The use and potential of flow devices in beaver management

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Abstract: After being nearly exterminated during the fur trade European beavers (*Castor fiber*) and American beavers (*Castor canadensis*) have been recovering and gradually re-flooding their long-vacant habitats in recent decades. This development has led to a growing conflict with humans. Flow devices are discussed as an alternative to beaver removal in controlling beaver-human conflicts. Flow devices control damming behaviour and therefore water levels. If well designed and well built they are a long lasting, low-maintenance method of preventing unwanted flooding. Furthermore, by negating the need to remove beavers from an area, flow devices allow for the possibility of other, non-threatening wetlands developing nearby. Consequently, flow devices represent an opportunity to preserve and restore wetlands.

Keywords: Castor fiber, *Castor canadensis*, flow device, wetland, beaver-human conflict.

Introduction

As European beavers (*Castor fiber*) and American beavers (*Castor canadensis*) continue to recover from the fur trade they are re-occupying a massive historical range (much of Eurasia and North America) that is now widely dominated by humans. Range expansion, particularly in Eurasia, can be expected to be dramatic in the next few decades (Halley & Rosell 2001). Given this pattern, beaver-human conflicts such as flooding of agricultural land or roads are likely to increase (Czech & Lisle 2003).

Conflicts are typically solved by removing beavers by trapping or shooting. Because of the tendency and ability of beavers to disperse around the landscape seeking new habitats, this is often a short-term solution, particularly if regional beaver populations are healthy and the local habitat is attractive. Therefore, an effective removal strategy has to be perpetual and cover a relatively large area surrounding conflict points (Lisle 2001). Ultimately, this can be expensive.

The installation of so-called flow devices represents an alternative strategy to diminish beaver-human conflicts. By controlling damming behaviour, flow devices allow for the presence of beavers while simultaneously protecting human properties for long periods of time. This has ecological and economic benefits. In this paper flow devices are discussed as an alternative for resolving beaver-human conflicts.

Flow devices

Flow devices control damming behaviour and water levels by making favorable damming sites less desirable, reducing damming stimuli (the sound and feel of running water and visual cues), and essentially sneaking water away from beavers. There are basically two categories of conflict sites: “regular” beaver dams not attached to human structures, and narrow outlets (e.g., road culverts) in manmade barriers. Pipes are almost always used in flow devices in beaver dams. The upstream ends of pipes and outlets both have to be protected with some sort of filter that is usually made with fencing material. Filters exclude beavers and damming debris while dispersing inflowing water over a broad area so it is difficult to detect. Following are two examples of how flow

Photo 1. Castor Master™ pipe systems use a Round Fence™ (RF) for a filter. Many types and sizes of pipes can be used; this one is of polyvinylchloride and measures 0.2 x 4 m. Because the pipe is placed level it has a silencing elbow to prevent the sound of running water from escaping and attracting beavers. This RF is small (diameter: 1.2 m) and lightweight so it has a rock on top of it to help counter liquid-displacement forces acting on the pipe. The pipe is also weighted down where it ends in the dam and covered with branches so beavers cannot access it. This is a relatively small system to match a small stream. *Photograph: Skip Lisle.*

devices and filter design vary according to site type.

The Castor Master™ is a pipe system that is used with a filter called the Round Fence™ (Lisle 2001; photos 1 and 2). Because beavers are conditioned to look for dam leaks *in* dams, pipes should extend into the impoundment until the intake is well separated from the dam. Unlike outlet filters, these filters are not attached directly to the dam or embankment. Therefore, they are relatively small, consistent in shape (upright cylinders), self-supporting, and, because they are used below or near the water surface, capped.

By contrast, culverts end at the edge of the embankment and are typically protected with more traditional fences with frames (at least posts) and no "roofs." A framed fence built "in place" allows for optimum design flexibility, which is important because the topography of every outlet is different. Furthermore, one can build a larger fence in this manner, which is often required for security because of the absence of dam-filter separation. For even more security pipe systems can be added to fence systems at outlets. Beaver Deceivers™ are rugged, wood-frame fences that are molded to match individual sites (Lisle 1999, Lisle 2001; photo 3). It should be noted that fences on culverts should not be allowed to become ecological barriers. Mesh size should be large enough to allow aquatic animals smaller than beavers to pass through. Especially when culverts are underneath busy roads or roads with steep embankments, special "doors" or openings in the fences also may be necessary to allow passage of beavers and large turtles (photo 4).

There have been few studies done on the effectiveness of high-quality flow devices. However, at 277 sites where flow devices were in place for an average of two years problems were solved to the satisfaction of the customer without the need for trapping over 90% of the time (Callahan 2003). In another study (Lisle 1999, and Lisle, unpublished data) maintenance was largely eliminated at 20 sites where clogged culverts and flooded roads had previously been a routine occurrence. This is a seven year record despite the near-constant presence of nearby, untrapped beaver colonies.

Discussion

The beaver-human conflict has become a widespread phenomenon in North America. To date, however, flow devices have not been widely used. Beaver removal has been emphasized over all other management techniques. Four reasons can be identified for the slow acceptance of flow devices: 1. *Legal status and perception of beavers:* Beavers are typically classified simply as "furbearers" and often managed as pests. In most US states harvests are limited only by trapper effort, which is largely determined by pelt prices (Hammerson 1994). There is usually no restriction on the number of beavers that can be taken and seasons are rarely less than several months long. 2. *Concerns about the scale of the problem:* The general perception of wildlife managers may be that the scale of the problem is too large to address by the use of flow devices only. However, beavers focus their damming efforts in small, low-gradient streams (Lizarralde 1993, Lisle 2001). Within these areas, which may only represent 1-2% of the landscape, conflicts are frequently limited to "flash points" like road culverts (Lisle 1994). For example, despite high beaver populations,

Photo 2. A Castor Master™ with a submerged polyethylene pipe 0.3 x 12 m. If pipes are placed so there is little difference between the water level above and below beaver dams, fish can easily swim through. *Photograph: David Wilkins.*

Photo 3. At narrow sites Beaver Deceivers™ should create a salient down the middle of the stream that allows beavers to swim by the front of the fence. If the fence blocks the channel, the front is likely to become a beaver dam. Crescent-shaped models like this one (perimeter: 11 m) work well at sites where the stream enters the outlet at an angle. *Photograph: Skip Lisle.*

relatively dense road networks, and fairly flat terrain, there were only 18 conflict points on 52,610 ha in Maine (Lisle 2001). It is also possible that a class of private contractors will develop to take over this work, which has historically been the responsibility of government agencies with insufficient resources to do it themselves. 3. *Limited and apparently bad experience with flow devices:* In certain occasions flow devices have been used, but the construction has been of a low quality and they have failed, reinforcing the original belief in the necessity of lethal control (Langlois & Decker 1997). 4. *Public opinion:* People may opt for a removal strategy simply because of a lack of knowledge and understanding of the key role beaver play in ecosystems (Muller-Schwarze & Sun 2003). Human intolerance of beavers, reinforced by a centuries-old predator and pest-control mentality, is often compounded by the belief that the presence of beavers will invariably lead to economic loss. Furthermore, the re-birth of ancient beaver-created wetlands, or flowages, is frequently greeted with the shocked sense that the land was "never like that before".

On the positive front, society is beginning to recognize that healthy aquatic ecosystems have significant monetary value (Costanza et al. 1997, Hey & Philippi 1999). For example, the US government instituted a "no net loss" programme that has attempted, with mixed results, to arrest the steady, longstanding loss of wetlands by building manmade replacements (cf. National Research Council 2001). There is great potential to recruit beavers in this effort. If a small fraction of wetland mitigation money or other funds now used for extirpation programmes could be diverted to landowners or municipalities to help protect properties non-lethally, and keep beavers in place, it could result

Photo 4. A 30 cm polyethylene T-joint in the front of this Beaver Deceiver™ keeps beavers and large turtles out of traffic by allowing them to travel through the fence and therefore the road culvert. The 90° angle prohibits beavers from transferring woody damming material inside. *Photograph: Skip Lisle.*

in a phenomenal increase in natural, high-value and low-cost wetlands. This type of monetary incentive would also encourage businesses to specialize in non-lethal strategies for controlling beaver damage. Furthermore, by protecting properties in a long-term manner flow devices can greatly decrease maintenance costs (Lisle 1999).

Conclusion

Well-built flow devices are an effective way to control beaver-related flooding. Success is greatly enhanced when designs are site-specific and when the builder has a good understanding of beavers and flow devices. Depending on the site, some monitoring is required to guarantee functionality. To increase the use of flow devices a change in the legal status of beavers is needed to reflect their status as a keystone species. The public image of beavers also needs to be improved through education. If beaver removal policies are replaced by non-lethal strategies, property defense and maintenance expenses could be reduced while simultaneously restoring a wealth of age-old wetlands.

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Samenvatting

Het gebruik en de potenties van stroomapparaten bij het beheer van bevers

Nadat de Europese en de Amerikaanse bevers (*Castor fiber* en *Castor canadensis*) door de pelsjacht vrijwel waren uitgeroeid, herstellen de beide soorten zich nu en hebben in de afgelopen decennia hun lange tijd leeg gebleven niche opnieuw bezet. Deze ontwikkeling leidt tot steeds meer conflicten met de mens. We bespreken het gebruik van zogenoemde 'stroomapparaten', een alternatief voor het verwijderen van bevers van plaatsen waar ze problemen voor mensen veroorzaken. Stroomapparaten houden het bouwen van dammen door bevers onder controle en daarmee ook de waterstanden. Als ze op juiste wijze worden ontworpen en geïnstalleerd vormen deze voorzieningen een duurzame en weinig onderhoud vergende aanpak ter voorkoming van ongewenste overstromingen. Het grootste voordeel is dat bevers niet uit het gebied hoeven te worden verwijderd. Hierdoor ontstaat de mogelijkheid om meer wetlands tot ontwikkeling te laten komen zonder dat dit gevaren met zich meebrengt. Dit betekent dat stroomapparaten een mogelijkheid bieden voor het herstel van wetlands.

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