

Rewilding

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America's vast forests and plains, Siberia's tundra, or Romania's Carpathian Mountains may seem wild and full of life. But they're all missing something big: the large animals that vanished by the end of the Pleistocene Epoch, roughly 10,000 years ago. In the United States, only bones and echoing footsteps remain of the mammoths, camels, massive armadillo-like glyptodonts, lions, dire wolves, and saber-toothed cats that roamed for millennia. "Without knowing it, Americans live in a land of ghosts," wrote the late University of Arizona scientist Paul Martin in his 2005 book, *Twilight of the Mammoths: Ice Age Extinctions and the Rewilding of America* (1).

Some scientists and others now argue that we should be bringing some of those ghosts back, part of a controversial movement to "rewild" parts of Europe and North America, whether by reintroducing extant species, reviving extinct ones, or attempting to reconstruct ecosystems. Martin first raised the idea back in the late 1960s, as a way to restore the lost richness of our natural world. "To behold the Grand Canyon without thoughts of its ancient sloths, goats and condors is to be half-blind," he wrote (2).



This region near the Danube delta is a primeval mosaic savannah landscape, a rarity in Europe. Negotiations to reintroduce the once-prevalent red deer, fallow deer, and wolf are underway. The beaver has returned on its own. Image courtesy of Staffan Widstrand (*Wild Wonders of Europe*).

Such a restoration would bring back vital but lost ecological processes and benefits, Martin and others came to believe. Without mammoths and millions of aurochs and other grazers (and wolves and big cats to keep the herbivores in check), the enormously productive grasslands of the Pleistocene turned into today's far less productive forest, shrub land, and mossy tundra, with a major loss of ecosystem complexity and diversity. "Paul realized there was a big missing ecosystem component—the megafauna," explains Harry Greene, professor of ecology and evolutionary biology at Cornell. "Everything in North America evolved with about 58 to 60 big mammals that went extinct."

That realization sparked a growing effort to recreate the lost past, especially in Europe. In the 1980s, Dutch ecologist Frans Vera spearheaded an effort to introduce primitive cattle and horse breeds as proxies for their extinct ancestors in the Oostvaardersplassen, a 6,000-hectare nature reserve east of Amsterdam. Similarly, Russian scientist Sergey Zimov launched a personal quest to reintroduce musk ox, bison, Yakutian horses, and other big grazers (and eventually, tigers) to a 14,000-hectare area in western Siberia he dubbed "Pleistocene Park."

In the 1990s, the effort received a catchy name: "rewilding." Initially the term alluded to protecting habitats, creating corridors that allow animals to move, and reintroducing predators, such as wolves, rather than replicating 10,000-year-old ecosystems.

Wading into the Mainstream

The path toward bringing the concept into the public eye started in 2000, when Josh Donlan (now director of the nonprofit Advanced Conservation Strategies) met Martin at a conservation biology conference. At the time, "most people thought Paul was crazy," Donlan recalls. But Donlan, who'd been eradicating invasive cats and rats on islands off the coast of Mexico—and was studying the possibility of reintroducing the once-endemic wood rats—befriended him. He worked with Martin for part of his doctoral research at Cornell, where he also found a kindred spirit in Greene. Donlan and Greene organized a workshop in 2004 of about a dozen scientists,

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including Martin, at one of Ted Turner's ranches in New Mexico. "We spent three days drinking coffee and beer, throwing ideas at each other," says Donlan. Their conclusion: "Big stuff is important, whether it's predators or large herbivores," Donlan says.

In a landmark 2005 commentary in *Nature* (3), the group laid out what it called a "bold plan for preserving some of our global megafaunal heritage." The idea was to bring to North America Asian asses, Przewalski's horses, Bactrian camels, Asian and African elephants, African cheetahs, and yes, African lions, all being the closest living relatives of creatures that had vanished from the Americas. The workshop also led directly to establishment of a breeding population, on Turner's Armendaris Ranch, of one Pleistocene epoch creature, the Bolson tortoise, to bolster the small remaining population in Mexico.

The media responded swiftly, with stories appearing everywhere from the *New York Times* to the *Today Show*. The press glossed over rewilding with mundane tortoises or horses, and jumped right to elephants and lions. "People loved the idea or hated it," recalls Donlan. One of roughly a thousand letters and emails Donlan and Greene received read: "You are a f\$#@ing moron if you release killers in our homeland." Meanwhile, many scientists worried that reintroduced animals might act like harmful invasive species. "We all remember 'Jurassic Park'," warned four scientists in a 2006 paper in *Biological Conservation*. "Pleistocene re-wilding of North America is only a slightly less sensational proposal" (4).

"Returning species that were native is a good thing, but returning proxy species to fill a presumed ecological niche is where the problem arises," says Dustin Rubenstein, associate professor of ecology, evolution, and environmental biology at Columbia University and coauthor of the 2006 paper (4). The effects would cascade through the entire ecosystem and food web, affecting everything from plants and insects to small rodents, "and might drive other endangered species to lower numbers," says Rubenstein. Plus, reintroducing elephants in, say, Kansas might hurt efforts to conserve the animals in their native Africa, where poaching is a growing threat, critics argued.

The controversy also laid bare deep rifts in how we view the natural world, Greene and Donlan contend. Greene says no one has objected to bringing the Bolson tortoise back to the United States, even though it could be considered invasive. In contrast, people got very upset over the possibility of lions and elephants and cheetahs, he says. "What we did is expose the real reason why this will not happen in the United States—because we are mostly not willing to put up with dangerous animals."

Moreover, the criticism failed to acknowledge that introductions would be done slowly, with extensive monitoring and control, says Donlan: "The scientific response, to this day, I think has been a little disappointing."



A free-living population of bison wanders through northwest Poland as part of a reintroduction program carried out by Rewilding Europe. Image courtesy of Staffan Widstrand (Wild Wonders of Europe).

Wilderness Paradox

In the decade since the paper (3), the debate has reinforced a uniquely American paradox. The nation has set aside vast "wilderness" areas, where humans are supposed to leave nothing but footprints. However, managers of every wilderness area must constantly wrestle with whether—and how much—to intervene to fix problems. Case in point: The reintroduction of wolves to the Yellowstone area in 1995 has shown some ecological benefits of restoring big predators. In some areas the wolves are keeping elk populations in check and moving the elk away from streams, thus allowing riverbank willows and then beavers to return. The result: richer, more diverse ecosystems (5). But the reintroduction remains controversial, and a debate rages over wolf hunting.

In contrast, with no real "wilderness," Europeans have been more willing than Americans to share the landscape with big predators, says Guillaume Chapron, associate professor at the Swedish University of Agricultural Sciences' Grimsö Wildlife Research Station. Europe now has twice as many wolves, more than 11,000, than does the entire contiguous United States, despite being half the size and having more than twice the population density. "One-third of Europe is now occupied by at least one large carnivore," says Chapron. "We are witnessing an unexpected conservation success story."

Europe also has embraced rewilding in a way America has not, although the effort focuses on animals gone recently extinct rather than on recreating Pleistocene megafauna. A group called Rewilding Europe is reintroducing European bison or wisent—the continent's largest mammal, which went extinct in the wild in 1927—to the Southern Carpathians and other locations. The group hopes to rewild one million hectares by 2022, "for the benefit of nature and people," helped in part by the abandonment of farmland. The goals include restoring grasslands and

ecosystem functions (including predation), and creating a rural tourist economy.

In the United Kingdom, the nonprofit Rewilding Britain, launched by journalist George Monbiot and others, plans to bring back such species as lynx, beaver, and wolves. Reintroducing predators to the Scottish Highlands, for example, would knock back the deer population, allowing trees to rebound and boosting biodiversity, the group figures. "It's exciting to see the momentum in Europe," says Donlan.

But few of these efforts are leading to new science on ecosystem function, an initial aspiration of Donlan and Greene. Movements have been led more by passionate advocates like Monbiot in Britain or journalist Connie Barlow in the United States, who founded an effort to save an endangered conifer, *Torrey taxifolia*, by planting it across the eastern United States. Even the experiments with big grazers in The Netherlands and Siberia have been short of science, other

than showing that big animals do indeed reduce the number of trees. "Rewilding is happening, but it's largely leaving the scientists behind," says Donlan. Or as the paper in PNAS (6), coauthored by Donlan, says, "rewilding has strong scope for ecological restoration...[but] empirical studies are rare." Perhaps the best evidence of ecological benefit comes from islands in the Indian Ocean, where reintroducing giant tortoises has increased germination for endangered plants like the rare Mauritian Ebony tree (7).

The controversy over rewilding will no doubt continue, and it may get a sensational boost if new genetic tools make it possible to reengineer (or "de-extinct") woolly mammoths and other lost species (8). In the end, suggests Greene, whether we give the ghosts of eons past another chance at life depends on what kind of world we value, and how "wild" and rich we want that world to be. For Greene, the wilder the better.

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- 2 Martin P (1992) The Last Entire Earth. *Wild Earth*, Winter:29–32.
- 3 Donlan J (2005) Re-wilding North America. *Nature* 436(7053):913–914.
- 4 Rubenstein DR, Rubenstein DL, Sherman PW, Gavin TA (2006) Pleistocene Park: Does re-wilding North America represent sound conservation for the 21st century? *Biol Conserv*. 132(2006):232–238. Available at https://www.princeton.edu/~dir/pdf_dir/2006_RubensteinDR&DL_BioCons.pdf. Accessed November 20, 2015.
- 5 Cornwall W (2014) Have returning wolves really saved Yellowstone? Available at www.hcn.org/issues/46.21/have-returning-wolves-really-saved-yellowstone. Accessed November 20, 2015.
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