Partnering with Beavers in Illinois:

A New Paradigm

Why should we want to partner with beavers in Illinois? Simply put, keeping beavers on our watersheds would improve our water quality, increase wildlife habitat and biodiversity, and increase our floodwater storage capacity.

Nearly every man-made culvert and drainage structure can be protected from beavers in a cost-effective, long-term, environmentally friendly and humane manner. When flow device designs are customized for the specifics of each site, they are very effective. Flow devices can be designed to allow for wildlife passage. 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.

River restoration specialists in other regions of the country are taking advantage of the ecosystem services that beavers provide. A number of states including California, Oregon, Washington, Montana, Iowa, Utah, Colorado, and New Mexico are partnering with beavers to restore streams, prevent wildfires, increase wetlands, restore salmon habitat, and raise water tables to feed and water livestock. Federal agencies such as the Bureau of Land Management, U.S. Fish & Wildlife Service, and the NOAA; state agencies; and nonprofit environmental organizations such as The Lands Council, The Nature Conservancy, and the National Wildlife Federation are also involved in such projects.

Process-based restoration is the practice of adding simple structures such as Beaver Dam Analogs (BDAs) to rivers and streams to jump start certain functions and processes; and then letting the beavers work their wetlands-creating magic. It costs a fraction of conventional river restoration and scales up easily.

Beaver restoration is a type of process-based restoration. Beavers are considered a keystone species because their wetlands habitats— which they engineer—al-

Illinois Beaver Alliance

educate | advocate | restore | resolve

Contents

low other animals, fish, birds, and amphibians to flourish.

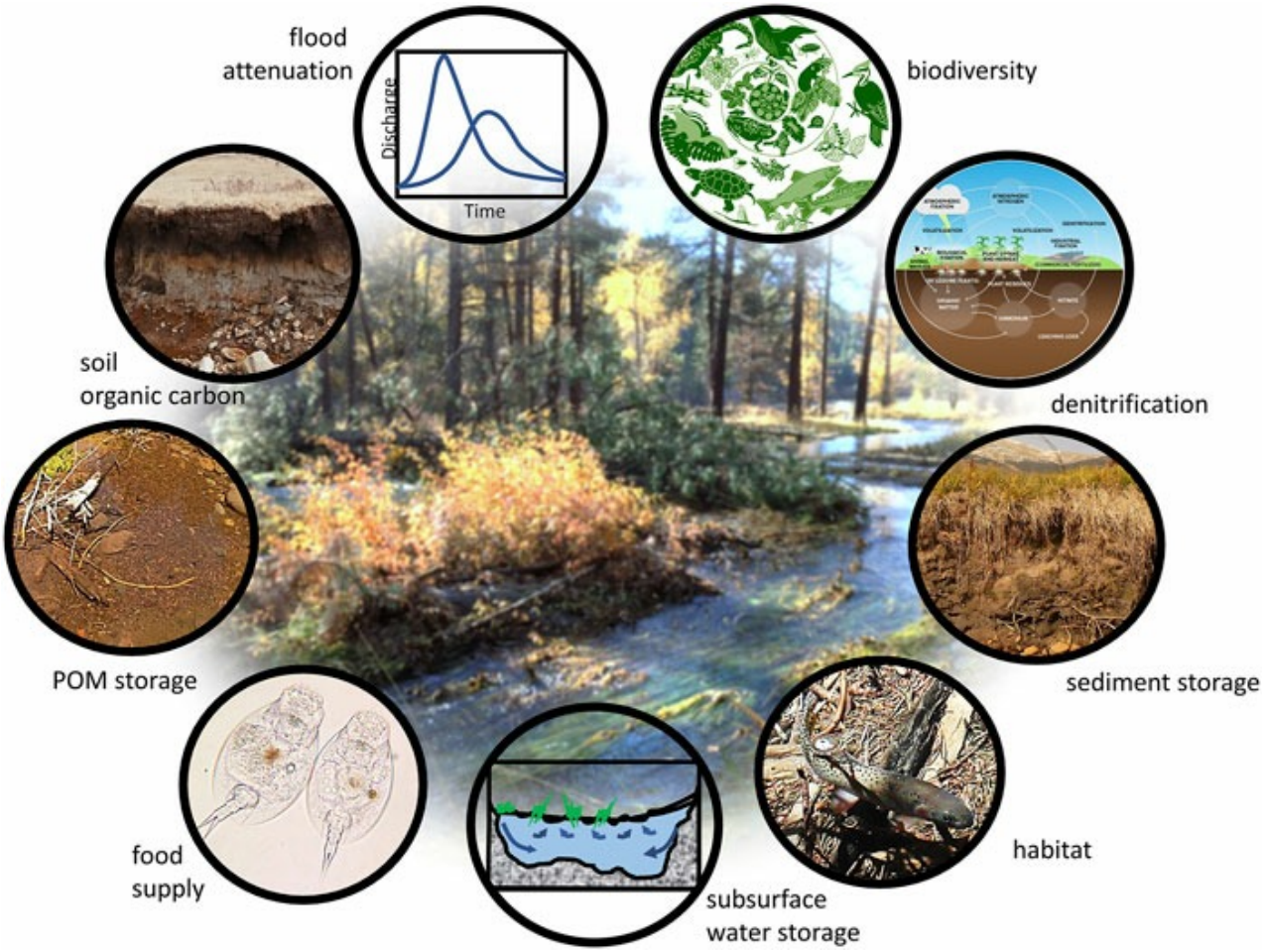
Many Illinois rivers and watersheds are in need of restoration based on a variety of measurements and priority areas have already been developed.

The Nutrient Loss Reduction Strategy biennial report documents efforts to reduce the amount of nitrogen and phosphorus that is entering our rivers. Despite the millions of dollars spent each year, Illinois is missing its targets. More wetlands are needed as an edge-of-field practice, and beavers provide free engineering services.

Illinois groundwater levels are trending toward depletion. Illinois farmers could better withstand drought conditions by allowing beavers to live in their waterways, using flow devices to control flooding, and allowing for wider riparian areas (where vegetation grows along the river margins and banks).

Right now, too many beavers are being trapped and killed because the IDNR discourages relocation and doesn't promote the use of flow devices. The IDNR should be doing more to keep beavers on our watersheds through the use of flow devices, and should develop a relocation program for "nuisance" beavers using best practices developed by other states. Recreational beaver trapping policies should be reexamined as well.

Illinois needs to change our culture from seeing beavers as an agricultural and urban enemy, to working with them achieve the goals of more wetlands, restored rivers, cleaner water, increased biodiversity, more floodwater



Functions associated with wetlands, which beavers create and maintain. Source: "Rediscovering, Reevaluating, and Restoring Lost River-Wetland Corridors," by Ellen Wohl, Janine Castro, Brian Cluer, Dorothy Merritts, Paul Powers, Brian Staab, and Colin Thorne, *Frontiers in Earth Science*, June 30, 2021.

Protecting Culverts from Beaver Dams

By Skip Lisle

Beavers are constantly exploring the landscape looking for good habitats. As territorial animals they're also looking for unoccupied ones.

Long beaver dams require an enormous amount of effort to build and maintain. By contrast, narrow "outlets" are easy to dam, and thus represent high-quality habitats.

Roads are large manmade dams with tiny holes in them called culverts. There has never been a more ideal damming site. When placed in beaver damming habitat low-gradient areas on small streams three quarters of culverts will always be clogged by the first explorer to come along. When beavers are killed to prevent this, a high quality habitat becomes vacant. In other words, a giant beaver magnet is created.

Killing beavers to solve the problem guarantees the opposite result. It assures a never-ending cycle of culvert cleaning (usually with heavy equipment) and road repair. It is the height of inefficiency, costing taxpayers millions of dollars a year.

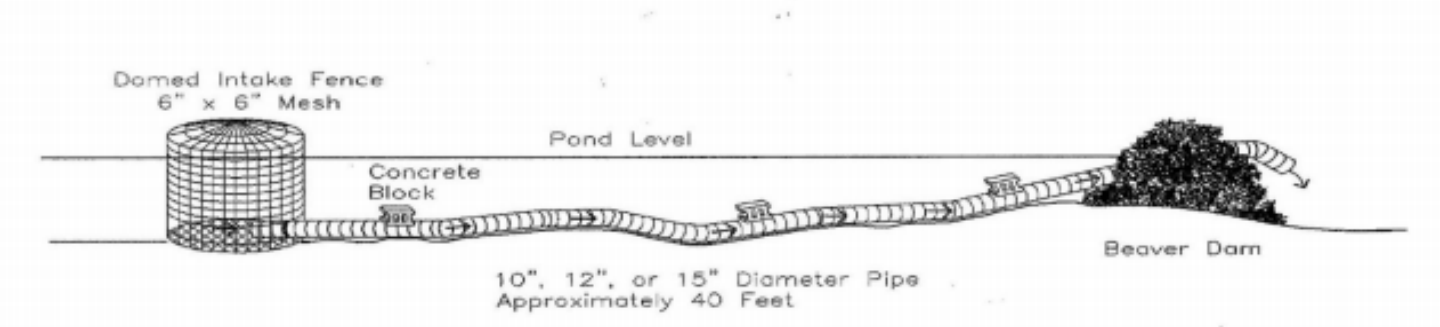
In addition, it's terrible environmental stewardship. It requires the permanent extirpation of this native, keystone species from the general vicinity of every culvert. Any non-threatening wetlands that have been created nearby will then drain, and the potential for any new wetlands to develop will be eliminated.

By contrast, high-quality flow devices like Beaver Deceivers™ can eliminate the conflict and make the presence of beavers irrelevant. This efficient, long-term approach presents a remarkable opportunity that can save vast amounts of human wealth while producing a similar volume of natural wealth.

Skip Lisle holds a Master's Degree in Wildlife Management and is the President of Beaver Deceivers International. He is a passionate biologist, conservationist, builder, scientist, inventor and entrepreneur. In 1995, he invented the Beaver Deceiver™, which in its original iteration was a trapezoidal fence to protect culverts. In 1997, he invented the Castor Master™ pipe system, which used a Round Fence™ filter (upright, enclosed cylinder of wire mesh) on the upstream end of a pipe in a beaver dam. (Others have renamed this concept the Pond Leveler.) Both inventions are shared by the Penobscot Indian Nation in Maine, for whom Skip was working in the 1990s. During this time, Skip also pioneered the use of Starter Dams™ (now widely referred to as Beaver Dam Analogues), Wildlife Doors™ to allow passage through Beaver Deceivers, fish ladders for pipe systems, and large, straight, low pipe systems to allow fish passage through dams. Skip's flow devices have been constantly improving over the decades; today's Beaver Deceivers and Castor Masters are quite unlike the original versions. These devices are all the product of original thought and did not borrow from any other types of flow devices, including the Clemson Leveler. This article was originally published in Beavers on Urban Landscapes, *Worth a Dam, January 2020. Reprinted with permission.*

Using Pond Levelers to Prevent Flooding

By Michael Callahan



A well-designed Pond Leveler pipe system can be a very effective solution. The first effective Pond Leveler was invented in the 1980s at Clemson University. Pond Leveler design has improved considerably since then. There are thousands of effective Pond Leveler pipes installed across North America. Professional installers can guarantee their effectiveness.

A Pond Leveler creates a permanent leak through the beaver dam that the beavers cannot stop. They are designed so beavers cannot detect the flow of water into the pipe. They typically do this by surrounding the submerged intake of the pipe with a large cylinder of fencing which is placed in as deep water as possible. This prevents beavers from feeling or hearing water flowing into the pipe so they do not try to clog the pipe, and a safe water level can be maintained. This eliminates the need for beaver removal.

The height of the pipe in the dam determines the pond level (see diagram). Water will flow through the pipe unless the pond level drops below the peak of the pipe. The pipe is set in the dam at the desired pond level.

Heavy storm runoff can simply flow over the top of the dam. Following the storm the pipe will return the pond to the normal level.

When installing a pipe system it is very important to lower a pond only enough to protect human interests. The more a pond is lowered the more likely it is beavers will build a new dam to render the pipe ineffective. Lowering a beaver pond by up to one vertical foot is generally not a problem.

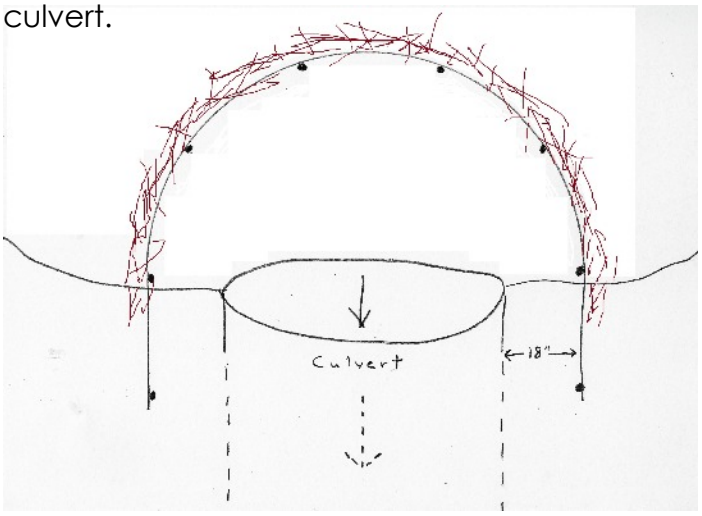
With routine maintenance a Pond Leveler pipe system should remain effective for many years allowing preservation of the beavers and the valuable wetland ecosystems they create with their dams.

Michael Callahan is the founder of the Beaver Institute Inc. In 2000 he started Beaver Solutions LLC and has personally resolved over 1,750 beaver-human conflicts. He teaches beaver workshops and created an instructional DVD to teach others to do this work. He has gained an international reputation as a leader in progressive beaver management. In 2017 he founded the Beaver Institute, Inc. to spread progressive beaver management to improve watershed restoration and climate resilience. This article was originally published in Beavers on Urban Landscapes, *Worth a Dam, January 2020. Reprinted with permission.*

Other Flow Device Designs

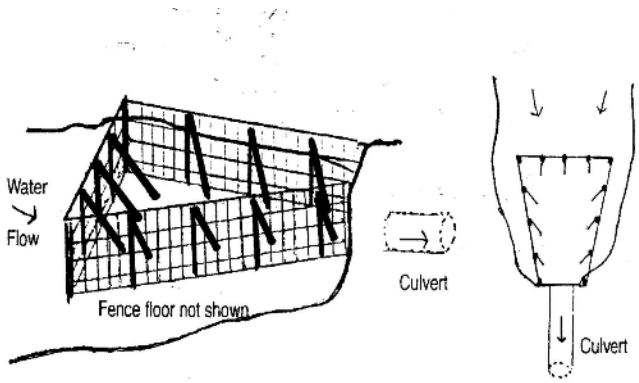
A **Culvert Diversion Dam** (CDD) inexpensively protects road culverts from beaver damming by encouraging the beaver to dam immediately upstream of the culvert instead of inside it. This keeps the culvert open and works well when some ponding upstream of the road is tolerable.

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.



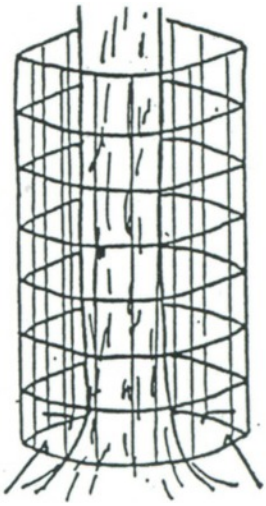
Keystone fences are effective at protecting culverts from beaver damming for several reasons. Damming 30 to 50 feet of fence is a lot more work for the beavers than plugging a narrow culvert, discouraging damming.

When beavers begin to dam near the culvert, the fence forces their damming away from the culvert which also discourages them. 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.



Source: The Beaver Institute

Tree Protection



Trees can be protected by wrapping the trunk with wire! The fence cylinders are best made from 2" x 4" mesh. Chicken wire often rusts out in a year or two (and beavers are way bigger than chickens!) Aim for a four foot high fence so the beavers cannot get above it, or at least two feet above the highest snow level. The initial gleam of the galvanized fence quickly fades to a nice dull gray patina which is barely noticeable on most trees. Make sure you leave room for the tree to grow!

Tree wrapping illustration reprinted with permission from Beavers Wetlands & Wildlife

More Beaver Habitat Means Cleaner Water and Healthier Ecosystems

Illinois used to be a quarter wetlands before European trappers arrived and trapped all the beavers. The beavers kept the ground nice and soggy. Rivers looked completely different; they meandered, looped around, and braided. Once the beavers were gone, the rivers became cut off from their floodplains. Soon much of the Illinois landscape—once peppered with depressions that retained water—was dry for farming and other development, and we developed "ecological amnesia" about how our rivers are supposed to look.

Farmers settled in Illinois, built levees, pumped the remaining water off of their fields, and installed drain tiles to keep the fields dry. The rivers became much more constrained, moved faster, and caused more erosion. The farmers farmed the soil until it became poor, and then the farmers had to start adding fertilizers to the soil so that food would grow—fertilizers that contain the nutrients nitrogen, phosphorus, and potassium.

A Beaver Dam Analog along the Bucktail Channel in California.

The fertilizers wash into the rivers in Illinois. Those rivers are tributaries of the Mississippi River. Because rivers move so quickly now, and because there aren't enough wetlands, there's no chance for the fertilizers to be filtered out and purified by wetlands.

Then the Mississippi River carries all of those fertilizers into the Gulf of Mexico. And the nutrients in the fertilizers cause large algae blooms to develop, depleting the dissolved oxygen in the area and causing a giant dead zone in the Gulf of Mexico where nothing can live.

Allowing beavers to maintain and expand their habitat on our watersheds would help to create "dynamically stable" complex river wetland corridors along our creeks, streams, and rivers.

As sediment, excess nutrients, and chemicals flow off of the land, wetlands filter the runoff before it reaches open water. Beaver ponds remove nitrogen and phosphorus through biochemical processes. Nutrients are also absorbed by aquatic plants found in beaver ponds. Because impounded water in beaver ponds moves slowly, the slow movement allows sediment to drop to the pond bottom, also resulting in cleaner water. Wetland plants and algae bind and remove toxins such as lead, arsenic, copper, cadmium, mercury, and selenium from the water. Additionally, carbon and greenhouse gases are stored in sinks in wetlands instead of being released into the atmosphere.

Plus their ponds offer habitats for fish, birds, amphibians, and mammals, encouraging biodiversity. Functional river-wetland corridors provide both abundant and diverse aquatic and riparian habitat and corridors for species migration. 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. Thus, keeping beavers on our watersheds would help to stabilize our ecosystems.

Process-Based Restoration in the Midwest

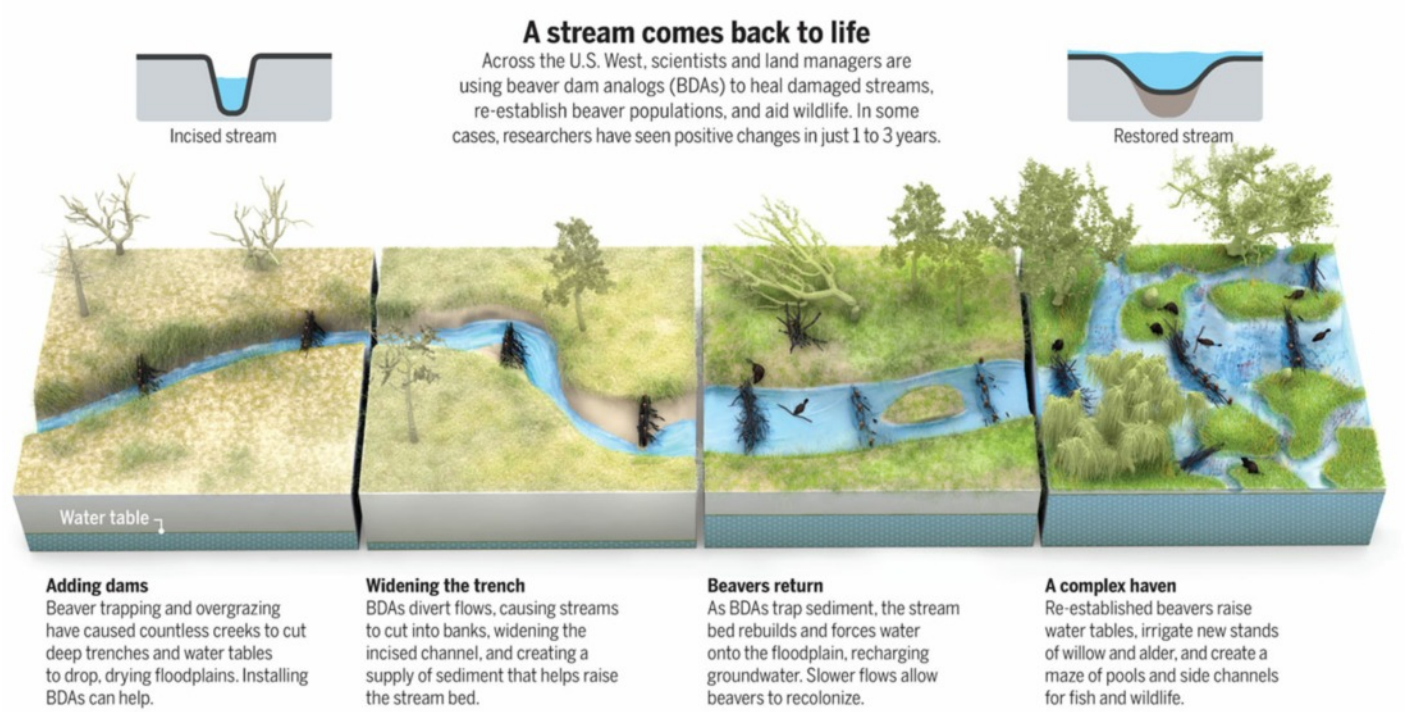
By Jeff Boland-Prom

Conventional river restoration tends to focus on protection of property, or aesthetic or recreational enhancements that do not necessarily improve ecological functions. The goal might be to stabilize a river bank or reconfigure a river channel. It is typically very expensive and involves heavy machinery.

Conversely, low-tech, process-based restoration is the practice of adding simple, inexpensive structural additions (locally sourced rock, BDAs, and anchored log structures) to mimic functions and promote system processes. When these inexpensive structural additions are added to the river, the river begins the process of restoring itself—sometimes with help from the beavers! The river starts to reconnect with its floodplain, grows more vegetation, creates wetlands, and becomes more resilient. Humans can influence but not absolutely control the eventual outcome and appearance of the restored river. But the restored river is more functional than one restored through conventional methods, at a fraction of the cost.

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 BDAs, or restoring riparian vegetation to attract beavers.

Rather than focusing on the channel, process-based restoration looks at the entire river-wetland corridor. This corridor, or riparian zone, can be as wide as 20 times the width of the channel and extends into the air and under the ground. When the speed of flow is slowed, the depth is increased, allowing more water to soak into the river banks and floodplain. Trees and shrubs on the floodplain send their roots deep to take up the water and the excess nutrients, then send their leaves up to soak in sunlight and slow the wind and the rain. Partial shade keeps the ground cool while enough sunlight maintains a thick layer of grasses and herbaceous flowering plants that protects the



Source: https://science.sciencemag.org/content/360/6393/1058/tab-figures-data

soil from erosion during heavy rains. Sometimes process-based restoration requires planting trees and shrubs, but in other locations they need to be thinned. Once the work is complete, the river, plants and animals work together to maintain the right balance.

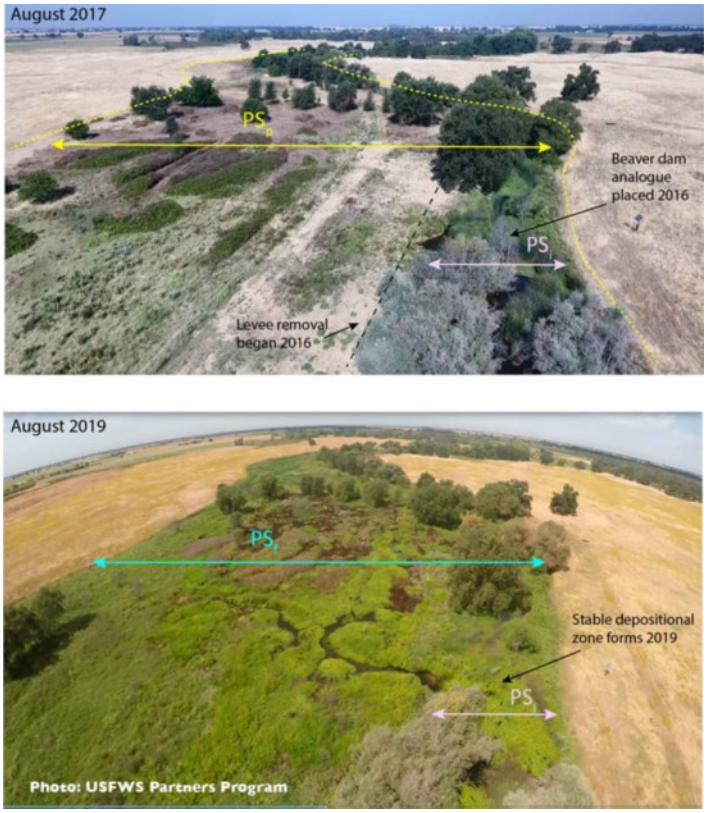
The volume of water underground can be several times greater than what is flowing above ground. When the water level in the river drops, the groundwater, now nearly free of pollution, seeps back into the river, resulting in a more consistent year-round flow. This passage through the ground cools the water in the summer and warms it in the winter. Cooler summer water holds more oxygen, while warmer winter water allows the biotic activity that cleans the water and feeds the fish to continue longer into the fall and resume earlier in the spring.

One goal of process-based restoration is to create or enhance wildlife habitat along the entire length of a stream from the headwaters to the confluence or mouth where it joins a river or empties into a lake. Then, the water, plants, and animals work together to regenerate and restore the wetlands and floodplains at the process-based restoration sites as well as upstream and downstream.

Sometimes stakeholders express fear that process-based restoration could impair habitat for fish. While it is true that some parts of the stream will become almost still (lentic) and have a thicker layer of silt on the bottom, the remaining faster moving (lotic) sections will have deeper and cleaner water throughout the year. Functional river-wetland corridors offer both abundant and diverse habitat, called "density diversity," leading to a range of micro-habitats that allow aquatic species to find the appropriate habitat within a relatively small area. Although a single dam in a channelized stream might be a barrier to fish passage, in a healthy river system, each dam or BDA becomes part of a larger wetland that can assist fish migration. As ponds fill and spread out, the dams force the water to flow laterally, creating side channels that fish can use to swim upstream or down.

Most Midwest streams have a low gradient and enough water to develop wetlands and the vegetation they require. Process-based restoration allows wetland managers to control where the wetlands will be larger, have the highest quality, and include the greatest diversity. Larger, high quality sites will attract more wildlife, including beavers, but unlike conventional constructed wetlands or retention ponds, there are no dikes to burrow into or drains to block. These semi aquatic rodents actually benefit the wetland by harvesting aggressive plants like cattails and willows. Process-based restoration projects are designed to minimize risks of flooding and blocked culverts. Flow devices are employed when necessary.

Jeff Boland-Prom, M.S., is the owner of Midwest Beaver Management in Beecher, Illinois. He received training from the Beaver Institute as a Beaver Wetland Professional, and is a member in good standing in the Beaver Institute's International BeaverCorps Association. He is trained to install flow devices and in low-tech, process-based river restoration.



Doty Ravine Preserve in California, Placer Land Trust, before and after process-based restoration.

Using Beaver Dam Analogs to Restore Streams

In the absence of beavers and their dams to slow stream velocities, many North America streams became badly eroded, incised, and damaged. As erosion cuts a stream channel deeper and deeper into the ground, the surrounding water table also drops. Once the water table drops too low for the roots of nearby plants to reach, the lush native vegetation dies off resulting in a barren, arid landscape with a loss of biodiversity.

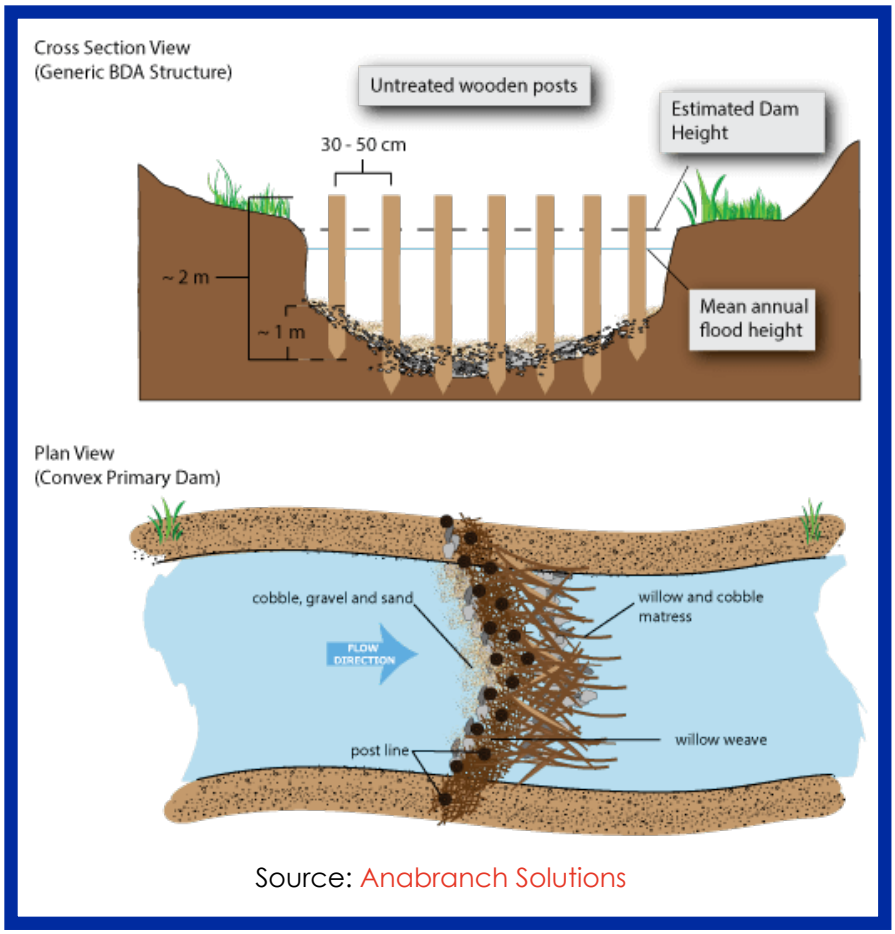
While beaver dams heal the damage of stream incision, some streams are so badly incised that they are inhospitable to beaver and other wildlife due to steep banks and the loss of nearby vegetation. Research has proven that Beaver Dam Analogs (BDA) combat stream incision by promoting sediment deposition. The sediment deposition process from BDAs has been surprisingly quick.

BDAs slow water velocity, allowing suspended particles to settle. As sediment accumulates, the stream bottom rises, resulting in corresponding elevations of the surrounding water table. Stream banks become less steep and the stream once again becomes hydrologically connected to the floodplain. With higher ground water native shrubs and trees begin to return, which will then attract beavers. Beavers continue the stream restoration process by building their own dams, often on top of the BDAs. The riparian corridor becomes a lush and healthy ecosystem that attracts all sorts of species.

Untreated wooden posts at least 2" in diameter are driven into the channel from one edge of the floodplain to the other. From there, longer materials are woven in and out of the post to create strength and to anchor brush and sod.

BDAs are constructed out of materials similar to beaver dams: willow branches, herbaceous vegetation, rocks, mud, and wood posts (non-treated). Equipment needed includes chainsaw (to cut and sharpen posts), hand saws to cut willow, and a post pounder/power source (hydraulic or pneumatic). Material cost and labor averages $500-$5,000 per structure, depending on size of structure (length), size of stream (depth of posts), source distance of building materials, and labor costs

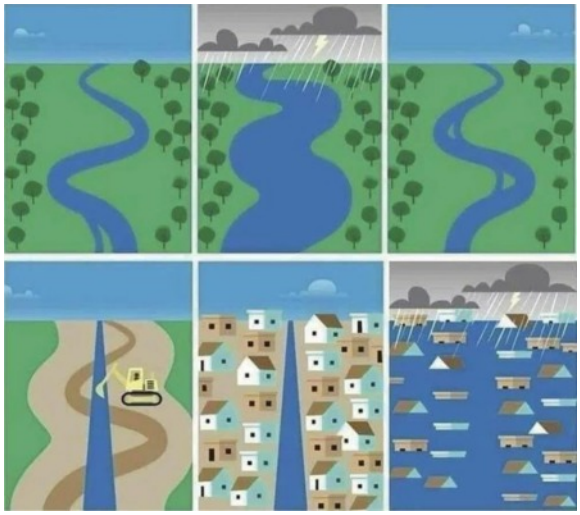
Anabranch Solutions offers "recipes" for BDAs, cautioning, "you can substitute ingredients to better match what you might have available in the cupboard (i.e. onsite), and find efficiencies an improvements that work better in your situation." In general, BDAs should be strategically installed in groups, with a large primary BDA and secondary dams to extend forage access for beaver. BDAs do not need to last forever, especially if beavers colonize and start to maintain the site.



Source: Anabranch Solutions

More Floodwater Storage Capacity

Due to climate change, our region is already getting more rain than was the case historically. Precipitation events are become more frequent and more intense but of a shorter duration, and our storm water infrastructure is simply not designed and sized to handle the amount of rainfall we are receiving.



Complex river-wetland corridors are able to impound more storm water throughout a watershed. Wetlands store water during large precipitation events and allow for a slow release, reducing storm-water runoff and erosion. According to FEMA, there are roughly 225,000 properties in the 100-year floodplain in Illinois. On paper, there is a 1 percent chance each year that these properties could be inundated with flooding. Unfortunately, 100-year flood events are becoming much more frequent.

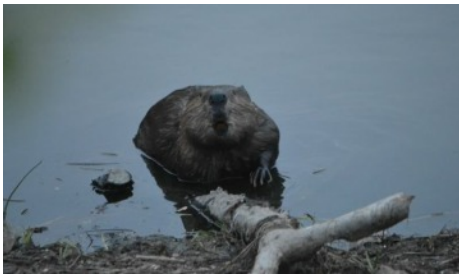
According to "Shelter from the Storm: How Wetlands Protect Our Communities from Flooding," "The ability of wetlands to hold large amounts of water enables them to serve as a key protection against flooding. During times of heavy precipitation, wetlands act as a sponge – slowing the velocity of runoff and retaining excess water, thereby reducing the danger of flooding. Once captured by a wetland, excess water evaporates, settles into the soil to replenish groundwater, or is slowly released over time.... The flood protection that wetlands provide is valuable. According to one study, inland wetlands in the United States provide over $237 billion in water flow regulation services annually."

Beaver Dams Upstream Decrease Flooding Downstream

A 2020 study of the Milwaukee River watershed, "Hydrological Impact of Beaver Habitat Restoration in the Milwaukee River Watershed," demonstrated that beaver dams upstream significantly decreased flooding downstream.

The study used the The Beaver Restoration and Assessment Tool (BRAT) to estimate the likelihood of beaver dam building activity and beaver dam capacities in the Milwaukee River watershed, based on GIS analysis of the stream network, vegetation cover, and stream power under baseflow and high-flow conditions. The simulations showed that peak flow rates were reduced by 6% to 48%, and flood flow volumes were reduced by 14% to 48%, depending on the development stages of beaver dams, and actual storm characteristics.

Finally, Illinois' levee system is aging and in dire need of more robust monitoring, reinforcement, and repairs of Illinois levees. There are levees at risk of breach all along the Mississippi River in Illinois, Iowa, and Missouri. A wider river-wetland corridor along these rivers would relieve a significant amount of the pressure off the aging levee systems.



Opportunities for Farmers

By Jeff Boland-Prom

Much of the land along Illinois rivers is farmland that is privately owned by farmers and used for intensive row crop agriculture. Allowing rivers to develop into wider river-wetland corridors, thus converting some formland into wetlands, would help prevent nutrient loss into our rivers. In addition to that environmental advantage, along with the economic possibilities of wetland mitigation banking, farmers can also choose to participate in the Conservation Reserve Enhancement Program (CREP). Administered by the Farm Service Agency, in exchange for removing environmentally sensitive land from production and establishing permanent resource conserving plant species, farmers and ranchers are paid an annual rental rate along with other incentives.

Converting portions of farmland to wetlands is assisted by the creation of buffers between the wetlands and the areas where conventional farming continues. This prevents soil erosion from the farmland into the wetlands and protects the crops from being harvested by the wildlife in the wetlands. These buffers do not need to be taken out of production, however, since there are many profitable alternatives for this land.

If the soil is well drained, the site could be a candidate for growing timber. Black walnut is one of the most valuable hardwoods of North America and is usually not harmed by beaver. It is a heavy water user and would benefit from the consistent water table provided by the nearby beaver ponds. Hickory and oak are also candidates and are usually avoided by beavers if other types of trees are available. Fast growing trees like black cherry and American tulip tree could be planted between the slower growing oaks and hickories. These tree species are tolerant of occasional flooding. Special techniques, such as horse logging, might be required to protect ecologically sensitive areas when the timber is harvested. In addition to the long term appreciation of the timber, the trees are a potential source of income in a carbon credit market.

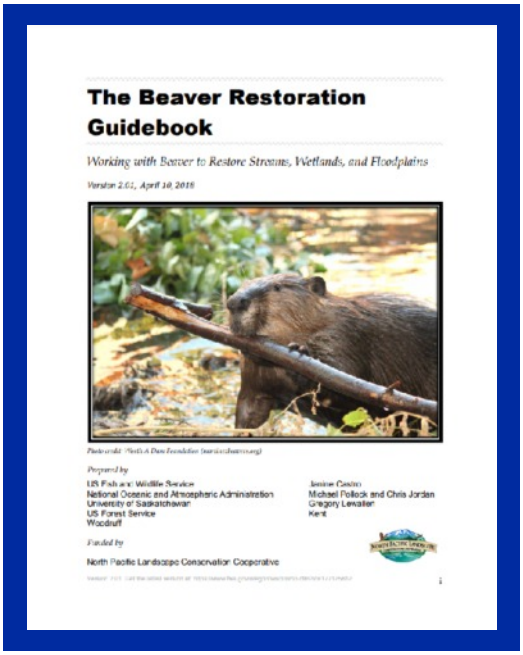
In addition to timber, all of these trees provide mast for wildlife and could be grown for nut production. Pecans are already a valuable cash crop in southern Illinois, and markets for black walnut and white oak acorns could be developed. White oak acorns are ground into a specialty flour, while black walnuts were traditionally popular in baked goods, having a flavor (and nutritional profile) superior to Persian walnuts.

With or without tree crops, buffers could be used for animal pasture and wet meadows in the wetlands would be suitable for limited and controlled grazing when the upper horizon is dry. Beaver canals provide the animals easy access to water without the risk of having them too close to the stream.

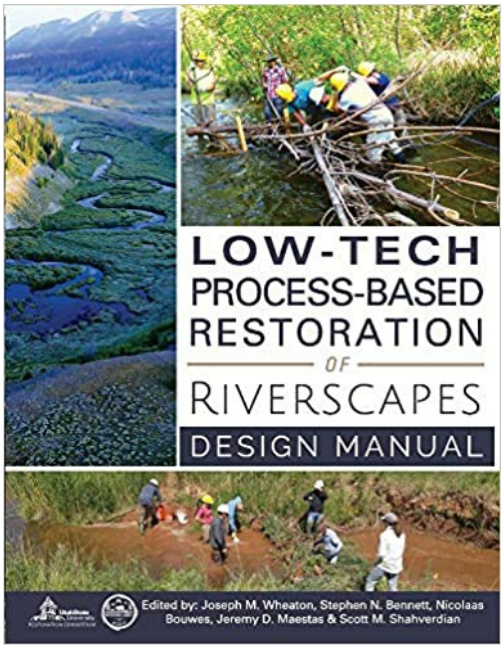
Buffers provide hunting opportunities and wetlands provide fishing opportunities. (It would be counterproductive to trap and/or kill beavers as they will be engineering the wetlands.)

Jeff Boland-Prom, M.S., is the owner of Midwest Beaver Management in Beecher, Illinois. He received training from the Beaver Institute as a Beaver Wetland Professional, and is a member in good standing in the Beaver Institute's International Beaver-Corps Association. He is trained to install flow devices and in low-tech, process based river restoration.

For More Information



This guidebook provides a practical synthesis of the best available science for using beaver to improve ecosystem functions.



This design manual provides restoration practitioners with guidelines for implementing beaver dam analogues (BDAs) and post-assisted log structures (PALS).

Illinois Beaver Alliance

educate | advocate | restore | resolve

"Partnering with Beavers in Illinois: A New Paradigm" is a publication of the Illinois Beaver Alliance, a fiscally sponsored project of Inquiring Systems, Inc. EIN: 94-2524840. The mission of the Illinois Beaver Alliance is to improve the health and function of Illinois watersheds, which will increase climate resilience, improve water quality, increase biodiversity, and create floodwater storage capacity; and to educate the public about the ecological importance of beavers and the modern tools for resolving human-beaver conflicts. The Illinois Beaver Alliance is an Affiliate of the Illinois Environmental Council. For more information, go to www.illiinoisbeaveralliance.org or contact Rachel Schick Siegel at rachel.siegel@illinoisbeaveralliance.org or (847) 528-8476.