

BEAVERS: NATURE'S WETLAND ECOSYSTEM ENGINEERS



Beavers play a critical role in maintaining healthy ecosystems, such as by creating wetland habitat and recharging aquifers. While these industrious animals are beneficial to many other species, including humans, they can sometimes cause damage to private property. This has led to the unnecessary trapping and killing of tens of thousands of beavers throughout the U.S. every year. Proactive and commonsense solutions can help beavers and people coexist and work together to preserve our wetland ecosystems.

BEAVERS: CRITICAL ALLIES FOR WETLANDS

Beavers, like humans, are one of only a few species that significantly alter their landscapes.¹ Also like us, these nocturnal, semiaquatic mammals live in families (known as “colonies”).² Beavers are most famous for building dams, which slow the flow of water and raise water levels behind them, creating ponds.³ Beavers also construct shelters, called “lodges,” and create canals for transporting food and building materials.

Beavers are known as “ecosystem engineers” because they directly influence resource availability for other species by reshaping the physical environment. They are thus considered a “keystone species” for their profound importance in an ecosystem.⁴ Beaver dams help create and maintain wetlands, transforming the interconnected water system in streams and ponds, in the surrounding soil, and in the ground below.⁵ Beaver dams and ponds replenish groundwater and provide a more consistent water flow in streams.⁶ Beaver ponds also improve water quality in streams, store nutrients for plants, and reduce erosion of stream banks.⁷

By flooding trees along the shoreline and removing trees to build dams, beavers change the types of plants that can grow and extend the area of wetland habitat around a stream.⁸ For example, researchers studied streams in Wyoming and found that the area of wetland habitat around beaver-occupied streams was about three times larger than around those unoccupied by beavers.⁹ These changes provide breeding

© Miles Kelly



Beaver colony, dam, pond and lodge, and surrounding wetland ecosystem.

habitat for birds and affect the entire food chain, attracting insects that serve as food for fish, which in turn serve as food for other animals, including amphibians, turtles, and mammals like mink and otter.^{10,11} By modifying their local environment, beavers support numerous other species and contribute to diversity and productivity across the landscape.¹²

Wetlands are among the most productive ecosystems on earth, providing resources like fish, other wildlife, timber, and opportunities for recreation.^{13,14} Wetlands also provide indirect benefits to both humans and wildlife through ecosystem functions such as flood control and groundwater recharge.¹⁵ Despite their tremendous importance, wetlands are disappearing at an alarming rate: more than 53 percent of wetlands in the United States have been lost since 1780.¹⁶

Beavers must be protected because they play a critical role in maintaining wetland environments, and thus in environmental restoration efforts.^{17,18} Many wildlife species rely heavily on wetland environments, especially in the western United States.¹⁹ Restoring wetland environments is also an important climate change adaptation strategy, since wetlands buffer many impacts of climate change, including increasing temperature and drought, wildfires, erosion, and floods. Because beavers create and maintain wetlands by allowing vegetation to grow, increasing the availability of water by storing it in ponds, and recharging aquifers,

they can be invaluable in restoring and protecting wetlands and increasing resilience to climate change.²⁰ Projects in Montana, Wyoming, Idaho, Washington, California, Nevada, and New Mexico have shown that introducing beavers can reverse environmental damage and enhance wetland habitats.²¹

COEXISTING WITH BEAVERS: FROM CONFLICT TO COOPERATION

During European settlement of North America, beavers were hunted and trapped for their furs. This drove them to extinction in many parts of the United States by the early 1900s.²² Despite this history, beavers have since been reintroduced in many areas and, having made a tremendous comeback, they are now abundant throughout much of North America.²³

Since much of the beaver's former habitat is now occupied by humans, expanding beaver populations can cause damage to private property by flooding roads, blocking culverts, flooding or consuming crops, and flooding or cutting timber.²⁴ Currently, the most common responses to beavers that are considered nuisances are lethal measures, such as traps and snares. For example, the [Wildlife Services](#) program, part of the U.S. Department of Agriculture's Animal and Plant Health Inspection Service, uses lethal control methods in more than 99 percent of responses to beaver damage complaints.²⁵ Over the last five years alone, the program has killed 116,900 beavers—an average of more than 23,000 per year.²⁶

© BLM, Elko District



Maggie Creek, Nevada, in 1980, before grazing restrictions were put in place and beaver returned to the area.



Maggie Creek in 2011.

© BLM, Elko District

THE TRUTH ABOUT TRAPS

Conibear or “body grip” traps are the most commonly used traps to kill beavers.²⁷ While these traps are supposed to kill quickly by crushing the animal's neck, they often cause slow and painful deaths by catching the wrong part of an animal's body.²⁸ In addition, traps that are set underwater exert less force than on land; this kills the animal by drowning, which can take up to 15 minutes.²⁹

Conibear traps also cause immense damage to nontarget species, or animals unintentionally caught or killed. River otters, muskrats, and turtles are some of the most frequent victims of Conibear traps set for beavers.³⁰ The majority of river otters killed by Wildlife Services each year are unintentional victims of such traps.³¹ In 2014, Wildlife Services unintentionally killed 363 river otters —93 percent of the total number of river otters the program killed that year.³² The wastefulness of this indiscriminate killing is even less acceptable considering that river otter populations have also been severely reduced and are the focus of reintroduction efforts in many states.³³ Other nontarget animals affected include family pets.³⁴ Since all wild animals play important roles in their ecosystems, their accidental removal causes significant environmental harm.³⁵

Rather than continuing our overreliance on destructive strategies, we can shift to more adaptive, proactive, and nonlethal approaches that prevent conflicts with beavers, avoid damage to human property, and preserve beavers and the ecosystems they help maintain.

© BLM, Elko District



A beaver barrier in Arden Park, Sacramento, California.



© Alex Derr/Flickr

Positioning the intake assembly on a beaver deceiver, Oregon.

Despite the immense amount of time and financial resources devoted to lethal control, it has not been a lasting solution to conflicts between people and beavers since other beavers tend to move into the open habitat.³⁶ Other methods, such as removing beaver dams and relocating beavers, are also problematic because beavers often rebuild dams in the same location, can travel long distances from where they are released, or do not survive the relocation.³⁷ Rather than continuing our overreliance on destructive strategies, we can shift to more adaptive, proactive, and nonlethal approaches that prevent conflicts with beavers, avoid damage to human property, and preserve beavers and the ecosystems they help maintain.

For example, property owners can install barriers such as wire fencing, hardware cloth, a sand-paint mixture, or taste or odor repellants to protect valuable trees.³⁸ Devices like Beaver Deceivers and Beaver Stoppers can be installed to prevent beavers from plugging road culverts and causing roads to flood.³⁹ In some sites, flooding can be prevented with a water level control device, which prevents a beaver pond from flooding while maintaining the beaver's habitat.⁴⁰

In some communities, beavers that have made their homes among residents have not only brought new life to rivers, but have also become icons of the community. For example, in Martinez, California, community advocates formed a group called [Worth A Dam](#) and prevented the city council from lethally removing a beaver colony that had built a dam in Alhambra Creek, near the city's downtown.⁴¹ Since their victory, residents have celebrated the beavers and other wildlife that moved in after the beavers improved the quality of the river.⁴² Martinez demonstrates how people and beavers can coexist and the benefits that such harmonious relationships can have for both human and ecological communities.

A HARMONIOUS APPROACH IS POSSIBLE

Beavers perform many critical ecosystem functions and have experienced a tremendous comeback across much of North America. However, this resurgence has also been met with unnecessary trapping and killing in response to private property damage. We need to recognize the important roles beavers play in our ecosystems, the nonlethal methods that are available for preventing damage, and the necessity and rewards of learning to coexist with these remarkable creatures—nature's wetland ecosystem engineers.

ENDNOTES

- 1 Frank Rosell et al., “Ecological impact of beavers *Castor fiber* and *Castor canadensis* and their ability to modify ecosystems,” *Mammal Review* 35, 3 and 4 (2005), pp. 248-276.
- 2 Bruce W. Baker and Edward P. Hill, “Ch. 15: Beaver,” from G. A. Feldhamer, B. C. Thompson, and J. A. Chapman, ed., *Wild Mammals of North America: Biology, Management, and Conservation*, Second Edition (Baltimore: Johns Hopkins University Press, 2003), pp. 288-310.
- 3 Rosell et al., 2005.
- 4 Baker and Hill, 2003, Rosell et al., 2005. Dietland Müller-Schwarze, *The Beaver: Its Life and Impact*, Second Edition (Ithaca: Cornell University Press, 2011).
- 5 Cherie J. Westbrook, David J. Cooper, and Bruce W. Baker, “Beaver dams and overbank floods influence groundwater–surfacewater interactions of a Rocky Mountain riparian area,” *Water Resources Research*, 42 (June 2006), pp. 1-12. Müller-Schwarze, 2011.
- 6 Rosell et al., 2005. Baker and Hill, 2003. Müller-Schwarze, 2011.
- 7 Baker and Hill, 2003.
- 8 Rosell et al., 2005. Baker and Hill, 2003.
- 9 Mark C. McKinstry, Paul Caffrey, and Stanley H. Anderson, “The Importance of Beaver to Wetland Habitats and Waterfowl in Wyoming,” *Journal of the American Water Resources Association* 37 no. 6 (December 2001), pp. 1439-1734.
- 10 Rosell et al., 2005. Baker and Hill, 2003. Connecticut Department of Energy & Environmental Protection, *Beaver, Castor Canadensis*, 2002-2017, http://www.ct.gov/deep/cwp/view.asp?a=2723&q=325970&deepNav_GID=1655 (June 26, 2017).
- 11 Rosell et al., 2005. Baker and Hill, 2003. Hilary A. Cooke and Steve Zack, “Influence of beaver dam density on riparian areas and riparian birds in shrubsteppe of Wyoming,” *Western North American Naturalist* 68, 3(September 2008), pp. 365-373. McKinstry, Caffrey, and Anderson, 2001.
- 12 Rosell et al., 2005, Justin P. Wright, Clive G. Jones, and Alexander S. Flecker, “An ecosystem engineer, the beaver, increases species richness at the landscape scale,” *Oecologia* 132 (April 2002), pp. 96-101.
- 13 Edward B. Barbier, Mike Acreman, and Duncan Knowler, *Economic Valuation of Wetlands: A Guide for Policymakers and Planners* (Gland, Switzerland: Ramsar Convention Bureau, 1997), http://www.ramsar.org/sites/default/files/documents/pdf/lib/lib_valuation_e.pdf.
- 14 Barbier, Acreman, and Knowler, 1997.
- 15 Barbier, Acreman, and Knowler, 1997.
- 16 Thomas E. Dahl, *Wetlands Losses in the United States 1780s to 1980s*, United States (U.S. Department of Interior U.S. Fish & Wildlife Service, 1990), <https://www.fws.gov/wetlands/Documents/Wetlands-Losses-in-the-United-States-1780s-to-1980s.pdf>.
- 17 McKinstry, Caffrey, and Anderson, 2001. Rosell et al., 2005. Baker and Hill, 2003. Wright, Jones, and Flecker, 2002.
- 18 Michael M. Pollock, Gregory Lewallen, Kent Woodruff, Chris Jordan, and Janine Castro eds., *The Beaver Restoration Guidebook: Working with Beaver to Restore Streams, Wetlands, and Floodplains* (Portland, Oregon: United States Fish and Wildlife Service, 2015), <https://www.fws.gov/oregonfwo/Documents/BeaverRestGBv.L02.pdf>. Müller-Schwarze, 2011. McKinstry, Caffrey, and Anderson, 2001.
- 19 Northwestern University, Medill School of Journalism, *Beavers Help Battle Ongoing Drought*, 2015, <http://climatechange.medill.northwestern.edu/2015/06/25/battle-born-beaver-tale>. McKinstry, Caffrey, and Anderson, 2001.
- 20 United States Environmental Protection Agency, *Wetland Protection and Beaver Habitat Restoration as Climate Adaptation Tools in New Mexico*, State Water Agency Practices for Climate Adaptation Database, 2016), https://www.epa.gov/sites/production/files/2016-12/documents/nm_wetlands_and_beaver_12_16_16_final.pdf. Rosell et al., 2005. Baker and Hill, 2003. McKinstry, Caffrey, and Anderson, 2001. Wright, Jones, and Flecker, 2002. Pollock, Lewallen, and Woodruff, 2015.
- 21 Caillat et al., 2014. Trout Unlimited, *Riparian Restoration using Relocated Nuisance Beaver in Western Montana*, March 2009, <ftp://mymontanalibrary.org/Maxell/Beaver/Beaver%20Report%20-%20TU%202009.pdf>. Pollock, Lewallen, and Woodruff, 2015. Gray, 2015. US EPA, 2016.
- 22 Baker and Hill, 2003. Müller-Schwarze, 2011.
- 23 Baker and Hill, 2003.
- 24 Baker and Hill, 2003. Müller-Schwarze 2011. Wildlife Services, United States Department of Agriculture Animal and Plant Health Inspection Service, *Beaver Damage Management*, 2011, https://www.aphis.usda.gov/publications/wildlife_damage/content/printable_version/fs_beaver.pdf.
- 25 Baker and Hill, 2003. Müller-Schwarze 2011. Wildlife Services, 2011.
- 26 Wildlife Services, Department of Agriculture Animal and Plant Health Inspection Service, *2016 Program Data Reports*, March 2017, https://www.aphis.usda.gov/aphis/ourfocus/wildlifedamage/sa_reports/sa_pdrs/ (June 26, 2017).
- 27 Wildlife Services, 2017. James E. Miller and Greg K. Yarrow, *Beavers*, (Internet Center for Wildlife Damage Management, 1994), http://icwdm.org/handbook/rodents/ro_b1.pdf. Wildlife Services, 2017.
- 28 Miller and Yarrow, 1994. Donald M. Broom, “The welfare of vertebrate pests in relation to their management,” *Advances in Vertebrate Pest Management* (1999), pp. 309-329.
- 29 Broom, 1999.
- 30 Michael A. Mares, American Society of Mammologists, “RE: recommendations for redirection of management operations by Wildlife Services” (letter)(March 2012), http://www.mammalsociety.org/uploads/committee_files/ASM-Federal%20wildlife%20control%20letter_0.pdf. Knudson, 2012.
- 31 Mares, 2012.
- 32 Wildlife Services, 2017.
- 33 Mares, 2012.
- 34 Tom Knudson, “The killing agency: Wildlife Services’ brutal methods leave a trail of animal death,” *The Sacramento Bee*, April 2012, <http://www.sacbee.com/news/investigations/wildlife-investigation/article2574599.html> (June 26, 2017). Bradley J. Bergstrom et al., “License to Kill: Reforming Federal Wildlife Control to Restore Biodiversity and Ecosystem Function,” *Conservation Letters* 7, 2 (March/April 2013), pp. 131-142.
- 35 Bergstrom et al., 2013.
- 36 Russell Link, *Living With Wildlife*, (Washington Department of Fish and Wildlife, 2004), <http://wdfw.wa.gov/living/beavers.html>.
- 37 Wildlife Services, 2011. Baker and Hill, 2003. Link, 2004. Connecticut Department of Energy & Environmental Protection (CT DEEP), 2002-2017.
- 38 Link, 2004. CT DEEP, 2002-2017. Wildlife Services, 2011. Baker and Hill, 2003.
- 39 Link, 2004. CT DEEP, 2002-2017. Wildlife Services, 2011. Baker and Hill, 2003.
- 40 Link, 2004. CT DEEP, 2002-2017. Wildlife Services, 2011.
- 41 Sam Richards, “‘Weekend project’ to help local beavers turns into labor of love for Martinez woman,” *East Bay Times*, July 2015), <http://www.eastbaytimes.com/2015/07/27/weekend-project-to-help-local-beavers-turns-into-labor-of-love-for-martinez-woman/>. Worth A Dam, *Our Story*, <http://www.martinezbeavers.org/wordpress/about-2/>.
- 42 Richards, 2015. Worth A Dam.