Strategic Planning for Water Rights Acquisitions in the Columbia Basin:

An assessment of regional streamflow response to climate change

Erin Donley
MS/MPA, School of Forest Resources & Evans School of Public Affairs

Adviser: Dr. Robert J. Naiman, College of Ocean and Fishery Sciences
Overview

- Introduction
- Driving Factors
- Research Objectives
- Methods
- Preliminary Results
- Preliminary Conclusions
Driving Factors:
Impact of low streamflows on salmon

- Thermal impacts on spawning adults
- Dewatering of redds
- Physiological impacts on smolts
- Extend smolt migration time
Driving Factors: Market-based Conservation
Driving Factors:
Uncertain hydrologic future resulting from climate change

UW Climate Impacts Group’s 2009 Washington Climate Change Assessment

- Lower spring snow water equivalent
- Changes in the timing of stream discharge
- Changes in seasonal stream discharge
Research Objectives:

- Provide a comprehensive understanding of the projected climate induced changes in hydrology in selected sub-basins.

- Create a strategic plan for water rights acquisitions in areas that may be most flow limited in the next 30 years.

- Facilitate the Department of Ecology, the Washington Water Trust and other organizations’ use of the strategic plan in an applied setting.
Methods:
Strategic Planning Process

- External Environmental Assessment
- Internal Organizational Assessment
- Strategic Direction
- Define Plan
- Strategy Implementation
- Performance Evaluation
Methods:
Strategic Planning Process

- External Environmental Assessment
- Internal Organizational Assessment

Strategic Direction → Define Plan → Strategy Implementation

Performance Evaluation
Methods

- External Assessment
  - GIS-based sub-basin selection
  - Simulation of historic and future managed stream flows
GIS-based Sub-basin Selection

- Listed Evolutionary Significant Units (ESUs) of salmon
- High water use for irrigation
- High potential for future hydrologic change
External Assessment: Simulation of historic and future managed streamflow
## External Assessment: Planning Scenarios

<table>
<thead>
<tr>
<th>Climate</th>
<th>20 % Ag Increase</th>
<th>40 % Ag Increase</th>
<th>Instream flow rule 1st priority</th>
<th>Biologically-based Flow Rule 1st Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020A1B</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020A1B</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020A1B</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>2020A1B</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>2020A1B</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020B1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040A1B</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040A1B</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040A1B</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040A1B</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040B1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040B1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040B1</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2040B1</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
External Assessment: WEAP Interface
Preliminary Results: Okanogan
Preliminary Results: Okanogan
Preliminary Results: Wenatchee

Flow-limited Summer Months
## Summary: % Reduction in Average Monthly Streamflow in Dry Season

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Okanogan</th>
<th>Methow</th>
<th>Wenatchee</th>
<th>Yakima</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020A1B</td>
<td>15%</td>
<td>21%</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td>2020B1</td>
<td>18%</td>
<td>20%</td>
<td>28%</td>
<td>18%</td>
</tr>
<tr>
<td>2040A1B</td>
<td>23%</td>
<td>30%</td>
<td>42%</td>
<td>31%</td>
</tr>
<tr>
<td>2040B1</td>
<td>27%</td>
<td>32%</td>
<td>46%</td>
<td>28%</td>
</tr>
</tbody>
</table>
## Summary: % Reduction in Average Monthly Streamflow in Dry Season

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Okanogan</th>
<th>Methow</th>
<th>Wenatchee</th>
<th>Yakima</th>
</tr>
</thead>
<tbody>
<tr>
<td>2020A1B</td>
<td>15%</td>
<td>21%</td>
<td>25%</td>
<td>20%</td>
</tr>
<tr>
<td>2020B1</td>
<td>18%</td>
<td>20%</td>
<td>28%</td>
<td>18%</td>
</tr>
<tr>
<td>2040A1B</td>
<td>23%</td>
<td>30%</td>
<td>42%</td>
<td>31%</td>
</tr>
<tr>
<td>2040B1</td>
<td>27%</td>
<td>32%</td>
<td>46%</td>
<td>28%</td>
</tr>
</tbody>
</table>
WEAP flows in Context

• **NEXT STEP**: Compare simulated flows with salmonid life-stage and species-specific flow duration curves
Preliminary Conclusions

- Many salmonids in the Central Columbia Basin are in danger of extinction
- Traditional command and control regulation has not significantly restored salmon population numbers
- Market-based approaches to instream flow conservation show great promise
- My study will result in strategic recommendations for future water rights acquisitions to maximize the benefit of instream flow conservation
Application: Political Governance

Federal Regulation: ESA

Environmental Outcome: Conserved Instream Flow

CBWTP: Conservation Funding

Water right acquisitions for flow conservation
Local Agencies and Organizations: Water right acquisitions for flow conservation

Objective 1

Environmental Outcome: Conserved Instream Flow

UW Climate Impacts Group

Climate Scenarios

Hydrologic Modeling

Water Resource Management Model
Water Evaluation and Planning System

Managed Streamflow
Environmental Outcome: Conserved Instream Flow

Objectives 2 & 3

Funding recipients: Water right acquisitions for flow conservation

CBWTP: Conservation Funding

Objectives 2 & 3

Strategic Planning

External Environmental Assessment

Strategic Direction

Define Plan

Strategy Implementation

Internal Organizational Assessment

Performance Evaluation

Washington Water Trust

Northwest Power and Conservation Council

BPA

Department of Ecology State of Washington
Acknowledgements

- Dr. Robert Naiman  
  *UW School of Aquatic and Fisheries Science*
- Dr. Joe Cook  
  *UW Evans School of Public Affairs*
- Dr. Joshua Lawler  
  *UW School of Forest Resources*
- Susan Adams and Amanda Cronin  
  *Washington Water Trust*
- Dr. David Purkey  
  *Stockholm Environment Institute*
Acknowledgements

- Dr. Vishal Meta  
  *Stockholm Environment Institute*
- UW Climate Impacts Group
- Dr. Alan Hamlet  
  *UW Department of Civil and Environmental Engineering*
- Mathieu Marineau  
  *UW Department of Civil and Environmental Engineering*
- Julie Vano  
  *UW Department of Civil and Environmental Engineering*
Preliminary Results: Okanogan

Flow-limited Summer Months
Preliminary Results: Methow

Flow-limited Summer Months

CFS
Preliminary Results: Yakima

Flow-limited Summer Months