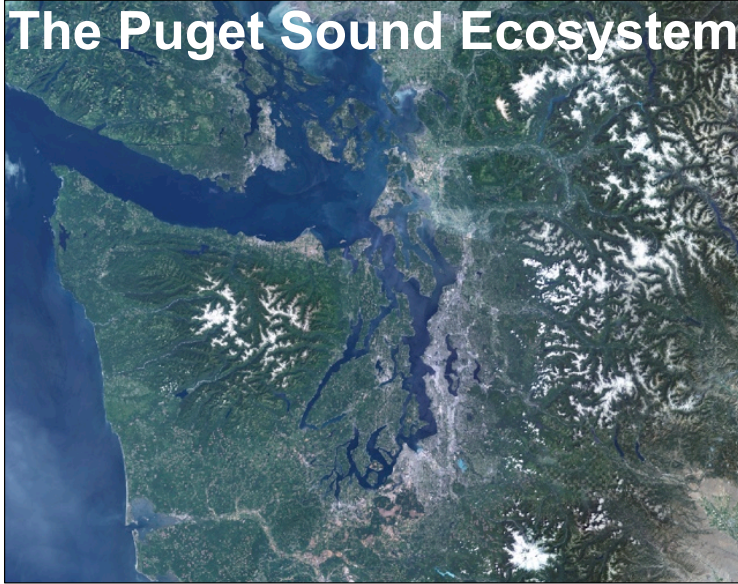


The Puget Sound Ecosystem

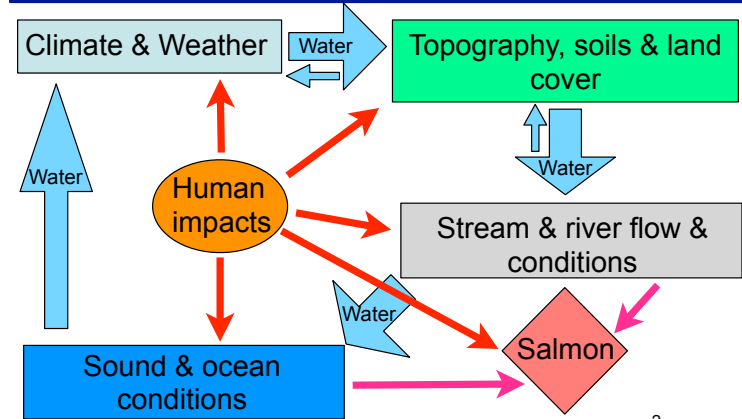


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Road Map of Puget Sound Ecosystem



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The Puget Sound Watershed



- Land from which water flows into Sound
- From Cascade crest to Olympic crest₃

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The “Blind Man & the Ecosystem”



- Several ways of classifying the Puget Sound Ecosystem
 - By salt water basin
 - By terrestrial watershed
 - By elevation & vegetation
 - By land cover & land use
 - By governmental jurisdiction & ownership
 - By human population density

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Puget Sound Basins

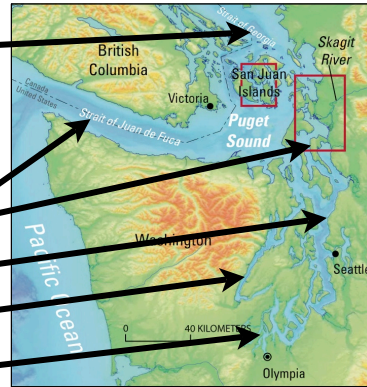


- Neighboring waters

- Strait of Georgia

- 5 major salt water basins

- Strait of Juan de Fuca
- Whidbey Basin
- Main Basin
- Hood Canal
- Southern Sound

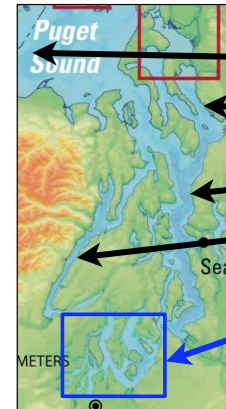


Puget Sound Basins



- 5 major salt water basins

- Juan de Fuca Strait
- Whidbey Basin
- Main Basin
- Hood Canal
- Southern Sound



Puget Sound Basins



- Why do we care about salt water basins?

- Affect water circulation
- Affect biological production
- Affect shoreline characteristics
- Affect dispersal of pollutants
- Create many more miles of shoreline

Puget Sound Watersheds



- What is a watershed?

- Land area from which rivers & streams drain to a common point
- Defined by topography
 - Cascade crest
 - E-W ridges



Puget Sound Watersheds



- State government demarcates watersheds
 - “Water Resource Inventory Areas” (WRIA)
 - Numbered
 - e.g. Nooksack River watershed is #1

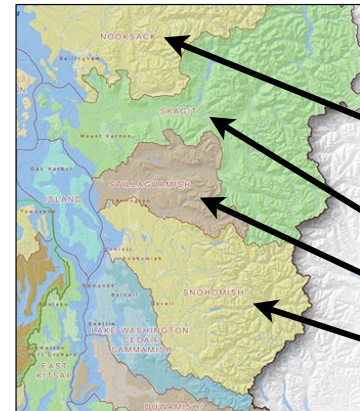
9

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Puget Sound Watersheds



- 9 major basins on the eastern shore
 - Entering Strait of Georgia
 - Nooksack
 - Entering Whidbey Basin
 - Skagit
 - Stillaguamish
 - Snohomish

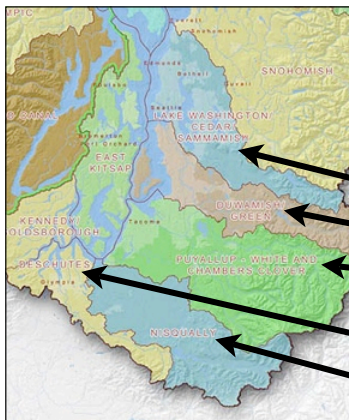
10

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Puget Sound Watersheds



- 9 major basins on the eastern shore
 - Entering Main Basin
 - Cedar/Sammamish
 - Duwamish/Green
 - Puyallup
 - Entering S. Sound
 - Deschutes
 - Nisqually

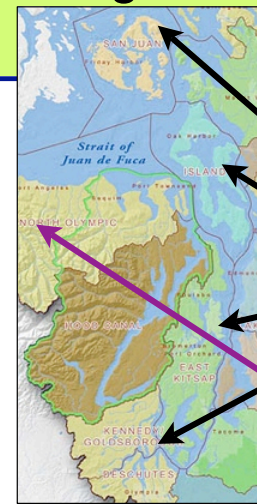
11

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Puget Sound Watersheds



- Watersheds with small streams
 - San Juan Islands
 - Whidbey Island
 - Kitsap Peninsula
 - South Sound inlets
 - N. Olympic Peninsula
 - Dungeness & Elwha R.
 - Streams

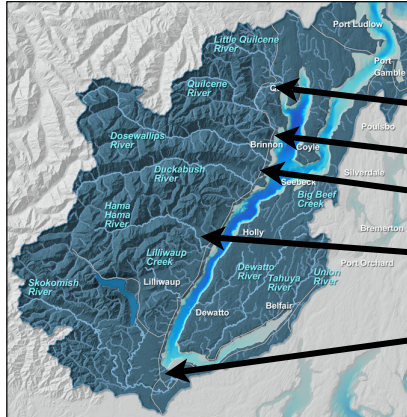
12

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Puget Sound Watersheds



- Basins feeding Hood Canal
 - Quilcene
 - Dosewallips
 - Duckabush
 - Hamma Hamma
 - Skokomish
 - Small creeks

13

Puget Sound Basins



- Why do we care about watersheds?
 - Each supports a separate set of salmon runs
 - Water supply in each operates independently of the others
 - Land alterations affect downstream areas only in the same watershed
 - Boundaries create barriers to land & water transportation

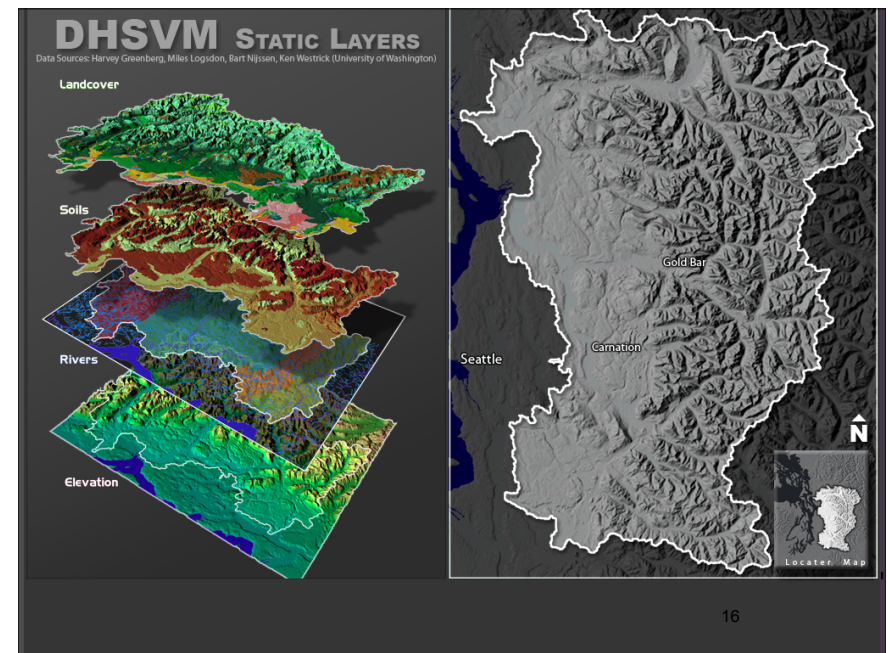
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Puget Sound Land Forms

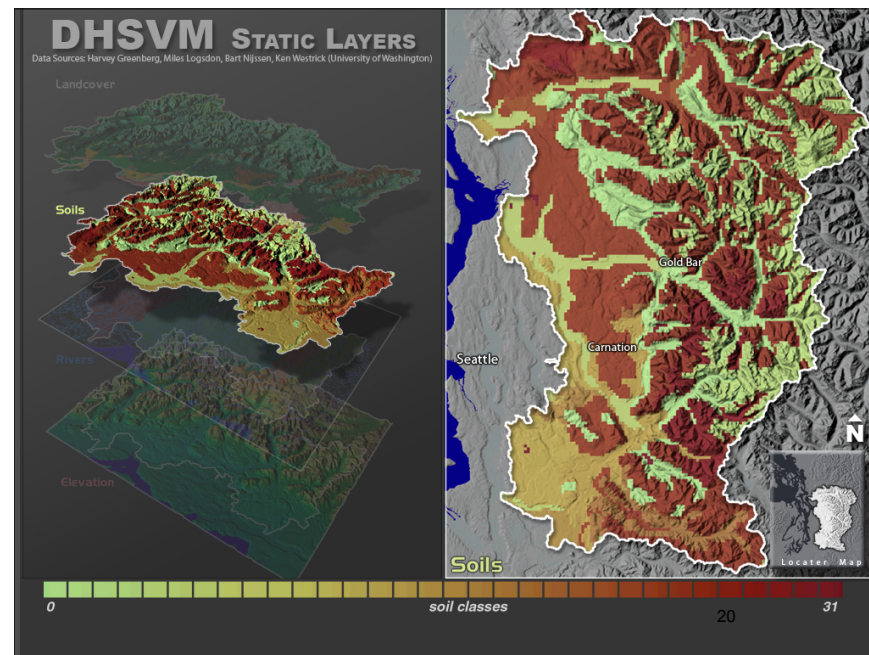
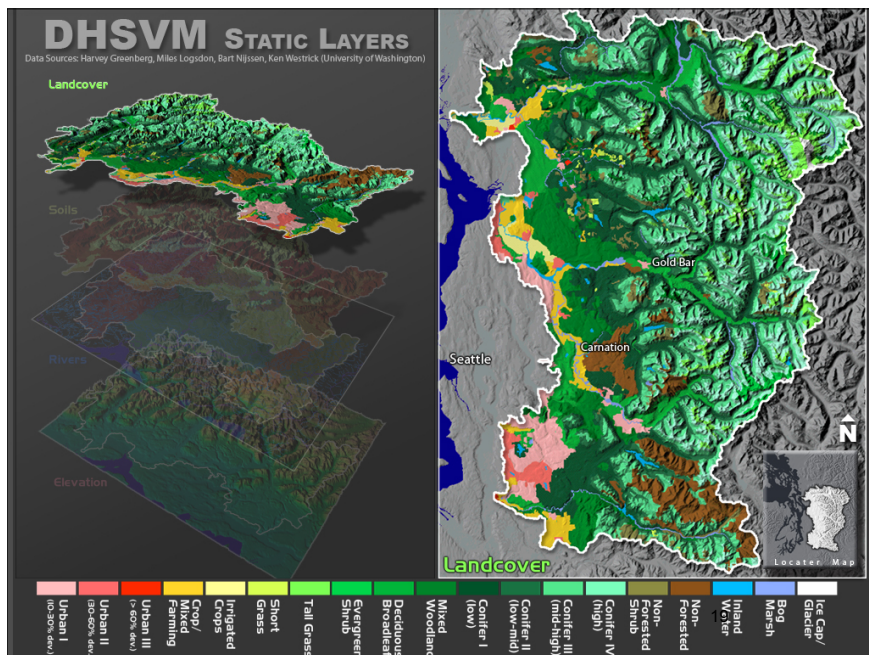
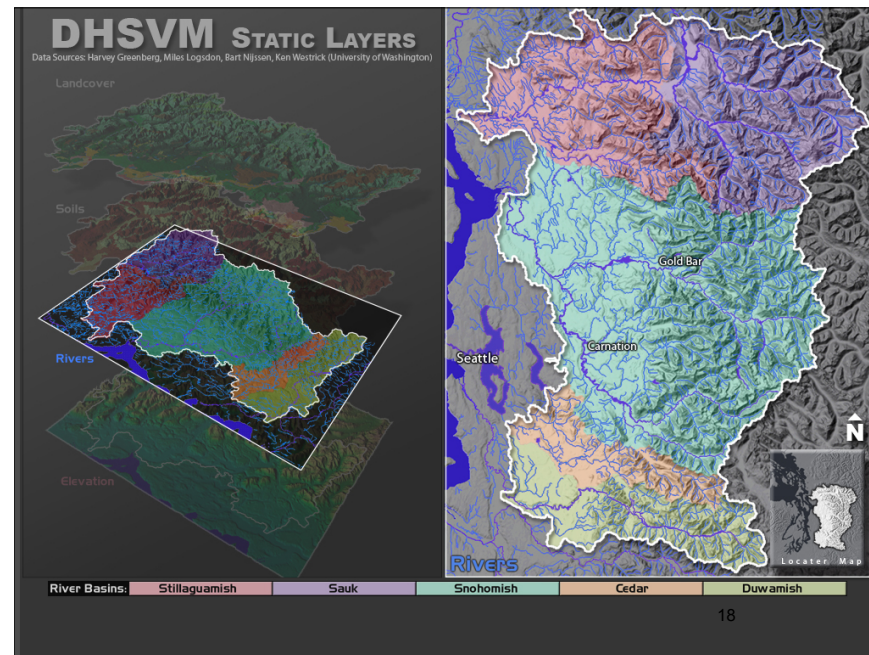
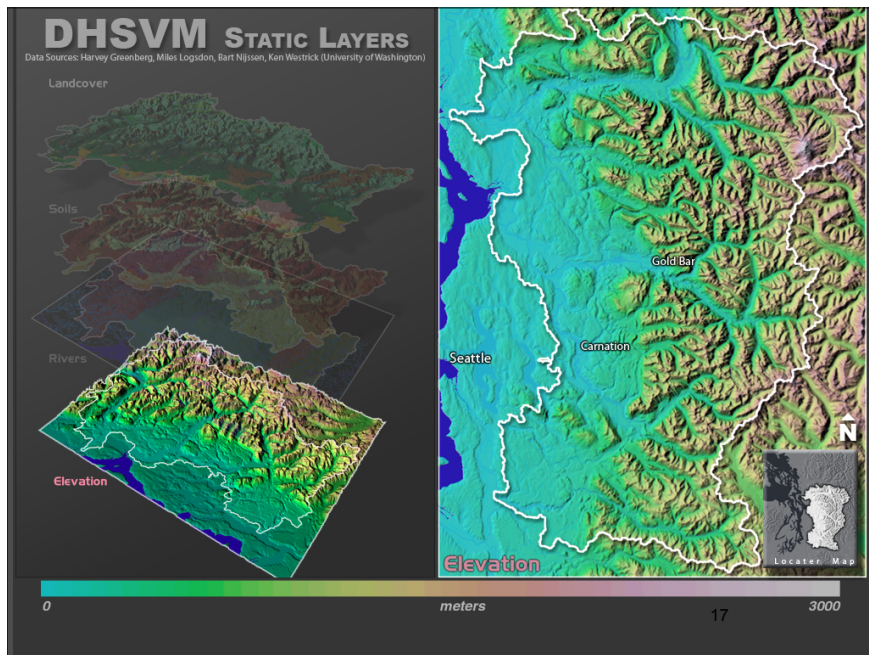


- The following slides illustrate three things:
 - The incredible amount of detail present in nature
 - And in the scientific databases we have produced to describe the region
 - The high-quality graphics used in PRISM
 - Illustrational maps of several properties that are important to the functioning of the ecosystem

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Puget Sound Land Forms

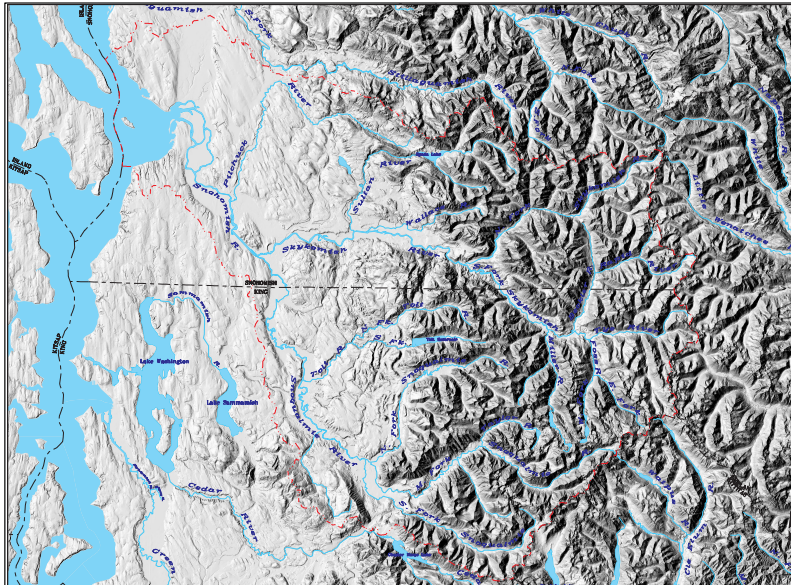


- You will not need to know this level of detail
 - Slides are mainly for illustration
 - Lab section will look at & manipulate portions of similar maps online
 - They will need to know a bit more detail

Puget Sound Land Elevations

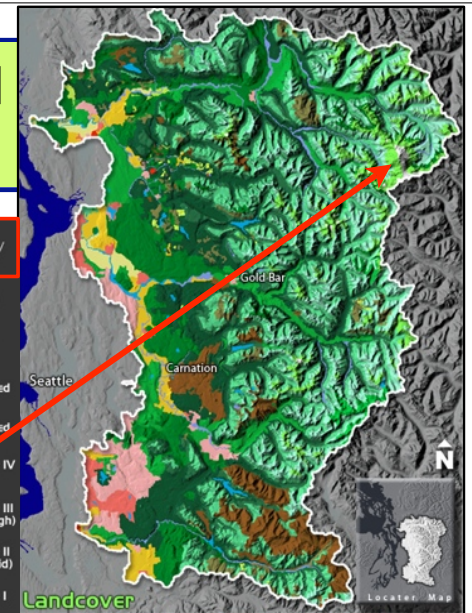


- Why does elevation matter?
 - Affects rain & snowfall
 - Affects length of growing season
 - Affects type of soil
 - All of these affect
 - Path & speed of streams & ground water
 - Type & amount of vegetation
 - Type & amount of animal life



Puget Sound Land Forms

- Zoom in on Stillaguamish & Snohomish watersheds
- Vegetation & elevation zones
 - Alpine
 - Rock & ice
 - Glacier Peak

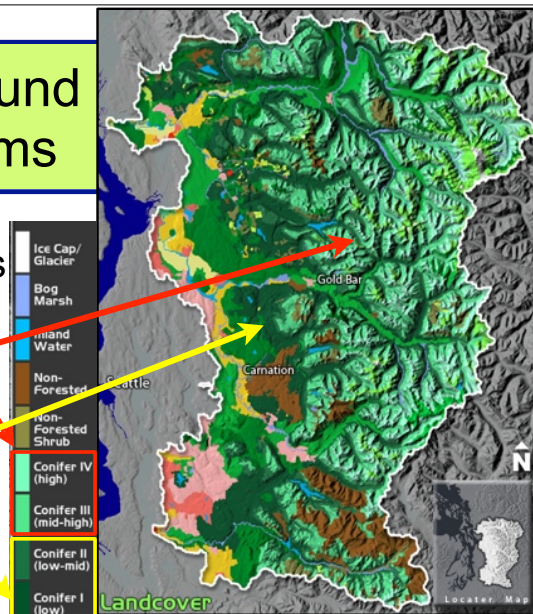


Puget Sound Land Forms

- Vegetation & elevation zones

- Mountain

- Subalpine forest
- Mid & lowland forest



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Puget Sound Land Forms

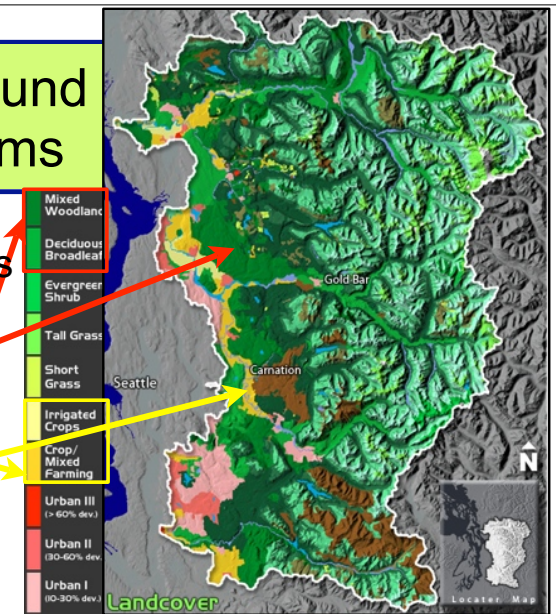
- Vegetation & elevation zones

- Lowland hills

- Forested & inhabited

- Flood plain

- Once forest, now farmed & inhabited



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Puget Sound Land Forms

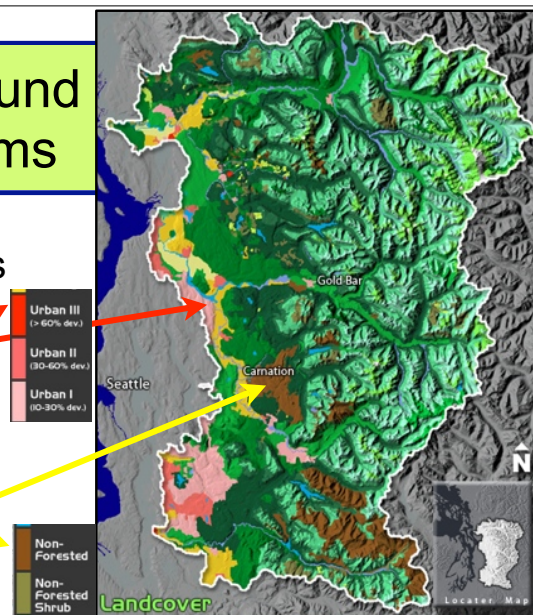
- Vegetation & elevation zones

- Urban & suburban

- Center cities not shown

- “Non-forested”

- Clearcut logging



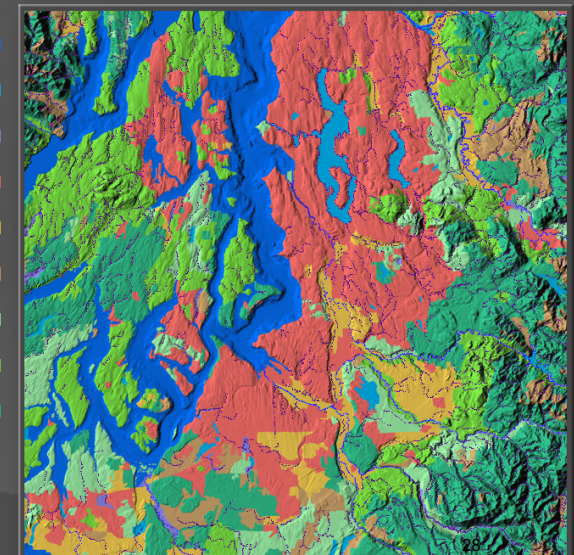
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Land Cover Classification for Central Puget Sound

- No Data
- Open Water
- Wetlands Riparian
- Developed
- Agriculture
- Non-Forests
- Hardwood Forests
- Mixed Forests
- Conifer Forests



Puget Sound Land Forms

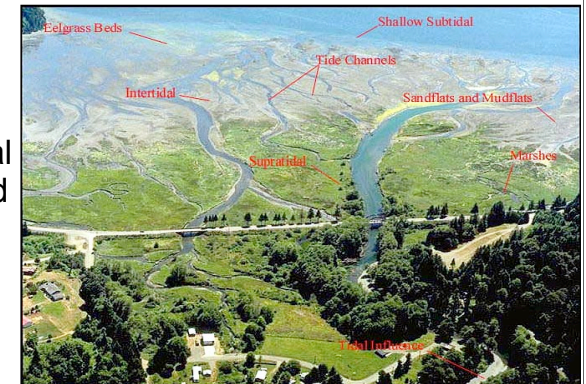


- Why do we care about elevation & vegetation?
 - Significant changes in climate with elevation
 - Determines resident flora & fauna
 - Vegetation affects animal habitat
 - Response to climatic forcing
 - Heavy rain on steep vs. flat terrain
 - Response & susceptibility to human alteration

The Puget Sound Coastal Zone



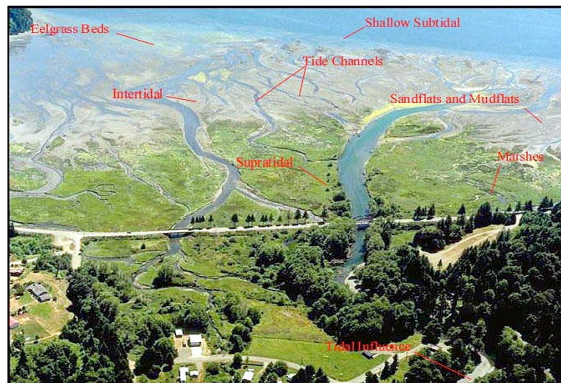
- Estuary (river mouth)
 - Supratidal vegetated wetlands
 - Salt marsh



Estuarine Nearshore Habitats



- Intertidal
 - Mud flat
 - Sand flat
 - Eelgrass
 - Shallow subtidal
- Other (not shown)
 - Sand, gravel, rock



Puget Sound Estuaries



- Why do we care about estuaries?
 - Substrate & vegetation affect animal habitat
 - Especially sand & mud flats
 - Shellfish production
 - Critical nursery habitat for marine animals
 - Response & susceptibility to human alteration
 - Diking, dredging, filling, contamination of coastal wetlands

Herring spawn by the millions in certain coastal areas, laying their pearl-like eggs in strands along blades of eelgrass or seaweed. The mouth of the Duwamish River was probably a major spawning area.

ELLIOTT BAY
(originally named Duwamish Bay)

Trail to Lake Union
Village at the site of Pier 70 on Elliott Bay.

JIJILAETCH, OR "LITTLE CROSSING OVER PLACE"
Several longhouses on the site of Pioneer Square, which was a small island separated at high tide from the mainland.

Trail to Lake Washington, with a branch leading south to river villages and eventually to Yakima Pass.

"FAT NOSE"
A small, probably seasonal, village.

MUD FLATS

TELTELK
Village site

TOLALTIX, OR "HERRING HOUSE"
A large village site with several longhouses, one more than 500 feet long. Prime fishing for salmon and herring.

Denny party lands in 1851.

ELLIOTT BAY 1851

Source: http://seattletimes.nwsources.com/news/local/seattle_history/maps/seattle1851_map.html

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ggest ed for ears.

Pier 90-91

Space Needle

BAQHAQWAB

JIJILAETCH

ELLIOTT BAY

Harbor Island

Safeco Field

"FAT NOSE"

West Seattle Bridge

TOLALTIX

HELCPUS

TELTELK

ELLIOTT BAY Today

Source: http://seattletimes.nwsources.com/news/local/seattle_history/maps/overview_map.html

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Estuarine Habitats: Before & After

Eelgrass Meadows www.wa.gov/wdfw/hab/sshiap/marnscl.htm

A "virgin" estuary

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Estuarine Habitats: Before & After

ELLIOTT BAY Today

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Estuarine Habitats: Before & After



Everett Harbor Today



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North Sound Estuaries



Nooksack
Samish
Skagit

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Central Sound Estuaries



Stillaguamish
Snohomish
Cedar/Green
Duwamish

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Puget Sound Estuaries



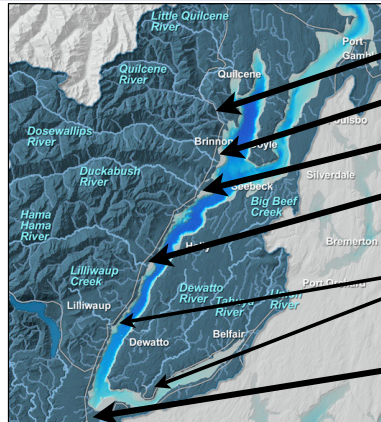
South Sound
estuaries
Puyallup
Nisqually
Hood Canal
estuaries
Skokomish

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Hood Canal Estuaries



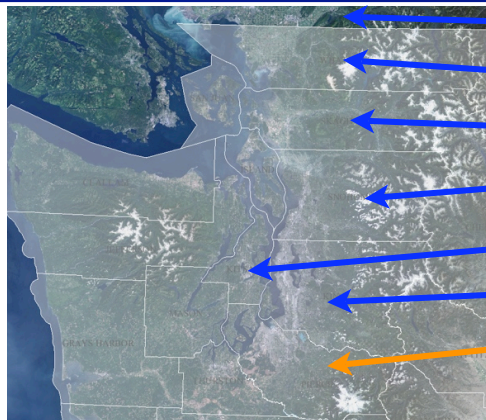
Quilcene
Dosewallips
Duckabush
Hamma
Hamma
Small
creeks
Skokomish

Puget Sound Political Boundaries



- All scales of political boundaries
 - U.S. Canada border
 - Crosses Strait of Georgia & Skagit watershed
 - State
 - Fortunately all within Washington
 - Tribal reservations
 - Legal rights extend beyond reservation
 - Counties
 - Cross watershed boundaries
 - Cities

Puget Sound County Boundaries



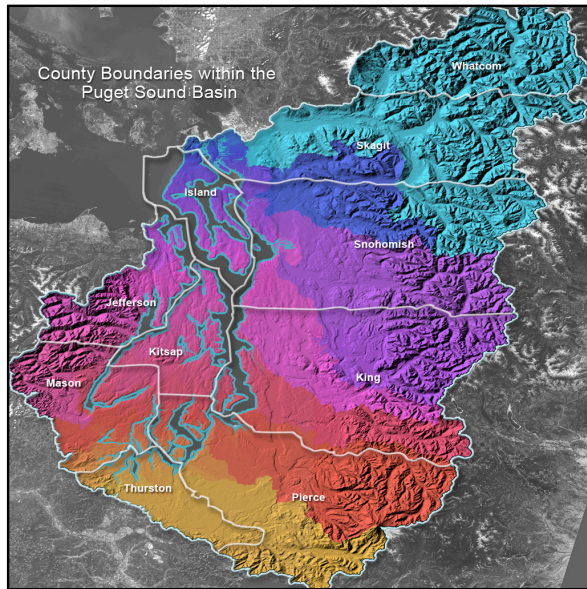
Canada
Whatcom
Skagit
Snohomish
Kitsap
King
Pierce

Puget Sound County Boundaries



Canada
San Juan
Clallam
Island
Jefferson
Mason
Thurston





Mismatch
between
county and
watershed
boundaries

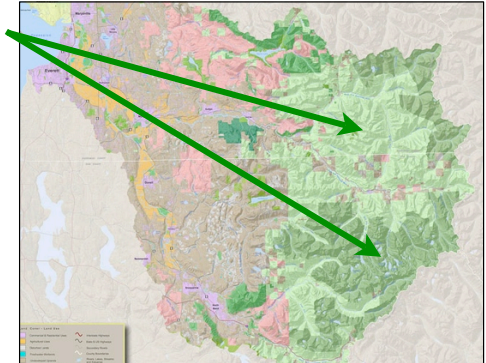
Puget Sound Land Ownership



Snohomish River watershed as example

Mainly forests
& parks

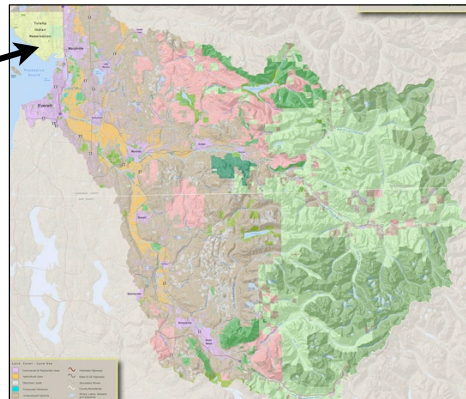
Federal lands



Snohomish Watershed Ownership



Tribal
reservations
Mainly
coastal

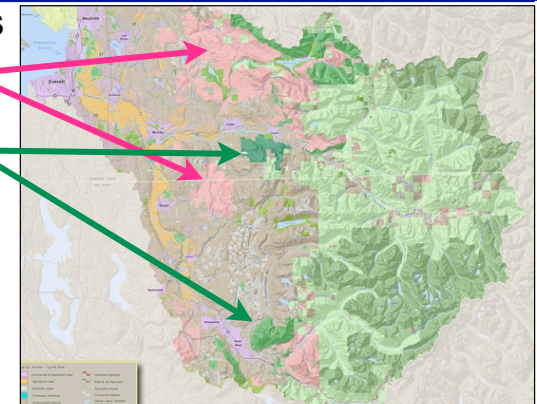


Snohomish Watershed Ownership

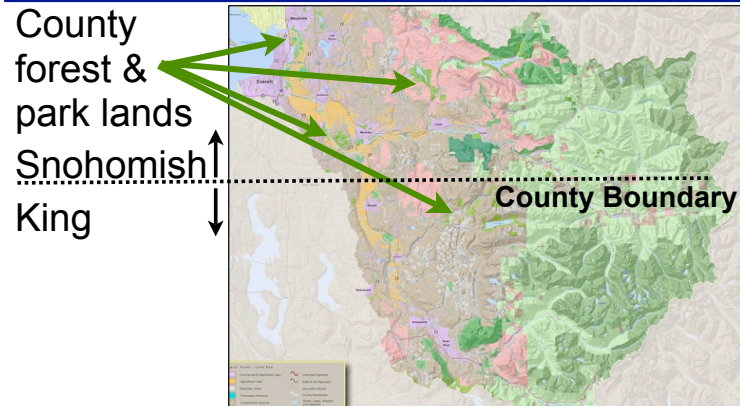


State lands

Working
forests
Parks &
preserves



Snohomish Watershed Ownership

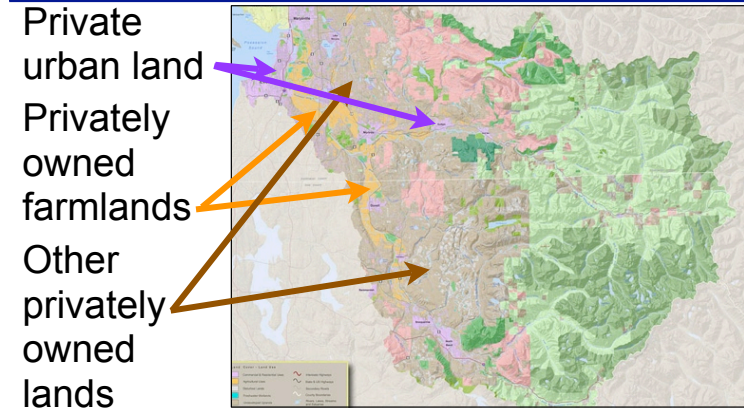


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Snohomish Watershed Ownership



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Puget Sound Political Boundaries



- Why do we care about political boundaries?
 - Different regulations & enforcement
 - Land ownership
 - Political jurisdiction
 - Requires coordination for resources that cross boundaries
 - Water
 - Migratory fish
 - Source of conflict as well as concord
 - U.S. vs. Canada salmon catch

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Classification Conflicts



- Who is in charge of the salmon?
 - Jurisdictions
 - Federal, tribal, state, county & city
 - May apply regardless of land ownership
 - Ownerships
 - Federal, tribal, state, county, city
 - Private individual, corporate, non-profit
 - Clue to how habitat & species degraded
 - Institutional challenges for recovery effort

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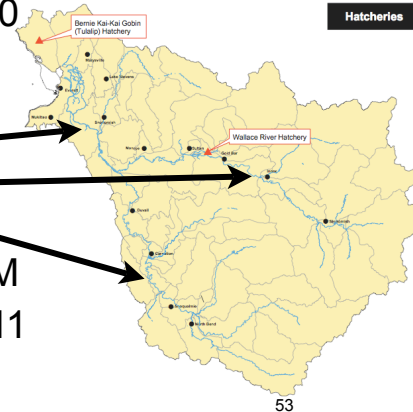
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Snohomish River Watershed



- Drainage area 4780 km²
 - 3 drainage basins
 - Snohomish R.
 - Skykomish R.
 - Snoqualmie R.
- Elevation 0–2427 M
- Precipitation 94–311 cm/yr



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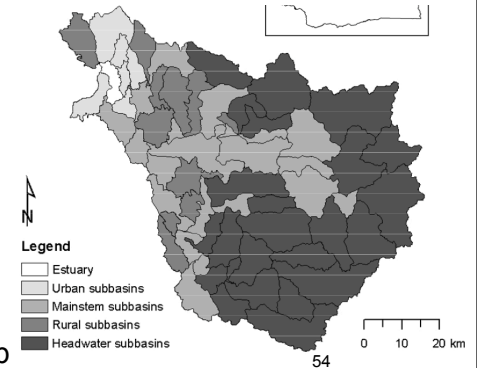
53

Snohomish River Watershed



- 62 sub-basins
 - Defined by topography & drainage patterns
- Land cover
 - Forest cover 7–83% of area
 - “Impervious” cover 0–49% of area
 - Rain doesn’t absorb

Snohomish Basin Salmon Recovery Technical Committee 2004



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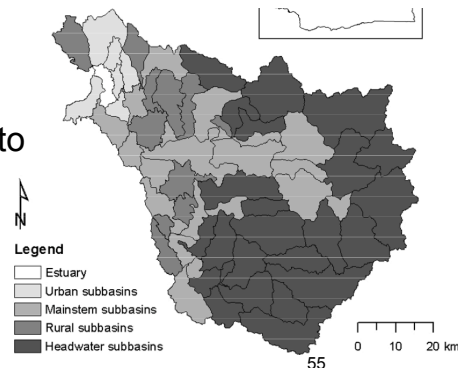
54

Snohomish River Watershed



- Trends in land cover
 - Predicted 50% increase in human population by 2020
 - Forest cover likely to decrease
 - Impervious cover likely to increase

Snohomish Basin Salmon Recovery Technical Committee 2004



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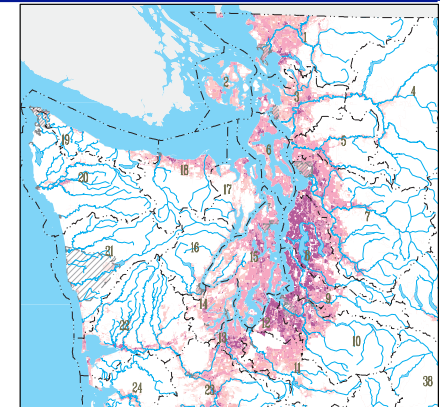
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Puget Sound Human Population



- Population density
 - Highest in the Puget Sound corridor
 - Source: Dept. Ecology



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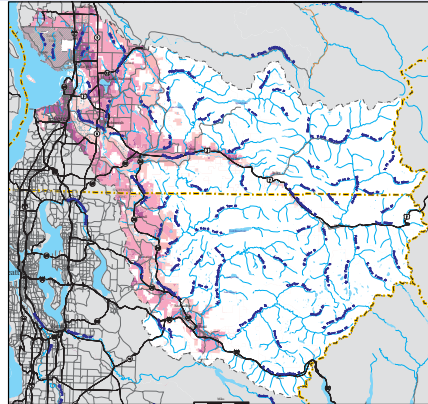
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Snohomish Basin Population



- Population density
 - Highest near rivers & Sound
 - Source: Dept. Ecology
 - Same as salmon habitat

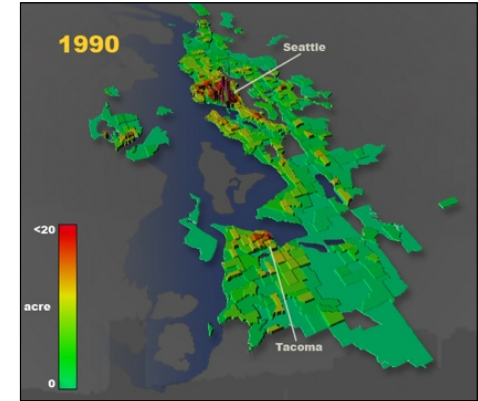


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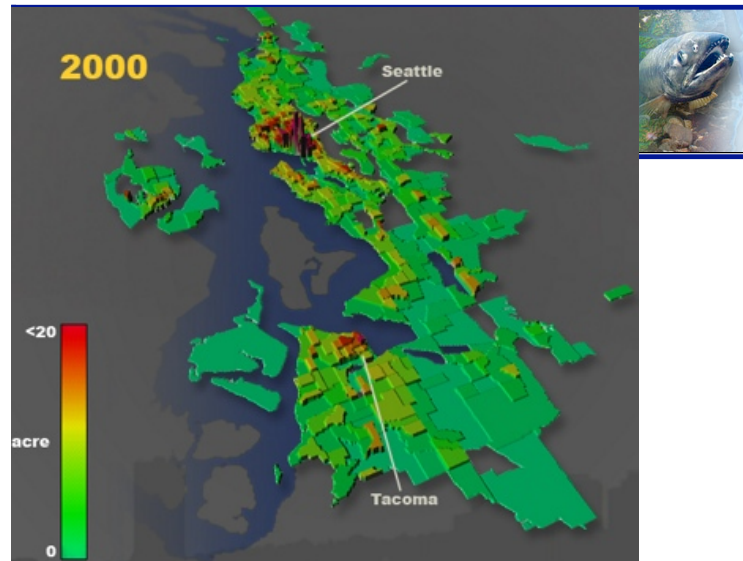
Puget Sound Population Growth



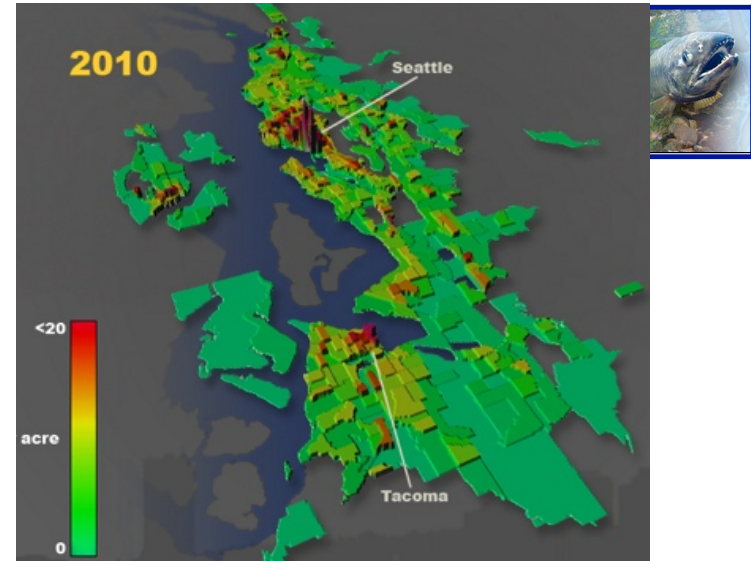
- Population density
 - People per acre
 - Increasing rapidly



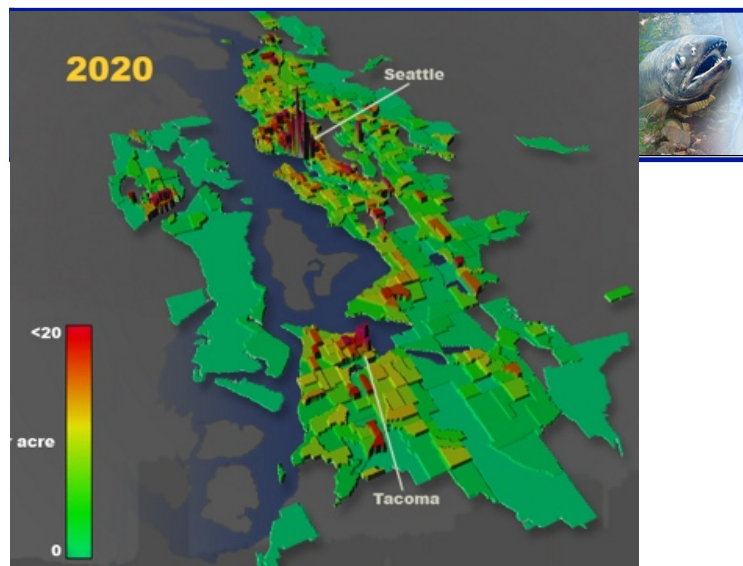
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59



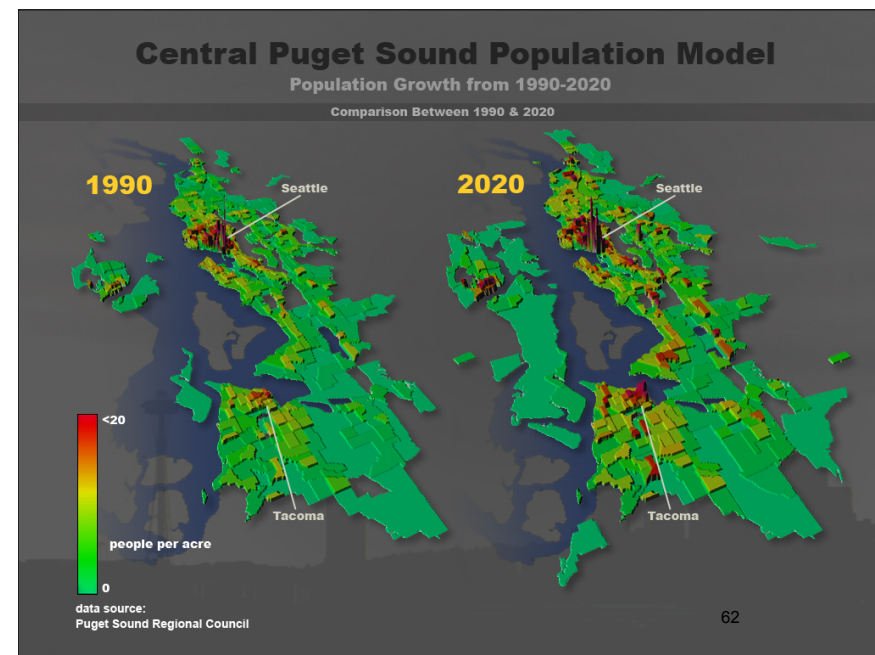
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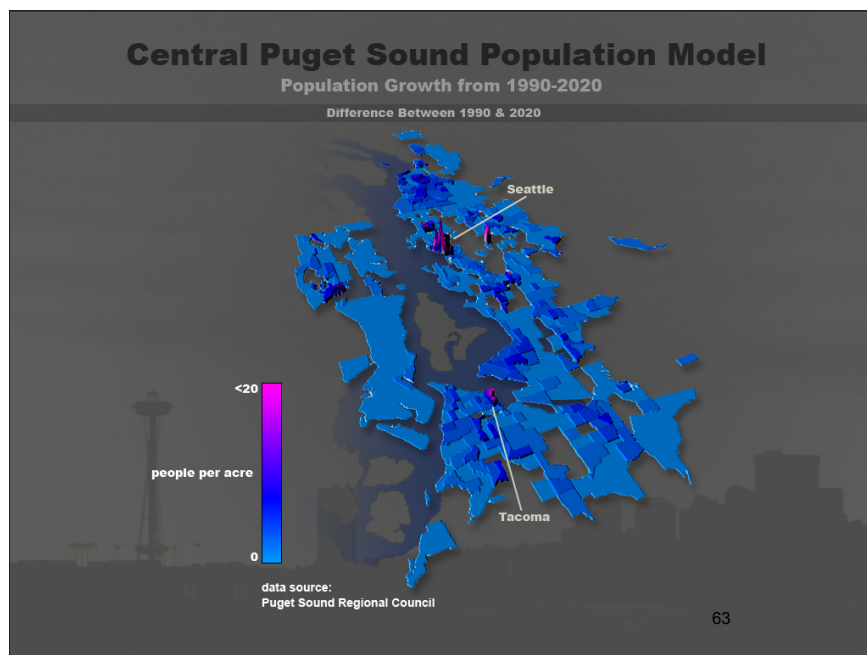
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