

EPA Region 10 Climate Change and TMDL Pilot Project South Fork Nooksack River, Washington

Climate Change Pilot Project

Place: South Fork Nooksack River, Washington

Problem: Climate Change Risks to Salmonids

Decision Framework: Clean Water Act (CWA) 303(d) Total Maximum Daily Load (TMDL) Implementation Plan and Endangered Species Act (ESA) Salmon Recovery Planning

Key Stakeholders and Collaborations:

- Nooksack Indian Tribe
- Lummi Nation
- Washington Department of Ecology
- Water Resource Inventory Area 1 Salmon Recovery Team
- University of Washington Climate Impacts Group
- Tetra Tech (EPA Contractor)
- U.S. Forest Service
- National Oceanic and Atmospheric Administration (NOAA) Fisheries
- U.S. Geological Survey

Project Background

Global climate change has the potential for significant impacts on the nation's freshwater ecosystems. Stream temperature is projected to increase in most rivers under climate change scenarios due in part to increases in air temperature, while changing precipitation and snowmelt patterns could influence water levels and water flow. Increases in stream temperature and changes in stream hydrology could have substantial negative effects on cold water fish species such as salmon.

To help better understand the potential impact of climate change on achieving water quality and salmon recovery goals, the U.S. Environmental Protection Agency's (EPA) Region 10, Office of Research and Development, and Office of Water launched a collaborative pilot research project in the South Fork Nooksack River in Washington State. The project uses the state's development of a temperature Total Maximum Daily Load or TMDL for the South Fork Nooksack River as a pilot for integrating climate change into a watershed-specific plan for improving

water quality. An overarching goal is to ensure that relevant findings and methodologies related to climate change inform the South Fork Nooksack River Temperature TMDL Implementation Plan.

Project Objectives

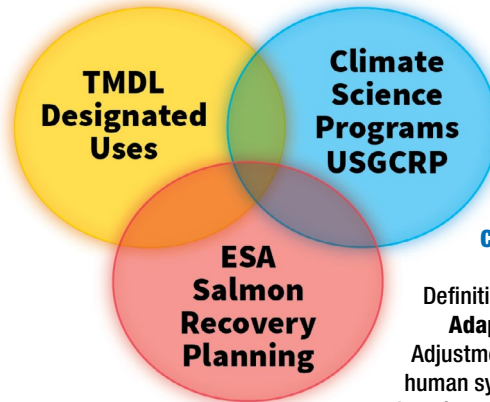
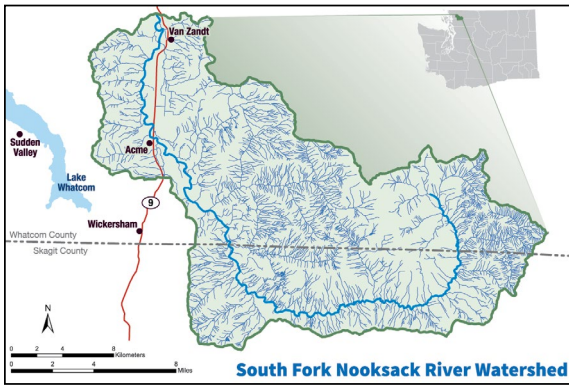
The following specific objectives were identified for the pilot research project:

- Assess the potential impacts of climate change on stream temperature and stream flow for a temperature TMDL Implementation Plan.
- Help prioritize stream restoration actions under climate change for Endangered Species Act (ESA) Salmon Recovery Planning.
- Guide implementation of EPA's *National Water Program 2012 Strategy: Response to Climate Change*.
- Support EPA's national tribal science priorities for climate change and integration of traditional ecological knowledge.



Juvenile Chinook (*Oncorhynchus tshawytscha*)

Roger Tabor (USFWS)



Climate Change Adaptation

Definition of Key Term-
Adapt, Adaptation:
Adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects (National Climate Assessment, 2014).

Project Methods

The pilot research project developed methods for a quantitative and qualitative assessment to support the project goals. The project is structured as a stakeholder-centric process, with numerous opportunities for stakeholder engagement and capacity building.

Quantitative Assessment

- Compared modeled stream temperature, including riparian shading, with and without climate change for the 2020s, 2040s, and 2080s.
- Compared modeled stream temperature to the state’s Cold-Water Temperature Water Quality Standard (WQS) to inform the TMDL Implementation Plan.
- Embedded as a risk assessment to provide risk managers with an understanding of potential climate change impacts on stream temperature and stream flow.

Qualitative Assessment

- Comprehensively analyzed freshwater habitat for ESA salmon restoration in the South Fork Nooksack River under climate change.
- Created a prioritized list of strategies that supports salmon restoration in the South Fork Nooksack River under climate change.
- Base the approach and method on *Restoring Salmon Habitat For A Changing Climate* (Beechie et al. 2013).

Project Results

The pilot research project results were published as Quantitative and Qualitative Assessments, which are available electronically on EPA’s web site. The respective links are included below.

Quantitative Assessment

Quantitative Assessment of Temperature Sensitivity of the South Fork Nooksack River Nooksack River under Future Climates using QUAL2Kw.
[EPA/600/R-14/233](#)

Results show that the risk of higher water temperature will accelerate over time. Predicted increases in heat inputs and lower summer flows associated with a reduction in the storage of winter snowpack will combine to exacerbate summer water temperature extremes.

The model simulations suggest that, without restoration of riparian shade, water temperatures during critical summer low-flow conditions could increase by amounts ranging from 3.5 to almost 6 °C by the 2080s. However, modeling also shows that restoration of riparian shading would significantly (30 to 60 percent) mitigate increasing water temperature.

Qualitative Assessment

Qualitative Assessment: Evaluating the Impacts of Climate Change on Endangered Species Act Recovery Actions for the South Fork Nooksack River, WA.
[EPA/600/R-16/153](#)

Climate change impacts on temperature, hydrologic, and sediment regimes could profoundly affect the distribution, life history periodicity, survival and productivity of salmonids in the South Fork Nooksack River. Results show that the most important actions to implement in order to mitigate the impacts of climate change in the South Fork Nooksack River are riparian restoration, floodplain reconnection, wetland restoration, and placement of log jams.

For More Information

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