was to provide a precise accounting of how many Grévy's zebras still exist, Rubenstein said. "If it's precise, it can become policy because people believe it," he said.

Instead of counting zebras from the air, Rubenstein and collaborators on a project called the Image Based Ecological Information System (IBEIS) developed a method of identifying zebras by their unique stripe patterns, much like taking a fingerprint. Software known as Hotspotter converts a zebra's stripes into a unique digital identifier that can be quickly "read" from a field photograph of the animal's right side, similar to scanning a bar code.

The idea for rapid software-assisted recognition originated in 2010 as a student project for a course taught at Mpala by Rubenstein and Tanya Berger-Wolf, a computational ecologist at the University of Illinois-Chicago and a member of IBEIS' core research team. From that, IBEIS core member Charles Stuart, a computer science professor at Rensselaer Polytechnic Institute, improved the original design and developed Hotspotter, which also can identify even more subtle patterns, such as the unique wrinkles in the skin of elephants and rhinoceroses.

"Every time someone took a picture we knew where and when it was, then we did the analyses to find out 'who' it was," Rubenstein said. "That's how we built our database."

A female Grévy's zebra foal. The results of the rally showed that nearly 30 percent of Grévy's zebras are infants and juveniles, or "recruits," which indicates the population is producing new generations. Credit: Morgan Kelly, Office of Communications

For conservationists such as Lalampaa, the database revealed specific areas of concern on which the trust can focus its efforts, he said. In particular, Grévy's zebras appear to be migrating south out of Samburu County, a possible indicator of ongoing degradation of the land and their food supply.

"We see Grévy's as a part of the landscape and we don't want to lose them. They're a critical part of our heritage and a critical part of our ecosystem," Lalampaa said. "We want local communities and other people to see these iconic species as an integral part of the landscape."

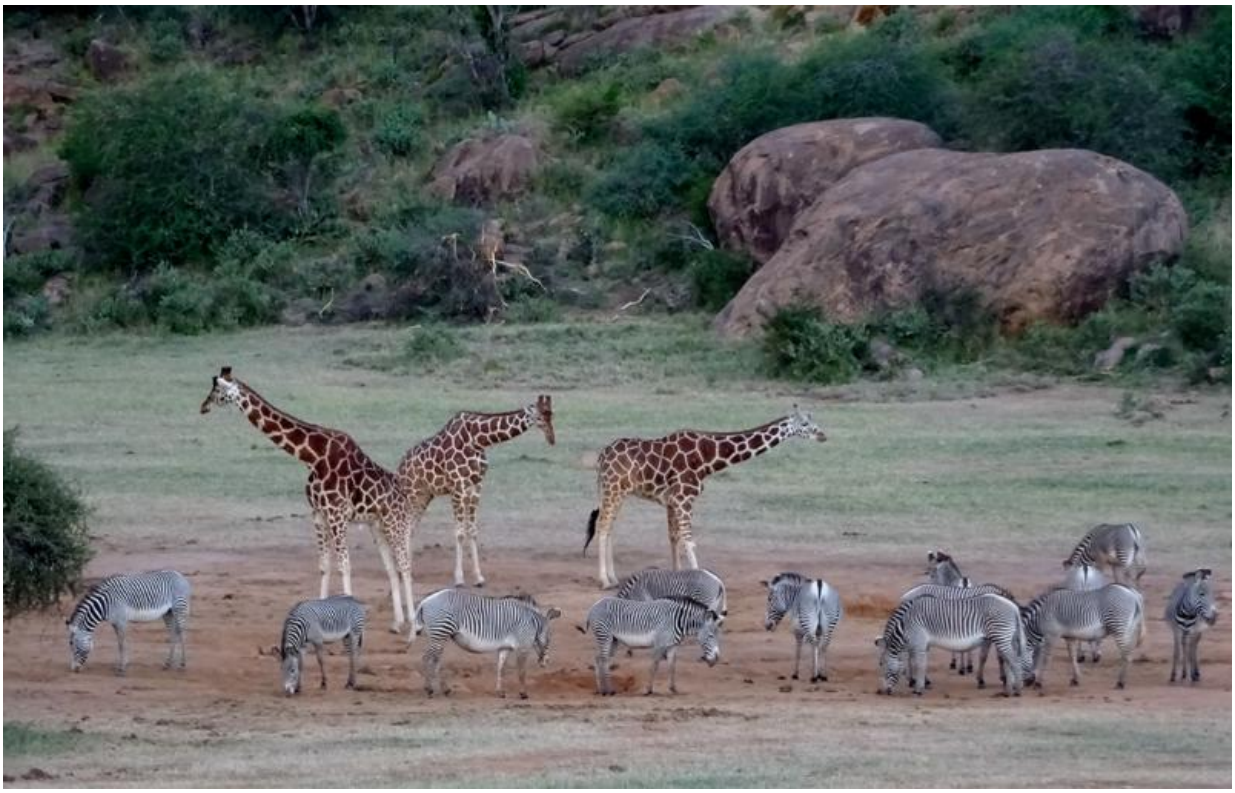
A chance to learn, a time for change

Anna Sharratt and her fiancé, Edwin Magendi, did not much think about zebras until a friend suggested they take place in the rally. Two days of searching out Grévy's at the Loisaba Conservancy in Laikipia County, however, fostered a personal interest in the animal, she said. She and Magendi, after spending all day in the wild, open country and getting their vehicle stuck in thick mud, eventually photographed 29 Grévy's zebras.

"When you go on safari in Kenya, you focus on the cats and the zebras are a side thing," Sharratt said. The knowledge of being part of a larger effort to save the zebra also inspired them, she said: "I liked the idea that even though we were in one place at one time, people all over northern

Kenya were doing the same thing."

"I didn't know anything about zebras and I don't think a lot of Kenyans do," said Magendi, a native Kenyan. "It's because conservation and wildlife are not something we're brought up to appreciate, especially where I come from. Sometimes, you get so used to living around animals, you don't know there is a problem. Now, I do."



A mixed herd of female and male Grévy's zebras alongside giraffes at a salt lick. Although the current population of Grevy's zebras falls far short of the more than 15,000 that roamed Kenya in the 1970s, the decline has leveled off. Nonetheless, less than 1 percent of the animal's territory is protected. Its greatest threats are human encroachment, overgrazing by livestock and poor land management. Credit: Morgan Kelly, Office of Communications

Mohammed Guleid, deputy governor of Isiolo County, said that saving the Grévy's zebras must begin with communicating the animal's cultural and ecological value to Kenya's political leaders. The reverence for wildlife that draws throngs of tourists to Kenya's national parks does not necessarily carry over to everyday life in Kenya, he said.

"I have three parks in my county. From the time I was a child to when I became deputy governor, I never set foot in any of those parks," Guleid said. "I didn't know Grévy's zebras existed until two years ago, and one of the largest populations is in my county. You can imagine how regular people think."

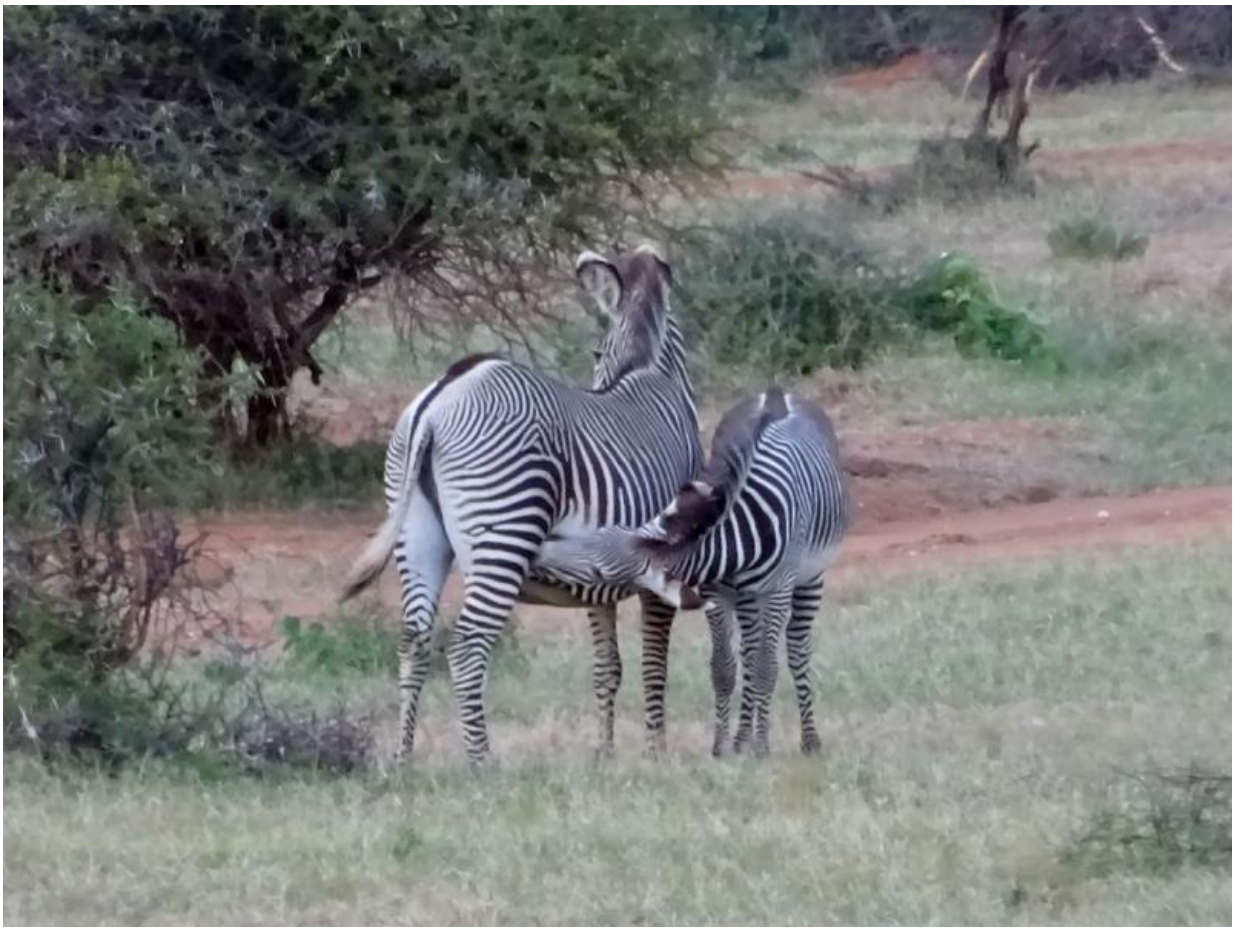
The predominant grievance against Grévy's zebras—and most wild African herbivores—is that they compete with cattle and other livestock for scarce food resources, Rubenstein explained.

Intrigued by zebras since he first studied wild horses in North Carolina during the 1980s, Rubenstein focuses a large portion of his research on exploring how wildlife and livestock interact. In 2011, two papers out of Rubenstein's research group offered the first experimental evidence that allowing cattle to graze on the same land as wild animals can enhance the cows' diet and health. Grévy's zebras in particular consume the rough upper-portion of grass that cows have difficulty digesting, leaving behind the lush lower vegetation on which cattle thrive.

"They're not vermin, they're not problems—they can be very beneficial," Rubenstein said. "For much of the year, they don't compete with livestock but actually help the livestock. They play a mutualistic role, but you need a healthy landscape."

Kitili Mbathi, director general of the Kenya Wildlife Service that oversees most of the country's national parks and reserves, said that the rally confirmed his organization's estimates of the Grévy's zebra's fragile

population. "But it does show us that the decline has plateaued. Our challenge now is to increase the population," he said.



A Grevy's zebra foal nursing. Grévy's zebras thrive in their arid, high-elevation range. Most can amazingly survive for five days without water, with the exception of lactating females that must drink every day until foals are three months old. Samburu herdsmen follow the trails blazed by the zebra to find water and grazing areas for their livestock. Credit: Morgan Kelly, Office of Communications

For that to happen, it is critical to involve county-level politicians and

administrators, Mbathi said. The results of the count could be integral to that effort by proving to local governors that they are uniquely positioned to save the Grévy's zebra, he said.

"We need their support to conserve them and reverse the downward trend," Mbathi said. "All of a sudden, they find out they're sitting on 95 percent of the world's Grevy's zebra population—they're in an incredible position."

Provided by Princeton University

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