Bridge Creek Intensively Monitored Watered

Partnering With Beavers In Stream Restoration

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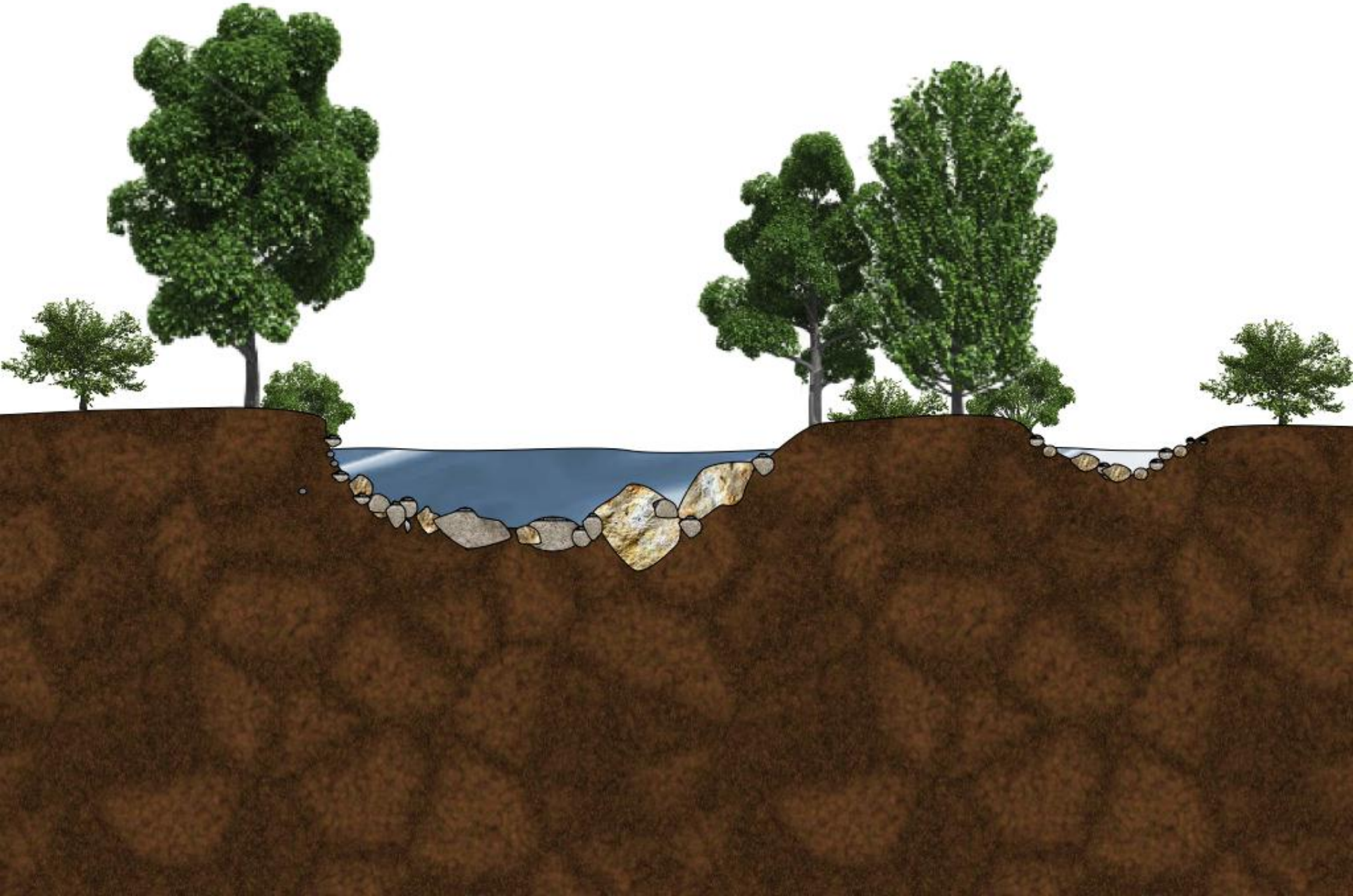
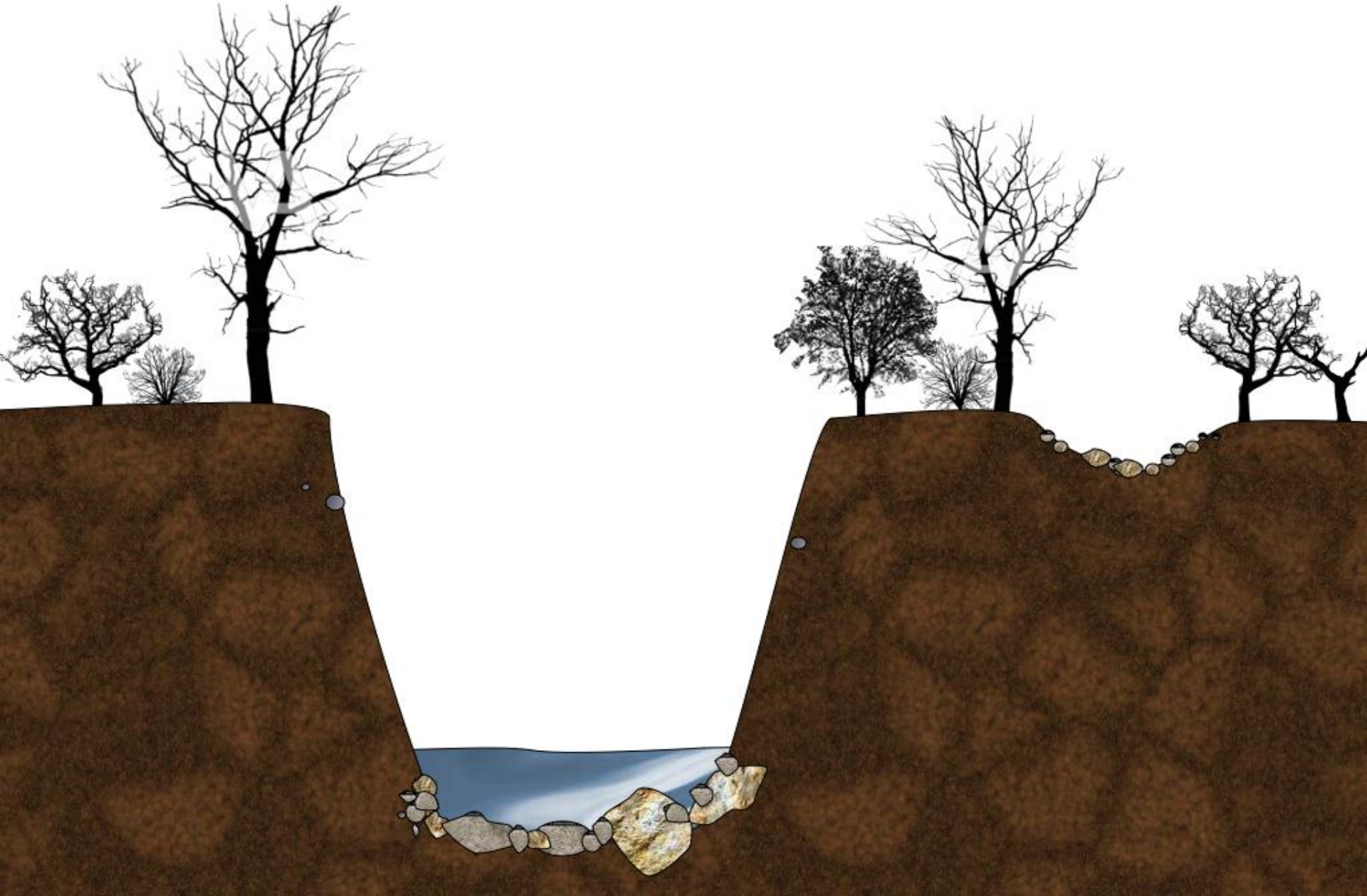
John Day Basin
Bridge Creek
You are here
Bend
Portland
Salem
Eugene
Medford
Longview
Kennewick
Walla Walla
Mt Hood
Columbia
OREGON
HARNEY BASIN
GREAT SANDY DESERT
BLUE MOUNTAINS
OCHOCO MOUNTAINS
ALDRICH MOUNTAINS
WILLOWA MOUNTAINS
OWYHEE MOUNTAINS
SISKIYOU MOUNTAINS
WILLAMETTE VALLEY
COAST RANGE
CASCADES
YAKIMA VALLEY
HORSE HEAVEN
Astoria Canyon

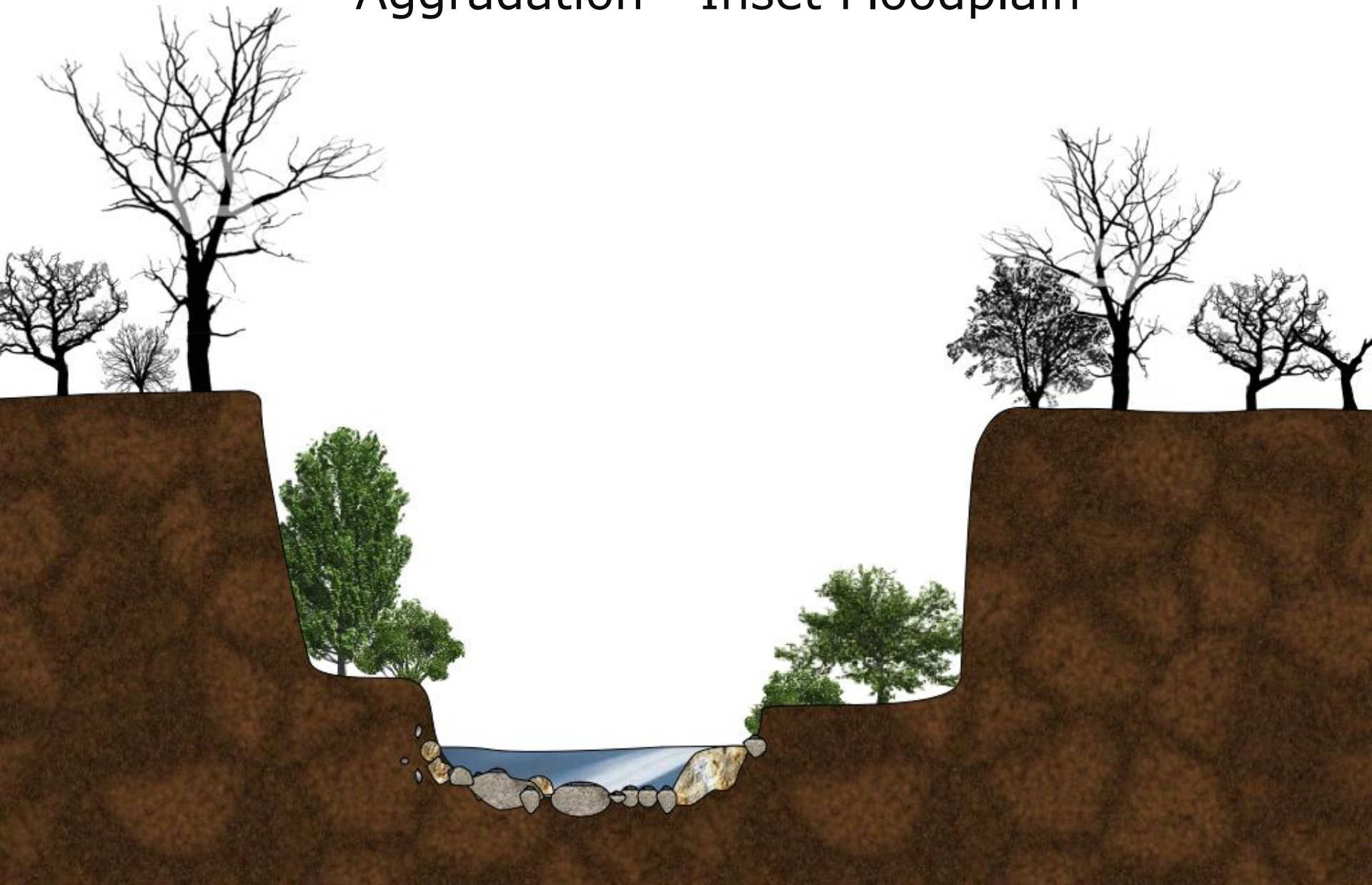
Process of Channel Incision



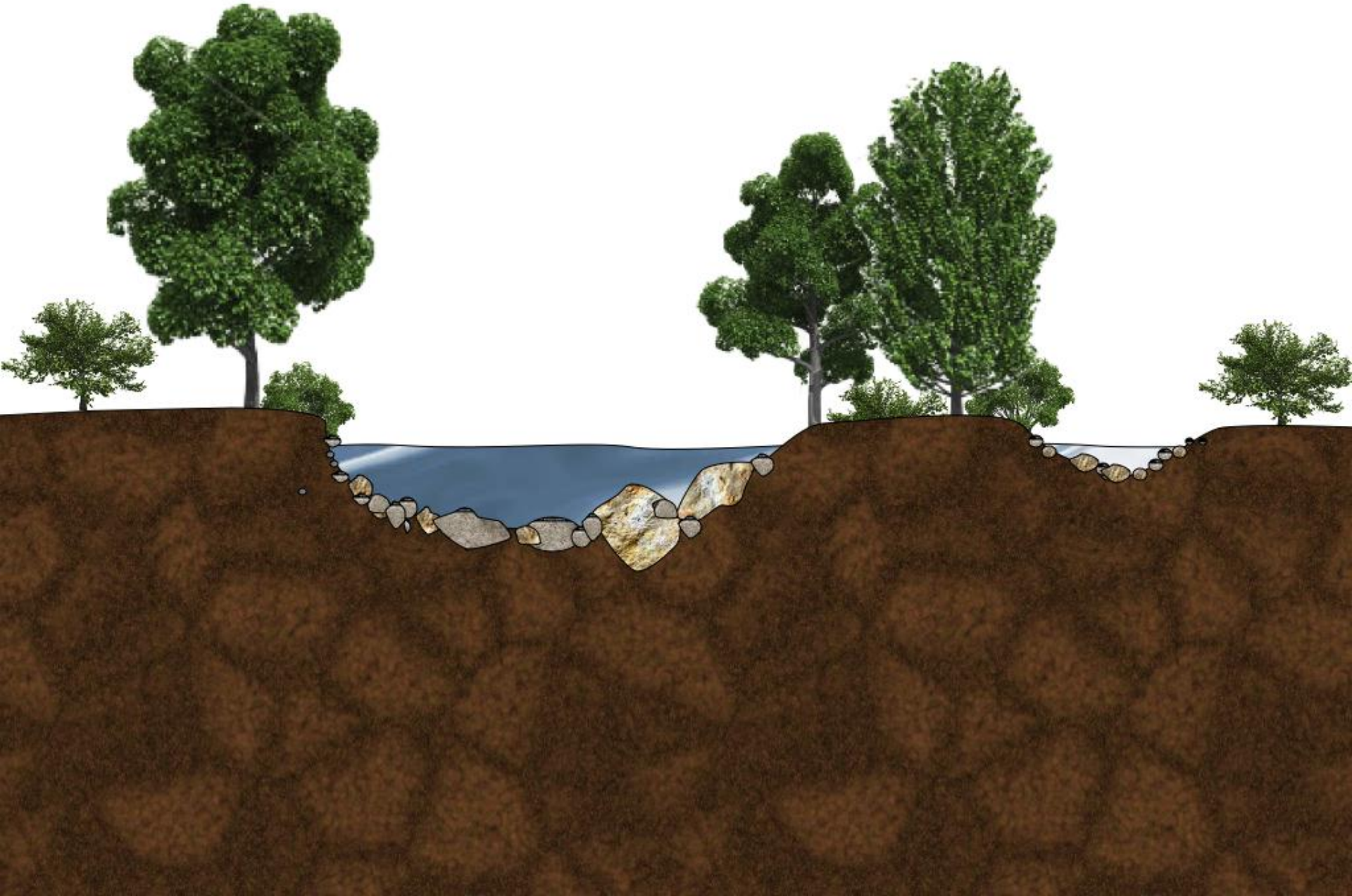
Incision – Disconnected Floodplain



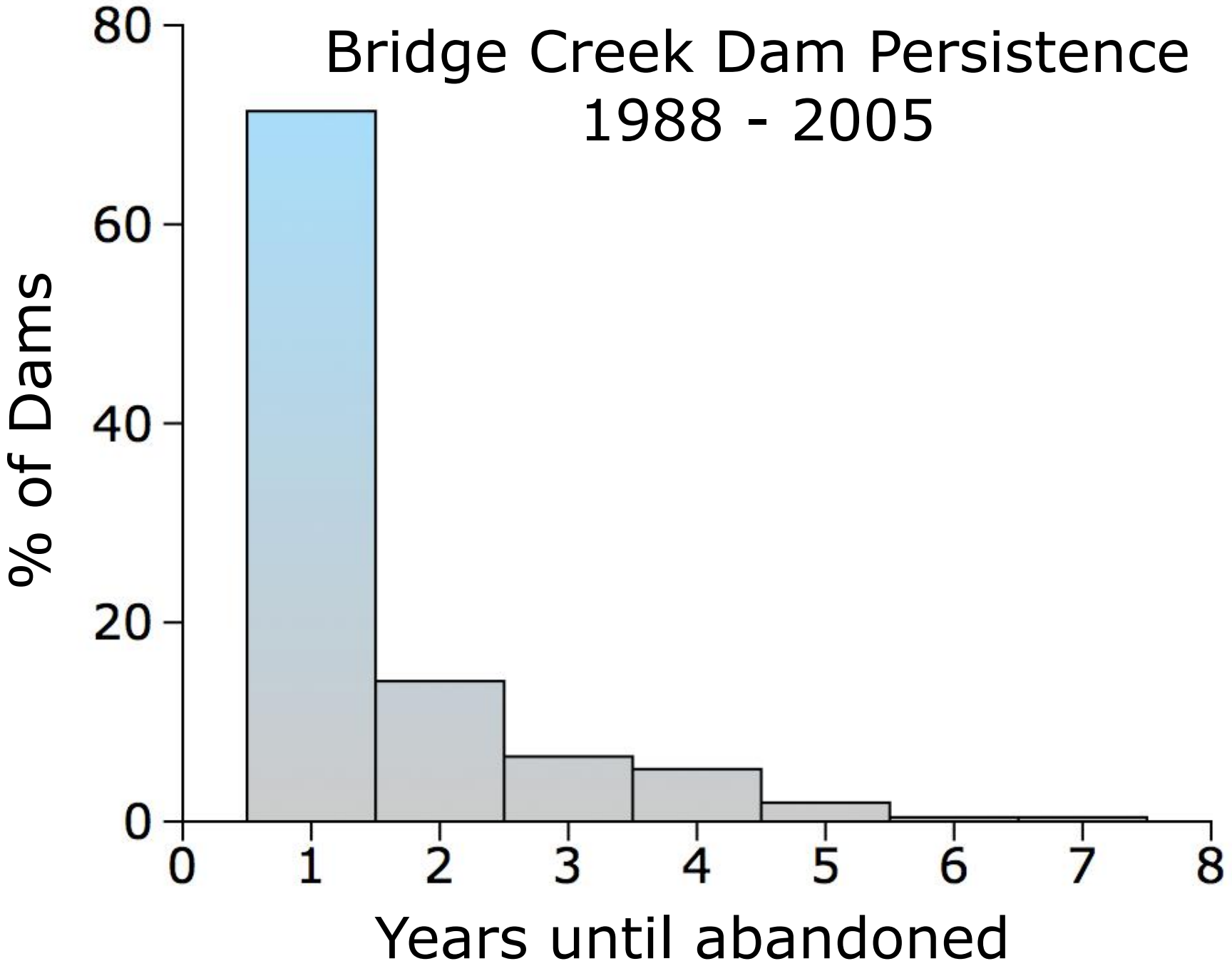
Lateral Erosion
Aggradation - Inset Floodplain

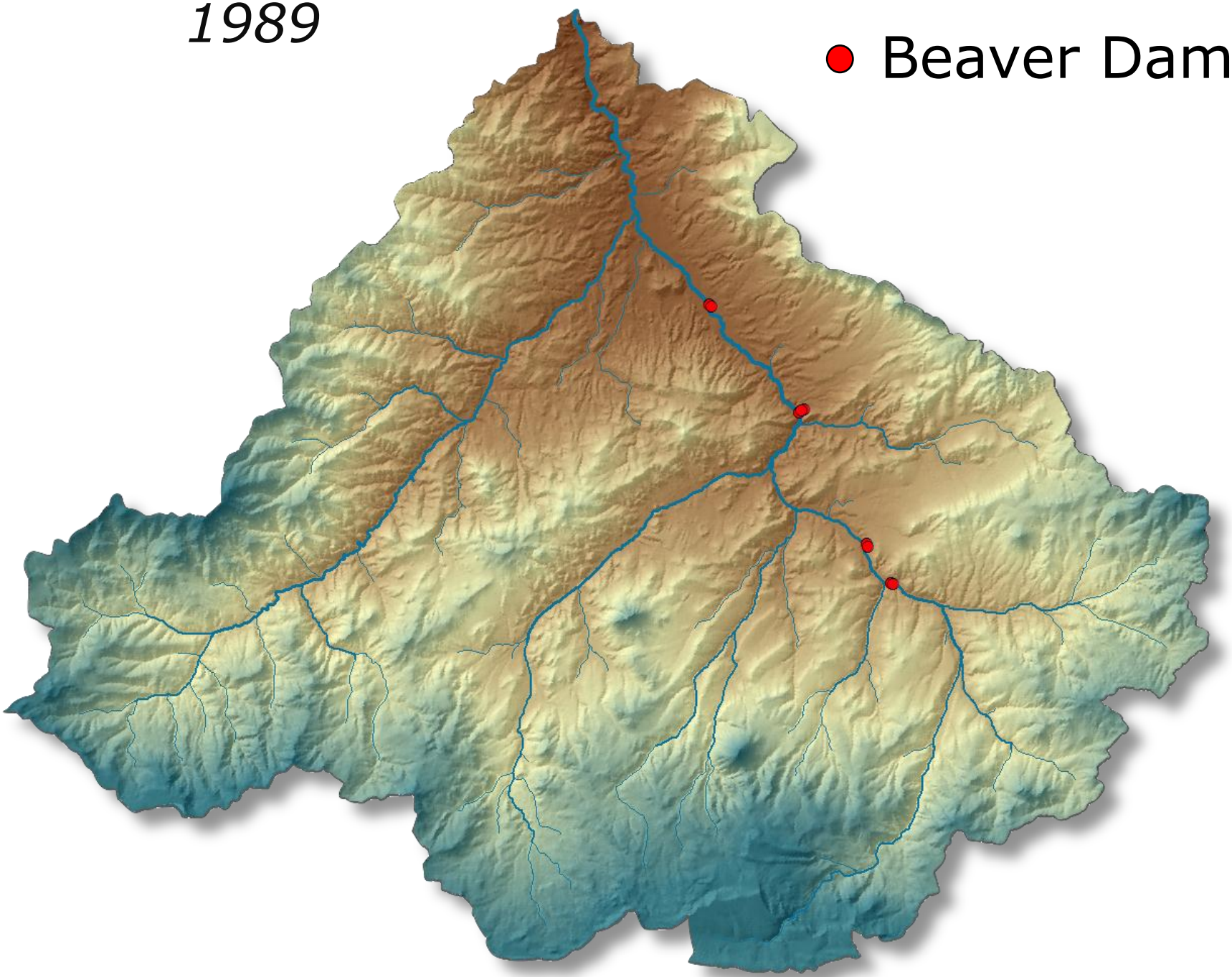


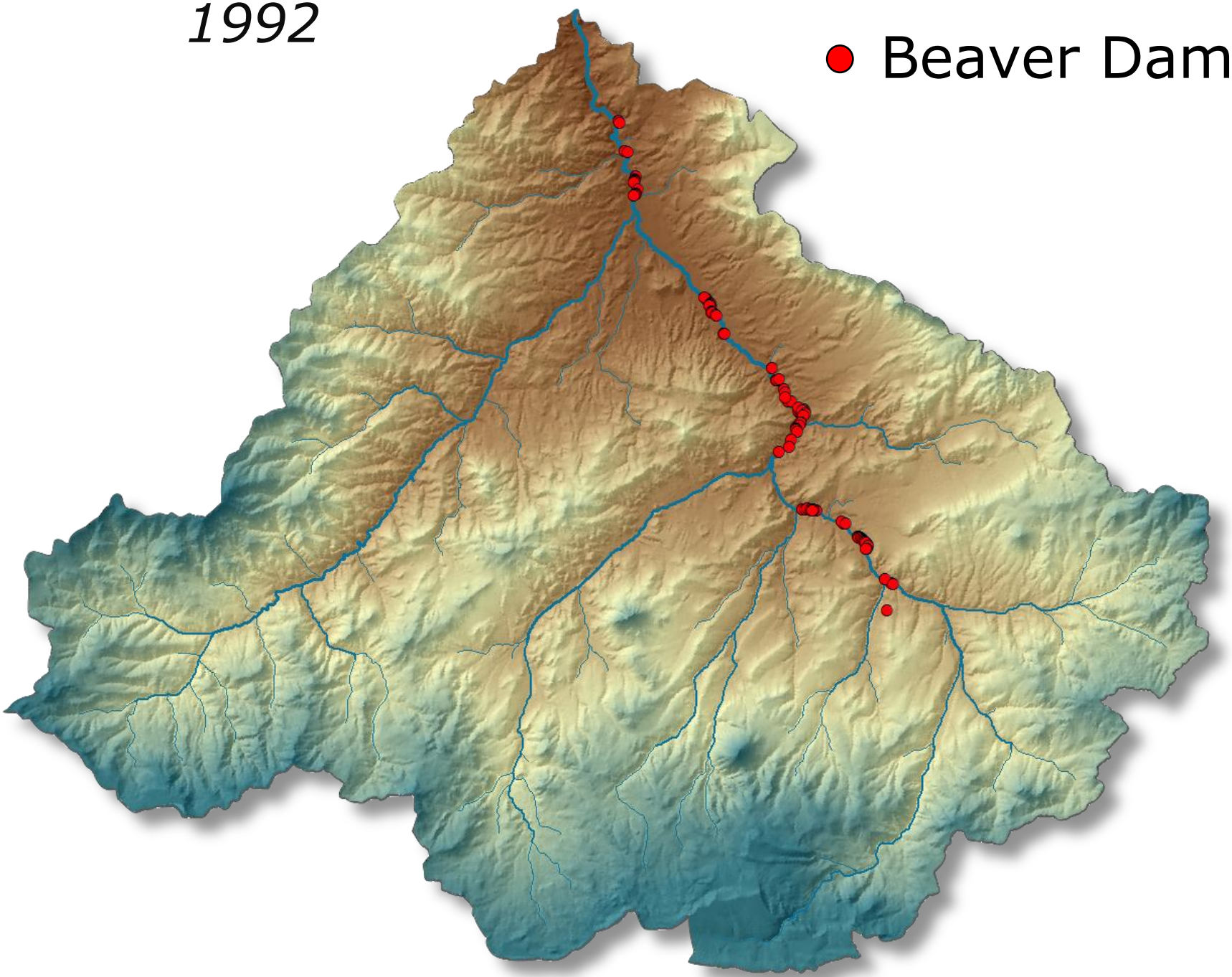
Aggradation – Floodplain Reconnection

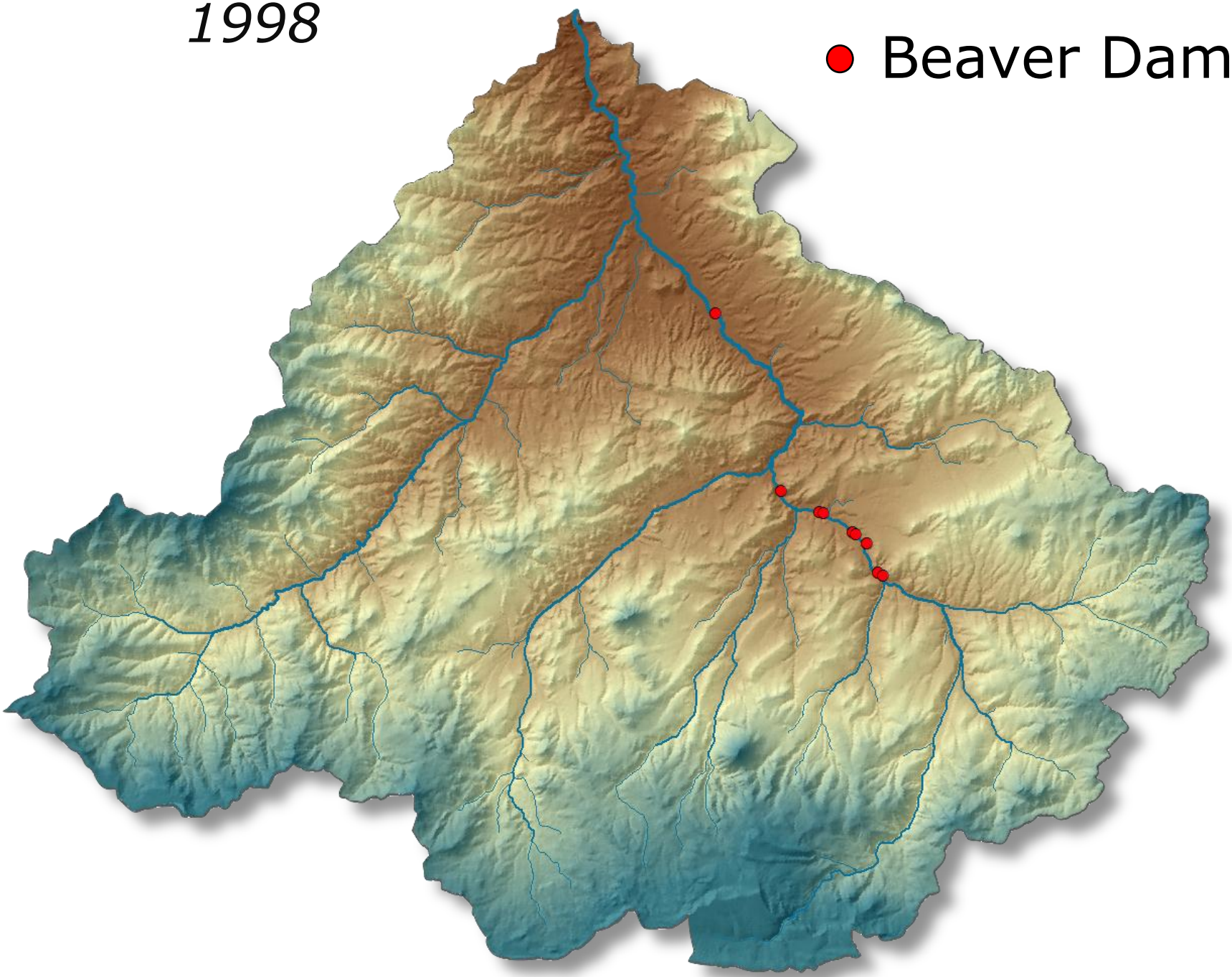


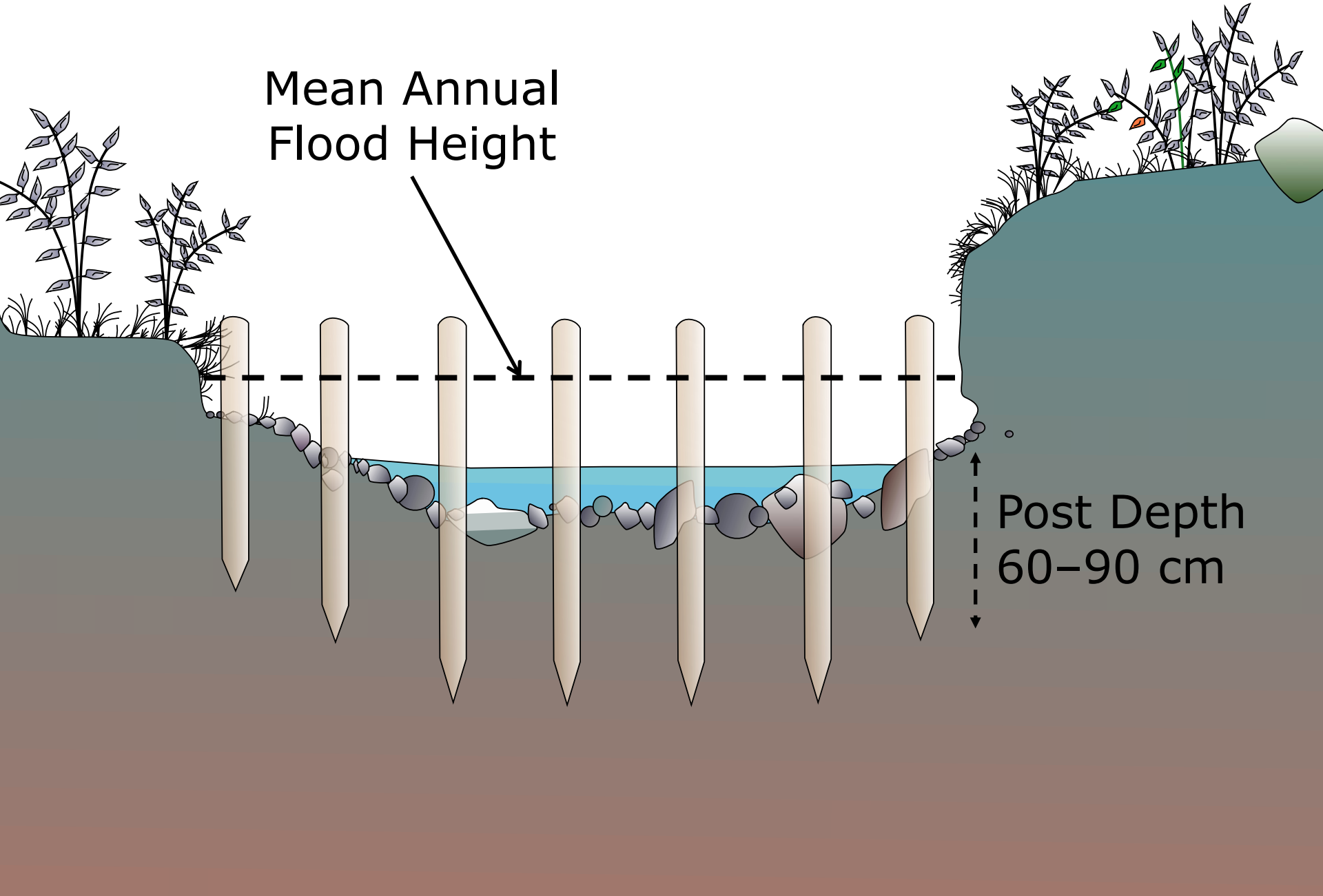

CAT
8. 6. 2004


Bridge Creek Dam Persistence
1988 - 2005
% of Dams
80
60
40
20
0
0
1
2
3
4
5
6
7
8
Years until abandoned

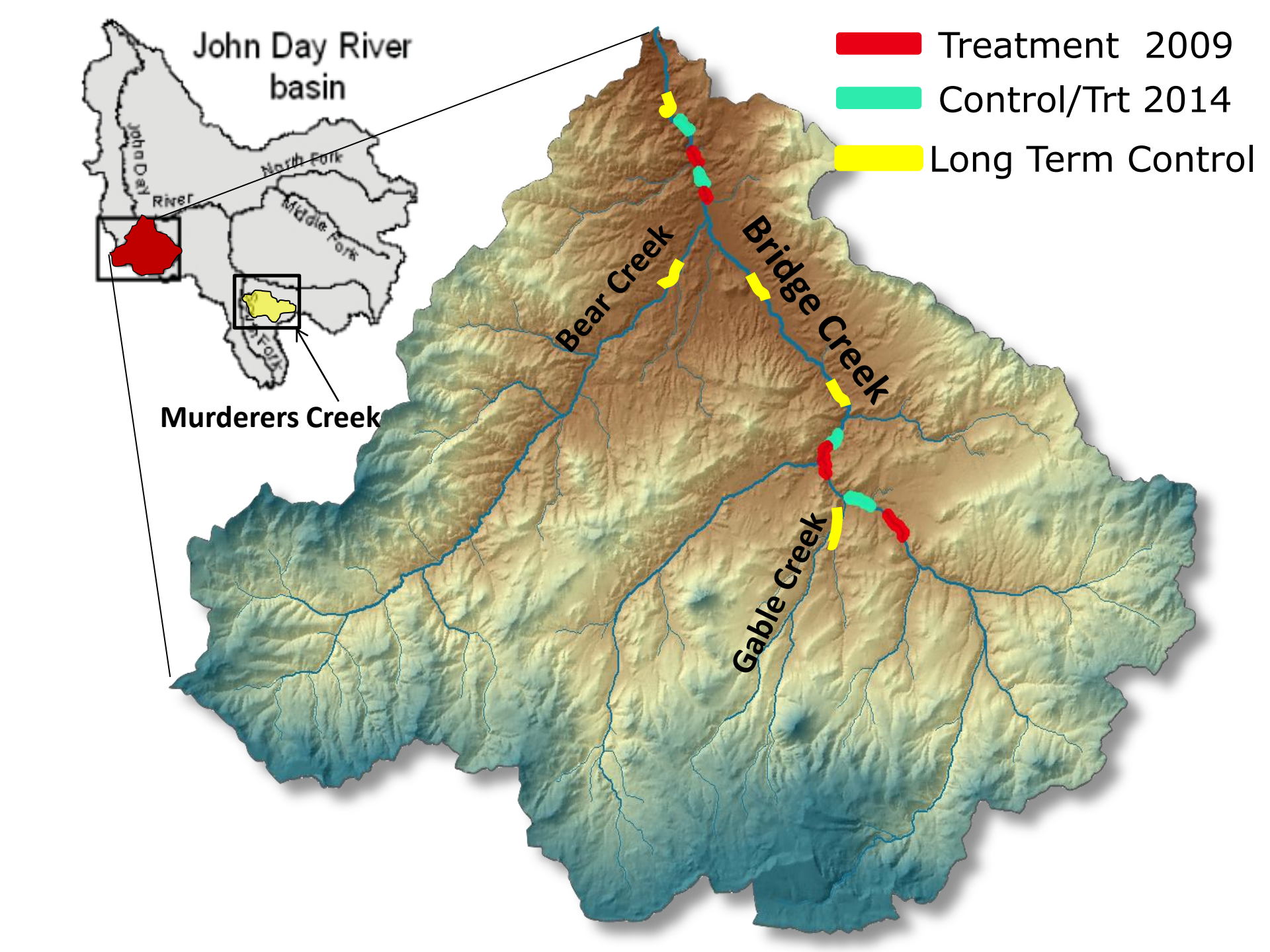

1989
Beaver Dam

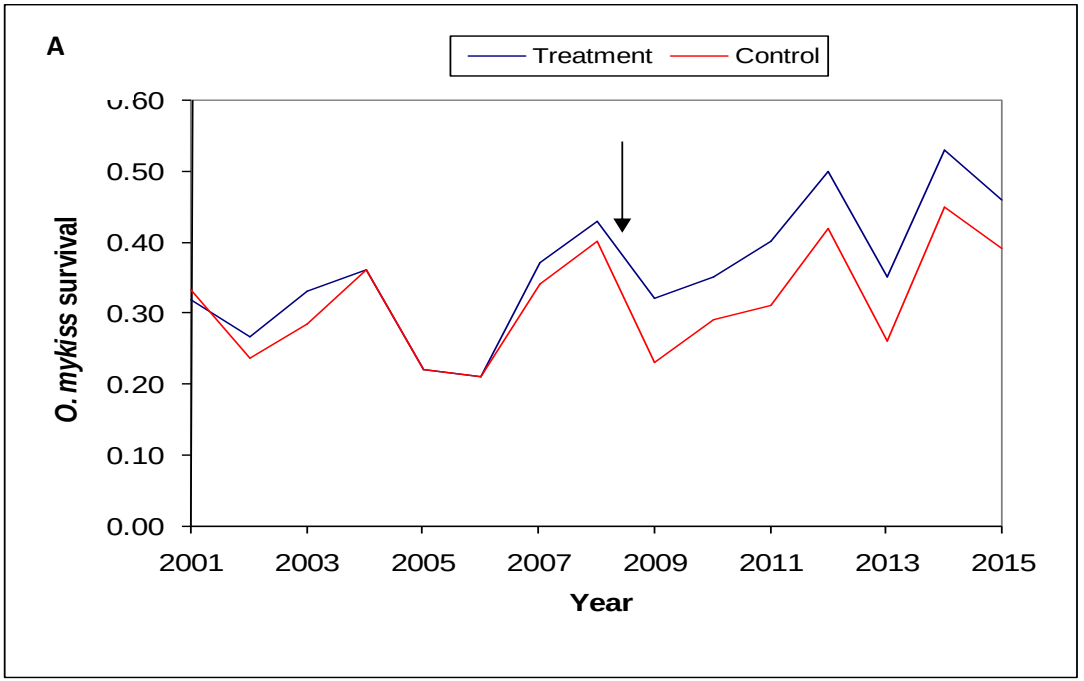

1992
Beaver Dam

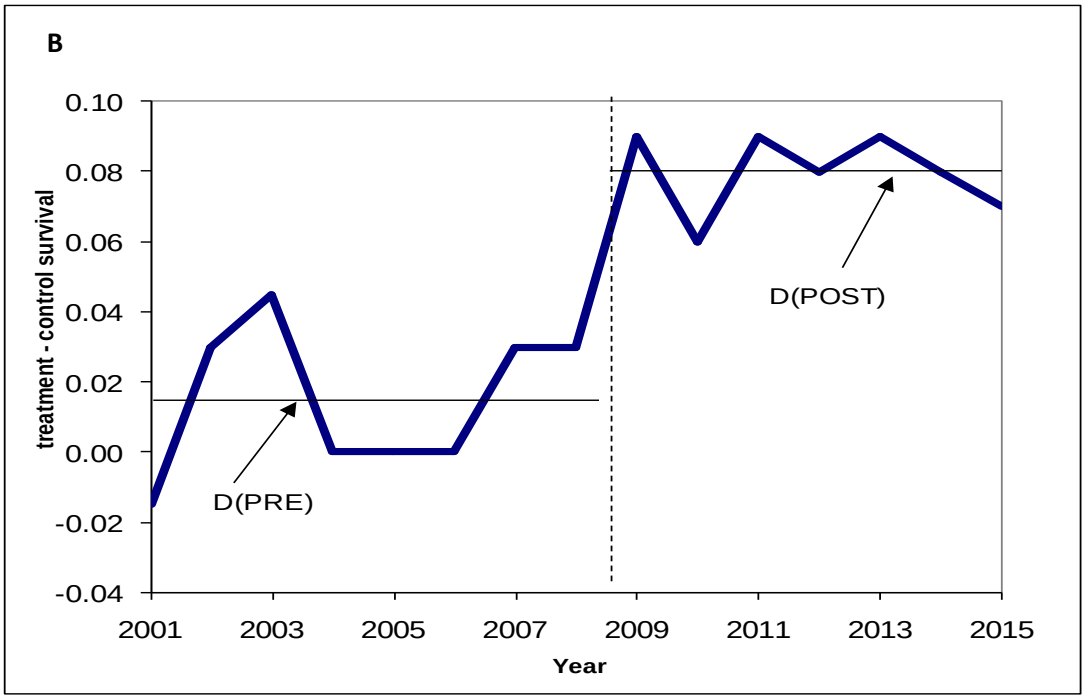

1998
Beaver Dam


Mean Annual
Flood Height
Post Depth
60–90 cm


20 m
BDS Structure


John Day River basin
John Day River
North Fork
Middle Fork
Murderers Creek
Bear Creek
Bridge Creek
Gable Creek
Treatment 2009
Control/Trt 2014
Long Term Control


A
Treatment
Control
0.60
0.50
0.40
0.30
0.20
0.10
0.00
O. mykiss survival
2001
2003
2005
2007
2009
2011
2013
2015
Year


B
0.10
0.08
0.06
0.04
0.02
0.00
-0.02
-0.04
treatment - control survival
D(PRE)
D(POST)
2001
2003
2005
2007
2009
2011
2013
2015
Year

Installed September 2009, Occupied by November 2009

- **Expected changes?**
- **Increase riparian vegetation**
- **Increase allochthonous inputs**
- **Decrease in stream power**
  - **Increase sinuosity**
  - **Floodplain dissipation**
- **Increase groundwater storage**
- **Increase hyporehic exchange**
- **Increase habitat complexity**
  - **channel braiding**
  - **plane-bed → pool-riffle or step-pool**
  - **Vegetation/dams**
- **Decrease temperature**

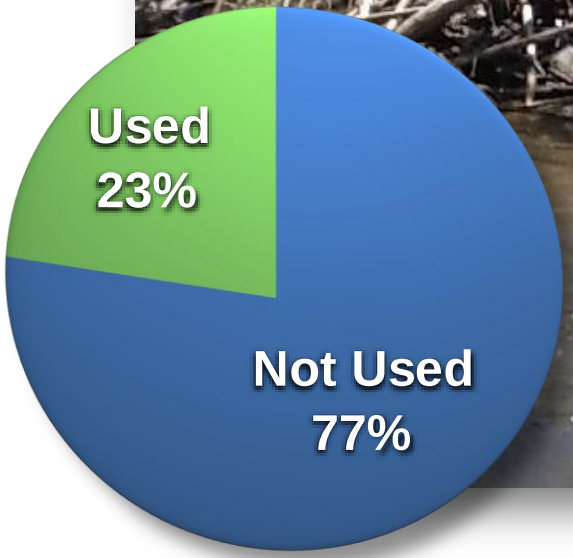
Fish Responses

- **Expected changes?**
- Increase riparian vegetation → velocity & predator refugia at high flow
- Increase allochthonous inputs→ increase nutrients/inverts
- Decrease in stream power
  - Increase sinuosity → increase flow heterogenity
  - Floodplain dissipation → flow refugia
- Increase groundwater storage → higher summer flows
- Increase hyporehic exchange → cooler water → more energetically op
- Increase habitat complexity → refugia, foraging, multiple life-stage
  - channel braiding
  - plane-bed → pool-riffle or step-pool
  - Vegetation/dams
- Decrease Temperature → energetically optimal

- **Increase growth, survival, abundance → fish production**

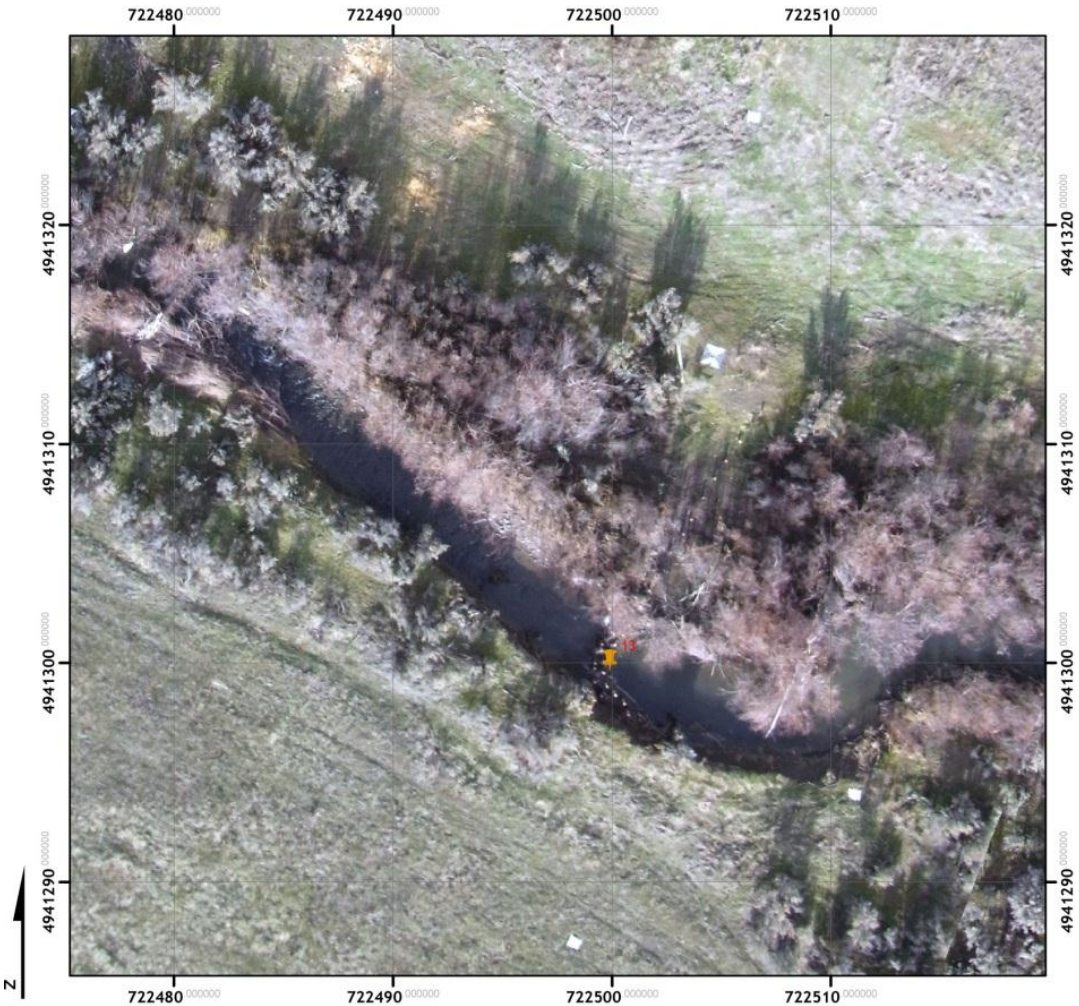
Does It Work?

Beaver Use

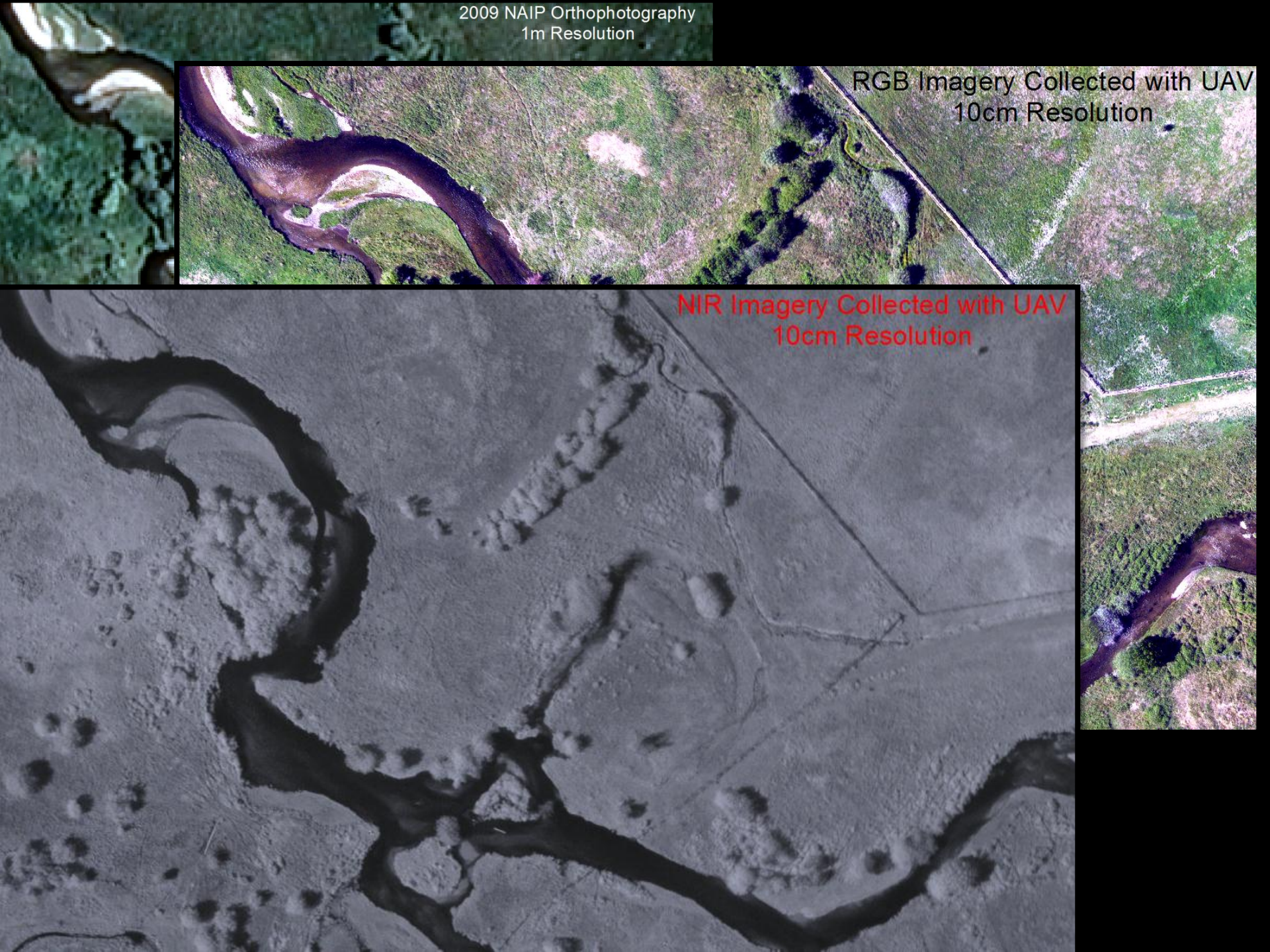


Dam Persistence

Structure Location (Red)
In Lower Owens Reach



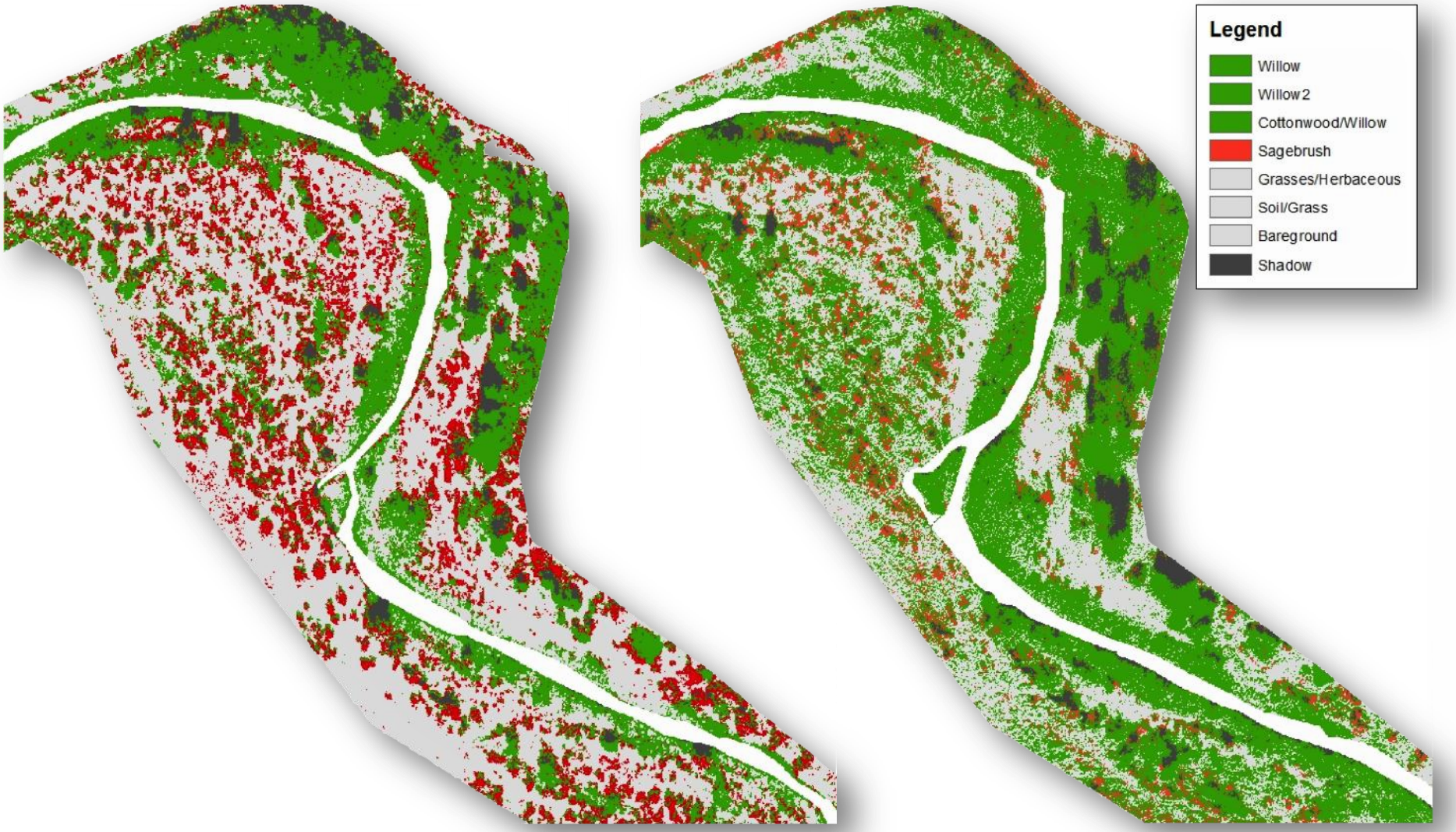
Bridge Creek - Lower Owens Reach
BCXX-13: Starter Dam


2009 NAIP Orthophotography
1m Resolution
RGB Imagery Collected with UAV
10cm Resolution
NIR Imagery Collected with UAV
10cm Resolution

Drone Imagery Vegetation Classification

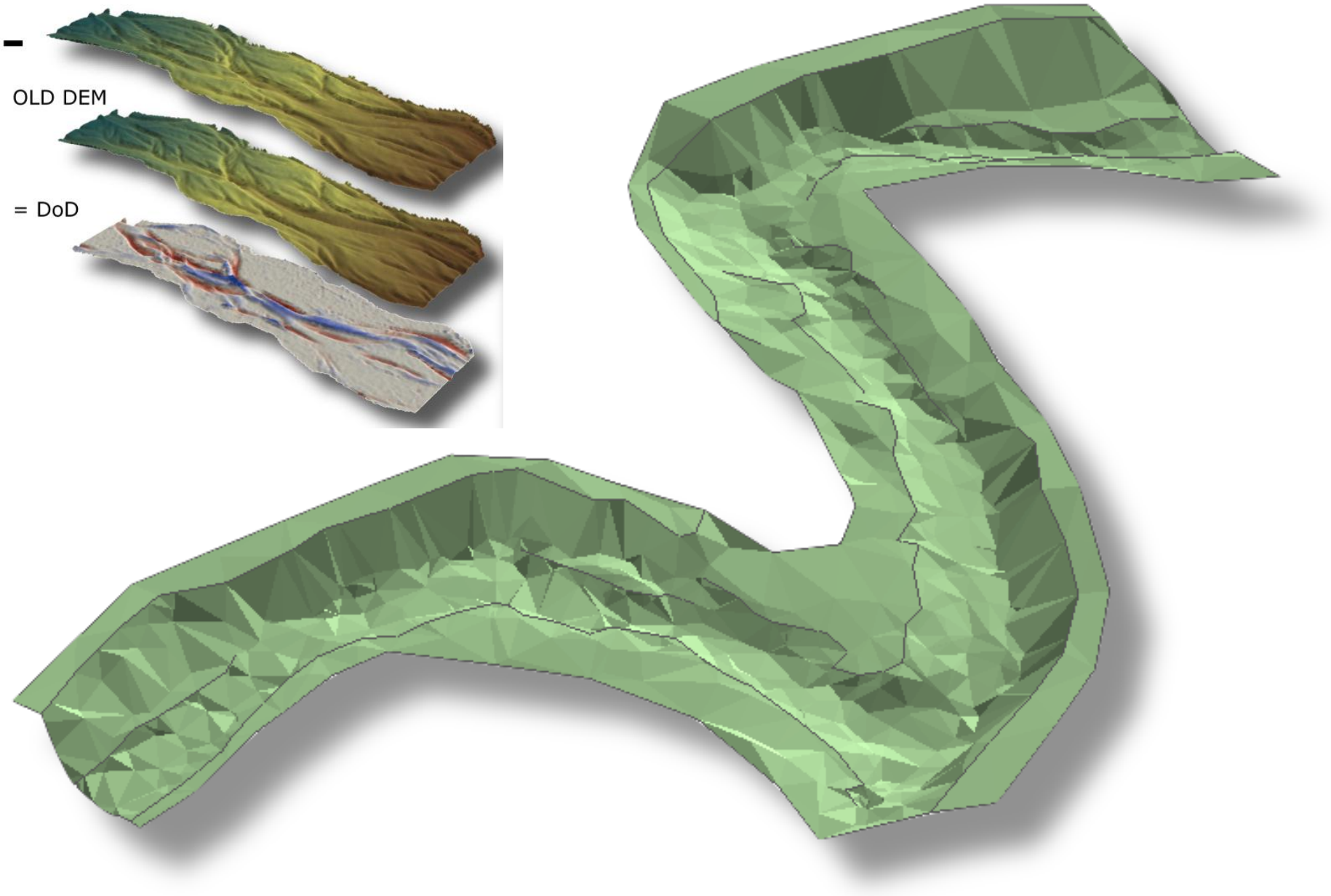
2005

2010

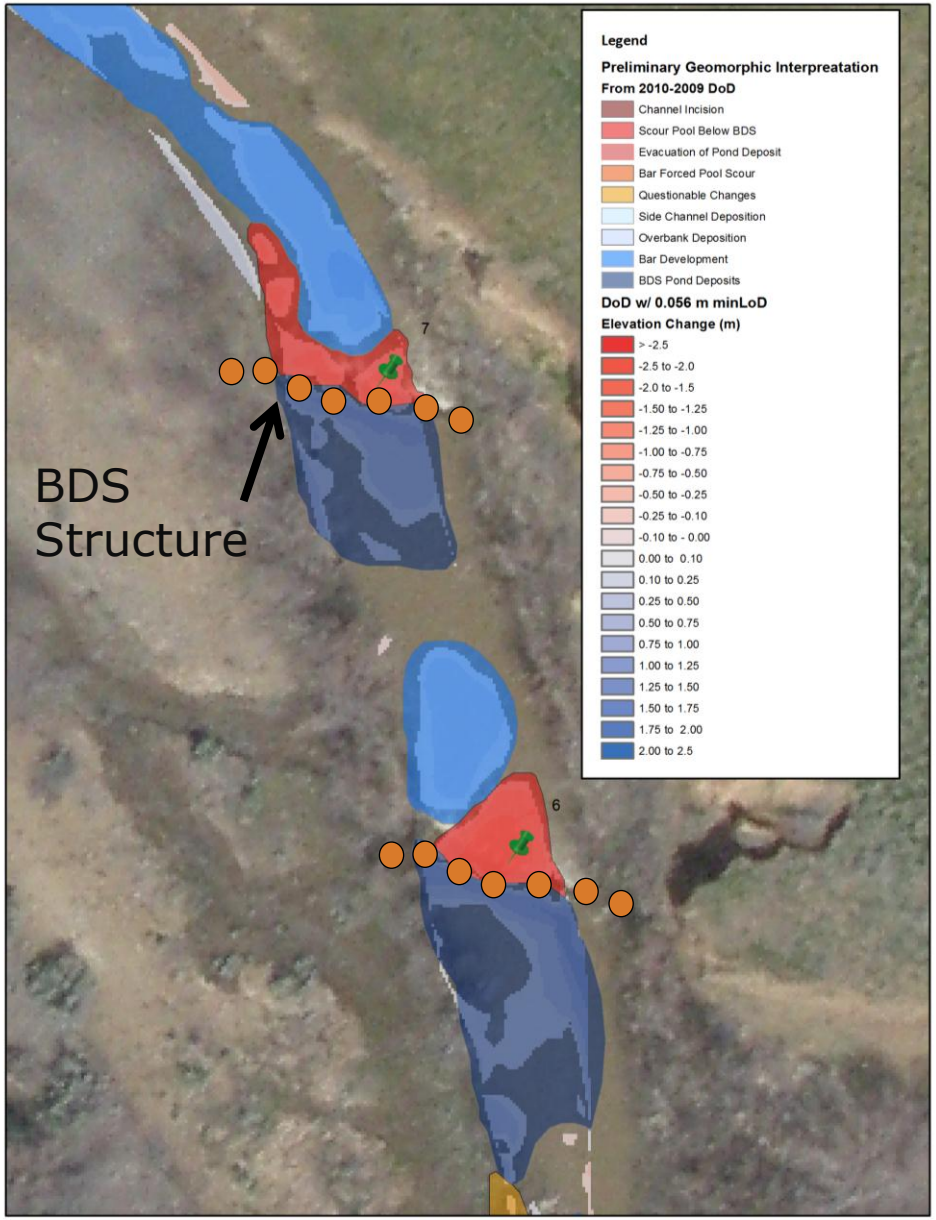


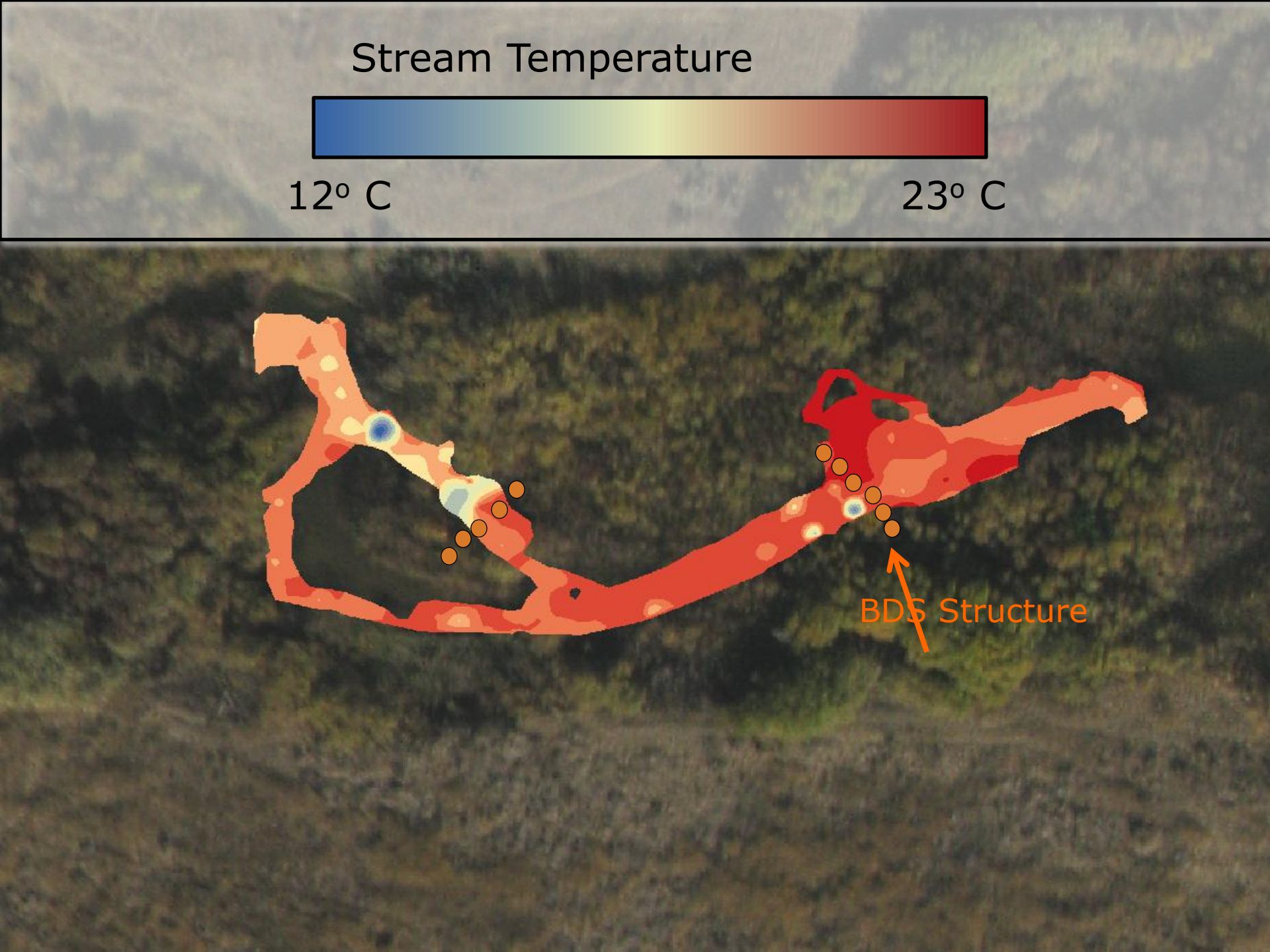

HOW DO WE QUANTIFY THE OBVIOUS?

Channel Topographic Survey

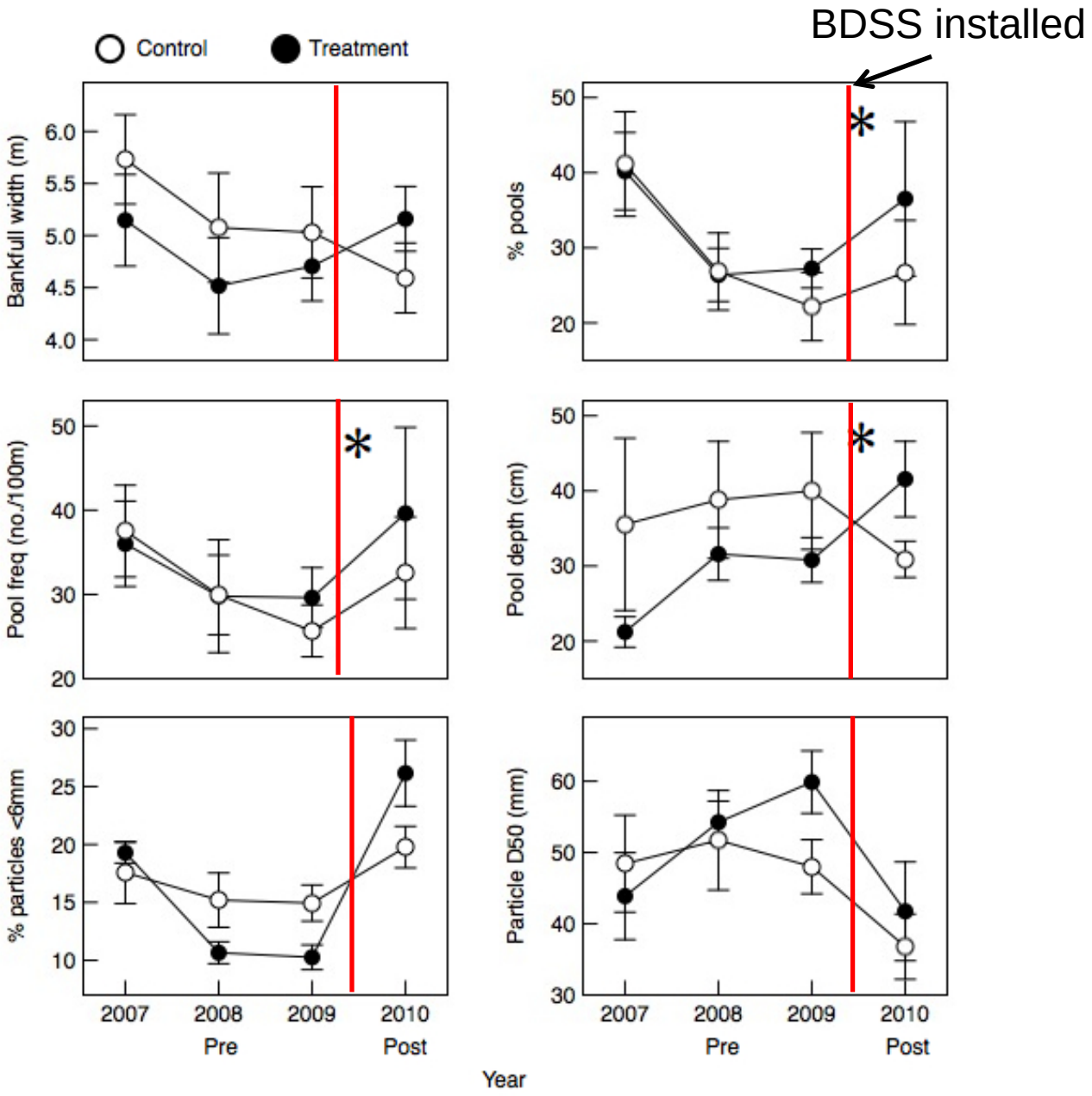


DEM of Difference




Stream Temperature
12° C
23° C
BDS Structure

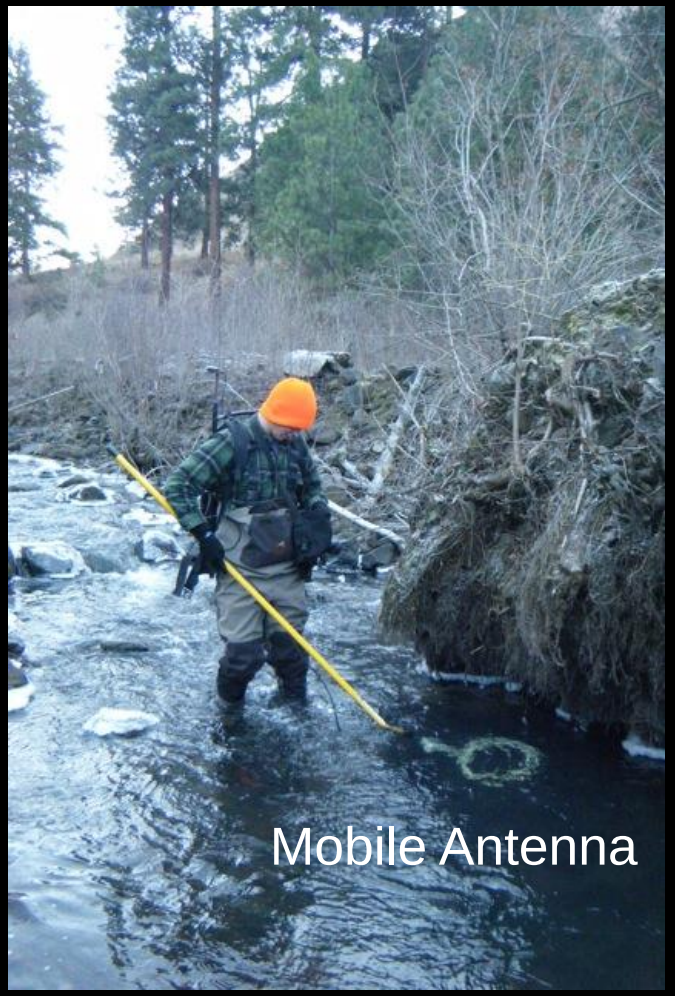
Habitat Characteristics



What About the Fish?

Catchment wide fish surveys

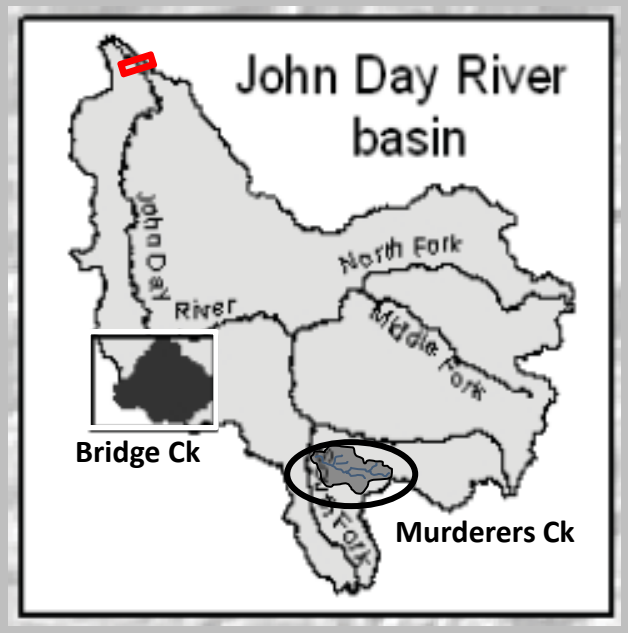

One-pass electroshocking


Mobile Antenna


Passive Instream Antenna

Pressure Transducer

Bridge Creek IMW



Adult weir

Passive Instream antenna

10 km

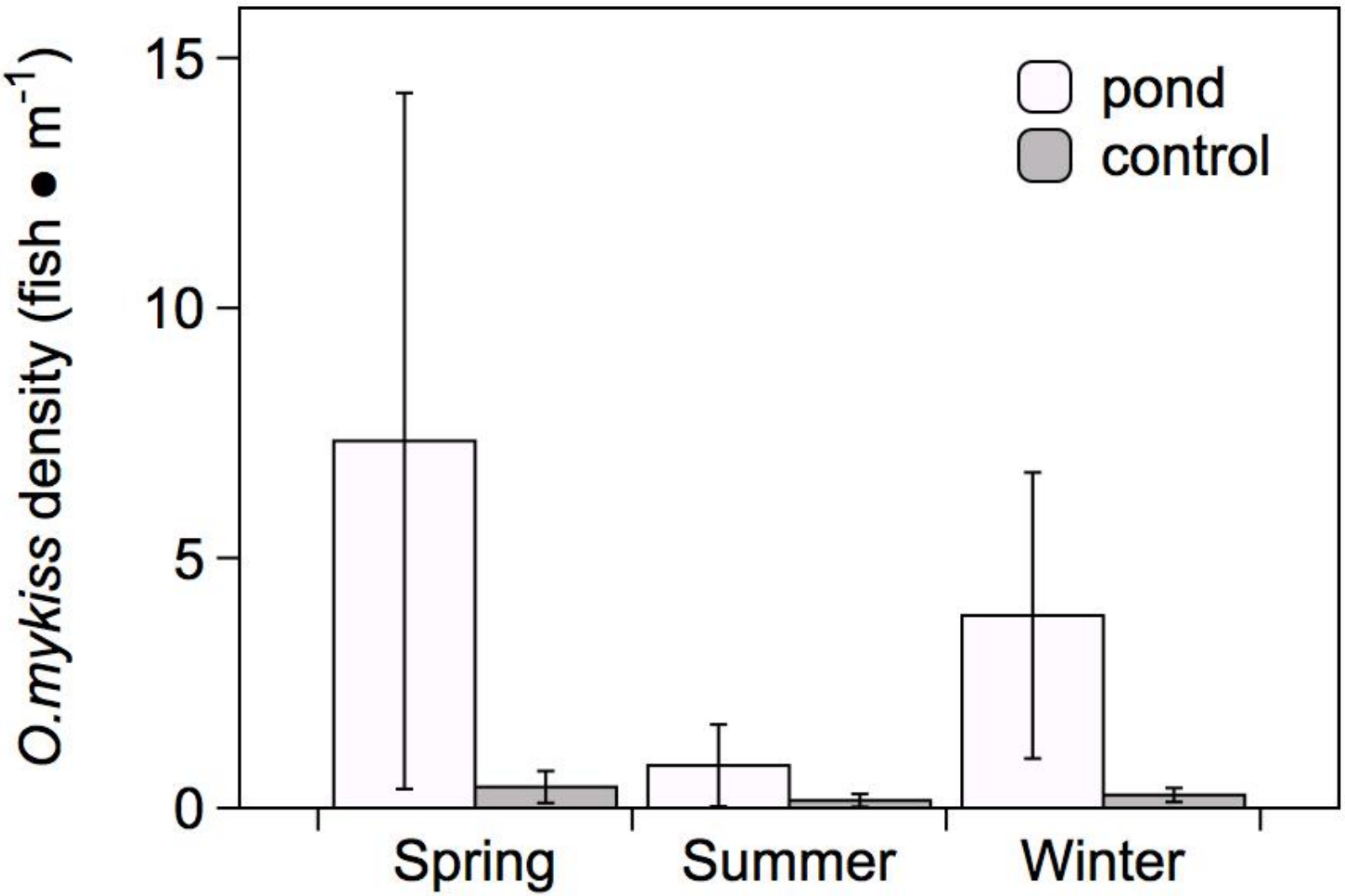
Bridge Creek

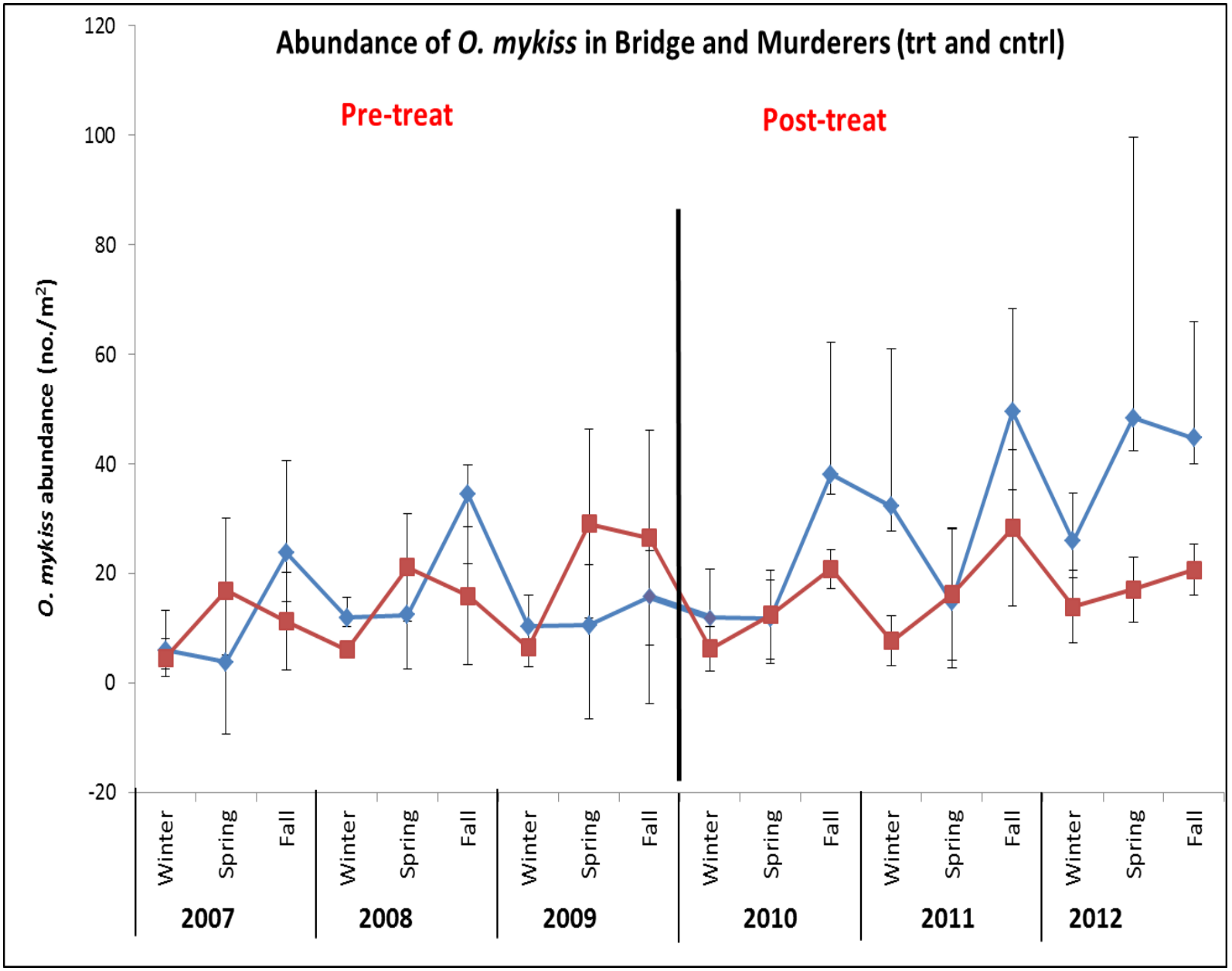
Bear Creek

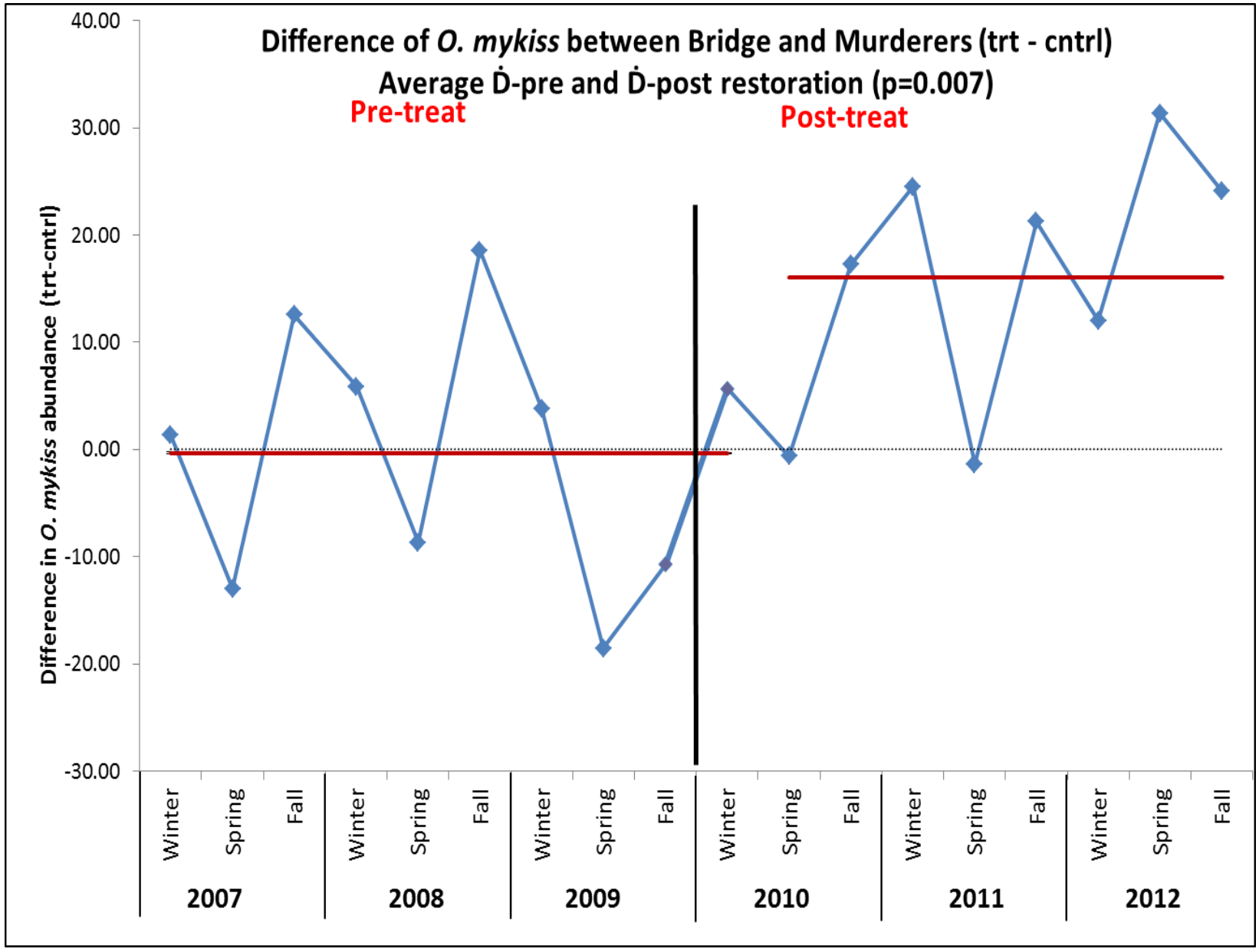
Gable Creek

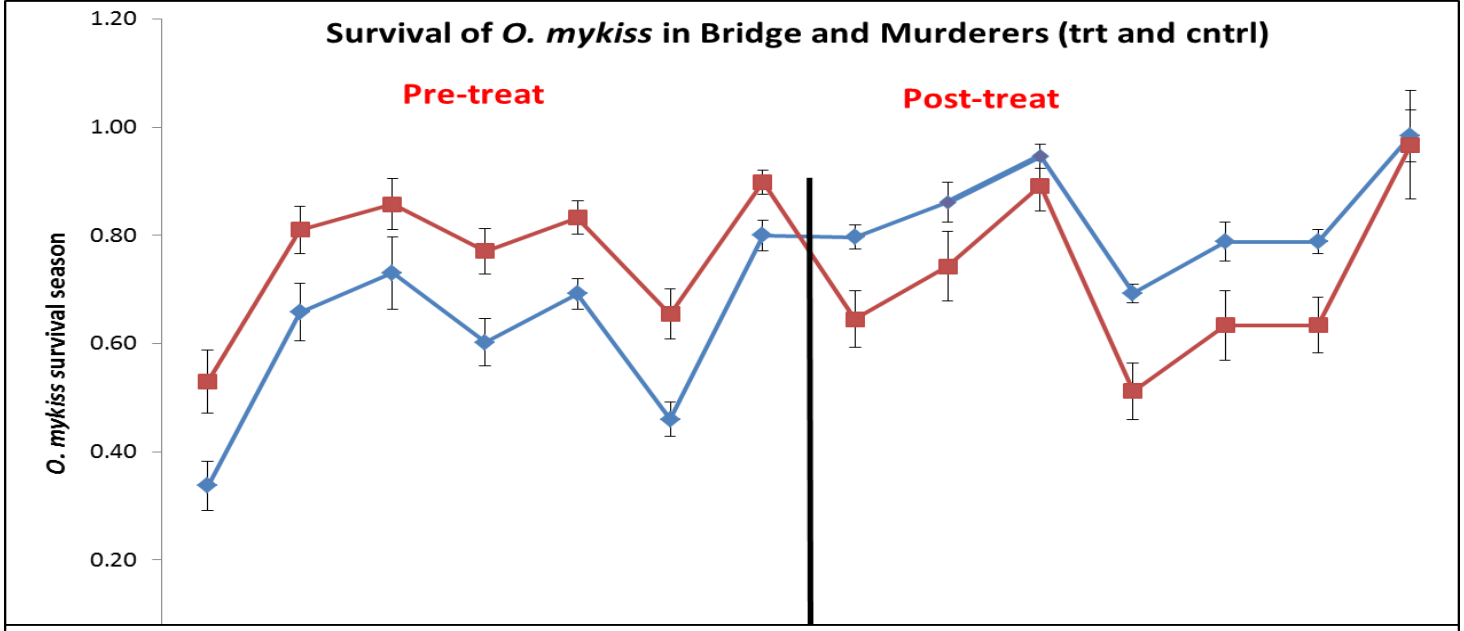
Mitchell

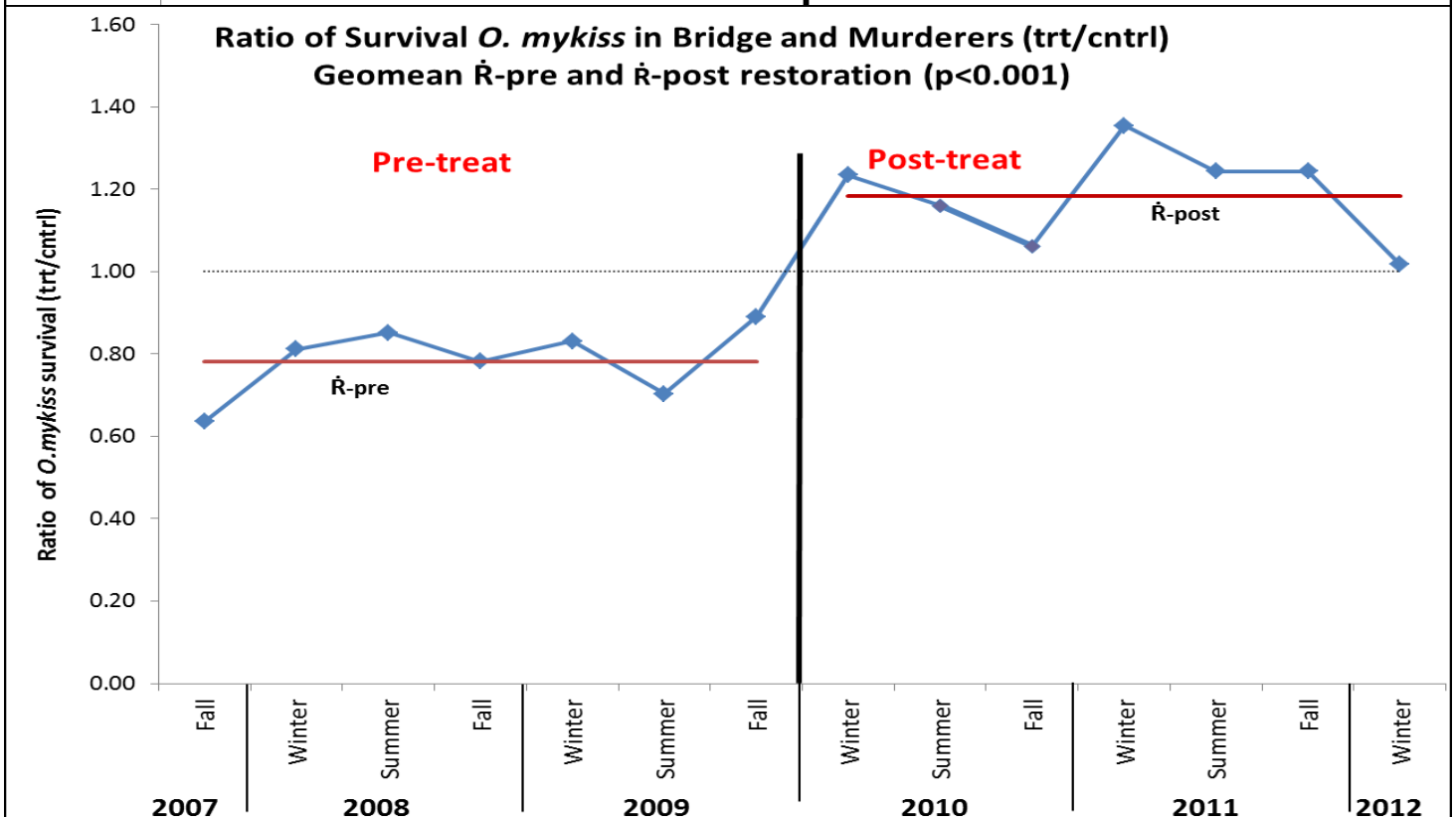
Juvenile Steelhead Habitat Preference

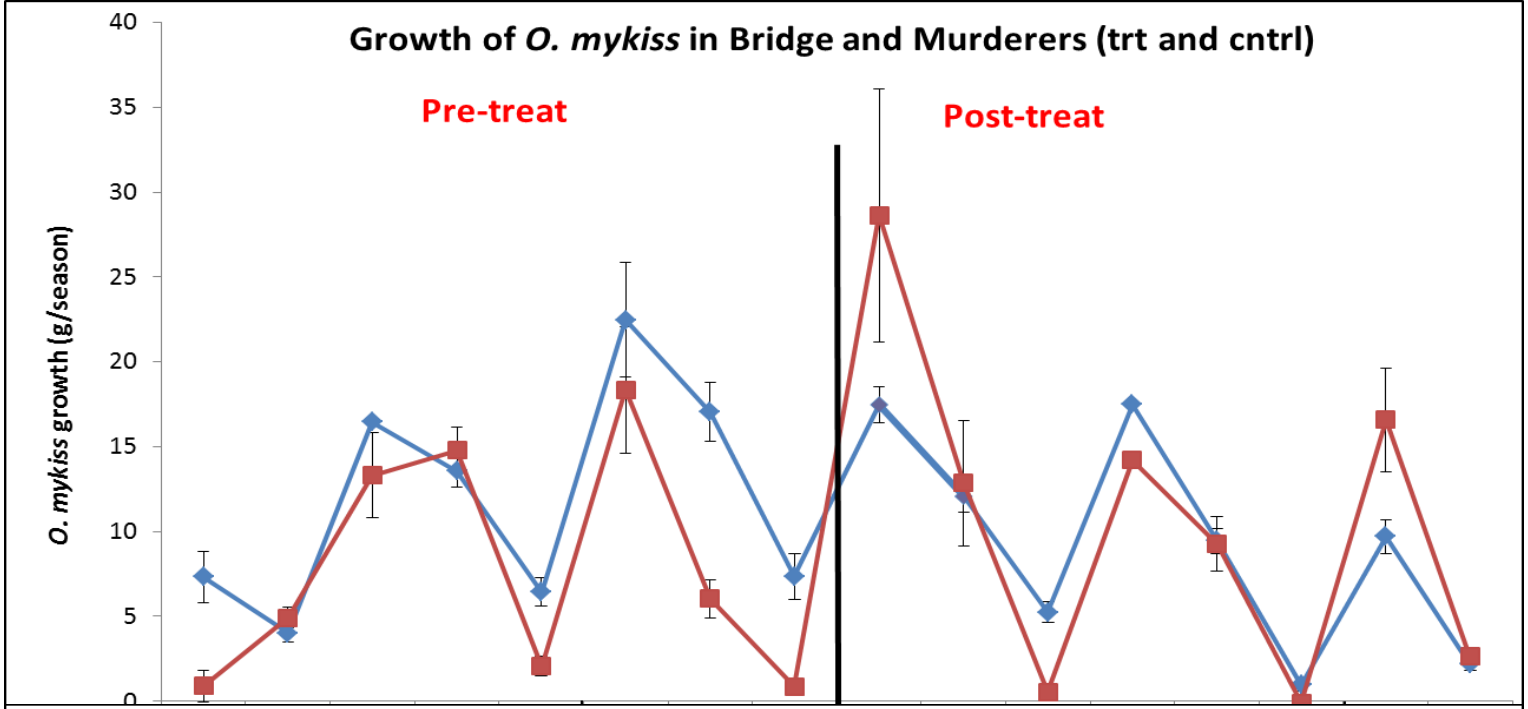


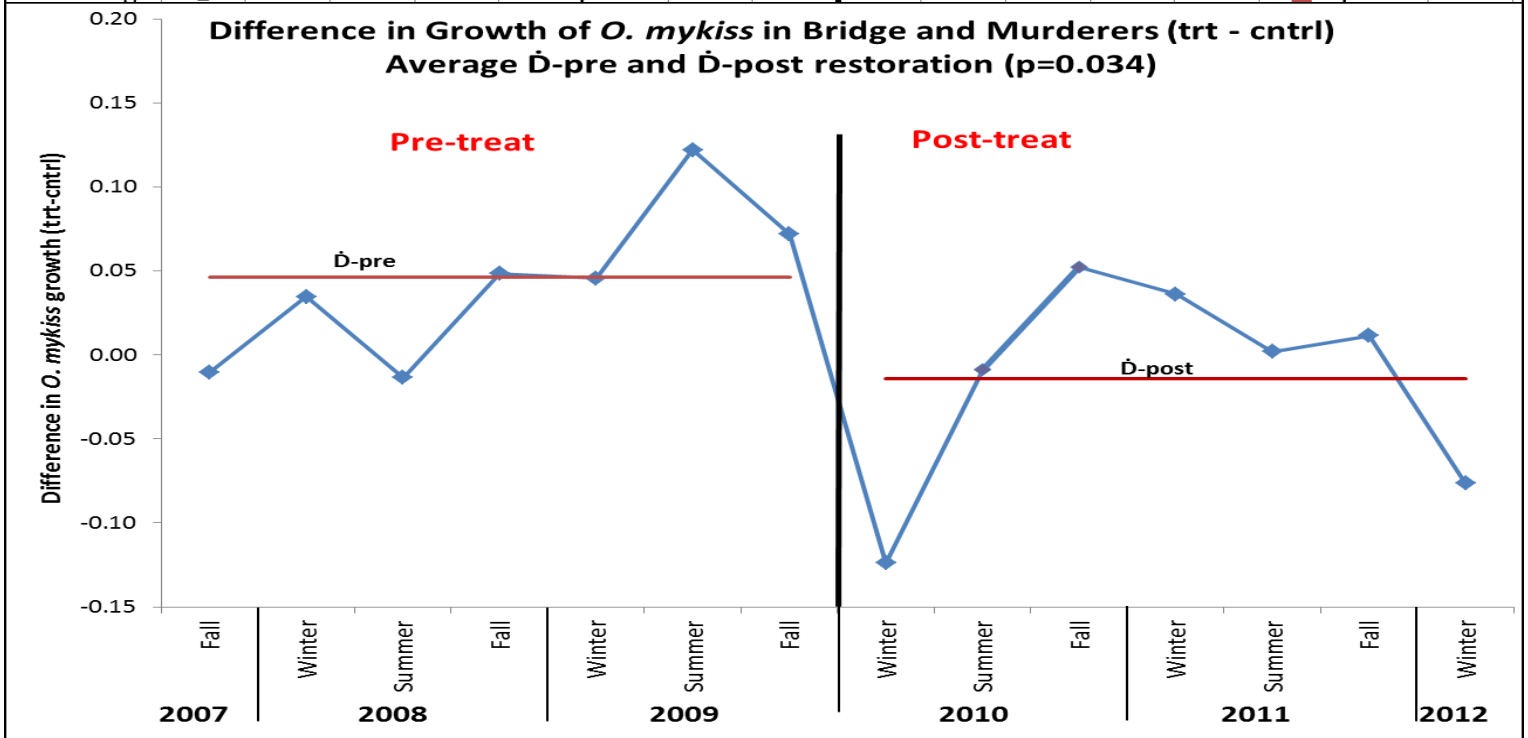

Abundance of O. mykiss in Bridge and Murderers (trt and cntrl)
Pre-treat
Post-treat
O. mykiss abundance (no./m2)
120
100
80
60
40
20
0
-20
Winter
Spring
Fall
2007
2008
2009
2010
2011
2012

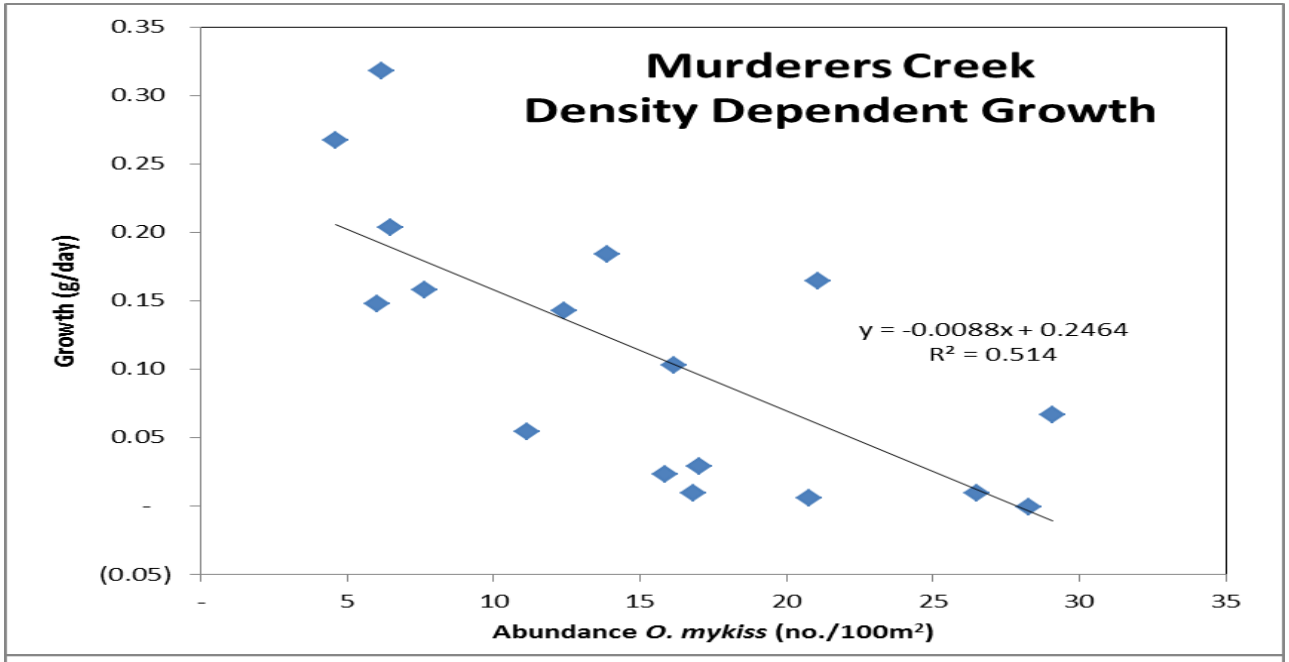

Difference of O. mykiss between Bridge and Murderers (trt - cntrl)
Average Ḋ-pre and Ḋ-post restoration (p=0.007)
Pre-treat
Post-treat
Difference in O. mykiss abundance (trt-cntrl)
40.00
30.00
20.00
10.00
0.00
-10.00
-20.00
-30.00
Winter
Spring
Fall
2007
2008
2009
2010
2011
2012

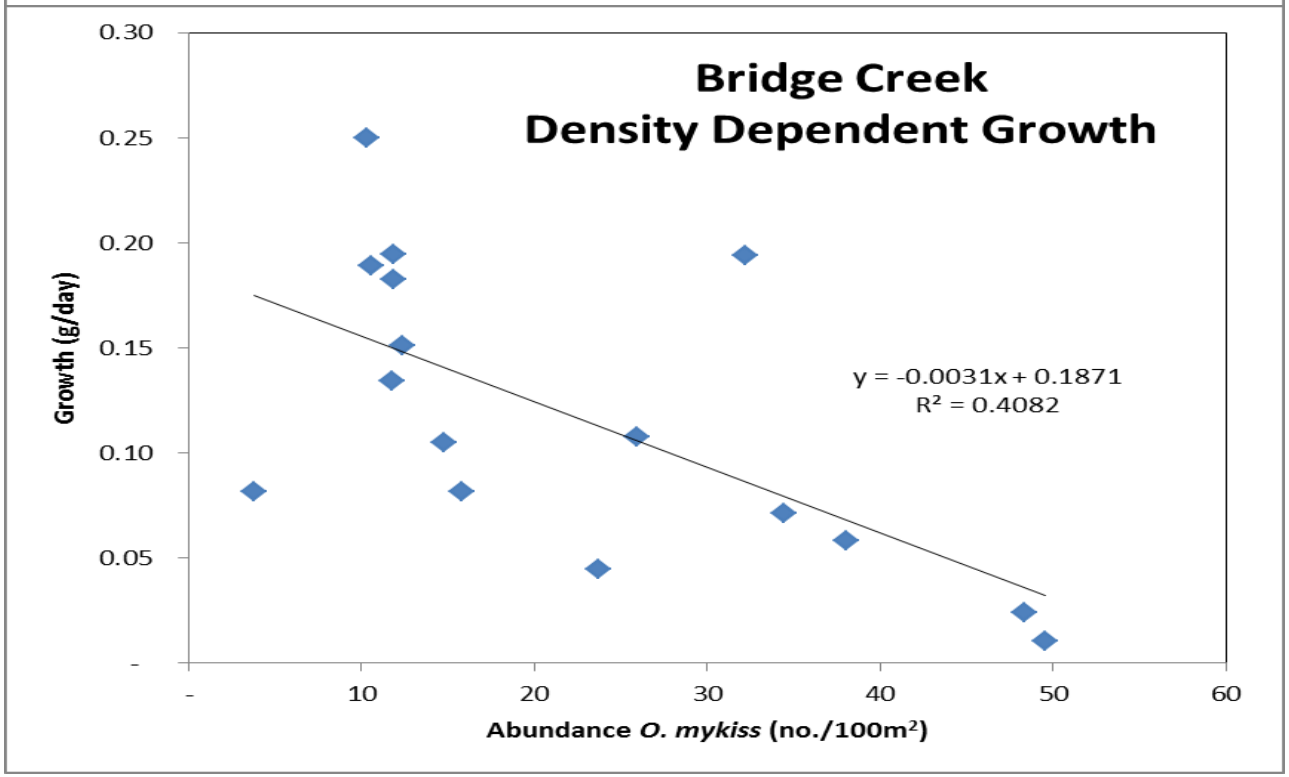

Survival of O. mykiss in Bridge and Murderers (trt and cntrl)
Pre-treat
Post-treat
O. mykiss survival season
1.20
1.00
0.80
0.60
0.40
0.20


Ratio of Survival O. mykiss in Bridge and Murderers (trt/cntrl)
Geomean Ṙ-pre and ṙ-post restoration (p<0.001)
Pre-treat
Post-treat
Ṙ-post
Ṙ-pre
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


Growth of O. mykiss in Bridge and Murderers (trt and cntrl)
Pre-treat
Post-treat
O. mykiss growth (g/season)
40
35
30
25
20
15
10
5
0


Difference in Growth of O. mykiss in Bridge and Murderers (trt - cntrl)
Average Ḋ-pre and Ḋ-post restoration (p=0.034)
Pre-treat
Post-treat
Ḋ-pre
Ḋ-post
Difference in O. mykiss growth (trt-cntrl)
0.20
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
Summer
Fall
Winter
2007
2008
2009
2010
2011
2012


Murderers Creek
Density Dependent Growth
y = -0.0088x + 0.2464
R² = 0.514
Growth (g/day)
0.35
0.30
0.25
0.20
0.15
0.10
0.05
-
(0.05)
-
5
10
15
20
25
30
35
Abundance O. mykiss (no./100m²)


Bridge Creek
Density Dependent Growth
y = -0.0031x + 0.1871
R² = 0.4082
Growth (g/day)
0.30
0.25
0.20
0.15
0.10
0.05
-
-
10
20
30
40
50
60
Abundance O. mykiss (no./100m²)

Take Home

- Accessible restoration approach
- Stable dams
  - aggradation, riparian function, temperature
  - Colony Establishment?
- Improve fish habitat
- Fish population Responding

Take Home

- Accessible restoration approach
- Stable dams
  - aggradation, riparian function, temperature
  - Colony Establishment?
- Improve fish habitat
- Fish population Responding

Take Home

- Accessible restoration approach
- Stable dams
  - aggradation, riparian function, temperature
  - Colony Establishment?
- Improve fish habitat
- Fish population Response? Not Yet!!

Take Home

- Accessible restoration approach
- Stable dams
  - aggradation, riparian function, temperature
  - Colony Establishment?
- Improve fish habitat
- Fish population Responding