Restoration to Preserve Treaty Protected Resources with Climate Change

Brett Shattuck
The Tulalip Tribes
Outline

• Snohomish and Stillaguamish Watersheds
• Restoration Actions Addressing Climate Change
• Longitudinal Connectivity
• Floodplain Connectivity
• The “Corridor” Concept
• Sea Level Rise and Estuary Projects
Increased Summer Temperature
Decreased Summer Low Flow
Loss of Spring Snowmelt
Increased Winter Floods
Changing Flows

Historical
2040s
2080s

Mauger et al., 2015
Decreased Low Flows

35-75% Decrease by 2080

Predicted change in lowest monthly flow

Beechie et al. 2013
Increased Peak Flows

10-50% Increase by 2080

Data source: http://www.hydro.washington.edu/2860/report/
High flow month flow ratio (future / historical)
August Mean Surface Air Temperature and Maximum Stream Temperature

Historical (1970-1999)  2040s medium (A1B)

<=10  15  20  26 °C
<=50  60  68  79 °F

Favorable for Salmon  Stressful for Salmon  Fatal for Salmon

University of Washington, Climate Impacts Group, June 2009
Decreased Snowpack

National Resource Conservation Service (NRCS) snow telemetry monitoring (SNOTEL)

Mote et al. 2018
The Coastal Squeeze

Source: The Nature Conservancy

Source: Washington Department of Ecology
Increasing Population

Net Domestic Migration for U.S. Counties: 2015-2016

Net domestic migration by county
- 5,000 or greater
- 1,000 to 4,999
- 0 to 999
- -100 to -1
- -5,000 to -101
- Less than -5,000

Snohomish County population growth
- In unincorporated
- In cities

Source: Puget Sound Regional Council Report, July 2017

Big Snohomish County growth is greatest outside cities

County population expected to surpass 800,000 this year
The estimate last year was 789,400. Snohomish County is now bigger than four states and D.C.
How Do We Prioritize Restoration/Protection with Change/Uncertainty?
• Connectivity
• Natural Processes
• Resiliency
<table>
<thead>
<tr>
<th>Restoration action</th>
<th>Temperature increase</th>
<th>Low flow decrease</th>
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<th>Increase resilience</th>
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Beechie et al. 2012
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Beechie et al. 2012
Rainfall/transitional hydrologic regime
Ocean-type Chinook population

Snowmelt hydrologic regime
Stream-type Chinook population

Waples et al. 2008
Pilchuck River Dam Removal

- Sub-standard fish ladder
- Impedes access to over 37 MILES
  - >1/3 mainstem length
- Chinook, coho, steelhead and other salmonids affected
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Beechie et al. 2012
Floodplain Connectivity & Complexity

• Process based restoration is most effective
  • Channel migration, floodplain forest development, etc.

• Connectivity is vital
  • Armoring/dike prevention removal, etc.
Floodplain Connectivity & Complexity

• Large Areas
• Long Time
Strategy for Connectivity in the Face of Change/Uncertainty

• Purchase
• Protect
• Restore
The Acquisition Strategy of the Stillaguamish Chinook Recovery Plan

Stillaguamish Watershed Council

Peak Flows and Chinook Survival in the Stillaguamish Watershed

Spatial Prioritization for Conservation and Restoration Action
Purpose

- Framework to prioritize parcels for conservation/restoration
- Nexus to obtain proactive acquisition dollars
- Capitalizing on opportunistic property availability
Goal

• Corridor naturally functioning riverine processes
• Secure Treaty protected resources
• Protect floodplain from development
• Accelerated project implementation
• Flood storage/conveyance
• Human safety
• Decrease flood damage claims
Acquisition Strategy GIS Tool

• “Floodplain Units” (FPUs)
• FPUs ranked for conservation/restoration
Derivation of Floodplain Units
Final Floodplain Units:
Ranking Metrics

- FPU Ranking
  - Chanel Constriction
  - Sinuosity
  - Armoring
- Land Use Type
- Number of Landowners
- Floodplain Elevation
- Parcel Ranking
- Adjacency
Conservation Priority

Most Desirable

Least Desirable
Restoration Priority

Most Desirable

Least Desirable
## Scoring Matrix

<table>
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<tr>
<th>NF/SF</th>
<th>Conservation Score</th>
<th>Restoration Score</th>
<th>Adjacency Score</th>
<th>Total</th>
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354 Acres
Acquisition

- 55 parcels purchased/easements
- 32 different owners
- purchase as much floodplain as possible.
# Project Implementation Timeline

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<td>Design and Permitting (Section 106, 401, 404, HPA, ESA,</td>
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## Project Costs

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<tr>
<th>PROJECT TASK</th>
<th>Amount ($)</th>
<th>% of Total</th>
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<td>Property Acquisition</td>
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<td><strong>TOTAL</strong></td>
<td><strong>21,155,854</strong></td>
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</table>

[Note: Project cost per acre was $59,762, which is average for this project type.]
Fish Present Pre and Post Project

Qwuloott - Jones Creek

Post Breach Fish Species
37 Beach Seines
n= 271:
Snohomish Estuary

Current land cover

SLAMM - Habitat Type
- Developed land
- Dry land
- Open water
- Estuarine beach
- Tidal flat
- Irreg. flooded marsh
- Tidal swamp
- Nontidal swamp
- Freshwater marsh
- Tidal fresh marsh
- Transitional marsh
- Reg. flooded marsh

Levee protection

Protected area
SLAMM - Habitat Type
- Developed land
- Dry land
- Open water
- Estuarine beach
- Tidal flat
- Irreg. flooded marsh
- Tidal swamp
- Nontidal swamp
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0.5 m SLR in 2100

With levee protection
SLAMM - Habitat Type
- Developed land
- Dry land
- Open water
- Estuarine beach
- Tidal flat
- Irreg. flooded marsh
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1 m SLR in 2100

With levee protection
Snohomish Estuary

SLAMM - Habitat Type
- Developed land
- Dry land
- Open water
- Estuarine beach
- Tidal flat
- Irreg. flooded marsh
- Tidal swamp
- Nontidal swamp
- Freshwater marsh
- Tidal fresh marsh
- Transitional marsh
- Reg. flooded marsh

2 m SLR in 2100

With levee protection
Snohomish Estuary

SLAMM - Habitat Type
- Developed land
- Dry land
- Open water
- Estuarine beach
- Tidal flat
- Irreg. flooded marsh
- Tidal swamp
- Nontidal swamp
- Freshwater marsh
- Tidal fresh marsh
- Transitional marsh
- Reg. flooded marsh

3 m SLR in 2100

Water depth
- <0.5 m
- 0.5-1 m
- 1-2 m
- 2-3 m
- >3 m

Low-lying Area

Probability of Inundation <80%
Summary

• There is significant change/uncertainty on the horizon

• Connectivity vital for natural processes/resilience

• Protection of connected corridors is essential

• Acquisition addresses uncertainty/cost

• Climate change may provide restoration opportunity in some locations
Questions ?