

# Western Confluence

Winter 2025, Issue 14

NATURAL RESOURCE SCIENCE AND MANAGEMENT IN THE WEST

## GLOBAL WILDLIFE CONSERVATION

From Serengeti to Yellowstone

Chronic Wasting Disease

Reindeer Pastoralism

Wolves in the Alps



# Western Confluence

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## Western Confluence

*Western Confluence* is a publication of the Ruckelshaus Institute at the University of Wyoming's Haub School of Environment and Natural Resources. It shares on-the-ground, science-based stories about interdisciplinary, collaborative solutions to our toughest natural resource challenges, while supporting new and emerging environmental writers.

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## EDITOR'S NOTE

By Birch Dietz Malotky

When the University of Wyoming brought together a couple dozen managers and researchers from around the world to visit the Greater Yellowstone Ecosystem and discuss international wildlife policy, one reaction stands out to me above all others: "For better or worse, it's nice to see that you're dealing with the same issues we are."

As national parks expert Bob Keiter observes in *Upstream* (p. 49), Yellowstone National Park has served as a model for global conservation since its protection in 1872. Widely heralded as the world's first national park—though Mongolia's Bogd Khan Mountain (p. 2), protected a century earlier, has a strong claim to the title—Yellowstone has continued to be a nursery for innovation in wildlife conservation and land management. From tracking and mapping animal migrations (p. 18), to supporting private land stewardship (p. 21), to collaborating across agencies for landscape-scale management (p. 25), the Greater Yellowstone Ecosystem is truly a leader.

And yet, in today's constantly evolving world, huge challenges remain. Managers and researchers continue to battle invasive species (p. 5) and wildlife disease (p. 10). They look to balance development pressure for food, fuel, tourism, and first, second, and third homes with preserving year-round wildlife habitat. And they work to reconcile what drought, wildfire, flooding, heat waves, and more will mean for the people and animals that depend on these cherished landscapes (p. 43).

As Katie Doyle discovered in Spain's Canary Islands (p. 46), going away can teach you a lot about home. Around the world, people and organizations are working to reduce conflicts between livestock and carnivores (p. 38), reconnect fragmented landscapes (p. 7), and foster community-driven ecotourism that supports both people and wildlife (p. 34). In these shared challenges, there is opportunity to learn from new and experimental thinking unbounded by decades of tradition, as well as the enduring wisdom of a people's age-old relationship to the animals and the land (p. 30).

While this issue of *Western Confluence* is divided into four, cross-cutting themes—evolving threats, patchwork governance, from the roots, and toward coexistence—what struck me in editing these stories was how entangled all the categories were. In the Alps, addressing conflict between wolves and people required coordination across a half dozen countries (p. 14). Climate mitigation strategies had unaccounted-for impacts on the bond between people and reindeer that has shaped the arctic tundra of Sápmi (p. 27). And repurposing a pastoralist community's centuries-old adaptation in Kenya offered an unexpected way to protect lions and the rare antelope they hunt (p. 41).

It's a good reminder that thinking across borders includes looking outside the systems and silos we work in to see the web of cause and effect, problem and solution, that unite people, animals, and the landscapes they share. From tropical forests to African savannah, wet meadows to Mongolia's mountain slopes, please join me on a tour of large landscapes around the world as they work to address the most pressing issues in wildlife conservation and management today.

*Above:* Red dots mark the settings for each story in this international issue of *Western Confluence*.

*On the cover:* Protecting large landscapes is about more than preserving individual species, it's also about sustaining ecological processes and relationships. In the arctic lichenlands of Sápmi, the cyclical migration of reindeer and people is woven into both land and culture. So too has the wildebeest migration shaped the Serengeti, working lands provided refuge for waterfowl and antelope in the Mountain West, and shepherds trod their mark on mountain slopes from the Alps to Mongolia. The story of wildlife conservation, then, is one of abundance, and movement, and coming together as people and animals to share the landscape, face new threats, and care for one another. Ina-Theres Sparrok, a herder in Voengelh Njaarke reindeer herding district in Norway, captures this confluence in the spring migration of reindeer across snow- and ice-covered routes that grow more treacherous with climate change.







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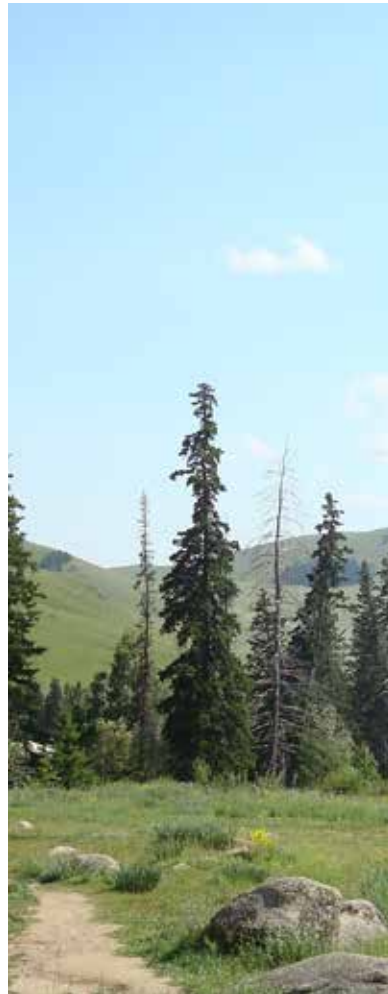
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Arksadam/Wikimedia Commons

At Manzushir Monastery on Bogd Khan's southern slope, prayers for the mountain's protection were a daily ritual.

# The Changing Face of Bogd Khan Mountain

## FINDING A BALANCE BETWEEN TRADITION AND MODERNITY IN MONGOLIA

*By Maria Vittoria Mazzamuto and Sukhchuluun Gansukh*

**Editor's Note:** In this story, authors Mazzamuto and Gansukh imagine the lives of Tserendorj (Цэрэндорж, meaning bravery and wisdom), a herder on Bogd Khan Mountain, and his daughter Tuul (Түүл, named after the Tuul River, symbolizing flow and life), who studies wildlife conservation. Inspired by the authors' colleague—a fellow wildlife biologist who comes from a herding family—Tserendorj and Tuul are composite characters. Their experiences and voices are grounded in an in-person survey the authors conducted with residents of Bogd Khan Mountain and the authors' firsthand experiences on the mountain.

As the sun rises over Bogd Khan Mountain, Tserendorj watches from the doorway of his ger, the round, felt-lined home that has been part of Mongolian life for centuries. The golden light washes over the forested slopes where Siberian larch, pine, and spruce meet the green and yellow steppe of the valleys. This is the place Tserendorj has known since childhood, where he and his ancestors have guided their horses and cattle, along with some sheep and goats, across sacred lands for as long as anyone can remember.



But something feels different. The hum of distant construction breaks the morning stillness, and Tserendorj can see the outline of a new road coming up the mountainside. Tserendorj sighs, reflecting on the changes that have come so quickly, as if the mountain itself is shifting under his feet. "This place has always taken care of us," he says, "but now I wonder how much longer it can."

For centuries, Bogd Khan Mountain has stood as a symbol of resilience, a natural fortress towering thousands of feet over the vast Mongolian steppe. It's not just any mountain; it's sacred. One of the world's oldest protected areas, revered and cared for by the Mongolian people since the 12th century, the mountain became a special protected area almost 100 years before renowned sites like Yellowstone. Generations of monks, nomads, and wildlife have coexisted on its slopes, the mountain shielding them from the rest of the world.

But even this sanctuary is not immune to the tides of change sweeping through Mongolia. At the foot of Bogd Khan, Ulaanbaatar, once a small city in the steppe, has transformed into a bustling capital

home to nearly half the country's population. As its influence creeps up the mountain, the pressures of urbanization are being felt most acutely by people like Tserendorj, whose nomadic lifestyle and spiritual traditions have helped keep the balance between human and nature for centuries.

Tserendorj, now in his sixties, remembers the stories his father and grandfather told him as a child. They spoke of the mountain's spiritual importance, how monks once lived in the Manzushir Monastery on the southern slope, and how prayers for the mountain's protection were a daily ritual. For the nomads, the land wasn't just a resource; it was a living being, revered and respected. "For us, the mountain is alive," Tserendorj says, watching his herd of horses and cattle grazing nearby. "It has given us everything we need, and in return, we have always been careful not to take too much."

This delicate relationship between people and nature was central to Mongolian life. Buddhism and traditional shamanistic practices fostered a deep respect for the environment, ensuring that the mountain's resources were used wisely. Nomadic herding, in

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When I was young, we had the mountain to ourselves. This road, the buildings, they were never here. Now there are people up here all the time, leaving behind trash, scaring the wildlife.

Tserendorj

”

particular, allowed the landscape to rest and regenerate between seasons, leaving little trace of human impact. With the herders' light touch on the land, Bogd Khan's ecosystems thrived, supporting deer, wolves, and the elusive Pallas's cat, all living in the mountain's high altitudes since time immemorial.

But now the city feels uncomfortably close. Tserendorj's daughter, Tuul, travels back from

the city each weekend, where she studies wildlife conservation at the university. She often speaks of the new roads, the ever-growing skyline, and the recreational trails winding up the mountain. The city, she says, offers new opportunities and new conveniences. But Tserendorj is uneasy.

"When I was young, we had the mountain to ourselves. This road, the buildings, they were never here," he says, looking toward the forest where new trails for hikers have appeared. "Now there are people up here all the time, leaving behind trash, scaring wildlife."

Indeed, Bogd Khan has become a hotspot for outdoor enthusiasts. Hikers and cyclists frequent its trails, while pine seed collectors and mushroom gatherers venture deeper into the forest. Roads and construction projects further fragment the landscape, threatening the habitats for all wildlife.

"It's not just the people; there are also more horses, more cows," Tserendorj explains. His own herd has grown larger, not because he wants more livestock but because the pressures of modern life demand it. When Mongolia was a satellite state of the USSR and everything was collectivized, herders had only



Discover Mongolia Travel

Just outside the capital city of Ulaanbaatar, Bogd Khan Mountain is an increasingly popular hiking destination.

as many animals as they needed to live. But after socialism fell in the early 90s, herders took ownership of their own livestock. Now, everyone is focused on growing their herds to secure their future.

The market for meat, wool, and especially cashmere has surged, making livestock one of the few ways to ensure a stable income in rural Mongolia. "People say it's our way to survive the new demands," Tserendorj adds. Yet, there's another reason, too: the climate. Harsh winters—known as *dzuds*—can wipe out entire herds, so herders are building up their numbers to protect against those losses. "It's like a safety net," he says. "If we lose animals, we still have more to fall back on."

As Tserendorj's herd has grown, so has the strain on the land. Overgrazing has stripped the once-lush meadows, and the herding dogs that accompany larger livestock populations have started to chase off and prey on the local wildlife. "It

feels like there's not enough space anymore," he says. "We need to feed our families, but the mountain can only give so much."

Tuul listens intently to her father's concerns. She knows all too well how the pressures of modern life are straining the balance that herders like her father have maintained for generations. But she also sees hope in her studies, hope in the possibility of finding new solutions that can protect both the mountain and their way of life.

One evening, Tuul approaches her father with an idea. She's been learning about new technologies that could help manage livestock and protect wildlife at the same time. "Father," she says gently, "we can't stop the changes that are happening, but maybe we can adapt. There are ways to protect the land and your herd without overusing it."

Tserendorj looks at her, skeptical but curious. "What do you mean?"

Tuul explains that remote sensing can track the movement of livestock and wildlife, ensuring that herders avoid overgrazing in certain areas. She also suggests that by rotating grazing locations more carefully and reducing the number of livestock, they could allow the land to regenerate more effectively. Tuul speaks passionately, her words a blend of her academic knowledge and the deep respect for the land her father has taught her. "We could also work with conservationists and administrations to set aside protected areas for wildlife," she says. "The mountain needs space to breathe, just like our herds."

Tserendorj listens, nodding slowly. Bogd Khan is more than a mountain to him; it is part of his identity, his past, and, he hopes, his future. The old ways have always worked for him, but he sees the wisdom in what his daughter is saying. Perhaps this new generation, with its mix of tradition and science,

holds the key to protecting the mountain and their livelihood.

He imagines a future where his grandchildren walk these same slopes, herding livestock as he once did, while also benefiting from the knowledge and tools of a changing world. "I've always trusted the mountain," Tserendorj finally says, "but maybe it's time we trusted new ways too."

It's that deep connection to the land, combined with a willingness to embrace change, that offers a path forward. After all, this mountain has stood the test of time—and with the right care, it can continue to stand for generations to come.

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**Maria Vittoria Mazzamuto** is an adjunct faculty member of the Haub School of Environment and Natural Resources at the University of Wyoming specializing in wildlife conservation. She has integrated ecology, animal behavior, and conservation biology into her wildlife research, providing a comprehensive understanding of ecological processes, species dynamics, and ecosystem functioning. Over the past few years, Dr. Mazzamuto has been at the forefront of several impactful projects in Mongolia, particularly within the UNESCO Biosphere Reserve of Bogd Khan Mountain. In collaboration with the Mongolian Academy of Sciences, she aims to implement conservation actions to protect small, medium, and large mammals in this region.

**Sukhchuluun Gansukh** is the head of laboratory of mammalian ecology at the Mongolian Academy of Sciences' Institute of Biology. His research focuses on community ecology, rodent physiology, and biodiversity conservation. He currently leads research on mammalian diversity and species interaction in the protected area of Bogd Khan Mountain Biosphere Reserve and non-protected areas around the capital city of Ulaanbaatar that are under human pressure.



Cavan Images/Alamy Stock Photo

The nomadic lifestyle and traditional ecological knowledge of Bogd Khan's herders have shaped the cultural and ecological fabric of the mountain.



A helicopter drops carcass-analog pellets around Carrington Island in Yellowstone Lake.



NPS

# Pellets versus Predators

## A NEW TOOL TO SUPPRESS AN INVASIVE FISH SHOWS PROMISE

By Isabella Sadler

Lake trout—an invasive, predatory trout species first discovered in Yellowstone Lake in 1994—threaten cutthroat trout and the animals that rely on them.

In October 2019 and 2020, helicopters hovered above the pristine waters of Yellowstone Lake, surrounded by an autumn landscape of yellowing aspen trees. The helicopters carried a weight equivalent to 14 small cars—17,000 kilograms of circular, brown pellets—which they released near a small, rocky island in the lake’s West Thumb. The pellets rained down, sinking to the lake’s bottom, where managers hoped they would suppress the thousands of invasive lake trout born in Yellowstone Lake annually. Years in the making, this novel technique targets a life stage that past efforts have been unsuccessful at controlling and shows promise as an effective, low-cost way to eradicate invasive fish.

Yellowstone Lake is home to the largest population of genetically

pure Yellowstone cutthroat trout, a spotted, golden-colored trout native to the western US. This culturally and ecologically significant fish attracts anglers from across the country and serves as a valuable food source for many land mammals and birds in the area. But lake trout—an invasive, predatory trout species first discovered in Yellowstone Lake in 1994—threaten cutthroat trout and the animals that rely on them.

Lake trout eat cutthroat, which led to a severe decline in the cutthroat population after the lake trout population expanded. Lake trout also do not occupy the same ecological role as cutthroat, which has implications for the Greater Yellowstone Ecosystem as a whole. Cutthroat are medium-bodied trout that reproduce in streams connected to Yellowstone Lake, making them

available as food sources for many land animals that pass by streams. Lake trout, however, are much larger and do not access the streams, making it nearly impossible for land predators to catch them. Because of this, fewer cutthroat means less food for brown bears, black bears, eagles, osprey, and more.

To combat this problem, the National Park Service fisheries program began removing lake trout in 1995 with gillnets, which are large nets that entangle fish as they attempt to swim through. While lake trout numbers in Yellowstone Lake have decreased since 2012, the invasive trout persist in large numbers and pose a substantial threat to the cutthroat. In addition, gillnetting is very expensive, and young fish, typically two years old and below, are small enough to slip through the gillnets.



Researchers check the water quality and nutrient content of Yellowstone Lake to monitor potential effects from the carcass-analog treatment.



Cutthroat trout spawn in streams around Yellowstone Lake and are important food sources for bears, eagles, osprey, and more.

Thus, park service biologists sought methods to kill young lake trout before and just after they've hatched. To do this, they targeted where lake trout lay their eggs, attempting to make these spawning grounds inhospitable to the developing fish. After years of research, they developed pellets that mimic the way a decomposing lake trout carcass removes oxygen from the water. Releasing these organic, "carcass-analog" pellets in the water around the spawning grounds reduces oxygen concentrations to lethal levels, smothering lake trout eggs. This only harms the lake trout young because cutthroat spawn in streams far away from Yellowstone Lake.

It's also cost-effective. More than \$2 million is spent gillnetting lake trout in Yellowstone Lake each year, while it's estimated that applying pellet treatments to all known spawning sites would cost just \$250,000 annually. Gillnetting would still be needed to target adult lake trout, but fewer fish hatching each year would slow their reproduction and reduce overall costs.

Park biologists piloted this new method in 2019 and 2020, dropping the pellets on the Carrington Island spawning reef. In the two years following pellet treatments, biologists didn't catch a single lake trout hatchling in traps surrounding Carrington Island, implying that nearly 100 percent of lake trout eggs died at this location. While these results are very promising for controlling young fish, Carrington Island is just one of 14 known spawning sites in Yellowstone Lake. Researchers do not yet know how suppressing hatchlings at one site will impact the lake-wide invasive trout population and would need to treat more spawning locations to determine the pellets' overall efficiency and impact on the lake trout.

Biologists must also consider potential negative side effects of this treatment. Two studies are currently evaluating the effect of pellet treatments on Yellowstone Lake. One project collects tissue

The cutthroat trout population has greatly recovered due to these efforts, but lake trout control will need to continue into the foreseeable future.

samples of algae, zooplankton, macroinvertebrates, and fish to measure the extent to which pellets are incorporated into the food web. The other project evaluates the impacts of pellet treatments on water quality and nutrient dynamics. Because pellets contain nitrogen and phosphorus—nutrients that can stimulate the growth of algae—there is a chance that the pellets reduce water quality and affect other organisms in the lake. While they don't expect unintended effects, biologists want to be certain before expanding the treatment to more spawning sites.

Overall, Yellowstone National Park is moving forward with cautious optimism. The cutthroat trout population has greatly recovered due to these efforts, but lake trout control will need to continue into the foreseeable future. Carrington Island will be treated again in autumn 2024 and 2025, and the pellets' initial success has inspired further development and research. Not only is this new method a milestone in the park's 30-year battle against lake trout, but the work in Yellowstone Lake is paving the way for management in other large, deep lakes where controlling invasive species has been extremely difficult.

*Isabella Sadler is a PhD student in the Program in Ecology at the University of Wyoming. Her research interests involve how invasive species and disturbance alter freshwater ecosystems.*



# Reconnecting the Kinabatangan

CAN THE DANAU GIRANG FIELD CENTRE REFOREST NORTHEASTERN BORNEO IN TIME TO SAVE ELEPHANTS, ORANGUTANS, AND PROBOSCIS MONKEYS?

By Ben Goldfarb

Mammals don't get much odder than the proboscis monkey, a primate that swings—and occasionally swims—through riverside rainforests in Borneo, the vast Asian island shared by Malaysia, Indonesia, and Brunei. *Nasalis larvatus* possesses rusty-brown fur, a rotund pot-belly, and a fondness for leaves and fruit. As its name suggests, though, the proboscis monkey's most notable feature is its pendulous nose, which, in males, can dangle lower than its mouth. The fleshy appendage may serve as a signal of social dominance or an amphitheater for raucous hoots and roars. Regardless, it is perhaps the primate world's most impressive schnozz.

Unfortunately, the proboscis monkey, along with nearly all other Bornean wildlife, faces urgent perils. Most severe among them is the explosion of palm plantations, which supply oil for soaps, biofuels, and a dizzying array of food products worldwide. In the Kinabatangan region, a biodiverse wonderland of forests and floodplains in northeastern Borneo, logging and palm oil production destroyed two-thirds of forest cover between 1982 and 2014. The remaining forest consists mainly of disconnected fragments, islands of habitat in an ocean of palm monoculture.



Rudi Delvaux

Despite their degraded habitat, Borneo's proboscis monkey—along with its clouded leopards, Bornean elephants, orangutans, and other species—have hope. That's thanks in part to the Danau Girang Field Centre, a research station whose many scientists are studying the region's wildlife, combating poachers, and protecting and restoring forest. "It's a landscape that is under huge threats," says Benoit Goossens, the center's director. "But it's still thriving, still harboring biodiversity."

Danau Girang's history dates to the late 1990s, when the Malaysian state of Sabah constructed an education center on an oxbow lake along the Kinabatangan River, which flows 350 miles from mountainous headwaters to the Sulu Sea. The building soon fell into disrepair and remained derelict until 2006, when Goossens, a conservation biologist at Wales's Cardiff University, proposed turning it into a research station. With support from the university and the Sabah Wildlife Department, Goossens and



Rudi Delvaux





Benoit Goossens



Oliver Deppert

After an oil palm plantation encroached on a protected area along the Kinabatangan River, the Danau Girang team began restoring the corridor in 2014 (left strip of forest) and Regrow Borneo replanted the final strip in 2021 (center). The restoration site is framed by river (far left) and palm plantation (far right).

Between 1982 and 2014, logging and palm oil production destroyed two thirds of forest cover in the Kinabatangan region, which connects Borneo’s upland forests to coastal mangrove habitat.

others refurbished the facility, and officially opened Danau Girang in 2008. In the years since, a rotating cast of local and visiting scientists has undertaken a dizzying array of projects, from amphibian surveys to the study of monitor lizard diets. Its staff even managed to attach GPS tags to the necks of estuarine crocodiles.

Yet the center has devoted the most resources to understanding how mammals use Borneo’s landscape. The Kinabatangan is a vital ecosystem in part because it connects two important habitats, upland forest and coastal mangroves. Since the center’s inception, Goossens has placed radio and satellite tracking collars on species as diverse as bearded pigs, Sunda pangolins, and Malay civets to determine how they navigate this corridor, and how to make it more functional for as many creatures as possible. Some species, like Sunda clouded leopards, require thick canopy cover to move through the landscape; others, like Bornean elephants, prefer sparser forests with

lots of bamboo, grasses, and other fast-growing foods. Orangutans are willing to disperse through palm plantations, while proboscis monkeys spend their nights almost exclusively in riparian areas, though they habitually stray as far as several hundred meters from the river’s edge. That’s an eye-opening discovery, given that the state requires

landowners to protect only twenty meters alongside rivers. “We should push for corridors of at least 700 meters,” Goossens argues.

The center’s research has also demonstrated that Borneo’s wildlife faces rampant poaching as well as fragmentation. Pangolins and bantengs—a wild, cow-like mammal—are killed for their

meat, and sun bears are captured for their bile, which is thought to possess medicinal qualities. The compounding pressures of oil palm plantations and wildlife trafficking can be enough to doom populations. Such was the case of the Sumatran rhinoceros, which was wiped from the preserve by horn poachers—an extirpation hastened by a lack of habitat connectivity and genetic diversity, which likely caused some females to develop ovarian cysts.

“If it was only fragmentation, we could potentially sort it out by establishing corridors,” Goossens says. “The two threats together, that’s where species can go extinct.”

That understanding, however, has also allowed the center to pursue solutions along two fronts—starting with law enforcement. To counteract the problem, Danau Girang has used grants from the US State Department to provide specialized training for the Sabah Wildlife Department’s enforcement officers, and to establish a local forensic unit capable of investigating wildlife crime. And,



Benoit Goossens

Sabah Wildlife Department’s Rapid Response Team.



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It's a landscape  
that is under  
huge threats.  
But it's still  
thriving, still  
harboring  
biodiversity.

Benoit Goossens

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of selling carbon offsets to fund restoration.

The idea was potentially fraught. Carbon offsets have recently come under fire for a variety of reasons. For one thing, some offset projects, particularly in tropical forests, have been undertaken without community consent; in one Peruvian park, locals were allegedly evicted to deter deforestation. For another, planted trees may subsequently die, allowing companies to claim credits for projects that aren't actually sequestering carbon. One 2023 analysis by the Guardian deemed more than 90 percent of the offsets purchased by Disney, Shell, and other companies “phantom credits.”

From the get-go, however, Regrow Borneo, Danau Girang's reforestation program, has taken a different approach. Unlike other carbon-credit programs, Regrow Borneo promises to restore hectares of forest rather than individual trees—

which means that it replants after natural flooding or other forces kill trees, and continues to replant until it has successfully regrown forest. The team quantifies carbon sequestration by measuring the mass of trees, deadfall, roots, and other plant matter, as well as sampling soil. Of course, a forest includes wildlife, too—which is why Danau Girang's scientists live-trap small mammals; deploy camera traps for larger ones; conduct nocturnal surveys for amphibians; mist-net understory birds; and even set pitfalls for dung beetles.

Moreover, Regrow Borneo aims to work with communities, rather than at odds with them. Its trees are grown at a nearby commercial nursery, and its two replanting crews are composed of locals. “This helps create sustainable livelihoods in an area impacted by oil palm plantations,” says Amaziasizamoria Jumail, a Danau Girang research officer and PhD student. “The

community's involvement helps them feel ownership and commitment to the project.”

According to Jumail, Regrow Borneo has restored around 30 hectares on the Kinabatangan floodplain so far. With nearly 2,600 hectares still in need of restoration, the project has decades of work ahead to protect and reconnect this corner of Borneo's landscape. Goossens, for one, believes Danau Girang can rise to the occasion. “Nothing is lost; there is still hope,” he says. “We're a very small organization, but we make things happen.”

**Ben Goldfarb** is an award-winning environmental journalist and author of the books *Crossings: How Road Ecology Is Shaping the Future of Our Planet* and *Eager: The Surprising, Secret Life of Beavers and Why They Matter*.

in 2022, it launched three Rapid Response Teams, ranger units that patrol for poaching in and around the reserve. The response teams “hope to eradicate poaching activities and ensure the survival of our national treasures in Sabah,” Yatela Zainal Abidin, the chief executive of the Malaysian philanthropy that helped fund the initiative, told one reporter.

At the same time, the center has aggressively pursued forest restoration. Its approach originated in 2014, when the Malaysian government tasked the group with replanting twenty acres of palm plantation that had illegally encroached upon a riparian reserve. The group planted 20,000 native trees, which induced proboscis monkeys and long-tailed macaques to repopulate the area. Today orangutans nest in the rejuvenated canopy. A formal restoration program began to cohere in 2018, when some of Goossens' colleagues from Cardiff University flew to Borneo for Danau Girang's ten-year anniversary and began to discuss the possibility



Amaziasizamoria Jumail.



Benoit Goossens.



By Christine Peterson

No one knew why the deer were losing weight, struggling to stand, and then keeling over, dead. So for years in the 1960s and '70s, researchers at a Colorado State University research facility recorded the mystery by collecting tiny slivers of the deer's brains and filing them away.

Then one day a PhD student named Beth Williams unearthed those slides. Under a microscope, each sample appeared filled with holes, like the brain tissue had turned into Swiss cheese. Those holes, she realized, were similar to the ones veterinarians had already identified in sheep brains, and the always-fatal illness with no cure was coined chronic wasting disease (CWD).

As she and other researchers sounded the alarm, the strange new disease spread from Colorado to Wyoming, and then Nebraska and South Dakota, killing any deer or elk it infected. In 1996, Williams gave what now feels like a prophetic piece of advice about managing CWD: "You'll have to be aggressive," she said. "Remove all sources . . . and all potential movement. Cut wider and deeper than you ever think necessary. The deer will come back; but you'll get one chance. If CWD gets widely established, you'll have it for a very long time."

In the decades since, states that followed her advice, like New York and Minnesota, have so far mostly kept the disease at bay. But in places like Wyoming and Wisconsin, which have largely lacked the will to cut as deep for as long as disease experts



# Alarm, Apathy, & Hope for Action

AS CHRONIC WASTING  
DISEASE SPREADS,  
WILDLIFE MANAGERS PLEA  
FOR STRATEGIES THAT  
COULD WORK

say is necessary, CWD has continued to spread. "There is apathy from both the wildlife managers but also the public," says Brian Nesvik, who was director of the Wyoming Game and Fish Department at the time of interview and has since retired. "Does this worry me? Absolutely."

Today, CWD has become one of the thorniest wildlife diseases of our time, infecting deer, elk, reindeer, and moose in three-fifths of the US and portions of Canada, Norway, and even South Korea, with prevalence rates as high as 60 percent. Despite this, most experts and wildlife managers agree that it's not too late to act. Try something, they say. Don't just watch and wait.



Chronic wasting disease, or transmissible spongiform encephalopathy as it's known to scientists, is caused by the buildup of misfolded proteins called prions, which kill brain cells and leave holes in animals' brains. Infected animals become lethargic and emaciated, wasting away until, inevitably, they die. Because it isn't a bacteria or a virus, it can't be treated with antibiotics or prevented with traditional vaccines.

The disease first spreads among animals largely through nose-to-nose contact. Once CWD is established in a population and animals shed prions onto the landscape, experts believe individuals can then contract the disease through infected soil or even, possibly, through prions clinging to blades of grass.

Researchers know that deer contract the disease at higher rates



than elk, which contract the disease at higher rates than moose, though no one knows exactly why. Bucks seem to be infected twice as often as does, likely because they tend to move and socialize more.

Left unchecked on a landscape, it moves slowly—it took about 40 years for CWD to creep from southeast Wyoming to the western portions of the state. But humans have given it a lift by moving captive elk and deer between businesses that raise them for food or hunting opportunities. Saskatchewan imported the disease in a captive elk from South Dakota in the late 1990s. South Korea then unknowingly imported an infected elk from Canada in 2001.

Because there is no cure, and infectious prions may linger on the landscape a long time, CWD researcher Krysten Schuler, a wildlife disease ecologist and director of the Cornell Wildlife Health Lab, says the best way to contain the disease is to limit possible sources of transmission. Stop treating deer and elk like livestock that can be shipped between captive facilities, particularly across state lines, she says. Explain to hunters that carcasses should go to landfills or carcass-disposal facilities and not get tossed on the side of a dirt road, where they could potentially infect nearby herds. Don't transport brain or spinal tissue to new areas.

“There’s an obligation to try and stop it and not just throw up our hands and say it’s going to be everywhere.”

Krysten Schuler

”



Justin Binger

D026, a female deer that was studied as part of a collaboration between the Wyoming Game and Fish Department, the University of Wyoming, and the USGS to better understand CWD and how it affects mule deer populations. She was collared southwest of Casper, Wyoming and died in October 2021 at five years old because of CWD, which is always fatal.

New York, where Schuler works, took this lesson to heart when it identified the disease in an infected deer from a captive deer facility that was made into chili for a local fire hall event in 2005. After the first discovery, officials found more positive deer at another captive facility, and ultimately paid to depopulate both businesses. Since then, they’ve worked on keeping the disease out by banning facilities from importing live deer or elk from out of state, prohibiting hunters from bringing intact carcasses in from other states, outlawing baiting and feeding to reduce gathering spots, and surveilling herds, especially in high-risk areas. The state has even paid meat processors and taxidermists \$10 and \$20, respectively, to send in either a head or lymph node for testing.

The state is proof, Schuler says,

that CWD can be isolated. “There’s an obligation to try and stop it and not just throw up our hands and say it’s going to be everywhere.”

Bryan Richards, the Emerging Disease Coordinator at the United States Geological Survey (USGS) National Wildlife Health Center in Wisconsin, advocates for an even simpler approach: Reduce the number of deer gathered in close quarters by thinning herds. It’s the same one Williams recommended almost 30 years ago.

When CWD popped up in Minnesota in 2011, wildlife managers used sharpshooters and a late-season deer hunt to try and reduce the spread. Since then, the state regularly culls several hundred deer from hot spots where infections pop up before the disease has a chance to spread. And the strategy has largely worked. Officials believe

only one herd has established CWD, and rates hover around 1 percent.

But this aggressive response only seems to work with a public prepared for what trying to control CWD requires. Years before the CWD outbreak in Minnesota, the state culled whitetail deer in its successful fight against bovine tuberculosis, a disease that can sicken and kill both whitetail deer and cattle. Because of that, says Kelly Straka, head of fish and wildlife for the Minnesota Department of Natural Resources, hunters and the general public knew what to expect.

In contrast, when researchers in the rolling foothills of the Norwegian mountains discovered CWD variants in a herd of reindeer, the swift response was deeply unpopular. They essentially eliminated one population, killing more than 2,000 reindeer, says Atle Mysterud, a



University of Oslo professor who has studied CWD for years. They're monitoring the spread of CWD in another one.

That initial attack was met with uproar from the public, and Mysterud is not sure Norway will be so aggressive again. "We should have clearer goals. Current aim is 'limit, if possible eradicate'—but limit versus eradicate involve quite different actions."



In Wyoming, where CWD is established in many, but not all, deer and elk herds, the state has had to walk the line between limiting the spread and managing infected populations. "For the vast majority of the time, we didn't engage in any meaningful statewide management," says Justin Binfet, a wildlife biologist with the Wyoming Game and Fish Department. But now the state has a new CWD plan, which he hopes will help Wyoming turn a corner.

The plan, finalized in 2020, calls for reducing deer or elk densities at potential hot spots, like center irrigation pivots or haystacks, and directs Game and Fish to sample at least 200 buck mule deer and 200 elk out of each of the state's herds every five years. It also says thinning herds or increasing buck hunting in some herds may be necessary to conserve the state's abundant wildlife. But the latter has proved challenging to enact.

In 2022, a mule deer herd in the early stages of CWD infection lived tucked up along the east side of Wyoming's Snowy Range. Rates of the disease in buck deer were around 8 percent, a far cry from the 40 percent or even 70 percent in mature bucks farther north.

Research in other herds showed that left unabated, prevalence would inevitably increase. It also showed that CWD spreads first in bucks and then into does. Cut down on the number of bucks, especially big, old bucks, which are prized by hunters but are more likely to carry the disease and spread it around, and potentially control the disease.



Justin Binfet, a wildlife biologist with the Wyoming Game and Fish Department, hopes the state's CWD plan will help Wyoming turn a corner with managing the disease.



Krysten Schuler, a wildlife disease ecologist and director of the Cornell Wildlife Health Lab, performs a tonsil biopsy on a deer to test for CWD.

So Lee Knox, a Game and Fish biologist, made a plan. He held a series of public meetings explaining CWD research and gauging hunters' thoughts on increasing buck harvest. At the time, the herd of almost 4,000 deer had about 40 bucks per 100 does. Many other Wyoming herds keep buck numbers around or under 30 bucks per 100 does, and states like Minnesota hold their herds often around 20.

He proposed, and many of hunters in those early meetings agreed, to offer 100 more buck tags spread across four hunt areas and allow hunters to look for them in November instead of exclusively during the first two weeks of October.

But before the concept could even make it to the Wyoming Game and Fish Commission the following spring, online hunting forums exploded. Game and Fish was trying to kill all of the area's bucks, people said. In a deer population that is already struggling, increasing hunting would ruin opportunities to shoot big bucks in the future. The outrage reached such a fever pitch that the department pulled the proposal, saying it was just not the right time.

"You'll hear people say the cure is worse than the disease, which is not true at all," Knox says. "But the public wants a guarantee, and we can't guarantee anything." Two years later, CWD prevalence rates in the herd now hover around 15 percent.

The story illustrates the difficulty of trying to reduce CWD's spread by increasing hunting in a state where mule deer are so prized they adorn license plates and herds are struggling from drought, development, invasive species, and disease.

Former Game and Fish Director Nesvik doesn't blame people. Increasing hunting or thinning herds is a hard pill to swallow when populations are already lower than people would like. Plus, he said, "the public can't see the disease killing deer. They know there's less deer, but

Christine Peterson

Courtesy of Krysten Schuler



they go to the things that are simpler to understand. They think, ‘Well, we know mountain lions eat deer, so mountain lions are the problem.’ I think that people are having a hard time believing that CWD is actually having an effect on the population.”

Wyoming officials are also quick to point out other differences between combatting CWD in New York and Minnesota and fighting it in the Cowboy State. The Midwest’s abundant deer stay relatively put, while deer and elk herds in the West migrate dozens if not hundreds of miles, which complicates efforts to slow the spread. Managing a landscape steeped in the disease, they say, is also very different than keeping the infectious prions out.

Once the disease has already taken root, even Schuler and Straka say there’s no reasonable way to get rid of it. At that point, entities are left to manage through monitoring the spread and trying to keep prevalence down. But if support for cutting

“ I think we need a groundswell of hunters and conservationists and the public to talk to their elected officials and say, ‘This is really important to me, and we need to do something about it.’ Because the status quo is we’re losing, and we’re losing pretty badly.

Krysten Schuler



Courtesy of Bryan Richards

Bryan Richards, the Emerging Disease Coordinator at the USGS National Wildlife Health Center in Wisconsin, advocates for fighting CWD by thinning herds to reduce the number of deer gathered in close quarters.

deeply once to prevent CWD’s establishment was difficult to come by, the will to cull year after year just to maintain disease levels has been even more elusive.

Wyoming wildlife managers once dramatically increased hunting in a deer herd in Thermopolis but soon discovered CWD was already enmeshed in the area. After two years, the public’s appetite for keeping deer numbers low dropped, hunting returned to usual, and rates spiked.

In Wisconsin, where disease pathologists first detected CWD in three deer killed by hunters in the fall of 2001, wildlife managers took the arrival seriously. They made deer hunting essentially unlimited in many places, required hunters to shoot a doe before they kill a buck in others, and department officials culled deer. But when they sampled more than 40,000 deer the following year, they found another 205 cases. The disease, it appeared, had already taken hold.

Six years later, the hunting public had had enough. They were

willing to invest in a short-term solution, it appeared, but not one that could last forever.

“Ultimately, populations are managed by hunters, and hunters wield funding and influence,” says Richards with the USGS. “As long as agencies keep producing lots of deer and big deer, the influence hunters apply is positive. But if hunters are unhappy, then the legislature takes over.”

Hunters wanted to go to back to the good old days of hunting, when the forests and fields were full of big deer, before culling dropped the number of overall deer. So the state legislature ordered an analysis of the efforts, and upon learning the results were inconclusive told the Department of Natural Resources to stop. Hunting seasons returned to normal, deer numbers bounced back, and now, 20 years later in a state with two million whitetail deer, prevalence rates in some areas are over 50 percent.

Somewhat ironically, Richards has a paper coming out this year that looks back at those early efforts to

contain the disease and found that they did, in fact, help curb the spread.



Researchers and wildlife managers like Richards and Nesvik are frustrated by the general lack of willingness to do anything, the desire to just go back to the days before the disease gripped the landscape, before hard decisions like thinning herds needed to be made. Even in places where prevention has largely been successful, like Minnesota, “there can be a perspective of impending doom,” says Straka. “You can continue to do whatever you want, but the threat will be there.”

“It’s a wicked problem,” Richards says. “There’s no easy answer and no one group by themselves can manage the outcome.” But researchers agree that states need to work together, sharing infection data and comparing strategies to aggressively prevent the disease’s spread and keep prevalence down in infected populations.

That’s not likely to happen unless CWD spreads to humans or domestic livestock like cattle, Richards says. Or, adds Nesvik, if a study could show irrefutable proof that reducing densities in areas like Wyoming’s rolling sagebrush and rugged mountains works.

Schuler thinks by now the message should be clear. “The one constant with CWD is it always seems to get worse, but I don’t think people are really trying to make it better,” she says. “I think we need a groundswell of hunters and conservationists and the public to talk to their elected officials and say, ‘This is really important to me, and we need to do something about it.’ Because the status quo is we’re losing, and we’re losing pretty badly.”

*Christine Peterson is a freelance journalist covering the environment, wildlife, and outdoor recreation for local, regional, and national publications from her home in Laramie, Wyoming.*

# Crossing Borders

WOLF MANAGEMENT  
IN THE ALPS  
REQUIRES ATTENTION  
TO SCIENCE AND  
PEOPLE

The first wolves to step foot in the Alps in nearly 100 years appeared in France's Mercantour National Park in 1992.

By Francesco Bisi

The first wolves to enter the Alps in nearly a hundred years found themselves in southeast France's Mercantour National Park in 1992. Like the area's glacial lakes, Bronze Age rock carvings, and "perched villages," the wolves were a relic of a time past. Once abundant and widespread, centuries of organized extermination had whittled down Eurasian wolf populations to nearly nothing, and had eliminated them entirely from the Alps by the early 1900s.

But wolves did not go extinct across Europe, and in the last 50 years, relict population have naturally spread back into parts

of their old range. Their return has sparked conflict, and with it, the need to bridge social, administrative, and disciplinary boundaries. At least, that's what partners of LIFE WolfAlps EU—an interdisciplinary, multi-national project I supported as a researcher—think is the key to moving towards coexistence, rather than returning to a time of hatred and fear.

Wolves have been systematically trapped, hunted, poisoned, and bountied for over a millennium, from England and Scandinavia to the Balkans and Bavaria. In France, Charlemagne institutionalized the practice around

the year 800 when he created the *louveterie*, an elite corps of hunters tasked with eradicating wolves. More than a thousand years later, France killed its last wolf in the 1930s.

But, as wolves became less of a threat to livestock and life in a rapidly industrializing world, and with the growing popularity of new environmental ideals, the fervor for extermination faded before the job was done. In 1979, when the Bern Convention made wolves a strictly protected species throughout Europe, about a hundred wolves remained fragmented in the Apennine Mountains—which run from toe to calf along Italy's boot.

A few more sheltered in the most remote parts of Slovenia's Dinaric Alps, with diminished populations elsewhere in eastern Europe. These have been the most important source populations for the species' natural recolonization of the Alps.

In addition to new protections, wolves benefitted from the decline of traditional rural economies and gradual depopulation of the mountains—particularly the most remote regions—as pastoralists and others sought better services and opportunities at lower elevations and in cities. This opened up habitat not only for wolves, but also deer, boar, and other prey species, making the Alps a lower-conflict place with



The returning wolves face a world that has largely forgotten what it was like to live alongside them, but has not forgotten how to fear them.

better food than they had been in centuries.

Over the course of two decades, the Italian Apennine wolves made their way toward the Alps, finally reaching France in 1992, the same year that the species saw further protection in the European Union (EU) under the Habitats Directive. From there, they have continued to expand through the crescent-shaped range, first reaching Switzerland in 1995, Italy in 1996, and Austria in 2008. In more recent years, wolves have also entered the Alps from southern Slovenia, the Karpathian mountains (Slovakia), and the central European lowlands (Germany, West Poland, Czech Republic). In each country, breeding pairs and resident packs lagged well behind the first wolf sighting, in some cases more than a decade.

The returning wolves face a world that has largely forgotten what it was like to live alongside them, but has not forgotten how to fear them. While those first Mercantour wolves found what National Geographic calls “the last *terre sauvage* in the Alps,” the range as a whole is not wild. The Alps still support 14 million people across 6,000 settlements, and a deep tradition of agriculture is bound up in both the culture and the landscape. Wandering shepherds and their cattle, sheep, and goats are iconic to the region, and their grazing maintains high alpine meadows and other distinctive ecosystems that support rich biodiversity and endemic species. Many see wolves as an existential threat to this precious and delicate system, raising questions

about the feasibility of human-wolf coexistence.

The LIFE WolfAlps EU project believes that such a sprawling, complex issue needs to be addressed at the same scale—with a coordinated, population-level outlook rather than fragmented management limited by administrative and disciplinary boundaries. Spanning France, Italy, Austria, and Slovenia, the team has worked for the last decade on a two-part approach. First, establish a solid baseline understanding of the wolf population and its spread in order to develop unified, scientifically grounded information and messaging. Second, work along nine different “axes of intervention,” to foster understanding and reduce conflict between wolves and people.

Part one began in Italy and Slovenia in 2013 with a focus on “knowing before acting,” meaning years of data collection on the wolf population, human attitudes, livestock depredation, poaching, and more. Wolves typically occur at low densities in rugged terrain, making basic monitoring a challenge. A lack of consistent methodology adds to the difficulty, especially when trying to compare data between administrative authorities in multiple countries. The WolfAlps team addressed this issue by training 512 participants—including volunteer associations, professional researchers, and public authorities—to collect standardized data through snow tracking, wolf howling, genetic analysis of biological samples, and camera trapping.

During this time, I was in charge of wolf monitoring in the

Lombardy region in the central Italian Alps. Most of the activities took place during winter, and for the first time during a snow-tracking activity, I came across evidence of a deer killed by a wolf. This discovery made me realize that I was not alone in the wilderness. However, the most significant aspect was that, while I was out there looking for tracks in the snow, many other operators were conducting the same monitoring efforts across the Alps.

These shared and scientifically collected data were the first step for researchers and managers to speak a common language over such a broad landscape, which aided credibility and coordination. Sharing this information took many forms, from a Wolf Alpine Press Office to newsletters, social media, conferences, an interactive, traveling

exhibition, a theatrical show, art contests, a children’s book, and more.

Overall, the first project laid the foundation for a broad network of stakeholders and partners working together on a shared and coordinated conservation program. Other early activities included assessing the threat of dog-wolf hybridization, supporting preventative measures, and implementing anti-poaching efforts.

Rucksacks full of scientific knowledge, listening to people became the next most important step for conservation. The second project, which began in 2019, expanded to include France and Austria and made improving human-wolf conflict its primary focus. Particular attention was given to understanding the needs of



Once exterminated from much of Europe, as of 2023 wolves have returned to every EU country except the islands of Ireland, Cyprus, and Malta.



Agriculture has been part of the cultural, social, and economic fabric of the Alps for hundreds of years. Above, a shepherd protects his herd in an 1860 oil painting. Below, cows graze near an Italian hiking *rifugio* in 2024.



those most impacted by the wolves' natural return and working with them to share knowledge and explore solutions for coexistence. In this project, I continued to coordinate the monitoring activities in the Lombardy region and participated in numerous meetings with shepherds, hunters, and environmental protection associations to discuss the wolves' return to the Alps and what it meant for them.

Shepherds have perhaps the oldest and most persistent reason to resent wolf recolonization—livestock depredation. A 2023 report by the EU estimates that wolves kill at least 65,500 head of livestock each year, nearly three-quarters of which are sheep and goats. The report also notes that wolf-killed sheep comprise just 0.065% of the EU's total population of 60 million sheep, but at a local level, livestock loss can be unbearable.

Depredation rates are typically

lower in areas where wolves never disappeared. For communities where wolves were absent for nearly a century, however, herders have largely lost the habit of coexistence with predators, including constantly accompanying free-ranging livestock and the use of guard dogs. Adapting their herding practices can mean increases in cost, work, and stress for farmers who are already struggling, and solutions like electric fences are not always feasible or sufficient. Capacity and expertise also vary widely between professional herders with large flocks and hobby farmers.

Although there is no one-size-fits-all solution, researching, supporting, and experimenting with best practices, particularly through peer-to-peer knowledge sharing, can contribute to making Alpine pastoralism more sustainable, thereby preserving a unique cultural institution, rural livelihoods, and important habitat. Talking



directly with people about these options, I noticed, tended to be more effective than simply giving them money to buy prevention tools or as reimbursement for livestock predation.

Hunters are another stakeholder group that have expressed concerns over wolf recolonization, seeing them as competition for game species. Rather than dismiss these concerns, WolfAlps designed a series of participatory studies that involved hunters throughout the process of investigating the wolves' impact on wild prey, particularly red deer. Researchers found that the impact of wolves on game populations is minor compared to hunters themselves, but hunting management may need to be adjusted in some areas where wolves have returned.

The project has likewise taken seriously the rural Alpine residents who fear for their safety, discussing potential risks (like improper food management and uncontrolled domestic dogs) and holding an International Conference on Bold Wolves. In the last 40 years, there have been very few cases of wolves attacking humans in Europe. None of them were fatal, and they were mainly caused by habituated wolves. The 2023 EU report concludes that "the risk of people being attacked by wolves is incredibly low in the modern world." However, I often heard people claiming the opposite, possibly influenced by media misinformation.

By creating regional dialogue platforms where people could express their concerns and feel heard, WolfAlps has perhaps not fully changed minds, but at least opened a door to greater trust and understanding. In my experience, even the people who shouted at me during meetings would sometimes come up afterward and thank me, not because I solved their problem, but because I listened to them.

These conversations have also revealed an opportunity for the wolf to shed light on a much broader context. Local community

Wandering  
shepherds and their  
cattle, sheep, and  
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Many see wolves as  
an existential threat  
to this precious and  
delicate system.

meetings often ended with the idea that wolves are not themselves the whole problem, but rather the straw that broke the camel's back; people use the time to talk about other challenges for farming and rural living. In this sense, the wolf becomes their microphone.

I also saw how in regions where wolves have been present for 30 years or more, both wolves and humans have been able to coexist, even though the conflict has not been entirely resolved. In these areas, the greatest challenge is not pushback from the public, but rather administrative fragmentation that complicates effective conservation and management.

These stakeholder engagement platforms are just one part of the project, which also includes Wolf Prevention Intervention Units, a host of trainings, hybridization prevention, development of eco-tourism, an Alpine Young Ranger Program, anti-poisoning dog teams, and more—almost too much to keep track of. But "the complexity of this project is its strength," says one final report, and I agree. As human beings, we are integral parts of ecosystems, and our interactions with nature—wolves, in this case—take many forms. Therefore, it is crucial to consider all these aspects comprehensively.

As of 2023, wolves have been detected in every EU country except the islands of Ireland, Cyprus, and

Malta. The population was 20,000 and climbing. Given wolves' legal protection and unassisted spread, the Alps will probably never be wolf-free again. Which means it will probably never be conflict-free, either. But hopefully, through a multi-pronged effort happening at the same time all over a huge region, the Alps will learn how to live with wolves in a way that protects the region's ecological, social, cultural, and economic values. And it may even be that wolves can become a bridge that forces people to think beyond boundaries.

**Francesco Bisi** is a zoologist and research fellow at Insubria University in Italy. An expert in alpine vertebrate monitoring, his research focuses on wildlife conservation and human-wildlife interaction and he teaches a course on sustainable use of wildlife. During the LIFE WolfAlps EU project, he has been responsible for wolf monitoring activities in the central Alps for the Lombardy Region and has been involved in stakeholder engagement through sharing information about species distribution and wolf population dynamics.



Courtesy of Francesco Bisi

WolfAlps stakeholder meetings became a platform for rural communities to express their concerns about more than just wolves. In this sense, wolves became their microphone.

# From Serengeti to Yellowstone

## AN INTERVIEW WITH DR. TONY SINCLAIR AND DR. ARTHUR MIDDLETON ON BRIDGING MIGRATION ECOLOGY ACROSS CONTINENTS

By Temple Stoellinger

*This interview has been edited for clarity and length*

**D**r. Anthony (Tony) Sinclair, born in 1944 and raised in Tanzania, has been a pioneering figure in ecology and wildlife conservation, particularly in the Serengeti-Mara ecosystem, where he has worked for over 55 years studying large mammal populations and ecosystem dynamics. His research revolutionized understanding of predator-prey relationships and ecosystem restoration, particularly through his documentation of the Serengeti's recovery from the 1890 rinderpest epidemic. Currently Professor Emeritus at the University of British Columbia, Sinclair's work spans multiple continents and has influenced conservation efforts worldwide, including in the Greater Yellowstone Ecosystem.

Dr. Arthur Middleton, G.R. and W.M. Goertz Professor of Wildlife Management at the University of California Berkeley, leads interdisciplinary research on wide-ranging wildlife and large-landscape conservation. His research group conducts field programs in the Greater Yellowstone Ecosystem,

Northern California, and the Andean and Patagonian Steppe of Argentina. Currently serving as senior advisor for wildlife conservation at the US Department of Agriculture, Middleton balances his academic work with practical conservation outcomes for communities.

**WC: What first drew you into the field of migration ecology?**

**Tony Sinclair:** When I first started research as a student in the mid-1960s, I was given the task of looking at a population of African buffalo that nobody knew anything about. I realized that understanding the buffalo required understanding the wildebeest, whose massive population had a big impact on the entire Serengeti ecosystem. Both populations were growing rapidly, but one was migrating and the other wasn't. That got me asking, "What is the difference?" and "Is there a link between the very large numbers of wildebeest and the fact that they migrate?" That got me thinking about the underlying cause of migration. At the same time, my early experiences growing up in East Africa had shown me there was something extraordinary about the Serengeti and I was asking, "Why

was that the case? Why aren't there other Serengetis in Africa, or indeed around the world?"

**Arthur Middleton:** I think for me it was sort of deep in my bones to be fascinated by the story of ecology, of animals and their movements. I grew up in the creeks and marshes and the forest in the southeastern US, where I witnessed seasonal changes in fish, bird, and marine mammal arrivals and that was my entry into ecology. After graduating from the University of Wyoming, which has a world-class wildlife ecology and zoology program, I was working on wolves and their impacts on elk in the Yellowstone ecosystem. But during the years I was out in the field collecting data, what became more interesting to me was the hidden and less-appreciated life of the elk. I began to wonder if the patterns I was seeing—the seasonal movements of elk herds back and forth across the landscape—were more widespread. Why was it occurring? How did it play into this predator-prey dynamic that was the dominant ecological paradigm at that moment? That's what drew me in.

**WC: What are the most important breakthroughs you have witnessed and contributed to in the conservation of large landscapes?**

**Anthony Sinclair:** As I worked on the question, "Why migration?" I was realizing that wildebeest were moving to areas that have very high-quality food, the best in the ecosystem. They didn't stay there, because there were times of the year when those areas became unsuitable because of a lack of water, forcing them to move to where the food was less suitable. But that extra food in temporary areas was what allowed them to reproduce and survive so well. It became clear that through migration, wildebeest had access to food resources that non-migrants didn't have and that allowed them greater numbers in their populations. After looking at other migration systems, this principle became even more clear to us—that migration was all about temporary high-quality food, and access to ephemeral resources is what drove migrations in the world.

A corollary is that migrant herbivore populations are not likely to be regulated by predators, since predators can't migrate like their prey. They're stuck raising their young in a den or equivalent for a length of time, by which time the migrants have moved on.

**Arthur Middleton:** Genuinely, the breakthroughs that Tony just described are some of the most important frameworks and hypotheses that we tried to pick up and further advance in the Greater Yellowstone Ecosystem.





**WC: Say more, how has Tony's work changed the approach to studying ecosystems and animal migration in North America?**

**Arthur Middleton:** Well, I wouldn't be doing what I am doing if it hadn't been for Tony's work in Serengeti. Back when I was a graduate student in 2007, it seemed like every conversation about the Yellowstone ecosystem revolved around predator-prey theory. Wolves were king, and the paradigm of top-down ecosystem control by predators dominated everything. But Tony had this body of work from the other side of the world that presented a different way of looking at that ecosystem. One day I was listening to Tony speak, and he said something that hit me: "Ungulates can be keystones too." And I finally had my "Aha" moment, realizing that Yellowstone is actually a bottom-up system, and if we don't start seeing it that way, we'll never truly understand its full extent or how best to manage it.

The other thing is that, even though I didn't know him personally, I watched him from a distance and saw someone who made a long-term commitment to doggedly unpack the ecology and needs for a particular area. Tony showed us how to deeply understand and advocate for an ecosystem—in his case, the Serengeti. That commitment was and still is incredibly inspiring to me.

**WC: What other breakthroughs have you seen and been a part of, Arthur?**

**Arthur Middleton:** One of the biggest breakthroughs in my time has been the set of technological advances that allowed us to see



Middleton's work has been instrumental in advancing the idea of the Greater Yellowstone Ecosystem and deepening our knowledge of how it works.



Sinclair's pioneering research in the Serengeti transformed our understanding of migrations and the relationships between predators and prey.

further and deeper into the hidden lives of these wildlife while they're on the move, foraging across the landscape, and evading predators. Satellite tracking and remote sensing, along with the computational and analytical tools developed to work with these data, have allowed us to prove the migration phenomena that Tony talked about and given

us new insights into why animals move across the landscape in their particular patterns and at their specific pace. On the application side, being able to see the detailed movement of these animals across a landscape gives land managers the kind of information they need to make better conservation decisions.

We have also learned that

even some of our biggest protected areas in the world—places like the Serengeti-Mara ecosystem, the National Wildlife Refuge in Alaska, or Yellowstone—are not big enough to contain and fully protect these species. Migrating animals are moving beyond the boundaries of the protected areas and are moving across landscapes that have a mix of land uses. So I think a really important breakthrough that is not progressing fast enough is how we can improve conservation across jurisdictional boundaries. It's this focus on larger landscape coordination, paired with the development of community-based conservation.

**WC: What are some of the biggest threats to migratory species today?**

**Arthur Middleton:** I've been working in the Yellowstone ecosystem for 17 years. I feel pretty confident now in my assessment that the biggest threat in the coming years is land use change. It's the conversion of land for building houses, for food, fiber, and fuel production, and for recreational use. People love being near these big western parks and protected areas so there's a boom of people wanting a piece of it. It's not just houses, it's also all the fences and roads that come along with development. Energy development is another threat when not planned and sited well. When roads and other infrastructure are developed in higher densities, it can impede migrating animals on their way to seasonal forage. In other areas of the world, shifts from range or grazing land to crop production can be a big threat.

Anna Sale

Courtesy of Tony Sinclair





We've also chopped these systems and these landscapes up into so many pieces, on the ground and in concept, that there's no one responsible for seeing the bigger picture. We need policies and tools that force us to cut through the fragmentation and work across big landscapes, focusing, in this case, on the entire corridor.

**Tony Sinclair:** Excellent points. We have to understand that conservation of migration systems is a lot more difficult and complex than conservation of other non-migratory species. People tend to see them as just another species among many, so we need to develop a deeper appreciation that migration systems are fundamentally different—they require additional resources and attention. This is because with non-migratory species you can just draw a line around an area, and for the most part that will encapsulate everything they need in their lives year-round. That's not the case for migrants. They require, as I mentioned earlier, areas of high-quality temporary food. They also require a refuge area, where they retreat to in the worst time of year. Then they require a third area, which is the corridor between the two. As Arthur mentioned, we've come to realize how critical it is to protect these corridors and minimize our interference. And one of the biggest threats, in my experience, has been setting up fence lines that restrict wildlife movement. When that happens, migration systems collapse. They collapse down to a resident population.

There are two other threats that I see. One is overtourism. In

Serengeti, there is an all-out policy of bringing in as many people as possible. Thanks to the technology Arthur mentioned, we can now see that wildebeest are avoiding their preferred refuge areas during critical periods due to high tourist concentrations, forcing them to feed in suboptimal habitats.

And then, if you're aware of the Atlas of Ungulate Migrations that has just been published, you know there are huge gaps in our knowledge about migrating animals. For example, we only know of one migration system in South America. I simply don't believe that's the case. It's amazing, because you'd think that such migration systems would be obvious and well known, but in fact, they're not. We can't apply conservation if we don't know that these systems exist.

**WC:** As leaders in your field, what emerging trends or possibilities in migration ecology and large landscape conservation excite you most about the future?

**Tony Sinclair:** For the future, I think the trend toward what I call rewilding is a hopeful sign. Arthur talked about dealing with human-dominated areas and community conservation. I agree. We need to make human-dominated landscapes biodiversity-friendly, especially for migrants that can't fly; they have to walk through these areas. A nice example is the buffalo migration that Robin Naidoo discovered in Botswana. It goes right through agricultural land, and they're taking great pains to ensure the corridors and right habitats are there. I think this principle of community

conservation and rewilding is the way of the future.

**Arthur Middleton:** For most of my life, the conservation and restoration of nature hasn't been a societal priority, but I think that's starting to change. On the international stage, despite whatever opinions we might have about initiatives like 30 by 30, it's encouraging to see countries signing on to more ambitious nature protection goals. Here in the United States, we're seeing unprecedented resources for land and water conservation through recent legislation—the Great American Outdoors Act, the Bipartisan Infrastructure Law, and the Inflation Reduction Act. To me, it feels like conservation is finally moving up the priority list. I hope this momentum continues and flows into the kind of initiatives Tony's talking about with rewilding, especially prioritizing large-scale conservation, corridor protection, and connectivity.

**WC:** Why should people care that animals migrate? What's their value in the ecosystem?

**Tony Sinclair:** I think that question can apply to any species on earth. Why do we want to conserve any animal? I think one answer is a philosophical one, which is that we have a moral responsibility to hand down to future generations what we ourselves have been able to enjoy. There is a scientific answer also, which is that we have no idea whether a species we have allowed to go extinct is actually necessary for the wellbeing of our own ecosystems. That includes the migration systems that affect us all the time—not

just the ones we're talking about, Serengeti and Yellowstone, but bird migrations systems that encompass the whole of North America. We can't play God and say, "We'll let this one live and let that one die."

**Arthur Middleton:** I agree with Tony, and also, we have growing indications that the ability of these animals to migrate across large landscapes is fundamental to their productivity and abundance. When you move around the landscape to get temporary food and shelter, you may be able to get more nutrition, get fatter, and grow your offspring better. This, in turn, is important to the productivity of the entire ecosystem. So, if we want to be able to enjoy a wolf or a lion in one of these systems, it may be that we need to pay a lot more attention the ability of the prey to be productive. For communities that depend on wildlife for subsistence, their wellbeing may hinge on the added productivity that these migratory populations provide.

In the United States, we are not good at this idea of preserving abundance, rather than simply existence. Our wildlife laws and policies are built around rarity and preventing species from going extinct. We really need to figure this out: how to preserve these massive, remarkable phenomena of abundance, from large bird and fish migrations to the vast ungulate movements Tony and I have studied.

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**Temple Stoellinger** is associate professor of environment and natural resources and law at the University of Wyoming.







Linocut with gouache, Jill Bergman

# Game on the Range

SMALL TWEAKS IN USDA PROGRAMS SUPPORT WORKING LANDS AND MIGRATIONS IN WYOMING

By Shaleas Harrison

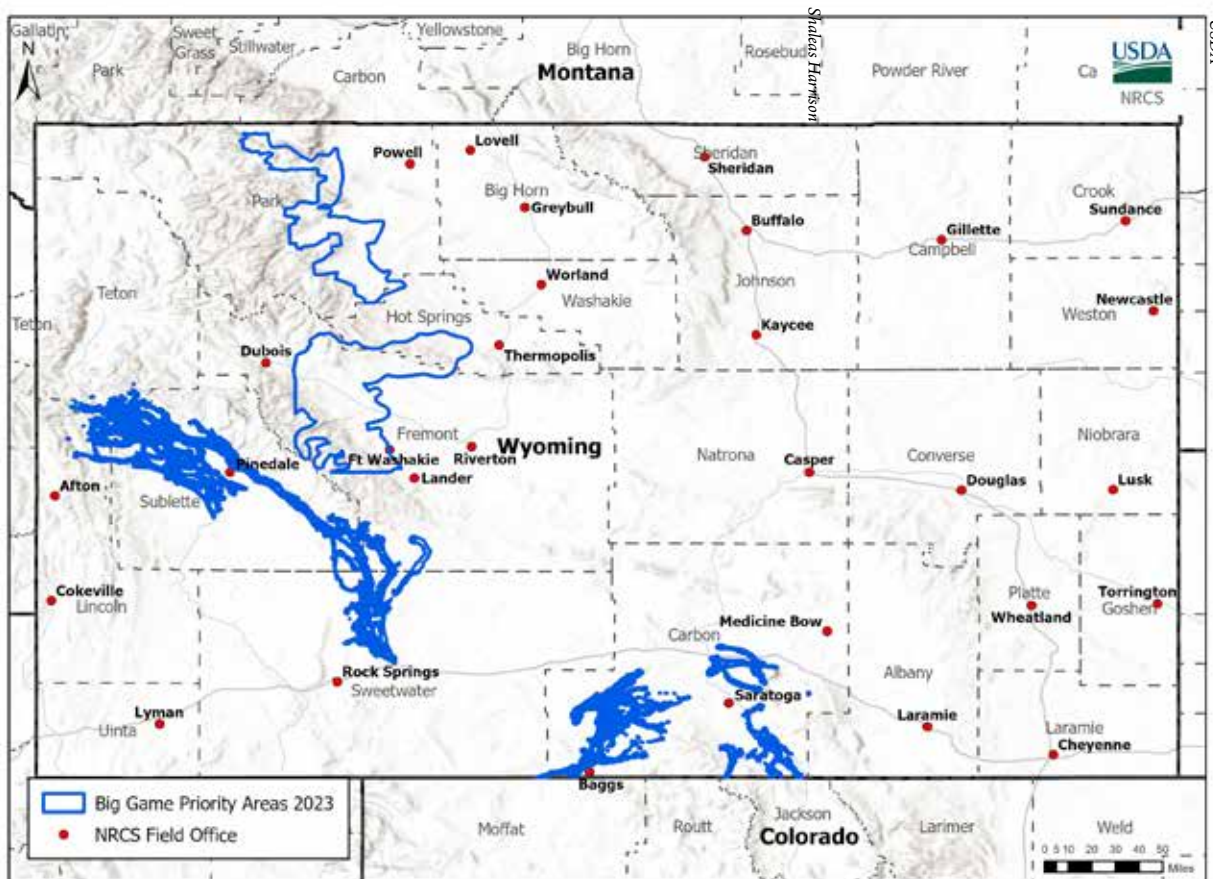
It's 8 am as the sunlight moves across the foothills of Carter Mountain, the longest mountain in the Absaroka range and east from Yellowstone National Park. Ronee Hogg loads Callie, her gray corgi, into her pick-up truck and we head down the road to inspect some newly built fences on a part of her ranch that is leased for wildlife habitat.

The lease spans miles of rolling hills, ravines, creeks, and native grasses. As we traverse the hillsides, pronghorn sprint to cross the road in front of our truck. We stop to

check a wildlife-friendly fence—built with funds from the US Department of Agriculture (USDA)—that has a smooth bottom wire for pronghorn to crawl under and a low wire at the top for elk and deer to easily jump. Nearby, small clumps of cows with nursing calves congregate on the green grass still remaining in July. Hogg makes sure that all the nursing cows have calves. Otherwise, she notes, “There’s a good chance that a grizzly got to them.”

Hogg and her two sons operate Hogg’s Black Diamond Cattle Company, which has been in the family for over a hundred years. Like many other properties in





The USDA Migratory Big Game Initiative works in four priority areas: the Absaroka Front east of Yellowstone, the high desert sagebrush steppe of the southern Wind River Range, the tribal lands of Wind River Country to the north of the range, and the grasslands surrounding Medicine Bow National Forest.

the region, the ranch supports more than just the Hogg's 250 Angus-cross cattle and small herd of Angus bulls. It also furnishes essential winter habitat for the thousands of deer, elk, and pronghorn that migrate between it and the high country of the Greater Yellowstone Ecosystem each year.

Hogg's habitat lease is part of a new program, known as the Migratory Big Game Conservation Partnership, that the USDA launched to better support landowners like her who provide wildlife habitat for migrating big game. What's unique about the initiative is that rather than creating novel programs, the USDA prioritized existing resources in key areas of big game habitat and tweaked the delivery of programs to work better for private landowners. These focused adjustments to USDA programs have amplified the impact of conservation investments

and helped protect migrations on a landscape level.

This attention to wildlife habitat on private lands is driven, in part, by relatively recent advances in documenting wildlife migrations in the West. Over the past decade, GPS technology has helped biologists demonstrate that wildlife migrate across land ownership boundaries and that private lands indeed provide critical habitat to these herds.

It's no accident that some of the best habitat today is private. It was settled because it holds the elements necessary for life in Wyoming's harsh climate—water, wetlands, and high-quality vegetation on flat land. It also tends to be lower in elevation with a milder climate. That makes ranches like Hogg's ideal places for big game in the fall and winter, where they can find optimal seasonal forage and refuge from deep winter snow.

But landowners like Hogg face many challenges keeping their

properties intact and economically viable due to development pressures, market conditions, and family succession issues. Supporting wildlife can add to the strain, through damages to crops and fences, diminished grass and hay production, and loss of livestock to carnivores.

Across the country, an estimated 14 million acres of rangeland were lost to development between 1983 and 2017. Between 2017 and 2022, Wyoming lost just over 200,000 acres of farm and ranch land to other uses—some of which was once valuable habitat for wildlife. Without support, the working lands that account for 30% of the Greater Yellowstone Ecosystem will continue to fragment and their important ecosystem services could disappear.

The Big Game Partnership, which began in 2022 when Wyoming Governor Mark Gordon and USDA Secretary Tom Vilsack signed a Memorandum of Understanding

called the USDA-Wyoming Big Game Conservation Partnership, aims to address this issue. It reorients conservation dollars and incentives to these places, regarding the producer and their working lands as essential to conserving wildlife and migrations.

In the years before the big game partnership's rollout, USDA leaders did their homework. First, they identified four priority areas that were productive landscapes valuable for wildlife and littered with private working ranches and farms rearing cattle, bison, sheep, and commodity crops. Hogg's ranch is in the Absaroka Front; the other three areas are the high desert sagebrush steppe of the southern Wind River Range, the tribal lands of Wind River Country to the north of the range, and the grasslands surrounding the Medicine Bow National Forest.

Then, USDA representatives made strategic visits to Wyoming to meet with leaders and landowners to better understand the challenges that producers face to stay operational. "Landowners consistently asked for the ability to enroll in multiple USDA programs and to be paid fairly for feeding wildlife," says Laura Bell,

Advances in wildlife tracking technology have revealed that pronghorn, elk, and deer migrate down out of Yellowstone National Park to spend winter on private lands, where there is better food and less deep snow.



a facilitator for the East Yellowstone Collaborative. Bell helped convene landowners and agencies in the years leading up to the big game partnership, along with several other organizations including Western Landowners Alliance. (Disclosure: The author is employed by Western Landowners Alliance.)

The USDA heeded landowners' input. Within the big game priority areas, the USDA increased payment rates for an existing habitat lease program, allowed producers to sign up for multiple conservation-oriented programs on the same land, and released more money for conservation easements. Now, families like the Hogs, and the wildlife they support, are reaping the benefits.

A habitat lease is an agreement between the landowner and a federal, state, or private entity that provides payment for maintaining wildlife habitat. Within the USDA's existing programs, the Grassland

Conservation Reserve Program, or Grassland CRP, functions most like a habitat lease. But enrollment in the Greater Yellowstone Ecosystem had been virtually non-existent. To conserve migratory big game habitat, it needed some improvements to make it work better for landowners.

To start, the USDA established a minimum rental rate of \$13/acre to more fairly reflect the cost of habitat to landowners. Previously, rates in Wyoming were often as low as \$1/acre. The USDA then offered an additional \$5/acre payment incentive for counties within the Greater Yellowstone Ecosystem. The initiative also made it easier for people like Hogg to enroll by ranking priority area applications higher, which helped them enter the nationally competitive program.

Since she enrolled in the Grassland CRP, Hogg has received two annual payments in exchange for maintaining forage for wildlife and not developing the land or

turning it into row crops. She follows a conservation management plan developed with the USDA's Natural Resources Conservation Service (NRCS), which stipulates grazing regimes that benefit wildlife. Her lease will run for 15 years.

"We use our habitat lease payment for buying hay," she says, referring to the payment she receives from the USDA. "We don't have much hay ground, so we need to buy around 200 tons a year to feed the cattle in the winter. The cost of hay ranges from about \$145-285 per ton, so the extra income helps with these types of operating costs."

Hogg is also able to enroll in NRCS's Environmental Quality Incentives Program (EQIP) while receiving Grassland CRP payments. EQIP helps landowners cover the cost of conservation practices or expensive infrastructure like wildlife-friendly fences, water developments, weed control, or habitat restoration. For example, replacing an old fence

with a wildlife-friendly fence can cost more than \$3.80 a square foot, or \$95,000 for twenty-five miles of fencing. EQIP helps offset these costs and encourages landowners to integrate conservation measures they may otherwise be unable to afford. Hogg used EQIP to help pay for the wildlife-friendly fences we spent the morning inspecting.

When I ask Hogg about conservation easements—the third prong of the Big Game Partnership—she says she is considering it. A conservation easement is the sale by a property owner of his or her development rights, usually accompanied by other promises which maintain the property's conservation values. Most working farms and ranches are able to continue their current land use practices after the sale of a conservation easement, so selling a conservation easement can prevent fragmentation of agricultural lands and be a valuable



Shelley Harrison

Through the USDA Migratory Big Game Initiative, Hogg leases part of her ranch for habitat through the Grassland Conservation Reserve Program and is also able to enroll in the Environmental Quality Incentives Program to help fund things like wildlife-friendly fencing.

tool for intergenerational succession planning. Although Hogg's ranch does not have a conservation easement, other ranches in the region do. In the first year of the Big Game Partnership, the USDA dedicated over 10 million dollars in Wyoming for its Agricultural Conservation Easement Program.

Beyond the USDA tools, Wyoming Game and Fish has a dedicated Big Game Coordinator to help agencies, NGOs, and other partner groups work together to help landowners access the programs. The USDA also granted the University of Wyoming nearly a million dollars to provide technical and scientific support to the NRCS, Game and Fish, and other partners. With those funds, the Haub School of Environment and Natural Resources is evaluating the initiative's implementation, and Jerod Merkel's lab is creating science-driven mapping tools to direct conservation practices like wildlife-friendly fences and invasive annual grass treatments.

Regardless of these small but

innovative changes, the initiative is not for everyone. For some landowners, the payments for the Grassland CRP are still not enough to justify complying with the management plan. Other landowners don't have the time to apply and jump through the hurdles required to access the programs, which can take three to five years, for example, for an agricultural conservation easement. These challenges, and many more, may limit the federal government's capacity to conserve private land on a landscape level. But the USDA has taken a first step and initial results indicate widespread success.

In 2023, the Grassland CRP enrolled 61,149 acres in designated Big Game Priority Areas—a 264 percent increase from the previous two program enrollment periods in 2021 and 2022. With the additional funding for agricultural conservation easements, land trusts supported landowners in forever conserving over 11,830 acres of working lands and big game habitat across the state. The initiative in Wyoming

proved so successful in its first year, the USDA expanded it to Idaho and Montana in November 2023. Now, producers in those three states can also benefit from the package of opportunities available through the Grassland Conservation Reserve Program, Environmental Quality Incentives Program, and Agricultural Conservation Easement Program.

Preliminary research indicates that the Big Game Partnership has plenty more room to grow. A recent survey of nearly 800 Wyoming landowners, many of whom live within big game habitat, revealed that 85 percent of survey participants were unaware of the programs and benefits offered through the Big Game Partnership. Despite this lack of awareness, 55 percent said they might participate in the initiative if they were eligible. "This shows tremendous need and potential for partners and agencies to get the word out," says Hilary Byerly Flint, a senior research scientist at the Haub School who is leading a multi-year project to track how landowners

are responding to these large-scale public investments in conservation. "The goal of our research is to better understand landowner experiences so that programs can meet landowner needs and achieve conservation goals at the same time," she says.

Never before has there been such a galvanized approach to supporting working lands and migrations within the Greater Yellowstone Ecosystem, especially one that involved landowners so closely in the development. Bell, of the East Yellowstone Collaborative, says, "We commend the USDA for listening to the landowners. This improved approach to working land conservation has increased partnerships and trust with the very people who steward the land. This little bit goes a long way."

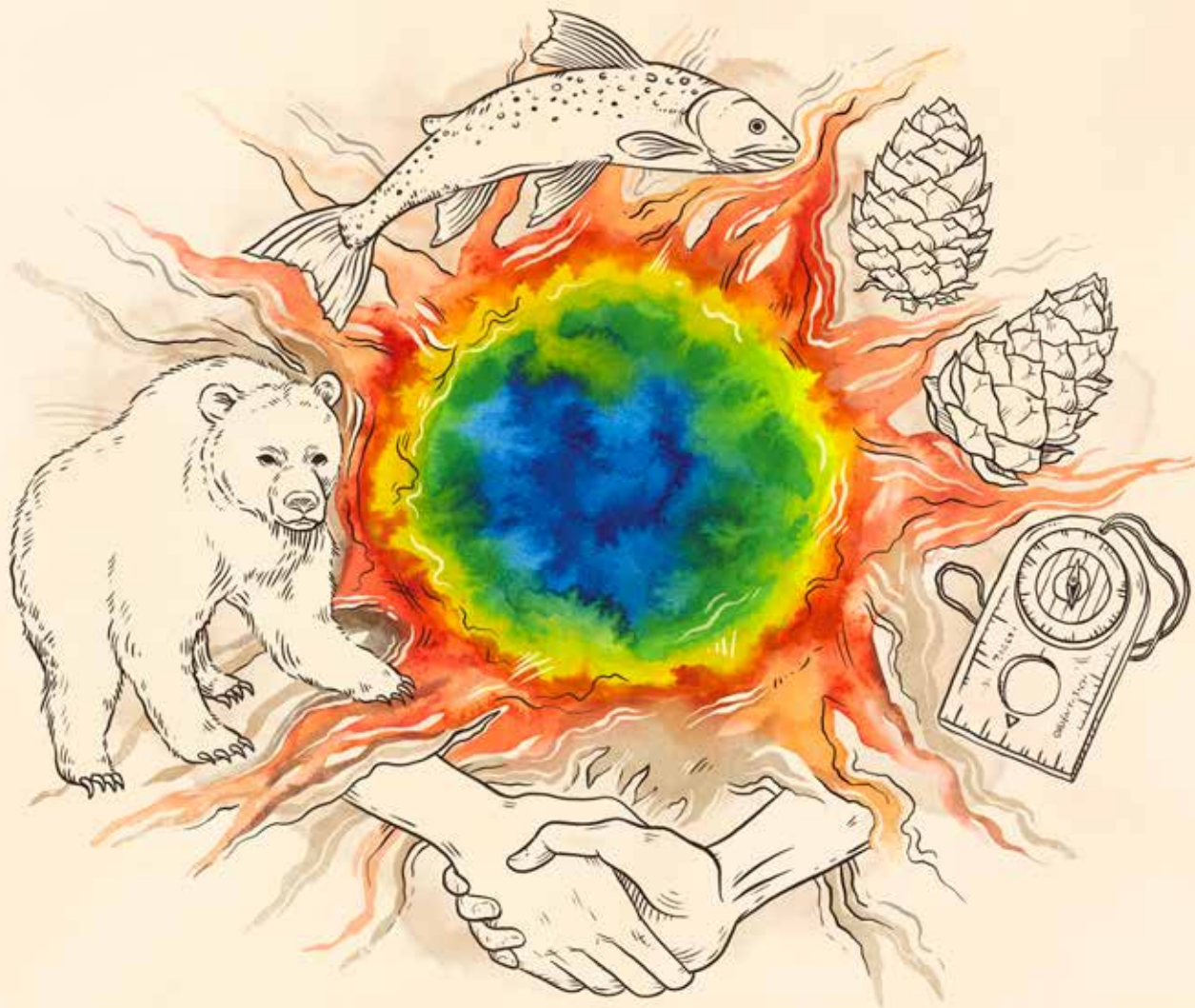
*Shaleas Harrison is the Wyoming Resource Coordinator for the Western Landowners Alliance, which advances the policies and practices that sustain working lands, connected landscapes, and native species.*



Tanner Wender/Wyoming Cooperative Fish and Wildlife Research Unit

Wildlife friendly fences have a smooth bottom wire for animals to crawl under and a low top wire for animals to jump over.





By Kristen Pope

Chip Jenkins, superintendent of Grand Teton National Park, knows he has to pay attention to what happens beyond his park's borders. He points to the Snake River, which he says is "arguably the lifeblood" of the park. "The headwaters are up in the Bridger-Teton National Forest. It flows through Yellowstone, flows through the John D. Rockefeller Parkway, through Grand Teton, and on through the community. So it's affected by what goes on outside the boundaries of Grand Teton National Park."

It's not just water, but also people, plants, and wildlife that cross boundaries, which is why Jenkins and other regional land managers participate in the Greater Yellowstone Coordinating Committee (GYCC).

# Managers Unite

THE GREATER YELLOWSTONE  
COORDINATING COMMITTEE  
CELEBRATES SIX DECADES OF  
COOPERATIVE CONSERVATION

The committee is not a formal decision-making body, but instead aims to foster voluntary collaboration and cooperation among agencies. Celebrating its 60th anniversary this year, the GYCC shows that the simple act of coming together,

even without extensive power and resources, improves conservation of large, complex landscapes.

The committee's purview—the Greater Yellowstone Ecosystem—is approximately the size of Maine, with Yellowstone located right in its heart.

Described as one of the largest nearly intact temperate-zone ecosystems on Earth, it is home to vast herds of wild bison and elk, grizzly bears, wolves, bald eagles, and even lynx and wolverines.

It also spans three states—Idaho, Montana, and Wyoming—and includes national parks, national forests, wildlife refuges, and other federal, state, and private lands. Because each land manager has their own unique policies, regulations, and priorities, issues that affect a broad area can get complicated. The GYCC, which began in 1964 as a Memorandum of Understanding between the US Forest Service and the National Park Service, has evolved over the decades to address this challenge.

“In the beginning, it was just the national parks and forests agreeing to communicate and collaborate at that time on routine matters,” says Tami Blackford, GYCC executive coordinator. Over the years, the group took on larger, more collaborative projects. In the 1970s, members worked together to develop consistent management direction for grizzly bears. In the 1980s, the group worked to aggregate their management plans and in 1990, they released a draft *Vision for the Future*, which culminated in the 1991 *Framework for Coordination*.

As the GYCC focused on wider projects, it only made sense to bring more land management agencies to the table. In 1999, the committee brought in the US Fish and Wildlife Service and in 2000, it created an executive coordinator position. In 2012, the Bureau of Land Management joined, followed in 2020 by the state wildlife directors of Idaho, Montana, and Wyoming. While cities, counties, private landowners, and tribes are not official committee members, the GYCC welcomes their engagement.

Together, committee members build relationships, exchange

“The reason that we have had these conservation successes is because people at the local community, at the state, and at the federal level have chosen to pursue and to work toward improving the condition of the ecosystem.”

Chip Jenkins

information, collaborate around cross-cutting issues, and support each other’s work through annual grant opportunities. “There are really rich opportunities to share and coordinate and not duplicate

effort,” Blackford says. The GYCC’s three strategic priorities are maintaining resilient landscapes, responding to increased visitor use, and strengthening coalitions, partnerships, and communications.

Jenkins, who currently chairs the committee, says the committee “provides a framework and form where we come together on a regular and routine basis. First and foremost, it provides the catalyst for us building relationships where we get to know each other as people. We get to know each other in terms of the work that we do, the challenges that we face, and what we’re trying to do.”

More than 300 people participate in the GYCC’s nine subcommittees, which tackle the transboundary challenges of fire management, hydrology, invasive species, whitebark pine, native fish, wildlife, climate change adaptation, and clean air. Coordinated research and planning efforts have led to joint products like the 2021 *Greater Yellowstone Climate Assessment* and the 2024 *Whitebark Pine Interagency Agreement*.

The GYCC also funds around \$250,000 of projects in priority areas each year. The 2024 round of selected projects focused on the ecological health of birds, creating smoke-ready communities, stream restoration, and more. One project addressed long-term monitoring of whitebark pine—an important fall food for grizzly bears—in northern parts of the Greater Yellowstone Ecosystem, while another project funded an outreach and prevention campaign about invasive species in the region.

“The Greater Yellowstone Coordinating Committee’s fingerprints are on a lot of really cool projects in that part of the world,” says Brian Nesvik, the just-retired director of the Wyoming Game and Fish Department. “While a lot of that ground is protected, there are still some real conservation needs. So the [GYCC] doing the work they’ve done over all these years is a really good thing for the ecosystem.”

Arthur Middleton, associate professor in the Department of Environmental Science, Policy, and Management at the University of California, Berkeley, thinks the committee has especially shined on certain issues, like work with grizzly bears and migrating ungulates. “The GYCC really is a place for these emerging issues to more rapidly become understood and kind of integrated into the planning across all those units,” he says.

In other cases, limited funding and personnel hours, as well as the spectrum of things the committee cannot control—like climate change and what happens on private lands—means the non-decision-making body’s power has been limited. “I think like anything that’s existed for 60 years, the GYCC has had its ups and its downs in terms of meeting its mission and intended goals,” Middleton says, though he points to the positive impacts of the organization saying, “I strongly feel that conservation has been improved by the GYCC.”

Jenkins acknowledges there have been bumps in the road, but believes the teamwork is paying off, pointing to the recovery of grizzly bears, wolves, and bald eagles, among others. “The reason that we have had these conservation successes is because people at the local community, at the state, and at the federal level have chosen to pursue and to work toward improving the condition of the ecosystem,” Jenkins says. “Yes it’s been contentious, yes there have been fights, yes there’s been political compromise, yes there’s been litigation, but arguably the ecosystem is in better health and better shape today than it was 60 years ago. And it’s because people set out to be intentional and thoughtful about the decisions that they want to make and recognize that they need to do that in a collaborative way.”

**Kristen Pope** is a freelance writer who lives in the Tetons. Find more of her work at [kepope.com](http://kepope.com).



In October 2022, GYCC managers took a field trip during their fall meeting to look at spring flood damage on the Custer Gallatin National Forest in the East Rosebud drainage. Current executives are listed at [fedgycc.org/about](http://fedgycc.org/about).



# A Promise at Risk

CLIMATE CHANGE  
THREATENS THE  
SÁMI WAY OF LIFE,  
AND SO DOES THE  
GREEN TRANSITION

By Camilla Sandström

Long ago, it is said, the Indigenous Sámi people of the North made a quiet, sacred promise with the reindeer. They would look after each other, bound in mutual trust and survival. The reindeer herders would ensure the herd's safety and provide food in exchange for a portion of the animals to support their families. Whether a myth or a deeply held belief, this connection between herder, reindeer, and land has formed the bedrock of Sámi culture, defining

a way of life that remains tied to the landscapes of northern Finland, Norway, Sweden, and parts of Russia.

This strong bond has shaped not only the Sámi people but also the lands they inhabit, known collectively as Sápmi, an area that is still perceived as relatively ecologically intact. But today, like many regions home to Indigenous communities, Sápmi faces mounting pressures not only from climate change, but also from the efforts to mitigate that change. The “green

transition,” or shift toward a fossil fuel-free society, has brought wind farms, mining, forestry, and more to the region. Without proper consultation, these projects threaten the reindeer's grazing lands and disrupt the delicate balance that has sustained this culture for centuries. As a result, the ancient promise between the reindeer herders and the reindeer is becoming harder and harder to uphold.

The landscape of Sápmi is characterized by a continuous

rhythm of change, from dark days to bright nights, warm summers to freezing winters. Beyond spring, summer, autumn, and winter, the Sámi people define four additional seasons: spring-summer, autumn-summer, autumn-winter, and spring-winter. This seasonal calendar, which structures the lives of the Sámi people, is based on the migrations of their semi-domesticated reindeer. In Sweden, this often means a journey of nearly 450 kilometers—from the high mountains near the Norwegian



Courtesy of Ina-Theres Sparrock

Ante Baer and Ina-Theres Sparrock. The Sámi are an Indigenous people native to Sápmi, a region spanning northern Norway, Sweden, Finland, and Russia's Kola Peninsula. Each year on February 6, Sámi People's Day is celebrated with traditional clothing, cuisine, and the flying of the Sámi flag.

border in the autumn-winter to the forest lands by the Bay of Bothnia in winter, then back again in spring-winter. This cyclical migration, intrinsic to Sámi culture, is made possible by the longstanding, legally upheld right of nomadic reindeer herders to use the land, public and private, for seasonal grazing.

Yet with climate change, these eight seasons are narrowing. Winters are becoming shorter, with as many as 58 days of snow already lost. This complicates the reindeer's passage across previously frozen rivers and lakes, making routes increasingly

dangerous as the ice thins. While the lack of snow can make food more accessible, "in Norway's coastal areas where we herd our reindeers during the winter," says Ina-Theres Sparrock, a herder in the Voengelh Njaarke reindeer herding district in Norway, "it complicates herd management and creates friction with local farmers."

In other cases, climate change can make lichen, reindeer's primary food source, harder to get to. "Unpredictable, extreme winter conditions, from heavy snowfall to cycles of freezing and thawing, creates

thick layers of ice that trap the vital lichen below, making it increasingly difficult for the reindeer to forage," says Ante Baer, a reindeer herder in the Vilhelmina Norra reindeer herding community in Sweden, and Sparrock's partner of over a decade. (Disclosure: Baer and Sparrock are the author's son and daughter-in-law.)

During these bad winters, it becomes more challenging to keep the herd together, Baer says, which also makes it more difficult to protect the reindeer from large carnivores such as lynx, wolverines, and eagles year-round, as well as brown bears during the spring-winter, spring, and summer seasons.

The summer, with its warmer temperatures and diminished snowfall, stresses the Arctic-adapted reindeer and brings new survival risks during heat waves. In these ways and more, the effects of climate change are already deeply felt in reindeer husbandry, reshaping the migratory patterns and the very fabric of Sámi life.

The green transition, which has emerged as a necessary response to the pressing challenges of climate change, has brought additional strain to these lands. Long used by the south for its resources, Sápmi has been host to mines, hydroelectric dams, and other extractive industries for more than a century. Today, the pursuit of cheap energy is accelerating a surge of activity, from battery factories and renewed mining ventures to large wind energy projects. For the reindeer herders, this relentless demand brings a double burden: the climate itself is changing, and so, too, is the land they rely on to preserve their way of life. A recent report on the impact from a Norwegian wind park on a reindeer herding community illustrates how one encroachment causes a chain reaction: loss of grazing areas disrupts seasonal pastures, directly impacting herd health, herders' finances, and finally their livelihood, language, and culture.

Forestry, too, is increasingly seen as a key component of the

green transition, due to its role as a significant carbon sink absorbing carbon dioxide and storing it long-term, while also providing renewable materials and bioenergy that substitute for more carbon-intensive products. However, in Sweden, it has also reduced the land rich in lichen—a critical food source for reindeer—by as much as 70%. This has left the landscape fragmented into smaller, isolated patches, increasing grazing pressure on the remaining areas. In Norway, forestry has a smaller impact, but farming, recreation, and tourism are increasingly occupying crucial mountain valleys, creating a lot of activity in areas that were previously rather pristine.

Research reveals that the cumulative effects of these various industries on Sámi lands are rarely fully considered, often leaving Sámi herders in court defending their right to land and the essential bond with their reindeer, with outcomes that vary. This undermines sustainable

“We have been here for countless generations, adapting ourselves and our practices to this landscape. It would take a great deal to move us from this place because our lives and the lives of our reindeer are woven into this land. We are still here, and we intend to stay.”

Ante Baer

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reindeer husbandry, which relies on a profound interdependence between people, animals, and land. “But,” says Baer, “it is possible to make some accommodations through careful planning, forest management, and collaboration.”

The Sámi, along with the United Nations Special Rapporteur on Indigenous Peoples, have long advocated for improved planning processes that more fully consider reindeer husbandry and align with international conventions on Indigenous rights ratified by the four nations encompassing Sápmi. For example, one pathway for cooperation is a formalized consultation process

embedded in forest certification schemes, which would require co-planning between forestry companies and reindeer herding communities. Recently, the introduction of free, prior, and informed consent has also provided herders with a new tool to protect vital grazing lands from further encroachment by forestry activities. However, effective processes remain lacking outside of the forestry sector, particularly those that would provide opportunities for co-planning and mutual consideration. This gap has become even more apparent as an increased sense of urgency fueled by climate change is accelerating decision-making around resource extraction.

Despite the many challenges they face, Baer and Sparrok, who are both 29, remain committed to a future in reindeer husbandry. They see the growing demand for healthy, unprocessed foods and the increased recognition of nature-based solutions as opportunities for their way of life to be part of the answer. They also acknowledge the urgent need for both individual and collective action to address climate change and the biodiversity crisis, and they believe reindeer herding offers unique insights and practices that align with sustainable land stewardship.

“We have been here for countless generations, adapting

ourselves and our practices to this landscape,” says Baer. “It would take a great deal to move us from this place because our lives and the lives of our reindeer are woven into this land. We are still here, and we intend to stay.”

**Camilla Sandström** is a professor in political science at Umeå University, Sweden and UNESCO Chair on Biosphere Reserves as Laboratories for Inclusive Societal Transformation. Her research focuses on how policy and governance can be designed to meet environmental goals and effectively manage conflicts between different objectives.



Ina-Theres Sparrok

Thinning ice along migration routes and summer heat waves are just two of the growing risks climate change poses to Sámi and their reindeer.



# HOME GROWN Hirolas

LOCAL  
COMMUNITIES  
LEAD THE  
PROTECTION OF  
AN ENDANGERED  
ANTELOPE

*By Tesia Lin*

In the 1990s, Kenya's hirola antelope population "plummeted from 15,000 to an estimated 300-500 animals," says retired professor, Dr. Richard Kock. As chief veterinary officer for the Kenya Wildlife Services at the time, Kock became involved because a virus called rinderpest was a suspected cause of the antelope's rapid downturn. The veterinary department was a new feature of the young agency, as was an emphasis on community-based wildlife management. Kenya's declining wildlife, including hirola, had spurred the reorganization of government conservation agencies and a growing focus on including different stakeholder perspectives in order to better regulate and meet management goals. The changes, within Kenya and broader African conservation communities, were not smooth ones, Kock recalls.

An early test for the new agency came when Elders of the Somali ethnic group sought the agency's aid in their stewardship of the hirola antelope. "They were saying, 'We really like this animal, and we don't want it to get taken away.' They felt that they had a right, in a sense, to



decisions made with this animal, as it was sort of sacred,” recalls Kock. But the team didn’t at first listen to their suggestions, reasoning that state authorities had rights over the antelope, not local people. “Being sort of arrogant conservationists, we thought, ‘Well that’s a nice idea, but we’re thinking something else instead,’” says Kock. Suspicious of the motives of local people, the team instigated relocation of a substantial number of hirola to Tsavo National Park to reinforce a small, previously translocated population. Without seeking further advice from the Elders, this created tension.

While places like Kenya are scientific meccas for foreign researchers hoping to work with “exotic” wildlife, people trained in other parts of the world are no match for the wisdom that local and Indigenous communities provide when it comes to cultivating or stewarding the land and its resources. Because these communities have persisted for centuries among eastern African wildlife, their understanding of the balance between people, wildlife, and the land is both deeper and more expansive.

Thus, when the Somali Elders requested assistance with a fenced-in sanctuary that would protect the hirola from predators, Kock recounts the idea as contrary to (what was then) best practice. “Their requests went against some [Western] principles of conservation,” he says. Fences cut animals off from the rest of their habitat, creating barriers to migration routes and reducing access to water and other resources. This can be particularly problematic in arid ecosystems like those in eastern Kenya, where water and good forage are already scarce.

But the team didn’t have many more promising options. Captive breeding had been fruitless and expensive in other countries and was considered unsuitable for this shy antelope. National parks and reserves had worked for other large mammals, including predators, but that success made them unlikely to



P. Matthews

When the hirola population plummeted from 15,000 to several hundred, Dr. Richard Kock—pictured here during helicopter darting operations—was called in to investigate rinderpest virus as a potential cause of the alarming decline.

support hirola. The sandy-colored antelope are highly visible in today’s grasslands, herd in small numbers, and leave their young relatively unprotected, all making them easy prey. Putting them in parks where predators were thriving could hurt the hirola numbers or stall population growth. Expanding national parks to encompass the hirola would also displace local people, whereas moving the hirola to existing parks isolated them from a beneficial environment alongside deeply invested protectors—the Somali community.

The Somali people have lived alongside hirola since time immemorial. The antelope, which Kock calls “living relics,” are thought to have existed in Kenya for almost 7 million years. As recently as the

Pleistocene (which ended around 12,000 years ago), populations roamed from the Horn of Africa to the continent’s southern tip. However, as the climate changed, so did the vegetation. Open, desert-like land that previously sustained the hirola dwindled and fragmented, pushing them closer to pastoral communities where the antelope found benefit in cohabitating with cattle. Cattle sites were better fertilized, resulting in more grass for consumption, and humans were protecting their livestock from predators, which increased hirola survival rates too.

Rather than see this as a conflict, Indigenous communities observed connections between the hirola, livestock performance, and land fertility. Only nourished land was

capable of sustaining both hirola and cattle, and the presence of hirola suggested healthy cattle, since the two are vulnerable to droughts and the same diseases. The hirola presented no harm to cattle and instead became tied to cattle well-being. “They became a symbol of good things, achieving a sacred value among the people,” says Kock.

As Kock and his team learned more about the depth of this relationship, they also realized the infeasibility of Western conservation ideologies. Echoing a need for change during this same time period, hirola were re-classified into its own genus, *Beatragus*, prompting the International Union for Conservation of Nature to elevate the species to *critically endangered*. This re-classification not only generated





The Somali people have lived alongside the hirola since time immemorial. Over time, the antelope has become associated with healthy cattle and fertile land.

“Conserving in our own land improves the living standards of our communities and helps minimize competition and conflicts.”

Abdullahi Ali

more interest and resources for conservation efforts, but it built momentum for the team to re-evaluate their approaches to restoring hirola populations. They began to accept that the Somali Elders—strong and committed in their efforts to save the hirola—had knowledge integral for maintaining hirola populations and that overlooking their advice would be data missing in the conservation effort. Kock says, “We didn’t have to work with the people, but it was the sensible thing to do to manage the species, so we eventually felt it was important to more concretely give them our support.”

As the millennium turned, a new community-based organization, the Northern Rangelands Trust, was set up out of the Lewa Conservancy (which Kock directed at the time).

Partially motivated by the tension and misunderstandings surrounding previous hirola translocations, this innovative trust developed to address the growing need for involvement of local and Indigenous communities with wildlife-related issues on a local level. Unlike government-owned national parks and reserves, trusts and conservancies tend to be smaller community programs that actively incorporate local people into stewardship. The trust worked with the Somali ethnic community to fulfill the Elders’ suggestions for a fenced refuge, and in 2004 laid the framework that became the Ishaqbini Hirola Community Conservancy. This conservancy is owned and managed by local, Indigenous people and is focused on empowering the pastoralist communities. Given the opportunity to sustainably manage

both their rangelands and hirola populations, the conservancy has since begun to see the recovery of the antelope.

“Problems at home need a homegrown solution,” says Dr. Abdullahi Ali. Ali is an Indigenous Kenyan, founder of the Hirola Conservation Program, and a University of Wyoming alumnus. He has always shared his home of Garissa—a small town situated by the Tana River in eastern Kenya that calls itself “Home of the Hirola”—with the antelope. Its enduring presence throughout his life inspired him to pursue a conservation career that puts his Indigenous knowledge first.

Growing up in the midst of Kenya’s changing conservation policies, he often noticed how scientists external to Indigenous communities would come in and misunderstand the situation at hand. For example, he says the enthusiasm for African predators caused scientists to seek out proof that predators were responsible for declining hirola populations. This excluded other factors contributing to hirola decline, such as habitat degradation, and it would have highlighted predator control as a solution. But predator control is resource intensive and, because “Africa has a multi-predator system that is key to ecosystem health,” Ali says, it could upset the delicate balance of natural and human communities.

For Ali, protecting the hirola is about maintaining that balance through grassland restoration, a more approachable method backed by his research. Ali’s doctoral dissertation at the University of Wyoming focused on the impact of habitat degradation on hirola antelope. He found that habitat change in eastern Africa from open grasslands to forested woodlands had been accelerated by the loss of elephants that no longer removed a lot of the woody trees. He believed that this could be remedied in a way that benefitted both local communities and ecosystems.



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Problems at home need a homegrown solution.

Abdullahi Ali

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Since “almost 70 percent of wildlife in Kenya thrives and coexists on community land,” he says, restoring grasslands to support the hirola also helps sustain people’s livelihoods.

Now, Ali’s Hirola Conservation Program endows eastern Kenyan communities with resources to conserve hirola, and inadvertently livestock, at a local level. The program employs people to essentially replace the work of elephants by thinning trees and planting native grasses. These same people then harvest the grass seeds and sell them back to the program. Farmers also receive suggestions on how to selectively graze their livestock on these grasses to ensure sustainability, and communities learn to help monitor hirola populations.

Given that the people have strong intrinsic cultural attachments to the land and wildlife that provides for them, many communities have established their own small conservancies, blending centuries of inherited knowledge and observation with modern needs for conserving wildlife. These smaller, more localized conservancies are a powerful tool for conservation and community development, Ali says. “Conserving in our own land improves the living standards of our communities and helps minimize competition and conflicts.”

If given space and inclusive voices, both Ali and Kock believe that ecosystems can recover—

and thus, people can recover. Ali believes, “When you empower the communities, you can feel a larger impact of conservation,” not only for the animals, but for the people. Despite the earlier involvement of many stakeholders in hirola conservation, it was the integration of foreign ideologies and science with locally led approaches that drove the development of solutions that ensured both hirola and human well-being. Ali believes that “there is a lot of conversation globally about putting conservation in local hands; we should add to that momentum. We all want to save the animals and the planet.”

*Tesia Lin is an ex-wildlife biologist and current biological systems researcher. She is passionate about learning from communities whose lifestyles and cultures are historically intertwined with their land and is grateful she has the opportunity to share their stories.*



Hirola Conservation Program

The Hirola Conservation Program’s Range Restoration Project employs local communities to restore grasslands for the hirola antelope by clearing invasive woody trees and planting native grasses.



Hirola Conservation Program

Around 70 percent of wildlife in Kenya thrives on community land, so restoring grasslands, like this group does, not only helps the hirola but also sustains people’s livelihoods.





# In the Shadow of the Lion King

## THE RISE OF COMMUNITY-BASED CONSERVATION IN AFRICA'S LAST ABSOLUTE MONARCHY

By Kelly Dunning

One of my first days in Eswatini, a small country bordered by South Africa and Mozambique, my guide told me a story about the Rhino Wars. In the 1990s, he said, “poaching of all wildlife was out of control,” and seemed poised to eliminate many wildlife species in the region. But then, “Eswatini’s biggest conservation leader, a man named Ted Reilly, brought a dead, poached rhino to the palace of the king and left it there for him. It was a sad sight—the rhino had been mutilated for its horn, the poor thing—but it left a message about the work the king needed to do to fix conservation in Eswatini,” he said. “From that day, and for decades, our king financed and supported projects to set aside preserves and to reintroduce wildlife that had been hunted to extinction.”

The change was dramatic. Today, you are more likely to see a rhino in Eswatini than anywhere else in the world. Overall, the country has 10 to 100 times less illicit wildlife poaching than nearby locations that are widely considered the crown jewels of wildlife safari tourism, including Kruger National Park. As a researcher interested in policy that supports sustainable tourism and wildlife conservation, I was in the country to investigate this incredible success. I wanted to know what wildlife

conservationists were doing in Eswatini to combat poaching, and if it could be replicated elsewhere on the continent. By the time my field work abruptly ended in a helicopter evacuation, I knew the question of poaching was tied up in the same cultural and political factors that shape the country itself.

Eswatini—known as Swaziland until the king renamed it in 2018 to celebrate 50 years of independence from colonial Great Britain—is Africa’s last absolute monarchy. The new name is in the native siSwati language and was meant to signify the importance of Indigenous culture to the Swazi people, embodied in their highest chief, the king. The king is also synonymous with wildlife—culturally, historically, and even linguistically. He is the *Ngwenyama*, which means lion, and the queen mother is the *Ndlovukazi*, or great she-elephant.

In the years since the Rhino Wars, the king has conferred royal protection on wildlife, with very stiff punishments for anyone who violates these protections. The royal protections are codified in Eswatini law and implemented by a complex system of Indigenous chiefdoms that span the kingdom at the local level. Each chief acts as the representative of the king in the village, overseeing natural resources (including wildlife), managing disputes, administering land uses, and enforcing the king’s rules.





Perhaps thanks to those rules, visitors are actually guaranteed to see a rhino in Hlane National Park, the king's royal preserve. I started my field work here, hoping to interview the elite game wardens who ensure the rhinos' survival. Waking early and excited in a green canvas bunk tent to the bellowing of hippos, I took a lightly heated shower courtesy of the camp's solar panels, which supplement the two hours a day a generator runs. Lack of power is common in Eswatini, which is among

This community-based wildlife conservation project harnessed the power of Eswatini's Indigenous culture and tradition, its youth, and its educational programs to build its own take on wildlife tourism.

the poorest nations in Africa, with 59 percent of the population living in poverty, and 20 percent in extreme poverty.

After a quick breakfast, I climbed aboard a safari truck with my Eswatini partners and set off to look for the "Big Five" of African safari tourism—rhinos, lions, leopards, African elephants, and Cape buffalo. On the way, my colleague explained that the royal national park had historically been the king's hunting grounds, with the strictest protections placed on the wildlife. Today, it makes up one of the largest (22,000 hectares), best resourced, most visited, and most well-managed protected areas in the country. Its conservation planning process is tightly controlled by the inner circle of the king and Ted Reilly, and its game wardens are some of the best in Africa. Sooner than I would have believed, we were eye to eye with rhinos. They were, simply put, majestic creatures, and the power of the king to protect wildlife species that are so widely poached elsewhere became immediately obvious.

When I interviewed the game wardens, who casually rested on their 30-caliber rifles while we chatted about their many brushes with death combating illicit poaching gangs, they suggested we take a detour to

what they said might be the "future of African wildlife tourism." According to the senior game warden, this community-based wildlife conservation project harnessed the power of Eswatini's Indigenous culture and tradition, its youth, and its educational programs to build its own take on wildlife tourism. Up to this point, most of the emphasis in my interviews was on the greatness of the king, so it was surprising to hear about the efforts of a smaller

village in protecting wildlife. I was eager to see it.

The next morning, my colleagues and I were on our way to the small community of Shewula, bundled up in coats, scarves, and hats against the winter morning's chill. When we exited the vehicle after four hours on rough dirt roads, we were immediately met with an extraordinary scenic view over the biodiversity hotspot of the Lubombo Mountains, with the border of



Courtesy of Kelly Dunning

Dunning tours Hlane National Park with All Out Africa and prepares to interview its elite game wardens. The king's royal preserve, Hlane is one of the best places in the world to see a rhino.





Kelly Dunning

Mozambique visible in the distance. We had arrived at Shewula Mountain Park, a community-based ecotourism project run entirely by members of the chiefdom.

Formed in 1999 with resources and encouragement from the king, Shewula is a stark contrast to Africa's bigger safari destinations, with their thronging crowds and Disney World-like atmosphere. Here, visitors are encouraged to become enmeshed in the life of the village, staying with community members, cooking with them, making handicrafts, and playing with their children. The wildlife walks are led by locals, and there are no fences, so the animals move freely around and through the village.

Our first stop was into the mud brick home of one of the local women who brews a milky white beer from sorghum. Under her thatched roof, we tasted beer with a communal ladle before another local took us out to look for giraffe, birds, and impala. It was just a quick walk from their homes to iconic African wildlife species and some of the best birding on the continent.

During our day of interviews with the Shewula villagers, we heard a lot about the king, and how it was his power protecting the wildlife from poaching. "If the king says wildlife is not to be poached, chiefs enforce this and villages listen," one community member told us. When—looking at a family of warthogs through binoculars—I asked our wildlife guide about the low poaching rates, he said, "The answer to your question can be found in the king himself. He loves wildlife. He is friends with the most important conservationists in the country, who have convinced him over years of friendship with the king and his father that wildlife are very important and great ways to make money. Without his support, Shewula would not exist as you experience it today."

"But," he added, "we are also a product of our way of life in our

village, and follow our chief." As I spent more time in Shewula, it was clear that the king wasn't the entire explanation for Eswatini's success in wildlife protection, or for Shewula's thriving and unique model of wildlife tourism. It was also the villagers, the importance they placed on intermingling Indigenous customs with wildlife tourism, and the opportunities it provided for economic development, youth education, and local stewardship.

I heard countless stories of widows supporting their children with their home brewing business and young men with no options immersing themselves in wildlife guiding, finding their specialty in birding or animal track identification. "If I didn't have the tour guide business, I would be unemployed. There would be no opportunity here," said our wildlife guide, who knew every bird by its call. "With the community-based wildlife tourism business that we all share in

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With the community-based wildlife tourism business that we all share in equally, there is a lot of opportunity to grow and be entrepreneurs. This demonstrates to us how important it is to protect wildlife that draws people here.

Wildlife guide

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Kelly Dunning

All the wildlife guides at Shewula Mountain Camp are locals, and the wildlife roam freely through the unfenced land around the village.



equally, there is a lot of opportunity to grow and be entrepreneurs. This demonstrates to us how important it is to protect wildlife that draws people here.”

The blending of culture and tourism has also helped win over the more skeptical community members, who worried that wildlife tourism would mean choosing to cater to foreigners with money over traditional ways—a frequent clash in African nations with wildlife tourism. Rather, Shewula villagers talked about leveraging traditional ways to bring in visitors, spur economic growth, and protect wildlife. Conservation was not viewed as something done for tourists, but rather as an essential part of the village’s way of life.

After leaving Shewula, I was starting to put together a story of royal protections interwoven with local people working to steward wildlife. Then, sitting in a colleague’s brightly lit kitchen in the capital city, an announcement came over the radio that some of the nation’s first and most extreme anti-monarchy protests were breaking out. Protesters were furious with economic conditions, including the persistent and extreme poverty, and the king’s absolute power to veto anything the government did. Within 24 hours, violence erupted and the king declared martial law, called in the army to put down the protests, closed the roads, and shut off the internet. Commercial airlines suspended flights in and out of the country and the US Embassy told us that they lacked the capacity to get us out—we would need to contact our crisis insurance.

The night the army came, our hotel’s owner allowed me into his family’s car and we drove up into one of the national parks, passing through a roadblock that was on fire. We stayed in one of the park’s lodges to avoid roving bands of protesters looking to burn any assets held by the king, including our hotel. I spent



Courtesy of Kelly Dunning

At Shewula Mountain Camp, visitors are encouraged to become enmeshed in the life of the village. This blending of culture and tourism has helped win over skeptics in the community who didn’t want to give up traditional ways to cater to foreigners.

the night watching flames engulf large portions of the city below and listening to thousands of rounds of unending gunfire. Grocery stores had been closed for three days, so all I had was a can of spaghetti sauce and a few gallons of water thankfully left in the abandoned hotel lobby.

The next day, we were able to evacuate by helicopter to Johannesburg, and then fly back to the United States. That first cheeseburger in the Johannesburg airport was the best in my entire life.

The extreme nature of the protests raised serious questions about the long-term survivability of the political system in Eswatini, and by extension the system of wildlife protection that just days before had seemed so strong to me. In a remote interview with a national park manager, he said, “When people

see wildlife as the same as the king, when the king is protested or maybe one day toppled, protests will target wildlife and parks because it is seen as part and parcel with the king. This makes our system brittle and puts our wildlife at risk.”

I knew that there was dissatisfaction and anger with the king, who embezzles significant money from public coffers, according to both my interviews and many good governance nonprofits. I also knew how closely associated the king and wildlife are. But still, brittle was not the word I would use to describe wildlife conservation in Eswatini. The situation was too complicated to be defined by a single narrative around the monarchy.

Within this autocratic system where the king’s word is law, community-driven enterprises

like Shewula are leading the way in growing the wildlife tourism community. There, wildlife conservation practice is strong. All walks of life are involved, invested, and benefitting. And they are embracing the change and innovation that is needed. It’s that strong investment by the community, rooted in the Indigenous cultural system, that I suspect conservationists across Africa may look to when trying to meet the many, multi-faceted challenges that face their countries and their wildlife.

**Kelly Dunning** is the Timberline Professor of Sustainable Tourism and Outdoor Recreation at the University of Wyoming. She has been working collaboratively on sustainable development in sub-Saharan Africa since 2009.



# So Much More than Habitat

## HOW THE INTERSECTION OF WILDLIFE ECOLOGY AND SOCIAL SCIENCE CAN IMPROVE HUMAN-WILDLIFE CONFLICT MANAGEMENT

By Ezra Stepanek

**B**runa Ferreira tried to go into her conversations with the people living around Atlantic Forest State Park without expectations. That was the point of Fantastic Detectives, the program she leads in central Brazil aimed at developing community-driven strategies for coexistence between people and wildlife. With farms, ranches, and villages surrounding the 3.6 square miles of protected area, it seemed like a recipe for conflict. There were some cases of mountain lions and other predators killing livestock, but Ferreira and her team were not making any assumptions. Instead, they were asking the community to define the problems they experienced and share their ideas for living alongside wildlife.

She was still skeptical when she heard story after story of black jaguar sightings. “My grandfather saw a black jaguar,” one rancher told her. “I was driving, and I saw one off the road,” another claimed. “It seemed really impossible, because there haven’t been any register of [black] jaguars in the area for decades,” she says. Then, just a few months after hearing these stories, the team caught a black jaguar on the wildlife cameras they set up in the state park. “People knew about it earlier than any of us that were researching there,” she says. “It was amazing to see and hear and then look through the people’s stories with new eyes.”

Fantastic Detectives is part of an emerging field that combines social and ecological understanding to attain a better picture of the complex interactions within a landscape shared by people and wildlife. This is a departure from conservation management and planning that focuses only on ecological data, like habitat suitability, and disregards people’s attitudes, beliefs, and behaviors completely or until the end. Meaningfully including people from the beginning, Ferreira and others say, is a far more effective way to reduce human-wildlife conflict and improve conservation outcomes.



Fantastic Detectives



Stephanie Teodoro dos Santos



Juliana Benck Passa

**Top:** A black jaguar and a mountain lion photographed by wildlife cameras in Atlantic Forest State Park in Brazil. **Left:** Bruna Ferreira speaking to one of the farmers around Atlantic Forest State Park. **Right:** A farmer that Fantastic Detectives interviewed shows off a large jaguar paw print on his property.



“Generally, we see when there is a coexistence project, there are [conservationists] that come and say, ‘These are the methods you can use to avoid predation [of cattle] and all that,’ but they don’t often ask what the farmers want or what the ranchers want,” says Ferreira. Situations like this often result in regulations that locals feel are forced on them and don’t reflect the situation on the ground. After being left out for so long, communities can be wary of engaging with researchers at all.

Fantastic Detectives, with support from the Cerrado Mammal Conservation Program and Colorado State University’s Center for Collaborative Conservation fellowship program, plans to develop a conservation and coexistence action plan that involves local people every step of the way. “We want this action plan that can be really implemented and can be made in collaboration with everybody, so everybody has ownership of the process,” Ferreira says. Hearing stories from the local people, like black jaguar sightings, has been the first step in building trust between the local people and the team. Their discussions and workshops with locals are centered around conserving the iconic, but threatened, jaguar, mountain lion, hoary fox, and maned wolf. The Fantastic Detectives have also presented in schools, hosted a fire training, and shared what they captured on camera traps to open the conversation.

Already, Ferreira has noticed a world of difference in how friendly the people are compared to the beginning of their research. One farmer, who was one of the team’s first interviewees, called her a month after they visited to report a huge jaguar pawprint on his land. He sent pictures and invited the team to come back to visit. “It was really special because after a month away, he still remembered us and talked to us,” says Ferreira. The key, she



Andrew Butler

Keifer Titus deploys a wildlife camera near a scent post marker to better understand the ecological part of the socio-ecological picture.

says, is just letting people into the conversation. “When you just give them time to talk, they engage in the projects because it’s more near what they know.”

Because they are still in the early stages of their work, the Fantastic Detectives have yet to observe tangible conservation improvements. Nevertheless, Ferreira is hopeful their efforts to create a collaborative space will not only foster human-wildlife coexistence but also increase citizen participation in conservation efforts.

Keifer Titus also studies conflict between agriculture and conservation, but on working lands in Montana. Before starting the field work for his PhD in wildlife and fisheries biology from Clemson University, he had seen and heard a lot of negativity about ranchers in the West. “The people that [do] extractive agriculture or agriculture

in general almost always get a bad rap, right? Like, they’re the ones doing the harm for the wildlife.” But, he says, “when I got out there and interacted with these folks . . . it couldn’t have been more opposite. These people care more about the land than most. They want to see wildlife doing well.” Those conversations showed him that “if we could just, from the beginning, get these stakeholders on the same page, it just would do so much better for conservation and preservation of culture and livelihoods,” says Titus.

Like Fantastic Detectives, Titus’s work is grounded in bringing local stakeholders into the conversation from the beginning, specifically to coproduce science, which he says can create better conservation strategies for both people and wildlife. “Without public buy-in, most of the time [wildlife restoration

and conservation efforts] are unsuccessful, especially in the long term,” says Titus. Where his work goes beyond community engagement is combining data about ranchers’ attitudes towards wildlife with common spatial modeling techniques to create a map of social and ecological conditions on a landscape. “We’re really good at modeling the environmental side. A lot of times we can have the best habitat available for the species we’re looking to restore or conserve, but if social conditions aren’t right, it’s a barrier to achieving a lot of the restoration goals that we might have,” says Titus. Being able to see where both factors are favorable, called areas of socio-ecological suitability, can help conservationists make more informed decisions on where to focus their efforts.

For example, part of Titus’s work was trying to identify the

best place to do habitat restoration for mountain lions in and around Charles M. Russell National Wildlife Refuge. To do this, he developed maps to identify places with both high habitat value for mountain lions and high local tolerance for them. To measure tolerance, Titus and his team sent out mail surveys to Montana ranchers across the plains region asking them to agree or disagree with statements related to their attitudes towards the species, their support for incentives and conservation for the species, and how they behave toward the species on their land. Titus mapped the survey results, relating tolerance to things like the proportion of public lands and the presence of conservation easements around respondents' ranch lands. Then, he modeled habitat suitability according to land type, elevation, terrain, and the distance to roads and water. Based off only the habitat data, the public land in the wildlife refuge appeared to be the best candidate for habitat restoration. But tolerance was relatively low there. Conversely, further north of the wildlife refuge in areas with more private land, the habitat quality was much lower but the tolerance for mountain lions

“Without public buy-in, most of the time [wildlife restoration and conservation efforts] are unsuccessful, especially in the long term.

Dr. Keifer Titus

was the highest, which “seemed backwards to us from the ecology side of things,” says Titus.

Since Titus's framework was one of the first of its kind, he was uncertain if the suitability results reflected an accurate picture of the landscape. He had the opportunity to share his results at The Nature Conservancy's Matador Ranch Science and Land Management Symposium, where wildlife researchers, ranchers, and the public come together to discuss the latest

research. Titus and his team spoke with some of the same ranchers surveyed to collect tolerance data, who confirmed the accuracy of the predictive maps. Because higher-quality mountain lion habitat is in the wildlife refuge, those working around it are more likely to have had negative interactions with mountain lions and therefore lower tolerance. The ranchers living where mountain lions don't frequent as much have higher tolerance because they haven't had any issues with them. Bringing the two sets of data together helped create a clearer picture than each on their own. “It hit home that it's so much more than habitat, and it causes us to need to think creatively about how we're aiming for restoration,” says Titus, who now works as a postdoctoral scholar in the Oregon Cooperative Fish and Wildlife Research Unit in the Department of Fisheries, Wildlife and Conservation Science at Oregon State University.

Though his model is among the first, socio-ecological integration is a growing field. A 2023 literature review in *Landscape Ecology* found 104 articles that used integrative approaches like Titus's, with the

majority from 2020 or after. There were several different approaches in analysis, including attempts to understand the complicated drivers behind tolerance and incorporating predictions about the outcomes of possible management strategies. Common research questions included where on a landscape human-wildlife interactions occurred, what ecological and social factors impacted interactions the most, and if interactions could be accurately predicted to improve management strategies.

The review also pointed out challenges and opportunities for growth, particularly around the measurement of sociological data. According to Titus, social variables like attitudes and tolerance can be hard to map onto a landscape, fluctuate often, and take time and money to repeatedly survey for. A lack of standard methodology, on the other hand, makes collaboration and comparison across studies difficult. But none of these challenges are stopping Titus. “While it might not be systematic, necessarily, from a Western science perspective, there's tons of qualitative information that can really help us move the needle for wildlife.”

The more research there is, the better. As new studies fill in gaps and streamline the process, socio-ecologically integrated approaches will become easier to implement widely and may start to change norms in the conservation community toward always including diverse voices in the conversation. Titus is very excited at the possibilities: “I think this is going to be the next frontier of how we approach wildlife restoration in working lands.”

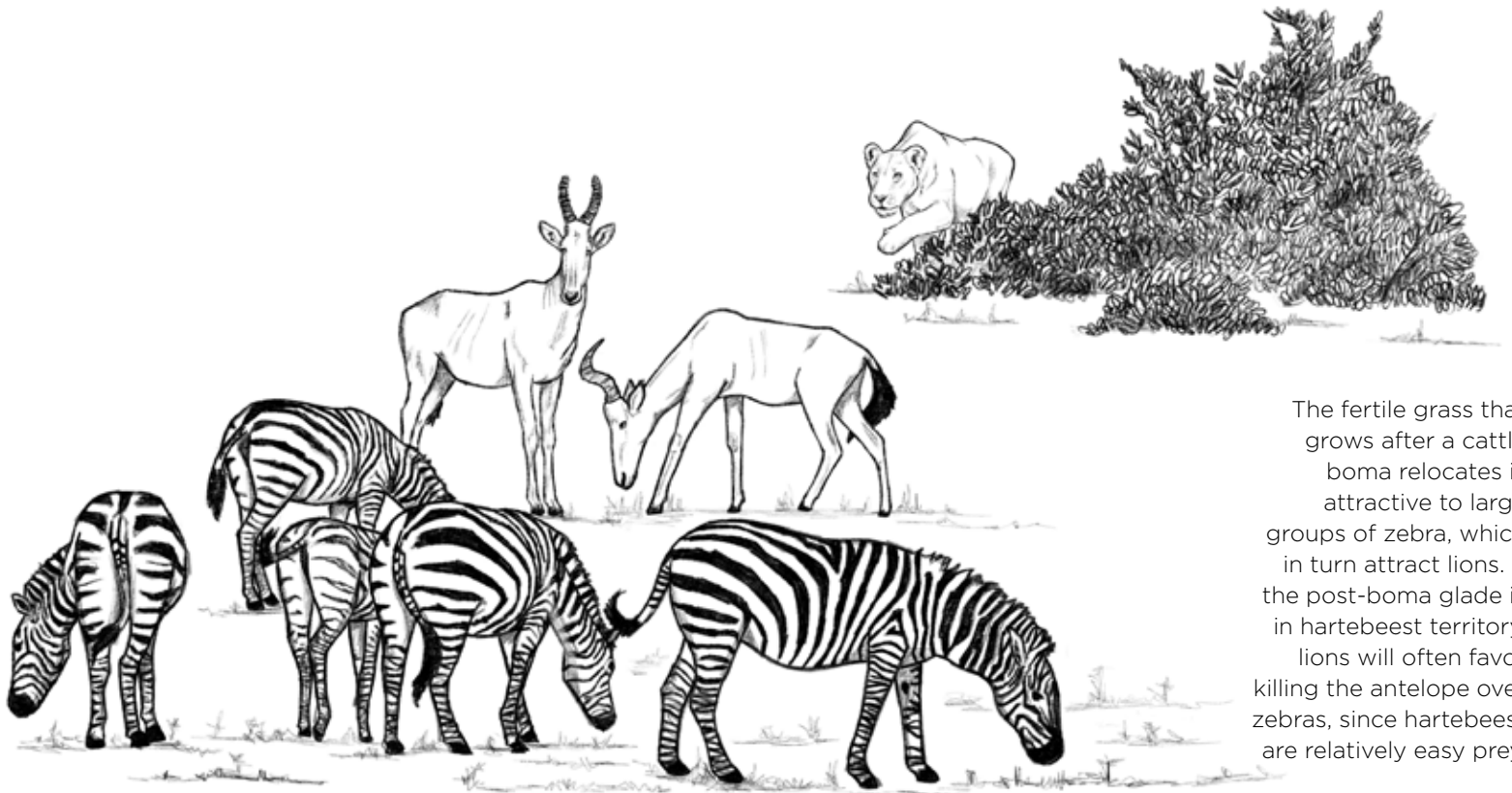
**Ezra Stepanek** is a WyACT Science Journalism Intern and an undergraduate student at the University of Wyoming. He is studying environmental systems science, environment and natural resources, and communication.



Keifer Titus

In addition to mountain lions, Keifer Titus also predicted “socio-ecological suitability” for swift fox, pronghorn, and black-tailed prairie dogs in the Northern Great Plains of Montana.





The fertile grass that grows after a cattle boma relocates is attractive to large groups of zebra, which in turn attract lions. If the post-boma glade is in hartebeest territory, lions will often favor killing the antelope over zebras, since hartebeest are relatively easy prey.

# Barriers to Survival

COULD  
A CENTURIES-  
OLD PASTORALIST  
TOOL HELP  
CONSERVE A RARE  
ANTELOPE?

By Annabella Helman

In Kenya's Rift Valley, a pride of lions begins to stir as the sun descends to the horizon and the air grows still. A pastoralist with his 60 cattle, alert to the night's dangers, begins to usher the herd inside of a large enclosure called a cattle boma. The boma, a centuries-old conflict mitigation tool typically made of branches from the acacia tree, creates a thorny barrier to keep out lions, leopards, and spotted hyenas that might eat, injure, or harass the cattle. Today, some communities use more effective, metal-fenced bomas to protect their livestock from depredation overnight.

Like many ways that people deal with human-wildlife conflict, these bomas work by creating barriers to separate property from wildlife. This method has greatly reduced the immediate problem—large carnivores killing livestock—but new research indicates that cattle bomas have an unintended consequence that threatens the Jackson's hartebeest, a unique and rapidly declining antelope in central Kenya. Rather than addressing this decline by advising against the use of this crucial human-wildlife conflict mitigation tool or reducing lion numbers, conservationists in Kenya have an

opportunity to strategically leverage the cattle boma to conserve lions and their wild prey.

As human populations and affluence escalate, human-wildlife conflict is increasing in both frequency and severity. Direct conflicts, like predators killing livestock and people, get a lot of attention; most solutions, including compensation schemes and predator removal, focus on these unambiguous situations. Indirect conflicts often go unnoticed but can have profound impacts on both wildlife and human communities.

In Laikipia County, located in central Kenya, local people's main economic activity is herding goats, sheep, and cattle. From the 1950s to 1980s, pastoralists and ranching businesses often killed lions to suppress predator population numbers and their perceived threat to the local cattle economy. But as wildlife tourism in Kenya gained popularity and offered an additional or alternative way to earn a living, local people saw the value in maintaining populations of large predators to encourage tourist dollars. This led to the restoration of lions in the late 1990s.

Concurrently, the growing popularity of multiuse landscapes in conservation, which aim

to maintain wildlife populations without disrupting human activities, means that pastoralists are herding livestock on the same landscape where tourists will have their first lion sighting. The increased overlap of wildlife and human activities means more conflict—predominately between livestock and wildlife—which has led to a reliance on cattle bomas across multiuse landscapes.

Recent research has discovered that these bomas create a legacy of impact on the behaviors of wildlife long after they are rotated to new locations or abandoned. In the months that cattle spend their nights fenced inside the bomas, their manure accumulates and fertilizes the area. After the cattle and bomas are gone, the rich soil gives rise to glades—lush lawns of highly nutritious grasses. The grass attracts grazers, especially zebras, that will gather in large numbers within the glades. Lions, who appreciate predictability when hunting, will then seek out these gatherings of zebra for a better chance at their preferred meal. This dynamic, where cattle bomas create hotspots that attract zebras, which subsequently attract hungry lions, has an unfortunate consequence for hartebeest.

Jackson's hartebeest, a hybrid between Coke's hartebeest and Lelwel hartebeest, only occurs over a small range in central Kenya and is one of the fastest-declining antelope species in this region. Researchers have historically attributed this rapid decline to a combination of disease, habitat loss, and predation pressure. Recent work linking predation pressure to bomas and glades could change the way the antelope is conserved.

Dr. Caroline Ng'weno and her team found that when hartebeest, a territorial species, have cattle bomas rotated within 500 meters of their territories, they suffer significantly higher predation rates compared to hartebeest that don't have cattle

Annabella Helman



bomas near their territories. That's because hartebeest are fairly easy to hunt, so if they are present at a glade, lions will often favor killing them over the zebras that first drew the lions in.

This finding highlights the unintended consequences of human activities on wildlife, even when those activities are aimed at reducing direct conflicts. It also demonstrates that efforts to mitigate conflict may miss dynamics like these when not taking a holistic view, focusing on single species, and not including humans in the conversation of ecology. The irony lies in the fact that cattle bomas, initially intended to

minimize clashes between livestock and wildlife and to reduce retaliatory killing of predators, are inadvertently contributing to the decline of a particularly vulnerable antelope.

However, because this dynamic originates with human intervention, there may be a way to leverage cattle bomas as a tool for conservation. If pastoralists are strategic in planning boma locations away from hartebeest territories, they could help concentrate lion hunting away from this sensitive species, thereby offering a spatial refuge.

This approach would not only engage pastoralists in conservation efforts but also contribute directly

The irony lies in the fact that cattle bomas, initially intended to minimize clashes between livestock and wildlife and to reduce retaliatory killing of predators, are inadvertently contributing to the decline of a particularly vulnerable antelope.

to the protection of the rapidly declining hartebeest population in central Kenya. Moreover, this method offers a promising alternative to the traditional approach of reducing predator populations to alleviate pressure on threatened species. By manipulating natural predator-prey interactions, we have the potential to conserve both lions and their prey, striking a balance between the needs of humans and wildlife in shared landscapes. Taking this more holistic approach, which accounts for both direct and indirect impacts of human activities, opens the door to creative solutions grounded in coexistence, not conflict.

**Annabella Helman** is a PhD Student in the Zoology and Physiology Department at the University of Wyoming under Jake Goheen. Her research focuses on methods of promoting human-wildlife coexistence in Laikipia, Kenya, with an emphasis on local-led conservation efforts. Her work will implement an informed boma placement strategy to conserve hartebeest in Kenya.





A field in Utah's Upper Bear River Watershed is flood-irrigated to produce grass hay. Flood irrigation in historic floodplains higher in watersheds can create a sponge effect that slowly releases water back into the waterway over the course of a growing season.



# HIGH BUT NOT DRY

By Emily Downing

Every spring, Chris Williams looks forward to seeing the terns alight on the meadows of the southern Wyoming ranch that he manages. It's a fleeting sight—the birds are there for one day and then they're gone, off to breeding grounds further north. However brief, the terns' stopover on the ZN Ranch is an essential part of their migratory journey, as it is for the dozens of other species Williams sees every year.

"We provide this edge of green right in the middle of the sagebrush, which is important for a lot of animals," Williams says. "Our irrigation isn't just about waterfowl and wading birds, but it's that edge habitat that supports deer, elk, antelope, sage grouse—all of it."

The ZN Ranch, like most other ranching operations in the Upper North

Platte watershed, relies on a system of dirt ditches dug by hand in the 1880s to sustain that edge of green. In the spring, when tributary creeks are running high, the ditches divert water and spread it over the floodplain to grow lush grass that will be cut for hay. In the face of a drying western climate, ranching operations that use flood irrigation to grow food for livestock have come under fire for taking too much water out of streams and rivers. But new research is showing that flood irrigation in certain places does so much more than grow hay—it might just be the glue holding western ecosystems together.

As the West's water resources are stretched thin, policymakers and the public are calling for increased irrigation efficiency on agricultural land to reduce one of the highest demands on water in the West. The reasoning goes that flood

IN THE RIGHT  
PLACES, FLOOD  
IRRIGATION MIGHT  
BE DOING MORE  
GOOD THAN HARM



Hamdi Nikonov

An Idaho rancher drops a board into a ditch to redirect irrigation water onto a grass hay meadow. State and federal programs that provide funding for irrigation infrastructure improvements overwhelmingly incentivize the adoption of more “efficient” systems like sprinklers.

“These sites are often invaluable because they’re putting water in the right place at the right time of year to provide the right kind of habitat for the birds moving through the area.”

Patrick Donnelly

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irrigation—where water is spread out over a field and left to slowly saturate the soil—is inefficient because much of the water that’s diverted is “lost” to seepage and evaporation, rather than directly supporting growing plants. Conversion to center-pivot sprinklers, lined canals, and other irrigation methods intends to minimize these losses while ensuring as much water as possible goes to crop production. As a result, federal programs that fund irrigation infrastructure upgrades are prioritizing the conversion to drip or pivot sprinkler irrigation systems.

But this calculated way of thinking about crop production doesn’t account for the interconnected pathways that water follows as it moves through a healthy watershed, supporting aquifers, fisheries, and wildlife along the way. Specifically, flood irrigation that happens along historic river floodplains can provide a slew of benefits beyond agricultural yields.

Before rivers became highly regulated and channelized, floodplain meadows served as sponges, soaking up the spring runoff that topped the creek’s banks. Beaver dams and other diversions slowed the fast-moving snowmelt, spreading it over low-lying meadows and saturating everything. The flooding formed temporary wetlands that provided habitat for migratory waterbirds and food for big game animals. Later in the season, when river flows were low, water that wasn’t absorbed by the plants growing along the floodplain returned to the waterway’s main channel, helping keep it flowing and functional.

Today, the dirt ditches used by Williams and his neighbors along the banks of Pass Creek mimic these natural flooding cycles, sustaining ribbons of green that provide outsized value for wildlife and human communities. A 2024 study published in *Agriculture, Ecosystems, and Environment* found that although flood-irrigated floodplain

meadows are only 2.5 percent of the Intermountain West’s irrigated footprint, they provide 58 percent of the region’s temporary wetlands (shallow wetlands that exist for fewer than two months each year) and 20 percent of seasonal wetlands (wetlands that remain wet between two and six months each year).

Both wetland types are needed by waterbirds and waterfowl at different stages of their lifecycle, from nesting and breeding to fueling up during migration. Patrick Donnelly, a spatial ecologist for the Intermountain West Joint Venture and the US Fish and Wildlife Service who led the research, says that without flood irrigation practices, many of these wetlands would vanish, creating massive habitat gaps for migratory birds. (Disclosure: the author is employed by Intermountain West Joint Venture.)

“These sites are often invaluable because they’re putting water in the right place at the right time of year to provide the right kind of habitat for the birds moving through the area,” Donnelly says. “When they dry up, due to infrastructure conversion or maybe even the loss of the agricultural operation to development, the flyway becomes increasingly fragile.”

Emerging research also suggests that flood irrigation can provide other benefits by saturating soils and feeding groundwater supplies, although there is still much to learn about how surface and groundwater are connected. *Frontiers in Environmental Science* recently published one such study on the Henry’s Fork River in Eastern Idaho, an important fishery at the headwaters of the Snake River.

Christina Morrisett, the lead author of the research, says that from 1978 to 2000, many agricultural producers along the Henry’s Fork converted from flood irrigation to pivot infrastructure. As expected, surface water diversion from the river decreased by 23 percent over those years, meaning operators were



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Water flows downstream, so whatever isn't used high up can be recycled by someone else.

Christina Morrisett

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taking less water out of the river. However, return flows to the river also decreased significantly. That's because when irrigators change to a system that sprinkles or drips small amounts of water onto crops, it waters the crops and nothing else. “You're probably not putting anything back into the system,” says Morrisett. The end result was that there was less water in the river after the conversion than there had been before.

In contrast, Williams points out that the irrigation water he uses is recycled multiple times as it moves downstream. After helping plants grow, the “excess” water from flood irrigation infiltrates the earth and can make its way back to the



Hamid Nikonov

A large flock of white-faced ibis take advantage of the shallow patches of surface water over vegetation created by flood irrigation. Fields like this provide most of the temporary wetlands that ibis and other waterbirds rely on during their migrations across the Intermountain West each spring.

river, creek, or aquifer and continue downstream for future uses. “My upstream neighbors turn it out and put it on their fields and then it goes back into the creek and I'll pick it up and irrigate with it again and again,” he says. “That water will get used four or five times before getting back to the creek.”

Morrisett says that's one reason why operations located higher up in watersheds might be the most important places to maintain traditional flood irrigation practices. There, irrigated meadows in the floodplain can soak up and slowly release water for wildlife and downstream users across the growing season. “Water flows downstream, so whatever isn't used high up can be recycled by someone else,” she says.

As communities of the West make difficult decisions about water, science that pinpoints where irrigation provides multiple ecosystem services will be increasingly helpful. Further research into how water moves through watersheds and affects groundwater supplies and aquifers—and how human actions influence both of those things—will also be important.

In the meantime, supporting farmers and ranchers like Williams who use flood irrigation high in the watershed is an easy way to bolster resilience and preserve

critical habitat in the West. Funding federal and state programs that enable producers to continue doing what they're already doing, on a relatively small percentage of private land, will have outsized impacts on preserving watershed function—and key habitat—in the places where it counts. That way, the terns (and the sandhill cranes, the warblers, the mule deer, the pronghorn, and the elk) have somewhere to return to next spring, and all the springs in the future.

**Emily Downing** is the Water 4 Communications Specialist for the Intermountain West Joint Venture, a regional public-private partnership that conserves habitat for the benefit of priority bird species, other wildlife, and people. Her role involves producing media that tells the story of emergent wetland habitats on public and private lands in the Intermountain West. In her free time, she is outside with her husband and dogs exploring the mountains and sagebrush around their home in Polaris, Montana.



Don Paul

A greater sandhill crane and its colt use a flood-irrigated grass hay meadow in early summer. An outstanding food source for cranes raising their young, these meadows account for 60 percent of sandhill crane summering habitat.

# In Sync with Sheep

## TRAVELING ABROAD TO FIND HOME

By Katie Doyle

Last winter, I stepped out of a cable car packed with people and onto a volcano in the Canary Islands, staring speechless at the North Atlantic Ocean 12,000 feet below. It was the furthest I'd ever been from my home in Wyoming and the incredible reality promptly knocked the wind out of me. My classmates on the study abroad trip scattered, eager to explore Mount Teide, whose eruption helped form Tenerife, the

Mouflon hunts did not become as popular as people expected, and with no predators to keep them in check, their populations flourished in the national park.

largest of the seven Canary Islands. I heard someone behind me ask the purpose of the barbed wire fence that stretched out before us, and the cable car operator replied, "It's to keep the sheep out." I immediately snapped out of my bewilderment and into wildlife biology mode, unsheathing my binoculars and searching for a good spot to settle in.

As I sat on top of Teide, binoculars glued to my eyes, I felt the familiar excitement and hope course through me that I had felt so many times during my four years working seasonally in wildlife management in Montana, Idaho, and Texas. During those years I honed my deer, elk, and bighorn sheep spotting skills, and I was thrilled at the chance to perform my favorite activity to look for a new species in a foreign place. It felt both familiar and strange, the kind of experience that blew my mind, inspired me to continue traveling, and made me miss home all at once.

Unfortunately, our group was limited to one hour at the top of the volcano. When our time was up, I reluctantly put away my binoculars and stored away the sunny memory to call upon during the long, dark Wyoming winter to which I would soon return. Although I did not spot



Introduced to Tenerife for hunting, mouflon sheep eat and trample native vegetation, exacerbating other stressors like climate change.

them, the sheep held my attention for the remaining few days of our trip. As our bus took us down winding roads away from the park, I asked our guide, Omar, to tell me everything he knew about them.

As he described the sheep, a species called mouflon, he showed me a picture on his phone of a large male with big curling horns and dark brown fur perched on the side of a cliff. Like the bighorn and barbary sheep they resemble, mouflon thrive in steep, rocky, and dry environments like those found in Teide National Park. He explained that hunters introduced them to Tenerife in 1970 to diversify big game hunting opportunities on the island. Mouflon hunts did not become as popular as people expected, and with no predators to keep them in check, their populations flourished in the national park.

Teide's high, rocky features are a great fit for the mouflon, but the land that encircles the volcano is home to delicate plant species that have suffered from the sheep's introduction and population growth. Omar pointed out the bus window at a scene that looked so much like the sagebrush steppe I was used to back home, and he explained that many of the plants we saw are endemic to Tenerife, meaning they do not grow naturally anywhere else in the world. Introduced mammals like mouflon sheep and European rabbits eat and trample these delicate species. Coupled with recent rising temperatures, this has increased stress on the plants and the park biologists that manage them. Twice a year, managers cull the mouflon populations to cut down their numbers on the island and reduce their impact on the plants.



The brown, rocky ledges turned to lush green forest as we drove, and massive turquoise waves rode onto black sand beaches. The awe and bewilderment rushed back into my mind, but I couldn't stop thinking about the mouflon. Even though I knew the amount of stress they cause to native vegetation and park biologists, and that ultimately they should not be here, I still wanted to see them browsing the high cliffs.

This internal conflict reminded me of the landowners and managers that I work with in Wyoming to better understand the human side of wildlife management. I chose this type of work for my graduate studies after finishing my wildlife degree, entering the field, and quickly realizing the inseparable effects that wildlife and humans have on each other. Recently, my focus has been on private landowners outside of Yellowstone National Park, who are most affected by deer, elk, and pronghorn that migrate out of Yellowstone and onto private lands during the winter, when resources are few and scattered. Once there, they can damage infrastructure, compete with livestock for food, and pass diseases to livestock. I spent a year traveling to these landowners' homes, sitting at large, wooden kitchen tables and listening to stories of grandmothers who counted migrating deer each fall and fathers who taught their sons and daughters to "leave some hay for the elk" when harvesting each year. Their love and respect for wildlife shone through as they spoke of their responsibility as stewards of the land and their job to keep it healthy for all who inhabit it. But their brows furrowed and wistful looks faded as they detailed the time and money that living with wildlife requires. For them, the season's first migrating animal can spark just as much worry as it does joy.

As we pulled into the parking lot of our hotel, my classmates and I talked about the effect that our time in Tenerife had on us and what we wanted to take home from the



Courtesy of Katie Doyle

Doyle spent years tracking and studying bighorn sheep, and other ungulates like deer, elk, moose, and pronghorn, in the Intermountain West.

experience. Some students felt that the trip broadened their professional opportunities, others excitedly talked about the bird species they could now cross off their "must see" list. I felt that my experience confirmed my career choice. My interest in the people involved in the protection of our natural resources grew immeasurably and my eagerness to find the mouflon told me that the wildlife management field is where I belong. The travel brochures show beautiful landscapes and fun in the sun, I thought, but the value of travel is found in the parts that hit close to home.

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**Katie Doyle** is a graduate student at the University of Wyoming pursuing the master's degree in Environment, Natural Resources, & Society. This piece was produced for the Western Confluence magazine fellowship course.



Katie Doyle

With ecosystems ranging from volcanic scrub to dense laurel forests, Tenerife features some 1,400 species of plants, more than 100 of which are endemic to the island.



## News from the Ruckelshaus Institute

*Western Confluence* is a publication of the Ruckelshaus Institute at the University of Wyoming's Haub School of Environment and Natural Resources. The institute supports community-driven approaches to environmental challenges through collaboration, convening, and communication. Learn more at [uwo.edu/ruckelshaus](http://uwo.edu/ruckelshaus).

### Western Confluence wins top regional awards

Issue 12, which explored the intersection of conservation and human prosperity, won two first-place awards in the Society of Professional Journalists' Top of the Rockies competition. The contest received more than 1,900 entries from 80 news outlets and 30 freelancers. Janey Fugate's "Bison on Wind River" earned first place in the Short Form Feature Writing category. Jill Bergman's "Flight Interrupted" won first place in the Illustration category for a pair of linocuts she created for the story. Top of the Rockies is a regional, multiplatform contest for reporters and news organizations in Colorado, New Mexico, Utah and Wyoming.



Jill Bergman



Ruckelshaus Institute

### Consternation and collaboration around public lands

In August 2023, the Bureau of Land Management released its Draft Resource Management Plan (RMP) for the Rock Springs Field Office in southwest Wyoming. In response to public outcry, Wyoming Governor Mark Gordon assembled a task force to develop consensus recommendations for revising the Draft RMP to meet the needs of Wyoming stakeholders. The Ruckelshaus Institute facilitated the task force meetings and held a series of interactive public workshops to help inform task force deliberations. More information and documentation is available at [uwo.edu/rmp](http://uwo.edu/rmp).

The institute will continue to support federal land use planning in the future. We just entered into a five-year agreement with the US Forest Service to help with forest planning in the Rocky Mountain and Intermountain Regions.

### SAVE THE DATE

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# Beyond Yellowstone

## REVISITING THE ORIGINAL NATURE CONSERVATION MODEL

*Perspective from Robert B. Keiter*

Yellowstone National Park—established in 1872 and widely regarded as the world’s first national park—represents the initial dominant model for nature conservation both here and abroad. Early US national park designations generally followed the “Yellowstone model,” which entailed setting aside broad swathes of publicly owned lands in the American West to protect native wildlife, scenic features, and wilderness-like settings. The new parks prohibited any permanent human presence, including the original Native American occupants. Other countries soon followed the same model, creating their own national parks and wildlife reserves that often also excluded human communities. It represented an enclave approach to nature conservation that has, over the years, proved problematic for failing to fully attend to the needs of natural and human communities.

Not long after Yellowstone was established, it became apparent that the high elevation park was not large enough to meet its wildlife conservation goals. In 1882, General Phil Sheridan coined the phrase “Greater Yellowstone” as part of an effort to address the absence of critical winter habitat within the park’s boundaries and highlight the need for landscape-scale thinking. Although park expansion efforts went nowhere, the establishment of forest reserves—now known as national forests—adjacent to Yellowstone during the ensuing decades helped with the habitat problem. Less than a century later, ecological science validated Sheridan’s concerns, giving rise to the “Greater Yellowstone Ecosystem” concept, which has further extended nature conservation efforts beyond the park’s boundaries.

Outside the United States, the “Yellowstone model” provided the impetus for early national park designations, but also proved problematic in many locations.



*Courtesy of Robert Keiter*

Centuries-old human communities frequently occupied and used landscapes suitable for national park status. Local residents regularly depended on park resources for their sustenance and were unwilling to ignore wildlife depredation and damage incidents that threatened their livelihood. As in the US, it was also apparent that ecosystem-level conservation was required to protect native wildlife while inside and outside the parks, and to secure local cooperation with these efforts. Enter the community-based conservation idea, designed to promote coexistence by enlisting residents in the conservation effort through local participation in park management decisions, community economic benefits derived from the preservation efforts, and compensatory programs addressing wildlife incidents.

Over time, this evolving Yellowstone conservation model, which featured an enlarged focus on the entire ecosystem and the need to integrate community concerns into wildlife conservation efforts, has been institutionalized in the developed and developing world. One example is the UNESCO Biosphere Reserve program, which employs concentric zoning that emanates outward from a protected core national park and permits a heavier human presence and more intensive uses the greater the distance from the park. Another example

comes from Nepal with its joint Makalu-Barun National Park and Conservation Area designation that reduces the level of protection in the surrounding conservation area. In Poland, buffer zones help protect wildlife straying outside its national parks.

A similar and related evolution is evident in US national park conservation policies. As time has passed, Congress has expanded the original national park idea by devising new designations—national monuments, national recreation areas, national preserves, national seashores, and the like—all of which deviate from the strict Yellowstone model of nature conservation. More recently, the ecosystem management idea has taken hold in the Greater Yellowstone region and elsewhere, informally yet effectively extending nature conservation efforts beyond park boundaries. Often drawing upon international models, local communities are now regularly brought into conservation efforts in recognition of the undeniable linkages between residents and nearby national parks. Significant efforts are also afoot to incorporate original Indigenous occupants and their traditional ecological knowledge into national park conservation efforts. And these trends will likely continue. Simply put, the original “Yellowstone model” has evolved as the US has adapted its nature conservation strategies to meet today’s challenges, sometimes employing conservation strategies that have originated elsewhere.

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**Robert B. Keiter** is the Wallace Stegner Professor of Law, University Distinguished Professor, and founding Director of the Wallace Stegner Center for Land, Resources, and the Environment at the University of Utah. His books include the forthcoming *Conserving Nature in Greater Yellowstone: Controversy and Change in an Iconic Ecosystem*, *To Conserve Unimpaired: The Evolution of the National Park Idea*, and other works.

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