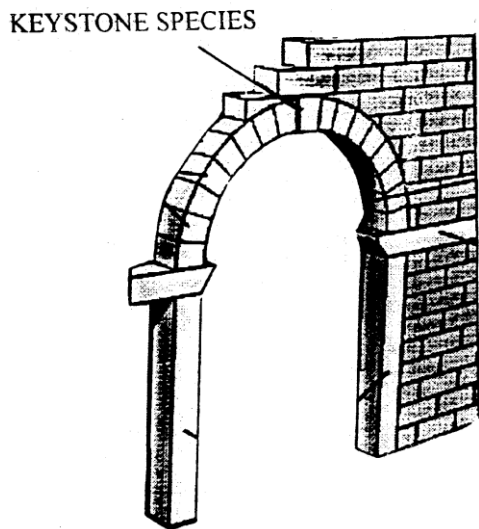


Beavers and the Environment

What happens to the neighborhood when beavers move in? Surely their visible impact on vegetation and waterways disrupt riparian habitat? The best answer is the more complex: beavers can have both a restorative *and* damaging effect on different aspects of their habitat under different conditions. Although instinct and common sense might suggest our beavers are depleting their creek there is a large body of scientific research that says the benefits of beavers significantly outweigh the costs in most areasⁱ. While study after study has shown that beavers *do* impact their habitat: the impact is largely for the better. In this section of the report the impact of beavers on specific aspects of their habitat will be examined.

What is a Keystone Species?



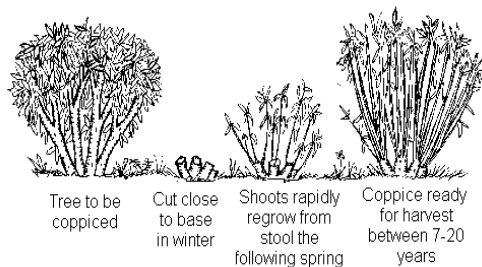
The Beaver is often called a “Keystone Species”. This concept was introduced in 1966 by R.T. Paine who studied the impact of removing one predator from an ecosystem.ⁱⁱ (In that case a starfish) He found that the original 15 species community was quickly reduced to only 8 species when the starfish was removed, prompting his analogy to the collapse of an archway if a “keystone” is taken out. (The keystone is the center piece which holds up both sides of the arch) Beavers have a similar role because their dams create habitat which are used by other wildlife. Bruce Baker, Ph.D. & Edward P. Hill wrote the seminal chapter on beavers in Feldman’s *Wildlife of North America* (2003). They described the beavers role as both a keystone species and an ecosystem engineer.ⁱⁱⁱ

A keystone species is one that greatly influences the species composition and physical appearance of ecosystems (Paine 1969) and whose effects on ecosystem structure and function are both large overall and disproportionately large relative to its abundance (Power et al. 1996). An ecosystem engineer is a species that directly or indirectly controls resource availability by causing “physical state changes in biotic or abiotic materials” (Jones et al. 1997;1946). The beaver is a definitive example of both a keystone species and an ecosystem engineer.

Beavers change soil deposition and augment nutrients in pools. There is even a growing body of evidence that dams may act as a kind of filter that improves water quality^{iv}

Beaver impact on Vegetation

Beaver foraging affects vegetation growth patterns. They remove trees and branches for food and dam-building. By current estimate some 60 trees of various sizes have been taken by our beavers, almost all native Arroyo Willow.. However, the roots remain in tact and will retain bank soil and eventually create new growth. Beavers use natural “coppice” cutting of trees^v, a forestry term for spurring future brushy growth by removing the main trunk and allowing shoots to spring around the base.



“Beavers coppice willow and cottonwood trees, creating the low, dense habitat preferred by vireos^{vi}. Indeed, beaver foraging promotes the growth of willow^{vii}”

A not-uncommon sight over the summer was to see a large partially felled tree sticking out of the stream. This is a kind of “beaver refrigerator”---the beaver does this to allow foliage to continue to grow and stay “fresh” but to make feeding more accessible for the kits. Beavers have been shown in some studies to decrease tree density and their selective foraging can reduce some species and increase others.^{viii} They shape tree dispersal by removing target food trees and leaving others to grow and reproduce.

ing season (Kindschy 1985). Where stem cutting is concentrated in late fall to build dams or prepare a food cache, plants are dormant when cut and respond with new shoots in the next spring in an attempt to recover former root:shoot ratios, maximizing plant production and minimizing plant damage. Cutting by beaver can also stimulate plants to initiate growth earlier in the spring, further increasing stem production (Kindschy 1989). However, biomass of new shoots can be decreased if regrowth is browsed by native ungulates or livestock.

One key factor as to whether or not vegetation is depleted or enhanced is the browsing of livestock^{ix}, which can produce enormous impact especially during dormant months when grass is less desirable. Obviously this is not an issue for this beaver habitat. Nonetheless, considerable interest has been expressed in augmenting willow habitat for our beavers with replantation, and this is discussed under the volunteer section of this report.

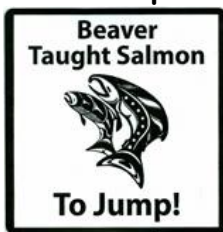
Beaver impact on Insects & other Invertebrates

Dams slow current and increase deposition of sediment and organic material in the water. These ponds play a key role in the development of complex insect life, which in turn feed fish, birds and mammals. Beaver activity greatly affects both aquatic and non-aquatic insect life in response to increased sediment deposition and still water behind the dam. Insects that prefer running water are replaced by insects that prefer still water, and the variety and density of species has been shown to increase^x.

In a study that compared stream riffle sites above and below beaver dams in the Adirondack Mountains, sites immediately below dams had lower invertebrate richness and diversity, but higher total invertebrate, predator, and collector-gatherer densities (M. E. Smith et al. 1991).

This of course leads to natural questions about mosquito larvae, which are known to accumulate in still pools. However, beaver ponds have been shown to actually reduce mosquito population^{xi}. There are nearly 3000 known species of mosquito but beaver ponds tend to shift composition of larvae – making conditions less desirable for some and ideal for others.^{xii} All mosquitoes are not created equal, some are much more damaging to human populations. For example, one of the species most associated with West Nile Virus and yellow-fever (*Aedes*) cannot survive in the permanent water of a beaver pond.^{xiii} Continued involvement by Mosquito Abatement can monitor conditions and help control negative species.

Beaver impact on Fish



Grant county
Conservationists

Beaver Ponds impact Fish in many ways. It has been shown that the standing crop of “plankton” in beaver ponds is 5 times larger than in the unaltered flowing stream^{xiv}. This means that fish life is denser and more varied. In fact, this winter’s Oregon TWS Conference on Beavers featured a lecture on the promotion of beaver to *increase* salmon.^{xv} Kelly Moore, NW Region Program Manager for ODFW research lab wrote,

“The primary effect is on over winter survival of juvenile salmonids – streams with abundant beaver created habitat had 2-3 times better over winter survival rates than streams with simpler riffle-pool structure.”^{xvi}

There has been concern that ponds impact reproduction by raising the temperature of the water and obstructing flow and dispersal of fish. The Oregon Department of Fish & Wildlife has noted that beaver dams can interfere with salmon passage. However Ms. Moore continues, “The consensus of Oregon fish biologists is that the benefits clearly outweigh the negative effects and that salmon and trout are better at moving over, around, and through beaver dams than we thought.” She referred to a much referenced native legend called “Beaver taught salmon how to jump” which basically credits beaver for Salmon prominence^{xvii}. Recent research shows that salmon and steelhead can navigate dams in periods of high flow and that the dam itself becomes a kind of reproductive “source” in fish community and dispersal.

Even small ponds have been shown to impact the diversity and density of fish species^{xviii}.

ponds. The size of beaver ponds is also important. As expected from general species-area relationships, fish species richness increases with size of pond, but very small beaver ponds can have higher than expected richness compared to ponds of a similar size not impounded by beaver (Keast and Fox 1990). Thus, beaver have a strong effect on fish species richness, but the effect is dependent on the size and age of beaver ponds and how ponds are distributed within the landscape.

Beaver Impact On Amphibians and/reptiles:

Beaver ponds create an ideal habitat for amphibians. Some species of newt may actually depend on beaver ponds for their survival^{xix}. Frogs, salamanders and toads are the hallmark of a healthy beaver pond. Towards the end of summer last year limited frog song could be heard at our beaver pond, which had not been documented before. Now a strong chorus of many pacific tree frogs can be heard at dawn. *“Amphibians, as a group, are sensitive to changes in water quality and so are considered indicators of environmental cleanliness.”*^{xx} The return of these frogs reflects the habitat restoration done by the beavers^{xxi}, and its subsequent benefits. There is some evidence that certain species are increased by the presence of beaver ponds (such as frogs) while others are decreased (such as salamanders).^{xxii} Turtles and other reptiles seem to gravitate towards and rest above the lodge, which is often warmer than the surrounding terrain.^{xxiii} There has been research documenting that older beaver ponds produce more kinds of snakes, lizards and turtles than younger beaver ponds, but that even a young pond had more reptile species than an undammed stream.^{xxiv}

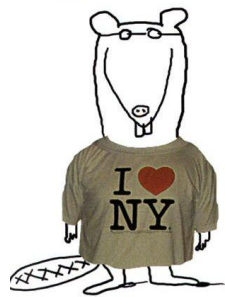
Beaver impact on Birds

A morning stop by the beaver pond reveals a larger cast of avian characters this winter than last. An early response to the deeper water was a breeding pair of secretive green heron that used the brushy shores to hunt for an increased fish population. By mid-summer kingfishers and great and snowy egrets were observed on both sides of the dam. A cormorant paid close attention to the dam lowering efforts by city staff in December and was photographed feeding opportunely on the fish suddenly displaced. The experience was so appreciated he continues to frequent the area, joined by a collection of winter ducks, coot and grebe. Observed songbirds include the marsh wren, song sparrow and common yellow throat. This spring many barn swallow families produced a second clutch of young, and at least 2 black phoebes were fledged. Winter visitors have included a ruby-crowned kinglet and a regular flock of nearly 30 lesser scaup that arrived unexpectedly in early February --possibly to feed on the sudden chorus of tree frogs but definitely enjoying the bubbling mussels in the mud seen as far up as Starbuck's. Certainly not every visitor is seen everyday, but at least one makes an

appearance on any given day. This is not unexpected given the research on beaver impact on bird life.

“A survey of birds at eight beaver ponds in eight counties in New York State demonstrated that active beaver sites support more species of birds than do vacant or potential sites.”^{xxv}

Beavers create better foliage and feeding for birdlife, allowing a greater variety and density of bird species to accumulate. Although beaver is occasionally sited as destroying habitat for songbird nesting^{xxvi} their gnawing actually spurs the very type of growth most breeding birds prefer. This summer Audubon Magazine reported on the beneficial effect of the “Bronx Zoo Beaver” on the surrounding population of birds and fish, saying,^{xxvii}



urban action. “Here is nature doing what we couldn’t even imagine,” says Eric Sanderson, an ecologist with the Wildlife Conservation Society, which oversees the Bronx Zoo. The rebounding Bronx River is now home to 45 species of fish and serves as a migratory corridor for birds. José

Often when waiting for the arrival of the somewhat unpredictable beaver, visitors can pass the time by watching the more visible and varied birdlife.

Beaver impact on other Mammals

Mammals are most likely to be seen where they can find are food, water and cover. Obviously the deeper pool, denser foliage created by coppice cutting and augmented fish and insect life draw other mammals to the beaver pond^{xxviii}.

ponds. Beaver ponds also create habitat for other semiaquatic mammals, such as river otter, mink, and muskrat, some of which may occur in a large percentage of active or abandoned ponds. In Idaho, the density and standing crop biomass of small-mammal populations was two to three times higher in willow-dominated beaver pond habitat than in adjacent riparian habitat (Medin and Clary 1991). Montane voles (*M. montanus*)

Our small stretch of beaver pond has already revealed at least two families of muskrats, an adult otter and baby otter this summer, a succession of raccoons and other small rodents. Obviously the most exciting of these is the otter, which feed on the fish that the beaver dam encourages. Interestingly, beavers and otters tend to overlap in their habitat a great deal (it was not uncommon to see the baby otter going over and even *inside* the lodge at times!) However, they are not exactly

friends and the few aggressive tail slaps seen by these beavers haven't often been in response to otter. Otters are carnivores and there is some research to indicate that they can take small kits at times. Indeed, many sources consider them a natural predator of the beaver.

Summary and Conclusions

As you can see, our beavers have a huge impact on the creek they inhabit. They affect the vegetation, insect and animal life by creating deeper slower water and different ecological conditions. Obviously potential impact increases with the age of the pond and the size of the family. If our beavers remain, research tells us that we can expect more varied fish, amphibian and birdlife to make use of the pond. Although their effects can be both positive and negative in nature, most naturalists agree that the general influence of beavers is a beneficial one.

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