

Beavers As Ecosystems Engineers: Why Illinois Needs to Partner with Beavers

Illinois Beaver Alliance



A Brief History Lesson of Beavers and Rivers in Illinois

Illinois used to be a quarter wetlands before European trappers arrived and trapped all the beavers. Rivers looked completely different; instead of straight blue lines, they were complex river-wetland corridors that meandered, looped around, and braided.

Once the beavers were gone, the rivers became cut off from their floodplains. Settlers dug drainage ditches and laid drainage tiles (underground pipes) to quickly and efficiently move water off the land into local streams and rivers.

Soon much of the Illinois landscape—once peppered with depressions that retained water—was dry for farming and other development. But the loss of wetlands has had unintended consequences.

Beavers Offer Many Important Ecosystems Services



Beaver-created wetlands provide many beneficial services for people and for fish and wildlife. These services include:

- Protecting and improving water quality
- Increasing biodiversity and creating fish and wildlife habitats
- Sequestering carbon
- Storing floodwater
- Mitigating the effects of wildfires
- Protecting against drought, including boosting food and water supplies for livestock in arid regions

How Beavers Create Wetlands

When beavers build dams on waterways, the dams start impounding water and sediment. As that happens, water starts to flow laterally across the floodplain and the streambed rises.

The raised creek bed and lateral flow of water reconnects the stream to its floodplain. The water table rises and riparian vegetation starts to grow.

Eventually, a complex river-wetland corridor develops.



Beaver Dams Improve Water Quality

Beaver ponds remove agricultural runoff (nitrogen and phosphorus fertilizer) and nutrients from stormwater and wastewater from streams and rivers through biochemical processes. Beaver ponds also capture and filter out sediment.

Wetland plants and algae bind and remove toxins such as lead, arsenic, copper, cadmium, mercury, and selenium from the water.

Why is this important? Agricultural runoff from Illinois farms ends up in the Gulf of Mexico, causing large toxic algae blooms that kill all of the aquatic life.



Beaver-Created Wetlands Improve Biodiversity

In nature, the stability and health of an ecosystem is closely tied to its biodiversity. Biodiversity refers to the number of different species present. The more diverse a community of plants and animals is, the better it is able to adapt and adjust to changes. Endangered species in Illinois that would benefit from more wetlands include:

- Eastern Prairie Fringed Orchid
- Hine's emerald dragonfly
- Illinois Chorus Frog
- Blanding's Turtle
- Wetlands birds: American Bittern, King Rail, Black Rail, Piping Plover, Common Tern, Least Bittern, Black Tern, Black-Crowned Night-Heron, Common Gallinule, Yellow-Headed Blackbird, Forster's Tern, Pied-Billed Grebe, and Wilson's Snipe.



Beaver-Created Wetlands Provide Wildlife Habitat



Image: The Beaver Pond, a 35 piece tray puzzle from Cobble Hill.

Beavers are a keystone species and their wetlands habitats allow other animals, fish, birds, and amphibians to flourish. Beavers are being used to boost salmon populations out west.

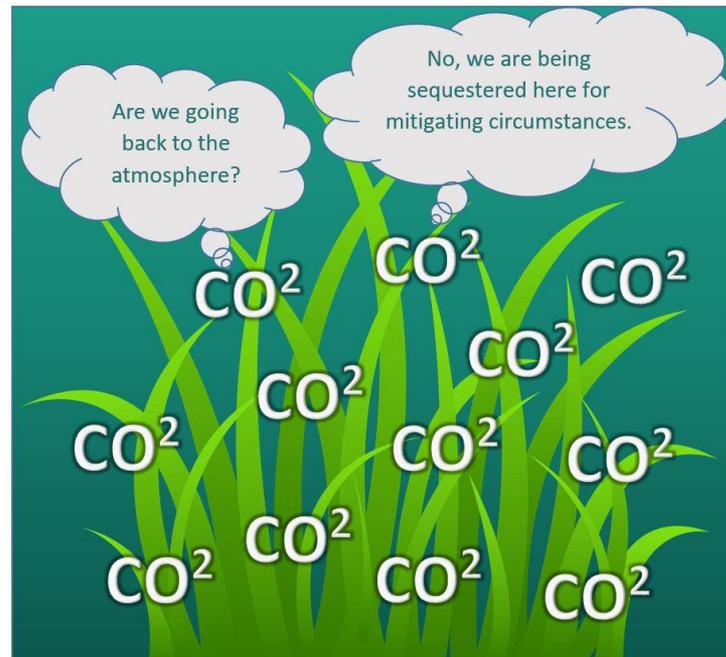
Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. An immense variety of species of microbes, plants, insects, amphibians, reptiles, birds, fish and mammals can be part of a wetland ecosystem.

Wetlands Sequester Carbon

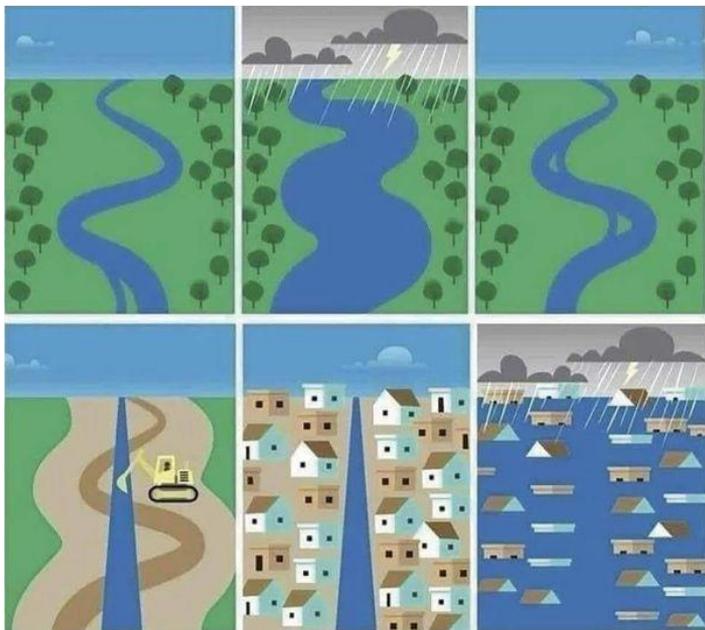
Carbon dioxide emissions are causing climate change.

Wetlands sequester carbon from the atmosphere through plant photosynthesis and by acting as sediment traps for runoff.

Carbon is held in the living vegetation as well as in litter, peats, organic soils, and sediments.



Wetlands Store Floodwater



- Humans have built housing and cities on floodplains near rivers, which are now simplified and fast moving.
- Due to climate change, our region is already getting more rain than was the case historically. Rain events are become more frequent and more intense but of a shorter duration.
- Our stormwater infrastructure is simply not designed and sized to handle the amount of rainfall we are receiving, so we will see increased flooding in the future.
- Studies demonstrate that beaver dams upstream reduce flooding downstream.

Beavers Offer Firefighting Services

A) California: Fire

Beaver-Dammed Creek

Undammed Creek



B) Oregon: Before Fire

C) Oregon: Fire



Research out west shows that if you have beaver damming in a creek, the area around the beaver dam stay wet and green and doesn't burn. The beavers create fire-resistant patches in the landscape because of all of the wet vegetation.

These wetlands patches offer shelter for wildlife during wildfires, and give firefighters precious moments to regroup and muster resources to fight the fires.

Image: Smokey the Beaver: beaver-dammed riparian corridors stay green during wildfire throughout the western USA," by Emily Fairfax and Andrew Whittle, Ecological Applications, 2020.

Beavers Can Protect Against Drought



By building dams, digging channels and changing small streams into broad wetland areas, beaver dams have the secondary effect of keeping plants green and lush, even during periods of drought. The channels the beavers dig act like a little drip irrigation system running through entire riparian areas.

In arid rangelands, ranchers are experimenting with beaver-related restoration. Results include more vegetation for livestock to eat and increased water availability for livestock to drink in the summer.

Image: Doty Ravine Preserve in California, Placer Land Trust, before and after process-based restoration, U.S. Fish & Wildlife Service.

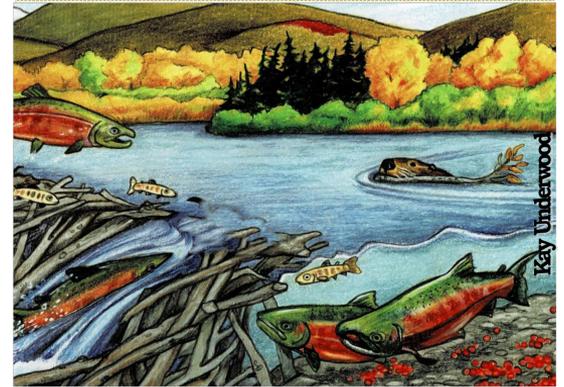
Beavers Are Restoring Salmon Populations

Effects of climate change and human development have put salmon on the brink of extinction.

Scientists are reintroducing beavers to Washington and Oregon watersheds to help restore wild salmon populations.

Beaver ponds provide suitable habitat for salmon fry, juvenile salmon, and adult salmon, with cooler water temperatures.

IN THE BEGINNING, SALMON NEEDED A PLACE FOR HER CHILDREN TO GROW AND FEED, SAFE FROM THE FREEZING WINTERS AND DRY SUMMERS.



Beaver TAUGHT SALMON TO JUMP

Charismatic Beavers Offer Lessons on Ecosystems



Beavers offer educational opportunities by engaging the public with the natural environment. Beavers provide first-hand lessons about habitat, biodiversity, and territory.

Children can see with their own eyes how the population of birds, frogs, turtles, and other wildlife respond to construction of a beaver dam.



Beavers Help Build Climate Resilience

- The planet is getting hotter.
- In Illinois, climate change can be seen in changing rainfall patterns.
- In other parts of the country, climate change is causing more frequent and severe floods, hurricanes, and wildfires.
- We need to do everything we can to make ourselves more resilient to climate change, including developing forward-thinking beaver management policies.

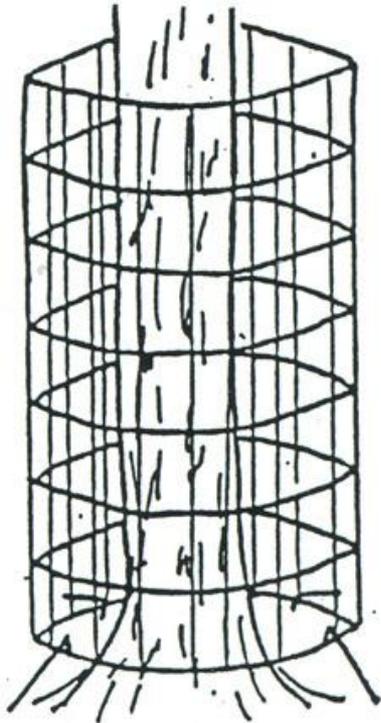


Tools to Resolve Human-Beaver Conflict

Beavers can be a pain in the a**. They can chew down trees, and their dams can cause flooding of infrastructure that we as humans value. Yet the ecological benefits of allowing beavers to engineer their complex ponds and wetlands means that humans need to tolerate beavers at a much higher level than is currently the case.

When properly designed, installed, and maintained, modern management tools such as tree wrapping, flow devices, beaver deceivers, exclusion fencing, etc., are effective at preventing beaver damage and ultimately less expensive than the continuous cycle of trapping and killing beavers.

Tree Wrapping



- Most tree cutting occurs within 50 feet of the water. Although beavers may travel 200 feet from water, the likelihood of tree damage decreases as the distance from shore increases.
- While beavers prefer certain tree species, they do not necessarily take them in order of preference, so it's a good idea to protect special ones.
- Leave the trees that are already down, so the beavers are not driven to cut more, while you are protecting others.
- In urban areas, tree trimming companies may drop off branches to provide alternative food.

Tree Wrapping

- Cylindrical cages are the best way to protect individual trees. Make them of sturdy 2 x 4 inch welded wire fencing, about four feet high.
- Encircle the trunk, leaving a space of about six inches between the tree and the fence. Cut every other horizontal wire to leave a long prong and bend these into hooks to attach with the other end.
- Cages should be anchored to the ground with stakes.



Flow Devices—Blocked Drainage Systems



Image: Beaver Solutions

Structures designed to drain water, such as man-made dam spillways and retention ponds, are common sites for beaver problems. A blocked drainage structure can quickly cause dangerous and expensive flooding issues. Fortunately nearly every man-made drainage structure can be protected from beavers in a cost-effective, long-term, environmentally friendly and humane manner.

The installer chooses the proper flow device design and customizes it to the site. Important considerations include: the type and size of the drain structure, seasonal water flows, desired water level, tolerance for water level fluctuations, etc.

Flow Devices: Blocked Culverts

Road culverts are the most common sites for problematic beaver damming. A blocked road culvert can quickly cause dangerous and expensive road safety issues. Fortunately nearly every road culvert can be protected from beavers in a cost-effective, long-term, environmentally friendly and humane manner.

Which beaver control method is best depends upon the site. Installers use several different designs that are customized for each site. Important considerations include: type and size of the culvert, road bed elevation, seasonal water flows, and fish and wildlife passage.



Flow Devices: Fence and Pipe Pond Levelers

A beaver pond leveler, or fence and pipe flow device, creates a permanent leak in the dam to keep water flowing despite the presence of beavers. It controls the beaver pond level to allow humans to coexist with beavers without conflict. The pipe outlet elevation determines the pond level. This end of the pipe can be adjusted up or down if a higher or lower pond level is desired.

The domed intake fence prevents beavers from hearing or feeling the flow of water into the pipe. Therefore they ignore the intake end of the pipe, and only dam on the culvert fence where they hear the water flowing.

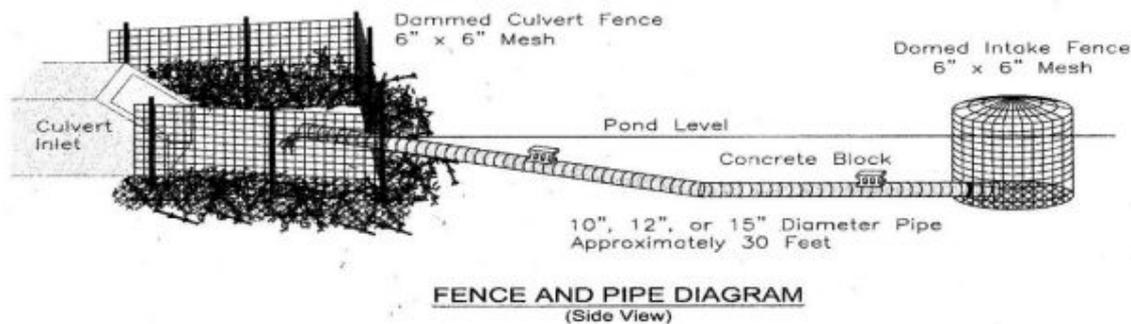


Image: The Beaver Institute

Flow Devices: Keystone Fences

Keystone Fence Diagrams

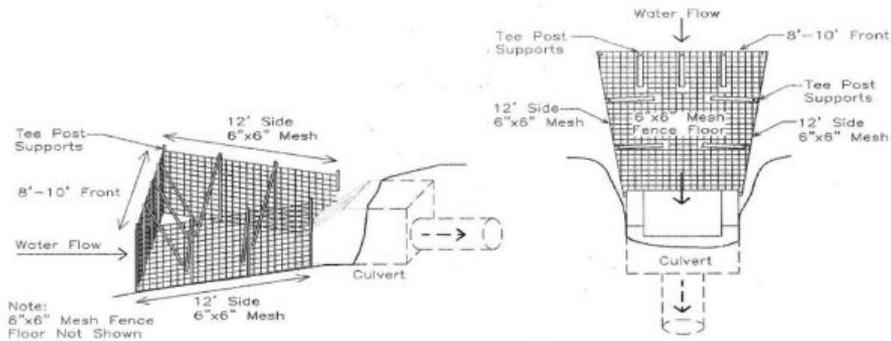


Image: The Beaver Institute

Keystone fences are effective at protecting culverts from beaver damming for three reasons.

1. Damming 30 to 50 feet of fence is a lot more work for the beavers than plugging a narrow culvert, discouraging damming.
2. When beavers begin to dam near the culvert, the fence forces their damming away from the culvert which also discourages them.
3. As beavers dam out on the fence, the opening that the water flows into becomes wider and wider. Therefore, less water is moving through the fence where the beavers are damming. Less water flow through the fence further decreases the damming stimulus for beavers.

Flow Devices: Culvert Diversion Dams

Fig. 1 – Undammed Div. Fence

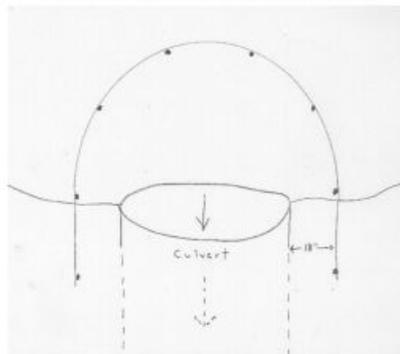
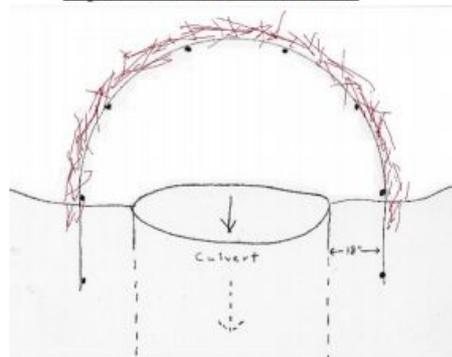


Fig. 2 – Dammed Div. Fence



Images: The Beaver Institute

A Culvert Diversion Dam (CDD) inexpensively protects road culverts from beaver damming by encouraging the beaver to dam immediately upstream of the culvert instead of inside it. This keeps the culvert open and works well when some ponding upstream of the road is tolerable.

The CDD is constructed 10 to 15 feet upstream of the culvert so when the beavers dam upon it the inlet of the culvert is not blocked. The CDD creates a small, noisy waterfall that will attract the beaver's attention. They will then dam on top of your CDD instead of the road culvert.

Resolving Conflicts Nonlethally Is Cost-Effective

- Over the mid-term, it is less expensive to resolve beaver conflicts with flow devices than to continue to trap and kill beavers.
- Because beavers are territorial, allowing a family of beavers to remain at a conflict site while protecting the site with a flow device will keep other beavers from settling in that area and causing further conflict. Beaver populations also stabilize with less trapping and killing.
- The cost of repeatedly trapping and killing beavers, cleaning out culverts, and addressing nuisance flood damage is greater than the cost of flow devices.



Process-Based River Restoration

Low-tech, process-based river restoration is the practice of adding simple, low unit-cost, structural additions—locally sourced rock, human-created Beaver Dam Analogs, and anchored log structures—to rivers to mimic functions and promote specific processes.

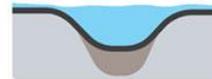
Beaver-related restoration is a type of process-based restoration that seeks to re-establish dam building in degraded streams by relocating beavers to streams where dams are desired, building Beaver Dam Analogs, or restoring riparian vegetation to attract beavers.

A Stream Comes Back to Life

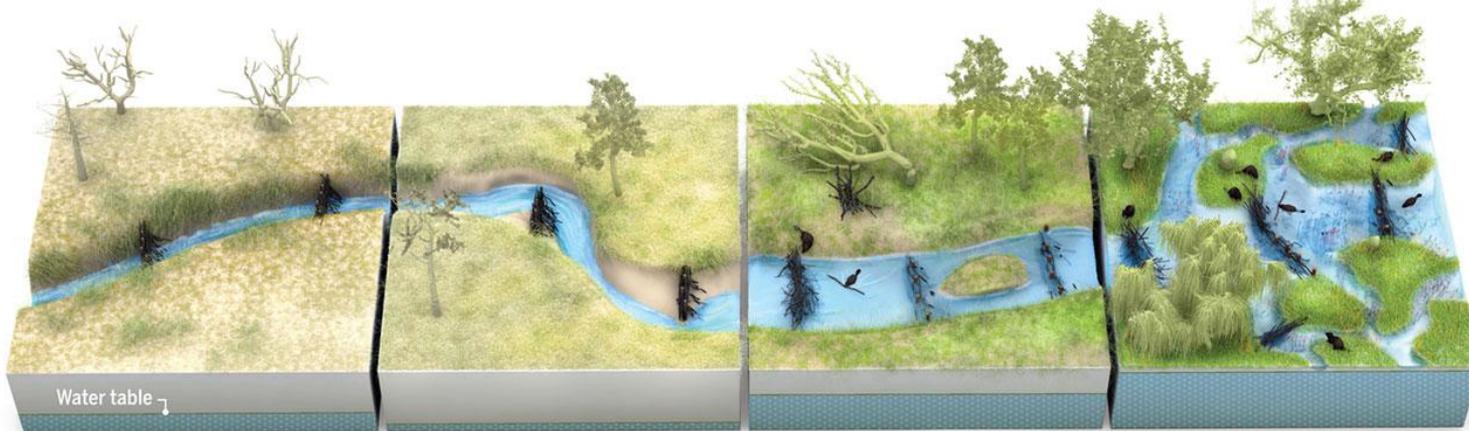


Incised stream

A stream comes back to life
Across the U.S. West, scientists and land managers are using beaver dam analogs (BDAs) to heal damaged streams, re-establish beaver populations, and aid wildlife. In some cases, researchers have seen positive changes in just 1 to 3 years.



Restored stream



Adding dams

Beaver trapping and overgrazing have caused countless creeks to cut deep trenches and water tables to drop, drying floodplains. Installing BDAs can help.

Widening the trench

BDAs divert flows, causing streams to cut into banks, widening the incised channel, and creating a supply of sediment that helps raise the stream bed.

Beavers return

As BDAs trap sediment, the stream bed rebuilds and forces water onto the floodplain, recharging groundwater. Slower flows allow beavers to recolonize.

A complex haven

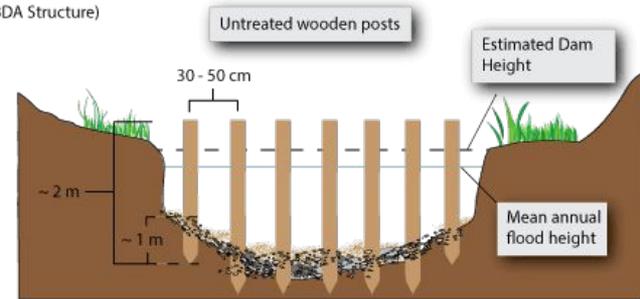
Re-established beavers raise water tables, irrigate new stands of willow and alder, and create a maze of pools and side channels for fish and wildlife.

Image: "Beavers Rebooted," Ben Goldfarb, *Science*, Vol. 360 No. 6393, June 8, 2018.

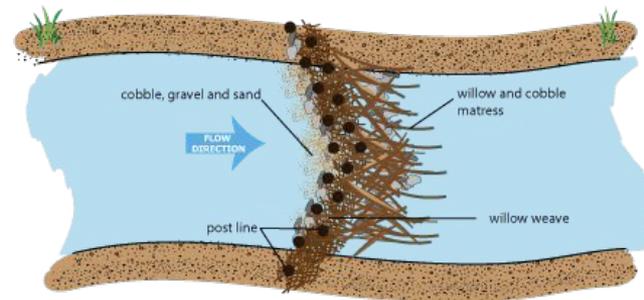
Beaver Dam Analogs

- Beaver dam analogs (BDAs) are structures that mimic natural beaver dams.
- BDAs are biodegradable and temporary.
- BDAs jumpstart a series of processes that bring the river back to health.
- BDAs function best when constructed in groups that work together.

Cross Section View
(Generic BDA Structure)



Plan View
(Convex Primary Dam)



Images: Anabranch Solutions.

Relocating Beavers

Researchers have found that relocations are more successful if beavers are relocated in pairs and family groups, so single beavers go through sort of a “match.com” to find mates.

Relocation sites are chosen that have appropriate vegetation, stream flow, and low chance of human-beaver conflict.

BDAs are often installed prior to relocation in the hopes that it will provide a head start for the relocated beaver family.



Image: Methow Beaver Project.

Current Illinois Policies Regarding Beaver Trapping and “Nuisance” Beavers

- Beaver trapping is allowed from November 10 through the following March 31.
- There is no daily or possession limit for beavers.
- Nuisance beavers can be trapped and killed year-round by companies in possession of nuisance wildlife removal permits.
- Current policies only allow relocation within 40 miles of capture. In practice few beavers are relocated in Illinois.

“Nuisance” Beavers

- In 2015, 1,646 beavers were handled by individuals with Nuisance Wildlife Control Permits. Of those, 84 were relocated, and the rest were killed.
- In 2018, 1,361 beavers were handled by individuals with Nuisance Wildlife Control Permits. Of those, 41 were relocated, released on site or surrendered to wildlife rehabilitators.
- Likely the actual number of “nuisance” beavers trapped and killed is higher than what was officially reported.



Trapping Beavers for Their Pelts

- In the 2019-2020 trapping season, an estimated 10,358 beavers were trapped for pelts in Illinois.
- Most of the pelts are destined for the fur market in China and Russia.
- The demand for beaver is low. Most beaver pelts sell for \$10 to \$15. They are much more valuable as ecosystems engineers.

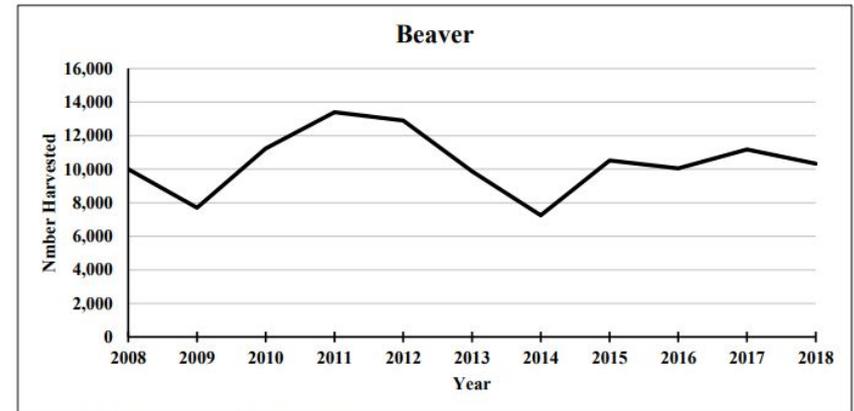


Figure 18. Beaver harvest 2008 to 2018.

Image: 2018-2019 Illinois Trapper Report: Harvest, Effort, and Marketing Practices

Write Beavers into Illinois Watershed Plans

- As new watershed plans are undertaken, write beavers' ecosystems services into the plans. Then it will be easier to find funding for beaver restoration.
- Stormwater management commissions will likely start funding grants for flow devices.
 - Squaw Creek Drainage District just applied for funding to install flow devices in three culverts on Squaw Creek, a subwatershed of the Fox River, in Lake County.

Forward-Thinking Beaver Management Policies

- Exempt watersheds undergoing beaver restoration from recreational trapping.
- Allow relocation of beavers beyond 40 miles.
- Share more and better information about resolving beaver conflicts nonlethally; discourage lethal methods
- Find suitable sites for beaver restoration projects on Illinois public and private land to create more wetlands.