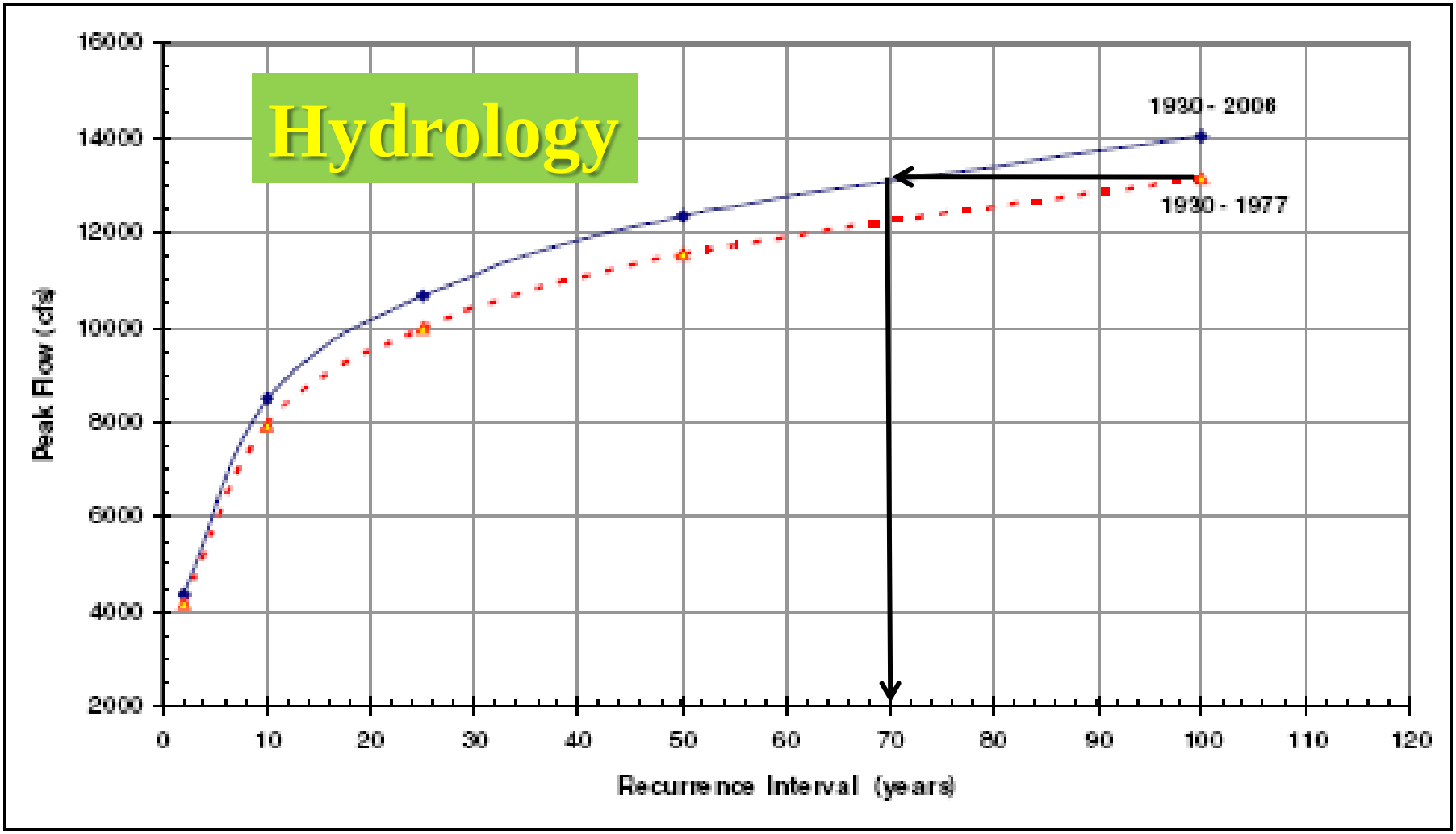
EXAMPLE 4: Carbon River road



Currently 10% of the road is flooded during a 5 year event.
In 50 years, it is projected that 32% of the road will be flooded during a 5 year event.

Aggradation Trends

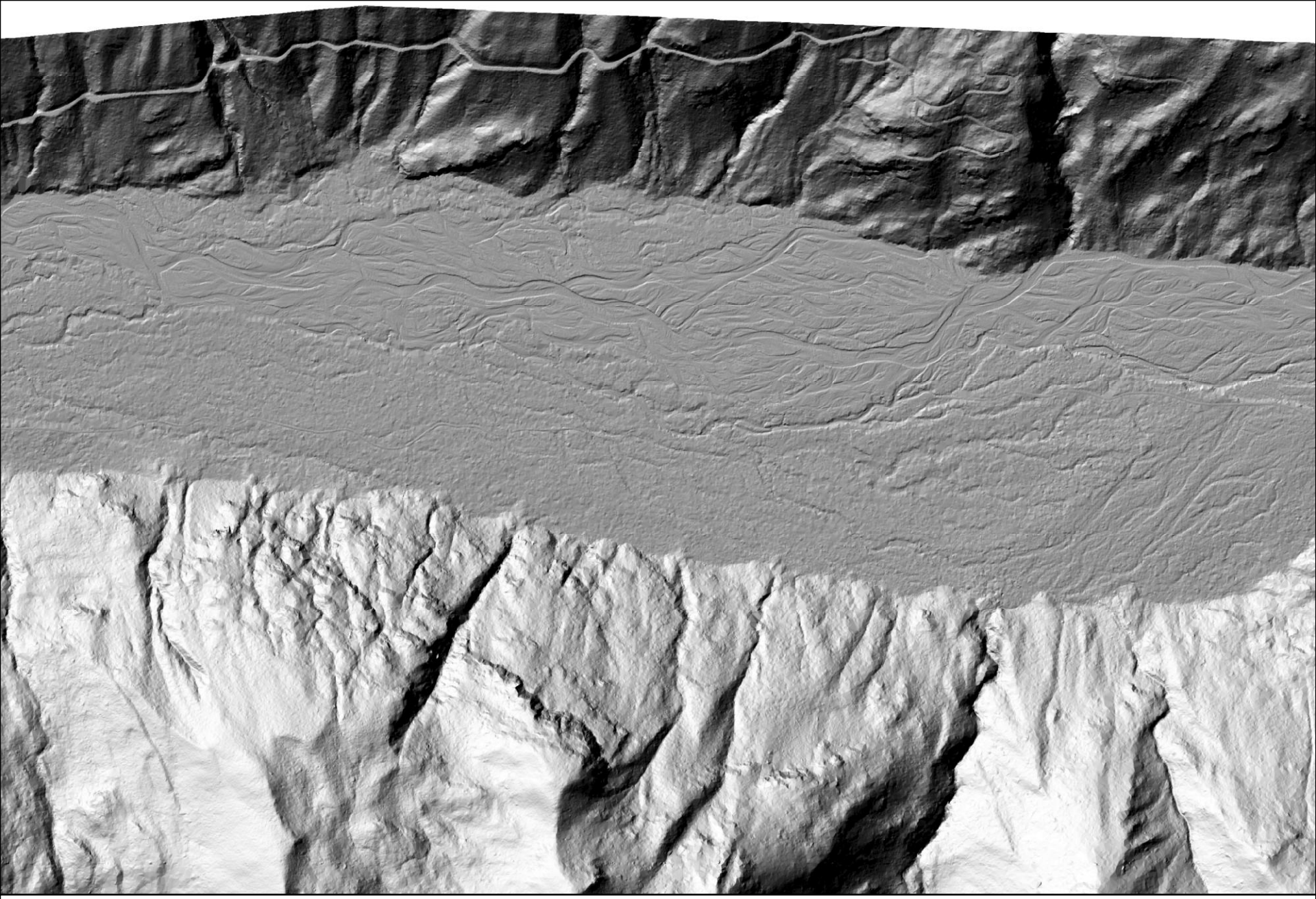
"Historical":

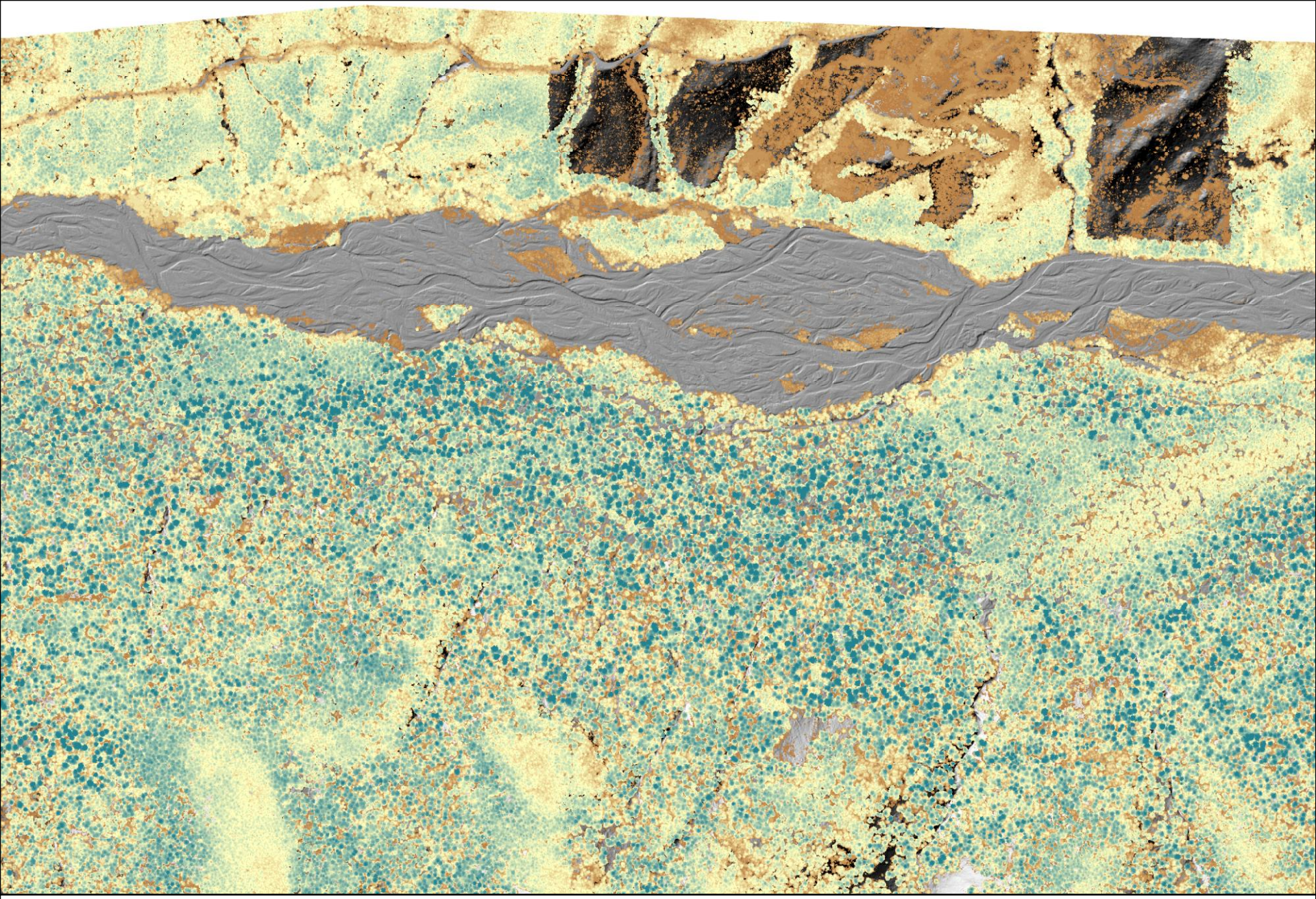
- Last 10 years: 6-50+"/decade;
  - ~ 3 feet/decade average;

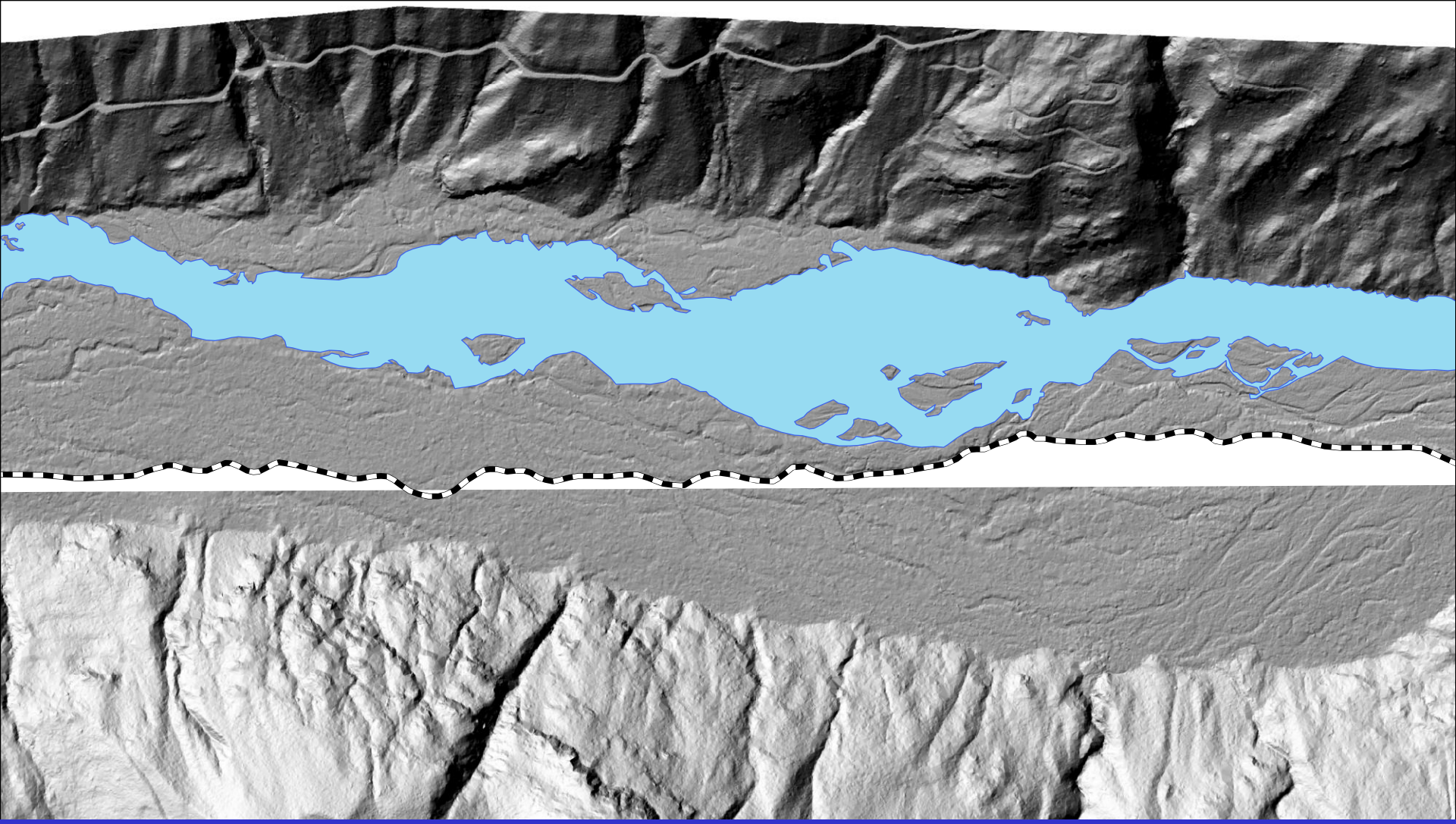
Carbon:

- Surveyed, 1996-2008:
  - 0.5 to 4 ft./decade ;

- Map-Based (since 1910):
  - 5.6 ft./decade;
  - 31.3 ft. total.


N
W
E
S
0
500
1,000
2,000 Feet
0
125
250
500 Meters


N
W
E
S
0
500
1,000
2,000 Feet
0
125
250
500 Meters



•Active channel confined to part of valley bottom, and surrounded by old-growth forest;
•Despite the floodplain disequilibrium (shown later) , avulsions are relatively minor (though very damaging to road), because of the forest.
•Next week's seminar, by Tim Abbe, discusses this in detail.

N
W E
S

0 500 1,000 2,000 Feet
0 125 250 500 Meters

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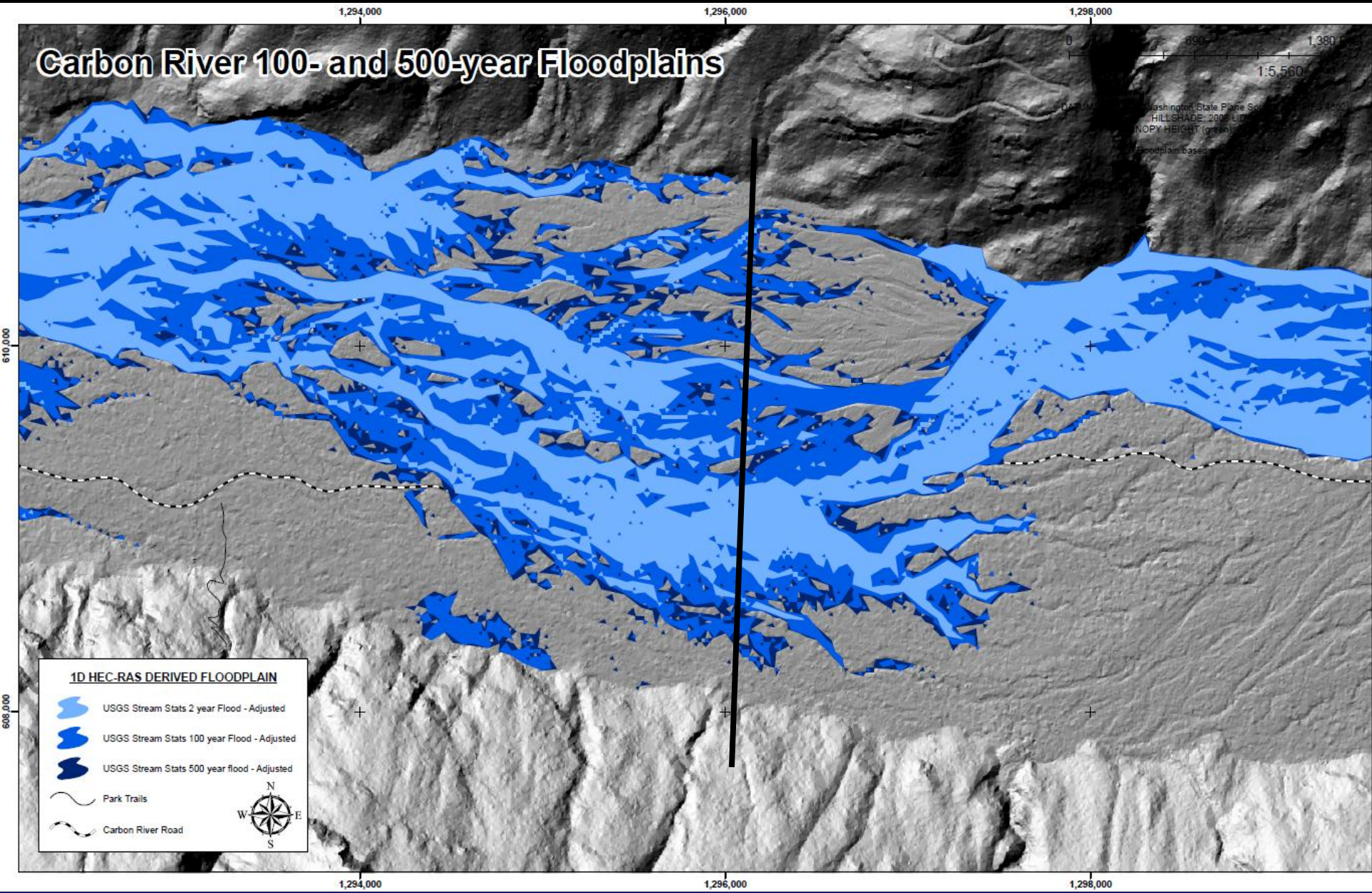
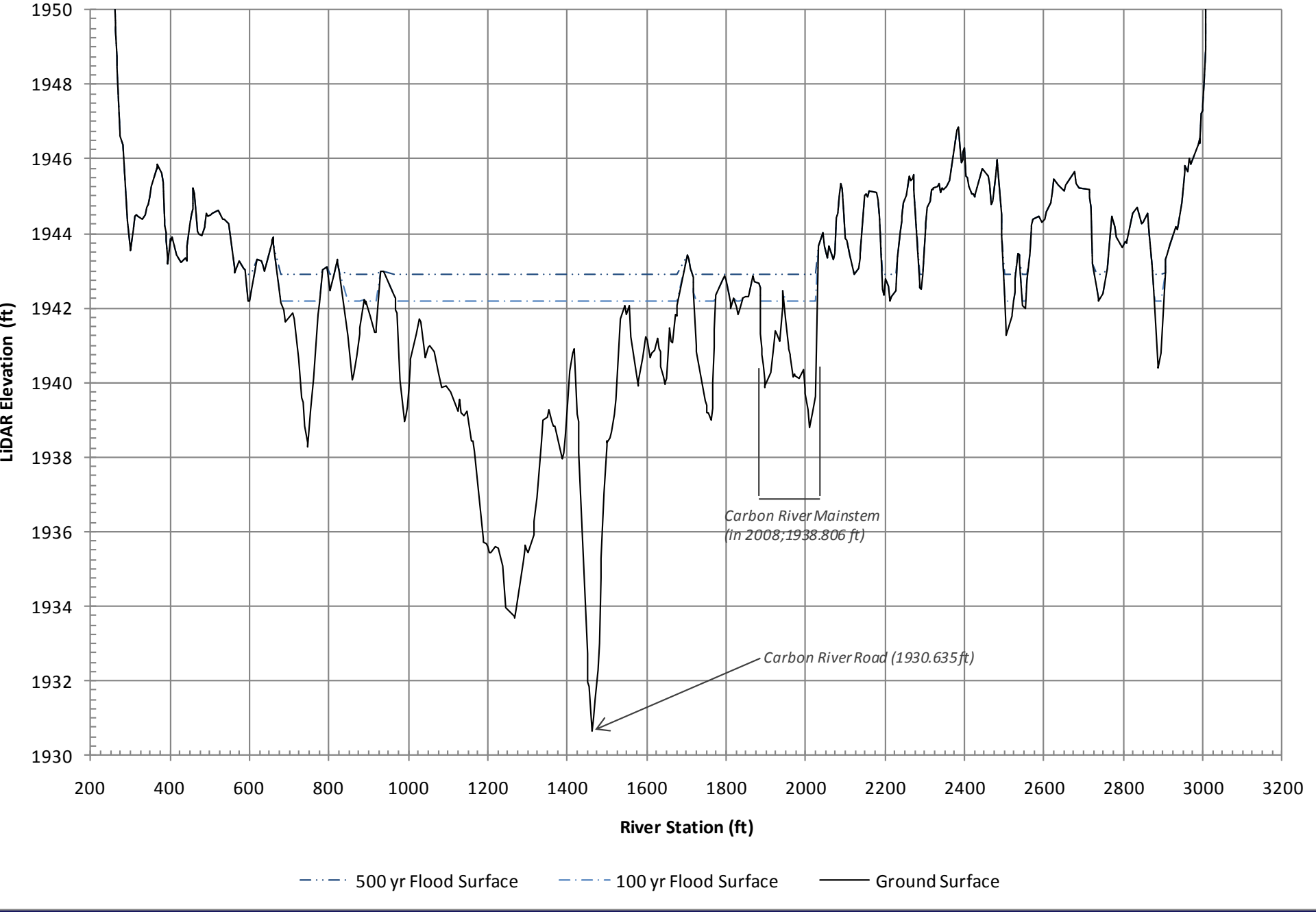
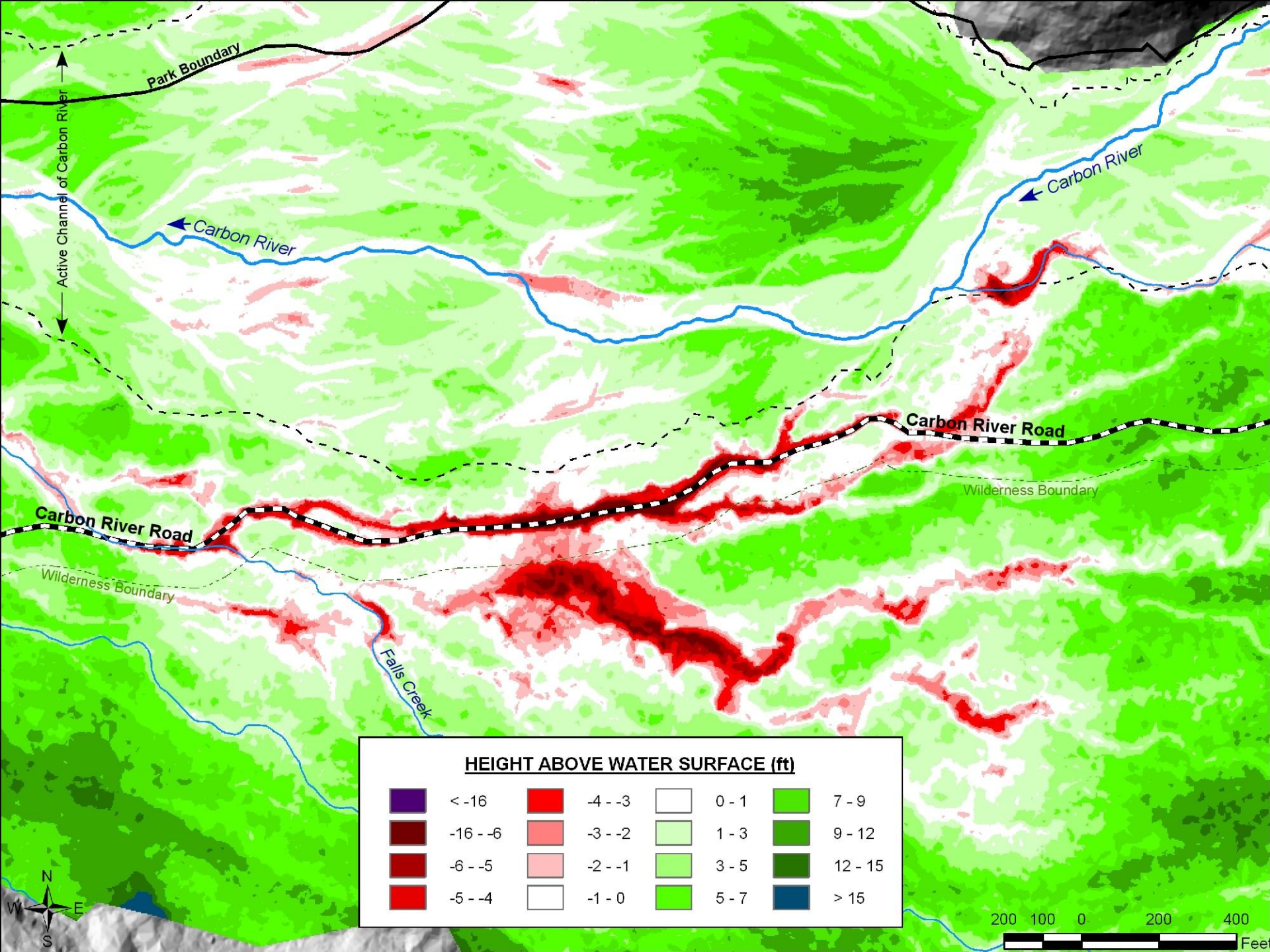
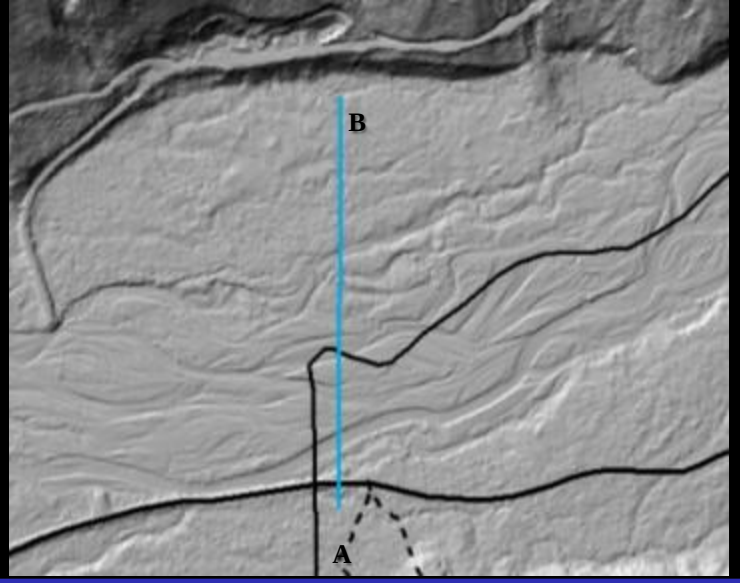


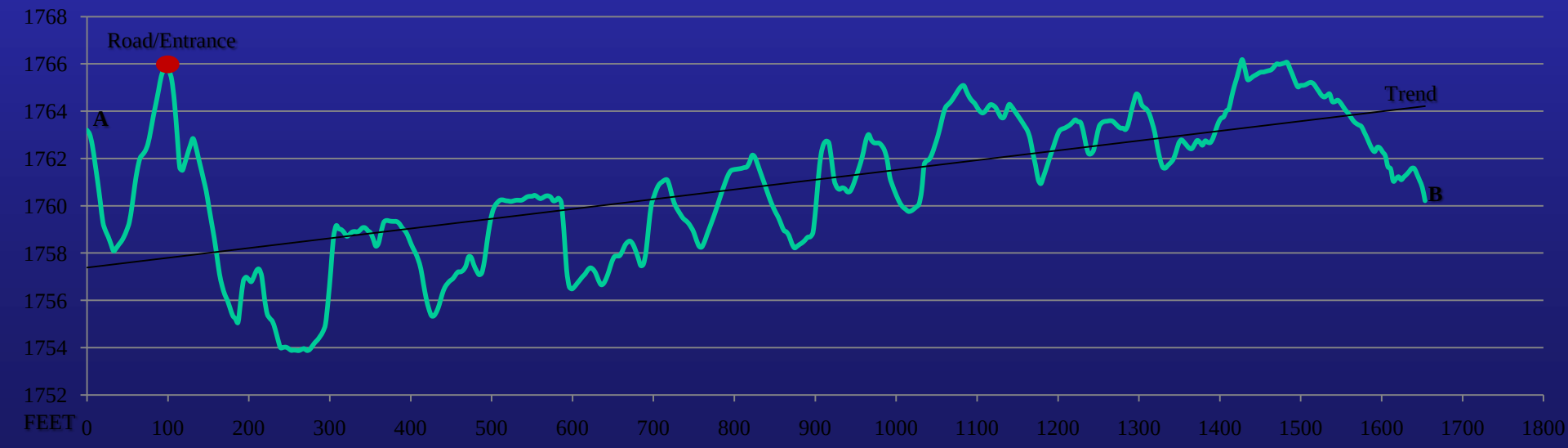
Carbon River at Falls Creek – River Cross Section




Park Boundary
Active Channel of Carbon River
Carbon River
Carbon River
Carbon River Road
Carbon River Road
Wilderness Boundary
Wilderness Boundary
Falls Creek
HEIGHT ABOVE WATER SURFACE (ft)
< -16
-16 - -6
-6 - -5
-5 - -4
-4 - -3
-3 - -2
-2 - -1
-1 - 0
0 - 1
1 - 3
3 - 5
5 - 7
7 - 9
9 - 12
12 - 15
> 15
N
W
E
S
200 100 0 200 400
Feet

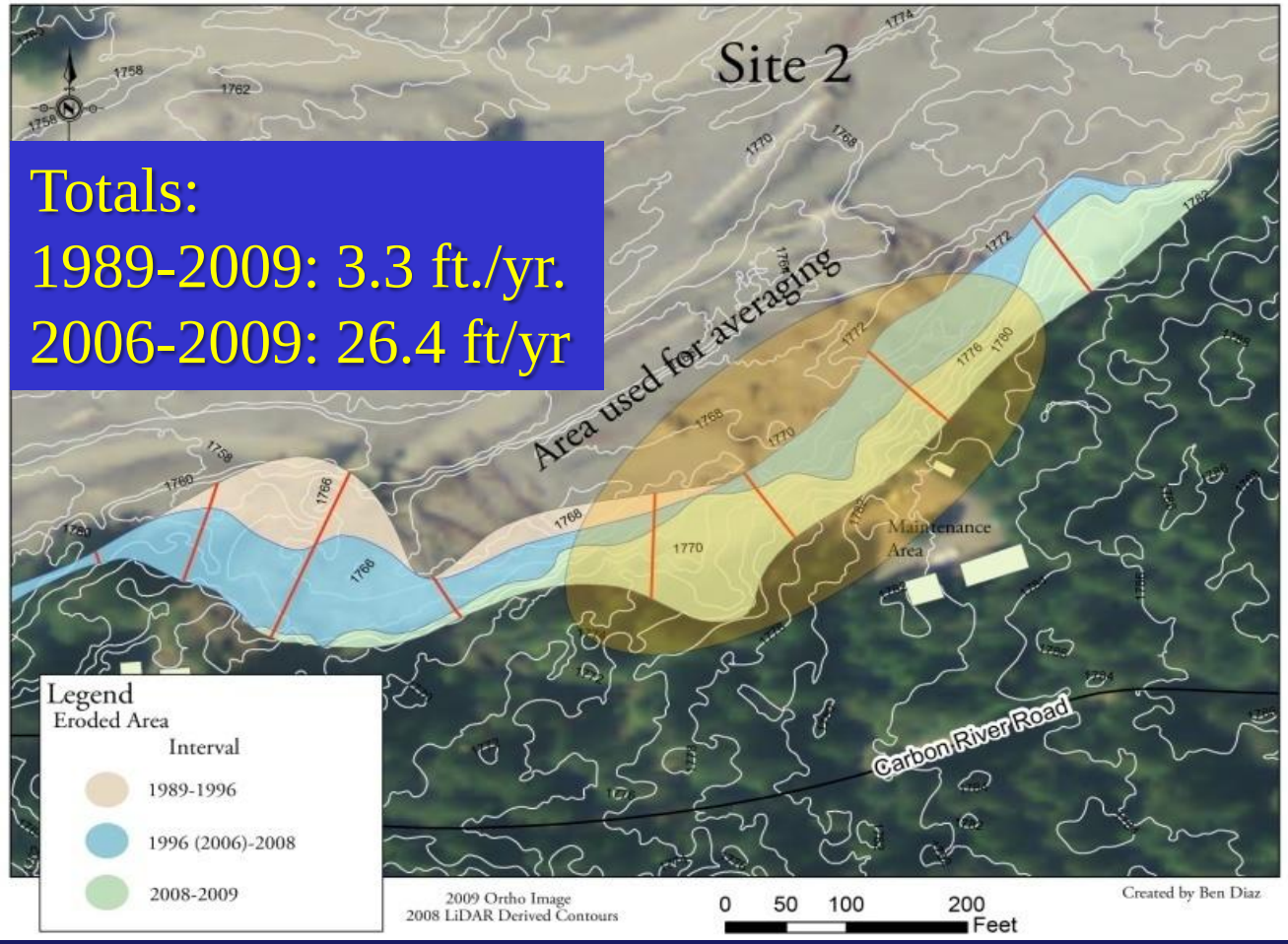
Entrance Station Cross Section





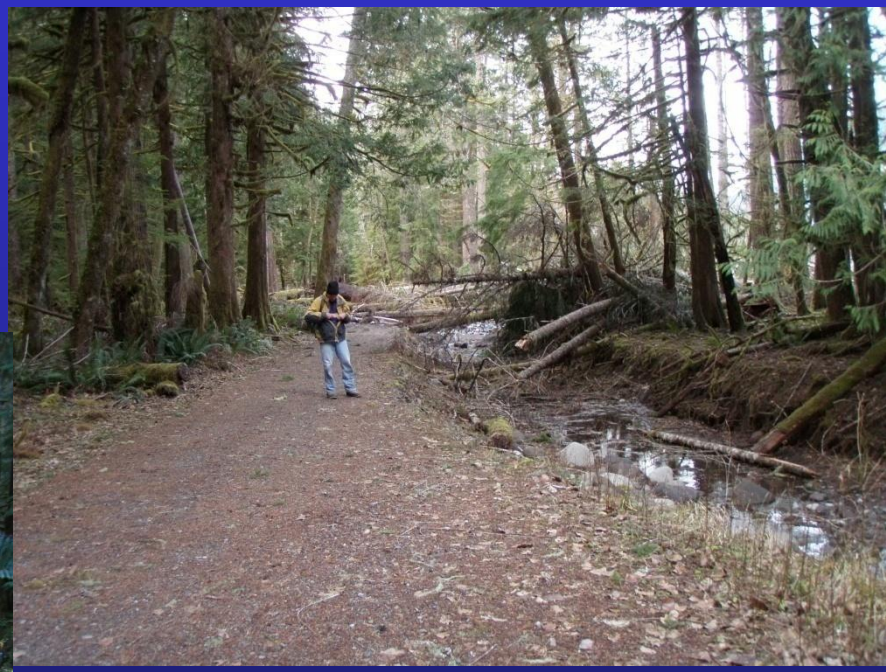
Note: lateral gradient exceeds down-river gradient (>2X), driving energy to left bank.

Typical stream bank erosion *averages*



Comparison of new channel in *forest* vs. *road piracy*

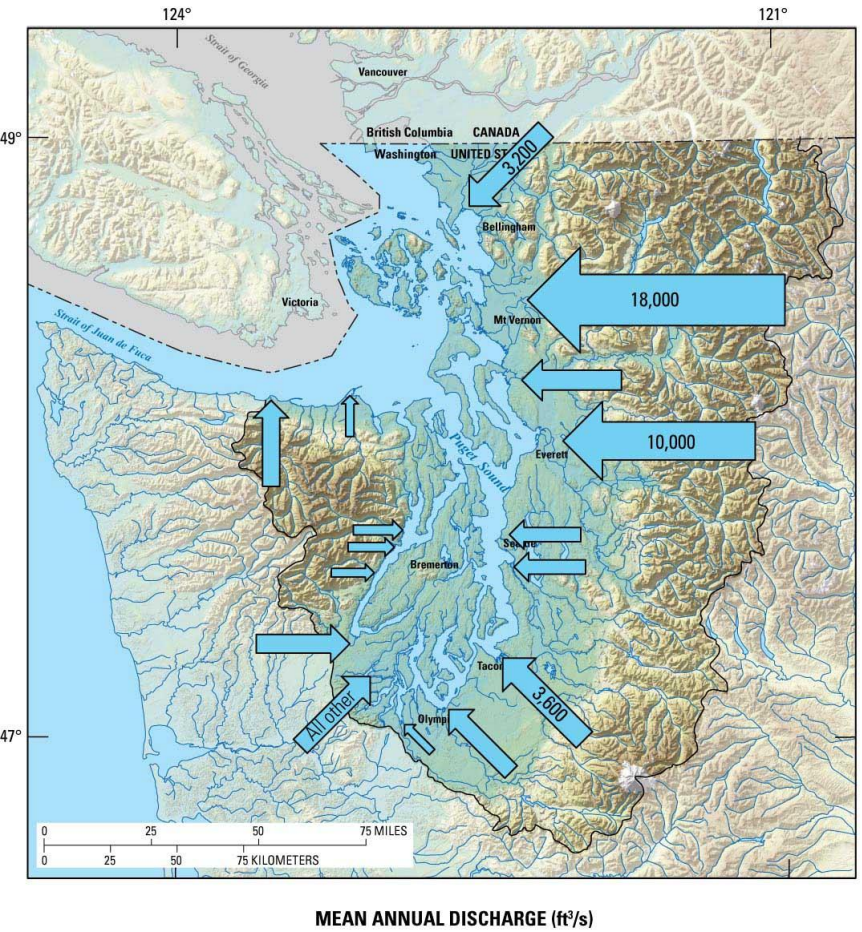
Magirl channel, below.

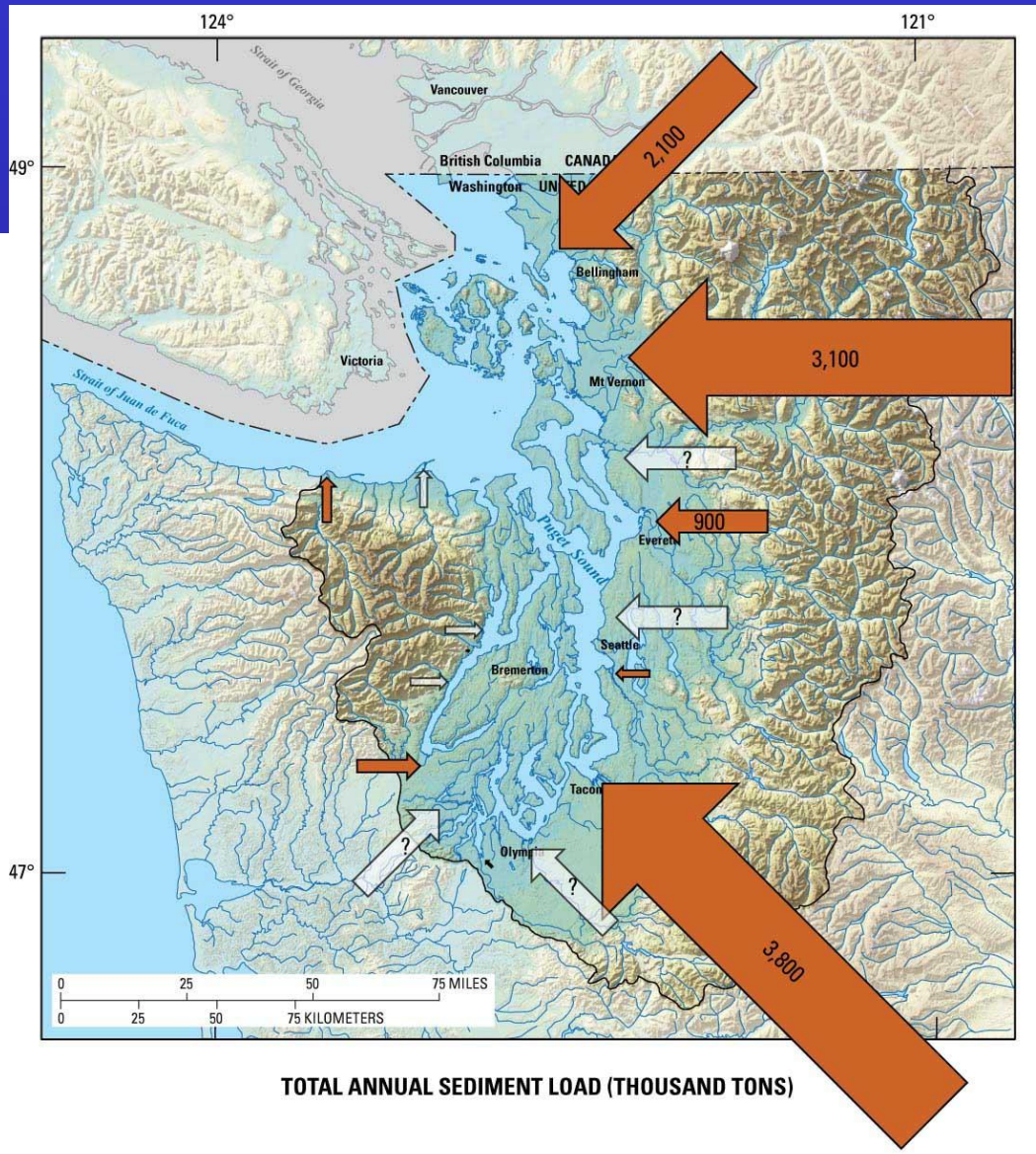


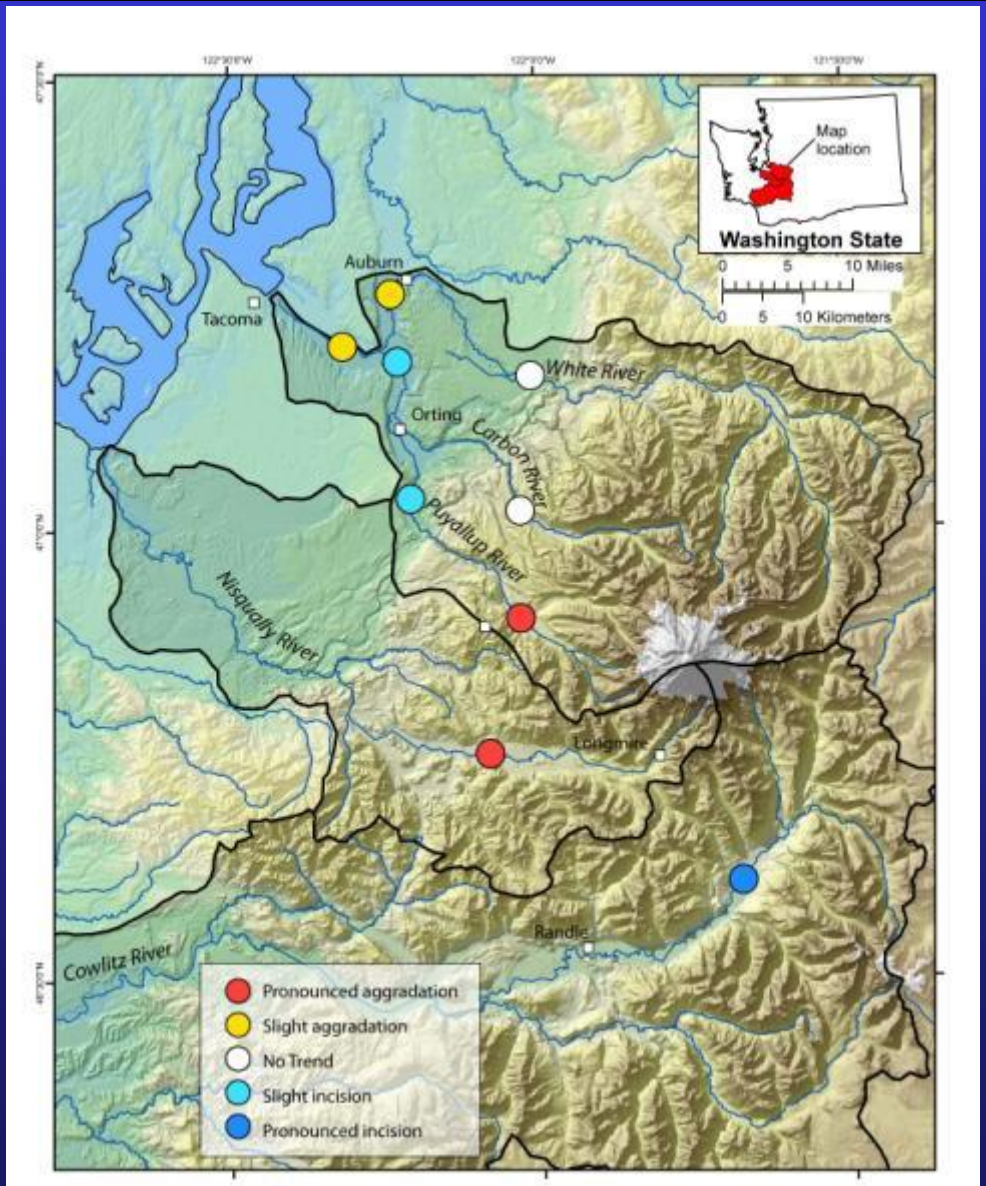
New Channel near Falls Creek, above.

Water and Sediment Loading into Puget Sound

- Very limited sediment data
- Puyallup system is heavily loaded with sediment







Aggradation outside the Park:

- Some areas aggrading, others not.
- River aggradation (outside the park) in excess of 7 feet has occurred since 1984.
- Jon Czuba (USGS) discusses this further in the Oct. 26 seminar.

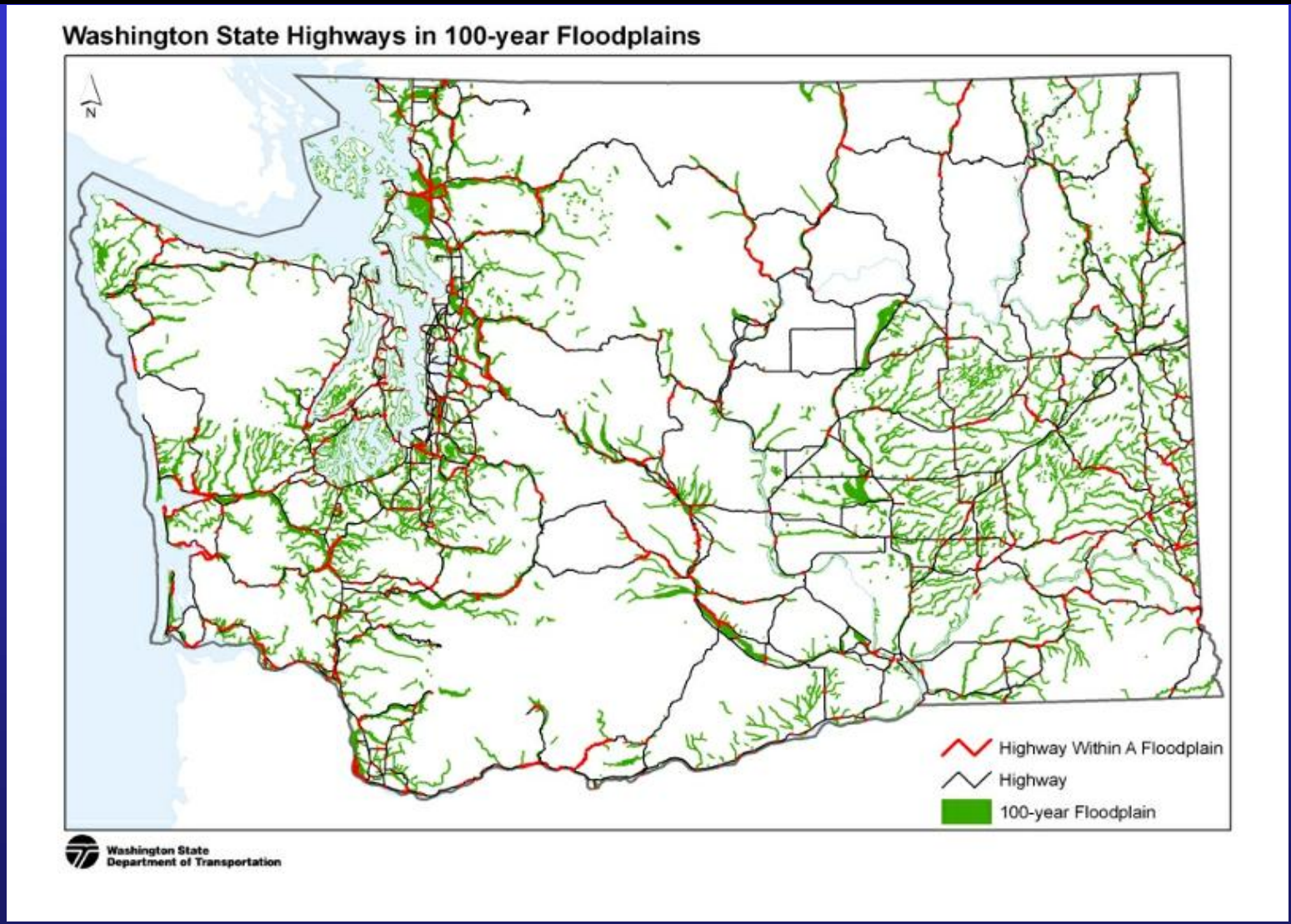
From Magirl, USGS, in prep.

In fact, this became a news story, regarding flooding…

Regional Issue

Volcanos and other glaciated peaks

Mt. Hood, OR, Nov. 7, 2007
(reinforced concrete sediment trap)



Of some 7000 miles of highway within Washington State, 500 miles (>7%) lie within jurisdictional 100-year floodplains.

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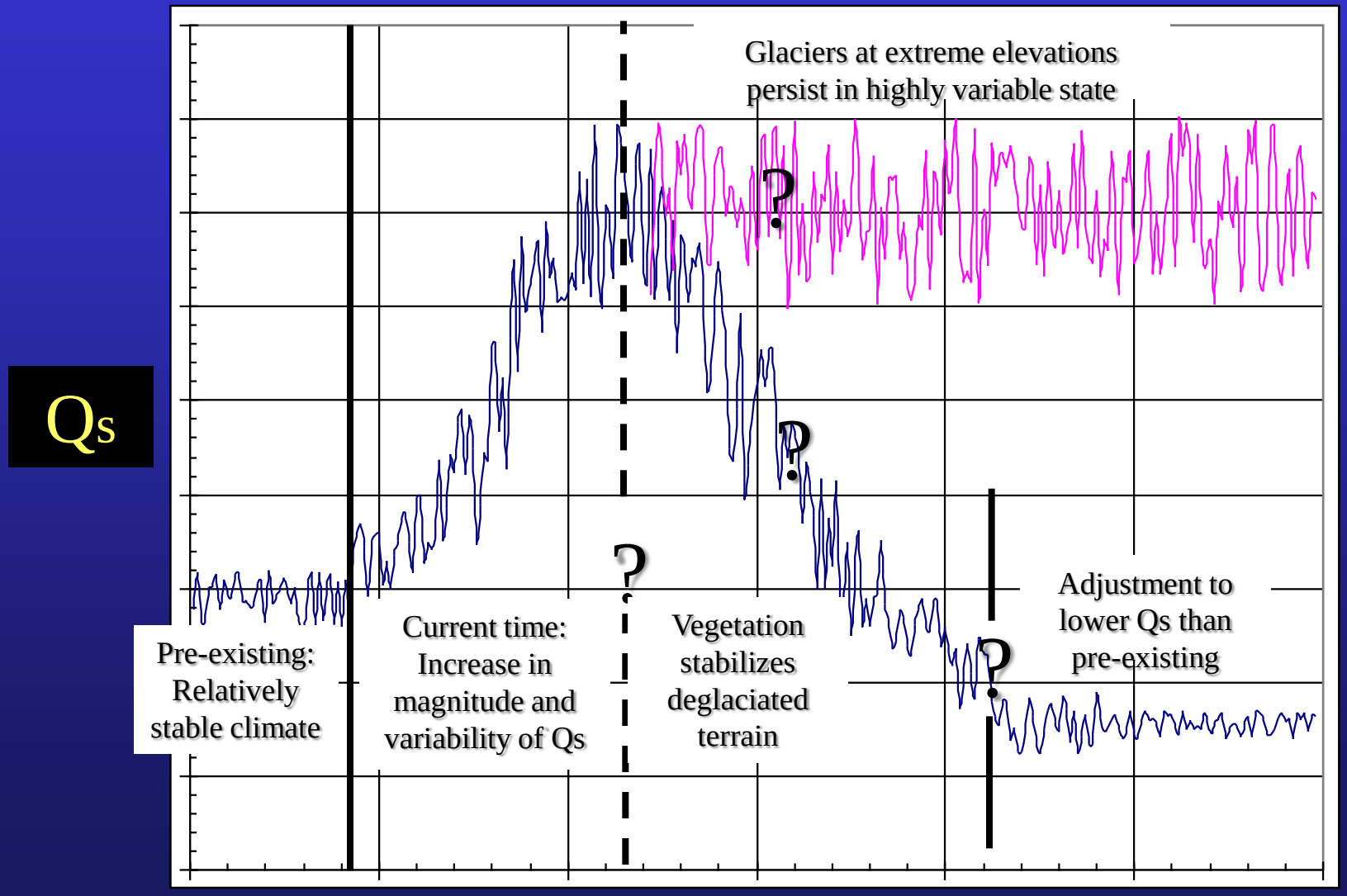
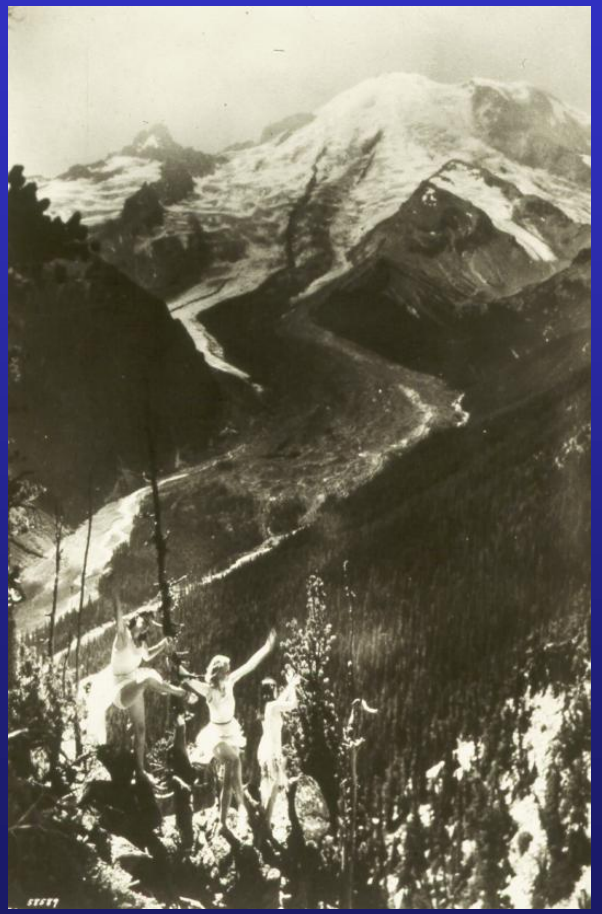
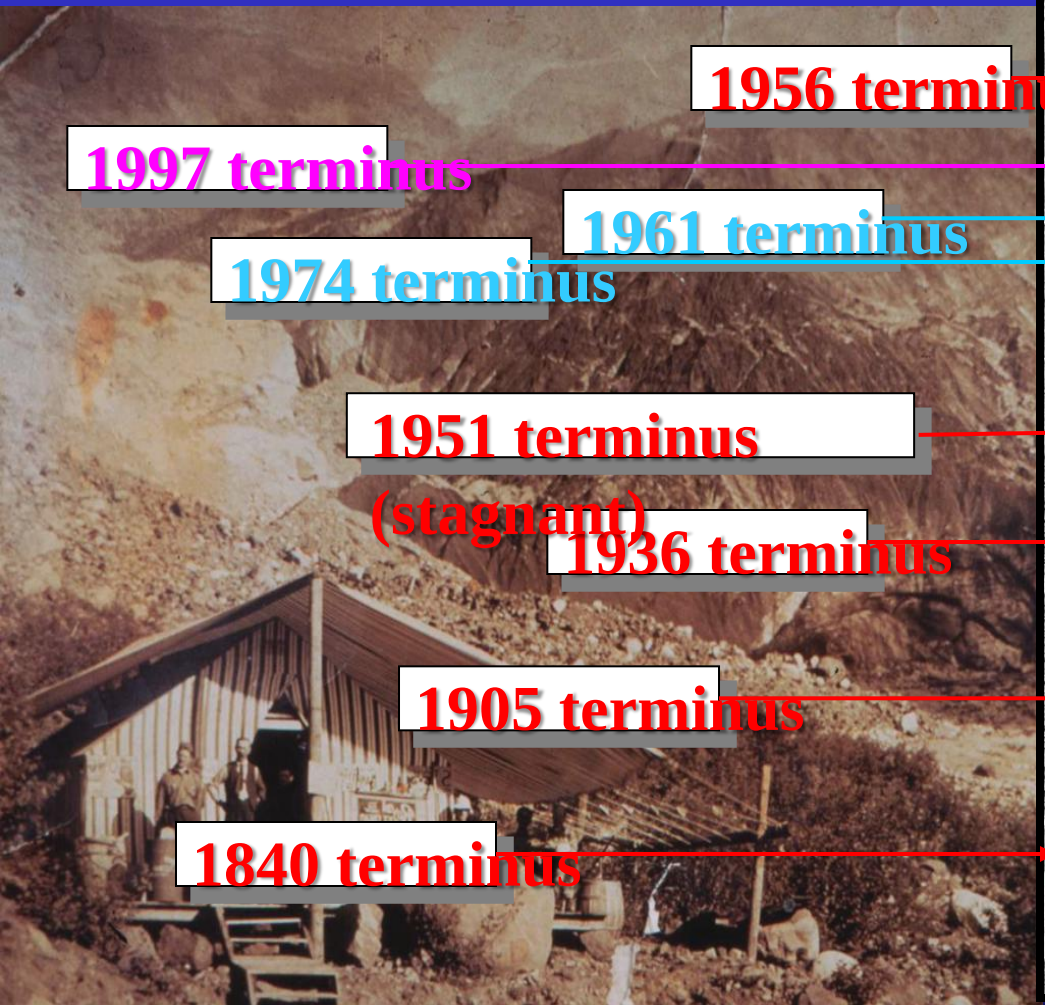
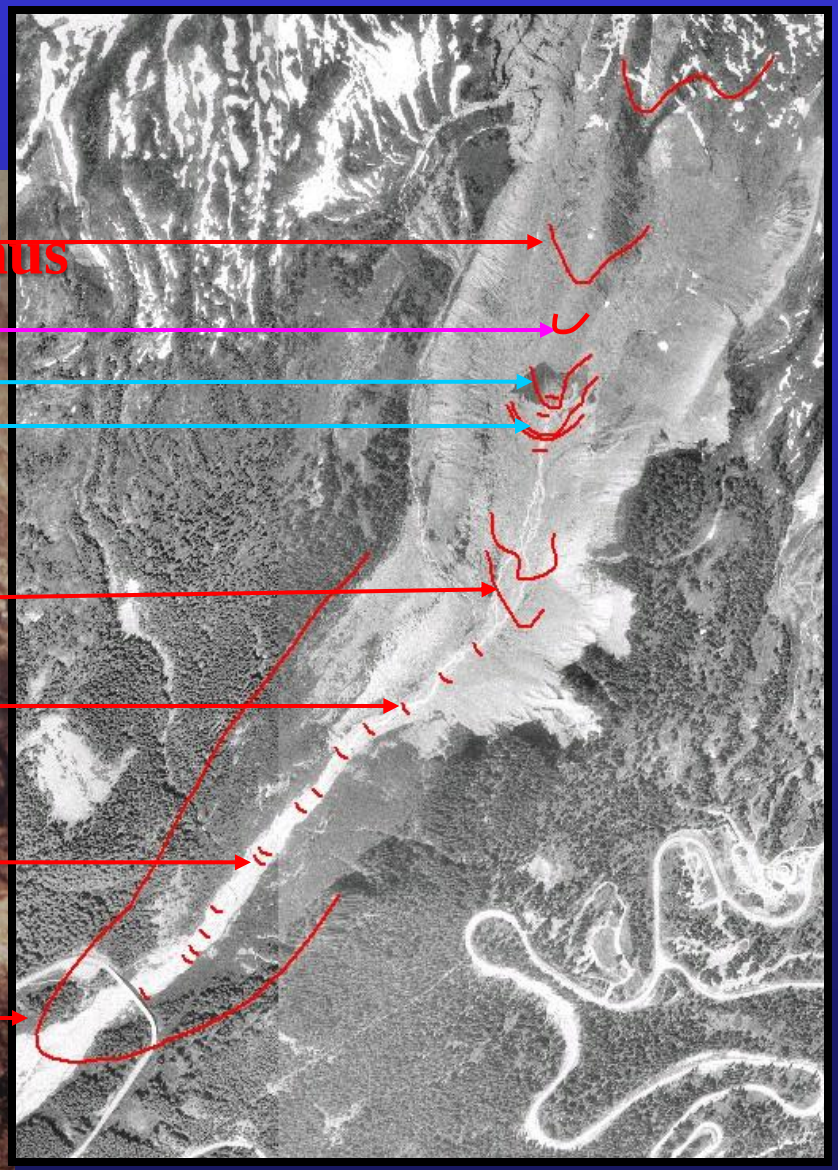


“I can see glaciers from my house.”



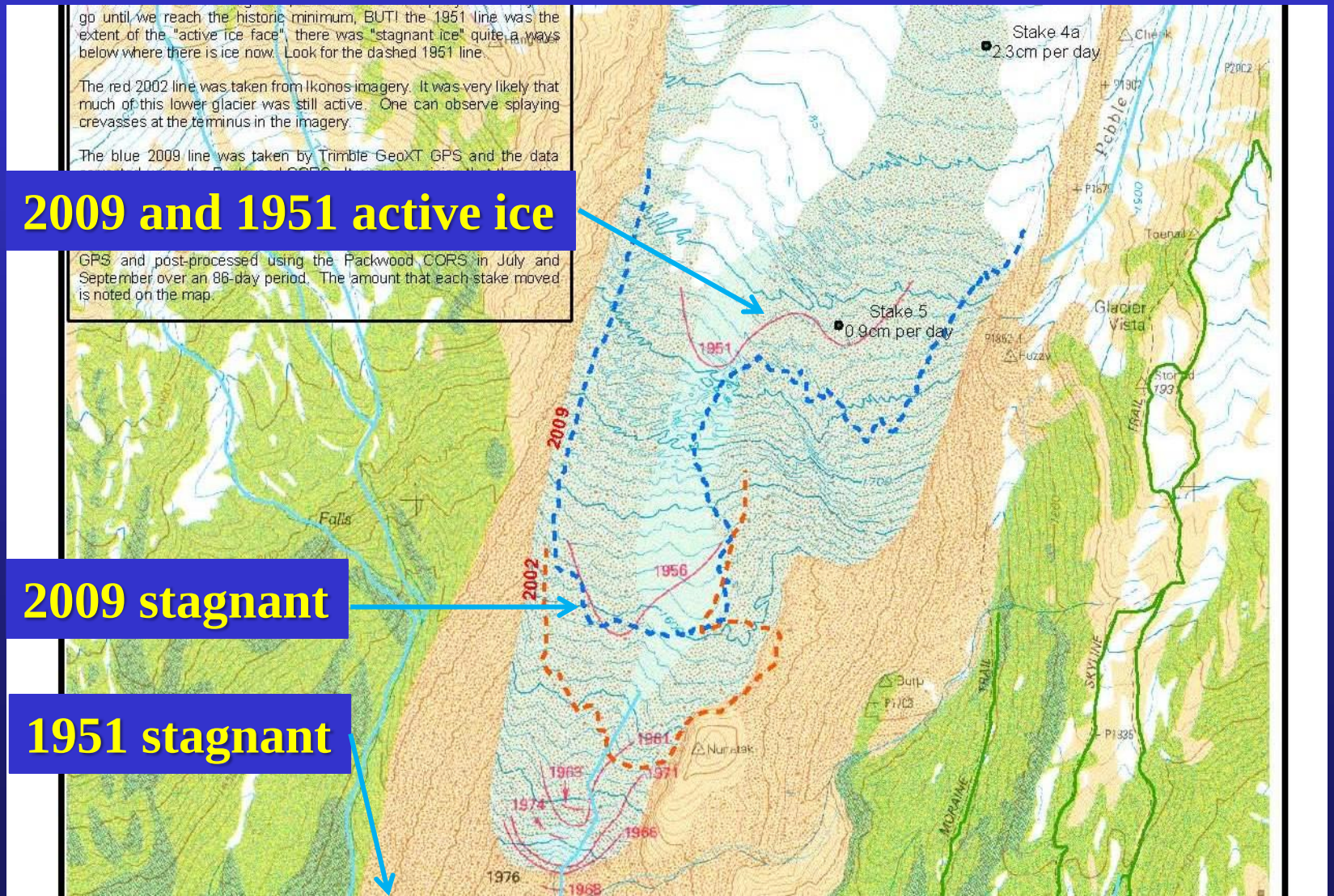
Glacier Variation and Retreat





The Nisqually retreated 700 feet since 2003, *S. Lofgren,* NPS.

Lower Nisqually Glacier - ~ 0-3cm / day



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Changes in Surface Altitude, Nisqually Glacier, 1931-2009

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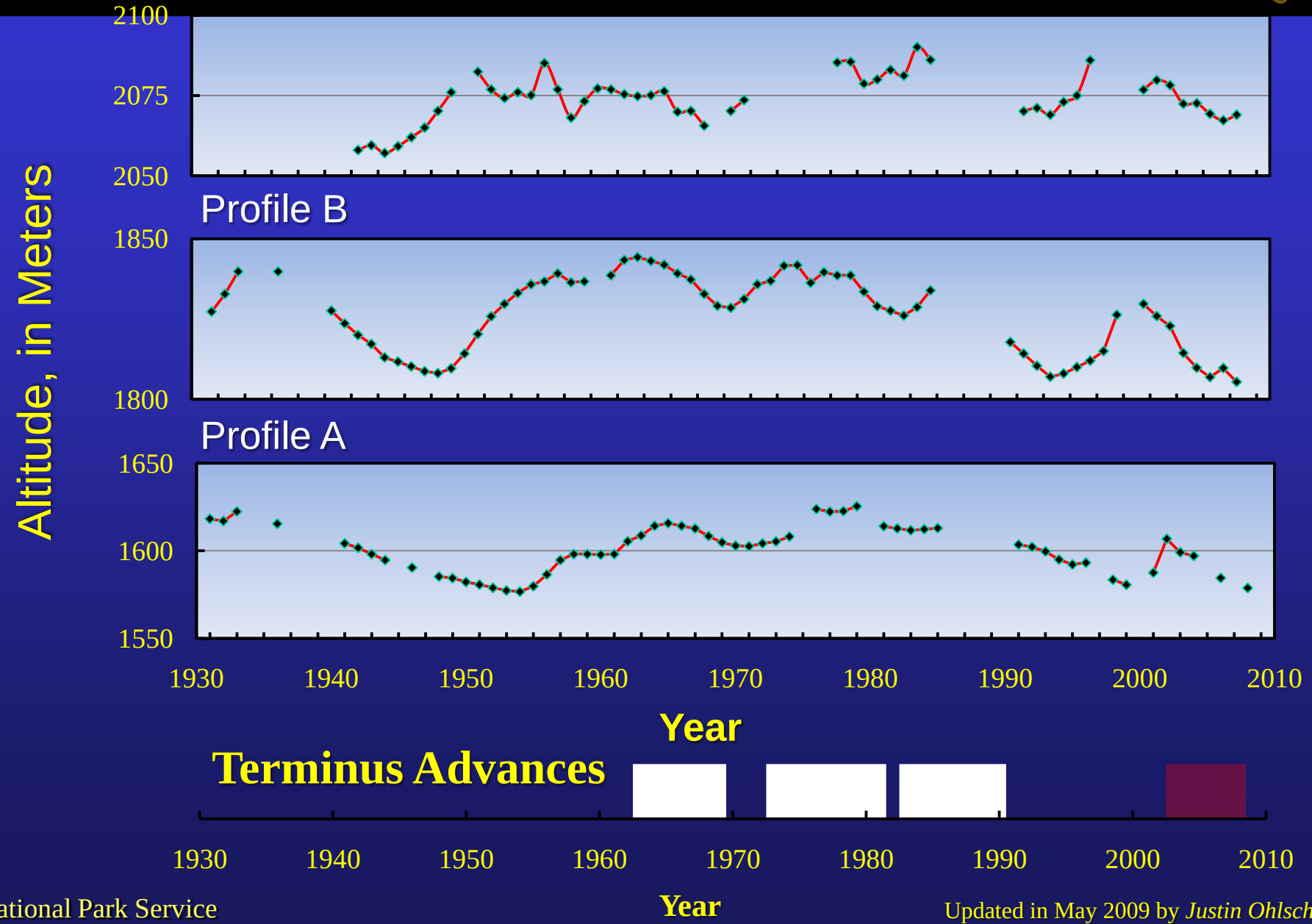


National Park Service

Updated in May 2009 by *Justin Ohlschlager*

Nisqually Glacier Now < 1950's Historic Minimum

Currently Receding
App. 100 feet / year

The fear is lower Nisqually is going stagnant…..

Longmire flooding 1951

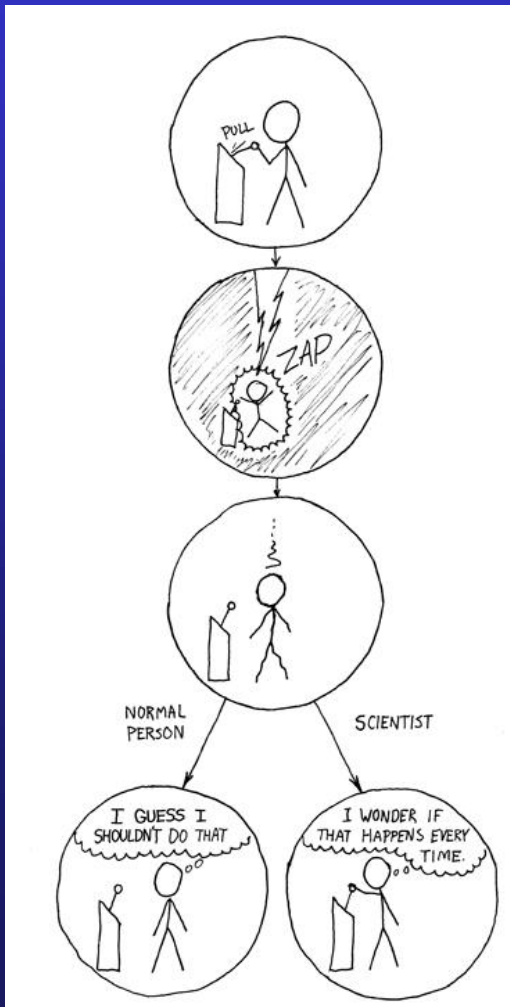
Stagnant ice breeds jökulhaups (glacier outburst floods)

Stagnant ice, above (Tahoma glacier).

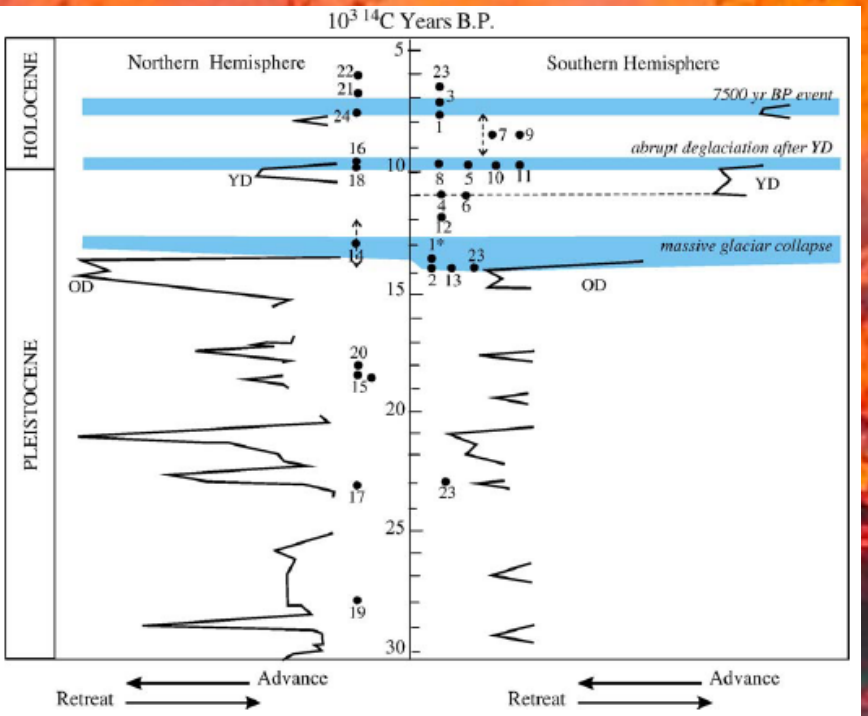
Below, jökulhaup, at Rainier.

Perhaps, it may be best to pick up the whole show and move it….

Thank you! Questions?



FACT #1: Monstrous, catastrophic, total volcano sector collapses are unambiguously correlated to climate change.



Source: Paul Kennard, Regional Geofluvialwhatever