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# Beaver Dam Analogs (BDAs) alter carbon pools and fluxes in intermountain headwater streams

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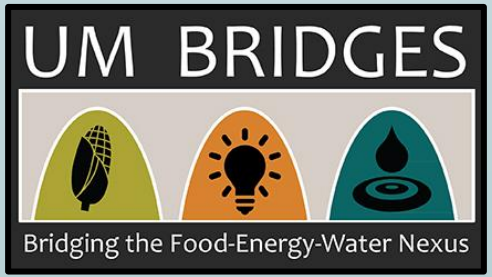
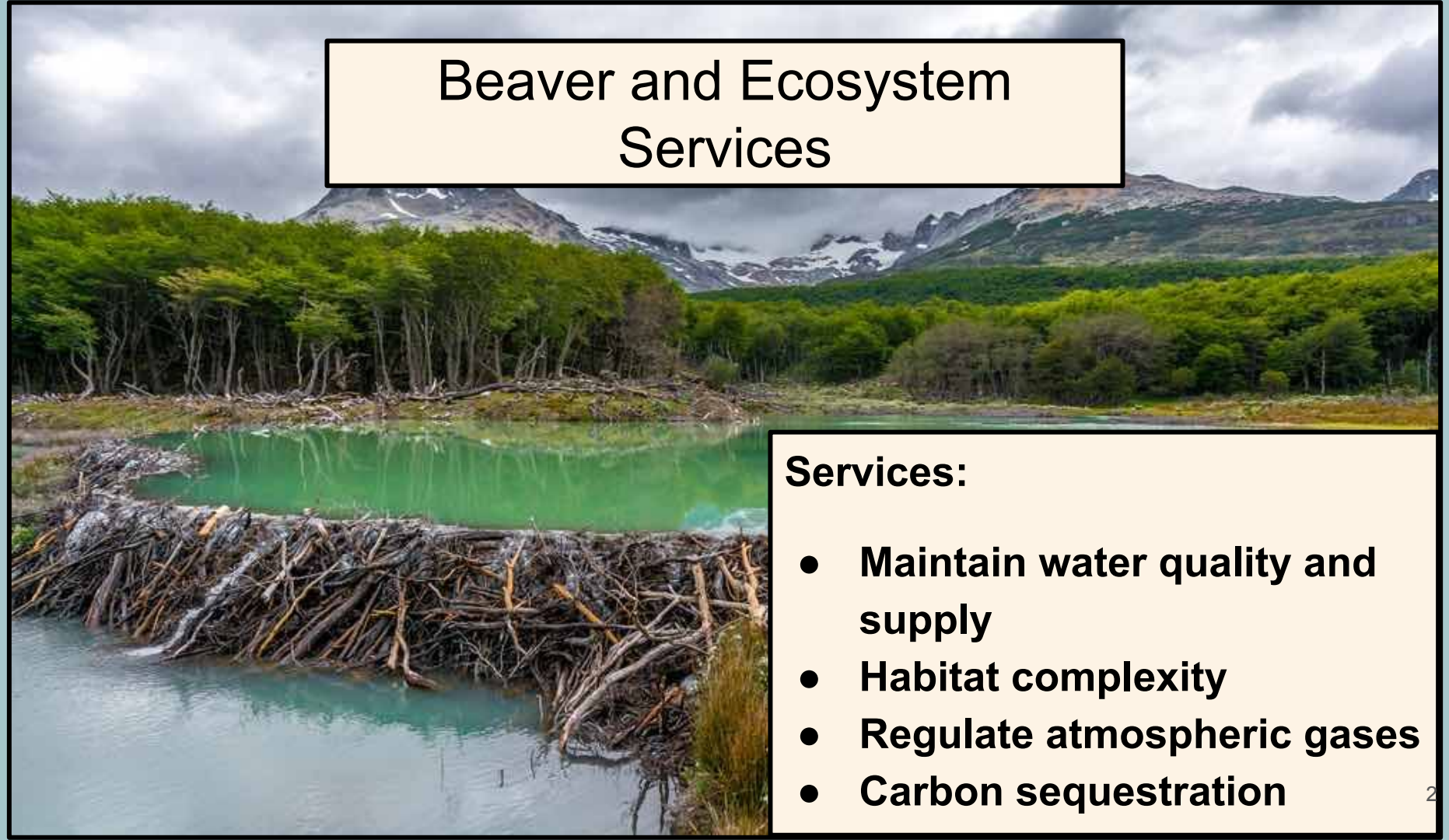



# Beaver and Ecosystem Services



**Services:**

- **Maintain water quality and supply**
- **Habitat complexity**
- **Regulate atmospheric gases**
- **Carbon sequestration**

Louie Yellowwolf. Property of the Montana Historical Society Photograph Archives

## Historical Beaver Range

1,000 Miles

N
W
E
S

# Stream Degradation

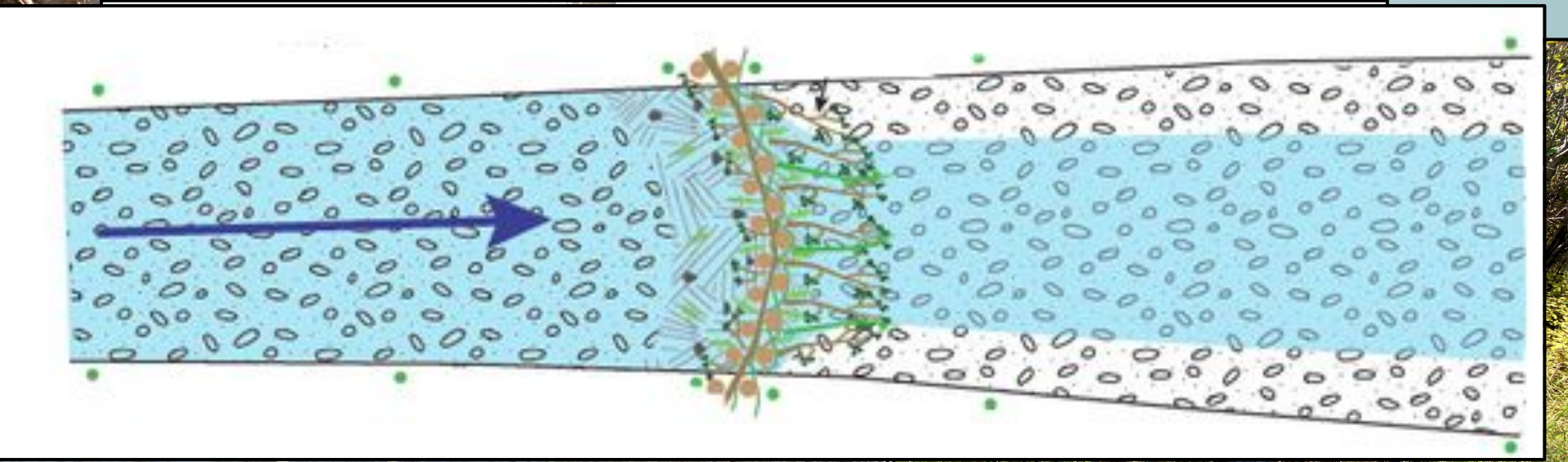
Inability to capture sediment and retain water

Disconnection from the floodplain

Drop in water table changes wetlands to dry uplands

Subsequent loss of carbon

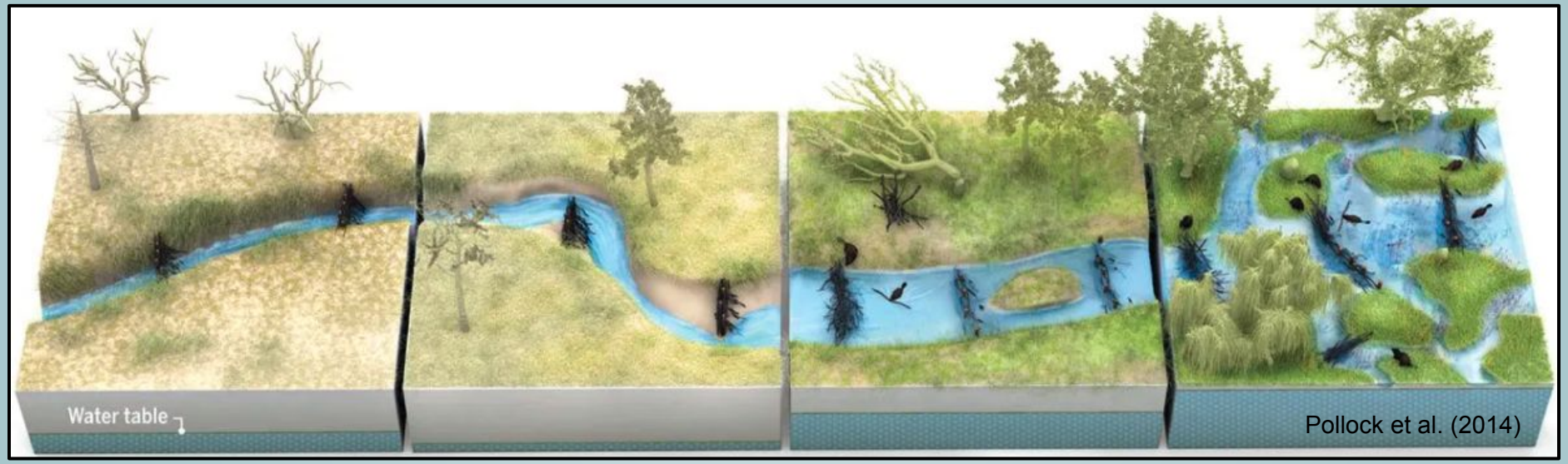
# Beaver Dam Analogs (BDAs)



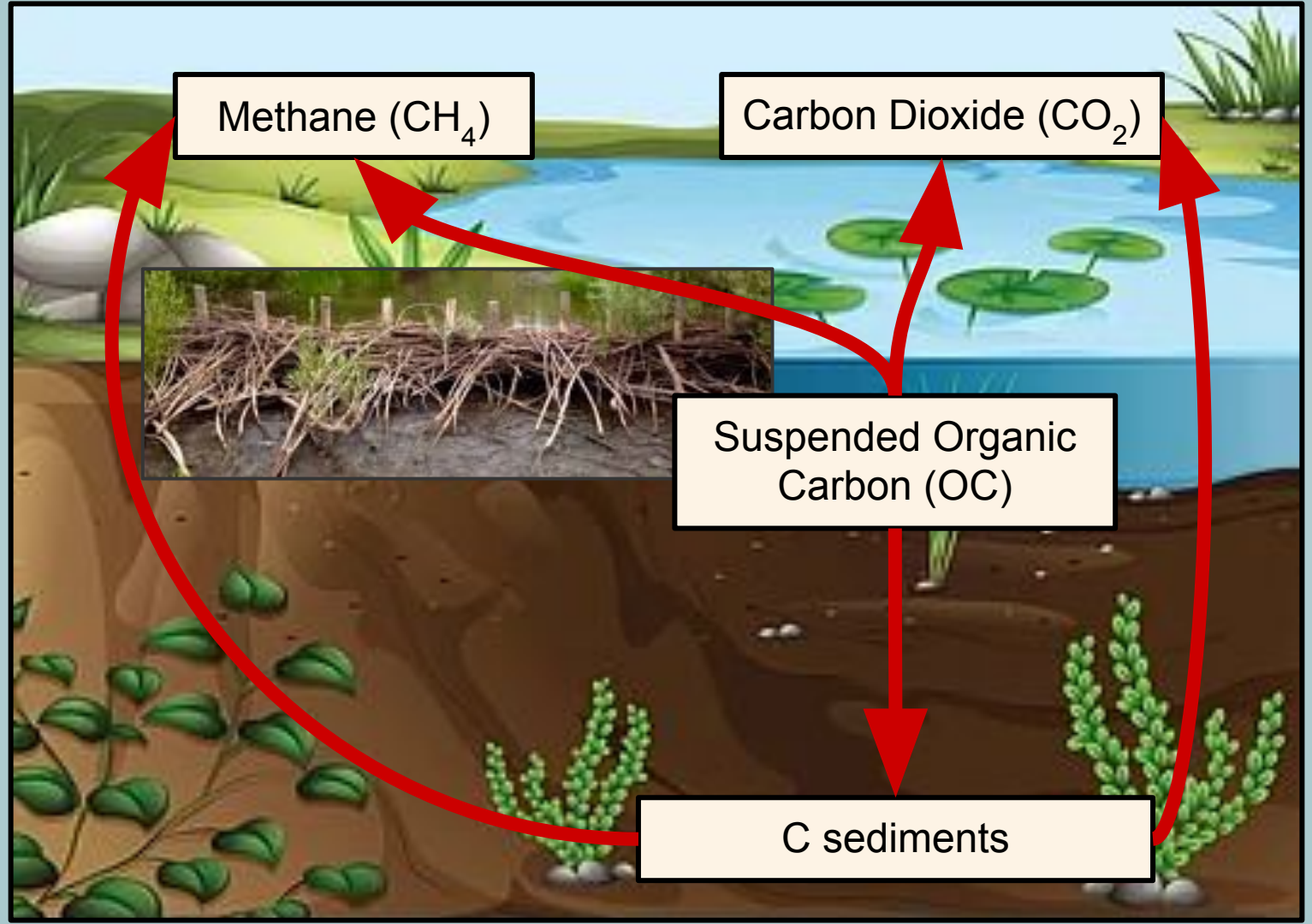
From Pollock et al. (2012)

Photo: Ben Colman

# BDAs in Action

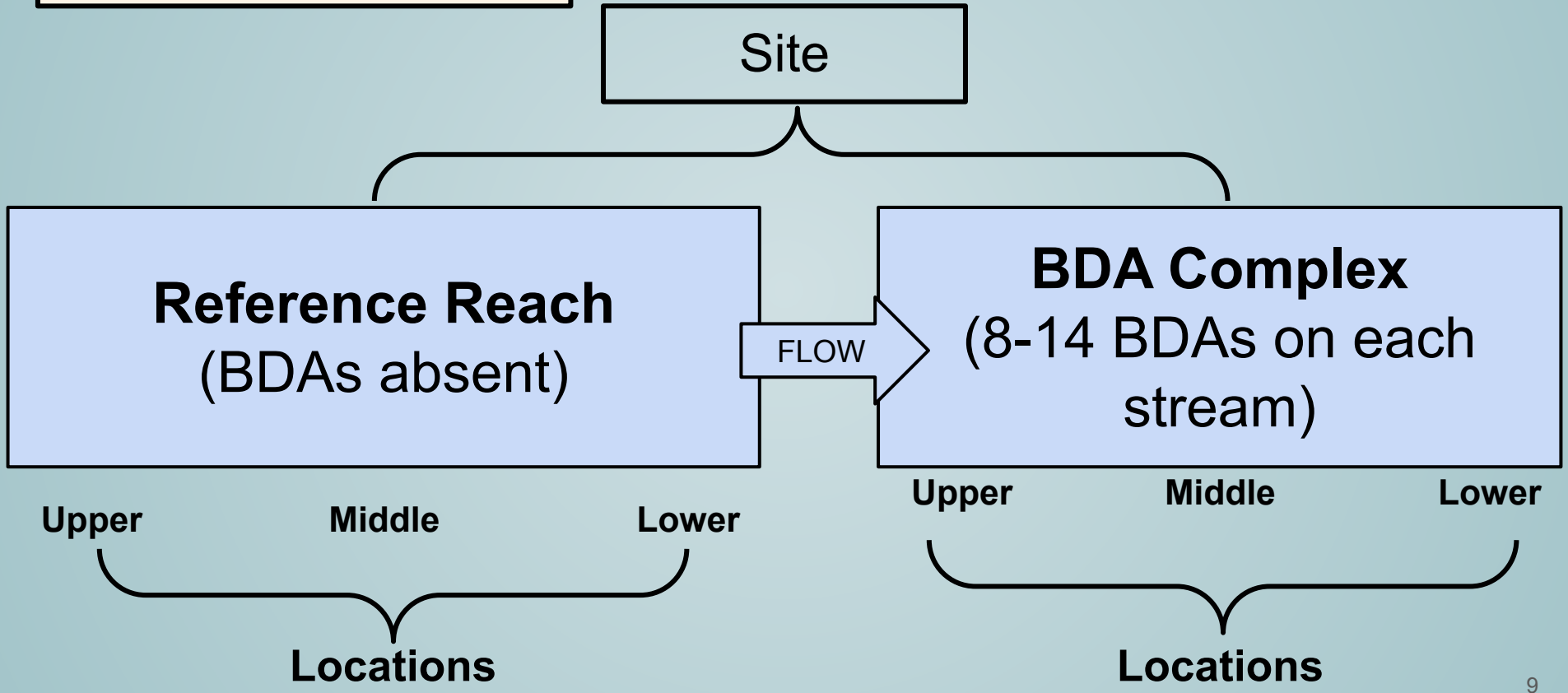



BDA Installation → Trench widening → Return of the beaver → Restoration


Methane ($CH_4$)
Carbon Dioxide ($CO_2$)
Suspended Organic Carbon (OC)
C sediments


Flathead
National Forest
Choteau
Thompson
Falls
Polson
Lost Prairie Creek
15
90
90
Missoula
Teepee Creek
Fish Creek
Helena
Stevensville
Deer Lodge
Nez Perce –
Clearwater
National
Forests
Hamilton
Anaconda
Butte
90

# Study Design



# Carbon Dynamics

Carbon pools:

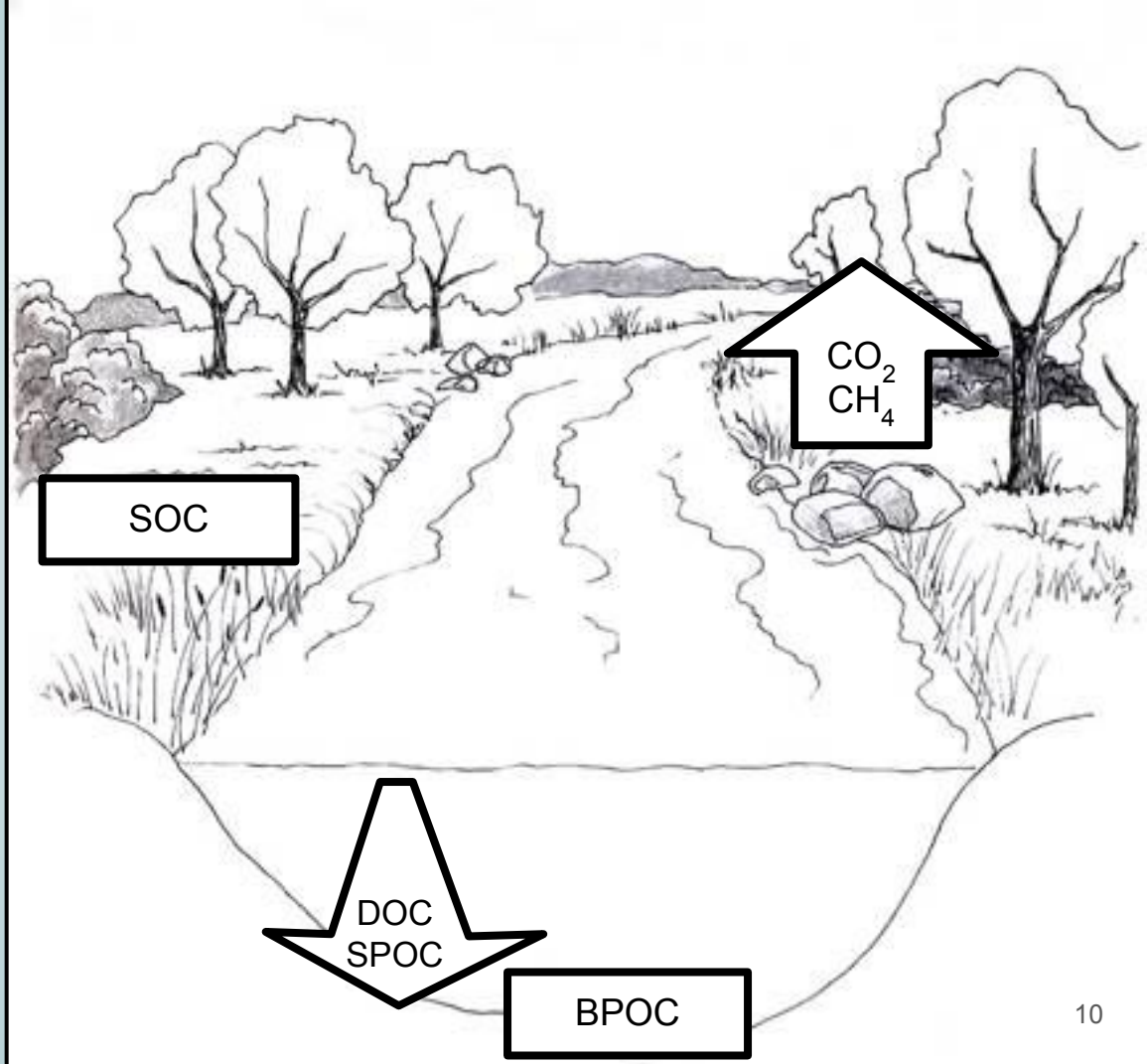
- BPOC (g C/$m^2$)
- SOC (g C/$cm^3$)

Carbon loads (g C/s):

- SPOC
- DOC

Carbon fluxes (g C/$m^2$/s):

- Riparian soil $CO_2$ and $CH_4$



# Research Questions

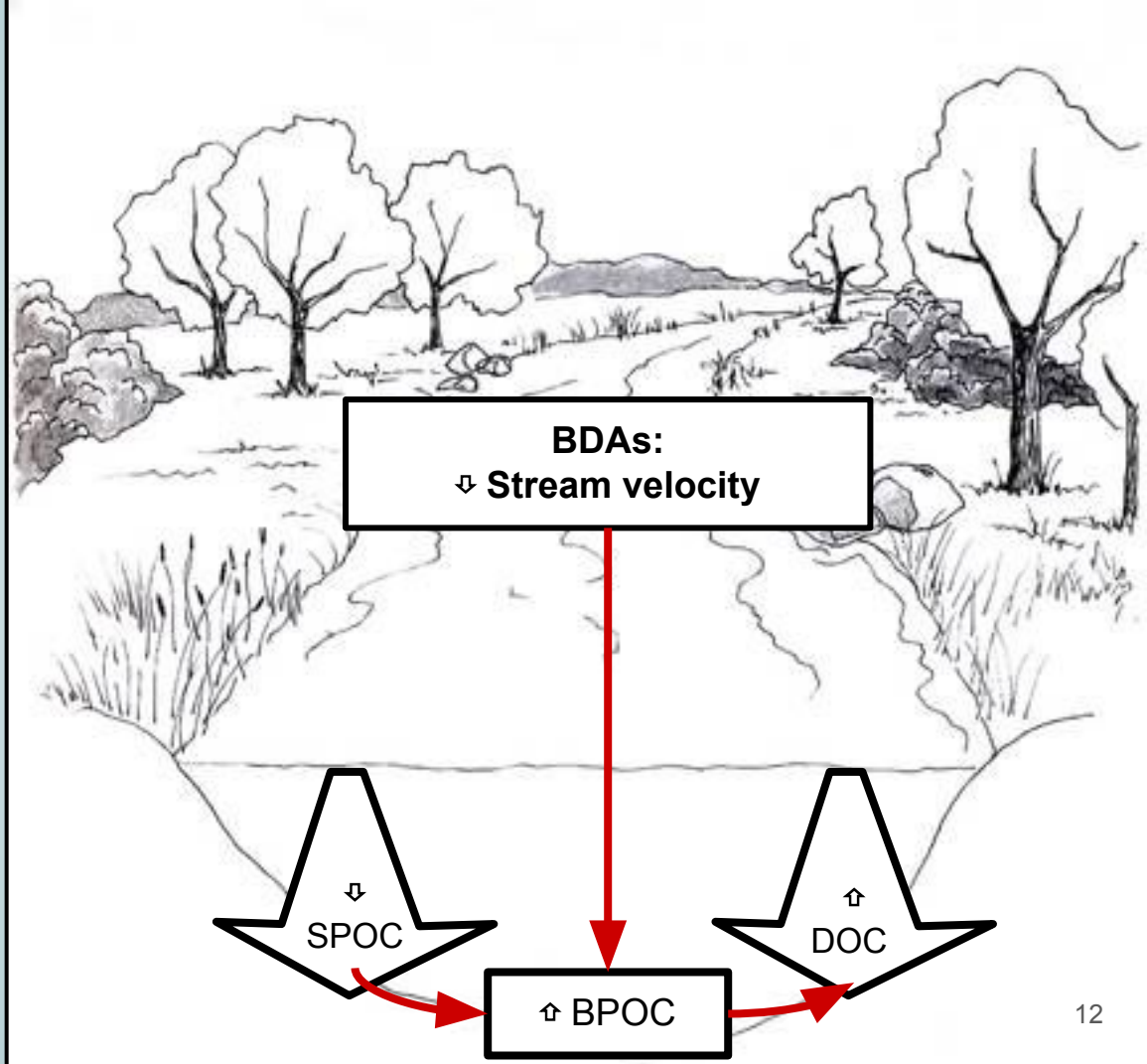
How do organic carbon pools and loads in the stream channel differ between reaches treated with and without BDAs?

How do $CO_2$ and $CH_4$ fluxes from riparian soils differ in reaches treated with and without BDAs?

# Q1: Hypotheses

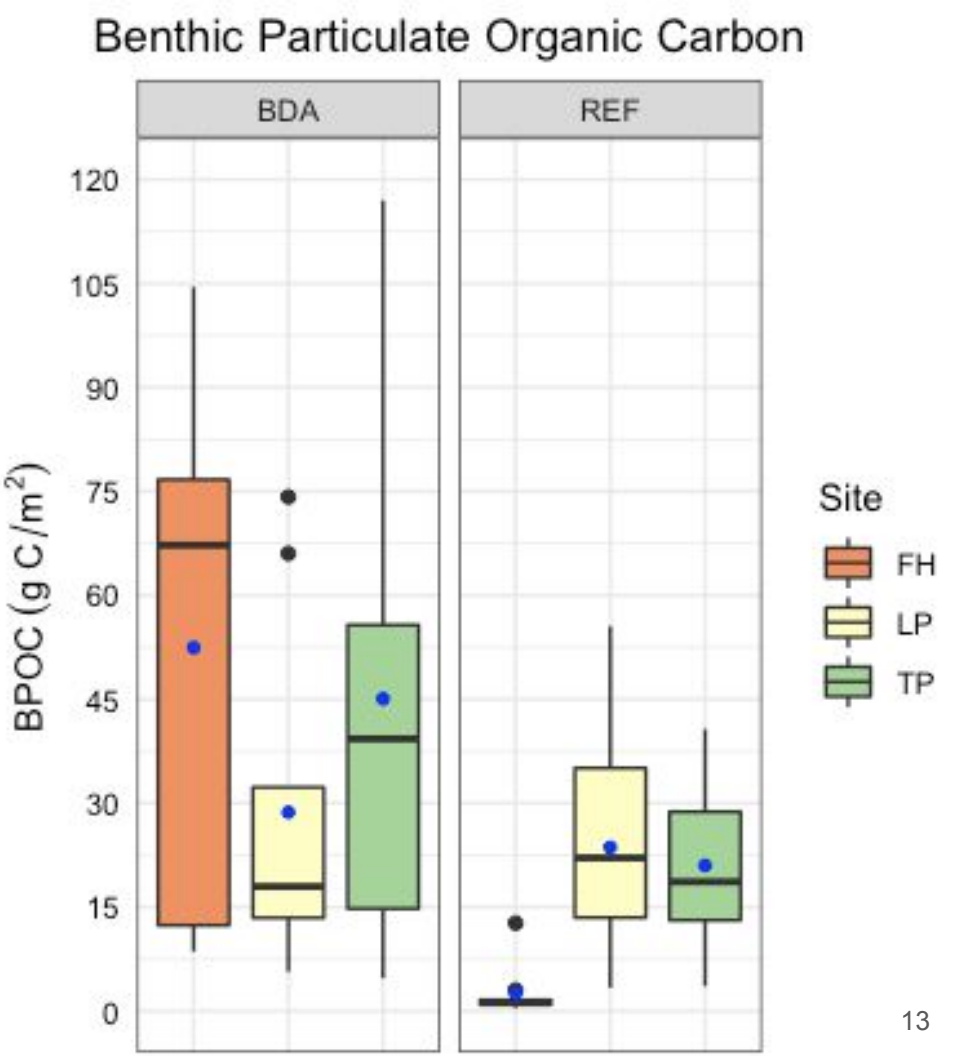
BDA treated reaches:
- ⇧ BPOC pools
- ⇧ BPOC/SPOC

Reference reaches:
- ⇩ BPOC pools
- ⇩ BPOC/SPOC



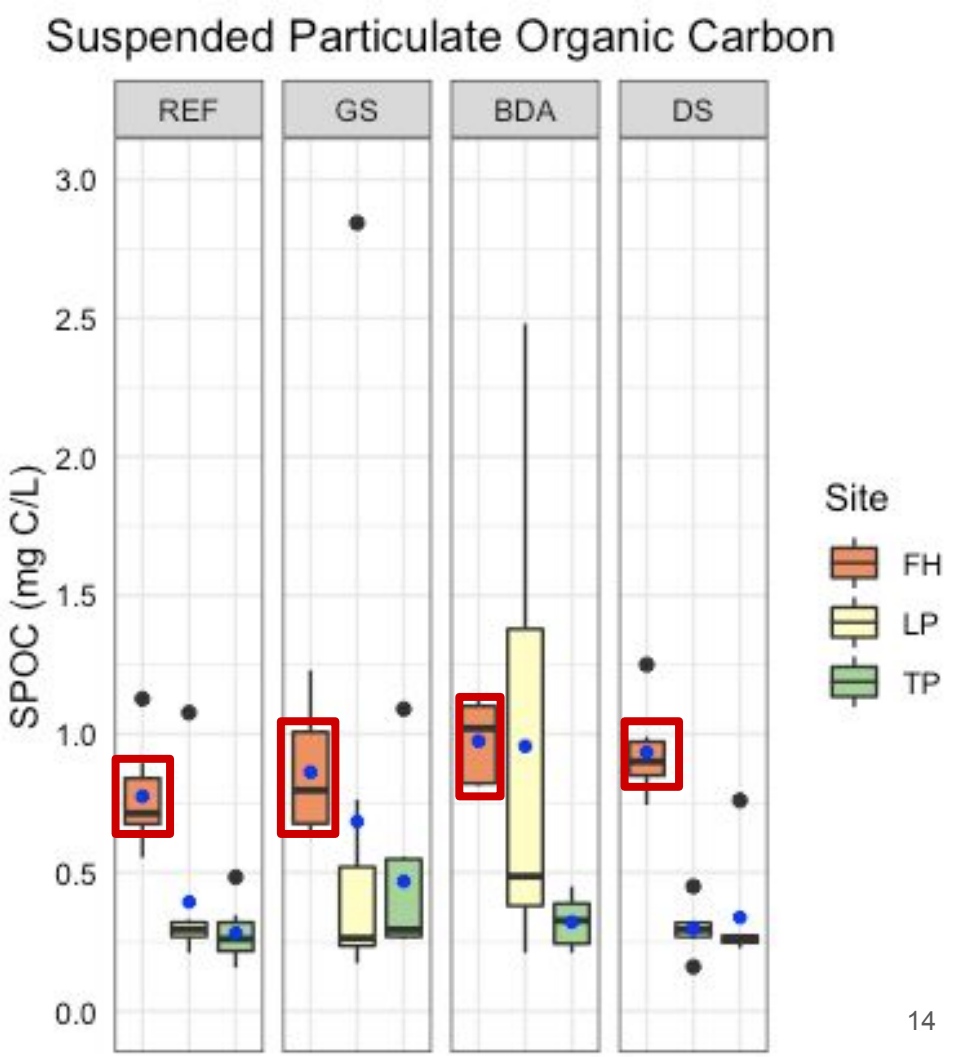
# Q1: Preliminary Results
BPOC

Overall:
- ⇧ BPOC in BDA reach
- ⇩ BPOC in REF reach



# Q1: Preliminary Results
SPOC

Overall:
- ⇧ SPOC from REF to BDA
- ⇩ SPOC in DS reach

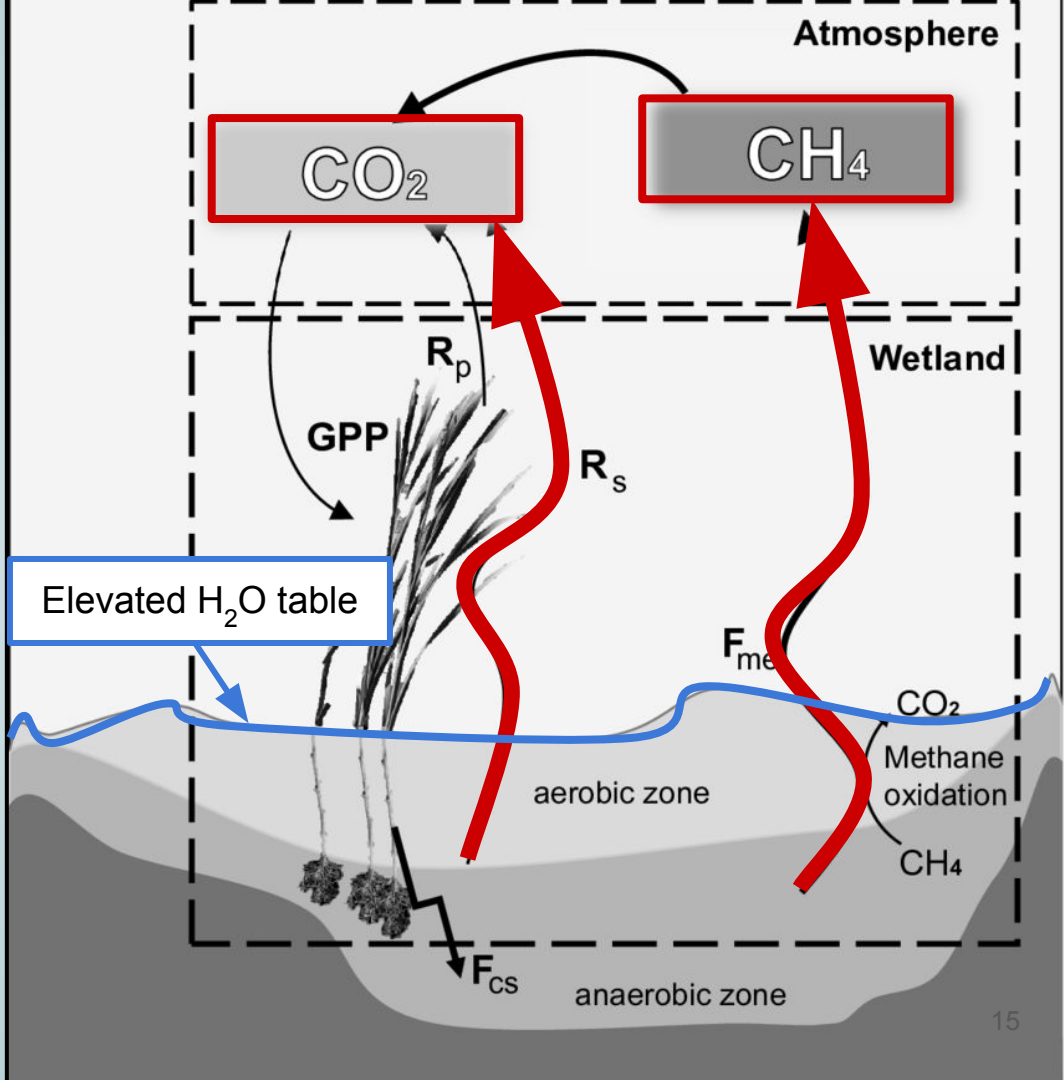


# Q3: Hypotheses

⇧ Greater connectivity & elevated $H_2O$ table = ⇧ soil moisture

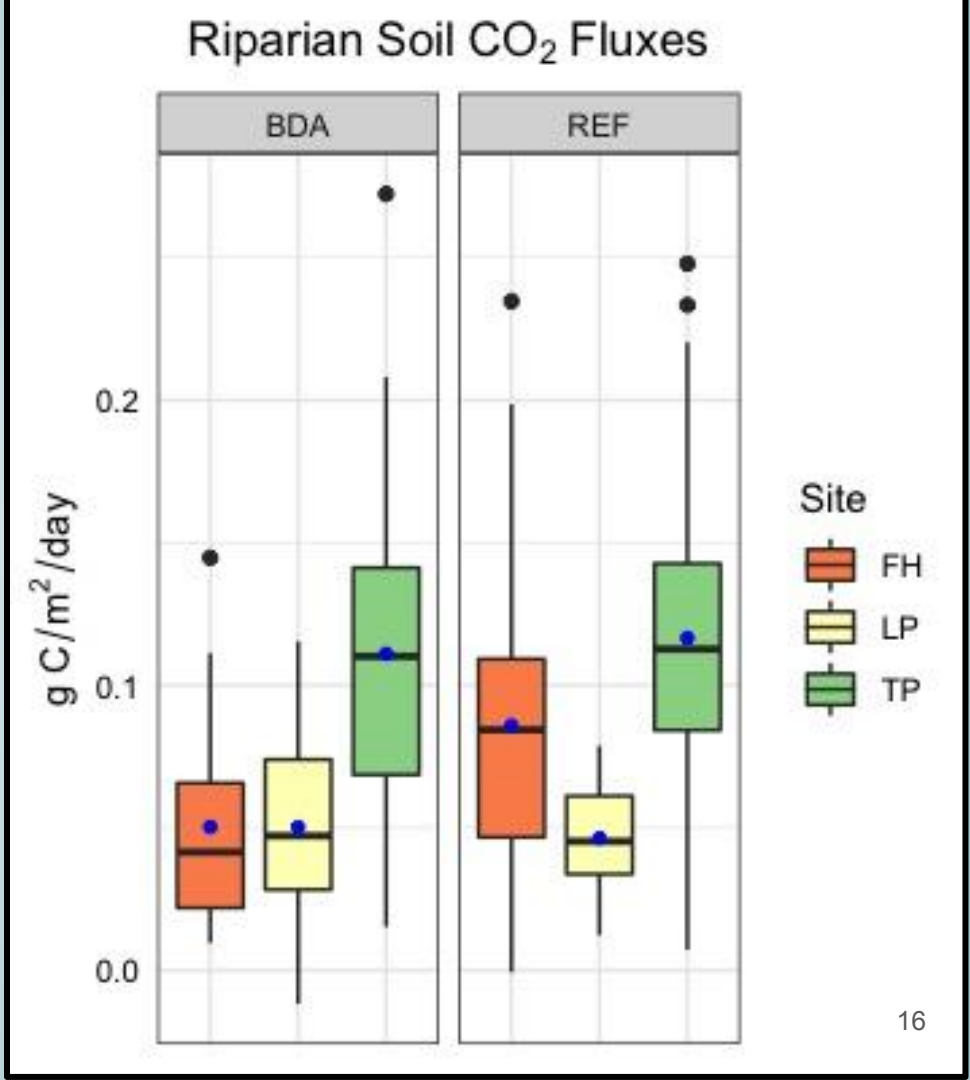
BDA treated reaches: ⇧ $CO_2$ and $CH_4$ fluxes

Reference reaches: ⇩ $CO_2$ and $CH_4$ fluxes



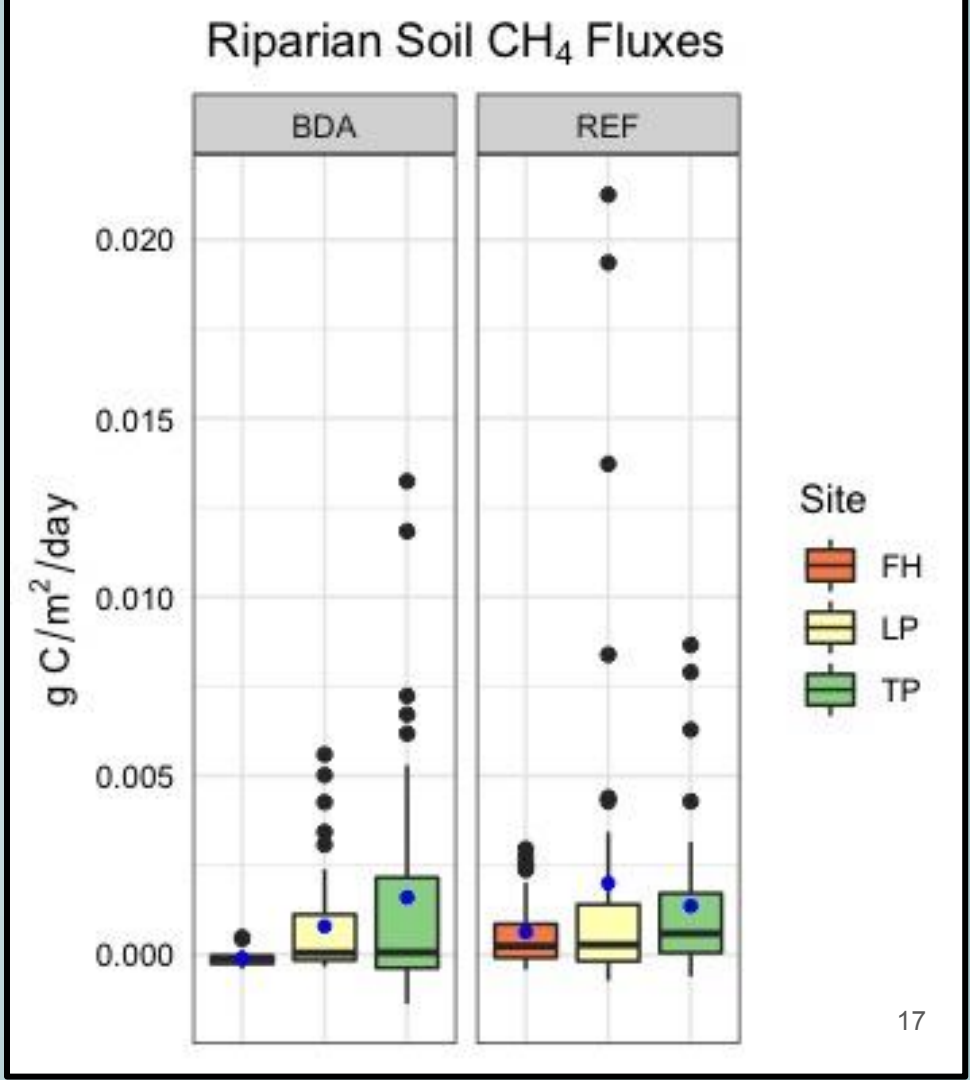
# Q3: Preliminary Results
## $CO_2$ Fluxes

Fish: ⇧ in REF
Lost Prairie: slightly ⇧ in BDA
Teepee: similar between reaches



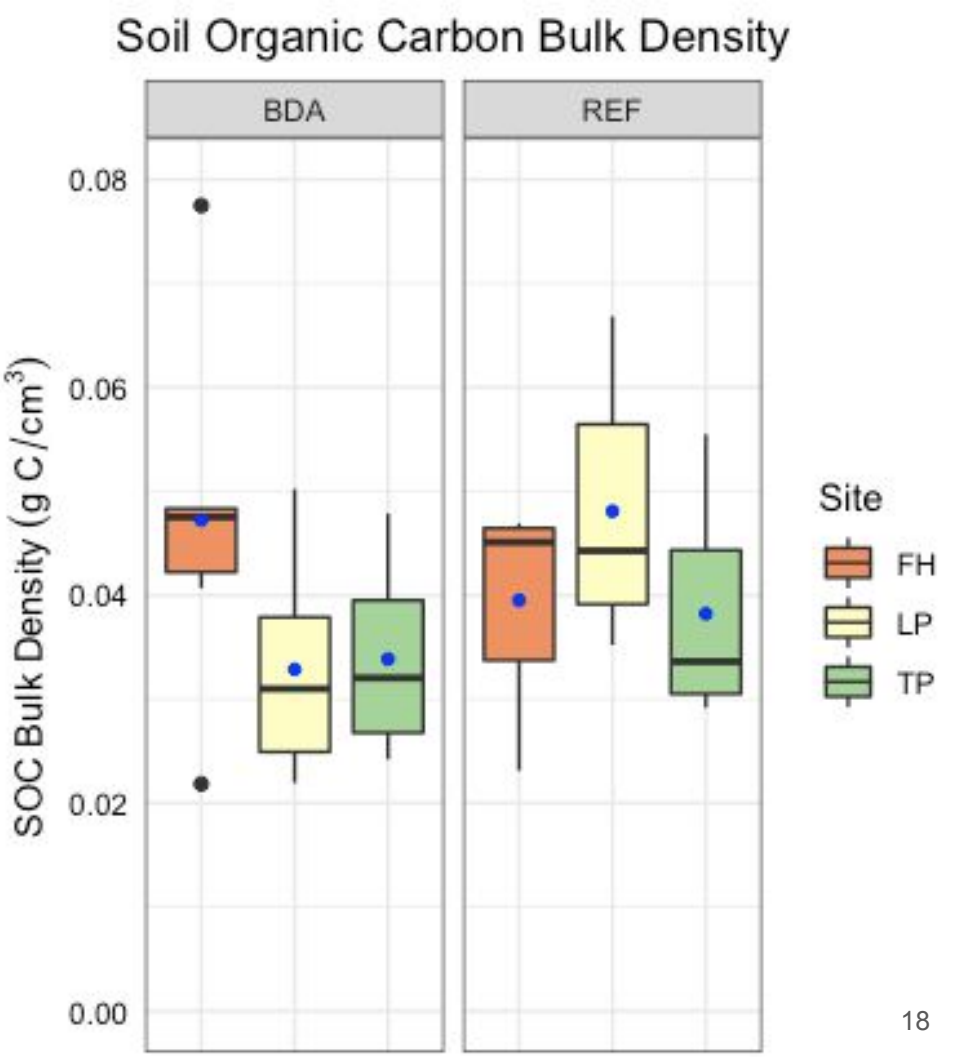
# Q3: Preliminary Results
## $CH_4$ Fluxes

Fish: ⇧ in REF
Lost Prairie: ⇧ in REF
Teepee: ⇧ in BDA



# Q3: Preliminary Results
## SOC Data

Fish: ⇧ in BDA
Lost Prairie: ⇧ in REF
Teepee: ⇧ in REF



# Broader Implications

# Are BDAs Worth a Dam?


Photo courtesy of Okanogan Highlands Alliance