Why Do We Restore Rivers?

Stream Restoration 101

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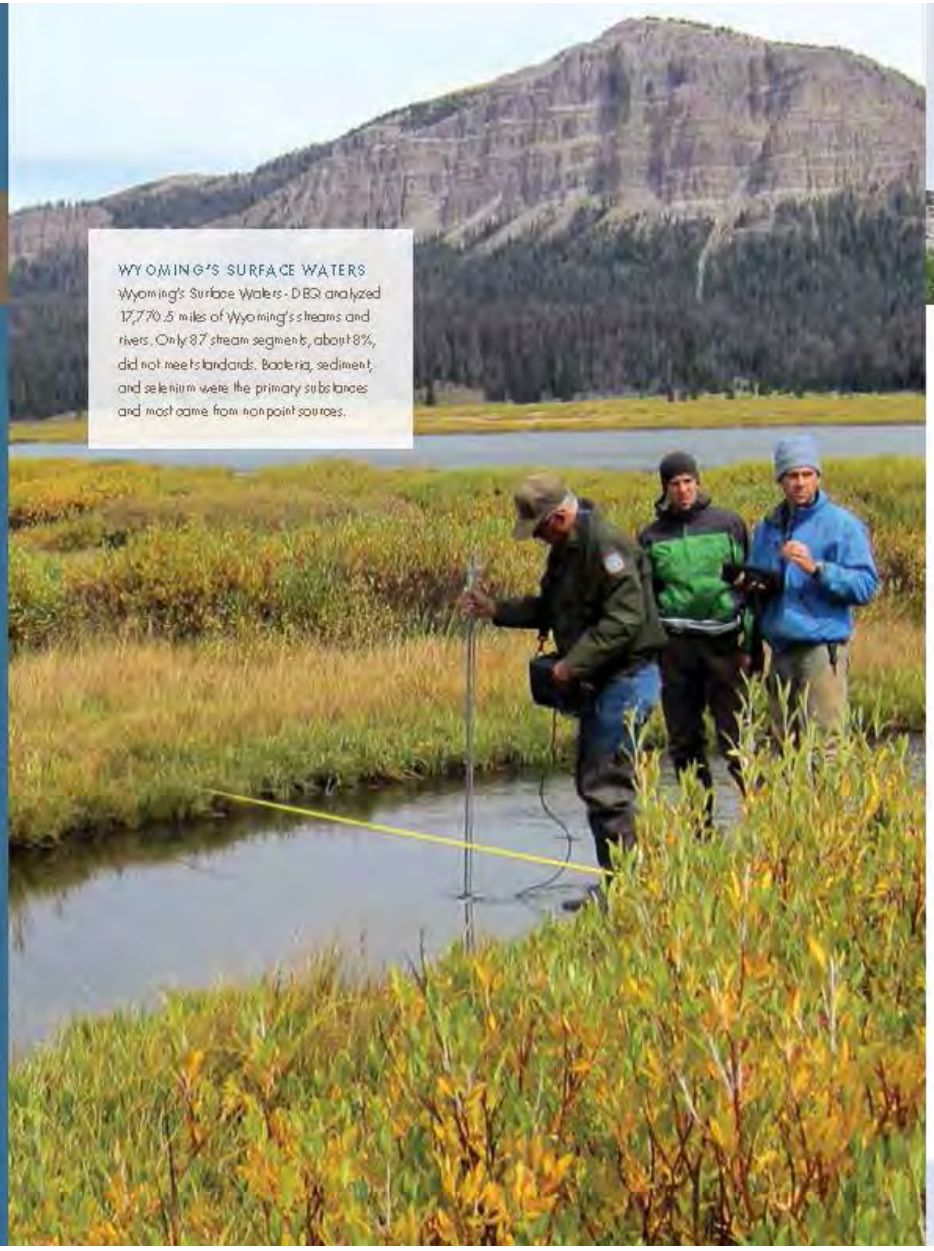
Wyoming Water Association
Casper, WY - October 27, 2016

Leading *the* Charge

WYOMING WATER STRATEGY

Governor Matthew H. Mead • 2015



WYOMING'S SURFACE WATERS

Wyoming's Surface Waters - DEQ analyzed 17,770.5 miles of Wyoming's streams and rivers. Only 87 stream segments, about 8%, did not meet standards. Bacteria, sediment, and selenium were the primary substances and most came from nonpoint sources.

Water and Watershed Restoration

It is difficult to overstate the importance of water in the American West. The increased demands for water—from a fastgrowing human population to an expanding energy industry, to an agricultural industry that must feed a growing world—emphasize the importance of water to the American West. Water can be scarce, with unreliable annual supplies based on variable snow or rain volumes and timing. The water we have is precious.

Wyoming stands out in the world of western water. A single snowstorm that slows down travel over Togwotee Pass in January will send water rushing out to the Pacific from the mouth of the Columbia, trickling toward the Gulf of California through the deserts of Arizona in the Colorado, and through the bayous of Louisiana in the Mississippi. Through the Bear River and its tributaries, Wyoming also contributes to the headwaters of the largest annual water source for the Great Salt Lake, America's inland ocean.

Russian olive and saltcedar trees were introduced in the late 1900s for both functional and ornamental purposes. Over the last few decades, these trees have spread. They now present a serious threat to native species and place stress on existing water uses. The State of Wyoming, through the Wyoming Wildlife and Natural Resource Trust (WWNRT), along with other state and federal agencies, local conservation districts, landowners, non-governmental organizations, and many other partners has tackled the problem. Together over the last decade, these entities have worked to remove Russian olive trees from river and streambanks throughout the Bighorn Basin. This large effort has resulted in improved water quality and water yield. Removal of invasive species has also restored habitat for deer, game birds, and fish.

Water consumed by thirsty, non-native Russian olive trees and saltcedar in the Bighorn Basin pulls water from the Basin's rivers and streams. Water users on farms, in cities, and in towns require a certain amount of water for agricultural and municipal uses. Excess consumption, rooted in non-native species, can lead to lower average annual flows in the river. Lower flows can have an impact on the anglers, boaters, and kayakers who use these waterways to recreate. Individuals, communities, and local economies can feel the squeeze.

Restoration balances the scales for all stream users. Maintenance of healthy watersheds and restoration in areas of need, can mitigate the need to curtail water uses. Removing Russian olive and saltcedar trees, replacing them with cottonwoods and willows, is one example of watershed restoration that has had a positive impact on the amount of water flowing in stream. This in turn benefits all those who rely on healthy water flows.

Casper Star Tribune – "Wyoming Legislature weighs $2M for North Platte River restoration in Casper" ***February 23, 2014***

Casper Star Tribune – "Construction underway on key Lander River" ***February 26, 2016***

Jackson Hole News and Guide – "Fixing up Flat Creek – restoration work underway aims to help cutthroat trout fishery" ***July 30, 2014***

Laramie Boomerang – "Laramie River restoration enters its final phase" ***March 11, 2011***

Casper Star Tribune – "Groups work foot by foot to fix Wyoming River" ***October 27, 2013***

Saratoga Sun – "River restoration moving forward" ***March 25, 2015***

Why Restore?

- Improve channel stability
- Reduce accelerated streambank erosion
- Protect infrastructure
- Enhance aquatic/fishery habitats
- Enhance riparian/floodplain habitats
- Promote public safety
- Increase recreation
- Improve water quality

What is a river's job?

What is a river's job?

What is a river's job?

How have we influenced our rivers?

How have we influenced our rivers?

How have we influenced our rivers?

How have we influenced our rivers?

How have we influenced our rivers?

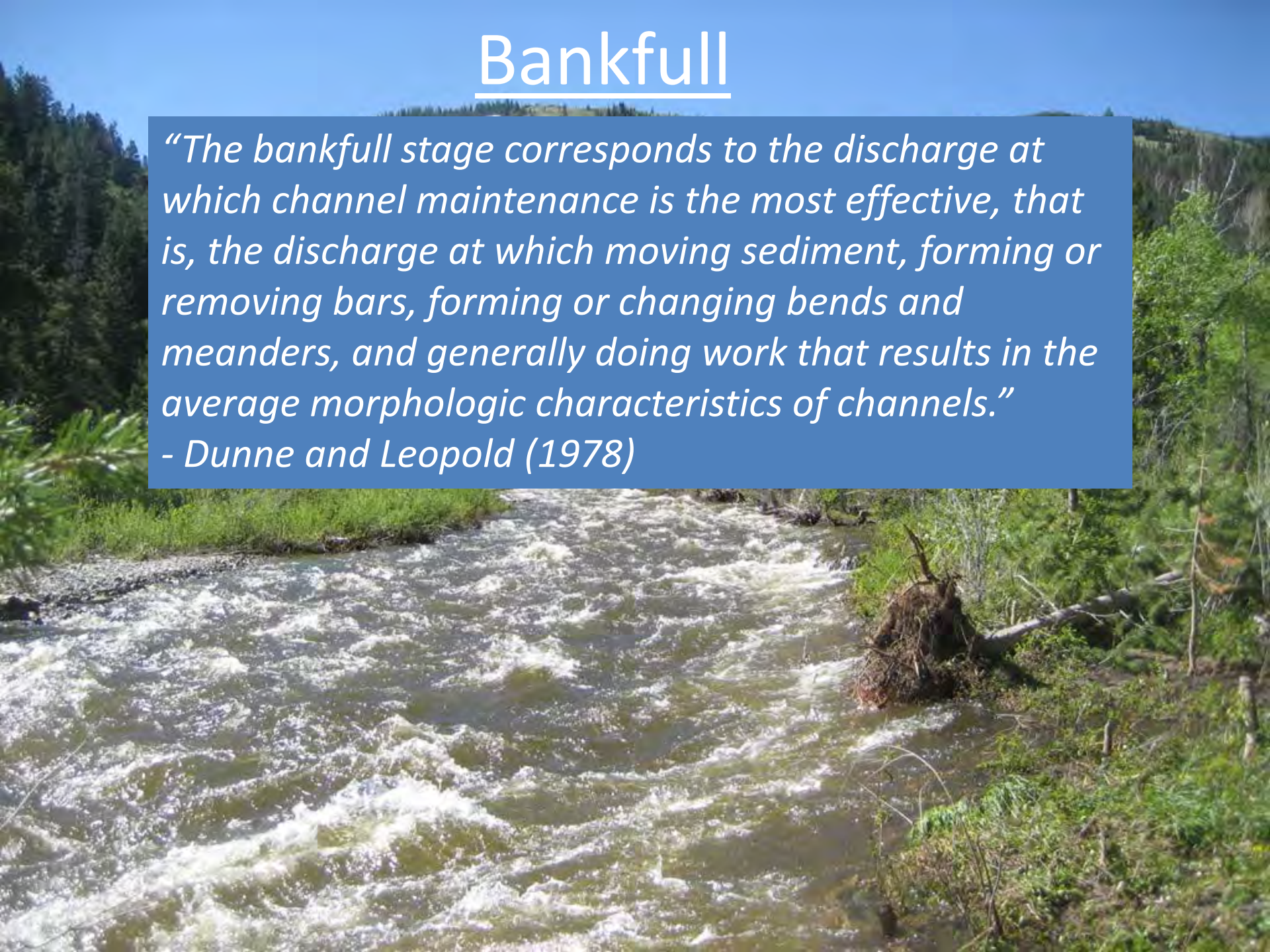
Other Influences

Other Influences

Bankfull

Bankfull

"The bankfull stage corresponds to the discharge at which channel maintenance is the most effective, that is, the discharge at which moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphologic characteristics of channels."
- Dunne and Leopold (1978)



Bankfull

-Channel forming flow – a river at work

- where flow fills the channel to the top of its banks and at a point where the water starts to overflow onto the floodplain

- flow that happens on **average** every other year in a snowpack system

Bankfull

8/1/2005

1/2005

Dimension, Pattern, and Profile

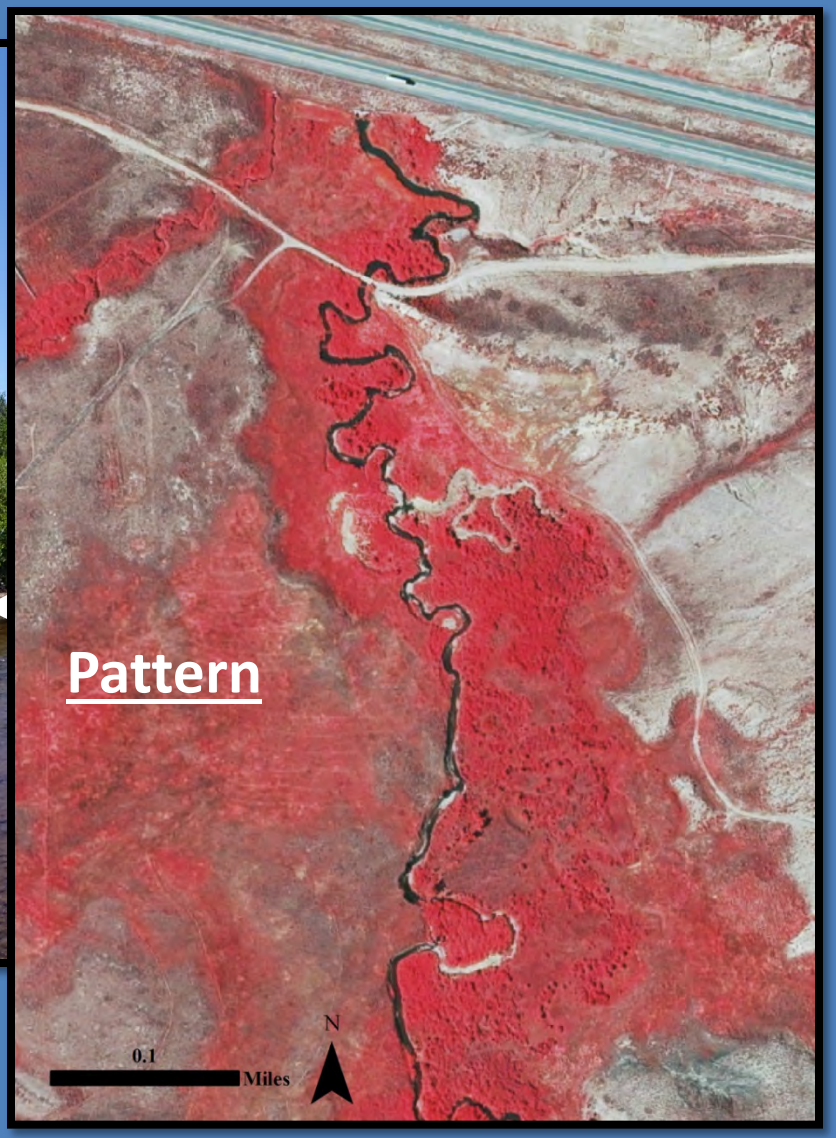
We need to look at a river from more than just one view

Dimension

- Cross-sections
- Stream width
- Stream depth

Dimension, Pattern, and Profile

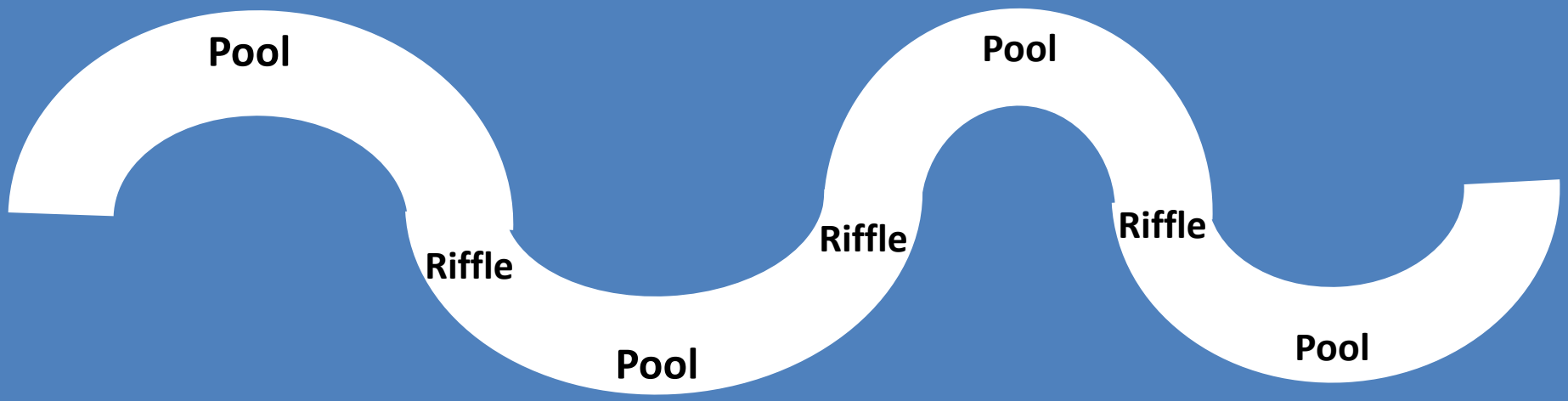
We need to look at a river from more than just one view



Pattern - Sinuosity

Pattern – Sinuosity

Pattern



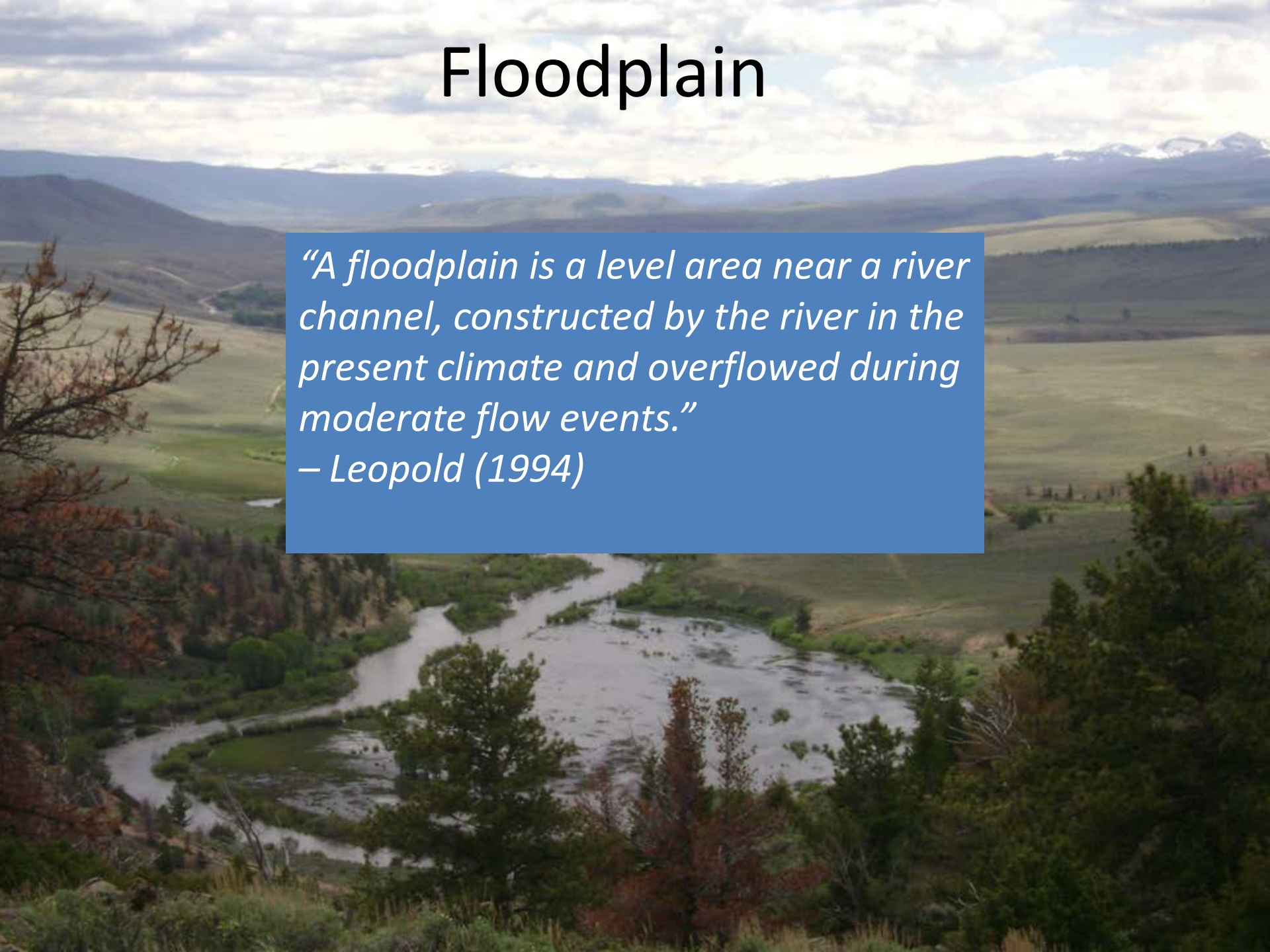
Dimension, Pattern, and Profile

We need to look at a river from more than just one view

Profile

Floodplain

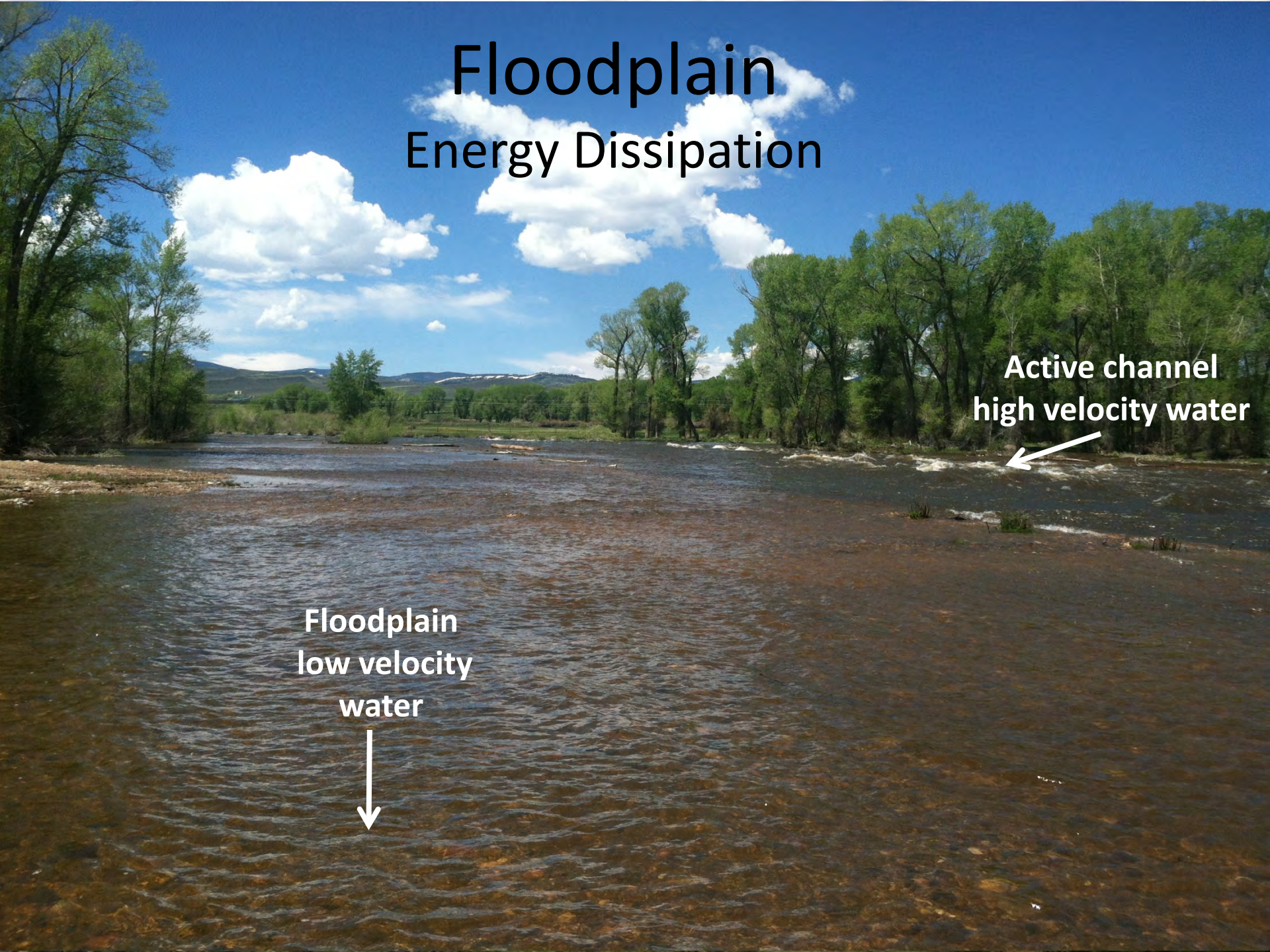
Floodplain



"A floodplain is a level area near a river channel, constructed by the river in the present climate and overflowed during moderate flow events."
– Leopold (1994)

Floodplain

Floodplain
Energy Dissipation



Sediment Transport

- Where is the sediment coming from?

Sediment Transport

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Sediment Transport

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Sediment Transport

- Where is the sediment coming from?

Sediment Transport

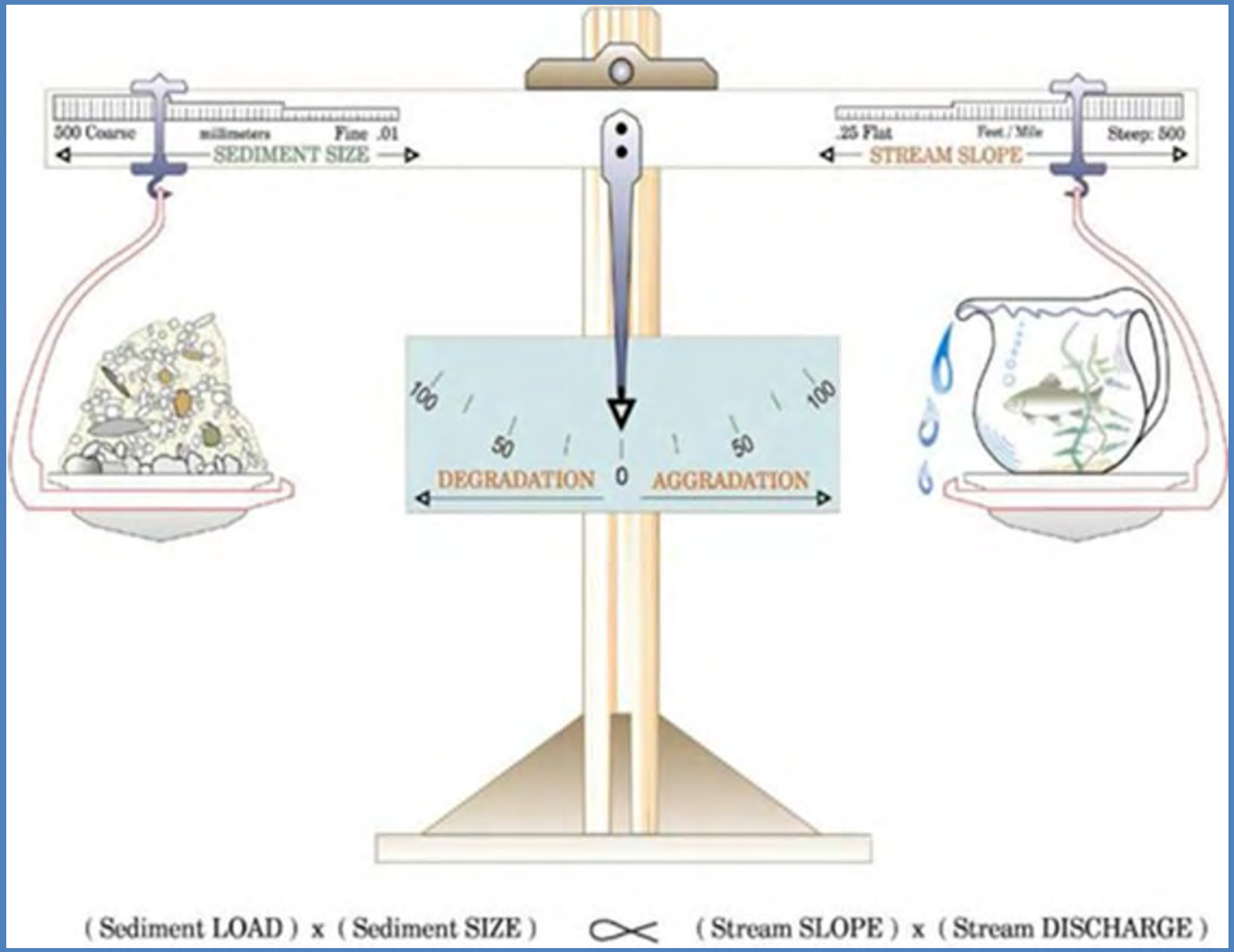
- What is sediment?

Sediment Transport

- What is sediment?

What is river stability?

A stable river is neither aggrading nor degrading


500 Coarse
millimeters
Fine .01
SEDIMENT SIZE
.25 Flat
Feet / Mile
Steep: 500
STREAM SLOPE
100
50
0
50
100
DEGRADATION
AGGRADATION
(Sediment LOAD) x (Sediment SIZE) ∝ (Stream SLOPE) x (Stream DISCHARGE)

So….what is an unstable river?

Aggradation - Channel bed elevation is rising

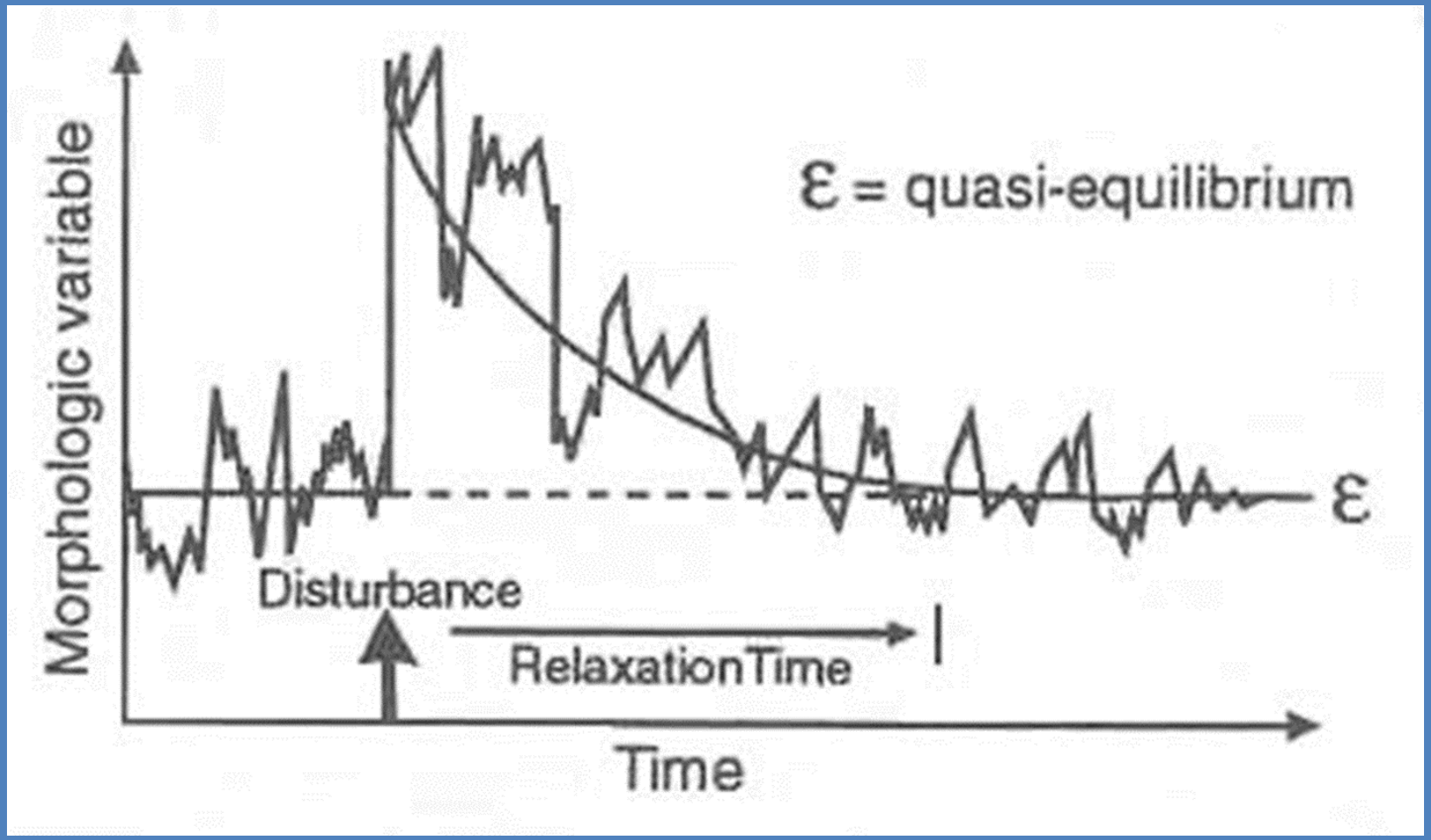
So…What is an unstable river?

Degradation - Channel bed elevation is dropping

sing

ping

Will a river fix itself?



Stream Restoration Techniques of the Past

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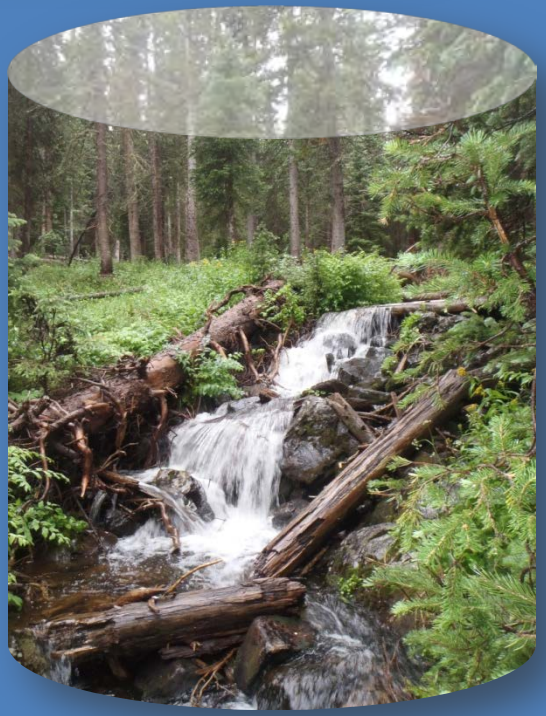
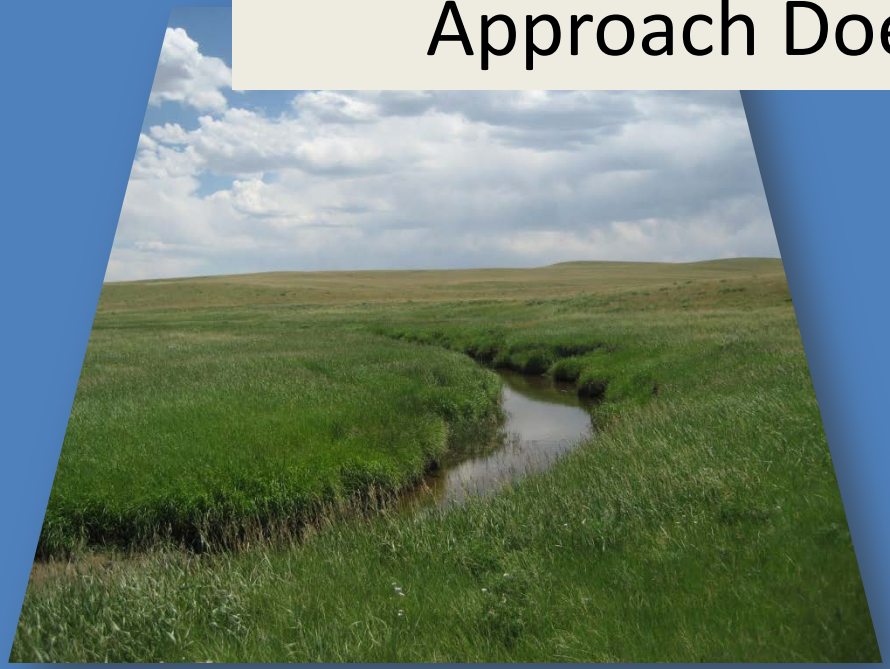
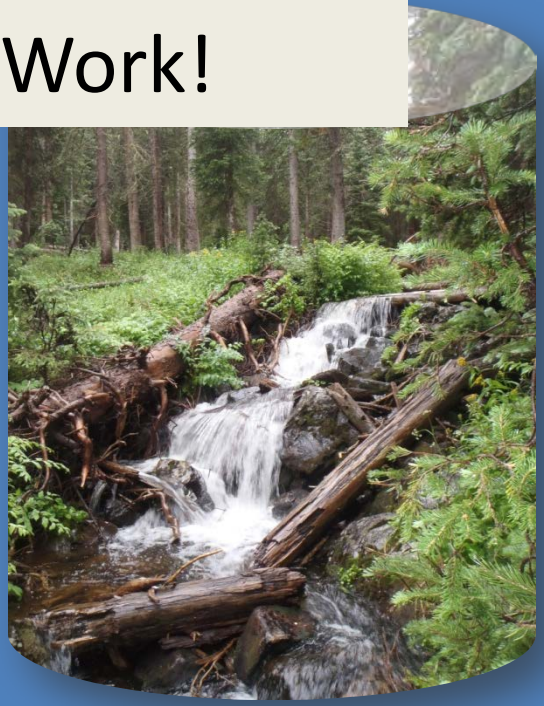


One-Size-Fits-All Restoration Approach Does Not Work!





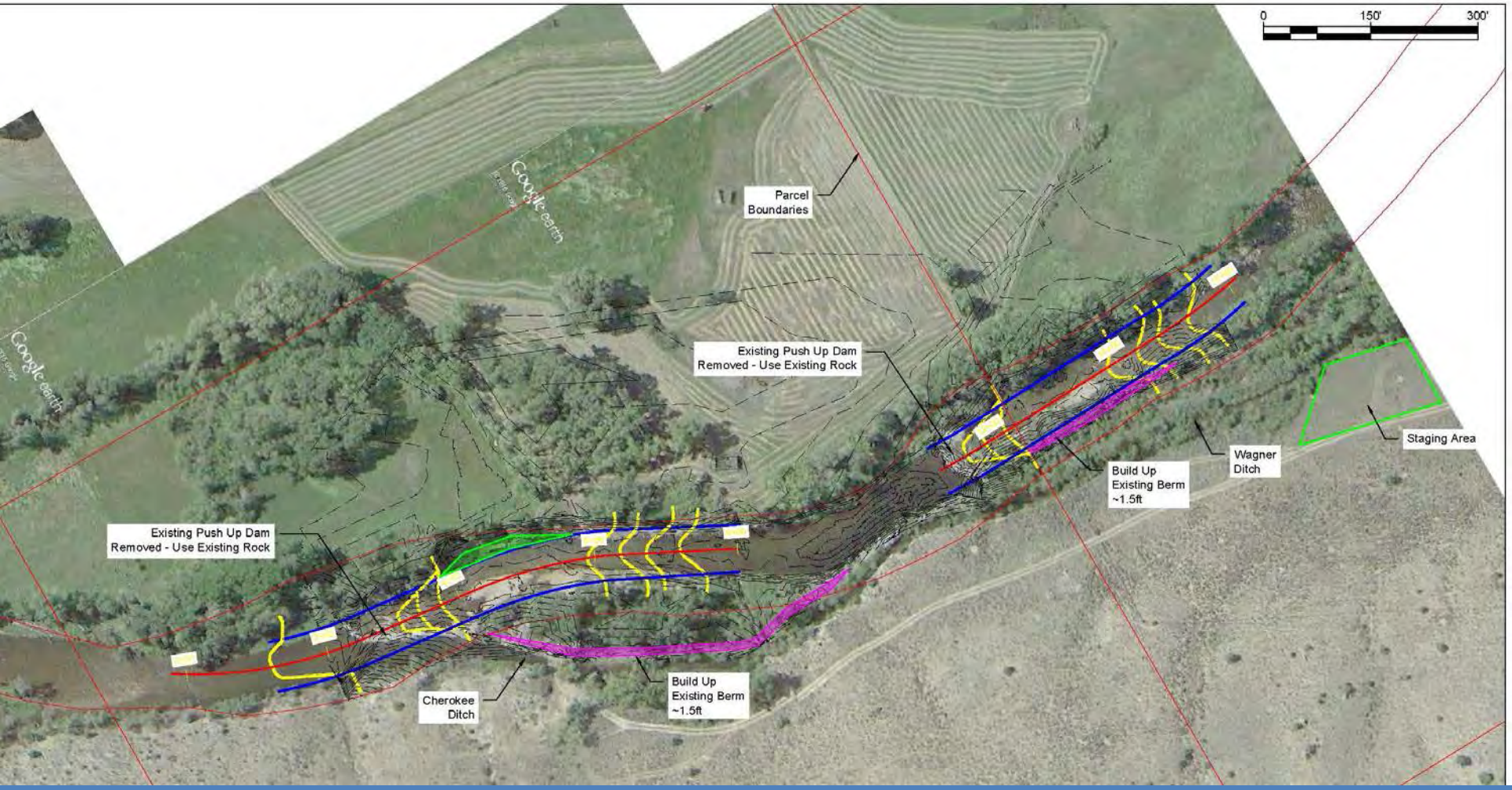
Restoration - what does it take?

- Data!
- Communication!

Restoration - what does it cost?

- River work is not cheap!
  - Design costs
  - Scope of project
  - Experienced engineers
  - Availability of materials (rocks, trees, vegetation)
  - Access and mobilization
  - Availability of experienced contractors
  - Extent of problem or instability
  - Size of river
  - River flows
  - Amount of material to move

Today's Restoration



0
60'
120'
XS-1
XS-2
XS-3
XS-4
XS-5
XS-6
Step 1 - Inv: 7052.3
Rock Vane
Step 2 - Inv: 7051.3
Rock Vane
Step 3 - Inv: 7050.3
Rock Vane
Arm #4 - Inv: 7149.3
Rock Vane
Arm #4 - Inv: 7148.3
Rock Vane
Arm #3 - Inv: 7147.3
Rock Vane
Arm #4 - Inv: 7146.3
Rock Vane
Repair Bank
0+00
2+00
4+00
6+00
8+00
Existing Waste Ditch
To Be Repaired
Existing Headgate
Rock J-Hook
Inv:
2+05
3+04
4+24
5+76
6+98
7+93

Encampment River – Cherokee Diversion Before

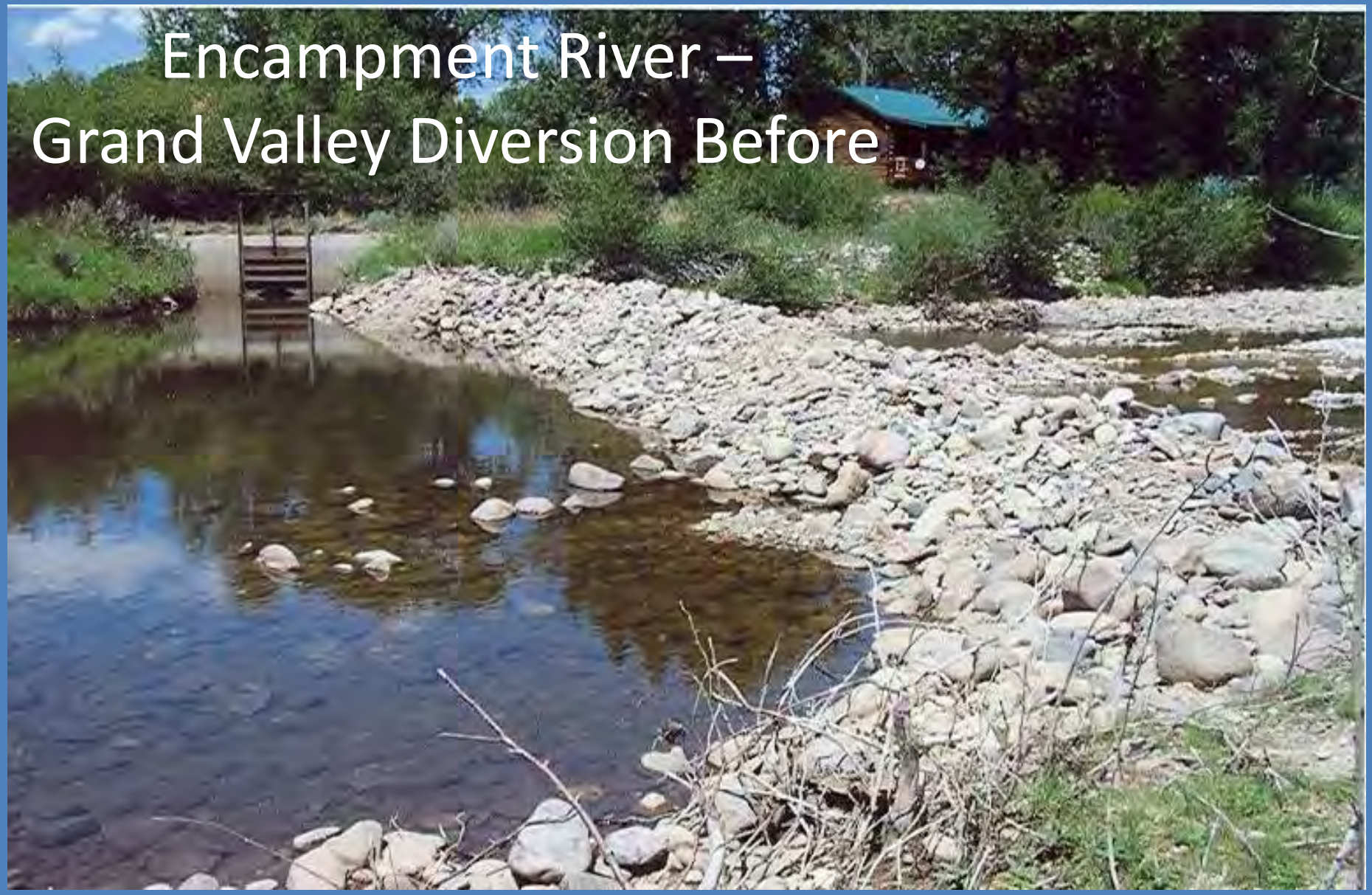
Encampment River – Cherokee Diversion After

Encampment River – Richardson Before

Encampment River – Richardson After

Encampment River – Grand Valley Diversion Before

Encampment River – Grand Valley Diversion Before



Encampment River – Grand Valley Diversion After

After Construction

- Expect some changes/adjustments
- Not all plantings may survive
- May require maintenance
- Monitoring is important

Questions?