Humans Are Destroying Animals' Ancestral Knowledge

Bighorn sheep and moose learn to migrate from each other. When they die, that generational know-how is not easily replaced.

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In the 1800s, there were so many bighorn sheep in Wyoming that when one trapper passed through Jackson Hole, he described "over a thousand sheep in the cliffs above our campsite." No such sights exist today. The bighorns slowly fell to hunters' rifles, and to diseases spread from domestic sheep. Most herds were wiped out, and by 1900, a species that once numbered in the millions stood instead in the low thousands.

In the 1940s, the Wyoming Game and Fish Department began trying to move bighorns back into their historic habitats. Those relocations continue today, and they've been increasingly successful at restoring the extirpated herds. But the lost animals aren't just lost bodies. Their knowledge also died with them—and that is not easily replaced.

Bighorn sheep, for example, migrate. They'll climb for dozens of miles over mountainous terrain in the spring, "surfing" the green waves of newly emerged plants. They learn the best routes from each other, over decades and generations. And for that reason, a bighorn sheep that's released into unfamiliar terrain is an ecological noob. It's not the same as an individual who lived in that place its whole life and was led through it by a knowledgeable mother.

"The translocated animals were literally let out of a livestock trailer and started looking around at their new environment," says Matthew Kauffman from the University of Wyoming. "And they almost entirely failed to migrate."

Kauffman knows this because the translocated sheep were often fitted with radio collars, allowing him and his colleagues to compare their movements to those of bighorns that lived in the same place for centuries. Within those longstanding herds, between 65 and 100 percent of the sheep migrated. But in the translocated herds, fewer than 9 percent migrated—only the sheep that had been moved into established populations that already knew the land.

The team also used satellite images to measure how closely the sheep were tracking the waves of emerging greenery. Then, they compared the animals' performance to two kinds of simulated sheep—naïve ones that moved around at random, and omniscient ones that had

perfect knowledge of the local plants. “Some of the recently translocated herds tracked the green wave no better than the ones that wandered randomly,” says Brett Jesmer, who led the work. The older herds did far better—“not as well as the omniscient ones, but closer,” he says.

“This changes how we think about wildlife habitat,” Kauffman adds. “Wildlife researchers have always focused on the physical landscape. How much grass is there? How many conifers? Then you can ask how good that habitat is for a sage grouse or a grizzly bear. But our work suggests that the true measure of habitat quality for mobile animals is both the physical attributes of the landscape *and* the knowledge that animals have of how to make a living there. Put naïve animals into awesome habitat and they may perform really poorly, while animals that know how to exploit landscapes that have been degraded could do really well.”

Scientists have long wondered how migrating animals know where to go. In some cases, that knowledge is innate. Sea turtle hatchlings read the Earth’s magnetic field to head off in specific directions, while hybrid songbirds will travel along routes that are halfway between those of their parents. In other cases, learning clearly matters. Whooping cranes get better at migration with age, and groups that include at least one elder are much better at staying on course.

Ecologists have long speculated that ungulates—hooved animals like deer, bison, and sheep—also learn to migrate, since many species seem to adopt the movement patterns of their mothers and peers. By studying the translocated bighorns, using data gleaned from their collars, Kauffman’s team has finally confirmed this longstanding assumption.

To an extent, ungulates can find emerging greenery through local smells and sights. “But they also possess excellent spatial memory,” says Jesmer. “They can remember when a path greened up and time their movements to go to that area the next spring.” Their mental maps are the foundations of migrations. They’re the difference between an animal that’s just going after nearby shoots, and one that’s moving long distances across the terrain in anticipation of greenery that it knows will arrive.

That knowledge takes time to accrue, which the team showed by studying both the bighorns and five groups of translocated moose. The more time these animals spent in a new place, the better their surfing ability was, and the more likely they were to migrate. Jesmer thinks this process likely occurs over generations: Individuals learn to move through the world by following their mothers, and then augment that inherited know-how with their own experiences. “Each generation, you get this incremental increase in knowledge,” Jesmer says. For sheep, he says, learning how to effectively exploit their environment takes around 50 to 60 years. Moose need closer to a century.

That knowledge allows the animals to find plants early, when they’re young, tender, and more easily digested. And by eating high-quality plants, they can more easily pack on the fat and protein that gets them through harsh winters. “When they lose that knowledge, their populations will suffer,” says Jesmer.

Wildlife conservation isn't just about raising the numbers on a population count. It's also an act of cultural preservation. When rangers stop poachers from killing an elephant matriarch, they're also saving her memories. When conservationists preserve routes over which bighorn sheep can travel, they're keeping the animals' traditional knowledge alive for future generations.

Cultural losses are harder to see than disappearing habitats or declining populations, but they're no less important, says Isabelle-Anne Bisson from the Smithsonian Conservation Biology Institute. "It's another angle that's crucial to document, in the face of unprecedented landscape and climate changes." Humans have increasingly parceled the landscape into smaller and smaller chunks. We lay road, erect fences, and build towns—all of which restricts the movements of wild animals and makes migration more challenging.

Recognizing these problems, conservationists have increasingly tried to modify fences, create overpasses, and minimize development along so-called migration corridors. But Kauffman emphasizes that these corridors aren't real physical things, like tracks or roads. "The corridor exists in *the minds* of these animals," he says. "If you sever it with a highway and then un-sever it with an overpass, the animals wouldn't necessarily immediately start using it again, because they wouldn't automatically have the memory of it. They'd need to re-learn."