How beavers could help save the western US from a dry future

Beavers aren't just cute and damn clever. Innovative projects are trying to create human-rodent collaborations to stave off drought

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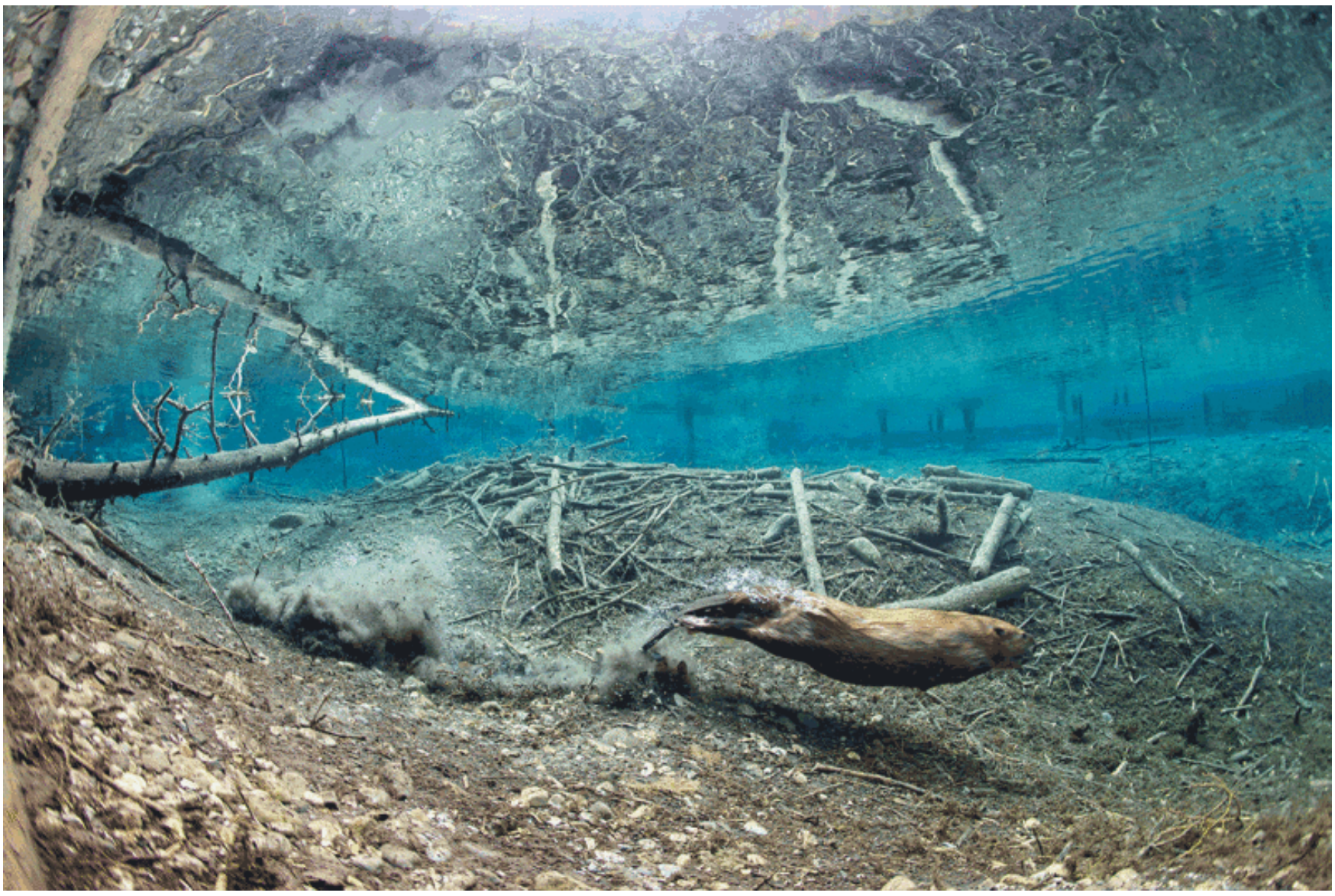

Michel Roggo/Naturepl.com

By **MacGregor Campbell**

GOLD wasn’t what drew the first European settlers out West. The California gold rush was preceded by the California fur rush: having exhausted what

nature could supply in Europe and in the eastern American colonies, trappers set out in search of new riches. The thick, lush coat of the North American beaver was particularly prized. It was traded for every commodity under the sun, shipped around the world and used to make clothes and hats.

How fortunes change. The fur rush drove the North American beaver, *Castor canadensis*, to near-extinction. Then, after a remarkable comeback last century, the once-prized rodent became a pest. Now, some say it could be on the cusp of a fresh rebranding: not as a prize or a pest, but as a prodigy.

Known as nature's engineers, beavers seem to magic water out of nowhere. Crucially, their dams also help to store that water. At a time when California faces endless water shortages and long-standing drought, could beavers be part of a more natural solution?

Once hunted to near-extinction, the North American beaver is making a comeback

George Konig/Keystone Features/Getty

Like much of northern California, the area around Sugar Creek, just off state route 3, was once dredged for gold. Streams were forced into channels and wetlands drained. As a consequence, metres-high mounds of bare river rock now bake in the sun. But tucked away in the midst of all this rubble, a curious scene unfolds.

Shrubs swallow the rocks, bulrushes stand in a wide expanse of clear, still water, and cottonwood trees tower over the landscape. In the speckled shadows, yellow butterflies dip and soar while finger-sized blue dragonflies perch on reeds. Translucent baby fish take cover under waterlogged sticks. Beavers and humans have been busy. “We’re building an ecosystem here,” says Michael Pollock, a researcher with the National Oceanographic and Atmospheric Administration (NOAA), based in Seattle, Washington state.

In 2010, local landowner Betsy Stapleton got in touch with Pollock after reading about some of his research. Pollock was interested in something called beaver dam analogues. Typically consisting of a line of posts set across a stream bed and interwoven with willow and cottonwood branches, these faux dams slow water down and widen out a stream to form a pond. The goal? To attract beavers. Putting one up is like prepping beaver real estate for sale.

In Sugar Creek, much to Stapleton’s delight, the faux dams worked. As she wades through soft muck into surprisingly pristine pond water, she points out evidence of beavers all around. Sticks with chew marks are strewn across the pond bottom. A scent-mound of dried mud stands guard telling interlopers that the pond is spoken for. Vegetation has been stuffed into both dam analogues. “They like to plug every little hole,” says Stapleton.

Where there's beavers, there's water: putting in the foundations for new dams at Sugar Creek (above) allowed beavers to create a lush ecosystem (below)

Scott River Watershed Council

Scott River Watershed Council

For Pollock, Sugar Creek was a test case for a new way to manage water. When Stapleton first contacted him, the site had just a trickle of water. It felt symptomatic of the wider issues facing California, namely persistent drought and dwindling groundwater resources, neither of which is likely to be eased by climate change. Traditionally, the answer has been to build more channels, reservoirs and other artificial water infrastructure. Pollock believes beavers are a better solution.

Parachuted in

The idea isn't new. In the 1950s, fish and game officers in Idaho parachuted nuisance beavers into new areas, far from humans, where they might be able to help with flood control and habitat restoration. Unfortunately, the impact of this work was seldom rigorously followed up. Humans thought of beavers primarily as a problem – out of sight, out of mind.

Later, in the mid-1980s, a wildlife biologist with the US Bureau of Land Management called Larry Apple attached old truck tyres to small beaver dams and watched as the animals happily integrated them into their structures.

Then, in the early 1990s, came an accidental experiment. Fish and game officers in Elko, Nevada, were working with ranchers to restore two dried-up stream basins that cattle had obliterated. To recreate a habitat for cutthroat trout, they put fences up – fish on one side, cows on the other. Willow, a favourite beaver food and building material, took root. By 2003, a colony had moved in and begun damming the streams. Before long, the dry creek beds had sprouted into verdant wetlands, which attracted other animals too.

It was never the officers' intention to lure beavers to Elko, but the events proved that under the right conditions and with very little money, beavers could completely transform an ecosystem.

That same process is now at play at Sugar Creek. The adjacent, undammed creeks are dry in the summer. When they do flow, in autumn and winter, the water moves fast, washing all the dust and nutrients they pick up out to sea. Come summer, it's just dry gravel again.

Water from nowhere

At Sugar Creek, on the other hand, the water gets stuck. Beneath it isn't just rock but rich soil too. NOAA hydrologist Brian Cluer points out sand and fine dirt that has come from further upstream. In the still waters of the ponds, it settles. Grasses, reeds and other plants take root in the stuff, locking it and its moisture in place. With time, a thick base of rich, moist soil builds up, helping to raise the water table.

Cluer says that all this has a huge knock-on effect. The water seeps down into the ground, recharging underground aquifers. That matters because

California is depleting its groundwater at an alarming rate. It is now tapping into “fossil” water that has been underground for tens of thousands of years. Farmland is sinking as aquifers collapse. This is the price you pay for an intensive water management system predicated on drained wetlands and artificial channels, says Cluer.

Slowing water down and storing it in natural ecosystems could be much more effective than creating reservoirs, where half the water evaporates, he says. And although beaver dams will never reverse the damage caused by increasing greenhouse gas emissions, it could help keep at least some of the water from the rapidly melting California snowpack on land – instead of letting it run out to sea each spring.

There’s good reason to believe this. Ten years ago, Glynnis Hood, a wildlife ecologist at the University of Alberta in Canada, and her colleagues systematically reviewed aerial photos of the province, taken between 1948 and 2002. Beavers returned in 1954, so the team could quantify their impact on the landscape. Sites recolonised by beavers had nine times as much surface water as before they came back, even in years of drought. The beavers proved more influential than climatic variations like temperature and precipitation.

Given the scale of the water problems facing the western US, beavers seem like a cheap and scalable solution, says Joe Wheaton at Utah State University in Logan, who has worked on beaver restoration efforts in Utah, Oregon and elsewhere. He says rather than spend billions to redirect streams and build a few big dams, the government could build tens of thousands of smaller dams for far less money and get beavers to maintain them for free. “They just need a little water and a little wood. They can survive and make a decent living in a huge variety of situations,” he says.

It’s not all sweetness and light, however. Humans and beavers working in harmony to restore degraded ecosystems is an alluring dream, but the reality is somewhat more complicated. For one, there’s a reason why

beavers are considered a nuisance: they don't always do what you want them to. Introduce them in the wrong area and they can wreak havoc. Chewed trees, plugged culverts, flooded fields and roads – the same behaviours that make beavers excellent engineers are often at odds with human infrastructure. Across the US, that means damage costing tens of millions of dollars each year.

Introducing beavers to an area doesn't always go well for the animals either, says Jimmy Taylor, a wildlife biologist with the US Department of Agriculture, based in Corvallis, Oregon. Dropping them into a new area can leave them vulnerable to predators and without enough food while they build their infrastructure.

Taylor points out that many beaver ranges have recovered since the fur trade ended. If a seemingly beaver-friendly area isn't already home to some, there's probably a reason. Maybe there are predators, or perhaps the food and wood supplies aren't right. Or the area could already be claimed: conflict between colonies can force one to migrate, possibly into areas where humans live. "It may be that the area we think is suitable, really isn't," he says. In his view, "when humans relocate animals, it's almost always a failure".

Taylor knows this from experience. He and his students recently trapped and relocated 38 nuisance beavers near the Oregon coast. Sixteen weeks later, more than half had died, many eaten by mountain lions. The dams they built were ephemeral and washed away in the higher winter flows.

It's not just resident beavers who dislike interlopers – people living in the area often object. Wheaton says one project in Escalante, Utah, was met with fierce local opposition from ranchers who saw the rodents as pests. To get around situations like this, his team have been building a software mapping tool to help predict where beavers might thrive and stay out of humans' way. It identifies areas where water flows are conducive to beavers and cross-checks them against human infrastructure. They are using the

tool to see how big an impact beaver restoration might make in the western US.

Minimising conflict between beavers and humans is a good start, but not the whole story. Some fish and wildlife managers are concerned that the dams obstruct fish and so will harm stocks. Pollock doesn't buy the argument. Together with Wheaton and others, he has recently completed a large-scale study of the effect beaver dams have on steelhead trout numbers at Bridge Creek in Oregon. In 2008, the team started building beaver dam analogues along a 32-kilometre stretch of the watershed, eventually completing 121 by 2012. The resident beavers chipped in, building on top of the artificial dams and creating new ones too. By 2013, there were 236.

"Areas recolonised by beavers had nine times as much water as before"

Before the experiment, the density of fish living in Bridge Creek was the same as at nearby Murderer's Creek, but by 2013 it was nearly double. It seems that far from being harmed by the dams, fish were benefiting from the wetter, more protected environment. What's more, so far as the team could tell, there was no change in the number of adult fish heading upstream to spawn. They seemed to have no trouble hopping over the dams.

"Beavers and salmon have been evolving together since at least the Pliocene, 3 million years ago," Pollock points out. He says preliminary results at Sugar Creek tell a similar story. Before the beaver dam analogues, they counted tens or hundreds of baby fish in a typical summer. After? Thousands. "There's way more than we can count," says Pollock.

Life at Sugar Creek is sweet indeed. But will it last? Part of a dam washed out downstream during last winter's high water. Standing in the middle of the pond with water up to her hips, Stapleton points to where the 4-metre-

wide breach was. The beavers have patched it up with sticks, reeds and mud. The water-storing, soil-building fish factory is fine. She smiles. “What’s not to love?”

Considered a nuisance, beavers are social and hardworking

Joel Sartore/NGS/Getty

Here’s looking at chew

How could you not love beavers? They are intensely social and form lifelong pairs. Each family – or colony – splits its duties: while one animal gathers building material, another excavates the pond and yet another watches the kits (that’s a baby beaver to me and you), keeping an eye out for predators or rival colonies.

A single family can create and maintain tens of square kilometres of water infrastructure. They thin local forests, both for building material and bark – their preferred food – and store it in underwater caches of sticks and small

logs that also provide homes to baby fish.

Beavers have webbed feet, transparent eyelids and closable ear and nose-valves, all perfect for their largely aquatic lifestyle. There's also an inner lip behind their impressive incisors, allowing them to chew underwater without drowning. They tirelessly put together dams, build the lodges they live in, excavate ponds and connect them with canals.

Their aim is to create large ponds so they can spend as little time on land as possible. This puts their main predators – wolves, mountain lions and wolverines – at an instant disadvantage. It also encourages aquatic vegetation, which provides food and building material. Plus, dragging a 6-metre log around on the ground is tough work, but put that same log in a pond and the dog-sized rodent can push it around with ease.

Their tails are incredibly versatile. Not only do they help with deft underwater acrobatics, they are also slapped against the water to warn the colony of imminent threats. Beaver tails store fat for the winter, which made them a delicacy during the fur trade days. They also prop their owners up so they can chew on trees, and have an ingenious circulation that helps regulate body temperature.

Perhaps the beaver's most surprising attribute is its anal scent glands. They produce a substance called castoreum, which beavers use as a calling card. Humans use it in perfumes and occasionally as a flavouring additive, typically in substitutes for vanilla.

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