Lessons Learned and Approaches for Climate Change Assessment

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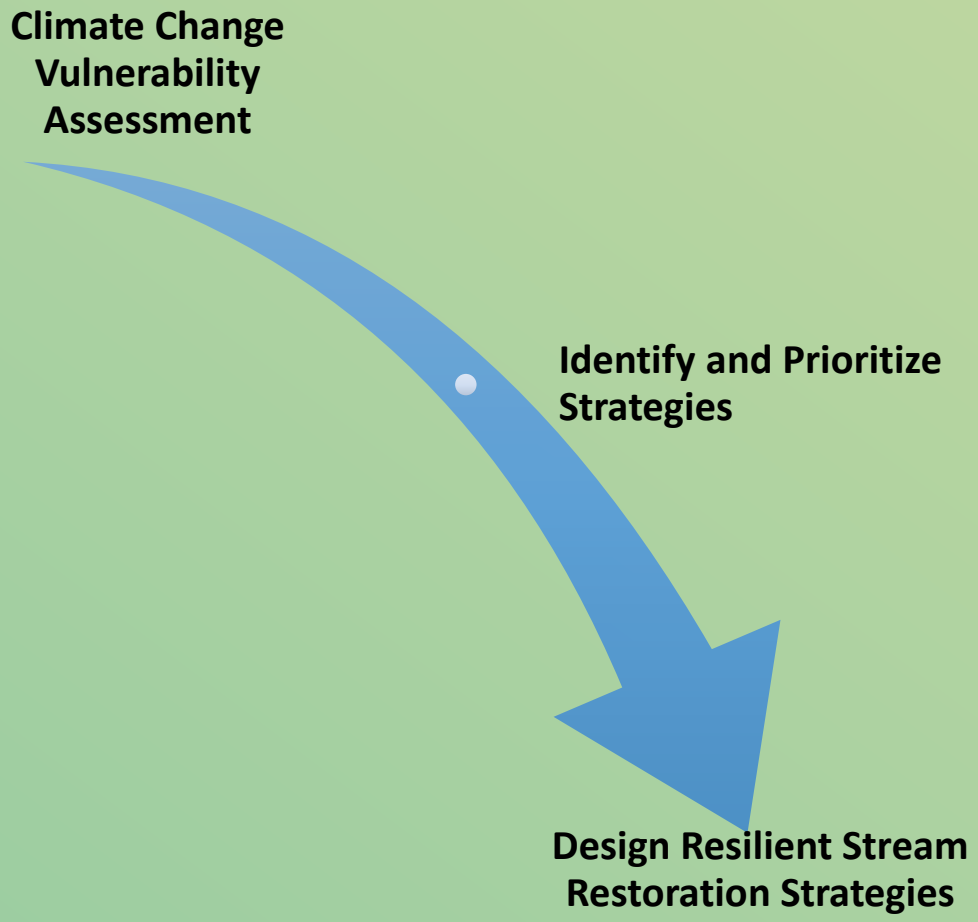
Presentation Overview

- Identify approaches and lessons learned using four projects
  - 20 Watersheds Project, USEPA
  - Climate Change Hydropower Pilot, IFC
  - South Fork Nooksack River Climate Change Pilot, EPA (Nooksack Indian Tribe, supporting partner)
  - Climate Change Assessment, Meacham Creek, Confederated Tribes of the Umatilla Indian Reservation
- Present climate change assessment not just as “studies”, but as tools to support resilient watershed management

General Panel Presentation Framework



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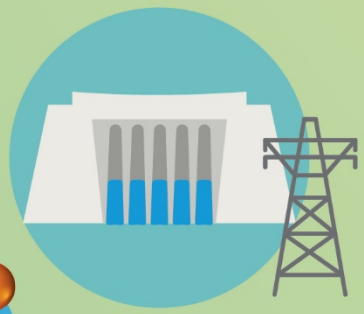
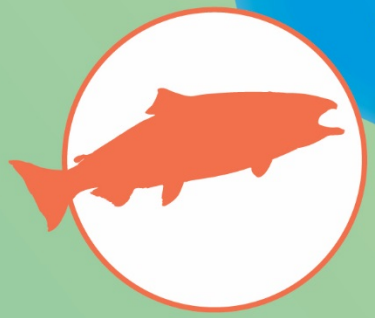
Watershed modeling conducted in
20 US Watersheds



Hydropower

Meacham Creek



South Fork Nooksack River
Assessments

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USEPA 20 Watersheds Study

Analysis of:

- Streamflow
- Nutrient (nitrogen and phosphorus)
- Sediment loading

To:

- Plausible mid-21st century climate change
- Urban development scenarios

Evaluated two watershed models:

- HSPF and SWAT

Evaluated different climate scenarios:

- Non-downscaled Global Climate Models
- Dynamically downscaled climate models (NARCCAP)
- Bias-corrected statistical (NARCCAP)

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Willamette River Impacts

Changes in forcings -

- The median annual mid-21st century precipitation across climate scenarios is comparable to historic conditions (change varies between -11.6% and +6.5%)
- Median annual temperature increases approximately 3.5° F across climate scenarios

Changes in outcomes:

- Median streamflow volume increase 5% (varies between -8% and +16%)
- Median 100-year peak flow increases by 15% (ranges between -21% and +30%).
- Median TSS increase is 10% (varies between -10% and +24%)
- Median TP and TN decreases 3% and 4% respectively

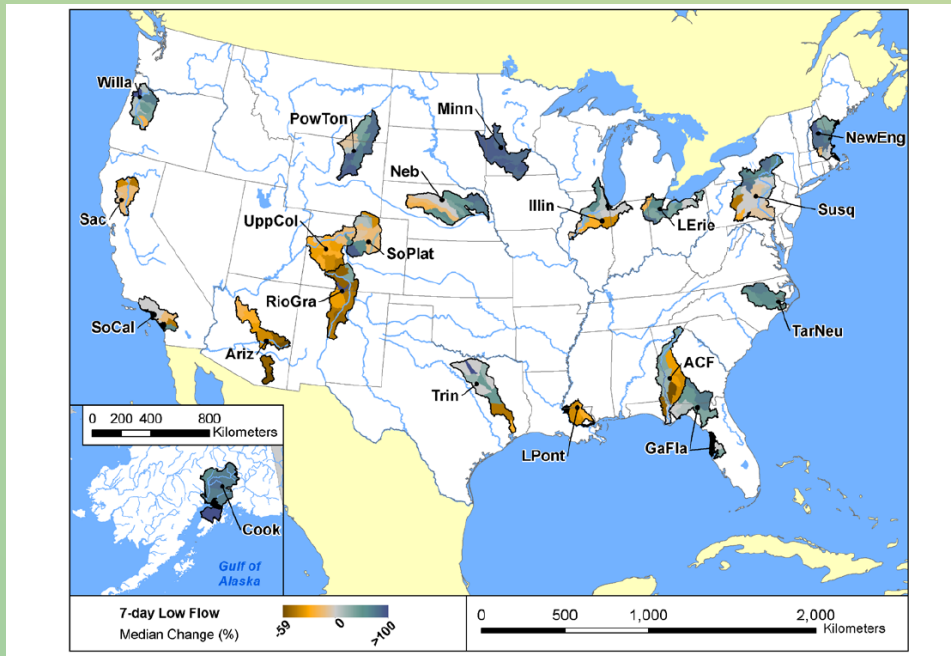

Figure 7-7. Median simulated percent changes in 7-day average low flow volume for six NARCCAP scenarios relative to current conditions by HUC-8 (median of NARCCAP climate scenarios with urban development).

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Outcomes and Lessons Learned

Still significant uncertainty in future precipitation

- Use an ensemble approach
- Consider to be a sensitivity analysis

Products

- EPA's Global Change Explorer: https://20watersheds.epa.gov/
- Several journal articles and summary report: report: https://cfpub.epa.gov/ncea/global/recordisplay.cfm?deid=256912

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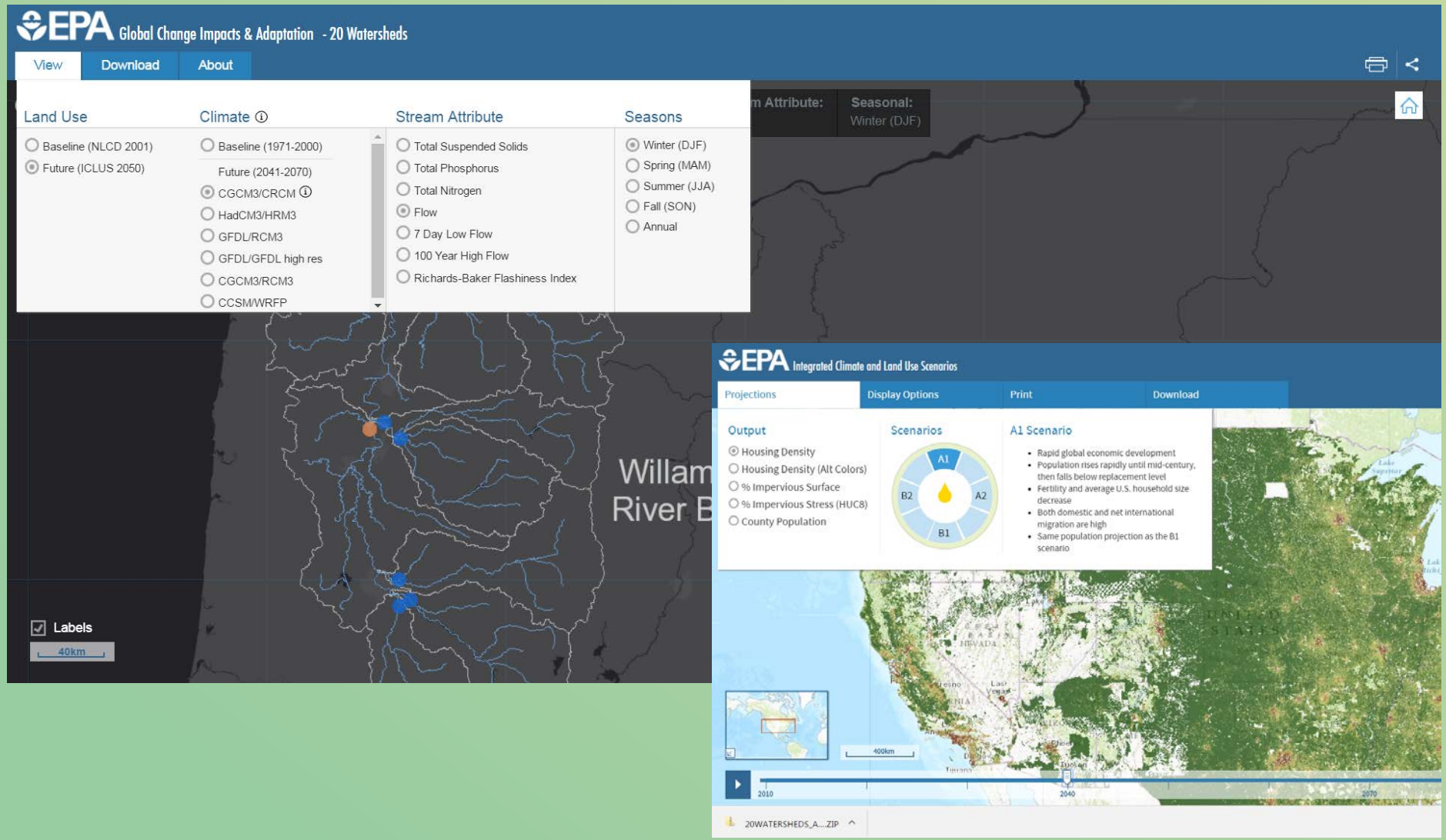
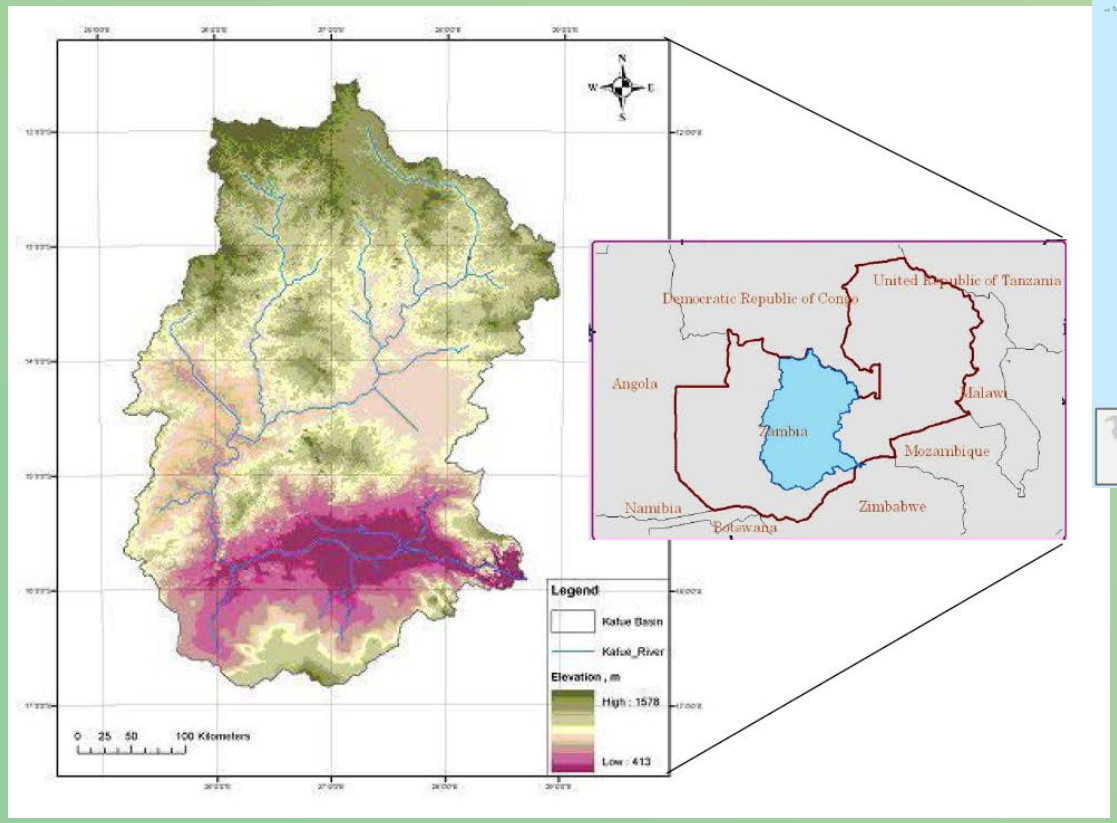
EPA's Global Change Explorer



IFC Climate Change Pilot for the Kafue River, Zambia



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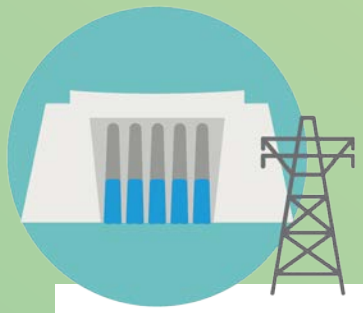
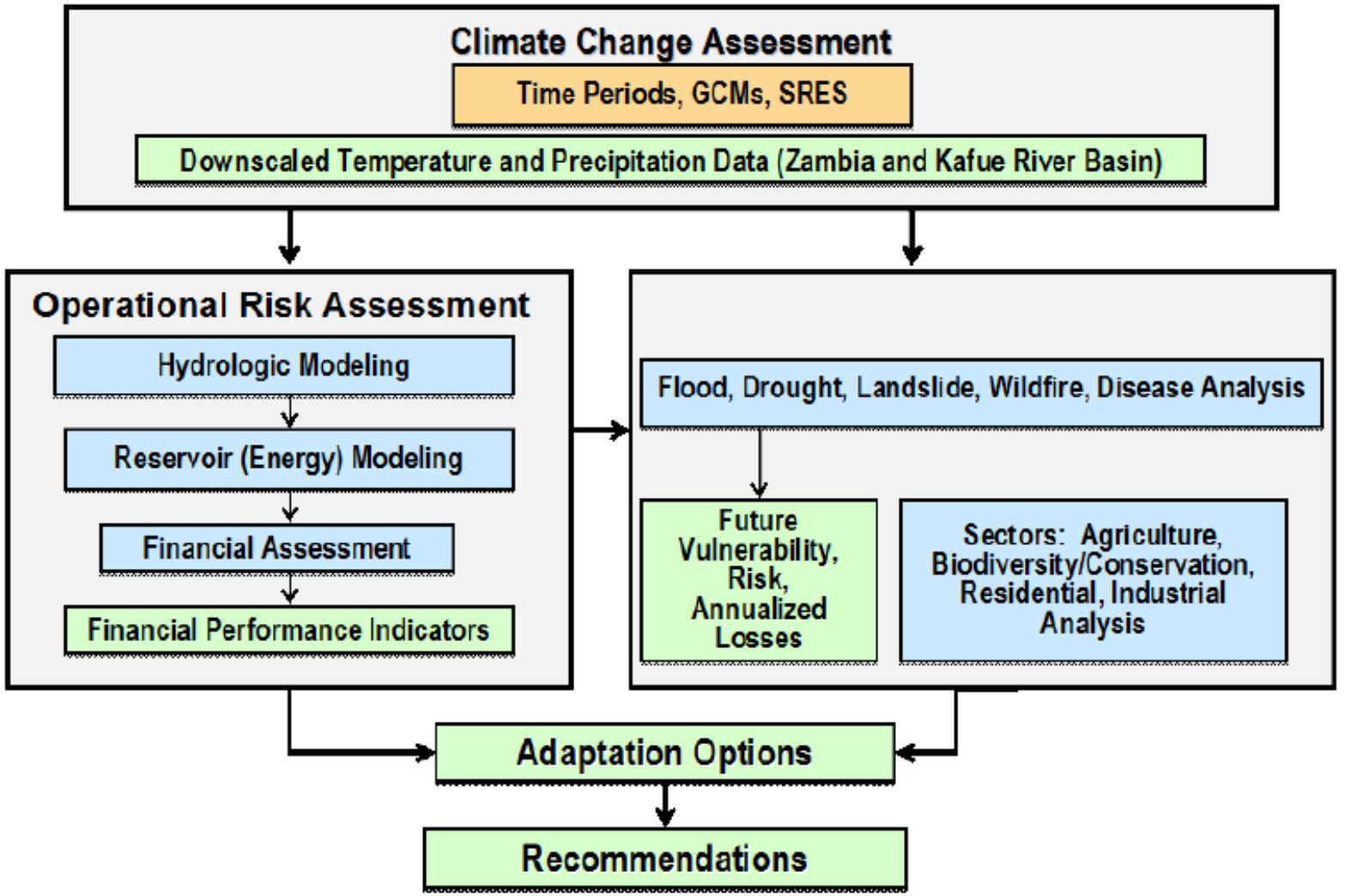
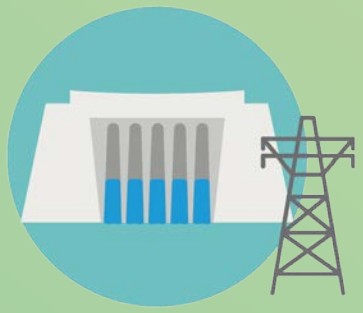
Climate Change Assessment Approach







Outcomes and Lessons Learned

Importance of:

- Stakeholder outreach and engagement
- Importance of managing water in an integrated manner
- Use of financial models to understand bottom line

Products

- IFC Pilot Project Summary Report: http://www.ifc.org/wps/wcm/connect/54595f004a830c6885dcff551f5e606b/ClimaetRisk_HYdro_Zambia_Full.pdf?MOD=AJPERES

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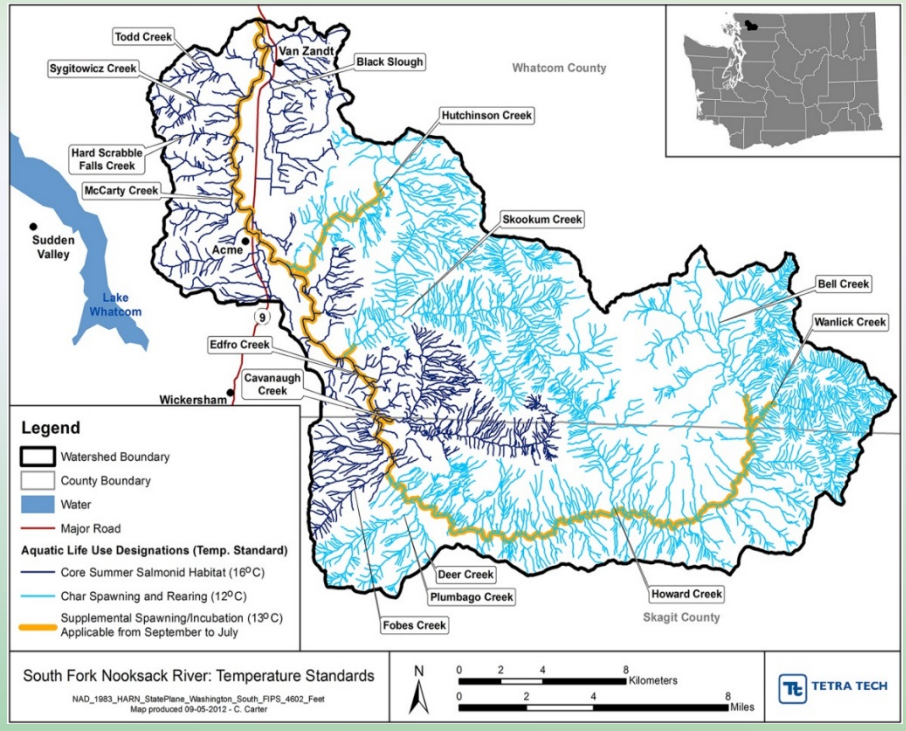
EPA South Fork Nooksack River Pilot Project

Climate Assessment Objective

- Assess the potential impacts of climate change on stream temperature and stream flow for a TMDL Implementation Plan.



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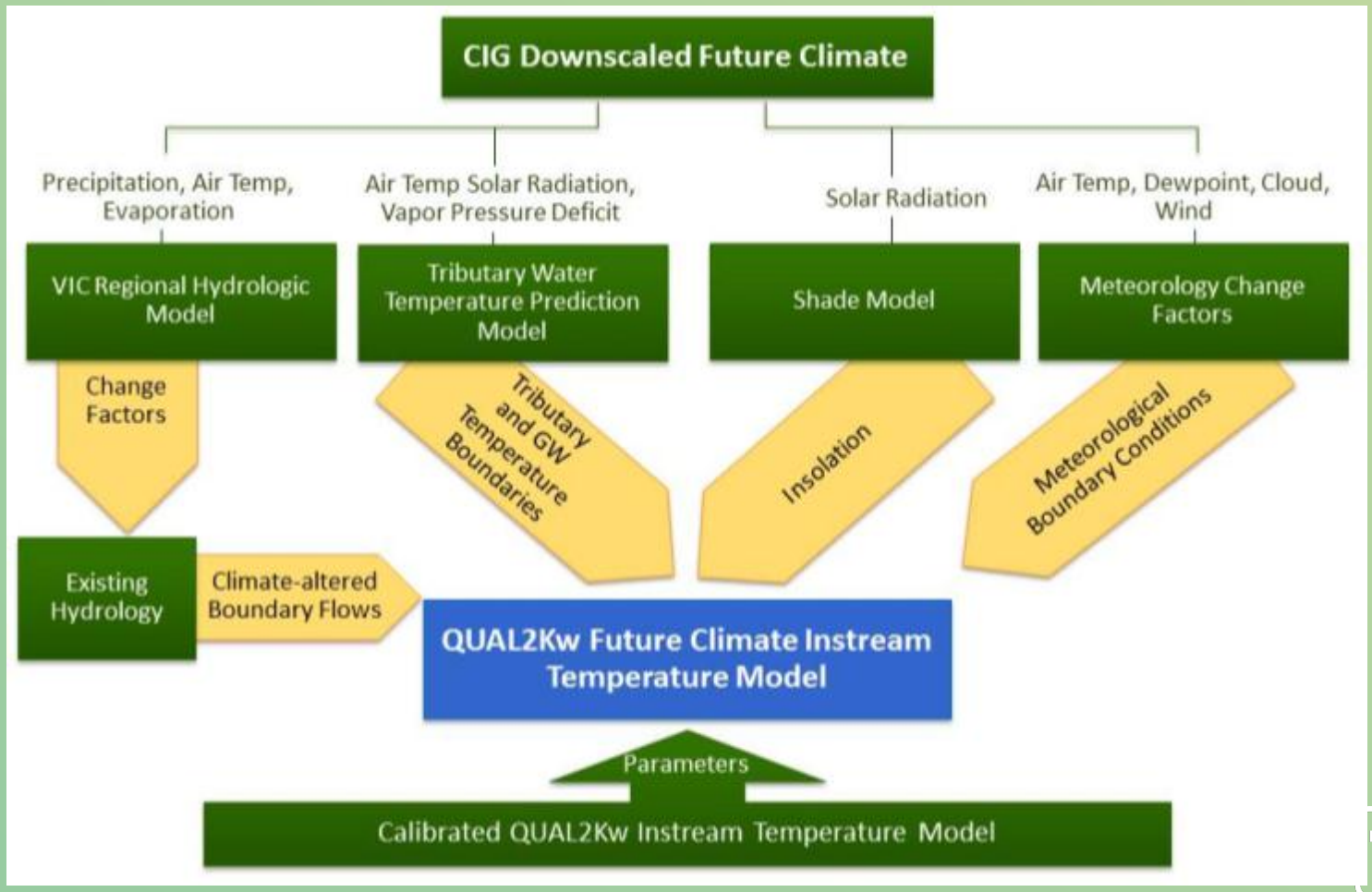
Quantitative Assessment: Modeling Integration, Inputs, Outputs, and Uncertainties



Source: Quantitative Assessment of Temperature TMDL, Washington Department of Ecology, EPA Region 10, Tetra Tech

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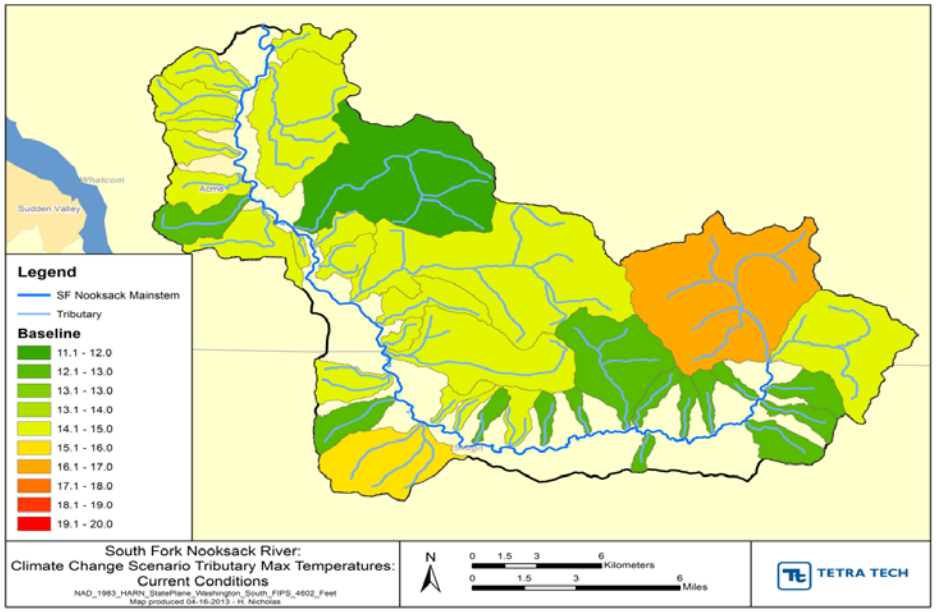
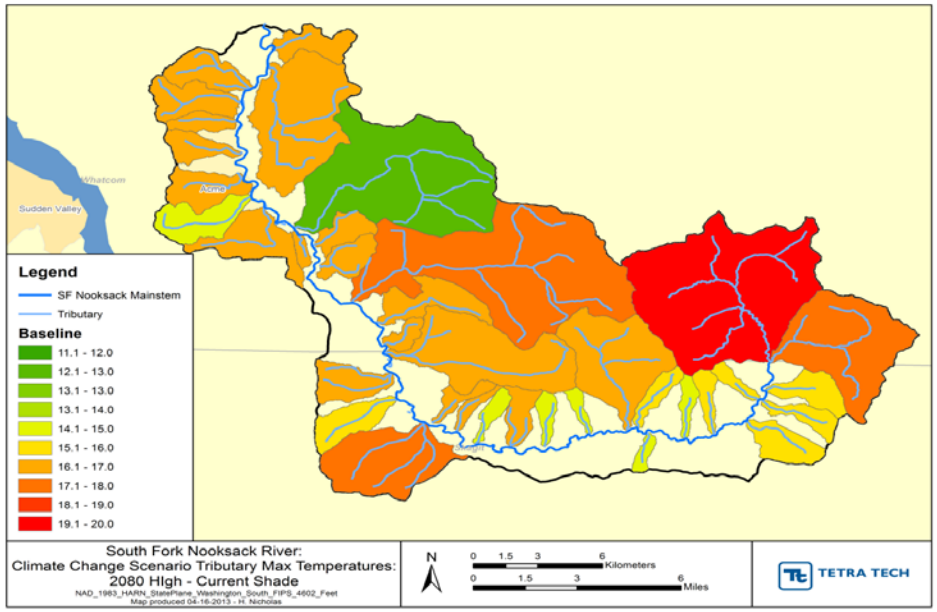
Quantitative Assessment Modeling Results

Maximum Tributary Stream Temperature 7Q10 Flow Conditions (Pending Publication by EPA)

Current Climate



2080s Climate



Source: Quantitative Assessment of Temperature Sensitivity of the South Fork Nooksack River under Future Climates using QUAL2Kw Draft Report June 10, 2013 by Tetra Tech (Butcher et al.)

Outcomes and Lessons Learned

- Climate change will exacerbate legacy impacts
- TMDL focuses on extreme conditions
- Importance of system potential shading and watershed processes

Resources

- CIG and resources: https://cig.uw.edu/
- Beechie et al (2012): http://onlinelibrary.wiley.com/doi/10.1002/rra.2590/abstract

Products (coming soon!)

- SFNR TMDL (Ecology)
- Quantitative Assessment
- Qualitative Assessment

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Climate Change Assessment for Meacham Creek

- Focused on the annual maximum of the 7-day average of daily maximum temperatures (7DADMax)
- Used a stream temperature regression model

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Climate Change Assessment for Meacham Creek

Used a statistical approach to develop future stream temperature

- A logistic regression approach developed by Mohseni et al. (1998)
- Mantua et al. (2010) used this regression approach in a stream temperature regression model to evaluate water temperature distributions in Washington State under future climate conditions.
- Mohseni models were fit to all 8 monitoring stations along Meacham Creek

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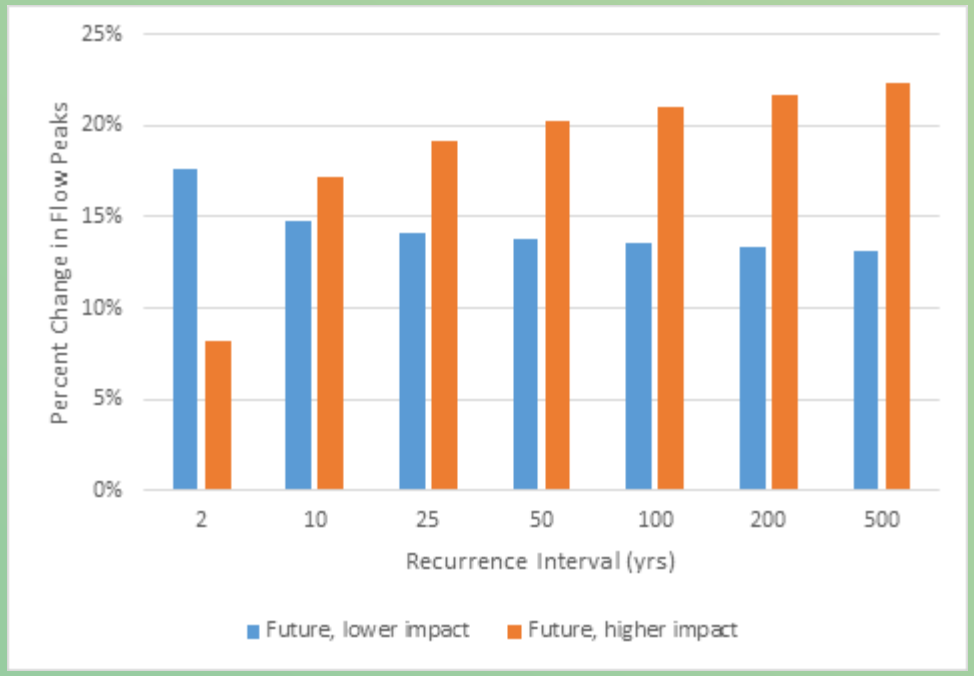
Outcomes and Lessons Learned

- Cost effective approach that still provides useful information
- Peak flows are likely to increase about 15-20% by 2065



Resources:

- Regression analysis methods (USFS): http://www.fs.fed.us/rm/boise/AWAE/projects/stream_temperature.shtml
- Mantua, N., I. Tohver, and A. Hamlet. 2010. Climate change impacts on streamflow extremes and summertime stream temperature and their possible consequences for freshwater salmon habitat in Washington State. Climatic Change 102:187-223.
- Mohseni, O., H.G. Stefan, and T.R. Erickson. 1998. A nonlinear regression model for weekly stream temperatures. Water Resources Research 34(10):2685-2692.

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Main Take-Away Points

- Identify local data and tools that can be leveraged
- Good scoping is important - identify parameters, time frame of analysis, methods of analysis
- Can use multiple approaches – from very resource intensive to more efficient to qualitative….doesn't have to break the bank!

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Thank You!

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