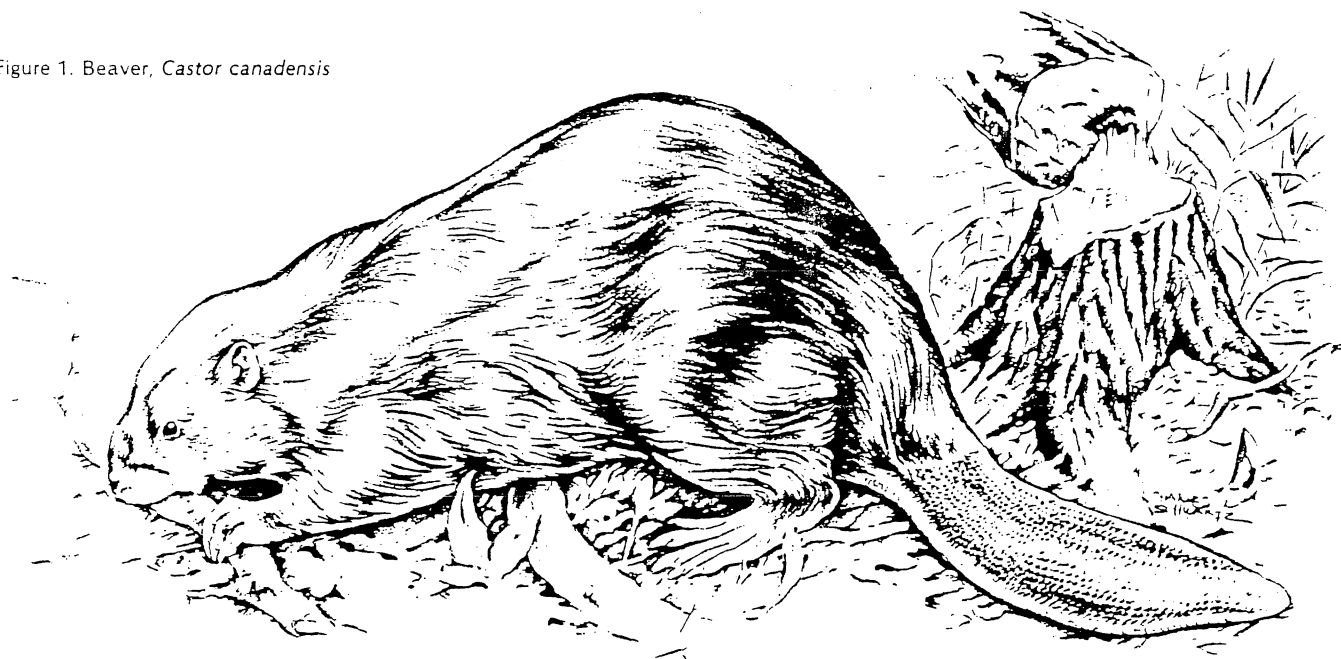


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# BEAVERS

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Figure 1. Beaver, *Castor canadensis*



## Damage Prevention and Control Methods

### Exclusion

Fence small critical areas such as culverts, drains, small ponds or lakes, and barriers around important trees in urban settings

### Cultural Methods and Habitat Modification

Eliminate foods, trees and woody vegetation where feasible; continually destroy dams and materials used to build dams; use a three-log drain or other structural device to maintain a lower pond level and avoid further pond expansion

### Frightening

Can occasionally work by shooting or dynamiting or other continued destruction of lodges, bank dens and dams

### Repellents

None registered, however there is some evidence that repellents may be useful. More research is needed.

### Toxicants

None registered

### Fumigants

None registered

### Traps

Conibear® type, size 330 are very effective, mobile, practical and humane, with no escapes. The

leghold types size No. 3 or larger (include coil-spring types with equivalent jaw spread and impact) are also effective when properly used. Basket/suitcase type traps are primarily used for live trapping. Where legal, snares can be useful particularly in dive sets and slides.

### Shooting

Rarely effective for complete control efforts and can be dangerous to humans

### Other Methods

Other methods rarely solve a beaver damage problem and may cause more damage to nontarget species than to beaver



PREVENTION AND CONTROL OF WILDLIFE DAMAGE

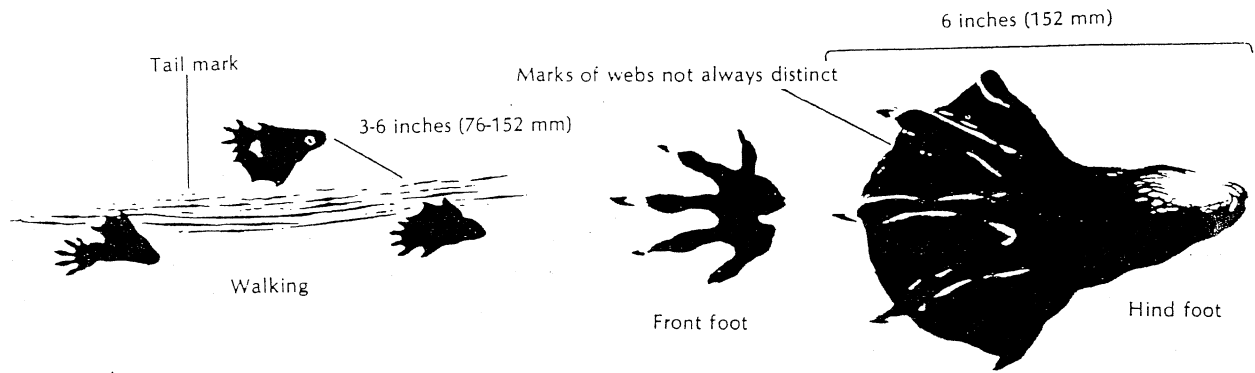


Figure 2. Beaver tracks.

## Identification

The beaver *Castor canadensis*, Figure 1) is our largest North American rodent. A few rare individuals reach over 100 pounds (45 kg). The weight of most adults ranges from 35 to 50 pounds (15.75 to 22.5 kg), with some rarely reaching 70 to 85 pounds (31.5 to 38.25 kg). The beaver is a stocky appearing rodent adapted for aquatic environments. It has valvular ears and nose and lips which close behind the four large incisor teeth. Each of the four feet have five digits with the hind feet webbed between digits and a split second claw on each hind foot. The front feet are small in comparison to the hind feet (Figure 2). The underfur is dense and generally gray in color, whereas the guard hair is long and coarse with the color ranging from yellowish-brown to black, with reddish-brown most common. Its prominent tail is flattened dorsoventrally, scaled and almost hairless. It is used as a prop while the beaver is sitting upright (Figure 3). The tail is also used for swimming and communication while in the water. The beaver's large front incisor teeth, bright orange on the front, grow continuously throughout its life. These incisors on the back side are beveled to be continuously sharpened as the beaver gnaws and chews in its feeding, girdling, and cutting of trees. The only way to externally

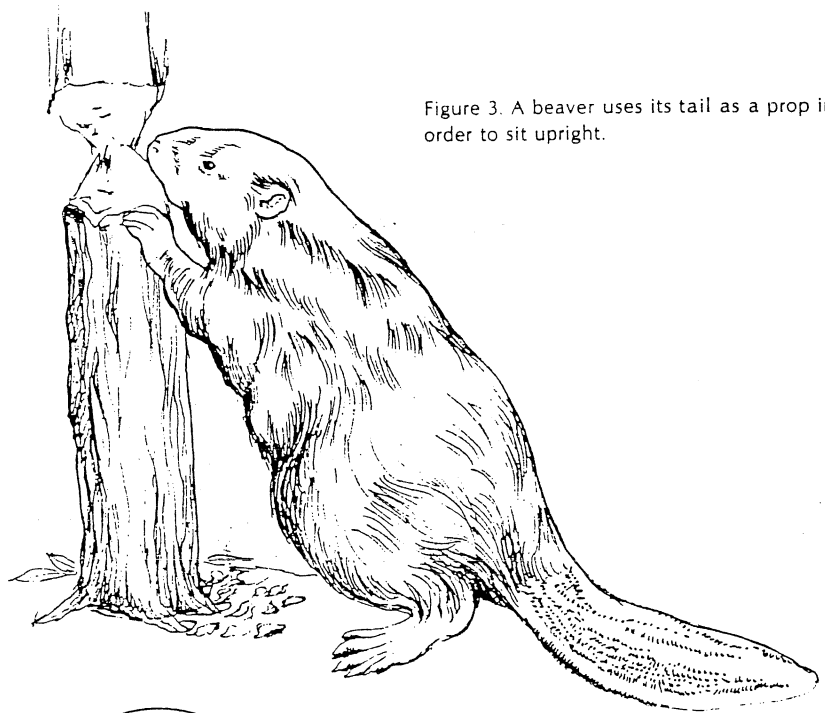
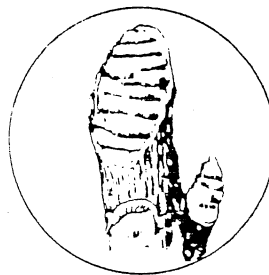


Figure 3. A beaver uses its tail as a prop in order to sit upright.



Details of beaver cuttings.



Figure 4. Range of the beaver in North America.

distinguish the sex of a beaver, unless the female is lactating, is to feel for the presence of a baculum (a bone in the penis) in males and its absence in females.

## Range

Beavers are found throughout North America, except for the arctic tundra, most of peninsular Florida and the southwestern desert areas (*Figure 4*). The species is locally abundant throughout the Great Plains wherever aquatic habitats are found, e.g., streams, lakes, farm ponds, wetlands and low lying lands or swamps and along flood-prone creek and river bottoms.

## Habitat

Beaver habitat is almost anywhere there is a year-round source of water, e.g., streams, lakes, farm ponds, swamps and wetland areas. Personal observations have located beaver in highway roadside ditches, drainage ditches, canals, mine pits, oxbows, railroad dumps, drains from sewage disposal ponds, and below natural springs or artesian wells. In areas beavers move into they seem to be stimulated by running water. They will quickly begin building dams to modify the

environment more to their liking. Some of the surrounding timber is cut down or girdled by beavers to form dams. Subsequent flooding of growing timber causes it to die, and aquatic vegetation soon begins growing. Other pioneer species, e.g., willow, sweetgum and buttonbush, soon are growing around the edge of the flooded area adding to the available food supply. The beaver thus helps create its own habitat.

## Food Habits

Beavers prefer certain trees and woody species depending on availability, such as populus species, e.g., aspen and cottonwood, and willow, sweetgum, blackgum, and pine. However, they can and will eat the leaves, twigs and bark of most species of woody plants which grow near the water, as well as a wide variety of herbaceous and aquatic plants. Beavers often will travel 100 yards (90 m) or more from the pond or stream to get to corn fields, soybean fields and other growing crops, where they generally cut the plant off at the ground and drag the entire plant back to the water. Adding insult to injury, they not only eat part of these plants, they often use the remainder as construction material in the dam.

## General Biology, Reproduction and Behavior

Beavers are active for approximately 12 hours each night except for the coldest of winter nights. The phrase "busy as a beaver" is appropriate. However, it is not uncommon to see beavers during daylight hours, particularly in larger reservoirs. Because of the valvular ears and nose and other physical adaptations, they can remain underwater for over 15 minutes when necessary.

After a gestation period of about 128 days, the female beaver generally gives birth to three or four kittens between March and June, and nurses them for from six weeks to three months. The kittens are born fully furred with their eyes partially opened and the incisors erupted through the gums. They generally become sexually mature by the age of 1 1/2 years.

Beavers have a relatively long life span, with individuals known to have lived to 21 years. Most, however, do not live beyond 10 years. The beaver is unparalleled at dam building and can build dams on fast-moving streams as well as slow-moving ones. They also build

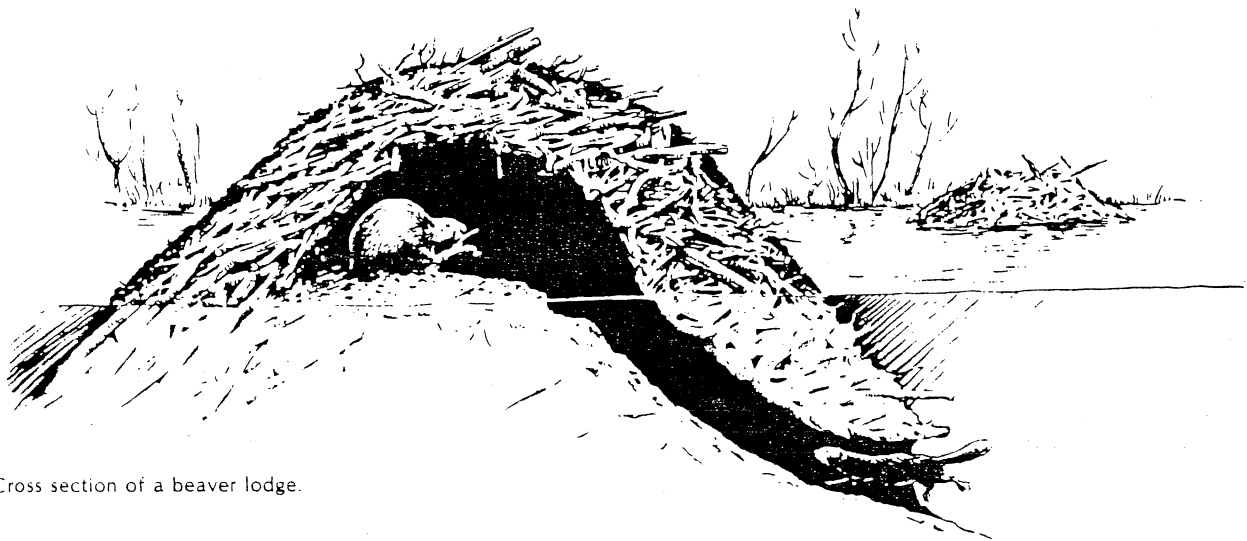


Figure 5. Cross section of a beaver lodge.

lodges and bank dens, depending on the situation. All lodges and bank dens have at least two entrances and may have four or more. The ledge or bank den is used primarily for raising young, sleeping and some food storage during severe weather (Figure 5).

The length or height of a dam generally depends upon what is necessary to essentially stop the flow of water and create a pond. In areas of flat topography, the dam may not be over 36 inches (.9 m) high, but as much as 1/4 mile (.4 km) long. In hilly or mountain country, the dam may be 10 feet (3 m) high and only 50 feet (15 m) long. The size of the tree the beaver cuts is highly variable, from a 1-inch (2.54 cm) DBH (diameter at breast height) softwood to a six-foot (1.8 m) DBH hardwood. In some areas beavers seem to cut down trees up to about 10 inches (25 cm) DBH and merely girdle or partially cut larger ones, although they often cut down much larger trees. For some reason the beavers seem to like to girdle large pines and sweetgums. They like the gum or storax that seeps out of the girdled area of sweetgum and other species.

An important factor about beaver biology is their territoriality. A colony generally consists of four to eight related beavers, who resist additions or outsiders to the colony or the pond. Young beavers commonly are displaced from the colony shortly after they become sexually mature, at about 2 years old. They often move to another area to begin a new pond and colony. However, some become solitary hermits inhabiting old abandoned ponds or a farm pond if one is available.

Beavers have a few natural predators aside from man, including coyote, bobcat, river otter and mink on young kittens. In other areas, bear, wolves, and wolverines may prey on beavers. They are hosts for several ectopar-



Figure 6. Pine plantation in Arkansas killed by flooding caused by beavers.

asites and internal parasites including nematodes, trematodes and coccidians. *Giardia lamblia* is a pathogenic intestinal parasite transmitted by beavers, which has caused human health problems in water supply systems. In fact, the Centers for Disease Control have reports of at least 41 waterborne Giardiasis outbreaks affecting more than 15,000 people. For more information about Giardiasis, see von Oettingen (1982). This thesis contains a number of additional references.

They generally are monogamous; copulation may take place either in the water or in the lodge or bank den. They communicate by vocalizations, posture, tail slapping and scent posts or mud dabs or mounds placed around the bank and dam. The beaver's castor glands secrete a substance that is deposited on mud dabs to mark territorial boundaries. These scent posts are found more frequently at certain seasons, but are found year-round in active ponds.

The habitat modification by beavers, caused primarily by dam building, is often beneficial to fish, furbearers, reptiles and amphibians

and to waterfowl and shorebirds. However, when this modification comes in conflict with man's objectives, the impacts of damage may far outweigh the benefits.

## Damage and Damage Identification

Most of the damage caused by beavers is a result of dam building, bank burrowing, tree cutting or flooding. Some individual southeastern states where beaver damage is extensive have determined from surveys that beaver damage estimates range from \$3 million to \$5 million dollars annually to timber loss, crop losses, roads, dwellings, and property flooded, and other damage. In some of these states, bottomland hardwood timber in areas of several thousand acres in one watershed may be lost because of beaver pond flooding. Some unusual cases observed over the years include state highways flooded because of beaver ponds, reservoir dams destroyed by bank den burrows collapsing, and train derailments caused by burrowing. Housing developments have been threatened by beaver dam flooding, and thousands of acres of croplands and young pine planta-

tions have been flooded by beaver dams (Figure 6). Road ditches, drain pipes and culverts have been stopped up so badly that they had to be dynamited out and replaced, as well as bridges destroyed.

The most unusual and difficult to explain was the beaver-cut tree by a highway bridge that, when felled, by the beaver, dropped across the hood of a family's automobile traveling down the highway. The damage caused by beavers is not only economically important, it is also very frustrating to landowners and others.

Identifying beaver damage generally is not difficult. Dams, dammed-up culverts, bridges, or drain pipes resulting in flooded lands, timber, roads, crops, and cut-down or girdled trees and crops, or burrows in pond and reservoir levees or dams. Sometimes when drain pipes in a levee or reservoir are stopped up, it may be very difficult to get the sticks, logs, mud and debris removed so that the water will move out and beaver can be trapped. In large watersheds, it may be difficult to locate bank dens. However, the limbs, cuttings and debris around such areas as well as dams along tributaries usually help pinpoint the area.

## Legal Status

The legal status of beavers varies from state to state. In some states the beaver is protected except during furbearer seasons; in others it is classified as a pest and may be taken year-round when causing damage. Because of its fur value, dam building, and resulting water conservation, it is generally not considered a pest until economic losses become extensive. However, fur prices for beaver in some states, particularly in southern states, make it hardly worth the skinning and stretching. In some northern states, trapping is prohibited near lodges or bank dens to

protect and perpetuate beaver colonies; however, fur prices for beaver pelts are substantially higher in these areas.

Before attempting to trap or otherwise take beavers in any state, always check the existing regulations.

## Damage Prevention and Control Methods

### Exclusion

Beavers can be excluded from ponds, lakes or impoundments. However, if the primary reason for fencing is to exclude beaver, fencing is not practical. Fencing of culverts, drain pipes or other structures can sometimes prevent damage, but often results in a dam with the beavers using the fence as construction material. Metal barriers around valuable trees may prevent damage where feasible.

### Cultural Methods

Because beavers usually alter or modify their aquatic habitat so extensively over a period of time, most practices generally thought of as cultural have little impact on beavers. With the exception of the elimination of food sources and in cases where the aquatic habitat can be eliminated, most other cultural practices have no significant impact on beavers. Daily tearing out dams and removing dam construction materials will (depending on availability of construction materials) sometimes cause a colony or individual beaver to move to another site. However, they might be even more troublesome at the new location.

The use of a three-log drain or other type of structural device which prevents beavers from controlling the water level will occasionally cause movement to other habitat. However, once beavers have become commonly abundant in a watershed or in a large con-

tiguous area, such as a stream system, swamp, or other wetlands area, periodic replacements or reinforcements of suitable habitat can be expected to occur.

### Repellents

There are no chemical repellents registered for beavers. Some research efforts in past years have tried to determine the effectiveness of potential repellent materials, however, none were found which were effective, registered for use on beavers, environmentally safe, or practical. One study in Georgia using a deer repellent (Hicks 1978) indicated some potential benefit. Many mechanical devices have been tried in attempts to repel beavers. The only effective and environmentally safe methods known do not in effect repel beavers, but do in some cases prevent damage. These would include fencing of structures in some areas, e.g., drain pipes or structures, fencing or other barriers around valuable trees, shrubs, or other crops, and construction of concrete or other permanent materials in spillways or other drainage systems.

As alluded to in an earlier section, in some drainage systems, total elimination of foods (aquatic vegetation and trees adjacent to the drainage system) will, where feasible, usually prevent colonization. Continual destruction of dams, especially where construction materials are scarce, will sometimes cause abandonment of the general area. However, personal observations have included dams constructed entirely of mud and crop materials, such as soybean plants, corn stalks, watermelon vines, cane, grasses, rice, wheat and others. The author has also observed dams constructed of mud and other native plant materials, aside from trees, such as vines, water lilies, cattails, ragweed, pigweed, coffeebean, and others.

Beavers are adaptable and will use whatever materials are available to construct dams — fencing mater-

ials, bridge planking, crossties, rocks, wire, and other metal, wood and fiber materials. Therefore, about the only available aquatic habitat beavers avoid are those systems lacking acceptable foods, lodge or denning sites and where no suitable site exists to construct dams. Additional research is needed on repellents for beaver damage prevention.

### Toxicants

None are registered. However, there have been research efforts conducted to find effective, environmentally safe and practical toxicants. Currently there are none which meet these criteria.

### Fumigants

None are registered. The situation is similar as alluded to under the toxicants section.

### Traps

A variety of trapping methods and different types of traps are effective for beavers depending upon the situation. Fish and wildlife agency regulations vary from state to state. Some types of traps and trapping methods, although effective and legal in some states, may be totally prohibited by law in other states. Individual state regulations must be reviewed annually before beginning a trapping program.

The use of traps in most situations where beavers are causing damage is the most effective, practical and environmentally safe method of control. The effectiveness of any type of trap for beaver control is dependent on the trapper's knowledge of beaver habits, including food preferences, ability to read beaver signs, use of the proper trap to fit the situation, and trap placement. Most anyone with trapping experience and some outdoor "savvy" can become an effective beaver trapper in a short time. Obviously, in an area where beavers are common and have not been exposed to trapping, one can expect

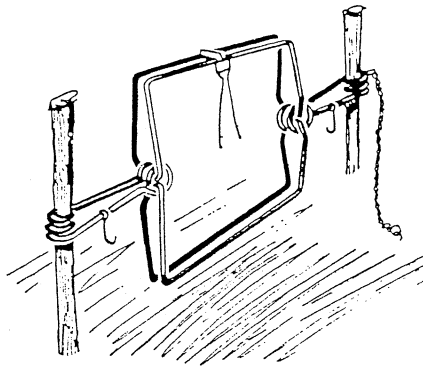


Figure 7. Basic method of setting and staking a Conibear® 330 trap. Additional stakes are normally used (see Figure 8).

good success. Additional expertise and improved techniques will be gained through experience.

In some states where beavers have become serious economic pests, special regulations and exemptions have been passed to allow for increased control efforts. For example, some allow trapping and snaring of beavers and other control measures throughout the year. However, other states prohibit trapping except during the established fur trapping seasons. Others have allowed exemptions for removal of beavers only on lands owned or controlled by persons who are suffering losses. Still, others require a special permit from the state fish and wildlife agency.

Of the variety of traps commonly allowed for use in beaver control, the Conibear® type, size 330, is one of the most effective for most situations (Figure 7). Not all trappers will agree that this type trap is most effective; however, it is the type most commonly used by professional trappers and fur trappers who are trapping principally for beavers. This trap kills a trapped beaver almost instantly. When properly set, this type trap prevents any escape by a beaver, regardless of its size. Designed primarily for water use, it is equally effective in deep and shallow water. Because of its size, effectiveness, mobility — no need for additional apparatus to drown the beaver, and

its capability to kill the beaver quickly, traps can be set quickly. Only one trap per site generally is necessary, thus reducing the need for extra traps. It exerts tremendous pressure and impact when tripped. Therefore, as with most traps, appropriate care must be exercised when setting and placing the trap.

Some additional equipment will help when trapping beavers. This includes an axe, hatchet, or large cutting tool, hip boots or waders, wire and wire cutters. When using the Conibear type trap, some people employ a device or tool called "setting tongs." Others use a piece of 3/8 or 1/2-inch (9.53 or 12.7 mm) nylon or other rope. Most people who use these traps extensively use only their hands. Regardless of the techniques used to set the trap, care should be exercised.

Earlier models of this type of trap came with some round, heavy steel coils which were dangerous to handle unless properly utilized in setting the trap. They are not necessary to safely set the trap. However, the two safety hooks, one on each spring, must be carefully utilized as each spring is depressed, as well as during the procedure of trap placement. On newer packaging of this type trap, an additional safety catch (not attached to the springs) is included for extra precaution against inadvertent spring release. The last step before leaving a set once the trap is in place is to lift the safety hook attached to each spring, sliding the safety hook back from the trap part toward the spring eye making sure to keep hands and feet safely away from the center of the trap. If the extra (unattached) safety catch is employed, it should be removed prior to removal of those attached to the springs to avoid it being in the way of movement of the safety hooks.

This type of trap is easier to prepare for setting while on solid ground with dry hands. Once the springs are depressed and the safety hooks in place, the trap or traps can be carried into the water for proper placement. Additional preparation before getting to trap placement is selection of some stakes for use in staking the trap down. In most beaver ponds and around beaver dams, plenty of suitable stakes can be found. At least two strong stakes, preferably straight and without forks or snags, should be chosen to place through each spring eye (Figure 7). Additional stakes may be useful to put between the spring arms and help hold the trap in place. Do not place stakes on the outside of spring arms. Aside from serving to hold the trap in place, these stakes also help to guide the beaver into the trap. Where needed, they are useful to hold a dive stick at or just beneath the water surface (Figure 8). If felt necessary, the chain and circle attached to one spring eye can be attached to another stake. In deep water sets where the set trap is slid into place deeper than the trapper can reach, the chain with attached wire should be tied to something at or above the surface. Otherwise the trap may be lost.

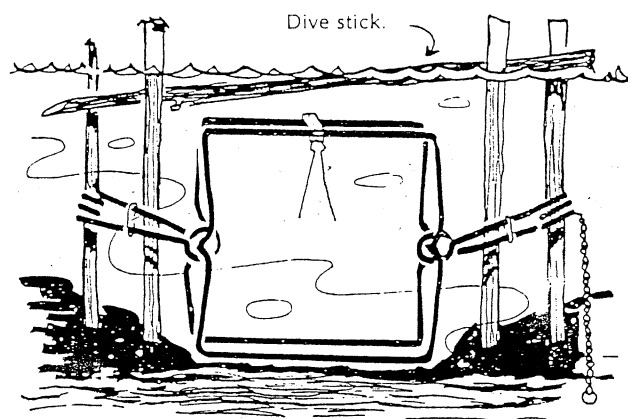


Figure 8. Conibear trap in dive set.

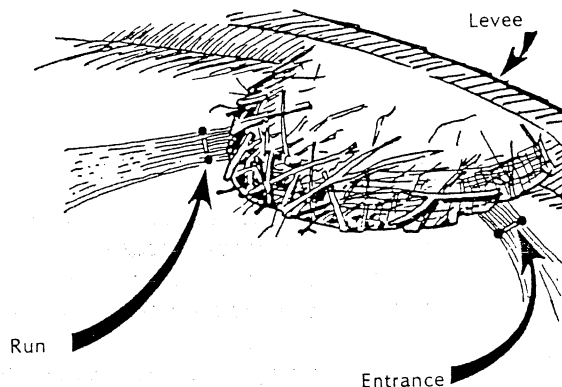


Figure 9. Runs or underwater entrances to lodges are good places to set beaver traps.

**Trap Sets.** There are many sets that can be made with this type of trap, depending on the situation, such as dam sets, slide sets, lodge sets, bank den sets, "run"/trail sets, under log/dive sets, pole sets, sets under the ice, deep water sets, drain pipe sets, and others depending on the trapper's capability and ingenuity. However, in many beaver ponds, most beavers can be trapped using dam sets, lodge or bank den sets, sets in "runs"/trails, dive sets or sets in slides entering the water from places beavers are feeding. Beavers swim mostly at the surface or along the bottom of ponds, depending upon the habitat. In shallow ponds, they obviously

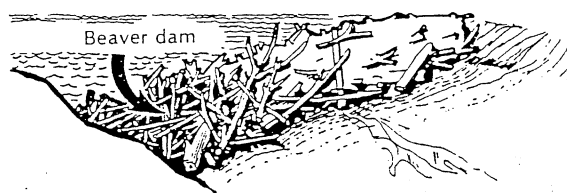
swim extensively along the bottom. They are scouring out runs or trails which they habitually use in traveling from lodge or den to the dam or to feeding areas, much like cow trails in a pasture. Where these "runs" can be found, they are sure sets for this type of trap if the trap is placed directly across the path of the run and on the bottom (Figure 9).

A helpful hint when wading in a beaver pond to locate runs or trails is to choose a good stake or "walking staff" to help locate deep holes

or runs. This will prevent your stepping off over waders or hip boots in winter, and will help ward off curious cottonmouth snakes in the summer. Used to feel along in front as one wades, your stake also can help locate good dive holes under logs as you walk out runs or trails. In old beaver ponds, particularly in bottomland swamps, it is not uncommon to find runs, lodge or bank den entrances where the run or hole is scoured out two to three feet (.6 to .9 m) below the rest of the bottom.

One of the things you can depend on is that if you tear a hole in a beaver dam and get the water moving out of a pond, you will stimulate beaver movement that night, except on the coldest of winter nights. Timing is also important if you plan to make dam sets. Tearing a hole in the dam or dams about 18 inches to 2 feet (45.72 to 60.96 cm) wide and 2 to 3 feet (.6 to .9 m) below the water level on the upper side of the dam in the morning generally will move a good bit of water out of the pond before evening (Figure 10). Evening is the prime time to set traps. If you set in front of the dam opening in the morning as soon as a hole is dug out, two problems can arise: (1) by late evening when the beavers become active the trap may be out of the water, and ineffective; or (2) a stick, branch or other debris in the moving water may trip the trap, again rendering it ineffective. Ideally, you should tear out the holes in a dam in the morning, let the water flow out until mid-afternoon, then set traps until early evening.

The best dam sets are made some 12 to 18 inches (30.48 to 45.72 cm) in front of the dam itself. Using stakes or debris on either side of the trap springs will help make the beaver go where you want it to — into the jaws of the trap. Generally speaking, it is always best to set the trigger on the Conibear type trap in the first notch, which helps prevent debris from tripping it before the beaver swims into it. The two heavy-gauge wire trippers can be bent outward and the trigger can be set away from the middle if necessary, to avoid debris tripping it or to suit the trapper's approximation of beaver size. If signs indicate small beaver or possible fish or turtles moving through the trap, this technique sometimes prevents premature trap spring.



Hole torn through dam to release water

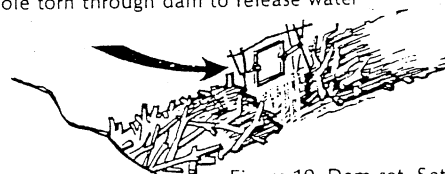


Figure 10. Dam set. Set the trap underwater in front of the hole created in the dam. When the beaver returns to patch the hole, it will go into the trap and be caught.

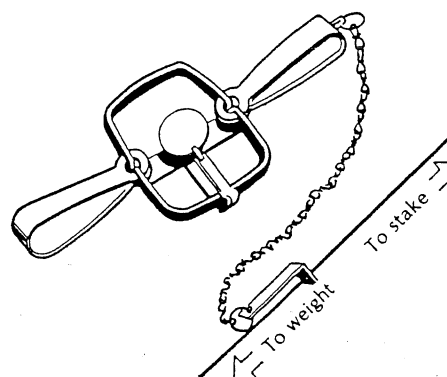


Figure 11. Leghold trap (No. 3 or No. 4 size, double spring) attached to wire for drown set.

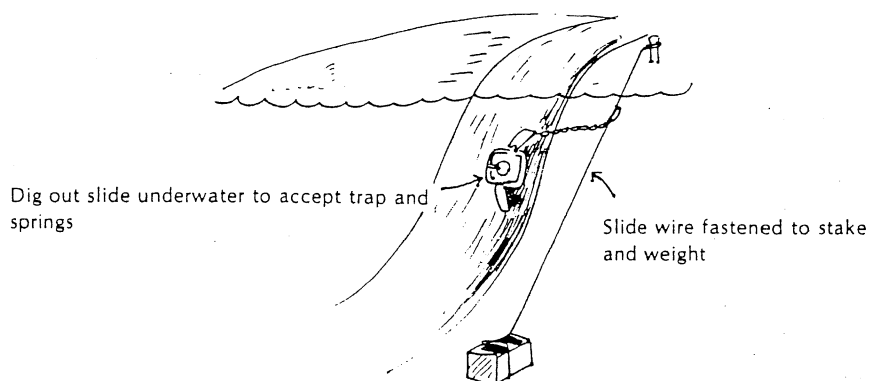


Figure 12. Leghold trap in slide set.



Double spring leghold traps have been used for hundreds of years and are still very effective when properly used by skilled trappers. Trap size of double (long) spring or coil spring type leg leghold traps for beavers should be at least No. 3 or equivalent size jaw spread and strength. Any leghold trap should be used with a drown set attachment (*Figure 11*). As the traps are tripped, the beaver will head for the water. A weight is used to hold the trapped beaver underwater where it ultimately is drowned. Some trappers stake the wire in deep water to accomplish the drowning. If leghold traps are not used in a manner to accomplish drowning, there is a good likelihood that legs or toes will be twisted off or pulled loose, leaving an escaped, trap-wise beaver.

The placement of leghold traps is equally as important as with the Conibear type, if not more so. Generally, such traps are placed just at the water's edge, slightly underwater, with the pan, jaws and springs covered lightly with leaves or debris or pressed gently into the bottom in soft mud. For this set, there must be a cavity under the pan so that when the beaver's foot hits the pan, it will trip the springs and allow the jaws to snap closed. Traps should be placed off-center of the trail or run to prevent belly pinching or a miss by the foot or leg. With some experience, beaver trappers learn to make sets that will catch the beaver by a hind leg rather than a front one, which is much smaller and easier to twist off or pull out. Where trapping with leghold traps without drown sets is done, it is not uncommon to catch a beaver with toes and even entire front legs missing.

It is sometimes wise when using leghold traps to make two sets in a slide, run, dam or feeding place to increase trapping success and more quickly obtain beaver control. In some situations, a combined use of

Conibear type traps, snares if legal, and traps will be necessary to shorten trapping time and increase success.

Trappers have come up with unique methods of making drown sets. One of the simplest and most practical to use is a slide wire with a heavy weight attached to one end or that end can be staked to the bottom in 3 or more feet (.9 + m) of water depth. The other end of the wire is threaded through a hole in one end of a small piece of angle iron; the trap chain is attached to a hole in the other end of the angle. The end of the wire is then attached to a tree or stake driven into the bank (*Figure 12*).

When the beaver gets a foot or leg in the trap, it immediately dives back into the water. As the angle slides down the wire, it prohibits the beaver from reaching the surface. The angle iron piece will not slide back up the wire and most often bends the wire as the beaver struggles, thus preventing it from coming up for air. Most trappers are prepared if a beaver is not drowned and dispatch it appropriately with a .22 caliber slug in the head as quickly as possible.

The leghold trap set in lodges or bank dens is also effective, especially for trapping young beavers. This set can be placed on the edge of the hole where the beaver first turns upward to enter the lodge or den. Another good set is on the bottom of the dive hole. The jaws and pan should be thrust upward by the springs being pulled backward, thus placing the pan and jaws off the bottom where a swimming foot will trip the pan. These sets can usually be staked closely to the bottom or wired to a stake, log or root on the bottom, thus avoiding the need for drowning weights, wires and angle iron pieces. Generally speaking, more time and expertise is necessary to make effective sets with leghold traps and snares than is required with the Conibear type.

The use of scent or fresh cut cottonwood, aspen, willow or sweetgum limbs may be an asset in enticing beavers to leghold trap placements. Bait or scent is especially enticing around scent mounds and up slides along the bank or dams. Although occasionally helpful, most trappers who use Conibear type traps rarely employ baits or scents. In some states it is illegal to use bait or scent.

Several other types of traps can be used, including basket/suitcase type (live) traps. However, these are rarely used in beaver damage situations, except by professionals in urban areas where anti-trap sentiment or other reasons prevent killing the beaver. These traps are difficult and cumbersome to use, and will not be further discussed here for use in beaver damage control. Any type of traps used for beavers or other animals should be checked daily. Note: Snare sets are not discussed in detail because many states prohibit their use.

### Shooting

In some states, because of the extent of damage caused by beavers, regulations have been relaxed to allow shooting. Some states even allow the use of a light at night to spot and shoot beavers. Before attempting to shoot beavers, check regulations, and if applicable, secure permits and let the local enforcement officer or game warden know what is being attempted.

Beavers are most active from late afternoon to shortly after daybreak, depending on the time of the year. They begin about 6 to 8 pm and are active until about 7 am, when they generally retire to the lodge or bank den for the day. Therefore, if night shooting is not permitted, the early evening and early morning hours are most productive. Choice of weapons depends on the range and situation. Generally speaking, the time spent trying to shoot damaging beavers would be much more productive if devoted to trapping. Rarely can one eliminate damaging beavers by shooting alone.

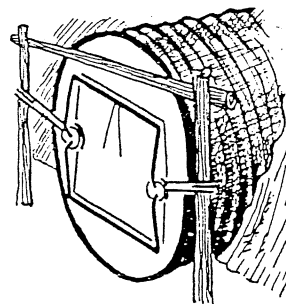
## Other Methods

Because of the frustration and damage beavers have caused landowners, almost every kind of method imaginable — legal and illegal — has been tried. These range from dynamiting lodges during mid-day to using snag-type fish hooks in front of dams, road culverts and drain pipes. Such methods rarely solve a damage problem, although they may kill a few beavers and non-target species and cause severe headaches for those that are not killed. One method used occasionally along streams prone to flooding is shooting beavers that have been flooded out of lodges and bank dens. This method is often dangerous and rarely solves a damage problem.

A final section on control methods: Beaver damage can be severe and cause extensive economic losses and frustration in many situations. However, the efforts necessary to effect control of beavers causing the damage is most often overestimated. Beaver colonies have a tendency, like other wildlife species, to build up the population to a certain level, then part of the population moves into other suitable habitat of nearby water sources. The beavers then develop or modify the habitat to their liking.

Beavers are territorial and even in old ponds that have held beavers for years, it is rare to find more than 8 to 13 beavers in any particular pond. Most often the number is from 4 to 8. The older and larger the pond, as long as food is plentiful, the more likely it is to have the higher number of beavers. A good trapper with a dozen traps can generally trap all the beavers in a given pond (behind one dam) in a week of trap nights. Obviously in a large watershed with several colonies, more trapping effort will be required.

Figure 13. Conibear® in culvert set. When beavers are stopping up a drainage culvert, (1) clean out the pipe to get water flowing through freely; (2) set the trap at the level of the drain pipe entrance, but far enough away to clear the culvert when the beaver enters; (3) put stakes on either side to make the beaver enter the trap correctly.



Landowners with beaver problems frequently overestimate the number of beavers in a pond and the difficulty of control. Many are reluctant to personally attempt trapping them out. Most would prefer having someone else do the job for them. Beaver trapping is hard, dirty work, but anyone with reasonable strength, and some outdoor experience can learn to be an effective beaver trapper.

Where legal to trap in lodges and bank dens, a good trapper can remove every beaver from a pond if dams are kept broken and the water is kept moving out on a nightly basis. In most cases, a week of trap nights is sufficient to remove all the beavers from a single pond. Periodic checks will make sure there are no survivors or that beavers from adjacent areas have not moved in.

## Economics of Damage and Control

The economics of beaver damage is somewhat dependent on the extent of damage that has occurred before the landowner or manager realizes that a problem exists and begins to attempt control. Some beaver damage problems are intensive, such as one or two beavers in a new pond caused by their damming or stopping up a culvert or

drain pipe, flooding roads or crops. Others are extensive, such as several beaver colonies in a flat-land area, responsible for the flooding of several hundred acres of merchantable timber that will die unless the water is removed quickly. Generally speaking, if the culvert or drain pipe can be unstopped, a knowledgeable trapper can trap one or two beavers in a night or two and eliminate further damage in the intensive damage situation (*Figure 13*). However, in the extensive situation, it may require a concentrated effort with several trappers, dynamiting or pulling dams, and a month or more of extensive trapping to get the water off the timber and reduce further timber losses.

The economics of each situation are obvious. Economically, one must weigh the tradeoffs, hundred of thousands of board feet of timber, and years of regeneration losses versus the cost of traps, time and effort or contractual arrangements with a damage contractor, for the worse case. For the least case, consider a couple of nights trapping effort and a half-day of labor to clear the culvert versus the cost of rebuilding a washed-out road or loss of some flooded crops or timber.

The most important point is that damage control should begin as soon as it is evident that a beaver problem exists or appears likely to develop. Once beaver colonies become well established over a large contiguous area, achieving control will be difficult and costly.

One of the most difficult situations is where a landowner adjacent to one who needs to control beavers will not allow beavers on his place to be controlled. In this situation, one can expect periodic reinvasions of beavers and beaver damage.

To the author's knowledge, no one has compiled beaver damage data nationwide, however, if it were done, a conservative estimate would be \$75 million per year. In the southeastern states alone, the figure is probably close to \$50 million annually. This would include all damage to crops, forests, roads, pastures, and other rural and urban properties, to commercial timber company lands, and to public lands.

Although not covered in depth here, there are a number of benefits that can be credited to beavers and beaver ponds aside from the significance of creating fish, waterfowl, furbearer, shorebird, reptile, and amphibian habitat. The beaver in many areas is an important fur resource, and for those who have not yet tried it, beaver meat is excellent table fare if properly prepared. Recipes for preparation and cooking beaver are found in a number of publications. If one is trapping beavers, the meat is a valuable resource and can be utilized whether the pelts are worth skinning or not. After the fat is removed and the meat is sliced into thin steaks, it should be cooked in the same manner as venison. In fact, the taste is remarkably similar. Carcasses of beavers also make good dog food, and it is a rare hunting dog that will not fight over a piece of beaver meat. When trapping for predators, beaver meat also makes good bait.

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Figures 1, 2, 4, and 5 from Schwartz and Schwartz (1981).

Figure 3 by Jill Sack Johnson.

Figure 6 by the author.

Figures 7 through 11 and 13 from Miller (1978).

Figure 12 by Jill Sack Johnson after Miller (1978).

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