

From watersheds to the sea in Puget Sound: the (inferred) dynamics of chemical export

J Scott Bechtold

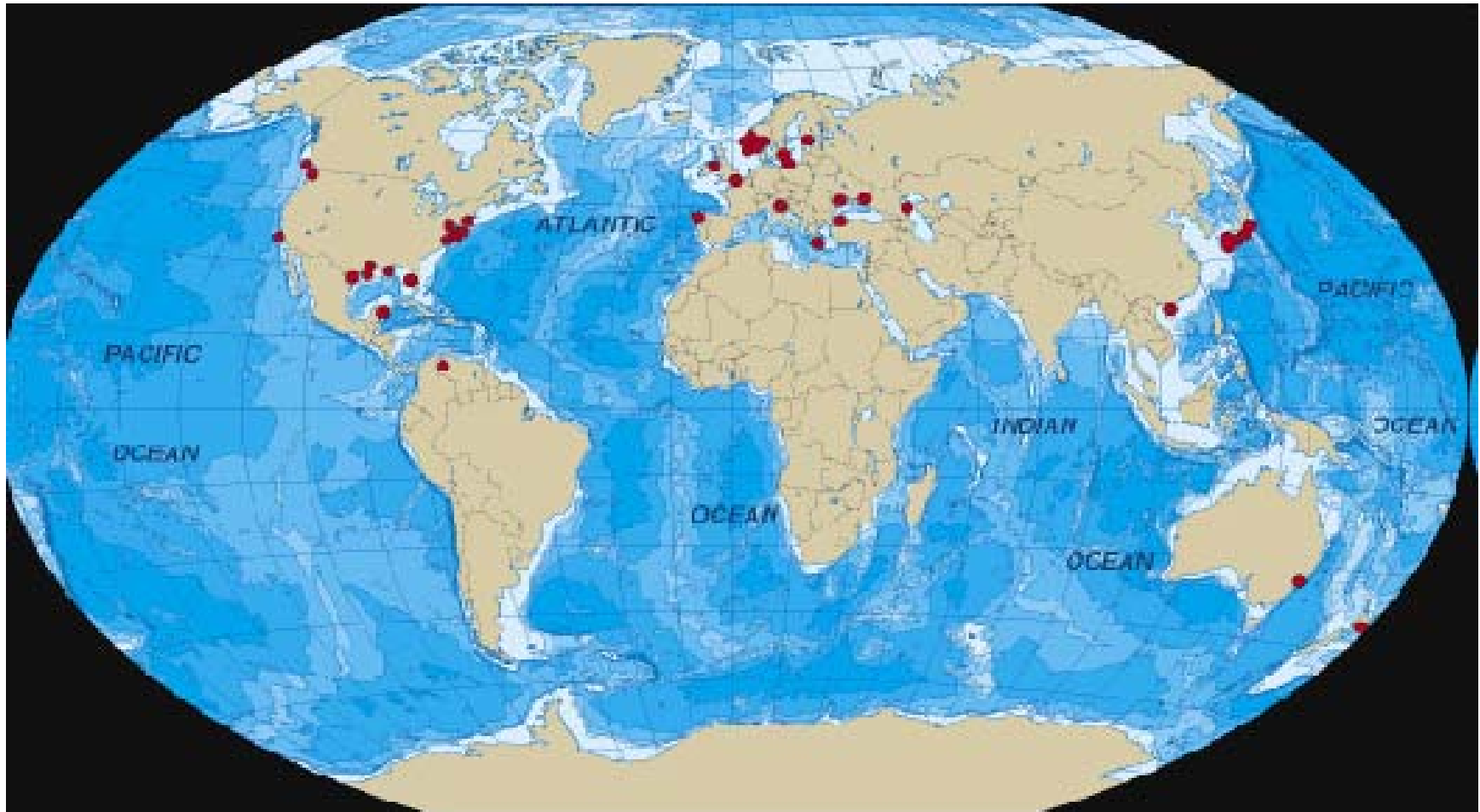
UW School of Aquatic and Fishery Sciences

Jeffrey Richey

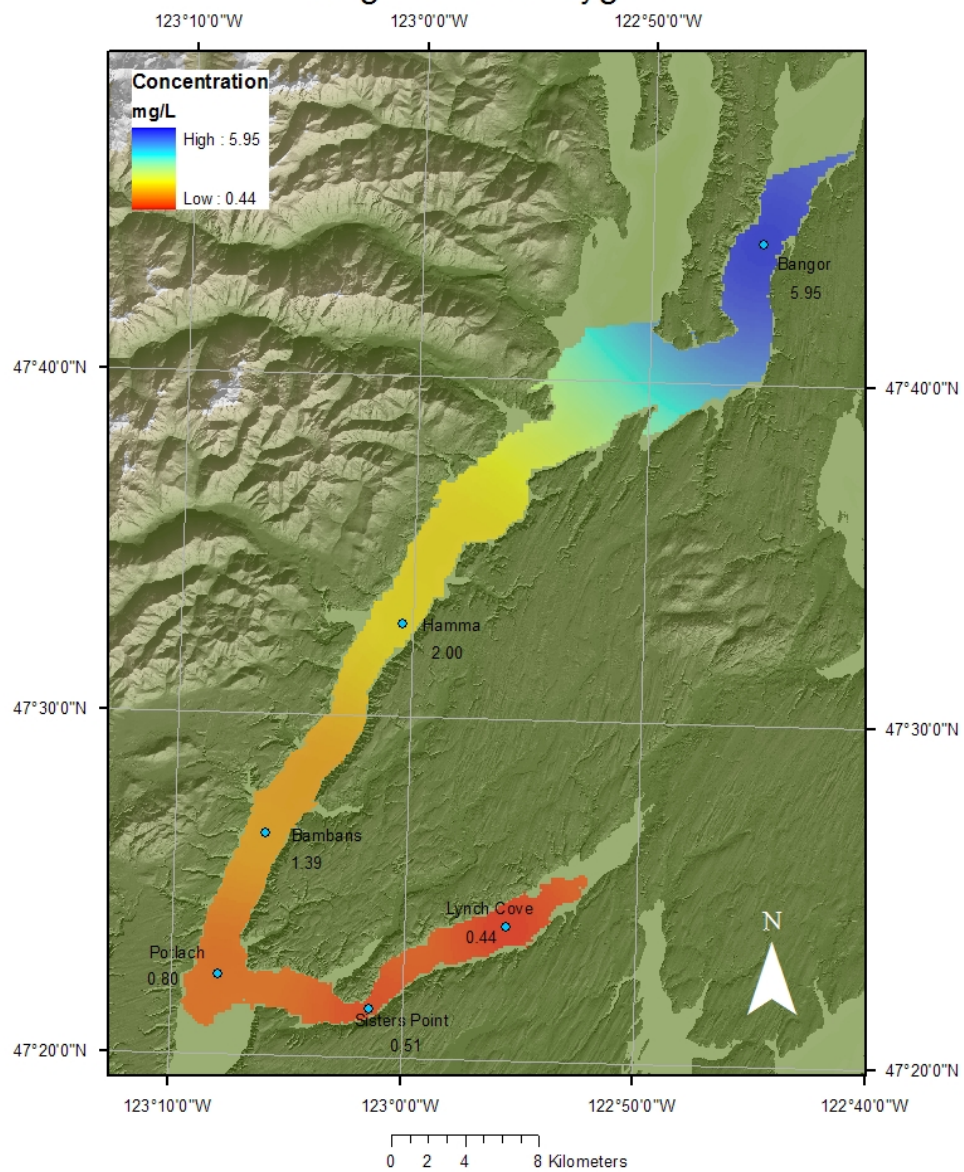
UW School of Oceanography



Occurrence of Dead Zones



Measured and Interpolated O2 August 2006 Oxygen



A topographic map of the Hood Canal region in Washington state, showing the canal and surrounding terrain. A central white text box with a green border contains the program's title and details. A compass rose is visible in the bottom right corner of the map.

Hood Canal Dissolved Oxygen Program

Marine measurements and modeling

Freshwater flows and nitrogen loading

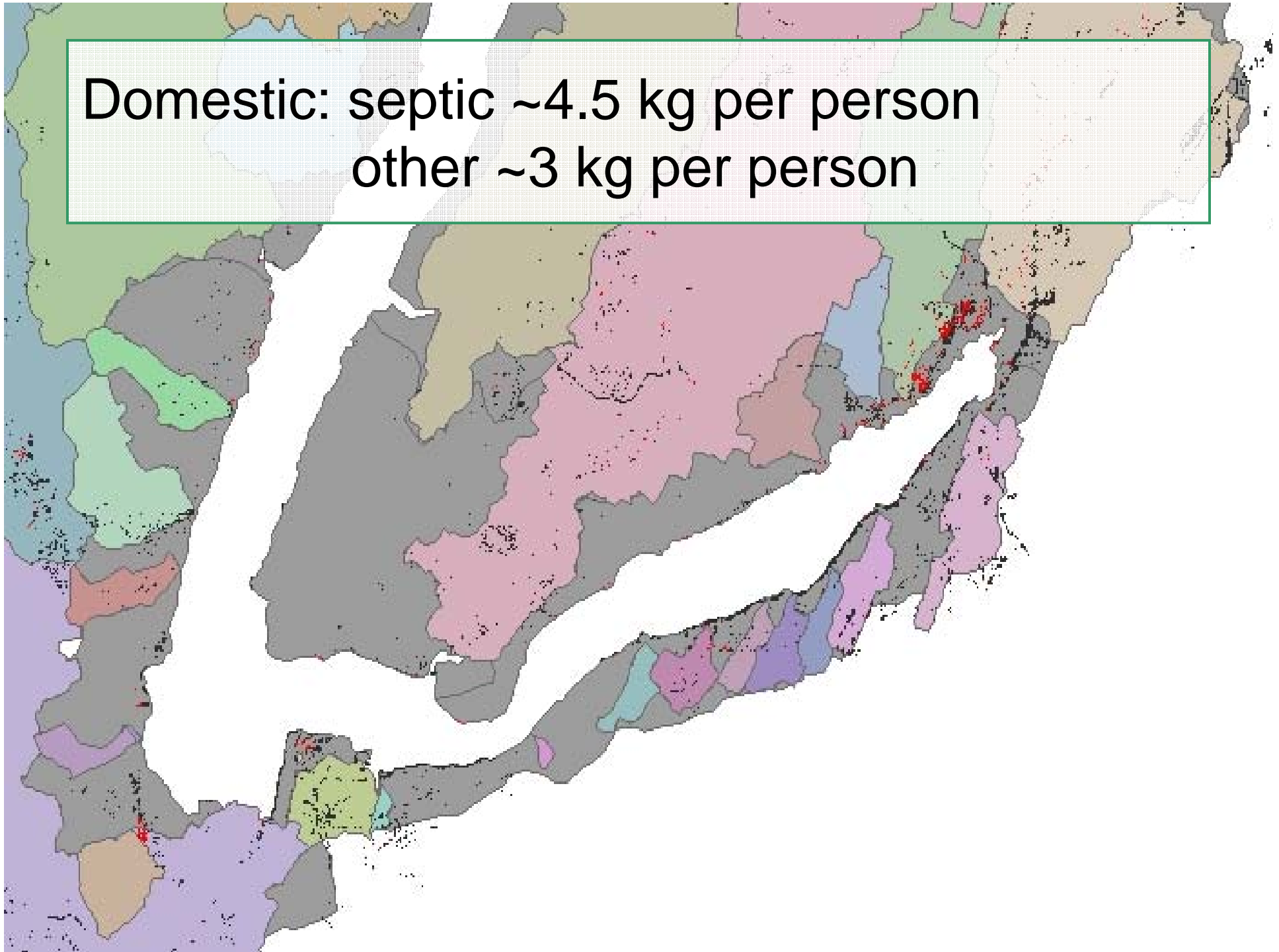
- measurements

- simulation modeling

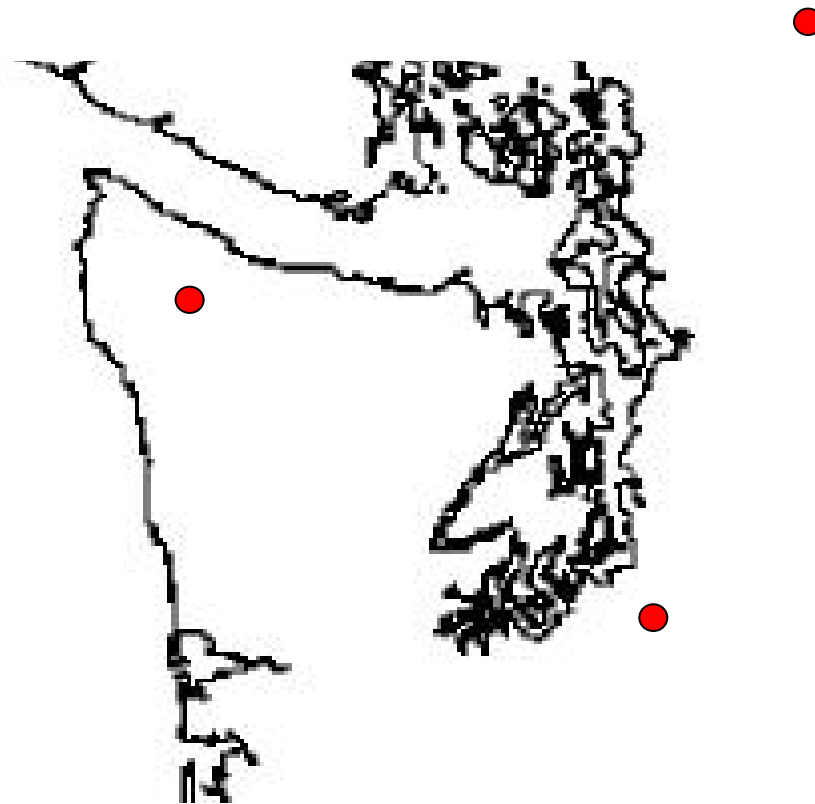
A map of Europe showing the distribution of red alder. The map is color-coded: red areas indicate the presence of red alder, while light blue and grey areas indicate its absence. Red alder is widely distributed across the continent, particularly in the western and southern regions, and along major river networks. A text box is overlaid on the map, providing a range of values for red alder.

Red alder: 20 – 300 kg/hr/yr

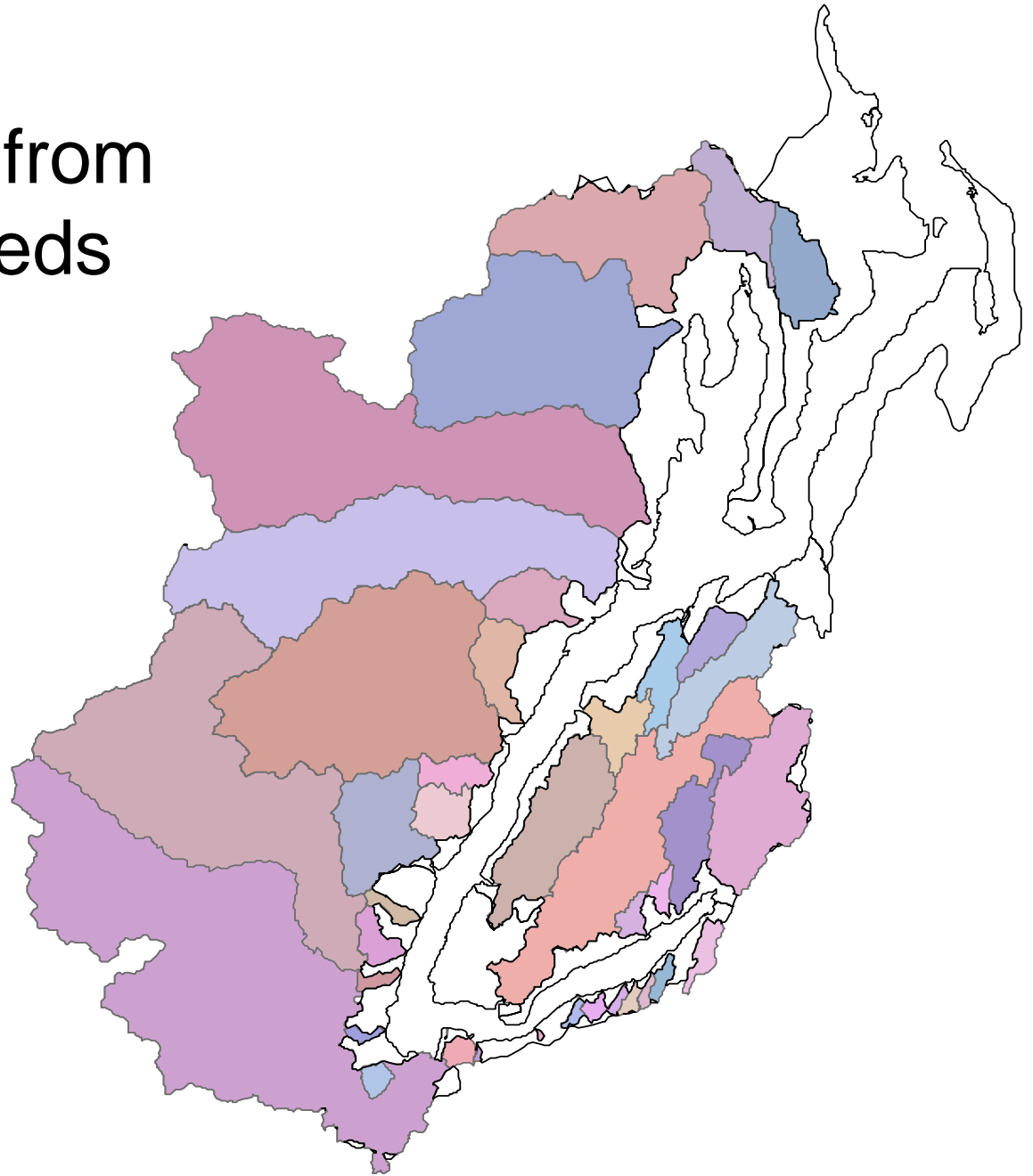
Domestic: septic ~4.5 kg per person
other ~3 kg per person



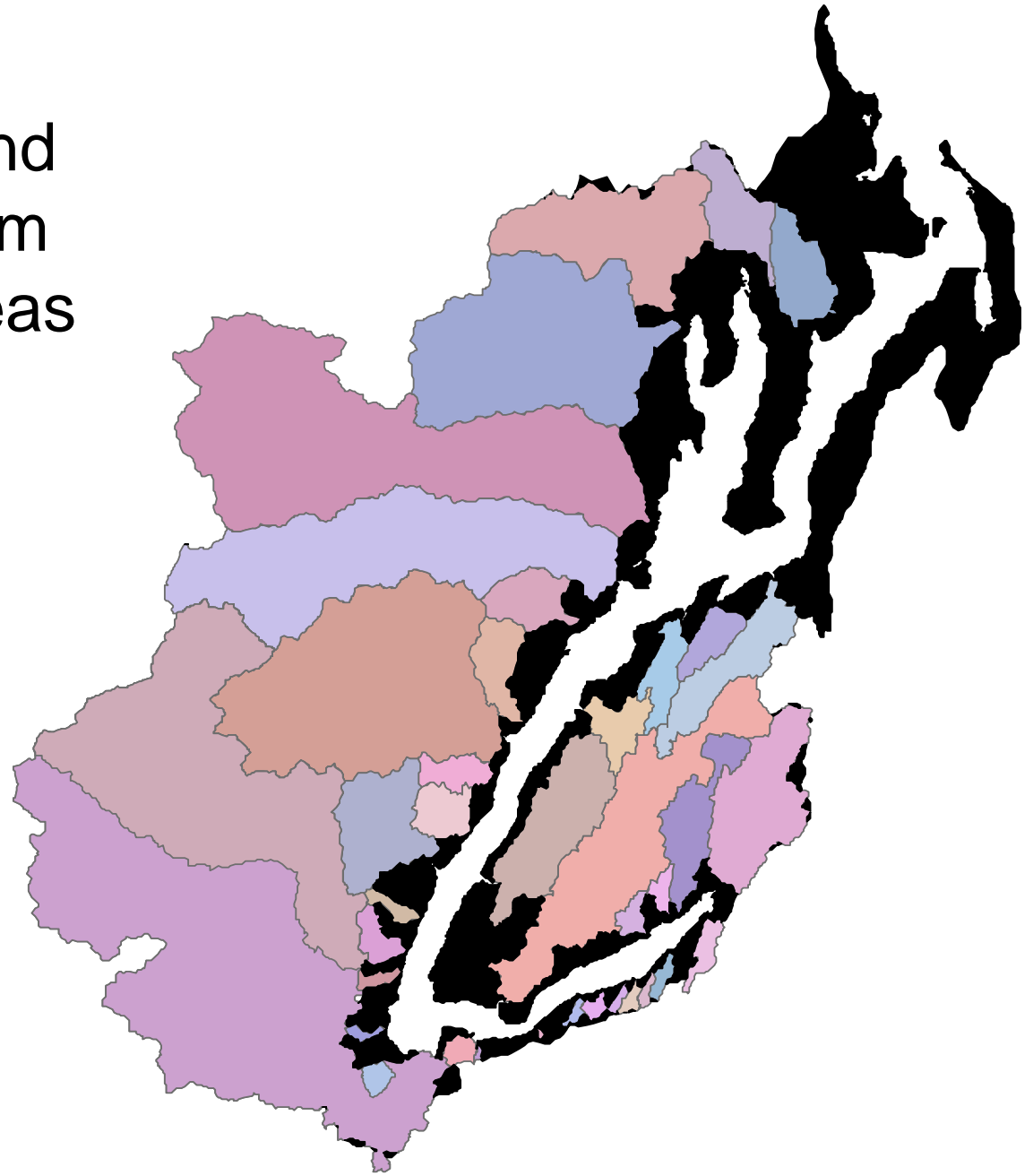
Atmosphere: 1.5 kg per hectare



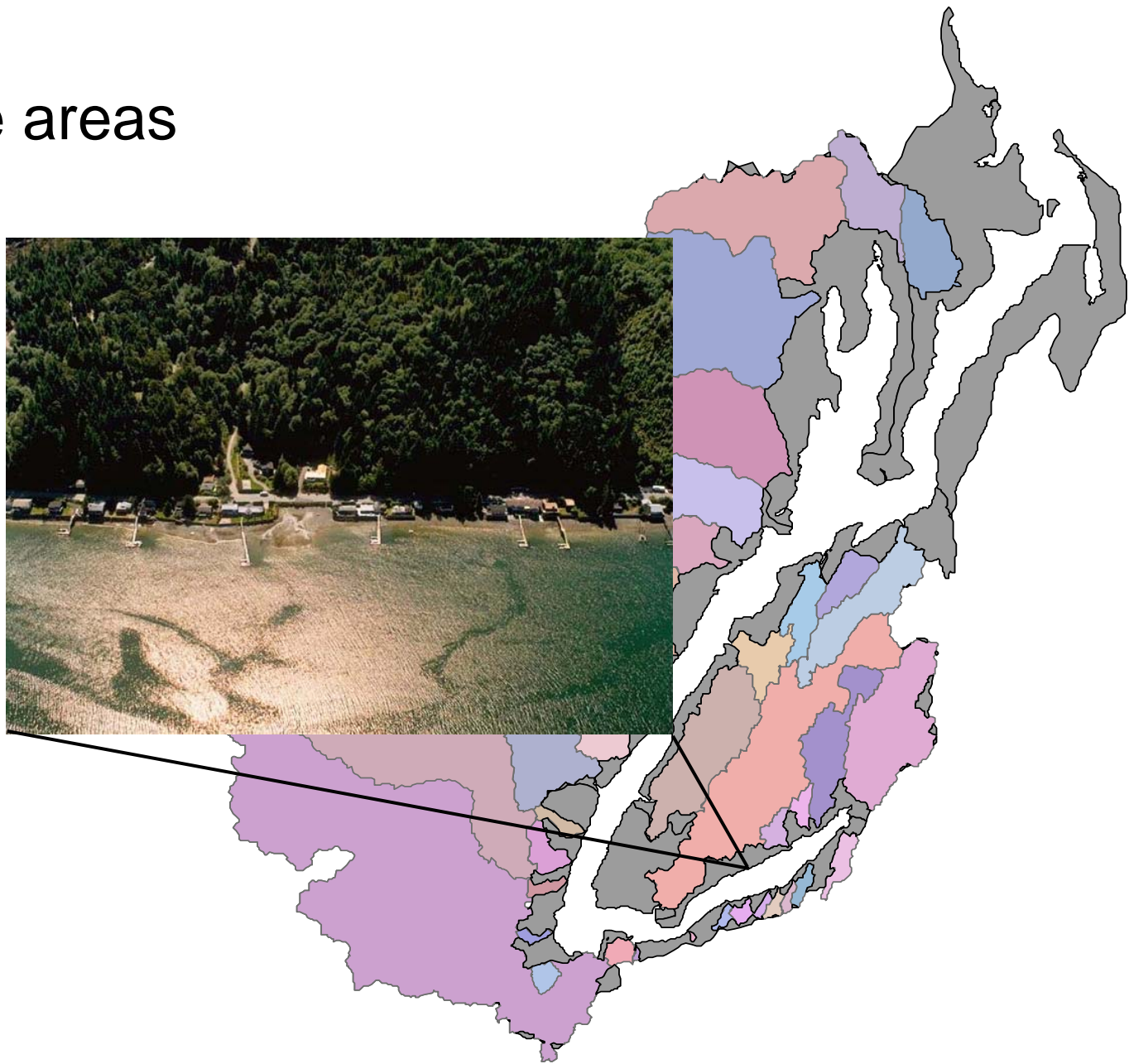
Surface water from major watersheds



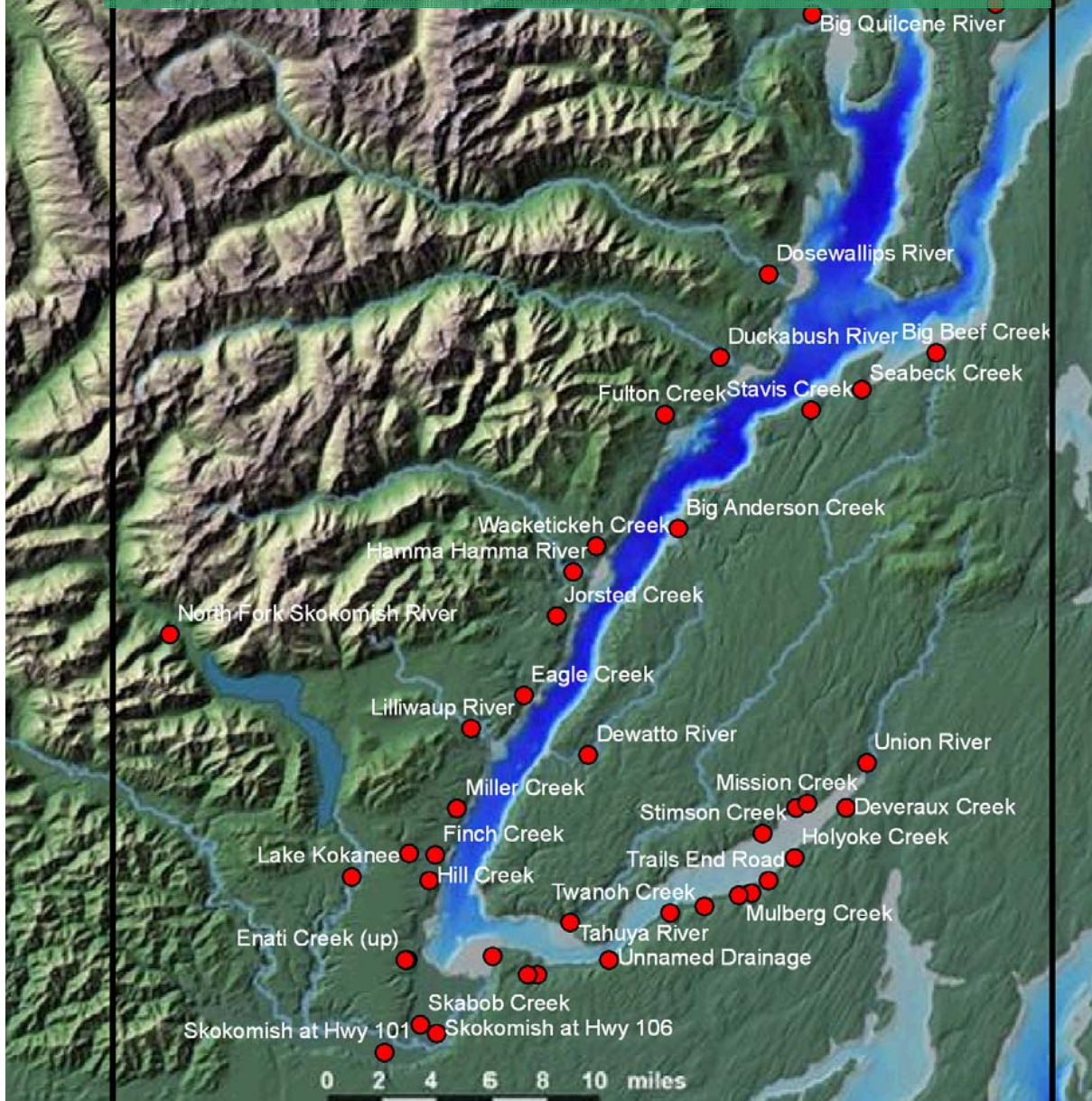
Surface runoff and groundwater from unchanneled areas



Shoreline areas

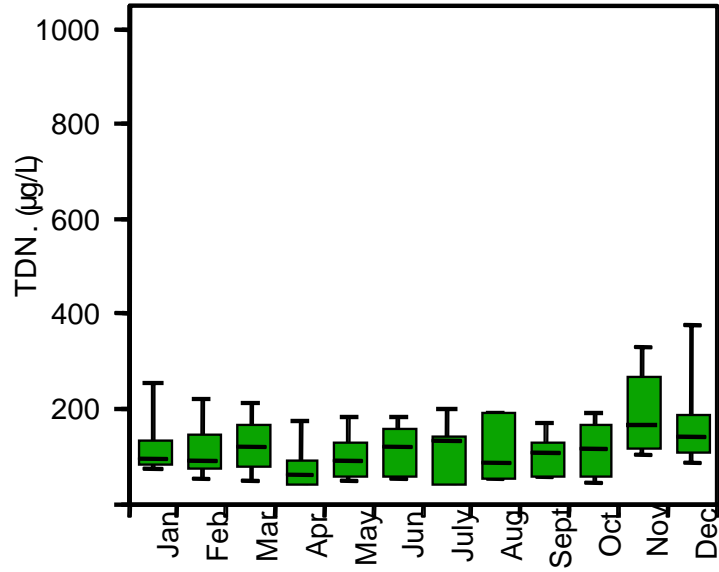


MONTHLY SAMPLING OF 43 STREAMS: JAN'2005 - 2007

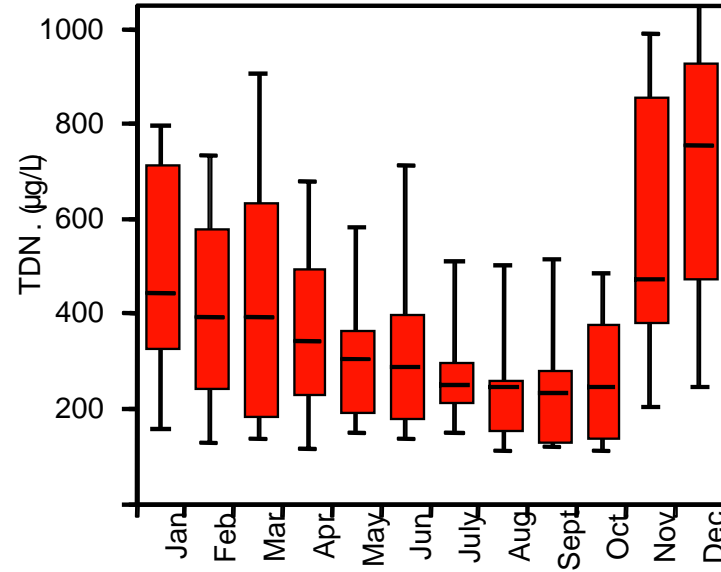


AVERAGE MONTHLY TDN IN TEN MOST...

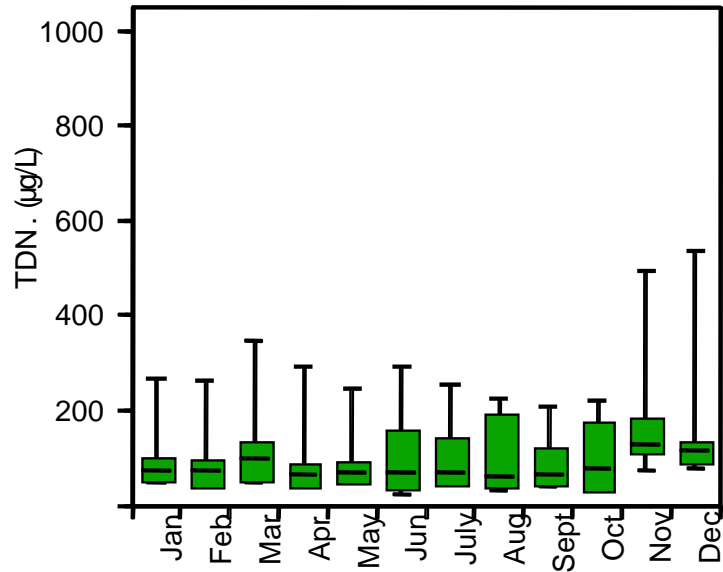
mature coniferous forest



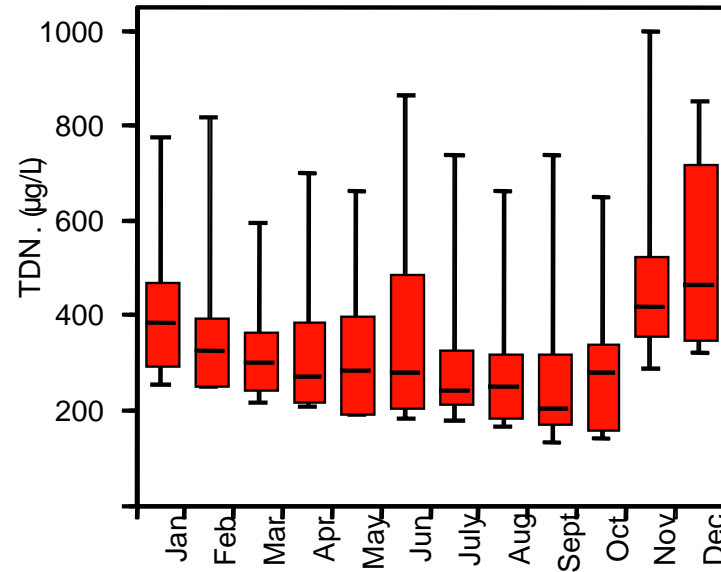
mixed deciduous forest



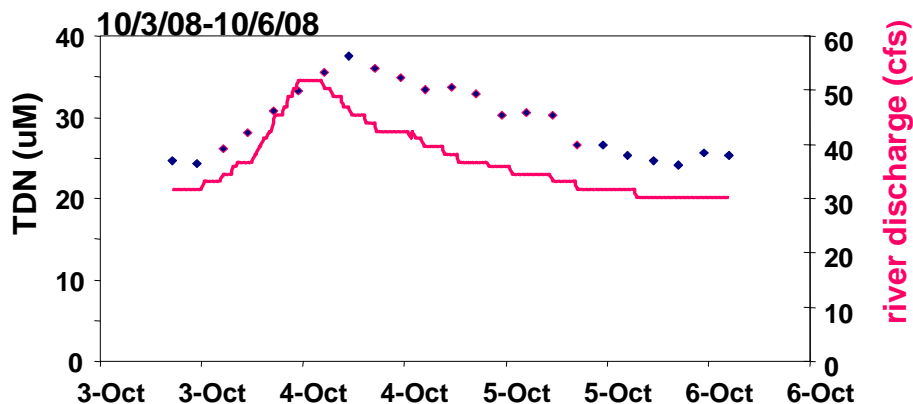
least densely populated watersheds



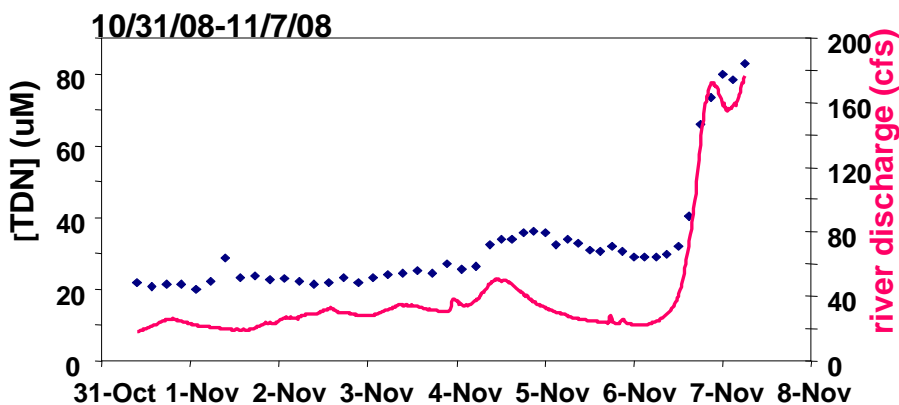
most densely populated watersheds



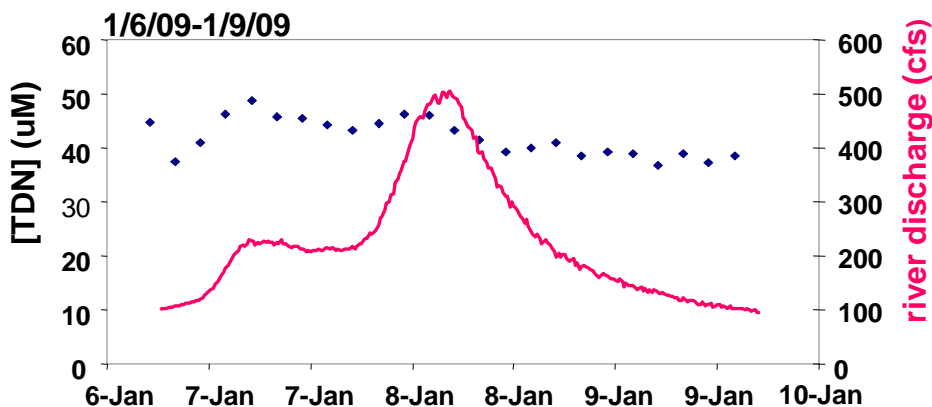
STORM RESPONSE: UNION RIVER [TDN]



First major storm of autumn displays near-doubling of TDN, then slow decline after peak flow.



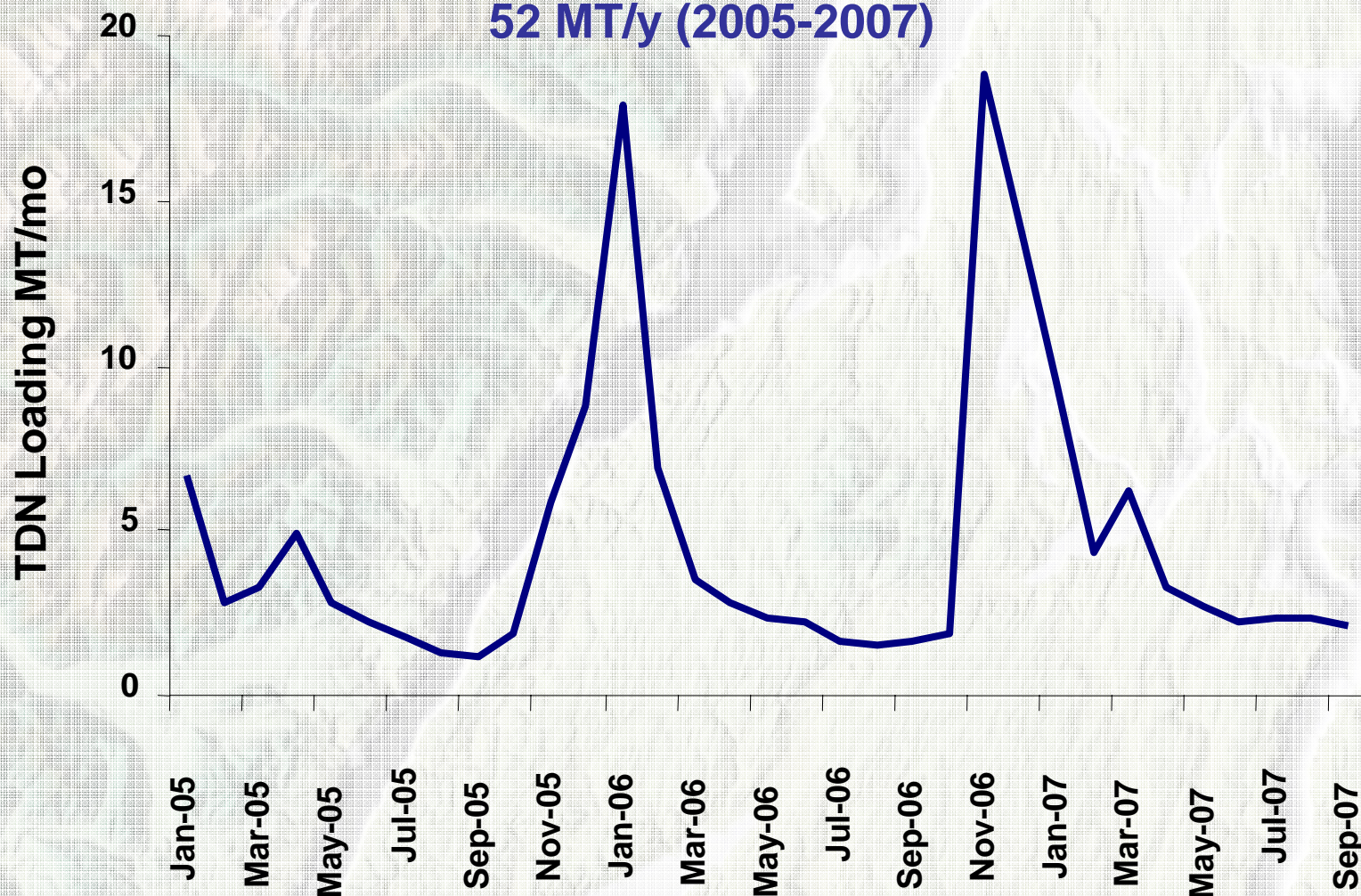
TDN concentrations continue to respond to large storm events in November. At peak river flow, concentrations are nearly 4x greater than just several days earlier



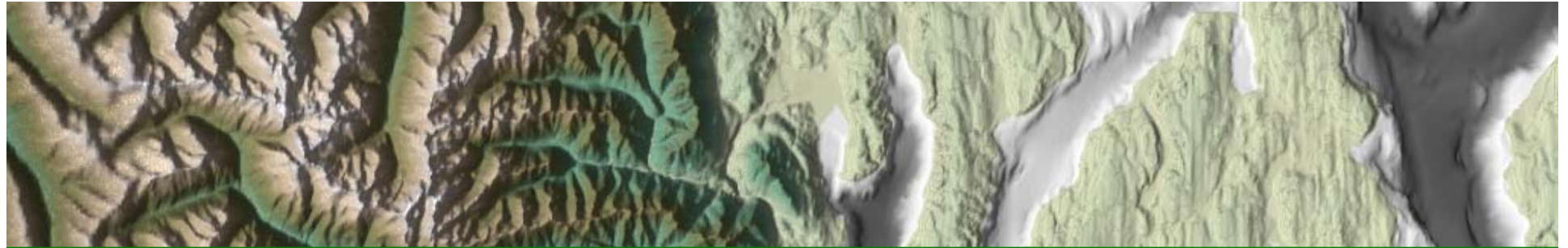
By January, TDN response to heavy river discharge is not as marked. Perhaps supply of excess nutrients stored in soils is depleted after numerous large storms.

LYNCH COVE TDN LOADING (DSEM*)

52 MT/y (2005-2007)



*Bechtold, Constans



Distributed Hydrology Soil Vegetation Model (DHSVM)

-Lettenmaier laboratory

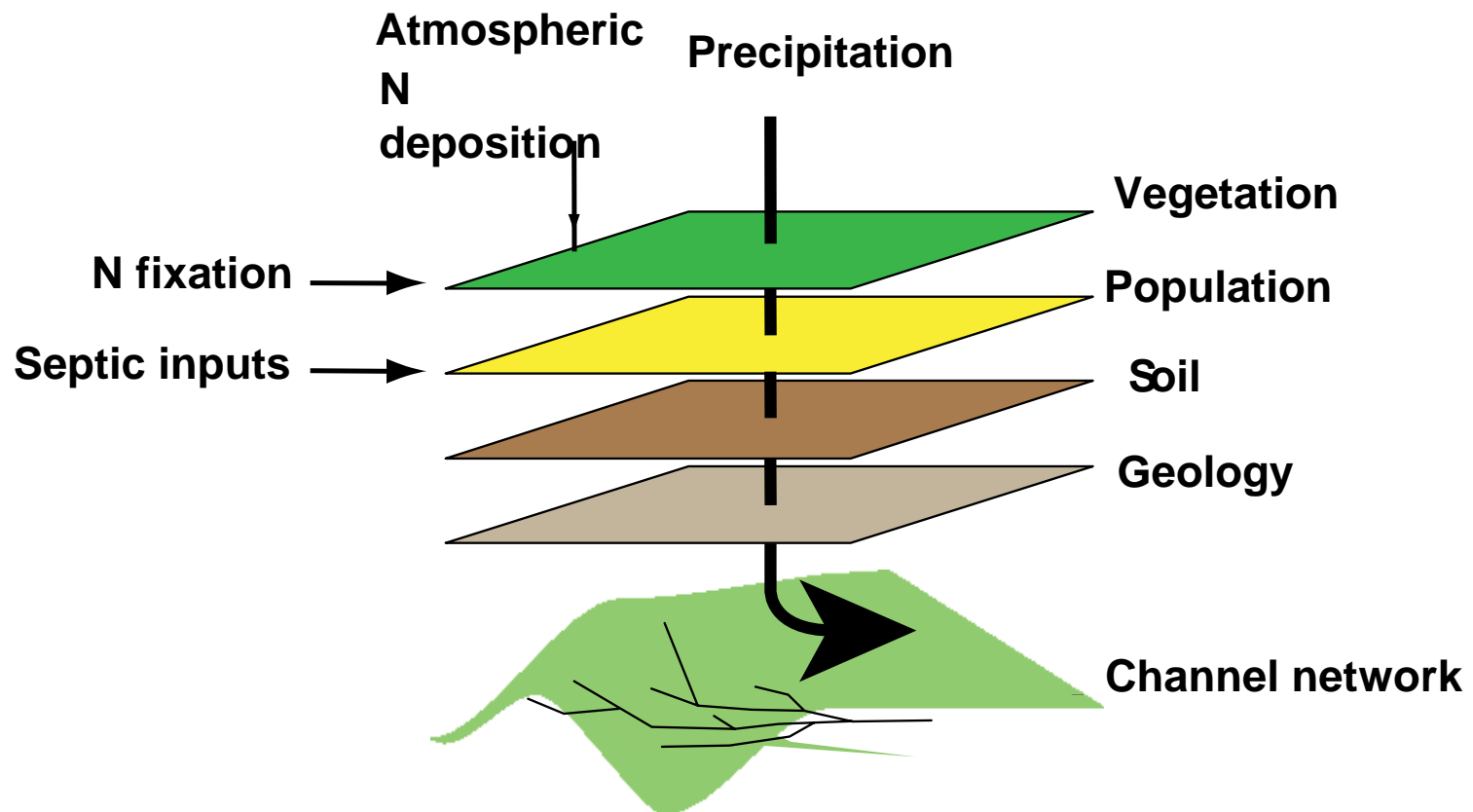
Solute Export Model (D-SEM)

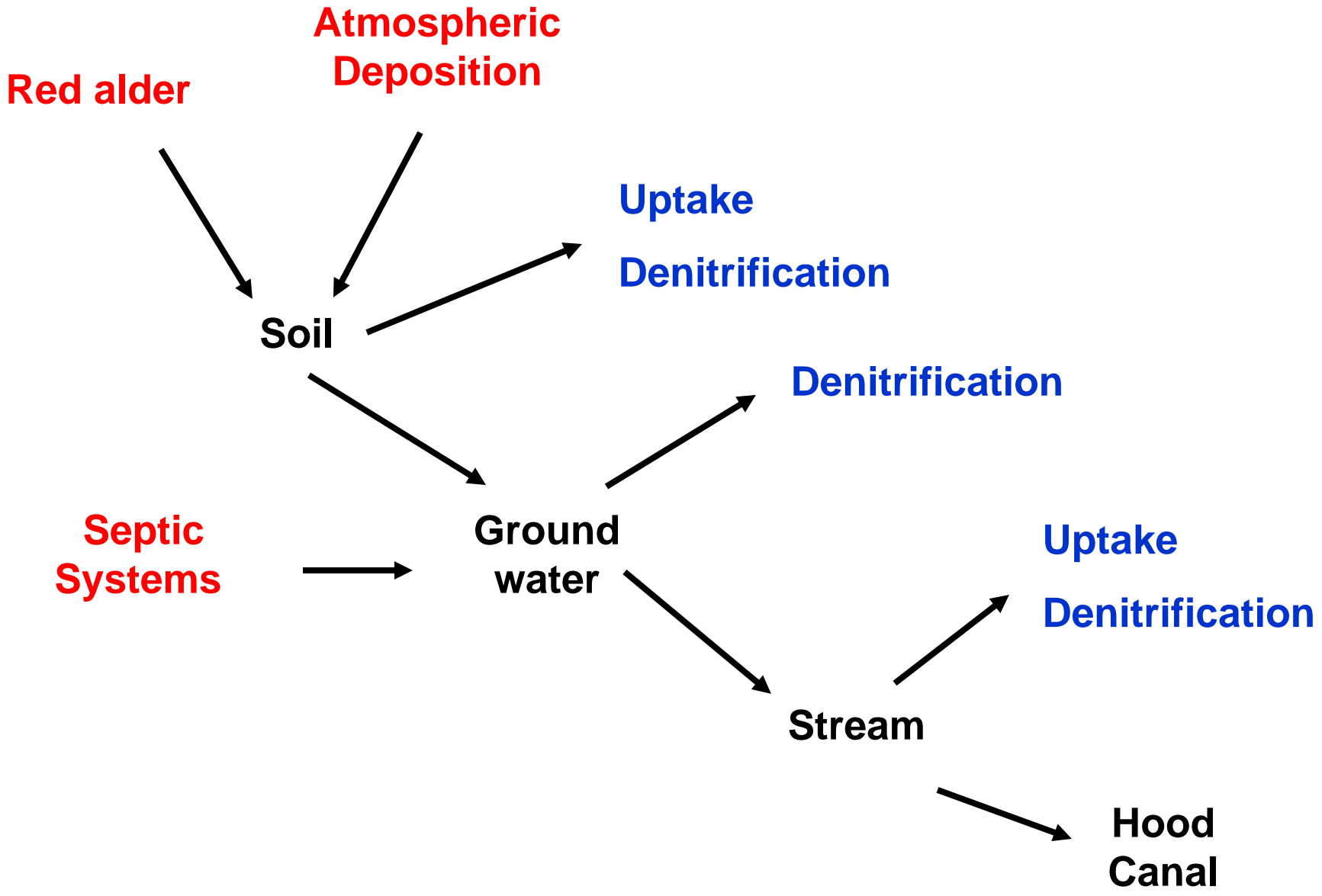
-Porrane Thanapakpawin

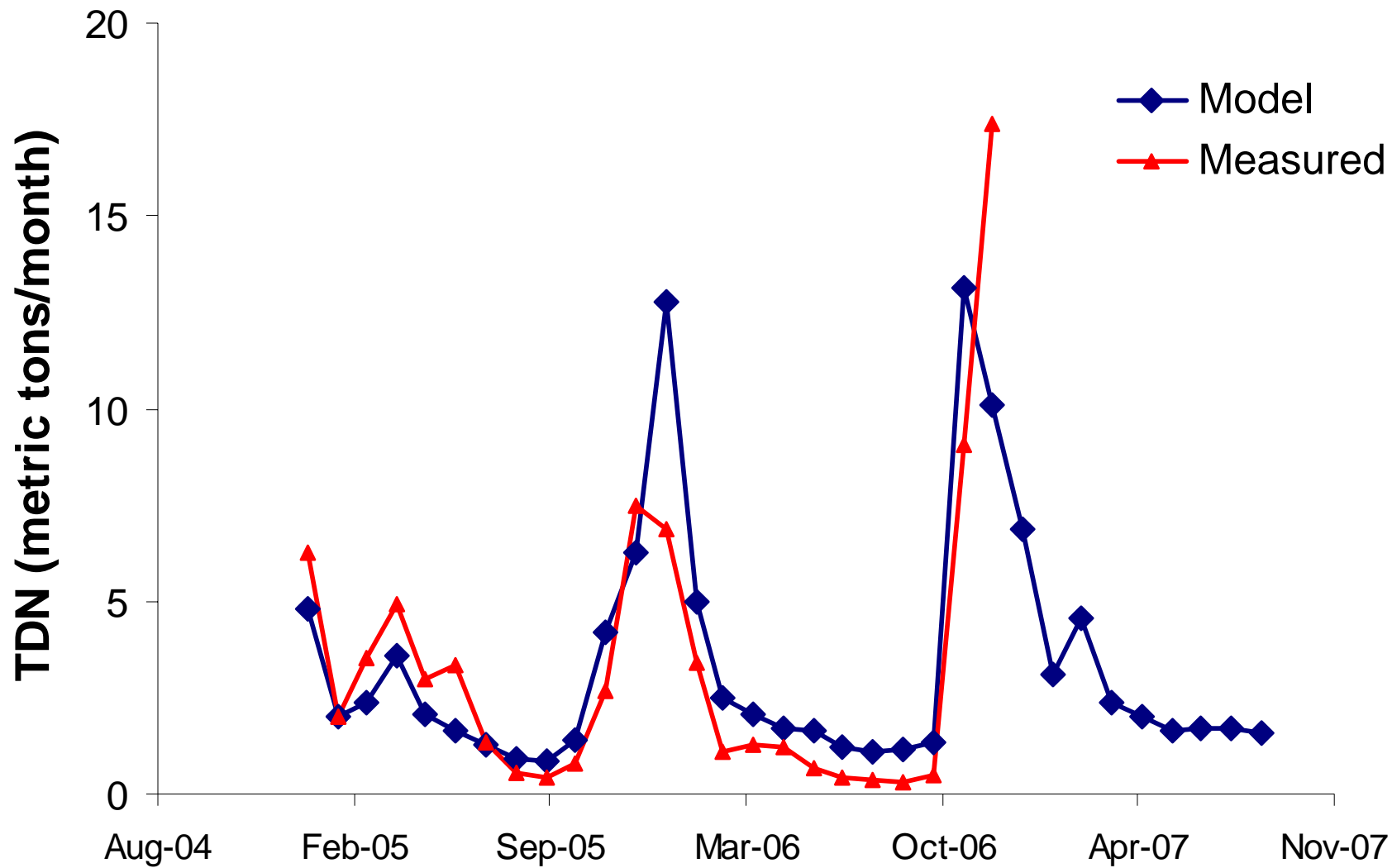


“MECHANISTIC” WATERSHED MODEL: *D-SEM*

Interpolation, process ID, future scenarios

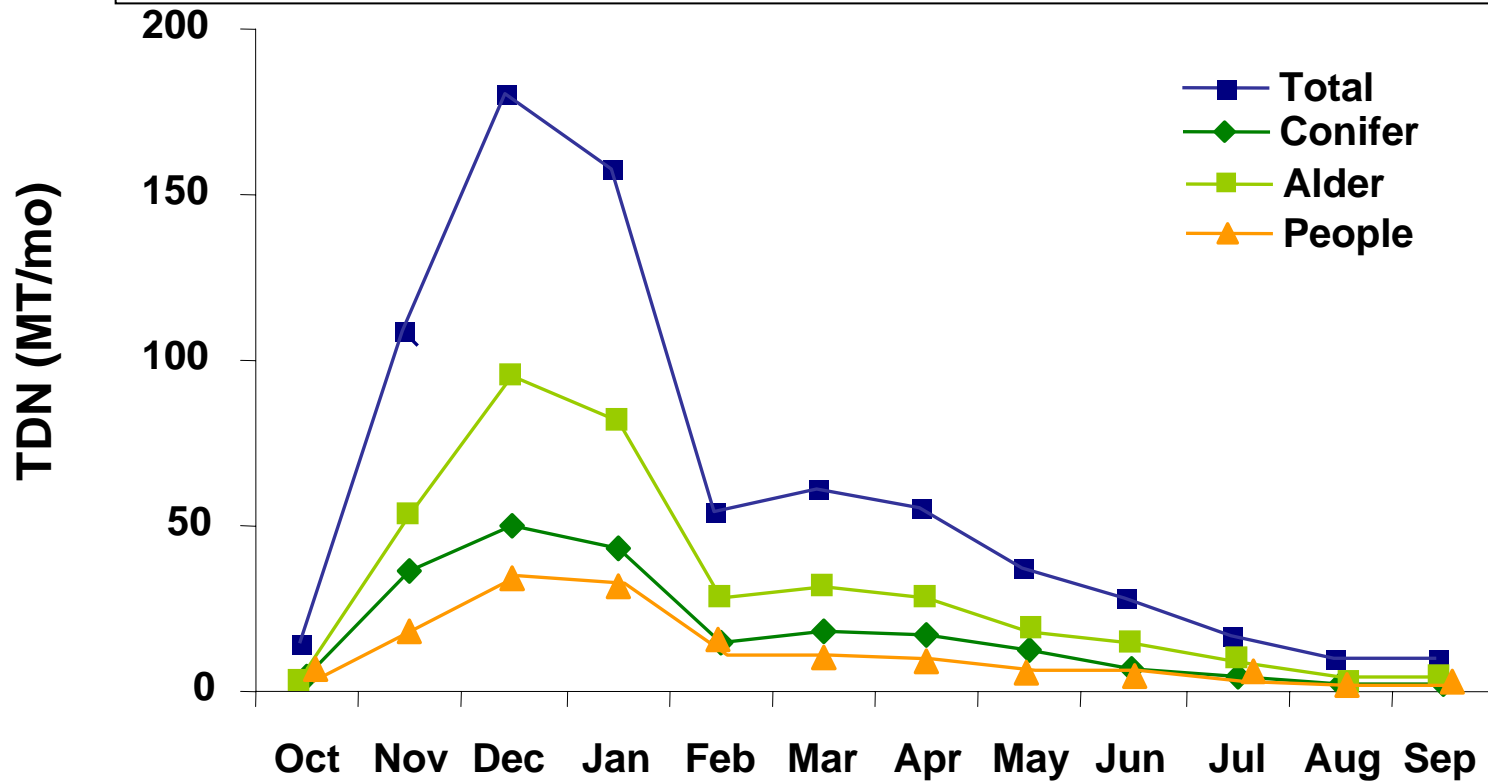






HOOD CANAL TOTAL TDN LOADING

2007, OVERALL UPDATES – *IN PROGRESS*



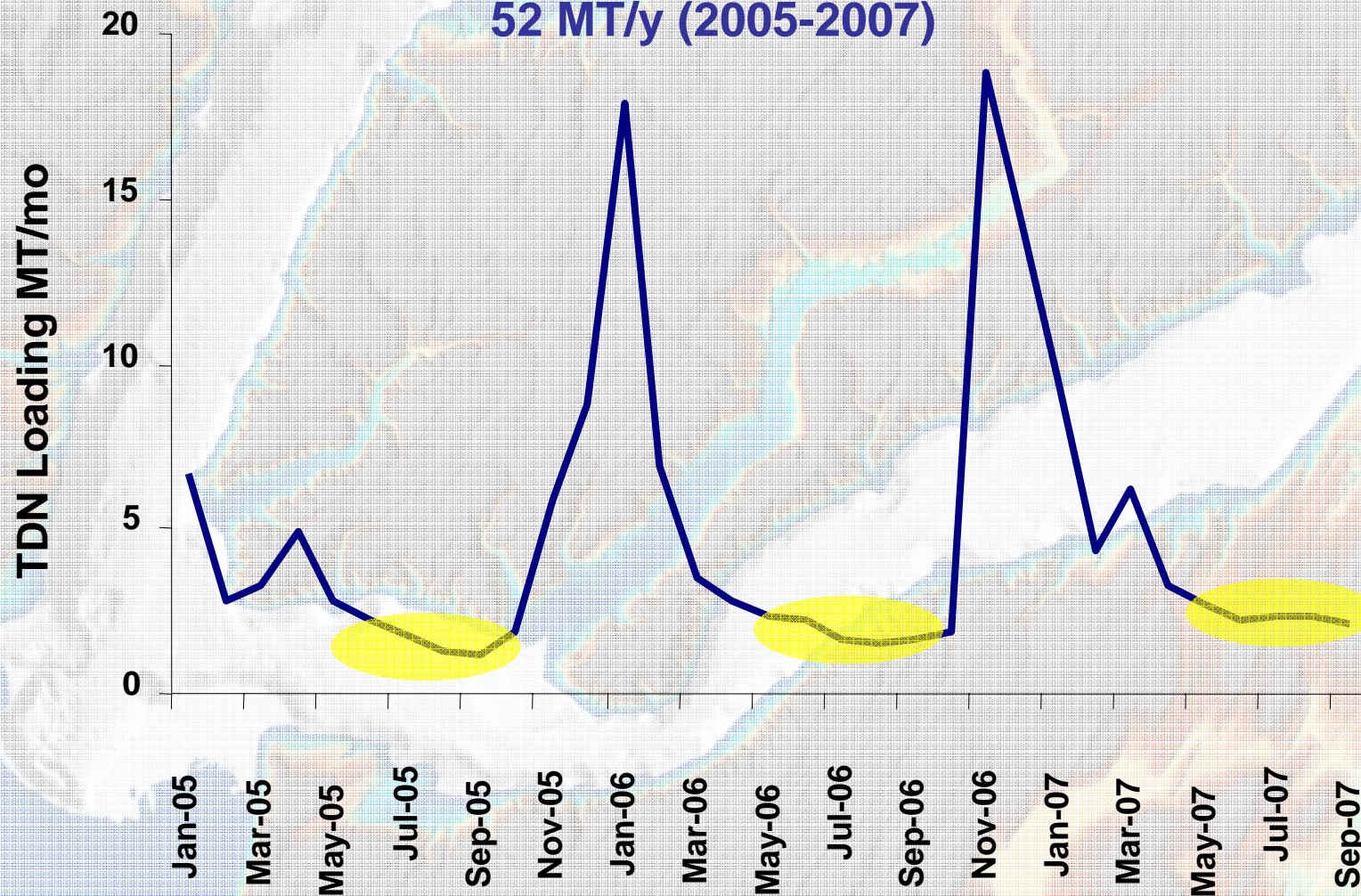
A topographic map of a coastal region, likely the Pacific Northwest, showing a complex network of rivers and a large inlet (Hood Canal). The terrain is color-coded by elevation, with greens and yellows for lower elevations and browns and greys for higher elevations. A central text box with a green border contains the main text. A compass rose is visible in the bottom right corner of the map.

How do watershed inputs compare with marine inputs?

- watersheds only contribute about
2-4 % of Hood Canal N
10-15% of Lynch Cove N
- winter river inputs are flushed out of
Hood Canal by spring

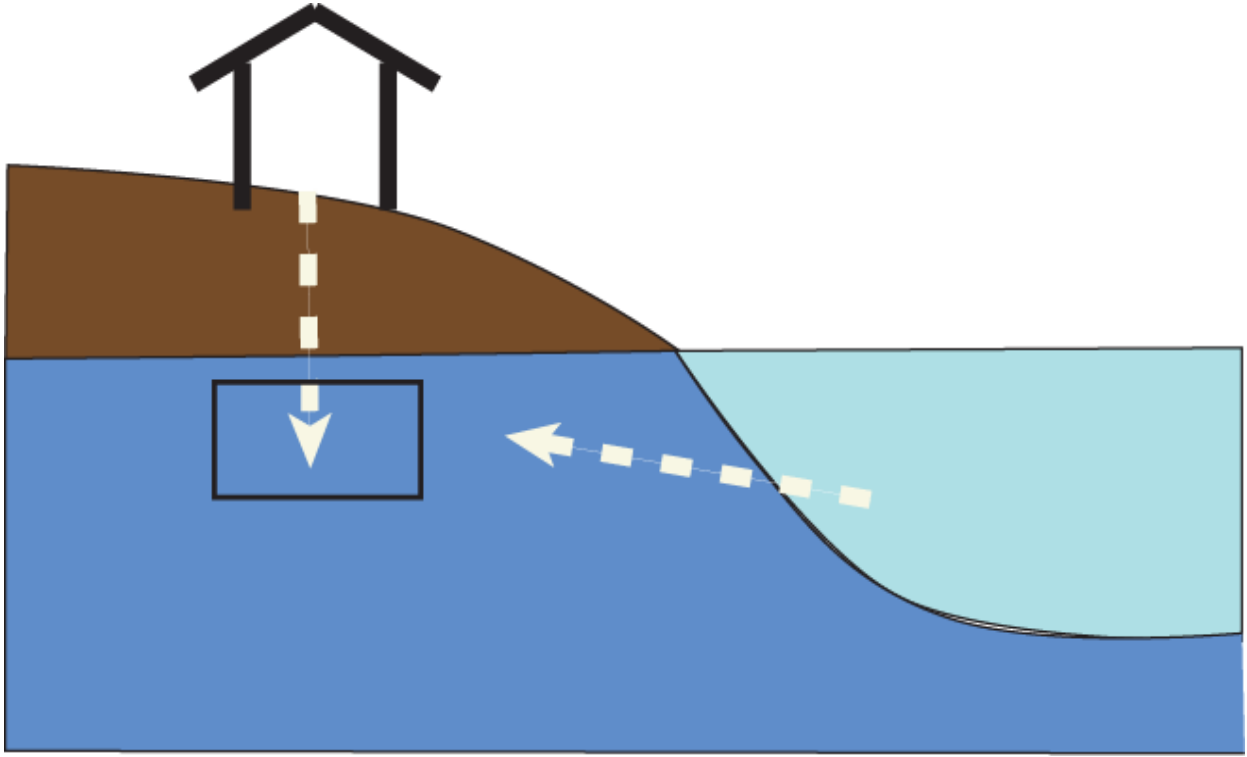
LYNCH COVE TDN LOADING (DSEM*)

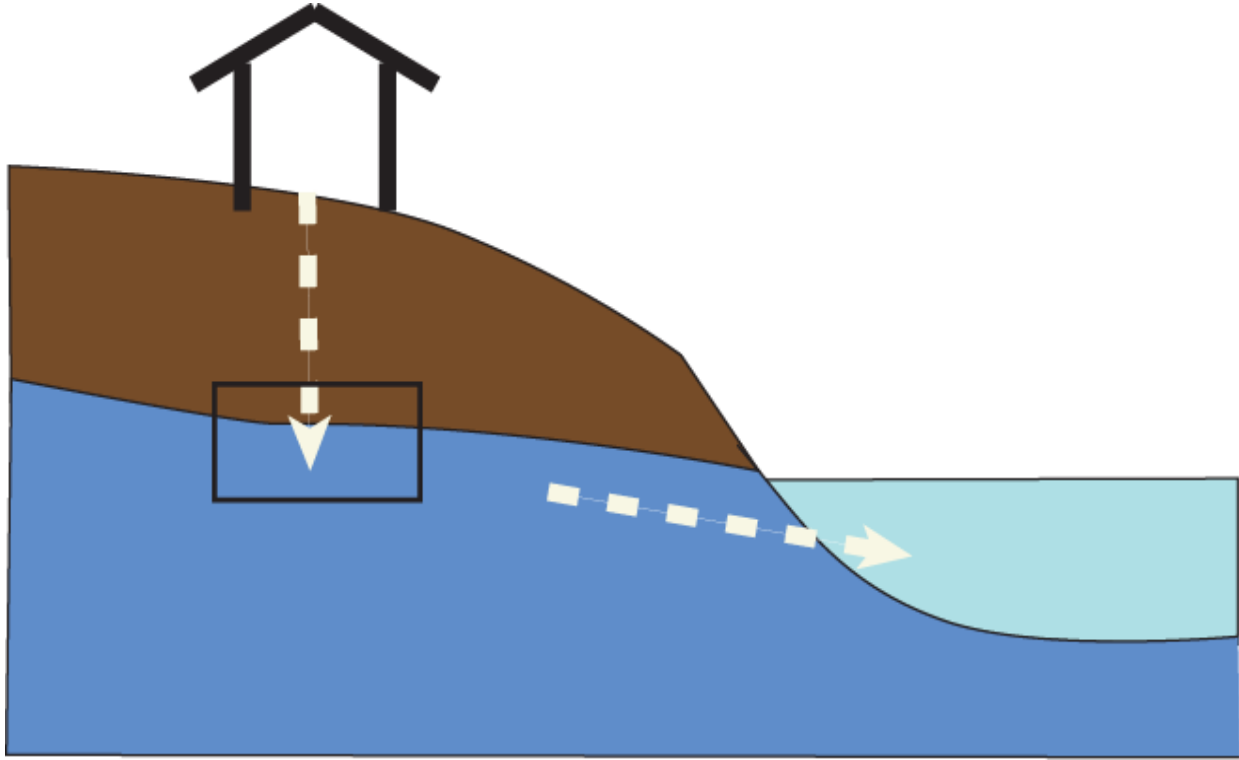
52 MT/y (2005-2007)



*Bechtold, Constans



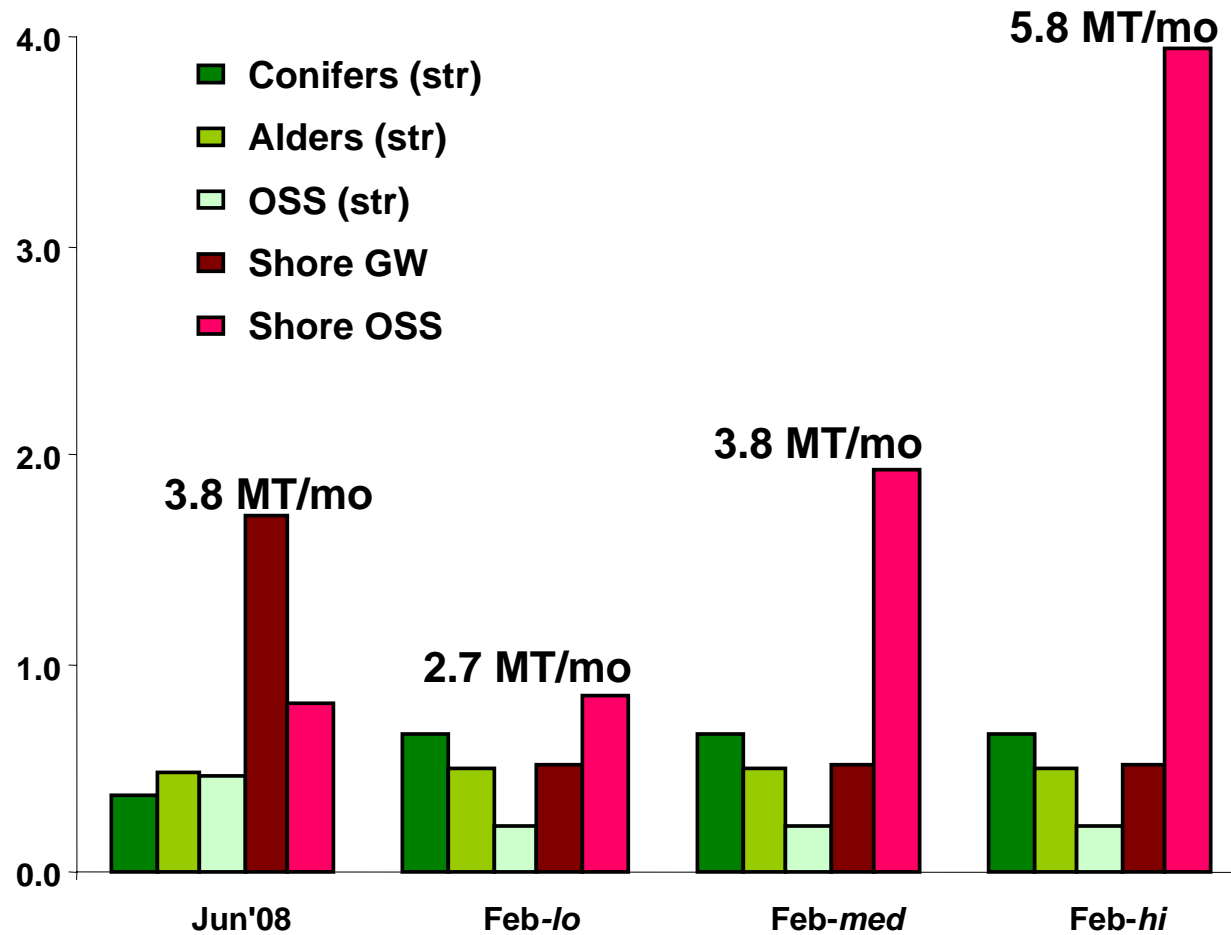






**Groundwater/Seepage inputs to Lower Hood Canal,
August September (USGS)**

Lynch Cove TDN Loading (DSEM)
June-Sept (MT/mo)



A topographic map of a mountainous region, likely the Pacific Northwest, showing terrain contours and water bodies. A large white rectangular box with a thin green border is overlaid on the map, containing text. In the bottom right corner of the map, there is a small circular compass rose with four arrows pointing up, down, left, and right.

Next steps:

Shoreline modeling of Hood Canal

Puget Sound – N and toxics

Skagit Futures

- agriculture
- conservation
- residential