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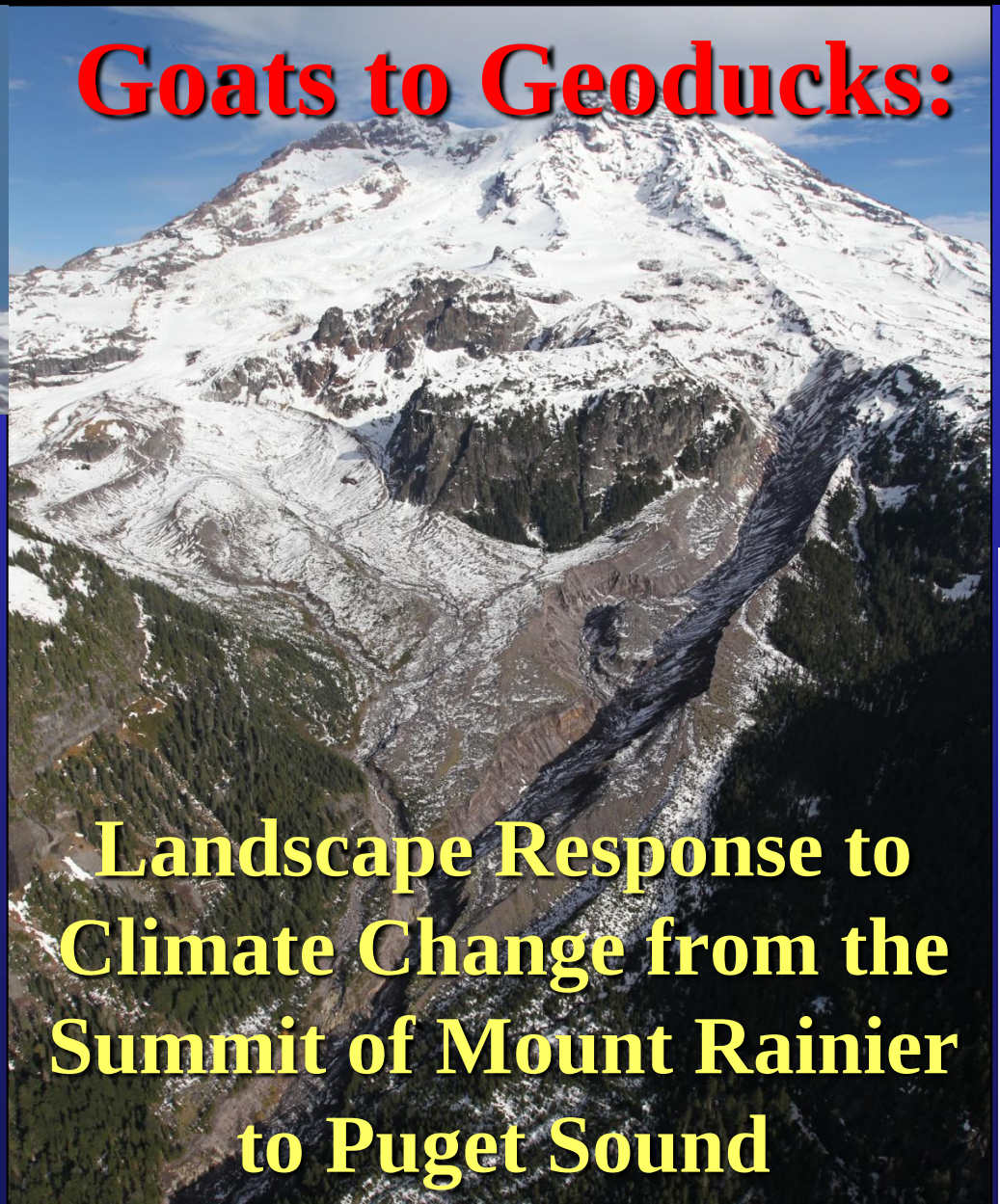
Pacific West Region - Mount Rainier National Park

Goats to Geoducks:



Landscape Response to Climate Change from the Summit of Mount Rainier to Puget Sound

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Stefan Lofgren*
Scott Beason*
Laura Walkup
Mt. Rainier NP

Tim Abbe
Cardno ENTRIX, Inc.
Chris Magirl
USGS

** = presenters*

or ….

Kautz Creek floods main road in 2008 and 2006.

Overview of Presentation

1. Flood of 2006
   - Why we care
2. Climate change and Rainier's glaciers
3. Consequences to glacier rivers: geomorphology, floods and sediment
   - Debris flows
   - Case studies
4. Regional implications
   - Outside of park
5. Emerging Hazards
   - The bad news…

Mount Rainier National Park

The Great Flood of November 2006

DESIGN CONDITIONS ARE CHANGING

Starting Nov. 6, 2006: 18 inches of rain fell in 36 hours, immediately flooding many roads.

Park rivers responded immediately, with record flows

The Usual Road Failures…

Stream capture by road (parallel to river).

Carbon River Road

- Roads have much lower roughness than surrounding forests.
- They become preferential flow paths.

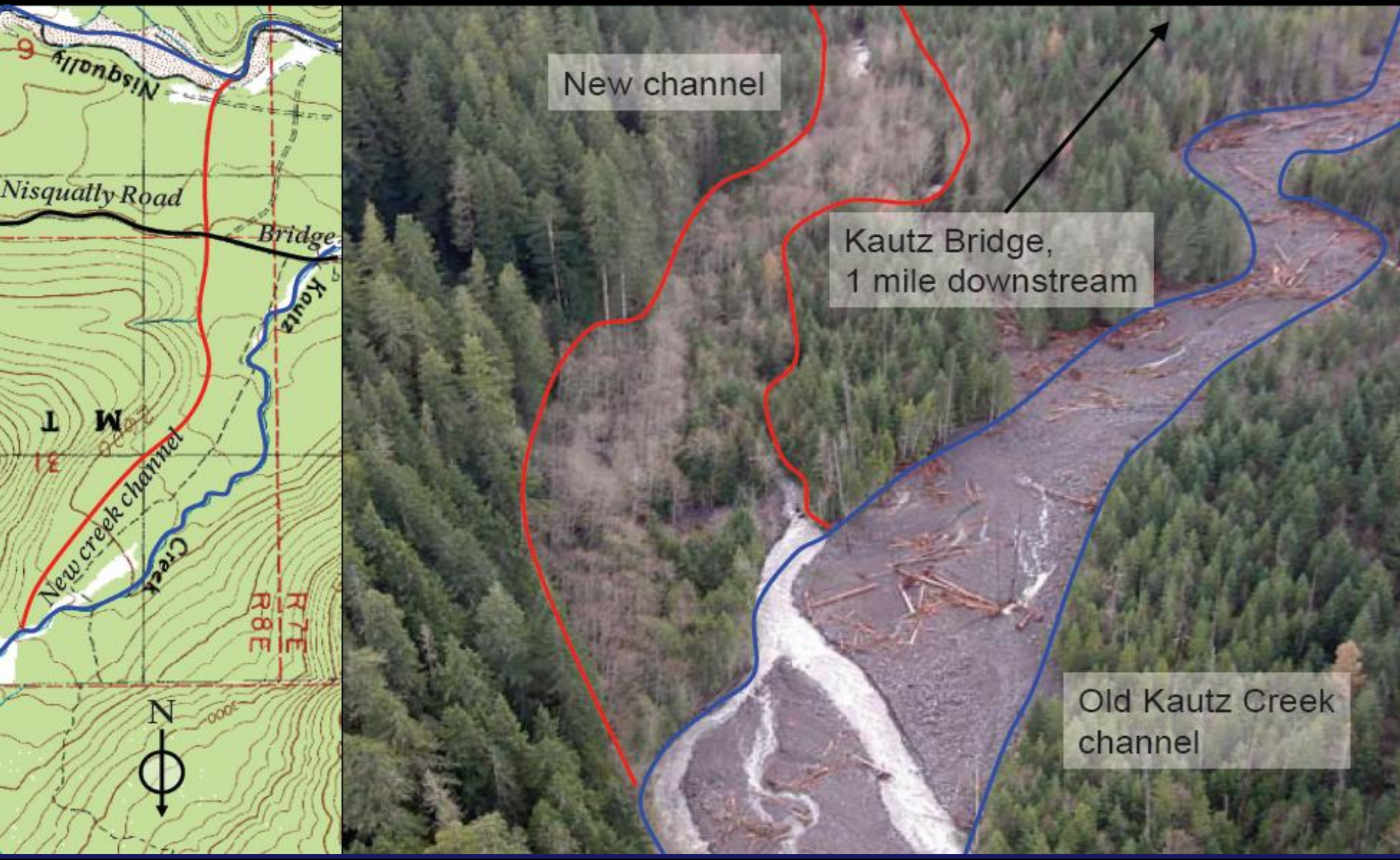
Mount Rainier National Park

November 2006 Flood Damage

Over half the campground, more than 5 acres of land in all, was washed away. The only winter road into the park was destroyed.

Mount Rainier National Park

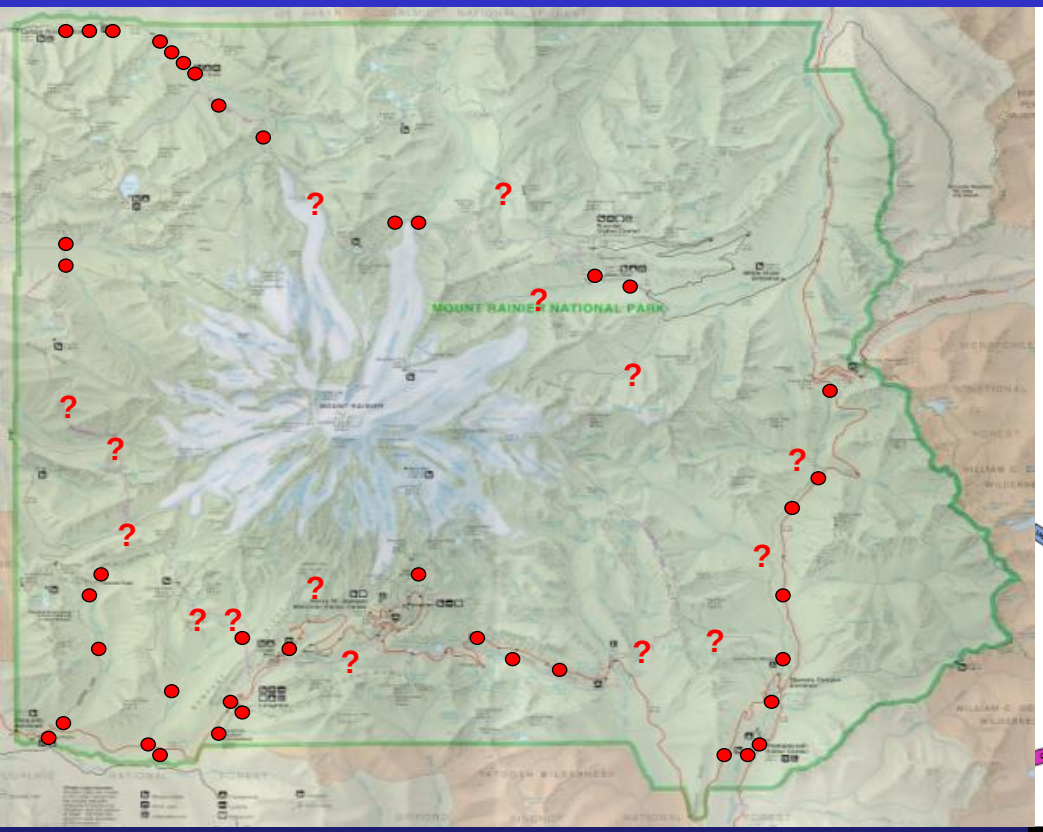
November 2006 Flood Damage

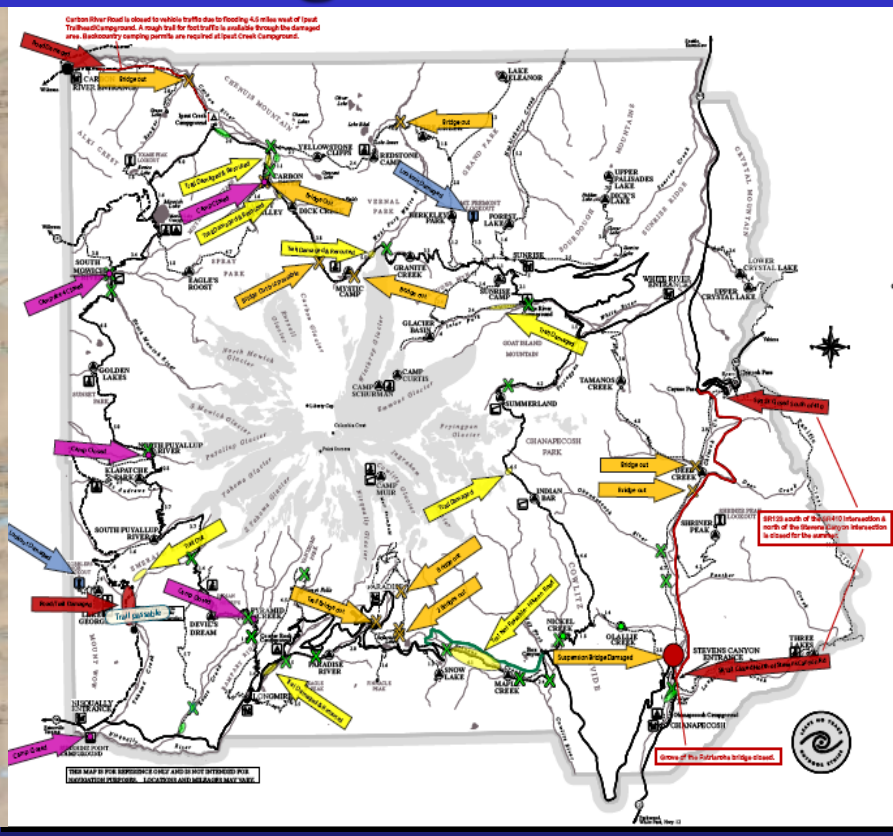


Aerial surveys showed that the creek had changed course more than a mile upstream from the road bridge.

Kautz Creek flooded main road after avulsion

Road and Trail Damage





- Park closed for over 6 months;
- Over $36 million dollars damage;
- Park still not fully recovered…

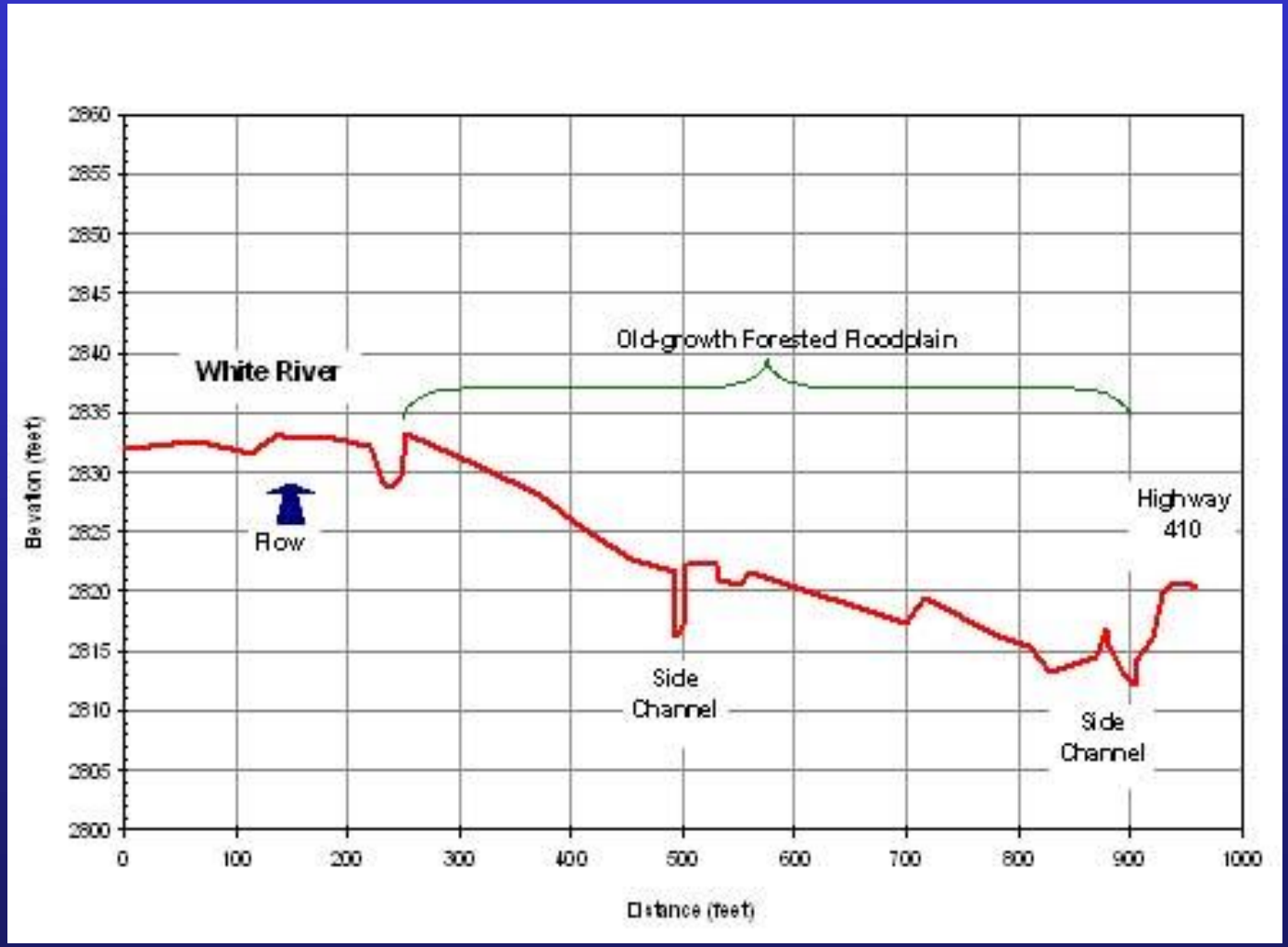
Mount Rainier National Park

The Great Flood of November 2006

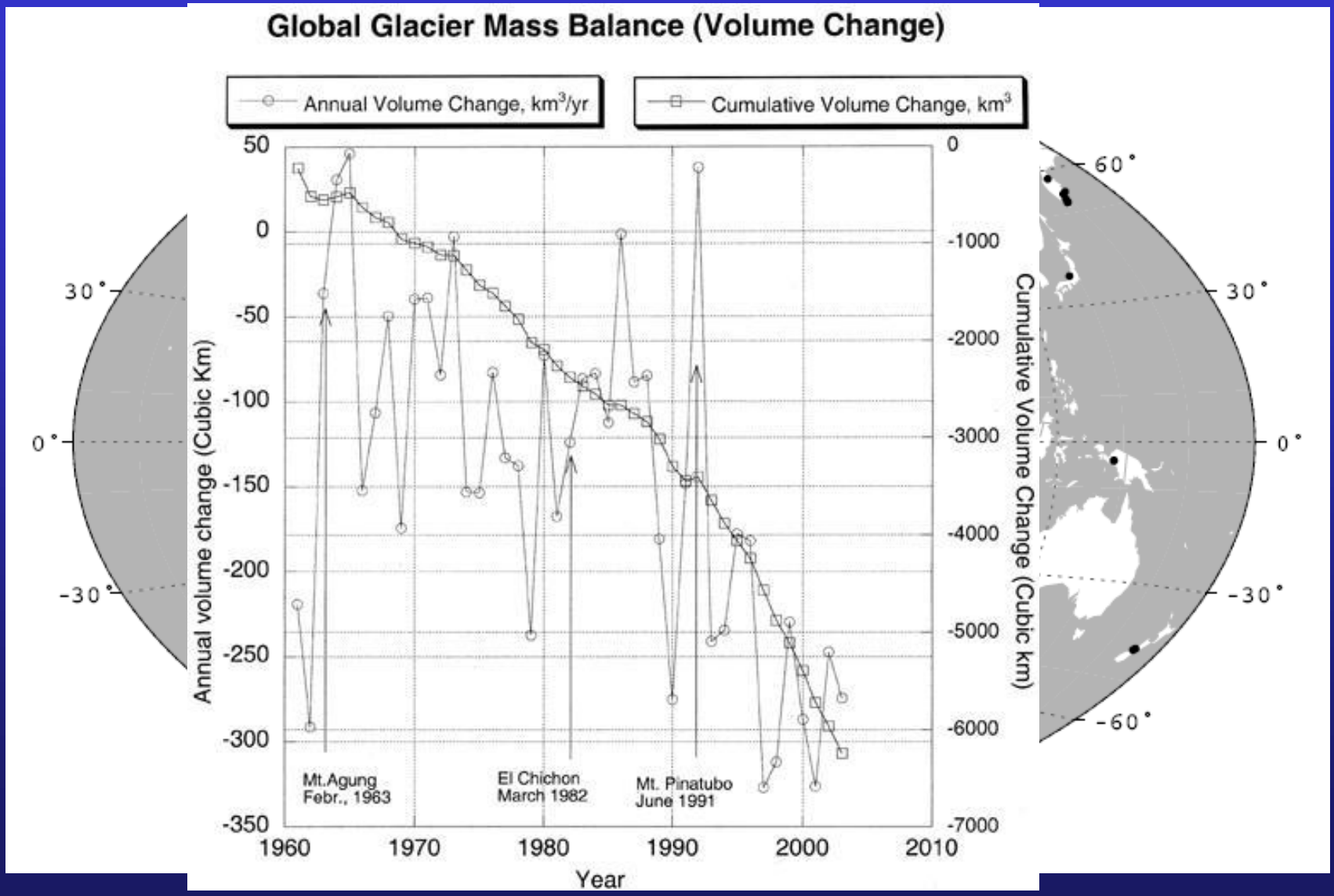
The riverbed under the Tahoma Creek Bridge rose more than four feet during the flood.

White River – flow above road surface in summer

Road Problem at White River



Road is up to 16 feet below river *bed*!



Evidence of glacier change (Dyurgerov 2002)

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Climate change

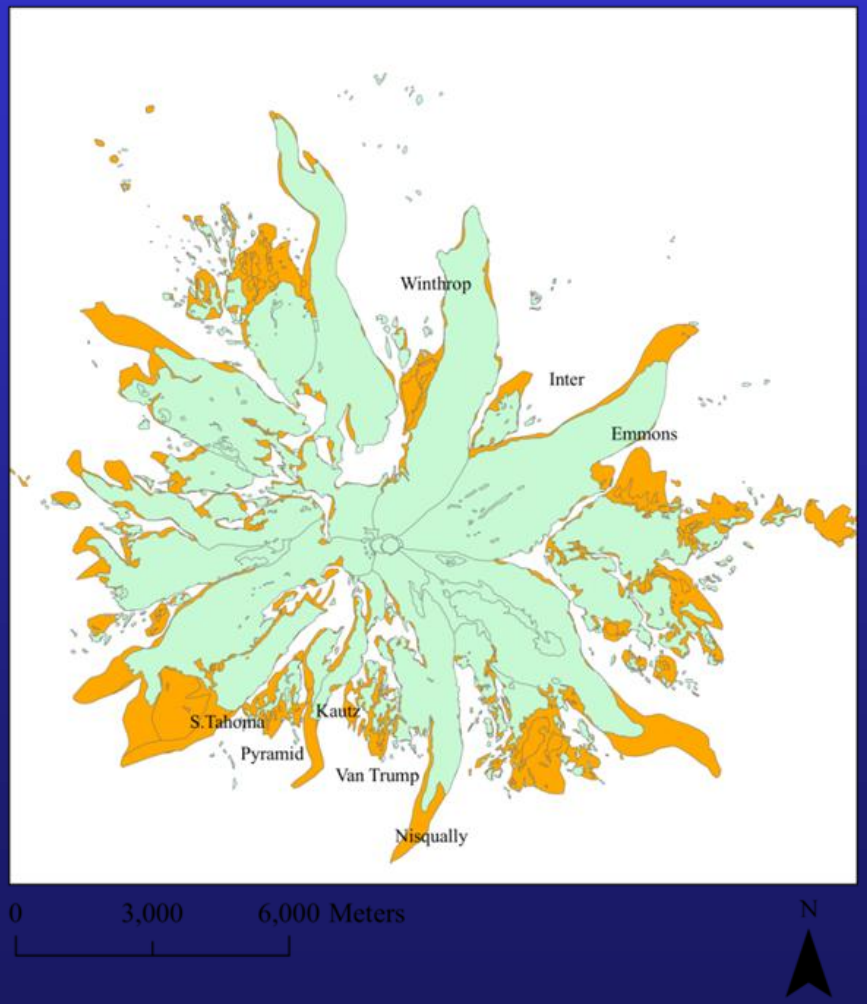
"Pacific Northwest temperatures are higher than anytime in the last 1300 years"

**Philip Mote,
Washington State
Climatologist (May, 2007)**

Enormous Amount of Glacier Ice: 1 cubic mile…

Glacier that have disappeared in our time…

- Steven's Glacier
- Pinnacle Glacier
- Van Trump Glaciers
- Pyramid Glacier
- Boundary Glacier
- Williwakus Glacier
- Paradise Glacier (Lower Lobe)
- Ohanapecosh Glacier?



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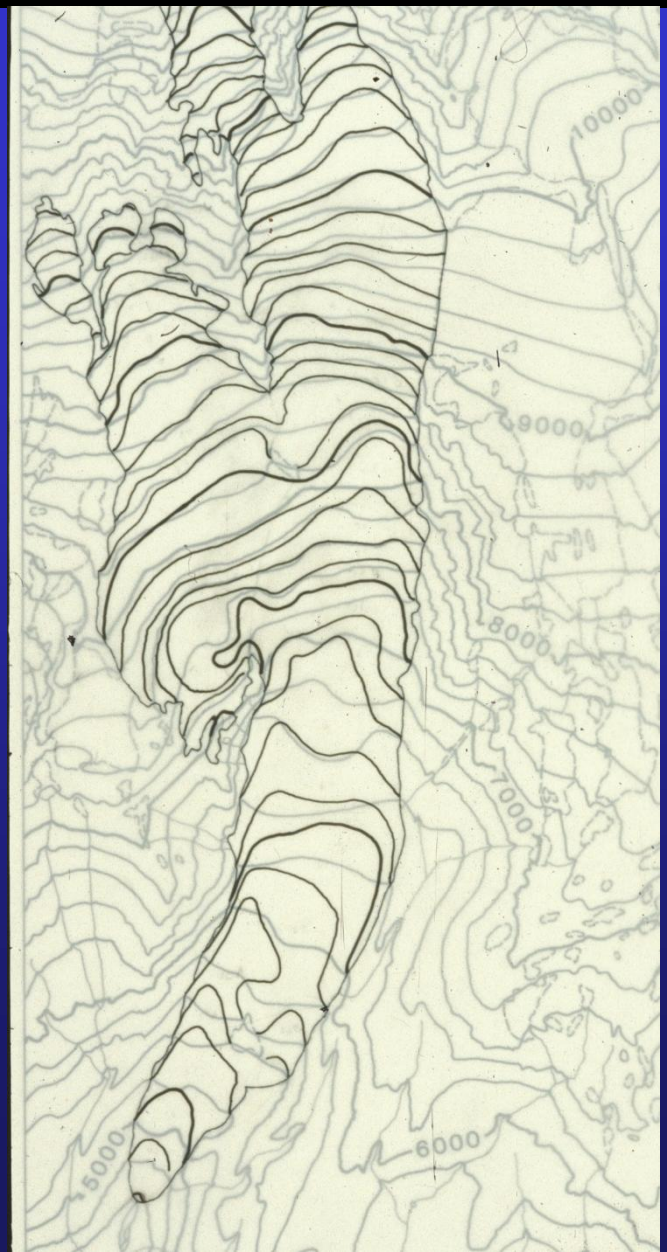
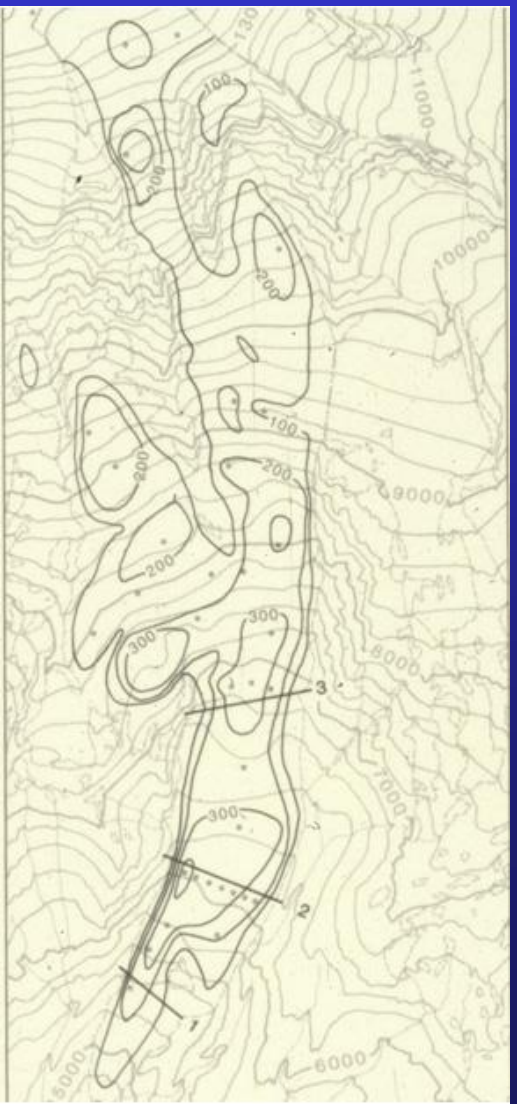


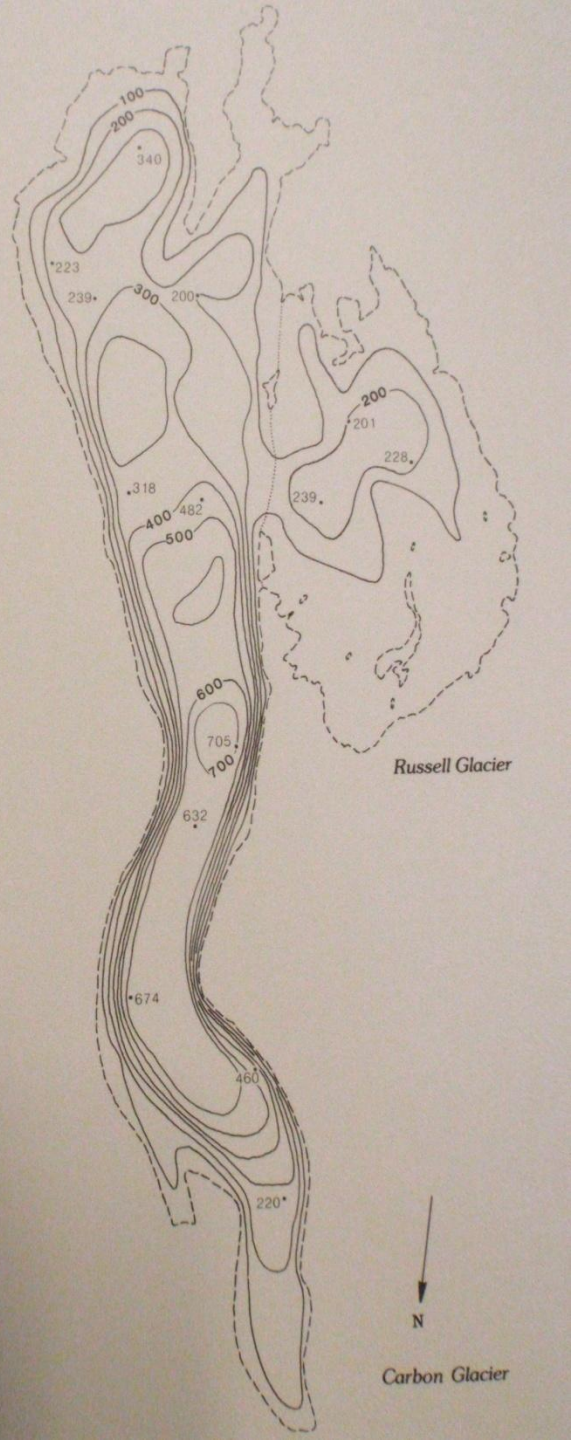
Glacier Ice Thicknesses



1) **Nisqually glacier**: over 400 feet deep; below the “Fan”;

2) **Carbon glacier**: 700+ feet mid-glacier;

3) **Crater**: ice 245 feet thick.



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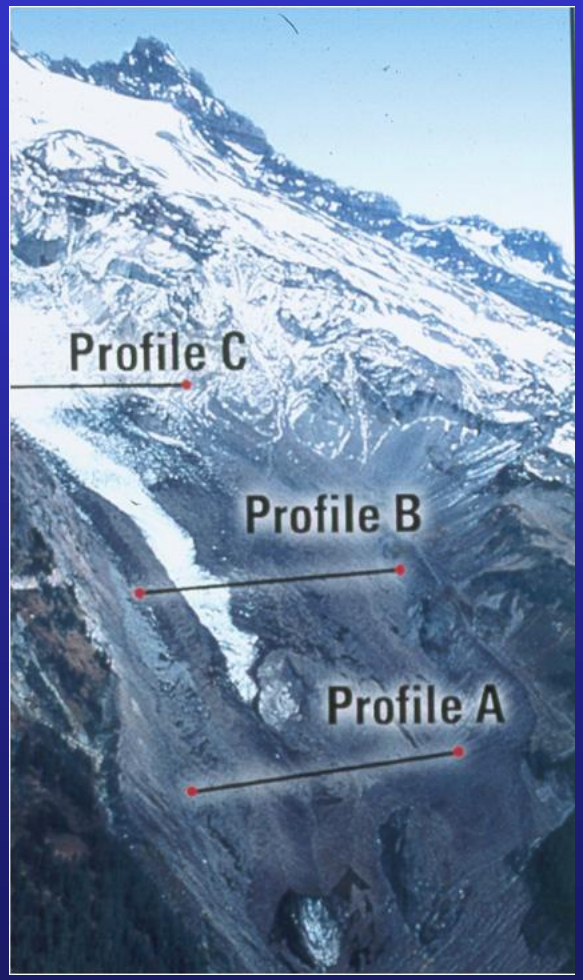
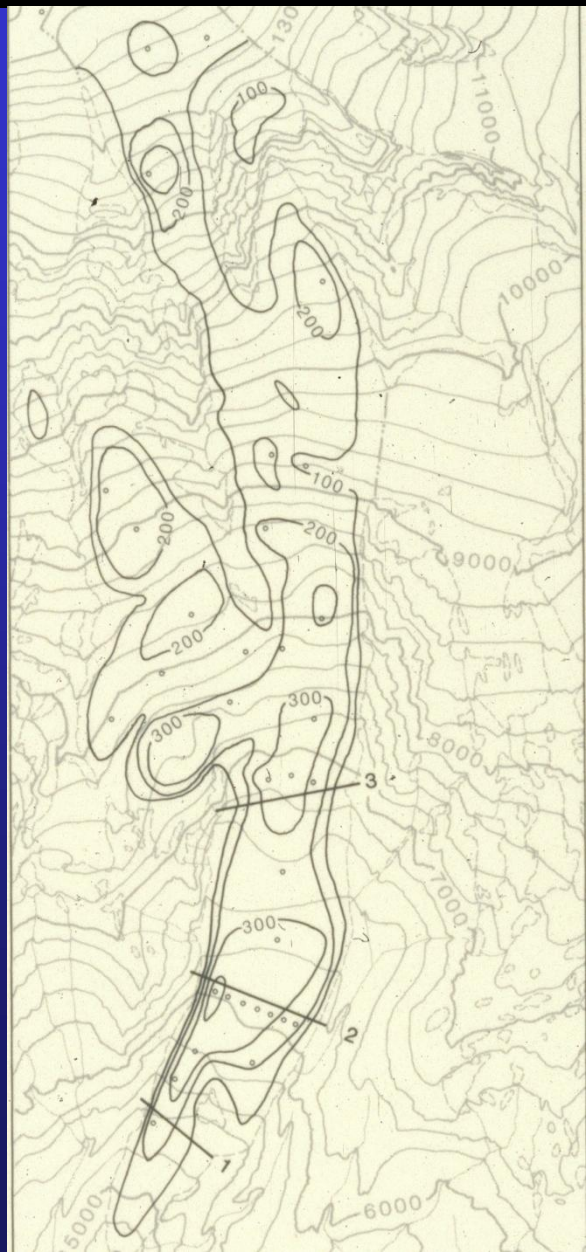
Nisqually Surficial Survey

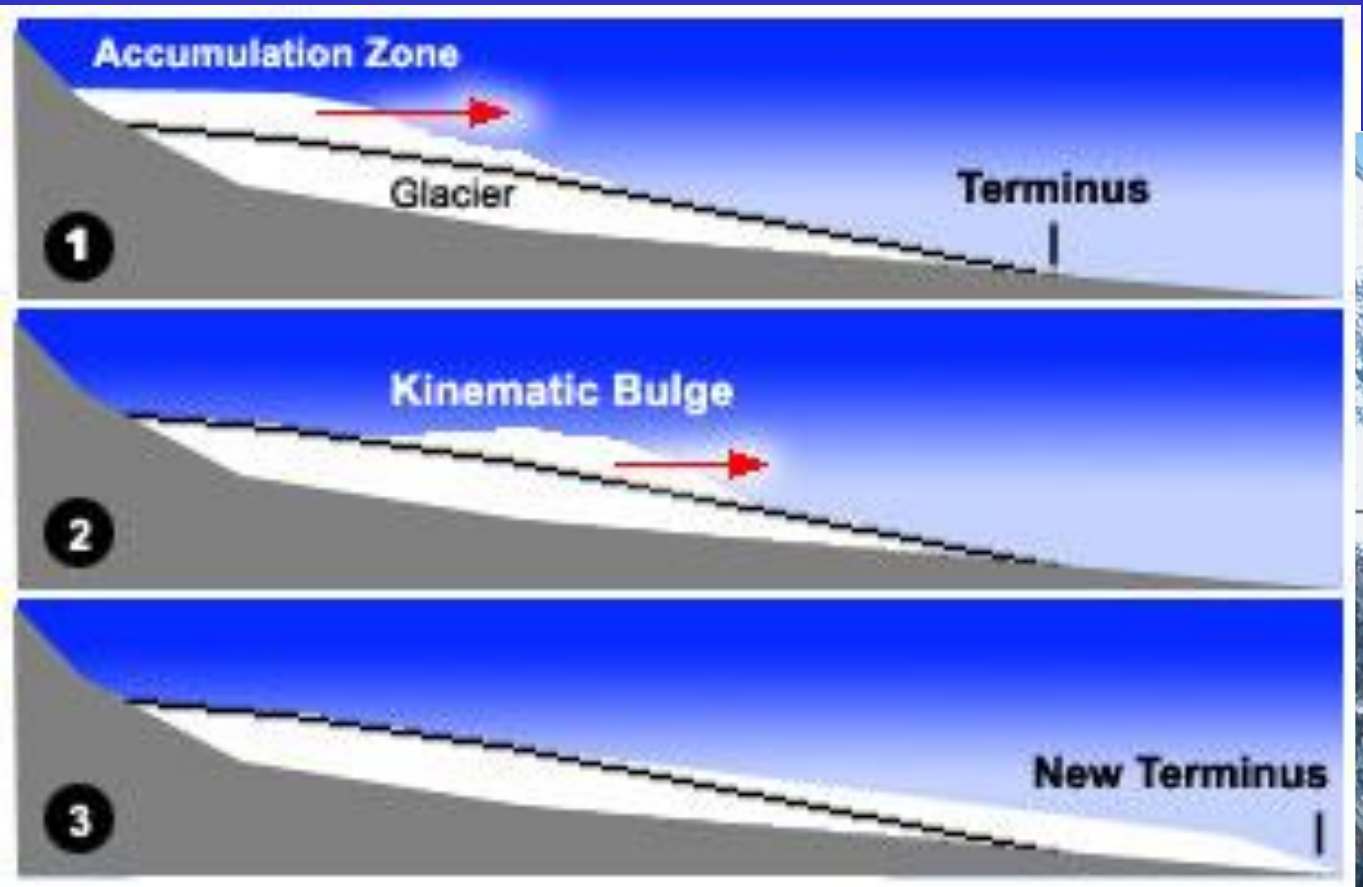
3 profiles

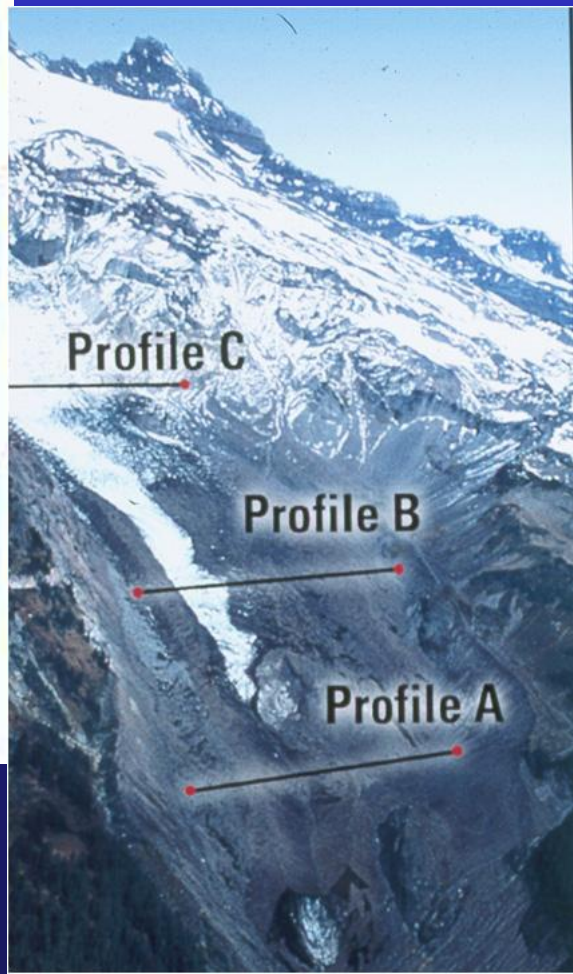


Surveys started in 1931.



Kinematic Waves, in response to accumulation of snow.





- Profiles , right, “bulge” by 10’s of meters, one after another.
- Wave travels about 4-5 times as fast as average speed of ice.
- Terminus usually advances 15 years after accumulation.

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Changes in Surface Altitude, Nisqually Glacier, 1931-2009

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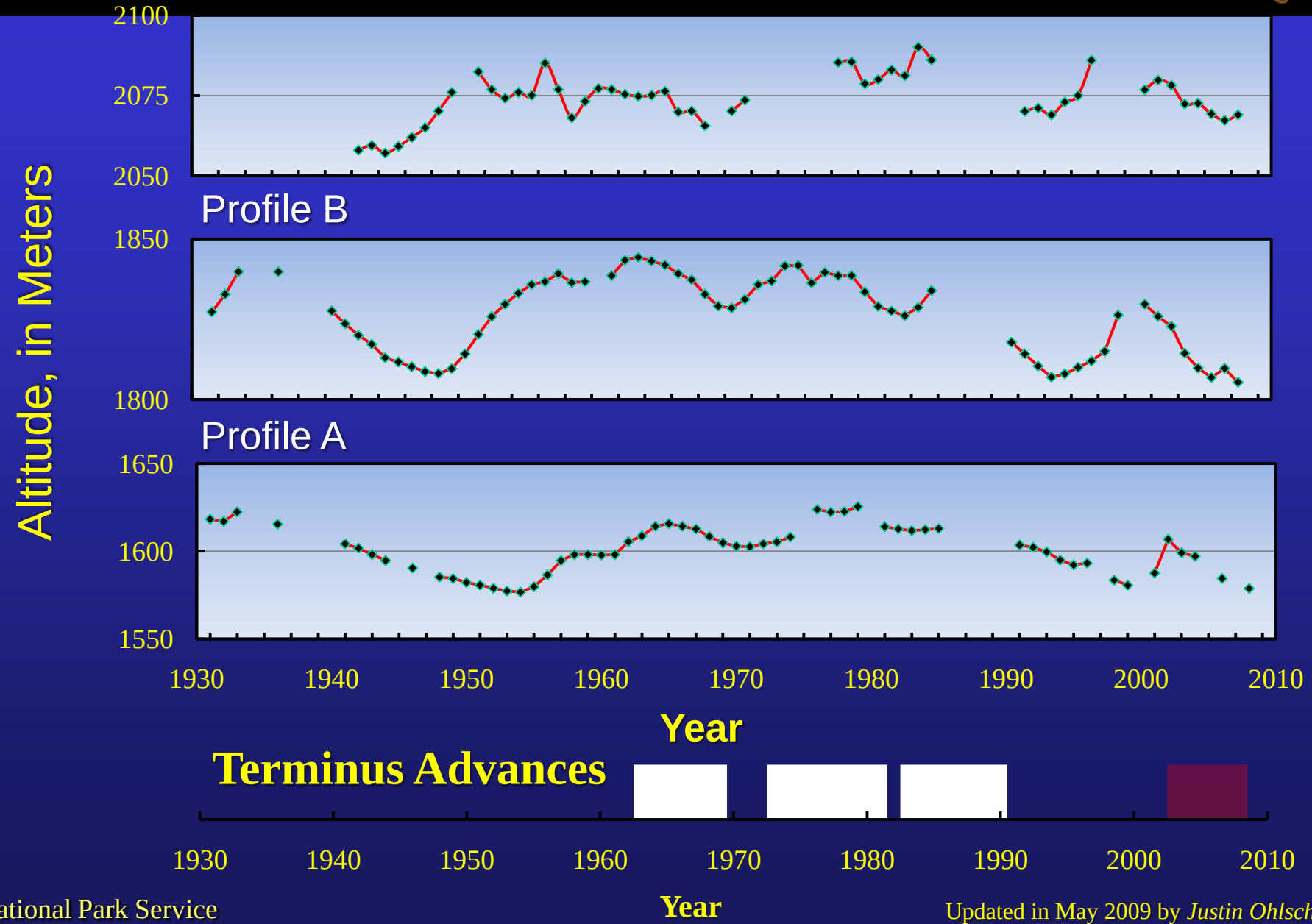

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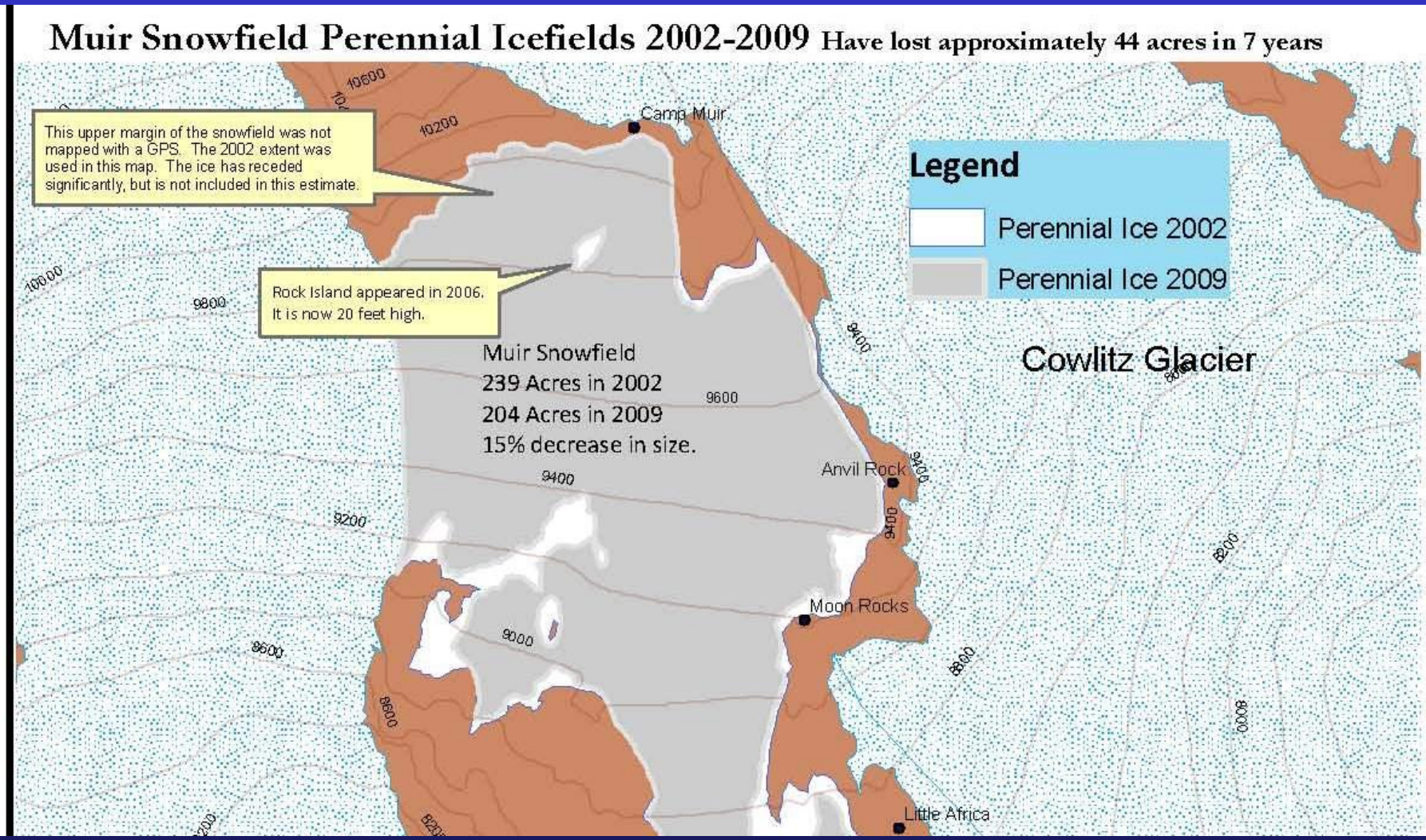
Updated in May 2009 by *Justin Ohlschlager*

"Muir Snowfield" ~44 acres in 7 years



Famed Muir Snowfield (climber's gateway) melting away.

The Muir snowfield has lost ~1 m w.e. of ice every year since me
started. Ice melt revealing bedrock on the Muir Snowfield, 200

Nisqually Glacier

2004

Photo: NPS/Scott Beason