Riverscape Health: Why does biofluvialgeomorphology matter to salmon?

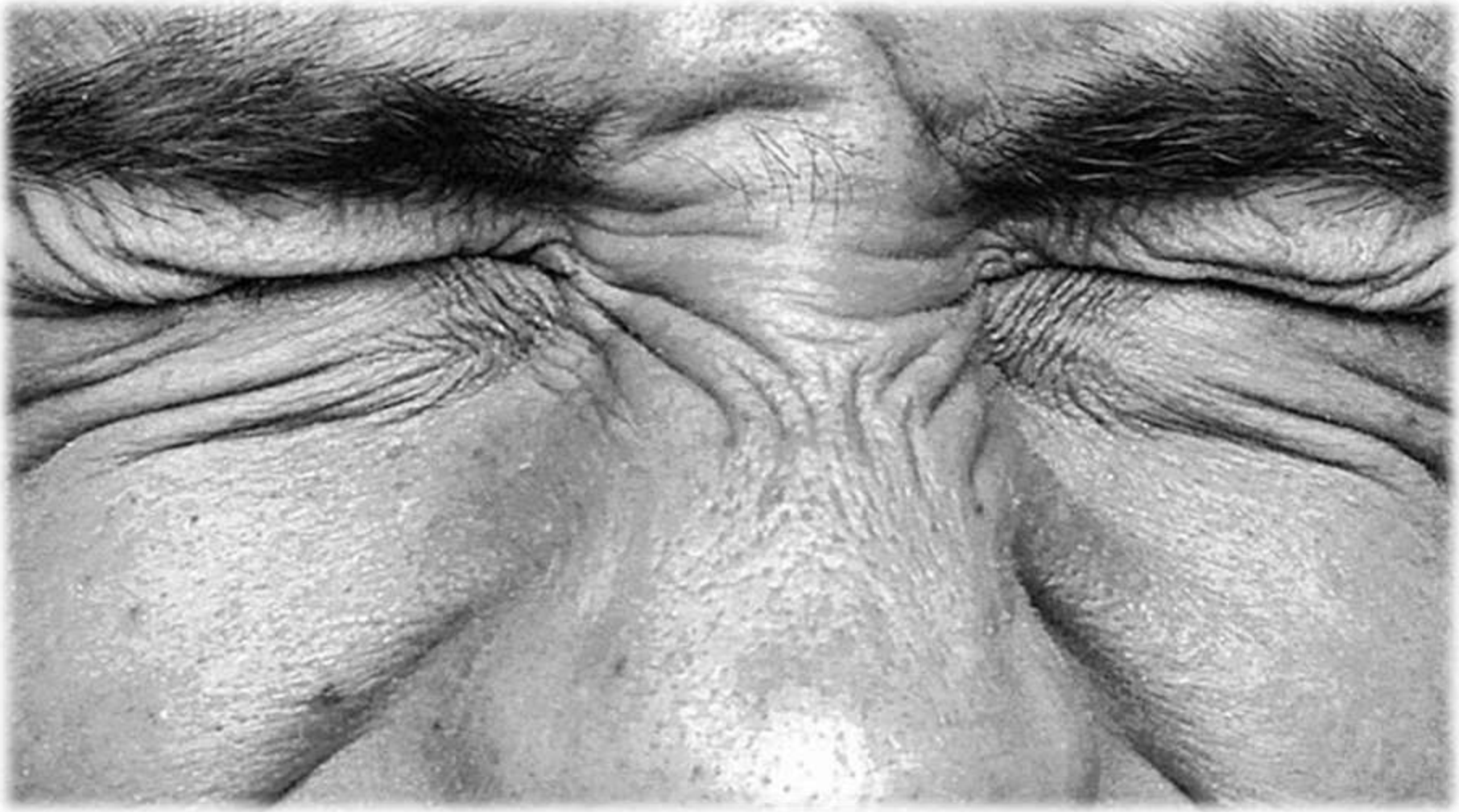
Chris Jordan – NOAA/NMFS/NWFSC

But first, let's talk about riverscape health…

Photo source: BLM Medford Oregon District

(trekandshoot/shutterstock)

Close your eyes and imagine a healthy stream…



What do you see?

If this is what you saw, then you need to work on your imagination.
Is this really as good as it gets?

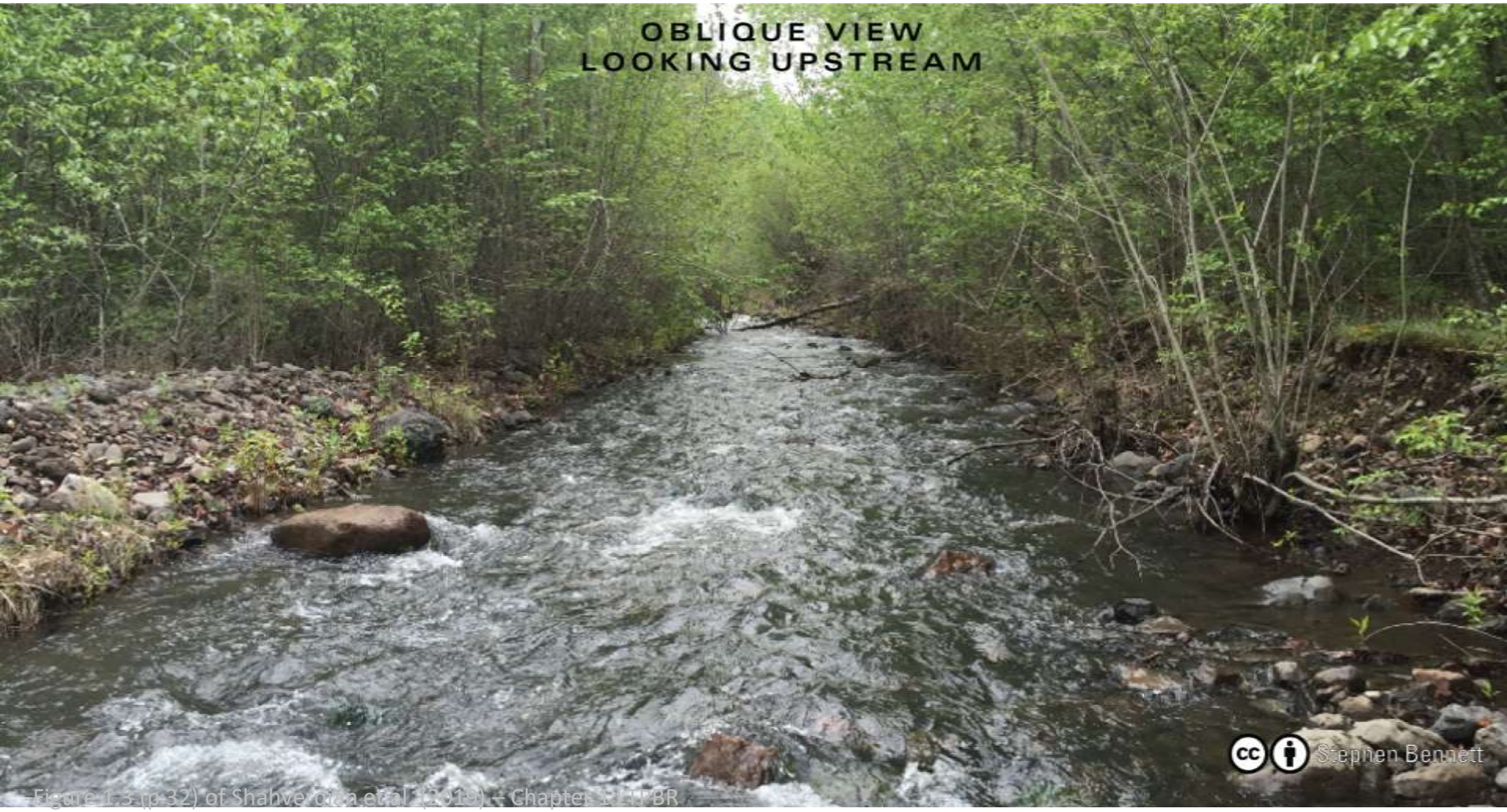


Figure 1.3 (p.32) of Shahve Ota et al. (2013) - Chapter 1 LTPBR

Manual DOI: 10.13140/RG.2.2.14138.03529

Reimagine what riverscapes can be

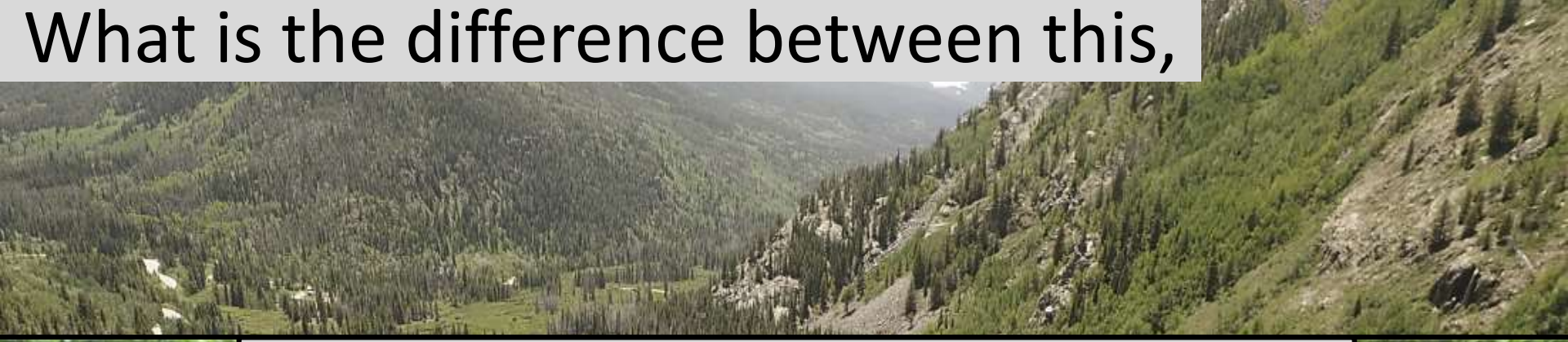
What did riverscapes look like before?

What can riverscapes look like again?

These are healthy riverscapes

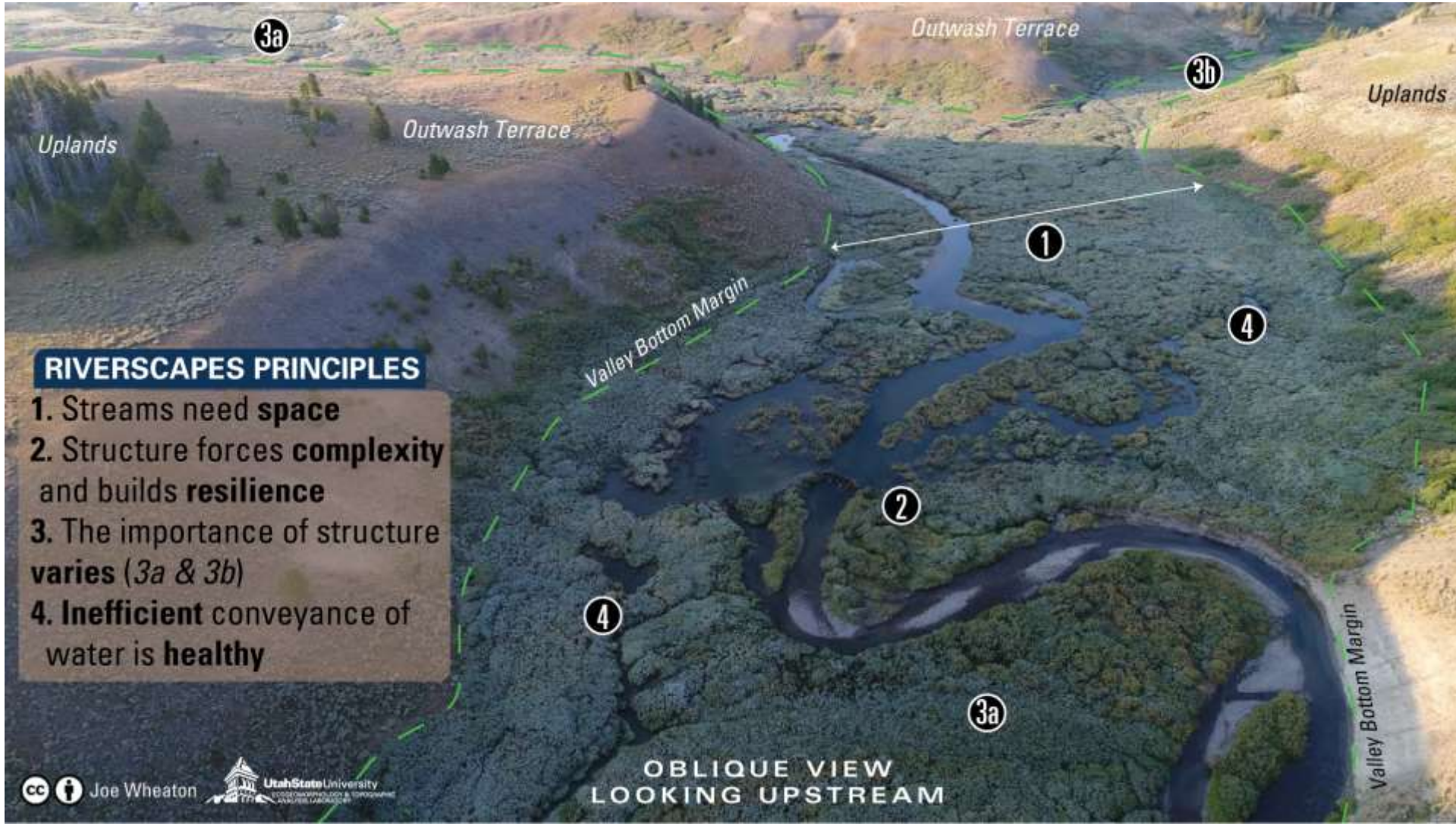
Adapted from Figure 1.7 (p 36) of Shahverdian et al. (2019) – Chapter 1 LTPBR Manual DOI: 10.13140/RG.2.2.14138.03529

What is the difference between this,



and this, and why can't we see it?

What constitutes a healthy riverscape?



Riverscapes Principles

From pages 3-4 of Pocket Guide; Wheaton et al. (2019)

DOI: 10.13140/RG.2.2.28222.13123/1

See Wheaton et al. (2019, p 60): Chapter 2 LTPBR Manual for Principles

DOI: 10.13140/RG.2.2.34270.69447

Biofluvialgeomorphic System

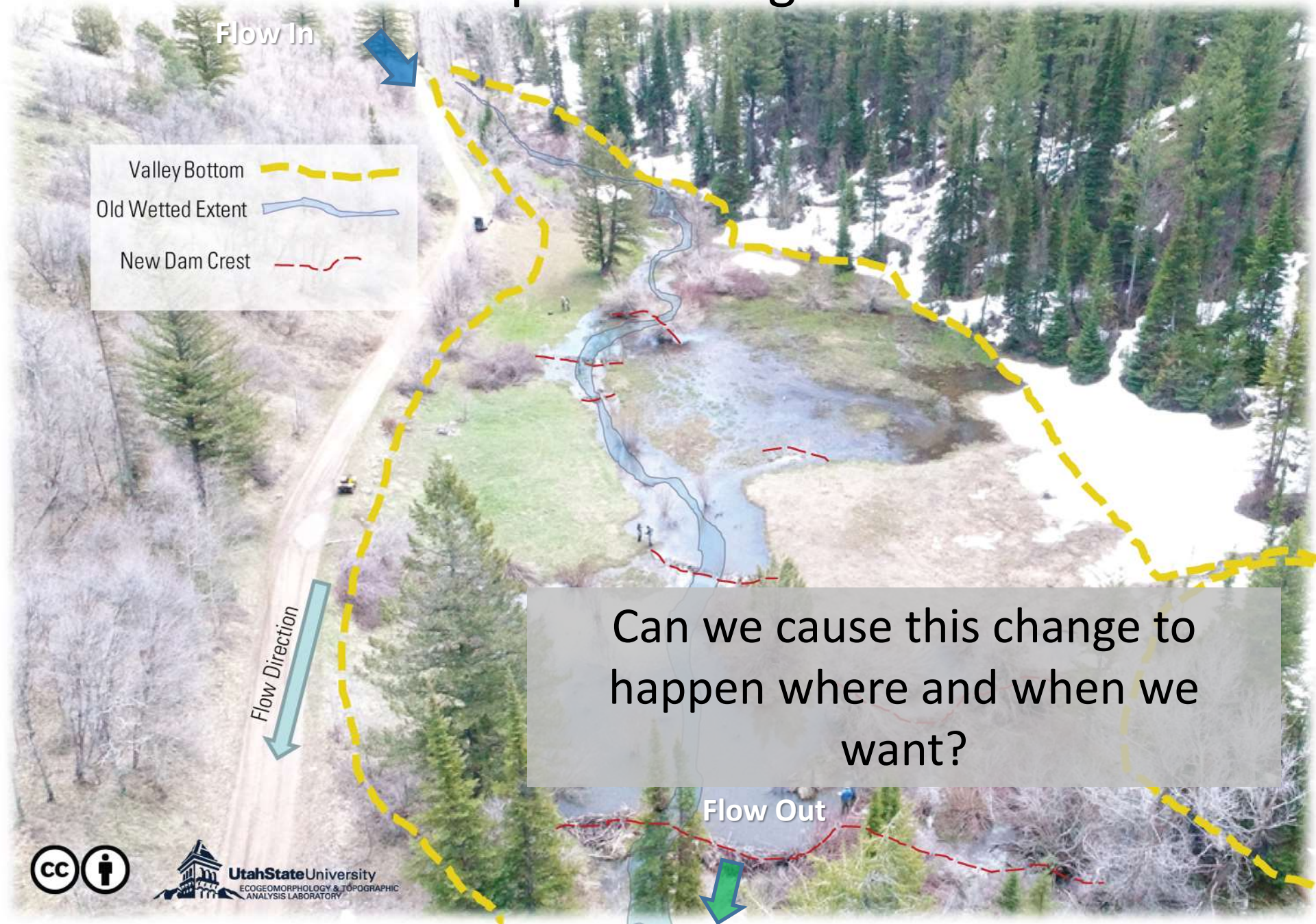
Hydraulic Roughness or Structural Complexity

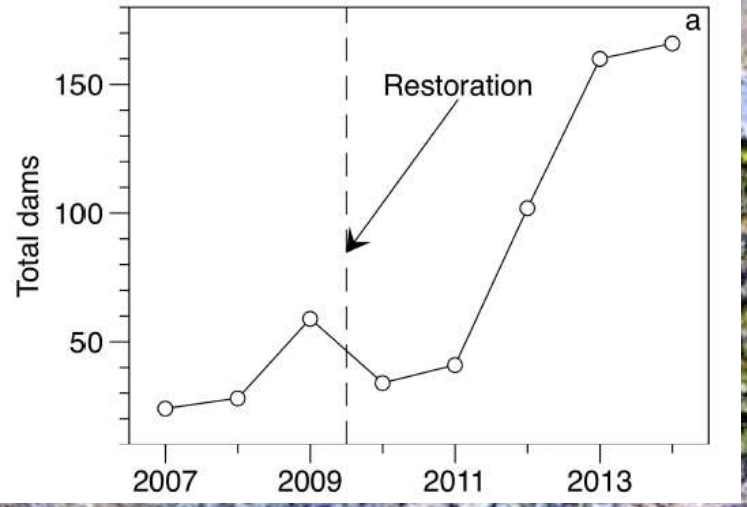

ODFW


USU

Loss of structural complexity is this biggest impact of humans on streams

How Does a Floodplain Change With Structure?



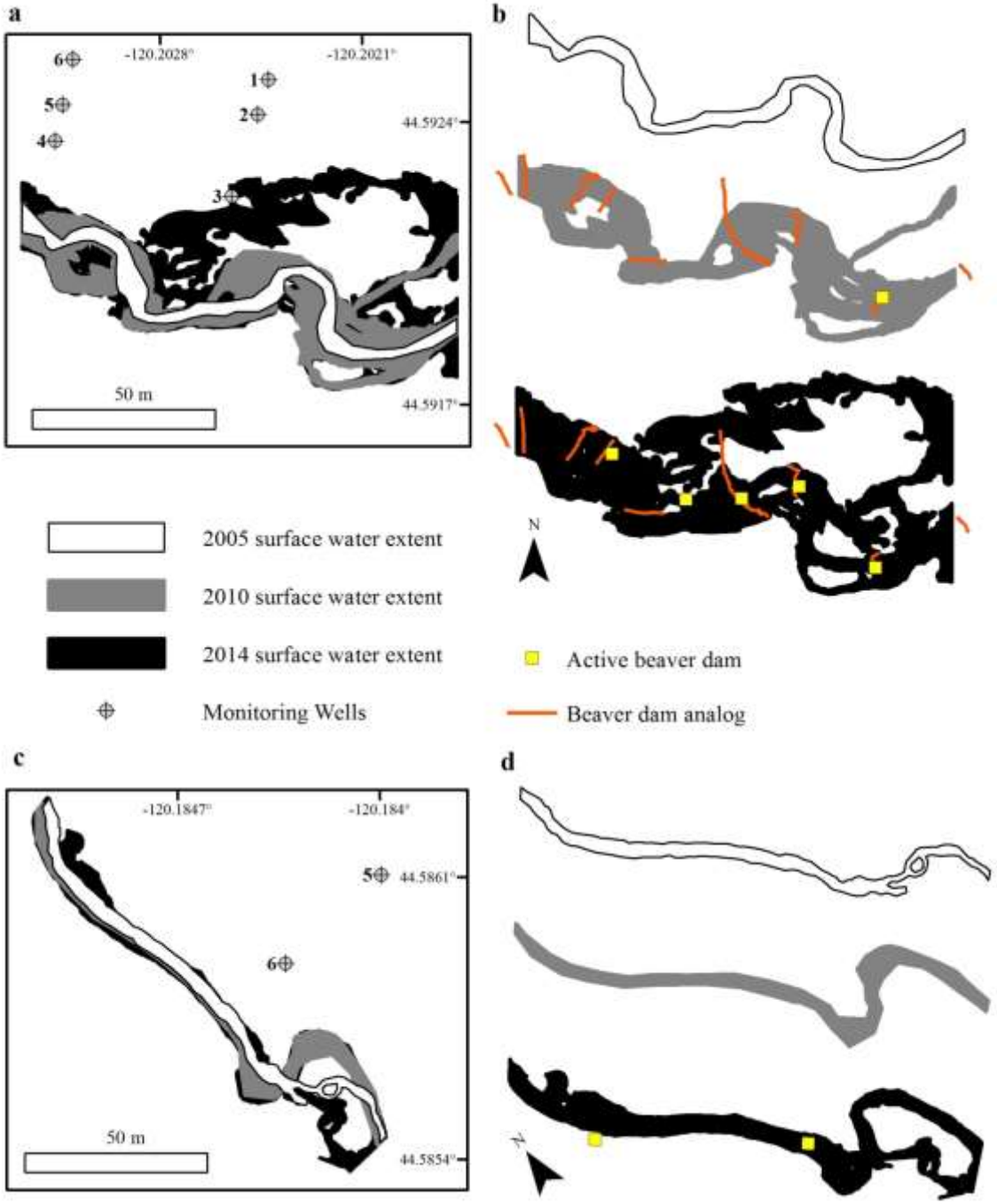


Summer 2005

Summer 2014

Inundation area increased 228%
Side channel area increased 1216%

Weber et al. (2017) DOI: 10.1371/journal.pone.0176313



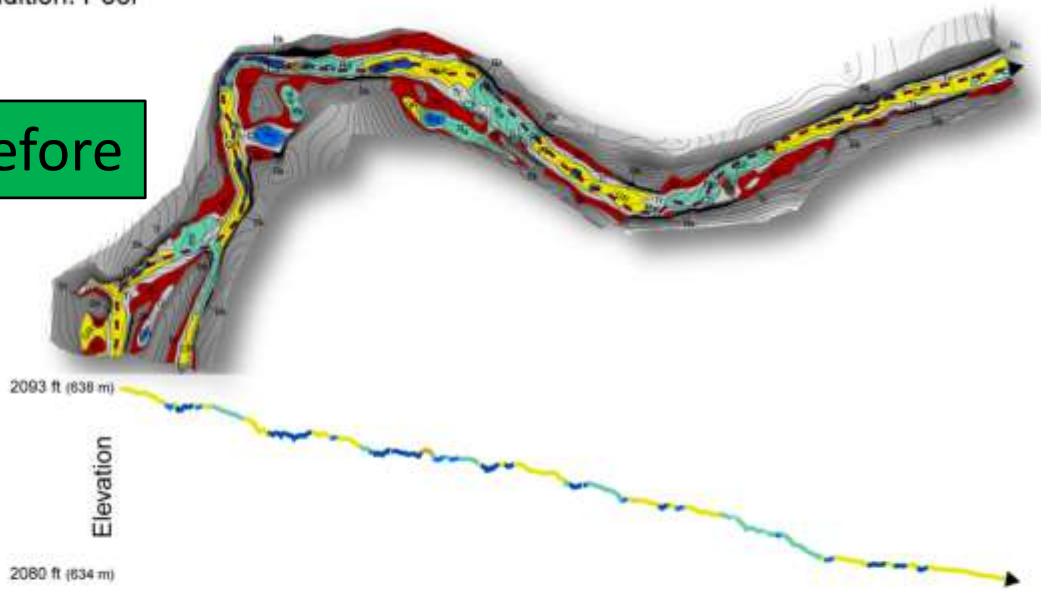
Water Surface Extent

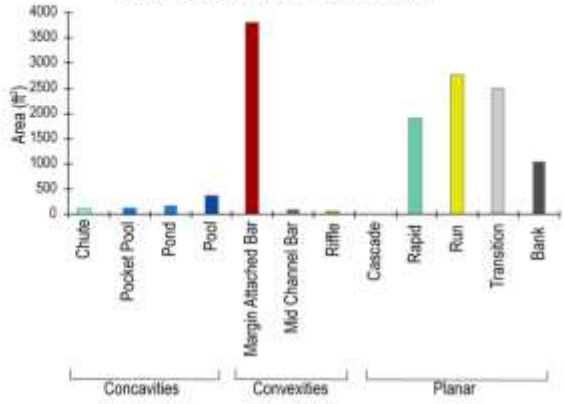
Volk et al. in review

South Fork Asotin Creek: Planformed Controlled with Discontinuous Floodplain Latitude: 46.24869088939191
Longitude: -117.2892015084726

Condition: Poor

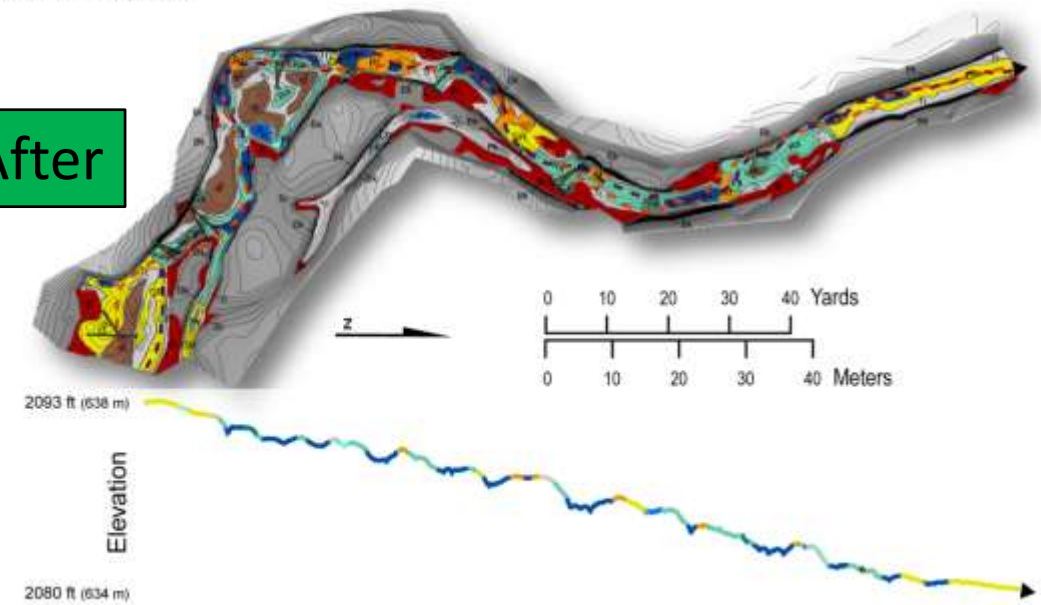
Before

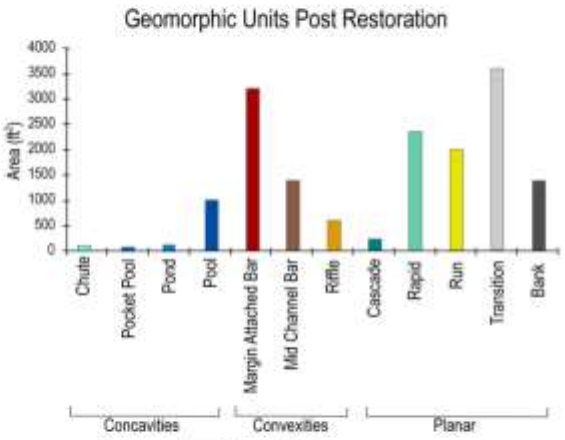




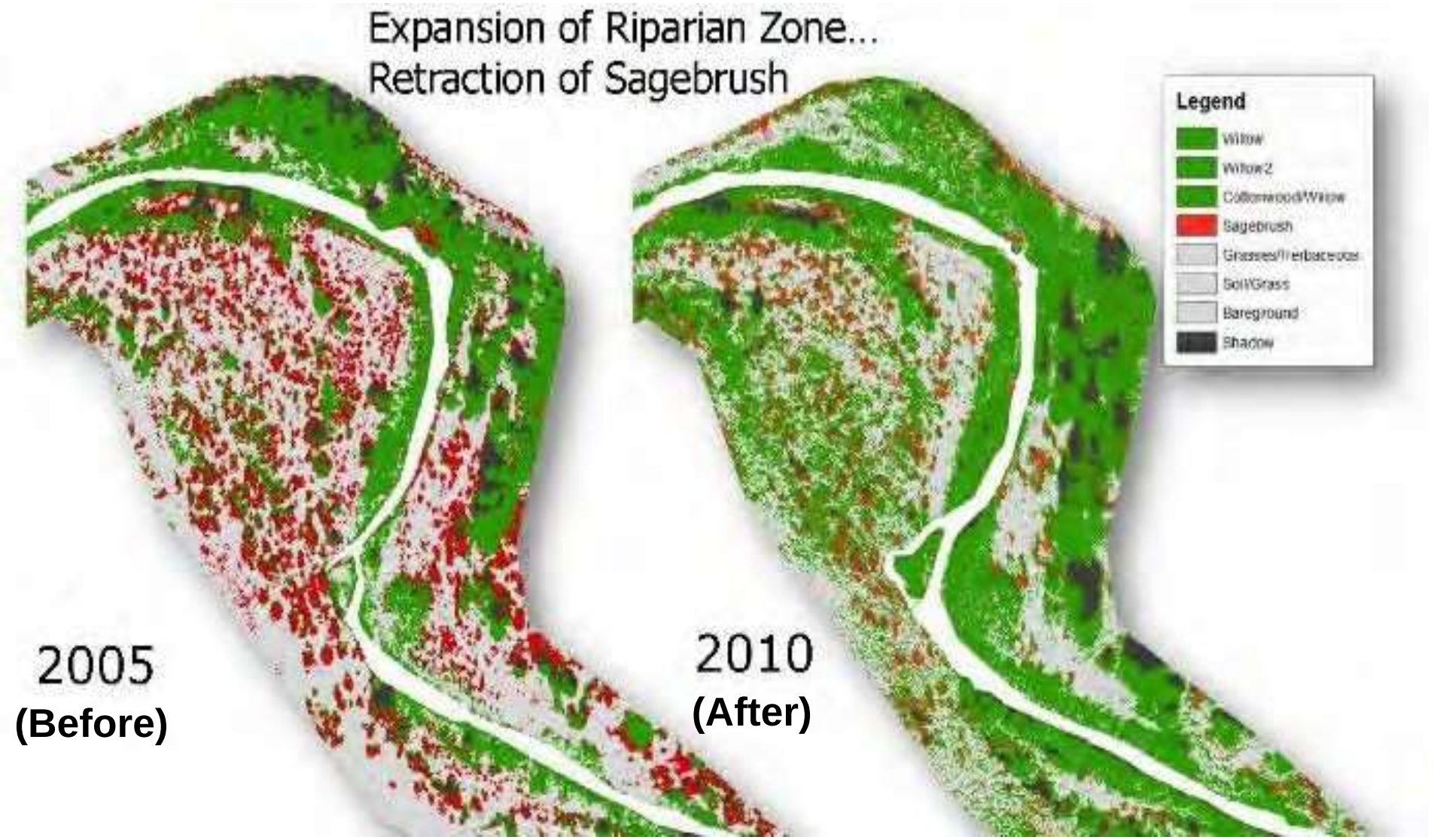
Condition: Moderate

After





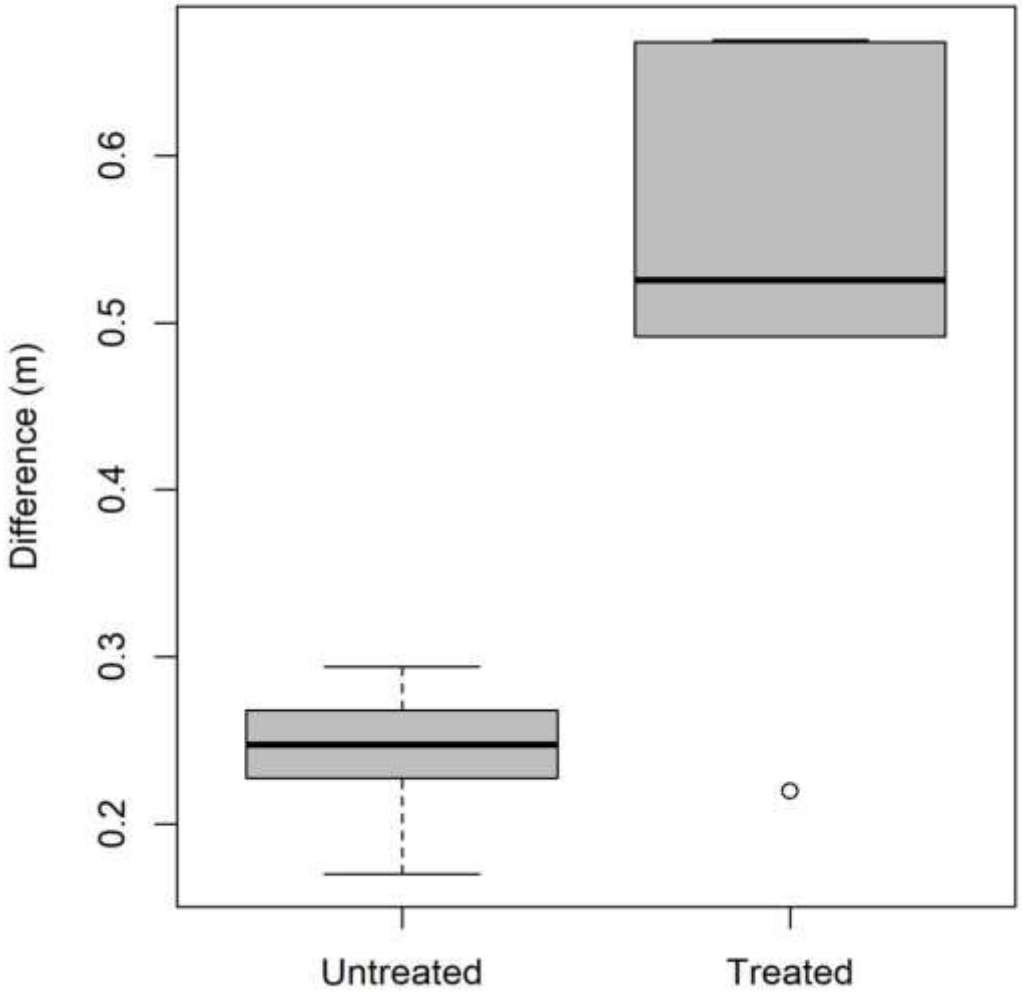
Expansion of the Riparian Zone



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

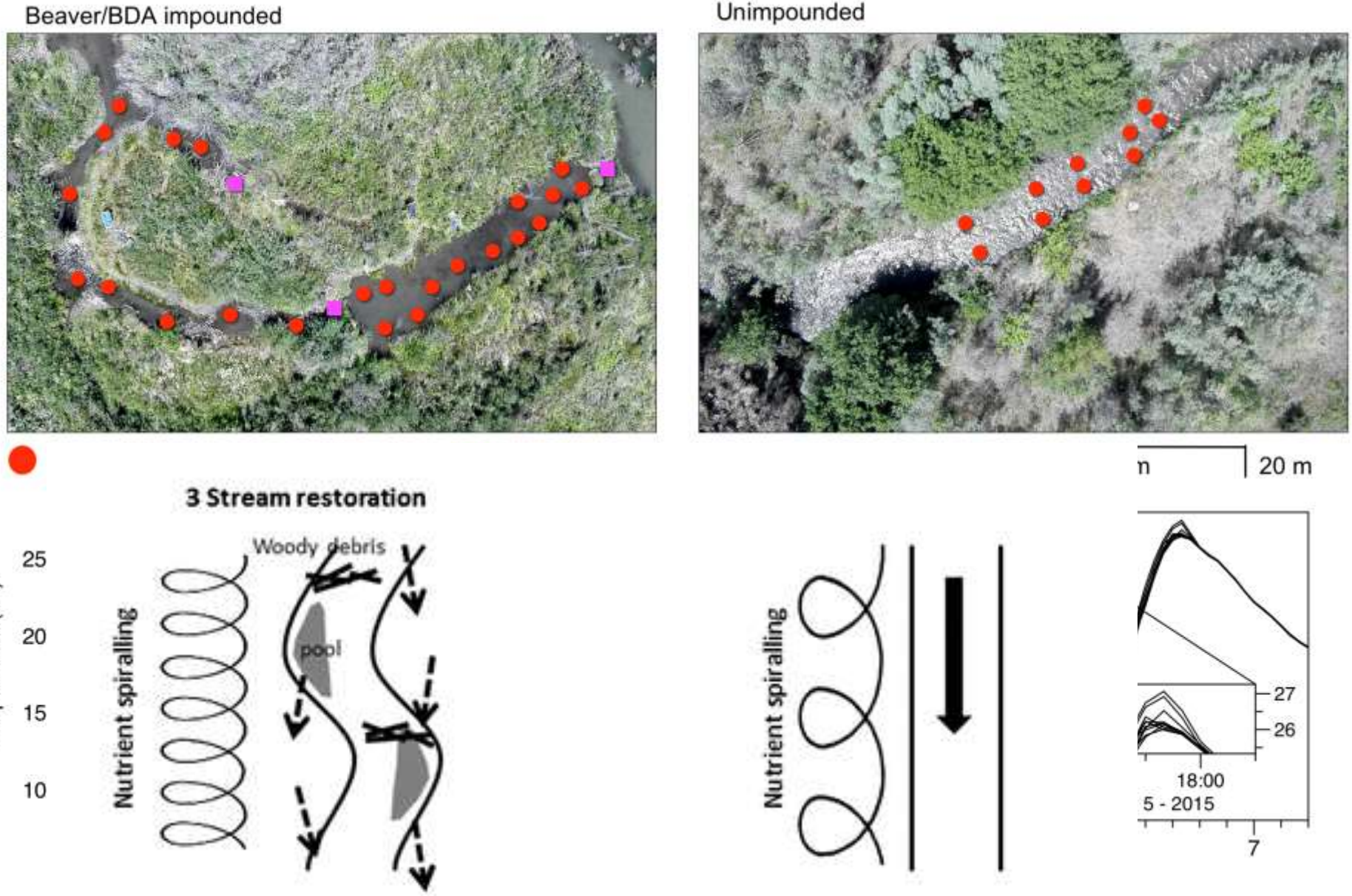
Figure from Carol Volk (South Fork Research)

Groundwater Elevation

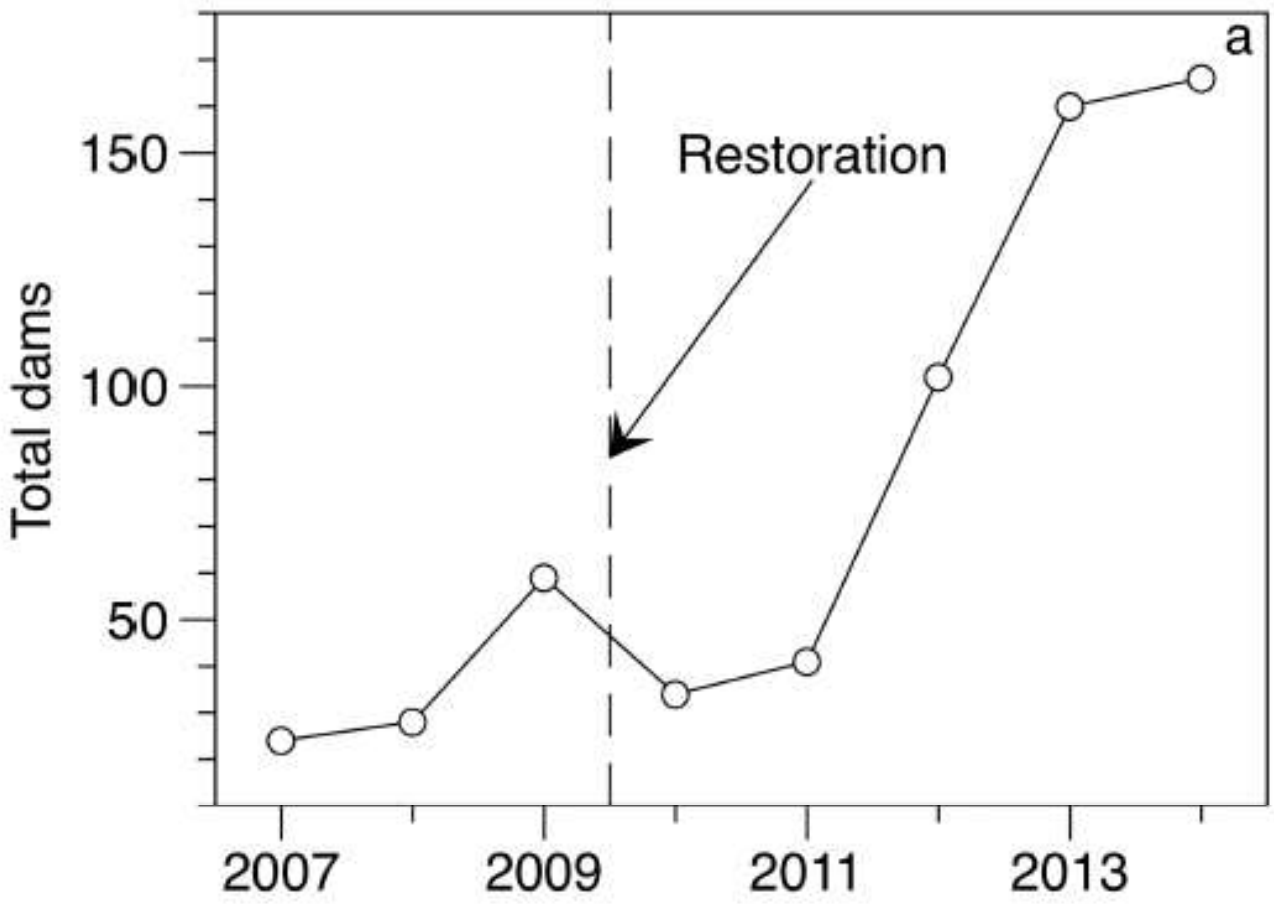


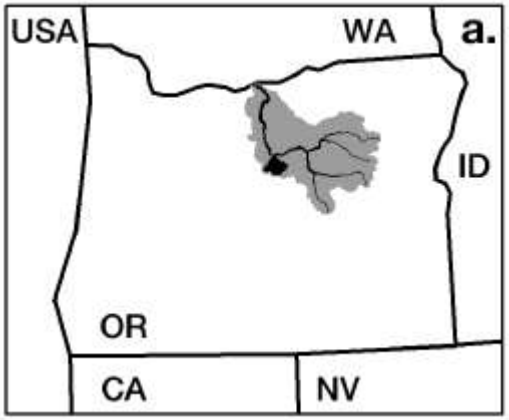
Volk et al. in review

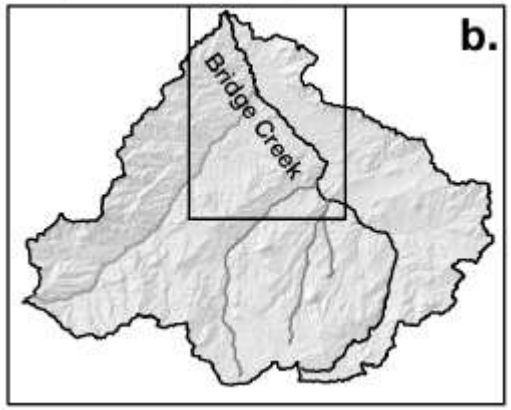
Channel Temperature Heterogeneity



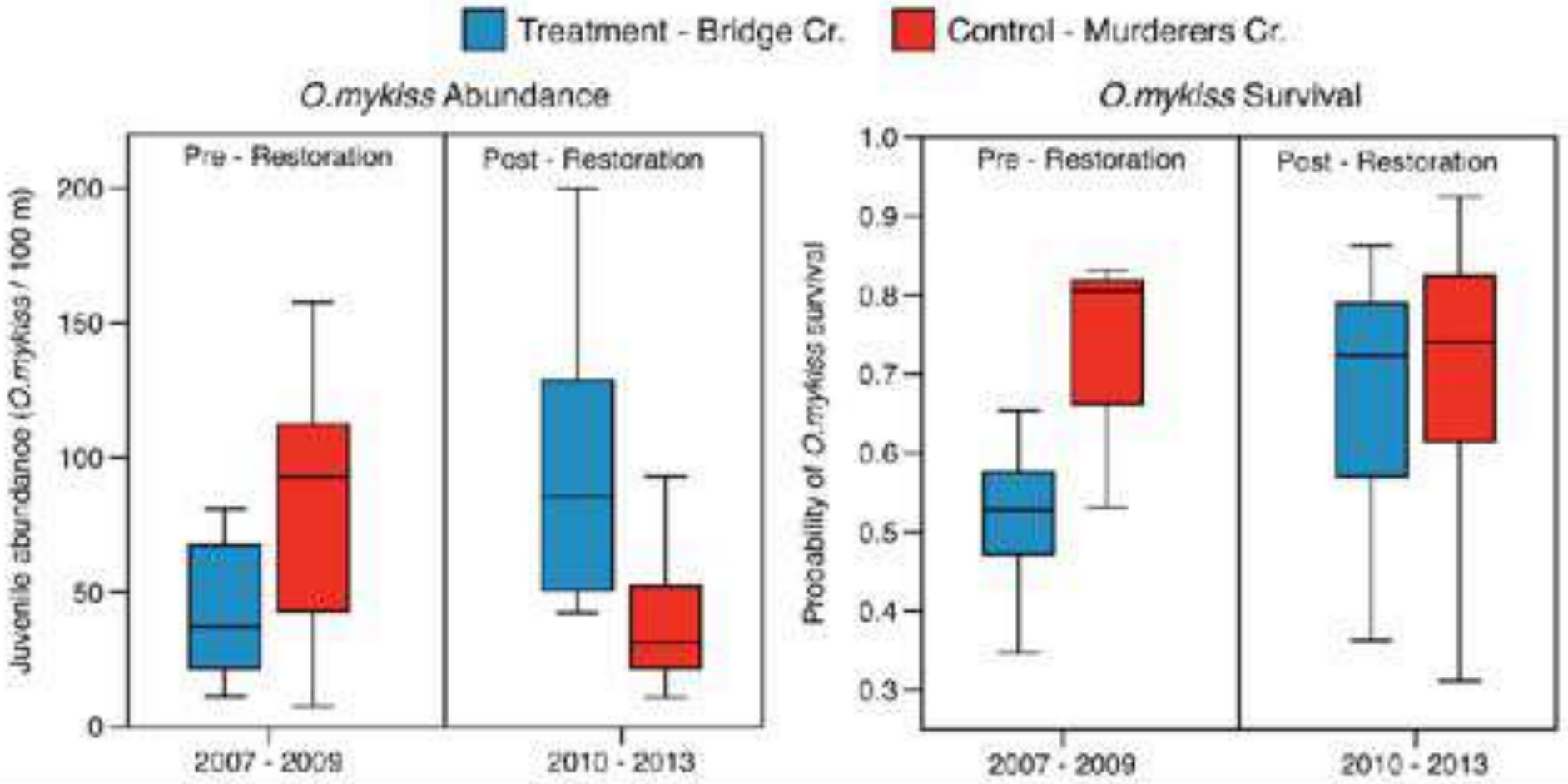
Weber et al. 2017


a
Restoration
Total dams
150
100
50
2007
2009
2011
2013


USA
WA
a.
ID
OR
CA
NV


b.
Bridge Creek

Juvenile *O. mykiss* Response



Abundance

168% increase

Survival

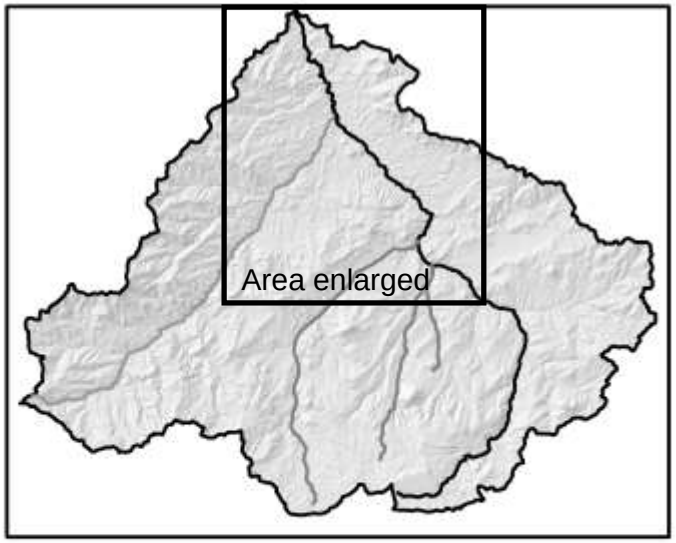
52% increase

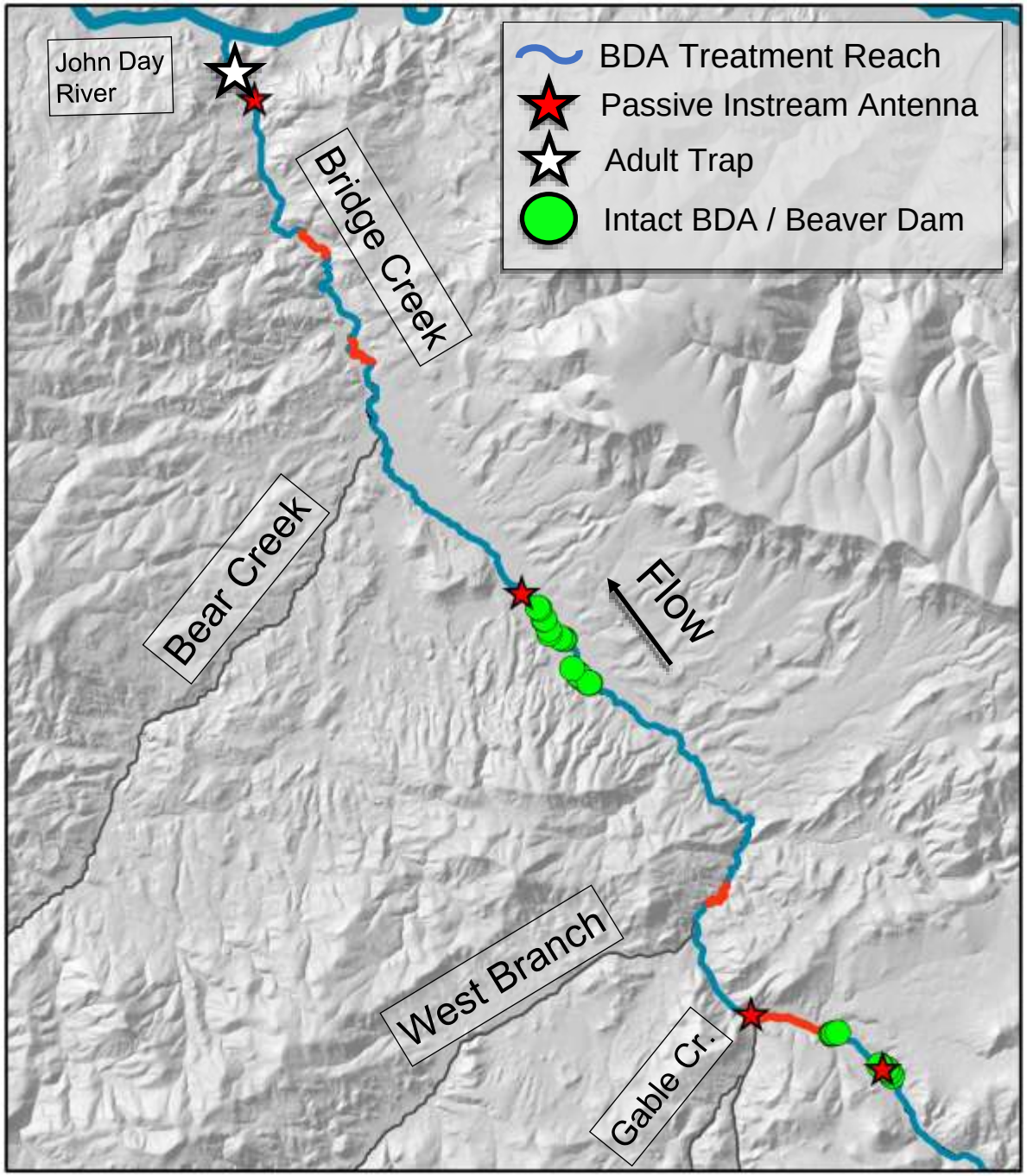
Bouwes et al. 2016 *Scientific Reports*

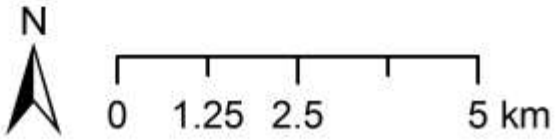
FISH PASSAGE

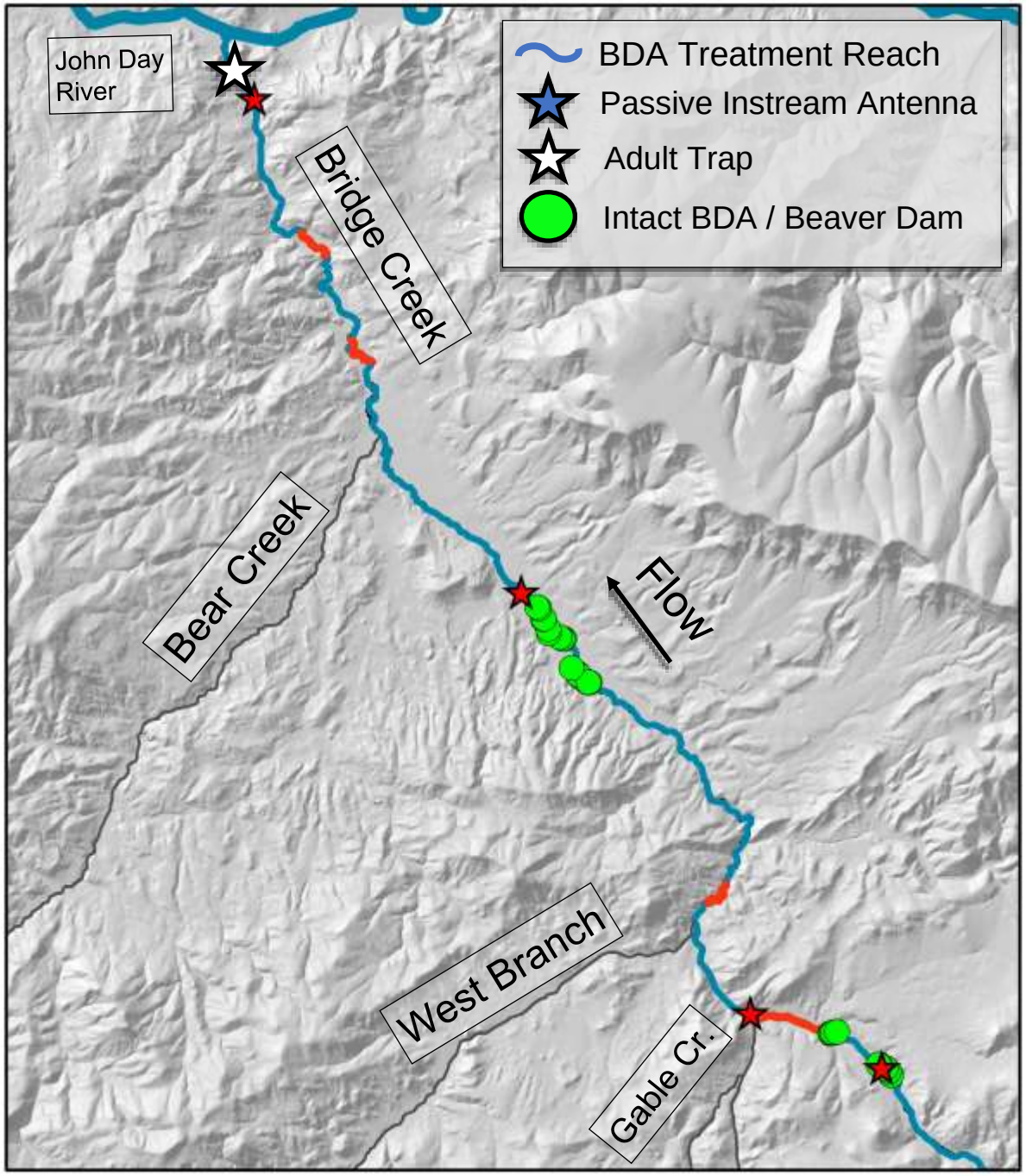
- 4 Instream Antennas
- Adult Steelhead Trap

78,000 PIT-tagged *O.mykiss*







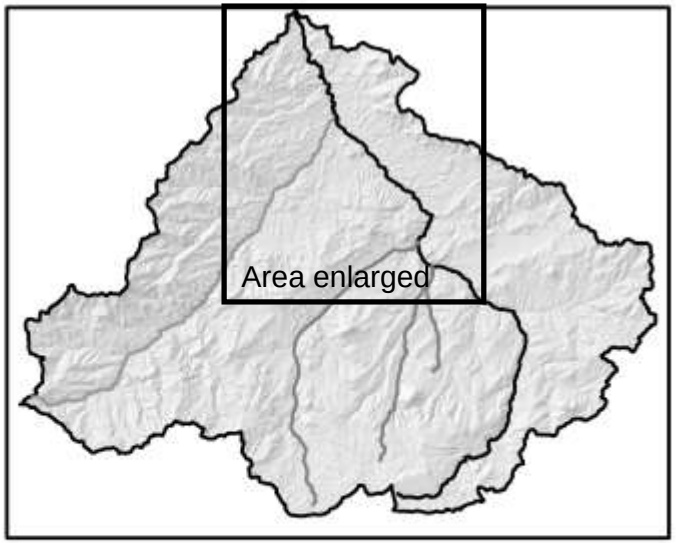


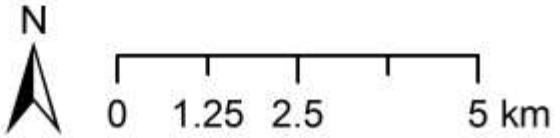
2009

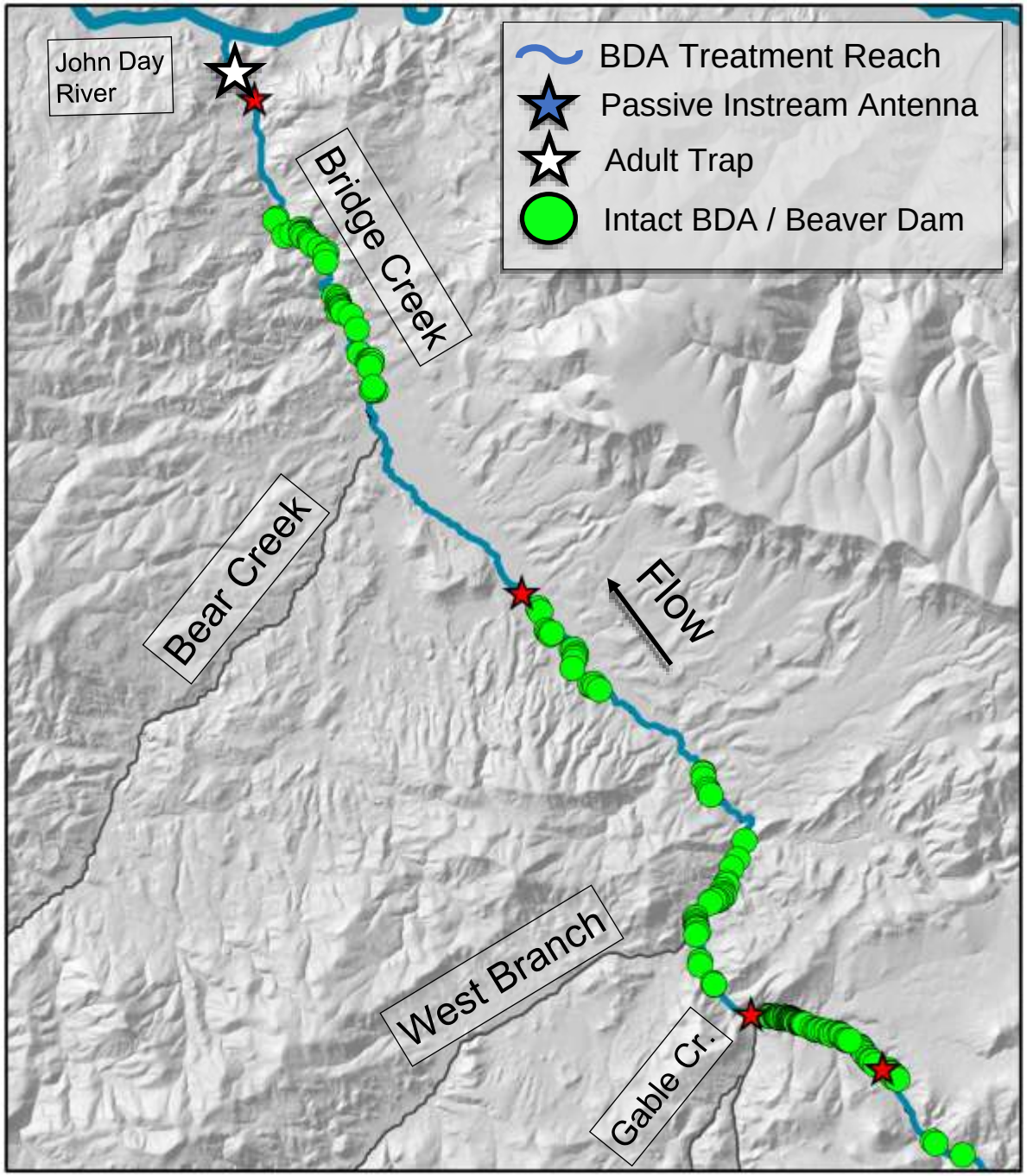
Pre-restoration

22 Beaver Dams

17% Passage





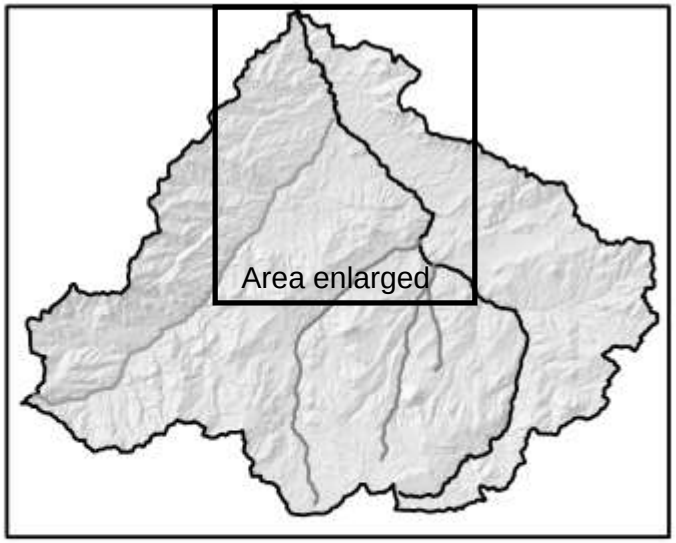


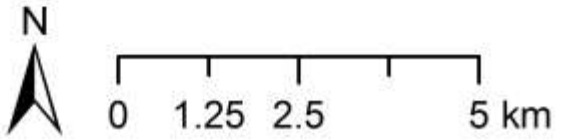
2016

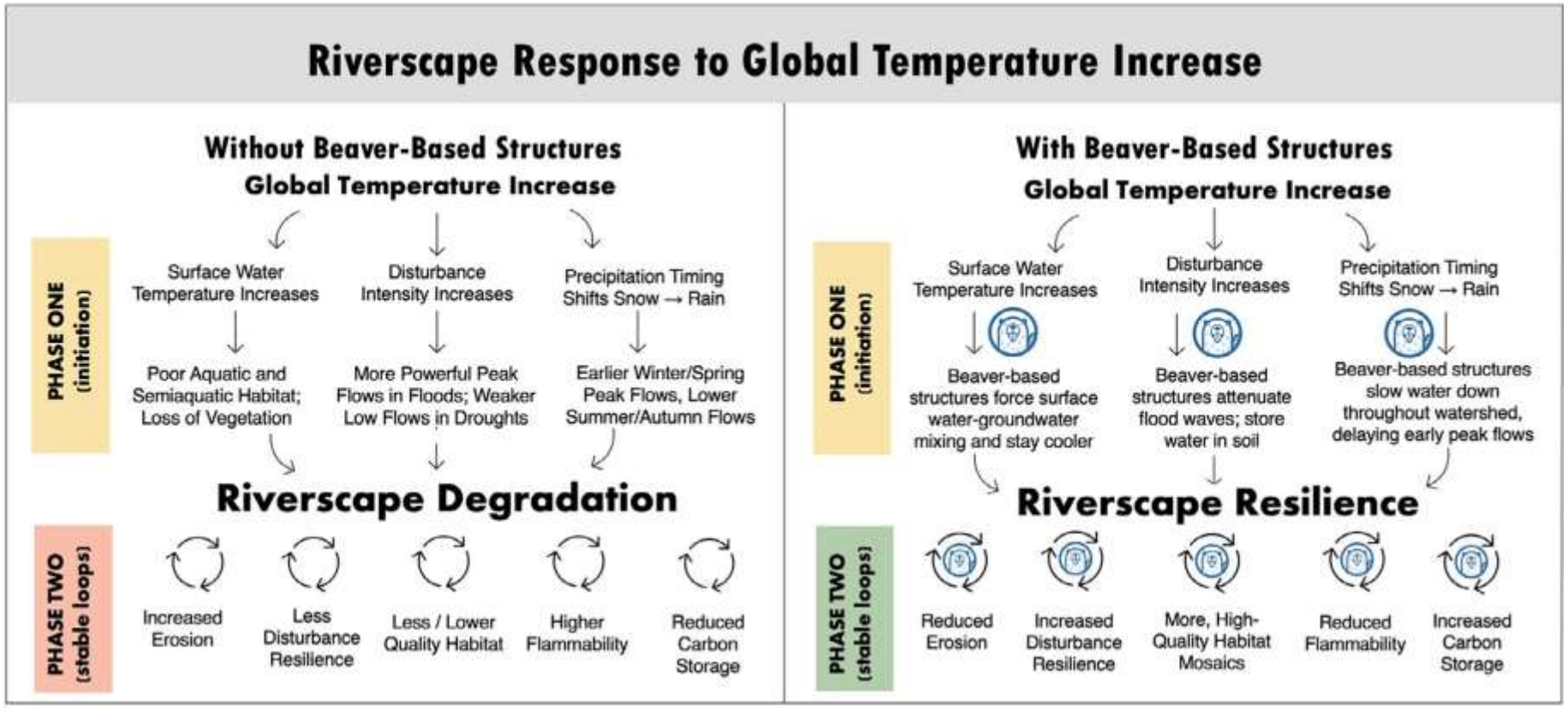
Post-restoration

164 Beaver Dams

29% Passage







Beaver: The North American freshwater climate plan

WIREs Water. 2022;e1592.
https://doi.org/10.1002/wat2.1592

https://www.opb.org/article/2022/05/03/beavers-climate-change-northwest-waterways/