Chewaucan River - *Michael McCullough*

Silvies River – *Patty Arnold*

Upper Whitehorse Creek – *Jason Dunham*

Donner und Blitzen River - *BLM Oregon*

Belgium - *Poesen et al. 2005*

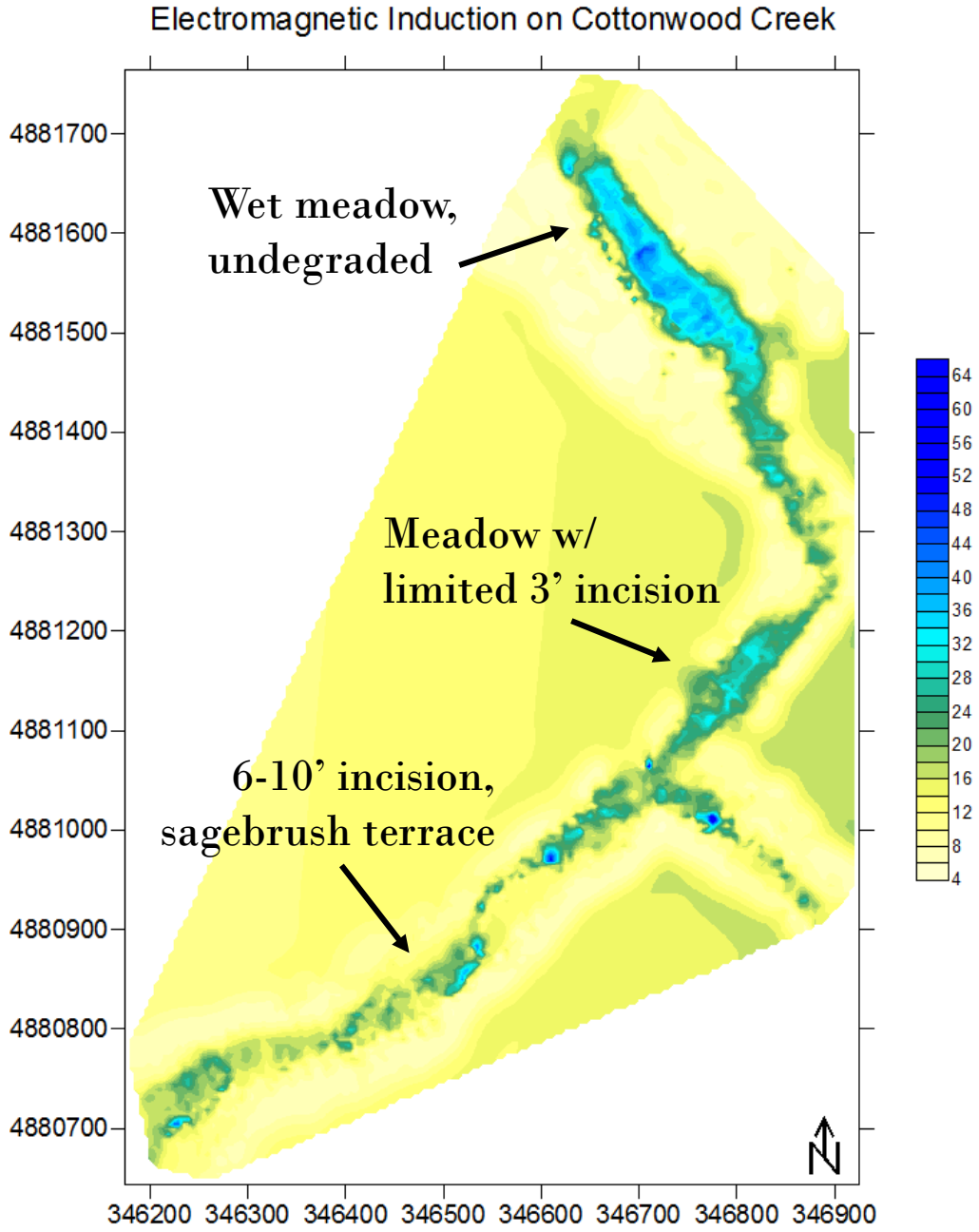
Israel - *Avni 2005*

Senegal - *Poesen et al. 2005*

Romania - *Ionita et al. 2015*

China - *Valentin et al. 2005*

Channel incision causes floodplains to dry



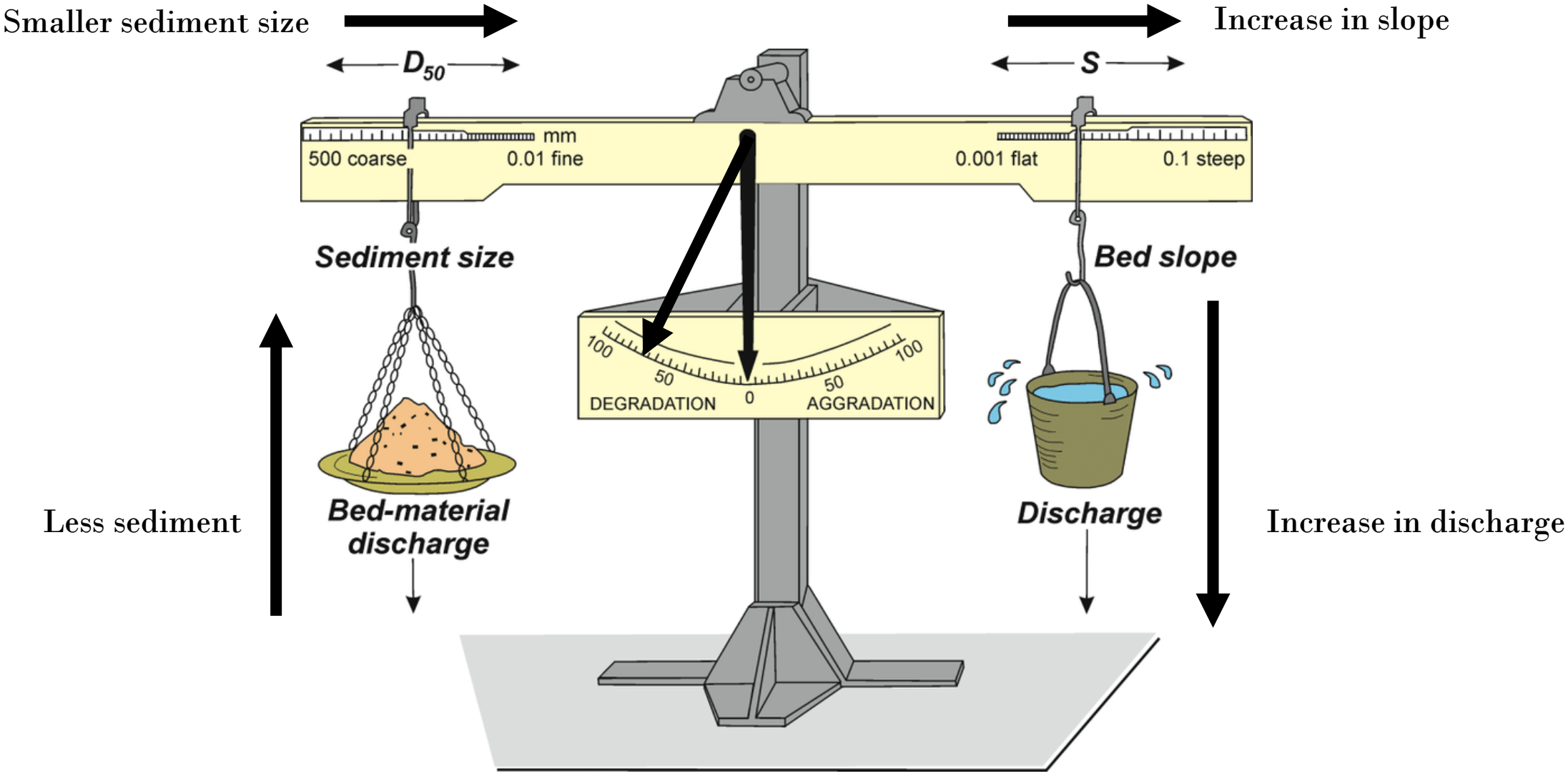
Nash et al., in prep.

Painted Hills –*Lee Rentz*

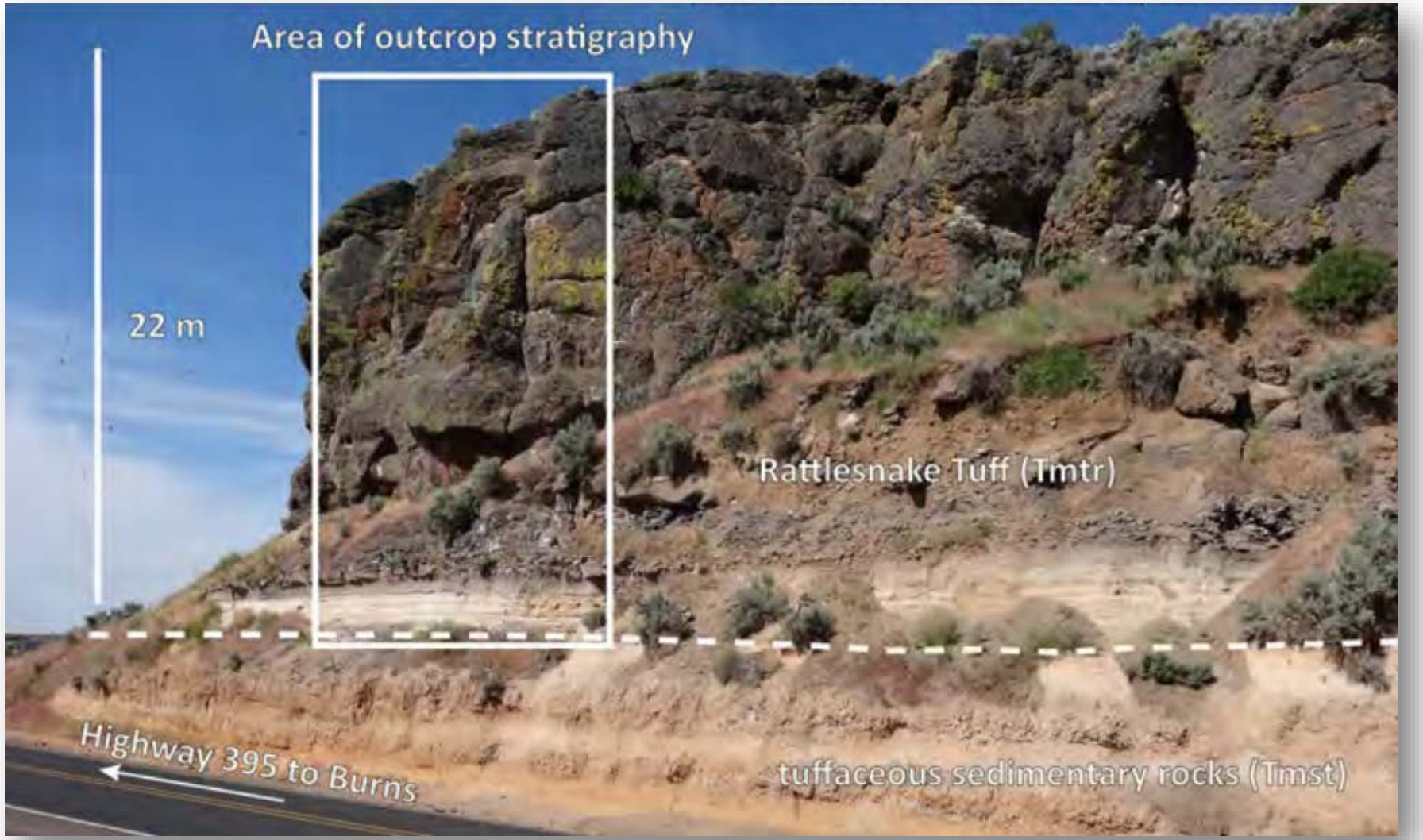
Owyhee River Canyon - *Wet Planet Whitewater*

Prairie Dog Creek, Montana

Borland (and Lane's) Balance – what can cause a channel to erode?

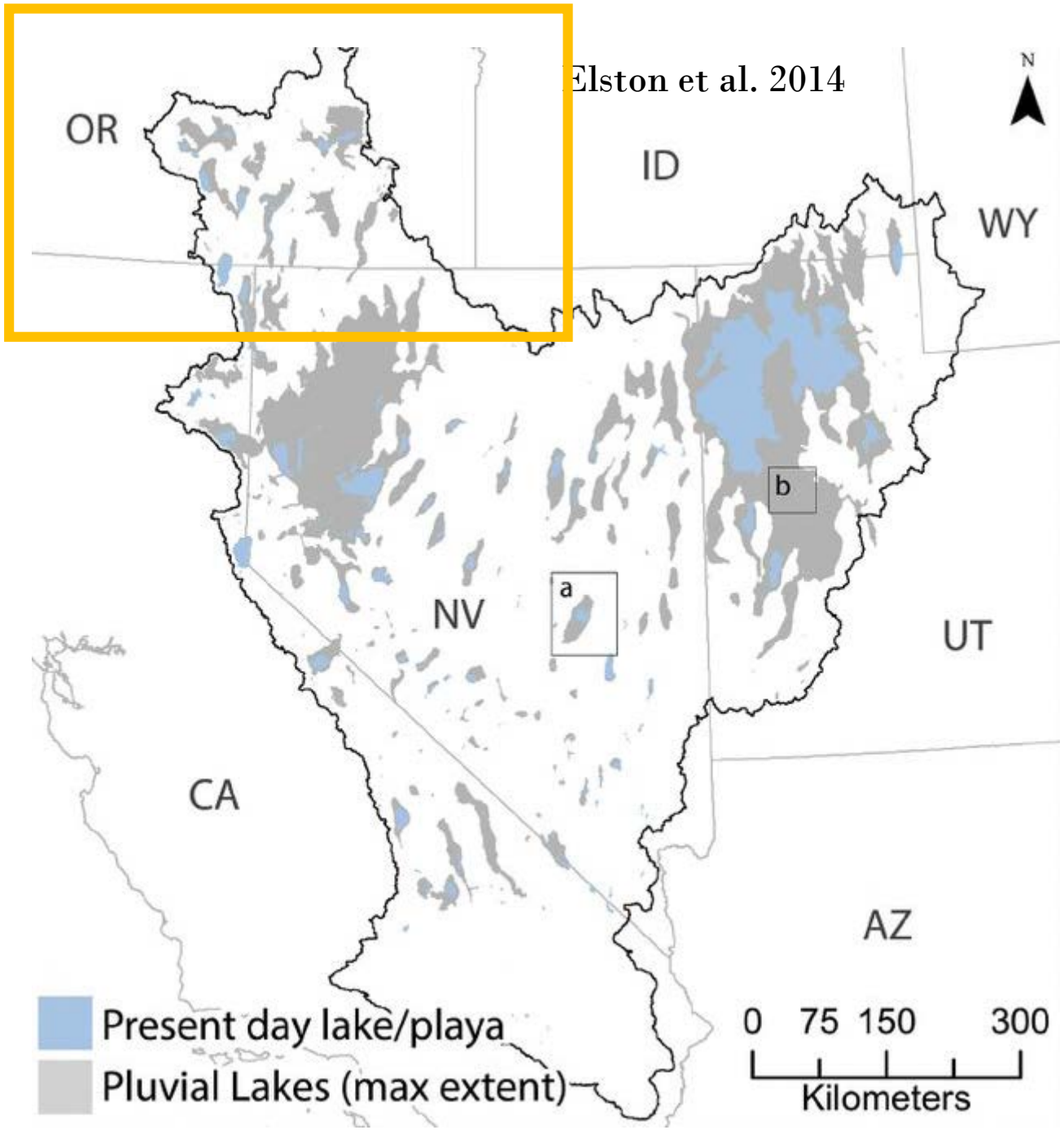


"The portion of the Great Basin in south-central Oregon compris[ing] the country west of Harney and Malheur lakes and north of Warner, Abert, Summer and Silver lakes….is practically without surface streams owing to the small precipitation, the porous character of the soil, and the fissured condition of the underlying lava sheets."
- I.C. Russell, 1905. P 17.



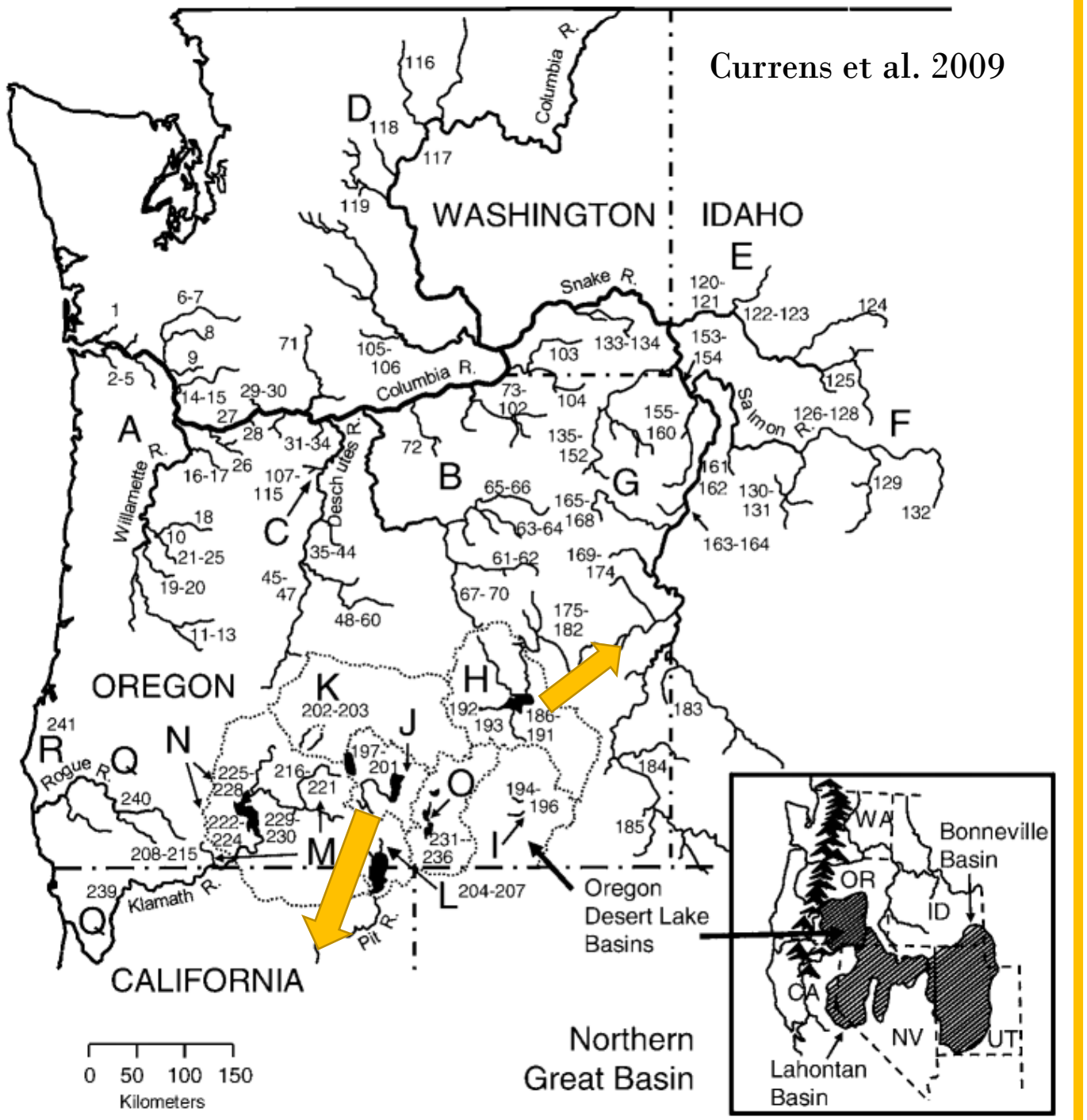
McClaughry et al. 2019

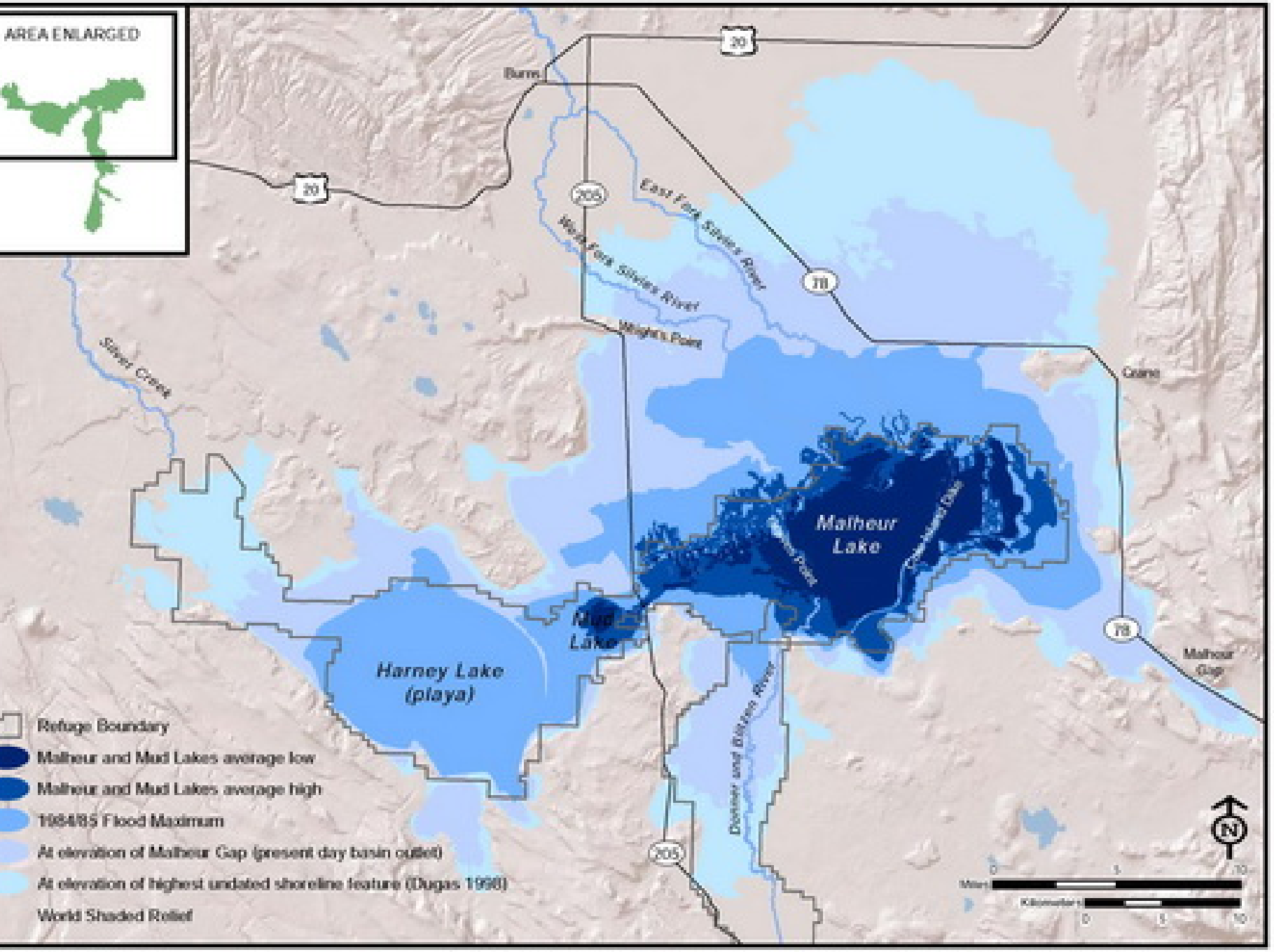
Elston et al. 2014



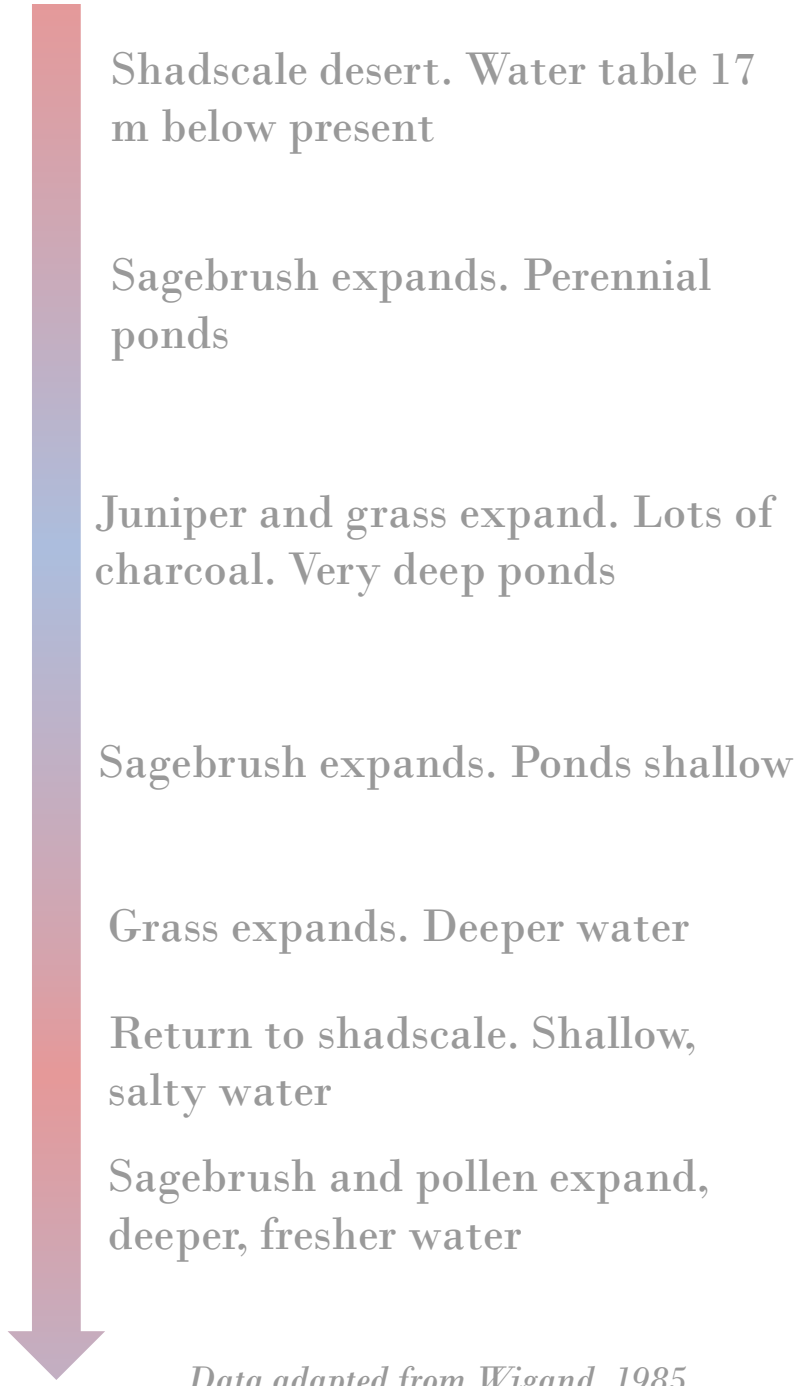
Elston et al. 2014

Currens et al. 2009





Map courtesy U.S. Fish and Wildlife Service



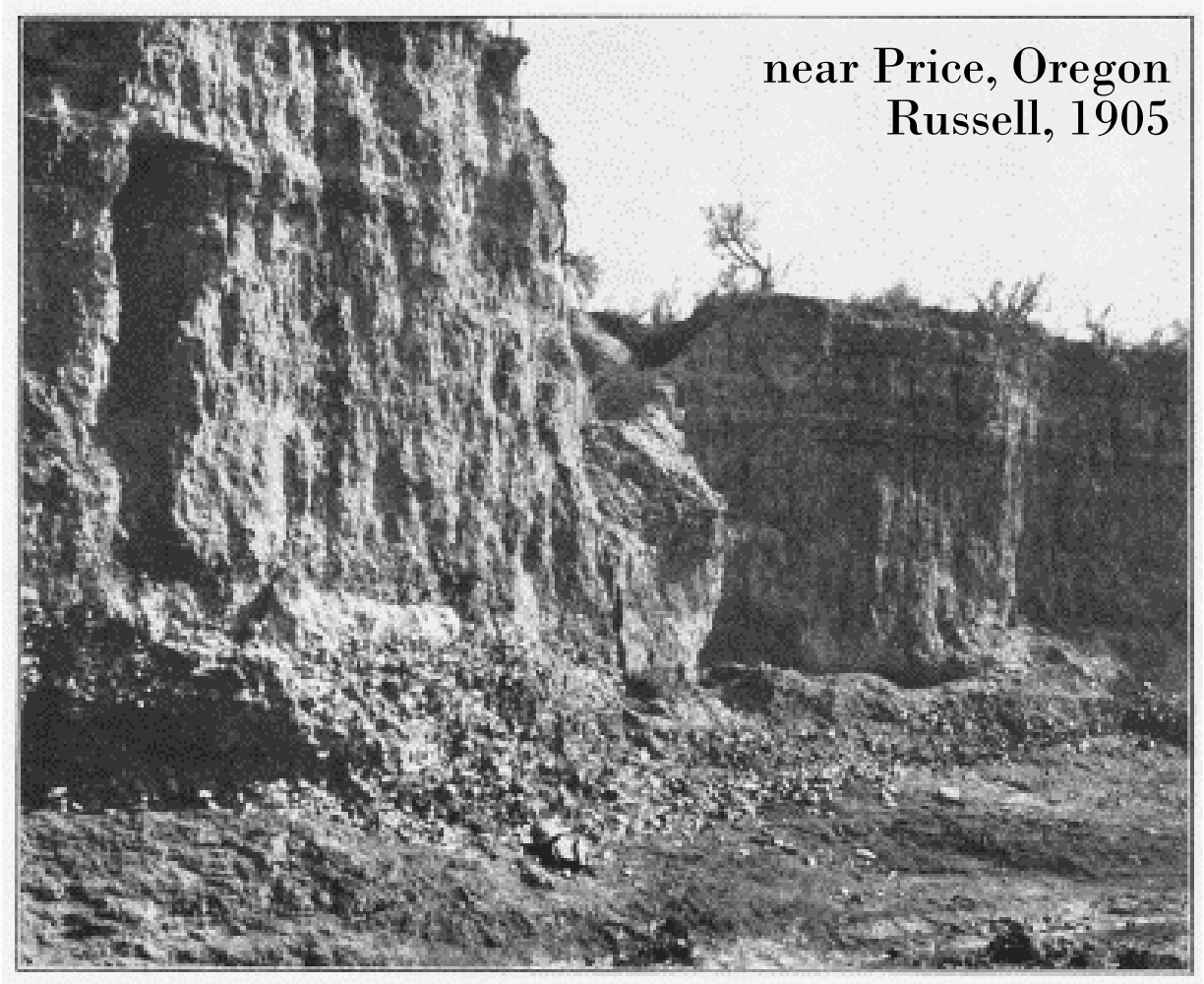
Data adapted from Wigand, 1985

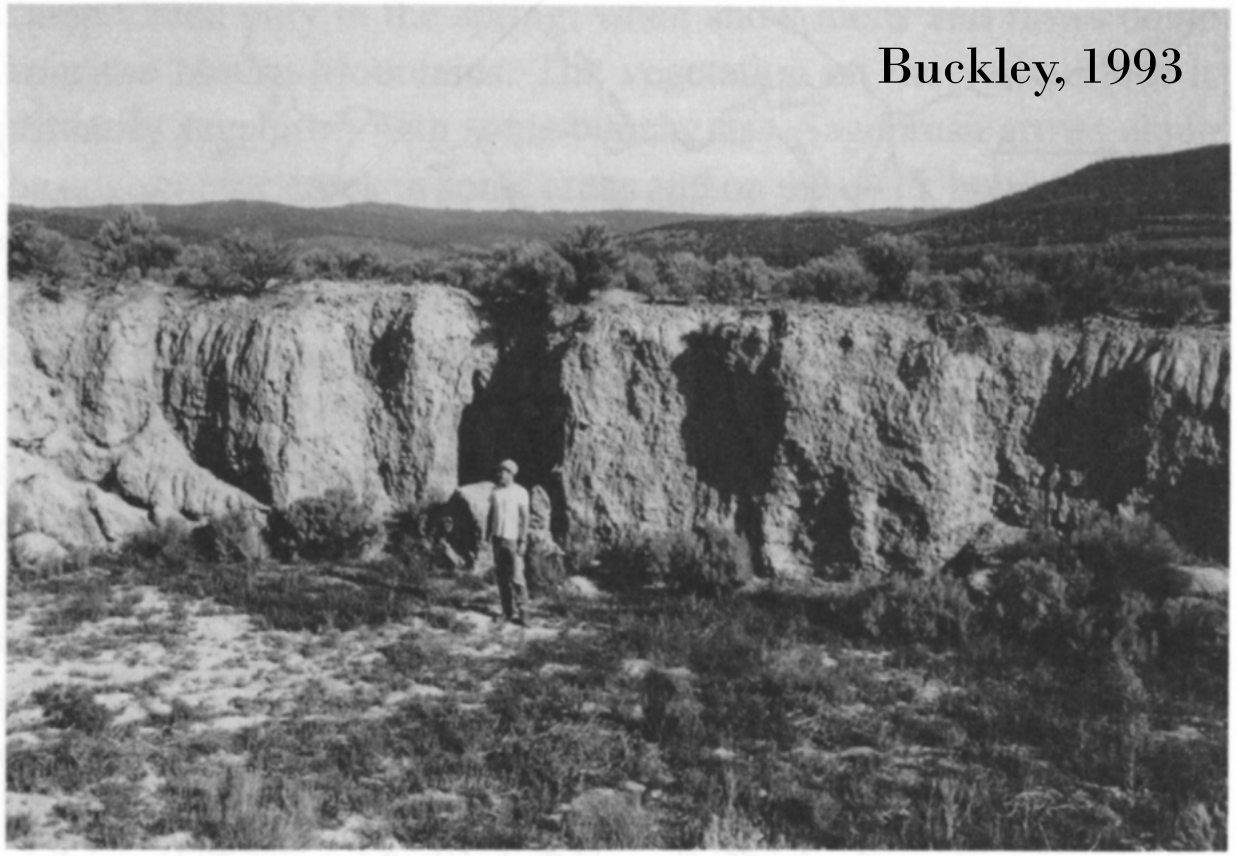
"…a beautiful level valley, covered with a luxuriant growth of bunch grass, wild pea vines, and red clover, interspersed with fields of camas on a rich soil abundantly watered by numerous mountain streams…"

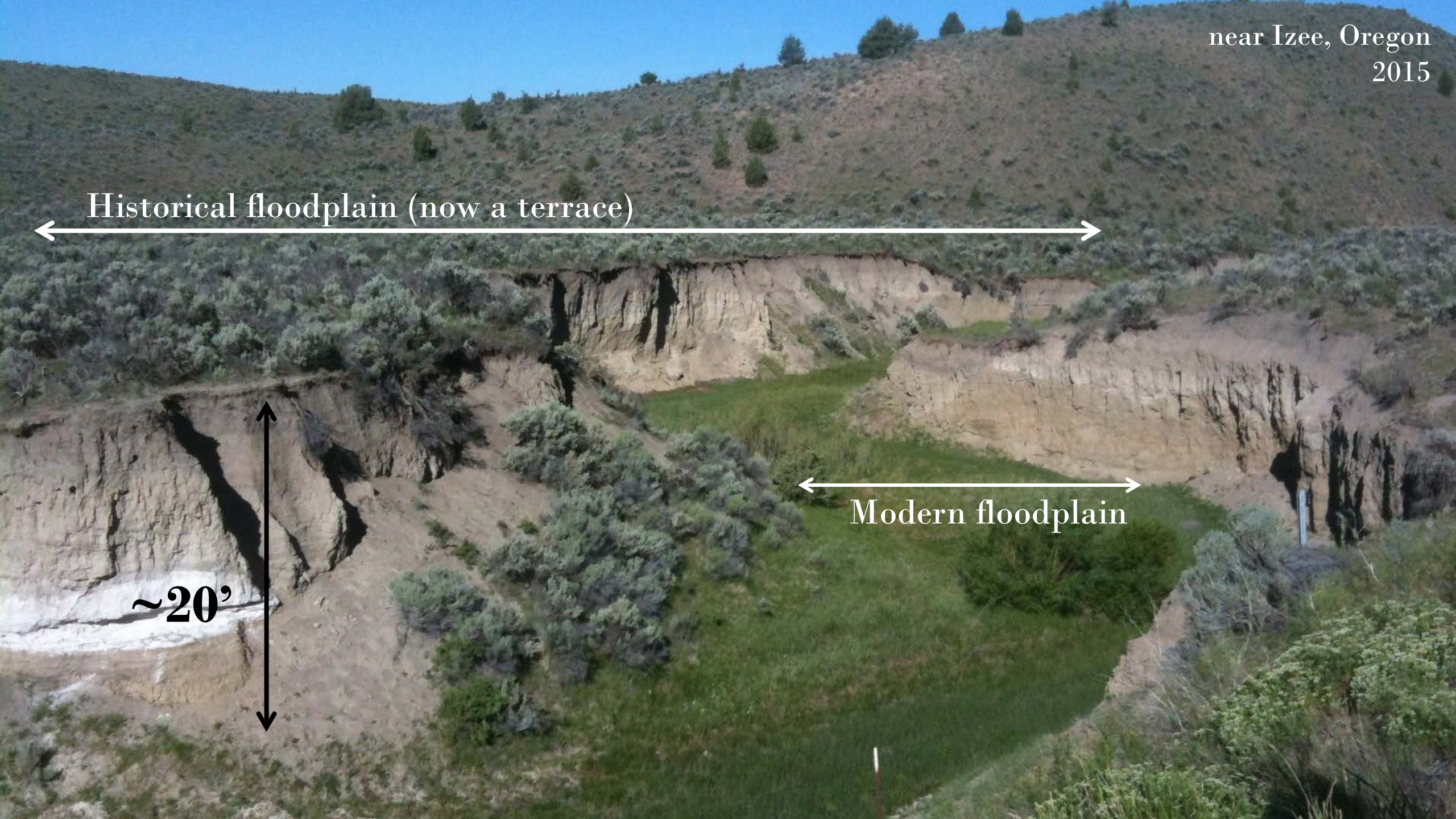
*- Lieutenant Joseph Dixon, describing the Harney Basin north of Malheur Lake in **1859***

"There were so few beavers left, after a decade of remorseless trapping, that no new dams had been built, and the old ones were letting go; wherever this happened, ponds full of fish and wildfowl degenerated into dry, crack-bottomed creeks. Last summer's overstocking, together with desperate foraging during the blizzards, had eroded the rich carpet of grass that once held the soil in place. What had once been a teeming natural paradise, loud with snorts and splashing and drumming hooves, was now a waste of naked hills and silent ravines."

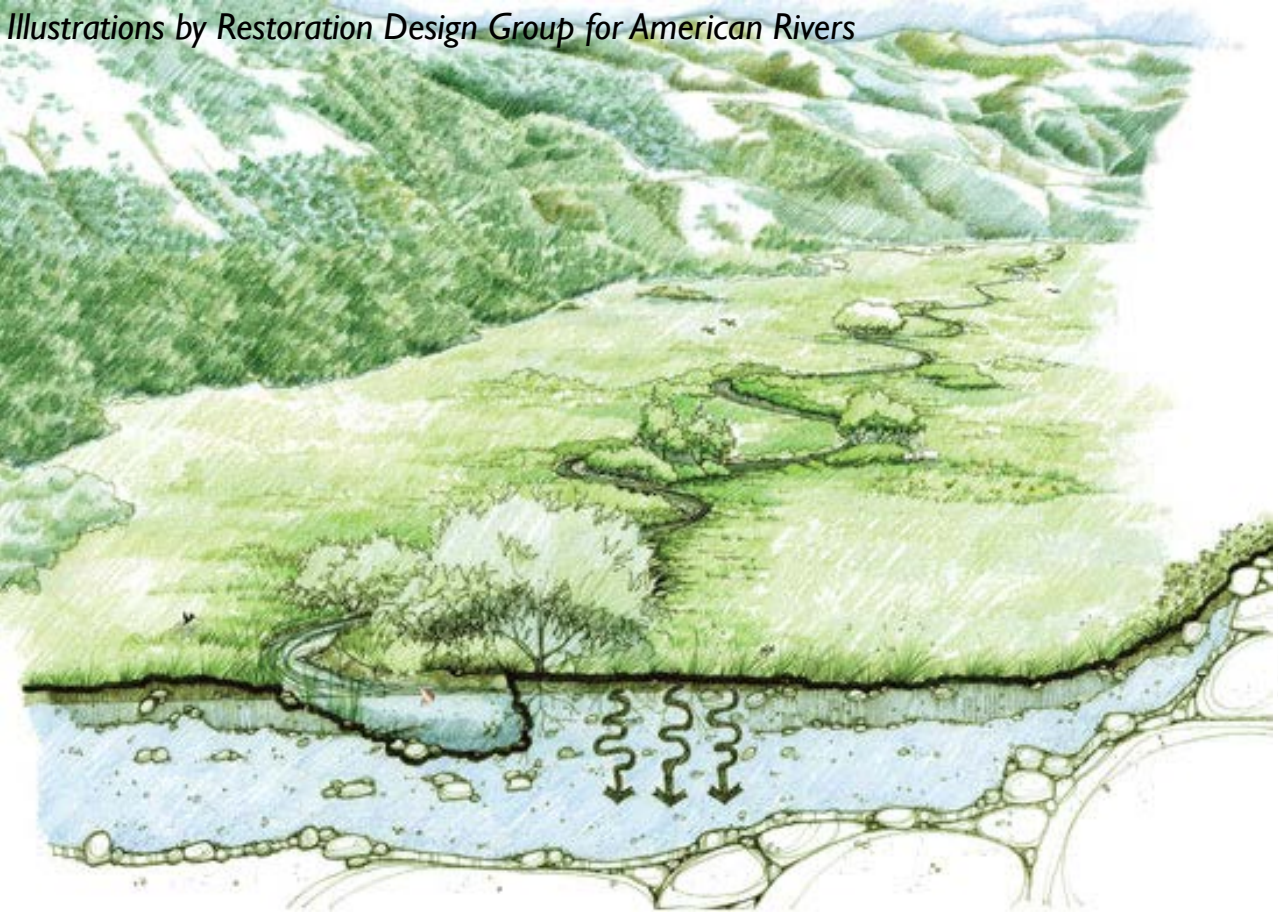
*– Letter from Theodore Roosevelt, describing the South Dakota Badlands in **1887***


near Price, Oregon
Russell, 1905


Buckley, 1993

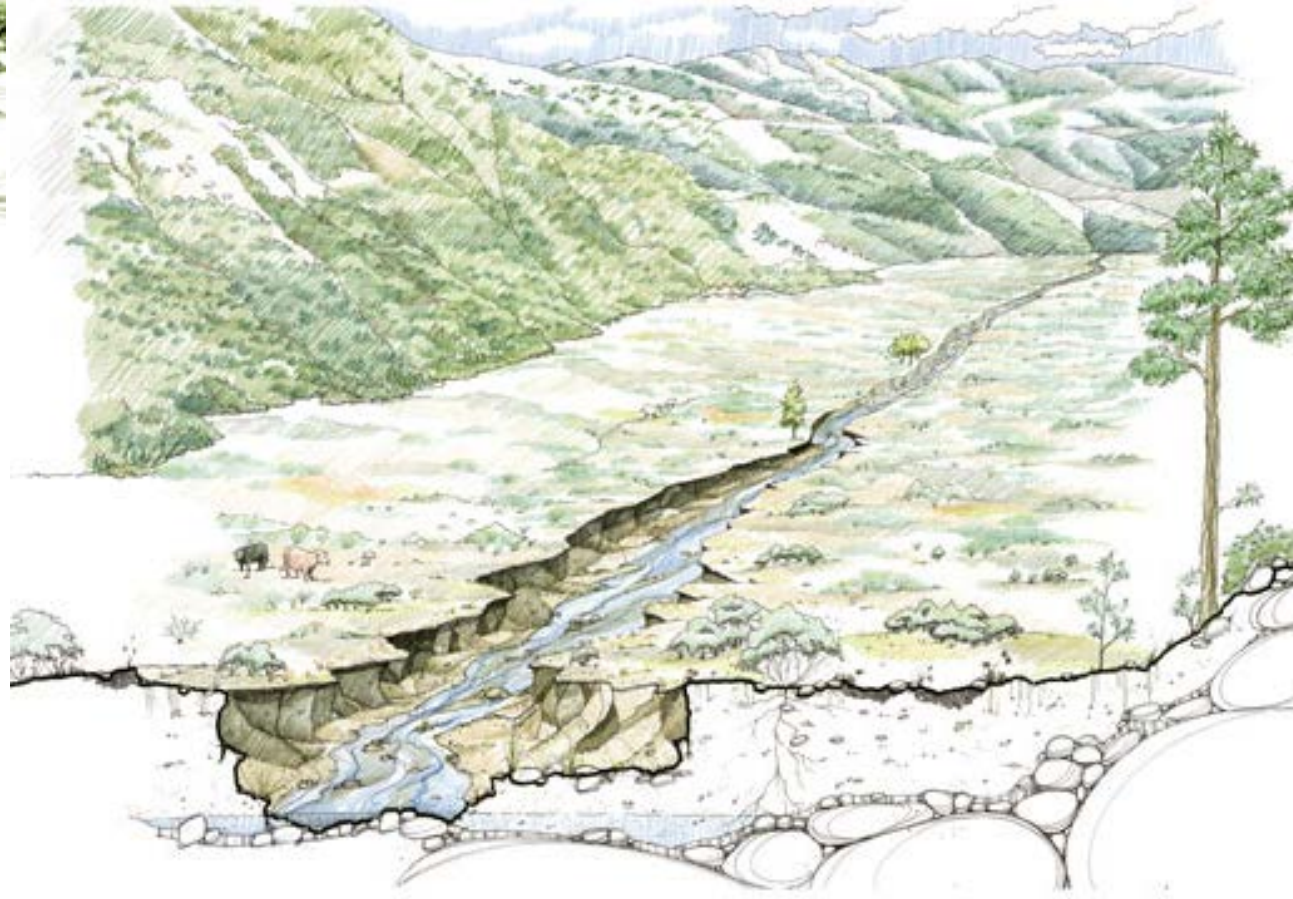

near Izee, Oregon
2015
Historical floodplain (now a terrace)
Modern floodplain
~20’

Illustrations by Restoration Design Group for American Rivers



"Complex"

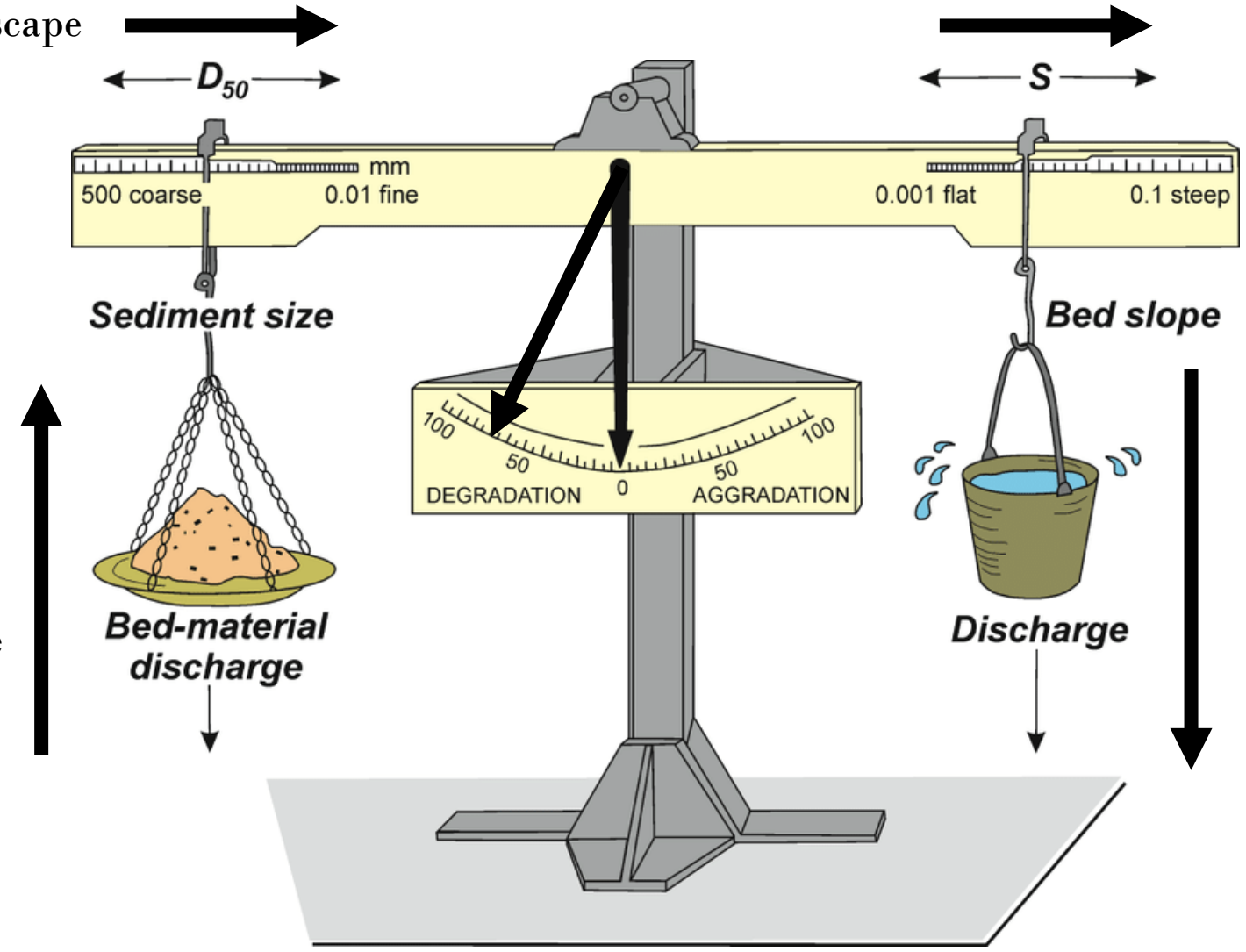
"Simplified"



Borland (and Lane's) Balance – what can cause a channel to erode?

Fine-grained landscape

Changing lake levels,
straightened streams,
Ditched wetlands



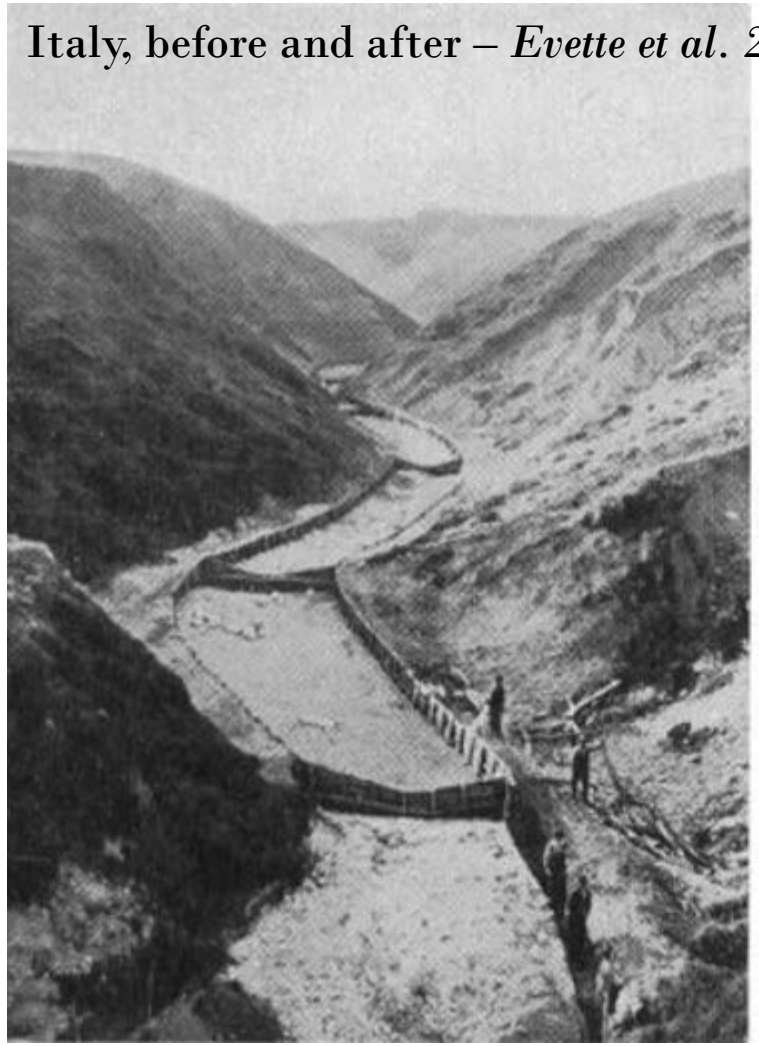
Shift to warmer climate

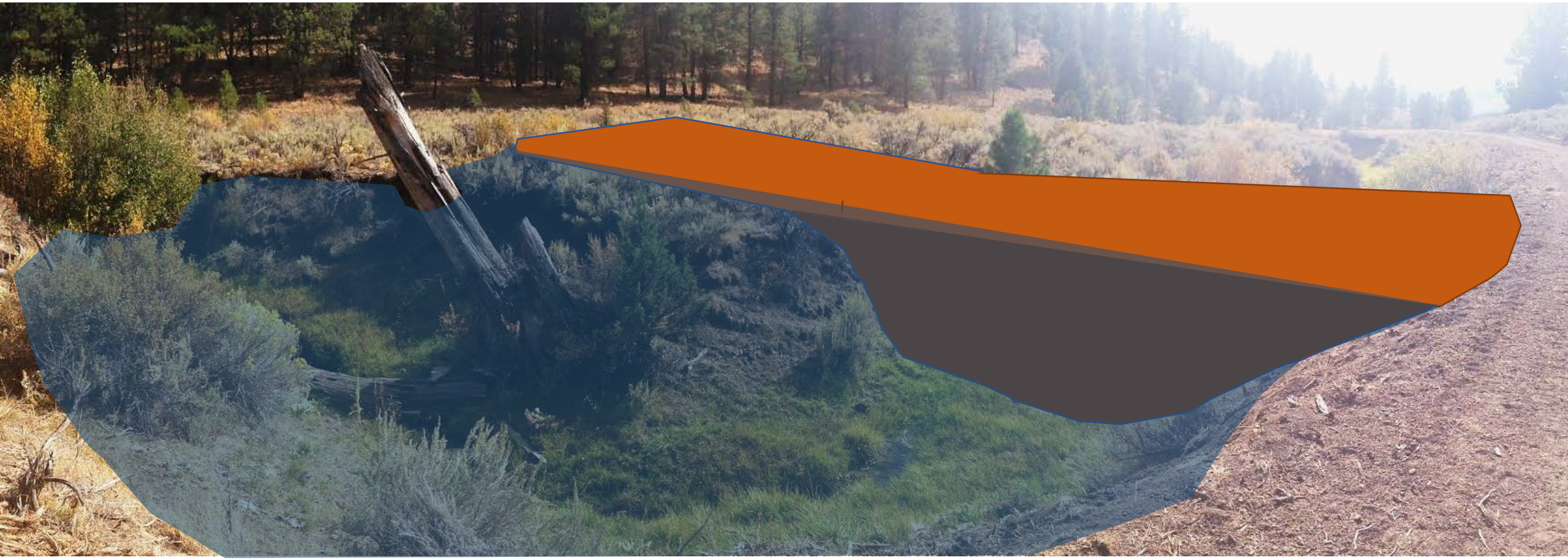
Reduced vegetation cover
Soil compaction
Increased overland flow

Pakistan – *Doolittle, 2010*

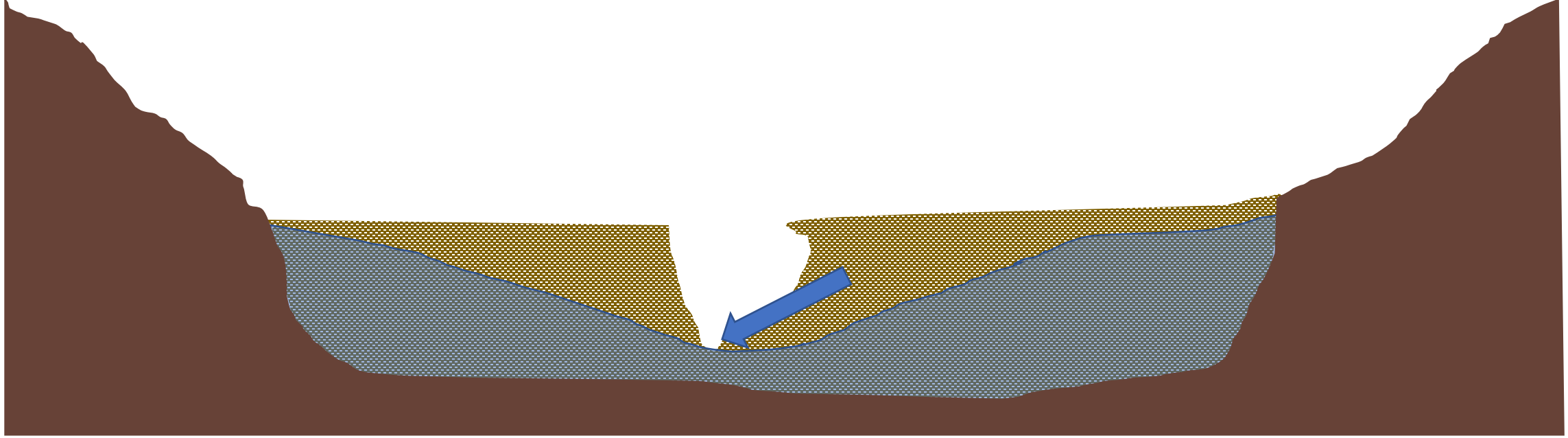
Iran – *Hassanli et al , 2009*

Italy, before and after – *Evette et al. 2009*





Cottonwood Creek
Silvies River Basin, OR



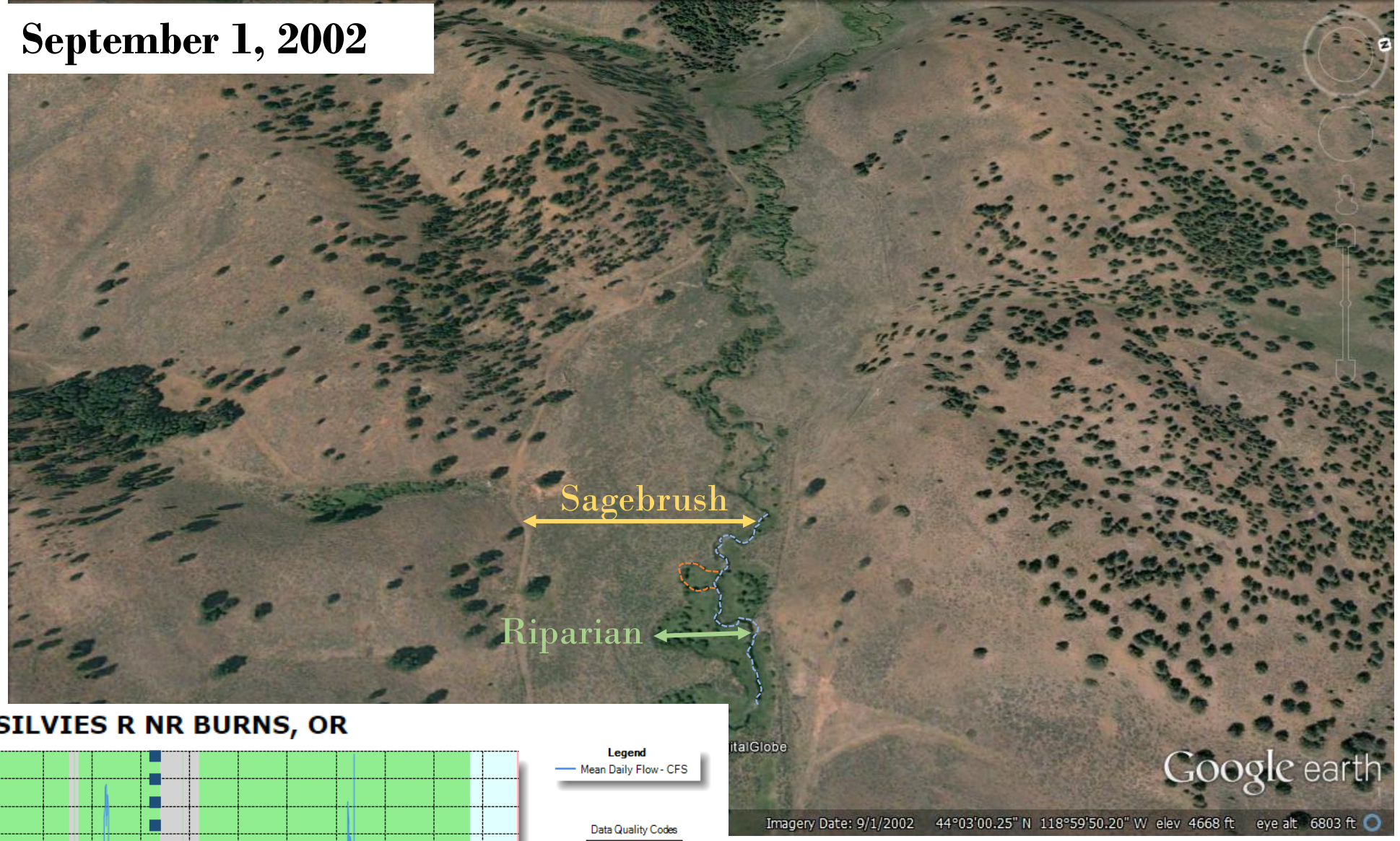
Camp Creek
Silvies River Basin, OR

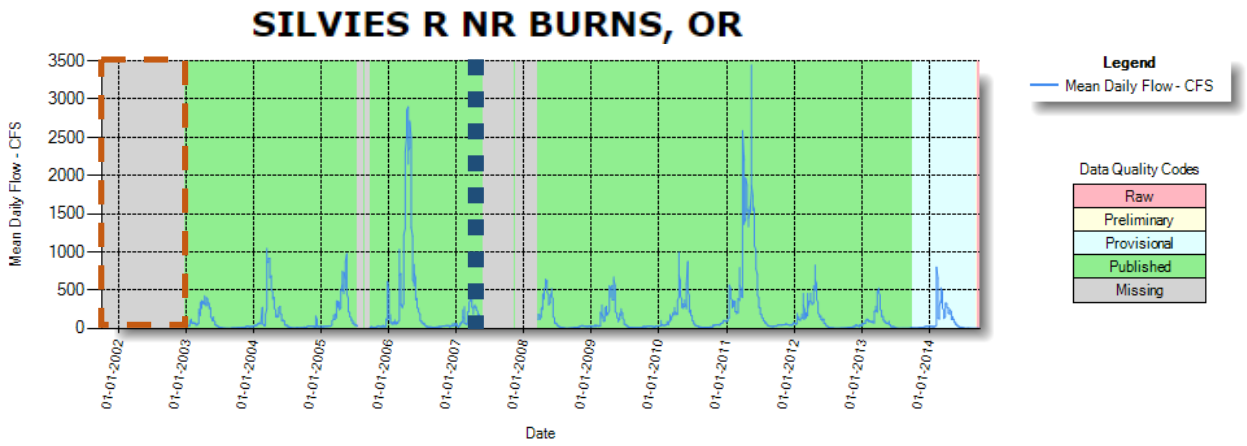

2 years post-construction


6 years post-con


12 years post-construction

September 1, 2002

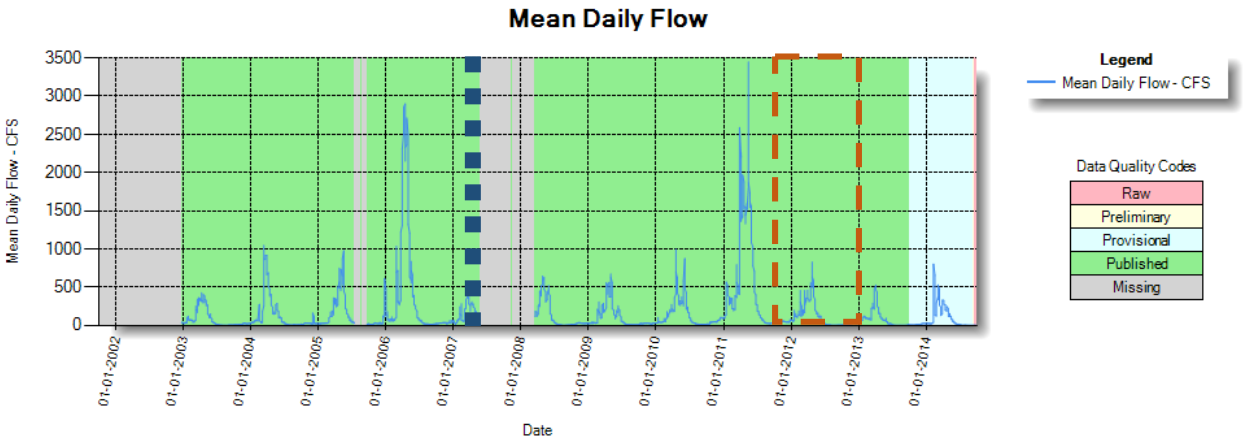




4 years prior to restoration

Camp Creek
Silvies River Basin, OR

September 10, 2012

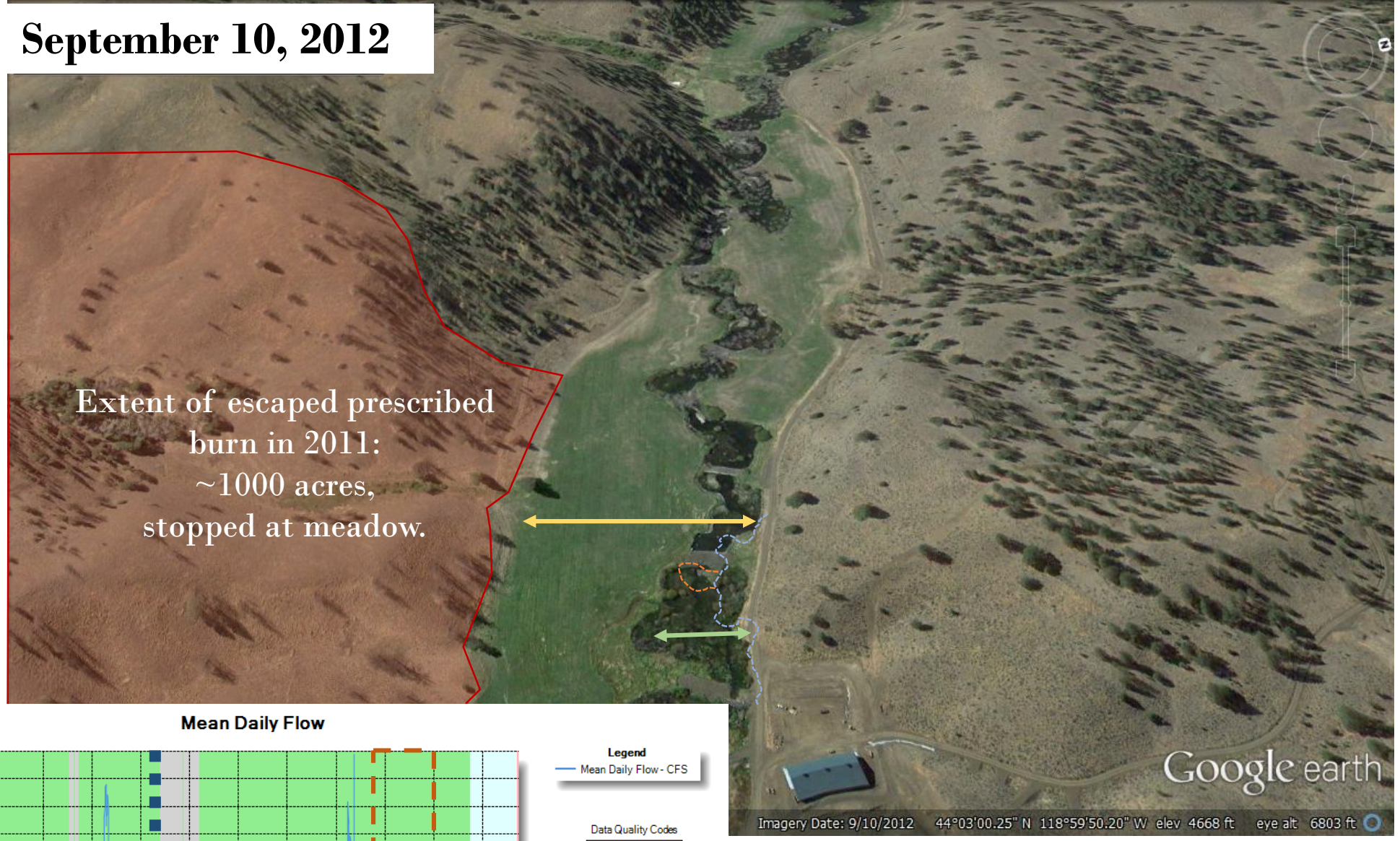


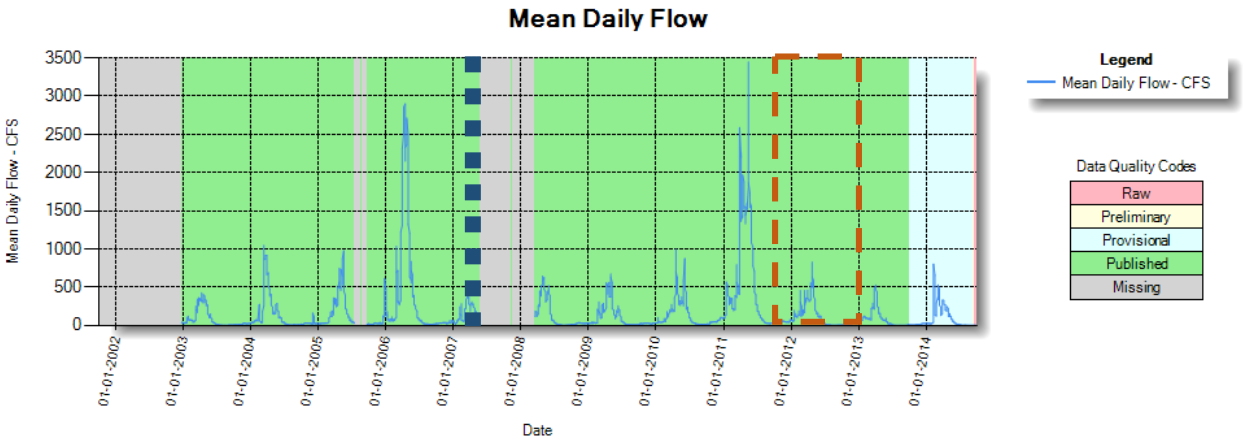
4.5 years after restoration

Camp Creek

Silvies River Basin, OR

September 10, 2012





4.5 years after restoration

Camp Creek

Silvies River Basin, OR

Zuni bowl and rock dam - *NRCS*


Pond-and-plug restoration – *Plumas Corp*

Media Luna- *NRCS*


Riffle Augmentation– *Plumas Corp*

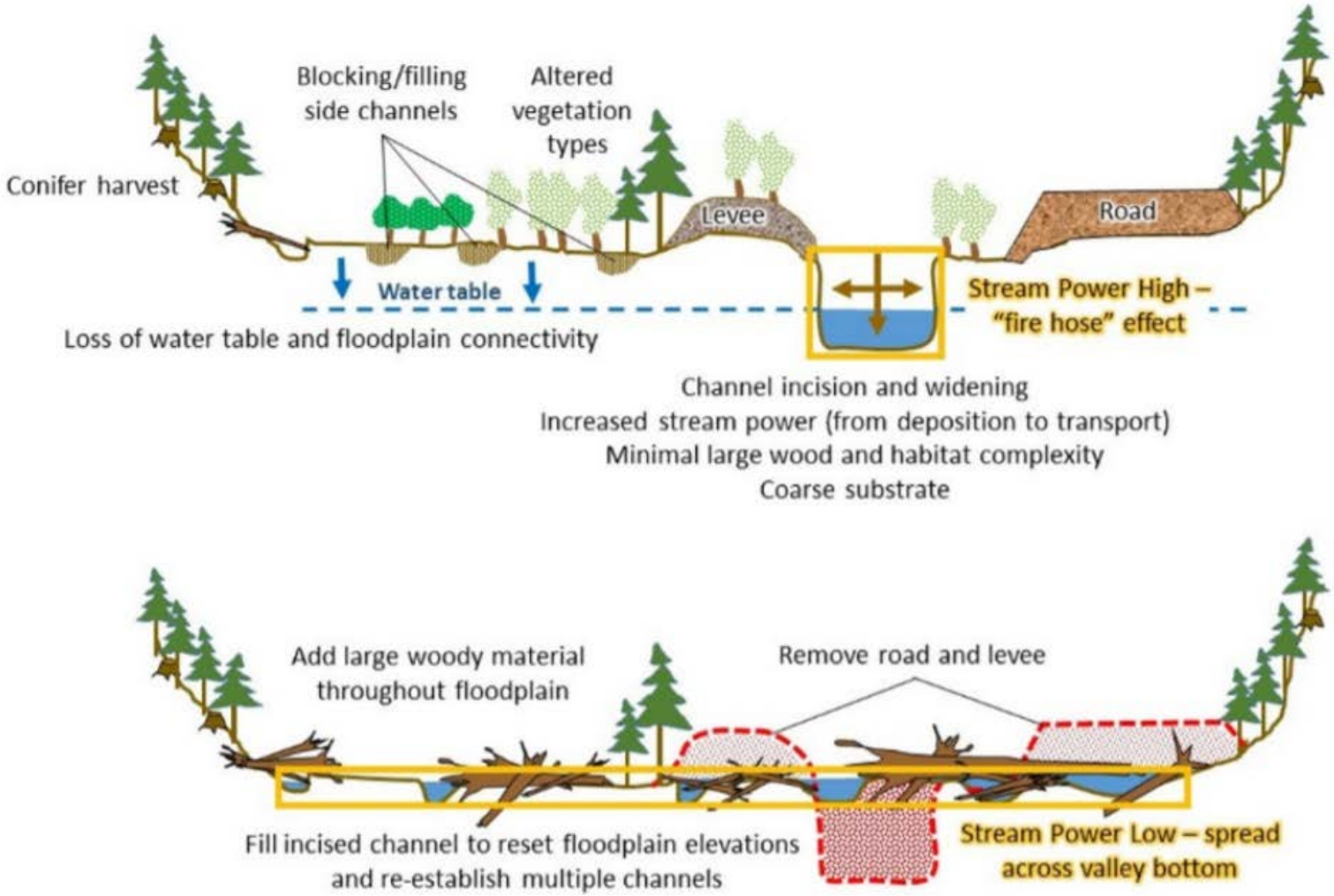


Figure - Forest Service and Kate Meyer, Fisheries Biologist with Willamette NF