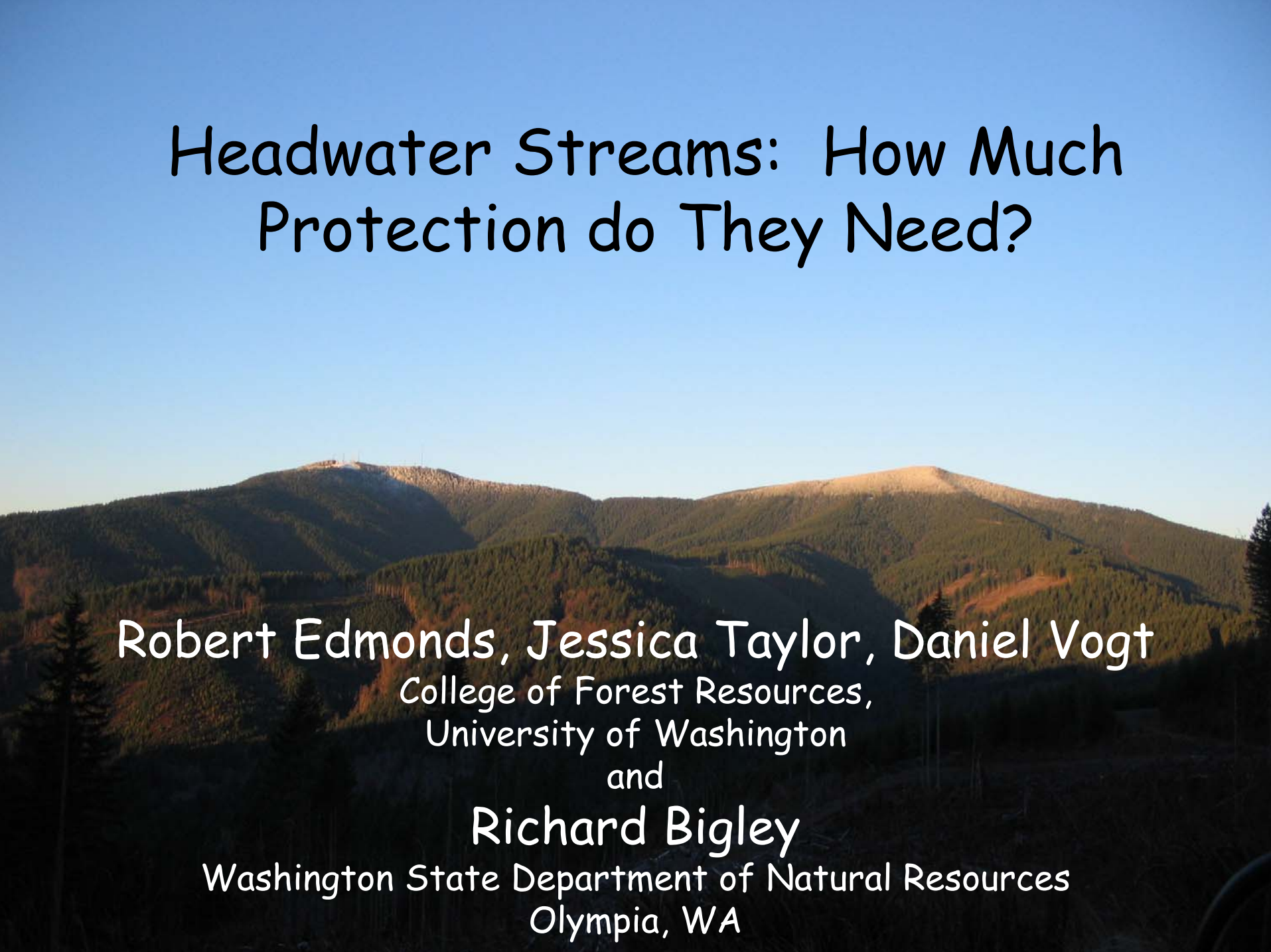
Headwater Streams: How Much Protection do They Need?

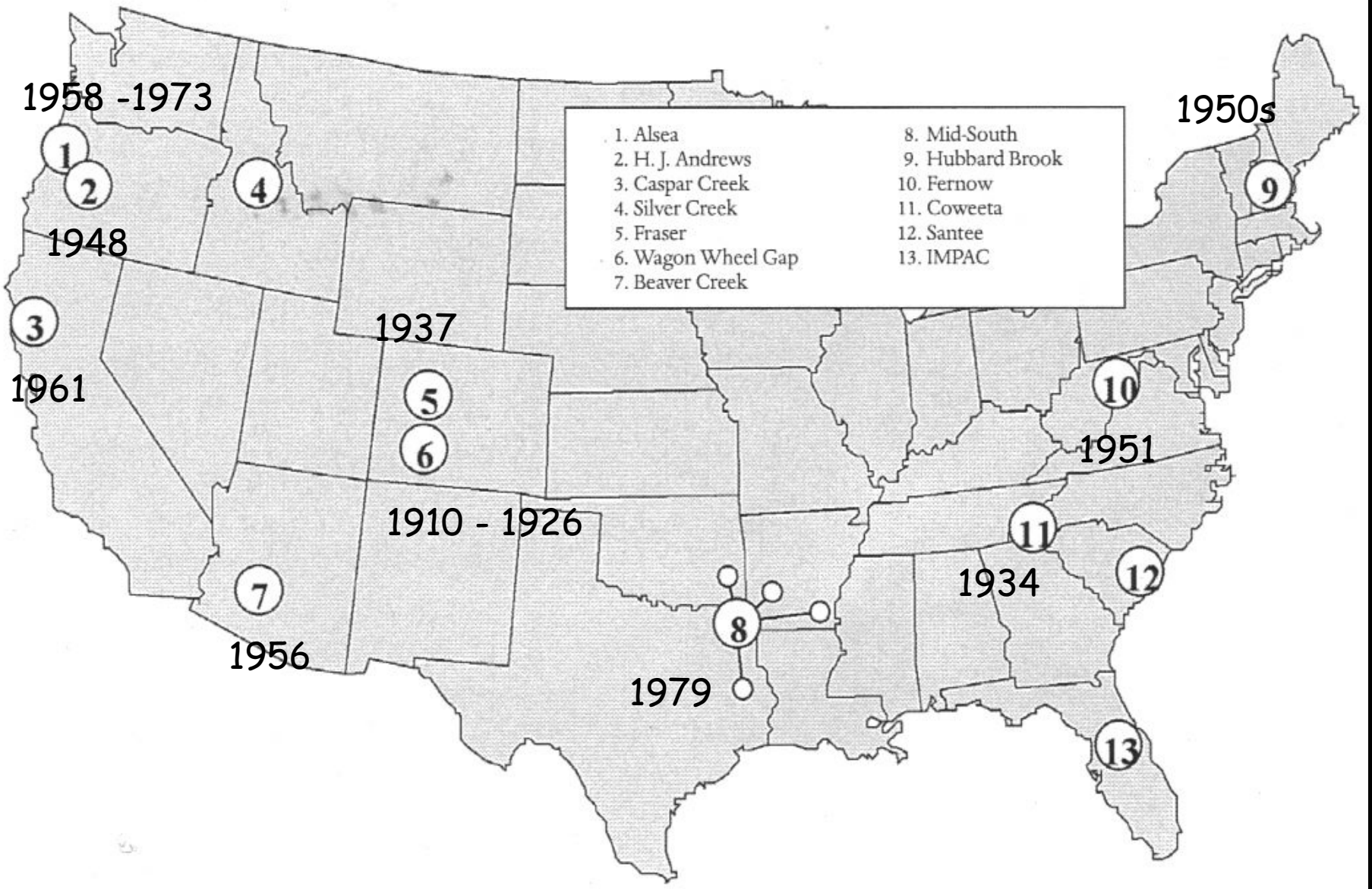


Robert Edmonds, Jessica Taylor, Daniel Vogt
College of Forest Resources,
University of Washington
and
Richard Bigley
Washington State Department of Natural Resources
Olympia, WA

Headwater Streams 101

- Small in size, but can be 50% of stream mileage
- High Biodiversity
- Impact Downstream Processes– Cumulative Effects
- Source of Organic and Inorganic Nutrients to drainage Network
- Influence Stream Network Temperature and Sediments

Location of major watershed studies in the United States.



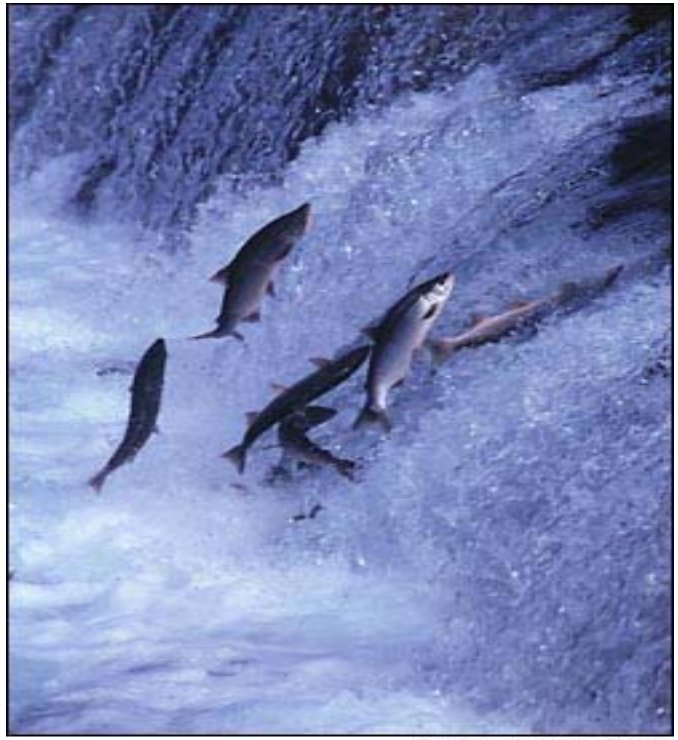
Indicators of Change

- Stream flow
- Nitrate concentrations and losses; changes in N form
- Temperature
- Sediments

Many stream chemistry studies have focused on nitrogen (N) because it is a limiting nutrient and in excess it is a pollutant.

Studying N cycling gives an understanding of natural ecosystems functioning and the influence of management practices such as clearcut harvesting

Stream N forms
DIN – Dissolved inorganic N (NO_3 and NH_4)
DON – Dissolved organic N
Particulate N



Courtesy American Rivers

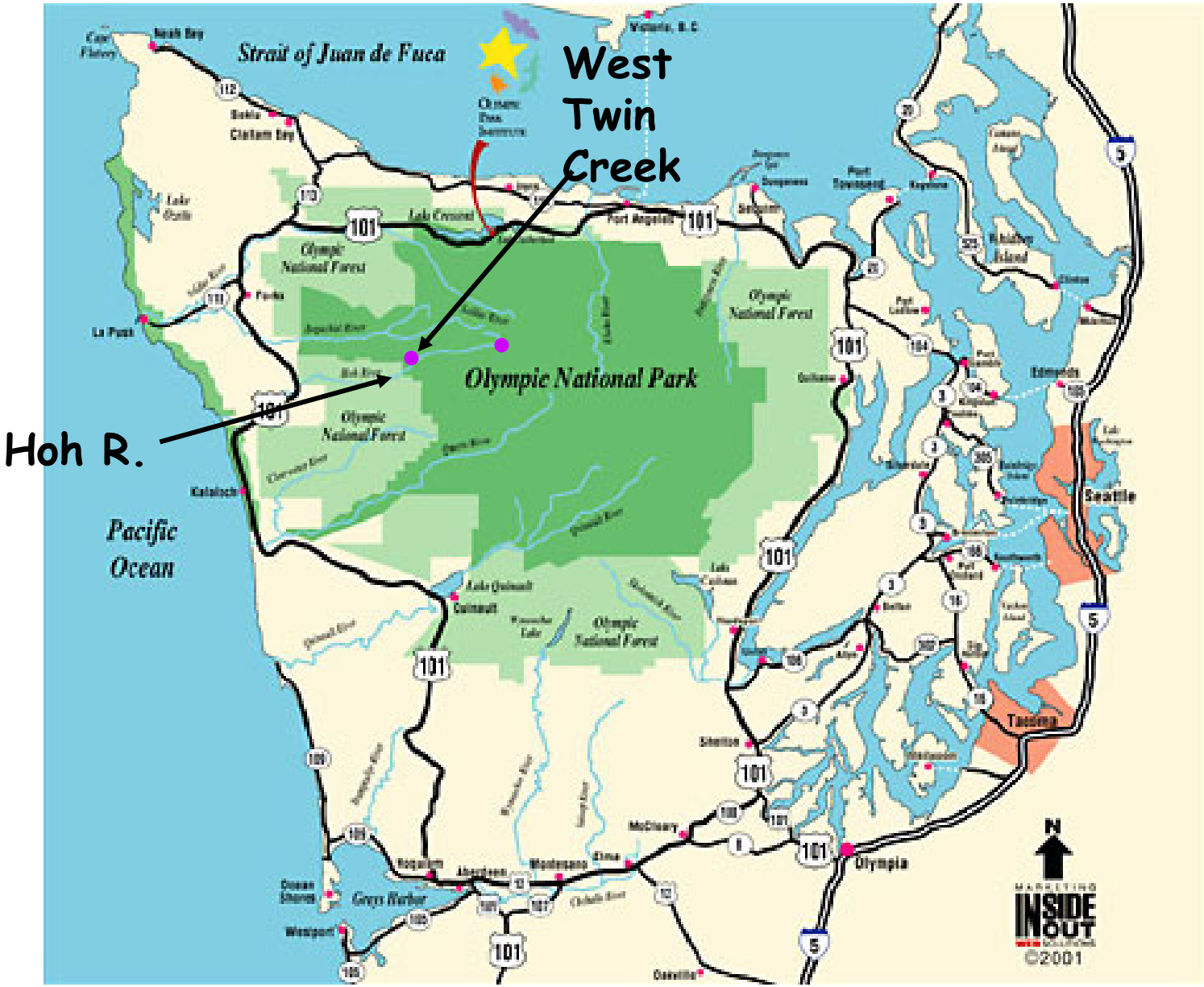
Some salamander species are sensitive to nitrate -N concs of 1 mg/L

Drinking water standard – 10 mg/L

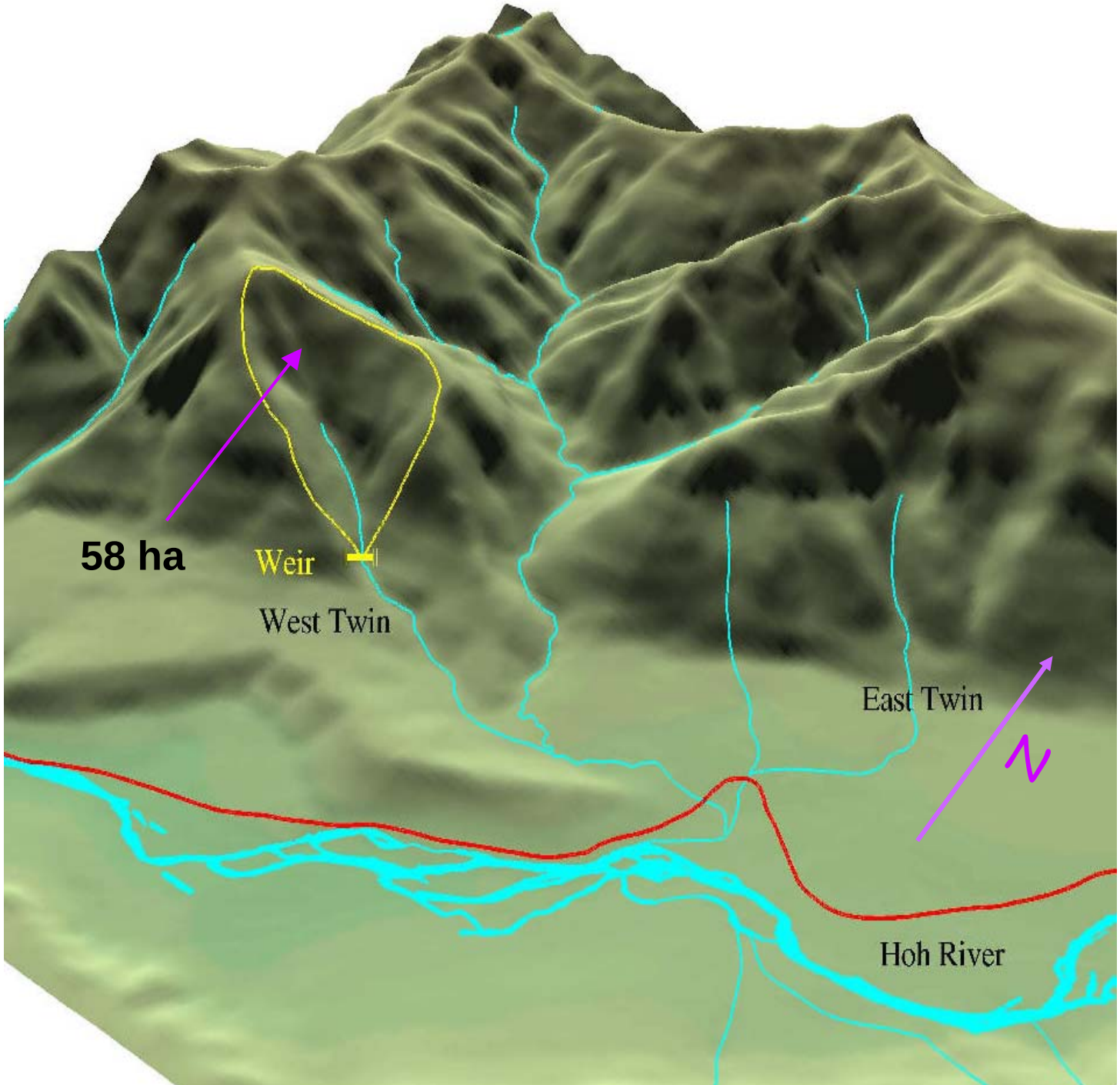
Two Headwater Studies

1. What can we learn from long-term monitoring of old-growth headwater streams? - West Twin Creek Olympic National Park

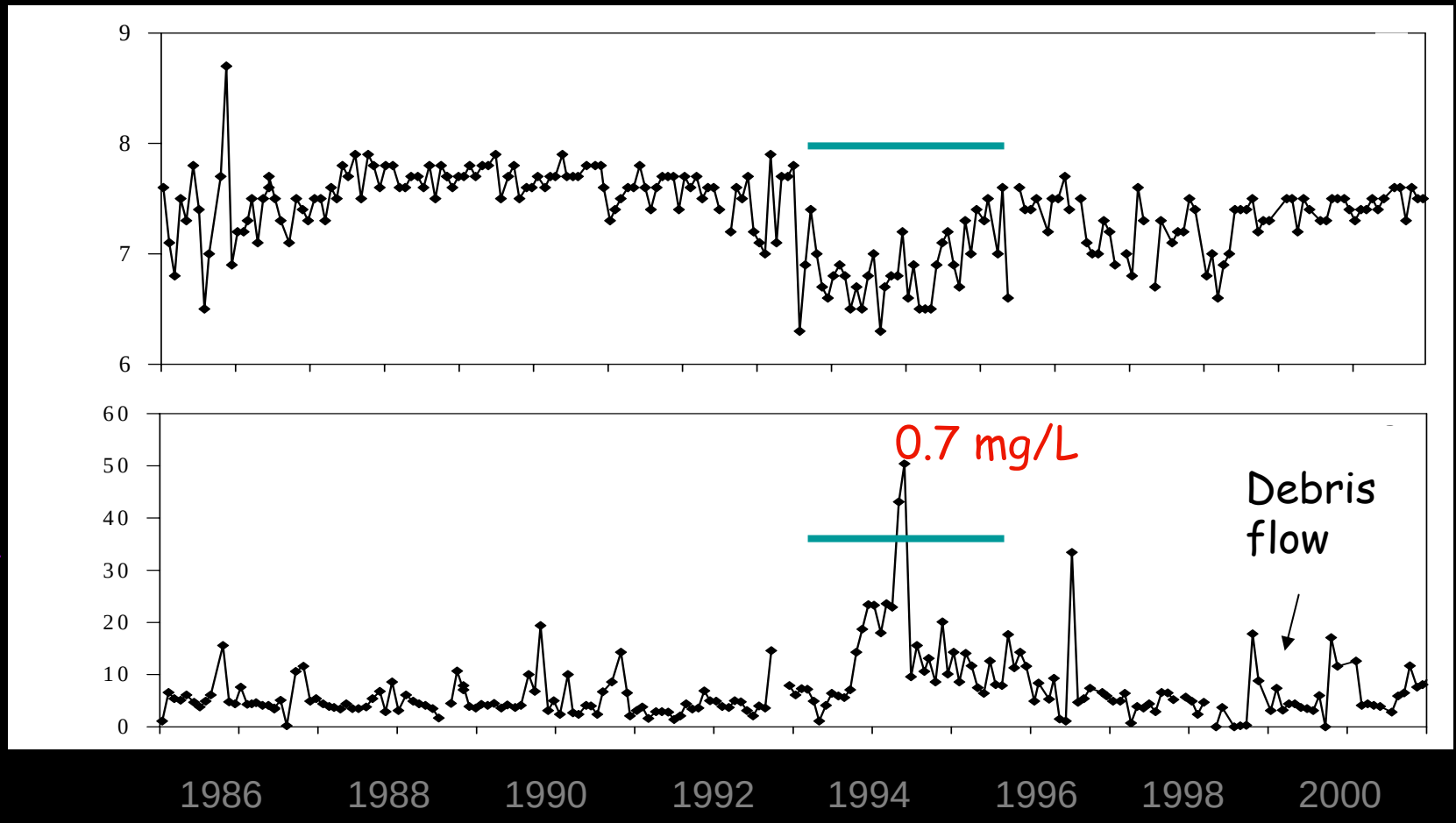
2. What is the influence of clearcut harvesting and riparian buffers on harvested headwater streams? - Capitol Forest, Olympia, WA



Map from Olympic Park Institute: http://www.yni.org/opi/location.html

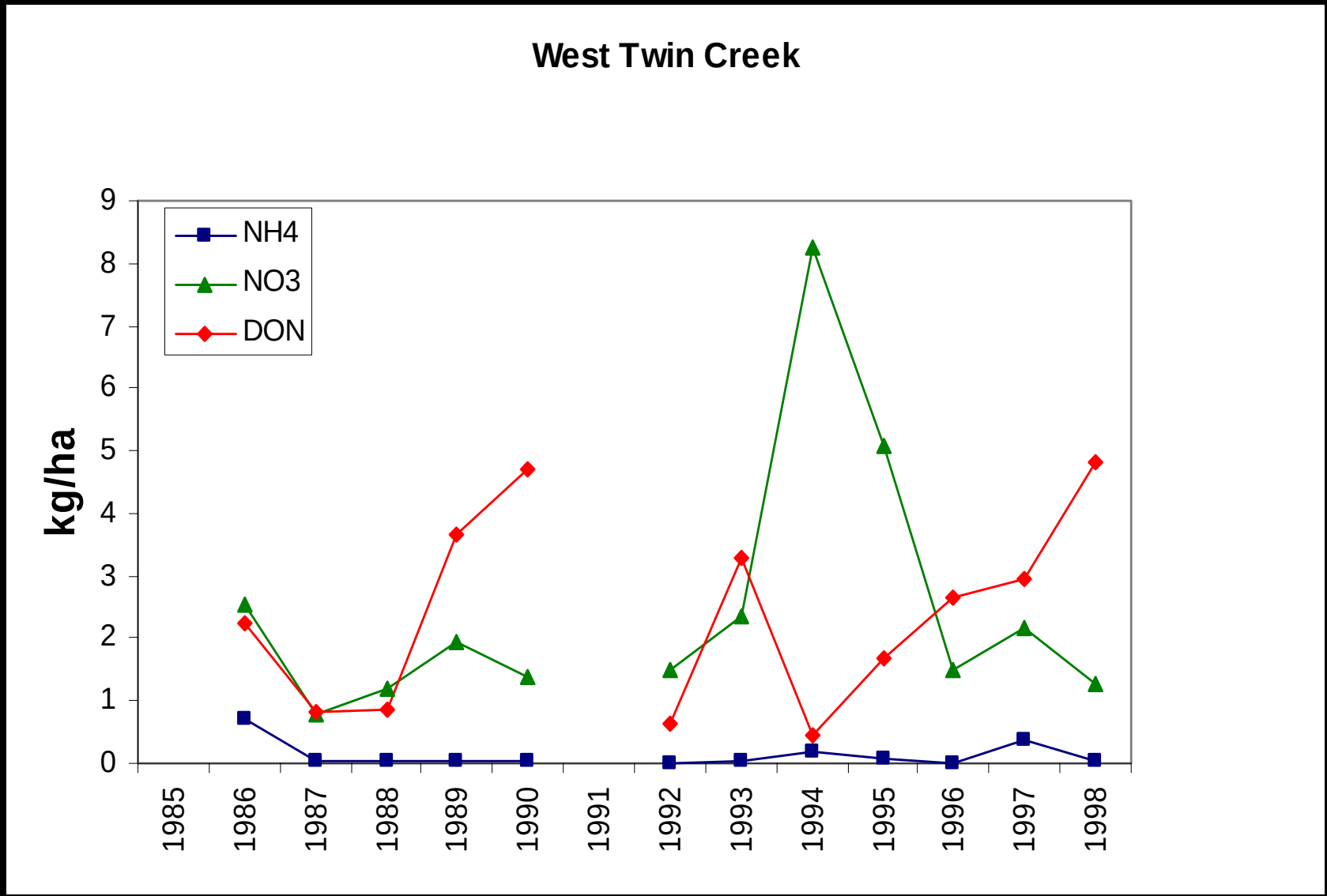

58 ha
Weir
West Twin
East Twin
N
Hoh River

West Twin Creek water samples



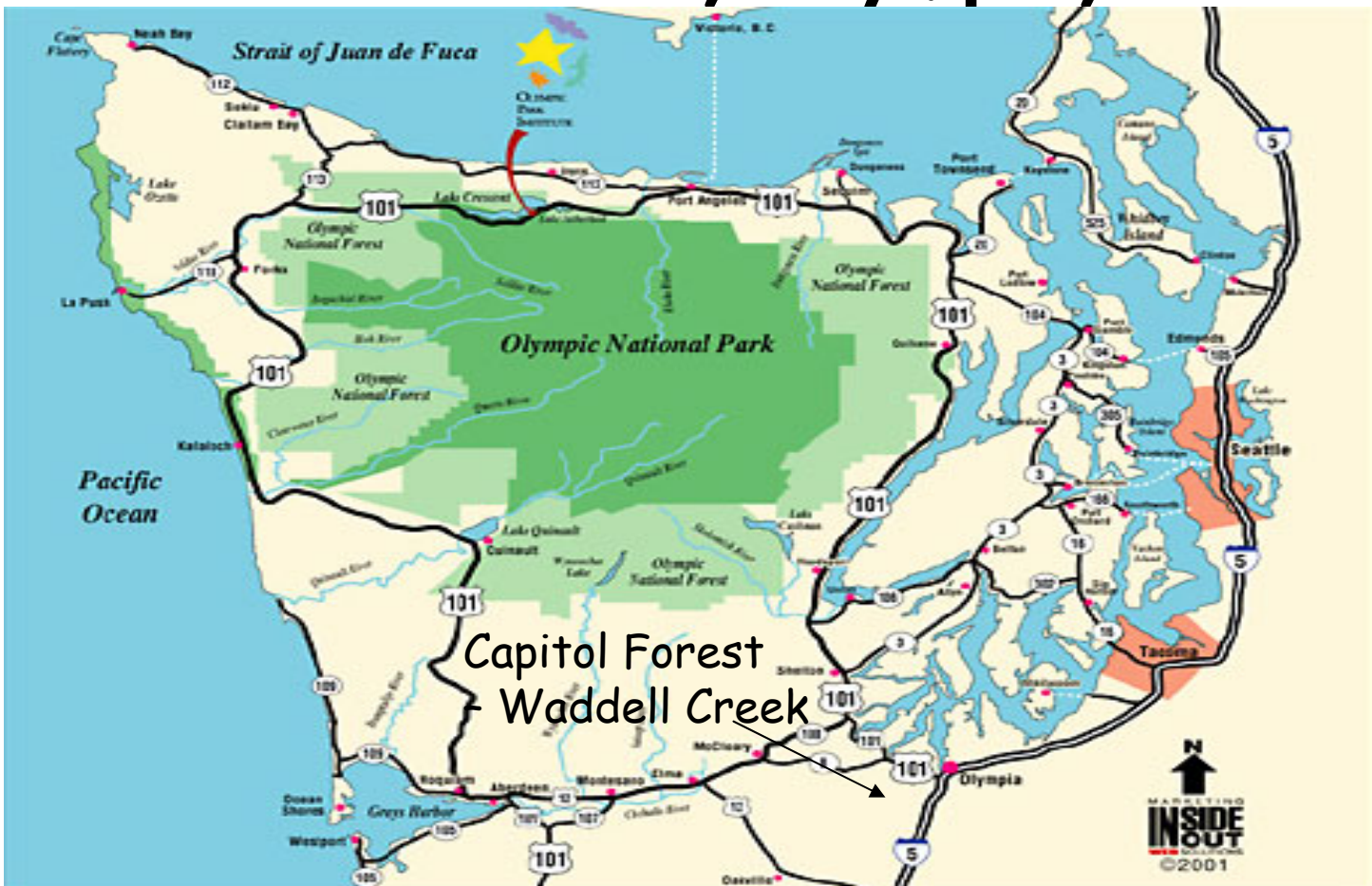
Before debris flow

After debris flow in Dec. 1999


West Twin Creek
kg/ha
NH4
NO3
DON
0
1
2
3
4
5
6
7
8
9
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998

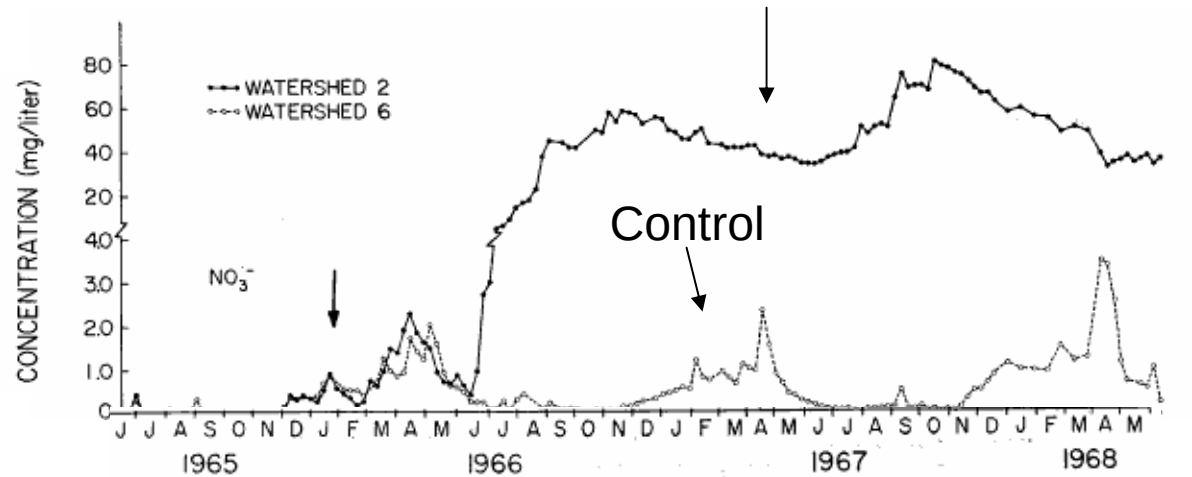
INFLUENCE OF CLEARCUT HARVESTING AND RIPARIAN BUFFERS ON HEADWATER STREAMS

Capitol Forest, Department of Natural Resources, Olympia, WA



Watershed 2

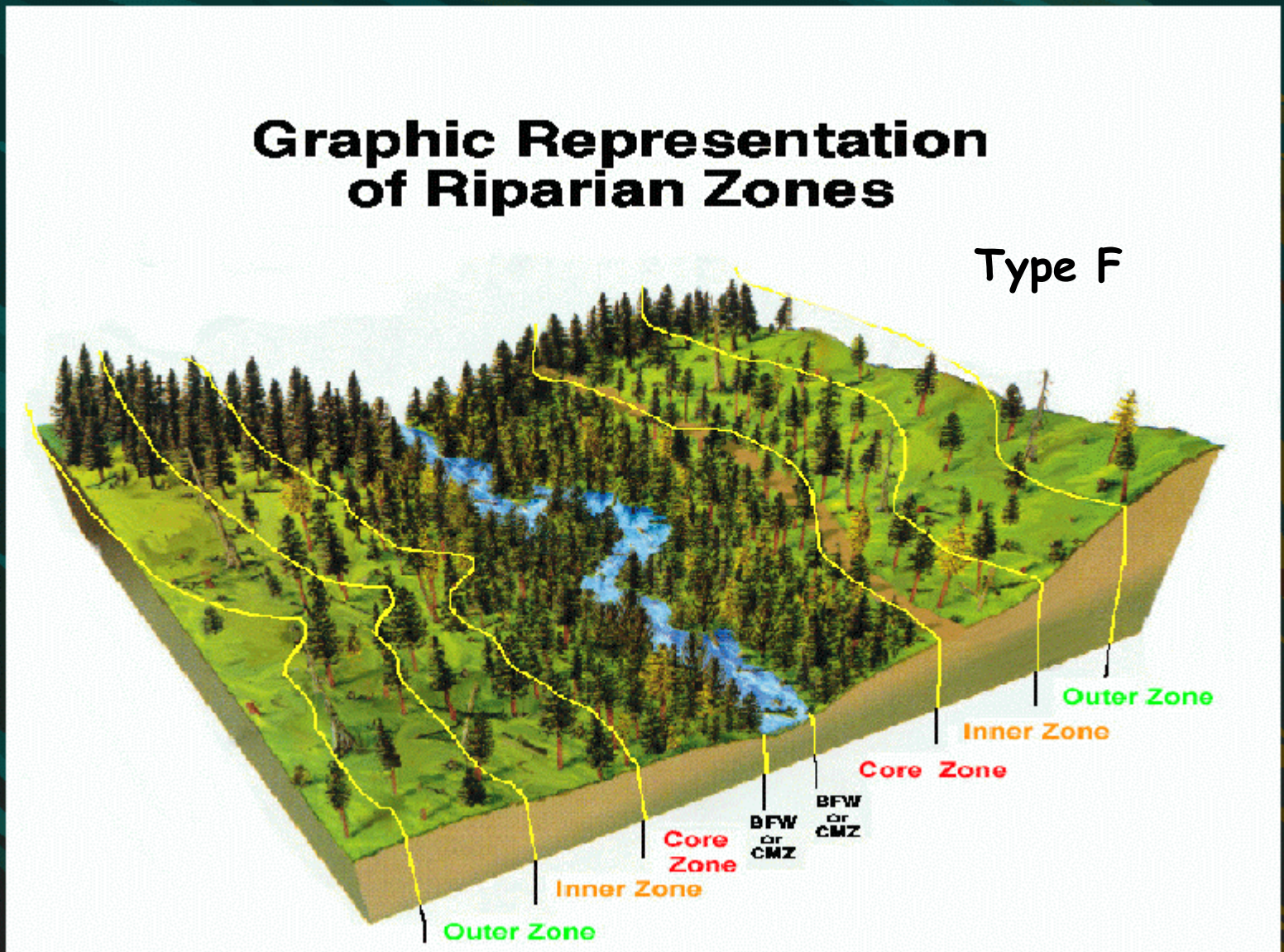
Harvested and herbicided



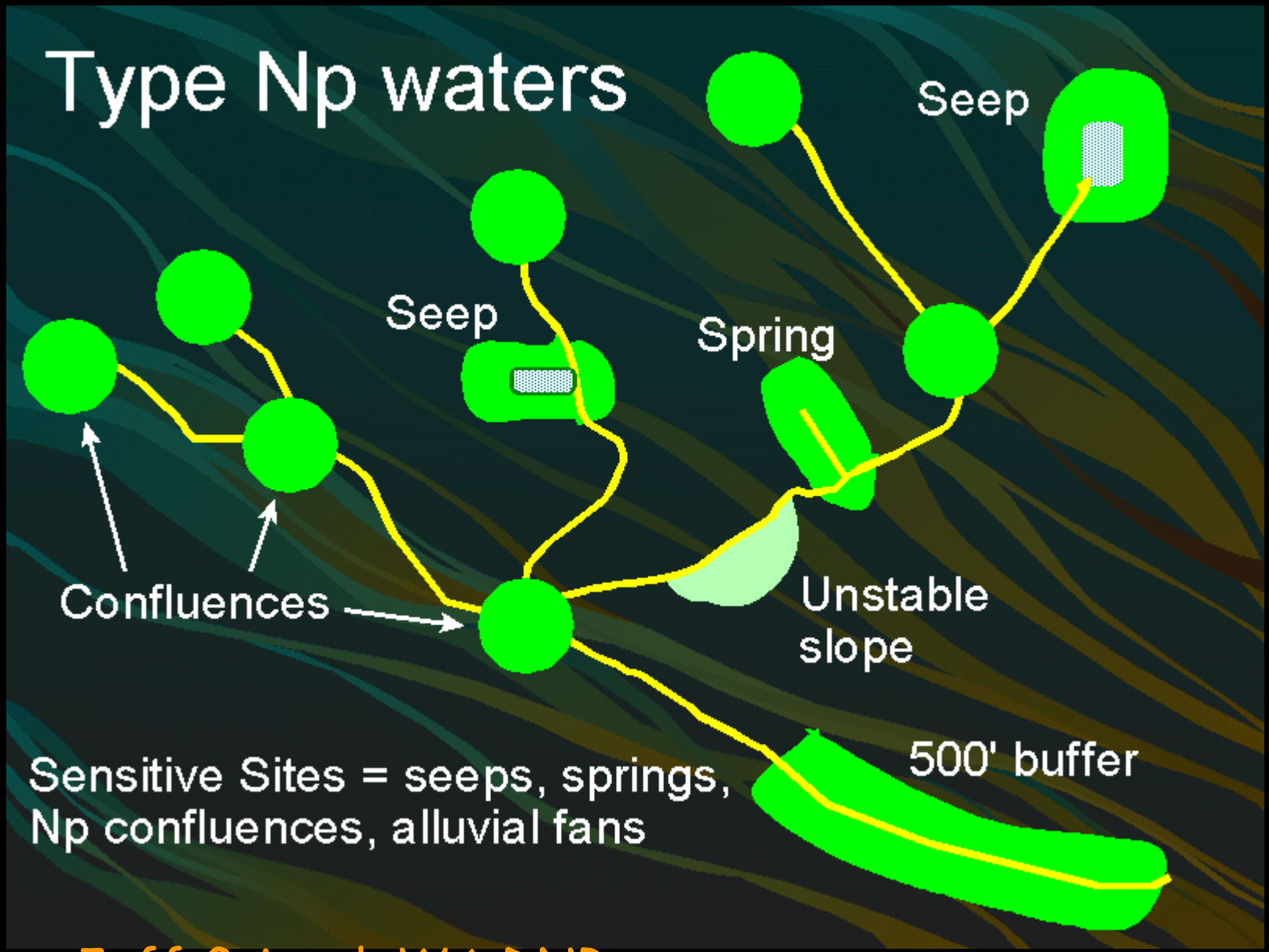
Small watershed studies at Hubbard Brook New Hampshire

Forest Stream Protection using Riparian Buffers in Harvested Sites in Western Washington

Forest and Fish Agreement

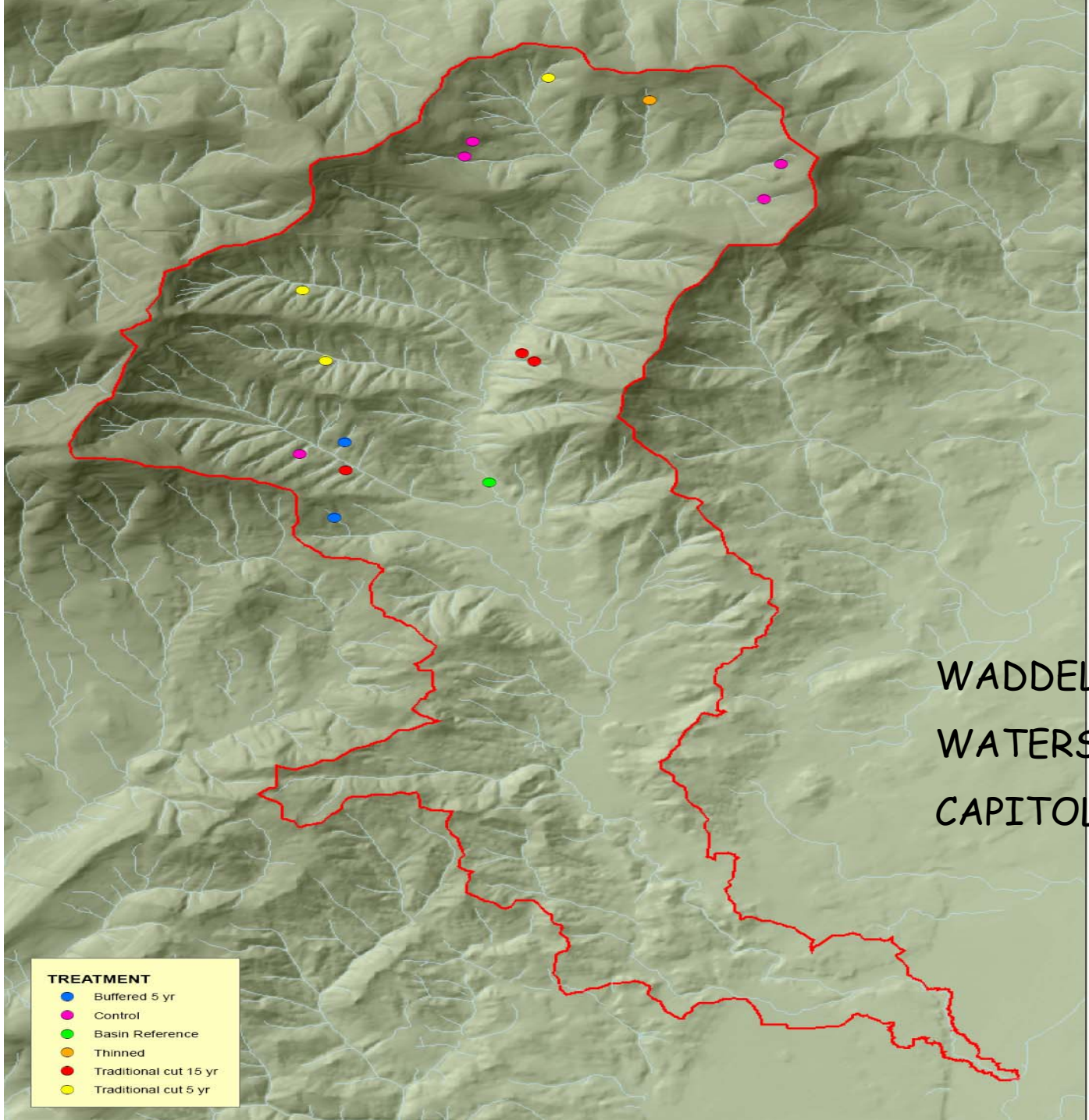


Jeff Grizzel, WA DNR



Jeff Grizzel, WA DNR

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)

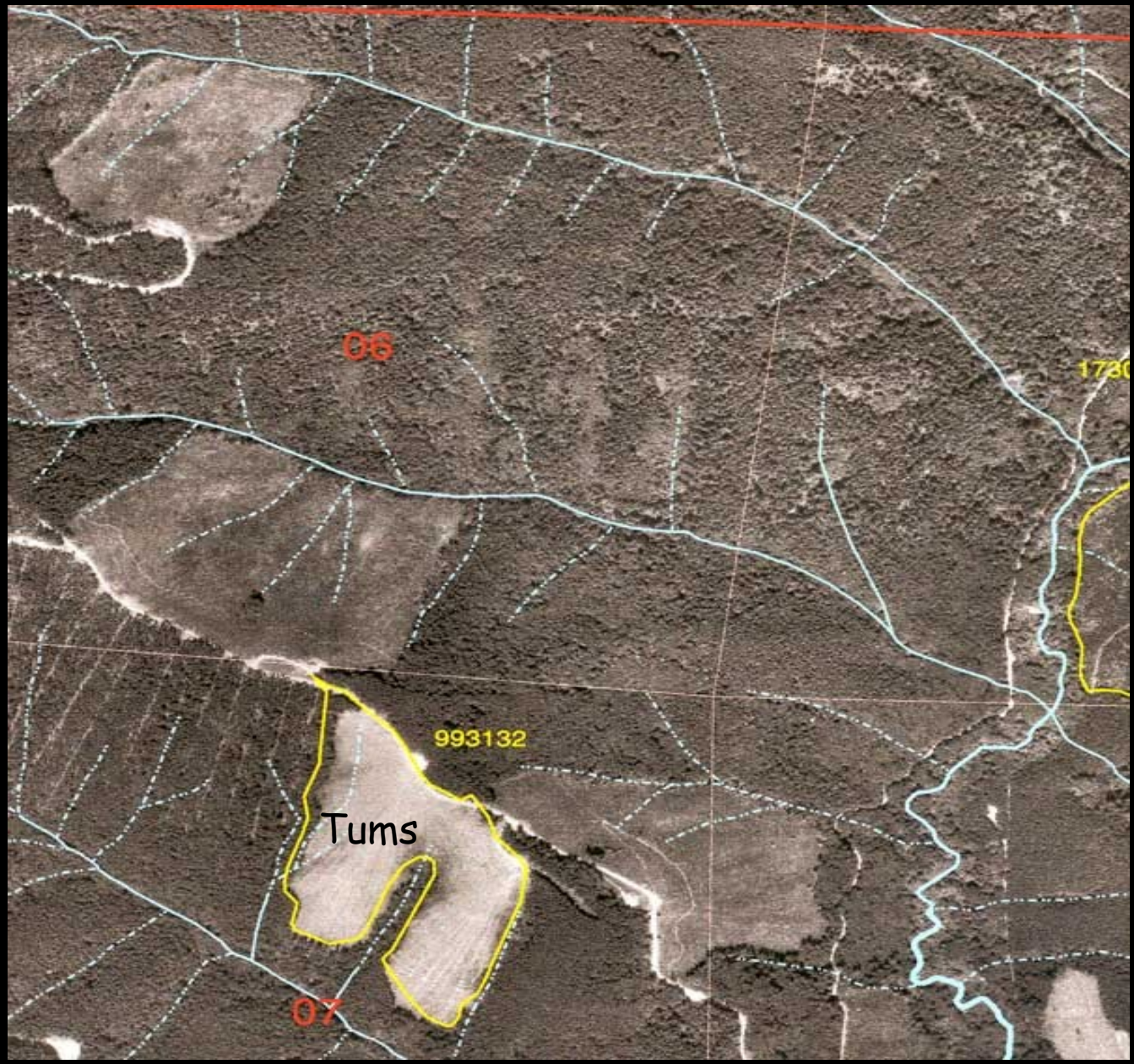


180-396 m

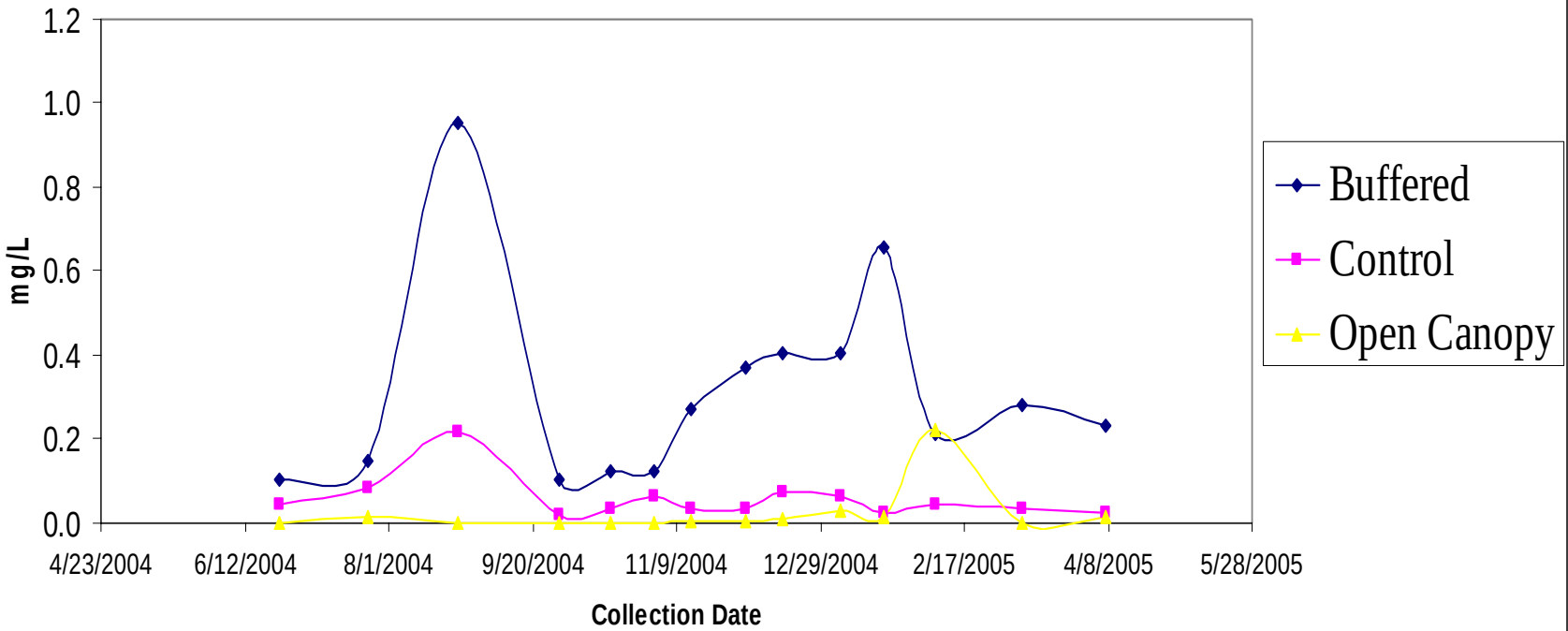
1-8 ha

WADDELL CREEK WATERSHED, CAPITOL FOREST

Typical weirs and pressure transducers


06
993132
Tums
07

Mean Nitrate Concentrations (mg/L)



Average concentrations June 04 – June 05

	NO3-N	NH4-N	DON (mg/L)
Buffered	0.27	0.05	0.04
5-8 yr clearcut	0.04	0.03	0.01
Control	0.11	0.04	0.02
Waddell Creek	0.29	0.07	0.07

ANNUAL EXPORT FROM TUMS

(kg/ha)

July 2004-July 2005

NO3-N – 9.2

NH4-N – 1.3

DON - 0.6

Stream Temperatures

(June 04- June 05)

Stand/Watershed	Avg. Mean	Avg. Max	Avg. Min
5-8 yr clearcut	9.0	13.8	5.7
buffered	10.1	16.2	5.0
70-80 yr control	8.8	13.5	5.6

CONCLUSIONS

- Are headwater streams being protected enough?
- Timber harvesting does not have a dramatic impact on N concentrations, stream temperatures, and turbidity in headwater streams.
- Buffered streams may have slightly higher nitrate-N concentrations than clearcut harvested and non-harvested streams because of red alder; but concentrations are low. N discharge is not excessive.
- Do they need more, less or the same amount of protection? Perhaps depends on what you measure. What about stream invertebrates, salamanders, etc.
- What do you think?

Ackowledgements

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- Washington State DNR
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- Olympic Natural Resource Center
- USGS
- National Park Service