PARTNERING WITH BEAVER IN RESTORATION

EXAMPLES FROM THE BRAT (UTAH) & BRIDGE CREEK (OREGON)

Joe Wheaton

UtahStateUniversity

Beaver & Wetlands Workshop

May 9, 2013

MAIN PARTNERS… OTHER THAN RODENTS

Nick Bouwes

Michael Pollock

Chris Jordan

Wally Macfarlane

PURPOSE OF TALK

All to easy to get people excited about beaver as a restoration tool… so we're interested in **expectation management**:

1. Where could beaver work?
2. What do we do where beaver alone are not enough?

Airborne Beavers Fight Floods

OUT in Idaho, the Department of Fish and Game is teaching eager beavers to yell "Geronimo!" These busy little creatures are being dropped by parachute to terrain where they can do their bit in the conservation battle.

Idaho state caretakers trap unwanted beavers which may be a nuisance in certain areas, round them up at central points and pack them in pairs in specially constructed wooden crates. After they are dropped, the boxes remain closed as long as there's some tension on the parachute shrouds but pull open as soon as the chute collapses on the ground. Then, out crawl Mama and Papa beaver, ready to start work.

After they're settled, the 40-pound, web-footed rodents multiply and become outpost agents of flood control and soil conservation. Fur supervisor John Smith reports that in carefully observed early operations, the beavers headed straight for water and started building a new dam within a couple of days.

However, one problem still remains to be solved—a question of ethics more than conservation. *Are these eager beavers bona fide members of the Caterpillar Club?* •

1. Boxed for travel, this beaver is placed in a crate designed by Scotty Heter, left. 2. Rubber bands pull the box apart when the chute hits the ground, freeing the animals. 3. Heading for water, the airborne beavers start working like beavers on their new dam.

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TALK PLAN

I. **Exploiting the Undiscriminating Rodent**

II. Where might this work? - BRAT

   I. Beaver Dam Capacity Model

   II. BRAT – In Progress

III. Beaver in Incised Streams?

   I. Bridge Creek IMW Experiment

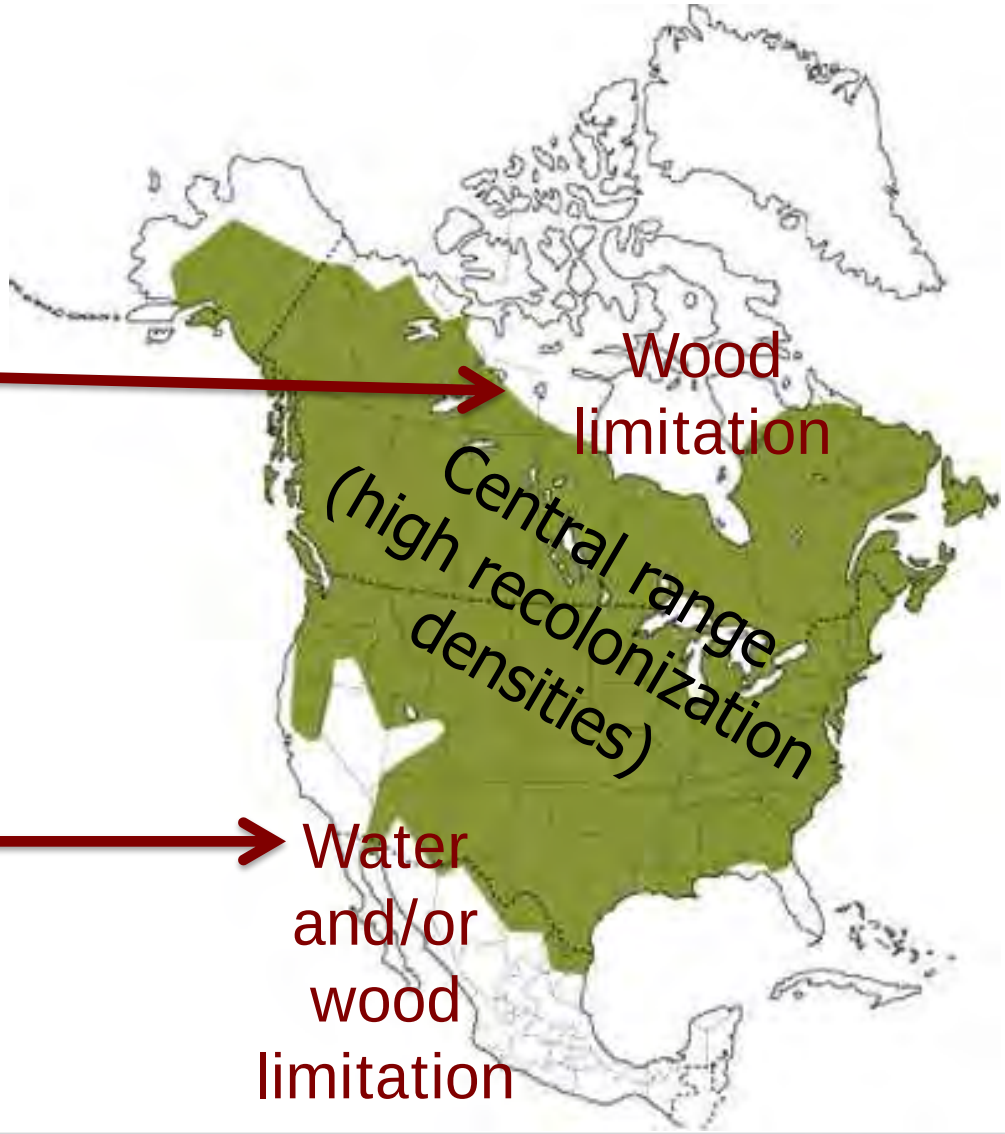
IV. Take-Homes

SOME COMPELLING REASONS TO PARTNER WITH A RODENT

- Just a rodent… but far more experienced at engineering riparian systems then we are
- Carry their own liability insurance & non-union
- Capable of creating dynamic stream habitat with benefits for multiple species
- Widespread throughout North America

BEAVER RANGE…

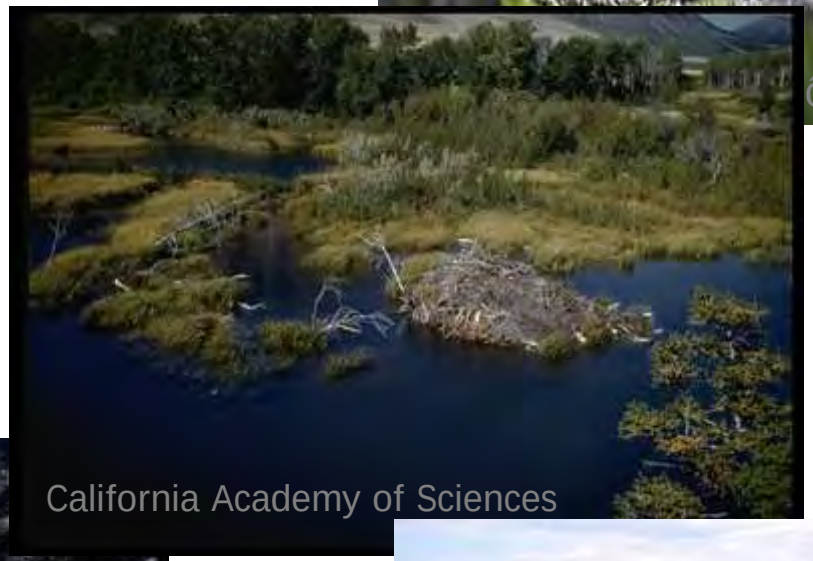
- Northern tundra and treeline range boundary: wood limitation
- Southern desert range boundary: perennial streamflow and/or wood limitation



Slide from John Stella

A HABITAT GENERALIST, AND HIGHLY ADAPTABLE

- Lakes
- Rivers and streams
- Abandoned channels on floodplains
- Wetlands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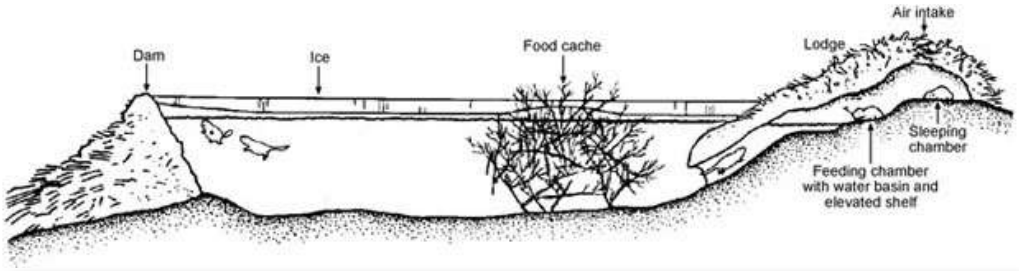
Slide from John Stella

AN UNDISCRIMINATING RODENT…

Beaver Habitat Requirements

- Water, Trees



HINTERLAND WHO'S WHO

http://www.hww.ca/hww2.asp?id=82

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BUT ITS WHERE THEY BUILD DAMS, THAT WE REALLY CARE ABOUT…

- The dams provide the ecosystem services we're primarily interested in

TALK PLAN

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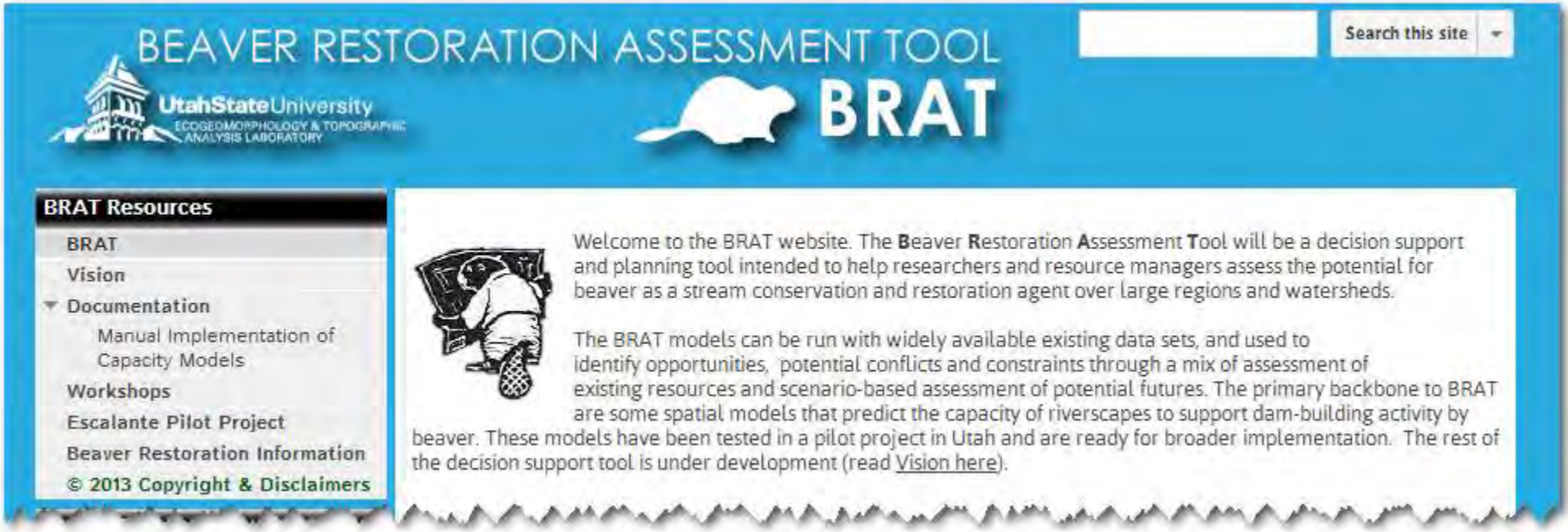
BRAT – BEAVER RESTORATION ASSESSMENT TOOL



Grand Canyon Trust

The WALTON FAMILY FOUNDATION

Mary O'Brien

ECOFLIGHT

http://brat.joewheaton.org

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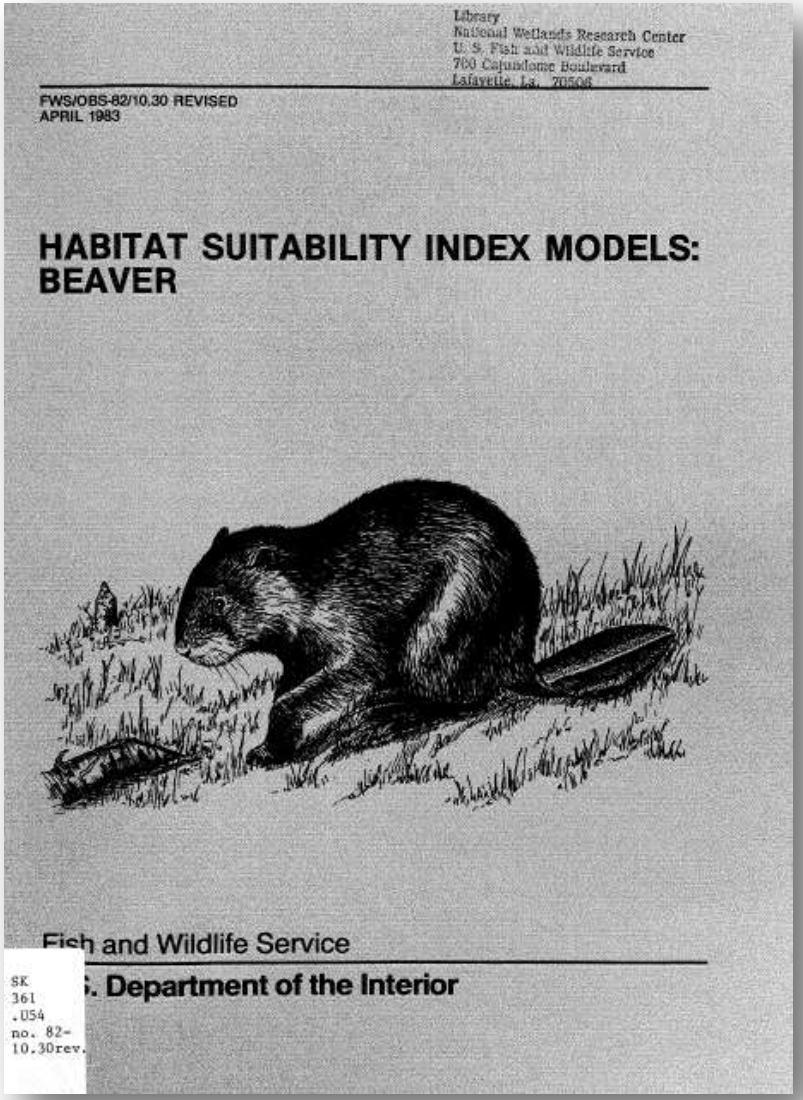
TRADITIONAL BEAVER HSI

- Lots of these models out there…
- Based on same HSI principles used in fish models…


Library
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FWS/OBS-82/10.30 REVISED
APRIL 1983

HABITAT SUITABILITY INDEX MODELS:
BEAVER

Fish and Wildlife Service

. Department of the Interior

SK
361
.U54
no. 82-
10.30rev.

ALLEN (1983)… WHAT MATTERS?

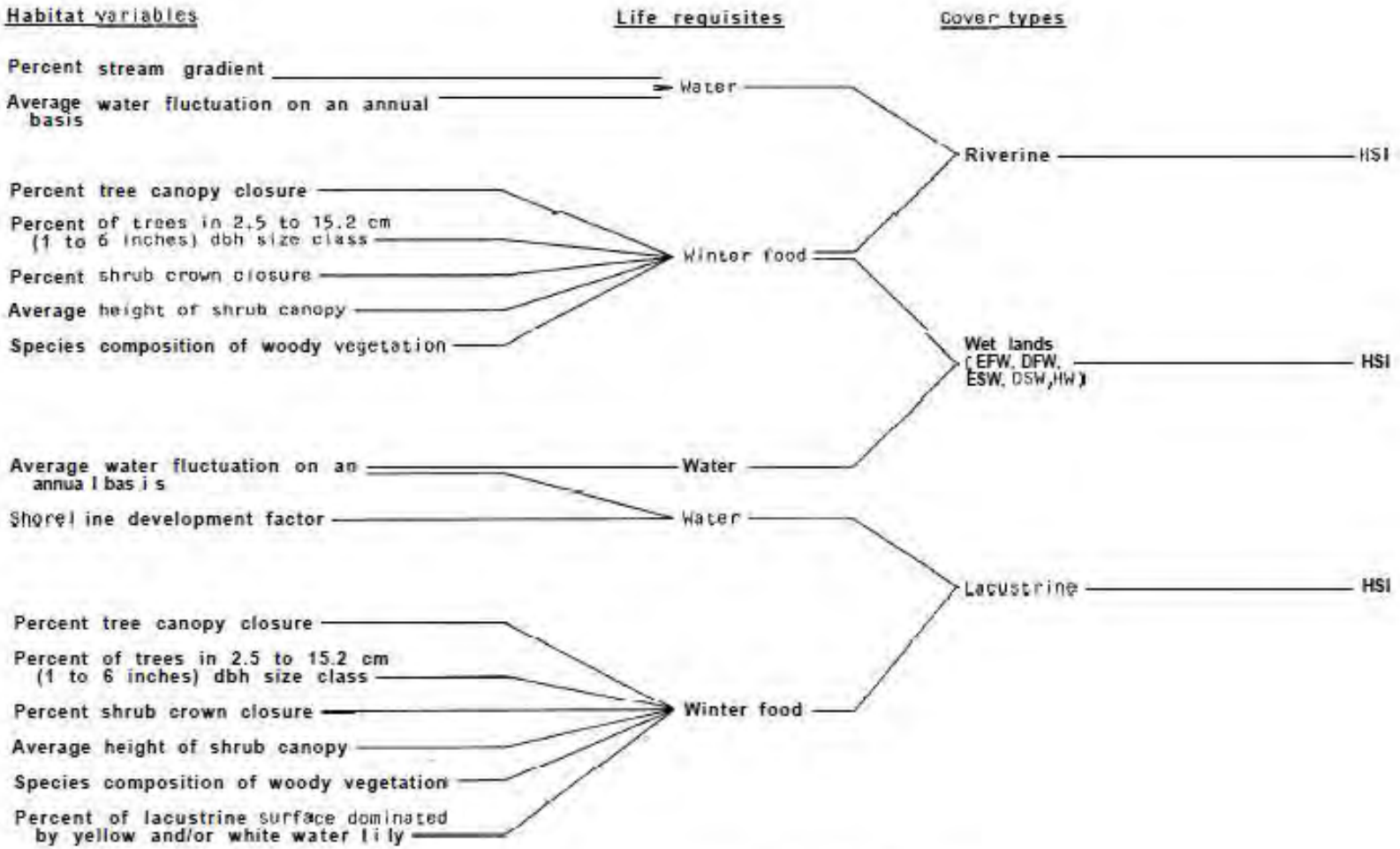
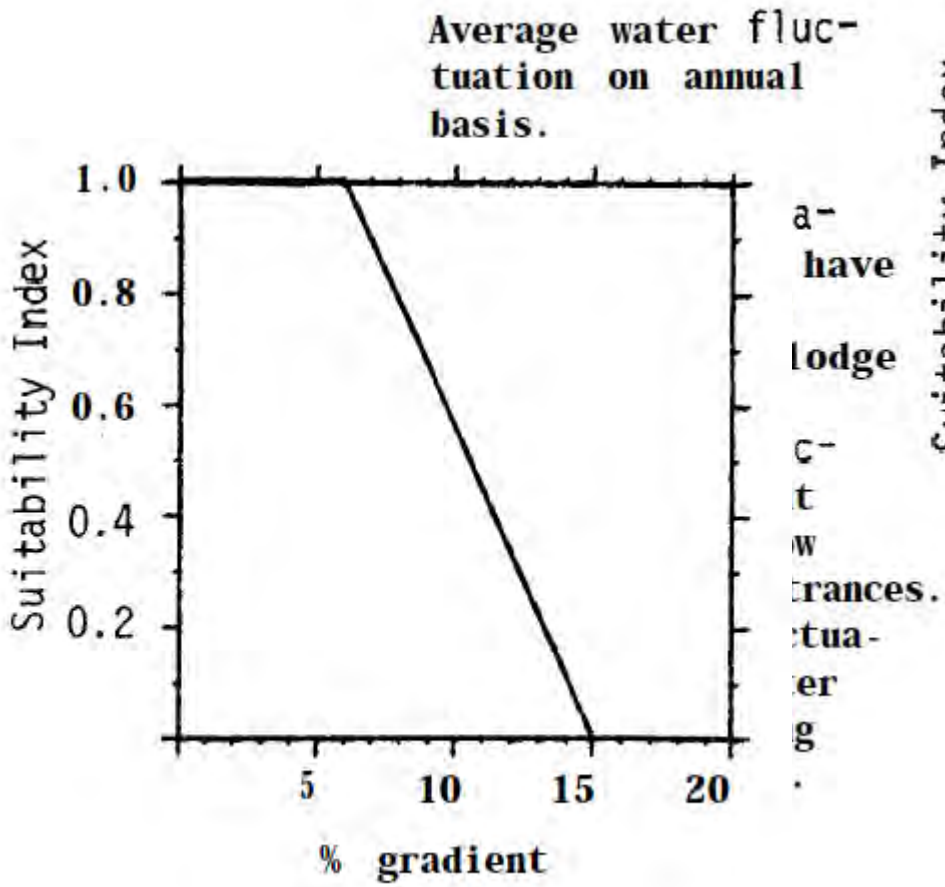
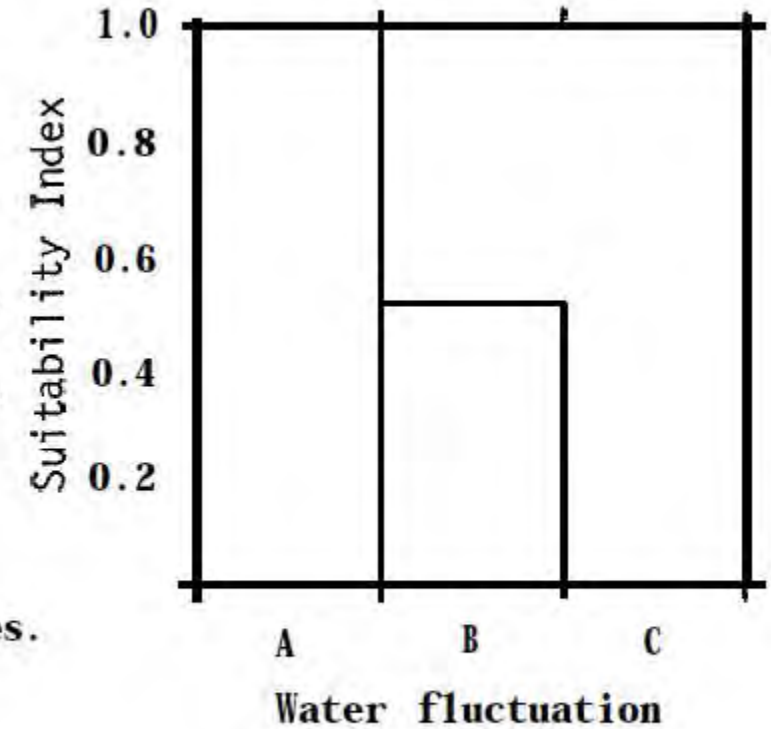


Figure 2. Tree diagram illustrating the relationships of habitat variables, life requisites, and cover types to the HSI for the beaver.

WATER FLUCTUATION & % GRADIENT





TRADITIONAL HABITAT SUITABILITY MODELS DON'T WORK FOR BEAVER

- With sufficient water, food beaver can survive almost everywhere- ***deserts*** to ***alpine meadows***.
  - As such beaver ***defy*** traditional habitat suitability models.
  - Correlations between suitability & beaver occurrence tend to be ***weak*** or ***non-existent***.

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A BETTER APPROACH: DAM-BUILDING CAPACITY MODELING

- *Beaver dams* not beaver themselves provide the restoration outcomes.
- 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*.

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

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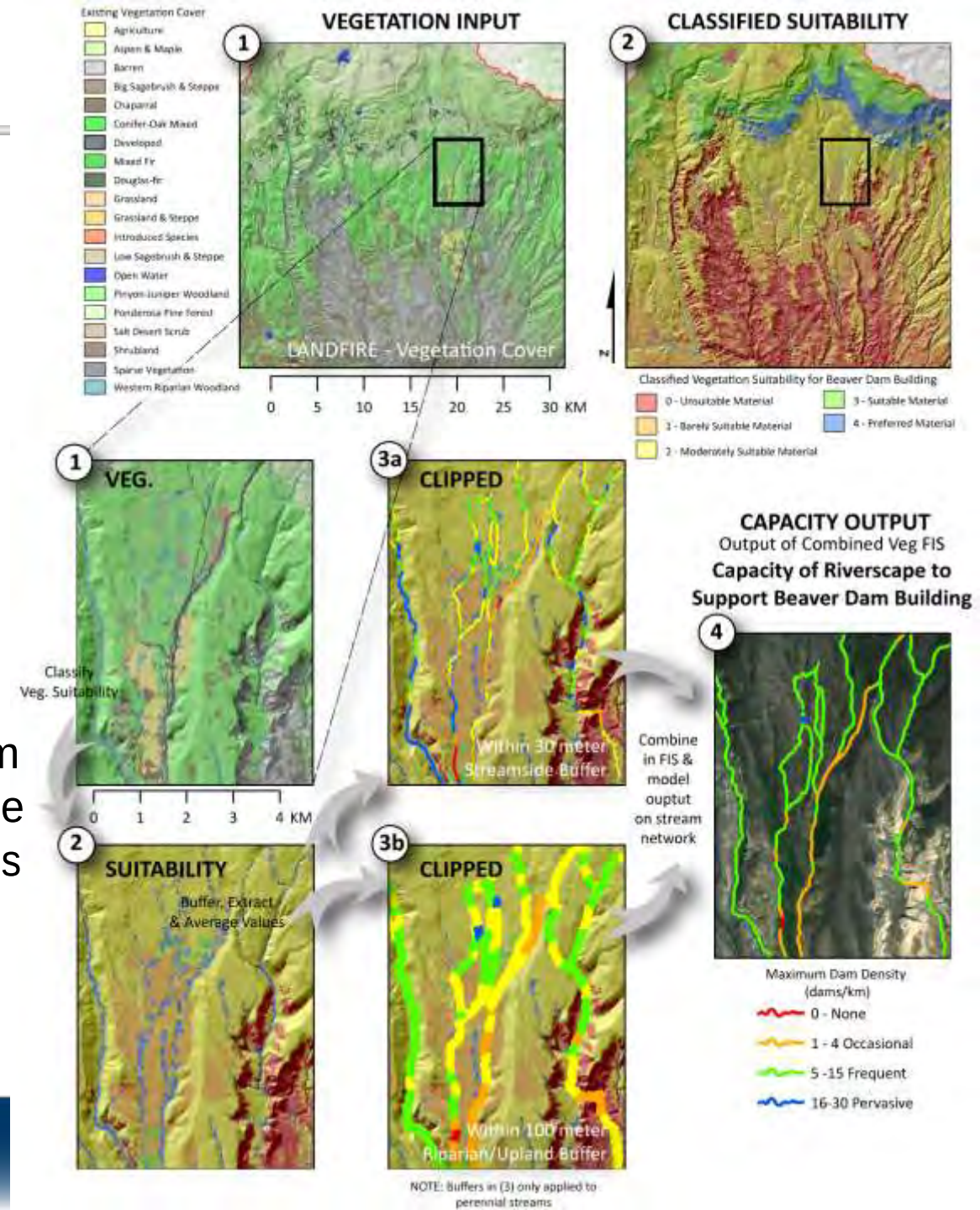
TEST-BEDS

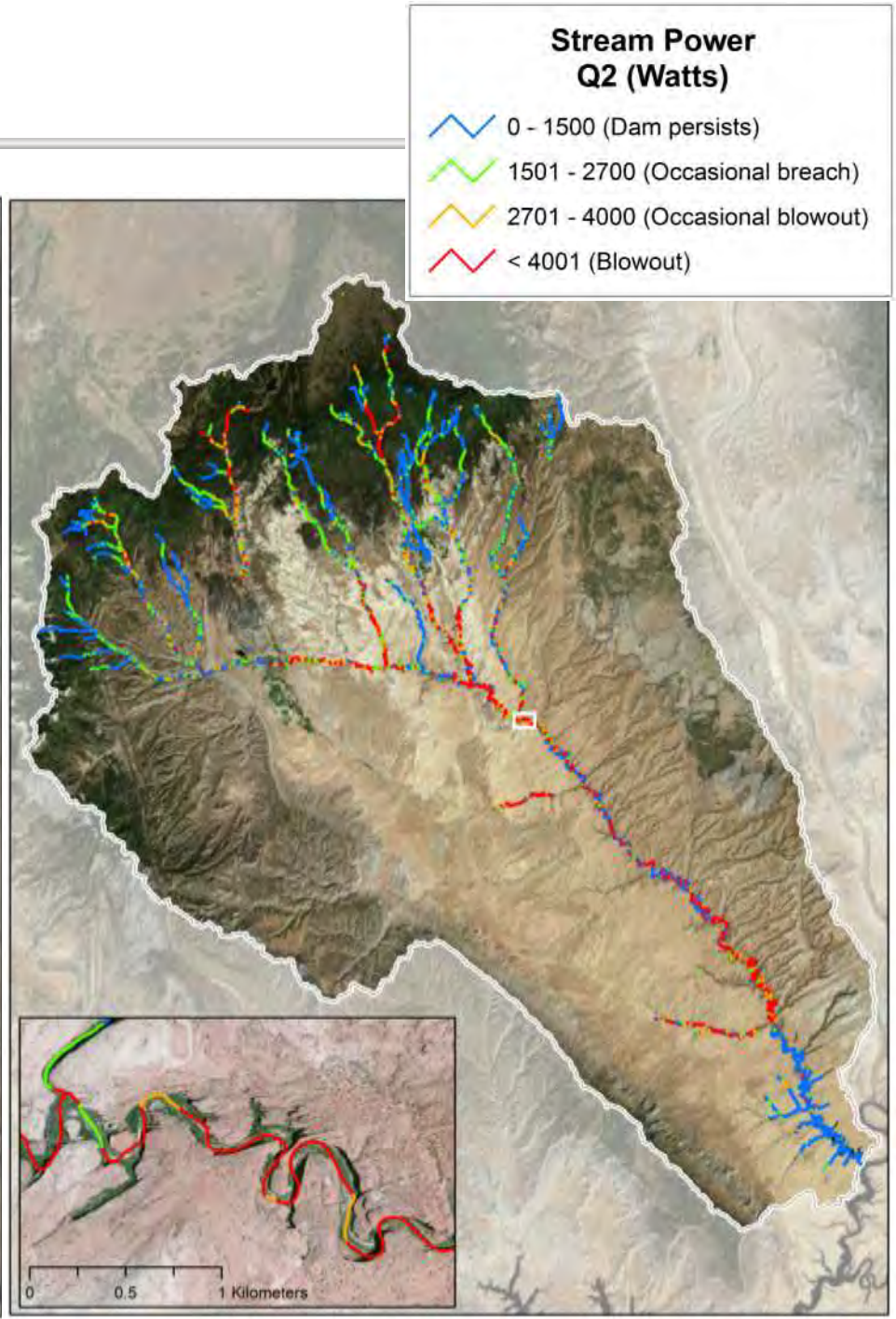
- Escalante Watershed, Utah*
- Logan River Watershed, Utah*
- Greater Yellowstone Ecosystem, Wyoming
- Lower John Day Watershed, Oregon
- Deschutes Watershed, Oregon

WORKFLOW

- Get LANDFIRE
- Classify it
- Clip it to streamside and riparian/upland buffers
- Run it through fuzzy inference system
  - Takes inputs and estimates the maximum dam density that can be supported based on this

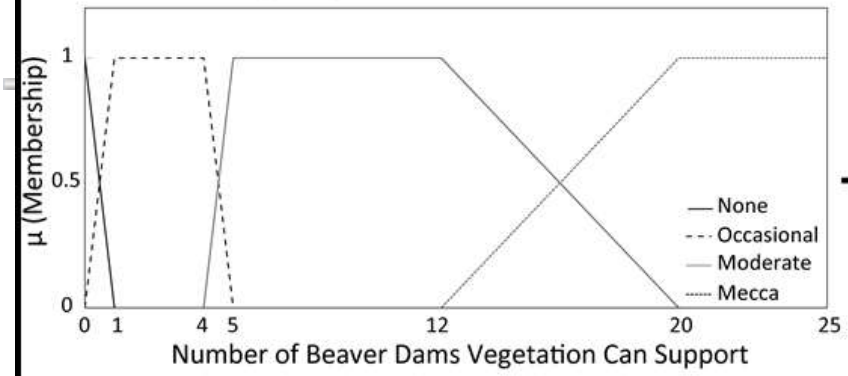


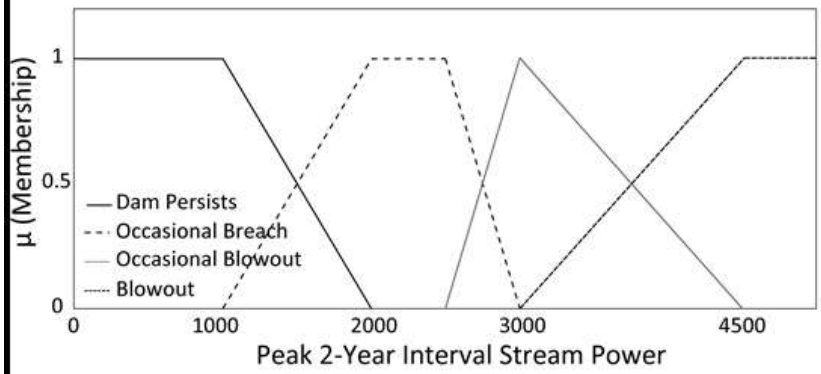
Stream Power
Base Flow QP80 for August (Watts)
0 - 185 (Can build dam)
186 - 360 (Probabbly can build dam)
> 361 (Cannot build dam)
0
0.5
1 Kilometers

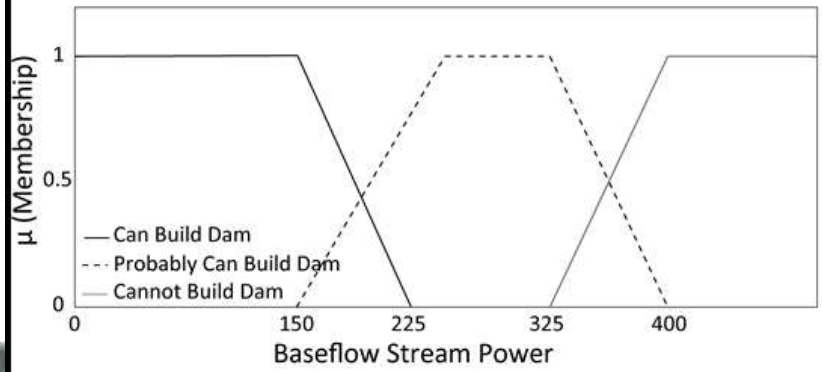

Stream Power
Q2 (Watts)
0 - 1500 (Dam persists)
1501 - 2700 (Occasional breach)
2701 - 4000 (Occasional blowout)
< 4001 (Blowout)
0
0.5
1 Kilometers

PERENNIAL STREAM VEGETATION & STREAM POWER FIS

INPUTS



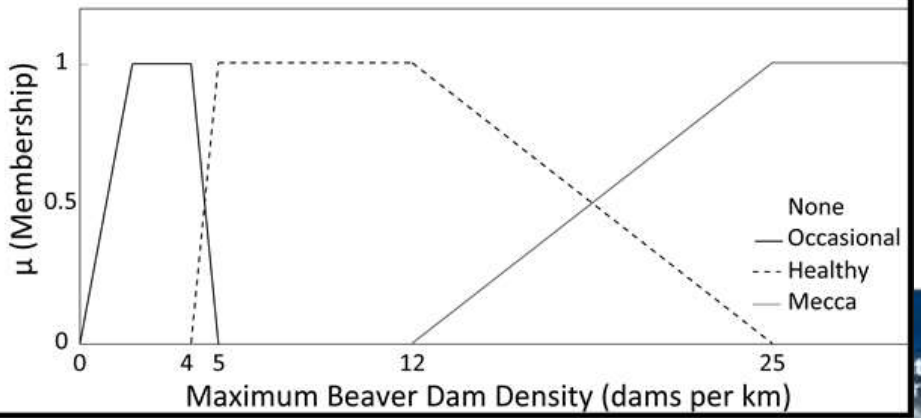




FUZZY INFERENCE SYSTEM

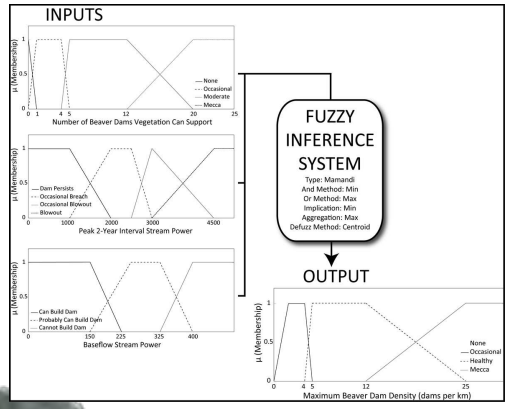
Type: Mamandi
And Method: Min
Or Method: Max
Implication: Min
Aggregation: Max
Defuzz Method: Centroid

OUTPUT



RULE TABLE…

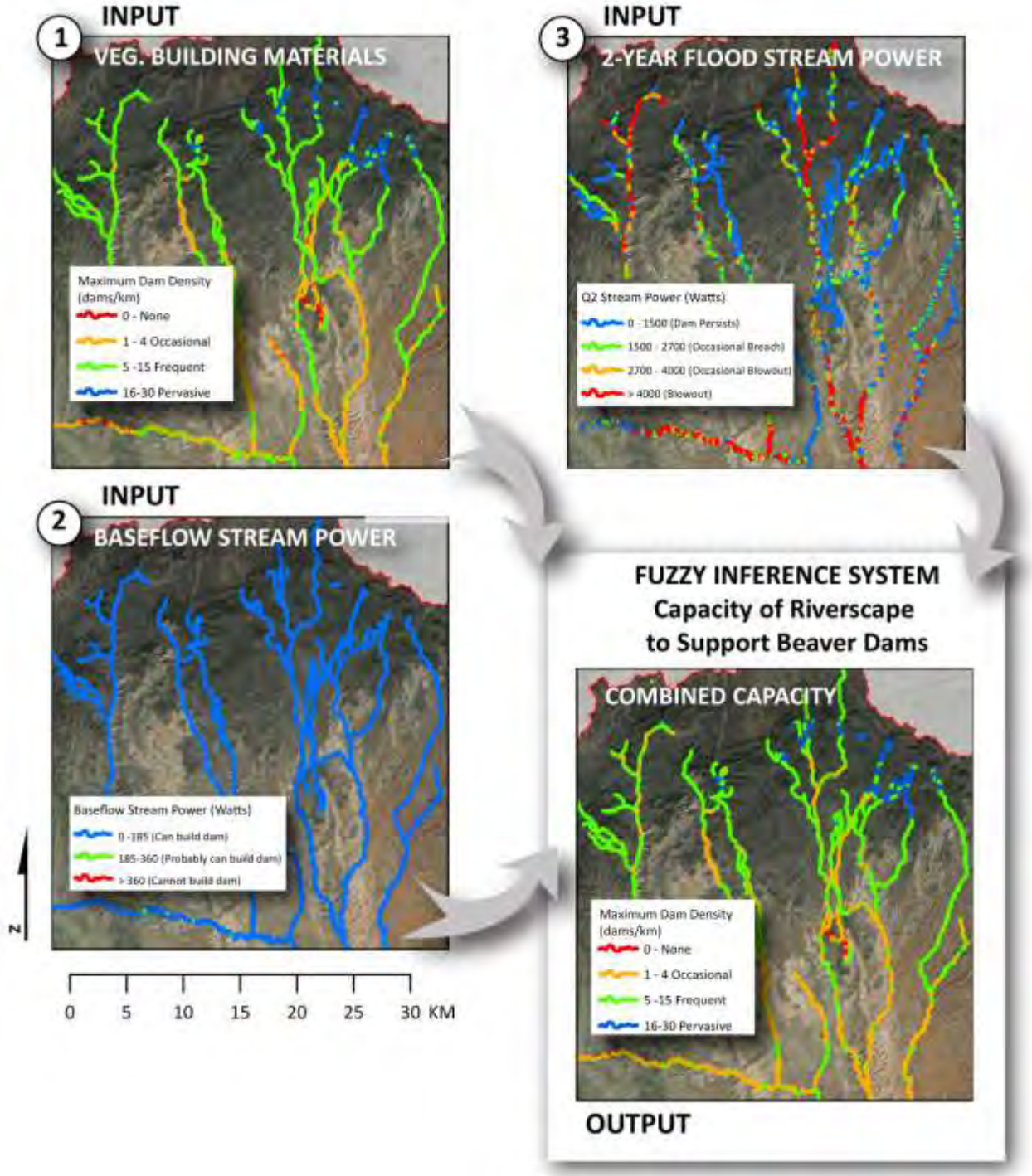
		INPUTS						OUTPUT
	IF	Vegetative Dam Density Capacity (FIS)		Baseflow Stream Power		2 Year Flood Stream Power		Dam Density Capacity
RULES	1	None	&	-	&	-	, then	None
	2	-	&	Cannot Build Dam	&	-	, then	None
	3	Occasional	&	Can Build Dam	&	Dam Persists	, then	Occasional
	4	Frequent	&	Can Build Dam	&	Dam Persists	, then	Frequent
	5	Pervasive	&	Can Build Dam	&	Dam Persists	, then	Pervasive
	6	Occasional	&	Can Build Dam	&	Occasional Breach	, then	Occasional
	7	Frequent	&	Can Build Dam	&	Occasional Breach	, then	Frequent
	8	Pervasive	&	Can Build Dam	&	Occasional Breach	, then	Frequent
	9	Occasional	&	Can Build Dam	&	Occasional Blowout	, then	Occasional
	10	Frequent	&	Can Build Dam	&	Occasional Blowout	, then	Occasional
	11	Pervasive	&	Can Build Dam	&	Occasional Blowout	, then	Frequent
	12	Occasional	&	Can Build Dam	&	Blowout	, then	Occasional
	13	Frequent	&	Can Build Dam	&	Blowout	, then	Occasional
	14	Pervasive	&	Can Build Dam	&	Blowout	, then	Occasional
	15	Occasional	&	Can Probably Build Dam	&	Occasional Breach	, then	Occasional
	16	Frequent	&	Can Probably Build Dam	&	Occasional Breach	, then	Frequent
	17	Pervasive	&	Can Probably Build Dam	&	Occasional Breach	, then	Frequent
	18	Occasional	&	Can Probably Build Dam	&	Occasional Blowout	, then	Occasional
	19	Frequent	&	Can Probably Build Dam	&	Occasional Blowout	, then	Occasional
	20	Pervasive	&	Can Probably Build Dam	&	Occasional Blowout	, then	Frequent
	21	Occasional	&	Can Probably Build Dam	&	Blowout	, then	Occasional
	22	Frequent	&	Can Probably Build Dam	&	Blowout	, then	Occasional
	23	Pervasive	&	Can Probably Build Dam	&	Blowout	, then	Occasional

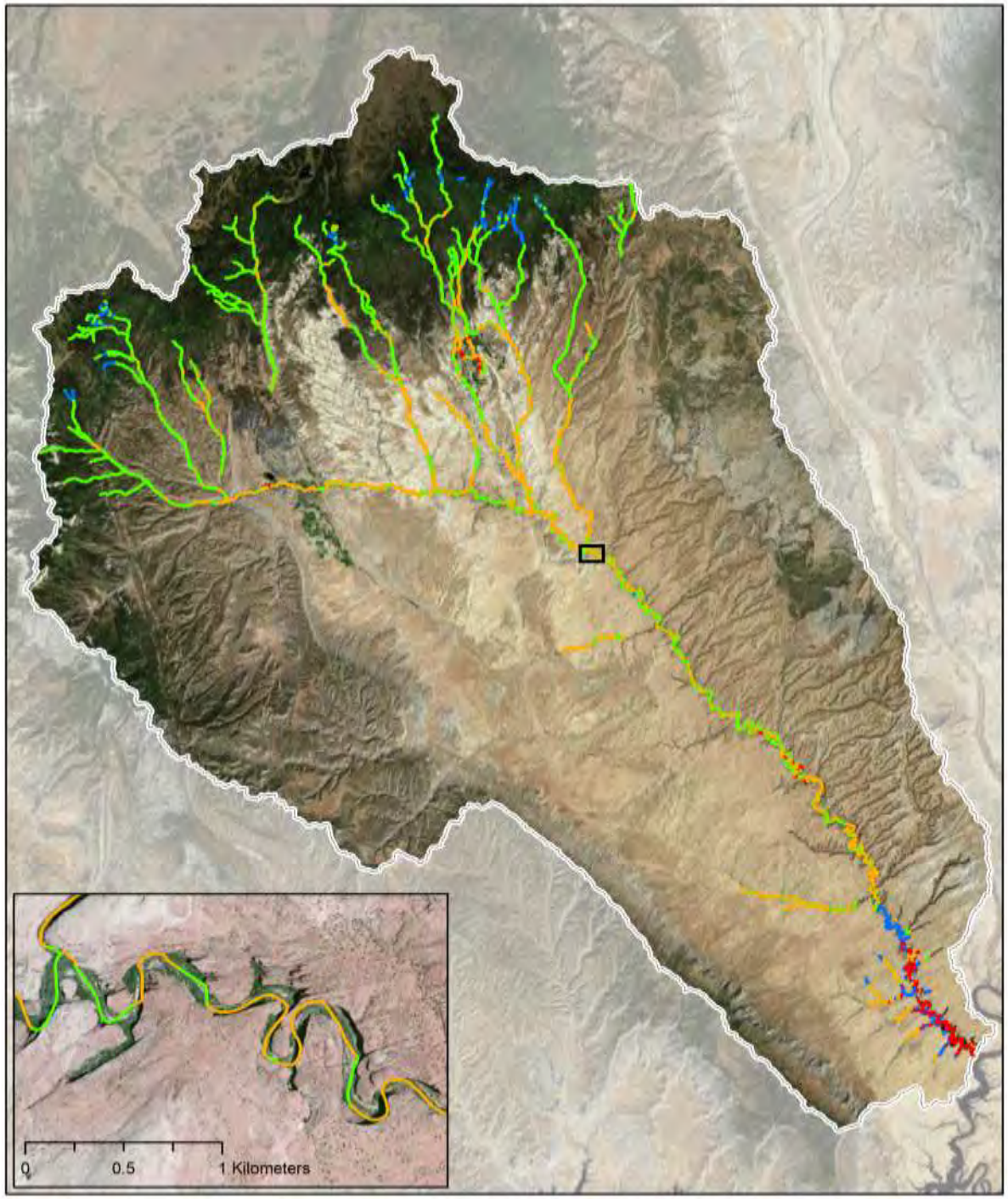


COMBINED

1. Veg FIS
2. Baseflow (can they build a dam?)
3. 2 Year Flood (does dam blow out)

= Resulting Capacity





Existing Combined FIS Dams per KM

- 0 (None)
- 1 - 4 (Occasional)
- 5 - 15 (Frequent)
- 16 - 30 (Pervasive)

Final Output

0 5 10 15 20 25 Kilometers

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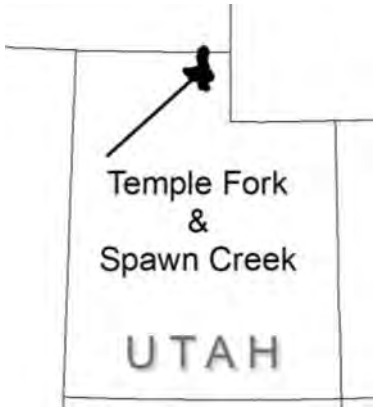
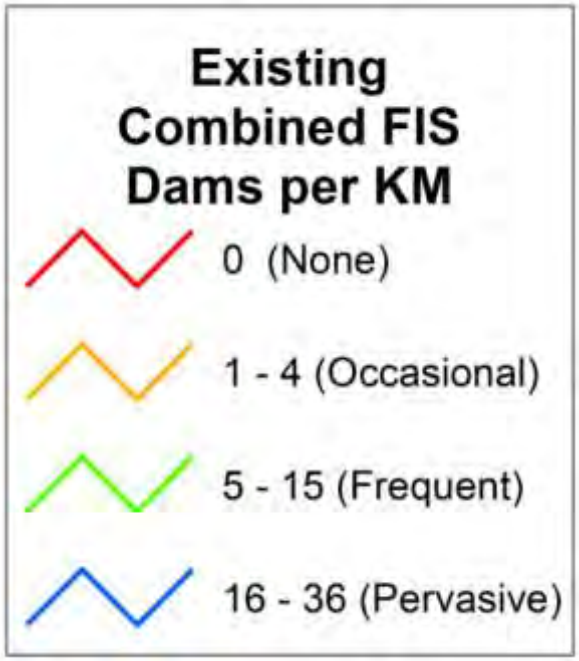
VERIFICATION





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VISION FOR BRAT

BRAT >

Vision

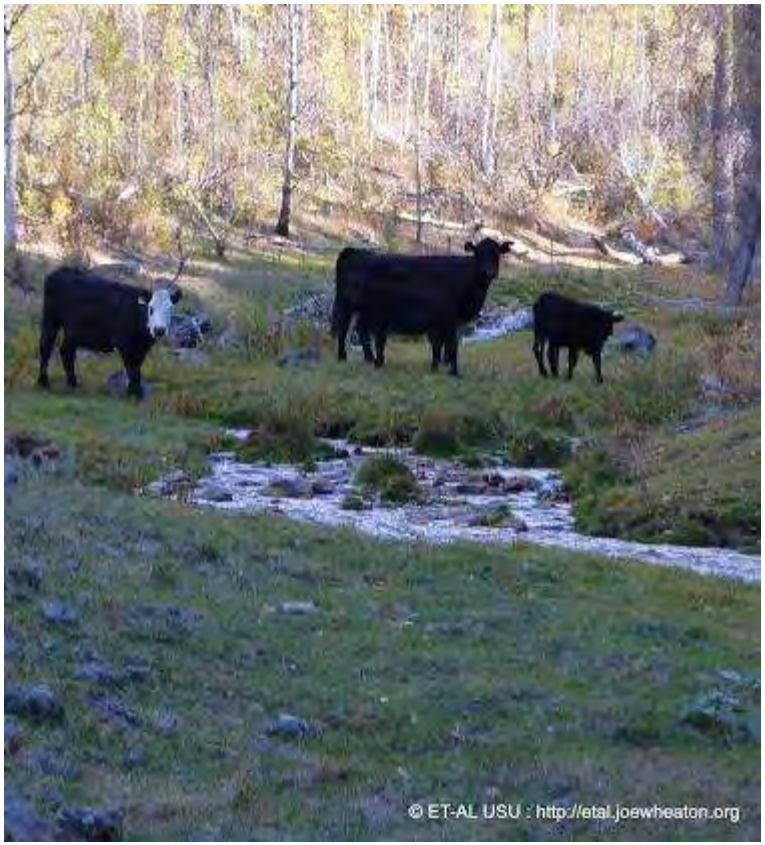
We see BRAT becoming a powerful research and restoration/conservation planning tool for questions relating to where in the landscape dam-building activity by beaver might be sustainable and at what sort of dam densities. At the heart of this is a capacity model, that models the capacity of the landscape to support dam-building activity by beaver. What will translate this from a simple capacity model to an assessment tool that will have the ability to:

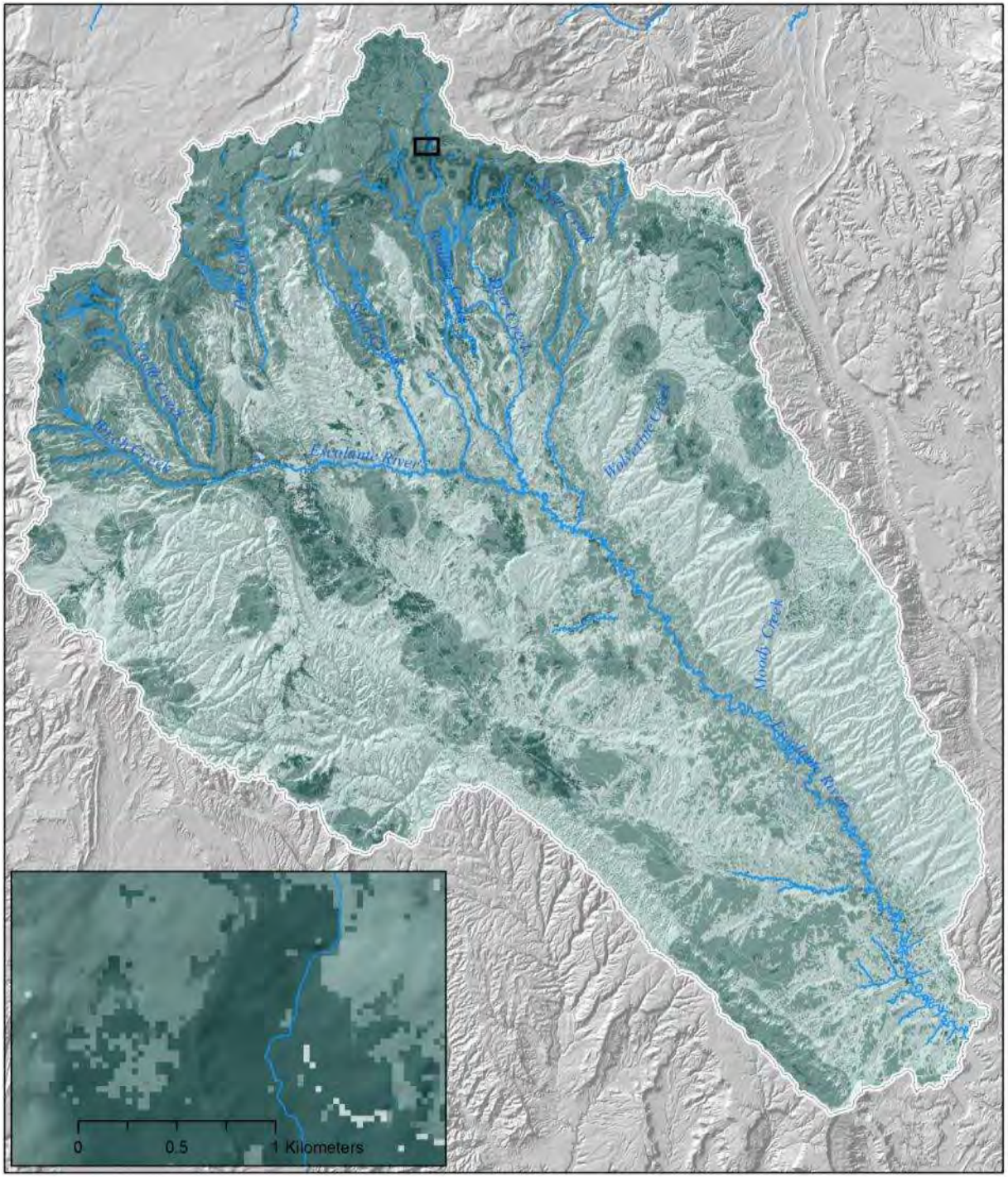
- Combine with other layers that **limit** realization of capacity (e.g. grazing pressure)
- Combine with **management layers** (e.g. proximity to potential nuisance conflicts, forestry, grazing, irrigation, roads, and agriculture) to look at **potential management conflicts** where people may not want beaver to be
- Combine with **RiverStyles** to look at restoration potential (e.g. reconnection of floodplains in incised streams)
- Develop and **explore different scenarios** that represent management options (e.g. riparian fencing or installation of BDSS) as well as different climate change scenarios (e.g. changing flow regimes).

With the completion of our pilot project, the capacity model is done. The next steps are to i) combine this model with the above components to complete the construction of BRAT, ii) verify and refine performance of BRAT across a diverse range of physiographic settings, and iii) test the utility of BRAT in different restoration and management contexts.

LIMITING FACTORS AFFECTING CAPACITY

- Overgrazing of riparian zone
- Trapping or predation
- Roads/development
- Timber harvesting
- Natural disturbance (flooding, fire)





Probability of Ungulate Utilization

High : 1

Low : 0

What goes in?

- Slope
- Distance from Water
- Vegetation

0 5 10 15 20 25 Kilometers

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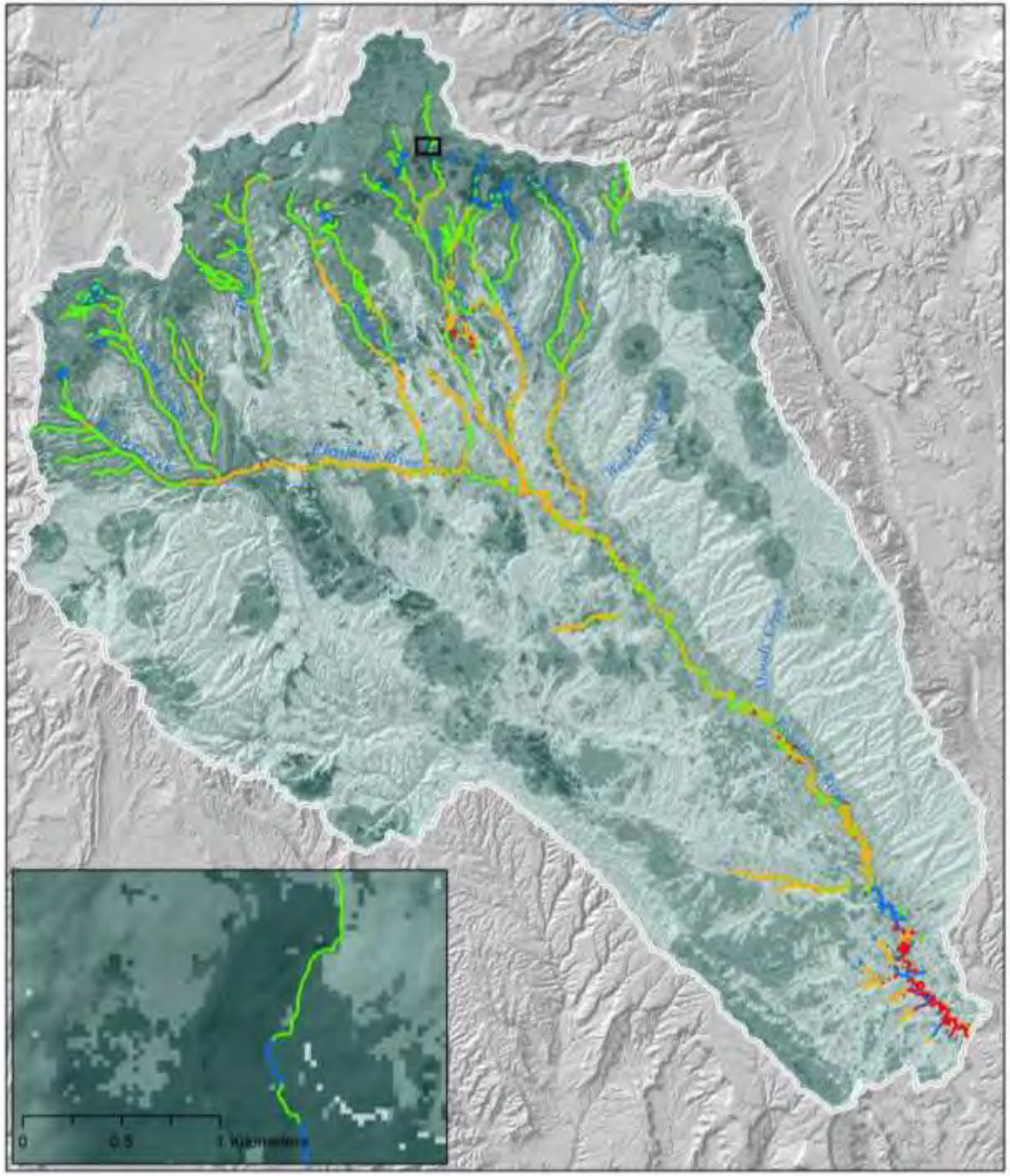


Probability of Ungulate Utilization

High : 1

Low : 0

Existing Combined FIS Dams per KM

0 - None

1 - 4 Occasional

5 - 15 Frequent

16 - 30 Pervasive

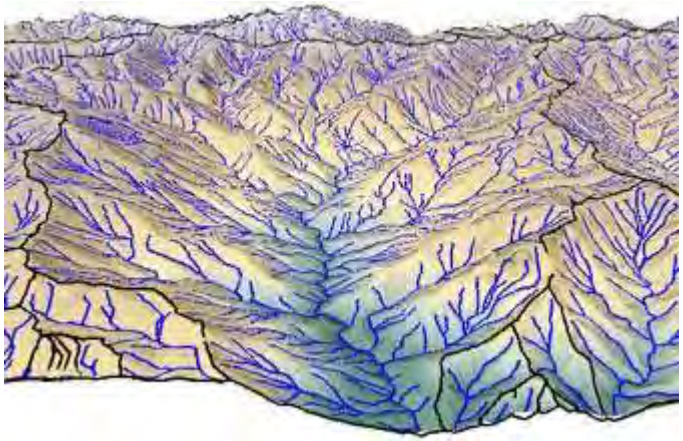
N

0 5 10 15 20 25 Kilometers

© ET-AL 2012

WHAT BRAT WILL DO…

- Classify the drainage network in terms of 'where could they be':
  - Low-hanging fruit streams
  - Quick return streams
  - Long-term possibility streams
  - Unsuitable, Naturally Limited Streams
  - Unsuitable, Anthropogenically Limited Streams



FUTURE BRAT TOOLS

Future BRAT Tools

We envision BRAT consisting of a series of transparently documented methods that any experienced GIS Analyst could deploy and implement manually. However, we think we could make BRAT more useful to managers, practitioners and researchers if we could deploy it as:

- A WebGIS application that would allow users to:
  - Explore and visualize a Base-Version of BRAT run for the Western US in a Google Maps interface
  - Run and produce simple BRAT Scenarios
  - Export BRAT outputs as KML or shapefiles
- An ArcGIS Plugin or Add-In that would allow users to:
  - Download and modify Base-Version of BRAT for area of interest
  - Run and produce BRAT Scenarios based on customized user inputs

BEAVER MONITORING APP!

- Simple enough 2nd graders can use it
- Sophisticated enough that researchers get useful data streams
- Going to launch statewide monitoring campaign with USU Extension & DWR

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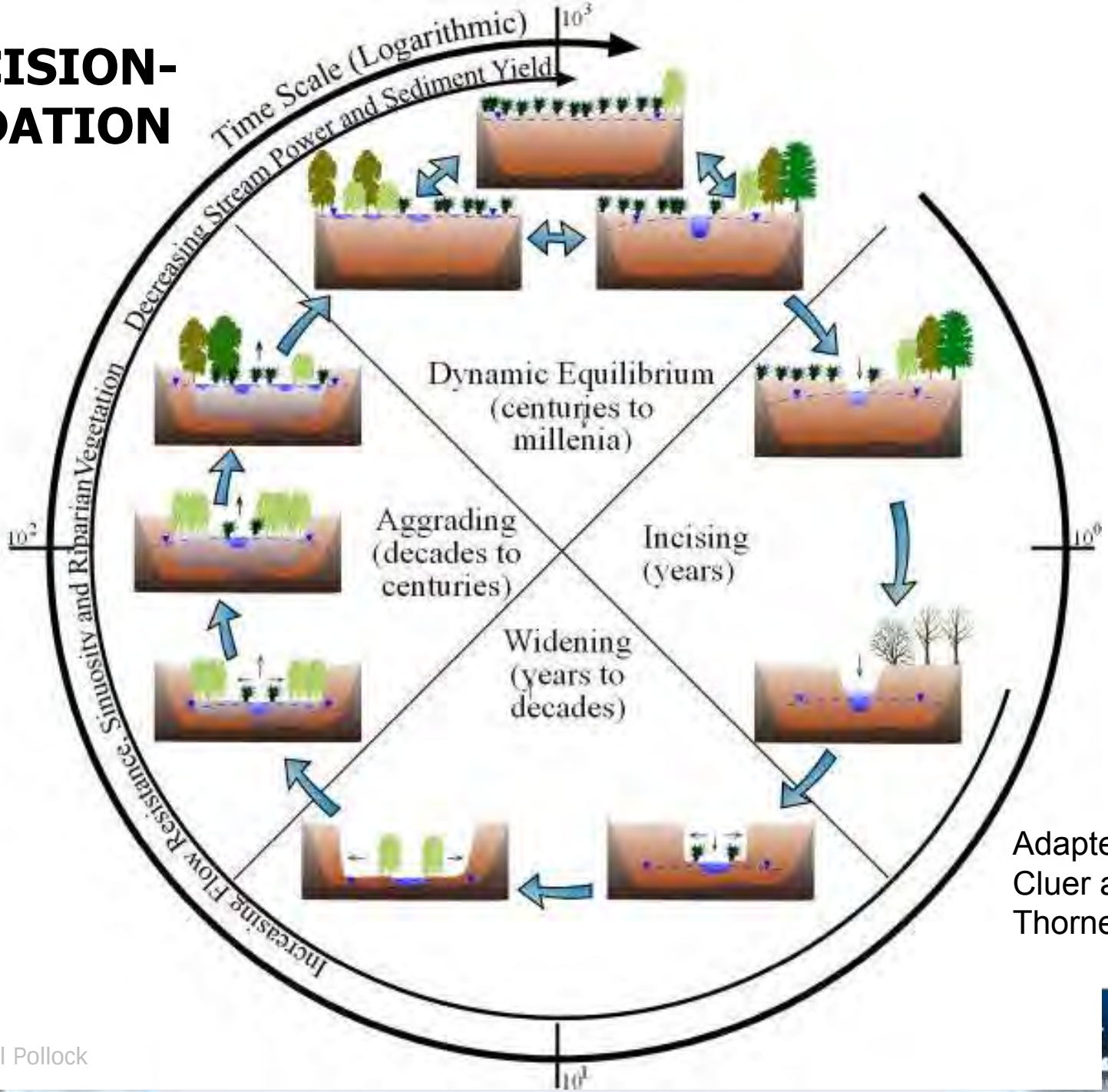
INCISED STREAMS ARE UBIQUITOUS

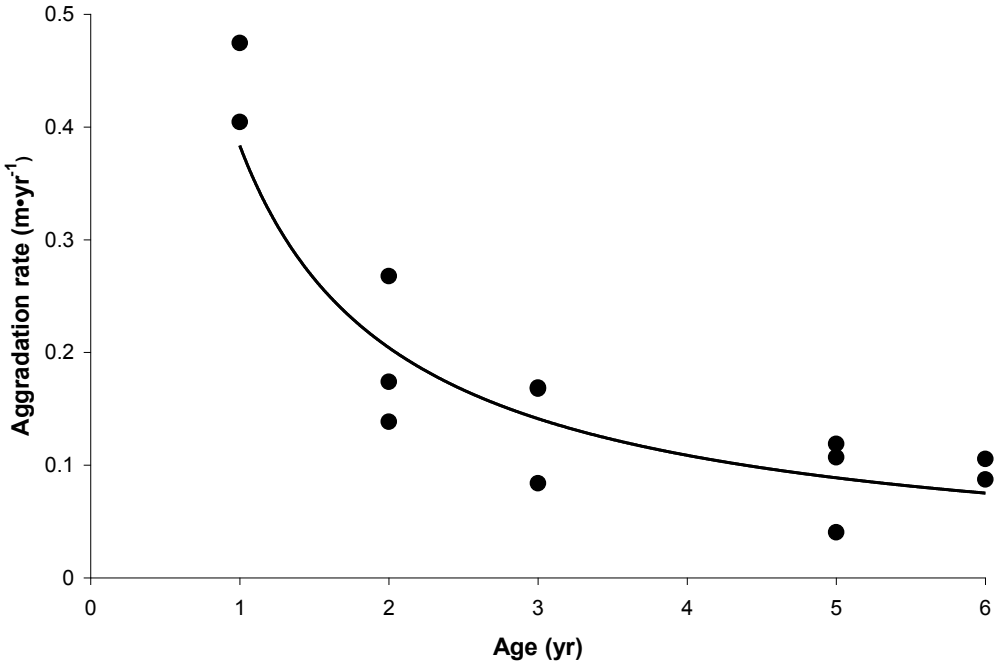
THE INCISION-AGGRADATION CYCLE



Adapted from Cluer and Thorne 2013

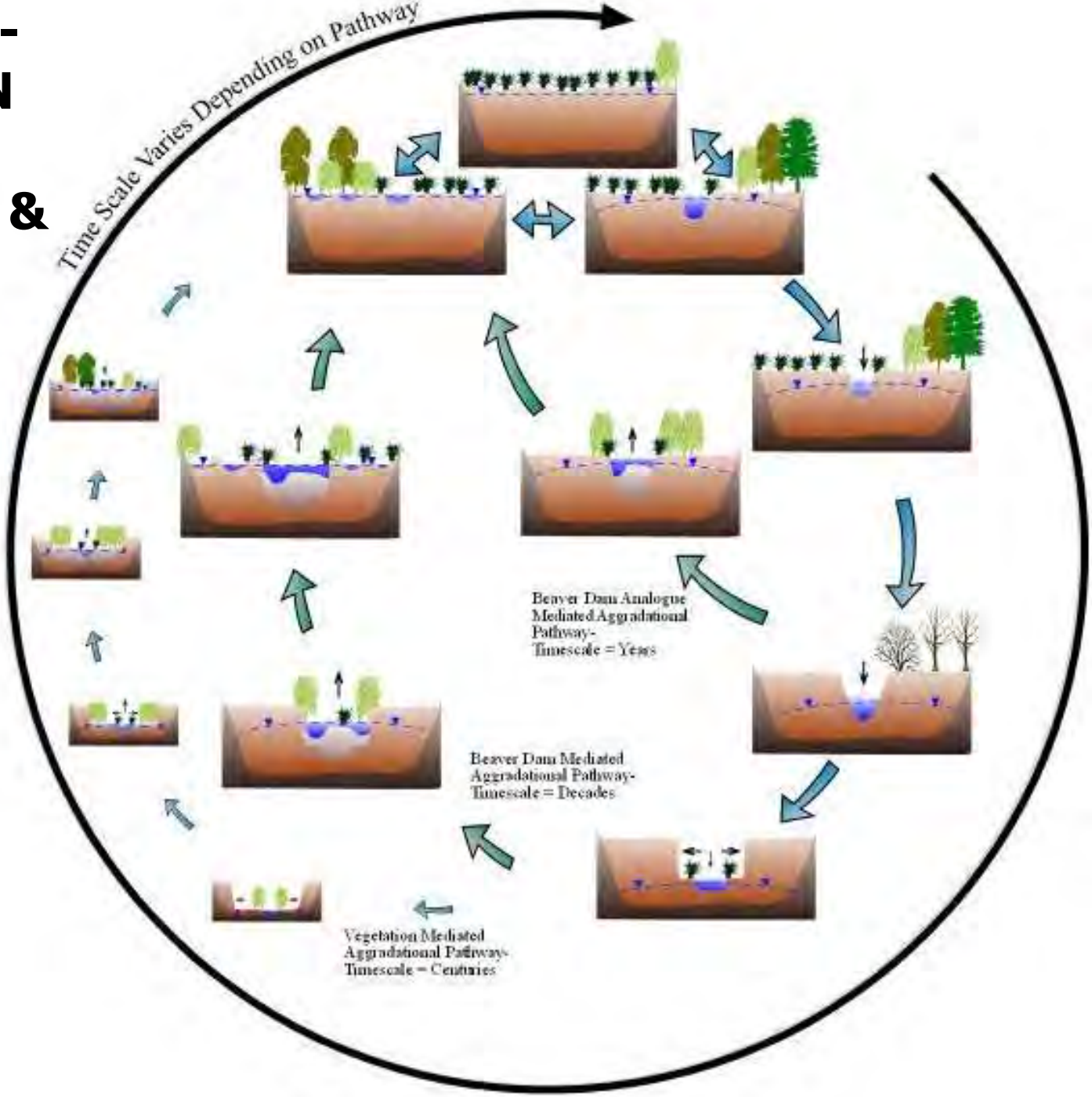
Slide from Michael Pollock

BEAVER DAMS EXPAND RIPARIAN VEGETATION EXTENT AND TRAP SEDIMENT



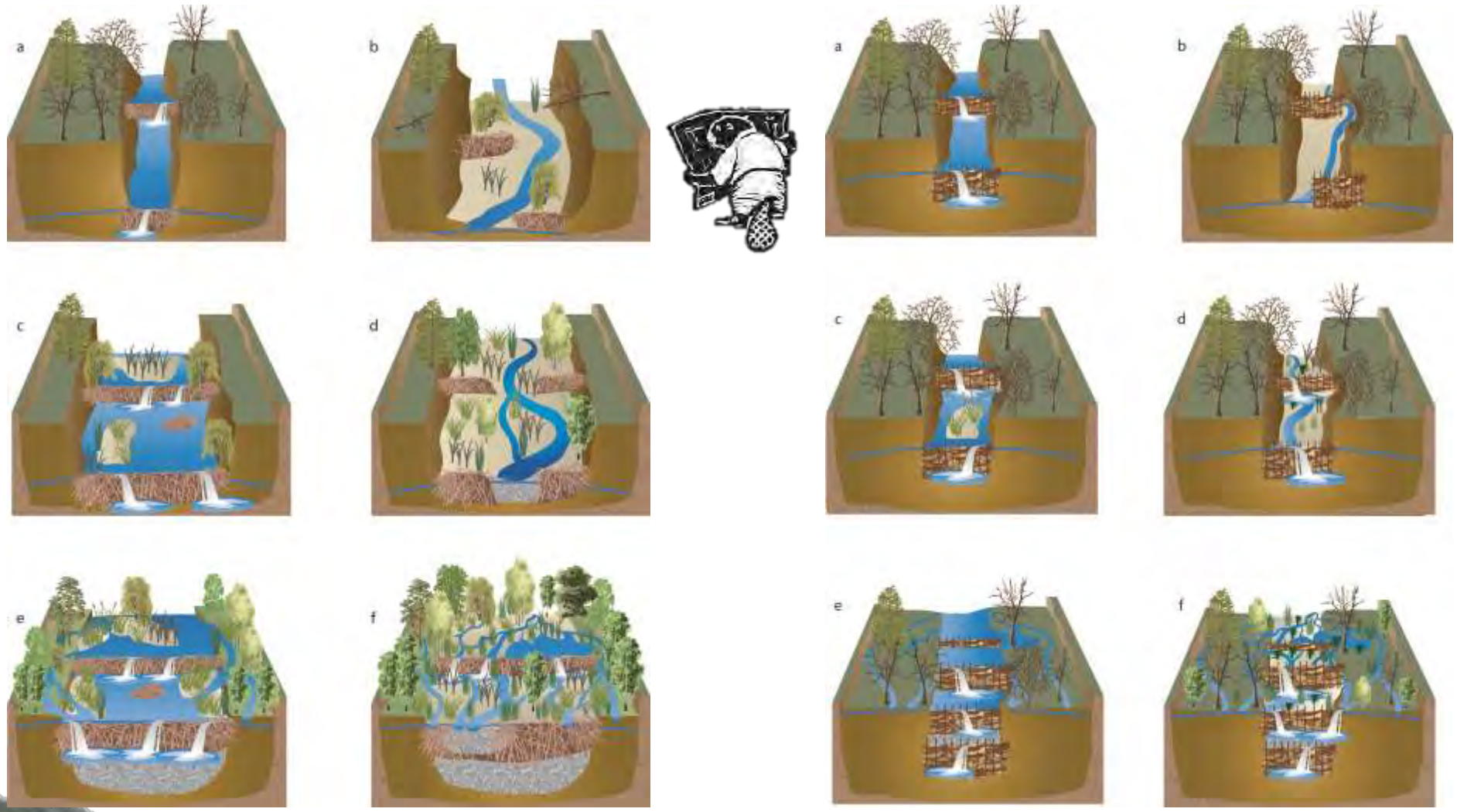
Pollock et al. 2007

THE INCISION-AGGRADATION CYCLE WITH BEAVER DAMS & BEAVER DAM ANALOGUES



From Pollock et al. (In Review)

USING BEAVER TO RESTORE INCISED STREAMS



From Pollock et al. (In Review) –
For submission to Bioscience

UtahState University

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CAN BEAVER DAMS AGGRADE INCISED STREAMS TO THE POINT OF FLOODPLAIN RECONNECTION AND RECOVERY?

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Kenny DeMeurichy
Nick Bouwes

Michael Pollock
Chris Jordan
Carol Volk
Nick Webber

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- Mike McKay (BLM)
- Alan Kasprak (USU)
- Elijah Portugal (USU)
- CHaMP Field Crews
- Boyd Bouwes (WC)
- Tim Beechie (NOAA)
- And many others…

BONNEVILLE POWER ADMINISTRATION

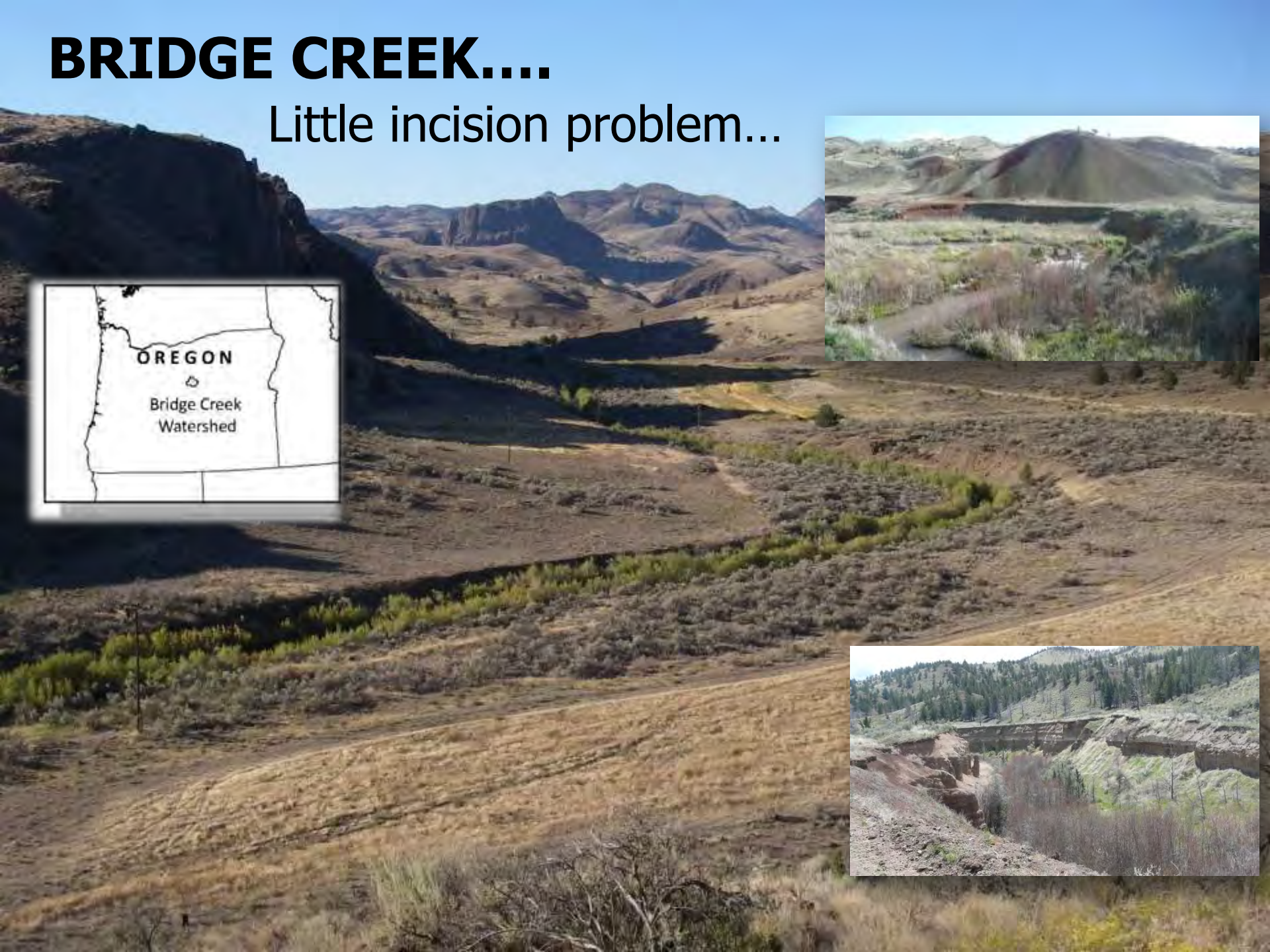
Northwest Fisheries Science Center
NOAA Fisheries Service

EcoLogical Research, Inc.

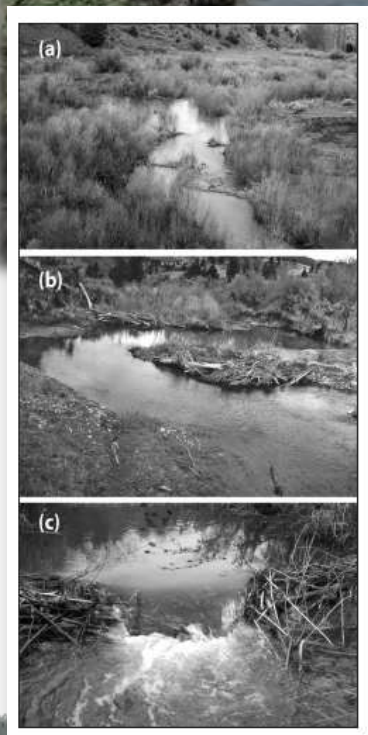
UtahState University

BRIDGE CREEK….

Little incision problem…



BEAVER DAMS JUST DID NOT LAST IN BRIDGE



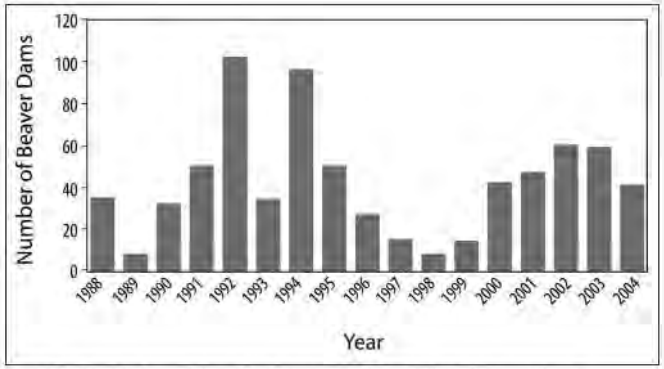


Figure 1. Total number of inventoried beaver dams, by year, along 25.4 km of Bridge Creek in central Oregon.

Rick Demmer, Bureau of Land Management, Prineville, Oregon 97754

and

Robert L. Beschta[1], College of Forestry, Oregon State University, Corvallis, Oregon 97330

Recent History (1988-2004) of Beaver Dams along Bridge Creek in Central Oregon

Abstract

Bridge Creek is a low-gradient stream in the John Day River basin of eastern Oregon. After decades of grazing, riparian vegetation along a 31.7 km reach was sparse and low in diversity, vegetated floodplains were typically narrow, and the stream was relatively wide and shallow. Cattle grazing within this reach was reduced in 1988, irrigation diversion ditches were replaced with culverts in 1989, and beaver (*Castor canadensis*) trapping was discontinued after 1991. Between 1988 and 2004, we inventoried beaver dams and ponds twice a year and estimated their dimensions. Field notes and photographs were used to document habitat use and better understand the potential role of beaver with regard to channel morphology and riparian plant communities. The annual number of beaver dams present in the study reach ranged from 9 to 103. On average, dams were nearly 8 m in length with ponds extending upstream 26 m. We also found that beaver dams/ponds, over time, typically accumulated sediment, improved conditions for establishment and growth of riparian plants, and altered channels. Dams that breached during periods of high flow often contributed to long-term increases in channel complexity through the formation of new meanders, pools, and riffles. Exposed sediment deposits associated with breached dams provided fresh seedbeds for regeneration of willows (*Salix* spp.), black cottonwood (*Populus balsamifera* ssp. trichocarpa), and other riparian plants. Although portions of the study reach were periodically abandoned by beaver following heavy utilization of streamside vegetation, within a few years dense stands of woody plants normally occupied a larger portion of the floodplain. Observations over a period of 17 yrs indicate that beaver facilitated recovery of riparian vegetation, floodplain functions, and stream channels.

Introduction

Although Beaver (*Castor canadensis*) once ranged across nearly all of North America, fur trapping in the 1700s and 1800s decimated their populations across much of the United States (Hill 1982). With the loss of beaver and their dams along streams in the American west, in conjunction with increasing levels of herbivory from livestock, channel incision and widening often occurred causing drastic reductions in subsurface water storage along floodplains and loss of wetland habitats associated with riparian ecosystems (Fouty 2003). In the Ochoco Mountains of central Oregon, Finley (1937, p. 296) observed that, "with no beaver engineers left to take care of the dams, the ponds disappeared; grassy meadows built up by sub-irrigation died out."

Beaver historically have been identified as destroyers of trees, roads, crops, and habitats (Bump 1941, Yeager and Hill 1954, Hill 1982, Avery 1983, DeByle 1985, Beier and Barrett 1987). More recent studies, however, have established their capability to improve watersheds, stream systems, and habitats (Brayton 1984, Naiman et al. 1988, Wright et al. 2002, Baker and Hill 2003). Even with increasing knowledge regarding the ecological benefits of beaver (Kay 1994, Ringer 1994, Sharps 1996, Wright et al. 2002), public agencies and private landowners were often reluctant to protect them from continued exploitation. This was perhaps due, in part, to damage complaints from landowners that occurred when beaver reoccupied portions of their former range (Hill 1986, Luoma 1996).

In the John Day River basin of central Oregon, the effect of beaver on stream systems was controversial in the late 1980s and thus they were widely trapped. Along Bridge Creek, a tributary of the John Day River, trapping kept populations at relatively low levels since ranchers were apprehensive about potential impacts to crops and irrigation facilities (Freilich et al. 2003). Similarly, various local, state, and federal land managers were concerned that failed beaver dams would contribute to bank damage and riparian impacts, especially where cattle grazed in riparian areas. In light of this controversy, we annually monitored

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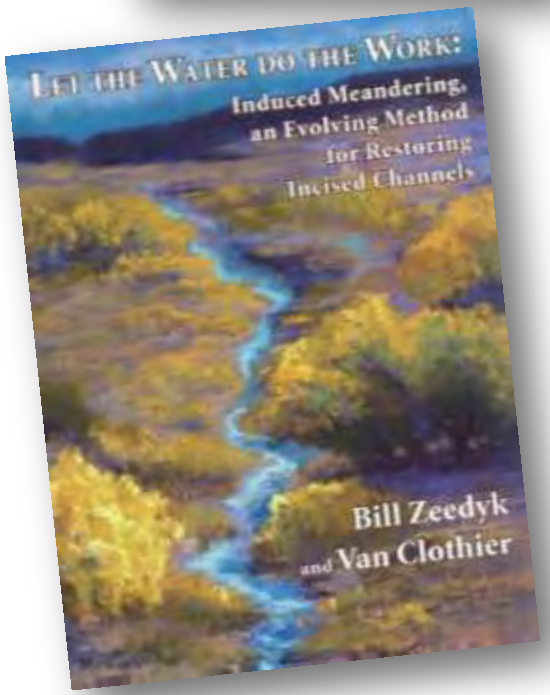
UtahState University

SO HELP 'EM OUT… BUY THEM ~~POSTS~~ TIME

COMMON INGREDIENTS

- Structural kick-start (not designed to last… designed to buy beaver time)
- Posts… (3″ to 4″ diameter)
  - $3 to $8 a post
- Opportunistic placement in field @ high densities
- Non-destructive installation
- Focus on process… 'letting water do the work' and/or 'letting rodent do work'



FOUR STRUCTURE TYPES

Figure 10. A typical starter dam (SF-17 at Sunflower) with willow branches woven between vertical posts and the back side sealed with rock and clay. Note the dam height is sufficient to divert flow onto the RL terrace, mimicking a stable beaver dam.

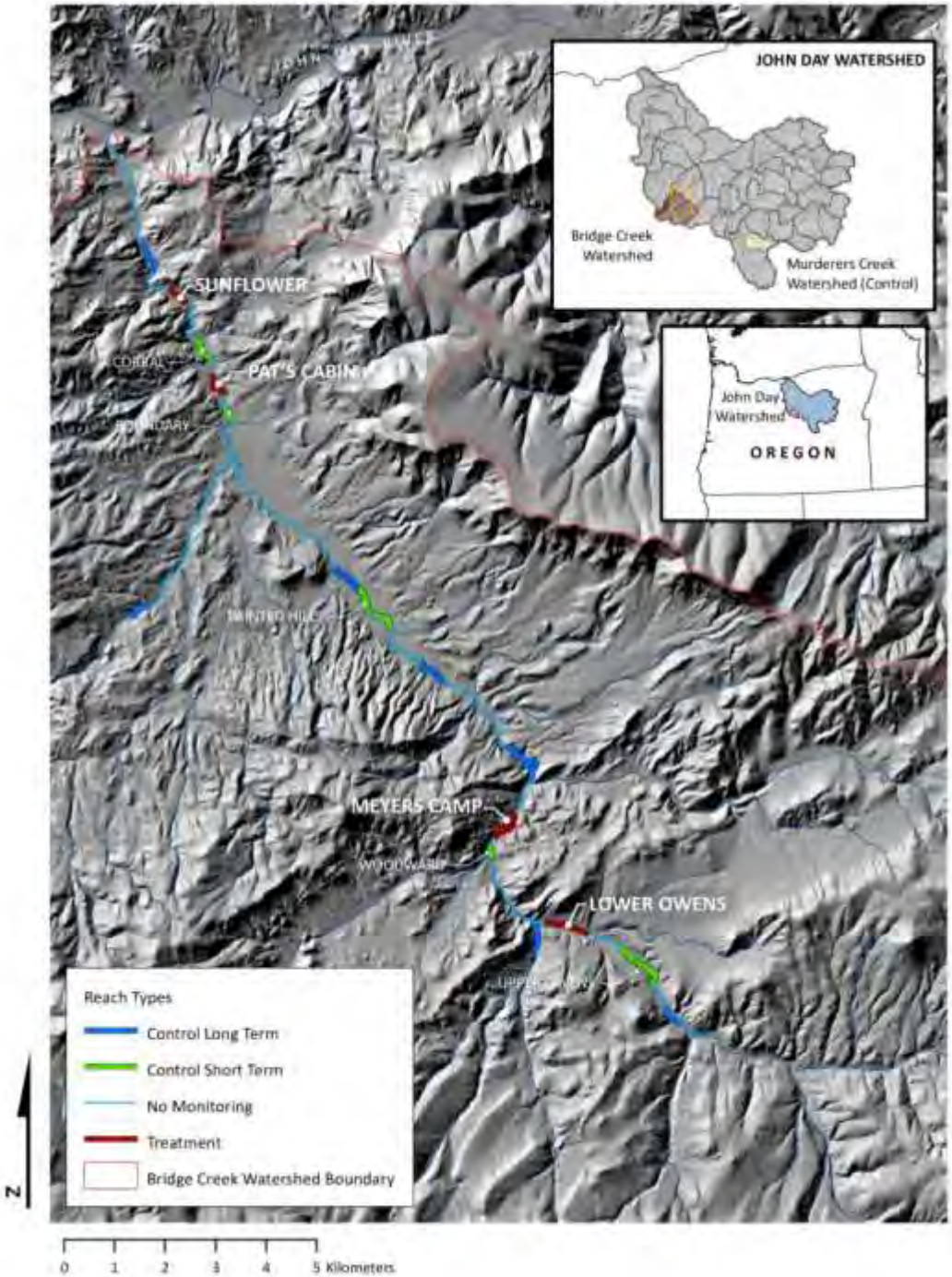
Figure 12. The purpose of a post line is to provide a site where beaver can build a stable dam. They generally create little or no geomorphic changes unless utilized by beaver.

Figure 11. A post line with wicker weave is similar to a starter dam, but acts more like a weir in that water is allowed to flow through the willow branches such that low flows are not over topping the structure and the woven branches may not extend to the top of the posts. These may naturally seal up by trapping sediment and organic material moving downstream or they may be utilized by beaver. Note that beaver have started to colonize this FLWW, as evidenced by the chewed stems on the right of the photograph, aligned parallel to the flow.

Figure 13. Any active dams within the treatment areas were strengthened with posts to lengthen their functional life, since most dams along the incised Bridge Creek have been shown to last less than a year (Demmer and Beschta, 2008). This structure was one of four dams built in sequence in Lower Owens to form a new colony. Within one year, all four dams had backfilled with sediment, which improved floodplain connectivity and habitat complexity, but made the site unsuitable for beaver. However, because we had installed additional post lines just downstream the beaver were able to use them to build new dams which allowed the colony to persist.

TO TEST IDEA…

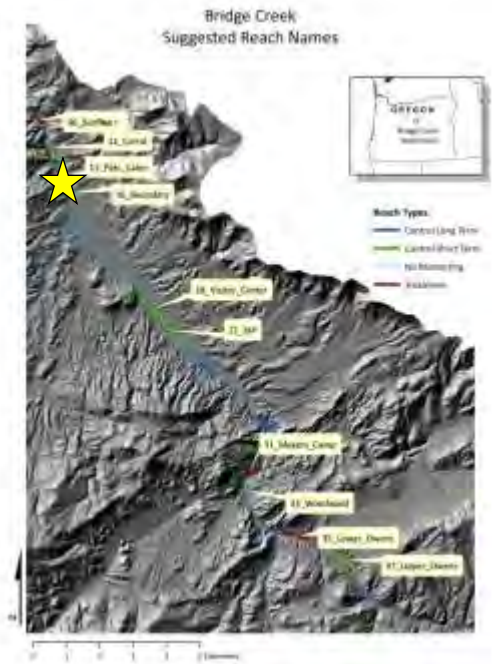
- 4 Treatments & 6 Contro (25 km)
- Slough of things…
  - BDSS Monitoring
  - Repeat Aerial Surveys
  - **Repeat Topographic Surveys**
  - Beaver Monitoring
  - Fish Habitat Surveys
  - **Fish growth, survival movement**
  - Fish diets



LETS LOOK AT ONE TREATMENT

Pat's Cabin Reach

- Can it work? **Can beaver really 'restore' an incised channel and reconnect it with its floodplain?**



STARTER DAM OCCUPIED…

Installed September 2009, Occupied by November 2009

FLOW FORCED ONTO FLOODPLAIN

Enough aggradation and dam activity @ secondary dam to force flow onto floodplain even at moderate flows.

STARTER DAM UPSTREAM OF FAILED DAM

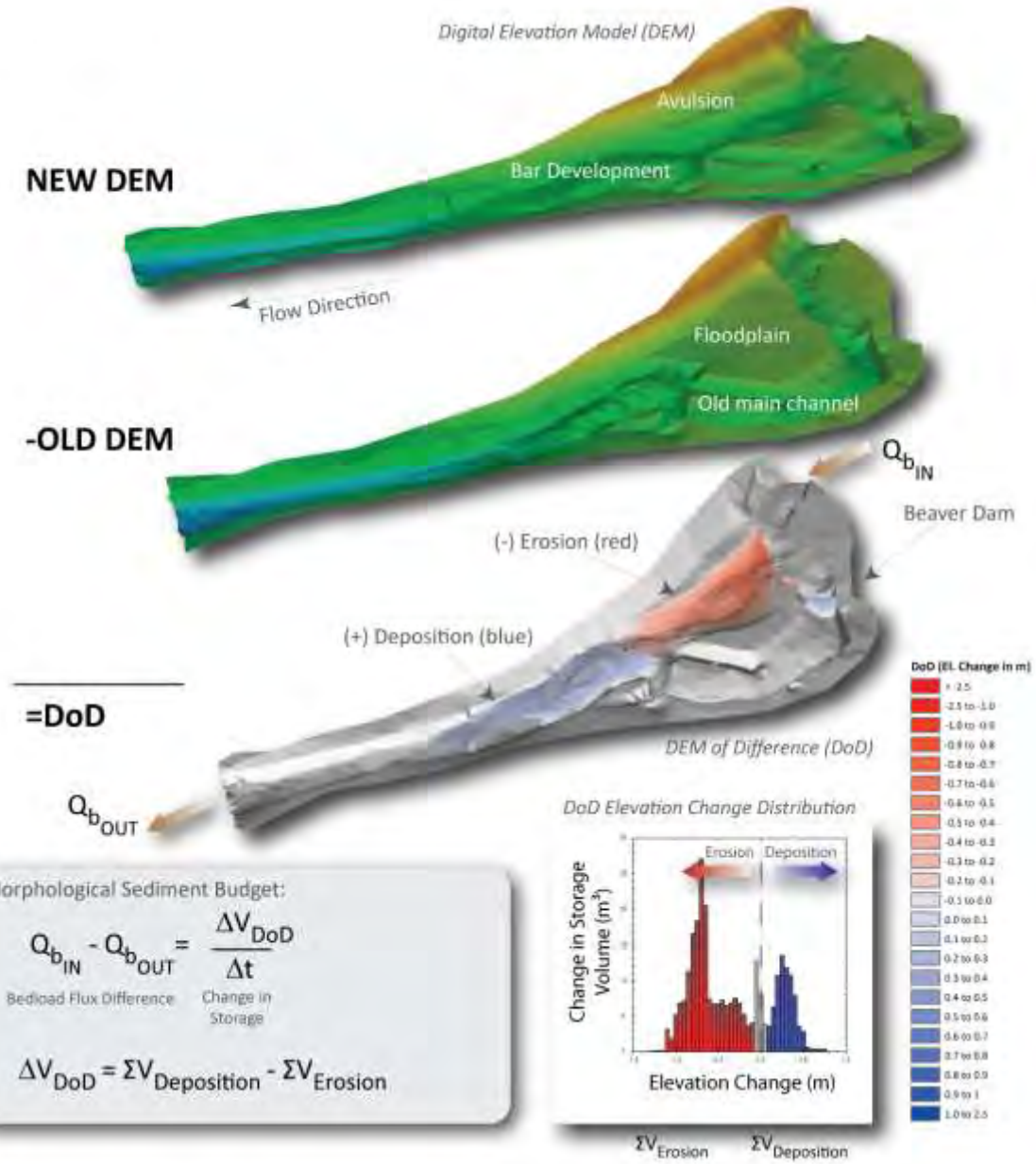
- Prior to project there was one abandon, breached dam in this reach...
- One year later, there are eleven (15 BDSS)

BEFORE & AFTER…

STUDY DESIGN: REPEAT TOPOGRAPHY

GEOMORPHIC CHANGE DETECTION

- What can we do with that repeat topography?
- Develop a direct measure of channel aggradation and floodplain reconnection



1st YEAR (2010-2009): OVERALL DoD

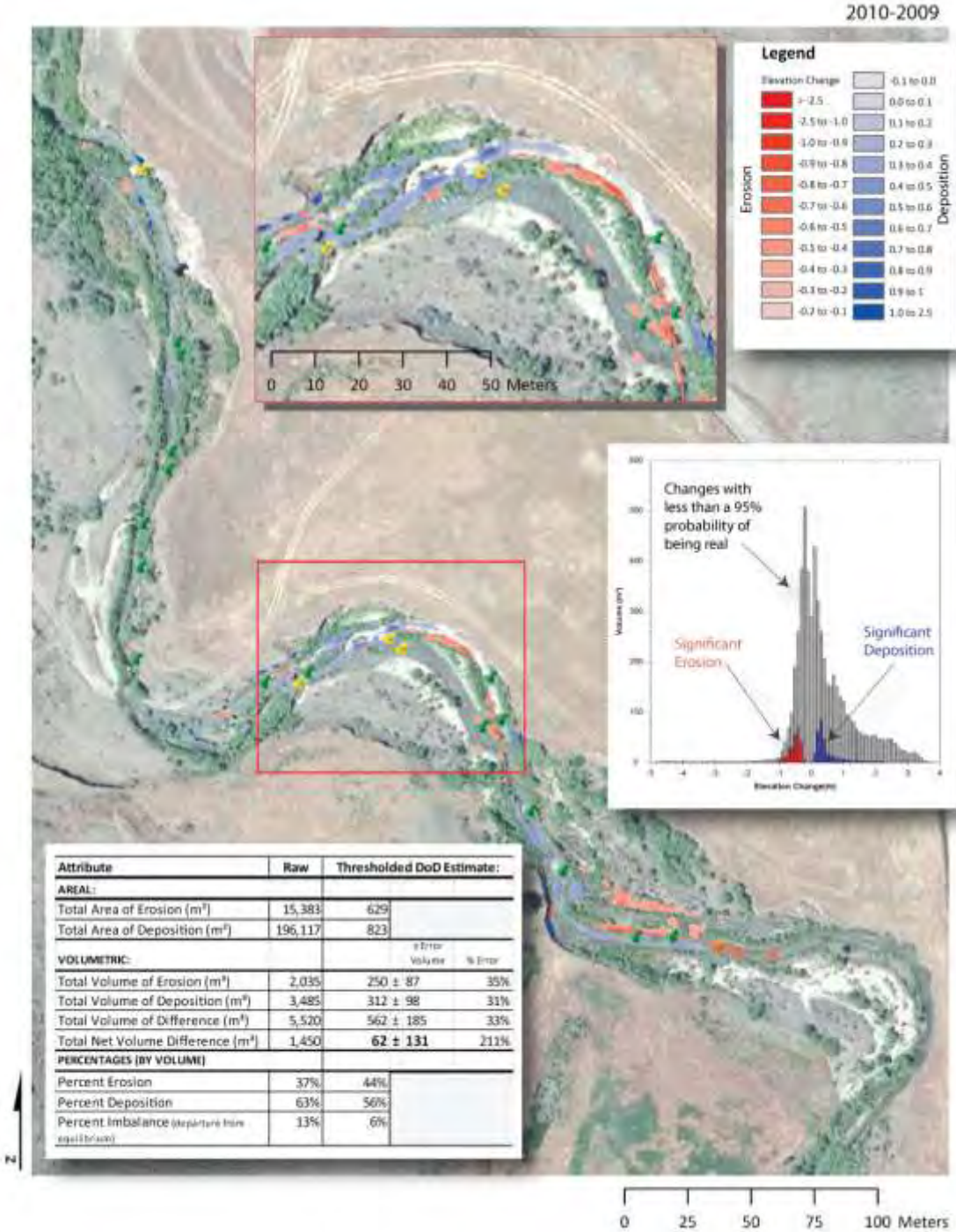
Deposition:

- Ponds filling up…
- Transverse gravel bars forming

Erosion:

- Scour pools downstream of structures
- Some lateral erosion

Erosion: 250 m^3 +/- 87
Deposition: 312 m^3 +/- 98
NET: + 62 m^3 (+/- 131)



Attribute	Raw	Thresholded DoD Estimate:	
AREAL:			
Total Area of Erosion (m^2)	15,383	629	
Total Area of Deposition (m^2)	196,117	823	
VOLUMETRIC:		± Error Volume	% Error
Total Volume of Erosion (m^3)	2,035	250 ± 87	35%
Total Volume of Deposition (m^3)	3,485	312 ± 98	31%
Total Volume of Difference (m^3)	5,520	562 ± 185	33%
Total Net Volume Difference (m^3)	1,450	**62 ± 131**	211%
PERCENTAGES (BY VOLUME)			
Percent Erosion	37%	44%	
Percent Deposition	63%	56%	
Percent Imbalance (departure from equilibrium)	13%	6%	

2nd YEAR (2011-2010): OVERALL DoD

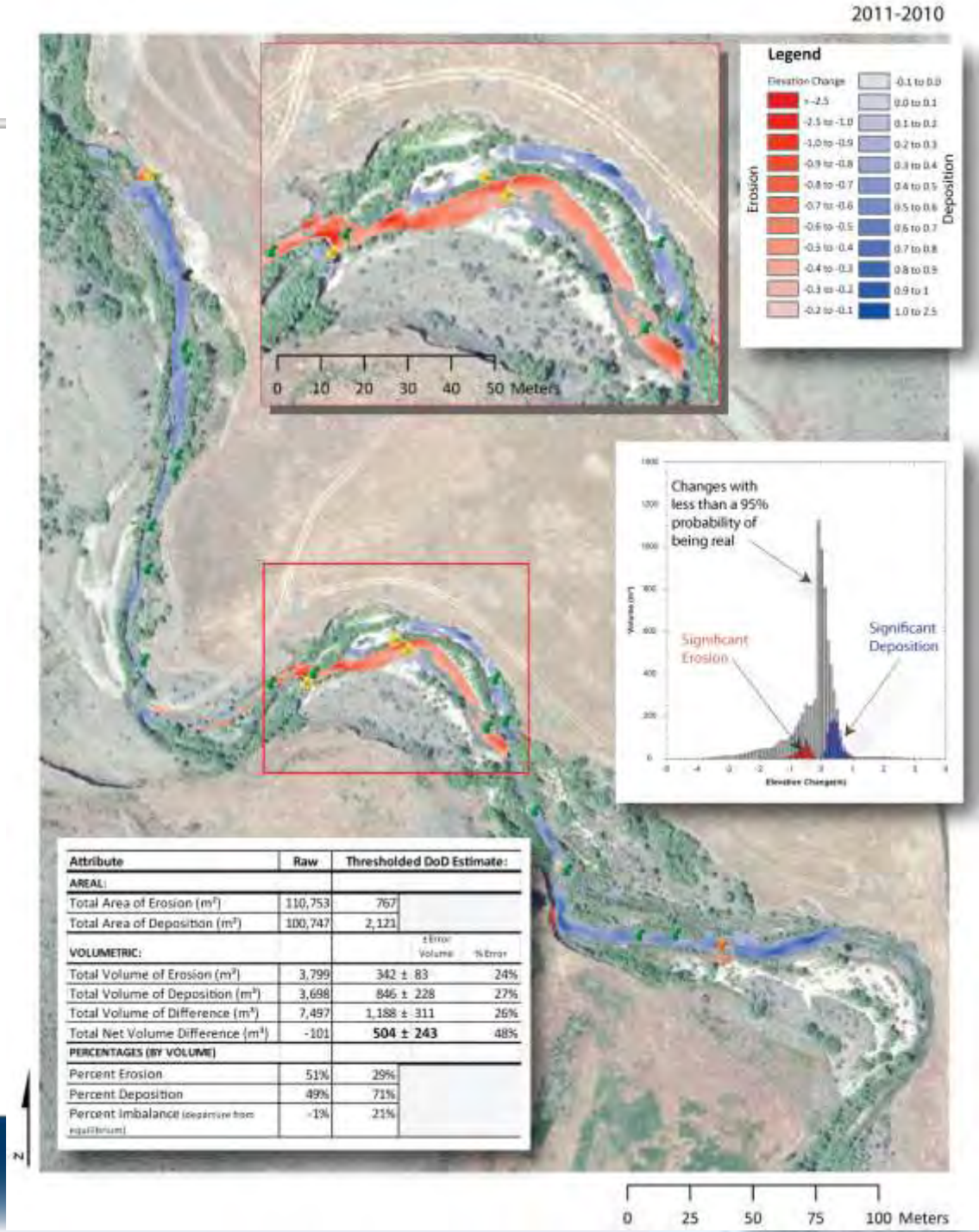
Deposition:

- Ponds filling up even more...
- More gravel bars forming

Erosion:

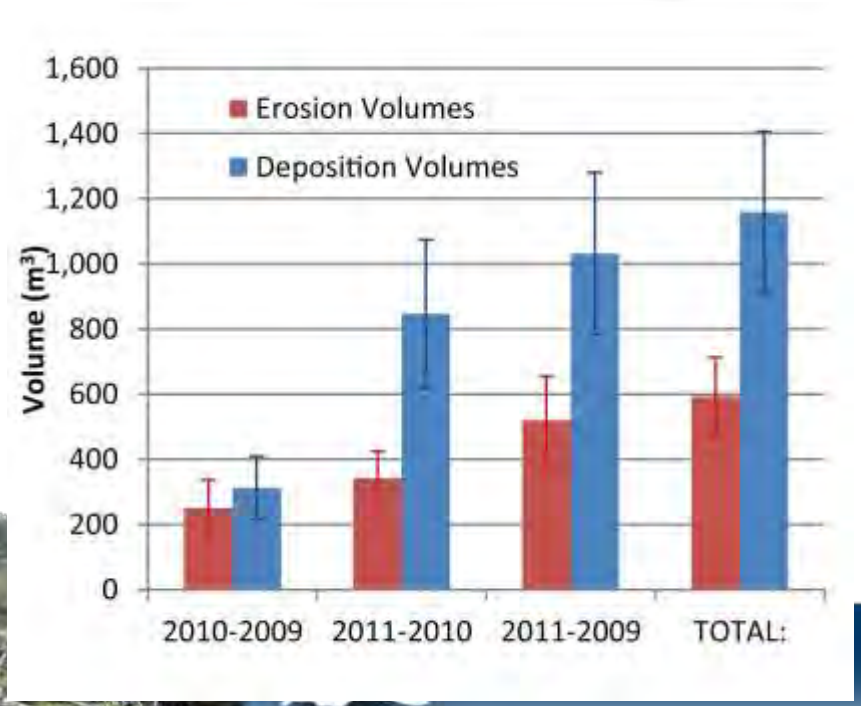
- Headcut with dam blowout
- Avulsion/cutoff...

Erosion: 342 m^3 +/- 83
Deposition: 846 m^3 +/- 228
NET: + 504 m^3 (+/- 243)



Attribute	Raw	Thresholded DoD Estimate:	
AREAL:			
Total Area of Erosion (m^2)	110,753	767	
Total Area of Deposition (m^2)	100,747	2,121	
VOLUMETRIC:		± Error Volume	% Error
Total Volume of Erosion (m^3)	3,799	342 ± 83	24%
Total Volume of Deposition (m^3)	3,698	846 ± 228	27%
Total Volume of Difference (m^3)	7,497	1,188 ± 311	26%
Total Net Volume Difference (m^3)	-101	**504 ± 243**	48%
PERCENTAGES (BY VOLUME)			
Percent Erosion	51%	29%	
Percent Deposition	49%	71%	
Percent Imbalance (departure from equilibrium)	-1%	21%	

WHAT WE TAKE AWAY FROM PATS CABIN…



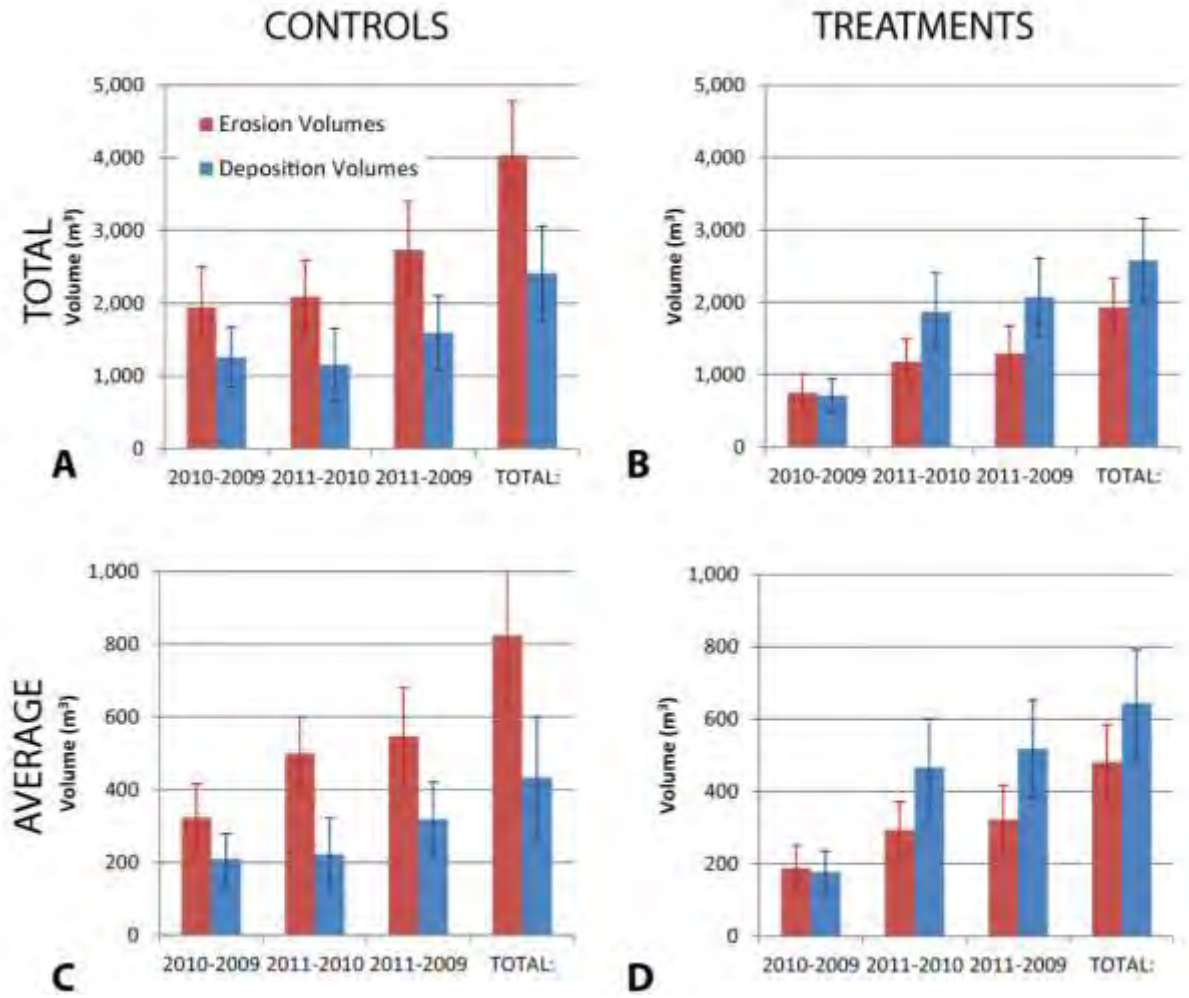
- 1st year budget indeterminant or equilibrium, but ponds filling
- 2nd year budget strong depositional signal despite major headcuts & breaches, ponds full
- BDSS Pond aggradation rapid and consistent
- Many former terraces are now inset floodplains

ELSEWHERE… WE SEE SIMILAR RESULTS

- 84 Structures installed in four reaches (in 2009); Now ~120
  - 5 Reinforced existing dams
  - 4 Reinforced abandon dams
  - 10 Starter Dams
  - 44 Post lines with Wicker Weaves
  - 21 Post lines only

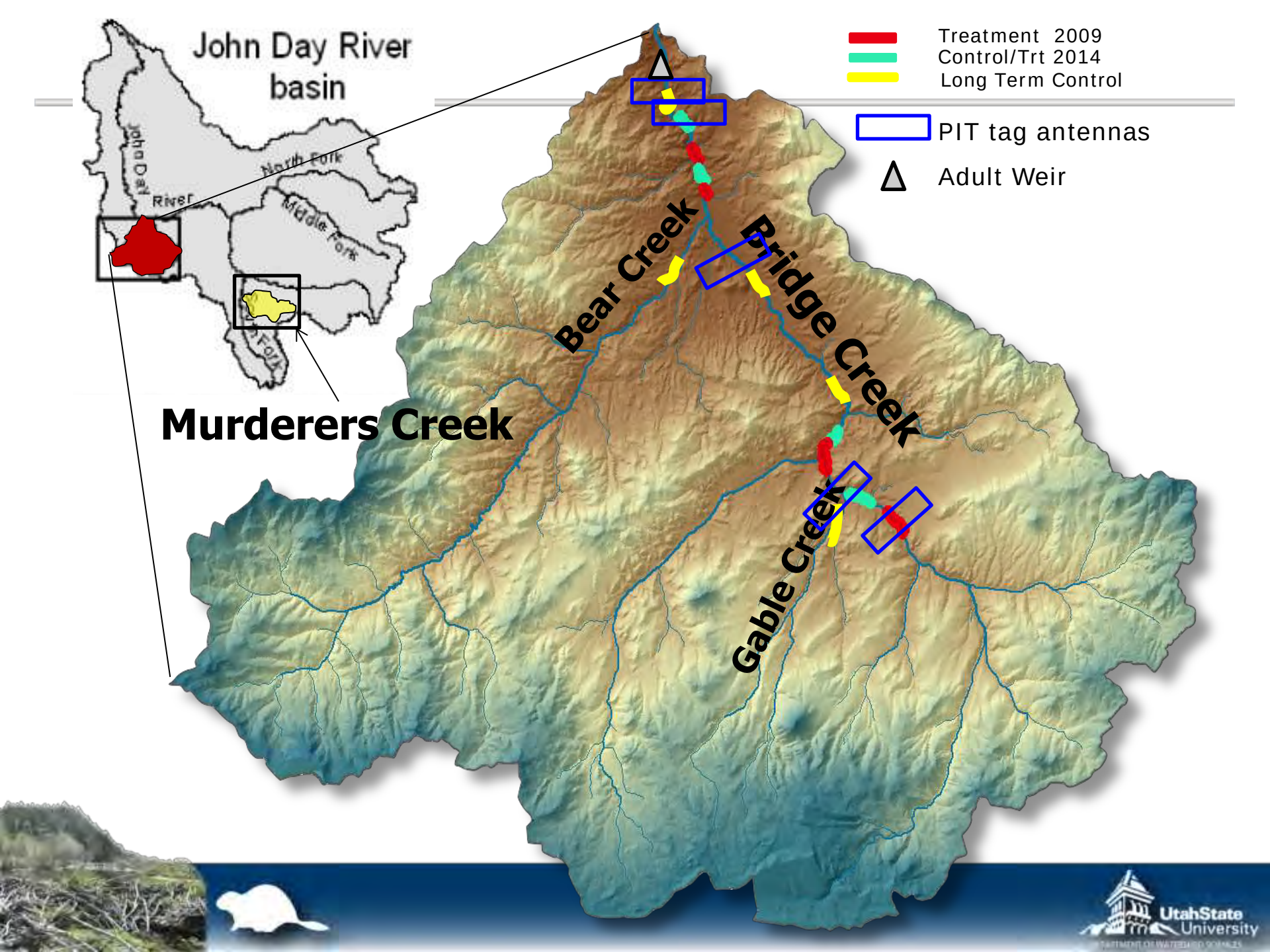
SUMMARY NET CHANGE IN STORAGE

- Controls Net Degradational
- Treatments Net Aggradational

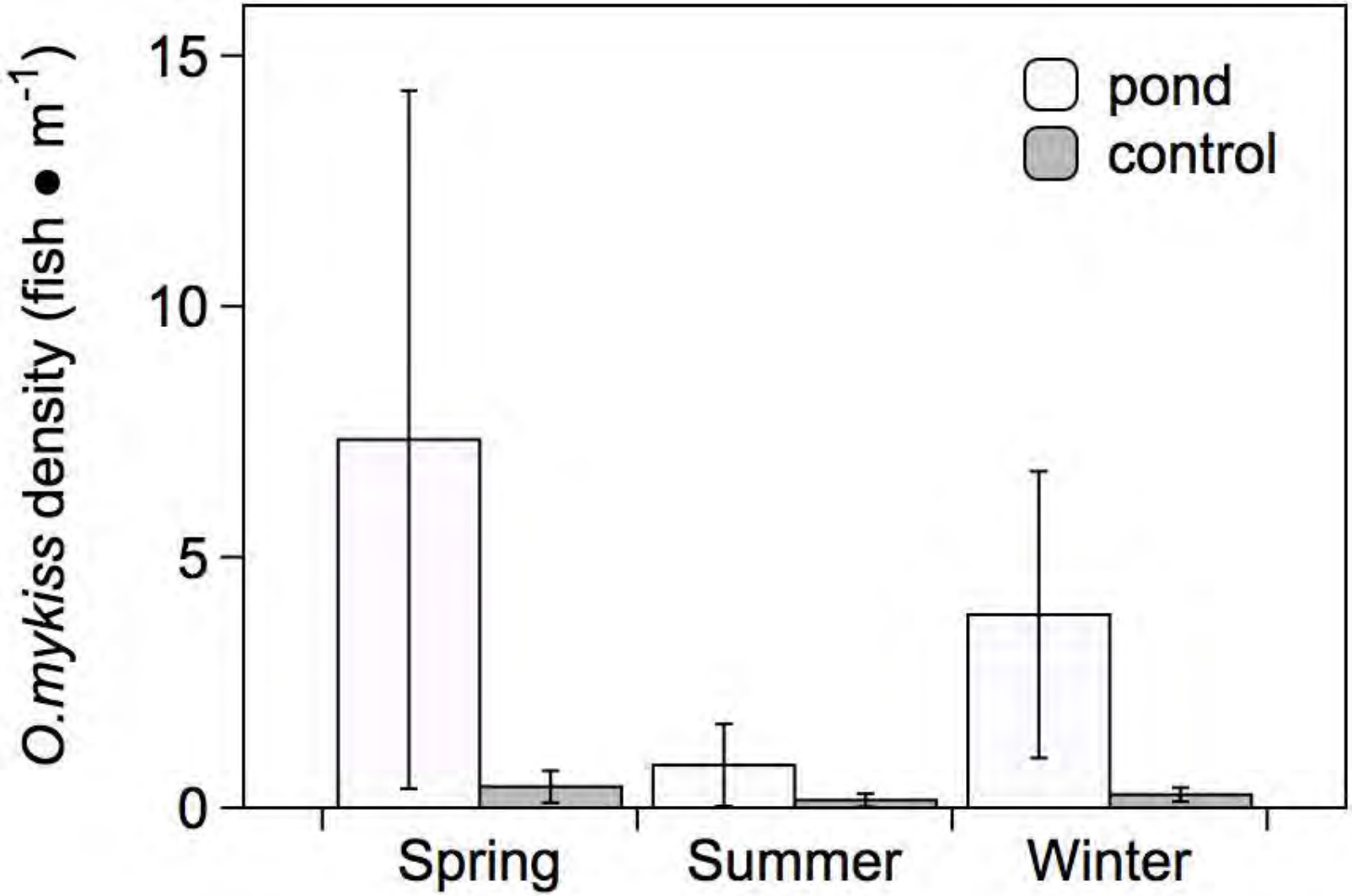


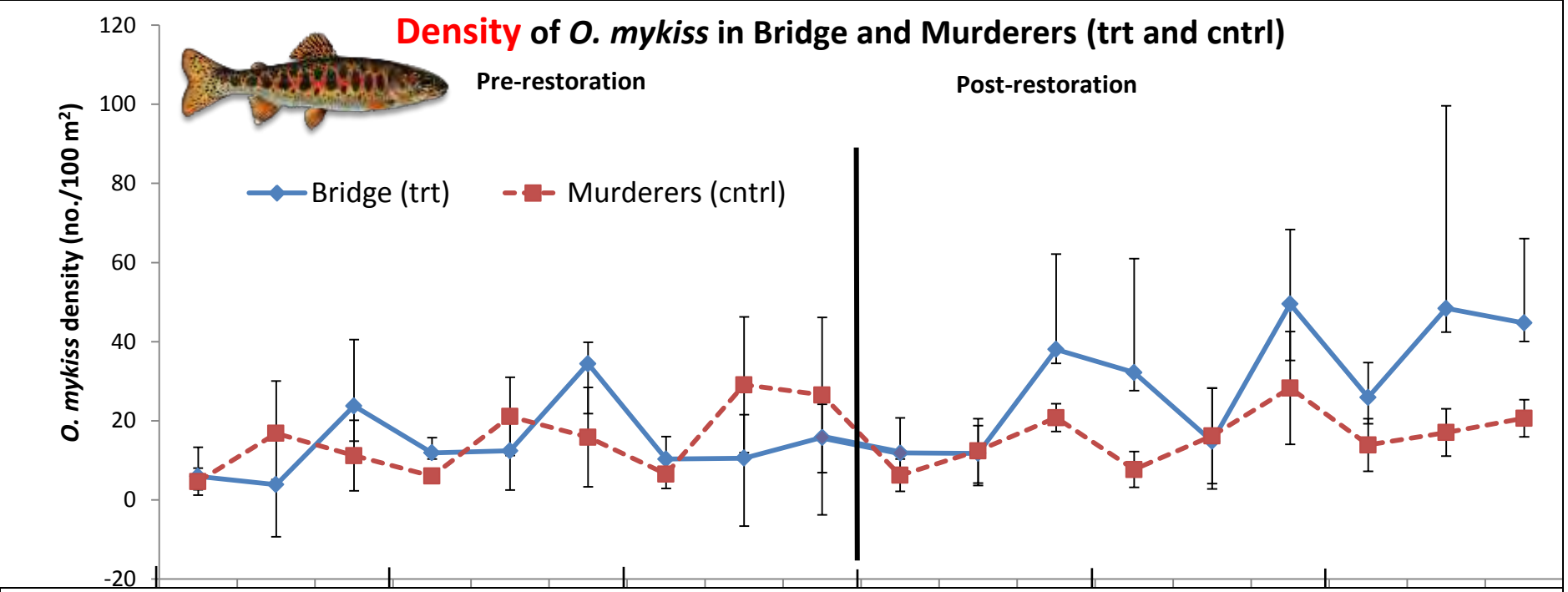
WHAT ABOUT THE FISH?

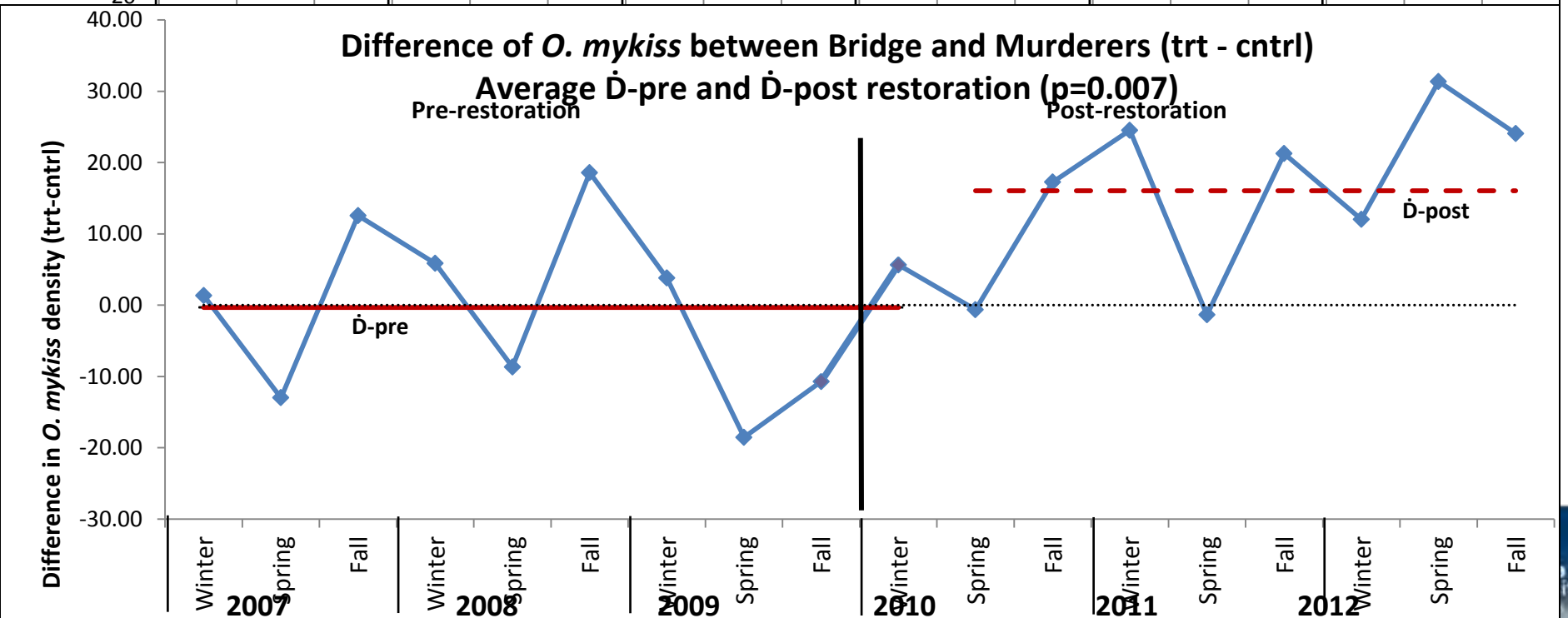
FISH SAMPLING

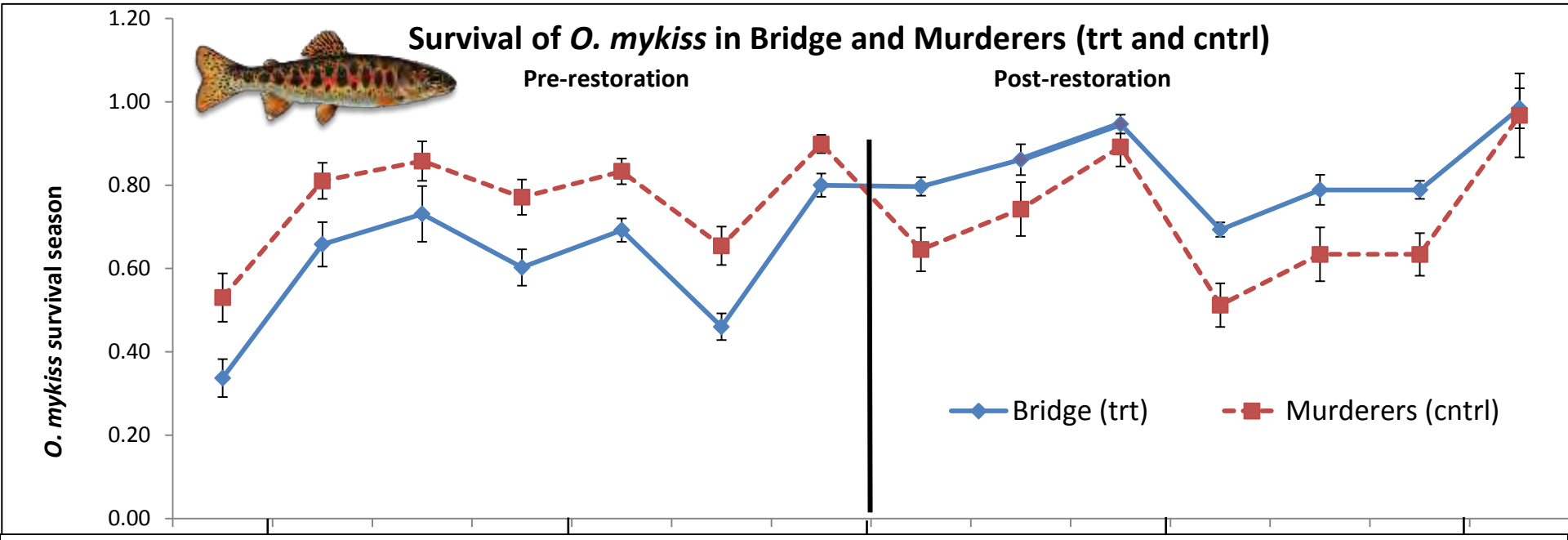

John Day River basin
John Day River
North Fork
Middle Fork
South Fork
Murderers Creek
Bear Creek
Bridge Creek
Gable Creek
Treatment 2009
Control/Trt 2014
Long Term Control
PIT tag antennas
Adult Weir
UtahState University

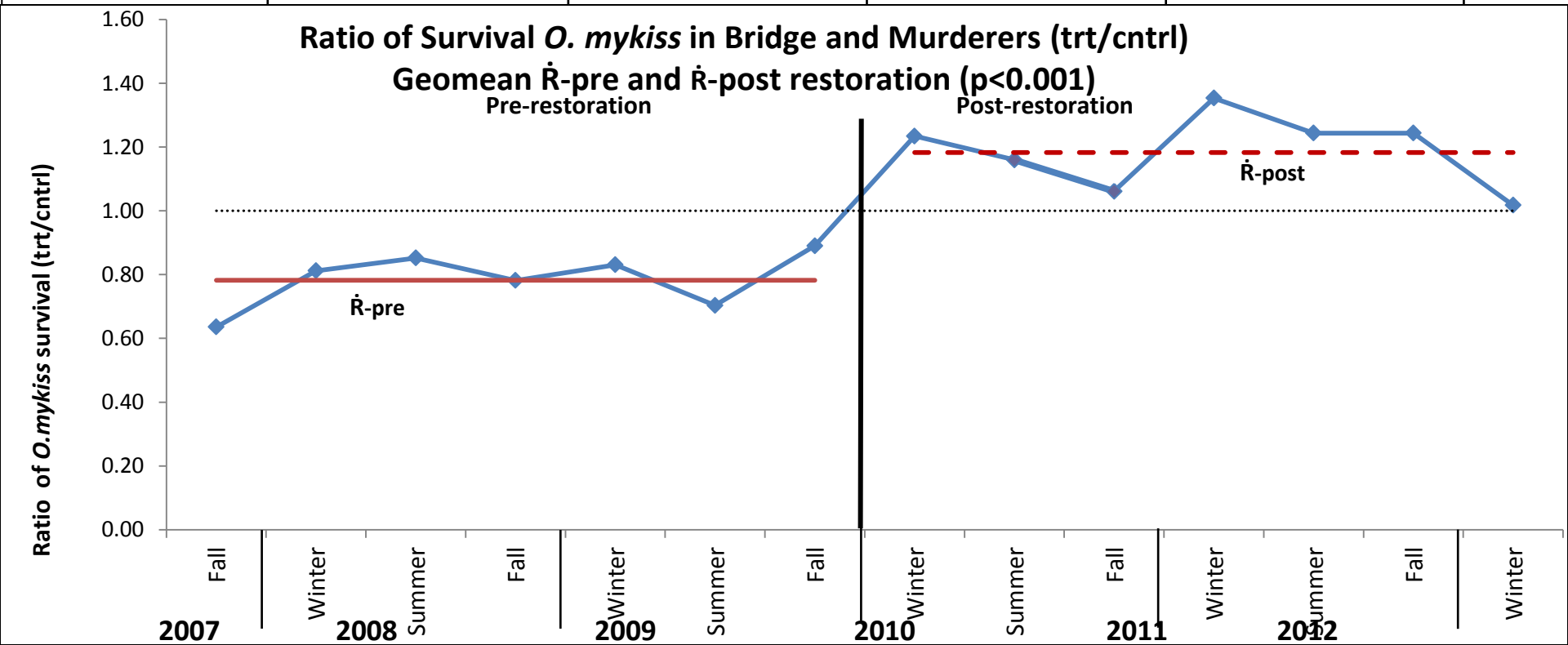
JUVENILE STEELHEAD HABITAT PREFERENCE

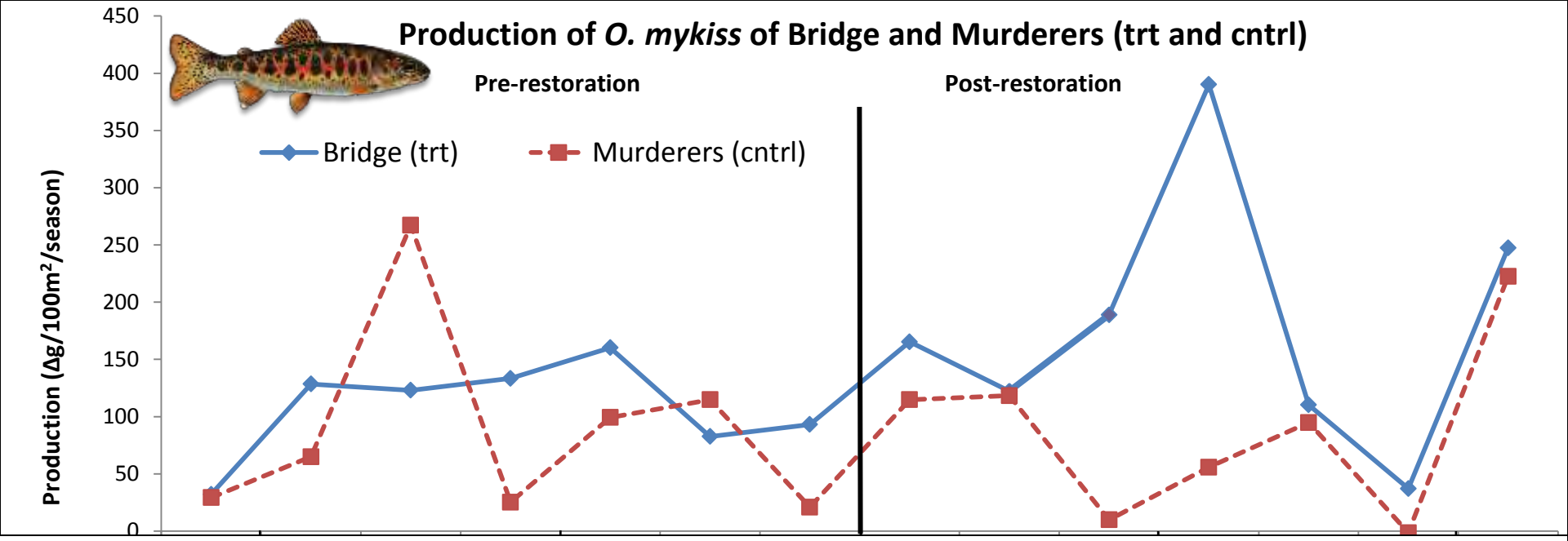


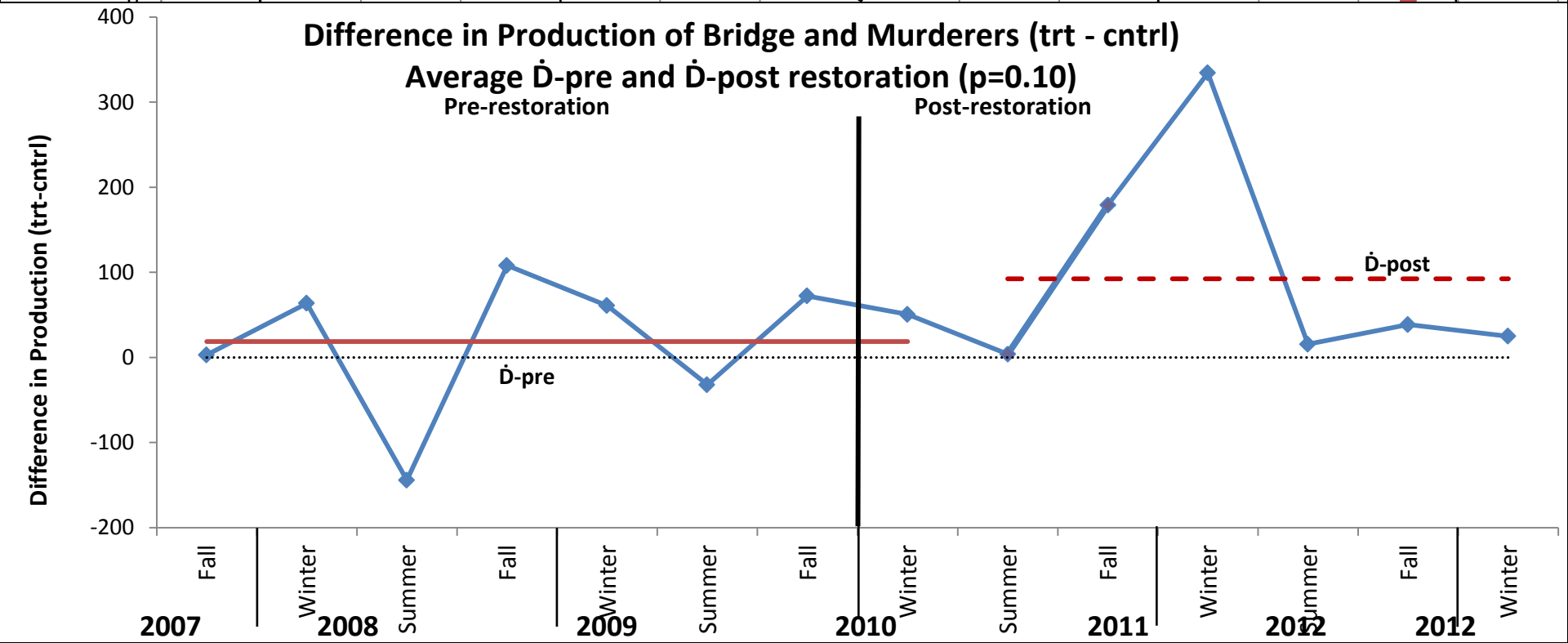

Density of O. mykiss in Bridge and Murderers (trt and cntrl)
Pre-restoration
Post-restoration
Bridge (trt)
Murderers (cntrl)
O. mykiss density (no./100 m²)
120
100
80
60
40
20
0
-20


Difference of O. mykiss between Bridge and Murderers (trt - cntrl)
Average Ḋ-pre and Ḋ-post restoration (p=0.007)
Pre-restoration
Post-restoration
Ḋ-pre
Ḋ-post
Difference in O. mykiss density (trt-cntrl)
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
Winter
Spring
Fall
2007
2008
2009
2010
2011
2012


Survival of O. mykiss in Bridge and Murderers (trt and cntrl)
Pre-restoration
Post-restoration
O. mykiss survival season
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Bridge (trt)
Murderers (cntrl)


Ratio of Survival O. mykiss in Bridge and Murderers (trt/cntrl)
Geomean Ṙ-pre and Ṙ-post restoration (p<0.001)
Pre-restoration
Post-restoration
Ṙ-pre
Ṙ-post
Ratio of O.mykiss survival (trt/cntrl)
1.60
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
2007
2008
2009
2010
2011
2012


Production of *O. mykiss* of Bridge and Murderers (trt and cntrl)
Pre-restoration
Post-restoration
Bridge (trt)
Murderers (cntrl)
Production (Δg/100m²/season)
450
400
350
300
250
200
150
100
50
0


Difference in Production of Bridge and Murderers (trt - cntrl)
Average Ḋ-pre and Ḋ-post restoration (p=0.10)
Pre-restoration
Post-restoration
Ḋ-post
Ḋ-pre
Difference in Production (trt-cntrl)
400
300
200
100
0
-100
-200
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
2007
2008
2009
2010
2011
2012
2012

BRIDGE CREEK FINDINGS…

- Rapid colonization of BDSS after installation
- Rapid geomorphic response working with beaver to restore incised channel & reconnect with floodplain in the right direction…. Will it last?
- Dramatic improvements in habitat complexity
- + Population level fish responses!

BDSS ARE CHEAP & CHEERFUL

- Cheap?
  - Design in field…
  - $13K for 4 km of installation
- Cheerful?
  - Furry rodent…?
  - It WORKS!
- Transferable?
  - BDSS is now being used in other incised streams to reconnect floodplain
  - Need vegetation (dam building materials)
  - Beaver can be used elsewhere… where habitat complexity limiting

TALK PLAN

I. Exploiting the Undiscriminating Rodent

II. Where might this work? - BRAT

  I. Beaver Dam Capacity Model

  II. BRAT – In Progress

III. Beaver in Incised Streams?

  I. Bridge Creek IMW Experiment

IV. Take-Homes

TAKE-HOMES

- BRAT
  - Capacity model shows promise for estimating beaver dam densities
  - New restoration planning and prioritization tool (expectation management)
- Incised Stream Restoration with Beaver
  - Structural intervention accelerates process of channel evolution (i.e. recovery) and buys beaver time to build stable colonies
  - In Bridge Creek, floodplain reconnection and aggradation was rapid… and population level fish response documented within three years

QUESTIONS?

For more information on BRAT, visit: http://brat.joewheaton.org

BEAVER RESTORATION ASSESSMENT TOOL
UtahStateUniversity
BRAT