



Methow Beaver Project

Accomplishments and Outcomes

April 2013



The Methow Beaver Project

History and Establishment

In 2000, John Rohrer had an idea. As a Forest Service District Wildlife Biologist working in the Methow Valley, he thought that ‘nuisance’ beavers removed by Washington Department of Fish and Wildlife enforcement agents might be valuable to restore an old wetland on Forest Service land where he had seen water tables lowered and riparian vegetation lost. After a series of releases there, the beavers set up shop and began restoring the site, returning the wetland to a 23 acre complex of dams and wet meadows. For the next few years, more attempts followed, some successful, some less than successful. All of this was a backyard, spare-time effort to try to improve places that had once held beavers. An inspiration for John was a 1932 map from the Forest Service archive that showed the original beaver relocation work at 61 sites in the Methow Valley. If it was possible to re-establish beavers then, maybe now would be even more feasible.



South Fork Beaver Creek successfully restored site

The year 2000 was a crossroads for beaver restoration in Washington State because the Legislature passed a bill that year banning body gripping traps statewide, meaning that it would be more difficult for trappers to remove beavers from streams where they had become established.

In 2006 Jon Merz with the Washington Department of Ecology learned about the project and thought there might be an improvement to water quality if beavers were returned to historic places. On the day after Christmas that year he met with USFS biologist Kent Woodruff to talk about the possibility of working toward solutions to the temperature violations that had been noted in the Methow Drainage.

For the next 6 months Ecology Staff, USFS biologists and hydrologists, Methow Conservancy Stewardship Director Steve Bondi, WDFW biologists Kim Bondi and Scott Fitkin, and Pacific Biodiversity Institute spatial analyst Hans Smith met to craft a project that could begin to restore beavers to suitable habitat in historic locations in the Methow. The team proposed to Hatchery Manager Chris Pasley the idea of using the Winthrop National Fish Hatchery as a holding facility, and he enthusiastically welcomed the project.

The result was an Implementation Plan, a partnership Memorandum of Understanding, a project structure including a steering committee, and partnership financial agreements that allowed Direct Implementation Fund money granted by DOE to be shared by the group to begin relocating captured beavers in spring 2008 to places where they would be more welcome.

Project Objectives

Beaver restoration efforts can have different objectives. For this project we decided to pursue the following:

Re-establish beavers in the Methow Watershed to places they occurred historically. Work with landowners to find solutions to nuisance issues. Share information that can help our community recognize the complexities of our water quality issues and the contributions healthy beaver populations can provide. Utilize beavers' unmatched natural engineering ability to build and maintain dams high in the watershed, bringing about the following benefits:

- **Store water for later season delivery**
- **Raise ground water levels in upper reaches of watersheds**
- **Improve water quality by reducing stream temperature**
- **Reintroduce complexity and dynamism to streams that were simplified when beavers were removed**
- **Increase nutrient availability in streams**
- **Improve stream function by reconnecting floodplains**
- **Decrease sediment delivery to the stream system**
- **Improve rearing and winter habitat for salmonids and other native fish**
- **Improve and expand riparian and wetland habitat**

A substantial amount of literature supported the teams' assertion that these objectives could be met by returning beavers to places they occupied historically (see Appendix A).

The ultimate goal is to successfully return beavers to 50 locations in the Methow Watershed in 10 years. If we succeed, we are confident this will provide a measurable, lasting benefit to the watershed.



2010 successful establishment on Libby Creek

Project Methods

A project Implementation Plan has been the guiding document for the project. As part of implementation, we developed a list of tasks needed to allow for successful re-introduction. Some were programmatic like “establish goals”, “assemble appropriate partners”, and “pursue a broad education campaign”. Others involved the basic mechanics of beaver establishment and included:

- 1. Identify suitable habitat**
- 2. Assess current population status**
- 3. Evaluate individual sites for suitability**
- 4. Determine priorities for release sites**
- 5. Interact with landowners who have beaver issues**
- 6. Pursue a trapping effort to remove beavers prior to lethal action**
- 7. Provide a facility for secure, healthy, short-term husbandry and group aggregation**
- 8. Carefully prepare the release site**
- 9. Deliver beavers as a group to the selected location**
- 10. Monitor beaver use**
- 11. Document results**

Project Implementation

After a very successful pilot year, an ambitious first phase effort was proposed to deliver beavers to at least 15 sites in the first four years with the goal of at least 5 sites becoming established in three watersheds. Prior to this project the success rate reported in other reintroduction projects in the Western US was about 20%. We felt like we might be able to improve upon that level of success.

In addition, because *documenting* the water quality benefits was also a project goal, we proposed to design and set up a monitoring effort to answer the questions:

- ✓ Does reintroduction of beavers affect the magnitude of water temperature in subwatersheds?
- ✓ Does reintroduction of beavers affect streamflow in small-order streams ?

To these ends, a grant was secured by the Methow Conservancy from the Washington Department of Ecology administered, Federal Clean Water Act Section 319 Program, followed by matching support contributed by the Yakama Nation, the National Fish and Wildlife Foundation, and Ecotrust.



Beaver sexing

One of the significant innovations of this project, beyond developing a strong GIS analysis of the beaver habitat, was the ability to rapidly and reliably tell male and female beavers apart. The need to determine gender is obvious, but is confounded by the confusing physical structure of beavers, with two sets of glands, internal reproductive organs, and genital openings that are difficult to discern – especially on live beavers that could inflict serious injury with their teeth.

Our initial effort was to work with the University of Idaho Genetics Laboratory lead by Lisette Waits. We helped the team there develop DNA markers for beaver males and females. We then collected hair from all beavers we captured and sent it to the lab for gender ID. This proved 100% reliable for sexing beavers and resulted in a 2011 publication (Goldberg et al. 2011). Issues were the 10 – 15 day turnaround time and the expense for the lab analysis.

In May 2011, with the generous help of beaver expert Dr. Lixing Sun at Central Washington University, we learned how to determine gender with secretions from the oil glands of beavers captured. His approach involved expressing oil from oil glands while beavers were anesthetized and examining color, odor, and viscosity. We learned that oil from male and female beavers is distinctly different. Issues were the 1-2 hour processing time for each beaver and the expense for anesthesia.

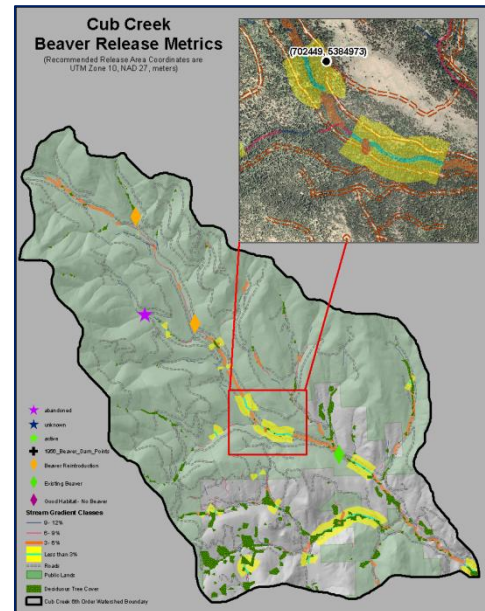
The next improvement involved connecting with the local North Cascades Smokejumper base where we asked for help designing a restraint bag that could eliminate the need for anesthesia. After a few trials, our jumper friend, J.T. Sawyer created a sturdy nylon funnel that fit over the Hancock traps and very effectively allowed us to hold a beaver immobile for our entire intake process, including sex determination, with no injury or trauma to crew members or beavers. Now, three to five minutes was the time required to remove beavers from the trap, sex, tag, and release the beavers into the holding facility. For the rest of the season we compared the crew's ability for oil gland sex determination with DNA hair analysis. At the end of the season we learned the process was 100% accurate and reliable.



The ability to quickly and reliably determine the sex of captured beavers greatly improved our competence in making grouping choices in the holding facility. This innovation, along with providing a period of group acclimation at the facility, was perhaps the most substantial benefit to increasing the establishment rate for groups released, because we had strong assurance that compatible males and females were included in release groups.

Project Benefits and Results

One of the most valuable initial connections for the project was with Hans Smith and Pacific Biodiversity Institute. They helped the project immensely by creating a model that became **the initial Geographic Information System assessment of the available beaver habitat for the entire Methow watershed**. This was an instrumental tool for evaluating beaver habitat suitability. In 2010 USFS spatial analyst Chaochung Tsai added his talent and helped refine the model that showed the places where suitable stream gradient, appropriate stream flow, and available food resources occurred together.



In 2011 the field crew helped **develop a score card used to assess individual sites in the field**, and in 2012 that was refined to the current final Release Site Score Card (Appendix B).

Our beaver intake procedures have evolved over the years. We now have **a written, thorough, detailed intake protocol** for tracking each individual beaver from capture to release and to any subsequent encounter.



We created a comprehensive release site monitoring protocol and a standard measure of success.

After release we visit the site weekly for 8 weeks, then semi-monthly for the rest of the first season. We deliver a small amount of aspen at each visit to provide some food and to help determine continuing beaver activity. We record the presence of beaver sign and look for dam and lodge building activity. If a site remains active for a period long enough to produce young, and if the beavers have maintained at least one dam sufficient to at least double the cross-sectional measure of the stream (width x depth), then the site is determined to be successful.

In 2012 we developed a **beaver handling protocol** to assure the safety and health of our crew, our visitors, and the animals we interact with each day.



We pioneered a **tagging system of FLOY ear tags for temporary identification in the holding facility, and tail injected PIT tags for permanent identification and movement analysis.** The tail tags are detected on either hand held readers for identification or



instream readers used for fish monitoring and allow

some indication of dispersal after release. Because

the tags are permanent and require no battery, we will be able to know about beavers we have handled if they are encountered again.

Temperature and flow investigation

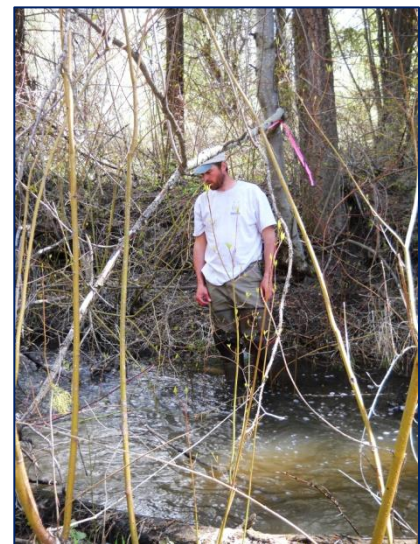


The substantial effort lead by Dr. Richard Woodsmith of the USFS Wenatchee Forestry Sciences Laboratory to **develop a comprehensive stream temperature and flow study using a Before-After, Control-Impact design to document the magnitude and scale of temperature improvement and the amount of flow attenuation in streams where beavers are re-introduced is unprecedented.** The scientific rigor with which we are attempting to document the changes in stream characteristics has not been attempted to date. The

study plan requires a minimum of 3 years of pre-treatment (pre-beaver release) data collection and 3-5 years of post-treatment data collection before results can be analyzed. That we were able to find suitable sites



for all replicates, establish and instrument all 6 flow stations, and establish and instrument all 32 temperature stations in one field season (consistent with Washington Department of Ecology SOPs and with the approved project Quality Assurance Project Plan) was nothing short of astounding. The 2011 field crew of Alexis Monetta, Carmen VanBianchi, Gabe Spence, and Chris Venum deserve



special recognition for the magnitude of their effort toward the success of the monitoring program. The data we have gathered since the sites were established will lead to a peer reviewed analysis and published results in about 5 years.

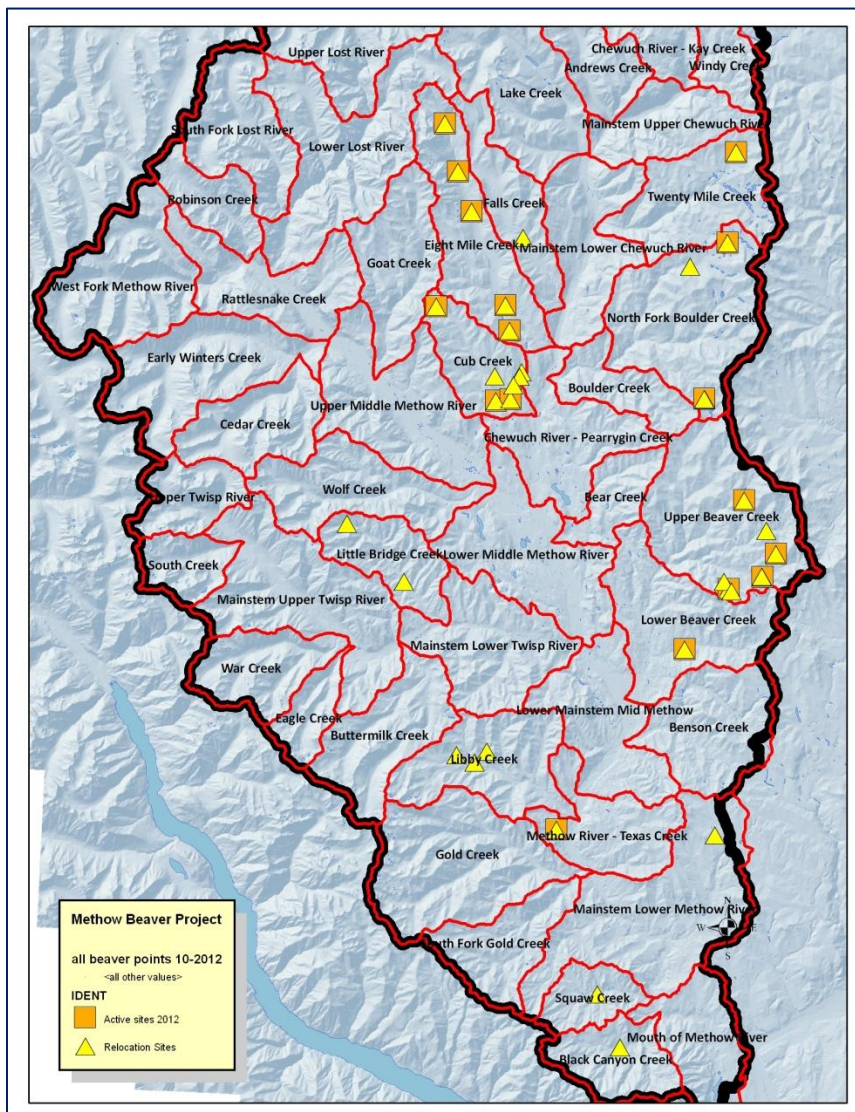
Beaver Capture and Release Outcomes

To date we have captured 181 beavers from 54 locations. In a few cases we did not keep the beaver, a few beavers died, and in 6 cases, beavers managed to escape from the holding facility. We have released 163 beavers to 35 sites. Beginning in 2011, all beavers captured were permanently marked with PIT tags for future identification. To date, because of these tags in the tail, two beavers were documented as recaptures of beavers we had previously caught and released. Both had travelled some distance. The furthest was about 37 miles from the release location.

Beaver Establishment Outcomes

Figure 1 displays the locations where we released beavers and where those efforts were successful. On October 25, 2012 17 sites were active. 14 sites have been established long enough to be considered successful

Figure 1. Methow Watershed Beaver Release Locations



Establishment examples



2012 successful establishment on South Fork Boulder Creek



2011 successful establishment near Bear Mountain

Temperature and Streamflow Data Outcomes

Figure 2 shows all the stream monitoring locations. The comprehensive study plan for this effort was completed in March 2011 and a Quality Assurance Plan was approved by the Department of Ecology. In June 2011, data gathering began at these sites for stream temperature and stream discharge. 82 temperature loggers are currently capturing baseline stream temperature in 18 subwatersheds. Six flow stations with water pressure loggers in 6 subwatersheds are currently documenting rising and lowering stream elevations. Hydrologic ratings curves for these six streams will be constructed in 2013 and flow calculations will then be derived. After the baseline period, beavers will be released at half the sites and all will be monitored for a period to determine what the effects to stream temperature and stream discharge are. We expect this to require another 3-5 years

Figure 2. Stream monitoring Stations

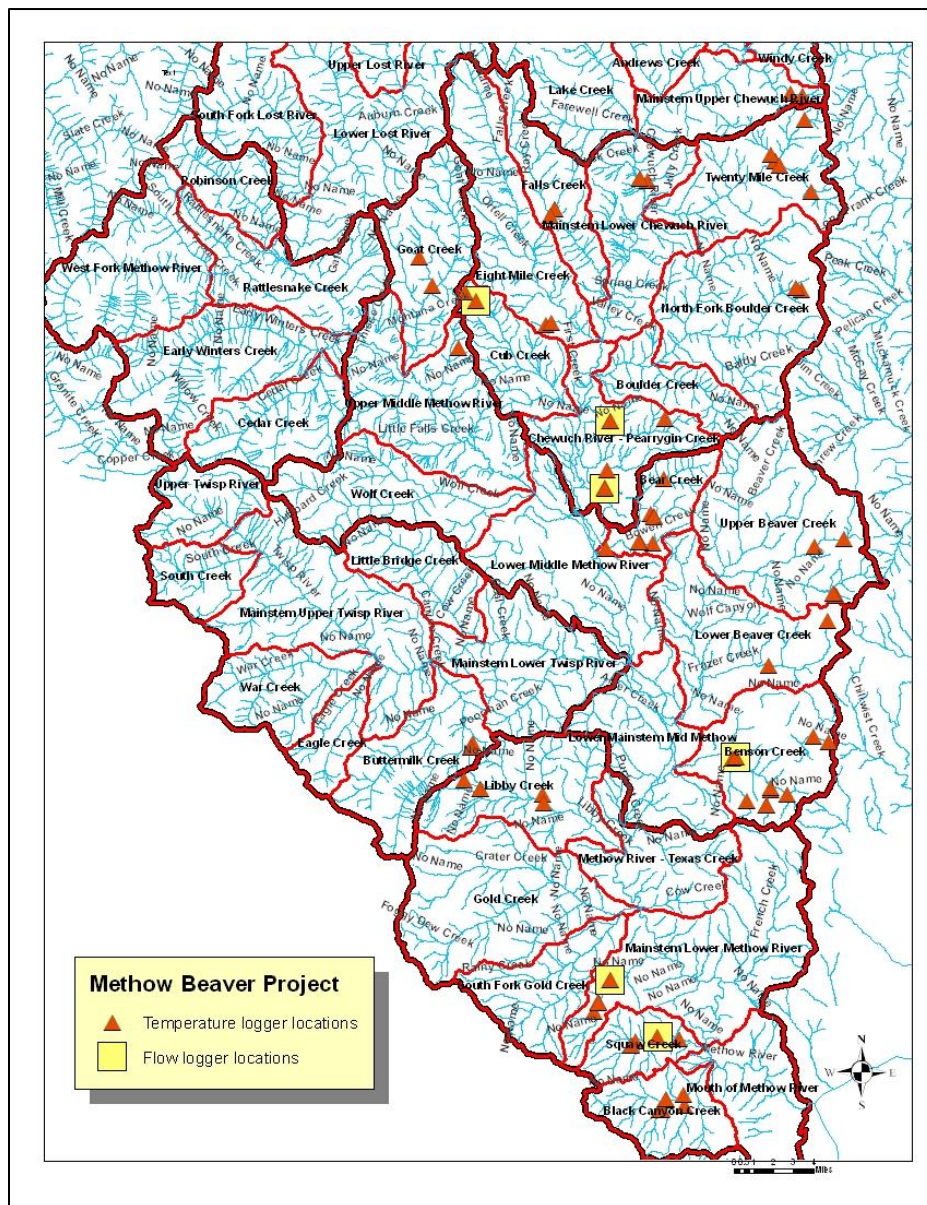


Figure 3 is an example plot of temperature records for approximately one year for one of the 84 temperature data loggers currently deployed. This plot is from the Chicamun Creek tributary to Libby Creek. This time period contains 17,096 records and shows a temperature range in that period from -0.06°C on February 27 to 11.47°C on August 17. **Figure 4** is a subsample plot of the same data.

Figure 3. Temperature graph for Chicamun Creek bottom monitoring station 10-6-11 to 9-26-12

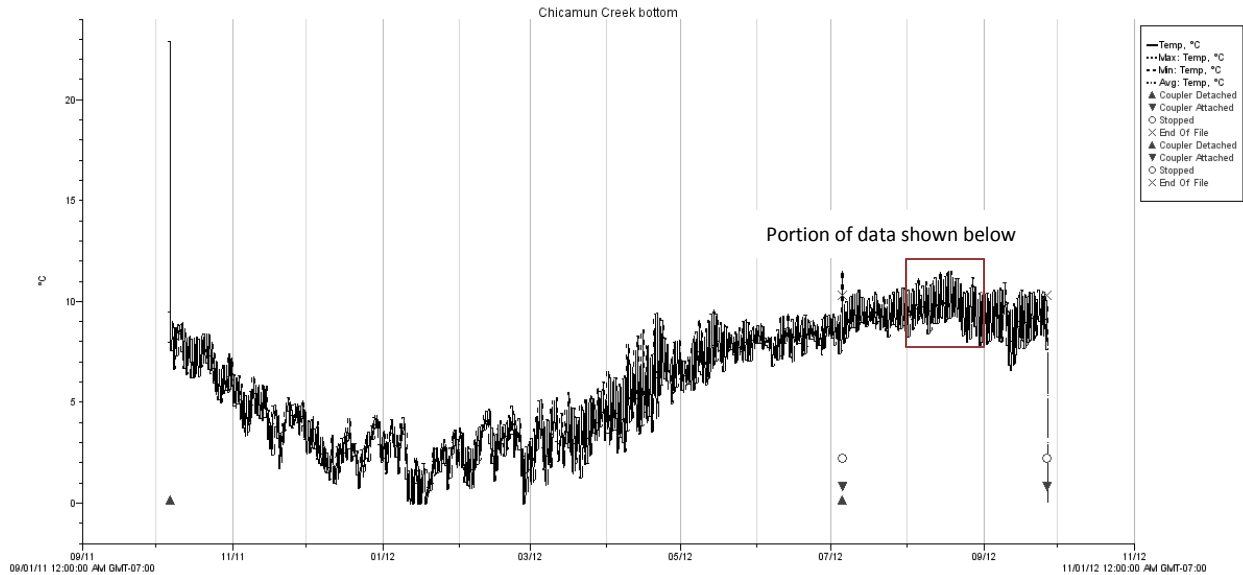
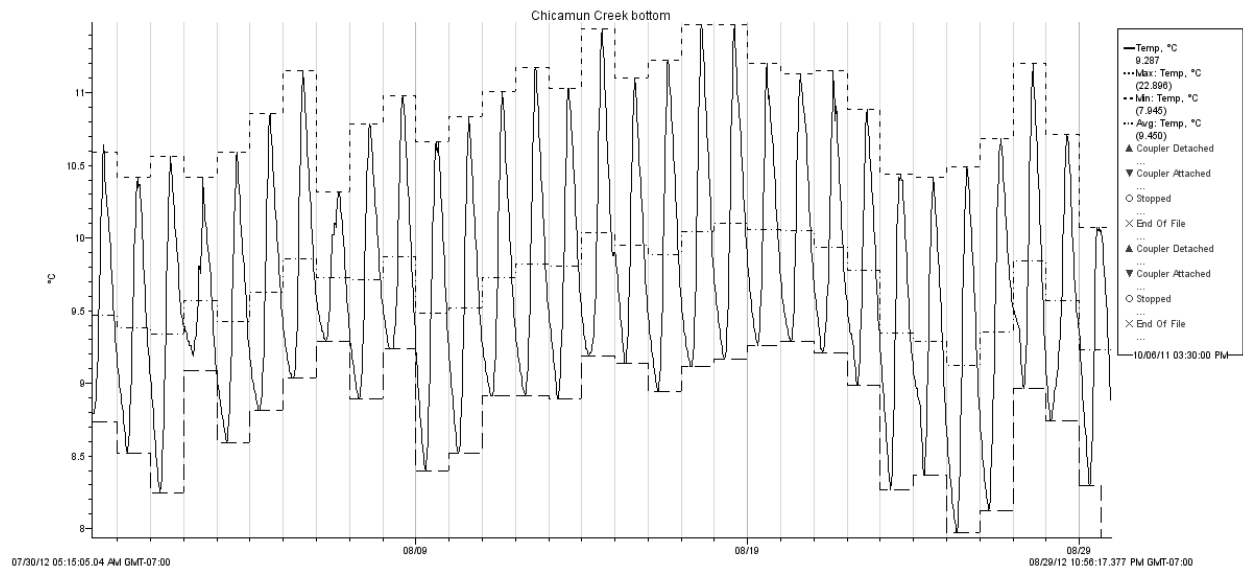


Figure 4. Temperature graph for Chicamun Creek Bottom monitoring station 7-30-2012 to 8-29-2012



Education Outcomes

The project partners developed and have implemented an Education Plan. **Table 1** shows the list of education programs and when they were provided.

Table 1. Education and Outreach Programs for the Methow Beaver Project as of October 15, 2012.

Program	2008	2009	2010	2011	2012	Topic
First Tuesday Presentation	x					Beaver ecology, 150+ people.
Newspaper article	x	x		x	x	Methow Valley News 6-13-2012. Wenatchee World 8-2010.
Classroom entry	x	x	x	x		Kindergarten and elementary school- interactive ecology lessons, holding facility tours.
National Fishing Day	x	x	x	x	x	100's of families/yr see captive beavers and read interpretive materials.
Public tour	x	x	x			Beaver ecology and release site assessment.
Water quality www link	x					Water quality/beaver project information.
Other press	x	x	x	x		Methow Conservancy fall/ winter newsletter. Ruralite.
Volunteer efforts		x				Audubon of Washington sponsored bird surveys.
Project information sheet	x	x		x		One page white paper for interested people.
Water quality community program				x		One planned for in 2011-2013.
Hatchery facility exposure/ water quality message delivery	x	x	x	x	x	500 visitors annually 2010-2013.
Classroom programs	x	x	x	x	x	>2/yr in 2010-2013 regarding beavers and their benefit to water quality.
Technology transfer workshops		x	x	x	x	Two in 2010-2013, perhaps through NW beaver symposium.
Publish article				x	x	One article in 2010-2013 that promotes beaver restoration as a water quality solution and highlights the innovative collaboration of project partners. Ruralite 7-5-11
www link on Methow Conservancy www site			x			Notes the partners engaged in water quality improvement and the actions undertaken in the watershed.
Interagency Publications	x	x				USFWS and USFS Regional Newsletters,
Academic Institutions			x	x		Interact with academics at various Colleges and Universities
Presentation to Methow Conservancy Stewardship Committee				x		Update on the beaver project accomplishments

Education activities



The education effort has been very successful. Since 2008, the project has reached more than 9000 people with watershed stewardship, water quality, and habitat conservation messages. See the link on the Methow Conservancy web page http://methowconservancy.org/beaver_project.html

In 2012 we contributed one small piece of a beaver documentary produced by David Suzuki for the Canadian Broadcasting Company and airing on Canadian and US television in 2013. <http://www.cbc.ca/natureofthings/beaverwhisperer/watch.html>

Also in 2012, we contracted Steven Foreman to produce our own project documentary compiled from video footage that Steven made and also footage captured by an Ecotrust film crew in June 2012. That documentary is available at <http://www.youtube.com/watch?v=CDXO0Yc8aOs>

Perhaps the most positive education event for the project is our participation with a number of partners in the US Fish and Wildlife Service sponsored National Fishing Day event at the Winthrop Fish Hatchery. We have shared the benefits of the beaver project with more than 2000 kids and adults at that event alone.

Another education activity is regular coordination with the Methow Restoration Council. We share information regularly with participating fisheries and watershed managers at monthly MRC meetings. The MRC Outreach Committee is charged with design and delivery of key messages for stewardship of local fisheries, water quality and quantity, and habitat restoration projects, as well as data gathering and presentation of results for local scientific studies. They highlight the beaver project as one of the successes in the watershed.

We have presented information at 4 annual beaver conferences and shared the techniques and discoveries we have made.

Landowner Outcomes

Working with landowners to solve beaver related issues is a positive part of the project. Many of these people recognize the partners participating in the Methow Beaver Project and appreciate the help and advice they receive for free. Sharing messages about beavers' role in water quality and beavers' ability to enhance late season water availability are key messages. That this project might be able to help landowners where problems are occurring with beavers is a key project contribution.

Following are the contacts made to date:

Landowner/Entity	2008	2009	2010	2011	2012	Capture?
Moccasin Lake Ranch	x			x	x	Y
Town of Winthrop	x	x				Y
Spring Creek Ranch	x		x	x	x	Y
Twisp Power & Irrigation Co.	x	x	x		x	Y
Wolf Creek Irrigation District	x		x			N
Barkley Ditch Co.	x		x	x	x	Y
Libby Creek Farm		x	x	x		Y
Hugh Glassburn		x				N
Shirlee Evans			x	x		Y
Patterson Lake Cabins	x	x	x			Y
Ray Robertson	x	x	x	x		Y
Bud Stevie		x	x		x	Y
Vic Stokes	x	x	x			N
MSRF – Chris Johnson	x	x	x	x	x	Y
Don Phillips	x	x	x			Y
Tim Sprague	x					Y
Doug Breed		x	x		x	Y
Lucy Reed	x	x	x			N
Okanogan County	x	x	x			N
Chelan PUD	x	x	x			N
John O'Keefe		x				N
Melton Utley		x	x	x	x	N
Bob Hart		x	x		x	N
Sarah Ulrich		x	x			Y
Smokejumper base			x	x		Y
Bernard Wathen			x		x	Y
Dustin Evans – MVID			x			Y
Covenant church			x			N
Larry Hill			x	x	x	Y
Kings			x		x	Y
Marc Hallet			x			Y

Landowner/Entity	2008	2009	2010	2011	2012	Capture?
Kammers			x	x		Y
Buzz and Betty Ann Elly			x		x	Y
Carol and Dave Haugan			x	x	x	Y
Bill Maple			x			Y
Rick Stone			x		x	Y
Dave Ellis / Mary Graham				x		Y
Rick Lewis PLSP				x	x	Y
John Koch				x	x	Y
Buzz and Loretta Maltais				x		N
Paul Jennings				x		N
Ann Osin				x		N
Bill Hottell				x		Y
Twisp River Fish Pond				x	x	Y
Troy Accord				x	x	Y
VanBianchi				x		Y
Evans				x	x	y
Breed Ranch				x	x	Y
Josh Morgan MVID					x	N
Corky Barker						?
Alan Parker Ch. Canal Co.						?

Riparian Protection Outcomes

Several Conservation Easements were added during the last five years. Two of the more recent additions include the Tawks II and Keith properties on the Upper Methow River that protect more than 0.6 mile of riverfront from development in perpetuity. The Tawks II Conservation Easement protects undeveloped riparian forest and wetlands along approximately 1000 feet of both sides of the Methow River, protecting 2000 feet of total shoreline. It includes a diverse mixture of native plants and provides excellent fish, songbird, amphibian, raptor and large and small mammal habitat. It provides habitat for spring Chinook salmon and steelhead trout, both of which are classified as endangered, and the bull trout, which is listed as threatened, under the Endangered Species Act.

The Keith Conservation Easement spans over 700 feet of the Methow River (and approximately 1,320 feet of shoreline, including both sides of the river) and incorporates dense riparian vegetation and wetland habitats. This property too provides habitat for spring Chinook salmon, steelhead, and bull trout.

Since 2008 at least 65 beavers have been removed from main river corridor riparian areas and relocated to tributary systems where their actions will be beneficial in raising the water table, storing water in the aquifer and expanding riparian habitat.

The Methow Conservancy, through its Cage-a-Tree project has caged 738 trees on 14 properties, most of which had either Methow Conservancy or WDFW conservation easements on them. This project is on-going to maximize its impact on the protection of riparian vegetation and the recruitment of shade producing trees.

Cooperation Outcomes

The project worked with the Methow Watershed Council and Aspect Consulting to evaluate the contributions beavers might be able to make and the suitability of some key selected sites for a **WATER STORAGE EVALUATION** for the Methow Watershed. Three key sites were noted as potentially viable beaver enhanced water storage areas: Davis Lake area, Beaver Creek, and the Walking D Ranch. The Walking D was proposed as a possible future beaver release site in Aspect's June, 2012 report.

We have shared stream temperature monitoring information with the USFS Methow Valley Ranger District Fisheries staff and the Methow Restoration Council Watershed Monitoring Project. In the Methow Basin we currently participate in a network of more than 300 temperature monitoring stations.

We have shared information with several projects that have ultimately begun their own beaver restoration efforts including the Lands Council Beaver Project in Spokane, the Yakama Nation Beaver Project, the Grand Canyon Trust beaver project in Utah, and the Yakima Basin Beaver Project in Ellensburg.



Sharing the project with others is a key project element

WDFW fisheries biologist Charlie Snow has been a very generous project cooperater. Since 2010 he has helped insure we have pit tags for all the beavers we handle and then helped load the data into the PTAGIS system so that we can 'see' when each beaver crosses one of the 27 instream readers. His contribution has allowed us to pioneer this type of movement monitoring for beavers.

Partners

The project has benefitted from very able partners. The Methow Conservancy has contributed project oversight, coordinated connections with private landowners, provided fiscal accounting and tracking, led the education effort for the project, and provided grant administration.

The Forest Service has coordinated project implementation, communication, and support, developed and maintained project records, developed and supervised monitoring efforts, identified and evaluated the best places for beaver release, and interacted with other organizations and agencies active in the Methow watershed. The Wenatchee Forestry Sciences Lab has worked out the statistical and logistic aspects of the water quality study and then very ably coached the implementation of temperature and flow data gathering

The Washington Department of Fish and Wildlife has coordinated the capture and care of beavers, assisted with beaver release and establishment, assisted with holding facility design and maintenance, conducted stream monitoring set-up and data collection, and made connections with private landowners that experience beaver damage.

Pacific Biodiversity Institute originally developed map products and conducted analyses for assessing the beaver habitat present in the Methow watershed. They passed that role to the Forest Service with staffing changes at PBI. The Forest Headquarters in Wenatchee has made significant contributions to the habitat model.

The Winthrop National Fish Hatchery has generously contributed a portion of the hatchery each year for the holding facility and hatchery staff has helped immensely with facility maintenance, construction, equipment repair, and a big part of the education effort during National Fishing Day.

Funding

We would like to acknowledge and thank the following contributors and supporters of the project.

- The Washington Department of Ecology
- The Yakama Nation
- The Nation Fish and Wildlife Foundation - Community Salmon Fund
- Ecotrust Whole Watershed Restoration Initiative
- Bureau of Reclamation – Methow Field Office
- Habitat Conservation Plan / Tributary Fund
- The Salmon Recovery Funding Board
- The Methow Watershed Council

Acknowledgements

The success of this project is completely the result of the dedication and hard work of the people involved. John Rohrer's original idea to improve the watershed with beavers was the important initial spark that began the project. Steve and Kim Bondi grew the beaver restoration idea into grant proposals that eventually paid off. Steve's passion for the project is evident in the many presentations and programs he has given over the years, and that he continues to give in his new role as Inn Owner. He speaks eloquently about the benefit that beavers bring to the watershed in the short video on the Methow Conservancy Website.

Beaver crew members Lindsay Welfelt, Dan Russell, Chris Street, Luke Yockey, Alexis Monetta, Gabe Spence, Carmen VanBianchi, Chris Vennum, Keith Douville, and Carla Jo Ehlinger all have showed amazing dedication and perseverance. Their significant contributions have been noticed and very much appreciated.

Our **friends** at the Winthrop National Fish Hatchery, including Bob Adams, Chris Dammann, Bob Gerwig, Jeremy Mail, Dave Carrie, Mike Johnson, Craig Chisam, and especially Chris Pasley have helped make sure we have had a nearly perfect holding facility and well-cared-for beavers.

The cooperation and patience of the researchers at the University of Idaho Genetics Lab were instrumental in allowing us to determine sexing methods. Caren Goldberg and Lisette Waits helped wade through the challenges of long-distance sex determination. Dr. Lixing Sun was very generous to share his techniques for sexing. His time with us in May 2011 was a game changer for the success of this project.

Northwest Trek small mammal keeper Jessica Hoffmann kindly gave us her ideas for holding facility design and feeding suggestions. High Desert Museum Wildlife Manager John Goodell was helpful in sharing ideas about husbandry as well.

A large group of veterinarians, pathologists, epidemiologists, and state health department officials helped us complete a thorough, careful evaluation of risks to staff and the trapped and wild beaver populations from water borne disease. Dr. Kristin Mansfield and Ella Rowan from WDFW, Dr. Gary Haldorson and Dr. Tom Besser from WSU, and Nicola Marsden-Haug from WA Department of Health (among many others) were tremendously helpful. This resulted in very careful handling and disinfectant procedures that will become standard for these types of projects from now on.

Mark McKinstry and Stanley Anderson of the Wyoming Cooperative Wildlife Research Unit pioneered large scale beaver restoration projects in Wyoming in the 1990s. Mark was tremendously helpful and supportive as we tried to learn techniques and develop our Implementation Plan. He generously reviewed our plans and shared his work with us to help this project get started.

Michael Pollock is the premier beaver researcher in the Northwest. He provided ideas and support from the beginning of our effort. He was helpful in his review of the study plan for temperature and flow monitoring and has been a valuable colleague to share ideas with.

The staff of the Methow Conservancy has been especially patient as we have learned what it takes to put together, fund, and implement a significant venture in ecosystem restoration. Thank you Joy, Sarah, Mary, Heide, Steve, Eric, Dawn, and Jason for lots of hard work and lots of perseverance.



Beaver establishment in a creek showing water being spread across the floodplain

Scott Fitkin has managed to wedge this project into a work schedule each year that has never had enough room for hiring, training, timesheets, field work, reporting, accident forms, vehicles, and awards – but he has pulled it off remarkably well each year.

John Rohrer continues to be steady in his relaxed encouragement to keep walking forward on the worthwhile project he imagined.

Appendix A

Literature Supporting Beaver Benefits to Watersheds

- Apple, L. L. 1985. Riparian habitat restoration and beavers. Pp 489-490 *in* Riparian ecosystems and their management: reconciling conflicting uses. First North American Conference. USDA Forest Service. RM-GTR-120. Fort Collins, CO.
- Beechie, T., Imaki, H., Greene, J., Wade, A., Wu, H., Pess, G., Roni, P., Kimball, J., Stanford, J., Kiffney, P. and Mantua, N. (2012), RESTORING SALMON HABITAT FOR A CHANGING CLIMATE. River Res. Applic.. doi: 10.1002/rra.2590
- Beechie, Timothy. 2011. Presentation to WDFW Climate Adaptation Workshop, July 7. 2011.
- Castelle, A.J. and A.W. Johnson. 2000. Riparian vegetation effectiveness. Technical Bulletin No. 799. National Council for Air and Stream Improvement, Research Triangle Park, NC. February 2000.
- Hollenbach, M., J. Ory 1999. Columbia River Inter-Tribal Fish Commission. Science, Technical Reports and Research. Protecting and Restoring Watersheds; A Tribal Approach to Salmon Recovery, Good Science-Part IV, Case study: McCoy Meadows Restoration Project.
- Lowry, M. 1994. Effects of a beaver pond on groundwater elevation and temperatures in a recovering stream system. American Water Resources Association. P. 503-513.
- Naiman et al. 1988. Alteration of North American streams by beaver. *Bioscience* 38(11) 753-762.
- Naiman, R. J., J. M. Melillo, and J. Hobbie. 1986. Ecosystem alternation of boreal forest streams by beaver (*Castor canadensis*). *Ecology* 67(5): 1254-1269.
- McKinstry, M.C. and S.H. Anderson, 1997. Use of beaver to improve riparian areas in Wyoming. *In* Wyoming Water 1997: Applied Research for Management of Wyoming's Water Resources, C. Goertler, C. Ramsey, T Bray, and D. Boysen (editors). Wyoming Water Research Center, Laramie, Wyoming, pp 128-134.
- ODEQ. 2002. Upper Klamath Lake Drainage Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP). State of Oregon Department of Environmental Quality, Portland, Oregon. Available at: <http://www.deq.state.or.us/wq/TMDLs/UprKlamath/UprKlamathTMDL.pdf>
- Olson, R. and W. A. Hubert. 1994. Beaver: water resources and riparian habitat manager. University of Wyoming, Laramie. 48 pp.
- Pollock, M. M., M. Heim, and D. Werner. 2003. Hydrologic and Geomorphic effects of beaver dams and their influence on fishes. *American Fisheries Society Symposium* 37:213-233.
- Stabler, D. F. 1985. Increasing summer flow in small streams through management of riparian areas and adjacent vegetation. Pp 206-210 *in* Riparian ecosystems and their management: reconciling conflicting uses. First North American Conference. USDA Forest Service RM-GTR-120. Fort Collins, CO.

Appendix B

Methow Beaver Project

Release Site Score Card

Date _____

Site ID _____

Observer _____

GPS Coordinates_UTM (NAD 83) _____ Subwatershed _____

Lat Long _____ Location Description _____

Stream Gradient of the defined habitat unit

_____ 5. ≤3% 3. 4-6% 1. 7-9% 0. ≥9%

Stream Flow

Min (fall)

	garden hose	fire hose	30" culvert	un-wadeable
garden hose	1			
fire hose	3	4		
30" culvert	4	5	5	
un-wadeable	1	2	1	0

Max (spring)

Habitat Unit Size (stream length)

_____ 5. Extensive stretch of the stream 1. Small isolated pocket

Woody Food

- a. 3. Aspen, willow 2. Alder 1. Other hardwoods
- b. 3. Within 10 meters 2. Within 30 meters 1. Within 100 meters
- c. 3. Large amount (thousands of stems) 2. Some (hundreds of stems) 1. Little (dozens)

_____ **Woody food score = multiply a x b x c**

Herbaceous Food

_____ 3. Grass/Forbs Present 0. No Grass/Forbs Present

Floodplain Width

_____ 5. Wide stream bottom 0. Narrow V Channel

Dominant Stream Substrate

_____ 5. Silt/Clay/Mud 2. Sand 1. Gravel 0. Cobble -1. Boulders -3. Bedrock

Historic Beaver use

_____ 10. Old structures present 0. No indication of previous occupancy

Lodge and dam building materials

_____ 5. A variety of 1-6" diameter woody vegetation avail. -10. no building material present

Browsing / Grazing impacts

_____ 5. No Impact or obvious presence of browsers / grazers (-10). Heavy browsing / grazing impact.

_____ **Bonus:** (5 points each) 1. Easy Access. 2. Recent fire. 3. No conflict with human values. 4. Existing aquatic escape cover. 5. Landowner / user enthusiastic

Total Score

Narrative description of site and notes/ Photo ID# / sketch on back: