

Salish Sea ecosystem services decision-making support via basin scale modeling of terrestrial inputs into the aquatic habitats

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PSIMF Project Overview

The Puget Sound Integrated Modeling Framework (PSIMF)

is a "coupled environmental and human systems modeling framework for the entire Puget Sound Basin. A connected terrestrial-freshwater-marine-human system modeling framework will help us understand the interactive effects of future threats to our region, and evaluate their impacts on ecological, social, and economic objectives. Linked models with high spatial and temporal resolution will simulate exchanges of water, carbon, nutrients, contaminants, sediments, and organisms across habitats, under current and future conditions" (PSIMF Team).



⁽Image Credit: PSIMF Team)

This modeling framework will support decision makers and inform recovery planning for Puget Sound. Overarching goals will be accomplished through model coupling among the Environmental Protection Agency VELMA (terrestrial ecohydrology), Pacific Northwest National Laboratory (PNNL) Salish Sea Model (estuarine circulation and biogeochemistry), National Oceanic and Atmospheric Administration (NOAA) Atlantis (estuarine food web) and Land Cover Change (Urban Ecology Research Lab, University of Washington) models.

Scenario Timelines: Climate Variation, Disturbances

Historical simulations 1990 through 2020 will validate model accuracy leveraging observed water quality and stream flow data. Future scenarios will estimate the impacts to the region due to land use change, forest management, climate change, and assess grey/green infrastructure Best Management Practices (BMPs).



Multi-Model Integration

This multi-model integration approach can assess land and water ecosystem service trade-offs and cobenefits under alternative climate, population, and land use futures for a broad range of regional objectives; e.g., from restoring orcas populations to enhancing human wellbeing.

this coupled modeling Within framework, VELMA terrestrial water quality outputs under alternative land use and climate scenarios are input to the Salish Sea Model which, in turn, feeds marine water quality outputs to Benefits/Services Atlantis estuarine food web model . Governance (microbes to orcas). The Land Cover Qualitative Model Change Model will inform VELMA's Spatial Mapping alternative land use scenarios.





PSIMF VELMA Watersheds



Salish Sea Coupled Modeling Framework

tribal communities and the salmonid populations essential to their sustenance, health, and culture. This work focuses on Salish Sea salmonid-bearing watersheds that the tribes and State of Washington co-manage for salmon recovery and habitat protection.

VELMA will model alternative future land use and climate change scenarios out to 2100 for 24 major Puget Sound basins (~30,000 km²). Simulations will evaluate impacts of changing terrestrial nutrient loads on observed historical salmonid declines and potential future degradation vs. BMP based trajectories for marine nutrients and sensitive biota.

Results from this res will assist commu tribes, and state and f decision makers determining how where, and what kinc urban and rural BMP required to achieve nutrient load reduction the Puget Sound estuary. and in the future. This progressive mod effort will provide enha

decision support rega revitalization of comm health and wellspecifically for Puget S tribes reliant on dec Endangered Species listed salmonid popula for their subsistence cultural well-being.

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VELMA Model

Visualizing Ecosystem Land Management Assessments (VELMA)



is an ecohydrology model being leveraged in the PSIMF effort to practical, identify proactive watershed restoration strategies that can be initiated now to lessen long-term impacts of land use change and climate change on Puget Sound communities. This effort is particularly pertinent to

Modeling Goals							
search			Vital Sign	SYSTEMS MODEL			
nities,	Theme	No.		Salish Sea marine	Atlantis food web	VELMA watershed	
in	Water Quantity	1	Summer Stream Flows	nyurouynamics	WED	processes	
111	Water Quality	2	Marine Water Quality				
much,		3	Freshwater Quality				
ds of		4	Marine Sediment Quality				
's are		5	Toxics in Fish				
torgat	Healthy Human Population	6	On-site Sewage Systems				
larget		7	Shellfish Beds				
ns to		8	Outdoor Activity				
v. now		9	Local foods				
9 0		10	Air Quality*				
		11	Drinking Water				
deling	Species & Foodweb	12	Chinook Salmon*				
1		13	Orcas				
anced		14	Pacific Herring				
ardino		15	Birds				
	Protect & Restore Habitat	16	Estuaries				
nunity		17	Floodplains				
haina		18	Land Development and Cover				
ocing,		19	Eelgrass*				
Sound		20	Shoreline Armoring*				
1	Quality of Life	21	Sound Stewardship				
ming		22	Economic Vitality*				
Act		23	Good Governance*				
		24	Sense of Place*				
ations		25	Cultural Wellbeing*				
and			*Requires links to other mod	lels or indices			

(Image Credit: Francis Et al.)

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Commonwealth Scientific and Industrial Research Organisation (CSIRO) Beth Fulton, Ph.D.

⁽Map Credit: Chokshi Et al.)