ACES Session 47

Governance barriers and opportunities for integrating ecosystem services into estuary and coastal management

- This session will present examples of science-governance partnerships for developing innovative solutions that are accelerating recovery of vital ecosystem services in threatened estuarine and coastal watersheds.
- Examples: Pacific Northwest, Great Lakes, Cape Cod and California.
- Cross-cutting themes:
  - Governance structure, barriers and opportunities for implementing ES-based recovery solutions.
  - How ES concepts can serve as a unifying theme for developing coastal recovery solutions across local, regional & national governance boundaries.
  - How ES decision support tools can engage local planners through visualization of ecological, economic and health tradeoffs for alternative decisions.

ACES Session 47

Governance barriers and opportunities for integrating ecosystem services into estuary and coastal management

- Bob McKane – A Science-Governance Partnership for Integrating Ecosystem Services into Puget Sound Restoration Planning
- Joel Hoffmann – Building a Science-Governance Partnership Around Ecosystem Services to Catalyze Revitalization in Great Lakes Area of Concern Communities
- Leska Fore – Implementation Strategies: Building Scientific Knowledge into Policy and Management Decisions
- Kate Mulvaney – Social acceptance and Governance Challenges of Alternative Technologies to Reduce Nitrogen on Cape Cod
- Jerry Diamond – Ecosystem Goods and Services: A Framework for Integrating Designated Use Protection and Restoration Strategies Under the Clean Water Act



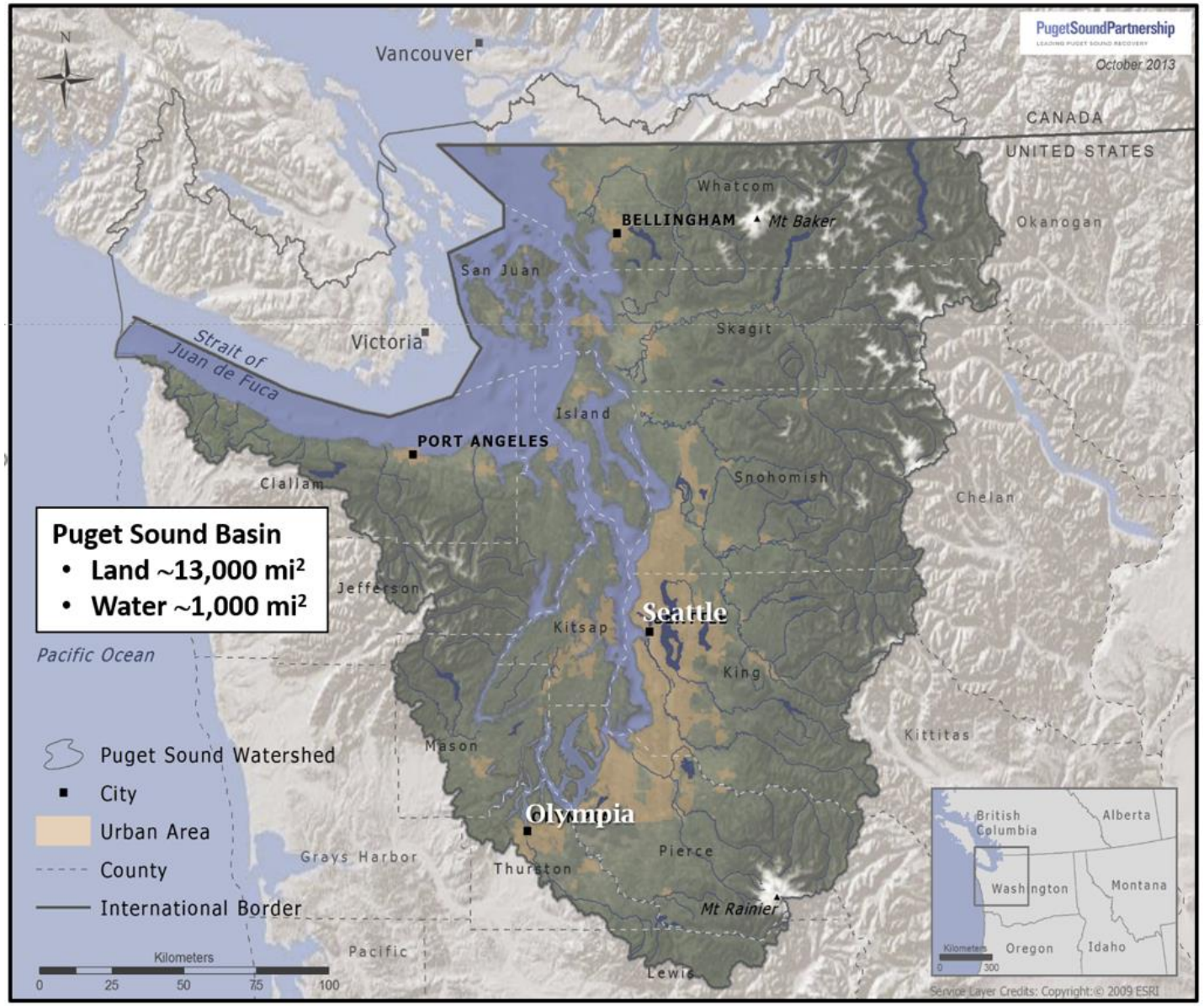

A science-governance partnership for integrating ecosystem services into Puget Sound restoration planning

Robert McKane[1], Brad Barnhart[1], Paul Pettus[1], Jonathan Halama[1], Allen Brookes[1], Kevin Djang[2], Tarang Khangoankar[3], Isaac Kaplan[4], Chris Harvey[4], Hem Nalini Morzaria Luna[4], Michael Schmidt[5], Emily Howe[6], Phillip Levin[6], Tessa Francis[7], Joel Baker[7], Stephen Stanley[8], Colin Hume[8]

[1]U.S. Environmental Protection Agency, Western Ecology Division, Corvallis, OR, USA
[2] Inoventures LLC, Corvallis, OR, USA
[3]Pacific Northwest National Laboratory, Seattle, WA, USA
[4]NOAA Northwest Fisheries Science Center, Seattle, WA, USA
[5]Long Live the Kings, Seattle, WA, USA
[6]The Nature Conservancy, Seattle, WA, USA
[7]University of Washington Tacoma, Puget Sound Institute, Tacoma, WA, USA
[8]Washington Department of Ecology, Lacey, WA, USA

ACES Conference, Washington DC, December 5, 2018

Puget Sound Ecosystem Services Restoration Case Study



Partners

State of Washington

- Puget Sound Partnership
- University of Washington: PSI, CUW
- Department of Ecology
- Department of Natural Resources

Communities

- Seattle / King County / Community Forests

Tribes

- Snoqualmie, Nisqually

Federal

- EPA Region 10, Seattle
- Pacific Northwest National Laboratory
- NOAA NW Fisheries Science Center

Impacts

Human Health

- 20+ Superfund sites, toxics in fish, water-borne diseases, HABs, quality of life

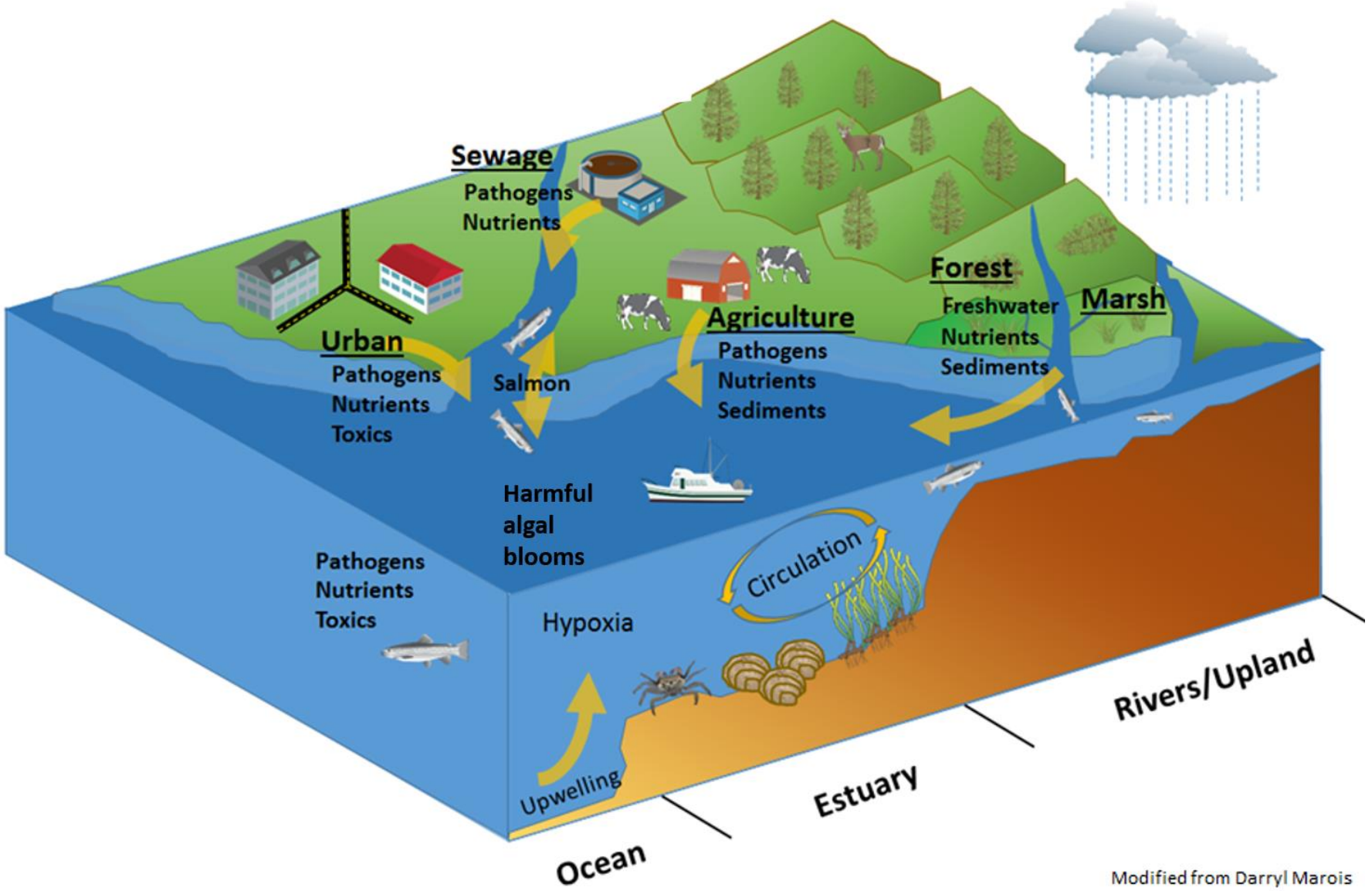
Environmental

- Clean drinking water, clean air, food & fiber, flood protection, fish & wildlife, recreation, cultural practices

Economic

- Fisheries, forest and ag products, tourism, local jobs… **$$ billions annually**

Puget Sound Land-Water Interactions



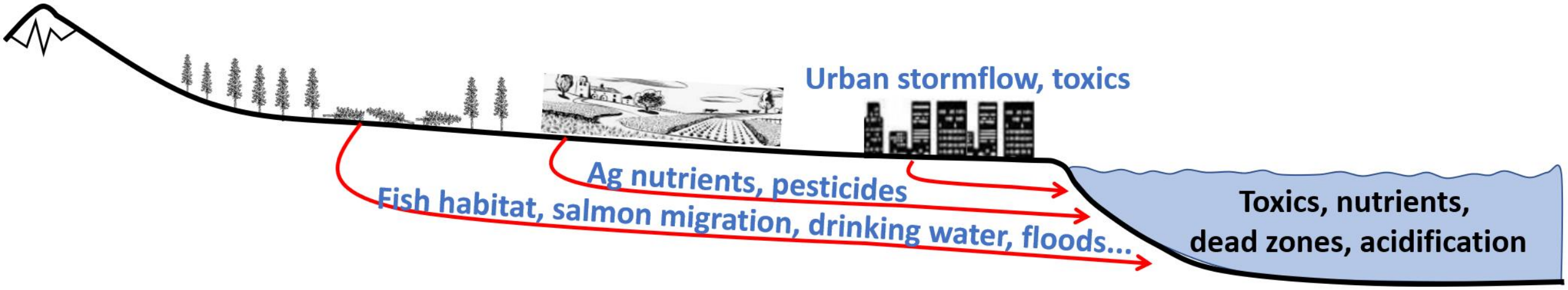
Modified from Darryl Marois

Puget Sound Land-Water Interactions

- "Everything connects to everything else"
- Systems models → comprehensive recovery strategies

Modified from Darryl Marois

How do local land use decisions propagate downstream to impact terrestrial and marine ecosystems?



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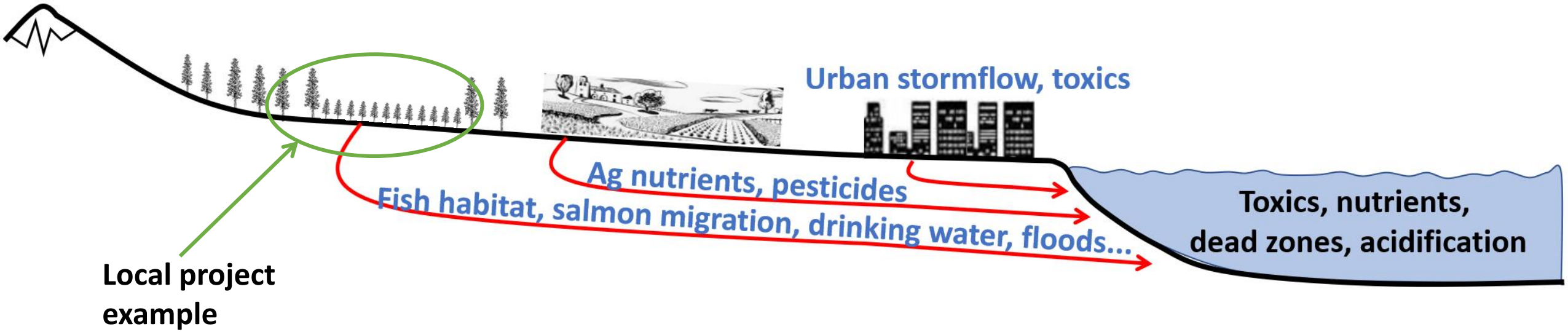

Tolt River floodplain restoration

King Co., Snoqualmie Tribe

Local benefits

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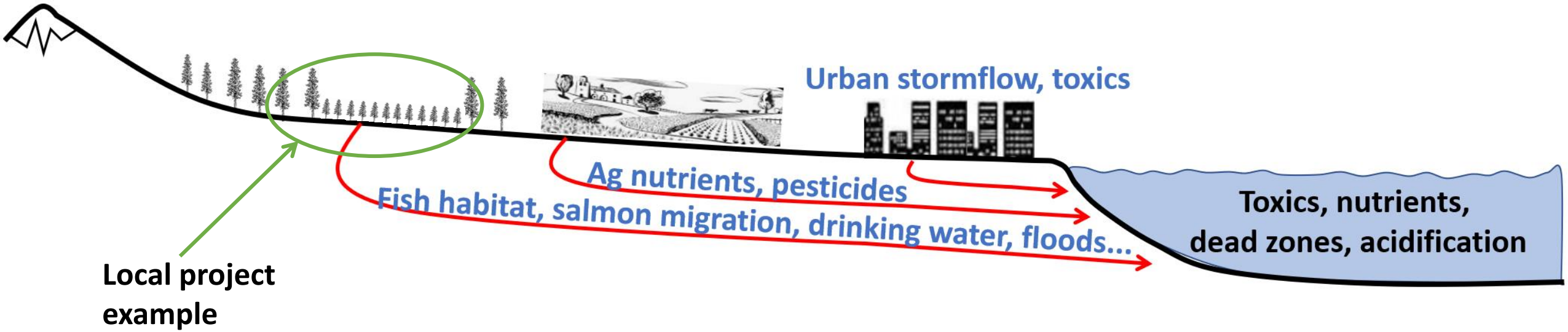

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Local benefits

Basin-scale benefits

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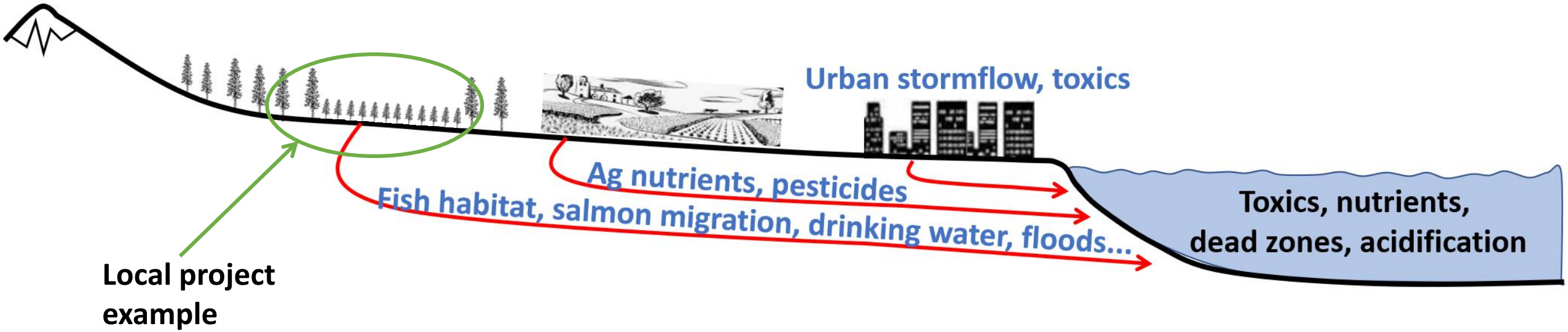

Tolt River floodplain restoration

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Puget Sound science-governance partnership

- Currently, local restoration planners and managers face the difficult challenge of extrapolating benefits and tradeoffs of their actions over time and space and across jurisdictional boundaries.

Puget Sound science-governance partnership

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- Similarly, ecosystem scientists find it difficult to accurately model large coastal watersheds such as Puget Sound (>31,000 km^2) without the detailed on-the-ground knowledge that local planners and managers possess.

Puget Sound science-governance partnership

- Currently, local restoration planners and managers face the difficult challenge of extrapolating benefits and tradeoffs of their actions over time and space and across jurisdictional boundaries.
- Similarly, ecosystem scientists find it difficult to accurately model large coastal watersheds such as Puget Sound (>31,000 km^2) without the detailed on-the-ground knowledge that local planners and managers possess.
- Our partnership seeks to combine the expertise of both groups → tightly integrate ecosystem service concepts and modeling into estuarine and coastal watershed planning and management.

Puget Sound science-governance partnership

Local Planners

- Communities
- Tribes
- Counties
- State offices
- Watershed Councils
- NGOs & Businesses

- **Local knowledge**
- **Restoration goals and methods**

Puget Sound Modeling Team

- U.S. Environmental Protection Agency
- Pacific NW National Laboratory
- NOAA NW Fisheries Science Center
- Long Live the Kings / The Nature Conservancy
- University of WA Puget Sound Institute
- WA Dept. of Ecology / Puget Sound Partnership

Puget Sound science-governance partnership

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- **Local knowledge**
- **Restoration goals and methods**

- **Local ecosystem services and benefits**
- **"Downstream" services and benefits**

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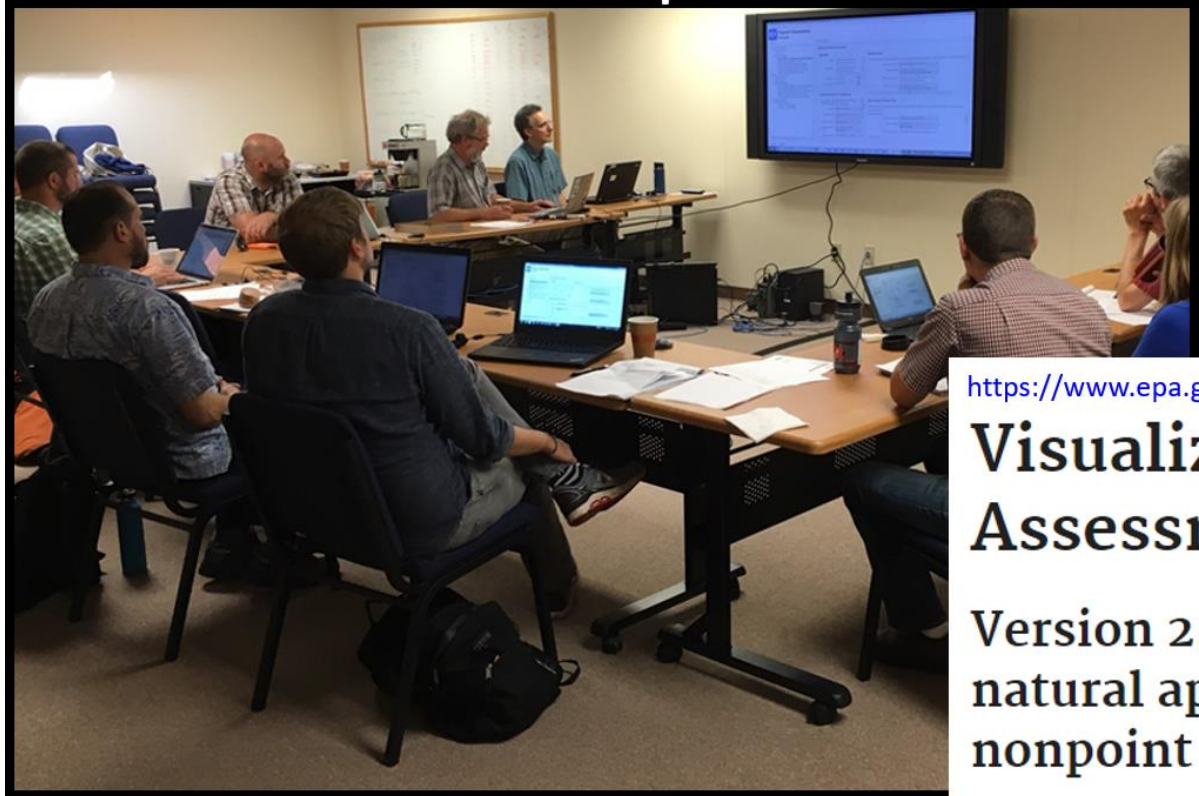
Engagement of communities, tribes, state agencies

Workshops



Online training & downloads

https://www.epa.gov/water-research/visualizing-ecosystem-land-management-assessments-velma-model-20

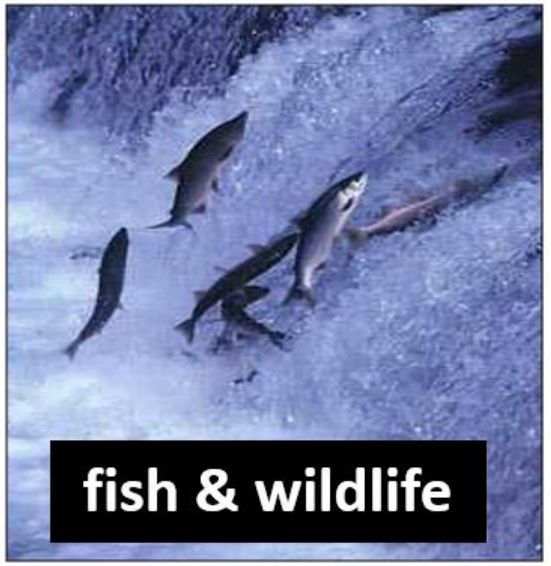
Visualizing Ecosystem Land Management Assessments (VELMA) Model – 2.0

Version 2.0 – Enhanced to address engineered and natural applications of green infrastructure for reducing nonpoint inputs of nutrients, and contaminants

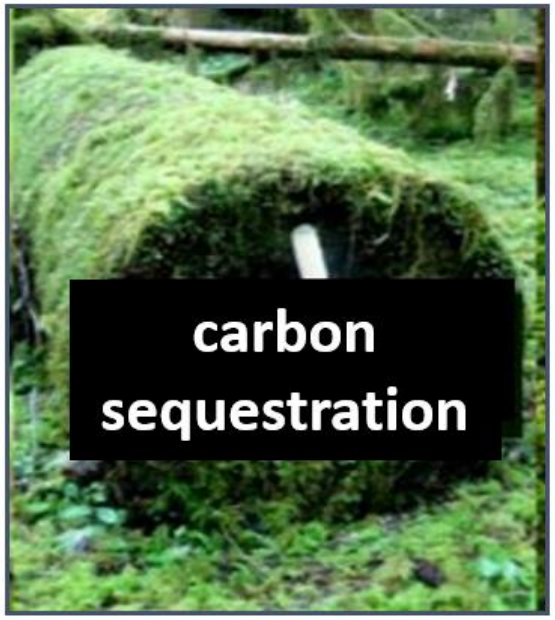
Description

VELMA can be used to help improve the water quality of streams, rivers, and estuaries by making better use of both natural and engineered green infrastructure (GI) to control loadings from nonpoint sources of pollution. It is designed to help users assess green infrastructure options for controlling the fate and transport of water, nutrients, and toxics across multiple spatial and temporal scales for different ecoregions and present and future climates.

Quantify local and regional ecosystem services and trade-offs for alternative restoration scenarios



Tradeoffs?



Tradeoffs?

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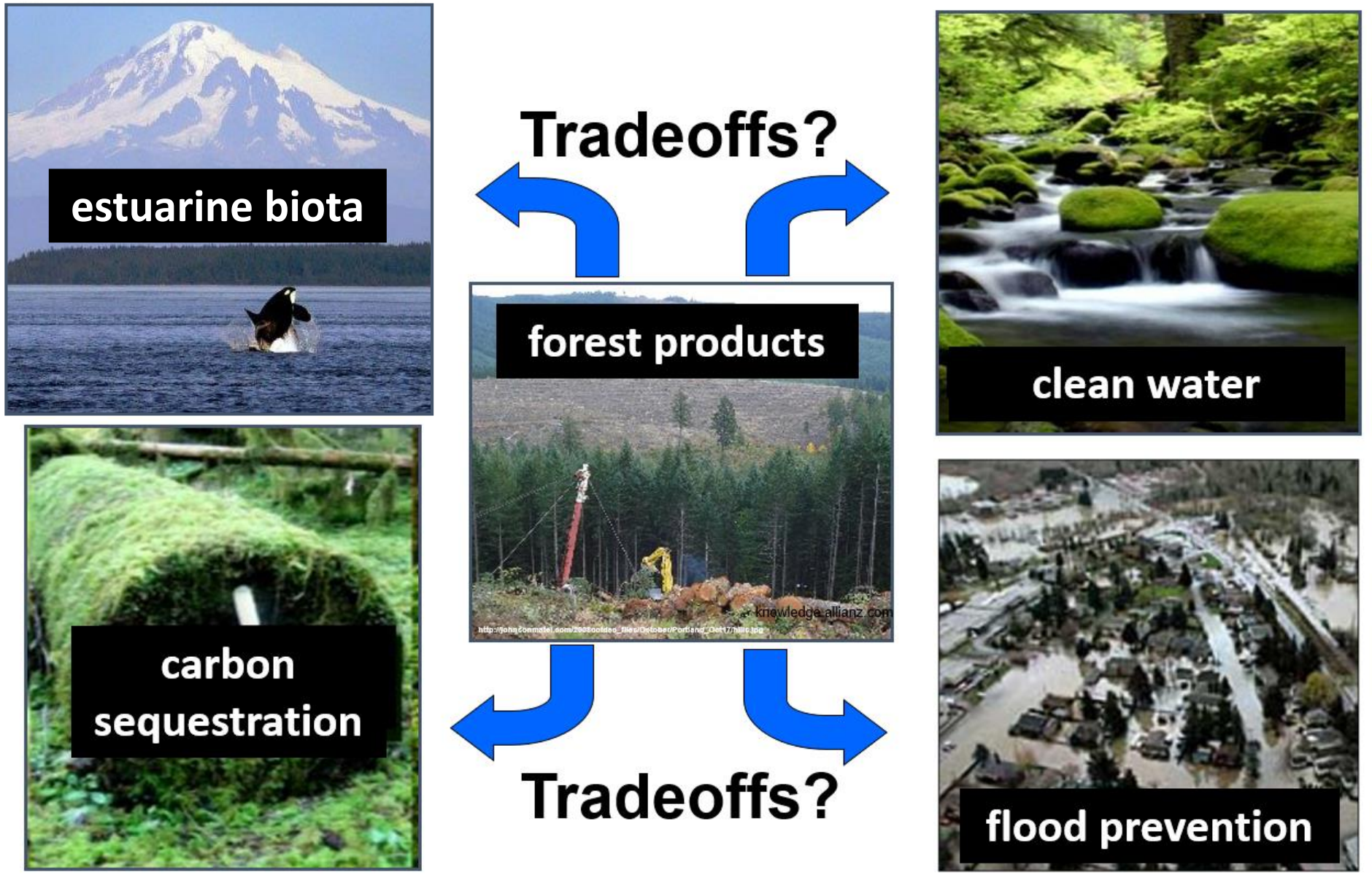

PUGET SOUND VITAL SIGNS

Water Quantity
- Summer Stream Flows

Water Quality
- Marine Water Quality
- Freshwater Quality
- Marine Sediment Quality
- Toxics in Fish

Healthy Human Population
- Onsite Sewage
- Shellfish Beds
- Outdoor Activities
- Local Foods
- Air Quality
- Drinking Water

Quality of Life
- Sound Stewardship
- Economic Viability
- Good Governance
- Sense of Place
- Cultural Practices

Species and Foodweb
- Chinook Salmon
- Orcas
- Pacific Herring
- Birds

Protect and Restore Habitat
- Estuaries
- Floodplains
- Land Cover and Development
- Eelgrass
- Shoreline Armoring

25 Vital Signs (and associated ecosystem services) to help identify whether Puget Sound recovery targets are being met

Puget Sound Partnership
http://www.psp.wa.gov/vitalsigns/

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Integrated terrestrial-marine models are needed to

- Synthesize decades of terrestrial & marine data
- Identify comprehensive recovery solutions across habitats & scales…

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Protect and Restore Habitat
- ✓ **Estuaries (Salt Marshes)**
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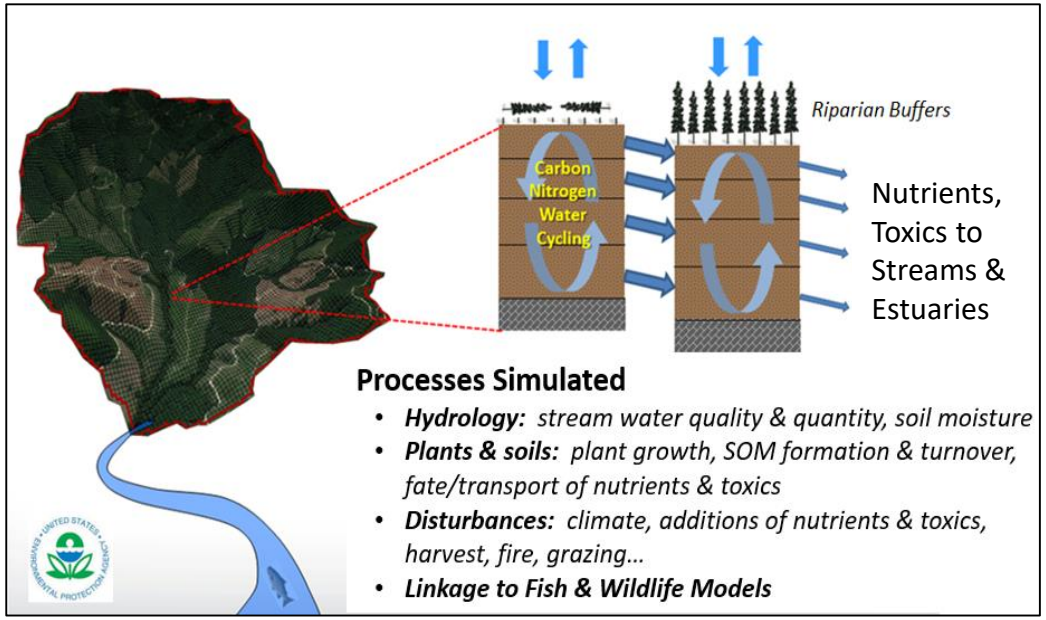
*Requires links to other models or indices

VELMA Model

Watershed Ecohydrology & Ecosystem Services



U.S. Environmental Protection Agency

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VELMA Model

Watershed Ecohydrology & Ecosystem Services

Ecosystem Services Simulated

- *Clean water & air*
- *Flood protection*
- *Food & fiber production*
- *Carbon sequestration / climate regulation*
- *Fish & wildlife habitat → population models*
- *Ecosystem services → human well-being*

U.S. Environmental Protection Agency

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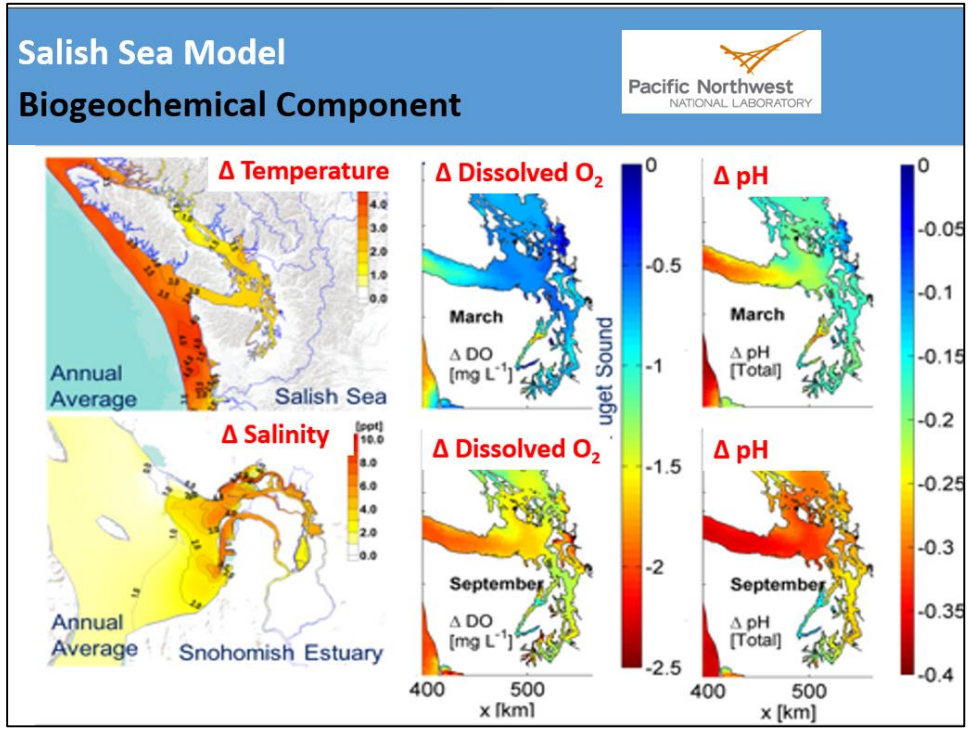
Ocean Circulation & Biogeochemistry



Pacific Northwest National Laboratory

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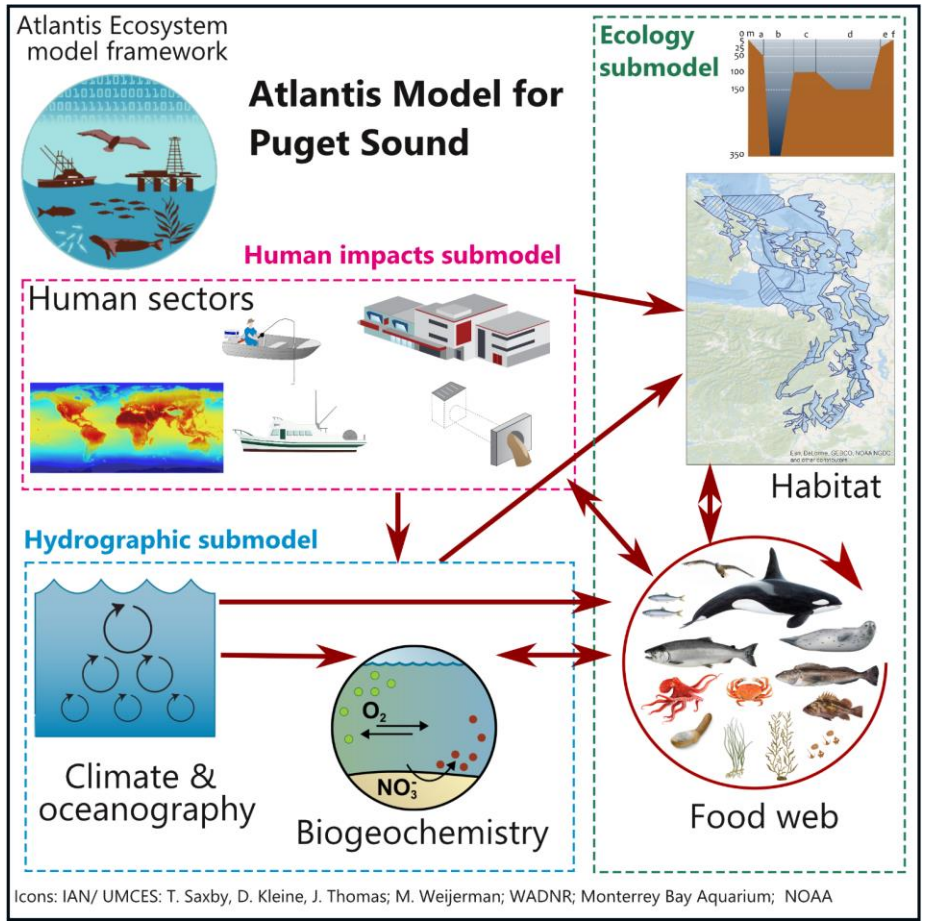
Atlantis Model

Marine Food Webs



NOAA Northwest Fisheries Science Center
Long Live the Kings

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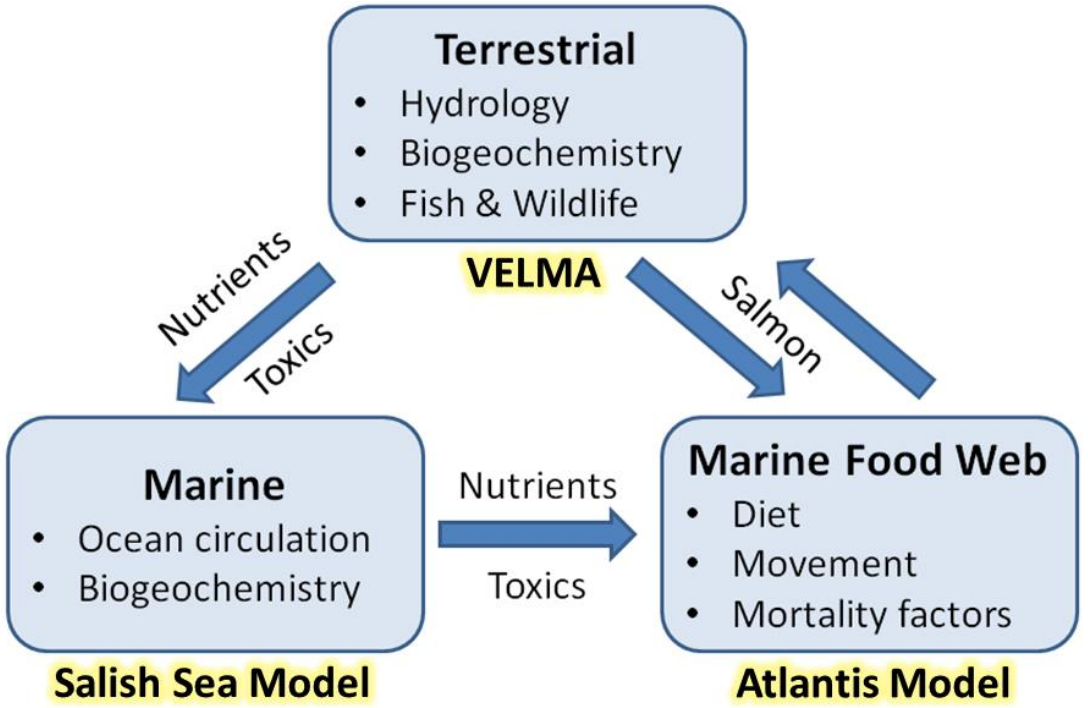
Puget Sound Ecosystem Model

Terrestrial-Marine Linkages & Ecosystem Services



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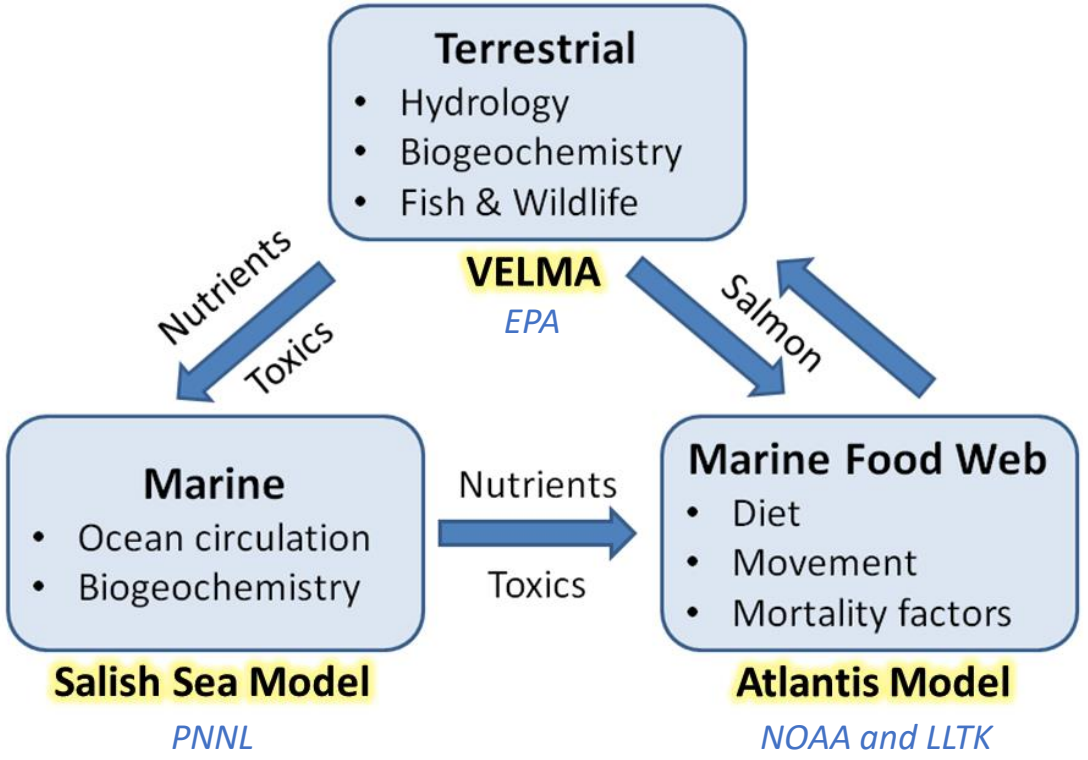
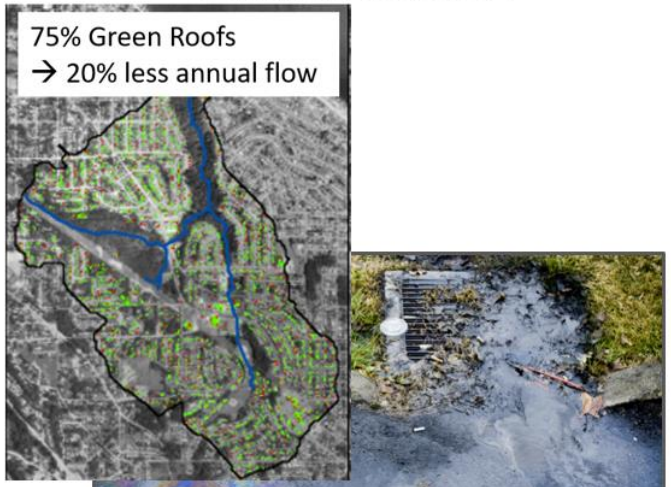


In coordination with:
University of Washington Puget Sound Institute,
Washington Dept of Ecology and Puget Sound Partnership,
Communities, tribes, counties, state & federal partners

Some initial Puget Sound Modeling Priorities

VELMA

Urban Stormwater,
Contaminant Transport,
Salmon Habitat



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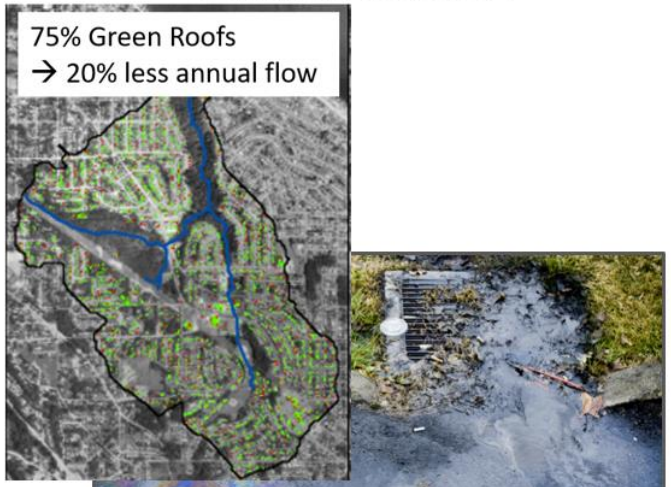
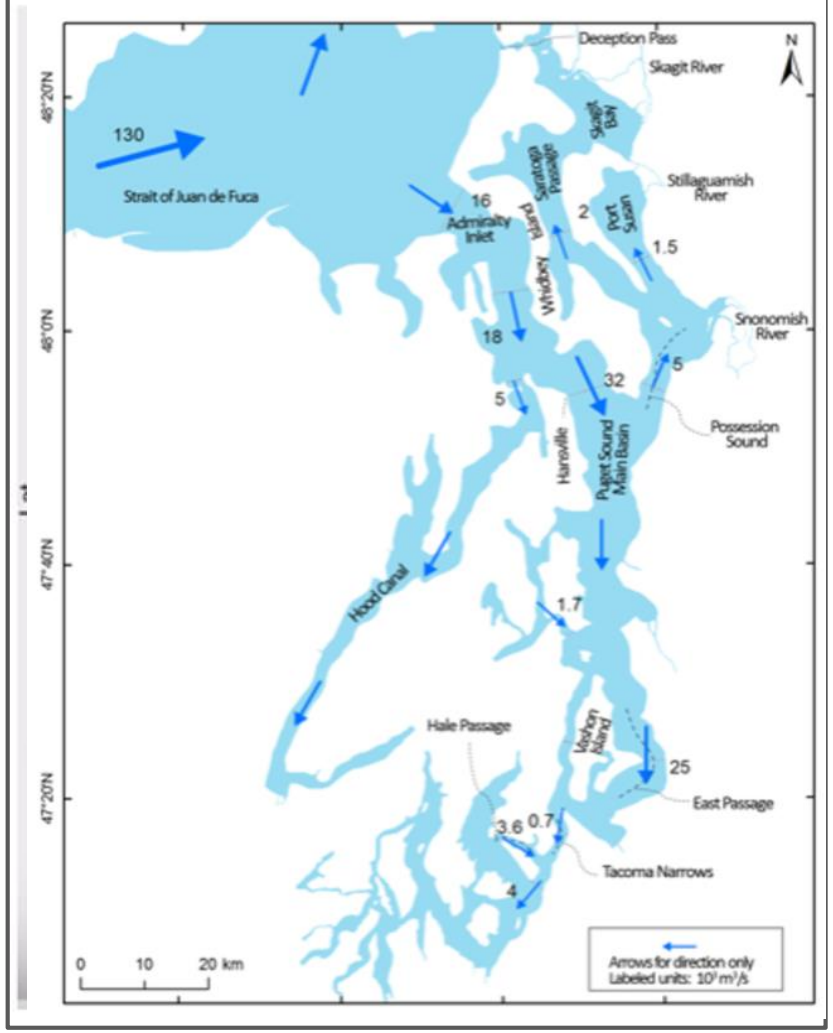


Freshwater,
Nutrients, Toxics

Salish Sea Model

Tidal Inflow



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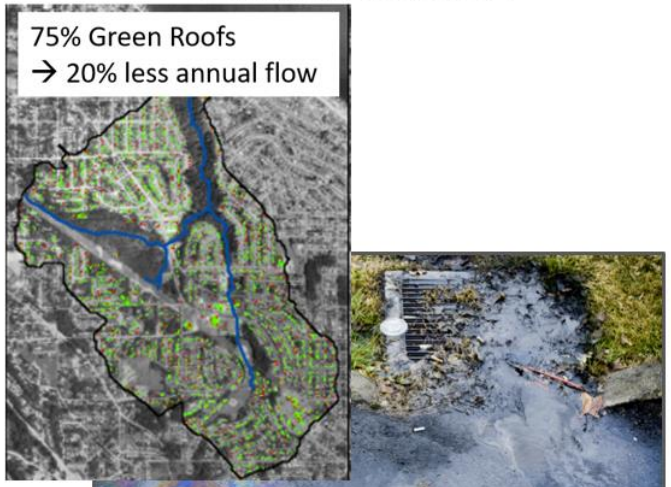

Freshwater,
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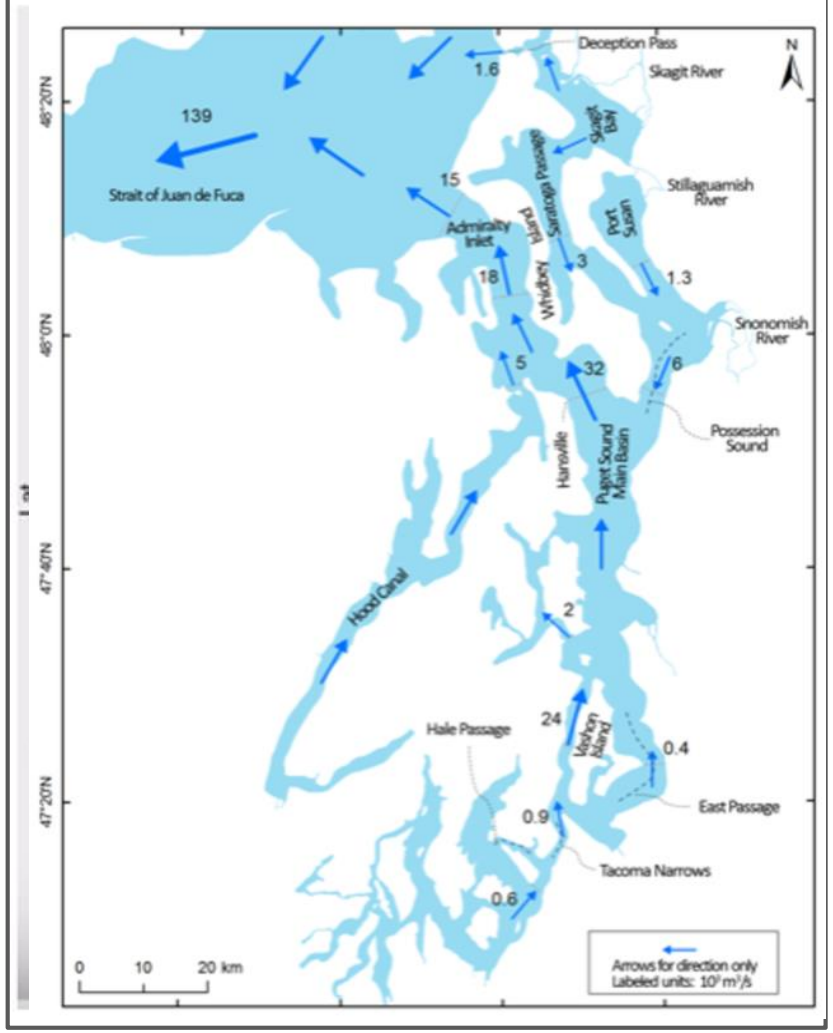
Tidal Outflow



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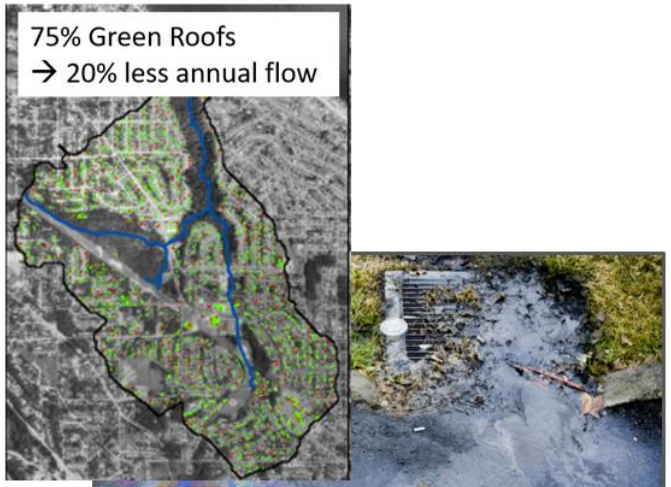

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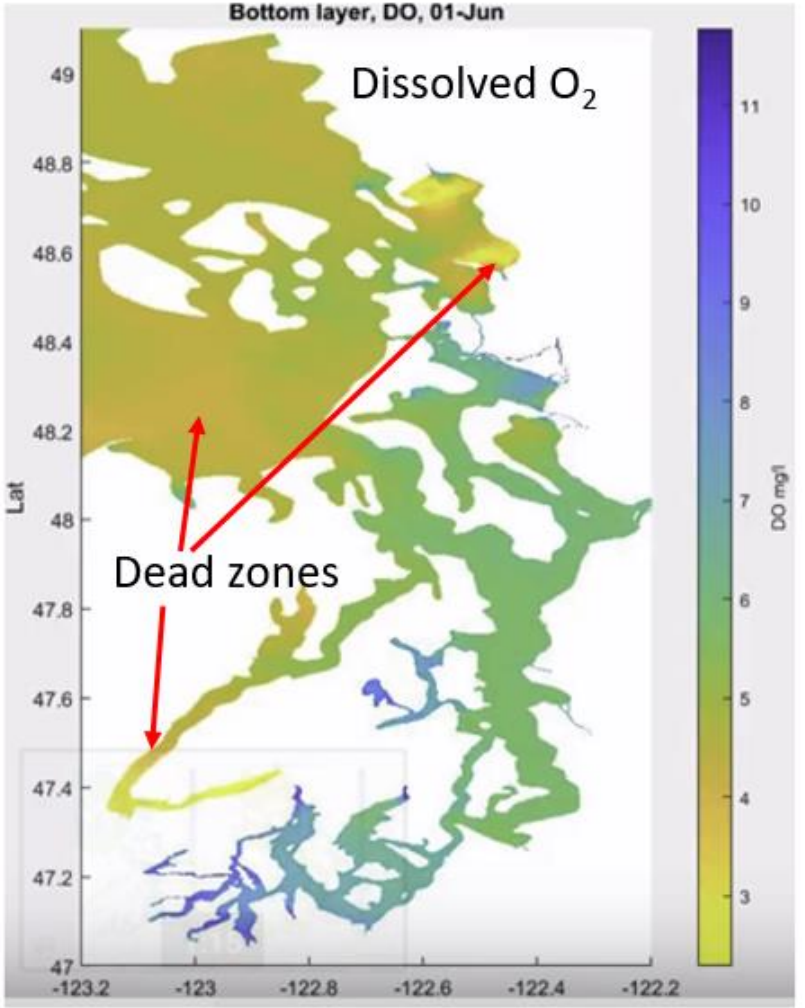
Marine Water Quality



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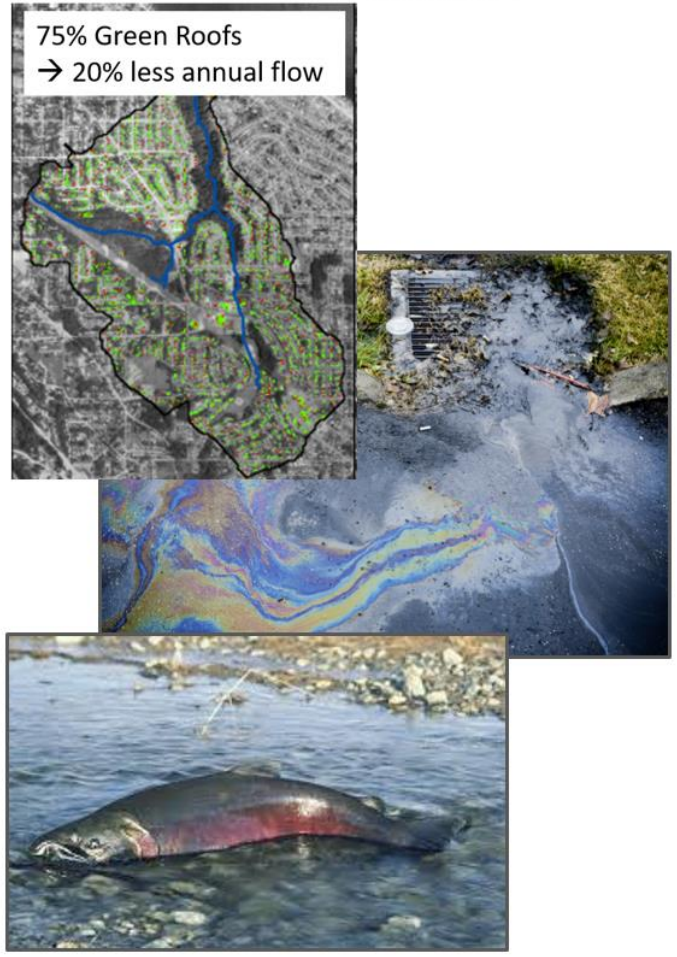
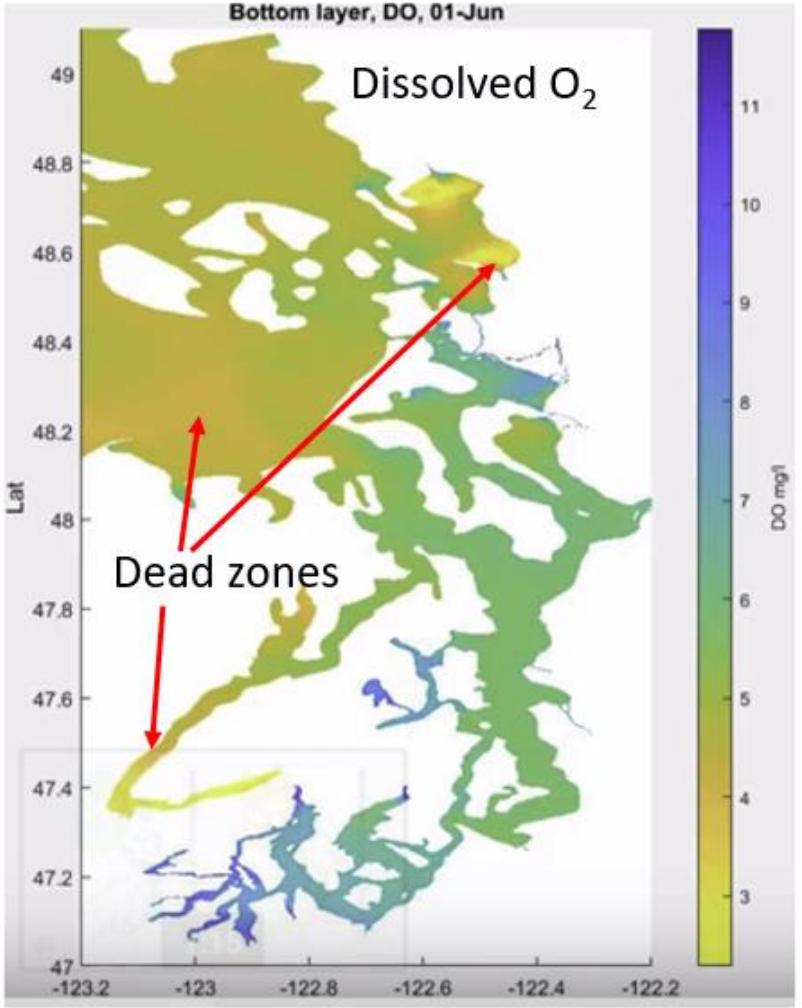


Freshwater, Nutrients, Toxics

Salish Sea Model

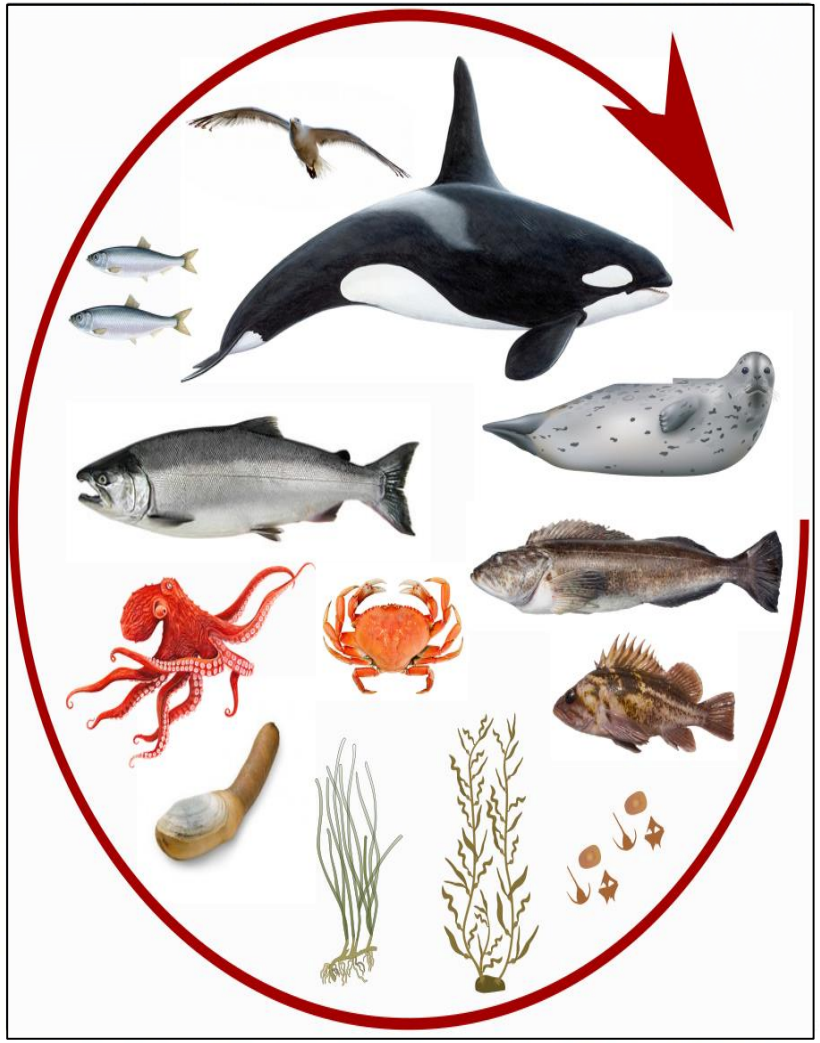
Marine Water Quality



Nutrients, Toxics, Temp, pH, Salinity

Atlantis Model

Marine Food Web, Toxics in Fish



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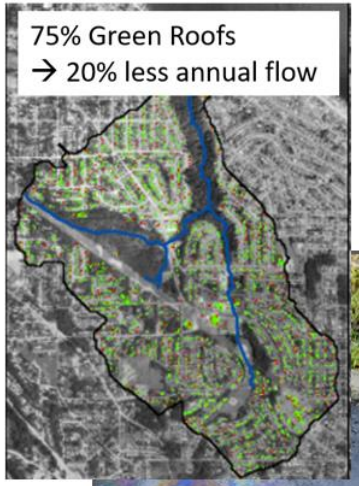

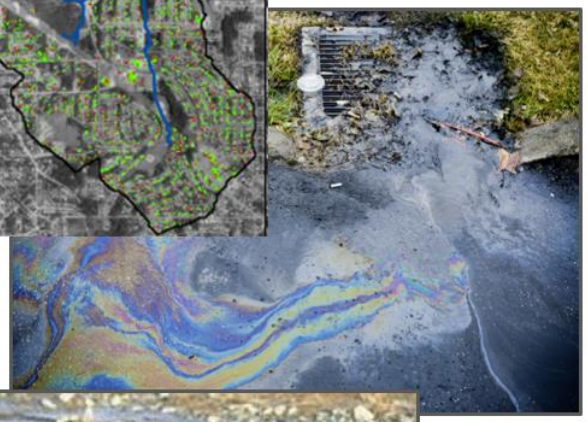

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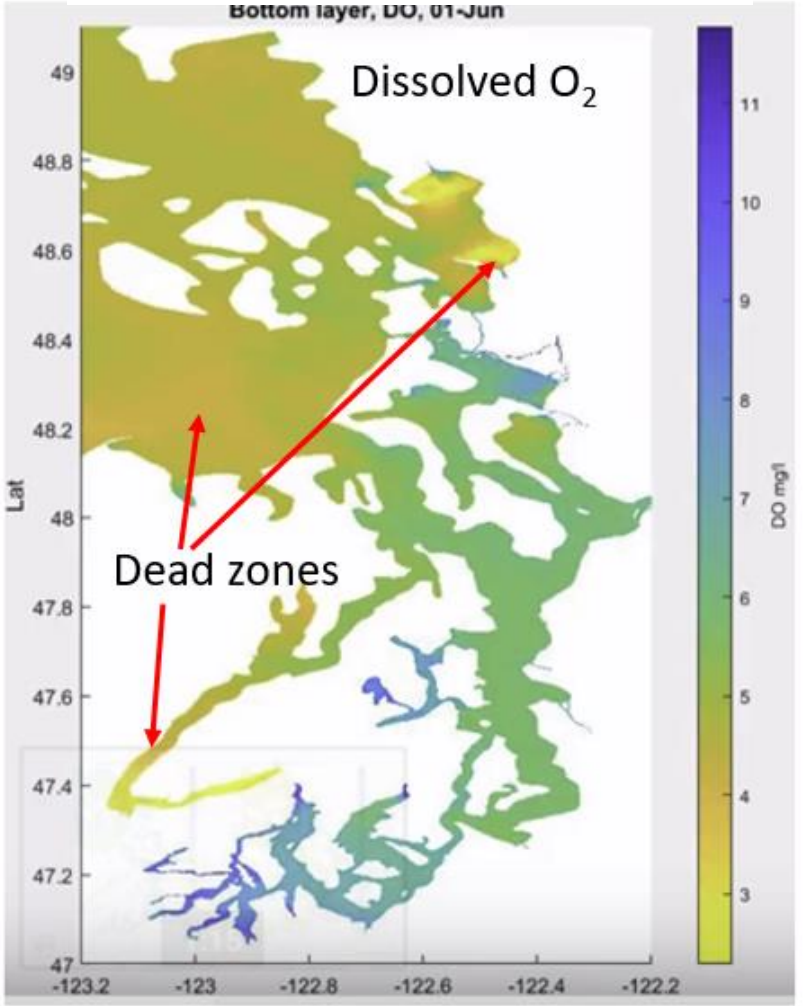

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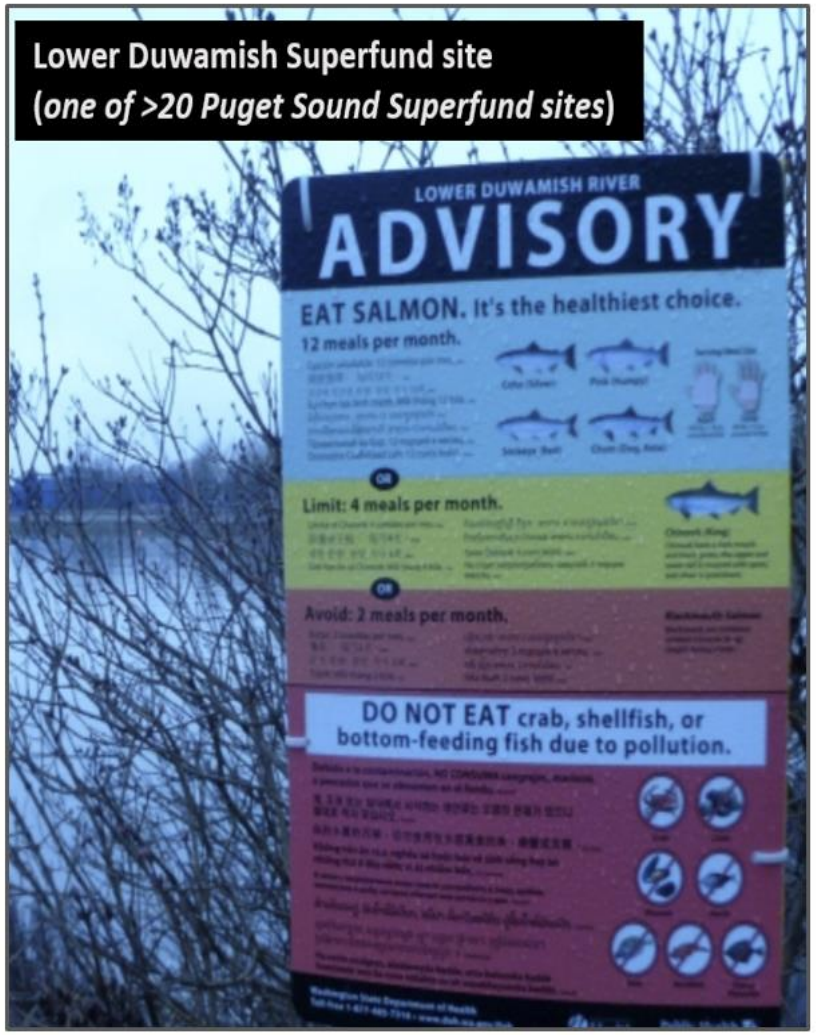
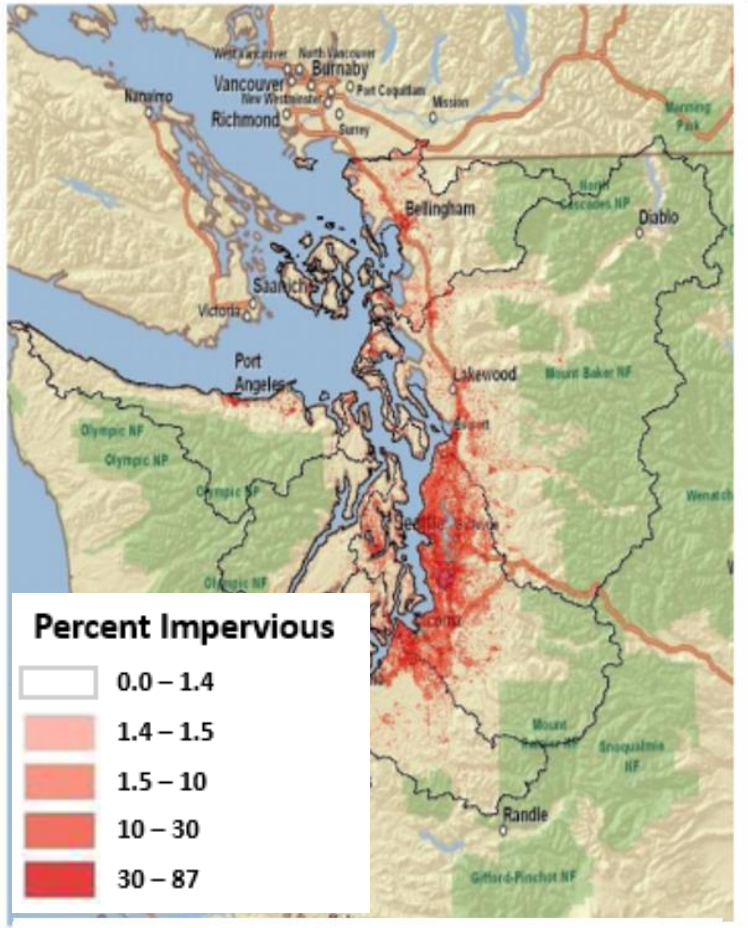
Atlantis Model

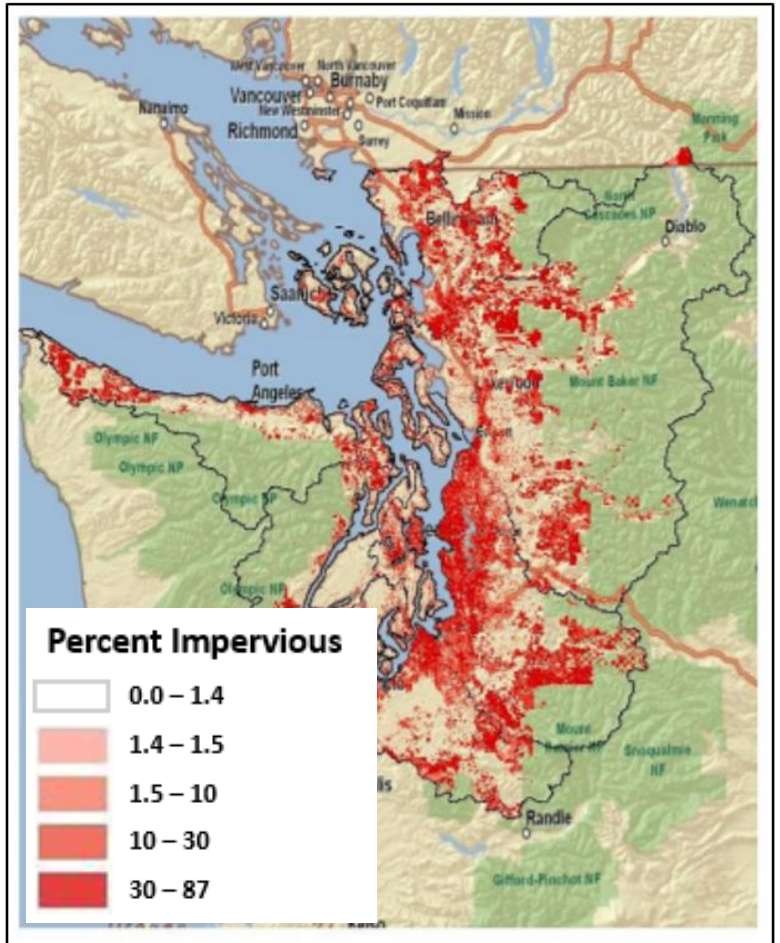
Marine Food Web, Toxics in Fish



Working with communities to model urban stormwater and contaminant runoff mitigation



Year 2000 % Impervious



Projected Year 2060 % Impervious

Bolte & Vache 2010: http://www.pugetsoundnearshore.org/supporting_documents/FRAP%20final%20report.pdf

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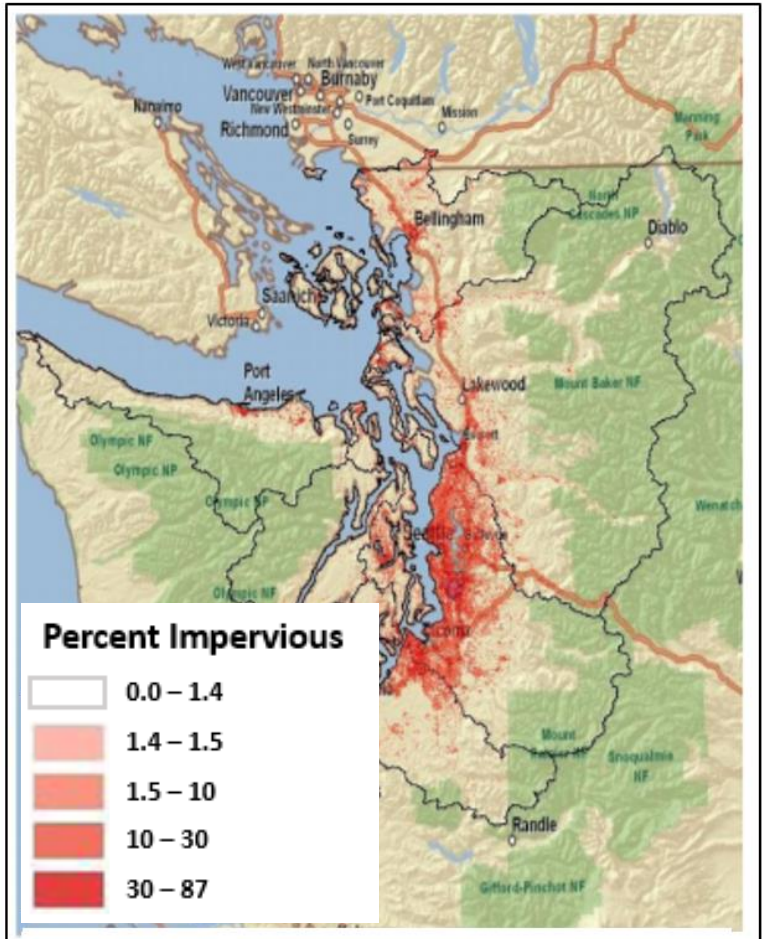
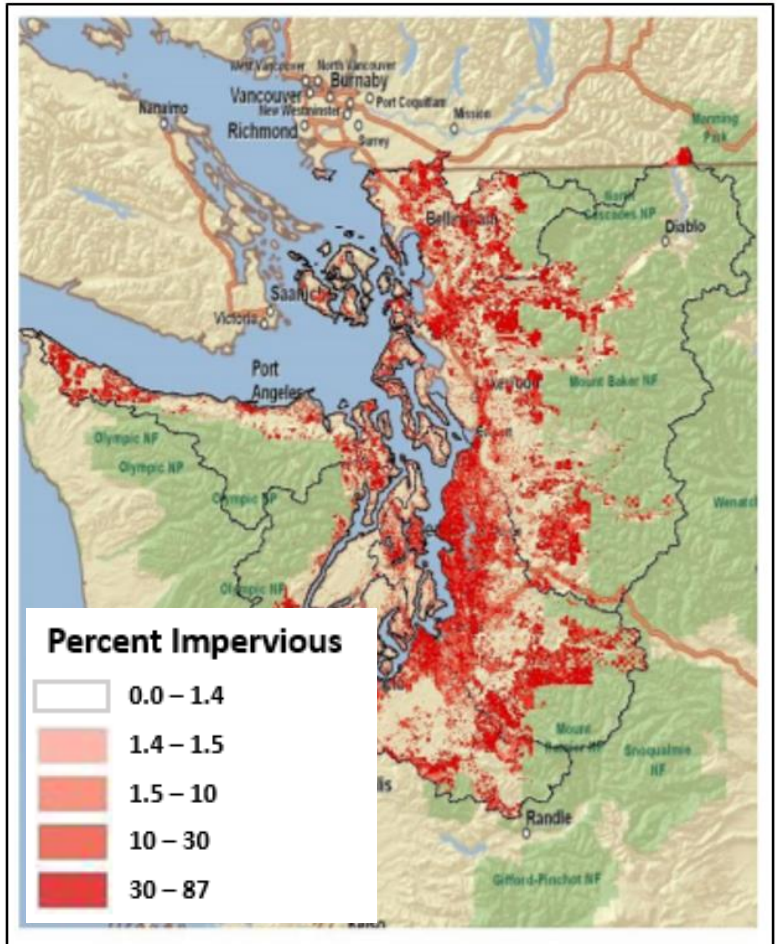


Year 2000 % Impervious



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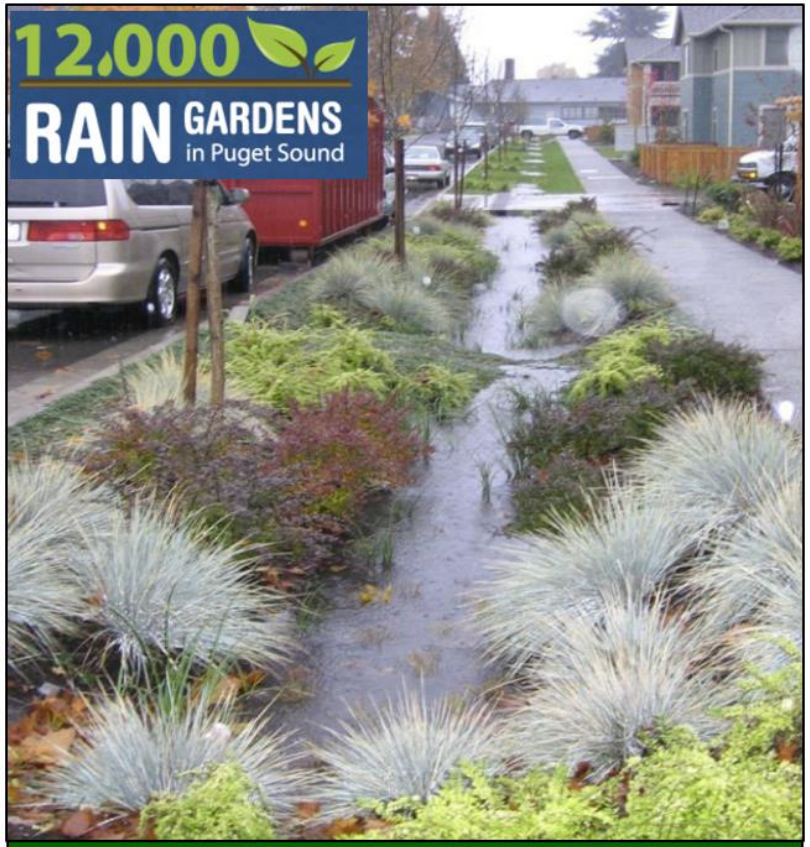

VELMA includes open source software, user manual and "how to" demos for quantifying contaminant fate & transport and mitigation strategies

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Puget Sound Science-Governance Modeling Partnership

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- **Ongoing ecosystem services decision support for communities, tribes, state and federal partners** (All models)
- **2019 – 2022 *Near Term Action* proposal submitted to State of WA Puget Sound Partnership** (All models: Integrated terrestrial-marine ecosystem services modeling framework for informing PS recovery planning)

Thanks!

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