



COLORADO STATE PARKS STEWARDSHIP PRESCRIPTION



Date Created: March 25, 2003

Revised: April 1, 2005

Author: Robert Fenwick

Parks Affected: Most

Beaver Management



Information for this prescription was derived in large part from Mammals of Colorado by Fitzgerald et al. (1994), unless cited otherwise.

INTENT – What do I need to know about beavers?

The primary goal of this prescription is to inform and advise state park managers and staff in how to manage beaver activities for conservation purposes while addressing visitor safety and property damage concerns. Specifically, this prescription will discuss:

- Beaver life history, behavior, ecology, and conservation
- How beavers affect the environment
- The beaver's role as a keystone species
- How to determine den locations and survey an area for beavers
- The potential danger beavers pose to natural resources and facilities
- How to manage beaver damage in natural landscapes

ISSUE – Why should I care about beavers?

People respond to the presence of beavers in a variety of ways. Some see them as an interesting and perhaps slightly unusual member of the local wildlife community. Those directly affected by their “projects” may see them as malicious creatures out to destroy their property. Most people probably fall somewhere in between admiring the beaver's industrious nature and being frustrated by its sometimes destructive habits.

Historically, beavers occupied nearly all of North America, including vast portions of Colorado. The fur trade of the 1800's devastated these original populations, but the animals have slowly rebounded as the demand for pelts has decreased in the last 150 years (Prosser 1998, Snodgrass 1997). Many areas that once supported beaver are now occupied by people, and conflicts may occur in the form of flooded roads and property, destroyed ornamental and commercial vegetation, and plugged storm drains and culverts. In such instances, management is needed to protect property and human safety, and control animal numbers as necessary.

Beavers are one of only a few animals that have the ability to modify the environment for their benefit, constructing dams, lodges, and canals to create a home that will afford protection from predators and provide a self-sustaining food supply. By constructing dams across flowing streams, beavers impound water, cause localized flooding and temporarily destroy a portion of the landscape. This flooding transforms former wetland habitat into aquatic habitat and converts some upland areas into wetlands. Tree cover is



often greatly reduced in such areas due to a combination of flooding and felling by beavers for use as food and building materials.

Though these activities temporarily destroy habitat, they soon affect positive changes that increase the diversity and productivity of the area. Numerous studies show that beaver activities provide benefits to natural systems by slowing and storing floodwaters, removing pollutants, increasing the amount and availability of nutrients, raising plant productivity, elevating the water table, and creating habitat for a greater diversity of plants and animals, especially compared to an unpounded section of stream. Thus, beaver should be considered and managed as a necessary, though sometimes destructive, component of any riparian system.

NATURAL HISTORY AND BEHAVIOR – what is life like for a beaver?

Beavers are the largest rodent in North America, with adults attaining a weight of 50-70 pounds and a length of over three feet. Beavers are best described as semi-aquatic. They spend the majority of their active time in the water, but often forage on land and may travel many miles across land to find suitable areas to establish territories.

Extensive dams, lodges, and canal systems are built to facilitate a water-based existence and limit their exposure to terrestrial predators. Not surprisingly, beavers have a number of special adaptations for aquatic life including clear membranes that completely cover the eyes underwater, valve-like ear and nostril openings, and webbed rear feet. Beaver also possess a remarkable fur that provides excellent, lightweight insulation and is highly water repellent. This fur, it was discovered,

also provides a superior felt for hat-making. Beaver felt hats were soon in such demand that by the late-1800's, beaver were nearly trapped to extinction in both Europe and North America. Law changes and a shift in fashion combined to significantly reduce beaver trapping in the early 1900's. Populations on both continents have been rebounding ever since and now occupy most of their former range (Prosser 1998).

Reproduction

Unlike many of their relatives, beavers grow and reproduce rather slowly. Due to their large size and relatively long lifespan (8-10 years), high rates of reproduction and growth cannot be supported in most areas of habitat. Therefore, female beavers normally do not reproduce until their third year of age, and then produce an average litter of 3-4 kits each year (Hill 1982). Females normally remain productive until around the age of ten, which is considered a normal life span (Stegeman 1954).

Figure 1. Beaver swimming in deep water. Note the small eyes and ears and the paddle-shaped tail.



Photo courtesy of DOW/ J. G. Hall.



Social Structure

Beavers also differ from most of their rodent relatives by having a fairly complex social structure. Beavers usually live in small family groups of related individuals called colonies. A colony usually consists of a mated pair of adults and one to several yearling and juvenile offspring. In Colorado, colony size ranges from four to eight individuals, with five considered average for most active sites. Mating is monogamous and the adult female is the dominant family member and leader of the colony. Important activities such as lodge construction, dam maintenance, and building the winter food cache fall to the female (Hodgdon 1978). Males assist dam maintenance, warn the colony of danger, and mark the boundaries of the colony with scent mounds. The entire family is involved in defending the home site against other beavers.

Dispersal

Dispersal is an important event in the life of a young beaver. With the birth of a new litter in late spring, two-year old beavers will leave the colony to seek their own territories. Spring is an ideal time for dispersal as temperatures are usually mild, food is abundant, and surface water flows are high. Elevated flows allow beavers to disperse via waterways rather than over land where they are much more vulnerable to predators. Dispersal distances may be affected by both the availability of food resources and territory ranges of existing beaver colonies in the area. Beavers are highly territorial and serious fighting may occur during dispersal. Studies in Idaho (Leege 1968) show that young move an average of 7 km (4 miles) away from the home site, but usually not more than 16 km (10 miles).

Mortality Factors

As with most wild animals, the early years of a beaver's life are the most critical to their survival. Due to their large size, beavers have only a few natural predators once full grown, but kits and juveniles may fall prey to mink, otter, fox, coyote, bobcat, and bear. Wolves and mountain lions appear to be the only significant natural predator of adults (Prosser 1998, Breck 2003). Young animals are also more susceptible than adults to other natural mortality factors such as severe winter weather, under-ice starvation, and drowning in flood events. In areas where trapping is allowed, humans are the most significant beaver predator. Young animals are again at greater risk, being especially susceptible during periods of dispersal (Rutherford 1955). Mortality in untrapped populations is low, usually 5-7% annually (NatureServe).

ECOLOGY – How do beavers affect the landscape, and why is this important?

Understanding the behavior and activities of beavers can go a long way in reducing unwanted impacts. Beavers are natural engineers that create their own place to live by using natural materials such as tree limbs, mud, sticks, and grass to construct lodges for shelter and dams to impound water. These actions (particularly dam building) often cause significant alterations to the areas beavers inhabit. *However, the result is nearly always a significant gain in both quantity and diversity of wetland habitats.* This net wetland gain translates into an increase in food, shelter, and prey for a wide variety of other mammals, fish, insects, birds, and plants. Thus, beavers provide cost-free

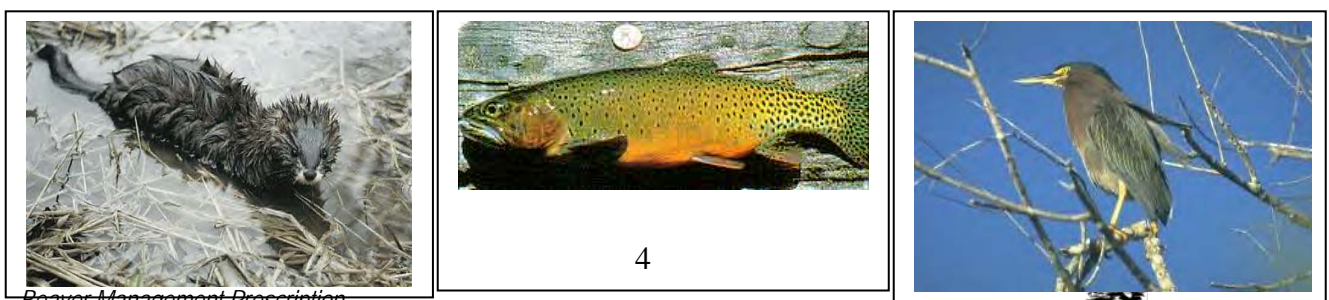


wetland creation and help to mitigate the overall net loss of wetlands (50% loss) in the state since pre-settlement times. Due to this ability to create habitat for other animals and affect ecosystem structure and dynamics, beavers are considered “keystone” species. Defined another way, the presence or absence of many native species in Colorado is dependent on the availability of beaver-created habitat that would otherwise not be present. Though lacking hard evidence for his conclusion, Ives (1942) attributed the extensive wet meadow systems of the Colorado Rockies to historic beaver activity. More recent studies have reported substantial increases in species diversity and richness for plants, fish, and invertebrates as a result of beaver activity (McDowell and Naiman 1986; Feldmann 1995; Snodgrass 1996).

Beavers affect their environment in a variety of ways. Some or all of the following affects typically result:

- 1) **Increased storage of precipitation.** Beaver ponds impound and store water during precipitation events and release it gradually. This reduces variability in the overall discharge regime of the stream and provides a source of water in dry periods.
- 2) **Decreased current velocity.** Beaver ponds and their associated vegetation are typically lush due to the abundance of water. This vegetation, combined with the influence of the ponds, acts to slow current velocity in the stream and thereby limit erosion of the stream banks and bed. This natural function is especially important for watersheds that have been overgrazed. Reducing current velocity also helps reduce flooding downstream.
- 3) **Increased water depth.** Beavers require ponds that are deep enough to hold water year-round and not freeze solid in the winter (usually about 3 feet minimum). This provides an important refuge for fish and amphibians as well, especially in times of low water.
- 4) **Elevation of the water table.** By increasing water storage and residence time, beaver ponds actually elevate the water table in the surrounding area. Where several impoundments occur along a stream reach, intermittent streams may be effectively converted to perennial (Snodgrass 1997).
- 5) **Habitat creation.** Favorable conditions are created for wildlife and plants, especially those that depend on ponds (waterfowl, fish, submerged vegetation), pond edges (amphibians and emergent vegetation), dead trees (cavity nesting birds) or other habitats not present or in limited supply in stream systems not modified by beavers.

Figure 2. A few animals that benefit directly from the presence of beaver ponds: Mink, Greenback cutthroat trout, and Green backed heron.



- 6) **Increased productivity.** Naiman et al. (1986) reported substantial increases for both plankton and emerging insects in beaver ponds as compared to unimpounded streams.
- 7) **Decreased water turbidity.** Beaver ponds effectively trap sediment and reduce turbidity, providing clearer water downstream. This is especially important for native trout (cutthroat) which are visual predators and require clean gravel beds for spawning.
- 8) **Increased nutrient availability.** Beaver ponds greatly increase the amount and availability of organic carbon, nitrogen, and other nutrients within the stream channel and provide greater nitrogen fixation by sediment microbes (Naiman et al. 1986)
- 9) **Improved water quality.** In addition to the above habitat improvements, beaver ponds act to buffer stream acidity (Smith et al. 1991), and may reduce the effects of non-point source and other forms of pollution by removing them through sedimentation (burial), chemical breakdown, and/or temporary assimilation into plant tissues (Maret et al. 1987).
- 10) **Resistance to disturbance.** By stabilizing water discharge rates, creating permanent water sources, and providing a diverse community structure, beaver ponds provide substantial resistance to disturbance at the ecosystem level.

RECOMMENDATIONS – How can I protect property from beaver activity?

While valuable in many natural settings, beaver presence and activities may be detrimental to land management goals in certain situations. Beavers are able to invade urban watercourses and impoundments and will often do so when food resources are adequate. The creation or expansion of wetland habitat caused by beavers is often beneficial, especially in arid Colorado, but this must be balanced against the destruction of desirable woody vegetation near the home site and the possibility of flooding. When necessary, management actions may include some or all of the following:

1) Limit Access to Food Sources

Limiting beaver access to such food sources may help restrict their activities in areas where they are not wanted. Most food is taken within 100 meters (330 feet) of the beaver pond, though animals may forage up to a few hundred meters from water for selected species. Tree protection may involve repellents, exclosures, or a combination of the two.

Beaver abundance and distribution is highly dependent on the availability of a winter food supply. In areas cold enough to freeze the surface of the pond, tree branches are cut and gathered in the fall and submerged in the middle of the pond. Once the pond freezes over, the beavers live off this food cache until spring. Young deciduous trees,



particularly aspen, cottonwood, and willow, are the most sought after species for developing a winter food cache.

2) Build Tree Enclosures

Individual trees can be protected by constructing an enclosure of heavy wire mesh, hardware cloth, or galvanized metal around the bottom 1 meter of the tree. A few stakes or rocks should be used to anchor the bottom of the enclosure to the ground so that beavers cannot push it over or squeeze underneath. The ends of the material should be fastened together rather than nailed to the tree. Leave a few inches of room between the protective material and the trunk to allow for tree growth if the structure is to remain in place for several seasons.

3) Use Chemical Repellents

Commercial deer repellents have also been used successfully to protect trees from beaver. The American Tree Farmer (October 1983) reported that full strength use of Magic Circle consistently repelled beavers. A diluted concentration (1:50) applied to damaged trees along the shoreline also repelled beavers. Rags saturated in full-strength repellent and hung from a cord above the beaver dam repelled beavers for three years, while the same treatment using diluted repellent (25% concentration) remained effective for only three months. Although Magic Circle is no longer manufactured, a number of other deer-specific chemical repellents (e.g. Deer Away, Tree Guard, Plantskydd, etc.) are available and may also work for beaver.

4) Provide Supplemental food

In some instances, providing a limited supply of cut limbs, especially aspen, will reduce beaver damage to standing trees. If proffered during the time of winter food cache

Figure 4. Enclosure built for a newly planted tree.



The Samuel Roberts Noble Foundation – used with permission.

Figure 3. A beaver colony in winter. Note the large food cache near the lodge.

Beaver lodge, food cache,

and dam in winter



Courtesy of the Canadian Department of Environment.



development, this action may prevent beavers from cutting existing trees. Gray (1990) found that this technique reduced damage to valued trees during a study in Denver, but cautioned that this is not a long-term solution.

5) Remove animals

For especially problematic situations, removal of the animals may be necessary. The methods below may be used singly or in combination.

Removal efforts should be coordinated with the Resource Stewardship Team. For current take requirements and regulations, as determined by the Colorado Division of Wildlife, please go to the following Internet posting:

<http://wildlife.state.co.us/regulations/ch03.pdf>

Live Trapping: Live trapping is probably the most humane way of dealing with a problem animal or family of animals. The Hancock trap is usually preferred due to its versatility and rate of catch success (see Novak 1987 for details). Apples and corn usually make effective baits. Though yearlings can usually be handled with gloves, anesthesia is recommended for handling live adults and juveniles (see Seal and Kreeger 1987 for dosages), as these animals can deliver a severe bite. Relocation is the goal of live trapping, but this can be a difficult process. **Many states, including Colorado, require permits for live trapping and may have further restrictions on relocation of animals.** Finding a suitable relocation site can be very difficult, especially near urban areas, and potential locations should be researched well in advance of trapping.

Kill Trapping: Kill trapping avoids many of the difficulties associated with live trapping, but still usually requires a permit from the state to be legal. Within municipal boundaries, additional city or county permits may be required as well. A trapper education course may also be required. Number 330 or 220 Conibear traps are usually effective, with death resulting in 1.5-9.25 minutes (Novak 1987). Leg hold traps (size #3 or larger) may also be used, but should be set underwater so that the animals drown quickly. **Note: As of 1998, this practice is illegal under most circumstances in Colorado.**

Shooting: Shooting is most effective in areas where boats and spotlights can be used, such as lakes, reservoirs, and large rivers (Hill 1982). In other situations, trapping is usually a much more effective means of removing animals.

****Important Note:*** Studies by Bergerud and Miller (1977) found that when beavers are removed from an area of suitable habitat, they will be quickly replaced by others, especially if beavers are common in the area. Therefore, removing animals is usually only a temporary solution.

6) Dam Removal

Removing beaver dams, in most cases, simply does not work. The beaver pond is home for two to several beavers and they depend on it for food, shelter and protection from predators. Because their survival depends on it, beavers will work overtime to repair or replace dams that are destroyed. Another important consideration is that in

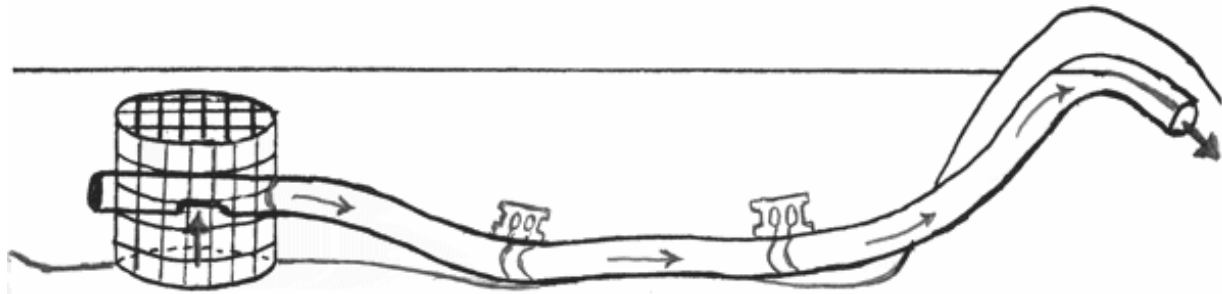


many states, wetland laws require a lengthy permit process to remove or destroy a beaver dam.

7) Install Water Control Devices

Largely due to the lack of success with dam removal, alternative methods employing water control devices have been developed recently. One of the simplest involves inserting a large diameter PVC or metal pipe into the dam to drain the pond to a level unsuitable for the beavers. The outflow end of the pipe should be sufficiently long enough and elevated a few feet off the ground so that beavers can't simply plug it with

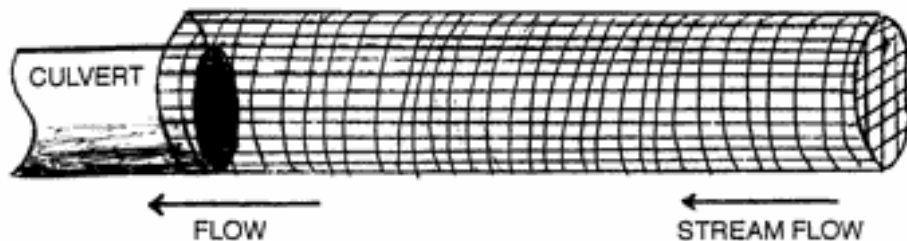
Figure 5. Flexible PVC pipe used to drain and maintain a beaver pond at a certain level.



Courtesy of Beaver Solutions

sticks or other materials. The intake end (within the pond) should be contained within a basket of large wire mesh to defeat any attempts by beaver to plug or bury it (See Figure 6). Monthly maintenance is usually required to keep such devices working correctly (Laramie 1963). Once unable to maintain the necessary water depth in the pond, the beavers will be forced to move elsewhere. This often works well when the problem is a flooded culvert or bridge. However, if a flooded road or field is the issue and suitable habitat exists elsewhere in the drainage, relocation may take place within a few hundred yards and potentially create the same problems.

Figure 6. Example of wire mesh basket used on the pond side of the drain to prevent beavers from plugging the pipe.



Courtesy of Beaver Solutions

8) Sterilization

Surgical sterilization has been explored as a means of controlling beaver populations where resources are becoming damaged and trapping and shooting are not viable options (i.e. protected natural areas). Though sterilization probably has limited use as a management tool, due to the associated expense, it is theorized that the territorial behavior of sterile animals should prevent nonsterile animals from migrating into the area. Older progeny within the family would also be restricted from breeding unless the



adults are removed (Brooks et al. 1980). Thus, the beaver population should decrease due to the lack of reproduction and dominant, territorial behavior of the sterilized adults.

Important safety note on handling beavers:

Humans working with beavers, either living or dead, may contract tularemia. This disease is transmitted by skin-to-skin contact with an infected animal, being bitten by a tick or deer fly that has also bitten an infected animal or consuming the meat of an infected animal. Symptoms often include a small ulcer at the point of infection, enlarged lymph nodes, and fever. Though not usually considered serious, treatment with antibiotics is recommended (Addison et al. 1987). Suitable precautions against infection include using rubber gloves whenever handling an animal or carcass, and disinfecting any clothing or equipment that may have come in contact with an animal.

SURVEY METHODS – How many beavers do I have?

Presence or absence is usually determined rather easily. However, the home range for a colony of beavers, or even the number of colonies in a given area can be much more difficult to determine.

Colony Identification

Active colony locations are most easily recognized in the fall, when beavers are cutting trees for their winter food cache. The presence of a fresh food cache in the middle of the pond, or recent tree cutting are good indicators that a colony is in residence. In the absence of a food cache, the following may also be considered as indicators of beaver activity (from the New York department of Environmental Conservation 1991):

- Fresh cuttings in the water or on the bank
- Fresh mud or sticks on the dam
- Intact dam with no significant areas of leakage
- Muddy water in the activity area
- Obvious trails leading from the water
- Freshly flooded or stressed trees and shrubs

Beaver “logging” also occurs in the spring when new dams are created, but may not be noticeable in areas with dams already in place.

Colony Size and Territory

A survey conducted by Hay (1958) found that in Colorado, beaver colonies range in size from 4.5 to 7.8 individuals, with five being average. Hay proposed that for rapid field surveys, five animals per colony should be considered an appropriate rule of thumb. Similar studies have reported that, in Colorado, the size of territory held by a colony ranges from 0.4 to about 8 hectares (1 to 20 acres), with a size of 1.6 to 3.2 hectares (4-8 acres) considered average. River valley and stream width, food availability and quality, and stream volume and gradient all affect territory size (Rutherford 1964). Colony boundaries are marked by the dominant male with scent piles made of mud and castor gland secretions. These mounds are placed at strategic locations around the perimeter of the colony (Aleksiuk 1970). Another factor sometimes helpful in determining the boundaries of a colony is the presence of trees damaged, but not removed by beaver well away from the colony pond.



POPULATION DYNAMICS - How do I know if I have too many beavers?

In many areas of the country, beaver populations are still rebounding from severe overharvesting in the 1800's. The past 100 years have brought significant changes to the natural landscape as well, and as beaver reoccupy areas of former habitat, they may encounter another species with the ability to manipulate the environment - man. In areas inhabited by both beavers and people, conflicts are often inevitable.

However, a number of scientific studies have shown that, in most instances, beavers will not overpopulate an area. Several aspects of the beaver's biology and behavior serve to provide natural population control:

- Reproduction – Compared to other rodent species, beavers grow and reproduce slowly. Females typically do not reproduce until three years of age, and then only produce an average litter of three to four kits once each year. In a Colorado survey, Rutherford (1955) found that for females of all ages, the pregnancy rate was 33%.
- Food requirements – Because of their large size and relatively inefficient digestive system (only about 1/3 of the food eaten is digested), beavers need access to a relatively large amount of good quality food. This is especially important for winter survival, and beavers will leave an area if they are unable to access a sufficient amount of food to cache for the winter (NatureServe 2001).
- Territoriality – Beavers are highly territorial, primarily as a means to protect food resources from other beavers. Males use piles of mud mixed with secretions from the castor gland near their anus to mark colony boundaries, and the entire family will fight to defend their home territory against other beavers. Establishing and holding a territory may be an important component of reproductive success (Bergerud and Miller 1977). In Colorado, typical colony size ranges from 1.6 – 3.2 hectares (4-8 acres) with nearest-neighbor distances of 0.7 – 1.5 km (Rutherford 1964).
- Occupancy rate – Defined as the proportion of habitat that is actually occupied by an animal compared to the total amount of suitable habitat available. A study by the New York Department of Environmental Conservation (1991) found that natural population levels occurred with an occupancy rate of only 30-50%. Thus, for all available suitable habitat, only one-third to one-half of it will be occupied by beavers at any given time.

Though beaver numbers are influenced, and largely controlled, by aspects of their biology and behavior, the following factors are also important to consider.

- Trapping ban – In 1998, the citizens of Colorado voted to restrict the use of kill trapping statewide. Coupled with the general reduction in predator populations over the past 100 years (especially wolves), beaver mortality rates are now at very low levels. This equates to an increased number of



beavers reaching adulthood and an overall population increase in Colorado.

- Predator reduction – The gray wolf and grizzly bear are two large predators known to include beavers in their diet. Both of these animals have been extirpated from the state for half a century. Lynx, wolverine, and river otter are also known to prey on beaver, but these animals exist only in very low numbers in Colorado and do not currently have a significant impact on beaver populations.
- Delayed dispersal – Juvenile dispersal normally occurs as a means to prevent food resources at the home site from becoming depleted. In high quality habitats with plentiful resources and/or areas saturated with beavers, dispersal may not occur, or be delayed until young beavers are able to compete for territory (Bergerud and Miller 1977). This can create management problems if beaver density increases and tree cutting becomes extensive in a concentrated area. In such instances, animal removal may be necessary. Sterilization may also be considered.

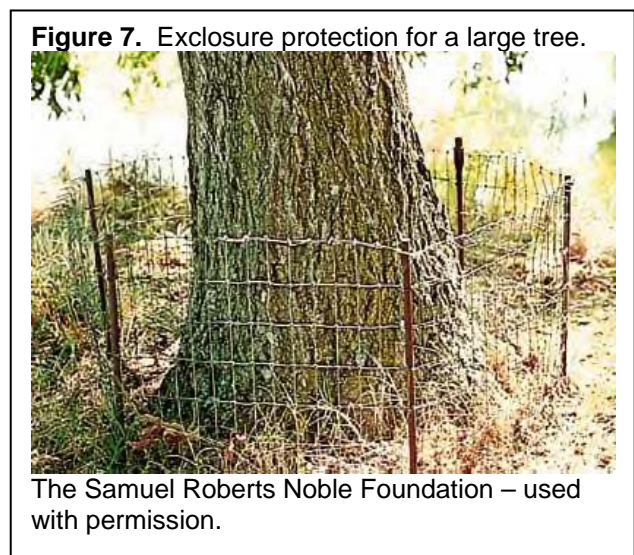
Suggested Management Actions for Park Staff: - Can beavers and the park coexist?

In areas inhabited by both beaver and humans, active beaver management is often required. The goals and objectives of beaver management vary with site conditions and resource priorities and so must be tailored to each site individually. For some areas, beavers will have a negative influence on resource management goals. In other settings they may actually help achieve such goals. Land managers must often weigh the benefits of beaver activity against the costs, both current and future.

Action: Education. Whenever possible, park staff should seek to communicate basic information about beaver to visitors. This will help address misconceptions about their behavior and habits and the general unwillingness to accept the natural changes they cause.

Action: Protect valuable trees. Beaver forage most frequently in an area approximately 100 meters or roughly 330 feet from their pond(s), though they have been known to remove highly desirable trees from areas up to 500 meters (1,640 feet) away. Once a beaver home site is located (see survey methods above), highly desirable trees should be protected with repellents or exclosures for up to 100 meters (330 feet) from the colony pond(s). If applicable, supplemental food may be provided in the spring and fall as another means of reducing damage to standing trees.

Action: Maintain water control devices. As



discussed above, water control devices may be used to encourage beaver to leave an area by reducing the water stored in the pond to unacceptable levels. Continued success of these devices requires consistent maintenance, usually on a monthly basis. Maintenance may include removal of materials used by beaver to try and plug the device, and checks to ensure that the device is properly anchored and draining the pond to the desired elevation.

Action: Management considerations. Because of the flood control, water storage, and increased habitat beavers provide, their activities should be included and considered in any sort of riparian management plan.

MANAGEMENT SUMMARY Important Facts about Beavers

- Beavers are skillful engineers that are often poorly understood and unnecessarily destroyed.
- Beavers are an important component of many Colorado ecosystems and should receive the same protection as other wildlife species.
- Though temporarily destructive, beaver activity actually creates habitat for a greater number and diversity of animals and plants compared to an un-impounded section of stream.
- Beaver ponds also perform many important natural functions, such as attenuating and storing floodwaters, removing pollutants, increasing the amount and availability of nutrients, raising plant productivity, and elevating the water table.
- Beavers are an important contributor to the health of many native ecosystems, but should be controlled when human safety and/or property is threatened.
- Beaver “logging” is greatest in spring and fall, when animals are constructing dams and storing food for the winter and usually occurs within 200 yards of the home site. Tree protection is most important at these times of the year.
- Removing animals is often only a temporary solution as other beavers will quickly move into unoccupied home sites.
- Flooding associated with beaver ponds can be controlled by placing a large-diameter PVC pipe through the dam, as an alternative to removing the animals.
- Wire mesh enclosures placed around trees of value to prevent harvesting by beaver. Enclosures are not necessary beyond 200 yards from the home site.



American beaver (*Castor canadensis*) – Fact Sheet

Derived primarily from Mammals of Colorado by Fitzgerald et al. 1994

Range:

- Widespread throughout North America from arctic regions to the Gulf of Mexico and the desert southwest.
- Found at sea level to elevations of over 11,000 feet.
- Inhabit permanent water sources of almost any type within their range, but prefer low gradient streams.

Size:

- Adults average about 1 m (three to four feet) in total length.
- 16-32 kg (35-70 pounds), with males being slightly larger than females.

Appearance:

- Compact, rotund bodies with small eyes and ears and a flat, scaly-looking tail.
- The fur is usually reddish-brown above and lighter brown or gray below.

Disposition:

- Not aggressive, but will defend themselves if threatened or provoked.
- Highly territorial towards beavers outside the family group (colony).

Ecology:

- Feed on herbaceous vegetation and the bark, buds, leaves, and branches of a variety of deciduous trees.
- Create habitat for a wide variety of waterfowl, insects, fish, amphibians, and plants.
- Known predators include wolves, coyotes, bear, bobcat, and mountain lions.

Reproduction:

- Courtship and mating occurs early in the year (January to early March), and litters are produced after a gestation period of about 15 weeks.
- Females normally have their first litter at the age of three and produce only a single litter each year.
- Litters average two to five in Colorado, depending on elevation and food quality.

Life History:

- Beavers in captivity can live up to 20 years, but the lifespan of wild animals is much lower, typically 8-12 years.
 - Typically live in family colonies consisting of a single mated pair of adults and one to several yearlings and juveniles.
- Subadult animals normally disperse from their home site at two years of age.

Figure 8. Beaver distribution in North America.

■ Beaver range



Courtesy of Canadian Department of Environment.

Figure 9. Beaver with aspen limb – a favorite food.



REFERENCES/MORE INFORMATION:

- Addison, E. M., I. K. Barker, and D. B. Hunter. 1987. Diseases and parasites of furbearers. Pages 893-909 in M. Novak et al., editors. *Wild furbearer management and conservation in North America*. Ontario Ministry of Natural Resources.
- Aleksiuk, M. 1970. The seasonal food regime of arctic beavers. *Ecology* 51:264-270.
- Breck, S. R. 2003. Personal communication.
- Brooks, R.P., M. W. Fleming, and J. J. Kennelly. 1980. Beaver colony response to fertility control: evaluating a concept. *Journal of Wildlife Management* 44:568-575.
- Feldmann, A. 1995. The effects of beaver (*Castor canadensis*) impoundment on plant diversity and community composition on the Coastal Plain of South Carolina. Master's Thesis, University of Georgia, Athens.
- Fitzgerald, J. P., C. A. Meaney, and J. M. Armstrong. 1994. *Mammals of Colorado*. University Press of Colorado. 467 pp.
- Gray, M. T. 1990. Denver's urban beavers – a gnawing problem. *Colorado Outdoors* 39(1):27-29.
- Hay, K. G. 1958. Beaver census methods in the Rocky Mountain region. *Journal of Wildlife Management* 22:395-402.
- Hill, E. P. 1982. Beaver. Pages 256-281 in J. A. Chapman and G. A. Feldhamer, editors. *Wild Animals of North America: Biology, Management, and Economics*. Johns Hopkins University Press, Baltimore. 1147 pp.
- Hodgdon, H. E. 1978. Social dynamics and behavior within an unexploited beaver (*Castor canadensis*) population. PhD dissertation, University of Massachusetts, Amherst. 292 pp.
- Ives, R. L. 1942. The beaver-meadow complex. *Journal of Geomorphology* 5:191-203.
- Laramie, H. A. 1963. A device for control of problem beavers. *Journal of Wildlife Management* 27:471-476.
- Leege, T. A. 1968. Natural movements of beavers in southeastern Idaho. *Journal of Wildlife Management* 32:973-976.
- Maret, J. J., M. Parker, and T. E. Fanny. 1987. The effect of beaver ponds on the non-point source water quality of a stream in southwestern Wyoming. *Water Resources* 21(3):263-268.
- Naiman, R. J., C. A. Johnston and J. C. Kelly. 1988. Alteration of North American streams by beaver. *BioScience* 38:753-762.



Naiman, R. J., J. M. Melillo, and J. E. Hobbie. 1986. Ecosystem alteration of boreal forest streams by beaver (*Castor canadensis*). *Ecology* 67:1254-1269.

NatureServe Explorer: An online encyclopedia of life. 2001. Version 1.6 . Arlington, Virginia, USA: NatureServe. Available: <http://www.natureserve.org/explorer>.

New York Department of Environmental Conservation. 1991. Status of beaver management in New York. Draft Report.

Novak, M. 1987. Traps and trap research. Pages 941-969 in M. Novak et al., editors. *Wild furbearer management and conservation in North America*. Ontario Ministry of Natural Resources.

Prosser, D. J. 1998. Avian use of different successional stage beaver ponds in Pennsylvania. Master's Thesis, Pennsylvania State University. 152 pp.

Rutherford, W. H. 1955. Wildlife and environmental relationships of beavers in Colorado forests. *Journal of Forestry* 53(11):803-806.

Seal, U. S., and T. J. Kreeger. 1987. Chemical immobilization of furbearers. Pages 191-215 in M. Novak et al., editors. *Wild furbearer management and conservation in North America*. Ontario Ministry of Natural Resources.

Smith, M. E., et al. 1991. Modification of stream ecosystem structure and function by beaver (*Castor canadensis*) in the Adirondack Mountains, New York. *Canadian Journal of Zoology* 69:55-61.

Snodgrass, J. W. 1996. The influence of beaver ponds on the temporal and spatial dynamics of southeastern stream fish assemblages. PhD Thesis, University of Georgia, Athens.

Snodgrass, J. W. 1997. Temporal and spatial dynamics of beaver-created patches as influenced by management practices in a south-eastern North American landscape. *Journal of Applied Ecology* 34:1043 -1056.

Stegeman, L. C. 1954. The production of aspen and its utilization on the Huntington Forest. *Journal of Wildlife Management* 18:348-358.

