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editor's note

Cover art **Aindri C.**

In 1950, only 20% of the entire human population lived in urban areas. Today cities are home to 45% of the world's 8.2 billion people. But what about their non-human residents? A global analysis of six faunal groups (including bats, birds and reptiles) across hundreds of cities found that species that are mobile, generalist, and able to exploit human-altered resources are more common, whereas others decline. This theme of loss, but also of hope, threads through the latest edition of *Current Conservation*.

Priyanka Borah's piece on Assamese oral traditions demonstrates how, as *xiyal* (jackals) vanish from places they previously occupied across India, so do the stories—and ecological knowledge and cultural values—associated with them. Our feature story by Liana Knipe similarly grieves the loss of natural landscapes to rapid urbanisation, but shows how a village in Hampshire, England, is turning despair into action. Meanwhile, coyotes have made a few big cities in the US their home, thus offering lessons on sharing space in a changing world.

In her article on soil microbes, Kristin Huizinga draws our attention to these overlooked organisms below our feet that are essential for the functioning of entire ecosystems. And our expanded Research in Translation section features everything from deep-sea sponges to capuchin monkeys and amphibians. We hope you enjoy this issue!

– ***Devathi Parashuram***

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Fading memories and forgotten tales

JACKALS IN ASSAMESE NARRATIVES

Author **Priyanka Borah** | *Illustrator* **Harshita Borah**

I was walking through the streets under the scorching sun. Suddenly, my gaze fell on an *aita,* an elderly woman, sitting on the threshold of her home. As soon as our eyes met, she smiled and gestured for me to come closer. I introduced myself as a wildlife researcher and told her I had come to speak with her. She welcomed me warmly and began recalling how the place looked some 30-40 years ago.

"Jackals?" she said, her eyes lighting up with memory. "Back then, this whole area was full of trees and wild vegetation. There were only two or three houses around. And on chilly winter evenings, around six o'clock, the jackals would start howling. They even came into our front yard and we could see them clearly in the moonlight."

As she spoke, weaving memories into vivid threads of nostalgia, I sat there thinking about how powerful it is to listen to these stories. This was during my fieldwork in Assam, India. I had set out to understand how people perceive species such as jackals—once commonly seen, but rarely heard or spotted now.

Assam is a land where wildlife is deeply embedded in the culture. Jackals too have long been associated with its storytelling traditions and folklore. Growing up in this state, I often heard stories about them, such as how they would sneak into villages to snatch poultry. Consequently, people would chase them off, sometimes throwing sickles or knives. One story that stayed with me was about a jackal who lost its tail during such an encounter, which gave rise to the image of the "tailless jackal" famous in Assamese folktales.

These stories made me wonder—were such narratives grounded in real-life interactions? With the spread of urbanisation and shrinking natural habitats, are younger generations still aware of these tales?

Oral traditions

Although considered ecologically resilient on account of their wide distribution and flexible diet, golden jackals are vanishing from places across India that they previously occupied. Habitat modification, intensive agriculture, urbanisation, fatal vehicular collisions, hunting, interactions with free-ranging dogs, are some of the threats faced by this so-called resilient species. And populations are now only found in fragmented patches.

As I continued speaking with people across different age groups from urban, peri-urban, and rural areas, I began collecting beautiful oral narratives that featured the *xiyal* (jackal) in everyday life. These included poems, lullabies, idioms, and stories.

"Xiyali ei, nahibi rati, ture kaney kati logamei bati. Kaankati murote moruwa phool, Kaankati palegoi Rotonpur." In this lullaby, a mother warns a jackal not to come at night to disturb her child. If it dares to come, she says, she will cut off its ear and use it as a wick for her oil lamp. She goes on to describe the jackal wearing an imaginary flower on its head. The animal is then said to be walking far enough to reach an imaginary village (famous in Assamese tales) called Rotonpur. Though sung playfully, this lullaby conveys subtle cues of human-jackal interactions and instils a fear of jackals in young children.

Another children's rhyme goes: *"Rod dise, boruxun dise, xora xiyal r biya, ghonsirikai tamul katise, amak-u olop diya."* It translates roughly to: "If it's raining and sunny at the same time, then it's the tailless jackal's wedding. The sparrows are cutting betel nuts. The guests, including humans, request them to share some nuts." The poem anthropomorphises jackals and links them with cultural practices in Assam such as betel nut chewing, and associating their presence with certain weather events—even if not ecologically grounded.

Proverbs, too, reflect the jackal's place in Assamese life. One saying goes: *"Xui thaka xiyal e haah dhoribo nuare",* a very common sarcastic dialogue used by Assamese parents. It translates to "A sleeping jackal can't catch poultry", implying that laziness leads to failure. But this expression also reveals ecological knowledge that they prey on poultry or birds.

"Siyale soru suwte, kukur motyote nai" is used when someone tries to blame another for something they didn't do. It likely arose from lived experiences. In the past, jackals would sneak into kitchens that were made of bamboo and mud, sometimes picking up or eating from clay utensils. If the animal wasn't seen, dogs were blamed. But the elders would say, "There were no dogs in the village then, it must've been a jackal."

Older respondents also shared how, in the past, dogs were domesticated specifically to deter jackals. Stories by Lakshminath Bezbaruah in *Burhi Aai'r Xadhu* (Grandmother's Folktales), often portrayed jackals as clever tricksters or wise animals. It shows their dynamic relationships with humans and other animals. These stories, while entertaining, also served to normalise human-animal coexistence, inflict moral values, and pass on ecological understanding, especially to children.

As I continued my fieldwork, one observation stood out clearly: perceptions of jackals varied greatly across generations. When I interviewed younger adults, a common pattern emerged. They had heard of *xiyal,* but many were unable to identify the jackal when shown a photo. Some recalled hearing jackal howls during their childhood. However, they also said such occurrences had become rare in recent years in the cities. Interestingly, most of them were familiar with the animals more through oral stories than real-life encounters. Many expressed concern over habitat loss and felt that jackals were disappearing due to rapid environmental changes. They believed that jackals and other wildlife in shared spaces should be protected. In addition, they also suggested nature education is important for raising awareness.

When I spoke to children, especially in urban areas, the connection had shifted even further. Most had never heard oral narratives about jackals. Their knowledge came primarily from textbooks or YouTube videos. In peri-urban and rural areas, some children had seen these canids but often expressed fear or disinterest. Many felt they belonged inside forests and should not be near human settlements. The emotional and cultural familiarity, and ecological knowledge about jackals as predators or scavengers that older generations possessed seemed to be fading.

Precious connections

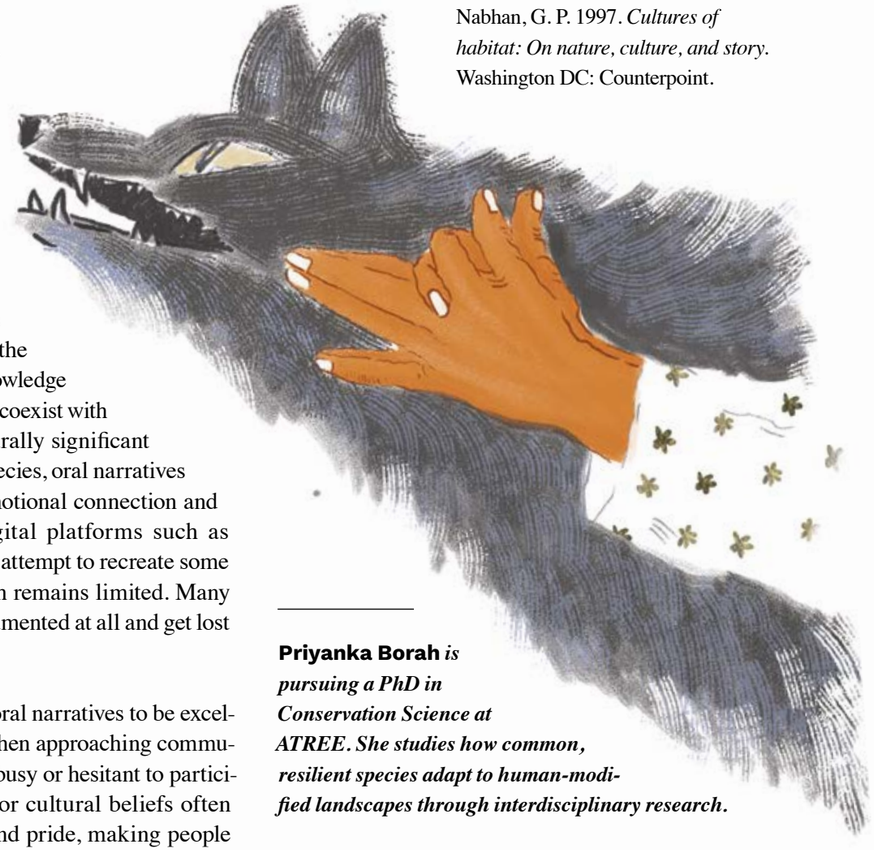
This whole experience made me realise that the species conservation is not only about counting them and mapping habitats—it is also about listening. Narratives are valuable repositories and an important part of culture. Shaped by knowledge, experience, and beliefs, they provide

a window to understanding the interconnectedness between human and more-than-human worlds. They also enable us to think about and make sense of social structures.

Further, narratives tell us how people historically observed and interpreted wildlife behaviour, as well as how they perceive and value the natural world. They can foster empathy and tolerance towards wildlife, or sometimes reinforce fear, hatred, or indifference. In communities across Assam, jackals live not just as biological entities, but as characters reflecting what Nabhan (1997) once called "cultures of habitat".

During my interactions, I began to sense that as cities grow and daily life becomes more fast-paced, people's connection with nature is gradually diminishing. Narratives were once a bridge between generations and between humans and non-human animals. But as they fade, it signals not only the loss of stories, but a form of knowledge that has long helped humans to coexist with non-human species. For culturally significant but overlooked or common species, oral narratives can help rekindle people's emotional connection and build awareness. While digital platforms such as YouTube and children's books attempt to recreate some of these narratives, their reach remains limited. Many traditional stories are not documented at all and get lost with time.

As a researcher, I have found oral narratives to be excellent icebreakers. Especially when approaching communities where people are often busy or hesitant to participate. Asking about folklore or cultural beliefs often stirred a sense of nostalgia and pride, making people more open, engaged, and willing to talk. Thus, in a world racing ahead, listening to forgotten stories can perhaps help us find our way back to our roots.



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OVERLOOKED ALLIES:

SOIL MICROBES DESERVE CONSERVATION ATTENTION TOO

Author **Kristin Huizinga** | *Illustrator* **Hitesh Sonar**

When we think about conservation, plants and animals are often the first organisms that come to mind. This makes logical sense as they are large, visible to the naked eye, and can be easily observed, allowing us to study their populations and understand their roles in their ecosystems. Many are considered charismatic and can evoke an emotional response to their plight—just think of a baby elephant or a panda eating bamboo. Or picture a sea turtle stuck in a fisherman's net or seaweed suffocated by plastic debris. Who wouldn't want to save them?

What about organisms we can't easily see or observe? Like soil microorganisms. At the base of the soil food web, they are essential to supporting biodiversity and nutrient flow within ecosystems. Given their microscopic size, they often remain neglected. And we typically only hear about microbes in relation to disease or illness. This raises two questions: **do soil microbes need conservation, and how would we even know?**

It's not as straightforward as referring to the IUCN's Red List of Threatened Species, because microorganisms are rarely included in such assessments.

In this article, let's look at why conservation of soil microbes is important (spoiler alert—it has to do with the ecosystem functions they perform!).We'll also cover how microbiologists look at microbial diversity and its drivers, the impacts of climate change on soil microbial communities, and what we should do to preserve this important group of organisms.

No small feat

Although invisible to the naked eye, soil microbes play a crucial role in our ecosystems. These microbes—bacteria, archaea, fungi, and viruses—are crucial for nutrient cycling. For example, if a tree dies, fungi and bacteria are largely responsible for breaking down organic compounds present in the wood (such as lignin, cellulose, and hemicellulose), so that carbon is released back into the ecosystem. Without them, our world would be full of dead plant tissue that would not decay effectively.

Besides carbon, soil microbes also play a key role in nitrogen cycling. Nitrogen is essential for plant growth and is used to make chlorophyll, proteins, the nucleic acids (DNA and RNA), and other compounds needed for growth and development. Nitrogen in the air cannot be used by plants until it is converted to ammonia, which plants are able to absorb through their roots. There are free-living and plant-symbiotic bacteria in soil that perform this conversion, called nitrogen fixation. In fact, one of the most well-known and agriculturally important relationships between plants and bacteria is found between leguminous plants (such as soybeans, chickpeas, alfalfa) and nitrogen-fixing bacterial symbionts.

These are just two examples of the important roles soil microbes play in ecosystem functioning. There are many more, and they are dependent on the vast diversity of microbes found in soil. Unfortunately, this diversity is being impacted by the same factors responsible for the global decline in biodiversity that we see today, such as land use change and climate change.

Quantifying diversity

To know if organisms should have a conservation plan, we need to know a few facts. These include understanding their ecological roles and populations, and the possible impacts if there is a change in their population size. So how do we collect this information? Before the advancements in DNA sequencing technology, this task was quite challenging. To determine the variety and abundance of microbial species in a soil sample, microbiologists had to depend on isolating pure cultures of the microbes found in soil. However, it is estimated that only about 1 percent of microbes can be cultured, which means this method did not provide a complete understanding of microbial life in the soil.

Fortunately, with advances in DNA sequencing technology, it became easier to sequence genes that help identify microbes as well as their functional genes. Functional genes encode proteins that provide clues about the ecosystem functions provided by the microbial community. For example, if DNA from a soil sample reveals many copies of a gene for the protein that converts atmospheric nitrogen to ammonia, we can predict that the microbial community includes members that are part of the nitrogen cycle, thereby supplying a nitrogen source for plants.

But despite the ease of using sequencing to explore microbial species and functional diversity (traits in a community that influence how the ecosystem functions), there are several challenges. Microbial diversity in soil is incredibly high, requiring statistical models to estimate the total number of species present. A recent estimate suggests that the total number of soil bacteria, fungi, viruses, and archaea could range from the millions to trillions. With such numbers, it's not surprising that there is still much to be explored. In fact, of the soil bacteria alone, only about 3 percent of the taxa present are estimated to have had their genome sequenced.

Diversity versus function

Scientists have found that soil microorganism communities vary based on the ecosystem they inhabit, such as deserts, tropical forests, or grasslands. This is mainly due to differences in the pH levels of these environments. In addition, there are other significant factors impacting community composition, including soil water content, organic carbon content, vegetation type, and oxygen levels.

Microorganism species diversity in soil is lowest in areas with very low or very high pH levels. Low pH soils are typically found in the tropics, the Arctic tundra, and boreal forests. In contrast, high pH soils are common in deserts, drylands, and arid grasslands. The regions known as 'hotspots', which contain the highest number of different microorganism species, are temperate habitats with a neutral pH level.

Unlike species diversity, the ecosystem functions performed by soil microbes vary depending on the specific ecosystem in which the community is found. For example, a survey of genes involved in nitrogen cycling showed that pH was not a reliable predictor of the diversity of these functional genes. Instead, habitat type and the amounts of carbon and nitrogen in the soil were more accurate predictors. Biomes with the highest abundance of nitrogen cycling genes include tropical forests and areas with high nitrogen inputs, such as pastures, lawns, and agricultural fields. This observation makes sense as nitrogen inputs tend to be high in human-influenced environments, and tropical forest soils generally have fewer nitrogen limitations compared to soils from other environments.

Climate impacts

So how will soil microbial communities be affected as the planet warms? A study from 2021 provided a global view to examine various scenarios of potential climate and land use changes. A key prediction is that climate change will have a greater impact on microbial communities than land use change. Perhaps this is not too surprising because climate change is happening on a global scale, while changes in land use occur locally.

The study also revealed that in over 85 percent of land-based ecosystems, the composition of soil bacterial communities will become increasingly similar. This trend is mainly due to changes in soil pH, which in turn, is linked to the changes in precipitation, temperature, and a reduction in vegetation cover that comes with a warming climate. These results are concerning because greater similarities in microbial communities can lead to reduced variability in their functional genes. And this decline in genetic diversity may cause challenges for microbial communities to adapt to a changing climate and perform essential functions needed for maintaining a healthy ecosystem.

In addition to a loss of genetic variability, the composition of soil microbial communities is predicted to be altered due to climate change. These changes will affect the functions that these communities provide. In fact, in many climate change scenarios, it is anticipated that soil microbes will release more carbon dioxide through the increased decomposition of organic matter. This will result in less healthy soils as they will lose organic carbon. To make it worse, this sets up a positive feedback loop: the release of more carbon dioxide contributes to rising temperatures, which in turn creates conditions that cause even more carbon to be lost over time.

The way forward

To conserve soil microbial communities, we must preserve the substrate they live in by establishing specific soil conservation targets when designing policies. While we have made progress in identifying soil microbial diversity and ecosystem function 'hotspots', there are still gaps in our understanding. Further research is needed to refine predictive models so that governments and conservation organisations have the information needed to make informed decisions.

Current studies on hotspots of soil microbial diversity and ecosystem functions indicate that these two types of hotspots do not always coincide. Therefore, both should be taken into consideration in conservation strategies. Additionally, ongoing land use change and climate change will impact microbial communities, potentially changing the locations of diversity and ecosystem service hotspots over time. This must also be considered when developing strategies.

Although there is much work to be done, we have made significant progress. We can maintain this momentum by continuing to expand our knowledge of soil microbe communities and encouraging government agencies and conservation groups to use that knowledge for incorporating soil conservation targets into their policy and conservation plans.

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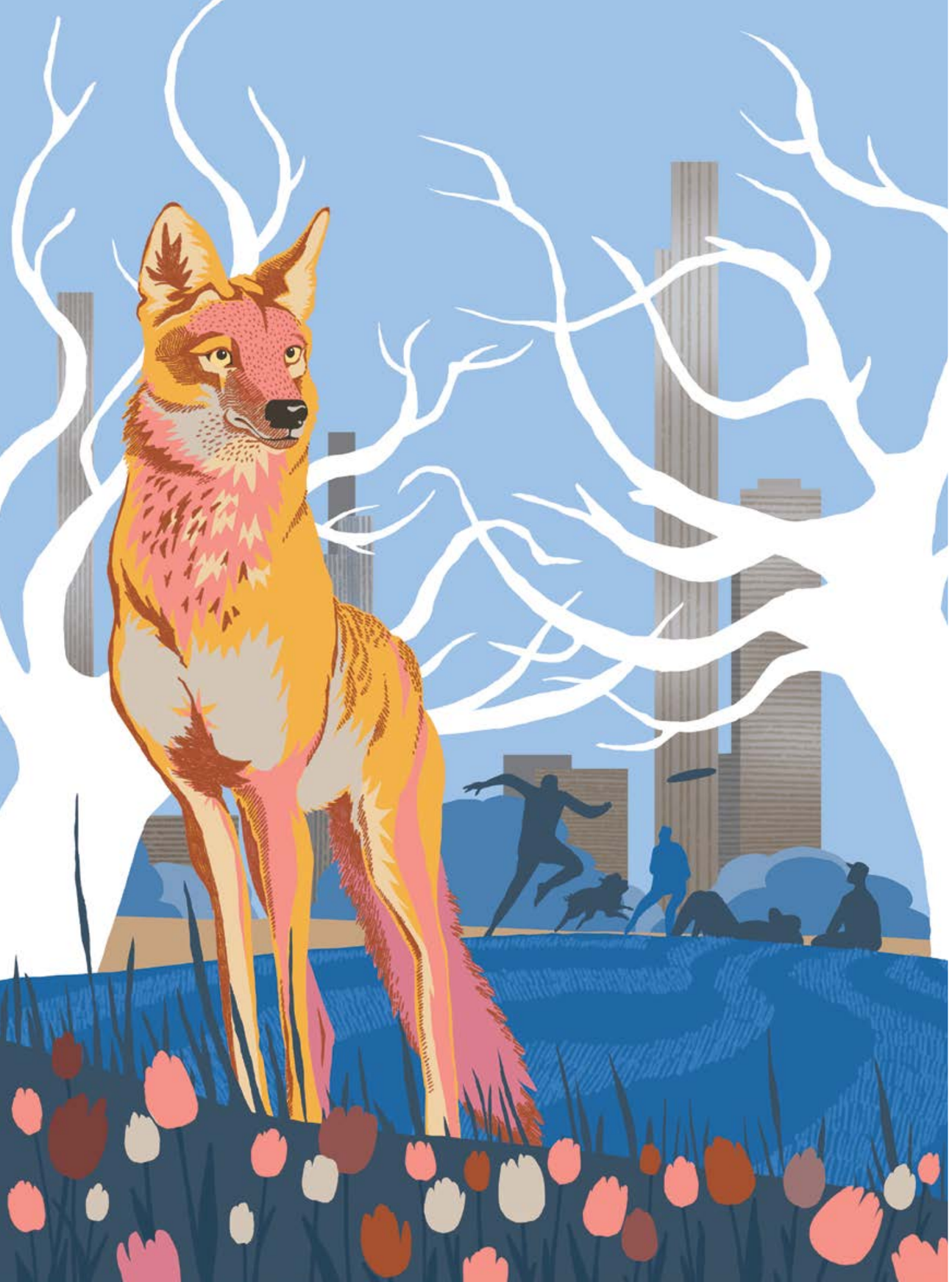
URBAN COYOTES: How these clever canids made cities their home

Author **David Rodriguez**
Illustrator **Harshad Marathe**

Over the past few decades, coyotes—animals most people associate with deserts or rural areas—have been popping up in places you'd never expect: big cities. From San Francisco and Denver to Chicago and even New York City, these wild canids are learning to live side-by-side with humans. It's a major shift, and it brings up some interesting questions. How are they surviving in these concrete jungles? What does that mean for us?

Coyotes have always been survivors. For thousands of years, they mostly stuck to the western and southern US. But things began to change in the 20th century. As bigger predators like wolves and cougars began to disappear due to habitat loss and extermination campaigns, coyotes moved into new areas—including the East Coast. In the middle of the century, coyotes from the west crossbred with grey wolves from Canada around the Great Lakes region. They continued to expand their range into the northeastern US at the end of the century, where they also crossbred with domestic dogs. The hybridisation with wolves made them bigger and stronger, allowing them to hunt larger prey such as deer that lived in large numbers on the East Coast. Combined with their adaptability, this unique hybridisation enhanced their predatory skills and allowed them to thrive in their new range.



Thus, the coyotes we see in the eastern part of the country today are hybrids, with genes from wolves and dogs. They each served a purpose for the coyotes. Wolf genes made the species larger, while genes from domestic dogs gave them a higher tolerance for anthropogenic conditions, such as loud sounds, lights, and human presence. These genetic shifts meant coyotes were adaptable; a crucial trait for an urban life that demands flexibility. Today, they've learned to make the most of what urban environments offer—even if it means dodging cars, scavenging from trash bins, and dealing with a lot of humans.

Making city life work

For coyotes, one of the biggest shifts to city life has been their food sources. In the wild, their diet mostly consists of small mammals and sometimes deer, alongside some supplementation with wild fruits. Urban life, though, asks for more flexibility. Coyotes will still hunt for small mammals that inhabit cities (such as rats and squirrels), but they're also scavenging from garbage cans, eating fruit from backyard trees, and even helping to control stray cat populations.

It's not just their eating habits that have changed. City coyotes are also getting creative with where they live. Their small family groups are finding dens in city parks, under thick brush, and in spots that give them a little privacy. They tend to like areas with a bit of slope, some good hiding spots, and places facing east—researchers aren't sure why, but it might help with morning sun exposure during pup-rearing season.

In New York City, learning how to utilise the limited green space the city has to offer gives urban coyotes an edge. Several years ago, wild coyotes were found in Central Park in the middle of Manhattan and were later relocated to the Queens Zoo in Flushing, where they live today. More recently, a new pair has moved into Central Park and become locally famous, showing that coyotes are making use of one of the most iconic parks in the world.

Researchers also tracked coyotes across various boroughs in New York City and found them in parks where there is enough cover and food to support them. Genetically, they appear to have descended from a relatively small founding group, but movement between green spaces such as parks allows different groups to intermix, keeping populations from becoming inbred. In the same place, they have also learned to use the local train tracks, such as the Long Island Railroad, which runs from the heart of New York City east for more than two hours, to reach the end of Long Island. They have realised that the trains run less frequently at night and travel on the tracks under the cover of darkness.

Despite being in the middle of one of the world's busiest cities, these coyotes seem to prefer a quiet life. They avoid people as much as possible, stick to night hours, and raise their pups in relatively secluded spots. However, coyotes born in urban areas seem to be getting more used to us. Their parents live near humans, so over time, their pups are becoming less afraid of people. This doesn't mean coyotes are soon going to come up and ask for a treat, but it does mean they might act more boldly than their country counterparts. For example, these urban coyotes are more active during the day and are frequently seen around houses as well as in densely populated areas.

But urban life might also be changing coyotes on a genetic level. Since living in a city comes with a whole new set of challenges—busy roads, less space, new food sources, and constant human activity—animals are pushed to evolve in different ways. Some coyotes in New York City carry significant amounts of DNA from domestic dogs. One coyote in Queens had nearly half of his genome from dogs, and his pups showed behaviours you'd expect more from pets than wild animals—such as being a little too comfortable around humans. This raises interesting questions on how urban coyotes might evolve in the future.

Friends, foes, or somewhere in between?

For the most part, coyotes want nothing to do with us humans. In cities like Denver and Chicago, the majority of coyote-related incidents are just sightings—no attacks, no real conflict. When problems do arise, they are usually related to domestic pets.

A small number of coyotes go after dogs or cats, especially if they are left outside unattended or venture too close to a den. But incidents are rare, and most coyotes avoid direct confrontation.

Still, it's understandable that some folks get nervous when they spot one in their neighbourhood—and that's fair! In response to this, many cities are starting outreach programmes to teach people how to handle coyote encounters. One effective method they teach is called 'hazing'—scaring coyotes away by yelling, clapping, or waving your arms—so they don't get too comfortable around people. Such approaches help keep both humans and coyotes safe in the long run.

Coyotes are showing us that nature doesn't stop at the edge of the city. Urban species adapt to our environments, evolve in surprising ways, and challenge the idea that cities are only for humans. They are not simply learning how to survive, they are learning how to thrive. Of course, with closer cohabitation comes responsibility. As more wildlife starts to share our urban spaces, we need to think about how to coexist peacefully. That means educating ourselves, protecting our pets, and finding ways to let these amazing animals be part of our urban ecosystems without putting anyone at risk.

Coyotes might not be everyone's favourite neighbour—but they're here to stay. If we pay attention, they have a thing or two to teach us about resilience, adaptability, and what it means to share space in an ever-changing world.

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Paradise lost

ROAD VERGES IN A CHANGING WORLD

Author **Liana Knipe** | *Illustrator* **Aindri C.**

In 1970, singer-songwriter Joni Mitchell wrote *Big Yellow Taxi* on her first trip to Hawaii. The morning after arriving at her hotel, Mitchell "threw back the curtains and saw these beautiful green mountains in the distance"—she said in an interview—but looked down to see a huge parking lot, which broke her heart. And so she wrote:

> They paved paradise
> And put up a parking lot

It was a small moment, but it's since become a universal lament—a line that captures the blunt sorrow of watching something beautiful disappear beneath concrete. That same sorrow hums under the surface of many of our landscapes today. Meadows flattened. Hedgerows lost. Wildflower fields traded for sterile lawns. Paradise, again and again, casually paved. But sometimes—on the edge of a field, by the curve of a lane—it survives in the margins, tended by those who understand what we stand to lose.

My father-in-law Paul is one of those caretakers. A trained ecologist who studied at the University of Leicester before working for the railroad and eventually becoming a self-employed conservationist, he has spent over 30 years in Longparish, Hampshire, England, watching over the landscape with the kind of quiet dedication that runs in families. His father, Peter—a lawyer by profession but a naturalist by passion—kept meticulous nature diaries and wrote for local magazines, recording the rhythms of the seasons with the eye of someone who truly saw. Peter once asked his future wife, Doreen, to be his girlfriend under the sound of blackbirds on a picnic, and noted throughout his life how blackbirds had been present at every milestone, even toward the end.

This love of the natural world wasn't unique to Paul's family. Growing up, I declared at age three that I wanted to be a lepidopterist. My father, a former scout, built me a large bug house where I raised butterflies. After his unexpected death, my mother transformed our inground pool into a garden. I kept pet squirrels that had fallen from our loft, and my grandfather brought home turtles from his fishing trips. My brother and I spent family camping trips catching salamanders, our hands muddy with creek water and wonder. Paul's brother Anthony raised atlas moths in his home, just as I later did in my university accommodation closet. Nature wasn't just around us—it was in us, passed down like an inheritance we couldn't imagine living without.

Now that inheritance is slipping away at an alarming rate, which makes what Paul tends all the more precious.

A legacy in the grass

In Hampshire, a narrow verge along a village road in Longparish is quietly defying that disappearance. What might seem like an unremarkable strip of grass to passing drivers is, in fact, a blaze of yellow each spring—thick with cowslips, nodding in the wind like something out of an older, gentler world.

Art by Aindri C.
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This verge has been cared for, not neglected. It's been watched, protected, allowed to change with the seasons. Paul understands that these small scraps of land can carry deep meaning—ecologically, yes, but personally too. His work is part conservation, part memory. The verge is a living tribute to his father's ideals, to the belief that our relationship with the land matters. That what we take, we owe. And that what we ruin, we must answer for.

Through a local countryside club, Paul is quietly passing on those ideals to a new generation. Children from the village come to the fields to learn the names of the flowers, to spot butterflies rising in bursts of colour, to notice the slow, seasonal magic of the land. Paul doesn't teach with speeches—he teaches by doing. And the children, naturally, follow, just as I once followed my father to check the bug house, just as Paul once followed Peter through Buckinghamshire fields.

Verges as vessels of life

Road verges are often treated like non-places—mowed flat, littered, dismissed as nothing more than the ragged edge of somewhere else. But they're not nothing. They are everything to wildflowers that have lost their meadows, to bees in search of nectar, to butterflies drifting on the wind hoping for a patch to land on.

When managed well, verges support hundreds of native species—nearly half of the UK's total wildflower diversity can be found in them. They serve as corridors, connecting fragmented habitats. They feed pollinators and shelter small mammals. And they remind us, if we're paying attention, that even the smallest effort to care for the land can ripple outward.

Good management mimics the rhythms of traditional hay meadows: allowing growth in spring and early summer, then cutting in late summer and removing the clippings to keep nutrient levels low. This encourages a broader variety of perennial herbs and flowers, curbing the dominance of aggressive species such as thistles, nettles, and docks. It's slow work. It's deliberate. But it works—something Paul learned through his years as a professional conservationist, knowledge now applied with the patience of someone who has found his calling.

A misunderstood dove

The European turtle-dove—so often romanticised, so rarely understood—is one of the many species whose survival may hinge on these slivers of wildness. It is not the snow-white bird from sentimental songs, but a slender, warm-chested summer visitor, patterned in russet and charcoal, soft in sound and rare in sight. Its numbers have plummeted by 98 percent since 1994.

The turtle-dove needs seed-rich ground—exactly the kind a thriving verge can provide. But its dry diet also means it must drink frequently, and with the decline of traditional livestock ponds, clean water is becoming scarce. Add to that the grim fate awaiting many turtle-doves on their migration routes—mercilessly shot and trapped across parts of Europe—and you begin to wonder if this shy, symbolic bird will go the way of its cousin, the passenger pigeon: once the most abundant bird in North America, now extinct. What is a world without its doves?

As someone who has spent a lifetime watching species—from the moths in my university closet to the butterflies in my childhood bug house—I know the quiet devastation of watching something beautiful become rare, then rarer still.

From despair to doing something

Some councils are beginning to see the value of places like verges. Cutting less, letting things grow, letting things live. Hampshire is trialing wildlife-friendly regimes, following in the footsteps of counties like Dorset, which has managed to both boost biodiversity and save money by reducing mowing schedules.

But change is slow. Many verges are still shaved down to the roots before they can bloom. Others are trampled, parked on, sprayed. Too often, we treat the world as if beauty and usefulness must be separate, as if wildness is untidy and order is king. But wildness is the order—we've simply forgotten how to read it.

The climate crisis looms large. Species vanish. Young people feel it most sharply: the guilt of inheritance, the anxiety of inaction. But in the face of global despair, there's something incredibly grounding about tending to a single stretch of land. About making space for cowslips and butterflies. About defending a little pocket of life not because it's convenient or profitable, but because of its intrinsic value.

When I watch Paul tend his verge, I see my grandfather returning from fishing trips with rescued turtles. I see my mother transforming our pool into a garden. I see the continuation of something essential—the belief that we are not separate from nature but part of it, responsible for it, diminished by its loss.

The verge in Longparish isn't just about conservation. It's about inheritance—the kind that passes not through wills but through example, not through money but through mud on your boots and the names of flowers on your tongue. It's about understanding that paradise isn't something we visit but something we tend, not something we had but something we choose to keep.

You don't know what you got, till it's gone. But sometimes, if you're very careful and very patient, you can keep it from going at all.

Liana Knipe *is an environmental writer passionate about local conservation, biodiversity, and the surprising wild corners of everyday life. She loves hopeful stories and pollinator-friendly places.*

Aindri C. *is an illustrator-animator currently based in Edinburgh. Her work blends different forms of self-printing with digital illustration. She is inspired by kitchen printmakers and early naturalists. For this series, drawing from pre-19th-century nature printing techniques, she collected plants from road verges to create botanical self-prints using a gelatin plate.*

Research in Translation (RiT) articles aim to make conservation science more accessible by summarising recently published scientific papers in jargon-free language. This was also one of the foundational goals of *Current Conservation,* and RiTs remain central to the magazine's purpose. Written either by the scientists who conducted the study, or by someone who found it particularly important, these short summaries clearly communicate the study's purpose, methods, findings, and relevance to our readers in an engaging way.

– Daniel Read, Chief RiT Editor

Art on page by Amo, Pari Satarkar and Priyanka K

Mysteries of the deep sea captured by a sponge

Author **Olivia Hewitt** | *Illustrator* **Pooja Gupta**

Like an obscure alien underworld, the deep sea beholds unique habitats and wonderfully weird creatures, from walking fish to spiky cucumbers and Casper the Octopod—a ghostly white octopus discovered in waters off Hawaii in 2016. Covering 65 percent of the planet's surface, the deep sea is the world's largest ecosystem, yet one of the least explored. However, a recent study by Ramón Gallego and colleagues, published in *Communications Biology* found that sea sponges can hold a genetic catalogue of deep, salty secrets.

With an average depth of more than 3,500 metres (11,000 feet), the deep sea is a costly ecological frontier. Immense pressures, near-freezing temperatures and pitch-black darkness make studying life in the deep sea one of biodiversity's greatest tests. Conventional methods to collect basic data near the ocean surface are prohibitively expensive and technically challenging in deeper waters.

Despite these difficulties, it is crucial to know which species live on the seafloor and where. Without this knowledge, rare and fragile habitats—including cold-water coral and sponge gardens—are threatened by overexploitation, bottom trawling, oil site prospecting, and deep-sea mining of rare metals.

In recent years, a relatively low-budget approach to collecting genetic data from seawater has revolutionised biodiversity monitoring and management in remote areas such as the deep sea. Every living thing sheds DNA into its surroundings—whether in the air, soil, or water. This genetic material, known as 'environmental DNA' or 'eDNA', can be used to determine the presence of different species. A mere 500 ml sample of seawater can contain thousands of shed animal cells, from which DNA can be extracted to identify which species recently passed through.

However, such samples are often inundated with single-celled microbes and capture relatively little information on corals, fish, and other large marine animals. Studies have also revealed that this method is restricted to capturing DNA within a relatively short temporal window—since eDNA degrades over time, this is the period during which it remains detectable and usable.

Fortunately, researchers from the National Museum of Madrid recently revealed a new 'high resolution' method for sampling eDNA by harnessing the natural filtering power of sea sponges. Their approach yields an unprecedented treasure trove of genetic data. Sea sponges are stationary creatures that continually filter large volumes of water, naturally accumulating and consuming microscopic particles such as cells shed by other animals.

Compared to seawater samples, sea sponges can harbour genetic material from far larger areas. This is likely because of their enormous filtering capacity, with a 1-kg sponge pumping up to 24,000 litres of water per day. A study from 2022 also found that certain sponges capture eDNA across a longer time period than seawater samples, making them an incredibly valuable inventory of eDNA.

Gallego and colleagues sampled 1 cm-sized pieces of tissue from 97 deep-sea sponges across four species from the Arctic and North Atlantic. The remarkable accuracy of eDNA obtained from sponges allowed the researchers to identify over 400 animal species, including several 'indicator species' such as corals, that are used to help identify vulnerable marine ecosystems (VMEs).

VMEs are ecosystems designated as 'highly threatened' by human pressures and protected through the United Nations' policy against destructive fishing practices. However, mapping the presence of VME indicator species in the deep sea currently faces significant financial, technical, and logistical hurdles. Recent advancements in 'sponge DNA' biomonitoring provide a transformative, cost-effective tool to inform deep-sea management and protection.

Unexpectedly, non-native species such as the North American horseshoe crab were also documented by the study. The team suggests that 'sponge DNA' can reliably detect species undergoing a shift in their distribution due to rapid climate change. For instance, the authors found evidence of a phenomenon called 'atlantification', whereby typically Atlantic-dwelling species are gradually colonising warming Arctic waters.

Looking ahead, the team aims to identify which species of sponge capture and store the most eDNA. They hope this will enable even more detailed data collection and further improve cost efficiency for deep-sea biodiversity monitoring.

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Olivia Hewitt *is a biologist and science writer whose research has delved into the evolution and development of sea sponges, one of Earth's most ancient and simple animal life forms.*

Pooja Gupta *is an environmental communication media artist, turning research into clear visual stories. She works with individuals and teams to inspire care and action.*

Saving land, saving birds:
A look at US conservation easements

Author **Daniel Read, Amy Johnson, Grant Connette, Levi Van Sant and Erin Shibley**
Illustrator **Divya Ribeiro**

In the late spring, just before sunrise, Smithsonian scientists and community volunteers arrive at designated points spread across northwestern Virginia's farmland. Working in pairs, they wait, watch, and listen. For 10 minutes, they record the species of each individual bird that they see or hear within a 100-metre radius. Most often, they spot common species, such as the red-winged blackbird or eastern bluebird. Less often, they record one of Virginia's increasingly rare species of grassland obligate birds, such as the northern bobwhite or eastern meadowlark. Of all North American birds, grassland bird populations are declining the quickest. Where the scientists and volunteers are working, these grassland species are threatened by earlier and more frequent hay cutting that destroys ground nests, agricultural intensification, pesticides, and grassland conversion to other land uses.

Our understanding of biodiversity on US agricultural lands is limited because most of these are privately owned, with few restrictions on how they are managed. One conservation tool that is increasingly popular is conservation easements. By enrolling land in a conservation easement, landowners cede some or all of that land's development rights—often in exchange for a tax benefit. Because conservation easements persist in perpetuity, even if the land is sold, some conservationists see them as contributing to conservation area targets, such as the target of protecting 30 percent of the world's surface area by 2030 set under the Kunming-Montreal Global Biodiversity Framework. As of 2025, about 4.3 million acres of land in Virginia, or about 17 percent of its total area, is under conservation easement. However, assessing the effects of conservation easements on biodiversity is limited by the fact that species monitoring is not required, leaving little data to evaluate their effectiveness.

Using data collected by Smithsonian scientists and volunteers, we aimed to provide the best evidence yet for how species abundance (the number of species and number of individuals per species) differs between agricultural properties with and without conservation easements. For over 10 years, Virginia Working Landscapes (VWL)—a programme of the Smithsonian National Zoo and Conservation Biology Institute—has partnered with volunteers to conduct bird surveys in private working grasslands, recording the presence of more than 100 species. We analysed VWL bird survey data alongside records from the National Conservation Easement Database (NCED), which uses voluntary crowdsourced information to show locations of conservation easements and their dates of origin. According to the NCED, which is the best database on easements available, despite not being comprehensive, 54 percent of the properties that had been visited by VWL and the volunteers were under an easement.

To understand the effects of conservation easements, we developed four statistical models. With these models, we compared grassland obligate species to the wider bird community, and examined the influence of both simply having an easement and the length of time a property had been under one. Our study showed that bird species respond to conservation easements in different ways. Some species were significantly more abundant on eased properties, others were less common, and many showed little difference at all. This variability across species meant that there was no consistent overall effect on species abundance in three of the four models. Further, we found no evidence that overall bird species diversity differs between properties with and without easements. However, in one model, which assessed the full bird community and only accounted for presence of an easement (versus time under easement), we found some evidence that the average bird species abundance was higher on eased properties.

These results indicate that conservation easements alone do not fully explain patterns in bird diversity and abundance. While our analysis accounted for differing land cover surrounding surveyed sites, we could not assess whether or how landowners of eased properties managed their land differently from those without easements. Further, the limitations of the crowdsourced data in the NCED made measuring the effects of easements more difficult.

Thus, while conservation easements play an important role in protecting private agricultural lands from development pressures, our analysis revealed highly variable effects on bird abundance by species—some showing positive responses, others negative, and some neutral—resulting in no clear overall trend across all species. Greater transparency in easement contracts and requiring standardised reporting metrics, particularly on land management practices, would significantly enhance scientists' ability to assess the role of easements in addressing multiple threats to biodiversity.

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No forest, no rest:
Capuchin monkeys in pine plantations

Author **Valentín Zárate**

Juvenile black capuchin monkeys in Iguazú National Park, Argentina
Photo: Stephanie Meredith

What happens to wild primates when their native forests turn into commercial plantations? In northeastern Argentina, black capuchin monkeys *(Sapajus nigritus)* face that question every day. Their lush Atlantic Forest has been largely replaced by vast pine monocultures—orderly, quiet, and lacking much of the rich life that once filled the forest canopy.

And yet, the capuchins persist.

Tracking GPS-collared capuchins through pine plantations
Photo: Hernando Rivera

Using GPS collars and field observations, we followed capuchin groups living either in native, continuous protected forests or in plantation-dominated landscapes. We studied how individuals move, where they rest, and how they find food across these contrasting environments.

What we discovered was both surprising and concerning.

Capuchins living in pine plantations traverse much more ground each day than those in protected forests. They need to travel far and wide to find enough food and shelter, moving through territories nearly three times larger than their counterparts. Yet most of their vital activities, such as eating, sleeping, and resting, still depend on the small remnants of native forest scattered throughout the sea of planted pines.

Just imagine the extra energy it takes to climb, jump, and hang while moving through the canopy across such vast distances, day after day! In fact, researchers have estimated that it takes up to twice as much energy to travel through the trees as it does to cover the same distance on the forest floor. But capuchins usually avoid travelling through the forest floor because it increases their vulnerability to predators such as wild cats and dogs, as well as to human presence in plantation areas. Staying in the canopy, though energetically costly, keeps them safer.

So although native forest fragments make up only a fifth of the plantation-dominated landscape, these scattered regions mean everything for the monkeys. In fact, 95 percent of all capuchin sleeping sites were found in these green islands.

Pine tree stripped of its bark by a black capuchin monkey
Photo: Hernando Rivera

But the story doesn't end there. Our findings show that these resilient capuchins have learned to exploit the planted pine trees for food. They peel back the pine bark to eat the sugary tissues underneath, particularly during late winter and early spring, when the bark is softer and easier to remove, and the layer underneath is thicker. This allows them to gain more energy with less effort. This behaviour, known as 'bark stripping', can cause significant damage to the pine and leads to conflict with forestry companies.

During the bark stripping season, we observed a shift in the monkeys' movements: they began spending more time in pine stands—large expanses of pine trees—frequently using them as feeding grounds, and thus reducing their reliance on native forest fragments and corridors. This highlights just how adaptable capuchins can be, and how their survival strategies can lead to conflict with humans.

What's happening in Argentina is part of a global story. Across the world, forestry plantations and other production landscapes are occupying increasing amounts of land, fragmenting habitats for many species. Nearly 60 primate species are known to occupy tree plantations, though many of them rely on nearby remnant forests to survive. The patterns we observed in capuchins mirror challenges faced by primates across the world—from Argentina to Borneo.

The message is clear: if we want wildlife to be able to persist in human-altered landscapes, we need to plan and design at the landscape level. Native forest fragments must be preserved, and connected by corridors, allowing wildlife to move between these protected areas. In order to support biodiversity and species conservation, the forestry industry and conservation scientists need to collaborate to create connected habitats, thereby reducing conflict and allowing for the survival of wildlife.

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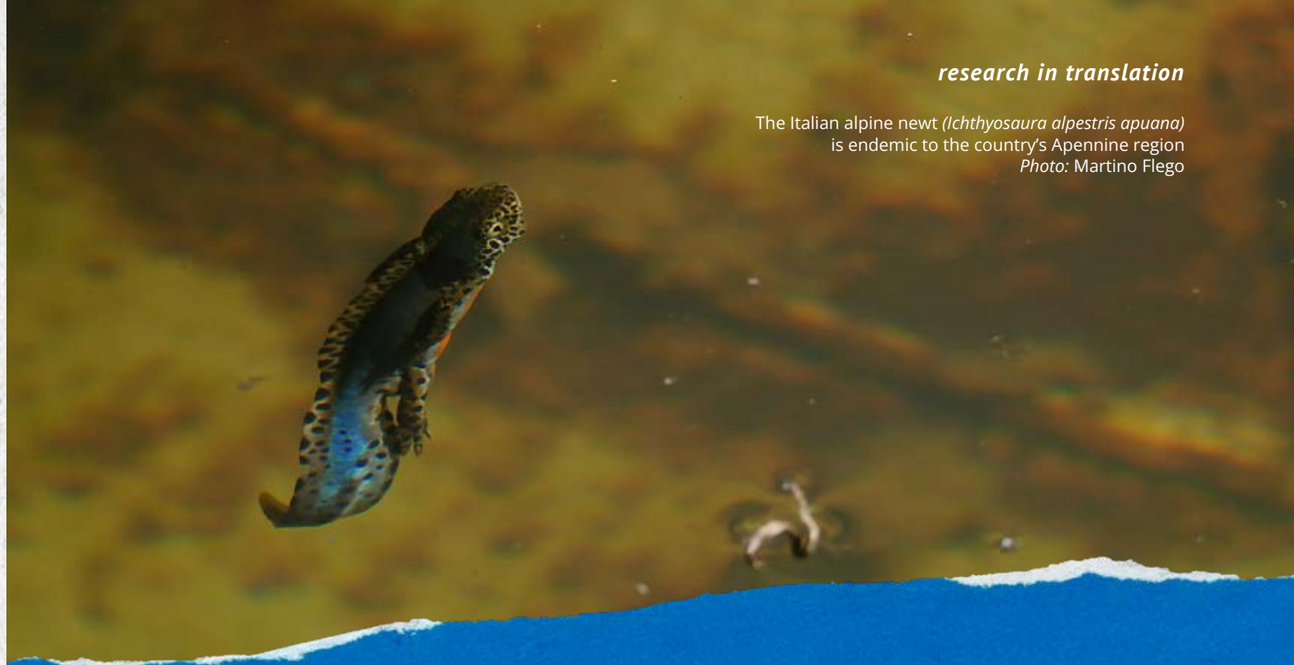
Valentín Zárate ***is a biologist from Argentina researching movement and feeding ecology of black capuchin monkeys in pine plantations to guide wildlife-friendly management.***

Adult female black capuchin monkey in Iguazú National Park
Photo: Agostina S. Juncosa–Polzella



The Italian alpine newt *(Ichthyosaura alpestris apuana)* is endemic to the country's Apennine region
Photo: Martino Flego

Amphibian conservation in a changing world

Author **Marco Mangiacotti**

Amphibians are among the most vulnerable creatures on Earth, with many species facing increasing threats from human-induced climate and habitat change. These threats are particularly concerning for amphibians with limited mobility and small ranges, such as endemic species that thrive in specific, often isolated habitats. Emphasising their dependence on stable environments, in a recently published study in *Biological Conservation,* researchers investigated the vulnerability of two endemic Italian amphibian species to climate change and habitat loss.

Climate and land use changes have dramatically reduced habitats with stable water sources and suitable land where amphibians once thrived. Rising temperatures and reduced rainfall have diminished the suitability of many regions, while urbanisation and agricultural expansion have fragmented habitats and isolated populations, limiting amphibians' ability to move to better areas. This isolation disrupts genetic diversity and reduces population resilience to further environmental stresses, including temperature-humidity imbalance and drought.

Italy's unique amphibians

The Italian peninsula's climate and geography make it home to unique amphibians. Two notable species are the Italian alpine newt *(Ichthyosaura alpestris apuana)* and the Apennine yellow-bellied toad *(Bombina variegata pachypus),* both endemic to Italy's Apennine region. These once thriving cold-adapted species now face threats from climate and land use change.

Rising temperatures and decreasing water availability have led to steady declines in the alpine newt's habitat. While this species has adapted to certain human-modified environments like artificial water bodies, habitat fragmentation has severely impacted its ability to move and reproduce effectively. Therefore, preserving or restoring habitat connectivity will be crucial for this species' survival.

On the other hand, the habitat of the Apennine yellow-bellied toad has remained relatively stable over the past decades, but is predicted to suffer a dramatic 49 percent decline by 2069. Unlike the alpine newt, the yellow-bellied toad already inhabits highly fragmented and isolated landscapes, making it even more susceptible to habitat loss. Therefore, preserving current habitat while establishing new populations in areas that will be suitable in the future are particularly important.

A strategic approach to conservation

The authors used innovative methods to model the impacts of climate and land use changes on these species. By combining habitat suitability models with landscape connectivity assessments, they identified critical, species-specific areas where conservation efforts could have the most impact.

For the alpine newt, they recommend restoring habitat cover and connectivity through the creation and maintenance of water bodies. For the yellow-bellied toad, they identify crucial habitat areas to protect immediately, and suggest exploring assisted migration. Their method of identifying species-specific recommendations can be adapted for other species and regions. For example, habitat corridors can help species move between suitable areas, while targeted land management practices can mitigate the effects of habitat loss. Traditional practices such as maintaining ponds or wetlands could support amphibian reproduction, even in altered landscapes.

This research highlights the intertwined effects of human-induced climate and land cover change on biodiversity using two endemic amphibian species as model organisms. It underscores the need for an integrated approach to conservation, combining historical data with future projections to prioritise actions. While the study focused on two Italian species, its methods and findings are broadly applicable to vulnerable species worldwide.

In summary, amphibians are critical indicators of environmental health. Their struggles reflect the broader challenges of preserving biodiversity in the face of rapid environmental change. Proactive conservation measures can help safeguard these fascinating creatures, ensuring they continue to enrich our ecosystems for generations to come.

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Apennine yellow-bellied toad, *Bombina variegata pachypus*
Photo: Martino Flego

An emerging crisis for Indian vultures

Author **Arockia E. J. Ferdin, Manchiryala Ravikanth and Nagarajan Baskaran** | *Illustrator* **Amo**

Often seen as nature's scavengers, vultures have long been misjudged as unsightly creatures with little appreciation beyond their role in cleaning up the environment. Their bald heads and habit of feasting on dead carcasses may not inspire admiration, but these birds are far more remarkable than their appearance suggests. In ancient Egypt, they were symbols of protection, motherhood, and royalty—so revered that female pharaohs, high-ranking priestesses, and royal wives adorned themselves with vulture crowns (a headdress in the shape of a vulture draped over the head, wings hanging down the sides).

Even today, vultures remain culturally important. In India's Parsi communities, the deceased are placed in the Tower of Silence, where vultures consume the flesh—a practice that dates back millennia. Yet, despite their historical, cultural, and ecological importance, 61 percent of vulture populations globally are threatened with extinction, including those in Asia.

Emerging threats

To better understand the challenges to vulture survival, we carried out a study in the Deccan Plateau of Telangana state, India. Our findings reveal both concerning trends and emerging threats to these critically endangered birds. We found that toxic wastewater discharge from the paper industry is a key factor negatively influencing the breeding success of long-billed vultures *(Gyps indicus)*.

Our study highlights urgent conservation needs and why protecting these birds matters beyond their intrinsic value. We recommend strict measures to filter hazardous substances from toxic waste discharged by the Sirpur Paper Industry in Telangana state. We also need detailed toxicological studies on vulture carcasses to better understand how industrial discharge and continued diclofenac use in cattle—despite the drug being banned due to its severe toxicity to vultures and other scavenging birds—are affecting local vulture populations.

The broader implications of vulture decline extend to human health and safety. The loss of vultures has led to a rise in feral dog populations, which are also carriers of rabies. Livestock carcasses, once a key food source for vultures, are now increasingly consumed by dogs, whose populations have grown dramatically. Studies in India have observed a strong relationship between vulture declines and increasing numbers of feral dogs, underscoring vultures' crucial role not only in maintaining ecological balance but also in reducing the risk of rabies transmission to humans.

Our study reveals a new emerging threat in the form of hazardous industrial substances greatly affecting these critically endangered birds. The Indian government has classified the pulp and paper industry as one of the "notoriously polluting industries", highlighting its devastating impact on human health and environmental integrity. The toxic industrial wastewater creates a cascade of consequences throughout the entire food web, affecting everything from river ecosystems to cliff-nesting species such as vultures. Immediate action is essential to prevent further environmental decline and protect these culturally and ecologically vital birds and their habitats for future generations.

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