13.4.7. Managing Beaver to Benefit Waterfowl

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Aside from humans, no other organism has the capacity to modify its environment as much as the beaver. In doing so, beaver create wetlands that provide valuable waterfowl habitats. Because beavers are widely distributed in North America (Fig. 1), beaver ponds can benefit waterfowl during breeding, migrating, and wintering periods. Mismanaged beaver populations, however, can severely degrade riparian habitats and become a costly problem. The key to successfully managing beaver for waterfowl benefits is understanding the values of beaver ponds in meeting the seasonal needs of waterfowl. Beaver populations must then be managed to provide these benefits in a self-sustaining manner compatible with the carrying capacity of the habitat.

Before the arrival of Europeans, 60–400 million beavers occupied 5.8 million square miles of North America. But by 1900, beavers had been so severely over-exploited by trappers and hunters that they were almost extinct. Today, beaver populations are on the upswing: 6 million to 12 million animals occupy diverse habitats ranging from the boreal forests of Canada south to the Texas gulf coast, and from California's Central Valley east to the Atlantic seaboard. This recent population increase is a testament to the resiliency of beaver populations and their responsiveness to management techniques. I review some techniques useful for managing beaver populations and enhancing beaver habitats to benefit waterfowl, and explain the ecological relations and characteristics that make beaver ponds attractive waterfowl habitats.

Beaver Ponds as Breeding Habitats for Waterfowl

Ecological Relations

Most of the important habitats created by beaver and used by breeding waterfowl are north of 40° latitude in the mixed hardwoods–coniferous forests of the Northeast, in the montane habitats of the West, in parklands and the Precambrian Shield regions of southern Canada, and in the boreal and subarctic forests of northern Canada. Beaver ponds in these regions are attractive to most dabbling duck species, particularly American black ducks, mallards, and green-winged teal. Hooded mergansers, ring-necked ducks, common goldeneyes, and buffleheads are common diving duck species found on beaver ponds. Beaver ponds also provide important breeding habitat for wood ducks throughout their breeding range.

A beaver colony is defined as a group of beavers occupying a pond or stretch of stream, using a common food supply, and maintaining a common dam or dams. An average of one or two beaver colonies per mile occur along suitable streams and

Fig. 1. Range of the beaver in North America. Modified from Novak 1987.

rivers. Each colony usually contains four to eight beavers. Their activities, most notably the creation of ponds by flooding of riparian habitats and removal of woody vegetation, may influence 20 to 40% of the total length of second- to fourth-order streams and may remain as part of the landscape for centuries. Unexploited beaver populations can create as many as 26 ponds per mile of stream length in suitable habitats, but typically the number of ponds ranges from three to six per mile. Most stream sections used by beaver have valley slopes of 1 to 6%, and of the remaining use, one-quarter occurs along sections with 7 to 12% slope. Beavers generally do not occupy streams where valley slopes exceed 15%. Suitability of a site also increases with valley width. First-order streams usually are narrow with high gradients and an undependable water supply, and therefore receive little use. Conversely, many streams greater than fourth-order often flood in spring, destroying on-channel beaver dams. On these streams and rivers, beaver activities are mostly confined to banks, backwater wetlands, and floodplains. Beavers commonly occupy natural lakes and glacial depressions, such as kettle ponds, throughout their range.

Availability of food is the most important biotic constraint to beaver distribution. In northern regions, beavers annually cut at least a ton of forage. Usually, they take food resources closest to their lodge or bank dens first. Most food is gathered within 100 yards of their pond. Although they will

consume a wide range of woody and herbaceous plants, beaver prefer quaking aspen, cottonwood, willow, alder, maple, birch, and cherry, supplemented by herbaceous emergents such as sedges and floating-leaved vegetation, including pondweeds and waterlilies. In agricultural areas, they consume a wide variety of crops such as corn and soybeans. Riparian zones dominated by deciduous tree species preferred by beaver may be virtually clear-cut. An important effect of removing this tree canopy is an increase in the density and height of the grass–forb–shrub layer, which enhances waterfowl nesting cover adjacent to ponds. Additionally, the deep channels created by beaver to help transport food within the pond provide travel lanes for breeding pairs and broods of waterfowl.

Beaver pond complexes create a wetland community with characteristics similar to waterfowl breeding habitats on the northern Great Plains. Most important among these characteristics is a wetland complex that is usually composed of several wetlands of varying sizes, shapes, depths, and successional stages. These diverse wetlands provide space for territorial birds to isolate themselves from individuals of the same species. Also, as in prairie habitats, such complexes enable breeding waterfowl to optimize their use of aquatic resources. For example, beaver colonies in highly desirable locations may persist for several decades, and wetlands may advance to late successional stages with vegetation and aquatic invertebrate communities functionally similar to semipermanent and permanent wetlands in the prairies. Other beaver ponds located on less suitable sites, or new ponds created by beavers dispersing from an established colony, may possess vegetative structure and invertebrate communities more similar to temporary or seasonal prairie wetlands. Wetland fertility, water permanency, and water temperature regimes also vary within a beaver pond complex.

In addition to increasing the quantity of wetlands available to waterfowl, beaver enhance wetland quality. Wetland fertility is increased because much of the sediment and organic matter that is normally carried downstream is retained behind beaver dams. Beavers also add new sources of organic matter in the form of fecal matter and the plant material they haul or fell into the pond and later use as food or building material. The net effect is an increase in the nutrient base for aquatic plants and invertebrates. Total invertebrate biomass and density in beaver ponds may be two to five times greater than in stream riffle sites, ranging from 1,000 to 6,800 organisms per square foot and from 0.1 to 1 gram per square foot, depending on the season. Moreover, the structure of invertebrate communities is changed as running-water taxa are replaced by pond taxa, which are more readily exploited by waterfowl. These aquatic invertebrates make up the protein food base so important to laying females and to growing ducklings.

The structural characteristics of beaver ponds also are attractive to breeding waterfowl. Habitat diversity increases as beaver flood lands and open forest canopies. The flooded area under the tree canopy and underlying shrub layer provides lateral and overhead cover sought by many dabbling duck pairs and broods. Later, northern flickers and other primary excavators may create waterfowl nesting cavities in the dead trees that remain standing in ponds. The “feathered edge,” typical of many beaver ponds, creates shallow-water foraging areas that warm quickly in early spring, and often provides sites where seeds and invertebrates can be obtained. Beaver lodges and dams afford loafing areas and nesting sites for geese, ducks, and sandhill cranes, depending on the degree of vegetative concealment on the structure.

Management Strategies

Beaver ponds provide a mosaic of environmental conditions, dependent on pond size and age, successional status, substrate, and hydrologic characteristics. Hydrologic characteristics are especially important to waterfowl managers. Controlling water levels in beaver ponds is an important but sometimes difficult proposition. As in any nesting habitat, water in early spring must be sufficient to attract and hold breeding pairs, and stable enough to sustain water through the brood-rearing period. Beaver ponds located in relatively small watersheds, off the main channel, or with dams in disrepair, may have inadequate water in early spring. Such wetlands do not provide optimal habitat for waterfowl. Conversely, beaver ponds located in montane habitats far below snowline may fill with water from snowmelt about the time early-nesting waterfowl species complete their clutches, flooding nests located around the pond margin.

Consider transplanting beaver to a site if water and food are adequate, but dams are in disrepair because beavers have abandoned the area. If water

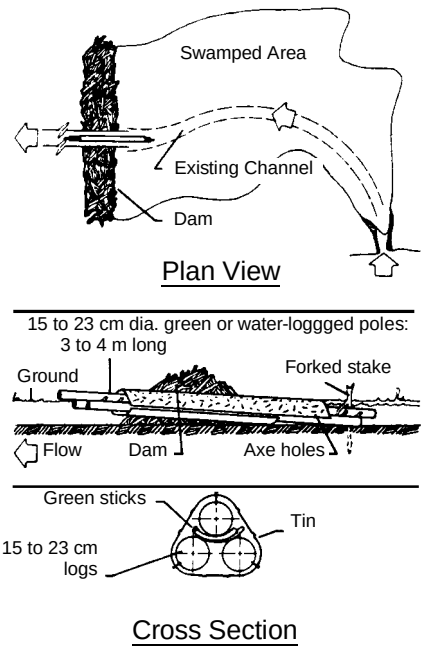
flow is inadequate, examine the feasibility of channeling water from a reliable source into the pond complex. One objective of managing beaver ponds as waterfowl breeding habitat should be to manage ponds for seasonally stable water levels.

Despite the benefits of stable water within the breeding season, this type of water regime reduces the productivity of beaver ponds when maintained over several years. The decline is primarily caused by anaerobic conditions, which bind nutrients to soil and organic matter, thereby making them unavailable to plants and animals. These anaerobic processes are exacerbated by the tranquil flow regimes and high organic loads typical of beaver ponds. Artificially increasing flow rates may help increase aerobic decay, but the best approach is to periodically drain or reduce the water levels in ponds to promote aerobic decay of organic matter and to reverse wetland succession. The interval between drawdowns is difficult to prescribe because the need for such action depends on the length of the warm season, water temperature, pond size and organic load, and water flow rates. In low latitudes, beaver pond productivity may decline in a few years, whereas ponds at high latitudes may take much longer to reach detrimental anaerobic conditions.

Drawing down a beaver pond is often easier said than done, because of the natural tendency of beavers to quickly plug any breach in their dam. Explosives or backhoes can be used to remove dams, but this often becomes an ongoing process because dams are quickly reconstructed. Better results are often achieved with beaver-resistant water control structures (Fig. 2), which are installed in the dam and are resistant to blockage by beaver. Only a fraction of the wetlands in a beaver pond complex should be dewatered during a given year to ensure adequate habitat for waterfowl and beaver in the remaining ponds. Ponds should not be drawn down during the brood-rearing period because young birds may become stranded or have to move, and become more exposed to predators.

Managing distribution of beaver can be a challenge equal to that of controlling water levels. Beaver that occupy sites adjacent to private lands, roads, or other human structures may impound water that causes timber or crop damage or creates a nuisance. Often, the only solution is to trap the offending beaver. If live-trapped, such individuals can often be successfully transplanted to suitable but unoccupied habitats. Supplemental feeding has been used to "hold" transplanted beavers in new areas until they become established, but supporting a beaver population by artificial feeding is an intensive and costly approach that is not recommended. A woven-wire fence, stretched across a stream channel between steel posts may be installed (where legal) to encourage beavers to build dams at selected sites.

Unexploited beaver populations can create numerous wetlands. With the extirpation of the gray wolf, which was a primary predator of beaver,



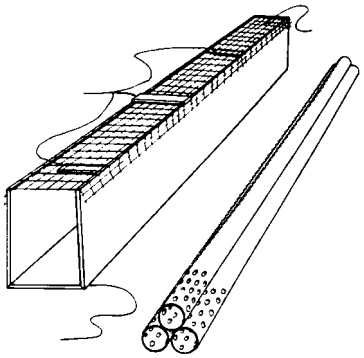


Fig. 2. Three designs for beaver-proof water control structures: three-log drain (*top*), box drain (*lower left*), and perforated plastic drainpipe (*lower right*). From Arner and Hepp 1989.

other factors such as trapping, food depletion, space, and disease have become the agents of population control. Before these agents intercede, however, beavers may severely degrade riparian and upland habitats. If unchecked, beaver populations and associated wetlands may oscillate from locally abundant to scarce. Populations exploited by trapping often remain at more constant levels commensurate with their food supply, their principal limitation. Field surveys are the most reliable means to determine the adequacy of remaining food resources. In good stands, 4 acres of quaking aspen, 12 acres of willow, or intermediate acreages of the two in combination are adequate to support an average colony of six animals. Such indices of adequate food supply are available for most regions of the United States. If managers control beaver by trapping, a general rule for maintaining stable populations at mid-latitudes (40–50°) is to remove about 25% of the fall population in willow habitat, 40% in quaking aspen habitat, and 70% in cottonwood habitat. This prescription reflects the progressive increase in reproductive rates of beaver with decreasing altitude and climatic severity, and increasing food quality and quantity.

In forested habitats, managing upland nesting cover around beaver ponds is usually impractical. Fortunately, the grass–forb–shrub cover that is common near beaver ponds often provides high quality, albeit limited, waterfowl nesting habitat. Nest success is often relatively high because many forested habitats have high habitat diversity, an abundance of buffer prey species, and predator populations that are more in balance with the habitat than are those on the northern Great Plains. Nevertheless, nests located along travel lanes such as dams and shorelines are more exposed to predators. Nests located on beaver lodges are often successful because such sites are secure from most mammalian predators. Trampling by livestock and flooding also cause nest failure, but flooding can be controlled by water-level management techniques, and fences often minimize damage by livestock.

Beaver Ponds as Migratory and Wintering Habitats

Ecological Relations

During spring and fall, beaver ponds are used by migrating waterfowl throughout North America. Open (ice-free) water, in which migrants can obtain aquatic invertebrates and plant seeds, tubers, winter buds and rhizomes, is the most important characteristic of these habitats. Beaver ponds, however, usually are not managed for migratory waterfowl except in the southeastern United States, where intensive management is sometimes used to attract fall migrants and wintering waterfowl for hunting. These areas are often associated with hardwood bottomlands or floodplain forests, where mallards and wood ducks are especially common.

Ecological relations described for beaver pond breeding habitats in northern regions are similar or identical to those in beaver ponds at southern latitudes. Successional patterns in beaver ponds in the South are similar to those in northern habitats, but occur more quickly. After beaver have created permanently flooded wetlands, trees die and the canopy opens, making conditions more suitable for growth of herbaceous plants or semi-aquatic vegetation. Sediments and organic matter are retained over time, thereby decreasing pond depth. Aquatic invertebrate communities develop and invertebrate biomass increases as the pond vegetation becomes established. Physical features of habitat created by beaver, such as dead, standing timber with a well-developed shrub layer, provide excellent habitats for wood ducks and other waterfowl to roost at night. Seed-producing annual plants associated with beaver ponds provide vegetative foods important to many dabbling ducks, particularly in years when mast crops such as acorns are unavailable. The wetland complex created by beaver provides diverse habitats that are readily exploited by waterfowl.

Management Strategies

Management strategies for migrating and wintering waterfowl must first consider important characteristics of beaver ponds: (1) those with few emergent plant species and shallow water areas, but with the potential for manipulating water level; (2) those with emergents and shallow water, where water levels can be manipulated; and (3) those with no possibilities for drainage. Ponds of the first type, which are common in the Southeast, are best managed by lowering the water level to allow germination of seed-producing, annual plants that are beneficial to waterfowl (Table). This technique, known as moist-soil management, relies on the timing and duration of drawdown to promote the germination and growth of seeds

Table. *List of desirable plants that occur in beaver ponds of the southeastern United States.*

Common name	Scientific name
Redroot flatsedge	*Cyperus erythrorhizos*
Millets	*Echinochloa* spp.
Pennywort	*Hydrocotyle ranunculoides*
Duckweed	*Lemna* spp.
Frogbit	*Limnobium spongia*
Water primrose	*Ludwigia leptocarpa*
Parrotfeather	*Myriophyllum brasilense*
Stout smartweed	*Polygonum densiflorum*
Nodding smartweed	*Polygonum lapathifolium*
Pondweeds	*Potamogeton* spp.
Beakrush	*Rhynchospora corniculata*
Burreed	*Sparganium chlorocarpum*
Watermeal	*Wolffia* spp.

already in the soil. In rare instances, when desirable aquatic vegetation is absent and the seed bank is inadequate, commercially available seed can be used. In Alabama, beaver ponds which were dewatered as described earlier, and then planted with Japanese millet, have yielded 1,400–2,400 pounds of seed per acre. Although moist-soil plants typically do not attain such high seed production, they do support high densities of aquatic invertebrates and provide seeds of a better nutritional balance than many commercially available plants.

Beaver ponds with an abundance of desirable emergent plants are best left undisturbed. If undesirable emergents are present, however, managers can alter the vegetative composition by water-level manipulations, mechanical disturbance, burning, or herbicide application. Water-level control is most easily achieved with beaver-proof control structures (Fig. 2). Mechanical disturbances and burning share the common objective of retarding vegetation succession and opening dense stands of vegetation. These management activities are usually conducted in late winter or early spring after water is drawn down. To effectively change plant composition, burning or mechanical treatments must damage roots of plants. Usually, this requires dry soil conditions, so that heavy mechanical equipment can be operated in the pond. If fire is used, heat must be sufficient to penetrate to root level. Herbicides such as Dalapon, Banvel, and Rodeo also can be used to control plants where such use is permitted. Managers should make certain that their herbicide of choice is approved for aquatic use and is applied at proper rates by a licensed applicator.

Impounded areas without drainage most commonly occur in cypress–tupelo wetlands where there is insufficient elevation change to use hidden drains. In these situations, managers may attempt to enhance the vegetative composition by introducing beneficial aquatic plants to the pond (Table). Floating-leaved plants such as duckweed and watermeal are beneficial species that are easy to introduce. If the overstory of trees provides too much shade to allow aquatic plants to establish, it may be beneficial to clear-cut small openings to help vegetation become established. By manipulating vegetative composition and interspersion, beaver ponds can provide attractive winter habitats for waterfowl.

Suggested Reading

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Appendix. List of Common and Scientific Names of Plants and Animals Named in Text.

Animals

Wood duck	*Aix sponsa*
Green-winged teal	*Anas crecca*
Mallard	*Anas platyrhynchos*
American black duck	*Anas rubripes*
Ring-necked duck	*Aythya collaris*
Common goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
Gray wolf	*Canis lupus*
Beaver	*Castor canadensis*
Northern flicker	*Colaptes auratus*
Sandhill crane	*Grus canadensis*
Hooded merganser	*Lophodytes cucullatus*

Plants

Maple	*Acer* spp.
Alder	*Alnus* spp.
Birch	*Betula* spp.
Sedges	*Carex* spp.
Japanese millet	*Echinochloa crusgalli*
Rushes	*Juncus* spp.
Duckweed	*Lemna* spp.
Waterlily	*Nymphaea* spp.
Tupelo	*Nyssa aquatica*
Cottonwood	*Populus* spp.
Quaking aspen	*Populus tremuloides*
Pondweeds	*Potamogeton* spp.
Cherry	*Prunus* spp.
Willow	*Salix* spp.
Baldcypress	*Taxodium distichum*
Watermeal	*Wolffia* spp.

Note: Use of trade names does not imply U.S. Government endorsement of commercial products.

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