NATIONAL *fish, wildlife & plants*
CLIMATE ADAPTATION STRATEGY

Report of the Climate Change Adaptation and Beaver Management Team to the Joint Implementation Working Group Implementing the *National Fish, Wildlife, and Plant Climate Change Adaptation Strategy*

Brett Roper Photo

November 7, 2014

INTRODUCTION

This report provides initial findings and recommendations of the Climate Change Adaptation and Beaver Management Team (Team). The Team was established in September 2014 by the Joint Implementation Working Group (JIWG) that oversees implementation of the *National Fish, Wildlife and Plants Climate Change Adaptation Strategy*. The JIWG is made up of Federal agencies, representatives of State fish and wildlife agencies, and a tribal fish and wildlife commission.

The Team was charged with reviewing reasonably available information concerning the potential for changes in beaver management practices to promote resilience of natural systems to climate change and making recommendations to the JIWG at its November 13th meeting.

The Team met by conference call on three occasions. The initial meeting was a chance to review the charge to the Team, consider initial background materials, and identify topics for future meetings. The second meeting included presentations from a range of parties with diverse prespectives on beaver management and climate change (see list of presentations in Appendix). At a third meeting, the Team considered the presentations and developed the summary of findings and recommendations provided in this report. A list of Team members and additional information reviewed is provided in the Appendix.

William Meyers Photo

This report provides a summary of initial findings and recommendations for next steps. In general terms, the Team concludes:

- beaver populations can provide valuable ecosystem services and benefits, but can also have negative impacts on human populations, such as localized flooding;

- some of these ecosystem services that beaver provide can make important contributions to strenthening the resilience of watersheds to the projected impacts of climate change, although expectations are not equal across and within all regions;

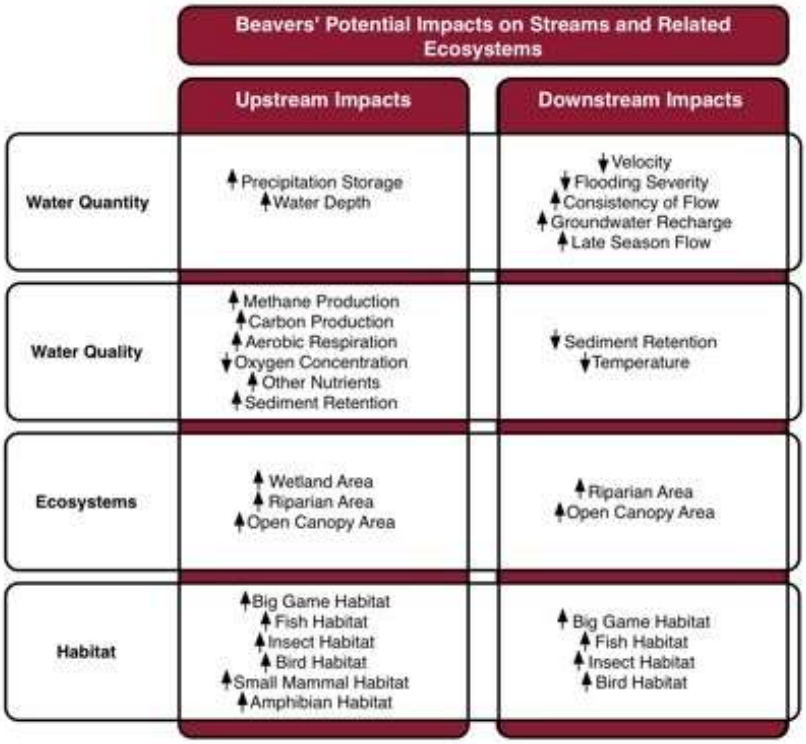
- Federal land management agencies and State fish and wildlife agencies should consider the climate change related benefits of expansion of beaver populations and use beaver management practices and assessment tools in adapting to a changing climate while taking care not to cause negative impacts; and

- The JIWG should formally establish a subgroup to advance work on this topic.

SUMMARY OF INITIAL FINDINGS

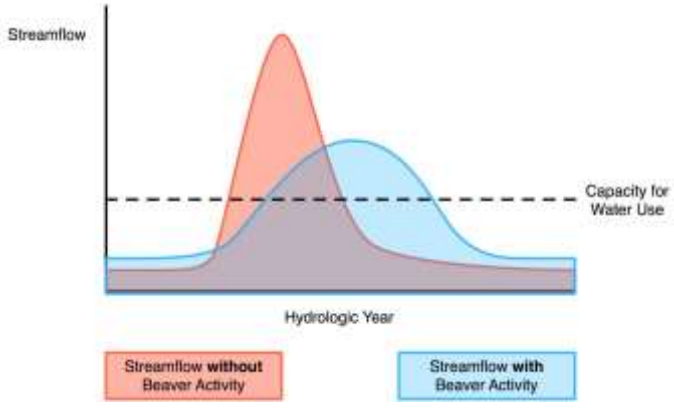
Based on review of literature and presentations by experts in the field, the Team found the following:

1. **Beaver Provide Diverse Ecosystem Benefits:** Beaver provide a diverse array of ecosystem services, including benefits for water quantity, water quality, and habitat (see graphic below from ECONorthwest).



2. **Beaver Help Offset Impacts of Climate Change:** Some of the ecosystem services associated with beaver populations also make escosystems more resilient to the impacts of cliamte change. Some examples include:

   - **Reduce peak streamflows**: Climate change is expected to result in reduced snowpack accumulation and more intense precipitation, leading to higher peak streamflows in some seasons and lower flows in other seasons. Beaver actvity within a watershed generally reduces peak flows and spreads flows over longer time periods (see graphic from ECONorthwest). Reduction in peak streamflows provides benefits for



water quality in terms of sediment reduction and water qualtity in terms of retention of water within a watershed as part of surface water or groundwater.

- **Improve drought resilience and water storage:** Climate change is expected to result in dryer conditions in many parts of the country and longer periods of drought and reduced water availability. Beaver dams retain water within a watershed, recharge groundwater near streams, and rehydrate degraded riparian ecosystems.

  The U.S. Forest Service has taken steps to improve methods for returning beavers to vacant habitat for water storage. Because approximately one out of five Americans depends on National Forests for drinking water, public forest land will play an increasingly vital role in providing it. In 2009, Forest Service Chief Tom Tidwell said that "Responding to the challenges of climate change in providing water and water-related ecosystem services is one of the most urgent tasks facing us as an agency". National Forests in Utah, Wyoming, Oregon, and Washington are using beaver dams as 'sponges' with promising results.

Joe Wheaton Photo

- **Stabilize water temperatures:** Climate change is expected to result in warmer air temperatures and water temperatures that have a negative imapct on fish and water quality and create pollution problems like harmful algal blooms. Beaver dams expand the presence of riparian plant communities and reduce sediment levels leading to more stable water temperatures. Stored groundwater that returns to streams also contributes to water temperature stability.

- **Help watersheds recover following wildfire:** Climate change is expected to result in drier and warmer conditions with an increase in wildfire extent and intensity Beaver have been relocated as part of post-fire restorations to establish dams for sediment control, to accelerate riparian recovery, and restore wildlife habitat.

- **Reduce coastal ecosystem and infrastructure impacts:** In coastal environments, climate change is expected to result in sea level rise and more frequent severe storms and storm surges. Beaver can help reduce flood impacts and provide habitat that would otherwise be lost to storm activity.

3. **Beaver Management is Pursued for a Variety of Reasons:** State and Federal agencies have historically had programs to limit beaver conflicts with humans. Problems with localized flooding, damage to infrastructure and plantings, and related nuisance impacts are a concern for citizens. In recent years, more efforts have been focused on achieving multiple benefits. These included restoring beavers to stream systems to improve salmon habitat, repairing lost watershed functions, and more recently to offset climate change related impacts. To date, however, there is limited experience in beaver management specifically intended to build resilience to long-term climate change. For example, significant tribal, non-profit, local, state and federal government application of beavers for climate adaptation benefits is occurring in Washington State.

4. **Beaver Restoration Assessment Tools are Emerging**: Several tools have been developed to support assessment of where beaver are located and where stream conditions and other factors, including potential negative impacts on infrastructure and human settlements. These tools identify locations where beaver introduction would be beneficial to the ecosystem. For example, Utah State University developed a Beaver Restoration and Assessment Tool (BRAT) and applied it to the State of Utah. Work is underway to apply this tool to New England. These tools have the potential to provide a strong foundation for improving beaver management decisions by Federal and State agencies.

5. **Existing Beaver Populations are Commonly Below Historic Levels and Below Potential Distribution Estimated in Restoration Tools:** Site-specific estimates using beaver restoration tools suggest that there is significant potential for expansion of beaver populations in areas where they pose little to human populations or infrastructure. The final report of the Utah Beaver Restoration Assessment Tool concluded "the state of Utah's rivers and streams are well below the capacity of those streams to support beaver dams." (page 3)

William Meyers Photo

6. **Climate and Other Benefits from Beaver are From Dams and Not All Beaver Build Dams:** Beavers don't build dams in all situations. Beaver may survive in diverse conditions and not build dams and thus not provide the benefits associated with the dams. In lakes, ponds, and deeper rivers, the escape cover habitat requirement is met, and no dams are needed.

   Situations where beavers establish colonies with dams include:

   - Low gradient streams (0-5%)
   - Relatively shallow water at low flow

- Availability of dam building material
- A persistent perennial water source
- Streams where beaver dams will generally survive high flow events
- Moderate valley floor width
- % Deciduous Vegetation (more)
- Distance from Open Roads (farther)
- Wilderness Areas (outside of)
- Other colonies (near to)

Beaver are generally under-represented in managed grazing lands.

7. **Economic Value of Beaver Benefits May be Substantial:** A study by ECONorthwest of the economic value of beaver ecosystem services in the Escalante River Basin in Utah concluded that "if beaer populations reached their regional potential, the annual value of benefits could reach well into the tens, or even hundreds of millions…". (p 59) The table on the next page summarizes quantified services resulting from beaver restoration in the northern portion of the Escalante Basin.

Quantified Services in the Northern Portion of the Escalante Basin

Ecosystem Service	Demand	Supply	Price	Valuation Method	Total Value
Sediment Retention	**Agricultural Users Municipal Users Recreationists Water Agencies**	33.6 million cubic yards per year 2,400 cubic yard per river mile per year 1,100 cubic yard per dam per year	$2 per cubic yard	**Dredging Costs**	$67.2 million per year $4,800 per river mile per year $2,200 per dam per year
Delayed Water Flow upstream of Wide Hollow Reservoir	**Agricultural Users Recreationists Water Agencies**	9,200 acre–feet per year 6.6 acre–feet per river mile per year 0.3 acre–feet per dam per year	$520 per acre–foot	**Avoided Cost**	$4.8 million per year $3,400 per river mile per year $156 per dam per year
Riparian Habitat	**Recreationists General Population Water Agencies**	77,000 acres 2.5 acres per dam	$1,000 per acre per year	**Meta–Analysis**	$77 million per year $2,500 per dam per year
Wetland Habitat	**Recreationists General Population Water Agencies**	27,700 acres 0.9 acres per dam	$8,000 per acre per year	**Meta–Analysis**	$221.6 million per year $7,200 per dam per year
Aquatic Habitat	**Recreationists General Population Water Agencies**	15,400acres 0.5 acres per dam	$4,000 per acre per year	**Meta–Analysis**	$61.6 million per year $2,000 per dam per year

8. **Expectation Management**: There is general agreement among experts in the field that it is important to manage expectations with respect to beaver management practices because beneficial results can take time to occur and projects may have unexpected outcomes.

RECOMMENDATIONS AND NEXT STEPS

The Team makes the following recommendations:

1. **For the JIWG:** The JIWG should establish a subgroup on the topic of climate change adaptation and beaver management to expand and develop these recommendations. The group should include Federal, state, and tribal agencies that are members of the JIWG as well as experts in the field from the academic and not-for-profit community. The group should be charged with providing a report to the JIWG within one year.

2. **For the Research Community:** More research on the beaver management practices and climate adaptation is needed in several areas:

   - how to better quantify hydrologic impacts of beaver dams and how they scale up;
   - differences in beaver impacts in western and eastern streams;
   - determine the social carrying capacities for beavers within and among states and regions;
   - development of climate change considerations and information as elements of beaver restoration assessment tools; and
   - develop models to estimate natural dispersal and range expansion/contraction of beaver populations under regional climate change scenarios.

William Meyers Photo

   Federal agencies should consider developing a coordinated strategy to address these issues and to avoid duplication of research efforts.

3. **For Federal Land Management Agencies:**

   - The Forest Service should consider identification of beaver as a "focal species" under the 2012 planning rule or "Management Indicator Species following the 1982 Planning Rule in the development of Forest Management Plans. The potential role that beaver might play in meeting both ecosystem restoration and climate adaptation goals should be evaluated. Six of 76 national forest units in western states identify beaver as Management Indicator Species.

   - Department of Interior Landscape Conservation Cooperatives (LCCs) should assessthe potential for beaver management practices to contribute to climate adaptation goals in areas served by the LCC and conducting research and pilot studies needed to address issues specific to the area.

- Other Federal land management agencies, including the National Park Service, Bureau of Land Management, and Bureau of Reclamation should evaluate existing beaver management practices and policies and consider whether changes to these practices and policies could contribute to the climate change adaptation goals of the agency.

- All land management organizations should collaboratively analyze the regional contribution that reestablishment of beaver populations would have to improving riparian conditions and in achieving climate adaptation goals.

4. For Other Federal Agencies:

- The Environmental Protection Agency should consider how beaver management practices might support meeting water quality goals, including reducing nonpoint pollution, meeting the pollution reduction goals established in Total Maximum Daily Loads (TMDLs), and increasing the creation and restoration of wetlands.

- The Army Corps of Engineers should consider the potential benefits of beaver management practices as "natural infrastructure" alternatives to more conventional flood control structures and to promote the protection and restoration of wetlands.

- The National Oceanic and Atmospheric Administration should evaluate the potential for beaver mangement practices to contrubite to coastal and estuarine ecosystem management goals including increasing habitat, reducing flooding, and moderating storm surge impacts.

- The Department of Agriculture Animal and Health Plant Inspection Service should continue to provide cooperators with best management practices for resolving conflicts by beavers using an adaptive management approach.

5. For State Fish and Wildlife Agencies:

- State fish and wildlife agencies should consider including or expanding attention to beaver in State Wildlife Action Plans. Beaver are named as Species of Greatest Concervation Need in at least four State Wildlife Conservation Strategies (i.e.; Arizona, Montana, New Mexico, and Vermont).

- State fish and wildlife agencies should consider development of a strategic plan for beaver management in the state, including where beaver are desired for increasing climate resilience and where they are not, including clear policy on where beaver are needed. For example, the State of Utah developed a statewide *Beaver Management Plan* in 2010.

ATTACHMENTS

Climate Change Adaptation and Beaver Management Team Members:

Association of State Fish and Wildlife Managers; Davia Palmeri

Environmental Protection Agency; Jeff Peterson

National Park Service; Cat Hawkins Hoffman, Glenn Plumb

State of New York; Patricia Riexinger

State of Washington; Cynthia Wilkerson

State of Wisconsin; Jack Sullivan

USDA Forest Service; Sandy Boyce, Trey Schillie, Kent Woodruff

USDA Animal and Plant Health Inspection Service; Jimmy D. Taylor

US Army Corps of Engineers; Eric Britzke

Materials Considered by the Team:

- Presentation by Brett Roper; US Forest Service; October 21, 2014; see attached
- Presentation by William Meyer; State of Washington; October 21, 2014; see attached
- Presentation by Mark Buckley; ECONorthwest; October 21, 2014; see attached
- Presentation by Joe Wheaton; Utah State University; October 21, 2014; see attached
- Presentation by Bryan Bird; WildEarth Guardians; October 21, 2014
- *Beaver and Climate Change Adaptation in North America: A Simple, Cost Effective Strategy*; WildEarth Guardians, Grand Canyon Trust, and the Lands Council; September, 2011
- *The Economic Value of Beaver Ecosystem Services; Escalante River Basin, Utah*; ECONorthwest; February, 2011

- *The Utah Beaver Restoration Assessment Tool: A Decision Support and Planning Tool: Final Report to Utah Division of Wildlife Reesources*; William MacFarlane, Joseph Wheaton, and Marth Jensen; Utah State University, October 2014

Additional References of Interest:

- Gibson P.P. and J.D. Olden. 2014. Ecology, management, and conservation implications of North American beaver (*Castor canadensis*) in dryland streams. Aquatic Conservation: Marine and Freshwater Ecosystems 24: 391–409. PDF

- Hammerson, G.A. 1994. Beaver (Castor canadensis): Ecosystem alterations, management, and monitoring. Natural Areas Journal 14:44-57

- Hood, G.A. and D,G. Larsen. 2014. Ecological engineering and aquatic connectivity: a new perspective from beaver-modified wetlands. Freshwater biology, doi: 10.1111/fwb.12487

- Johnson, Glenn E. and van Riper III, Charles; Effects of reintroduced beaver (Castor canadensis) on riparian bird community structure along the upper San Pedro River, southeastern Arizona and northern Sonora, Mexico; Open-File Report 2014-1121; USGS; Department of Interior

Beaver Information from Washington State:

- Methow Beaver Project. http://www.pacificbio.org/initiatives/beavers.html

- Lands Council: http://www.landscouncil.org/beaversolution/the_beaver_chronicles.asp

- http://midcolumbiarfeg.com/what-we-do/floodplain-reconnection/beaver-reintroduction/

- Another resource: http://www.thebeaverbelievers.com/

Presentations to the Climate Change and Beaver Management Team

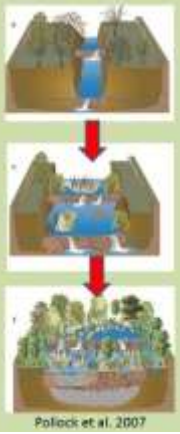
Beavers, Climate Change, and the Forest Service

Brett Roper
Aquatic Ecologist - WFWARP

Beavers, Stream Complexity, Connection to Floodplain, and the resistance and resilience of the stream channel and aquatic biota to climate change.

From a legacy of past management actions towards complex stream channels.

How do we use beaver to hasten change and recovery?



Pollock et al. 2007

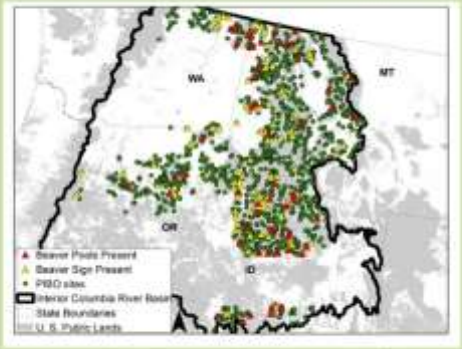
Understand beaver colonization rates and habitat conditions in the interior Columbia River Basin

- Where are beaver colonizing?
- How do they influence stream habitat condition?

Pacfish/Infish Biological Effectiveness Monitoring Program

2004 2006 2010

Where did beaver establish in the last 12 years?



- Beaver Sign Present: 10 %
- Beaver Pools Present: 4 %

Conditions where beaver establish?

- Gradient (mostly low, 0-5%)
- % Deciduous Vegetation (more)
- Distance from Open Roads (farther)
- Wilderness Areas (outside of)
- Other colonies (near to)

Simple relationships between patterns of land management and colonization of stream reaches by beaver.

	Sites colonized by Beaver
Managed and Grazed	Under represented
Managed and Not Grazed	Over represented
Reference	Under represented

Need to understand how landscape characteristics and management impacts in the grazed portion of the landscape affect the presence of beaver?

Beaver as a indicator of management

- Keystone species; it can alter the environment.
- If its environment has been altered, beaver distribution can be altered as well.
- Management Indicator Species, Focal Species.
- Surrogate for more difficult to monitor frog species.
- Easy to monitor on-foot and remotely.

Design to monitor trend in abundance and presence of American beaver (*Castor canadensis*) at the national forest scale

Beck et al. 2010. Environmental Assessment and Monitoring

Habitat Conditions – Increased Complexity (resiliency)

Pools

Sediment

Wood

Temperature

Connection to Groundwater

Fish Distribution and Spawning

2003

2008

Home of last resort – nuisance and transplanted beavers, state plans and Forest Service efforts.

Objective 1:

Work to improve riparian habitats, associated streams and wetlands in a minimum of 10 tributaries through translocating beaver into unoccupied suitable habitat on public and/or private land by 2020.

UDWR REGION	REGIONAL PRIORITY	TRANSPLANT SITE NAME	COUNTY	STREAM/DRAINAGE	LAND MANAGEMENT AGENCY OR PRIVATE PROPERTY OWNER
Southern	1	Pine Creek	Beaver	Pine Cr. /Beaver River	Fishlake National Forest
Southern	1	Duncan Creek	Beaver	T29S/R7W	Fishlake National Forest
Southern	1	Mud Creek	Beaver	T29S/R6 7W	Fishlake National Forest
Southern	6	East Fork Boulder Creek	Garfield	Boulder Creek	USFS
Southern	1	East and West Hunt Creeks	Garfield	Sevier River	USFS – Dixie
Southern	6	Deer Creek	Garfield	Deer Creek	USFS – Dixie
Northern	1	Blacksmith Fork and Tributaries	Cache	Cache Creek and Rock Creek	USWRC/USFS/Private
Northern	2	Logan Ranger District	Cache Rich	All Rivers and Streams	USFS
Northern	6	Chalk Creek	Summit	Chalk Creek and Tributaries	Private

88% percent of the locations identified for translocation list within the Utah Beaver Management Plan are on lands managed by the Forest Service

Beaver Restoration Toolbox (2013 – Karl Malcolm) – Overview of lessons learned and ways the Forest Service and other agencies have and can used beaver in meeting management objectives.

-- NEPA
-- Whirling disease
-- Keeping them alive during transport

Where we put beaver and/or how we use them in restoration need to be thought out and coordinated.

Beaver Effects and Climate-Induced Scarcities

Mark Buckley
ECONorthwest
buckley@econw.com
October 21, 2014

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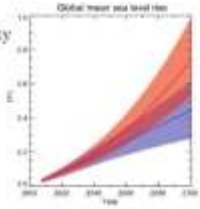
Adaptation Challenges

- Increasing temperatures
- Shifting ecosystem geography, availability
- Natural hazard frequency and severity (e.g. floods)
- Nonstationarity
- Changing precipitation, snowpack
- Drier conditions, drought, wildfire
- Disrupted nutrient cycles, life cycles
- Sea level rise
- many others (known/unknown, with/without precedent)



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Beaver Effects and Scarcities

- How do beaver affect their environment?
- How does climate change affect environments?
- Where, when, how do these forces oppose?
- What would be the damages without the opposing forces, or the cost of manufacturing the opposing forces?
- What information is necessary to inform relevant decisions?

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Escalante Basin Background

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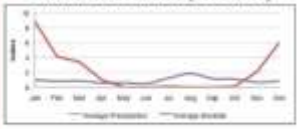
Precipitation and Volume

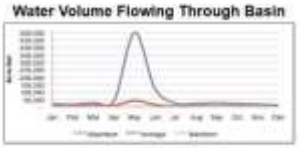
Average Monthly Precipitation and Snowfall in Escalante (1901-2005)



Water accumulates in the winter

Flows peak in late spring

Water Volume Flowing Through Basin



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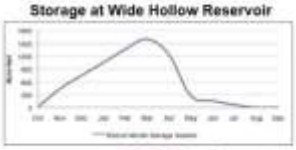
Surface Water

Storage at Wide Hollow Reservoir



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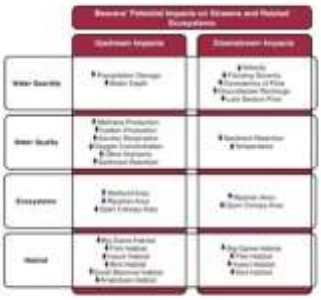
Beaver Impacts



Habitat and stream lengths suggest a potential for 1300 colonies in the basin, with 5200-7800 beavers

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Beaver Density

Colony Density

	Northern Portion of the Basin	Southern Portion of the Basin
Large Waterways	**Preferred beaver habitat** (0.42 colonies per mile) About 70 colonies	**Good beaver habitat** (0.21 colonies per mile) About 80 colonies
Small Waterways	**Preferred beaver habitat** (0.42 colonies per mile) About 520 colonies	**Good beaver habitat** (0.21 colonies per mile) About 640 colonies

Dam Density

	North Portion of the Basin	South Portion of the Basin
Large Waterways	**Preferred beaver habitat** (22 dams per mile) About 3,190 dams	**Good beaver habitat** (11 dams per mile) About 2,210 dams
Small Waterways	**Preferred beaver habitat** (22 dams per mile) About 27,000 dams	**Good beaver habitat** (11 dams per mile) About 55,067 dams

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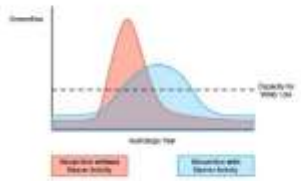
Impact on Water Quantity

Beaver activity could increase stream flow and volume in the Basin

	Assuming Maximum Stream Flow	Assuming Average Stream Flow	Assuming Minimum Stream Flow
Annual Stream Flow (cfs)	4,191–8,381	577–1,155	48–92
Annual Volume (acre-feet)	354,503–709,005	34,904–69,808	2,773–5,545



Beaver activity could also flatten the hydrograph, increasing the volume of water available during dry months

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Economic Benefits of Beaver Activity

Beaver Ecosystem Effects Quantified	Beaver Ecosystem Services Identified in the Literature and Described Qualitatively	Beaver Ecosystem Services Monetized
Structural Effects • Number of Colonies • Number of Dams • Pond Size • Wetland Creation • Riparian Creation **Process Effects** • Water Storage • Sediment Capture • Water Temperature • Habitat Creation	**Water Quantity** • Regulation of Quantity • Regulation of Timing **Water Quality** • Sediment Retention • Pollutant Storage • Temperature Reduction • Filtration **Habitat** • Invertebrate Habitat • Fish Habitat • Reptile Habitat • Amphibian Habitat • Bird Habitat • Mammal Habitat **Other Services** • Flood Mitigation • Recreation	**Water Quantity** • Water Storage **Water Quality** • Sediment Retention • Pollutant Storage • Temperature Reduction **Habitat** • Riparian Habitat • Wetland Habitat • Aquatic Habitat **Other Services** • Recreation

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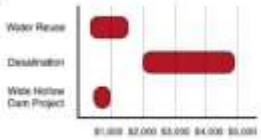
Water Quantity Value

Volume of Water Stored by Beaver Activity	
Volume of the Average Beaver Pond	0.3–0.9 acre-feet
Total Volume of Beaver Ponds Upstream of Wide Hollow Reservoir	2,700–8,100 acre-feet
Total Volume of All Beaver Ponds in Basin	20,000–60,000 acre-feet

Value of Alternative Water Sources



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Impact on Sediment and Water Quality

Potential Sediment Retention Provided by Beaver

	Average Area of Pond	
	0.5 Acres	1.0 Acres
Average sediment retained per dam, lifetime (cubic feet)	19,600	80,200
Average sediment retained per dam, annually (cubic feet)	2,000	8,020
Average sediment retained by all dams in basin, annually (cubic feet)	204 million	848 million

• Water Temperature
• Pollutants (nitrogen, phosphates, fecal coliform, heavy metals)

Best Management Practice
Channel Bank Vegetation
Riparian Herbaceous Cover
Riparian Forest Buffer
Stream Habitat Improvement and Management
Streambank and Shoreline Protection
Channel Stabilization

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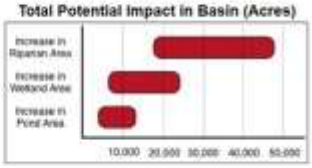
Impact on Land Cover

Average Impact of Beaver on Land Cover

	Average Area of Pond	
	0.5 Acres	1.0 Acres
Average Volume of Water per Pond (Acre-feet)	0.3	0.9
Average Increase in Area of Wetland per Pond (Acres)	0.9	2.6
Average Increase in Area of Riparian Habitat per Pond (Acres)	2.5	4.4

Beaver activity could increase the total area of riparian habitat, wetlands, and aquatic habitat in the Basin

Total Potential Impact in Basin (Acres)



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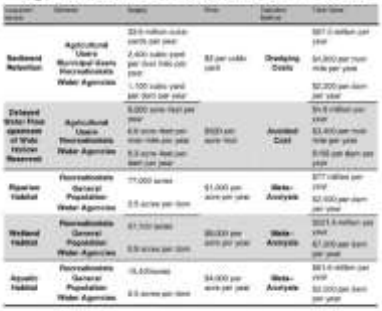
Quantified Total Annual Values



Many other benefits identifiable but specific incremental value difficult to isolate

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Coastal Effects

- Beaver are active in coastal areas
- Improve, increase habitat
- Flooding, storms, shifting habitat

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Planning Implications

- Beaver effects align well with areas of climate-induced scarcity
- Strategic communication must reveal the benefits to these expecting costs
- Beaver effects and value are context-specific

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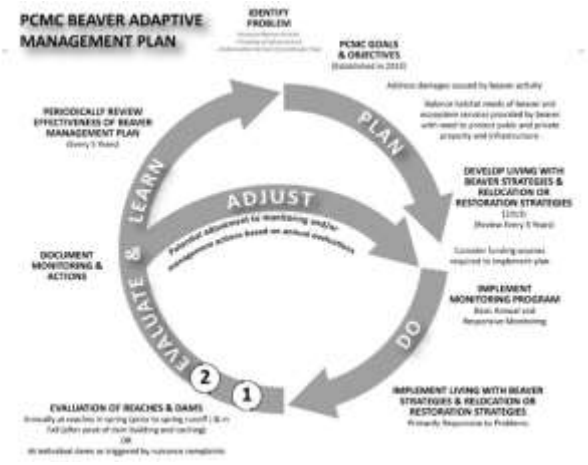
RECOMMENDATIONS FOR CLIMATE CHANGE ADAPTATION & BEAVER MANAGEMENT TEAM
Joe Wheaton
Utah State University
October 21, 2014


POPULARITY GROWING RAPIDLY RECENTLY
Beaver Taught Salmon To Jump!
THE WALL STREET JOURNAL.
With Trouble on the Range, Ranchers Wish They Could Leave It to Beavers
OFTEN PESKY BEAVERS PUT TO WORK RESTORING STREAMS
Beavers Offer Solution to Climate Change


LETTING BEAVER DO MITIGATION NOT NEW!!!
As early as 1930s, beaver used as mitigation tool
Logic is simple… just take nuisance beaver and relocate them where we want their ecosystem engineering expertise
Easy to get people excited… its logical & its cheap
Expectation management is critical
Airborne Beavers Fight Floods

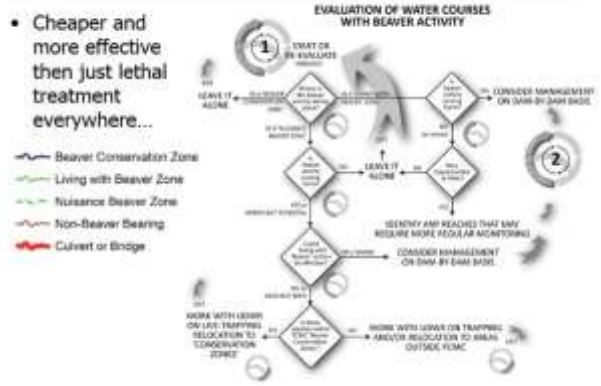

CLIMATE CHANGE ADAPTATION & BEAVER
I. Adaptive Beaver Management
II. Expectation Management with BRAT
III. Quantifying Hydrologic Impacts


LIVING WITH BEAVER STRATEGIES…
Is problem real or perceived?
If real:
'Beaver Deceivers'
'Pond Levelers'
'Caging' trees
All require maintenance
If those don't work, live trap and relocation
BEAVER SOLUTIONS
Working With Nature


PCMC BEAVER ADAPTIVE MANAGEMENT PLAN
IDENTIFY PROBLEM
PCMC GOALS & OBJECTIVES
PLAN
DEVELOP LIVING WITH BEAVER STRATEGIES & RELOCATION OR RESTORATION STRATEGIES
DO
IMPLEMENT MONITORING PROGRAM
IMPLEMENT LIVING WITH BEAVER STRATEGIES & RELOCATION OR RESTORATION STRATEGIES
EVALUATE
DOCUMENT MONITORING & ACTIONS
LEARN
PERIODICALLY REVIEW EFFECTIVENESS OF BEAVER MANAGEMENT PLAN
ADJUST
EVALUATION OF REACHES & DAMS

SIMPLE DECISION POINTS – BY WATER COURSE

- Cheaper and more effective then just lethal treatment everywhere…



@ EACH DAM

ADAPTIVE BEAVER MANAGEMENT PLAN

EXAMPLE OF HOW TO DO THIS…

Lays out an adaptive management response to the beaver problem…

NATIONAL *fish, wildlife & plants* CLIMATE ADAPTATION STRATEGY

Goal 4

Support adaptive management in a changing climate through integrated observation and monitoring and use of decision support tools.

- Simple adaptive beaver management plans can be tailored to address practical local concerns about damage from beaver while still promoting the climate change resiliency benefits of beaver

CLIMATE CHANGE ADAPTATION & BEAVER

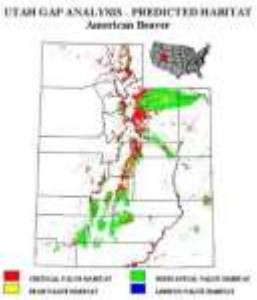
I. Adaptive Beaver Management

II. Expectation Management with BRAT

III. Quantifying Hydrologic Impacts

WHERE COULD WE USE BEAVER?

- This is not a very useful map… →
- What about in my watershed, on my stream?



beavers in excess of estimated carrying capacity (Blackwell and Pederson 1993). The predicted beaver habitat in Utah was mapped as part of the 1999 Utah GAP Analysis (Figure 1). Current beaver distribution and abundance is not fully understood, however they are considered common and most of the suitable habitat believed to be occupied.

DAM-BUILDING CAPACITY MODELING

- **Beaver dams,** not beaver themselves, provide the positive feedbacks we seek
- While beaver can survive in wide range of conditions, **where they build dams is more limited**
- Dam building activity varies dramatically according to flow regime & availability of dam building materials

BRAT – BEAVER RESTORATION ASSESSMENT TOOL

Grand Canyon Trust

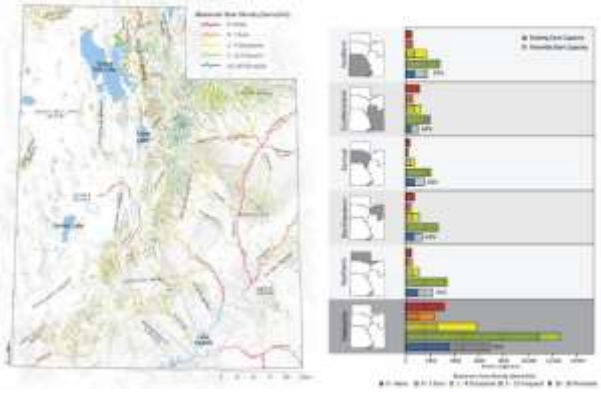
UTAH DNR

http://brat.joewheaton.org

LINES OF EVIDENCE TO ESTIMATE BEAVER DAM DENSITIES AT FULL CAPACITY

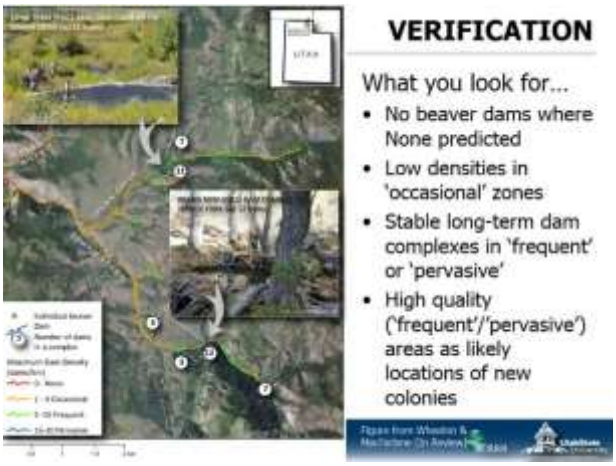
- Evidence of a perennial water source
- Evidence of riparian vegetation to support dam building activity
- Evidence of adjacent vegetation (on riparian/upland fringe) that could support expansion and establishment of larger colonies
- Evidence that a beaver dam could physically be built across the channel during low flows
- Evidence that a beaver dam is likely to withstand typical floods

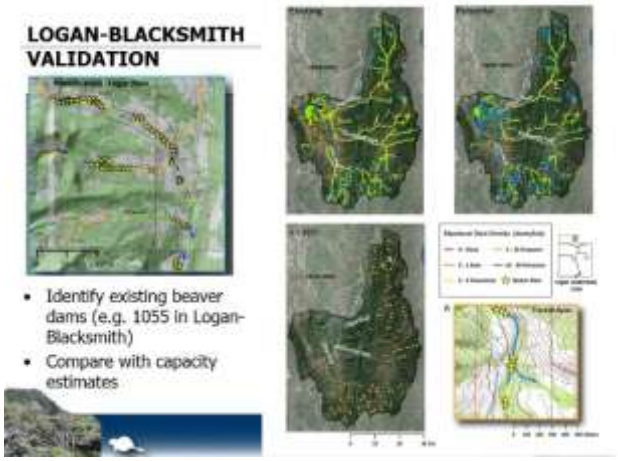
RAN FOR 27,000 km OF PERRENIAL RIVERS & STREAMS IN UTAH + 15,000 km OUTSIDE UTAH

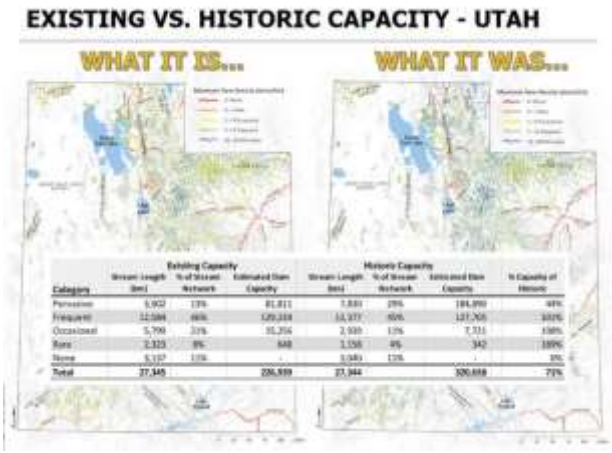


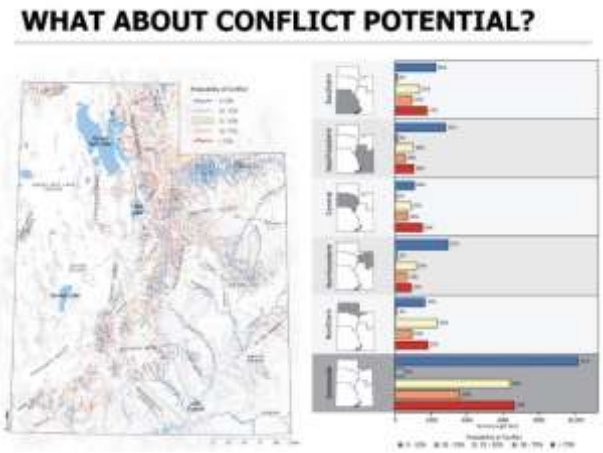
RESOLUTION OF BRAT

- At a scale that is still meaningful on the ground (250 m reaches)
- Just because BRAT predicts high capacity, does not mean it will be realized… but it does define a plausible upper limit
- In many places, at some point in time this upper limit is reached… just never all at once


VERIFICATION
What you look for...
• No beaver dams where None predicted
• Low densities in 'occasional' zones
• Stable long-term dam complexes in 'frequent' or 'pervasive'
• High quality ('frequent'/'pervasive') areas as likely locations of new colonies


LOGAN-BLACKSMITH VALIDATION
• Identify existing beaver dams (e.g. 1055 in Logan-Blacksmith)
• Compare with capacity estimates


EXISTING VS. HISTORIC CAPACITY - UTAH
WHAT IT IS...
WHAT IT WAS...


WHAT ABOUT CONFLICT POTENTIAL?


A FIRST CUT
• Simple management zones by stream reach...


http://brat.joewheaton.org
BEAVER RESTORATION ASSESSMENT TOOL
BRAT
UTAH Wide BRAT Project Completed!

NATIONAL *fish, wildlife & plants* CLIMATE ADAPTATION STRATEGY

Goal 1

Conserve habitat to support healthy fish, wildlife, and plant populations and ecosystem functions in a changing climate.

- BRAT can help identify:
  - Connected beaver dammed areas, likely to be resilient to climate change
  - Where it makes sense to restore
  - Where it makes sense to conserve

NATIONAL *fish, wildlife & plants* CLIMATE ADAPTATION STRATEGY

Goal 3

Enhance capacity for effective management in a changing climate.

- Use decision support & planning tools like BRAT to highlight where beaver might make sense & coordinate consistent expectations nation-wide
- BRAT uses nationally-available datasets (NHD, NED, LANDFIRE, StreamStats)

CLIMATE CHANGE ADAPTATION & BEAVER

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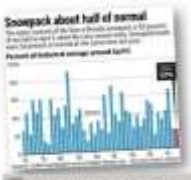
WHAT ABOUT DECLINING SNOWPACK?

- Could we get enough beaver dams back on landscape to mitigate this?



- We desperately need research to better quantify hydrologic impacts of beaver dams and how they scale up

A HAPPY COINCIDENCE

- Anyone know where this is?

Pollock et al. (2014) Bioscience. DOI: 10.1093/biosci/biu036

The Yakima Beaver Project

Landscape Solutions

Yakima Basin and Climate Change

- Largest agricultural-producing region in the Northwest
  - $1.8 billion Ag; $2.3 billion food processing industry
  - Apples, wine grapes, hops, hay
- Second only to Snake River in supporting historic salmon and steelhead runs

Climate Change

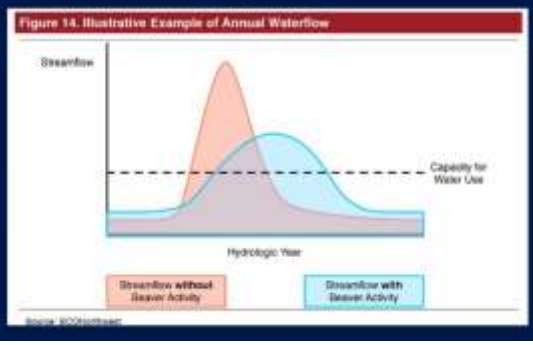
- Droughts & Years of Proration: 1977, 1979, 1987, 1988, 1992, 1993,1994, 2001, 2003, 2004, 2005
- Snowpack declining (12-71% runoff)
- Decimated fish populations – dams and climate change
- Proratable Irrigation Districts reduced to as little as 37% of allotments

Beavers are a part of an Integrated Ecological Restoration Solution

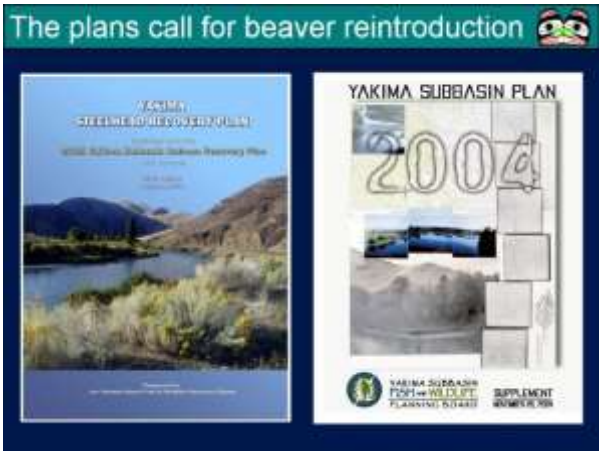
Restoration Techniques: **Habitat Restoration Goals:**

	Floodplain Connection	Water Storage	Riparian Restoration	Rearing Habitat	Instream Complexity
LWD Introduction	●			●	●
Riparian Planting			●	●	●
Beaver Reintroduction	●	●	●	●	●
Nutrient Enhancement			●	●	
Engineered Structure	●			●	●
Fish Passage				●	

Beavers and Climate Change Adaptation




Goal: Restoring stream complexity one beaver colony at a time
• Creating rearing habitat
• Storing Water
• Introducing woody material
• Reconnecting floodplains


The plans call for beaver reintroduction
YAKIMA SUBBASIN PLAN
2004


Simplified Incised Stream without beavers
Disconnected floodplain
Lowered water table
~6 Feet
Lack of rearing habitat
Indian Creek – Teanaway Tributary


Beavers create stream complexity
Stream complexity = Fish & water storage
Jack Creek - Teanaway


Beavers are a Keystone Species


How it all Starts…


How it all Starts…


Beaver Holding Facility
Arriving Beavers


Meet the Beavers:
Chew Barka
R2 Tree Chew
Princess lay-down-a-tree
Bark Vader
Luke Streamwalker
Beaver the Hut
Barkley


Results 2 months
Bear Creek Release Site
NF Teanaway Tributary

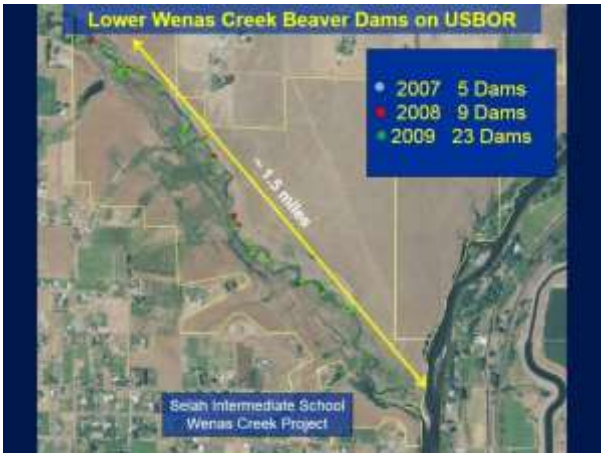

Results 10 months
Hurley Creek Release Site
Swauk Tributary

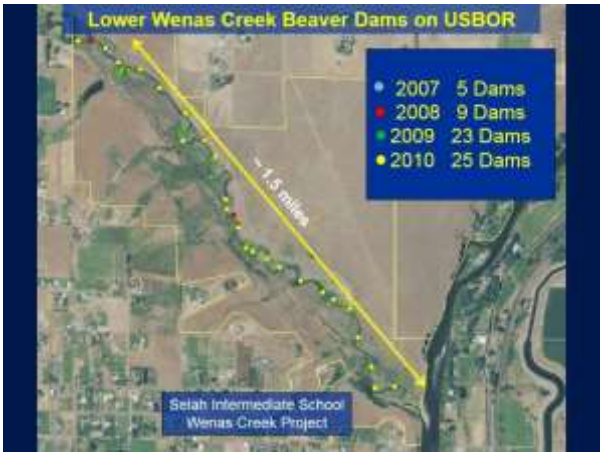

Results 16 months
~5 Feet
Not a high flow
passage barrier for fish
Jack Creek Release Site


Cool
Clean
Complex
Connected
Beaver
Biologist
Results 2 years
NF Manastash
Creek Release site

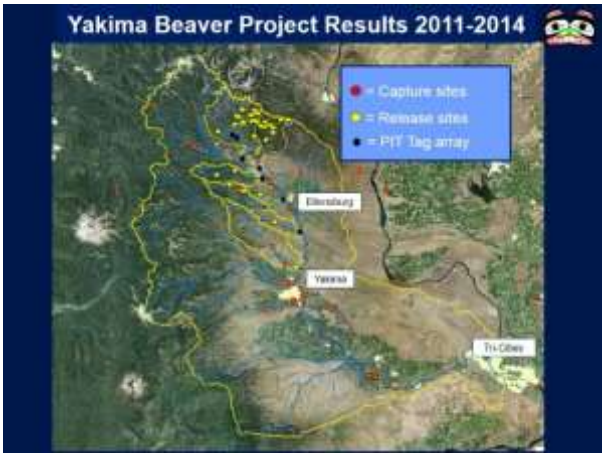

Lower Wenas Creek Beaver Dams on USBOR
2007 5 Dams
~ 1.5 miles
Selah Intermediate School
Wenas Creek Project


Lower Wenas Creek Beaver Dams on USBOR
2007 5 Dams
2008 9 Dams
~ 1.5 miles
Selah Intermediate School
Wenas Creek Project


Lower Wenas Creek Beaver Dams on USBOR
2007 5 Dams
2008 9 Dams
2009 23 Dams
~1.5 miles
Selah Intermediate School
Wenas Creek Project


Lower Wenas Creek Beaver Dams on USBOR
2007 5 Dams
2008 9 Dams
2009 23 Dams
2010 25 Dams
~1.5 miles
Selah Intermediate School
Wenas Creek Project


Wenas Creek


Yakima Beaver Project Results 2011-2014
= Capture sites
= Release sites
= PIT Tag array


Questions