

River Corridor Responses to Beaver Restoration Activities

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Outline of Talk

Background

river corridors, beads & strings
heterogeneity, connectivity, resilience

Beavers as ecosystem engineers

Beaver reintroduction & restoration to mimic beaver effects
the importance of context





Background I:
river corridors, beads & strings

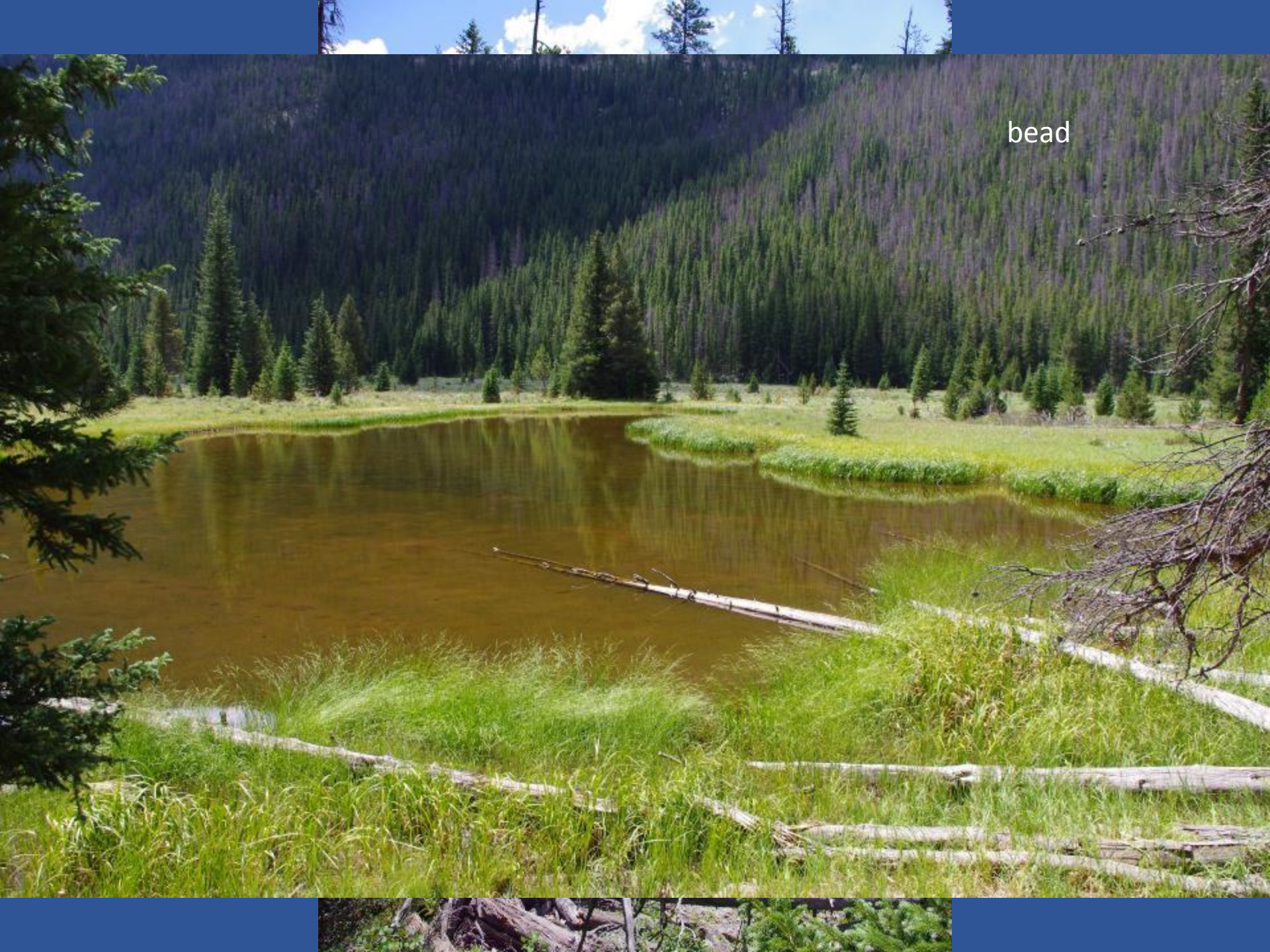
Conceptualize river networks as
river corridors composed of
beads & strings

Beads more retentive (water,
sediment, solutes) & biologically
productive

Retention reflects spatial
heterogeneity and lateral &
vertical connectivity

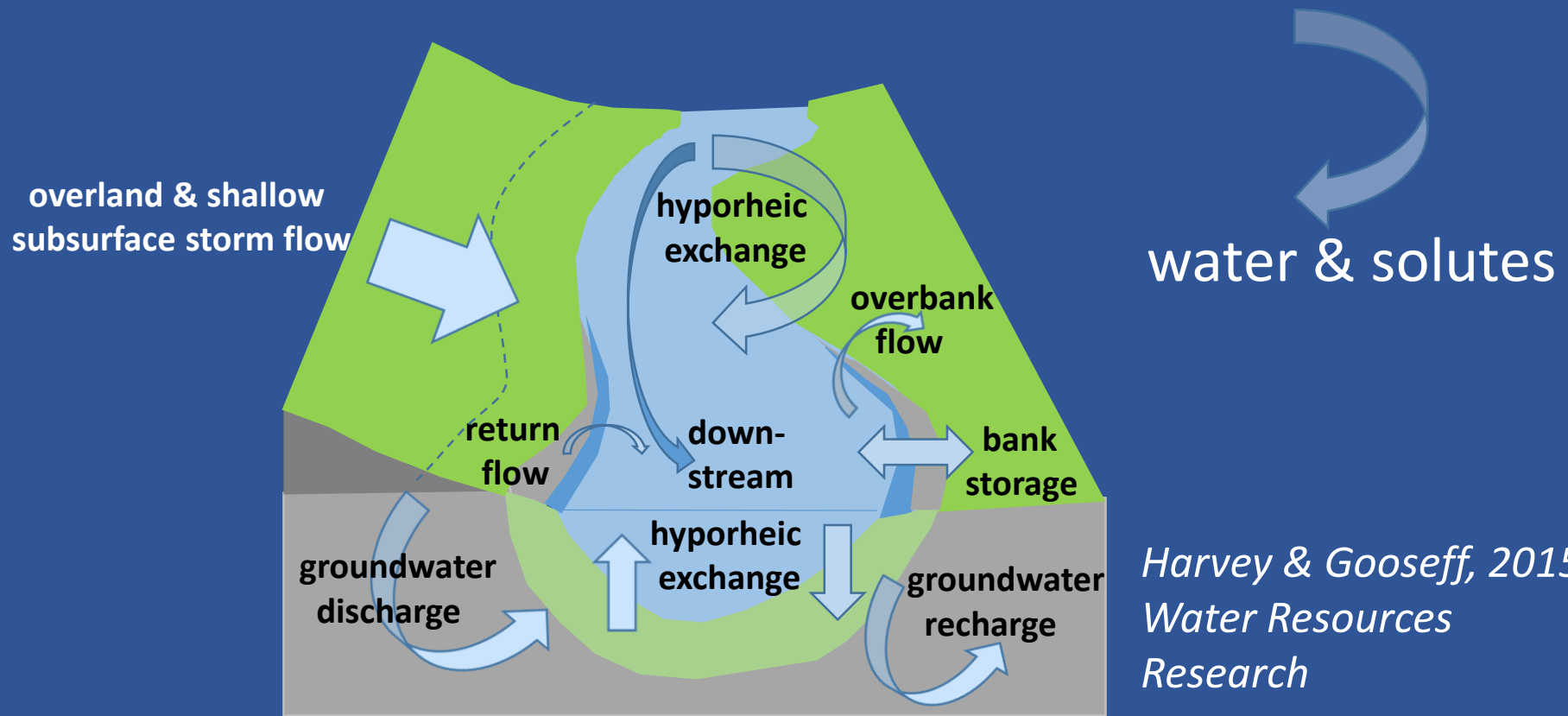
Beads also more resilient to
natural & human disturbances





bead

A river corridor includes the active channel(s), floodplain, & underlying hyporheic zone

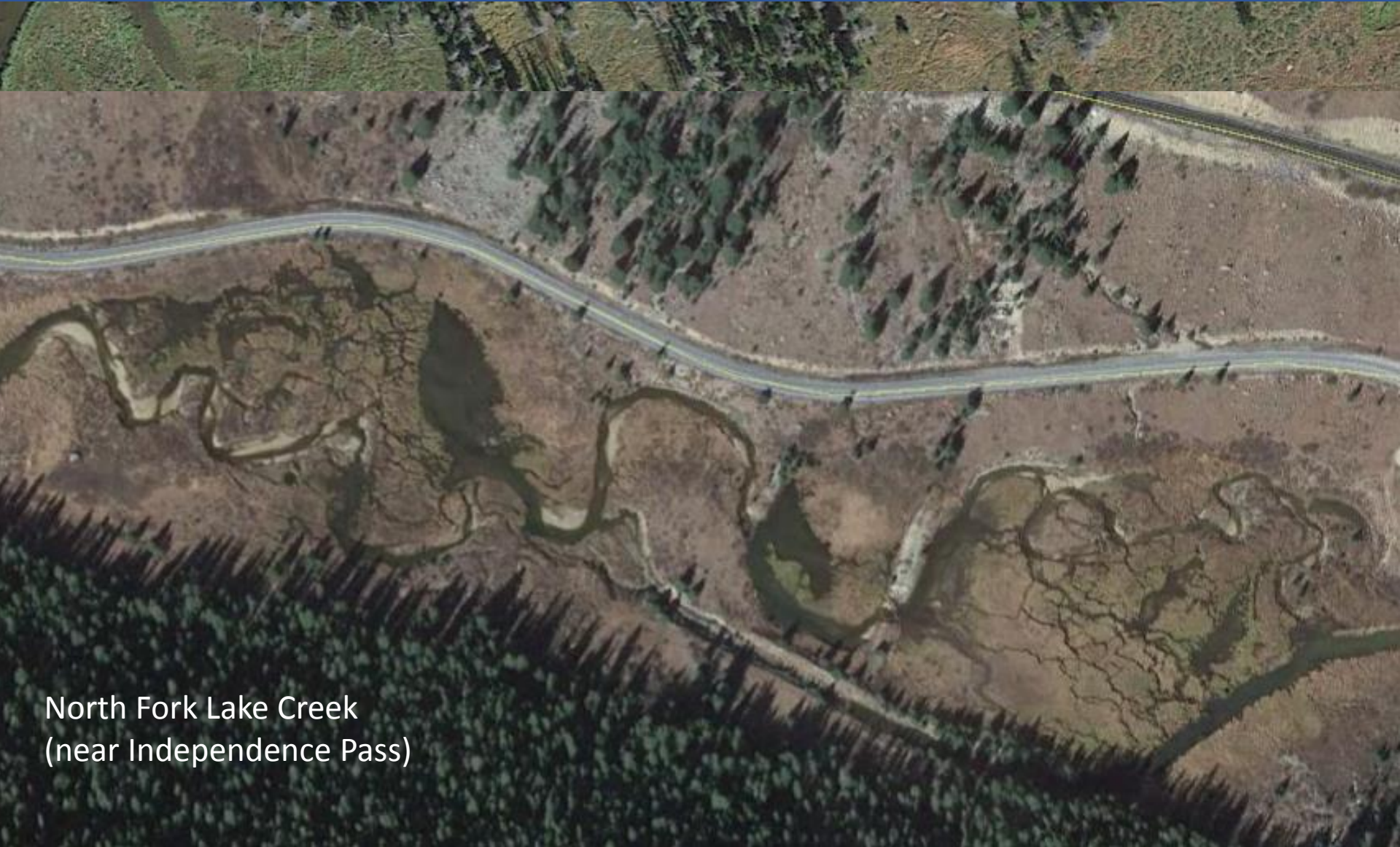


Bead portions of rivers are wider & can have greater spatial heterogeneity & connectivity – details best understood using a river corridor perspective

A landscape photograph showing a mountain valley. In the foreground, a stream flows through a rocky and brushy area. A small pond in the middle ground reflects the sky and clouds. The background features rolling hills and mountains covered in dense evergreen forests under a blue sky with scattered white clouds.

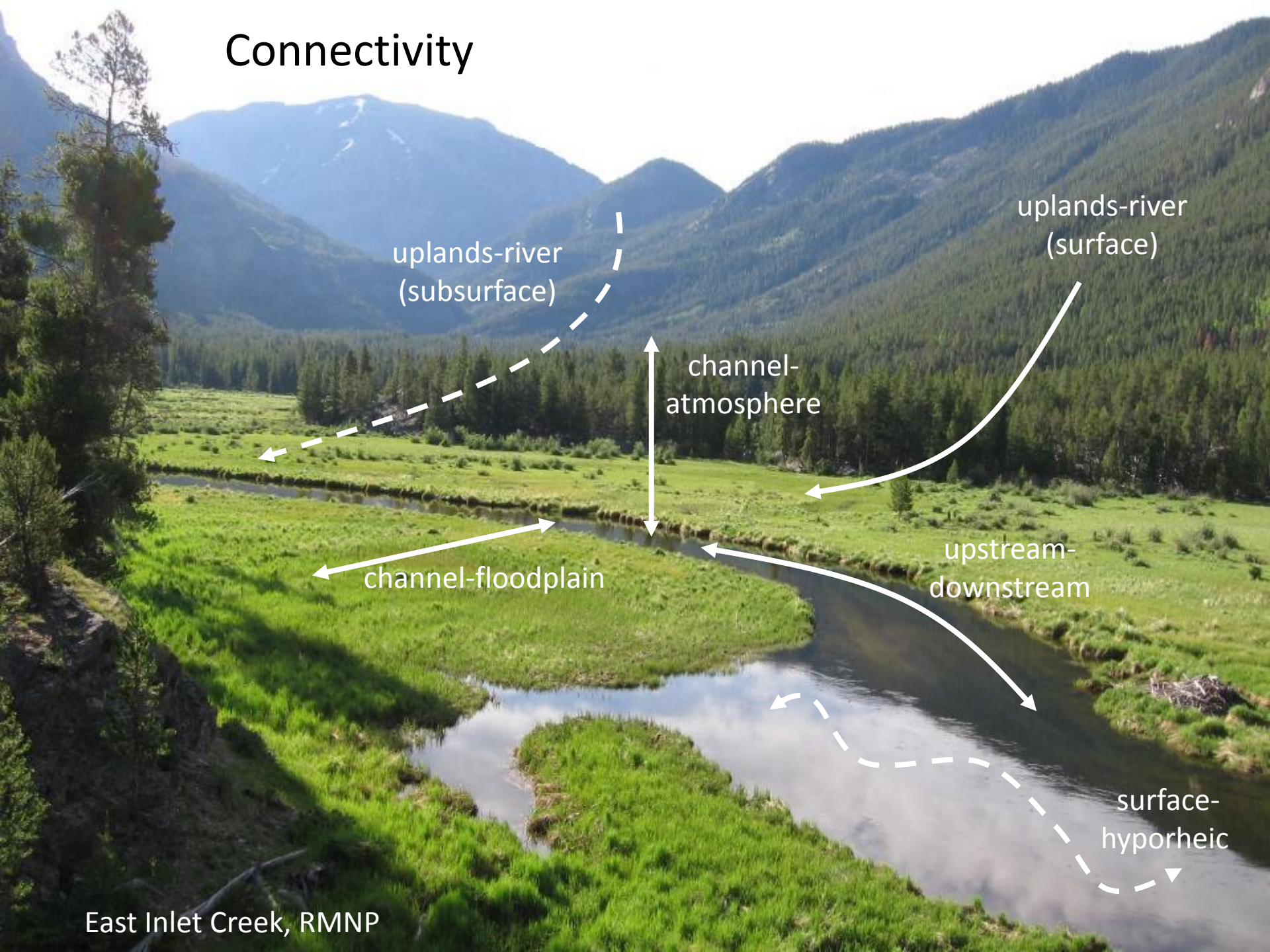
**Background II:
Heterogeneity, connectivity, resilience**

Spatial heterogeneity



North Fork Lake Creek
(near Independence Pass)

Connectivity



uplands-river
(subsurface)

uplands-river
(surface)

channel-
atmosphere

channel-floodplain

upstream-
downstream

surface-
hyporheic

East Inlet Creek, RMNP

Resilience

drought
fire
flood

N. St. Vrain Creek, RMNP



Baugh Creek, Idaho
(photo courtesy of Joe Wheaton, Utah State University)





Within beads, spatial heterogeneity, connectivity,
& resilience are enhanced by beaver dams, ponds, & canals

Beavers as ecosystem engineers

- increased lateral & vertical connectivity
- surface water storage & higher riparian water table



- peak flow attenuation (& base flow increase)



- sediment & organic matter storage



- improved water quality (e.g., nitrate sinks)
- more stable channels
- greater habitat & biodiversity



- increased soil organic carbon stock



A landscape photograph of a mountain valley. In the foreground, a small pond is partially enclosed by a beaver dam made of sticks and branches. The water in the pond reflects the sky and the surrounding landscape. The middle ground shows a wide, open valley with sparse vegetation and scattered trees. In the background, there are forested mountains under a blue sky with scattered white clouds. The overall scene is a natural, mountainous environment.

Beaver reintroduction & restoration to
mimic beaver effects

Conceptual Model for Beaver Meadows/Elk Grasslands

beaver meadow:
extensive
persistent
complex
connected



floodplain wetland
deciduous riparian trees
multiple channels

beaver food
& habitat

more dams
& ponds

↑ backwater
↑ overbank flow



beaver present

beaver dam

threshold based on presence of beavers & dams

elk grassland:
simple
disconnected



↓ backwater
↓ overbank flow

drier floodplain
single channel

beaver absent



The Beaver Restoration Guidebook

Working with Beaver to Restore Streams, Wetlands, and Floodplains

Version 1.0, June 30, 2015



Photo credit: *Wesley A. Dam Foundation* (www.wadmf.com)

Prepared by

US Fish and Wildlife Service
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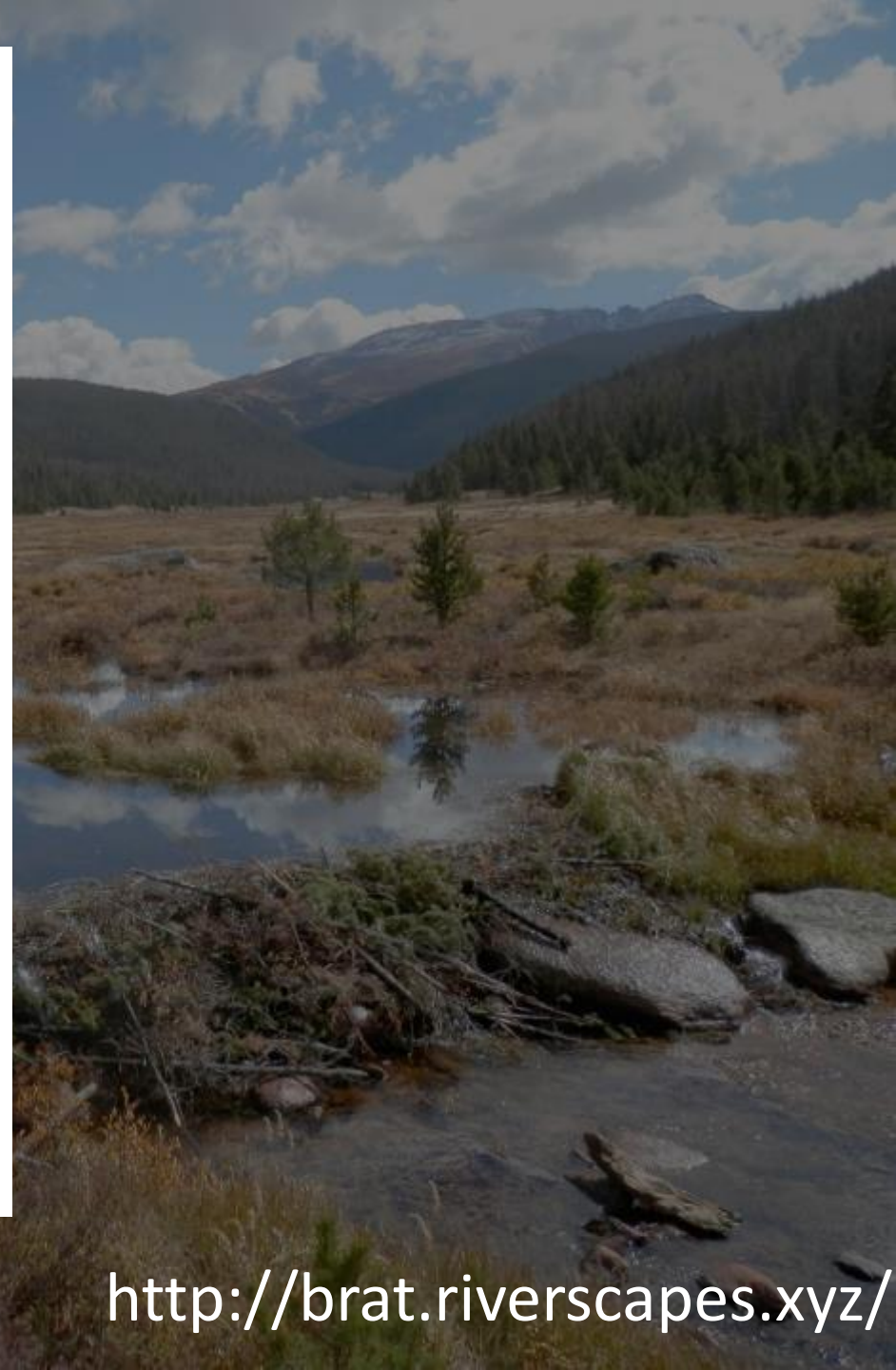
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<http://brat.riverscapes.xyz/>

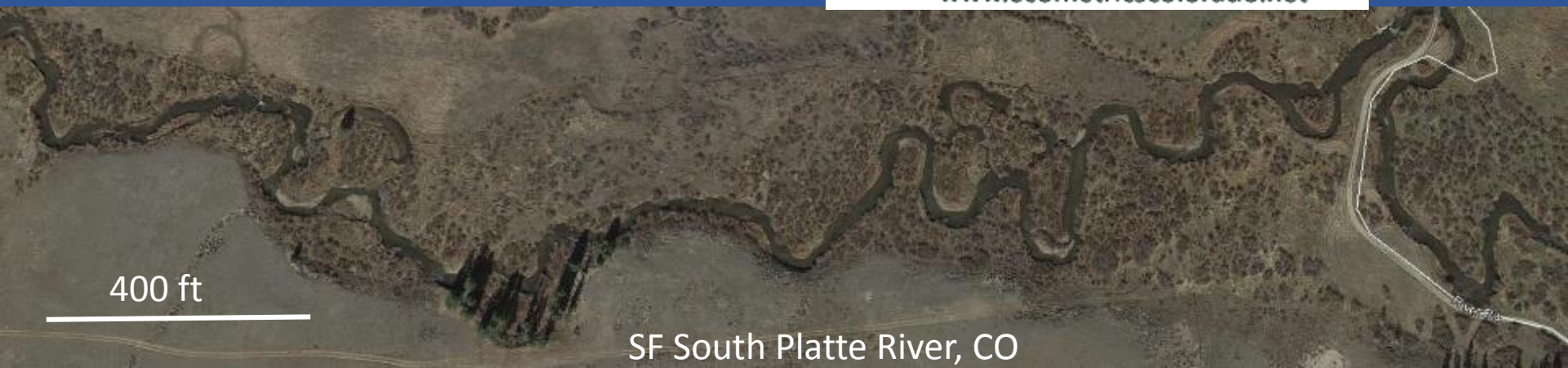


<http://www.beaverdeceivers.com/>





EcoMetrics
www.ecometricscolorado.net



400 ft

SF South Platte River, CO

The importance of context: beaver dam analogues (BDAs)



Fish Creek, Cheley Ranch





BDAs

real beaver dams

Google Earth

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200 ft

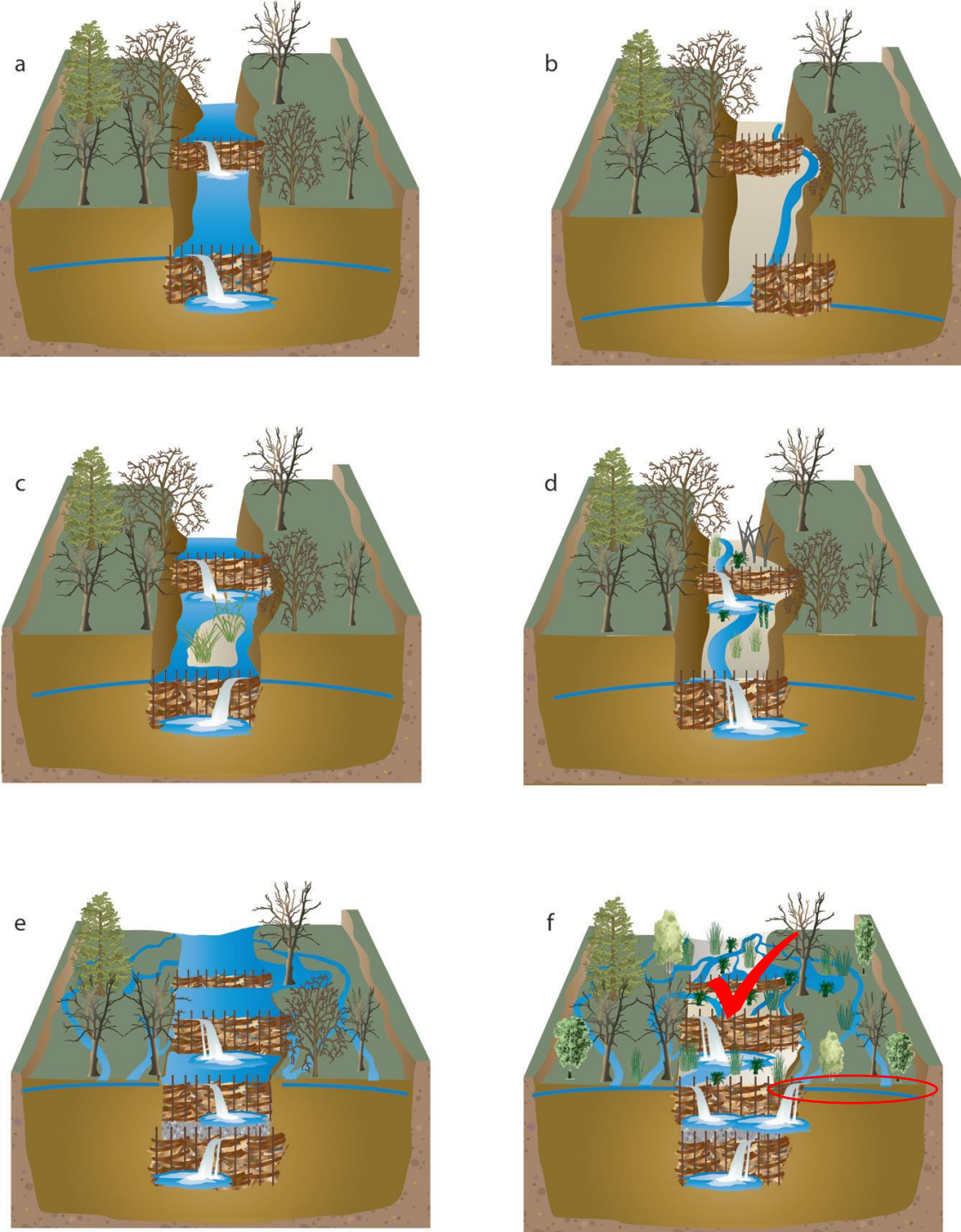
Fish Creek, Cheley Ranch, Oct. 2018



Campbell Creek



Observed effects of BDAs



Pollock et al., 2014,
BioScience, Figure 7

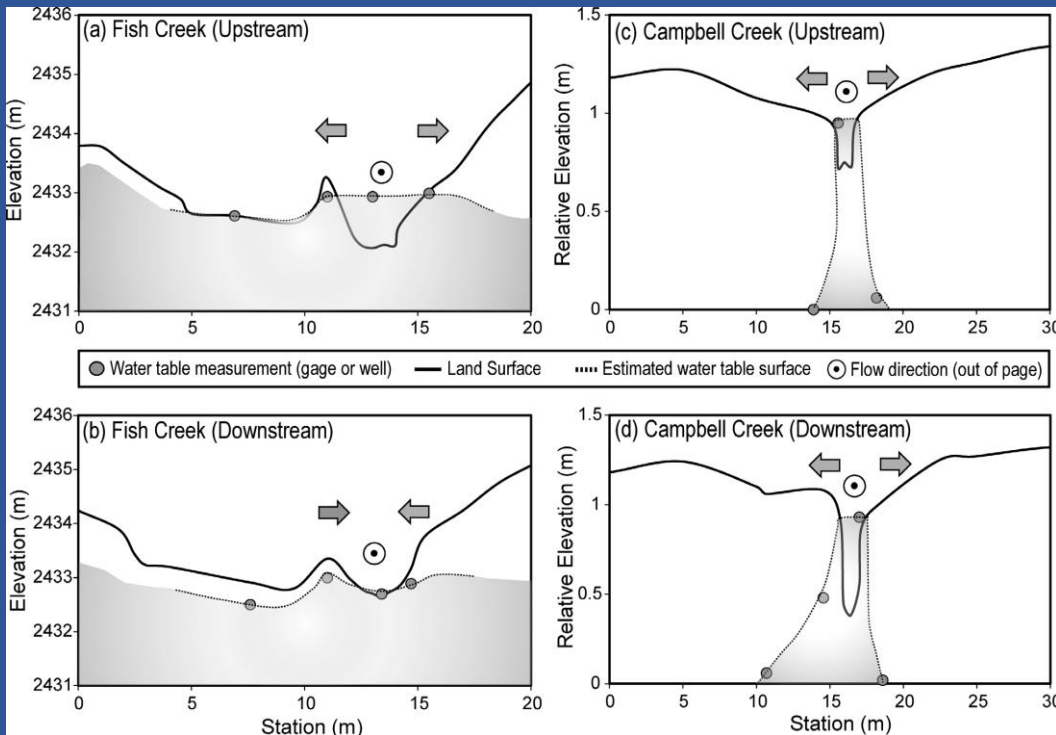
Juli Scamardo



We monitored geomorphic (sediment in backwater ponds) & hydrologic (stream stage & riparian groundwater) response to BDAs 1 year after restoration

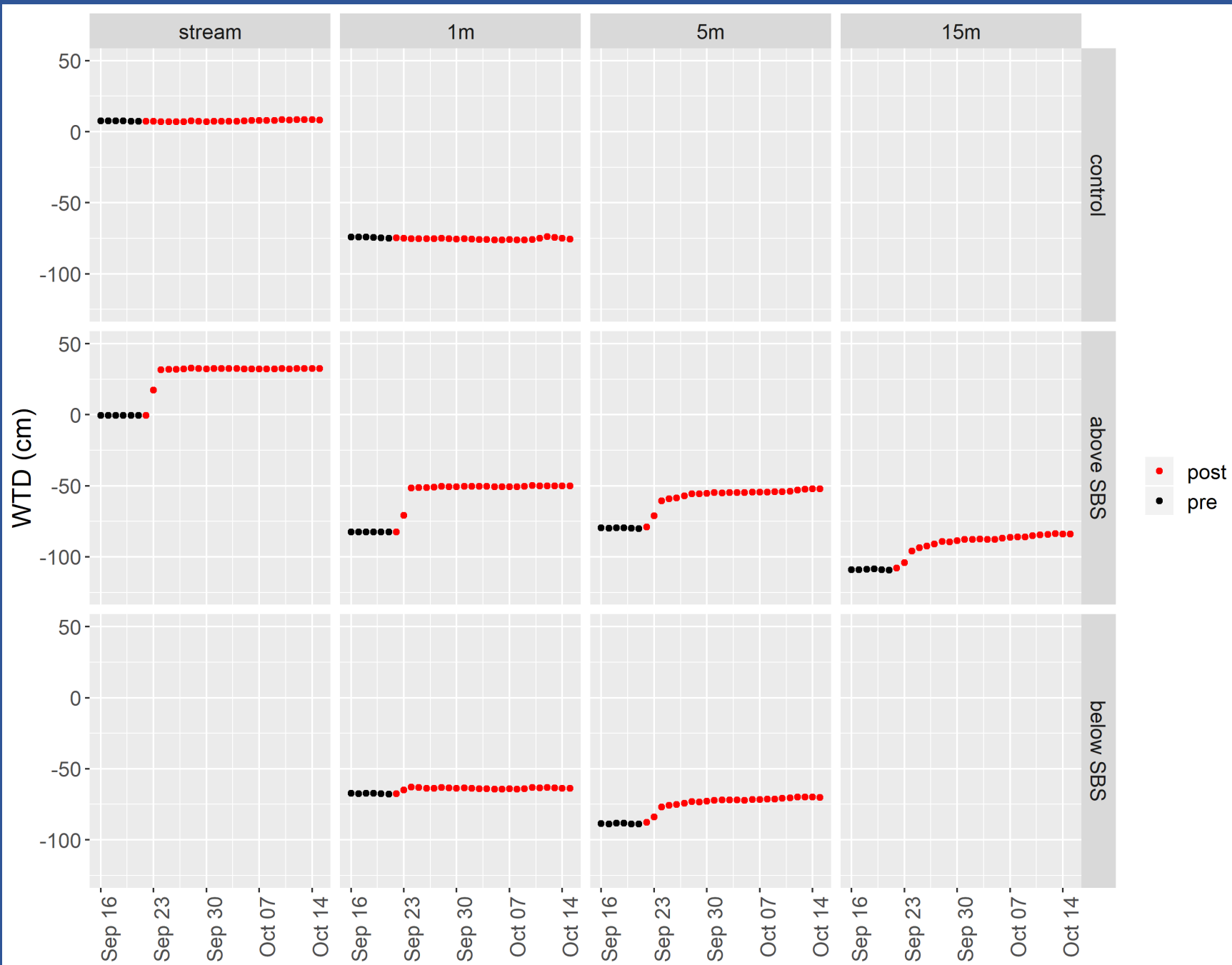
BDA pools stored similar volumes of water & more sediment than pools in upstream reference reaches: sediment storage correlates positively with BDA height & pool surface area

BDAs did not significantly influence shallow ground water



*Scamardo & Wohl, 2020,
River Research & Applications
(Figure 5)*

Cow Creek, Rocky Mountain National Park, CO



Cow Creek, Rocky Mountain National Park



Open questions: how many beads & where?

Historically



Today



Future



What maintains functionality?
How much functionality is necessary?

Opportunity to address these questions using partnership
between research scientists & practitioners