Mountain Meadow Restoration in California: Reconciling Research and Implementation

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U.S. Department of Agriculture
Pacific Southwest Research Station
Science that makes a difference

UCDAVIS CENTER FOR WATERSHED SCIENCES

What are mountain meadows?

Why are meadows important?

- Flood attenuation
- Sediment filtration
- Ground water recharge
- Productivity
- Biodiversity
- Carbon sinks

Status of California's Mountain Meadows

- Historical overuse
  - Livestock grazing
  - Mining
  - Timber harvest
  - Fire suppression
- ~70% degraded

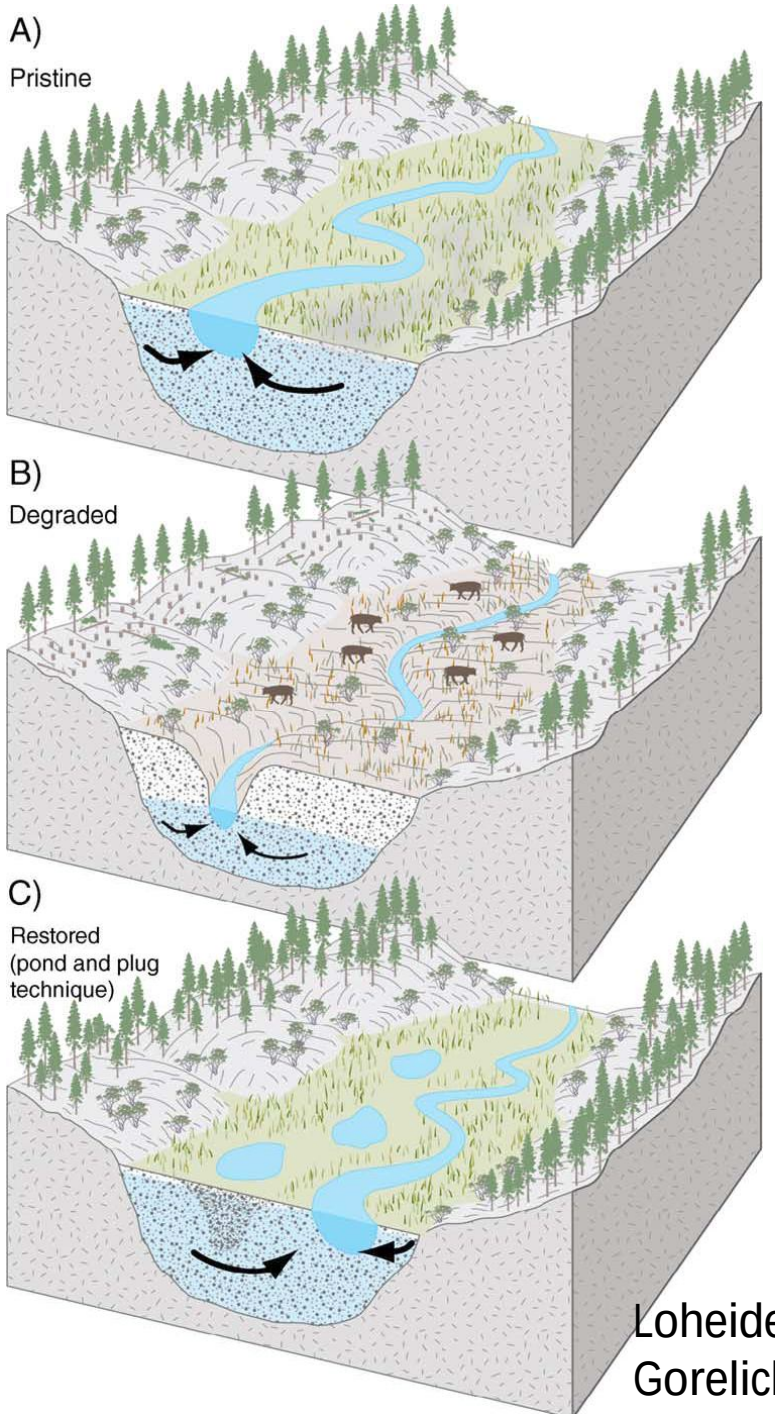
Options

1. Allow the channel to establish a new equilibrium condition
2. Assist the channel in reaching a new equilibrium
3. Restore the hydraulic grade of the system to reestablish the hydrologic connection to the historic floodplain

Restoration Methods

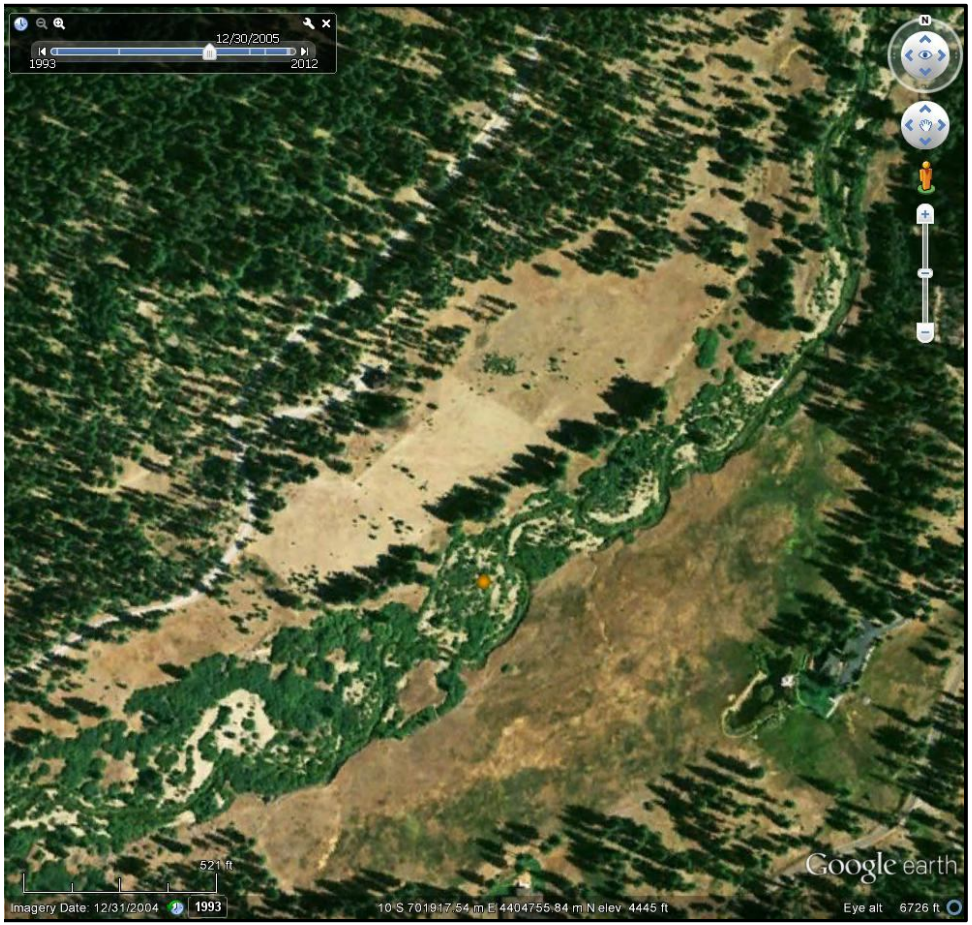
Pond-and-Plug

- Excavate and fill incised channel
- Redirect water to channels on historic floodplain
- Results in:
  - Raised water table
  - Reconnected floodplain
  - Series of ponds and dams

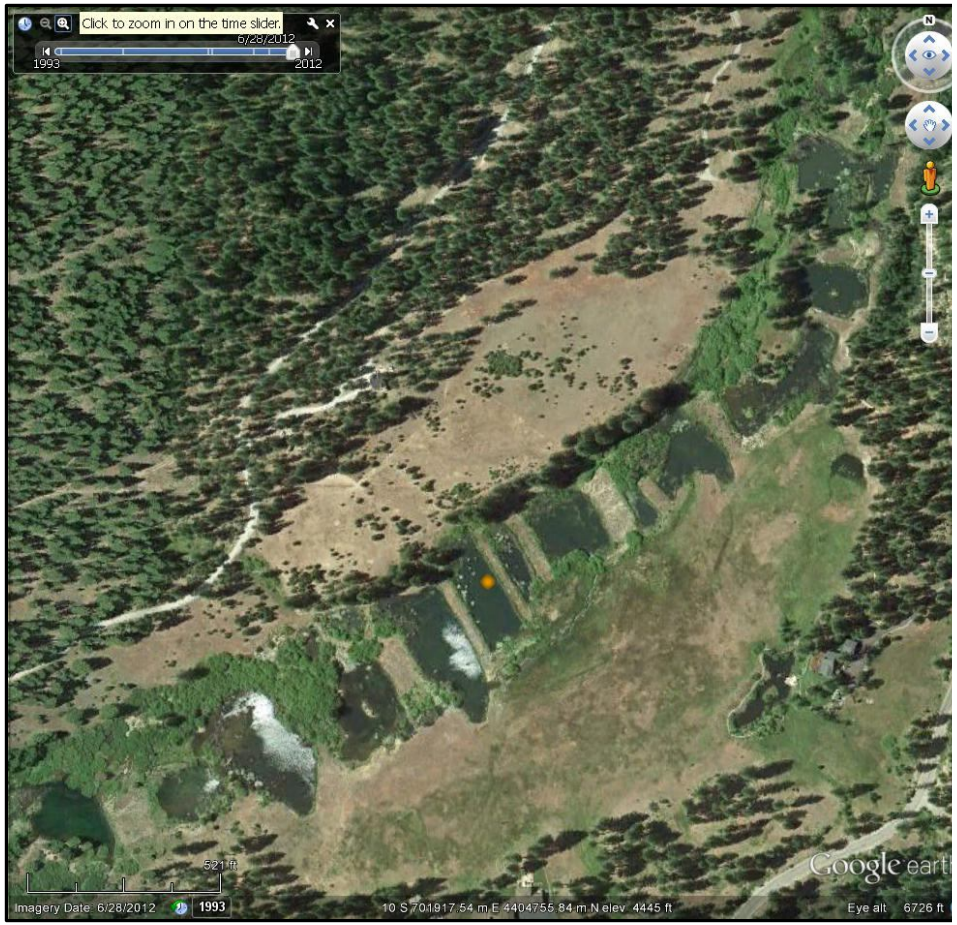


Loheide & Gorelick 2005

Smith Creek



2005



2012

Success Stories

- Sediment depletion
- Absence of flooding
- Low groundwater storage
- Xeric plant community

- Sediment storage
- Frequent flooding
- High groundwater storage
- Mesic plant community

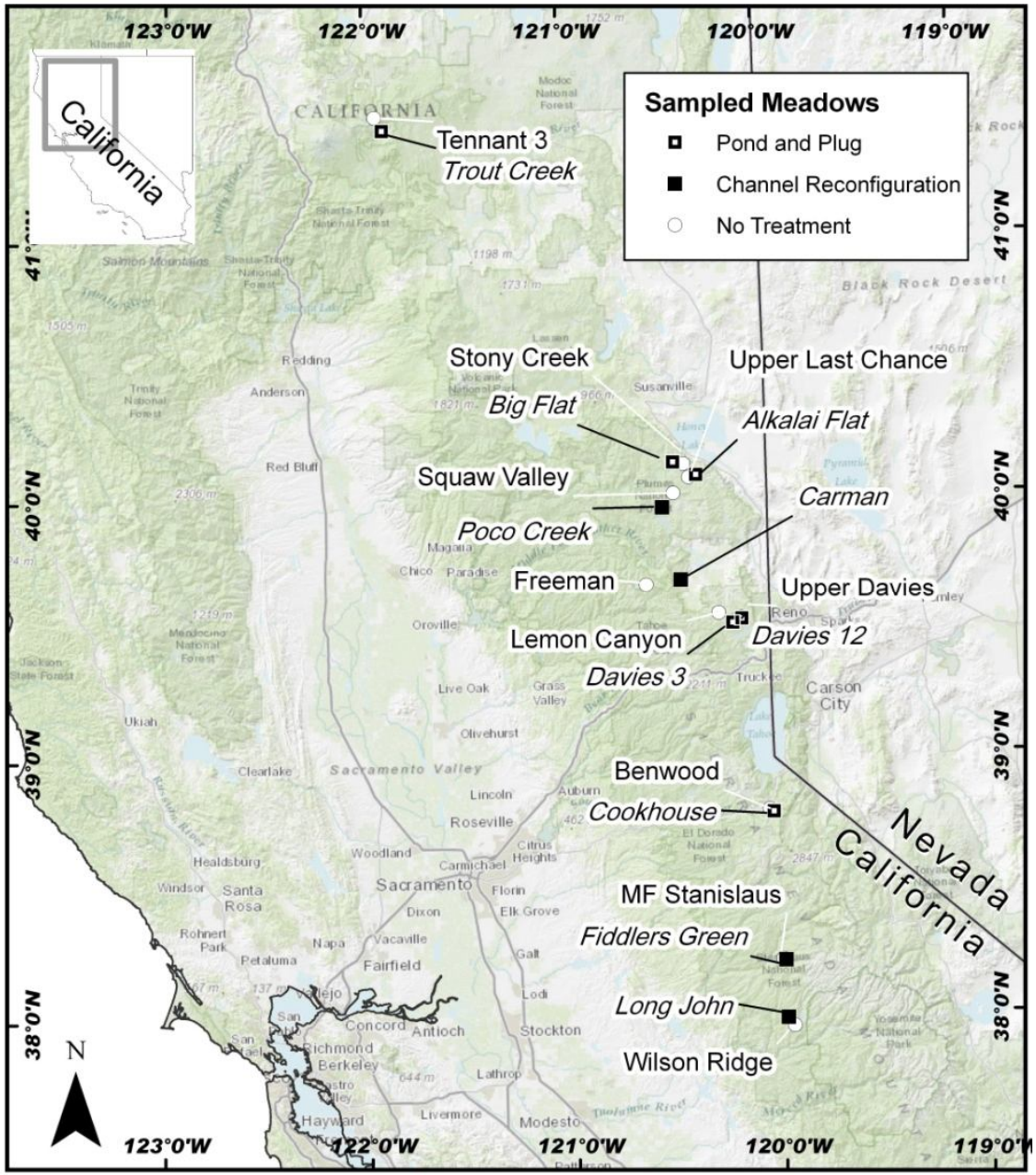
*www.**feather-river-crm**.org/*

Published Studies

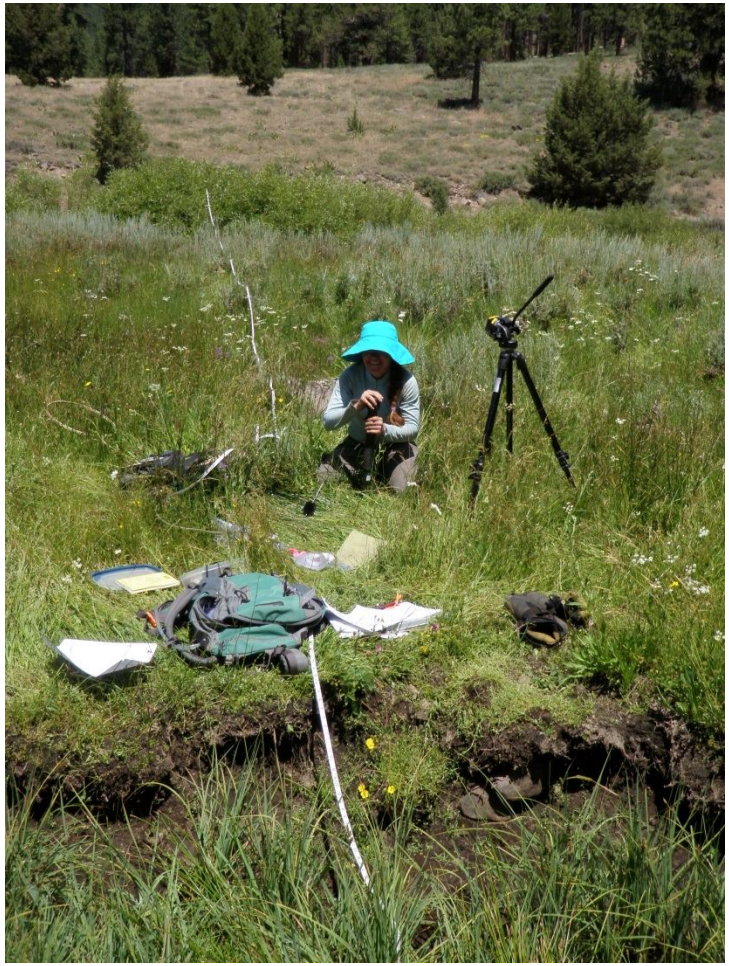
- Few but positive
- Hydrologic
  - raised water table
  - increased duration of inundation
  - decreased magnitude of flood peaks
- Focused on few, well-funded projects
  - 3 of 4 studies were from the same watershed
- Difficult to determine realistic expectations of outcomes

Study Design

- Randomly selected 10 restored meadows
- Paired with unrestored
  - Nearby
  - Similar size
  - Similar elevation
  - Similar management histories

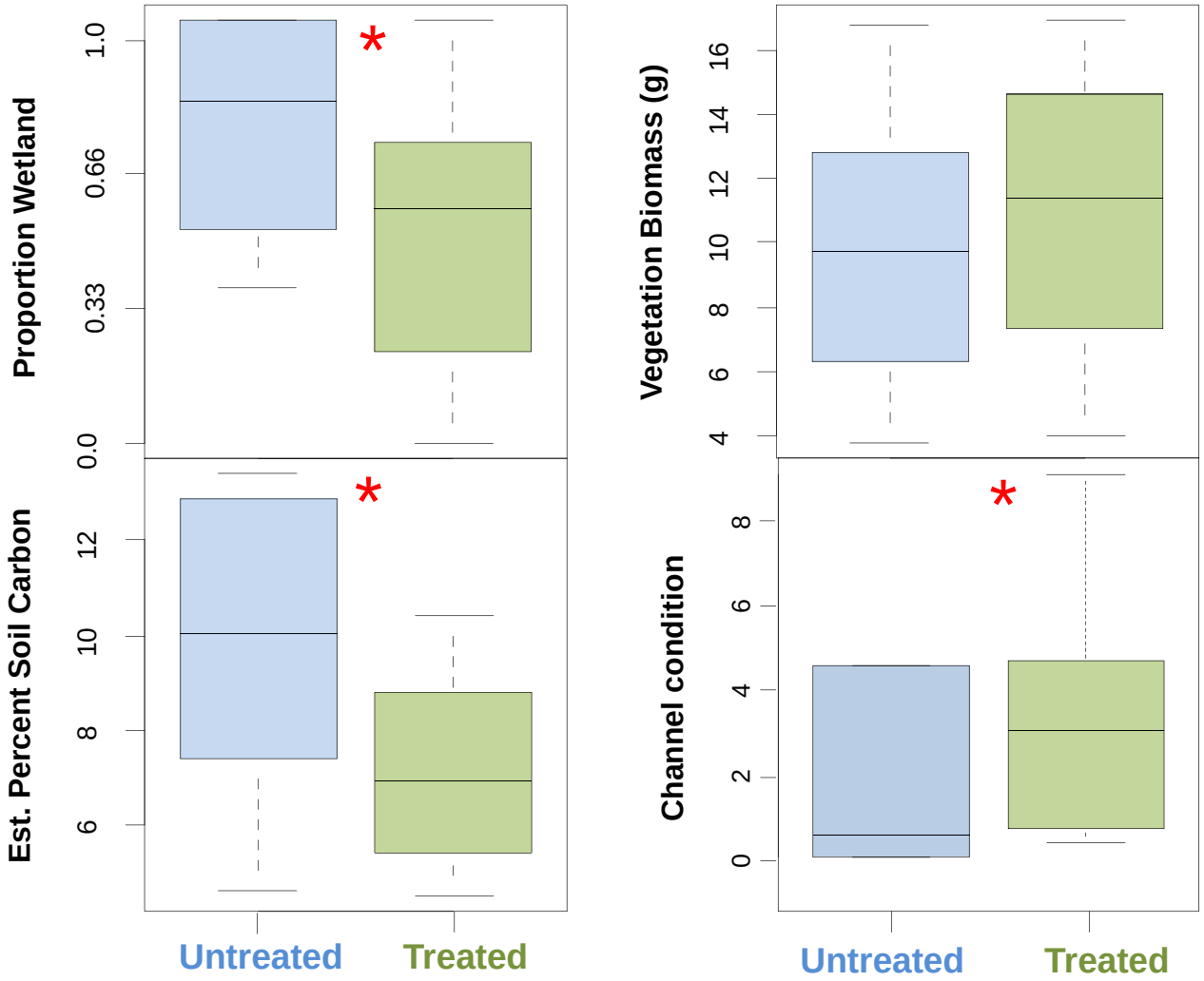


Biomass, Cover, Wetland Status and Soil Carbon



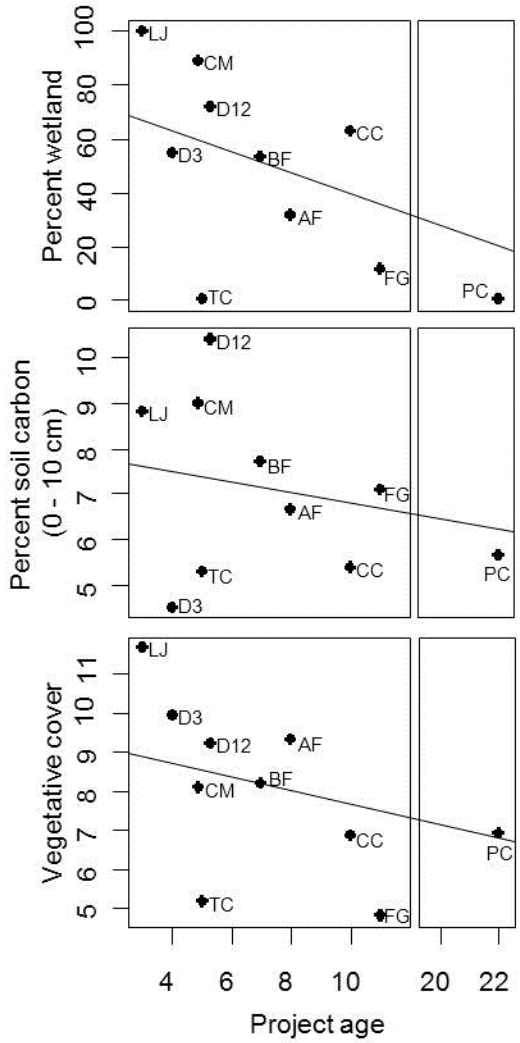
Channel condition

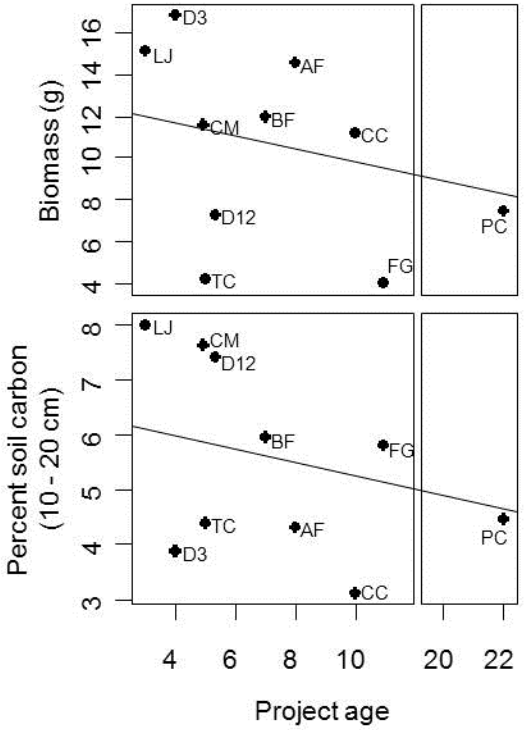
Results

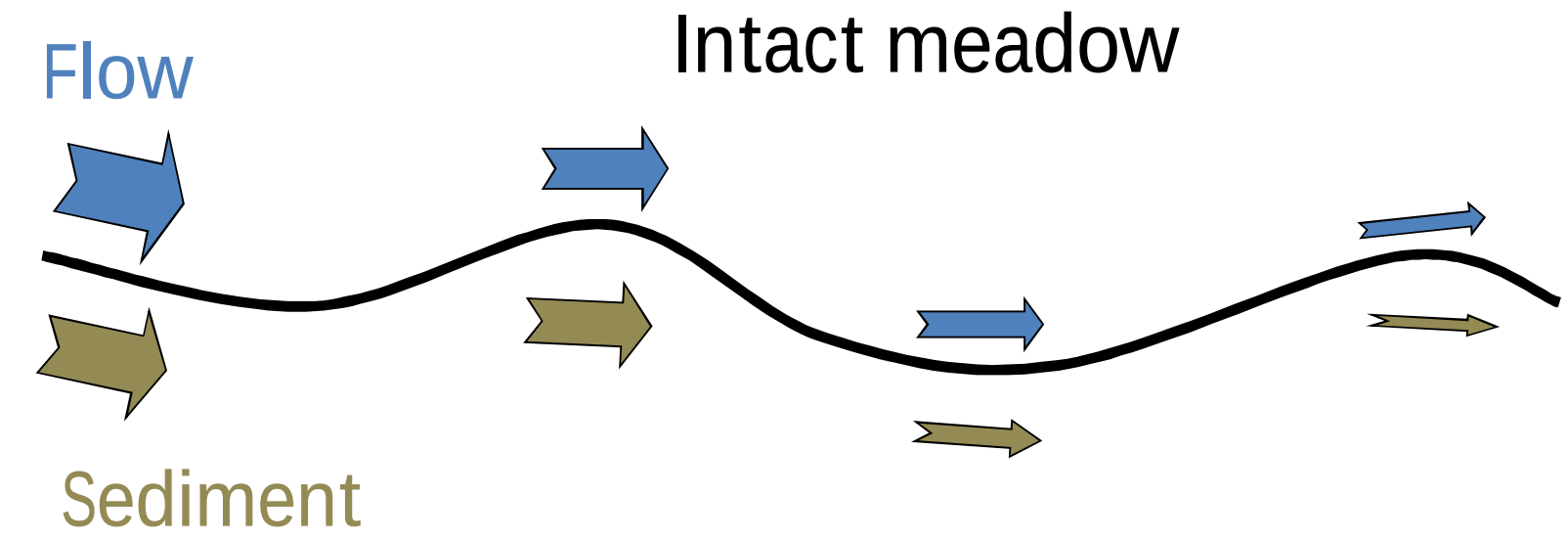

Proportion Wetland
0.0
0.33
0.66
1.0
*
Est. Percent Soil Carbon
6
8
10
12
*
Untreated
Treated
Vegetation Biomass (g)
4
6
8
10
12
14
16
Channel condition
0
2
4
6
8
*
Untreated
Treated

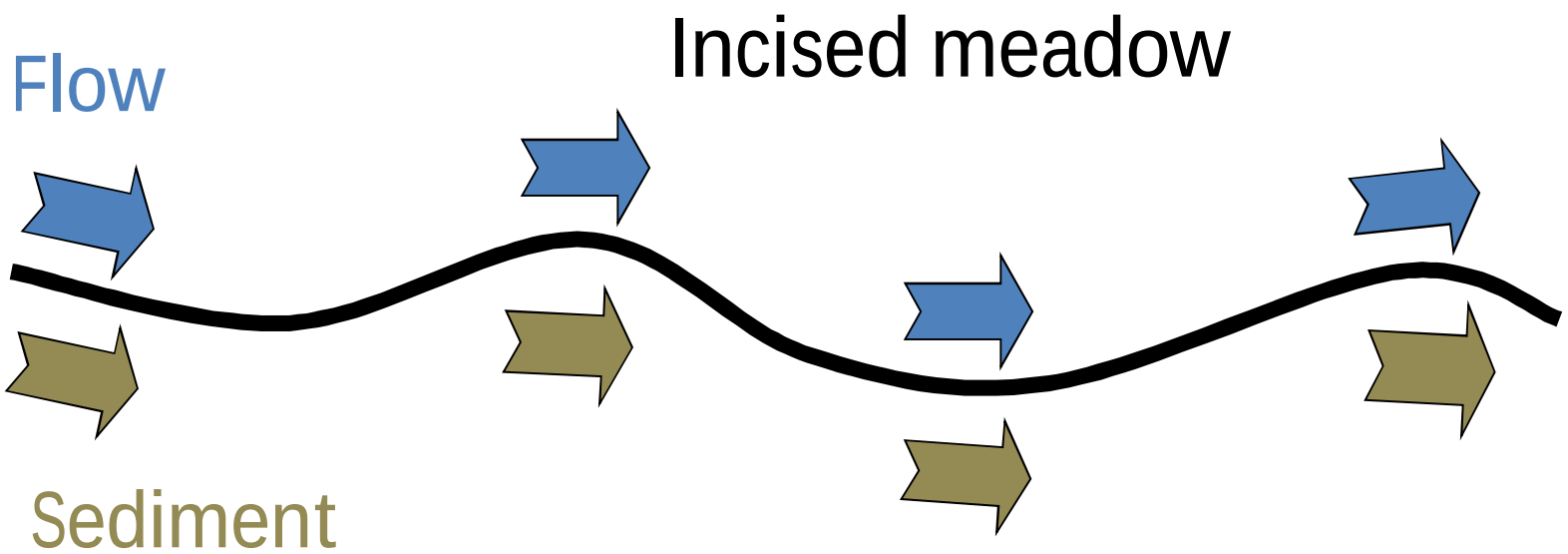
Why?

- Not comparable
- Not enough time
- Not always so successful

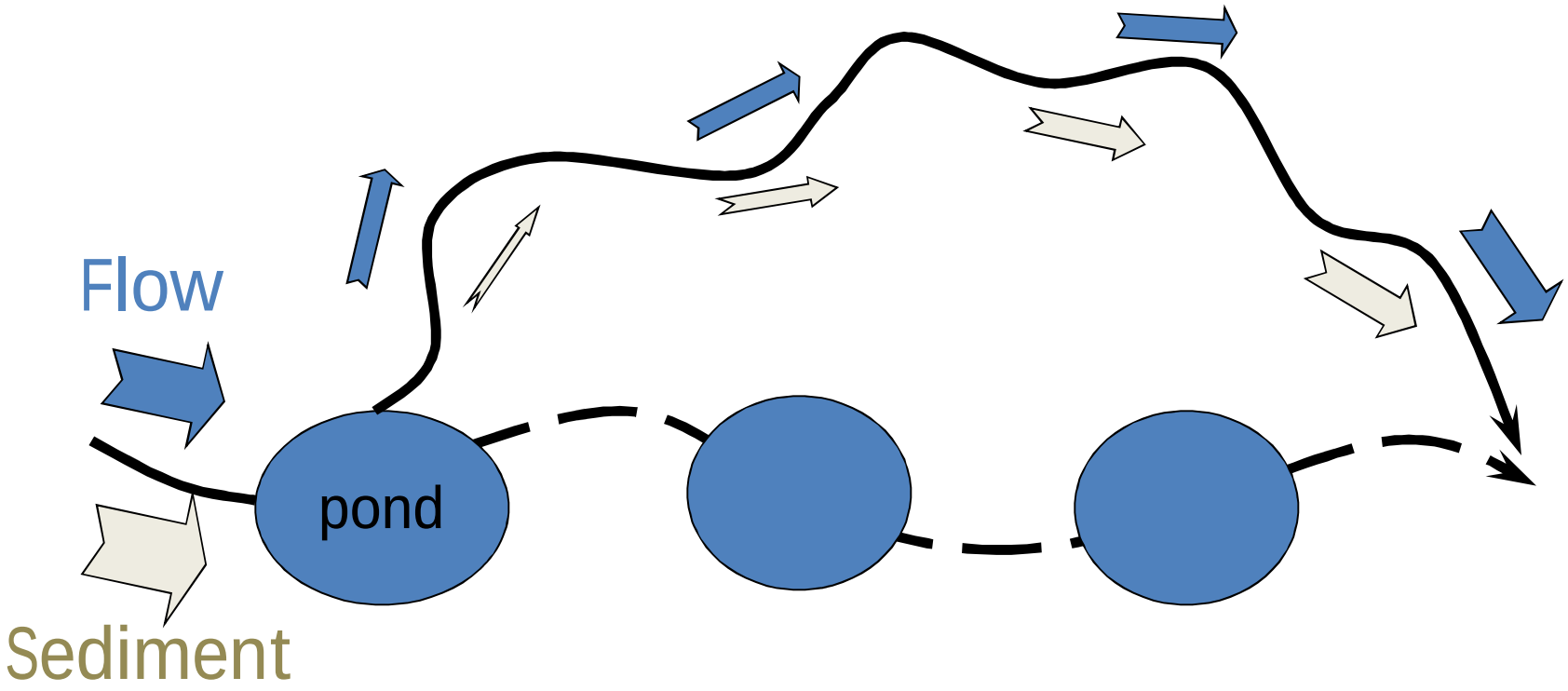




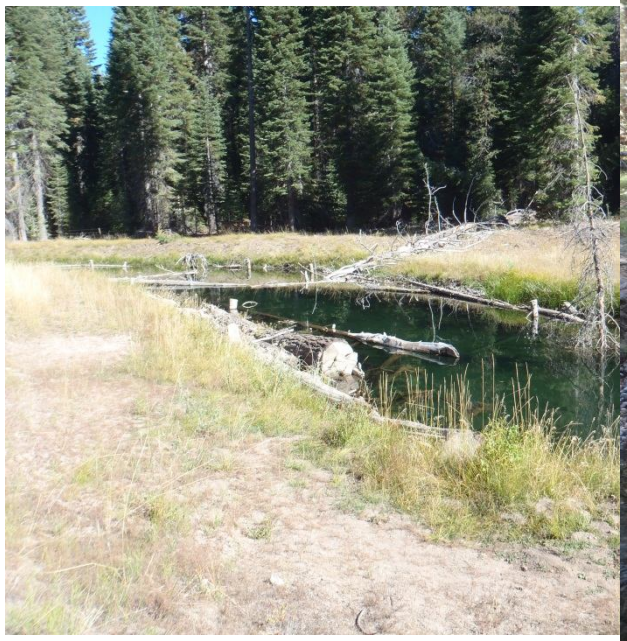

Intact meadow
Flow
Sediment


Incised meadow
Flow
Sediment

Post-treatment meadow



e.g., Trout Creek, Shasta-Trinity National Forest



Red Clover – McReynolds

2005

2012


Carman-Kuthson


Nevada
California

Meadow Restoration in CA

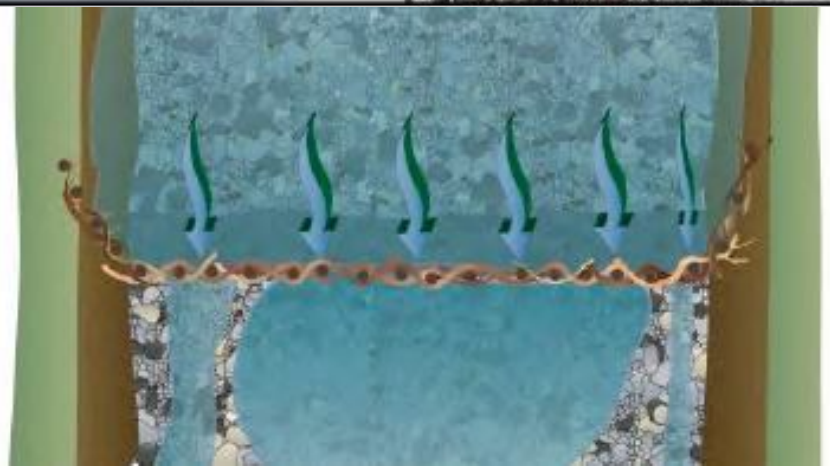
- Ramped up in the past decade
- Prop 1 funds likely to increase rate even more
- Many projects involve fairly intensive land alteration
- Monitoring is focused on documenting success
- Minimal research is focused on post-project processes
- Difficult for research to keep pace with implementation
- El Niño test case?

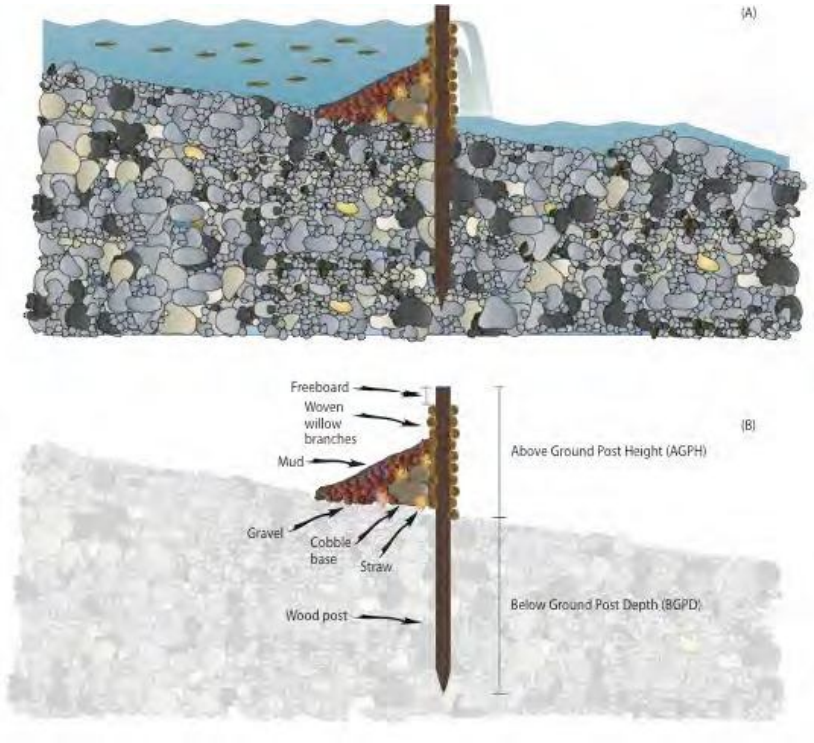
A Demonstration of the Carbon Sequestration and Biodiversity Benefits of Beaver and Beaver Dam Analogue Restoration Techniques

Childs Meadow, Tehama County CA

UC Davis Center for Watershed Sciences, The Nature Conservancy, PSW, Point Blue

Beaver Dam Analogues (BDAs)



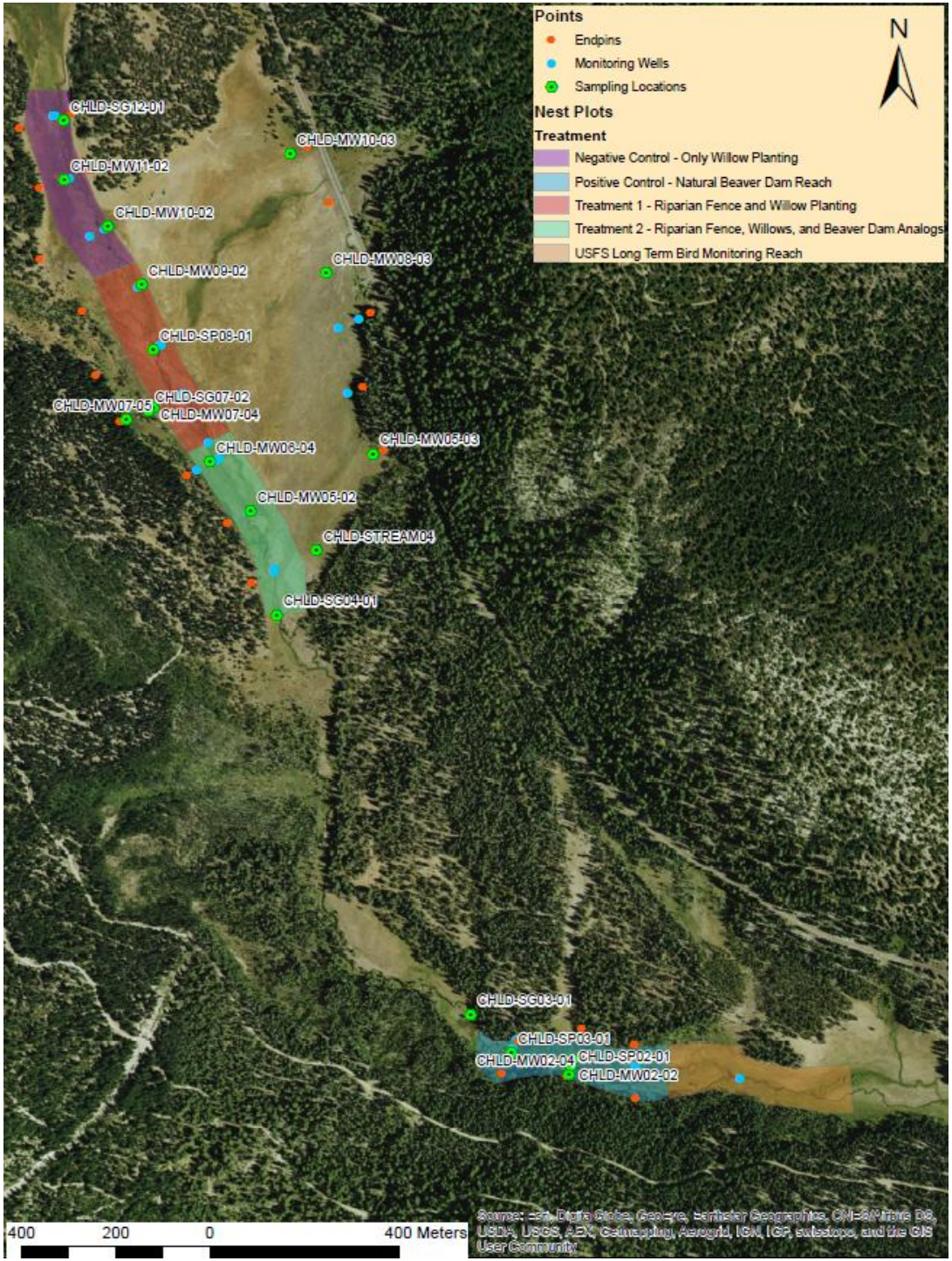


Pollock, M.M., G. Lewallen, K. Woodruff, C.E. Jordan and J.M. Castro (Editors) 2015. The Beaver Restoration Guidebook: Working with Beaver to Restore Streams, Wetlands, and Floodplains.

Childs Meadow

Study Design

- BACI
  - 2 treatments
  - 2 controls
- Above and below-ground Carbon
- Hydrogeomorphic conditions
- Response of targeted wildlife spp.
  - Willow flycatcher
  - Cascades frog




Yuba Headwaters Meadow Restoration – *Rachel Hutchinson, South Yuba River Citizens League*
Green Acres: A Collaborative Vision for Meadow Recovery in California – *Rene Henery, Trout Unlimited*
Researching and Repairing Legacy Grazing Impacts in Sierra Nevada Wetlands – *Evan Wolf, UC Davis*