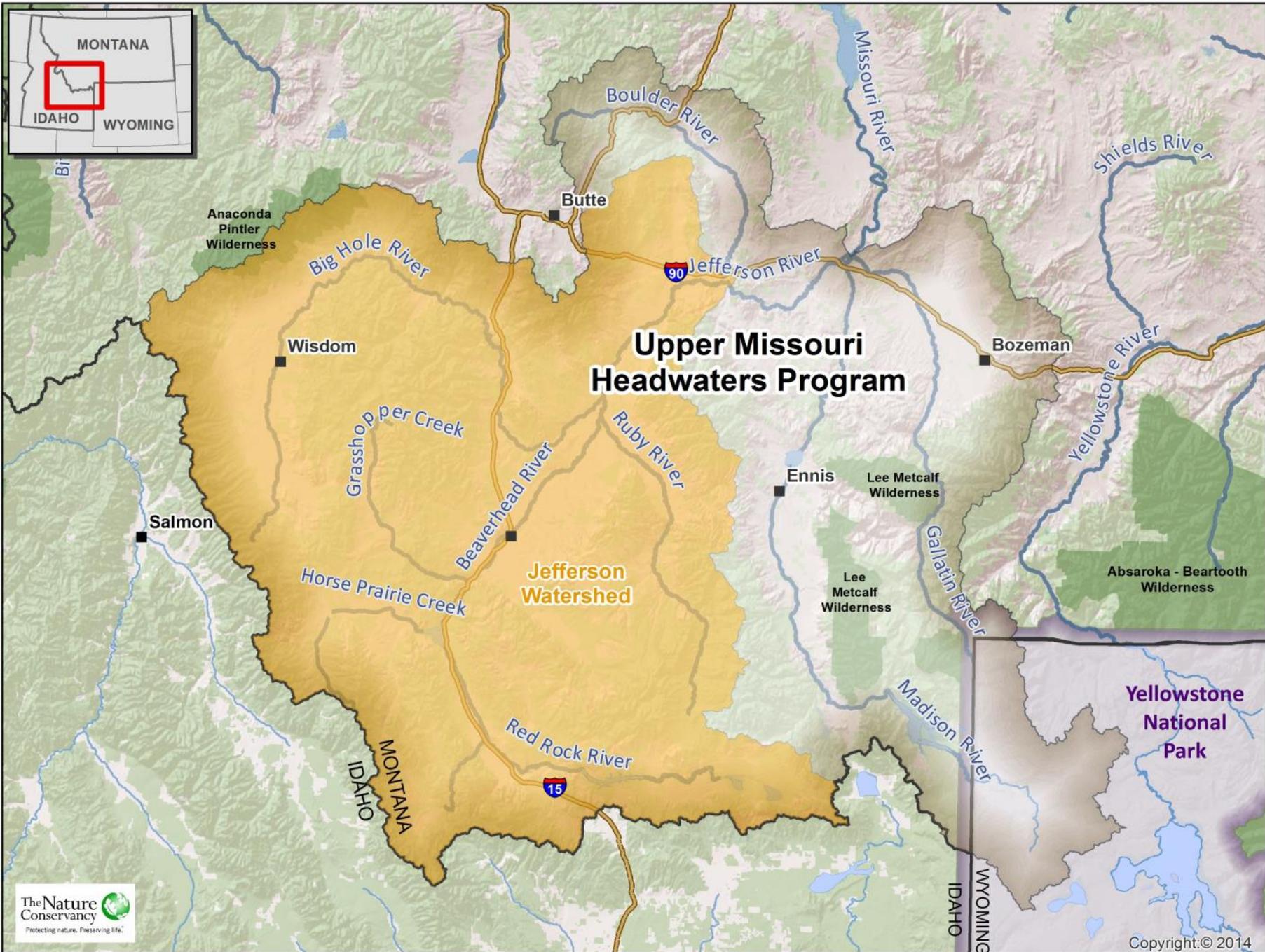
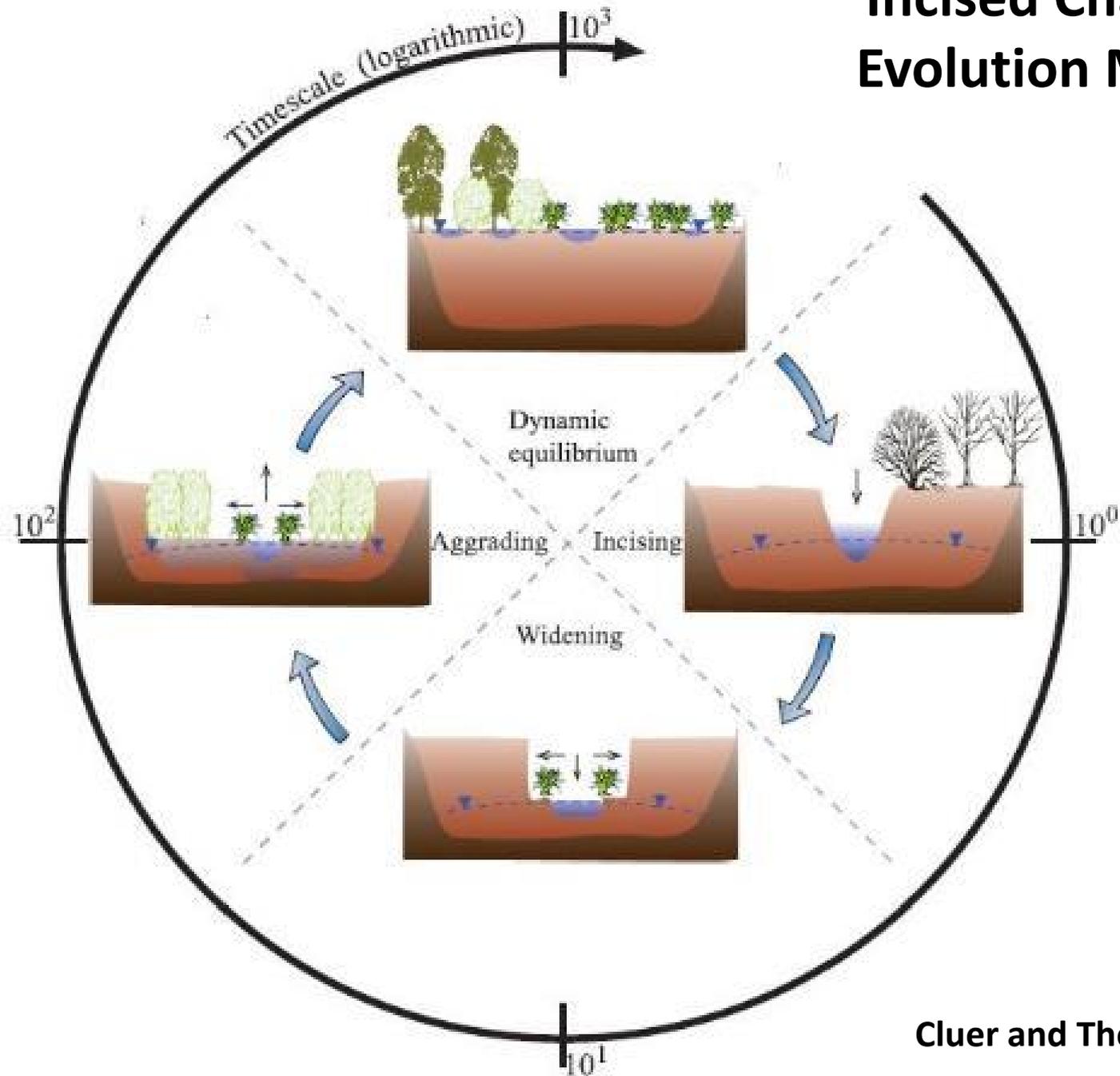


# Shallow Aquifer Recharge and Incised Channel Restoration





# Incised Channel Evolution Model

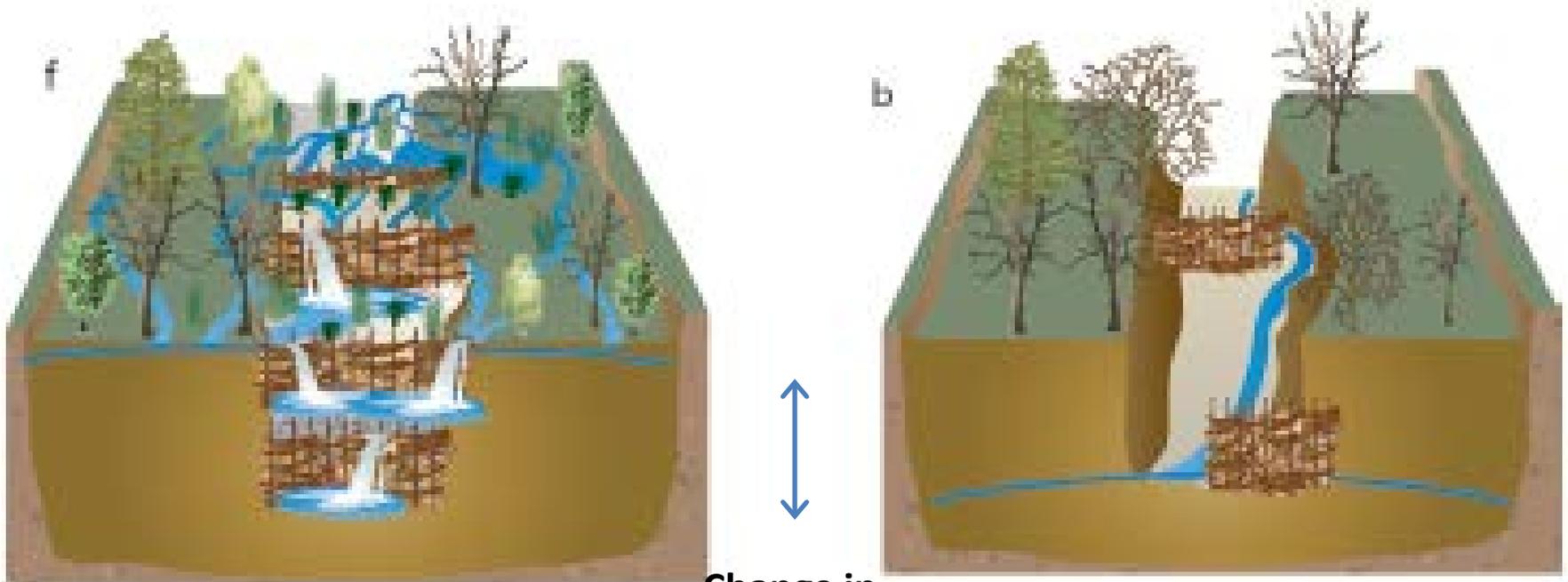


# Implications for Shallow Aquifers

Where has incision occurred?

What is the effect on shallow aquifer recharge?

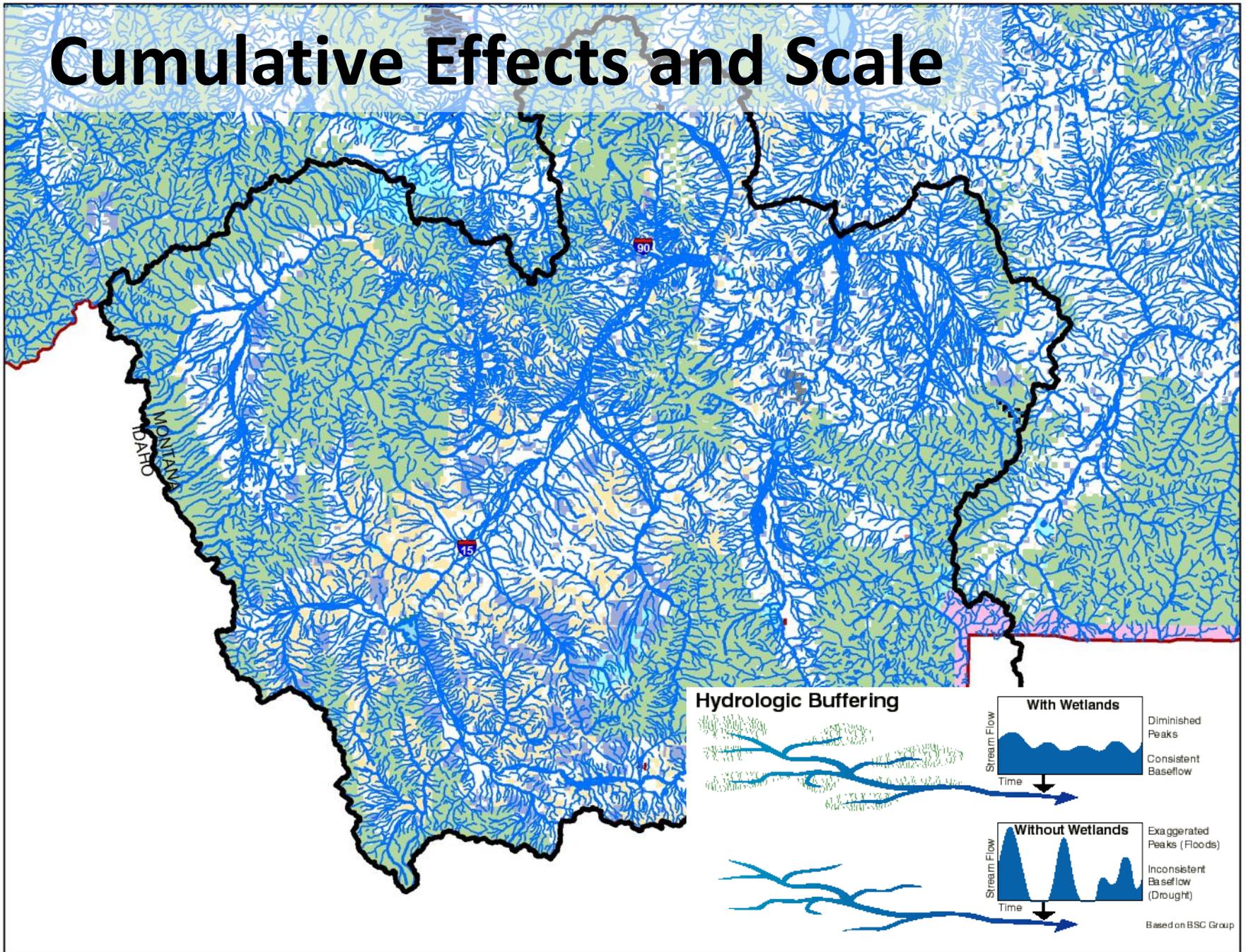
Can effective, low-cost approaches be applied broadly enough to improve water availability during high-demand periods?



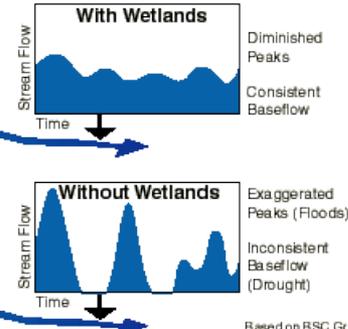
Change in  
Water Table

From Pollock et al. 2014

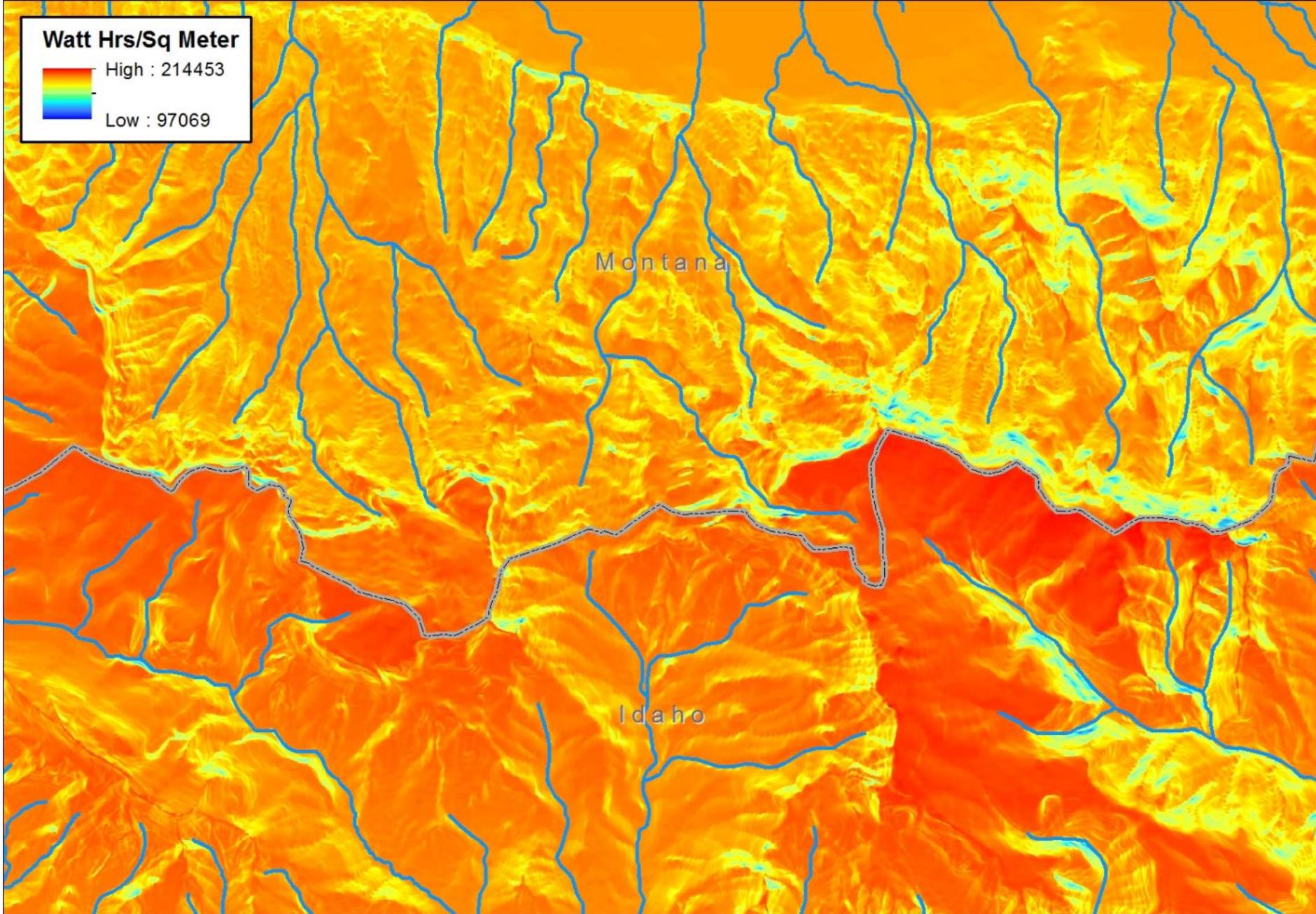
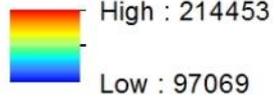
# Cumulative Effects and Scale



## Hydrologic Buffering



### Watt Hrs/Sq Meter

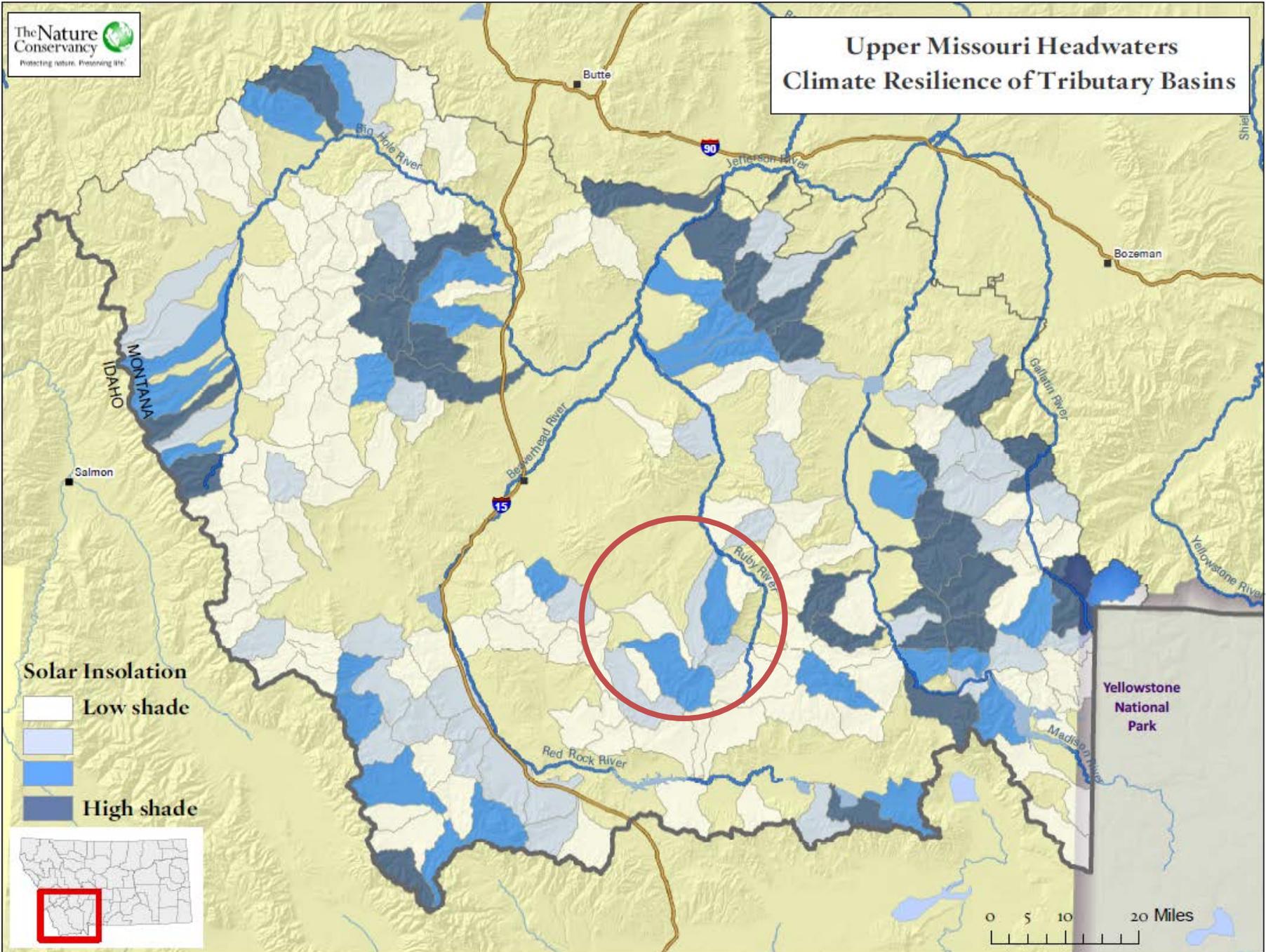


June - Solar Radiation

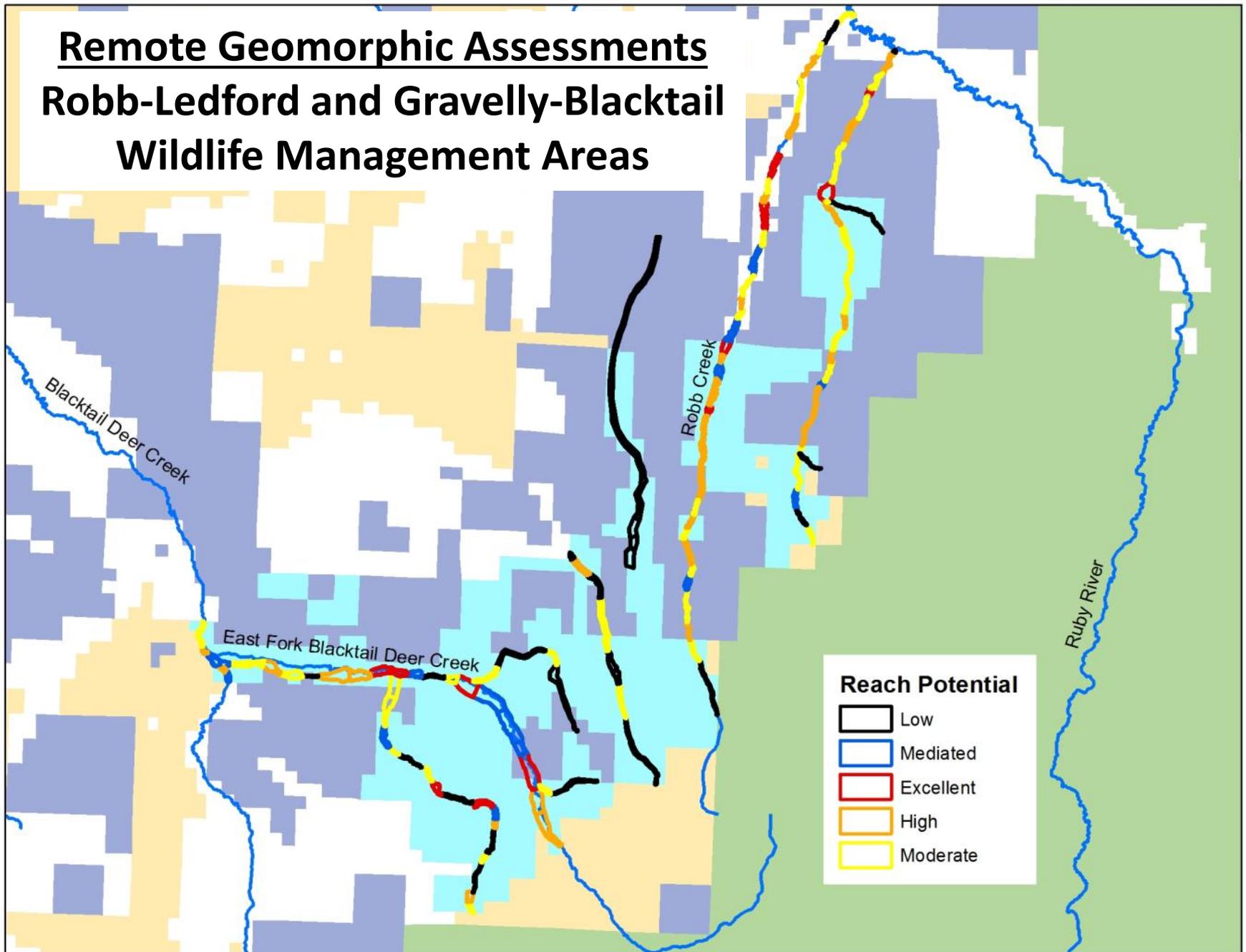
0 0.75 1.5 3 Miles

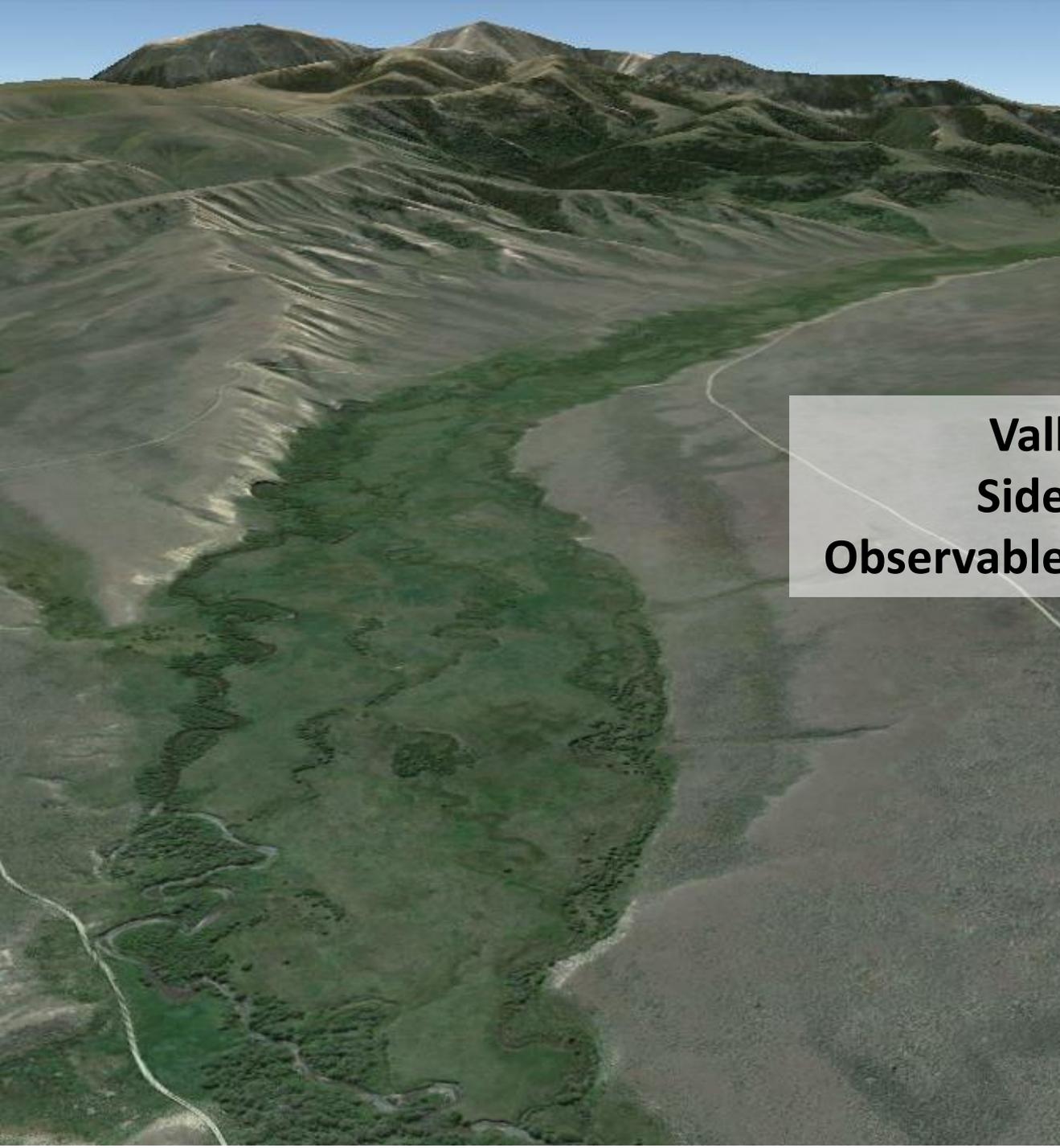


# Upper Missouri Headwaters Climate Resilience of Tributary Basins



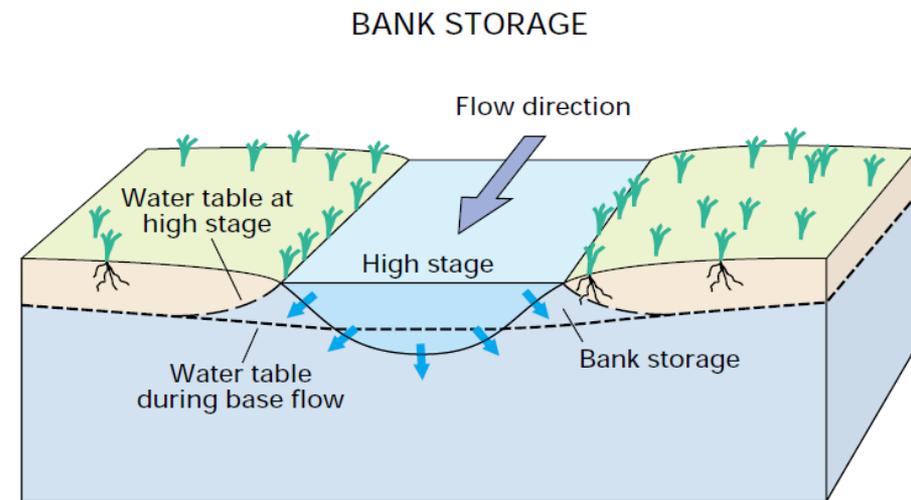
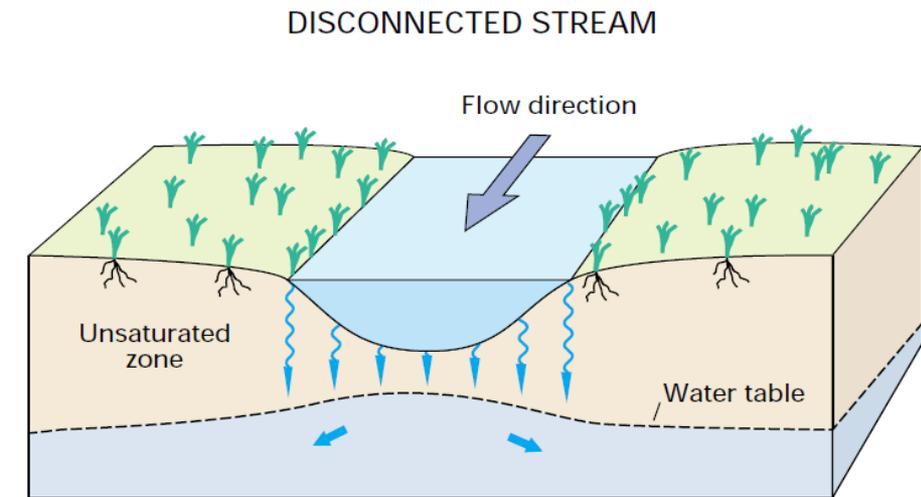
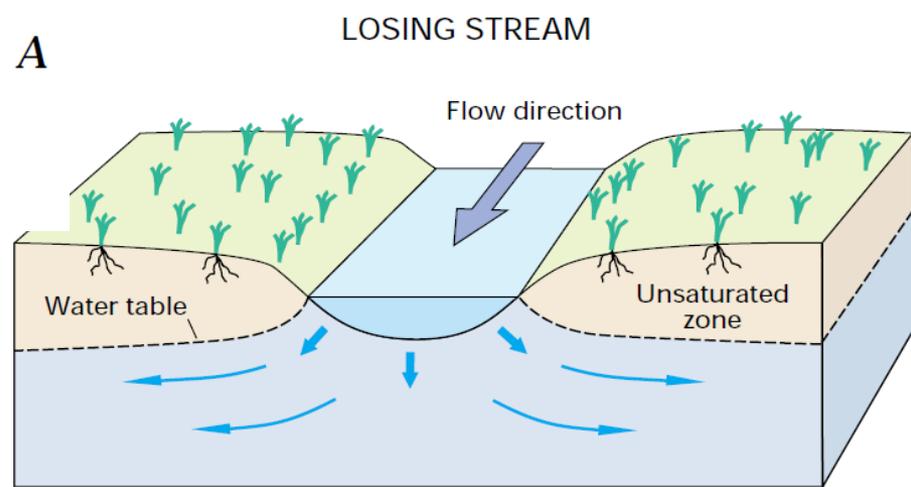
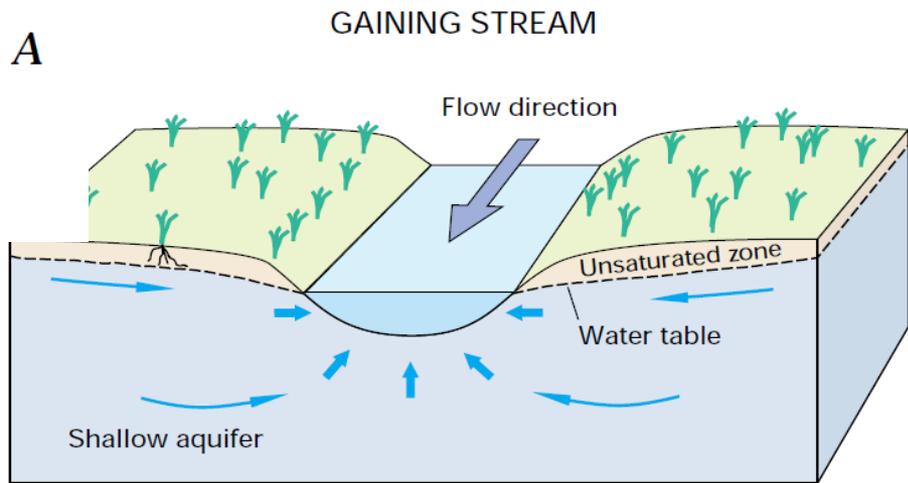
# Remote Geomorphic Assessments Robb-Ledford and Gravelly-Blacktail Wildlife Management Areas



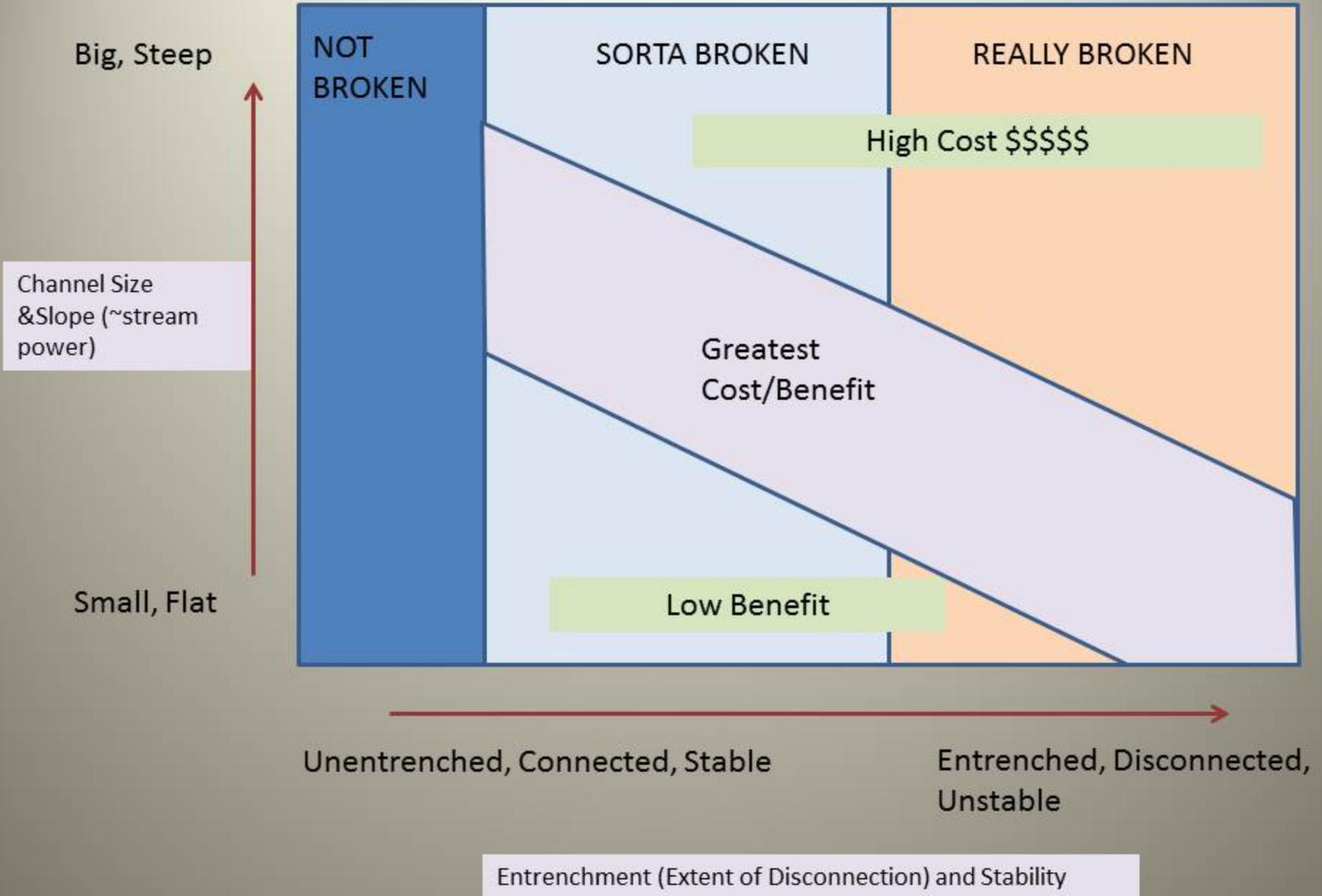


**Valley Width**  
**Side Channels**  
**Observable Geomorphology**





Figures from Winter et al., 1998

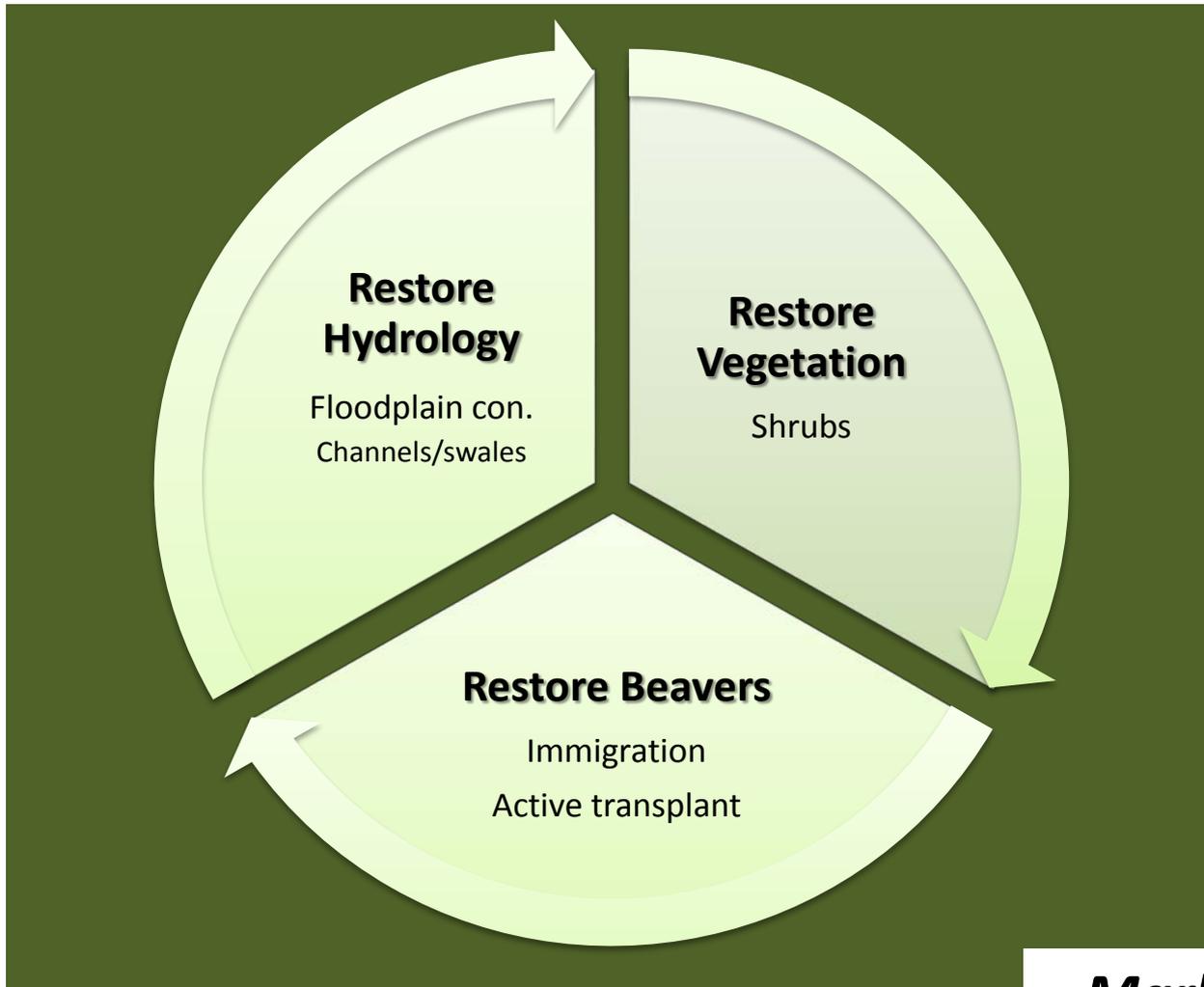


# Passive Restoration



# Active Restoration





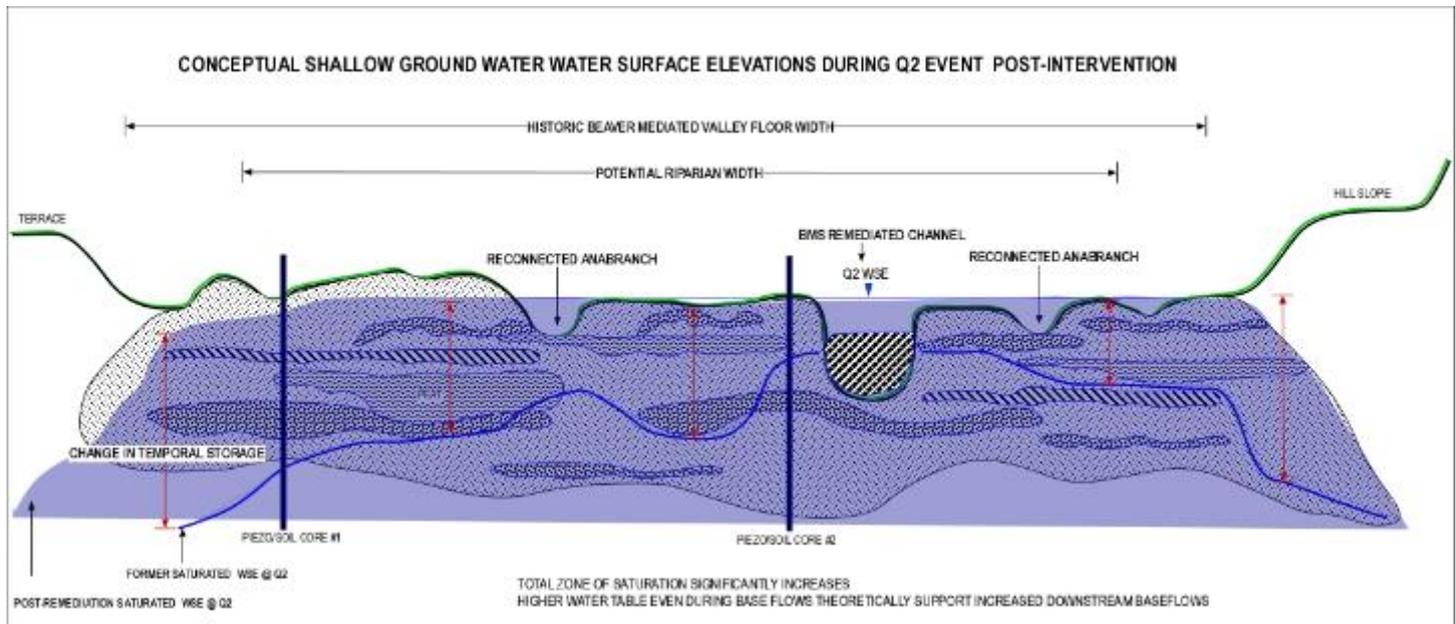
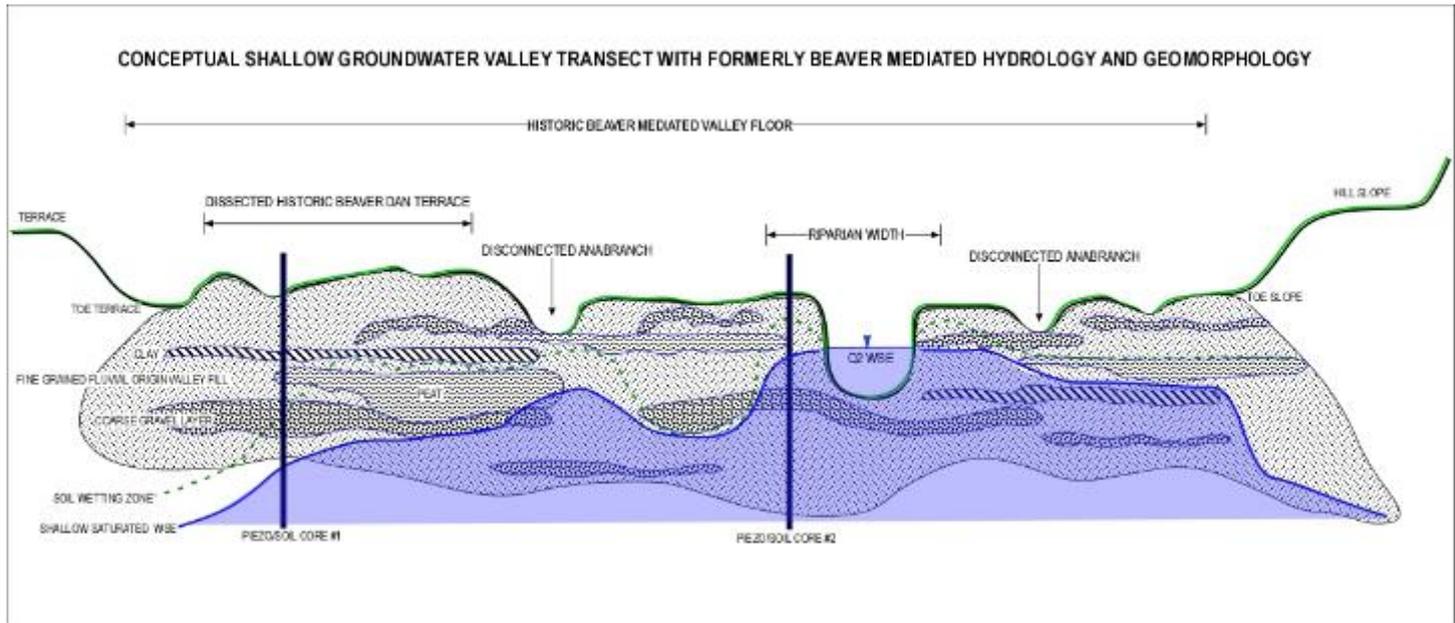
**Mark Beardsley**



Stream & Riparian Monitoring, Assessment & Restoration

# Red Rock Creek





# Middle Creek



# Long Creek



# Long Creek



# Long Creek

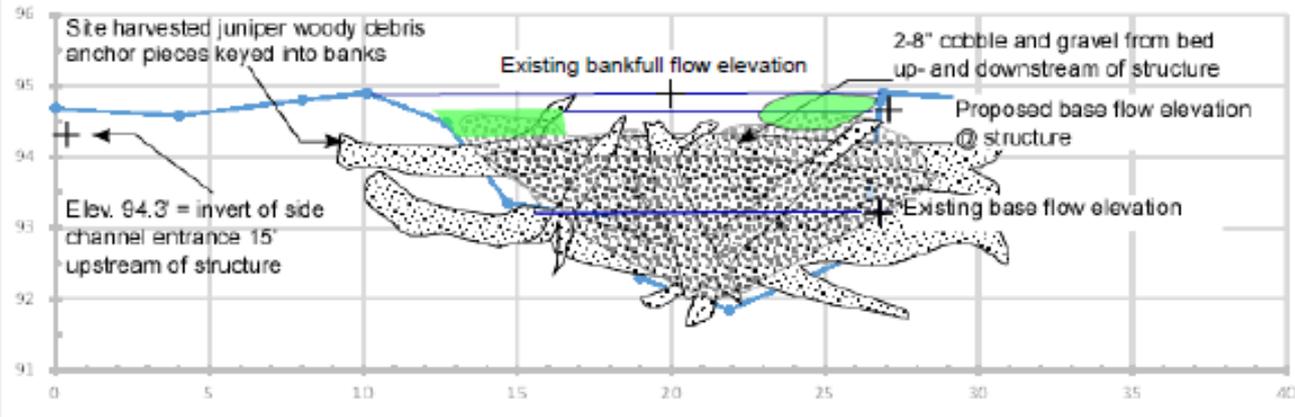




# **Ruby River Miller Restoration Project**

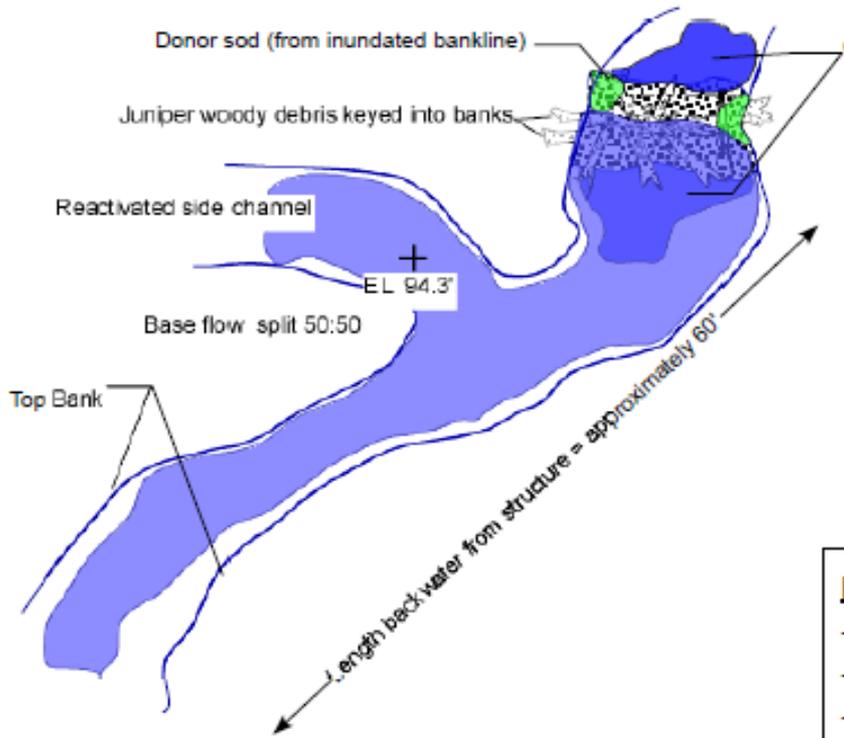


# XS # 1 And Typical Woody Debris and Cobble Structure @ S1



# Robb Creek

## XS # 1 and Typical Woody Debris and Cobble Structure Planview

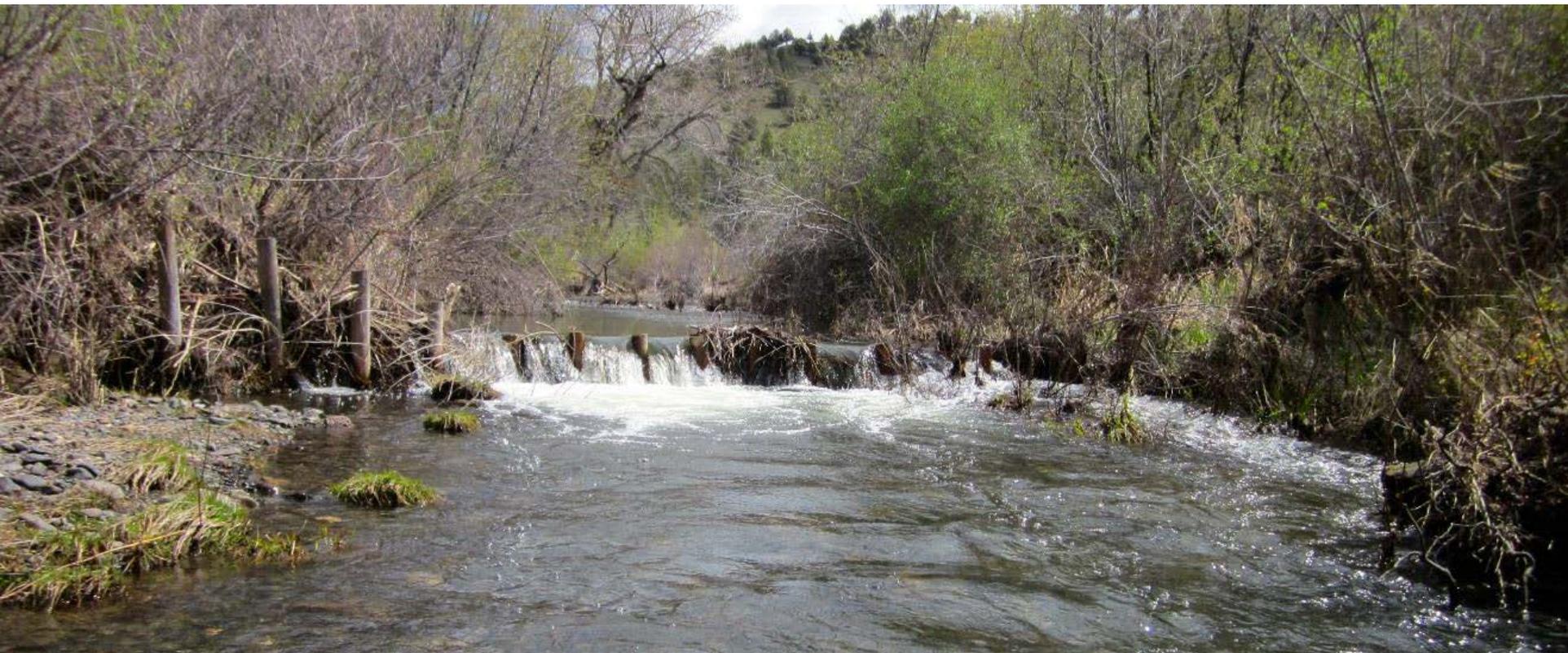


RELATIVE DIMENSIONS

- REACH CHARACTERISTICS**
- Avg. channel slope = 1.87%
  - Avg. Bankfull Topwidth = 13 ft
  - Estimated Hydrology
    - Baseflow = 6-8 cfs
    - Bankfull = 35 cfs



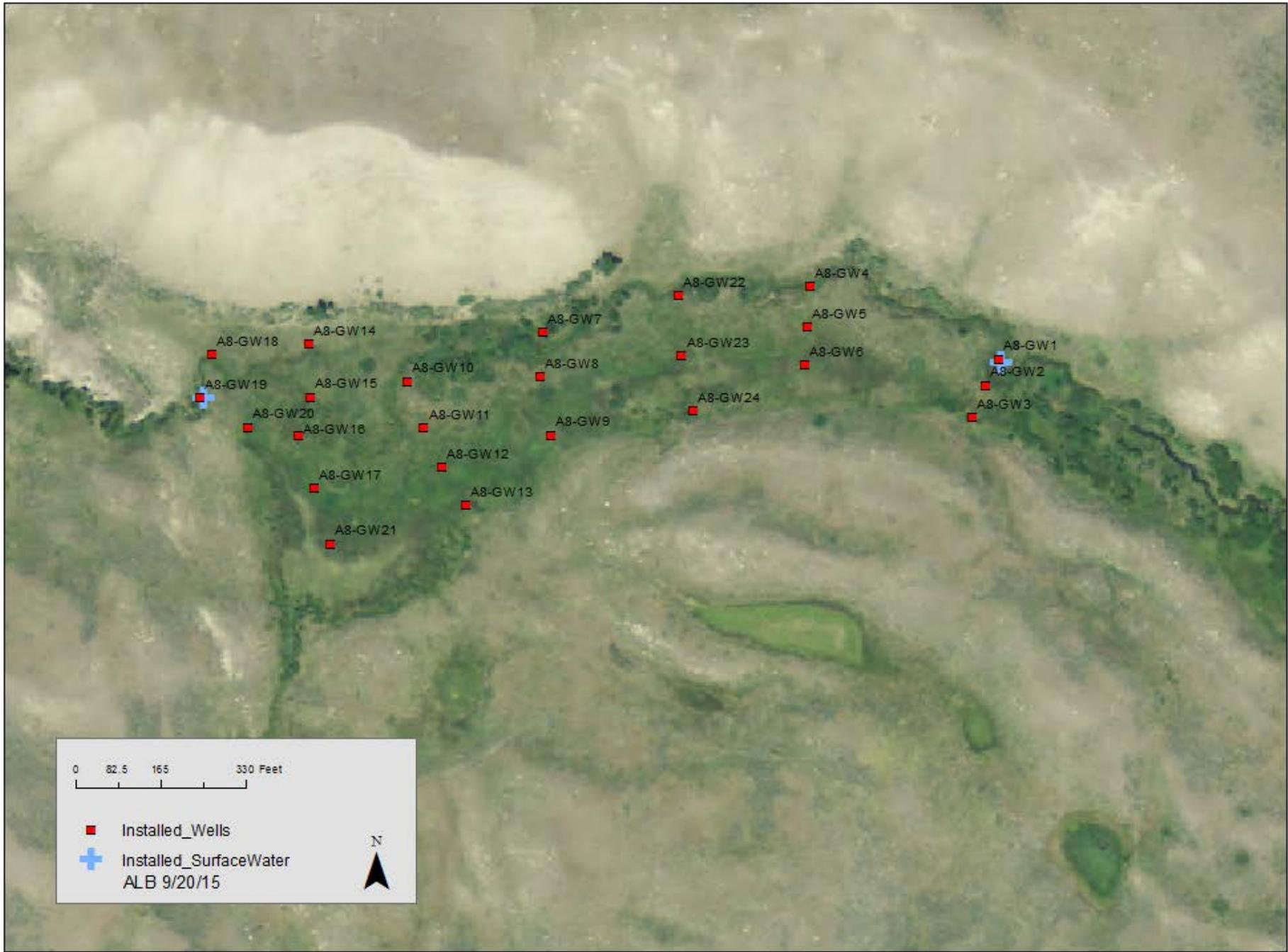
**Elijah Portugal, Joseph Wheaton, and Nick Bouwes, 2015**



**Elijah Portugal, Joseph Wheaton, and Nick Bouwes, 2015**



**Janine Castro, Michael Pollock, Chris Jordan, Gregory Lewallen, and Kent Woodruff 2015**



A8-GW18

A8-GW14

A8-GW7

A8-GW22

A8-GW4

A8-GW19

A8-GW15

A8-GW10

A8-GW8

A8-GW23

A8-GW5

A8-GW1

A8-GW20

A8-GW16

A8-GW11

A8-GW9

A8-GW24

A8-GW6

A8-GW2

A8-GW17

A8-GW12

A8-GW13

A8-GW21

0 82.5 165 330 Feet

■ Installed\_Wells

⊕ Installed\_SurfaceWater

ALB 9/20/15

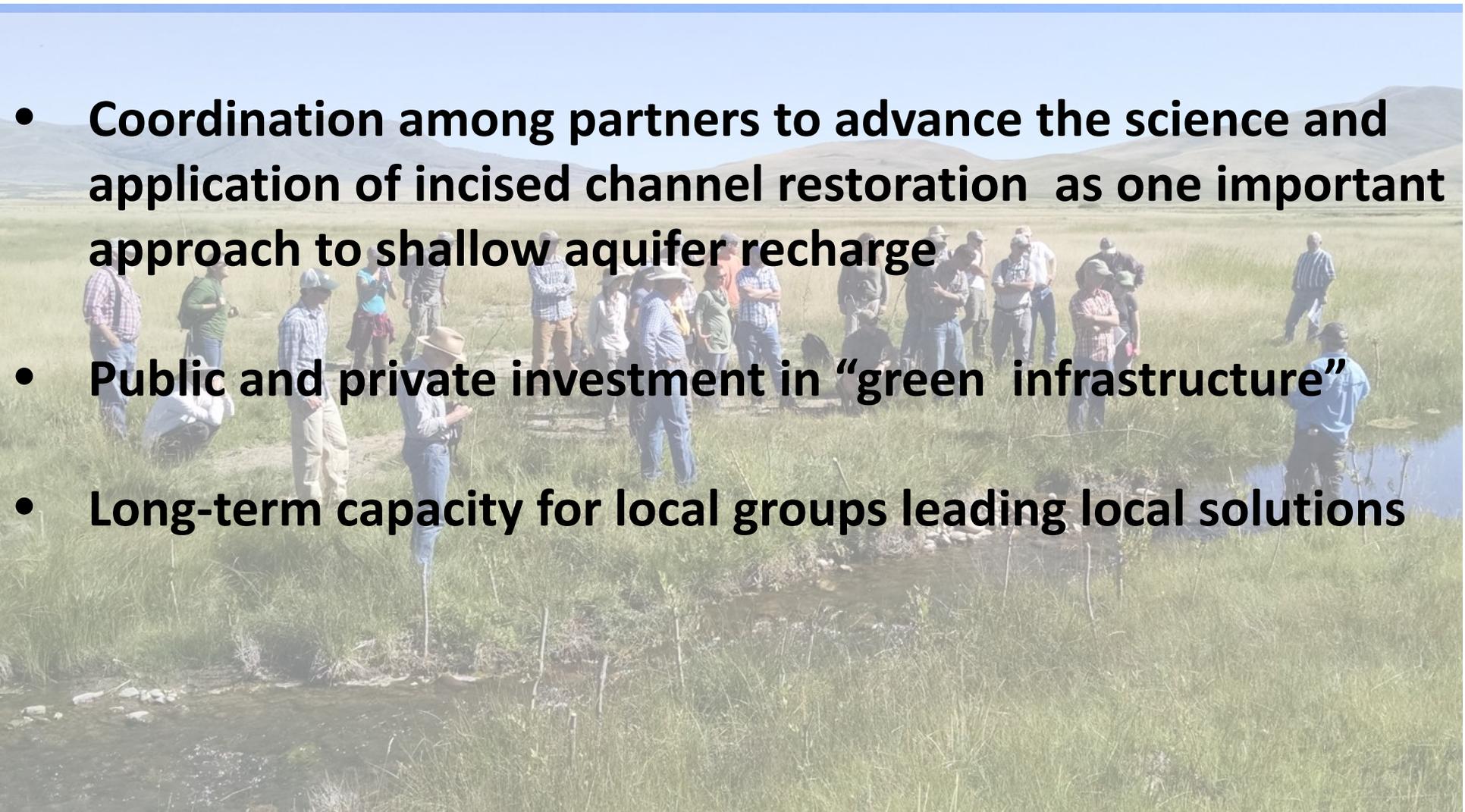
N

# Restoration $\neq$ Water Storage





# What do we need?

- **Coordination among partners to advance the science and application of incised channel restoration as one important approach to shallow aquifer recharge**
  - **Public and private investment in “green infrastructure”**
  - **Long-term capacity for local groups leading local solutions**
- 
- A group of approximately 20 people, including men and women of various ages, are gathered in a grassy field. They are dressed in casual outdoor attire, including hats, plaid shirts, and jeans. In the foreground, there is a small, shallow stream or channel with some rocks and sparse vegetation. The background shows rolling hills under a clear blue sky. The overall scene suggests a field visit or a community meeting related to environmental restoration.

**Questions?**

