BEAVER BENEFITS

What role do beavers play in riparian habitat management?

WYOMING GAME & FISH DEPARTMENT

HABITAT EXTENSION BULLETIN NO. 38

In recent years, resource managers have placed increased emphasis on protecting and managing riparian habitats (those areas next to or influenced by water). Land managers recognize that healthy riparian habitats provide numerous benefits. Proper management of these habitats can improve water quantity and quality, increase herbaceous forage production and quality, diversify wildlife, and provide human recreational and aesthetic values.

Many land managers have realized that beaver can play a very cost-effective role in riparian habitat management and enhancement. With the exception of humans, a single beaver can modify its environment more dramatically than any individual of any species in North America. Beaver are occasionally referred to as "grassroots conservationists" because of their water impoundment and conservation efforts in our nation's watersheds. Without beaver on our Wyoming headwaters, downstream flooding would be more severe each spring, and water conservation would be a much more serious concern. The manpower and monetary costs of providing the benefits beaver provide would be staggering.

Beaver played an important role in the early economic development and settlement of Wyoming, beginning with the first fur trappers around 1820. Beaver were trapped so intensively that, by 1860, they were nearly extinct in the region. Legislative protection from 1899 to 1919, combined with intensive restoration efforts by the Wyoming Game and Fish Department, resulted in beaver recovery. In Wyoming, the beaver remained classified as a protected animal until 1958 when it was reclassified as a furbearer. Today, beaver may occupy only one third their original Wyoming range. The loss of riparian habitats as a result of urban development, stream channelization, dams, overgrazing, agricultural land conversions, and direct losses from illegal shooting has contributed to beaver reduction in some areas. In other areas, beaver are not compatible with existing land uses and are intensively controlled.

In recent years, between 1,200 and 4,600 beaver have been harvested in Wyoming annually, providing over $200,000 in annual revenues to the state from license sales, trapper expenditures and related costs (U.S. Department of the Interior, 2016). Beaver trapping is an important economic and recreational activity in Wyoming. However, the economic benefits of trapping to the state cannot begin to compare with the economic benefits derived from the beavers' stabilizing influence on watersheds.

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Beaver improve riparian and aquatic ecosystems by expanding wetlands and elevating water tables resulting in subirrigation of adjoining areas. Subirrigation into the floodplain encourages plant growth that

stabilizes streambanks. The increase in vegetation provides additional forage and cover for livestock and wildlife. The elevated water table, caused by beaver dams, can sustain high quality forage in times of drought, and when the upland plants are curing in late summer months (Thacker, 2018).

Beaver ponds stabilize watersheds by moderating high flows and reducing downstream flooding; maintaining more constant summer flows; storing water during flooding and releasing water during droughts. Ponds retain sediment and organic matter, thus improving fish habitat, and the increase in water surface area produces a corresponding increase in total aquatic productivity. These ponds also provide important pool habitat for certain fish species, additional recreational opportunities (fishing, wildlife viewing, etc.), and diverse scenery.

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Many landowners are understandably intolerant of beaver on their property. Beaver can cause serious damage, especially in lower portions of watersheds where they may conflict with other land uses by flooding roads, hay meadows, croplands and facilities; damming culverts and irrigation ditches and damaging valuable trees or ornamentals. Yet even in areas where beaver are a nuisance, management practices can sometimes be employed to preserve existing land uses while maintaining the benefits beaver provide.

Riparian habitats provide the greatest overall value to wildlife of any habitat type in Wyoming, and the benefits of beaver-modified riparian habitat to wildlife are even more significant. For example, total bird density in some beaver-occupied riparian habitat has been found to be three times that of adjacent riparian habitat. Beaver-occupied riparian habitat provides resting, feeding, nesting, and brood-rearing habitat for waterfowl. Sandhill cranes seek out beaver ponds for nesting, and both trumpeter swans and Canada geese have been found to nest on beaver lodges. Moose are attracted to aquatic vegetation found in beaver ponds. Muskrat and otter will sometimes take up residence in abandoned beaver dwellings. The presence of muskrat and fish in beaver ponds may attract mink. Brook trout thrive in the productive pond waters. Though dams can sometimes pose a barrier to fish movement, beaver ponds benefit most fish species inhabiting stream habitats in Wyoming. Beaver ponds are especially critical to the continued survival of our four native cutthroat trout species, Bear River, Colorado River, Snake River, and Yellowstone Cutthroat trout.

BEAVER LIFE HISTORY AND BEHAVIOR

The beaver (Castor Canadensis) is North America's largest rodent. In Wyoming, an average adult beaver weighs over 50 pounds and exceeds 40 inches in length from the snout to the tip of the tail. Beaver in excess of 100 pounds have been reported in Wyoming.

Beaver live in family groups (colonies) consisting of an adult pair, young of the year (kits) and young of the previous year (yearlings). In Wyoming, the average number of beaver per colony is five but can range from two to 12 or more. Males and females are virtually indistinguishable from one another externally except when the female's mammary glands are evident for one to two months after giving birth.

Beaver mate in the water (under the ice) in the month of February. Litters of one to six kits (rarely eight) are born in late spring (mid-May to mid-June). During this same period two-year olds, leave the family group in search of mates (Olson 1994). Dispersals of well over 100 miles have been reported,

A beaver is actively cutting down a cottonwood tree.

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An Aquatic Habitat Biologist used a Comstock trap to live capture a young beaver.

though the average dispersal distance for young beaver is usually five to ten miles. Dispersing two-year olds will sometimes travel considerable distances overland.

Though beaver can be active at any time of day, they are primarily nocturnal, becoming active near dark and remaining active through the night. Occasionally, beaver can be seen during daylight hours, especially in the fall when they are hurriedly repairing lodges and dams and caching food for the winter.

Well adapted to aquatic life, beaver have been reported to dive for as long as 15 to 20 minutes. The broad, flat, leathery, scaled tail serves as both a rudder and prop. When alarmed, beaver will slap their tails on the surface of the water. The webbed hind feet are specialized for swimming while the clawed front feet are specialized for grasping and digging.

Though beaver are infrequently seen, signs of their activities are readily evident. Beaver lodges (dwelling) are of three distinct types: the open-water lodge, the bank lodge and the bank den or burrow. A single colony may have one or several lodges scattered over the colony's home range. The beaver lodge is one of the most interesting and functional structures in nature, serving as a formidable barrier to predators and providing a micro-environment suitable for habitation independent of outside climatic conditions. While temperatures outside the lodge may be well below zero, heat radiating from the occupants inside maintains above-freezing air temperatures throughout long, icebound periods.

Probably the best recognized and most important feature of beaver-occupied habitat is the dam. Why do beavers dam streams and rivers in the first place? The dams reduce the flow of a stream, creating a pond. The ponds provide escape cover. In essence beavers build dams to escape predation, and to provide access to food in winter (Wheaton, 2018). Studies have shown that variations in sound frequency of flowing water induce dam building behavior in beaver. Steep gradients, eroding or rocky channels and high flows can limit beaver dam building actions, as can the lack of dam building materials. Extremely versatile, beaver will build dams from the materials available. In marginal habitat, they may even use rocks, sagebrush, corn stalks, or other unusual items as dam-building materials.

Another distinct beaver activity is the cutting of trees and shrubs. Beaver are strictly vegetarian (herbivores). Their diets are comprised largely of woody materials when forbs, grasses, or aquatic vegetation are unavailable. During the summer, beaver rely extensively on non-woody food. During fall, colonies that will be ice-bound through the winter collect a food cache made up of trees and shrubs. The colony will feed on this cache through the winter.

Many species of woody plants are cut for building materials (dams and lodges) but are not eaten. For example, beaver rarely consume the bark of evergreens such as spruce or pine, but they occasionally cut these trees for building materials when preferred species are unavailable. Since only the leaves, bark and smaller branches of preferred species are eaten, the remainder of the tree is often used as building material.

Beaver within a colony are highly territorial toward members of adjoining colonies or transient individual or pairs moving through their territory. The generally accepted opinion is that beaver mark territorial boundaries (those boundaries a beaver will defend) with castoreum, a strong smelling substance released by special castor sacs located at the anal area. Castoreum, which is believed to function as a pheromone or communicating substance, is often deposited on mounds of mud carried from the stream bottom. These mounds can be found throughout a colony's territory but are most commonly found at territorial boundaries. In areas with high beaver population

densities, a colony's territory and home range may be identical. At low densities, or when unoccupied habitat separates colonies, a colony's home range may exceed its territorial boundaries. Beaver in isolated colonies will generally not exhibit territoriality or marking behavior.

Throughout Wyoming, beaver colony density is determined largely by the quality of existing habitat. Streams with good beaver habitat can have at least two beaver colonies per mile of stream, although this can vary widely. Beaver colony home range can exceed one mile along a stream course in sub-optimum habitat.

BEAVER HABITAT SELECTION AND LIMITING FACTORS

Use of beaver for riparian habitat management requires a knowledge of the animal's habitat preferences. Nationwide beaver can be found throughout the United States and Canada except for Florida, southern California and southern Nevada (Streubel, 2000). They prefer the bark of deciduous trees such as aspen, birch, maples, and cottonwoods. Beaver distribution within Wyoming is closely tied to the distribution of quaking aspen (Populus tremuloides). Aspen is used extensively for dam building and appears to be the preferred forage of beaver. Beaver use a variety of other riparian habitats in Wyoming, particularly willow and cottonwood.

Aspen predominately regenerate by suckering (sprouting), a process induced by fire or cutting. Aspen stands have a network of interconnected lateral roots from which suckers originate. Aspen abundance has been reduced statewide due, in part, to fire suppression. Resource managers and landholders can improve beaver habitat by manipulating over-mature aspen stands with techniques like prescribed burning and clear-cutting. Where conifers are encroaching into aspen stands, selective cutting or clear-cutting both the conifers and the aspen can induce aspen suckering. Beaver play a limited role in aspen stand regeneration by cutting trees, thereby stimulating resprouting.

Habitats with aquatic vegetation available year round may also be occupied, as long as dam and lodge building materials are available. For example, beaver can subsist on water lilies year round, using the leaves and stems during the growing season and the large root stocks during winter. Beaver have also been reported to use a variety of upland habitats (e.g., sagebrush), but these habitats are not suitable for longterm beaver subsistence.

Forage quantity and the size of unoccupied habitat necessary for long-term beaver establishment are difficult to assess. Beaver will forage at distances exceeding 600 feet from water, but most foraging occurs less than 300 feet from the water's edge. The availability and accessibility of forage are important factors limiting beaver colonization. A 40 to 60 percent tree or shrub canopy cover within 165 ft of water's edge of preferred beaver forage species is considered optimum for beaver establishment (WDFW, n.d.). Generally, beaver require a minimum of one-half mile of stream channel. Stream complexity (side channels, sloughs, Oxbows, etc.) allow beaver easier access to forage. Narrow floodplain habitats, such as canyons and ravines, are generally considered unsuitable. However, in some areas of southwestern Wyoming, beaver historically occupied narrow canyon habitats and were the stabilizing factor in some of these watersheds. Where beaver occupy lakes, reservoirs and marshlands, the minimum habitat area necessary for long-term occupancy appears to be one-half square mile.

Beaver require a permanent, relatively stable water source. Streams with gradients in excess of 15 percent are seldom occupied; the optimum stream gradient appears to be six percent or less. If beaver are unable to dam a water course, soils suitable for establishing bank dens are necessary.

BEAVER MANAGEMENT OPPORTUNITIES

Degradation of riparian areas is common in the west and Wyoming. And while beaver can improve degraded riparian areas, these habitats are generally not suitable for beaver until the floodplain and stream channel are stabilized and riparian vegetation restored. Riparian habitat degradation can be caused by a variety of factors, singly or in combination, including overgrazing, fire suppression, drought, development, increased erosion, formation of gullies, or other natural events that have resulted in loss of vegetation.

If livestock grazing is the problem, measures should be taken to direct livestock away from the riparian zone.

If livestock grazing is the problem, measures should be taken to direct livestock away from the riparian zone. These measures can include providing mineral blocks on uplands, herding, fencing, providing upland shade with trees or shelters, upland vegetation treatments (burning/ mowing) to improve forage quality, and upland water developments. Once recovered, the riparian habitat can again be used by livestock under a carefully controlled grazing regime. More detailed information regarding livestock management techniques can be found in the Wyoming Game and Fish Department habitat extension bulletin number 35, "Wooded Draw Management in Northern Great Plains Rangelands."

Where streambanks have been severely eroded or where gullying has occurred, simple restoration measures, such as Beaver Dam Analogs (BDAs), or

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WGFD personnel need to visit translocation sites to evaluate habitat suitability. Contact your regional WGFD office for advice and assistance.

The WGFD may provide support and assistance for trapping and translocation services, if it is a priority to improve aquatic habitat at select translocation sites.

riparian vegetation plantings (i.e., willows, cottonwoods), should be considered. More aggressive engineered stream enhancement measures utilizing heavy equipment to stabilize the banks and improve riparian vegetation also offer potential solutions.

Newly established riparian trees and shrubs should be given sufficient rest from wildlife and livestock grazing to prevent new plants from being destroyed by grazing or trampling. Beaver can then be reintroduced to further enhance habitat recovery. Beaver ponds will raise the water table and expand the area of vegetative recovery. In all recovery efforts, a commitment to livestock and beaver population management is necessary to prevent a return to former, degraded conditions.

It is important to recognize that beaver do not follow a manual regarding suitable or unsuitable habitat. They are very adaptive and may establish themselves in marginal habitat when suitable habitat is unavailable. While these occupations are often short-lived, they can provide immediate benefits to riparian habitats. This adaptiveness has been demonstrated in southwestern Wyoming where attempts to restore degraded riparian habitat by encouraging beaver with supplemental food and/or building materials has met with some success. This approach has limited application for most areas; it takes a lot of effort to continually provide young branches for food and building materials during periods when alternate forage is lacking. Yet this approach can be successful if conducted simultaneously with vegetation management to improve willow and aspen densities throughout the drainage.

Another method to attract beavers is to give them a jump start on their dam building. Installation of BDAs, which are structure designed to mimic the form and function of a natural beaver dam; create immediate deep water habitat that reduces the risk of predation. In general, the design and installation of BDA complexes is a simple, cost-effective, non-intrusive approach to riparian floodplain restoration that can influence a suite of hydraulic, geomorphic and hydrologic processes benefiting the stream corridor (Anabranch Solutions, n.d.).

TRAPPING AND TRANSPLANTING BEAVER

In considering beaver transplants into seemingly suitable, unoccupied habitat, a landholder may be prudent to ask why the habitat is currently unoccupied. Beaver do not always remain where they are released, and if the immediate habitat is less than optimum, transplanted beaver may disperse to other areas. In doing so, they may not provide the benefits originally envisioned, instead becoming a nuisance requiring control. Informing landowners upstream and downstream from targeted transplant sites prior to beaver release is highly recommended.

Beaver trapping and transplanting is a permitted activity and needs to be conducted in consultation with personnel from your local Wyoming Game and Fish Department regional office. In some situations, the department may provide assistance. Captured beaver need to have their age class (adult, yearling, kit) determined. Sex determination is difficult unless the female is lactating (producing milk for young). Where external evidence of sex is lacking, it is possible to determine sex utilizing anal gland secretions. Male secretions will be more viscous and brown to a reddish brown; while a female's secretions will be less viscous and olive to gray in color (Schulte, 1995).

Two trap designs are recommended for beaver live-trapping: the Bailey trap (underwater set) and the Hancock trap (bank set). The Bailey trap requires shallow water and is most useful for trap-wary beaver. The Hancock trap seems to work best in areas where beaver are actively marking territories or when trapping a colony for the first time. Unlike the Bailey trap, the Hancock trap seldom "misses." Comstock style traps have also been employed with great success as well. Snares are sometimes used for capturing beaver to be transplanted, but the risk of injury, or death, to the animal is much greater. For this reason, the use of snares is recommended only when experienced persons are involved.

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Ideally a family unit should be transplanted to increase the likelihood that the beaver will colonize your stream. However, if this cannot be achieved, adult or yearling beaver should be transplanted in male/female pairs. Transplanting all males or all females may result in animal dispersal to other areas in search of mates. Adult females should not be transplanted until after kits are weaned (August) unless the kits accompany the female. Yearlings and adult males can be transplanted any time between May 1 and September 30. Transplanting after September can be a problem, especially at higher elevations where winter may set in before transplanted beaver have the opportunity to build a dwelling and cache winter foods.

Beaver have strong homing instincts, so transplanted animals should be moved a sufficient distance from their home colony to reduce the likelihood they will return. This is particularly a problem when adult pairs are separated (in one documented case, a transplanted adult male beaver returned to its home colony within a week following transplant to a site 12 miles away).

BEAVER MANAGEMENT FOLLOWING RELOCATION

Once beaver are released to a watershed, a commitment to manage the population is necessary, particularly where fisheries enhancement through beaver pond establishment is an objective. Otherwise, only short-term benefits will be realized. Beaver management should be on a drainage basis. Beaver can rapidly populate a drainage, to the point of occupying all suitable habitat. There is no accurate method for estimating beaver population size. However, if the number of separate colonies can be determined, the average colony size can be applied to get an estimate of the population. Since precise numbers of individuals can not be readily determined, beaver management plans should be based on the number of colonies.

The longevity of a beaver colony depends on the quality of the habitat and the size of the colony's home range. Where the colony establishes a large home range in optimum habitat, the site may be continuously occupied for many years. One site in northwestern Wyoming has been continuously occupied for at least the past 50 years.

Conversely, beaver occupancy in certain types of riparian habitat can be relatively short-lived, though the ponds and dams may remain in place for many years thereafter. For example, occupation of some willow communities may last only six to eight years. The abandoned ponds will eventually silt in, and a productive meadow will result. Under natural conditions, trees and/or shrubs will eventually become established, making the site suitable for beaver colonization once again. The length of this cycle is highly variable,

Beaver tidbits

The best time of year to trap and transport colonies is during the dam-building season – late summer through early fall. The best strategy is to transplant a family unit, the next best thing is to trap 3-4 beavers (both males and females) from a colony, that includes at least one breeding pair.

A beaver uses a recently installed Beaver Dam Analog Structure.

ranging from a few years to a century. Unregulated wildlife and livestock grazing of these beaver-made meadows can extend the length of this cycle or prevent beaver habitat restoration altogether by deterring reestablishment of preferred trees and shrubs.

Beaver abandoning an area will likely move to the closest unoccupied habitat. If that unoccupied habitat is in the same drainage, the cycle of occupancy-abandonment-succession will repeat itself. Where multiple colonies occupy the same drainage, previously abandoned sites may be recolonized before they have had sufficient time to rejuvenate. This can result in habitat degradation and subsequent beaver abandonment of an entire drainage in a relatively short period of time. With abandonment, fisheries potential is often lost. The best management approach is to control the beaver population by targeting one or more colonies, so that some habitat in the drainage remains unoccupied.

BEAVER CONTROL AND MINIMIZING BEAVER DAMAGE

Where beaver are in conflict with existing land uses, land managers can exercise options other than elimination of the beaver population. The riparian habitat benefits lost with total beaver control often outweigh the elimination of a nuisance problem. Since beaver fill a key role in perpetuating riparian habitat, each case should be evaluated on a site-specific basis. Without this consideration, the land manager may incorrectly interpret and react to the problem.

For example, a landowner once requested assistance in removing an estimated 200 to 300 beaver on a three-mile stream segment. During review, a wildlife biologist discovered that the area was marginal

beaver habitat, and only one colony was present. The landowner was seeing beaver cutting activity over the entire stream segment, much of which was old. The more recent activity from the single colony was restricted to about one mile of stream. It is likely that this colony's home range was large because of marginal habitat. Multiple dams and/or dwellings were thought to reflect a larger beaver population than actually existed. The landowner failed to realize that no direct relationship exists between the number of dams and dwellings and the number of beaver in an area.

A few methods can be employed to minimize beaver damage, but the options available vary with the site-specific problem. It is best to determine the nature and extent of the problem, then take the appropriate action.

DAM BUILDING

Multiple dams can sometimes be a detriment to fisheries, especially where spawning areas are needed, but generally, the more dams constructed by beavers, the greater the benefits to the riparian system. If dams are a problem, it does little good to remove the dam. One dam adjacent to a roadway in northwestern Wyoming was removed nearly every day for an entire summer by a highway maintenance crew. The beaver rebuilt the dam each night. The U.S. Forest Service and other land management agencies have successfully used perforated pipe to ensure continued water flow through beaver dams.

When beaver construct a dam across a culvert, placing fencing upstream (beaver deceiver) from the culvert has proven successful. In most cases, beaver will build a new dam against the fence rather than the face of the culvert, thus allowing water flow. Land managers should consult local Game and Fish Department, Natural Resources Conservation Service, Forest Service and Bureau of Land Management personnel for advice on these and other alternatives.

TREE REMOVAL

Removal of valuable trees, ornamentals, or entire tree stands by beaver is another concern of land managers. Ornamental damage is usually associated with rural homes and occasionally with urban situations. Techniques such as exclusion fencing and/or wrapping have successfully deterred beaver from cutting ornamentals. In urban situations, repellents, lights and noise have all been attempted with limited success; the best solution is often beaver removal. If transplant sites are available, live trapping may be considered. Again, consultation with wildlife managers is necessary.

CONCLUSION

Because of their ability to dramatically alter their environment, beaver can play a key role in riparian habitat management. Several agencies and numerous publications are available which provide the land manager with proven riparian habitat management techniques. The US Fish and Wildlife Service has a "living publication" titled: "The Beaver Restoration Guidebook, Working with Beavers to Restore Streams, Wetlands, and Floodplains". The document is an excellent resource for any topic related to beaver. Wyoming Game and Fish Department biologists are available for advice and assistance and several department publications offer stream management suggestions. The Natural Resources Conservation Service in association with local conservation districts is an excellent source of technical and financial assistance. Other resource management agencies such as the Bureau of Land Management, U.S. Forest Service, Wyoming Department of Agriculture, and Wyoming Department of Environmental Quality can provide additional insight into riparian habitat management.

Beaver tidbits

Installing PVC water level control pipes through beaver dams can be a potential solution to allowing a dam to remain, while passing water downstream.

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MORE INFORMATION

For more information about beavers or to see the other Habitat Extension papers, visit wgfd.wyo.gov and click on “Habitat” in the navigation bar.