Prioritizing Chinook Salmon Habitat Restoration for Southern Resident Killer Whale Recovery

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Problem

Southern Resident Killer Whales (SRKW) (*Orcinus orca*) have environmental, economic, and cultural importance to the Puget Sound region of Washington State. The endangered species' 60-year population decline to 74 individuals is attributed to limited prey availability, vessel disturbance, and chemical pollution. SRKW's nutrition, reproduction, and calf survival are strongly linked with the dwindling of their main prey base, the endangered Chinook salmon (*Oncorhynchus tshawytscha*). As a result, the National Oceanic and Atmospheric Administration (NOAA) has listed Chinook salmon recovery as a top priority for SRKW recovery. Salmon habitat degradation from land use change and climate change have considerably interfered with spawner survival due to reduced habitat structure, temperature regulation, and protection from predation. Although multi-agency efforts have directed billions of dollars to address Chinooks' primary threat, recovery projects have been largely unsuccessful due to misalignment with ecological needs. With limited time and resources, estimating a cost per additional spawner is a critical strategy for prioritizing restoration projects and increasing prey availability for SRKW recovery.

Key Findings

- **Costs are highly variable.** The Mainstem's high restoration costs are primarily driven by land value and high degradation levels. For remote locations, high restoration costs are primarily driven by stream size, terrain, and accessibility. Within the subbasins with floodplain restoration benefits, the highest cost of agricultural land lies in the Mainstem subbasin at $22,321 per acre.
- **Floodplain restoration has the highest potential increased capacity of spawners one year after restoration (211)**, followed by riparian planting (112)


Wikipedia/Robert Pitman

Approach

Estimate costs of floodplain restoration, riparian planting, and engineered log jams in the Puget Sound's Stillaguamish River basin

Predict increases in spawning-age Chinook salmon resulting from the three interventions

Compare subbasin cost-effectiveness ratios to recommend restoration locations and actions

Examine agricultural land acquisition costs and local demographics to weigh feasibility and social impacts


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and engineered log jams (78). These numbers apply if the basin was restored to historic conditions. Long-term Chinook population growth, which is not accounted for in our estimates, could offset high cost estimates over time.

- **Floodplain restoration is generally the most cost-effective intervention** within the Stillaguamish, with an average cost-effectiveness ratio of $25,345 per spawner. Although implementing engineered log jams or riparian planting may offer short-term benefits, these less permanent actions are evidently less cost-effective.

Impact

- **Optimize restoration efforts:** Quantifying salmon output per restoration dollar input is challenging but useful. This methodology can help restoration managers prioritize and justify potential projects from a cost-effectiveness perspective. This framework can be applied to other watersheds and species, which can support consultations, grant applications, and essential fish habitat conservation recommendations.

- **Considerations of co-benefits:** Coho and steelhead spawner abundances also increase from floodplain restoration. Additionally, all priority subbasins overlap with census tracts that contain tribal land and populations above the Washington state average unemployment and poverty rates. With recent policies directing record funding amounts to underserved communities, demographic considerations can help restorationists access funding to therefore support salmon recovery and flood control for floodplain communities.

- **Next steps: 1)** Repeat analysis on Puget Sound basins with larger Chinook salmon populations. **2)** Account for additional costs and benefits (land acquisition, long-term population growth, project monitoring).

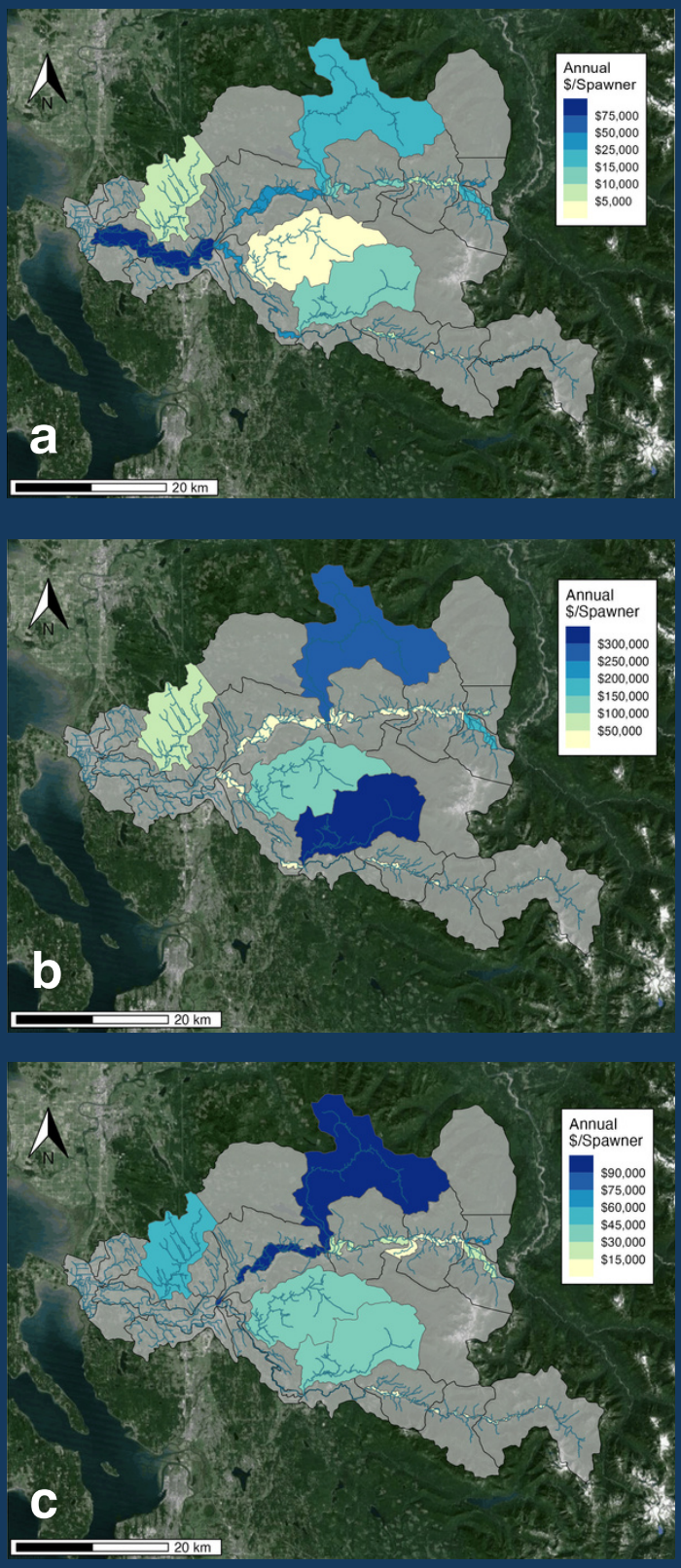

Figure: Annual cost per Chinook spawner in the Stillaguamish River basin for a) floodplain restoration, b) riparian planting, and c) engineered log jams. Low cost-effectiveness ratios do not inherently indicate the best interventions, as restoration costs and population outputs may increase with subbasin size.

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