



# Leave It to Beavers

Under the right conditions, these big, chisel-toothed rodents are transforming Montana's environments (mostly) for the better. BY TOM DICKSON

**ALMOST ELIMINATED** Before European settlement, an estimated 100 million beavers populated North America. The species was nearly wiped out by commercial trapping between the early 18th and 20th centuries. Numbers have since rebounded slightly to roughly 10 percent of precolonial times.

PHOTO BY ALEX BADYAEV





uch! Another branch whacks me in the face as I follow Torrey Ritter through an alder and willow thicket in the waist-deep water of Spotted Dog Creek. The FWP nongame wildlife biologist looks back and grins.

“I told you it was a jungle.”

He had, but I still couldn’t get my head around it. The day before, Ritter said we’d be visiting a westslope cutthroat trout stream that bisects Spotted Dog Wildlife Management Area, 20 miles northeast of Deer Lodge. I’d imagined a serpentine ribbon of water winding through an open grassy meadow. But this boggy 3-acre widening of the creek, where we are pushing our way through thick brush, is a chaotic quagmire, more swamp than stream.

“Most people have never seen a beaver dam wetland complex like this up close,” Ritter says. He points to the stumps of two thumb-thick willows recently cut by beavers, then indicates where the industrious rodents wove branches into a dense, 20-foot-wide dam, creating deep water. As I watch four mallards, disturbed by our approach, flush up ahead and fly off, Ritter says, “Careful where you step. It’s about 8 feet deep right there.”

Though it’s barely navigable by humans, I later comprehend that this mess of water and wood is a good thing—for beavers, other wildlife, people, and even trout. That perspective can take time getting used to. Like many people, I’d always considered beaver dams a problem, blocking the “natural” flow of streams. But I discovered that those gnawed tree trunks, flooded backwaters, and cheek-slapping shrubs are not only Montana’s most wildlife-rich environments; they also may offer some relief to the state’s perpetual water shortage caused by increasingly warmer summers and snow-deficient winters.

Not bad for a bunch of rodents once valued mainly as material for making top hats.

#### SAFE WATER

As we continue through the waist-deep water, Ritter points to a nearby beaver lodge, also

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made with a layer of sticks and cementlike mud 2 or 3 feet thick. “A mountain lion would have a tough time getting through that,” he says of one of the beaver’s primary predators. Built either in the middle of a pond or into the bank, these domed structures contain a dry den above the waterline where beavers sleep, raise their young, and survive even the coldest winters, during which they do not hibernate. The big rodents leave these safe havens at night to cut down nearby trees and chew off branches to eat, use in dam and lodge construction, or store underwater as food.

Beavers build their dams because they

can’t outrun cougars, coyotes, bears, and other predators. The slow, lumbering furbearers—about the size of a cocker spaniel—are easy pickings on land. Deep water is their salvation. The stick-and-mud dams back up streams and create pools, ponds, and canals where beavers swim safely and gain access to trees, shrubs, and other vegetation.

#### SO MANY BENEFITS

While building a dam, beavers set in motion a whirlwind of ecological actions. Ducking under alder branches, Ritter shows me where the stream has backed up and spread amoeba-like across the floodplain. The weight of the pond, he explains, presses water into the earth, where microbes filter out heavy metals and other pollutants. The underground water flows downstream in subterranean channels, cooling as it goes, then seeps to the surface, in many cases increasing summer flows and lowering stream temperatures.

These wooded wetlands absorb powerful floodwaters, reducing their destructive force and checking erosion. Snowmelt from surrounding mountains is captured, stored, then slowly released during the summer when downstream areas need it most. What some are now calling “Smokey the Beaver” can thwart wildfires by creating lush wet areas that slow or even extinguish flames. “Beaver wetlands also act as a type of Noah’s Ark, where small mammals, frogs, birds, and other animals can escape fire,” Ritter says.

The additional water above and below ground benefits ranchers, farmers, and com-

munities in other ways. For instance, just north of the Montana-Alberta border, the city of Lethbridge is using beaver activity to increase water supplies during drought. And in Idaho, ranchers like Jay Wilde are partnering with state and federal wildlife biologists to “re-beaver” creeks and hold back more water for livestock. “When you see the results, it’s almost like magic,” Wilde told *Beef* magazine. Not surprisingly, all that extra water and vegetation is a boon to fish and wildlife. Species that share beaver-made wetlands include moose, deer, otters, mink, muskrats, great blue herons, cavity nesters like woodpeckers and wood ducks, fishing birds such as ospreys and kingfishers, bats, waterfowl, frogs—even sage-grouse, which lead their chicks in summer to green meadows surrounding beaver ponds to find insects.

Fish benefit from increased streamflows and oxygenated upwellings of cold water below beaver dams. Deep beaver ponds, which don’t freeze solid, provide winter refuge. They also trap sediment that otherwise would wash downstream and cover spawning gravel. According to David Schmetterling, head of FWP’s fisheries research unit, when snowmelt on steep rivers like the North Fork of the Blackfoot gushes downstream

each spring, it scours the streambed. “We’re finding that beaver dams there actually prevent spawning gravel used by bull trout and westslope cutthroat trout from washing away,” he says.

#### A FASHION CASUALTY

The modern beaver (*Castor canadensis*) arrived in North America from Eurasia via the Bering Strait roughly 7 to 8 million years ago. Before European settlement, an estimated 100 million beavers populated a range covering most of the continent—from what is now Alaska and Canada south to northern Mexico. For thousands of years, indigenous people ate the rodents’ flesh and fatty tails and made tanned pelts into warm clothing.

Then came the top hat. Just as the craze for ladies’ feathered hats in London and Paris led to the near-extinction of North America’s egrets in the late 1800s, the mania for men’s beaver-felt headwear, which began in the early 17th century, nearly wiped out beavers. By 1930, it’s

estimated that only about 100,000 of the animals had escaped commercial trapping, mostly in remote Canada. Subsequent trapping bans and low fur prices—a pelt today fetches just one-tenth the price in 1890, adjusted for inflation—have resulted in continental populations rebounding to 5 to 15 percent of historic numbers.

#### THERE GOES THE WATER

The widespread loss of beavers and their dams made much of North America drier. Snowmelt and rain previously stored in ponds, wetlands, and underground aquifers now rushed downstream to the ocean. In mid-summer, wetlands and meadows became parched while water levels in tributaries dropped, leaving little for spawning fish.

At the Spotted Dog swamp, Ritter says that beavers historically created a similar wetland complex but on a far grander scale. He points to decades-old gnawed sticks jutting out from a deep-cut bank. Beavers were removed in the mid-20th century, probably to keep the meadow from flooding. Without dams to slow its flow, Spotted Dog raced downstream “like an irrigation ditch, gushing like a fire hose,” Ritter says. Instead of naturally overflowing its

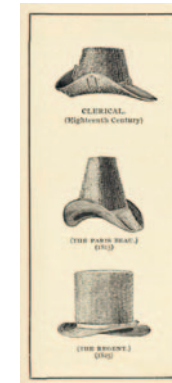


**STICK-AND-MUD CITADEL** A beaver constructs a lodge in western Montana. A fortress of sticks and mud, the structures have a dry chamber inside above the water line. Accessible only by underwater tunnels, lodges allow beavers to sleep and raise their young safe from predators.



**BEAVER BELIEVER** Torrey Ritter, FWP regional nongame biologist based in Missoula, at a dam along the Clark Fork River. “Montana is getting drier,” he says. “We need beavers to help store water on the landscape.”

LEFT TO RIGHT: TOM DICKSON/MONTANA OUTDOORS; STEVE MICHORRAN; WIKIPEDIA





# The Complex, Chaotic World of a Beaver Dam Wetland

**1** It all begins when beavers hear moving water and start backing it up to form a deep pool. Here they can live safely from predators like mountain lions, bears, wolves, and coyotes. The large rodents first construct a low ridge of rocks, sticks, and mud across the stream channel. Over that they add more sticks and mud, building the structure higher.

**2** Additional mud is added to the entire face of the dam to seal the structure.

**3** Dams can block upstream and downstream fish passage, especially for bull trout. The large salmonids move upstream to spawn in late summer, when water levels are especially low.

**4** Beavers and salmonids co-evolved over millions of years. Fish like westslope cutthroat trout often—though not always—find slots in dams where they can make their way upstream.

**5** Some dams are only several feet long, while others extend for hundreds or even thousands of feet. One especially massive beaver wetland complex in Alberta, visible from space, is inundated by a dam stretching a half-mile long.

**6** The backed-up water spreads sideways across the floodplain, filling meadows with water and nutrient-rich silt that invigorates plant growth. Moose are among the dozens of wildlife species that use these shallow wetlands.

**7** Trees toppled into the water provide resting places for turtles, birds, and other species.

**8** Bats and other insect eaters visit beaver-made wetlands to feed on moths, mosquitoes, caddis flies, and mayflies. **9** Kingfishers and other piscivores hunt for minnows and other fish.

**10** Beavers build their dams by toppling nearby trees into the water using their chisel-sharp front teeth.

**11** They then gnaw off branches, which they eat on the spot, use for building material, or carry back to the lodge to store for later consumption, like keeping food in a pantry.

**12** After cottonwoods and willows are cut down, the trees and shrubs resprout, creating new growth.

**13** Among their many benefits, beaver-made wetlands serve as firebreaks that slow or even stop wildfires from spreading and as refuges for fleeing wildlife.

**14** As the wetland complex raises the water table, surrounding meadows become green and lush, attracting grazers such as elk.

**15** Flooded trees die and create snags for cavity nesters like woodpeckers and wood ducks. They also provide perches for ospreys and other raptors.

**16** Most shrubs in a beaver dam wetland are alders and willows.

**17** Waterfowl thrive in this watery world.

**18** So do great blue herons and other wading birds.

**19** Beaver dam wetlands trap snowmelt, holding it for months so it can dribble out in small doses, cooling waters downstream during the hot summer.

**20** Small side ponds along wetlands are homes for frogs and toads. The warmed shallow water provides ideal conditions for the amphibians' life cycle.

**21** Beavers build their domed lodges in the pond or along a bank. The structures are hollow inside with areas above the water line where beavers sleep and raise their young. **22** Access is through underwater tunnels inaccessible by land predators.

**23** Most predators, including lions, cannot dig through the thick lodge, allowing beavers to remain safe.

**24** The weight of a beaver pond presses water down into the ground. **25** Microbes in the soil filter contaminants, purifying the water. As the water flows underground, it cools.

**26** Downstream, the cold, clean water percolates up to the surface. There it oxygenates fish eggs, cools trout streams, and provides additional water for irrigation and community drinking supplies. **27** Deep water in ponds provides warmer wintering areas for fish.

**28** As beaver ponds slow streamflow, sediment in the water settles to the bottom. Though they can increase silt upstream, the dams prevent silt from washing downstream and covering fish spawning areas and suffocating underwater insects living in gravel areas. ■





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**WATER DOESN'T BURN** Above: Researchers across the West are finding that beaver dam complexes can slow or even halt wildfires. Shown here is a beaver dam wetland oasis in the center of the Sharps Fire, which burned 65,000 acres of central Idaho in 2018. Wetland complexes like these are set in motion as soon as beavers begin blocking a stream channel with their dams (below), backing up water and sending it out across the floodplain.

TOP TO BOTTOM: JOE WHEATON/UTAH STATE UNIVERSITY; SHUTTERSTOCK





banks and spreading water across the floodplain during spring runoff, the stream carved down ever deeper until hitting bedrock, its banks dropping 4 feet or more. “Then, whenever beavers tried to build a dam across that channel, it got blown out each spring,” Ritter says. Meanwhile the surrounding valley floor, cut off from the stream, dried up, and with that water went ecological benefits that beavers had created for thousands of years.

**PROBLEMS AND SOLUTIONS**

Despite all the good they do, beavers definitely can cause problems. They plug irrigation ditches, headgates, culverts, and any other place where moving water triggers their damming impulse. Dams flood roads, cattle pastures, golf courses, and more. The industrious rodents also gnaw down shade trees, like the stately cottonwoods toppled a few years ago along the Flathead River at Old Steel Bridge Fishing Access Site a few miles east of Kalispell.

The two biggest concerns for fisheries managers are siltation and movement barriers, especially for bull trout, Arctic grayling, and westslope cutthroat trout—three at-risk species now at a fraction of historic population levels. Though beaver dams prevent sediment from washing downstream, they can also cause it to accumulate upstream in backed-up water. Dams have covered spawning gravel with silt in slow-flowing tributaries of the Big Hole, Madison, Jefferson, and Yellowstone rivers.

Dams can also prevent salmonids from swimming upstream to spawning waters. In Red Rock Lakes National Wildlife Refuge, one of the last holdouts of Arctic grayling in the Lower 48, beaver dams have both silted spawning areas and blocked spring migration.

Yet beavers and salmonids co-evolved for millions of years. Before European settlement, the West was awash in beavers and coldwater fish species. Why are the industrious rodents considered a threat today?

Historically, if a beaver dam blocked or silted in one spawning tributary, salmonids could still reproduce in countless others. Not anymore. Habitat loss and warming temperatures have shrunk Montana’s bull trout population to a small percentage of former numbers. Grayling loss is even greater.



**PROBLEMS** Above: Water from beaver dams can flood and even wash out roads. Below: The structures can also block bull trout and Arctic grayling seasonal movements and increase siltation upstream that can smother spawning gravel.



**FLOODING SOLUTION** Below: Pond-leveling devices like this can lower water levels without having to remove beavers and destroy their dams, which incoming beavers can quickly rebuild in a few days.



Beavers aren’t bad for trout and grayling everywhere, just in certain critical streams. Though FWP fisheries crews still remove some beaver dams, “studies in Montana are showing more and more that the benefits to trout and grayling usually far outweigh the detriments,” Schmetterling says.

Solutions to other beaver problems include galvanized welded wire fencing to protect vulnerable riverside trees, and other fencing to keep beavers away from irrigation ditches and headgates. To lower water levels

on flooded fields and roads, crews use “pond levelers” made of a flexible, large-diameter PVC pipe punched through the dam with a wire-fenced intake at the inlet. “Basically, it creates a permanent leak in a dam that beavers can’t plug,” says Elissa Chott of the Clark Fork Coalition, who helps resolve beaver conflicts.

Since starting with the coalition in 2018, Chott has trained hundreds of landowners, road and railway maintenance crews, and public agency staff to install and use pond levelers as well as tree and culvert fences. Funding for cost-sharing and technical assistance comes from the National Wildlife Federation, Defenders of Wildlife, FWP, and counties.

As she’s helping ranchers and others solve beaver conflicts, Chott touts the animals’ enormous value. “We want to get people to think about them in a different way, not as a pest that needs to be removed but as an animal we can coexist with and reap their benefits, like more wildlife habitat and groundwater storage,” she says.

**BRINGING BACK THE BEAVERS**

Expanding those benefits across Montana often requires repairing “incised” streams like Spotted Dog. “It doesn’t take much,” Ritter says, pointing to a sofa-size pile of rocks and logs that crews placed in the creek in 2020. The plug immediately backed up water that spread sideways across the shallow valley and attracted beavers from colonies downstream. The newcomers added more dams, dug channels, and built lodges. “The idea is to get streams back to a state where beavers can be successful,” Ritter says. “Then they take over the restoration work.”

Another way to make areas more inviting to beavers is adding rocks and logs within a deep-cut channel bed. This raises a stream so that spring rains and snowmelt once again breach the banks. “There are different ways to connect a stream with the floodplain, which is the goal,” Ritter says. “It just depends on the particular stream.”

FWP and conservation groups are looking for more streams where improvements could encourage beavers to move in. Trapping beavers from one area and moving them to potential sites can work, but only under ideal conditions. “If the habitat isn’t



**UNDERWATER WONDER** Though slow and clumsy on land, beavers are swift, agile swimmers. The rodents are aided by powerful webbed feet; a broad, rudderlike tail; transparent eyelids; and an extra set of lips behind their teeth so they can chew and carry branches beneath the surface without drowning. A challenge for FWP biologists and land managers is returning these marvelous mammals to areas where they do more good than harm.

good, translocated beavers just leave,” says Ritter. “And if conditions are favorable, either they are there already or will eventually move in on their own.”

To find areas where natural beaver recolonization would succeed, Ritter and other wildlife biologists use what’s known as the Beaver Restoration Assessment Tool (BRAT).

Developed at Utah State University and managed here by the Montana Natural Heritage Program, BRAT is a computer mapping program that predicts where beavers could most easily build sustainable dams without disrupting roads, bridges, irrigation canals, and other development. “You can’t put beavers just anywhere. The conditions have to be

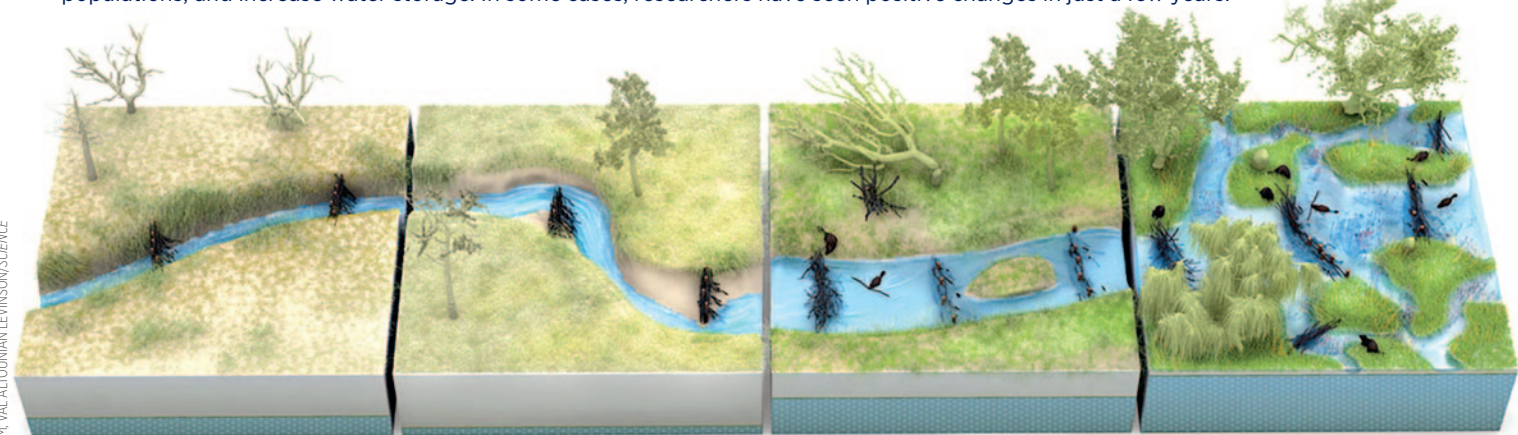
ease summer droughts. But by keeping more water on the landscape and underground, they can help. “They just need a nudge in the right direction,” Ritter says.

[Watch a video of crews building a beaver habitat structure on Spotted Dog Creek.](#)



**A stream comes back to life**

Across the West, scientists and land managers are using artificial beaver structures to heal damaged streams, reestablish beaver populations, and increase water storage. In some cases, researchers have seen positive changes in just a few years.



**Adding dams**

Beaver trapping and overgrazing have caused many creeks to cut deep trenches, causing water tables to drop and dry up floodplains. Installing channel-blocking structures can help.

**Widening the trench**

The structures divert flows, causing streams to cut into banks, widening the incised channel and creating a supply of sediment that helps raise the streambed.

**Beavers return**

As the structures trap sediment, the streambed rebuilds and forces water onto the floodplain, recharging groundwater. The deep water attracts beavers, which then recolonize.

**A complex haven**

Reestablished beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife and groundwater recharge.

TOP TO BOTTOM: USFS; JOEL SARTORE/ NATIONAL GEOGRAPHIC & WADE FREDENBERG/ USFWS; WIKIPEDIA

TOP TO BOTTOM: STEVEN GAWK; VAL ALTOJUNIAN LEVINSON/SCIENCE