

# Temperature, drought influencing movement of Plains bison

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Credit: AI-generated image ([disclaimer](#))

It epitomizes the Great Plains in spirit and in form: a 2,000-pound tank on hooves, cloaked in shaggy winter-tested coat, capped by horns acting as warning and weapon.

Even its scientific name, *Bison bison bison*, seems to conjure an echo

worthy of its majesty. Still, the implacable profile of the Plains bison—the national mammal of the United States and largest on the continent—belies the vulnerability in its history, which saw its legions decimated from tens of millions to just a few hundred in the span of a few colonial centuries.

Conservation efforts have pushed its number back to roughly 20,000, and its status from endangered to near-threatened. But a recent study led by the University of Nebraska–Lincoln's Nic McMillan hints that the ongoing conservation of the Plains bison will demand accounting for the climate—especially the number of scorching days and powdery landscapes—it encounters moving forward.

In their study published in *Ecology and Evolution*, McMillan and colleagues at Oklahoma State University have found GPS-backed evidence that temperature and [extreme drought](#) can drive movement among herds of Plains bison. Continued increases in both, combined with the fact that most bison herds are now confined to fractions of the land they once roamed, could pose challenges to managing the iconic species, McMillan said.

"When we think about reintroducing bison or any large animal to a landscape, the landscape that the animal is inhabiting is potentially a lot smaller than it was historically," said McMillan, assistant professor of agronomy and horticulture at Nebraska. "In 1491, if there was a drought in northeastern Montana, the bison had the entire Great Plains to escape that drought. They could move as far as they needed to.

"In this time when we're seeing more extremes—more of those extreme air temperatures, more of those extreme droughts—we probably need to rethink how these landscapes are structured, and whether or not they're actually meeting the fundamental physiological needs of these animals."

The team reached its conclusions after analyzing the movement data of 33 Plains bison from two disparate sites in Oklahoma: the Wichita Mountains Wildlife Refuge in the southwestern part of the state, and the Tallgrass Prairie Preserve near its northern border. Each of the bison wore GPS-equipped collars that tracked their location every 12 minutes over multiple years, yielding a total of 715,344 measurements. Pairing that data with temperature, rainfall, wind and other variables recorded by nearby weather stations, plus drought-revealing moisture readings of the soils at both sites, allowed the team to search for links between bison movement and weather.

Air temperature explained variations in bison movement better than any other factor the researchers analyzed. When the temperature ranged from a few degrees below zero to 83 degrees Fahrenheit, bison movement increased 92.5% for every 18-degree rise, so that movement nearly doubled when the temperature rose from, say, 65 degrees to 83 degrees. Above that threshold—from 83 degrees through at least 112, the highest recorded temperature—an 18-degree increase instead corresponded to a 48.5% decrease in movement.

The temperature-related increase in movement hints that the Plains bison were in search of grasses that grew better amid the greater heat, the team said, especially given that bison get the majority of their water from foraging. The reduced movement in the face of excessive heat, meanwhile, suggests that they rested and cooled themselves in places where standing water and the shade of nearby trees prevented the equivalent of heat stroke.

"When you consider (that) this is the first study of Plains bison across multiple herds—and then we find the same relationship across herds, in two very different landscapes—that's a big deal," said McMillan, who noted that the trend also paralleled a study of wood bison in Canada.



Plains bison graze beneath the moon of an Oklahoma sky. Credit: Deniz Bertuna / Anthony Cook

In looking for potential effects of drought, the team turned to sensors that measured soil moisture at two depths: 5 centimeters, where dryness indicates moderate drought, and 25 centimeters, where it signifies severe drought. Though bison seemed mostly unaffected by the former case, reinforcing that they can tolerate moderate drought by taking up water through vegetation, they moved substantially more when contending with the severe drought that struck Oklahoma in the early 2010s.

"There's a lot of (prior) research that suggests that bison are basically drought-proof," McMillan said. "They're like these tanks out on the prairie that don't need anything. They can just take whatever comes, and no big deal. At least, that's the dogma in the reintroduction world.

"So I think this is really interesting, because we show that, hey, they still are not immune to drought. They have this potential threshold where they can't handle it."

## **'I was just hooked'**

Back when bison blanketed the Great Plains, they served not just as a vital food source and cultural touchstone for Indigenous peoples but also a species that many others, animal and plant, relied on for survival, McMillan said. Following the dwindling of their population and eventual relocation to protected areas, Plains bison may or may not serve the same ecological purposes they once did. Regardless, McMillan said their place in the history of the continent and country should be preserved in the animals themselves.

"They're incredibly culturally important and represent the cultural identity for all of the Plains tribes, at a minimum," McMillan said. "But they also represent one of the most charismatic animals that we have in North America. So they're really important for our identity as a country and all the people who live here."

They resonate with McMillan on another frequency, too. As the son of a plant biologist and ecologist who hosted a national TV show that aired on PBS, the South Carolina native tagged along with his father on a visit to Nebraska when he was 15. That visit, and the vistas he took in from atop the badlands of western Nebraska, would kindle his "profound attachment" to bison and help set the course of his career.

"We came to the Great Plains, and I was just hooked," he said. "I never thought about anything else after that. I never necessarily originally envisioned myself being a scientist or studying bison as a scientist, but I was just always fascinated by how they exist on the landscape, bringing them back—that really emotional story. So for me, it's very personal."

McMillan said he hopes the team's findings can inform the management of Plains bison in places like Yellowstone National Park, which houses the largest wild herd of the species. Those findings, he said, make the case for paying attention to what the animal's behavior is telling ecologists and conservationists. Though the size and natural beauty of national parks and other protected areas may seem to offer everything the Plains bison could need, the fact that the animals still attempt to leave would seem to suggest otherwise.

And if the heat and extreme drought that apparently encourage Plains bison to move are only becoming more commonplace, then the space that was once considered sufficient may no longer be, McMillan said. That issue could be compounded by the fact that ensuring the diversity of their habitat—that they have access to grasslands, but also trees, and also standing water—appears to become even more important as that habitat shrinks.

"Then it's an ethical question for us," McMillan said. "Are we really being ethical if we're forcing these animals to live in a landscape that may not actually be suited for them into the future? Whether [bison](#) were in Yellowstone historically is irrelevant to the likelihood that they can persist there into the future. Because today is completely and fundamentally different than yesterday."

**More information:** Nicholas A. McMillan et al, Bison movements change with weather: Implications for their continued conservation in the Anthropocene, *Ecology and Evolution* (2022). [DOI: 10.1002/ece3.9586](https://doi.org/10.1002/ece3.9586)

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