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BEAVER

LIKE ITS EUROPEAN counterpart, the North American beaver was once nearly driven to extinction by the demand for its fur: the thick, dense under hairs of the beaver pelt could be processed into a fine waterproof felt that made superior hats (Figure 26). So many beaver were killed in the year 1700 that 200,000 pelts were removed from a warehouse in Montreal and burned to keep them from driving prices down on the European market. Where beaver had been trapped and killed, they left behind the wetlands they had created as rich, treeless plots for growing crops in the New World. No one will ever know exactly how much help beaver provided to the European colonization of North America, but all indications are that it was considerable.

Beaver are now making a comeback. Their return is leading to growing conflicts with human beings, usually over who gets to occupy floodplains. People are only beginning to recognize that, while it is reasonable and environmentally appropriate for the beaver to build and live in these areas, it is far less so for humans. One of the great chal-



Figure 26 *Beaver*

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- ◆ **Beaver create wetlands, key habitats for many other species of animals.**
 - ◆ **Beyond habitat, wetlands also provide environmental services such as filtering environmental contaminants out of the water before it enters rivers and estuaries.**
 - ◆ **Beaver are able to submerge in water for periods of up to fifteen minutes, using special adaptations, such as skin flaps that seal their mouths, to stay submerged.**
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lenges facing us as we seek to harmonize our relationships with the natural world is to recognize the environmental benefits we can derive from working with, rather than against, animals such as the beaver.

Classification and Range

The beaver (*Castor canadensis*) is the largest rodent found in North America. It has a very close relative in the Old World (*Castor fiber*) that some taxonomists regard as essentially the same species. But the European beaver has twenty chromosome pairs, while North America's has but sixteen, making that assumption unlikely. In many parts of Europe, efforts are underway to repatriate *C. fiber*, which is often found now side by side with the *C. canadensis* populations, arising from imports released some time ago. The challenges this presents are daunting enough, but they are only the beginning of what will be a highly interesting experiment: how densely settled human populations, in landscapes they have dominated for thousands rather than just hundreds of years, can coexist with repatriated wildlife.

Habits

The North American beaver can weigh more than sixty pounds, but an average adult is more likely to weigh about thirty five to forty. Including the trademark flat tail used as a rudder, construction tool, and communication device, adults are about thirty inches long and a foot high. When standing on his hind legs, however, an adult beaver can reach almost three feet in height. Where the winter snows accumulate, beaver can sometimes gnaw high enough on trees to conjure up tall tales about the possible return of the bear-size Pleistocene form of these animals.

Beaver live in and around water and constantly modify streams by building dams and impounding water to create ponds, although they will also live by large rivers and lakes without building dams at all. Early naturalists such as Lewis Henry Morgan and Enos Mills

were keen observers of beaver and their works. We have their descriptions of the landscapes these animals occupied to give us an inkling of what once was. Morgan visited beaver impoundments just south of Lake Superior that had probably been in place for hundreds, if not thousands, of years. The dam at Grass Lake that he describes was 260 feet long, over 6 feet tall, and had obviously been the work of generations of beaver. Still, it would be dwarfed by the dam Mills measured at an astounding 2,160 feet long near what is now Rocky Mountain National Park in Colorado.

The beaver impoundment, or flowage, as Skip Lisle prefers to call it, provides a rich environment for many animal and plant species. The beaver dam is not like our more impervious structures of the same name. It holds back water to be sure, but it also leaks and allows water to move through the impounded system slowly—a system that may provide many benefits to the environment (Figure 27).

Beaver are herbivores, or plant eaters, feeding on the inner layer of the bark of woody plants (the cambium), leaves, shoots, and aquatic herbs such as duckweed, water lilies, and pondweed. Occasionally the fruits of terrestrial plants, some herbaceous forest plants, and even crops such as soybeans and corn may be eaten. The favored woody

Beaver Devices

The design and installation of beaver devices is often sufficiently complex that technical assistance from experienced professionals is recommended.

Experience in reading sites and predicting how beaver will respond to attempts to defeat their dam behavior can be invaluable. It is also necessary to be aware of local, state, and federal regulations when planning to install these devices.

Figure 27
The beaver dam not only backs water up to help create and maintain wetlands, it also allows the water to leak slowly through, prompting the term “flowage” for this type of system.



species may vary from area to area, depending on what is locally available, but where they are found, aspen, birch, willow, cottonwood, poplar, maple, apple, and even oak are preferred. A beaver's preferred food trees may also include popular ornamentals such as dogwood, hybrid poplar, and fruit trees. Their taste for cherry trees is evident every few years when they establish a presence, albeit temporary, on Washington, D.C.'s, historic Tidal Basin. Evergreen trees are rarely eaten, and signs of beaver working trees such as pine may be an indication that more suitable food is lacking. In the fall beaver may sink large accumulations of branches into the mud close by the lodge, to serve as winter food caches.

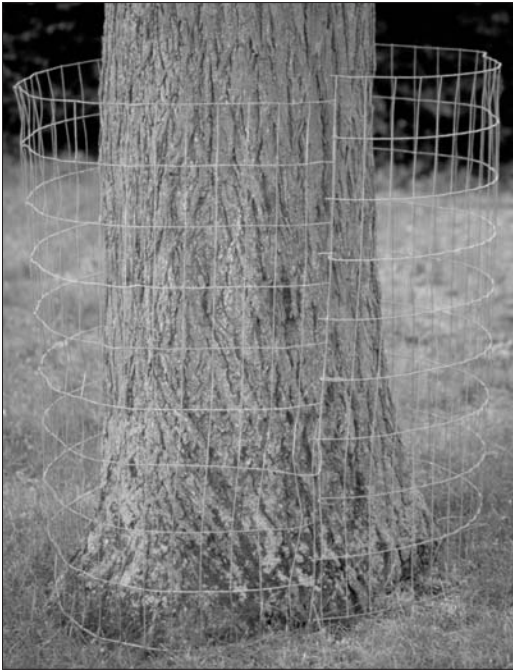
Most of the trees used for food or for other construction activities are felled within a hundred feet of the main body of water the beaver are using. Activity up to six hundred feet from water can occur, but probably only where colonies are urgently pressed to search for food. All told, beaver only occupy and influence a fraction of the landscape (some say as little as 3 percent). Beaver can cut down fairly large trees but seem to prefer those two to six inches in diameter. Often they partially or completely “girdle” trees, removing the bark but leaving the trees standing.

Many wetland plants and beaver have a long history of co-evolution. Some—such as aspen and willow, because they resprout when cut—may thrive in the presence of

these animals, not as trees, but as shrubby riparian growth. Others may adapt physiologically to the presence of beaver by producing toxic compounds that make them less palatable to beaver.

Beaver produce one litter, typically of three or four kits, per year, usually between March and June. A beaver colony commonly contains six to eight animals, including an adult pair, one or two two-year-olds, and the kits from the last litter. Some parental duties are shared by the female and male and, in part, by the preceding year's young, who remain with the family as adolescents. Intense trapping and removal appears to stimulate the production of more young than when the animals are not trapped. Beaver become sexually mature and usually leave the area of birth by their second birthday, in a process referred to as dispersion. Dispersing beaver usually travel less than 6 miles in search of new homes, but movements of up to 150 miles have been documented.

Beaver build dams, lodges, canals, and scent mounds, all of which have an obvious presence, as well as an impact on the landscape. Canals occur in many beaver habitats where colonies have been established for some time and beaver need to move farther abroad to obtain needed food and building supplies. Dams and lodges, the woody structures built from branches, mud, and other debris, are most obviously associated with these animals, but living quarters can also be



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Figure 28 Simple wire cages will protect trees from beaver damage. Large-scale installation projects along ponds and reservoirs are perfect for Boy or Girl Scout groups.



THE HSUS

Figure 29 A small beaver “deceiver” built by Skip Lisle to protect a roadside culvert. Lasting upward of fifteen to twenty years, these devices are practical and economical, not to mention humane.

less obvious dens dug into the banks of streams or lakes. Bank dens can also take on the appearance of lodges as woody material is mounded over their openings. Both dams and lodges are packed solid with mud to make them strong and to help with insulation. Residences have at least two openings.

The late animal behaviorist Donald Griffith filmed the insides of beaver lodges with a specially built camera probe and found them to be teeming with all sorts of life, micro-ecosystems in their own right.

Public Health Concerns

It has long been suggested that beaver may be responsible for outbreaks of the parasitic disease giardiasis in humans. However, recent studies and examination of past outbreaks suggest that other factors, such as contamination of drinking sources with human waste, may play a larger role in the spread of the disease than beaver do.

Problems

The two most common problems associated with beaver are the flooding that results from impoundment or blockage of vulnerable structures, such as culverts, and the damage done to trees. Flooding can become a crisis if unusually heavy rains or snows cause sudden local inundation. On the other hand, dams can store water during periods of drought and slow down the movement of water from land to river systems that is often responsible for serious floods and significant financial damage downstream. Damage to trees in urban and suburban areas is likely to be noticed before it becomes critical but perhaps not before a valuable tree or two has been lost. Operators of commercial forests, especially in the southeast, attribute millions of dollars of timber loss annually to beaver.

Solutions

Tolerance

We’ve mentioned before the important role beaver can play in establishing and maintaining wetlands. Recognizing this is often a key to convincing people they should tolerate and try to live with these animals. Beaver impoundments provide habitat for many sensitive plant and animal species, improve water

quality, and provide flood control by slowing water movement. To these can be added the considerable aesthetic and recreational benefits people derive from beaver and the habitat they create. Public education can thus be an important key to ensure better recognition of the benefits beaver can bring.

Tree Protection

Simple, homemade tree guards using galvanized welded wire (two-inch by two-inch), placed out from the trunk and standing about three feet high, can be used to cage trees and prevent beaver damage. These can be especially effective where small (two- to six-inch-diameter) ornamental or specimen trees need to be protected. Cylinders around larger trees may require staking, and mulching within the cylinders is a good idea to keep weeds from becoming a problem. Chicken wire is generally too flimsy to provide good protection, and finer-mesh hardware, such as that used for window screens, is more expensive and need not be used unless welded wire is unavailable (Figure 28).

Experimental work by the U.S. Department of Agriculture has shown some success in protecting trees by using a mixture of coarse mason's sand (30–70 mil) and exterior latex paint. The ratio is twenty ounces of sand to one gallon of paint. The abrasive quality of the mixture is said to deter beaver, and the paint color can be matched to the tree so it will blend in with the environment.

Fencing can also be effective in blocking beaver's access to larger groves or trees in areas where they are not wanted. Beaver are not good climbers, and a three- to four-foot-high fence can be a permanent deterrent. Fences should be monitored frequently to make sure that beaver have not pushed under them, especially where the structures cross established beaver trails. An electrified wire strung approximately four inches off the ground can also prevent beaver from entering an area. This type of fence can be especially effective in a small garden or crop plot when set up to protect plants for a few weeks and taken down afterward.

Flood Protection

Beaver are superb engineers but still no match for human engineering. No matter what problems beaver cause, humans can trump them with solutions of their own. In the past, "solutions" to the building of dams by beaver have often involved the use of heavy machinery to tear the dams apart or sometimes even explosives to blow them up. Neither of these approaches is particularly enlightened, given that beaver will quickly attempt to rebuild their structures and will use new material to do so, exacerbating any perceived or real damage they may have done. Removing resident beaver through trapping or shooting only creates a vacuum into which new animals will move, often sooner rather than later. And all of the strategies aimed at removal or destruction deny the presence of beaver wetlands—landscapes that, we argue, are both appropriate and needed.

In the past decade, a rapid growth of new technologies that involve simple yet elegantly designed structures has promised prevention or control of flooding caused by beaver dams. Venerable devices such as the "Clemson leveler" have been used for more than thirty years. Newer concepts include the Beaver Deceivers™, Round Fence™, and Castor Master™ devices developed by Skip Lisle, as well as CulverClear™ technologies developed by Mike Callahan of Southampton, Massachusetts. Lisle's formula for success produces devices that are simple but rugged enough to withstand the force of ice (Figure 29). Whether these devices are constructed with wood or steel frames, the overall savings they represent, when compared to the costs of repeated beaver removal or dam destruction, make them highly cost effective as well as humane.

As with any good nonlethal approach, experts use various devices to take advantage of the behavioral predispositions of the beaver themselves. Beaver are thought to be motivated to build and repair dams using cues from the sound and perhaps the feel of flowing water. This is a logical response, since a draining pond could quickly expose a

colony to predators. Notching an existing dam and running a pipe through the breach will stimulate the beaver to repair the dam at the site of the notch but not at the pipe ends, thus allowing the water to be set at a level where it meets human needs. To ensure the upstream end of the system is not blocked by beaver or accumulating debris, a filtering device, called a Round Fence, can be installed. Rigid PVC pipes, used often in the past, are replaced now almost entirely with flexible corrugated plastic pipe, sized to the particular job, but usually somewhere between eight and fifteen inches in diameter.

Culvert pipes running under roads are often plugged by beaver, and where new roads are to be built or old ones retrofitted, proper culvert design should never allow this to happen. At existing culverts, the Beaver Deceiver is used, sometimes in conjunction with Round Fence and a pipe system at its front, and often as a stand-alone device. This approach involves creating a fence barrier in front of the culvert (usually shaped like a trapezoid but adaptable to different configurations as well) that takes the beaver so far away from the stimulus of running water that their instinctive motivation to dam seems to be defeated.

A Last Word

When the first European settlers arrived, it is estimated that the beaver population of North America numbered between 60 and 400 million individuals. Today, the United States has 6–12 million beaver, back from nearly complete extirpation. Americans are only slowly coming to realize that this return can provide significant benefits to a continent that has lost much of its former nontidal wetlands to development or agricultural conversion. The good news, if there is any, is that society has ceased the wholesale slaughter and wanton destruction of these animals to appease fashion trends. Other species are still at risk, however, for this and similar vanities, and we can only hope that the wholesale

slaughter of any animal for its fur will stop soon as well.

Additional Resources

A book that is a must for anyone who is interested in the natural history of these animals is Dietland Muller-Schwarze and Lixing Sun's *The Beaver: Natural History of a Wetlands Engineer* (Cornell University Press, 2003).

A charming and enduring account of life in a beaver colony that is now a classic: Hope Ryden's *Lily Pond* (William Morrow, 1989).

Organizations and individuals to contact for information about beaver and assistance with beaver conflicts include:

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