

Urban Refuge: How Cities Can Help Solve the Biodiversity Crisis

Cities have long been considered species deserts, devoid of wildlife beyond pigeons and squirrels. But with animals such as snowy owls, otters and bobcats now appearing in urban areas, scientists are recognizing that cities can play a significant role in fostering biodiversity.

BY JANET MARINELLI • JULY 1, 2021

Last year, as billions of people around the globe were in coronavirus lockdown, students of Queens College ecologist Bobby Habig discovered a bobcat roaming around the Bronx River in New York City, better known for its recent past as an open sewer and repository for automobile tires and rusted chassis than as a habitat for elusive wildcats. In January, a snowy owl, native to Canada's Arctic tundra, touched down in Central Park for the first time in 130 years and spent more than a month supplementing its usual diet of boreal lemmings with choice urban fare such as mice and rats. For weeks a coyote was spotted in the Ramble, a 37-acre "wilderness" of rocky crags and hilly forest in the heart of Central Park.

New York wasn't the only city where wildlife wandered freely. Sea lions galumphed up to shuttered storefronts in the Argentinian port of Mar Del Plata. Mountain goats, which normally live on the rocky Great Orme in Wales, munched on hedges and grazed flower boxes in the nearby seaside town of Llandudno. A puma was seen in the deserted streets of Santiago, Chile's capital city.

Urban areas such as these have long been deemed to be devoid of biodiversity, especially by Americans, who glorify wilderness and believe that nature can flourish only where cities do not exist. "It's been easy for people to think that cities, they're just these moonscapes, completely sterile environments with just humans and maybe trees or grass," said Seth Magle, director of the Urban Wildlife Institute at the Lincoln Park Zoo in Chicago. Even scientists bought into the narrative and believed "we have no business spending any time or energy in cities," he said.

As Eric W. Sanderson, senior conservation scientist for the Wildlife Conservation Society said, "I can't tell you the number of conservation analyses in which places like cities with high human influence were just blocked out because they have zero biodiversity value — they're wasted. There's nothing there."

Wildlife is increasingly occupying novel niches such as green roofs, constructed wetlands and vacant lots.

This is called "the biological deserts fallacy" by the authors of a **new paper** in *BioScience*, who make the case that cities contribute more than we think to regional biodiversity. In fact, a raft of recent studies has found that long before the pandemic, the planet's cities were important refuges for an array of plants and animals, in some cases even threatened and endangered species.

While the value of urban areas to wildlife conservation remains contentious, there is a growing recognition that cities are key to the future of conservation as the human footprint expands relentlessly around the globe. In fact, researchers are increasingly working with city planners, landscape architects and urban wildlife managers to make cities part of the solution to the global biodiversity crisis.

Recent studies have found that animals from fishers to coyotes are appearing in force in urban areas. Magle points to the expansion of coyote populations in the United States as an urban success story. "Ninety-nine percent are good at avoiding us and eating squirrels and rats," he said. "In just the past couple of years, we're suddenly seeing a ton of flying squirrels in Chicago," Magle said. "We never thought of them as an urban species, and now we're seeing them all over the place." Another surprise, he said, is the return of otters to the Windy City. "Who ever thought, given the quality of the water, that we'd ever see otters in the city again, but now they're here."

Some species, such as peregrine falcons, have higher survival rates or greater reproductive success in cities than in rural areas. Some even prefer urban landscapes. A **2017 analysis** of 529 bird species globally found that 66 were found only in urban areas, including not only classic urban birds like feral pigeons, but also a variety of species native to their regions, like burrowing owls and black-and-rufous warbling finches. According to another **review**, diverse communities of native bee species persist in cities around the world, and in several cases, more diverse and abundant populations of native bees live in cities than in nearby rural landscapes. In Australia, researchers recently **identified** 39 imperiled "last chance" species that endure only in small patches of urban habitat, including trees, shrubs, a tortoise, a snail and even orchids.



Mountain goats roam the streets of Llandudno, Wales on

March 31, 2020 while quarantine measures are in effect. CHRISTOPHER FURLONG / GETTY IMAGES

For centuries, urbanization has resulted in the wholesale removal and fragmentation of natural vegetation. After the initial onslaught, a complex mosaic of novel habitats consisting of native, non-native, and invasive plants emerged, dominated by buildings, roads and other impervious surfaces and contaminated with pollution.

Urban ecologists view these as a series of “filters” that make it difficult for many species to persist in cities, especially those with specific habitat requirements. Myla Aronson, an urban ecologist at Rutgers University, pointed out, for example, that so-called ericaceous plants such as blueberries and rhododendrons, which require acidic soils, have been disappearing from cities. One likely cause, she said, is that concrete has increased the alkalinity of urban environments.

While urbanization continues to pose a substantial threat to species and ecosystems, cities abound with a “wonderfully diverse” array of unconventional habitats “that can provide important habitat or resources for native biodiversity,” wrote University of Melbourne scientists in a 2018 paper in *Conservation Biology*. These range from remnants of native ecosystems such as forests, wetlands and grasslands, to traditional urban green spaces like parks, backyards and cemeteries, as well as golf courses, urban farms and community gardens. In addition, as cities invest in green infrastructure to ameliorate environmental harm, wildlife is increasingly occupying novel niches including green roofs and constructed wetlands and colonizing former brownfields and vacant lots. And the positive roles cities play in fostering biodiversity “can be bolstered through intentional design,” write the authors of the *BioScience* article on the “biological deserts fallacy.”

In recent years, urban ecologists have carved out a new niche in the field of conservation biology. One seminal paper, published in 2014, analyzed 110 cities across a range of biogeographic regions with comprehensive inventories of the resident plant life and 54 with complete bird lists. According to the study, the cities retained most of their native biodiversity. Aronson, the lead author of the paper, and her colleagues also found, however, that the plants and birds in the cities they studied had become much less abundant, losing 75 percent and 92 percent of their pre-urban density, respectively.

Some species have become more tolerant of the higher temperatures in cities.

Another founding paper of urban conservation biology, published two years later, was written by Australian scientists who found that cities harbor 30 percent of the country’s imperiled plants and animals, including Carnaby’s black-cockatoo, a large, gregarious cockatoo that lives only in southwest Australia, where large-scale farming has fragmented much of its habitat. In fact, they found that cities contained substantially more threatened species per square kilometer than non-urban areas. “Australian cities are important for the conservation of threatened species,” they wrote.

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Scientists have described several ways in which urban areas can benefit regional biodiversity. For example, cities can provide a refuge from pressures such as competition or predation that native species face in the

surrounding landscape. A greater density of prey in cities has been linked to the success of several urban raptors, including Cooper's hawks, peregrine falcons, crested goshawks and Mississippi kites. Cities also serve as stopover sites where migrating birds can rest and refuel. Large city parks, such as Highbanks Park in Columbus, Ohio, provide critical stopover habitat for thrushes, warblers and other migratory songbirds. Researchers have also documented adaptations that have made some species, such as acorn ants and water fleas, more tolerant of the higher temperatures in cities than in surrounding areas. These adaptations, they say, could create populations that may be better able to tolerate climate change and in the future could colonize and help fortify rural populations.

But urban conservation biology is still in its infancy, and much remains to be learned. "Because we have no idea, we start off with the assumption that wildlife will behave the same in urban habitats" as it does in rural ones, Magle said. But that prediction is almost invariably wrong. "You have to throw out the entire playbook," he said. "Sometimes I joke that I feel like I'm doing research on an alien planet."



A sea lion on a sidewalk in Mar del Plata, Argentina during a coronavirus lockdown, April 16, 2020. MARA SOSTI / AFP VIA GETTY IMAGES

Magle, who got his start as an urban wildlife biologist by studying black-tailed prairie dogs living in sidewalk median strips near his home in Boulder, Colorado, founded the Urban Wildlife Institute (UWIN) to address one of the primary research gaps in urban conservation biology, the lack of multicity data. "Somebody would write a paper about how Toledo coyotes are super active at night. Then someone who studied coyotes in Dallas would come along and say, 'Well, I didn't find what you found so you're wrong.' And it drove me nuts," he said. UWIN has developed wildlife-monitoring protocols that employ tools like motion-triggered cameras to better understand the ecology and behavior of urban species, find differences across regions, and find patterns that remain consistent around the globe. These protocols are currently employed by research partners throughout the U.S. and in Canada.

To date, almost all urban wildlife studies have been done in North America, Europe and Australia. UWIN is trying to find partners in Asia and Africa, where most urban areas projected to become megacities in the next decade are located. In addition, just a few charismatic groups such as large mammals, pollinators and songbirds have received most of the research interest. Little is known about other groups, such as mice, voles, shrews and other small mammals, insects like flies and moths, reptiles and amphibians.

What's more, "It's worth remembering that some species are a problem" in urban areas, Magle said. "Some are a nuisance or carry disease." He said that greening cities needs to be better informed by wildlife science "so we can be sure to attract the species that we want."

"I think one of the biggest research gaps is how do we balance the different needs of multiple species with limited space," said Aronson, who has co-authored several papers on research needs in urban conservation biology. In addition, she pointed out, scientists still don't really know how much biodiversity different types of green spaces can support, although her **research** has shown that size is by far the most important factor in predicting their conservation value. "Larger spaces conserve the most species," she said. Another unknown,

according to Aronson, is whether green spaces work together to provide habitat connectivity through a city, and if so, how, and at what scale. “Those are the big questions,” she said. “There are many more.”

Conservation “is not just about biodiversity but about the human relationship with that biodiversity.”

Meanwhile, more than half of the world’s human population lives in urban areas, and this is expected to rise to 70 percent by 2050. A striking 60 percent of the additional land projected to become urban in the next decade is yet to be built on. And some of the most rapidly expanding urban areas are in mega-diverse moist tropical forests along the Brazilian coast and in West Africa and southeast Asia.

More than a decade ago, Sanderson of the Wildlife Conservation Society, was pondering the future of conservation while standing under the Cross-Bronx Expressway, one of the busiest freeways in the U.S., beside the river that gave the highway its name. Just three blocks upriver, at the Bronx Zoo, is the headquarters of his employer, one of the oldest and most prestigious conservation organizations in the country, which is dedicated to conserving nature in the planet’s most remote and sparsely populated places. “In contrast,” he said, “before me was the antithesis of a wild place: an ecosystem that, in the popular vernacular of conservation, had been ‘hammered,’ which was literally surrounded by people.”

However, years of community effort to pull up invasive plants, remove garbage and haul away abandoned cars from the Bronx River paid off, and even before the bobcat made its debut late last year, a beaver reappeared in 2007 after an absence of 200 years. The area is the last place most conservation groups would consider a priority, Sanderson and co-author Amanda Huron wrote in “Conservation in the City,” a 2011 editorial in *Conservation Biology*, yet people had cheerfully committed themselves to cleaning up the river, “because they live there.”



A snowy owl in Central Park, New York on January 27, 2021.

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Conservation, Sanderson said in a recent interview, “is not just about biodiversity but about the human relationship with that biodiversity.” The healthier nature is in cities, where people live, the better that relationship will be, and the more people will care about preserving biodiversity everywhere, he said.

In fact, Sanderson believes that cities are “the way that conservation will ultimately succeed.” In a paper analyzing demographic and economic trends, he and two WCS colleagues found, in a 2018 study, that as people have migrated from the countryside to towns and cities, poverty has diminished and fertility levels have dropped. And contrary to conventional thinking, per capita consumption also decreases in densely populated areas. “The conservationist’s paradox,” they wrote, “is that the same forces that are destroying nature now are also creating the circumstances for long-term success.”

Drawing inferences from current patterns, Sanderson and his co-authors predict a severe bottleneck during the next 30 to 50 years, with heightened pressure on living systems, when more biodiversity losses can be expected. “However, if we can sustain enough nature through the bottleneck,” they write, the pressures will lessen, and a hundred years from now, with the vast majority of people living in cities, very few of them in extreme poverty, the human population could stabilize and even decrease. The only sensible path for reaching a world with 6 billion people and vast natural expanses, they conclude, is for conservationists to continue efforts to protect biodiversity, including in cities, “to build the foundations for a lasting recovery of nature.”