Integrating watershed-scale and river-reach protection and restoration planning to promote climate resilience in the South Fork Nooksack River (SFNR)

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Integrating Watershed-Scale and River-Reach Protection and Restoration Planning to Promote Climate Resilience in the South Fork Nooksack River, WA

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SFNR Climate Change Watershed Project

Co–Investigators:

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• **Steve Klein**, Research Scientist, EPA–ORD
• **Jezra Beaulieu**, Water Resources Specialist, Nooksack Indian Tribe
• **Robert Mitchell**, Professor of Geology, Western Washington University
• **Christina Bandaragoda**, Senior Research Scientist, University of Washington
• **Michael Maudlin**, Restoration Geomorphologist, Nooksack Indian Tribe
• **Treva Coe**, Habitat Program Manager, Nooksack Indian Tribe
• **Holly O’Neil**, Crossroads Consulting, Public Outreach/Stakeholder Engagement
• **Ian Smith**, Restoration Planner, Living Systems
• **Jason Hatch**, Washington Water Trust
Sources of Funding:

- EPA – PPG, NEP
- BIA
- NWIFC
- NPLCC and ATNI
- WA Dept. Ecology - NEP
Why the SFNR?

- Spring Chinook salmon ESA listing and other Pacific salmon
- Temperature impaired
- Excessive fine sediment
- Cultural importance to the Nooksack Indian Tribe
- WA Dept. Ecology/EPA Region 10 temperature TMDL
- EPA Region 10 climate change pilot research project
- Nooksack Tribe-lead watershed conservation planning effort
Attributes of Overall Climate Project:

Baseline Monitoring:

- Temperature
  - Seasonal temperature sensors
  - Year-round temperature sensors
- Discharge, year-round and seasonal
- Turbidity, suspended sediment
- Water oxygen isotope
- Glacier ablation/behavior
- Water quality
- Lapse rate
- Salmon Habitat Restoration Effectiveness
Attributes of Overall Climate Project:

Modeling:

- Glacier ablation
- Hydrologic change
- Sediment dynamics
- Stream temperature
Attributes of Overall Climate Change Project:

Holistically address:
LEGACY IMPACTS

CWA COMPLIANCE

TREATY RESOURCES

CLIMATE CHANGE

ESA RECOVERY
Climate Change Planning:

- Baseline conditions
- Cumulative impact of:
  - Legacy impacts
  - Climate change impacts
- Watershed processes
Climate Change Impacts

- Vulnerability Assessment
  - Species
  - Life Stage
  - Location
  - Timeframe
- Adaptation Planning
- Fish
Collaboration between:

- EPA-ORD,
- EPA Region 10,
- Nooksack Indian Tribe,
- WA Dept of Ecology,
- Tetra Tech, Inc.
Not just a technical project, but also a story of:

- Converging and integrating project pathways
- Voluntary collaboration
- Co-production of actionable climate change science
Converging and Integrating Project Pathways

• In 2011, Nooksack Indian Tribe provided comment on SFNR temperature TMDL:
  • Climate change
  • Upland watershed processes
  • Among other comments

• Independently, EPA-ORD initiated a climate change pilot research project in 2012 to:
  • Demonstrate how climate change can be included in a temperature TMDL
  • Address climate change, ESA fish recovery, and CWA compliance in one research demonstration pilot project

  “Circumstance meets opportunity” to yield the:

  “EPA Region 10 Climate Change and TMDL Pilot Project”
Climate Change Risk Assessment

*Consists of a Quantitative and Qualitative Assessment*

**Quantitative Assessment** (Led by EPA-ORD and Tetra Tech, Inc.):

**Qualitative Assessment** (Led by the Nooksack Indian Tribe):

- Comprehensive analysis of restoration effectiveness in the SFNR with continued climate change.
- Resulted in a prioritized list of climate change adaption strategies that supports salmon restoration in the SFNR under climate change.
- Protect CWA beneficial uses under continued climate change
- Support ESA recovery under climate change
“Qualitative Assessment: Evaluating the Impacts of Climate Change on Endangered Species Act Recovery Actions for the South Fork Nooksack River, WA”
ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

- RECONNECT RIVER TO FLOODPLAIN

- RESTORE AND PROTECT RIPARIAN AREAS

- CONTINUE INSTREAM REHABILITATION/RESTORATION

- RESTORE FLOW REGIMES

- PROMOTE LONGITUDINAL CONNECTIVITY

- REDUCE SEDIMENT DELIVERY

NEP Grant

Watershed function restoration and enhancement

None of these actions can individually ameliorate all legacy impacts and climate impacts.
ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

• ADDITIONAL ACTIONS:
  • ACKNOWLEDGE AND ADDRESS THE ROLE OF UPPER WATERSHED PROCESSES
  • DEVELOP A WATERSHED CONSERVATION PLAN
  • DESIGN AND IMPLEMENT WATERSHED RESTORATION TOOLS THAT SUPPORT AND SUPPLEMENT TRADITIONAL INSTREAM TOOLS
  • VOLUNTARY ACTIONS THROUGHOUT THE WATERSHED
    • Forestry
    • Transportation
    • Agriculture
    • Development
Acts on the recommendations of:

- Draft Temperature TMDL
- EPA Region 10 Pilot Climate Change Project
- WRIA 1 - Nooksack River Salmon Recovery Plan
- WRIA 1 – Nooksack River Watershed Management Plan
- SFNR Watershed Conservation Plan
Our Project:

- Developed a reach-scale plan
- Lower 14.3-mile reach of the SFNR
- Evaluated 345 individual parcels on the floodplain for:
  - Cover type
  - Condition
  - Quality
  - Opportunity for protection
  - Opportunity for restoration
Our Project:

- Contacted landowners with highest priority parcels to determine initial willingness to participate in NEP Phase 2 funding
Our Project:

- Fourteen parcels with willing landowners were identified
- Conceptual riparian protection and restoration profiles developed
Eight parcels with four landowners were addressed in the Conceptual Scope of Work that serves to qualify protection and restoration actions for NEP Phase 2 funding.

We are pending formal comments from Ecology on our Conceptual SOW.

Phase 2 funding imminent.
Final Phase 2 Parcels

Black Slough

South Fork Nooksack River
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$1,351,600 ≠ $430,000
The missing piece of the overall restoration puzzle:

Restore and enhance watershed hydrologic function
Climate Change Impacts Streamflow

South Fork Nooksack River
Historic and 2075s

Projected (2075):
- Larger winter peaks
- Less Snow & Earlier Melt
- Lower baseflow

Murphy, 2016; MS Thesis, WWU – Streamflow at Wickersham
Climate Change Impacts on Streamflow

South Fork Nooksack River
Historic and 2075s

Shift in water storage functions affects water temperature:
- Reduced baseflows
- Timing of cold water inputs
- Channel widening

Daily Streamflow (cms)

Murphy, 2016; MS Thesis, WWU – Streamflow at Wickersham
Watershed-Scale

Snow
Soil Moisture
Surface Water
Groundwater
Legacy Impacts on Water Storage Functions

Dense, Even-age Forest
Re-generating Clear cuts
Roads
Over-widened Stream
Wildfire
Development
Restoration Strategies in SF Nooksack
Snow Storage Varies with Forest Cover

Snow: Longer in Gaps

Snow: Longer in Forest

Snoqualmie Pass, WA

Hogg Pass, OR

Amount of Snow Storage

Duration of Snow Storage

Photos: Google Earth. See Dickerson-Lange et al. 2017
Snow Storage Duration and Stream Temperature

Less snow storage $\approx$ Warmer stream temperatures

Snow data from Elbow Lake SNOTEL and Water temperature from USGS gages on the SFNR
Soil Moisture & Forest Stand Age

Re-generating forests use more water

≈

Up to 50% less baseflow after 40 years

Perry and Jones (2016): Doug Fir Stands in HJ Andrews Exp. Forest, OR
Restoration Strategies in SF Nooksack
THANK YOU!