

## **Beavers, Beavers Everywhere**

The Tres Rios Wetlands and our large semiaquatic herbivorous rodent friends

Alice Brawley-Chesworth P.E., Civil Engineer III, City of Phoenix Water Services Department

Aimée Conroy, P.E., Water Services Superintendent, City of Phoenix Water Services Department

Presented at the 2004 AWWA Water Sources Conference

### **Abstract**

The Tres Rios Constructed Wetlands Demonstration Project was planned, designed, and constructed to provide habitat, water treatment, low-impact recreation, and research opportunities in Maricopa County, Arizona. Experts from around the country contributed data and experience to make this a successful project.

After initial construction was completed, the true river engineers moved in with their own plans for the water and vegetation – the beavers. Our approximately 13 acres of wetlands became home to around 50 beavers. They dammed our outlet structures (apparently 13 acres wasn't enough for a growing family), ate our trees, and tunneled into our berms. Most pleasing of all, they created short-circuits for the water by dragging branches across the wetlands to their dams, scraping out the bottom of the wetland cells and creating beaver highways. Who knew they were also traffic engineers? Our neighbor to the north, Congressman Stump, was now able to live up to his name, as his trees became stumps due to our beavers. And once again, we humans were reminded of our place in the world; to be frustrated and overruled in our feeble attempts to control nature.

After a few months of politely asking the beavers to leave and even lecturing them on occasion, we decided that things were now getting serious. Many suggested selling beaver skin hats and coats (we also hear beaver burgers are delicious). But, as a public institution, we're not ready to go into retail sales. So, taking this welcome opportunity to get more research done, we geared up with the United States Department of Agriculture, Wildlife Services to study non-lethal control options. We tried fencing, painting trees, mild shocking devices and most successfully, "Keep Out" signs.

These last few years have certainly been a learning experience for everyone involved with Tres Rios. We now know better than to think that we have any control over wild animals.



### **Background**

Arizona, and the desert southwest, has lost most of its riparian and wetlands habitat over the last 100 years. Early in the century the large rivers were dammed to provide water and flood protection to the growing Phoenix metropolitan area. This, along with groundwater pumping throughout the state, has

caused the loss of approximately 90% of the original riparian areas. The Salt River is completely dry through most of Phoenix, except for discharges from the major Wastewater Treatment Plants and a few comparatively small storm water outflows. The largest of these Wastewater Treatment Plants is at 91<sup>st</sup> Avenue. The 91<sup>st</sup> Avenue Wastewater Treatment Plant is jointly owned by the participating cities in the Sub-Regional Operating Group (SROG), including the cities of Glendale, Mesa, Phoenix, Scottsdale, and Tempe. Since the mid-1980's SROG has been interested in reclaiming this water for various uses, including restoring a portion of the Salt and Gila Rivers (which come together just downstream of 91<sup>st</sup> Avenue). Thus, the idea for Tres Rios was born. As an added bonus to the owners of the Treatment Plant, constructed wetlands also provide extra polishing of the water.

The Tres Rios Demonstration Constructed Wetland Project (Tres Rios) has been operational since 1995, using reclaimed water to provide water quality improvements, wildlife habitat, recreational opportunities, and research opportunities in the far south west corner of Phoenix, Arizona. The wetlands area is split into three sites, with approximately 13 acres of emergent marsh, free-water surface wetlands. Research has concentrated on water quality improvements, vegetation sustainability, mosquito control, and wildlife attraction. Tres Rios was constructed and is run with help from the United States Bureau of Reclamation and research and operational knowledge gained from the Project will be used in design of a larger, full-scale wetlands and river restoration project being built by the United States Army Corps of Engineers in the same area. Some of the other partners in Tres Rios include the Arizona Department of Water Resources, Arizona Game & Fish Department, Environmental Protection Agency, Arizona State University, and University of Arizona.



### **Hooray, We Have Beavers!**

Contrary to popular belief, this area of the Salt and Gila Rivers was once lush and marshy. Amadeo M. Rea quotes in his book "Once a River"

There were extensive marshes, swamps, and floodplains with cattail (*Typha domingensis*), bulrush (*Scripus olneyi*), giant reed (*Arundo donax*), commonreed (*Phragmites communis*), arrowweed (*Pluchea sericea*), and many trees.<sup>1</sup>

Beavers were responsible for creation of many of the marsh areas through dam building along the river. However, beaver trappers entered the area, the rivers were dammed, and beaver numbers declined in the late 1800's and early 1900's until the area was left with few signs that beavers ever resided here. The Tres Rios team was excited and surprised to discover soon after completion of the wetland that beavers had moved in once more. The arrival of the beaver was a sign that the wetlands were doing their job in attracting native wildlife and providing habitat that has been severely degraded in the last 100 years.

### **Help, We Have Beavers!**

Then, the beavers multiplied. Using a nighttime spotlight survey, beaver numbers were estimated at somewhere between 34 and 50 individuals. Other evidence of excessive beaver activity included extensive damage to wetland plants from foraging, cut or girdled trees, burrows, and runways. The

outlet weirs were repeatedly clogged, making it impossible to regulate the flow and level of the water surface. Berms and maintenance roads were compromised. Water short-circuited through the runways established by beavers dragging wood to burrow sites. The detention time in the wetlands was shortened, and wetlands staff was having trouble just keeping up.

At this point the managers at Tres Rios realized that a few beavers were good, but 50 beavers were bad. What could they do about it? A quick check of the internet gives some good suggestions on how to catch, skin, and cook beavers (sweet pickled beaver sounds delicious and can be found at [www.justgamerecipes.com](http://www.justgamerecipes.com)). In fact, a recent article in the Associated Press relates the story of a Girl Scout Troop in Alaska that does just that.<sup>2</sup> Maybe Tres Rios could work this into the public education and recreation component of the Project?

But, instead a call was put in to the United States Department of Agriculture Wildlife Services (Wildlife Services). They have experience all over the country in beaver control. It turns out that many places across the country have similar problems with excessive beaver numbers causing destruction of habitat. Since it is no longer popular to wear beaver fur hats and coats (darn, there goes a potential revenue stream for Tres Rios), and since riparian habitats have been losing ground in some parts of the country, beaver control has become a necessity for many communities across the United States. Wildlife Services has taken the lead in many of these beaver control programs. However, many of these rely heavily upon removal and destruction of the individual beavers overpopulating a region. This option (though tempting) was not acceptable to the managers of Tres Rios.

### **Now What Do We Do? Phase One.**

After consultation with Wildlife Services, a cooperative non-lethal beaver research program was established. This research is devised in two phases. The first phase is complete and the second phase is entering its second year. The first phase had the following goals<sup>3</sup>:

1. Assess efficacy of fencing, electronic beaver guard, frightening device to reduce beaver damage to bulrush and cattails on demonstration plots.
2. Assess efficacy of fencing, frightening device to reduce beaver damage to cottonwood stems on demonstration plots.
3. Assess impact of these techniques on flora and fauna on demonstration plots.
4. Develop a poster presentation demonstrating possible non-lethal approaches to reduce beaver damage to vegetation
5. Develop a long-term project to address concerns caused by aquatic mammals on wetland restoration areas.

Basically, this phase involved scaring the dickens out of the creatures so that they'd go away.

Just before the research was to begin, the Tres Rios team noticed a decline in beaver numbers. Local citizens have reported people shooting some of the beavers to take home for dinner. Other theories include disease (no sick or dead beavers were found at the wetlands) and predation by wild dogs and bobcats that live in the area. The other possibility, of course, is that the beavers saw the Wildlife Services truck coming, and ran for their lives.

Even so, some good information was obtained from Phase I. There did appear to be some value in fencing of particularly vulnerable areas (a new stand of cottonwood trees, a newly revegetated area of the wetlands), but forage material would need to be found elsewhere. In other words, beavers can't be fenced out of the entire wetland; they'll dig under the fence before they starve. Also, textural repellants appeared to reduce damage to selected trees. Mixing sand in with paint, and then painting the trees caused the beavers to avoid these areas in favor of untreated areas. However, the scare

devices did not work over the long term. Beavers got used to the sound, light, and mild shock devices very quickly.

### **Now What Do We Do? Phase Two.**

Everyone knew the beavers would be back, so a five-year plan was developed with most of the early research efforts occurring in Wildlife Service's laboratory in Washington State. The major objectives of the first year of Phase two were<sup>4</sup>:

1. Develop a mobile laboratory (to hold beavers, insert transmitters, and possibly perform surgery)
2. Identify proper anesthetics and recovery times
3. Develop ways to insert transmitters in beavers in the field
4. Determine beaver response to select visual, auditory, and tactile stimuli (can we make the wood feel and look bad? This includes painting the trees with sandy, colored paint)
5. Determine beaver response to select olfactory and gustatory stimuli (can we make the wood smell and taste bad?) and identify stimuli they don't like
6. Determine whether beaver can be conditioned to avoid select foods (this involves giving them a tummy ache – akin to a person eating a bad piece of fish, and then they will avoid eating fish for a while)
7. Develop general informational materials on beaver ecology and behavior.

The mobile laboratory is now complete, and ready to be moved. Controlled experiments have been conducted with anesthetics and transmitters. Research has begun on different colors, textures, smells, and tastes to repel beavers from target areas. The next step is to move all this down to Arizona and see if everything works as well with wild Arizona beavers as it does with captive Washington beavers.



### **And Into the Future . . .**

Recent surveys have indicated a return of the beavers. Evidence of damage to trees and burrowing has been seen in the wetlands. This validates the Tres Rios team's decision to continue with the research. The long term plan has five major objectives<sup>4</sup>.

1. The first objective is to develop new research methods. Since non-lethal beaver control is a relatively new concept, innovative methods need to be developed.
2. The second objective is to develop non-lethal means of restricting beaver movements or altering damaging behaviors. Fencing and textural repellants were the first step in this research. Later phases will try to refine these techniques and explore other options (for example chemical/olfactory repellants).
3. Another objective is to develop effective strategies to protect wetlands. Most of the available literature on beaver control was conducted in the Midwestern or northern United States, and little is known about their applicability to warmer climates. The goal is to develop an understanding of reproductive and foraging behavior in this climate.

4. Fourth, the team will try to monitor beaver movement. An understanding of dispersal patterns will be important to control damage to surrounding properties. A capture, tag, and release study will be conducted. Also, transmitters will be inserted into some animals so that real time tracking of movement can occur.
5. Education is also a very important part of this research. Tres Rios and Wildlife Services are both committed to providing all of the information to others who can use it in their wetlands. Informational materials will be prepared, and presentations will be made at scientific and public meetings.

## **Conclusion**

Beavers are a natural and desirable species for any wetland in North America. Their activities promote vegetation and animal diversity and help reduce erosion. They are native to the Salt and Gila Rivers, and need to be maintained at a sustainable level in a restoration project. However, excessive activity can cause many problems. The research currently being conducted by Wildlife Services and Tres Rios staff will be vital in maintaining acceptable populations of beavers within the full-scale Tres Rios project. The research is currently at a very early stage, but will continue for approximately four more years, providing the opportunity to learn much about beaver ecology in the southwestern United States, and assess efficacy of non-lethal control options.

In the end, a balance is always achieved. As food runs out, populations decline then rebound when food is more plentiful. This is a natural process when a species moves into a new area. However, in a constructed wetland with varied purposes, this type of a cycle is not ideal. Invasive species, such as salt cedar, can quickly replace more desirable native species, unless efforts are made to protect the natives. The goal of the research is to provide a more stable beaver population, which will stop this destructive boom and bust cycle from happening. In the end, humans are only capable of controlling nature to a very limited degree. By understanding the natural process, and working within the limits, Tres Rios hopes to provide a habitat that is beneficial to beavers, other native plants and wildlife, and humans.

## **References**

- <sup>1</sup> Rea, A. *Once A River, Bird Life and Habitat Changes on the Middle Gila*. University of Arizona Press, Tucson, Arizona 1983.
- <sup>2</sup> D'Oro, R. "Beavers, not cookies, for these Girl Scouts". Retrieved November 13, 2003 from the World Wide Web: [http://seattlepi.nwsourc.com/national/147839\\_scouts12.html](http://seattlepi.nwsourc.com/national/147839_scouts12.html).
- <sup>3</sup> Nolte, D., Bergman, D., Tres Rios Beaver Research Project Report. December 1, 2002.
- <sup>4</sup> Nolte, D., Bergman, D. Tres Rios Beaver Research Project Report – 2003.