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A dark unicorn snail in Dana Point, California, in September 2021. | Eric Johnson/iNaturalist

It’s time to stop demonizing “invasive” species

Climate change is forcing some animals to move. Don’t call them “invasives.”

By Marina Bolotnikova | Nov 28, 2021, 8:00am EST

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The biodiversity crisis, explained

Marine ecologist Piper Wallingford was doing fieldwork on the rocky shore of Laguna Beach, California, in 2016 when she noticed a dime-sized creature she’d never seen before. It was a dark unicorn snail, a predator that drills into mussels and injects an enzyme that liquefies their flesh. “Then,” Wallingford explains, “they basically

suck it out like soup.”

The animal is native to the Mexican state of Baja California, Wallingford later learned, and it’s been migrating up the coast over the last few decades in search of new habitat, eating into local mussel populations along the way. It’s also one of countless species around the world — from white-tailed deer to lobsters to armadillos to maple trees — that are moving with the climate.

Ecologists expect climate change to create mass alterations in the habitats of these “range-shifting” or “climate-tracking” species, as they’re sometimes called, which will reshuffle ecosystems in ways that are hard to predict. The migrations are critical to species’ ability to survive hotter temperatures.

The scientific community largely views this kind of habitat shift as a good thing, Wallingford and other ecologists told Vox. But the primary lens available to the general public and to policymakers is less forgiving. “Invasive species” is a concept so ingrained in American consciousness that it’s taken on a life of its own, coloring the way we judge the health of ecosystems and neatly dividing life on Earth into native and invasive.

A 2018 [Orange County Register](#) story on Wallingford’s work, for example, called the dark unicorn snails “climate invaders.” “I think any time you introduce this idea of a new species, there’s sort of this inherent reaction of, ‘Oh, that’s bad, right?’” Wallingford says. But she encouraged local stakeholders not to try to remove them.

For decades, invasion has been a defining paradigm in environmental policy, determining what gets done with limited conservation budgets. Species deemed invasive have often been killed in gruesome ways. Even though invasion biologists readily point out that many non-native species never become problematic, the invasion concept almost by definition makes scientists skeptical of species moving around. But a growing community of scientists and environmental philosophers now question whether a concept defined by a species’ geographic origin can capture the ethical and ecological complexities of life on a rapidly changing planet. In the 21st century, there’s no such thing as an undisrupted ecosystem, and this will only become truer as climate change and habitat loss accelerate. It’s crucial that we get this right.

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Range shifts have “been a real problem for the hardcore invasion biologists to deal with,” says Mark Davis, a biology professor at Macalester College and a critic of the invasion framework.

In a controversial recent [paper](#) published in *Nature Climate Change*, Wallingford and a team of co-authors argued that the tools of invasion biology — for example, looking at a species’ impact on local food or water sources, or figuring out if it’s encountering prey that aren’t used to predators — could be adjusted to understand the impacts of range-shifters.

The proposal got “a lot of pushback,” says Wallingford, who doesn’t necessarily oppose the “invasion” lens. Detractors said that merely linking climate-tracking species with invaders taints them by association. Range-shifters ought to be seen “not as invasive species to keep out, but rather as the refugees of climate change that need our assistance,” University of Connecticut ecologist Mark Urban argued in a [comment](#) published in the same journal issue.

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Climate change and the range shifts it’s causing are extraordinary circumstances. If a species flees a habitat that is burning or melting, is it ever fair to call it invasive? Even outside of a climate context, this tension reflects a more fundamental problem within the invasive species paradigm. If the label is so stigmatizing that the only appropriate response feels like extermination, perhaps something else needs to take its place.

The origins of “invasive” species

“Invasive species” might feel like a firmly established scientific category, but invasion biology, which studies the impacts of non-native species, is a relatively young field.

British ecologist Charles Elton drew attention to non-native species in his 1958 book *The Ecology of Invasion by Animals and Plants*, arguing that there is a place, or niche, for every species on the planet where they’ve evolved to survive. Those that move, he believed, should be removed.

Even before that, “There were people who recognized invasions and remarked in great detail on them,” including Charles Darwin, says University of Tennessee ecologist Daniel Simberloff, one of the originators of invasion biology. It wasn’t until the 1980s, Simberloff

says, that it cohered into a subfield of scientists talking to each other and looking at invasions as a general phenomenon.

Invasion biologists aren't opposed to the presence of all non-native species — many of them are innocuous, some are even beneficial. A widely accepted rule of thumb says that about 10 percent of species introduced into new ecosystems will survive, and about 10 percent of those (so, just 1 percent of all non-natives) will cause problems that lead them to become “invasive.” Some can do real harm, such as threatening vulnerable endemic species. Feral cats in Australia, for example, are thought to be a major driver of extinctions of small mammals.

Invasion biology became entangled with politics as its influence grew. In 1999, then-US President Bill Clinton signed an executive order establishing the National Invasive Species Council. It defined an invasive species as a non-native species “whose introduction does or is likely to cause economic or environmental harm or harm to human health.” Simberloff, who advised in drafting the order, says the White House added the “economic” component to that definition — which often amounts to harming agribusiness. “There are introduced species that have some substantial impact on some agricultural crops that don't really have much of an impact on anything else,” he says. “Many scientists wouldn't worry about them.”

Combining commercial and environmental concerns in the “invasive” category can make it sound as though threats to the bottom line of a business are tantamount to an ecological problem. This is particularly troublesome considering some businesses — industrial monocropping or cattle farming, for example — that are protected against invasive species by federal and state management programs are themselves hugely harmful to biodiversity. Scientists on both sides of the invasive species debate agree this conflation is problematic.

Common starlings, for example, a species of bird native to Europe and parts of Asia and Africa, have become wildly successful as an introduced species in North America. They're blamed for hundreds of millions of dollars in agricultural damage annually in the US, often eating grains in cattle feedlots, says Natalie Hofmeister, a PhD candidate in ecology and environmental biology at Cornell University. “That's like a treasure for the starlings,” she says. The USDA Wildlife Services poisoned 790,000 of the birds in fiscal year 2020. While starlings have long been thought to harm native bird species, which might sound like a more scientific rationale for killing them, Hofmeister says the literature isn't settled on whether that is true.



A European starling on a branch in Victoria, Minnesota. | Stan Tekiela Author/Naturalist/Wildlife Photographer via Getty Images

The invasion model has a nativist bias

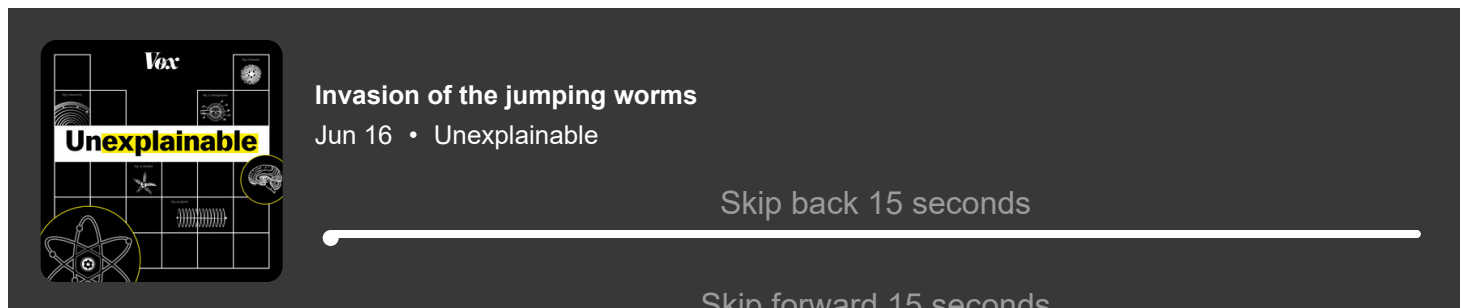
Some conceptions of invasive species' harms are questionable.

For example, invasives can be considered a threat not only by killing or outcompeting native species but also by mating with them. To protect the “genetic integrity” of species, conservationists often go to extraordinary lengths to prevent animals from hybridizing, environmental writer Emma Marris points out in her book *Wild Souls: Freedom and Flourishing in the Non-Human World*. Consider the effort in North Carolina to prevent coyotes from breeding with endangered red wolves, which bears uncomfortable parallels to Western preoccupations with racial purity that only recently went out of fashion.

That's why some scientists look askance at the influence of invasion biology and argue that the field has a baked-in, nativist bias on documenting negative consequences of introduced species and preserving nature as it is. Invasion biology is like epidemiology, the study of disease spread, biologists Matthew Chew and Scott Carroll wrote in a widely read opinion piece a decade ago, in that it is “a discipline explicitly devoted to destroying that which it

studies.”

Historically, the term has erroneously expanded to the idea of, “If you’re not from here, then you are most likely going to be invasive,” Sonia Shah, author of *The Next Great Migration: The Beauty and Terror of Life on the Move*, said on a June 2021 episode of *Unexplainable*, Vox’s science-mysteries podcast. Conservation policies have been crafted around the idea that if something is not from “here” — however we define that — “then it is likely to become invasive, and therefore we should repel it even before it causes any actual damage,” as Shah says, which is part of the nativist bent that pervades ecological management.



What’s more, the very notion of “invasion” draws on a war metaphor, and media narratives about non-native species are remarkably similar to those describing enemy armies or immigrants. For example, a recent news story in the Guardian about armadillos “besieging” North Carolina described them as “pests” and “freakish.” It also gawked at the animal’s “booming reproduction rate,” an allegation that, not coincidentally, is leveled against human migrants.

Many scholars have explored how anxieties about humans and nonhumans crossing borders, or going places where they don’t “belong,” map onto one another. “The fear of immigration is never isolated to humans,” writes science studies scholar Banu Subramaniam in *The Ethics and Rhetoric of Invasion Ecology*. “It includes nonhuman migrants in the form of unwanted germs, insects, plants, and animals.”

A “curse word” that harms entire species

One important set of interests isn’t considered in invasive species management at all: those of the “invasives” themselves. Arian Wallach, an ecologist at the University of Technology Sydney who is well known for her criticism of invasion biology, calls invasive species “nothing less and nothing more than a curse word” used to demonize species and exclude them from moral consideration. She first began to question invasion biology after she moved for her PhD to Australia, which has some of the most militant invasive species management programs in the world, aimed at protecting the country’s own unique species.

“I started seeing conservationists blowing up animals with bombs, shooting them from helicopters, poisoning them, spreading diseases through them,” she says. Australia has shot feral goats, camels, deer, pigs, and other animals from the sky (a method also used in the US), and the country kills many small mammals with 1080, a poison that is widely regarded as causing an extremely painful death. Invasion biology, Wallach believes, is “a bad idea that’s had its run.”



Dingoes in the Painted Desert in South Australia. | Julie Fletcher/Getty Images

Wallach’s own research looks at how dingoes, dog-like animals that are thought to have been brought to the continent thousands of years ago, can control the populations of more recently introduced cats and foxes that eat some of Australia’s iconic marsupial species, such as the eastern barred bandicoot. Her work serves as a proof of concept for “compassionate conservation,” a movement that opposes the mass killing of some animals in an attempt to save others. A core tenet of this framework is to value animals as individuals with their own moral value, rather than just a member of a species.

It might seem, then, that there’s a trade-off between caring about animals as individuals and caring about them in the context of species and ecosystems, but Wallach argues it’s more complicated. Bias against non-natives doesn’t just harm individuals; it can harm entire species.

In a 2019 study, Wallach and a team of researchers pointed out that non-native species are excluded from world conservation goals. This creates situations where, for example, a species like the hog deer, a small deer native to South Asia, is endangered in its home range but hunted and treated as feral in Australia. Using a sample of 134 animals introduced into and out of Australia, the team found that formal conservation counts significantly underestimated their ranges, and that 15 of them could be downgraded from “threatened” or “near threatened” status if their non-native ranges were counted. For many endangered species, non-native habitats can be part of the solution, providing refuge to wildlife that can no longer survive in their native ranges.

A broader movement wants to see beyond the invasion lens

If we try to think outside the invasive species framework, what else can we look to?

Indigenous knowledge is increasingly being recognized as essential to conservation, write Nicholas Reo and Laura Ogden — Dartmouth University professors of Indigenous environmental studies and anthropology, respectively — in an ethnographic study of Anishinaabe perspectives on invasive species. (The Anishinaabe are a group of culturally related First Nations peoples in the Great Lakes region of Canada and the US.)

Anishinaabe ideas, Reo and Ogden found, reflect a worldview that sees animals and plants as belonging to nations with their own purposes and believes people have the responsibility to find the reason for a species’ migration. The authors’ sources recognized parallels between the extermination of species deemed invasive and the dark history of colonial violence against Indigenous peoples. The interviews “helped me recognize the ways in which different philosophies of the world shape our ethical response to change,” Ogden says.

Life is “extremely adaptable and regenerative and dynamic,” Wallach says. “Go back 10,000 years, and it’s a completely different world. Twenty thousand years, it’s different. A million, 2 million, 500 million ... There is no

“THERE IS NO POINT THAT THINGS AREN’T SHIFTING AND MOVING”

point that things aren’t shifting and moving.”

Another scientific idea that captures this notion is “novel ecosystems,” or, as environmental journalist Fred Pearce has termed it, “the new wild”: ecosystems that have arisen, intentionally or not, via human introduction.

In Tierra del Fuego, at the tip of Chile and Argentina, a particularly dramatic novel ecosystem is taking shape. In 1946, beavers were introduced there in a futile attempt to create a fur industry. Instead, the animals proliferated and munched down the region’s *Nothofagus* — southern beech — forests, creating dams and ponds. “They are these miraculous world builders,” says Ogden, who wrote an [essay](#) imagining the beavers not as invaders, but as a diaspora. (Beavers have also been a [boon](#) for ducks and other marine species.) The invasive species paradigm, Ogden adds, is devoid of nuance, history, and politics; she prefers a concept that gives expression to the moral complexity of the beavers’ presence in South America, as well as the fact that they had no choice in being moved there.



A North American beaver on Navarino Island, Chile, in Tierra del Fuego. | Wildnerdpix/iStockphoto via Getty Images

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The beavers should ultimately be removed from the forested areas, Ogden believes, though she doesn’t think we can do so with a clear conscience, and says eradication “seems very unlikely.” But the idea of a diaspora opens up a way of thinking about what we owe the beavers, as opposed to how to expel them. After 75 years in South America, don’t the animals have a claim to living there? What right do we have to exterminate them?

I posed this question to Daniel Simberloff, the prominent invasion biologist. “I don’t believe they’re endangering any of the *Nothofagus* species,” he acknowledged, noting that there hasn’t been enough study to know what impact the beavers are having on species that require the southern beech forest habitat. Still, “I think it’s a disaster that this native ecosystem is being destroyed and replaced by pastures of introduced plants,” Simberloff

says. “Other people may not agree with me.”



Dead trees, caused by beavers introduced to the area from Canada in 1946, stand along a stream near Ushuaia, Argentina, on the southern edge of Tierra del Fuego in November 2017. | Mario Tama/Getty Images

Even when it’s packaged as objective science, conservation always entails value judgments. One might say that the deaths of 100,000 beavers should count as a “disaster” just as much as the demise of an old-growth forest. Conservationists will have to choose whether to meet ecosystem disruptions like this one with the “war machine” of invasion biology, as Ogden calls it, or to come to terms with a changing world.

For now, the dark unicorn, the thumbnail-sized snail that caught marine ecologist Piper Wallingford’s eye, continues inching up the coast of California. “The question of how they’re getting from one site to another is still one that we can’t answer,” Wallingford says.

There is something humbling in seeing other species’ will to survive in an interconnected world undone by climate change. Though the dark unicorns’ movements elude our understanding, they already know where they need to go.

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