

Partnering with Beaver to Restore Fish & Wildlife Habitat

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FHC THE FLUVIAL
HABITATS CENTER



ALTERNATIVE WAYS TO RESTORE RIVERS



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WHEN I SAY WE...



Joe Wheaton



Steve Bennett



Scott Shahverdian



Wally Macfarlane



Northwest Fisheries Science Center



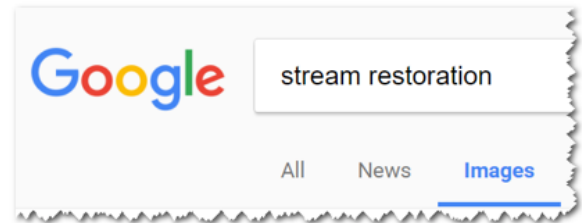
- Nick Weber (ELR/AS)
- Andy Hil (ELR/AS)
- Reid Camp (ELR/ AS)
- Gus Wathen (ELR)
- Jake Wirtz (ELR)
- Ross Gleason (ELR)
- Gary O'Brien (USU)
- Sara Bangen (USU)
- Jordan Gilbert (USU)
- Jordan Gilbert (USU)
- Konrad Hafen (USU)

- Chalese Hafen (USU)
- Carl Saunders (USU)
- Chris Jordan (NOAA)
- Michael Pollock (NOAA)
- Justin Jimenz (BLM)
- Jeremy Maetas (NRCS)
- Brett Roper (USFS)
- Dennis Duehren (USFS)
- Brad Higginson (USFS)
- Kent Sorenson (UDWR)
- Thad Heater (SGI)



- Carol Volk (SFR)
- Philip Bailey (NAR)
- Boyd Bouwes (WS)
- Jay & Diane Tanner
- Jay Wilde
- And many others... I'm neglecting

WHY ALWAYS TONKA TOYS?



BIG RIVERS ARE IMPORTANT, BUT...

- They constitute < 10% of the 3.5 million miles of streams in US...

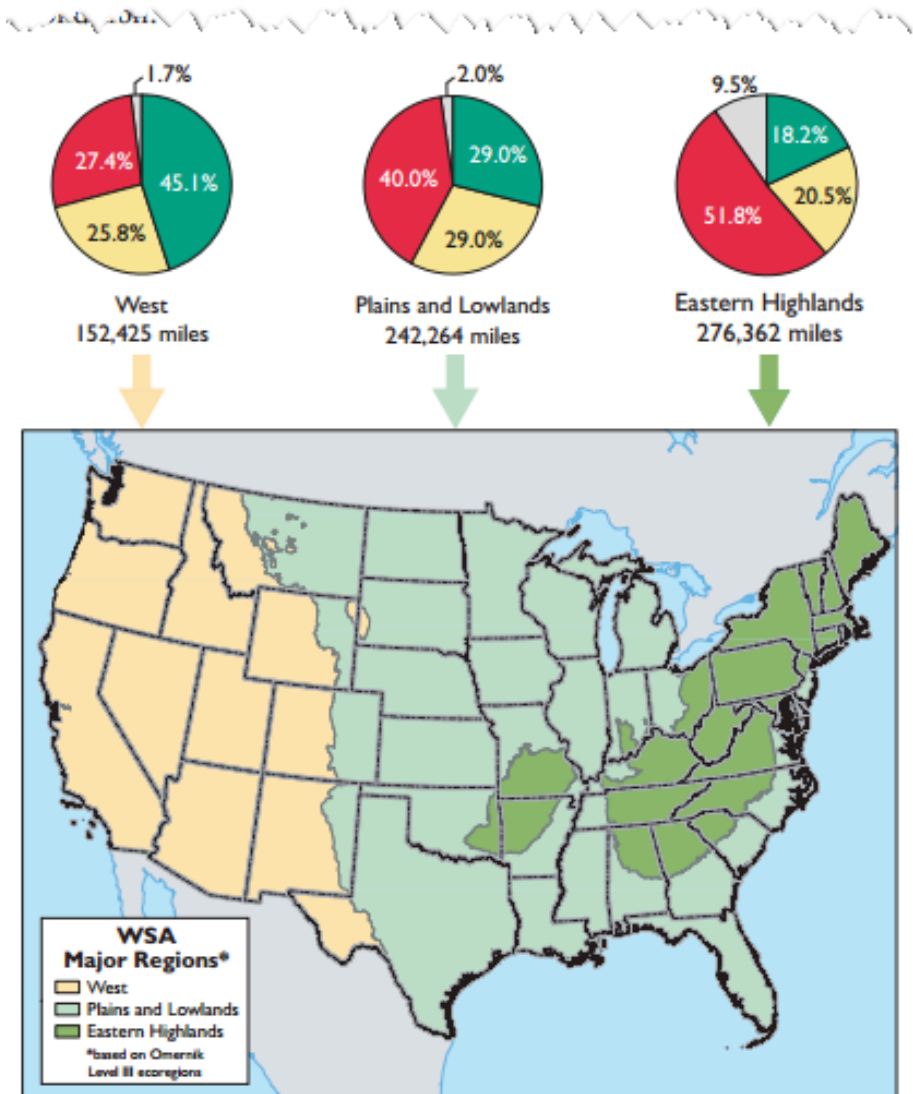


US EPA (2007)

Figure 3. Major rivers and streams of the conterminous United States (NationalAtlas.gov, 2006). Major rivers comprise only 10% of the length of U.S. flowing waters, whereas the nation's wadeable streams and rivers comprise 90% of the length of U.S. flowing waters.

BIOLOGICAL CONDITION OF STREAMS IN WEST

- Wadeable streams make up ~90% of the stream length in a given watershed
- 53% of Western wadeable streams are in fair or poor condition
- 76,000 miles of degraded streams



TAMING A RIVER?



First time = \$250K/km Second time = \$350K/km

IMAGINE WHAT IS POSSIBLE



CAN WE AFFORD TO DO THIS?



\$300,000 for 3 structures

PROBLEM IS SIMPLE TO STATE...

- Scope of stream and riparian degradation is massive
- Even with >> \$10 Billion spent annually, barely scratching surface
- We spend disproportionate amount of money on too few miles of streams and rivers

[Agricultural Stream Ecosystem \(PDF\)](#)



[Urban Stream Ecosystem \(PDF\)](#)



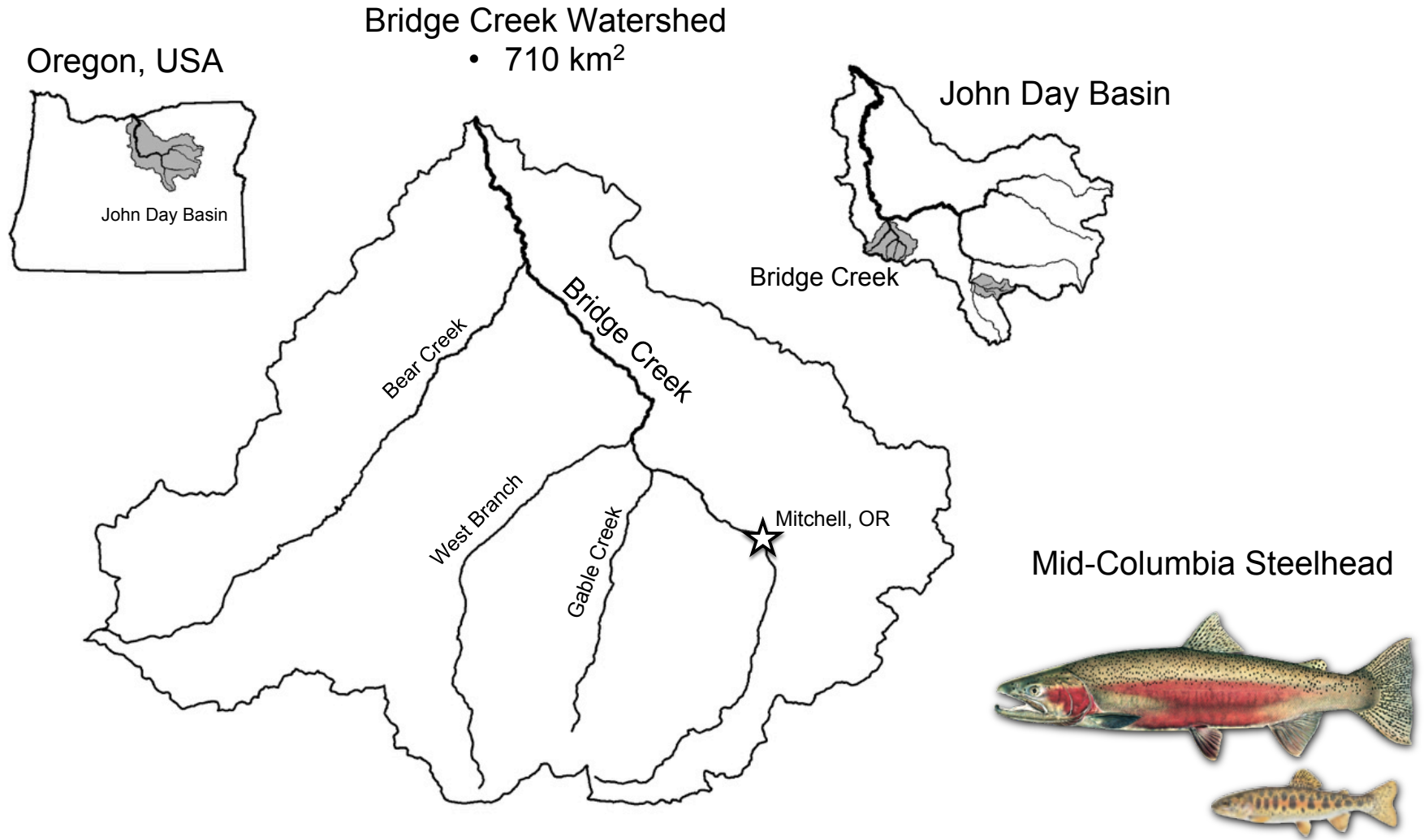
CHEAP AND CHEERFUL

- ...restoration is the *only* way we're realistically going to address the problem
- Beaver as one critical tool



Bridge Creek

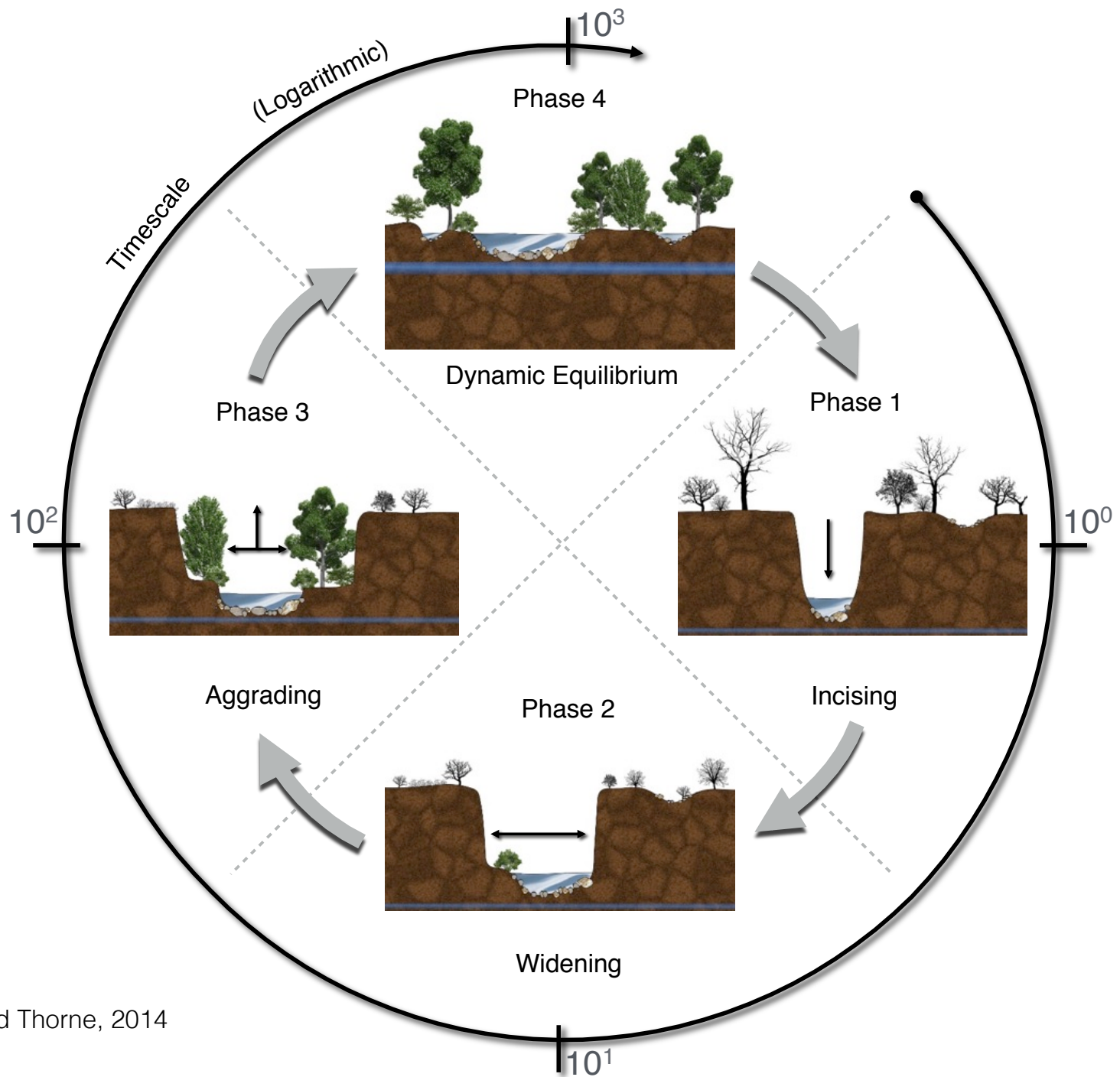
Intensively Monitored Watershed



Channel Incision

Bridge Creek
ca. 1993



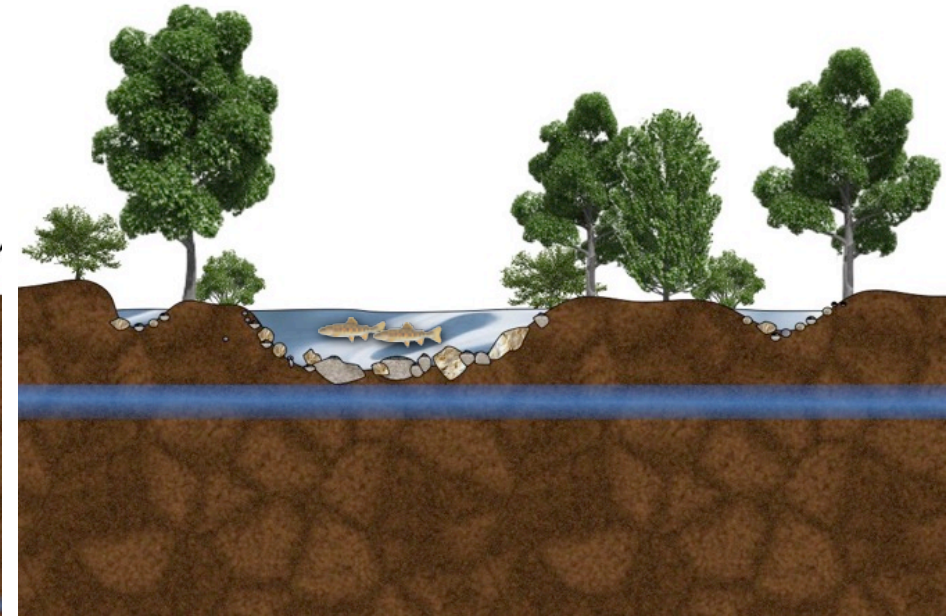
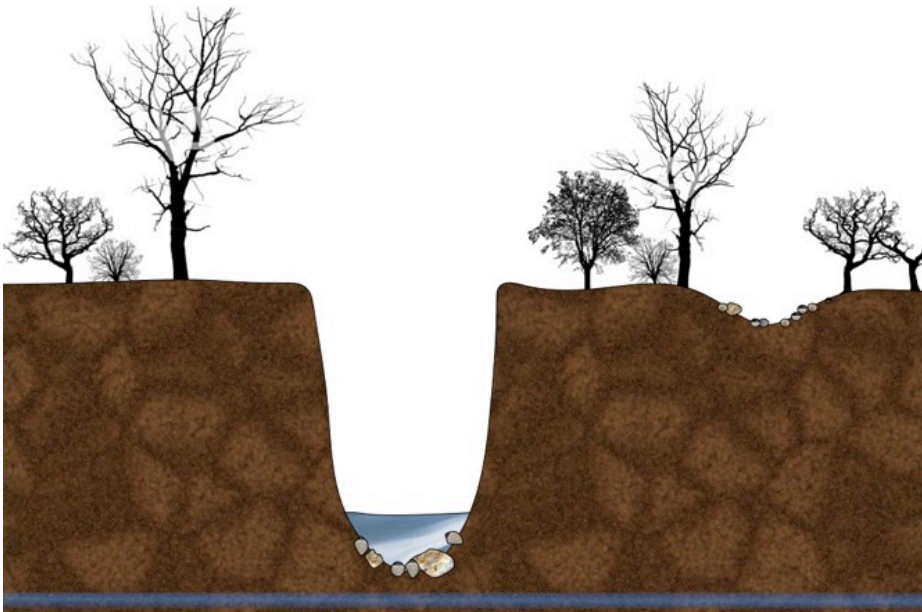


Channel Incision Recovery

Incised Channel

10^3 years

Channel in Equilibrium



- Simplified and static channel
- Low habitat quality

- Sediment output = inputs
- Complex and dynamic channel
- Floodplain and groundwater connectivity
- High habitat quality



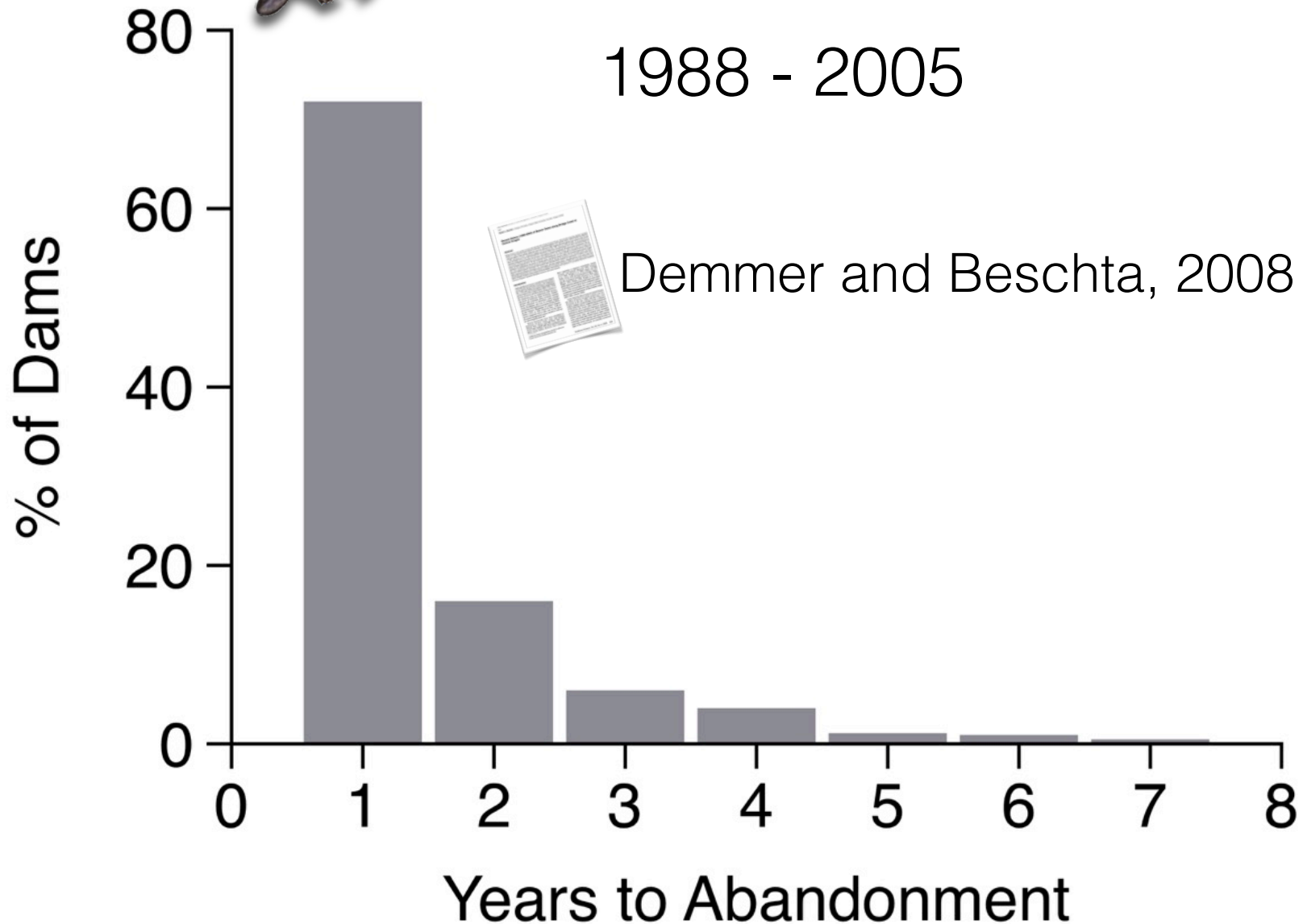






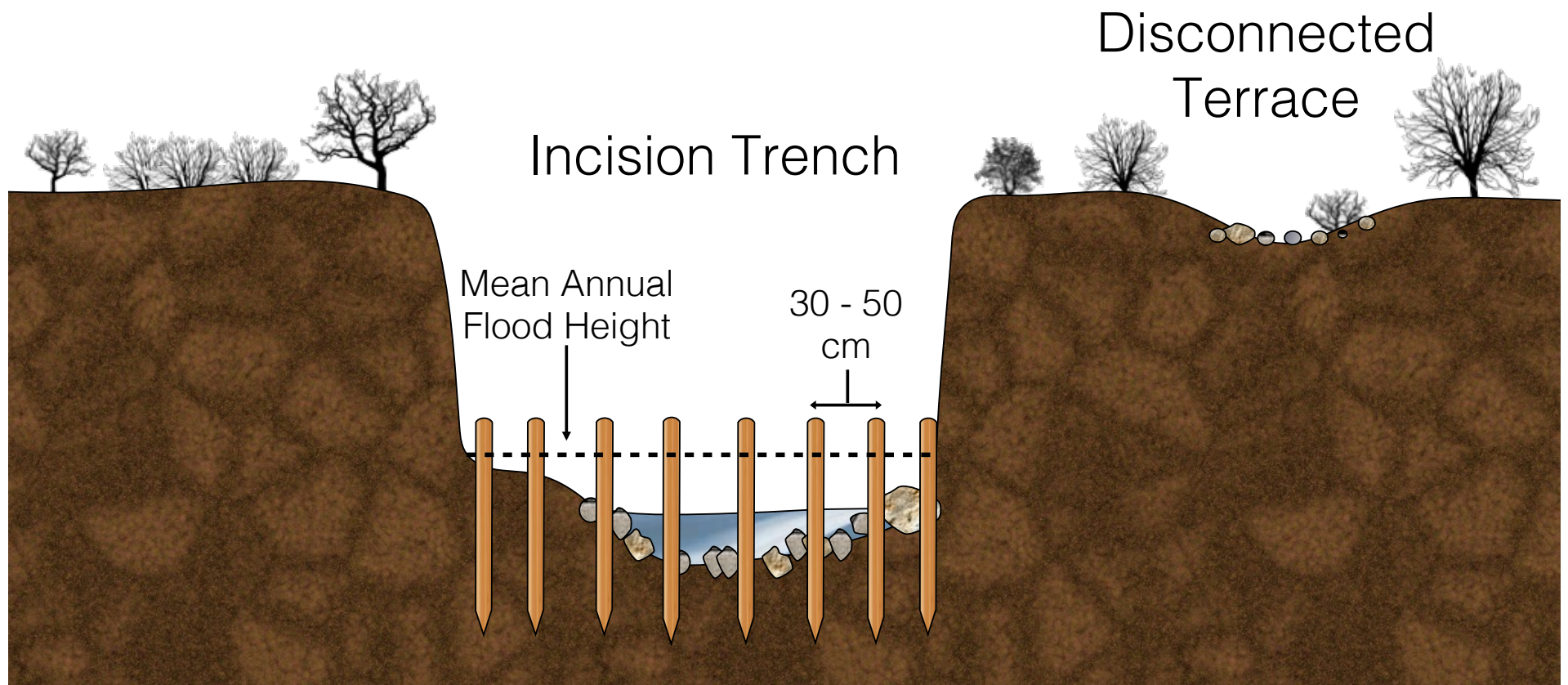
Dam Persistence

1988 - 2005



BDAs

Beaver Dam Analog Structures

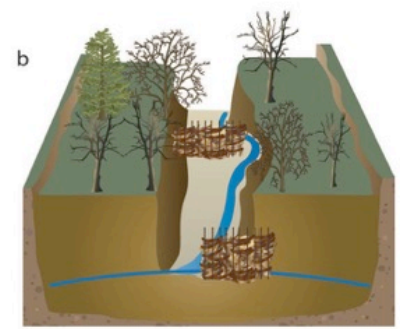
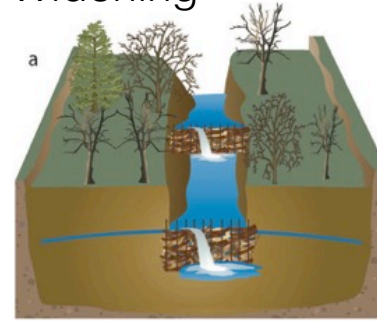
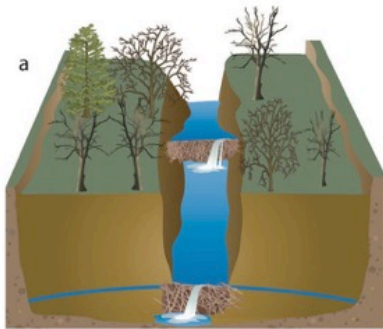


Incision Recovery with Beaver Dams

Natural Beaver Dams

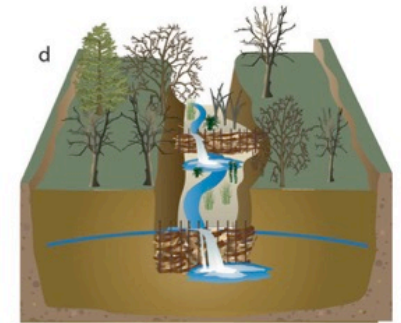
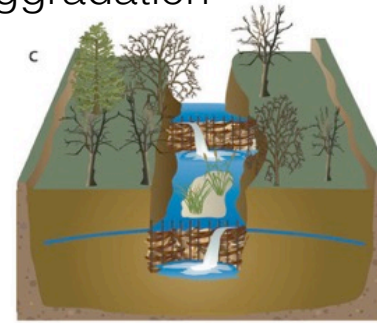
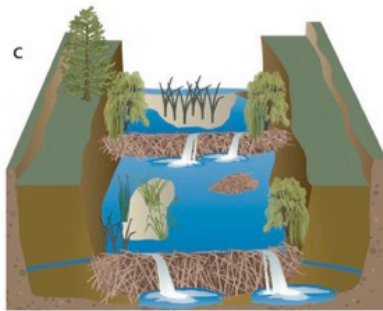
Beaver Dam Analogs (BDAs)

Phase 2 - Trench Widening



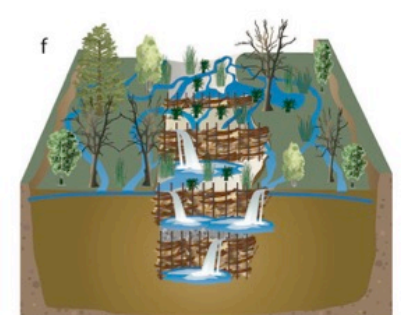
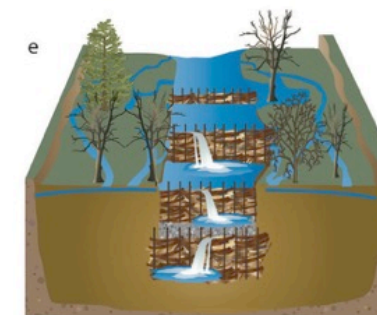
Phase 3 - Channel Aggradation

Reduced trench widening

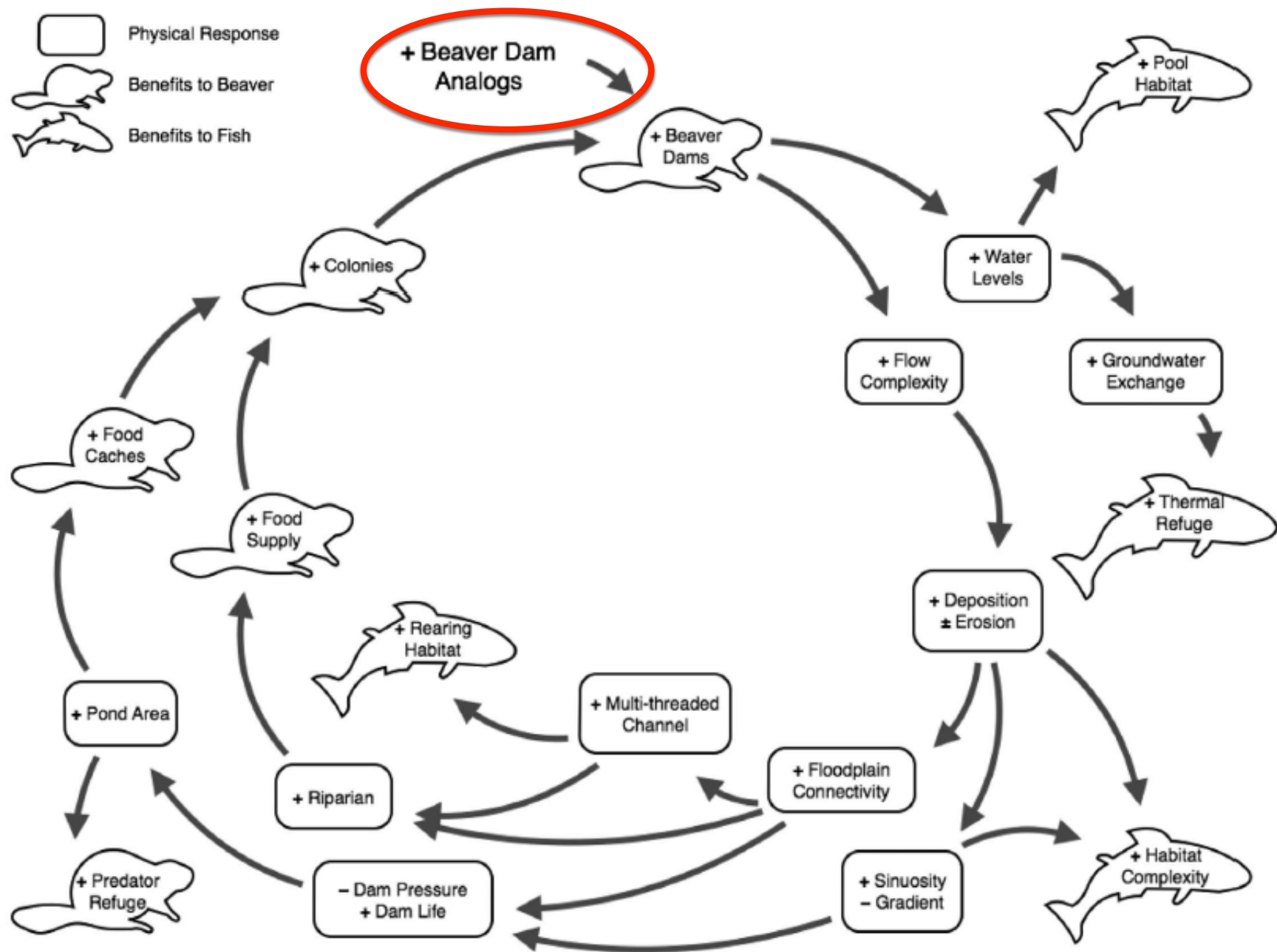


Phase 4 - Dynamic Equilibrium

Greater dam density

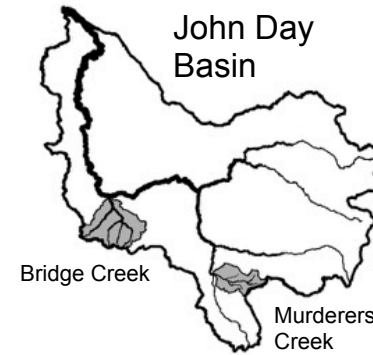
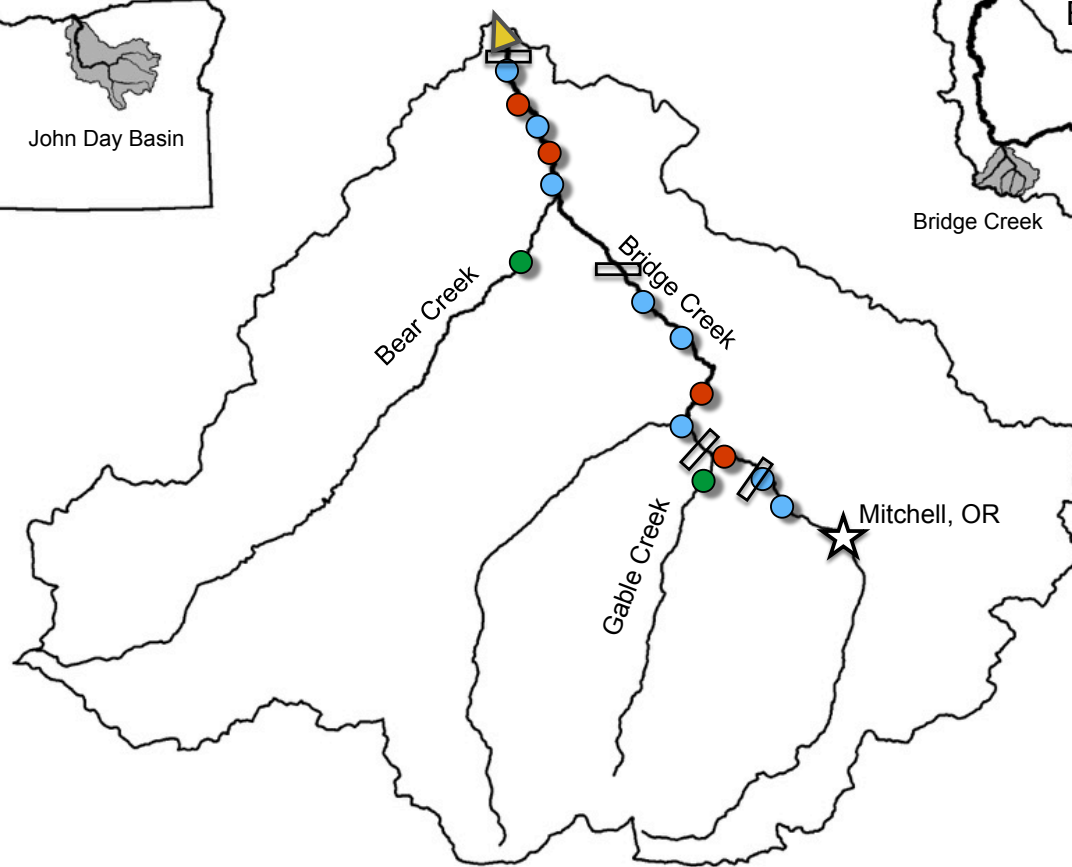


Pollock et al. 2014 BioScience





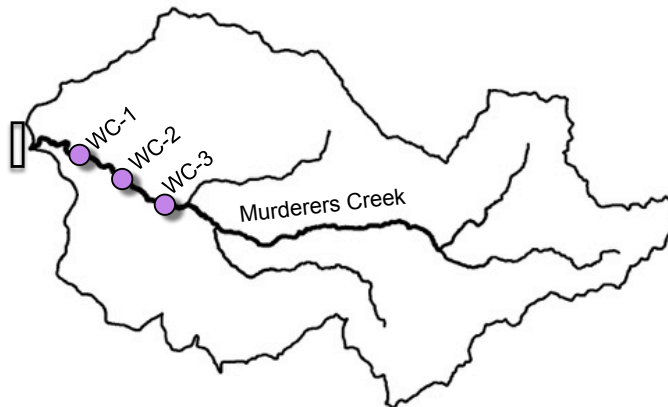
Bridge Creek Watershed



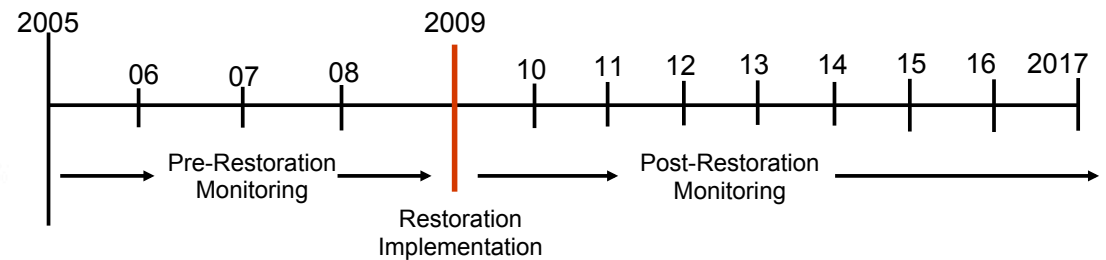
Spatial Design

- Treatment Reaches - 4
- Control Reaches - 8
- Tributary Control - 2
- Watershed Control - 3
- ▭ PIT Tag Antenna - 5
- ▲ Adult Trap

Murderers Creek - Watershed Control



Temporal Design



Structure ID:
MC-08.2



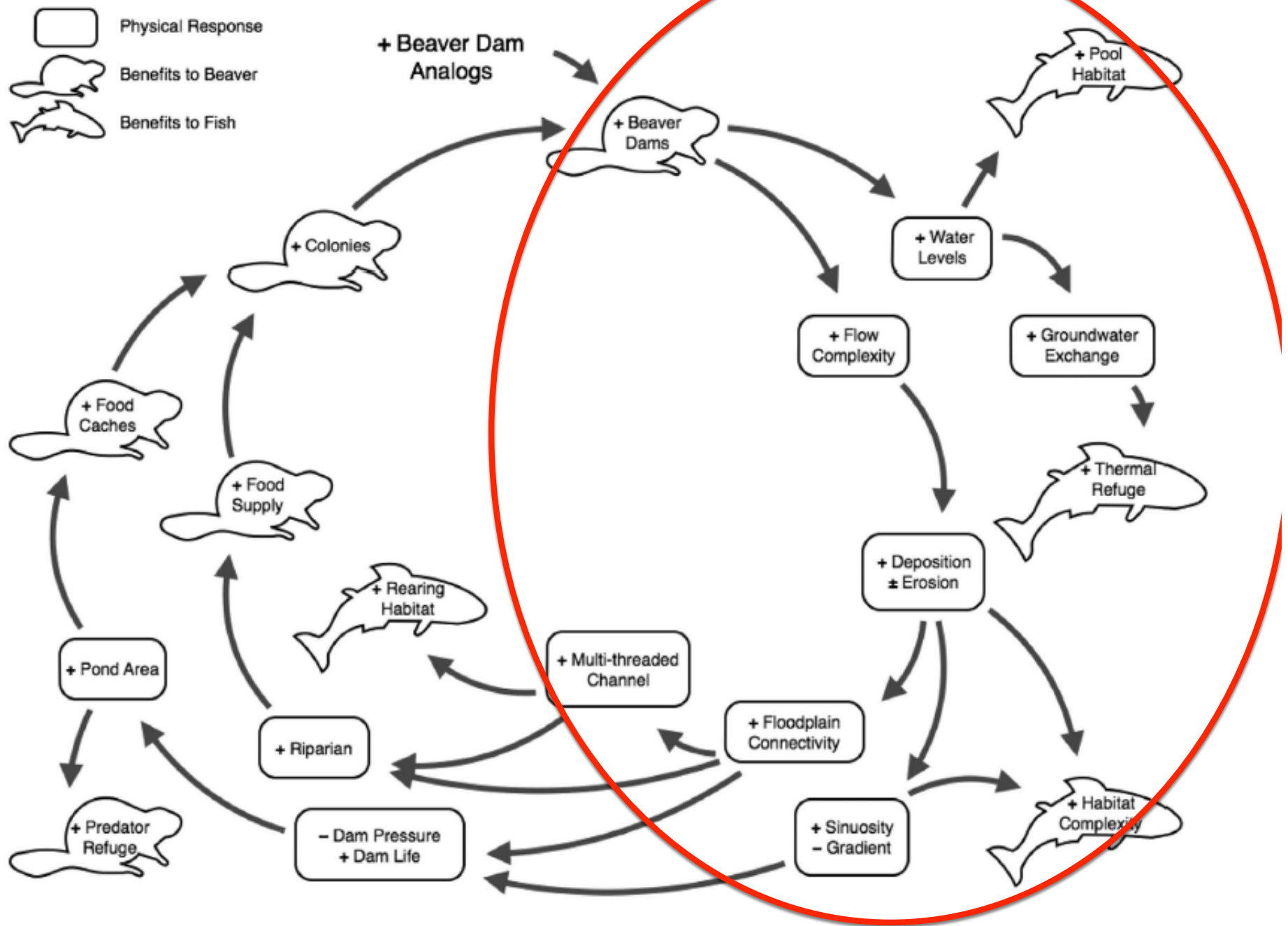
Sunflower Treatment Reach - Summer 2015



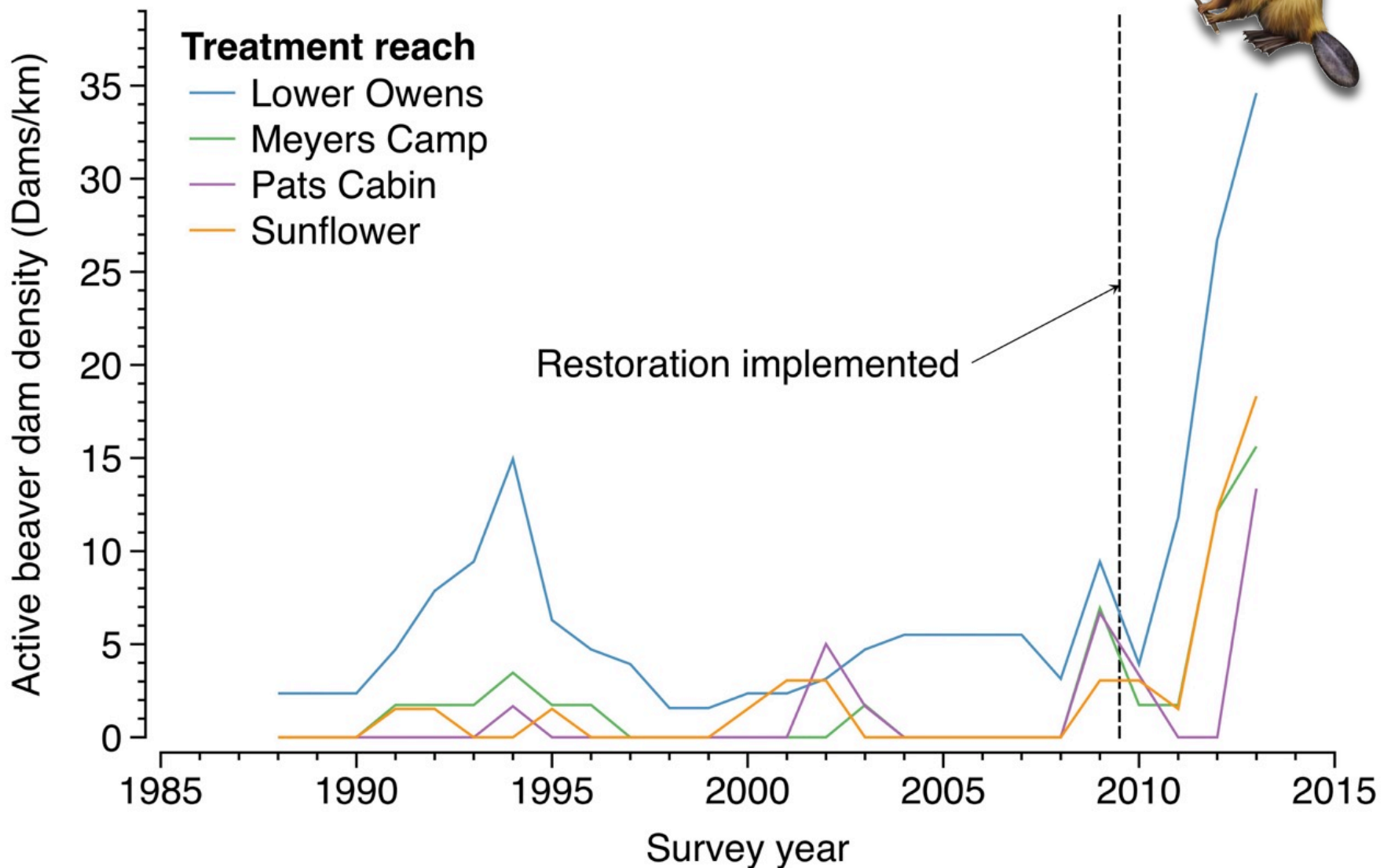
Restoration Implementation
4 Treatment Reaches ~ 1 km
114 Total BDA Structures

0 25 50 100 m

● BDA Structure



Active Beaver Dams



Aggradation and pool formation



Floodplain frequently inundated



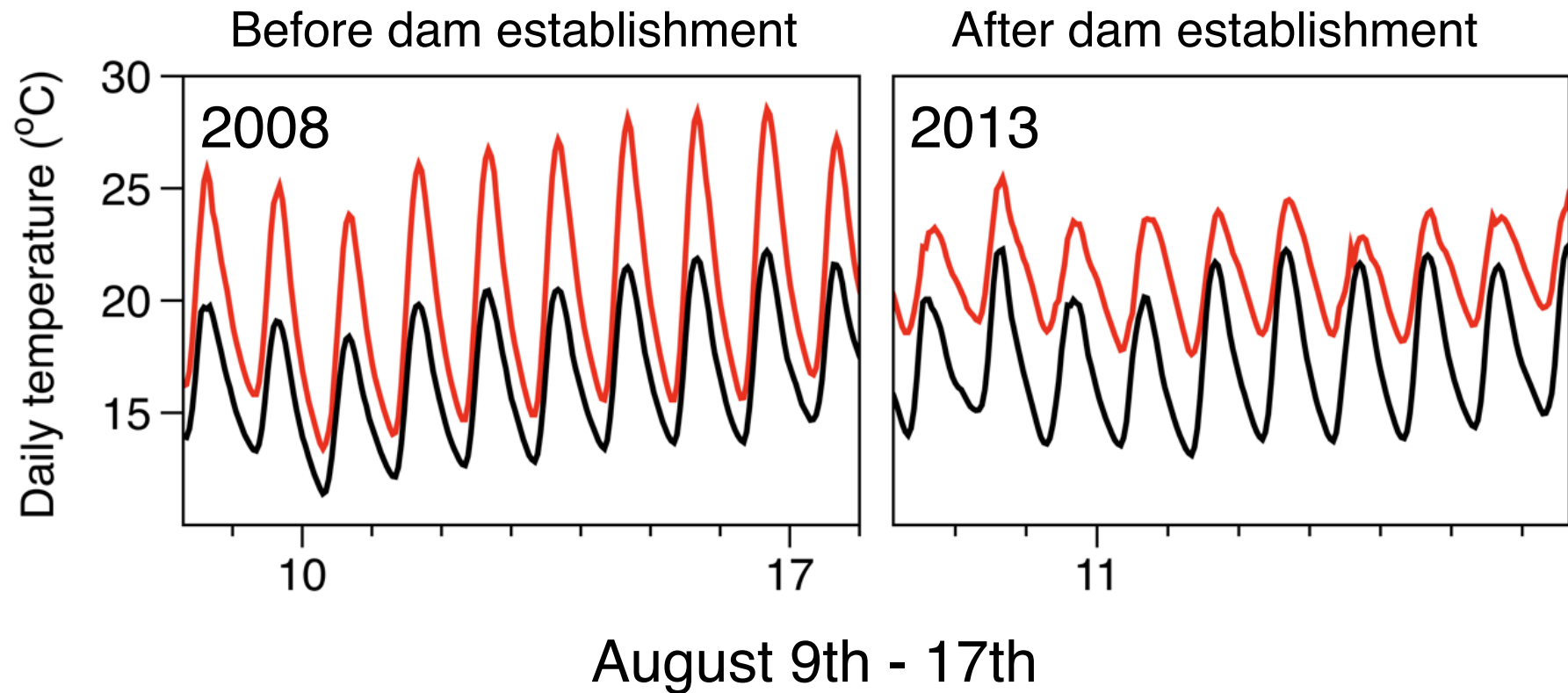
Water table elevation change

1'-3' increase in the height of the water table

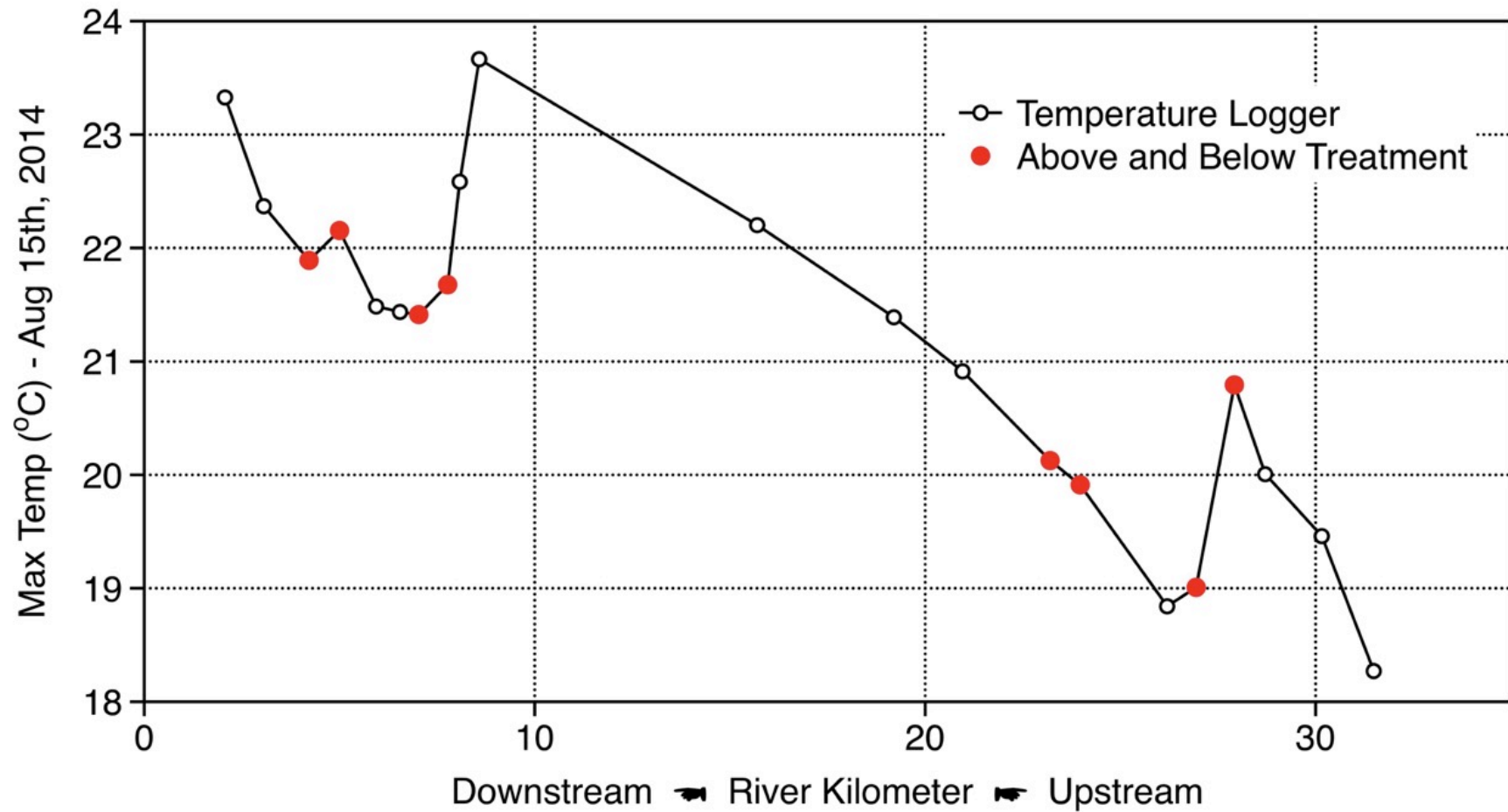


Compressed diel temperature range

— Treatment reach - Dam influenced
— Control reach - No dams



Long Temperature Profile August 2014



Channel Temperature Heterogeneity

Beaver/BDA impounded

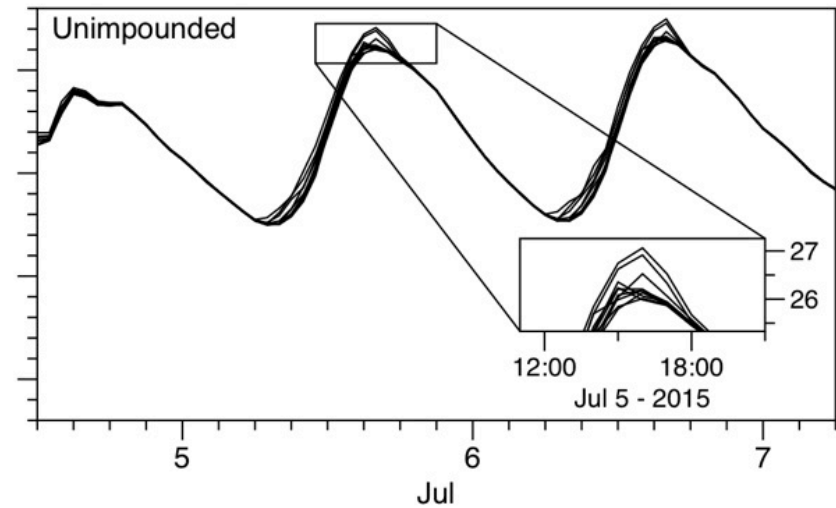
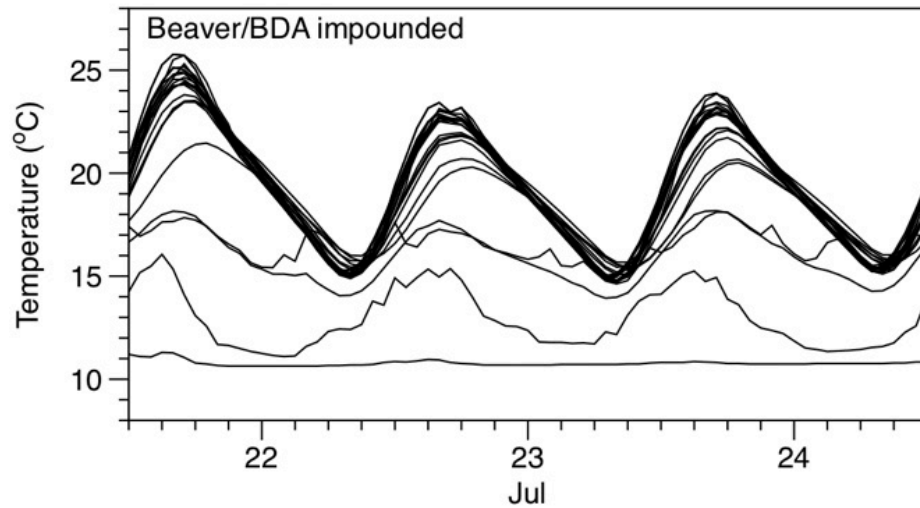


● Temperature measurement location ■ Beaver dam

Unimpounded



← Flow 0 m 10 m 20 m



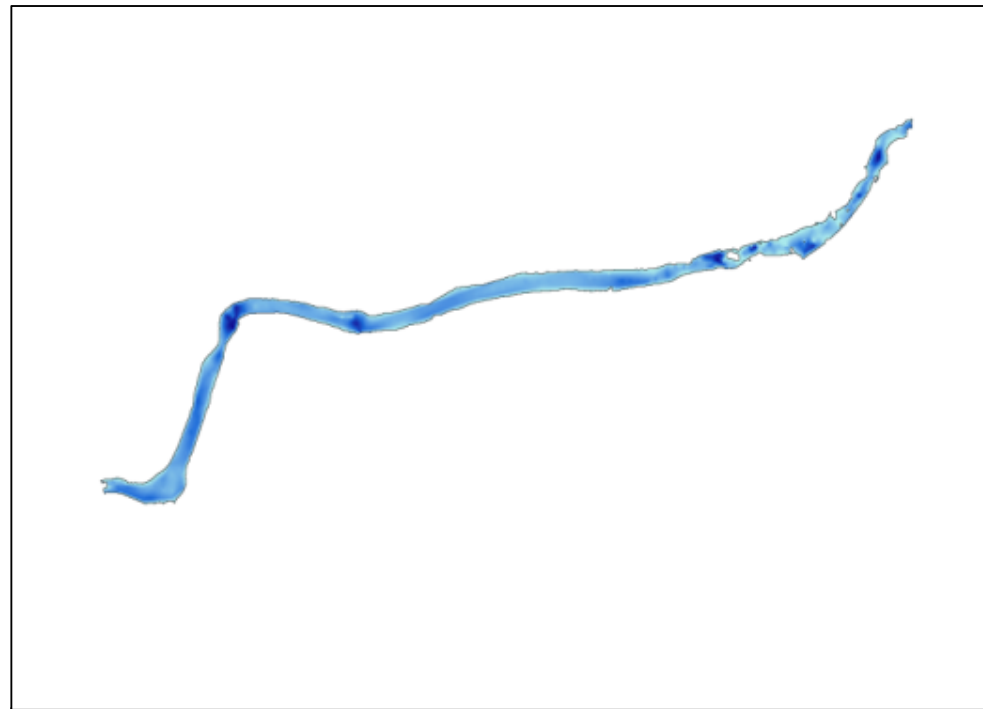


Summer 2005

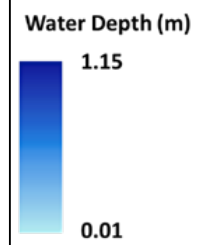
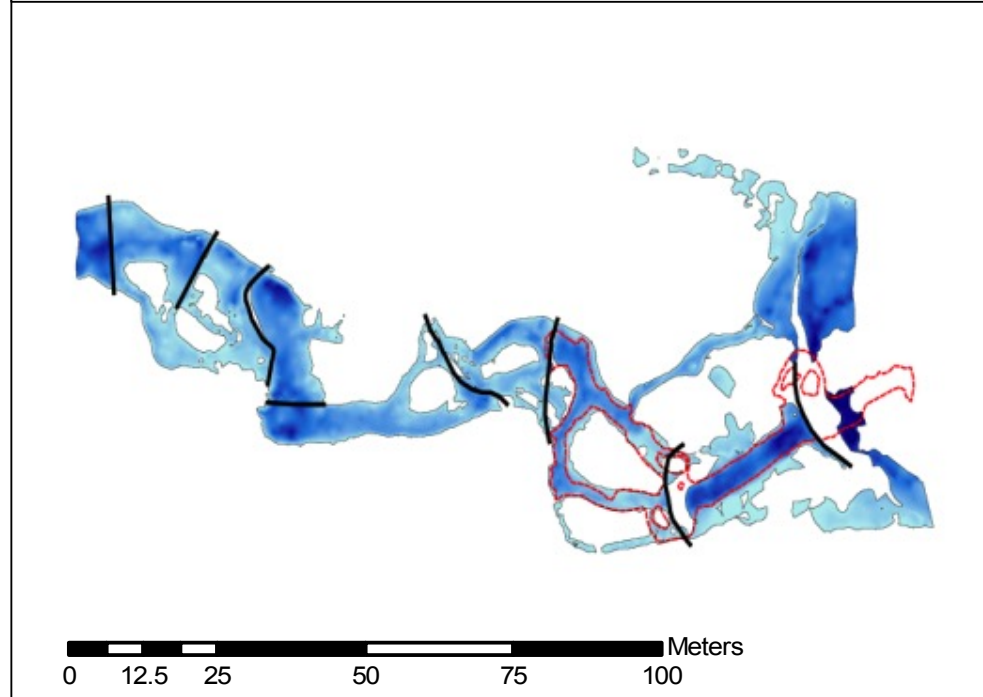


Summer 2014

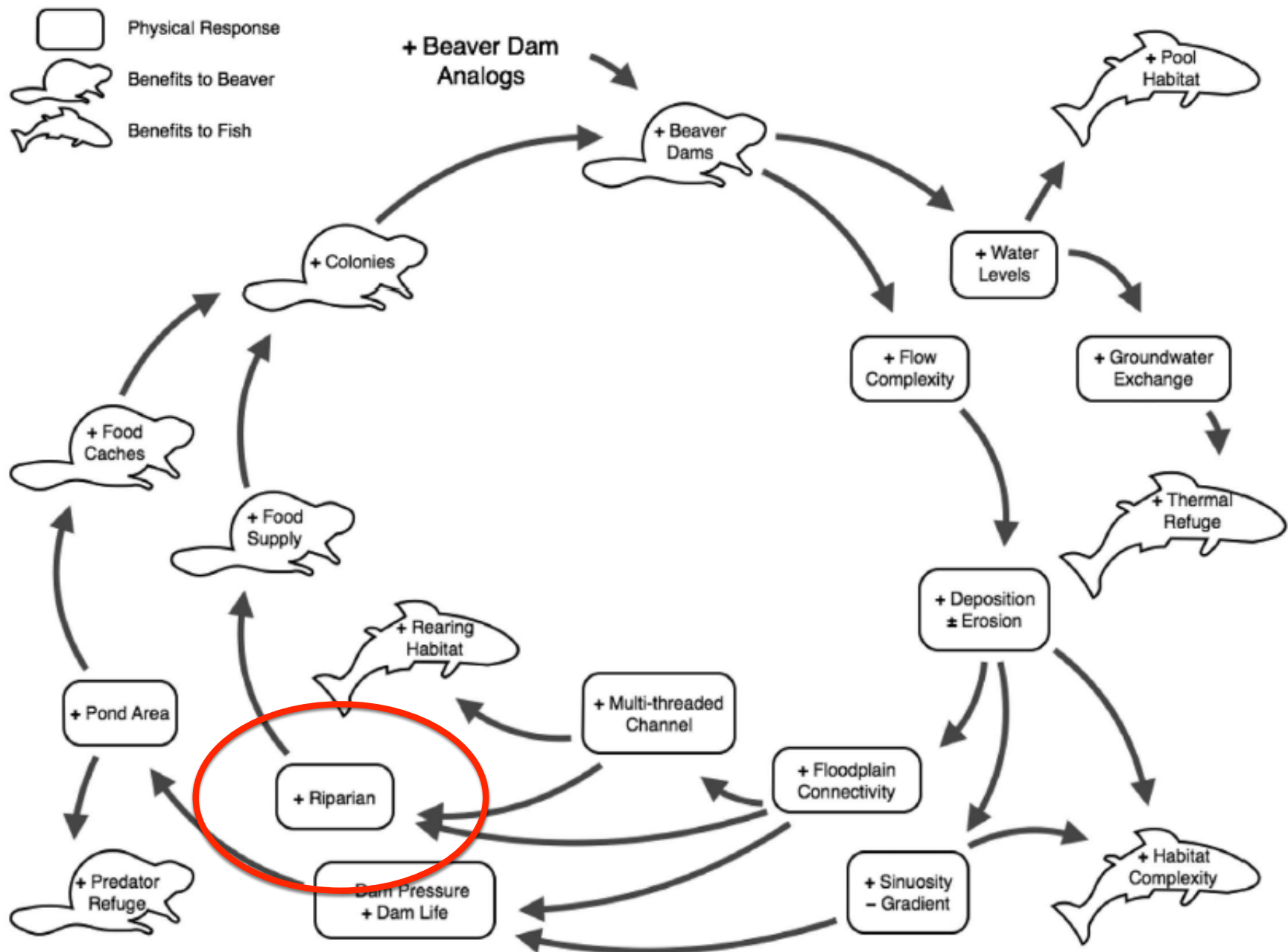
Control



Treatment

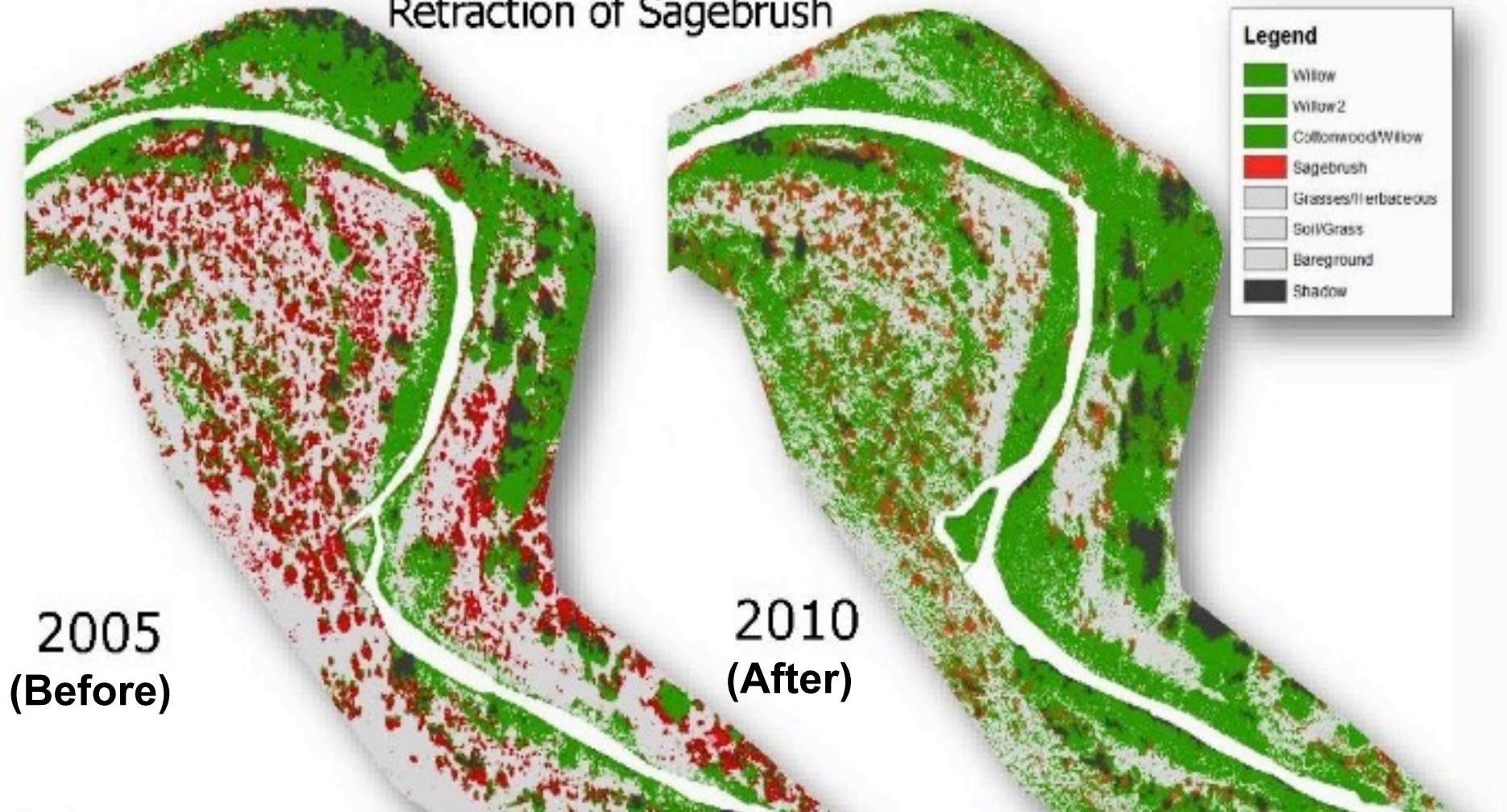


Bouwes et al. 2016
Scientific Reports



REALLY? KILLING SAGE BRUSH?

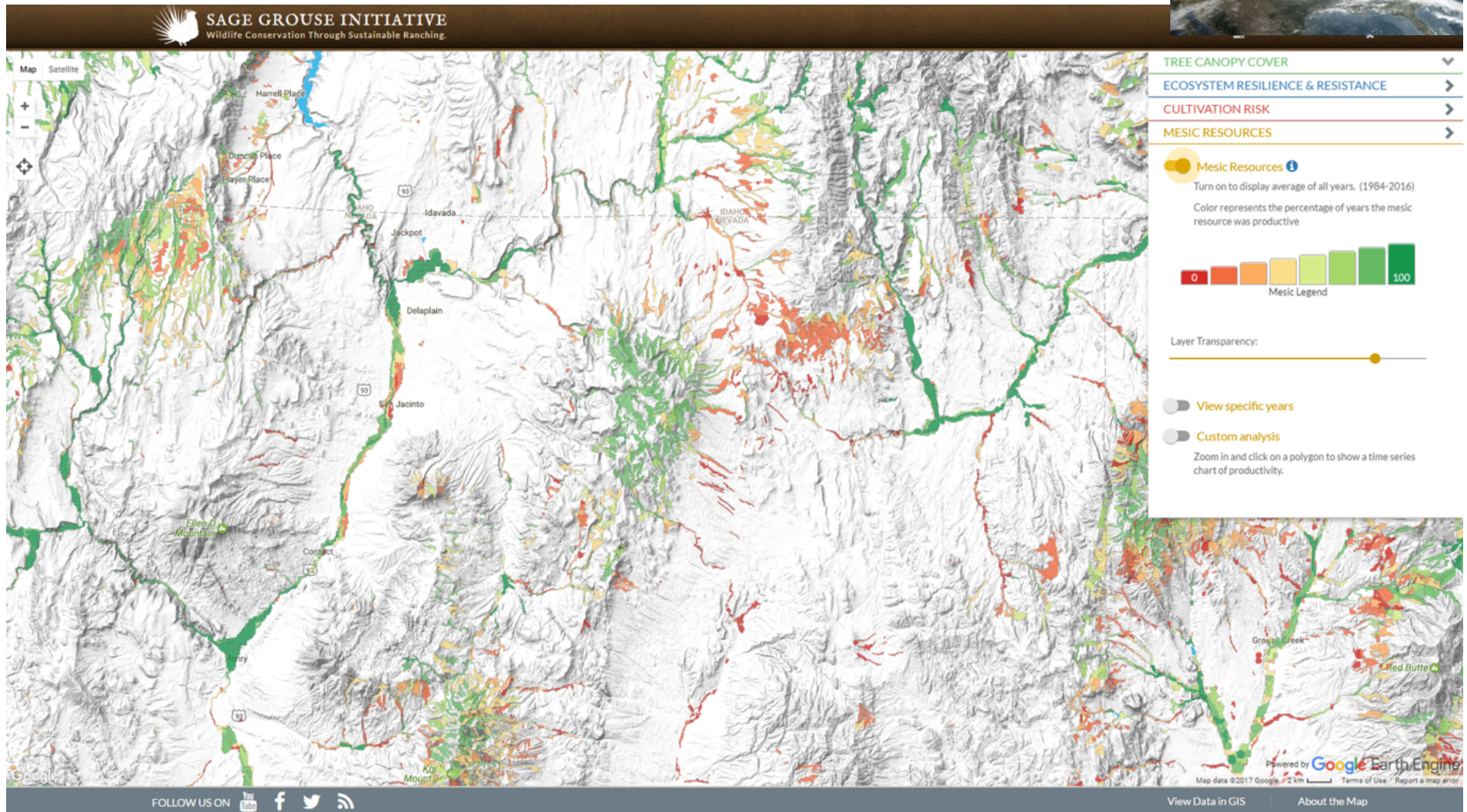
Expansion of Riparian Zone...
Retraction of Sagebrush



- Repeat high resolution (10 cm) imagery before & after 2009 treatment

Figure from Carol Volk
(South Fork Research)

IF SIGNAL IS MEANINGFUL...



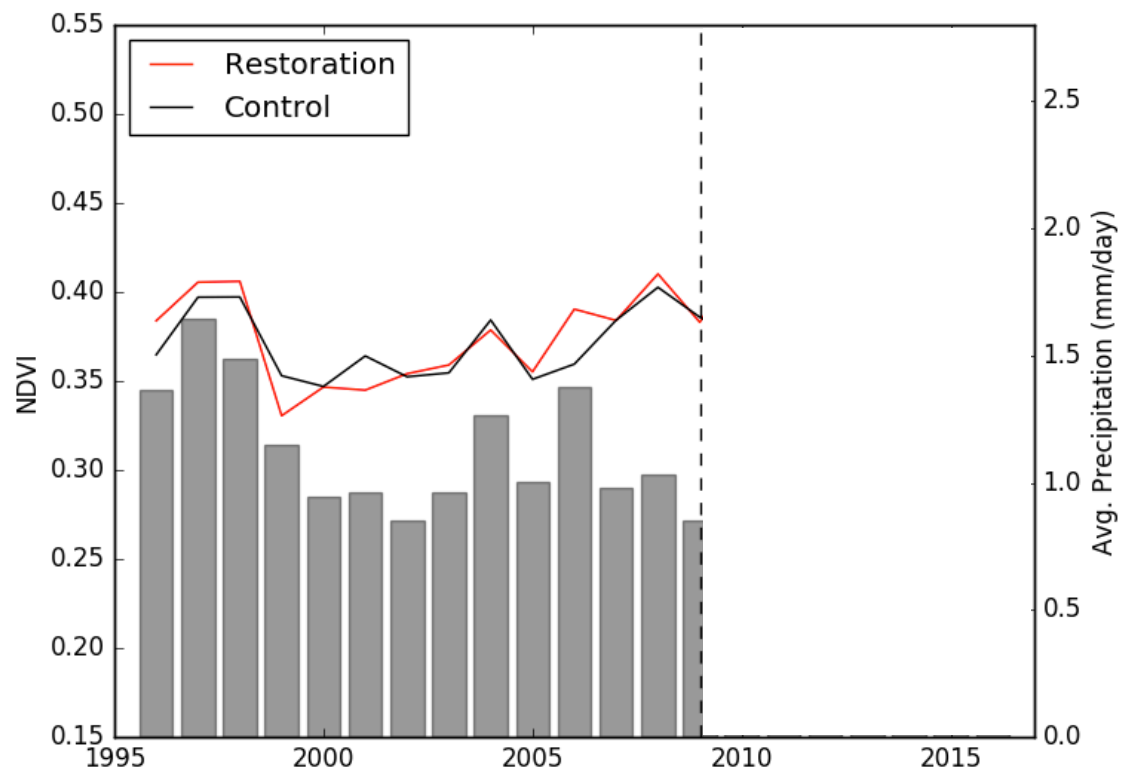
WE OUGHT TO BE ABLE TO DETECT IT FROM SPACE

map.sagegrouseinitiative.com

BRIDGE CREEK NDVI ANALYSIS



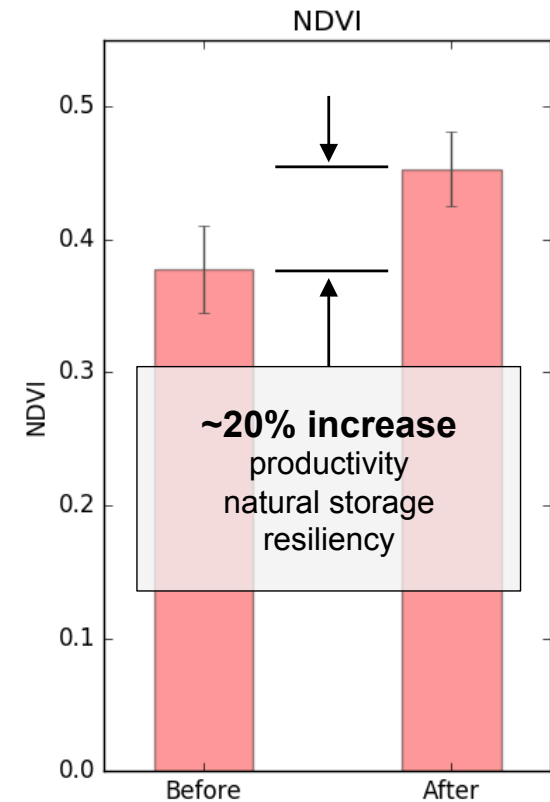
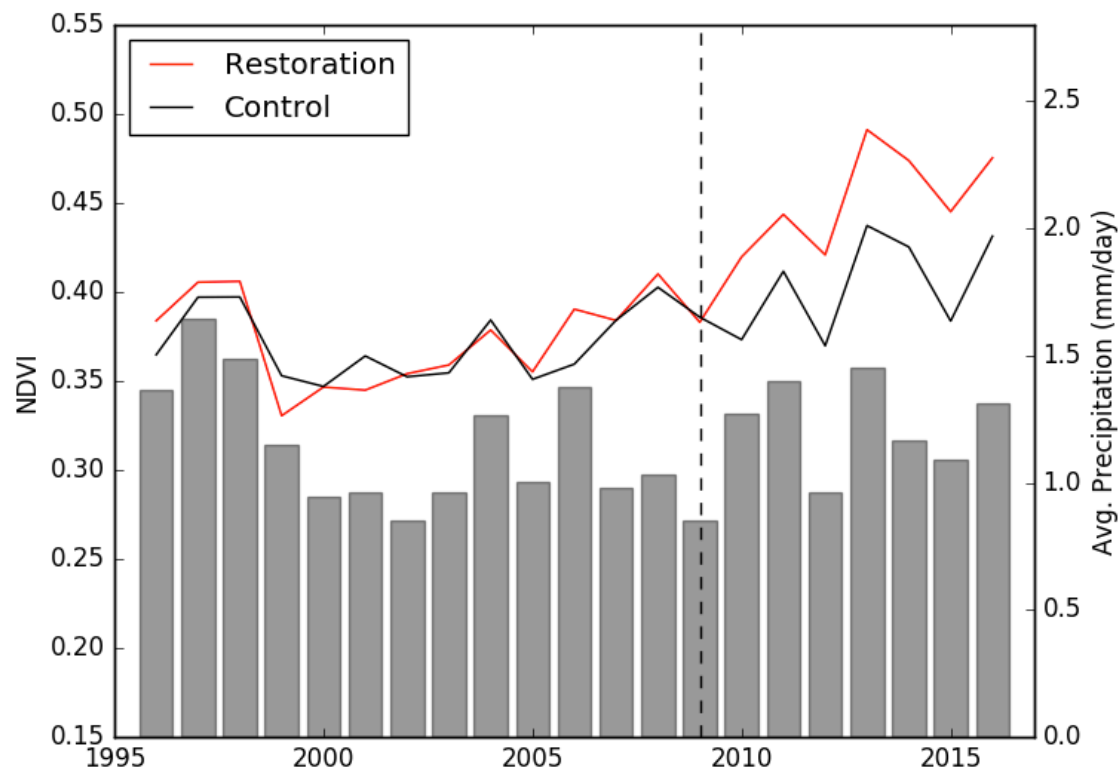
Silverman et al. In Prep



BRIDGE CREEK NDVI ANALYSIS



Silverman et al. In Prep



Weber et al. 2017 PLoS One

