

The forest/stream connection:
What have we learned in the past
50 years?

Robert L Edmonds
School of Environmental and Forest
Sciences
University of Washington

What have we (I) learned in the
past 50 years?

A Lot

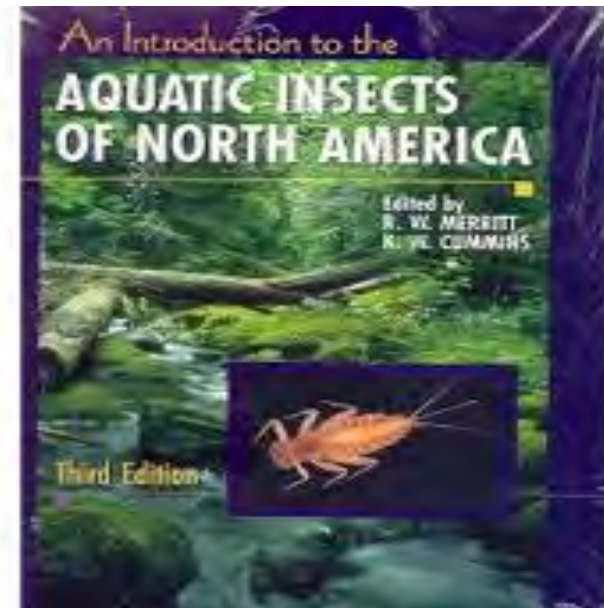
Talk Outline

- Healthy landscapes are dependent on fully functioning forest/stream connections.
- My objectives are: (1) to give a historical perspective of the impact of land use on forest/stream connections in the Pacific Northwest and (2) what we have learned over the last 50 years since I began my university studies.
- I will discuss what I think were the most important periods or events, relate this to my own research, end with a few conclusions.

Healthy forests/Healthy biota/ Healthy streams



Courtesy American Rivers



A walk through Pacific Northwest land use/water history

Before 1850 - prior to the start of old-growth logging, commercial salmon fishing and mining

1850-1930 + - the intense period of old-growth forest harvesting and mining,

1890 –1930 – establishment of dams for city water supplies and power, Seattle, Tacoma

1930-1960 - the “taming of nature” period – dams for hydroelectricity, flood control, irrigation and river transportation. Columbia River - Grand Coulee 1933, Bonneville 1934, etc. TVA - 1934
USFS watershed harvesting hydrology studies

Old-growth logging log jams

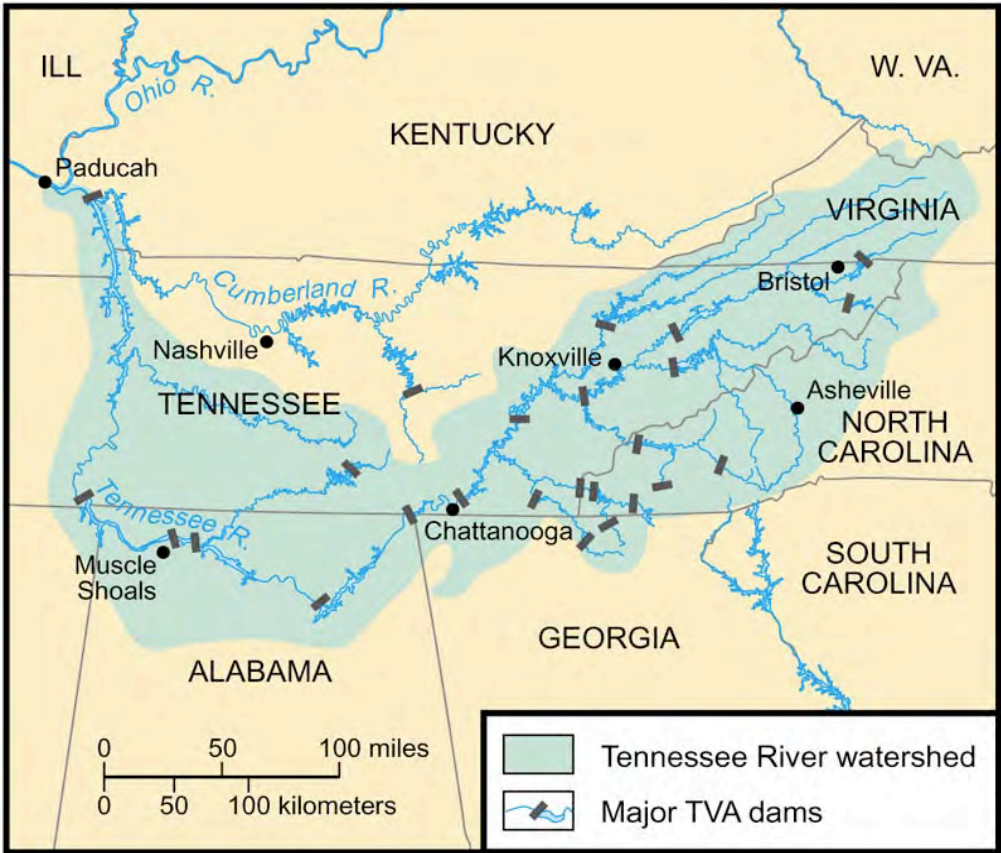


Center: Log jam on Elkhorn
Creek, Trask River. (9-28-49)

Near Tillamook Oregon

Gharrett and Hodges. **1950**. Salmon fisheries of the coastal rivers of Oregon south of the Columbia

- The Oregon Fish Commission has developed a long range management program for the coastal rivers. This encompasses **stream clearance**, the use of **artificial propagation** in introducing runs and supplementing natural runs, and the **close regulation of the commercial river and offshore fisheries**.
- This program has not been underway long enough to ascertain its success, but in **several instances it appears to offer promise**.



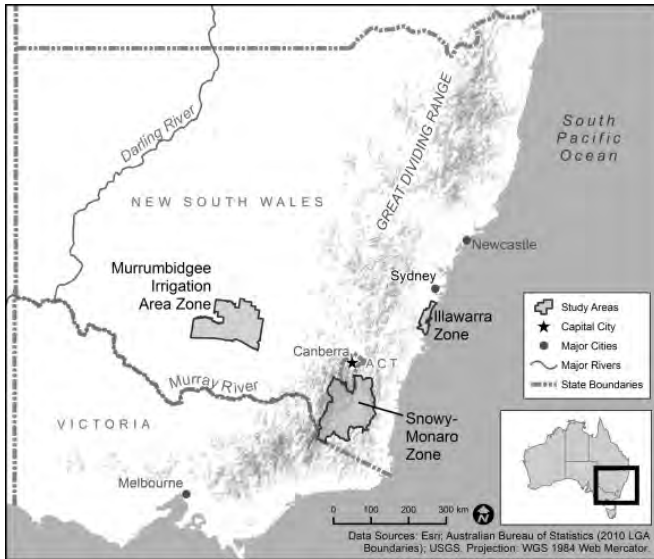
THE TENNESSEE VALLEY AUTHORITY

32 dams in Washington State



*"Bonneville Dam looking east"
Image from U.S. Corps of Engineers Archives*

Snowy River Scheme, Australia 1959-1974



History continued

- **1950 – present** - the period of modern forest harvesting,
- **1960 – present** - the ecological and ecosystem period (importance of the IBP Coniferous Forest Biome Program (1969-1982) – streams and forests should be studied together and the importance of dead wood in streams

Modern forestry has created a landscape that looks like this on the Olympic Peninsula – note Olympic National Park



History continued

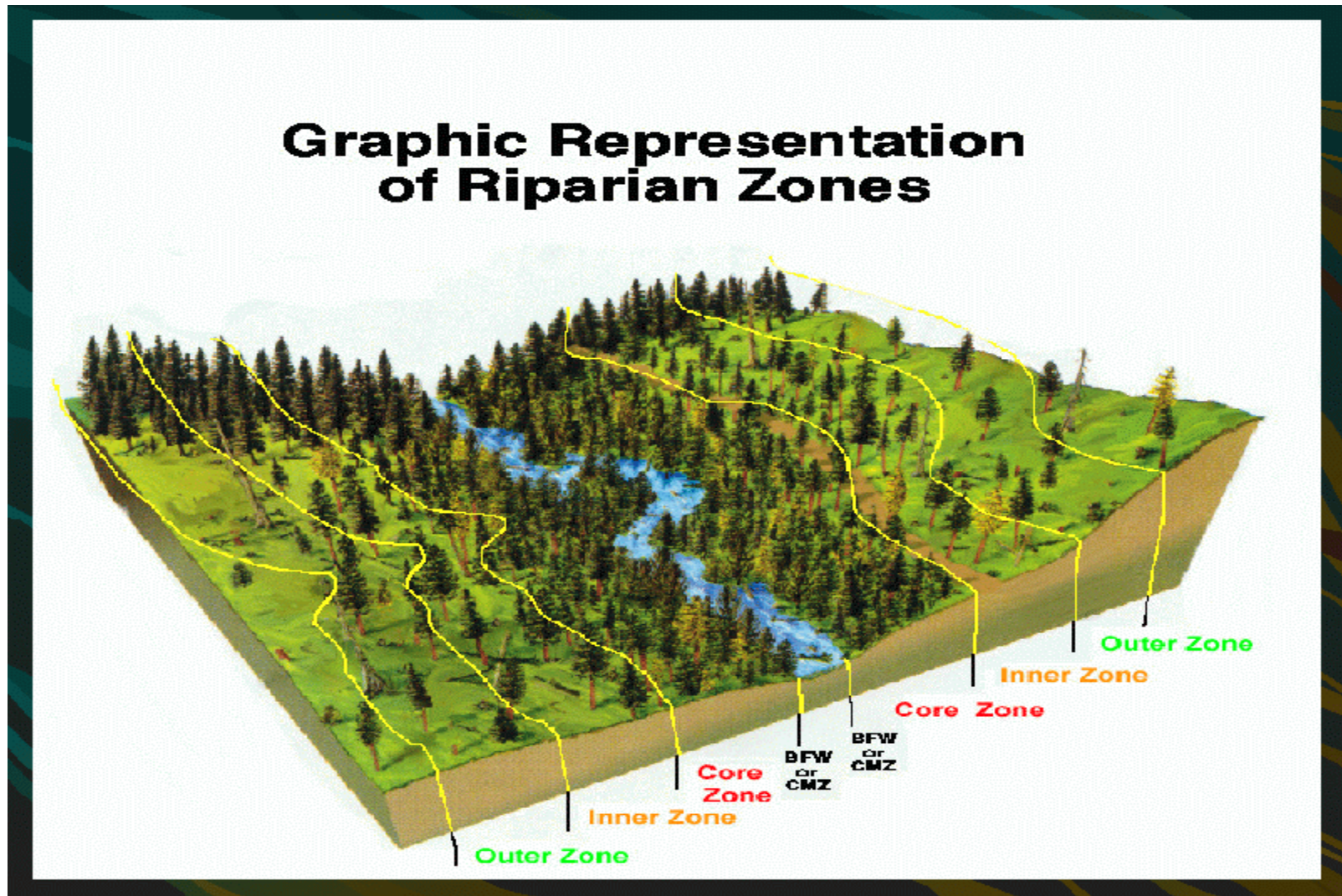
- 1970 – present, the period of regulation – EPA, forest practices, forest-fish-riparian laws
- 1980 – present, the air pollution period (acid rain, excess nitrogen, trans ocean pollution)
- 1980 – forest/fish academic studies period – establishment of the Center for Streamside Studies (1984 -2010)
- 1990 – landscape issues - the concern about urbanization and stream restoration, sustainability of forests and streams, invasive plants and pests

History of forest protection legislation and practices in the PNW

- WA Forest Practices Act 1976
- Northwest Forest Plan 1994
- Forest and Fish Agreement 1999, Forest and Fish Rules 2001
- Statewide HCP 2006
- Forest Certification
 - SFI - Sustainable Forestry Initiative - US industry
 - FSC - Forest Stewardship Council - Worldwide

Are we over regulated?

Riparian zone management; protection for large streams less for headwater streams





The future

2000 on - concern about the health of Puget Sound and the Puget Sound Watershed – establishment of the Puget Sound Partnership (2007); Center for Urban Waters (2005)

2000 on – fixing our mistakes period - dam removal, stream and river restoration projects, kindler/gentler forest management, keeping the landscape green, urbanization, stormwater management, climate change effects.



Seattle, WA

Image © 2012 TerraMetrics

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
© 2012 Cnes/Spot Image

47°15'24.98" N 121°54'06.79" W elev 1434 ft

Google earth

Eye alt 238.25 mi

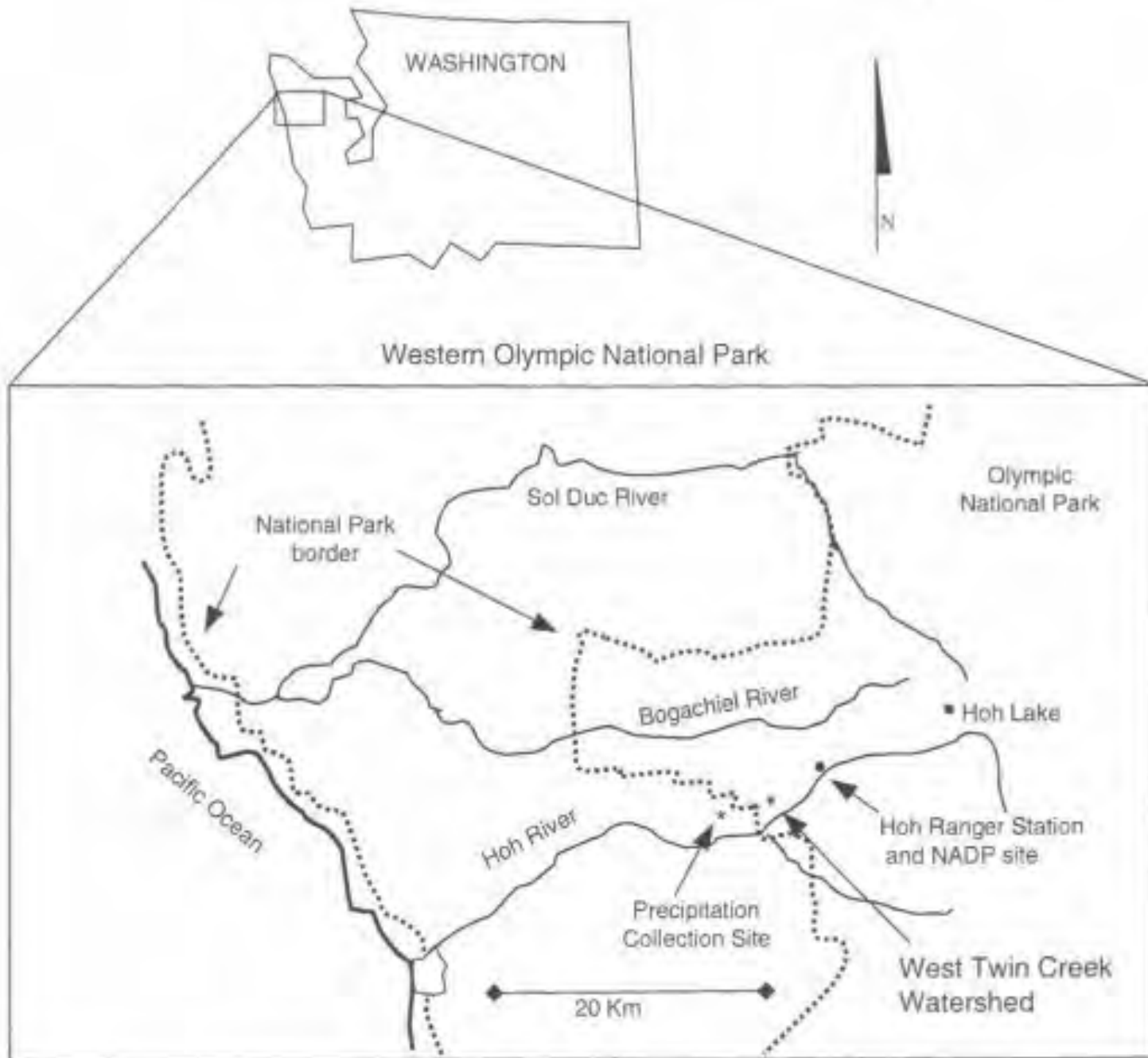
Some interesting tidbits on land use/water research from past research by my students and colleagues

- **Old-growth streams** – Roger Blew, Peter Kiffney
- **Managed forest streams/riparian zones** – Garrett Liles, Pete Bisson, Melissa Maxa, Carol Volk, Peter Kiffney
- **Effects of mining** – Dan Peplow
- **Salmon studies** – Kerri Mikkelsen, Jeremy Cram, Peter Kiffney, Demetrius Fletcher

Old-growth forest studies

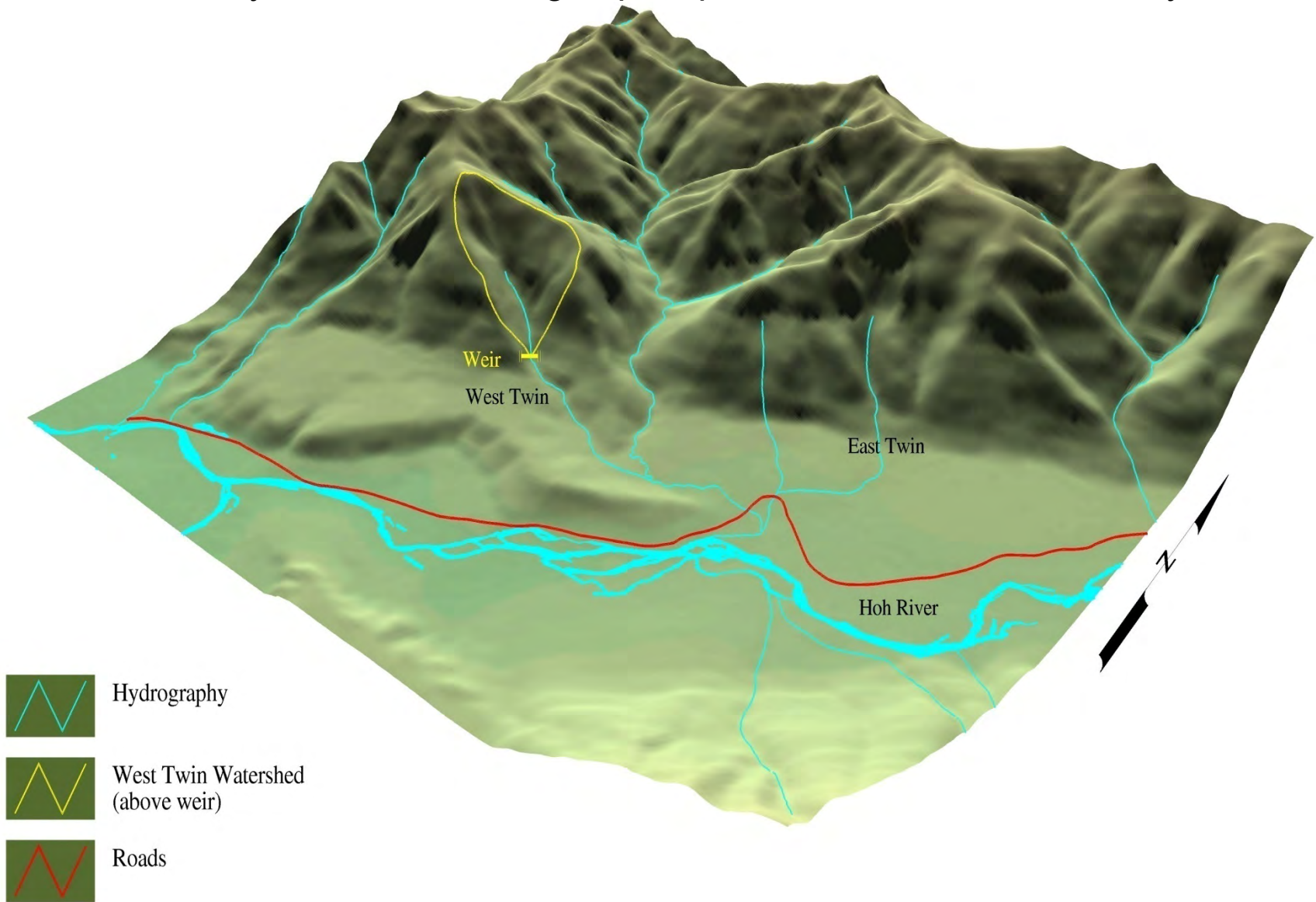
Old-growth forest watersheds suffer natural disturbance from wind, debris flows, diseases, insects and fire, and human caused cross ocean air pollution







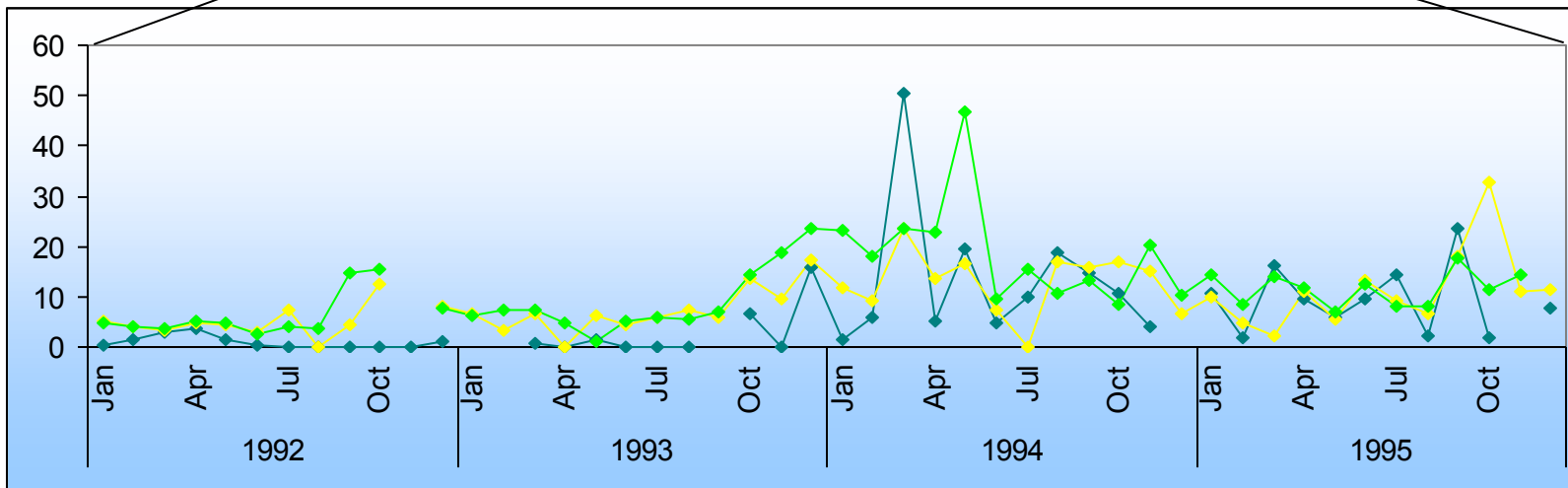
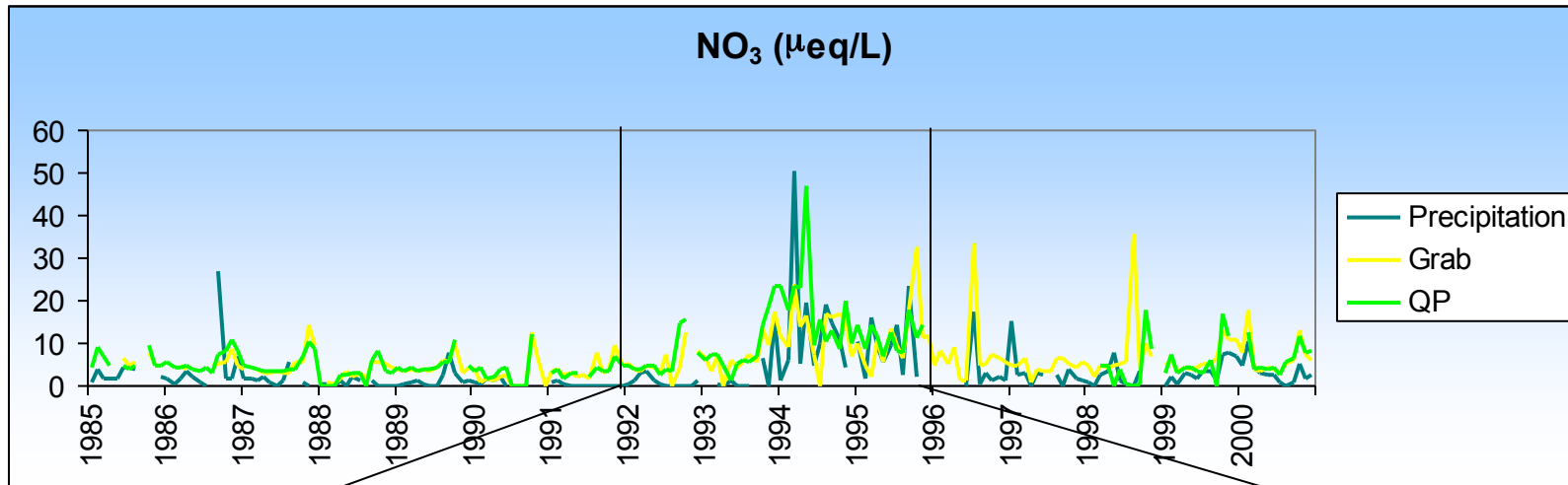
20 years of monitoring of precipitation and stream chemistry





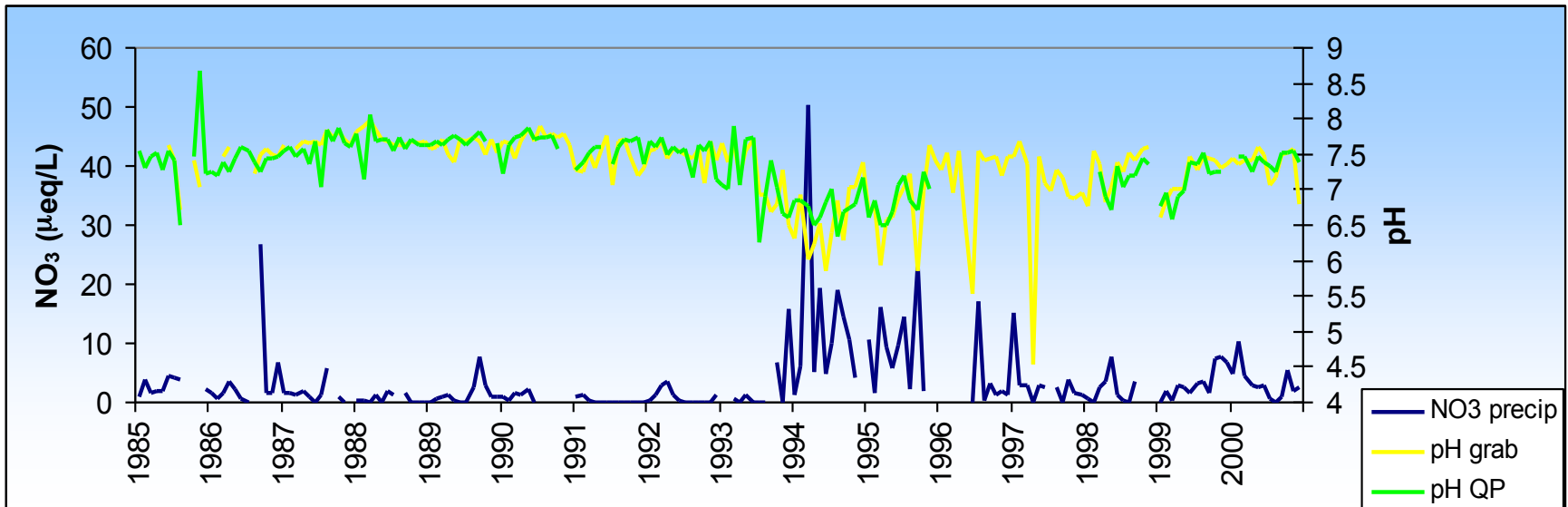
West Twin Creek

Nitrate in the Watershed



Rapid translation of precipitation anomaly to stream water

Stream pH



Managed forests/riparian zones
How effective are riparian buffer
strips in headwater streams?
Nutrients, temperature, sediment

Considerable harvesting occurs in lowland Douglas-fir forests in western Washington (0-3000 ft ASL) that contain headwater streams (types 4 – Np and 5 - Ns)





Mining effects on streams in
eastern Washington

Are old abandoned mines a
continuing problem?



Near Twisp, Washington

Salmon studies



How should we manage red alder in riparian zones?
Should we be adding salmon back to streams?

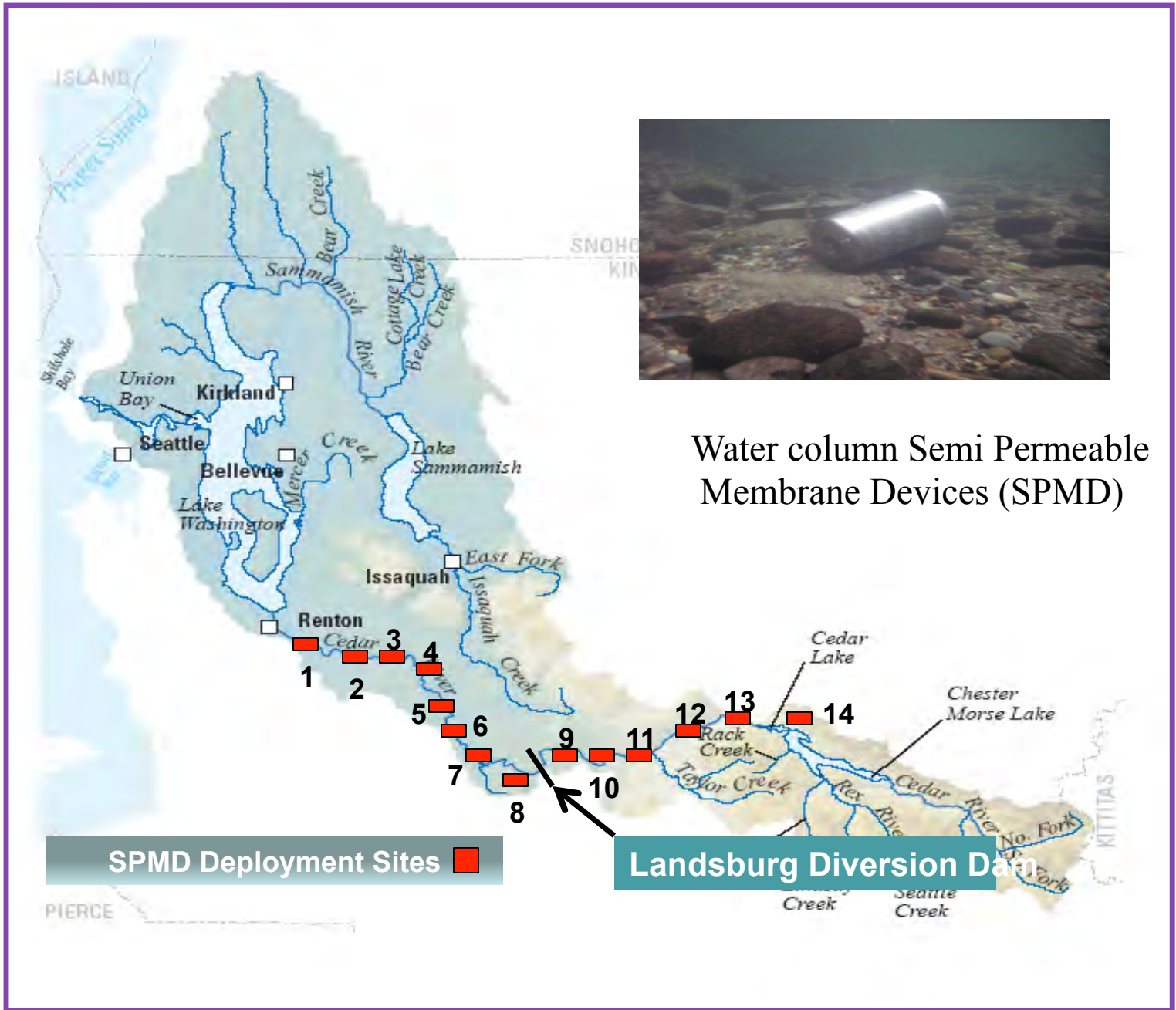


Artificial stream studies
– Cedar River

Cedar River, Chinook, Coho, PBDEs, and PCBs

- In 2003, Chinook and coho were allowed to pass above Landsburg Diversion Dam
- Are PBDEs and PCBs present in returning salmon and potentially affecting Seattle, Water supply?





Conclusions

- Old growth streams are subject to natural disturbances, but recover quickly
- Past and present land use (forest harvesting, mining, pollution, commercial fishing, dams, urbanization) have caused permanent changes to streams and rivers in the Pacific Northwest.
- Streams and rivers are remarkably resilient
- We have had successes – addition of wood to streams, riparian and stormwater management, sewage treatment, Cedar River Watershed, Elwha dam removal, dam spillage, better road design, culvert replacement, etc.

- We are now more ecologically aware of what our impact is, but it is hard to stop landscape degradation because of continued population increase, urbanization, economics, cost of restoration, politics and the unknown impact of climate change
- Keeping the landscape green (even in working forests) will certainly keep streams healthier.
- All things are interconnected