South Fork Nooksack Temperature TMDL: Nooksack Indian Tribe's Contribution to Co-Production of Actionable Science

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Presentation To:

2022 NATIONAL TRAINING WORKSHOP ON
WATER QUALITY DATA, ASSESSMENT, AND PLANS

June 2, 2022

NOOKSACK INDIAN TRIBE'S CLIMATE CHANGE PROGRAM

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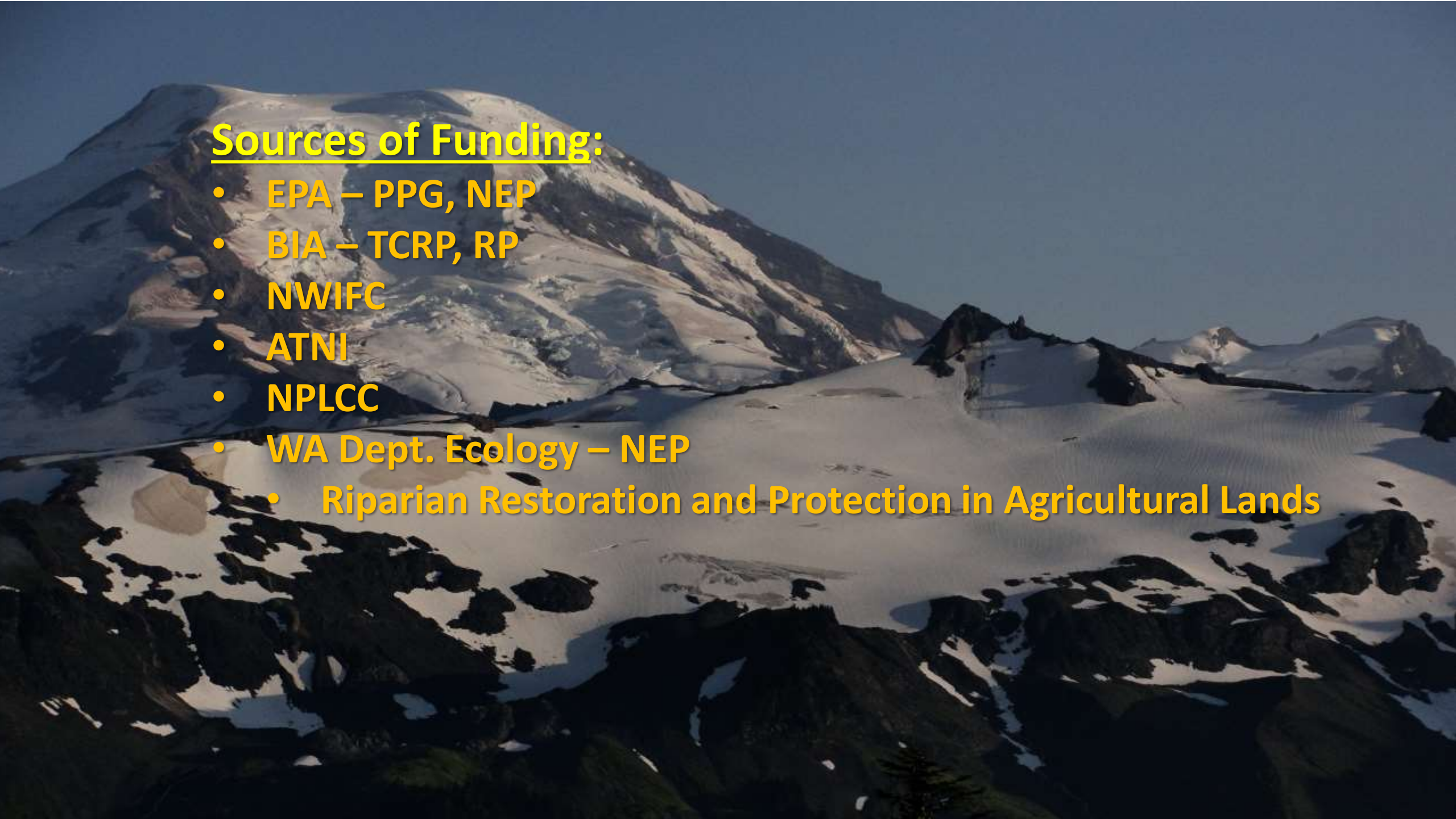
- Rosie O'Neil, Brel Froebe, Evergreen Land Trust
- Steve Hood, Teizeen Mohamedali, WA Department of Ecology
- Laurie Mann, EPA R-10

NOOKSACK INDIAN TRIBE'S CLIMATE CHANGE PROGRAM

Objectives of presentation:

- Provide a history of developing the SNFR stream temperature TMDL
- Highlight the Nooksack Indian Tribe's involvement
- Summarize how climate change was integrated into the TMDL as a major stressor
- Highlight the effectiveness of the Tribal-State-Federal collaboration
- Identify how the TMDL integrated Tribal concerns over water quality exceedances
- Summarize the Tribe's leadership in addressing inadequacies in regulations and knowledge gaps related to non-point source pollution in the SFNR
- Focus on knowledge gaps that must be filled to address land use and management, watershed health, water supply, water quality, and climate change
- Identify possible solutions
- Act on those solutions



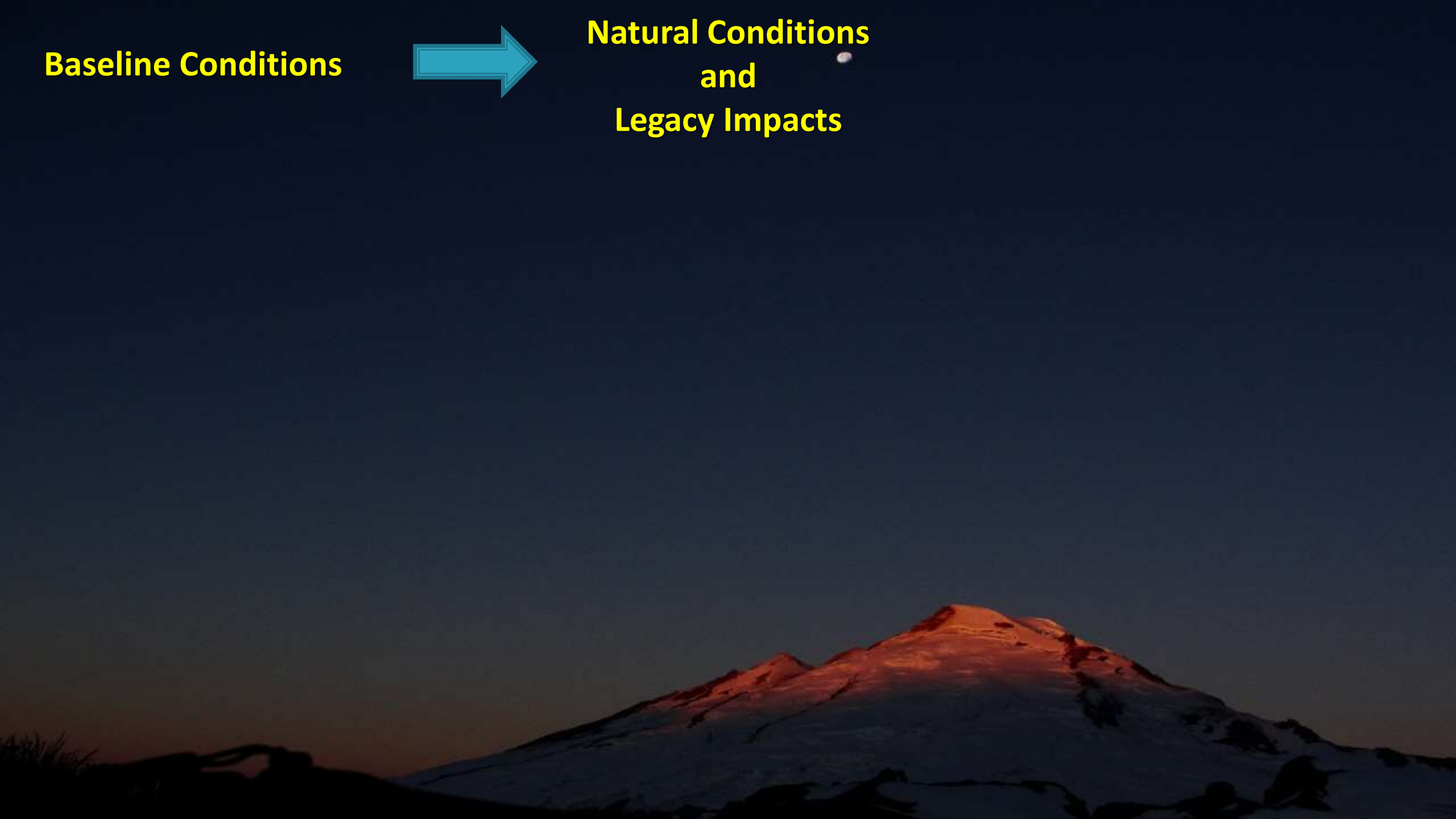
Sources of Funding:

- EPA – PPG, NEP
- BIA – TCRP, RP
- NWIFC
- ATNI
- NPLCC
- WA Dept. Ecology – NEP
  - Riparian Restoration and Protection in Agricultural Lands

Nooksack Indian Tribe Climate Change Project

Baseline Conditions

Natural Conditions
and
Legacy Impacts

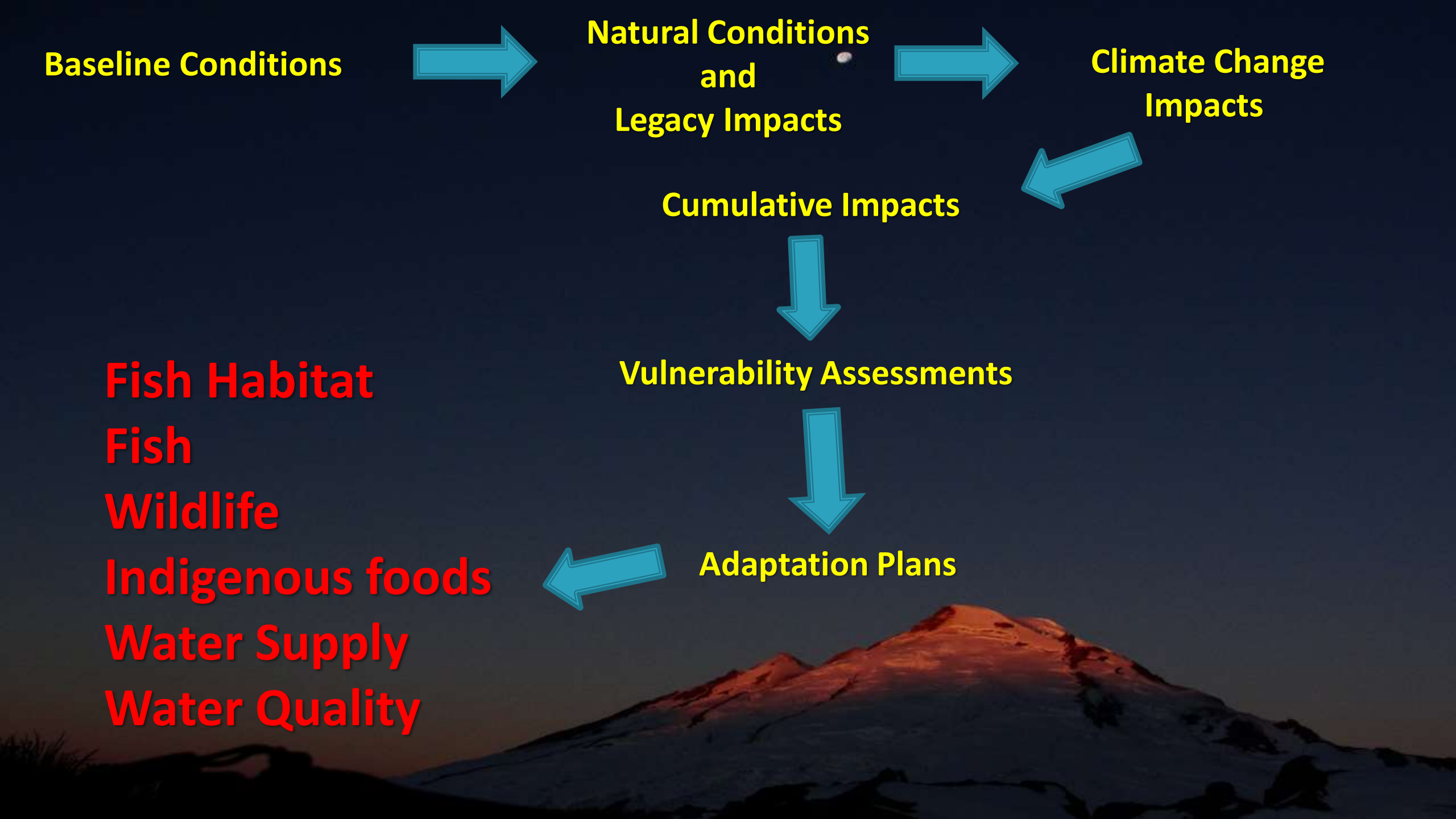


Natural Conditions.....

Legacy Impacts.....

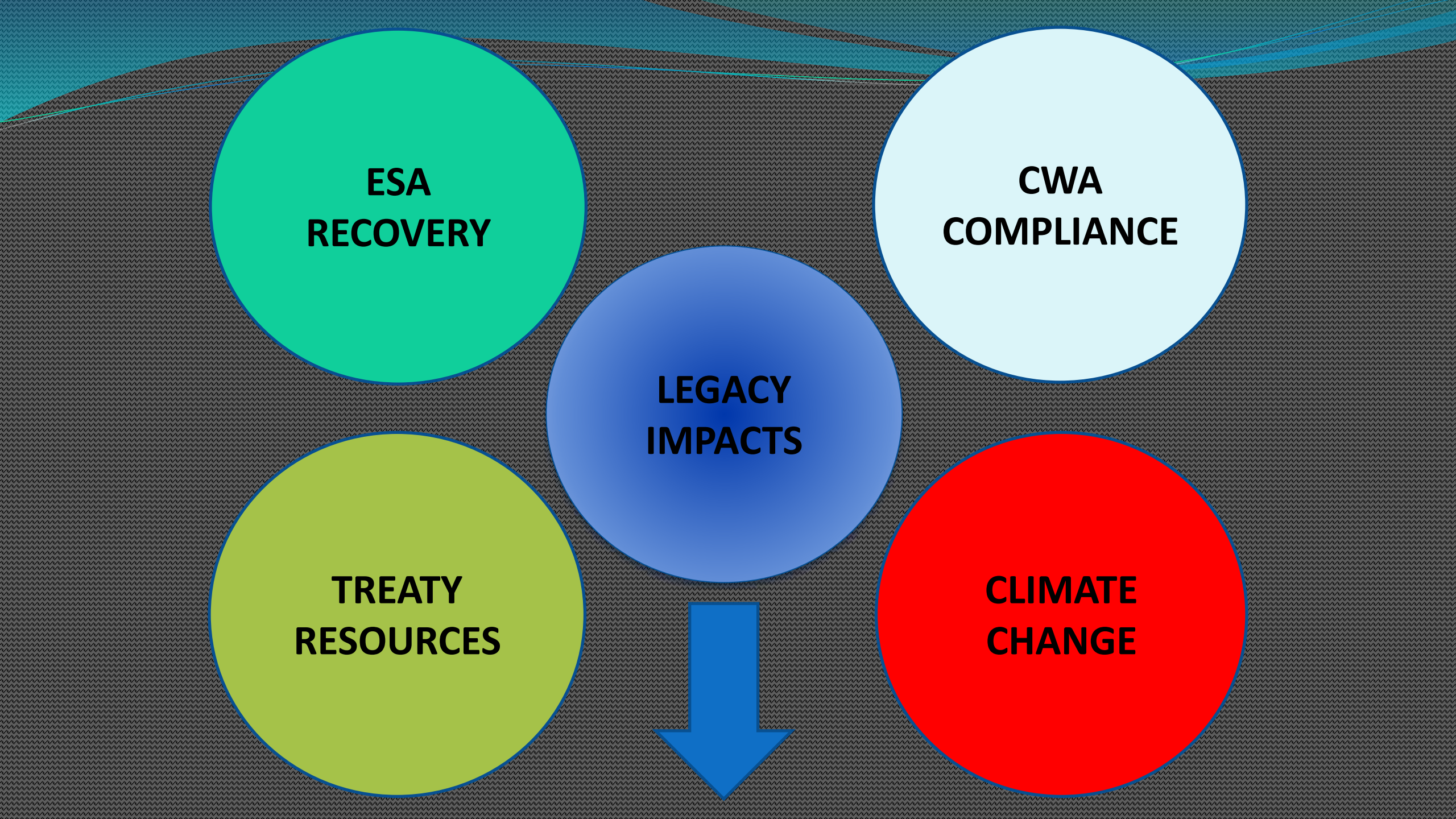
Cumulative Impacts:

- Legacy Impacts
- Climate Change impacts


Baseline Conditions
Natural Conditions and Legacy Impacts
Climate Change Impacts
Cumulative Impacts
Vulnerability Assessments
Adaptation Plans
Fish Habitat
Fish
Wildlife
Indigenous foods
Water Supply
Water Quality

Attributes of Overall Climate Change Project:

Holistically address: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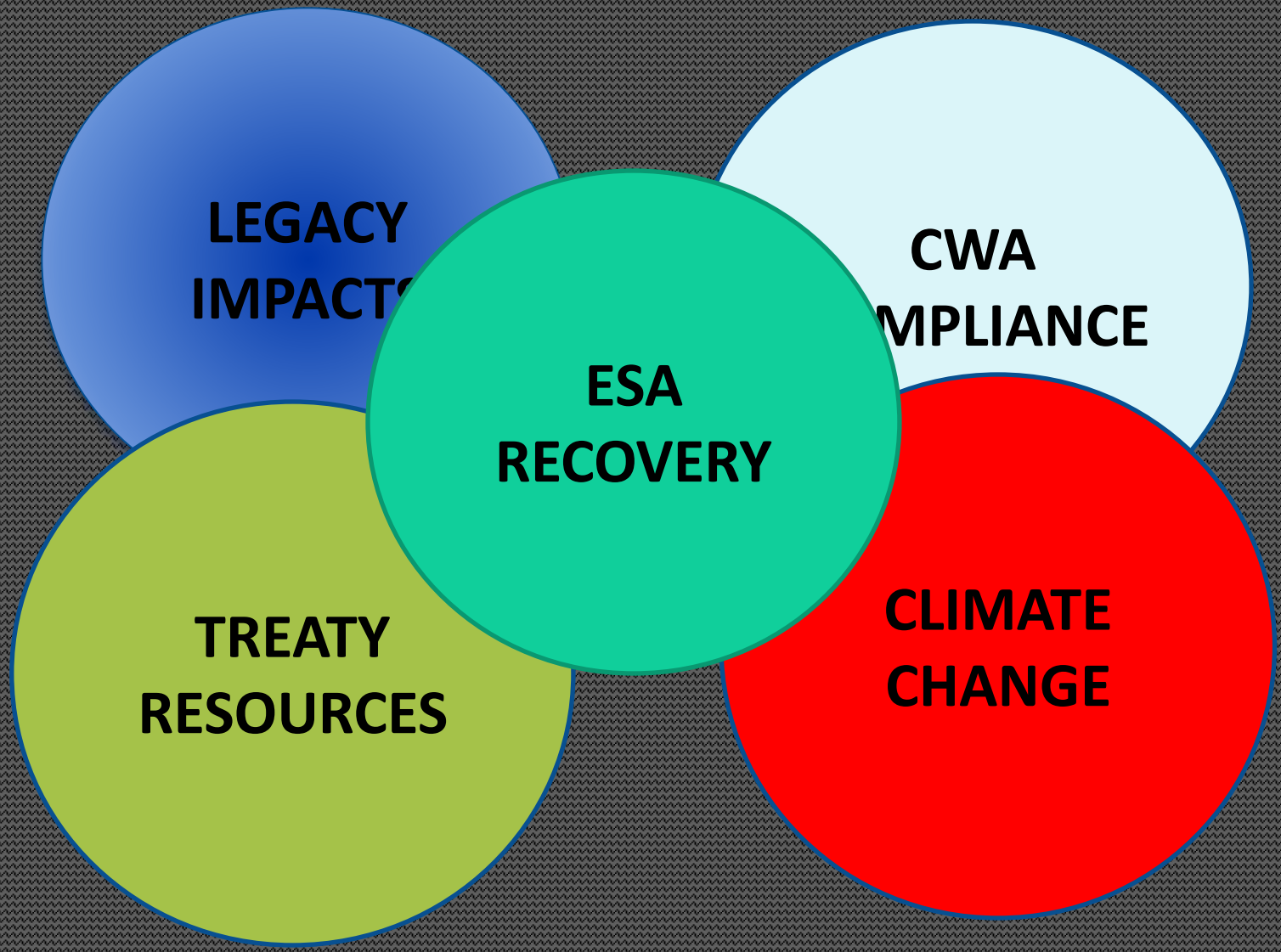
RECOVERY
CWA
COMPLIANCE
LEGACY
IMPACTS
TREATY
RESOURCES
CLIMATE
CHANGE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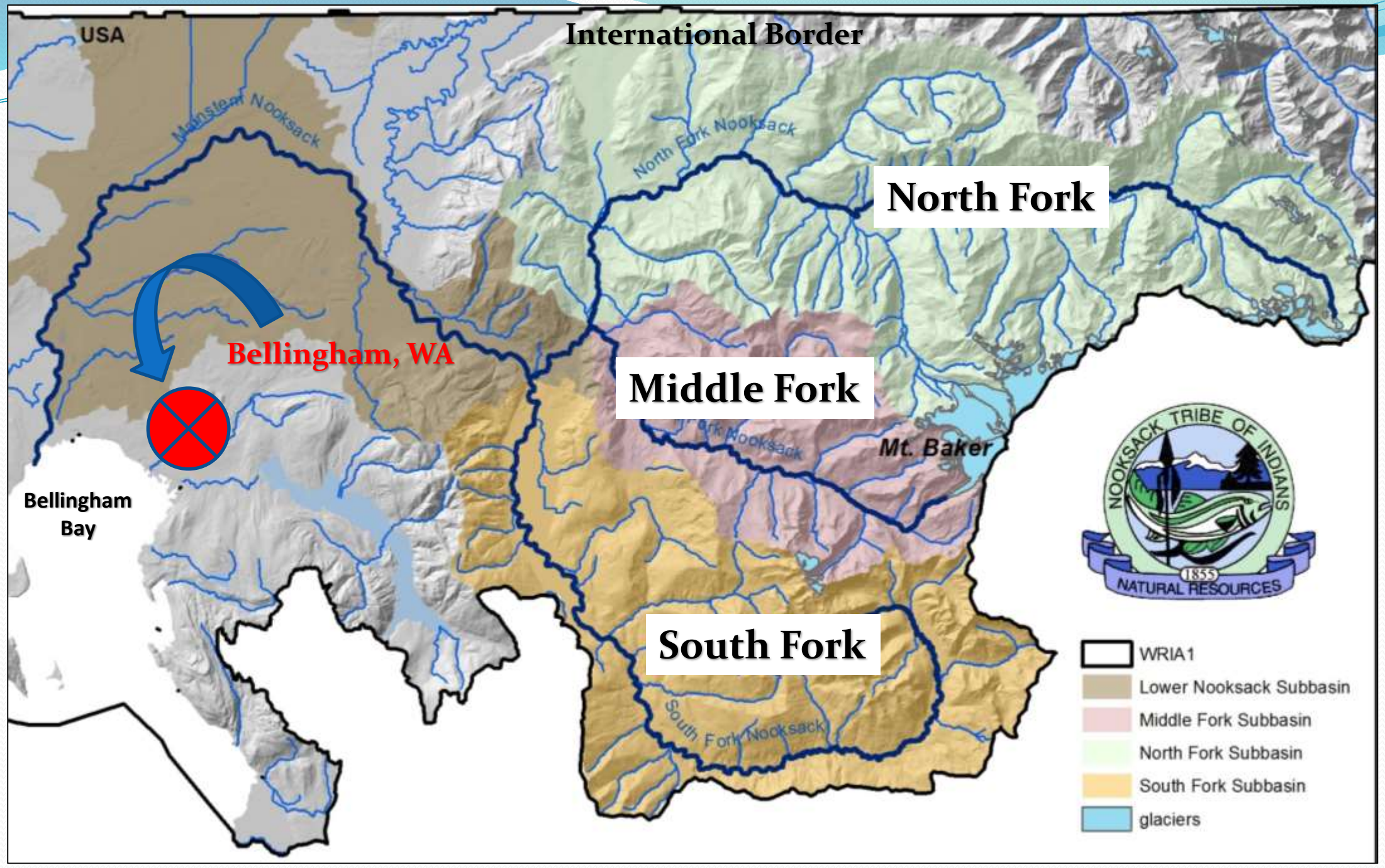
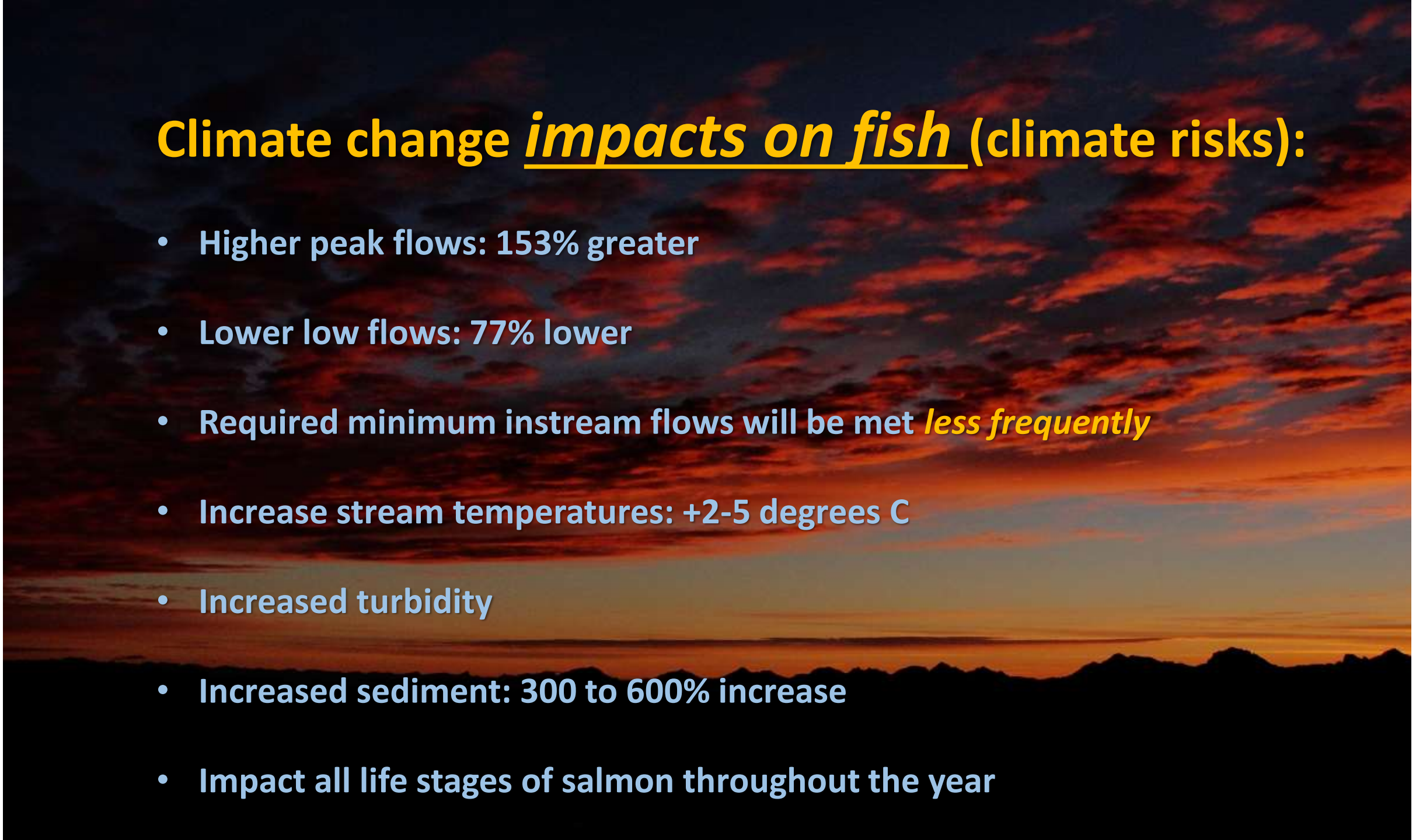
CHANGE


USA
International Border
Mainstem Nooksack
North Fork Nooksack
North Fork
Bellingham, WA
Middle Fork
Mt. Baker
Bellingham Bay
South Fork
South Fork Nooksack
NOOKSACK TRIBE OF INDIANS
1855
NATURAL RESOURCES
WRIA1
Lower Nooksack Subbasin
Middle Fork Subbasin
North Fork Subbasin
South Fork Subbasin
glaciers



Climate change *impacts on fish* (climate risks):

- Higher peak flows: 153% greater
- Lower low flows: 77% lower
- Required minimum instream flows will be met *less frequently*
- Increase stream temperatures: +2-5 degrees C
- Increased turbidity
- Increased sediment: 300 to 600% increase
- Impact all life stages of salmon throughout the year

South Fork Nooksack River:

- 2nd largest fork – 192 square miles
- Lowest elevation at 220 ft; tops out at 7000 ft
- Lacks glacial ice, minimal summer ice melt component
- Most heavily impacted by land use
- Frequent CWA standard exceedances for temperature and sediment
- Surrogate for conditions in 2075 for NFNR and MFNR
- Tributary to the Salish Sea

Why do we care about the SFNR?
Salmonids in the Nooksack River

- Nine species of Pacific salmonids
- Three species are protected under the ESA
  - Spring Chinook salmon
  - Steelhead/rainbow trout
  - Bull trout

Spring Chinook salmon are of particular value to the Nooksack Indian Tribe for subsistence, cultural, ceremonial, and commercial uses

Why do we care about the SFNR?

- Flows are declining, particularly during the summer-fall months.
- Typically, state-mandated minimum instream flows are currently not met approximately 220 days per year.
- Late summer streamflows will likely decrease 70% by 2075 due to climate change.
- Climate change by 2075 could further extend this deficiency by an additional 70 days, or total 290 days.
- Significant water quality exceedances occur for temperature and sediment due to legacy land uses and natural causes.
- All of these factors have contributed to a large reduction in salmon stocks in the SFNR and have impeded recovery results.
- Today, native salmonid runs are <u>less than 8%</u> of the runs in the late 1800's.
- Recent indications suggest runs <u>closer to 1 to 3%</u> for SFNR.

Projects that address these issues:

1: SFNR temperature Total Maximum Daily Load (TMDL)

- In August 2011, WA DOE and EPA Region 10 invited the Tribe to participate in the development of the TMDL project.

- The Tribe provided comments on the scope of the TMDL immediately upon being invited to participate and contribute.

- A TMDL is an evaluation process and regulatory tool to help bring an impaired water body (303(d) Category 5) into compliance with the State and Federal and State Clean Water Act standards.

What is a TMDL?

1. **Watershed Characterization** — understanding the basic physical, environmental, and human elements of the watershed.

2. **Impairment Status** — analyzing existing data to determine if waters fully support beneficial uses and/or supported under natural conditions.

3. **Data Gaps and Monitoring Report** — identification of any additional data needs and monitoring recommendations.

What is a TMDL?

4. **Source Assessment** — identification of sources of pollutants, and magnitude of sources both point sources (e.g., industrial) and non-point sources (e.g., forest practices).

5. **Load Allocation** — determination of natural pollutant load, and load from human activities (i.e. diffuse nonpoint sources and point discharges).

6. **Set Targets** — establishment of water quality targets intended to restore or maintain beneficial uses. **(e.g., realistic natural conditions, CWA standards)**

7. **TMDL Implementation Plan** — a watershed management strategy to attain established targets.

Projects that address these issues:

#1: SFNR temperature Total Maximum Daily Load (TMDL)

- In the case of the SFNR, non-point source pollution predominates, with only one point source.
- Non-point source pollution is not subject to regulatory action, only voluntary actions.

South Fork Nooksack River

- Tribe concerned that the temperature TMDL would not directly address:
  - Upland watershed processes
  - Legacy impacts
  - Climate change
  - Reasonable natural conditions
  - Don't just focus on the CWA numeric criteria, but more importantly:
    - Focus on impacts to fish – the designated or beneficial use of the SFNR

South Fork Nooksack River

- In Tribe's opinion, the temperature TMDL would not be as useful of a tool unless climate change, legacy impacts, and upland watershed processes were also addressed.

- If the point of the TMDL was to bring the SF Nooksack River into water quality compliance, how would the TMDL address salmonid fish survival—the beneficial use of the river under the CWA?

Implications of Natural Conditions:

- Outcome of TMDL highly dependent on the assumptions made for the modeled “natural conditions”, or “system potential.”
- By definition: “Conditions present prior to the pollution problem.”
- Climax forest conditions prior to European settlement.
- TMDL assumptions not consistent with the Tribe’s understanding of natural conditions.
- Using data from the Tribe, modeled temperature under natural conditions cooler than the results based on the standard assumptions made.

Implications of Natural Conditions:

- This is particularly important in regard to how **WAC 173-201A-260 (1)(a)** is applied.
- WAC states that if the modeled natural conditions of Category 5 water do not meet the applicable standard, then the new standard becomes that modeled temperature regime for natural conditions.
- A possible interpretation of this state policy is that there is no water temperature issue in the SFNR.
- Does not facilitate compliance with the intents of the CWA.
- Has huge implications on salmon recovery and restoration planning.

Important factors in assessing realistic natural conditions:

- Tributary temperatures
- Natural channel planform geometry
- Buffer tree height and buffer width
- TMDL assumed natural conditions adequately represented by tree height associated with the 100-yr site index, 160 vs 250 ft
- Depth of hyporheic exchange
- However, existing tributary flow conditions were assumed to be natural conditions

Results of TMDL

Agencies made a reasonable attempt to address our concerns over natural conditions by conducting a sensitivity analysis.

Condition	Average Maximum Stream Temperature (deg C)		
WQ Criteria	12	16	16
River Reach	Headwaters to RM 28	RM 28 to Confluence	All Reaches
Original Prediction	17.8	19.6	18.7
Cooler Headwaters (20%)	16.9	19.0	18.0
Natural Channel Geometry	17.2	18.9	18.1
Increased Riparian Tree Height and Buffer Width	16.7	18.2	17.5
Enhanced Hyporheic Exchange	17.8	19.3	18.6
Combined Natural Parameters	15.1	16.4	15.8
Percent Change	-15.2%	-16.3%	-15.5%

Results of TMDL

Importance of Reasonable Natural Conditions

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Percent Change	-15.2%	-16.3%	**-15.5%**

These results not fully integrated into the TMDL, but presented as a sensitivity analysis

South Fork Nooksack River

- The SFNR temperature TMDL identified the potential tool of a watershed conservation plan as a means to address non-point source pollution.
- No regulatory requirements to address non-point source pollution.
- Commercial forestry the primary land use.
- The current regulatory programs assume compliant forestry has no impacts on water quality or quantity.
- Deferred addressing non-point source pollution to the “community.”

South Fork Nooksack River Temperature Total Maximum Daily Load

Water Quality Improvement Report and Implementation Plan

TMDL initiated August 2011
DRAFT TMDL released August 2018
FINAL TMDL not released until February 2020

DEPARTMENT OF ECOLOGY
State of Washington

February 2020
Publication No. 20-10-007

Important factors in assessing realistic natural conditions:

- The fact that the SFNR temperature TMDL addressed our comments on natural conditions and the sensitivity analysis was accomplished allowed the TMDL to move forward from Draft to Final while other TMDL's in WA and OR were on hold awaiting the outcome of litigation over the issue of reasonable natural conditions.

Our Comments on the TMDL implementation plan:

- A plan on how to address the NPS pollution issue to bring the waterbody back into compliance.
- A required element of a TMDL.
- SFNR TMDL implementation plan lacked detail.
- Deferred development of implementation detail to SFNR community for monitoring and adaptive management after 5 years.
- Suggests that local stakeholders be responsible for developing the plan detail, implementation, and monitoring.

Our Comments on the TMDL implementation plan:

- TMDL assumed compliant forestry had no influence on water quantity, water quality, and was not a consideration of the TMDL.
- Primarily focused on the impacts of agriculture, community development, transportation, and flood control as the primary human influences on temperature exceedances.
- Little information presented on upper watershed land uses because of NPS pollution not being regulated.
- Minimal information on how forestry could be engaged to participate in addressing the NPS that might be a source of the pollution.

#2: SF Nooksack River Temperature TMDL/ Climate Change Pilot Research Project

- Concurrently with implementing the TMDL project, EPA–ORD was developing a pilot research project that functionally integrated climate change into a temperature TMDL.
- EPA was searching for a TMDL project and decided to apply the pilot research project to the SF Nooksack River.
- The pilot research project was designed to support the TMDL project in reducing the impact of high stream temperatures and climate change impacts on salmon.
- But more importantly, support both salmon recovery and CWA compliance by focusing on what salmon habitat restoration actions would be needed to promote salmon survival and recovery in the face of climate change.

SOUTH FORK NOOKSACK RIVER CLIMATE CHANGE PILOT RESEARCH PROJECT

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**

Tribe had substantial impact on outcome of federal research project and TMDL regulatory program.

SF Nooksack River Temperature TMDL/ Climate Change Pilot Research Project

- Circumstance meets opportunity to yield the:
- "EPA Region 10 Climate Change and TMDL Pilot Project"
- First temperature TMDL project in the US to directly and functionally address climate change as an important factor in the TMDL process.
- The Tribe's focus on reasonable natural conditions allowed the Final TMDL to be released to the public (2020), while all other TMDLs in WA and OR were on hold pending the results of litigation over "assumed" programmatic natural conditions.

Quantitative Assessment:

- Modeling of flow, shade, and temperature under various climate scenarios.
- Analysis conducted by Tetra Tech, Inc.

Qualitative Assessment:

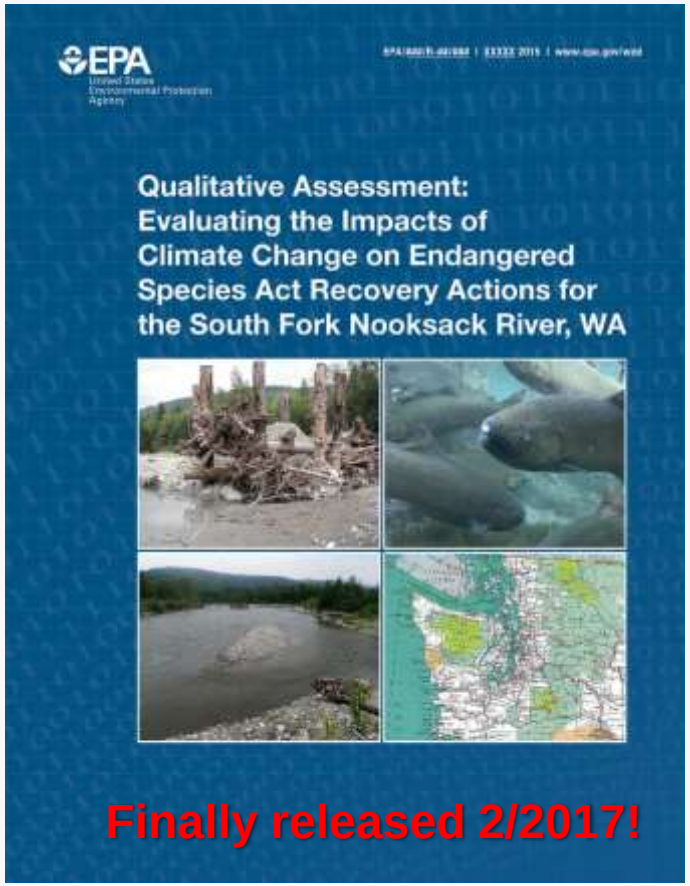
- Comprehensive analysis of freshwater habitat for ESA salmon restoration in the SFNR in the face of climate change.
- Resulted in a prioritized list of climate change adaption strategies that supports salmon recovery and habitat restoration in the SFNR under climate change.

Local technical expertise and experience provided by Nooksack Indian Tribe.

Pilot Research Project

- **Together, these Assessments represent robust and comprehensive actions to:**
  - **1) get to the intent of the CWA criteria/standards**
  - **2) protect the CWA beneficial uses (salmon survival and salmon habitat) *AND***
  - **3) facilitate meeting ESA recovery goals taking climate change into consideration.**

Qualitative Assessment: Evaluating the Impacts of Climate Change on Endangered Species Act Recovery Actions for the South Fork Nooksack River, WA



Key Messages:

- Identify and prioritize ESA climate change adaptation strategies or recovery actions for the SFNR that explicitly include climate change as a risk.

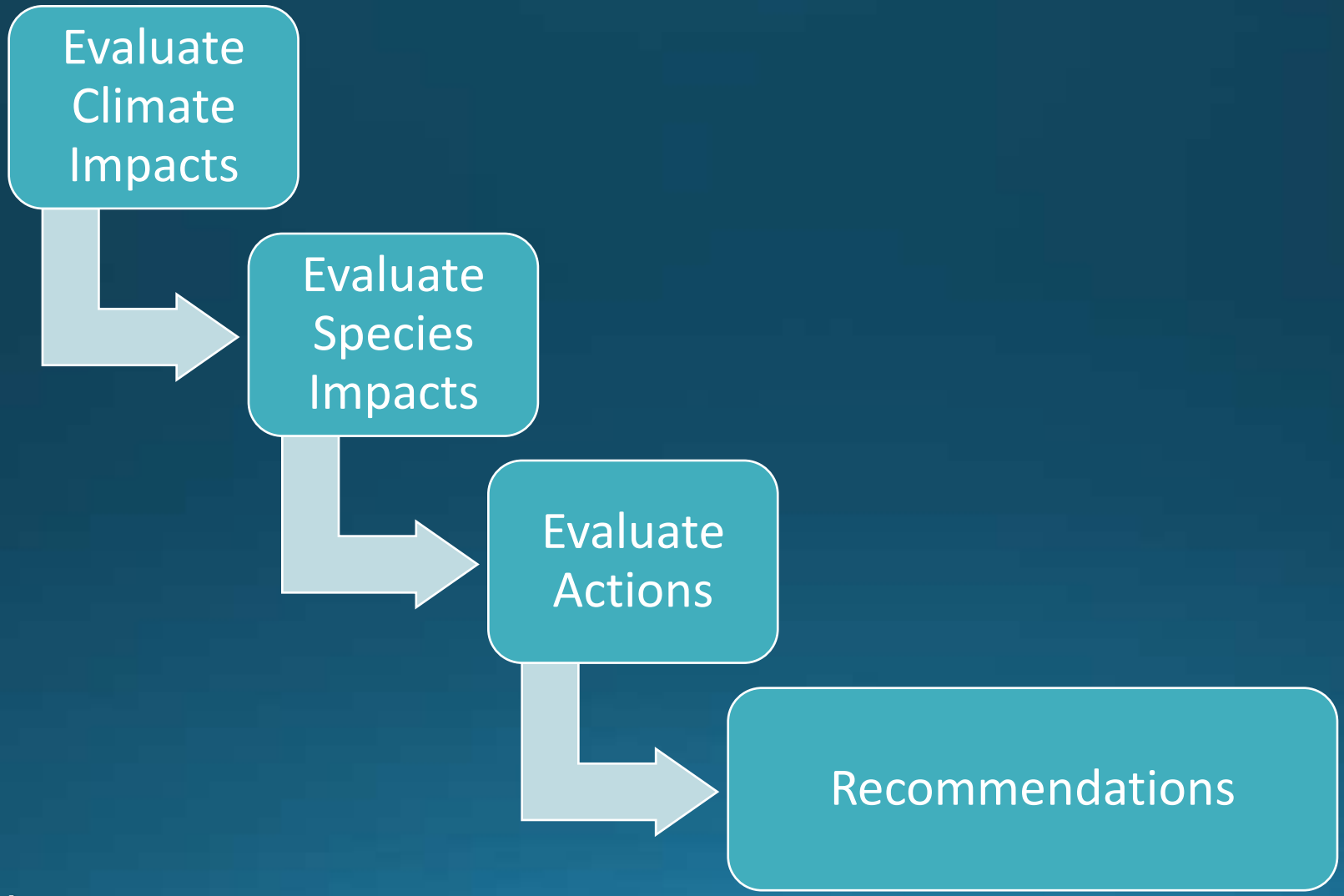
- Methodology based on Scientific Literature: ***Restoring Salmon Habitat for a Changing Climate*** (Beechie et al. 2013).

- Utilized Interdisciplinary Teams (Federal, Tribal, State, Local, WRIA 1) to develop research pilot demonstration and complete the assessment.

Projects that address these issues :

- **EPA-ORD SFNR Climate Change Pilot Research Project**
- Tribal staff were the authors of the "Qualitative Assessment" report, published by the EPA in 2016 (Grah, Coe, Maudlin, Currence, Beaulieu).
- Publication focused on CWA compliance, climate change impacts on fish, vulnerability assessment, and adaptation and resilience planning.
- First EPA publication with Tribal staff as senior authors.

QUALITATIVE ASSESSMENT



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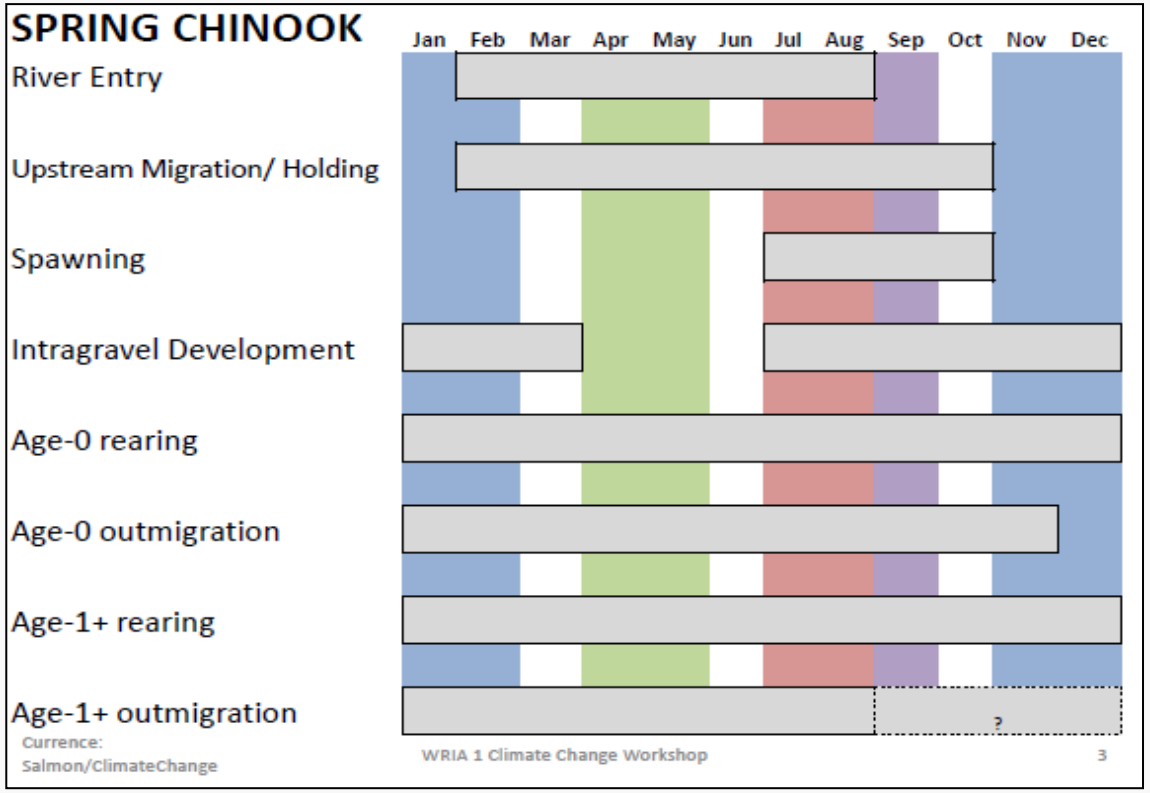
Qualitative Assessment: Timing of Climate Change Effects of Stream Flow and Temperature on Spring Chinook by Life History Periodicities



LIFE STAGE

CLIMATE RISK

- – Increased Winter Peak Flows
- – Loss of Spring Snowmelt Reducing Discharge
- – Increased Summer Temperatures
- – Decreased Summer Low Flows and Increased Temperatures
- – Respective Life Stage Periodicities

Includes increases in turbidity and sediment

Source: Workshop Summary, Final Draft Report, May 14, 2013, Restoring Salmon Habitat for a Changing Climate In the SFNR, Washington. Adapted from Currence (Nooksack Natural Resources Staff) and Beechie et al 2012.

Qualitative Assessment: Summary of Major Categories of Restoration Action Types

Ability To Ameliorate Climate Change Risks

Restoration Tool

Climate Risk

Expected climate change effect	Longitudinal connectivity	Floodplain connectivity	Restore incised channel	Restore stream flow	Restore riparian functions	Reduce sediment supply	Construct instream habitat
Increased temperature	Y	Y	Y	Y	Y	N	N
Decreased low flow	Y	N	Y	Y	Y/N	N	N
Increased peak flow	N	Y	Y	N	N	N	N
Reduced diversity	Y	Y	Y	Y/N	N	N	N

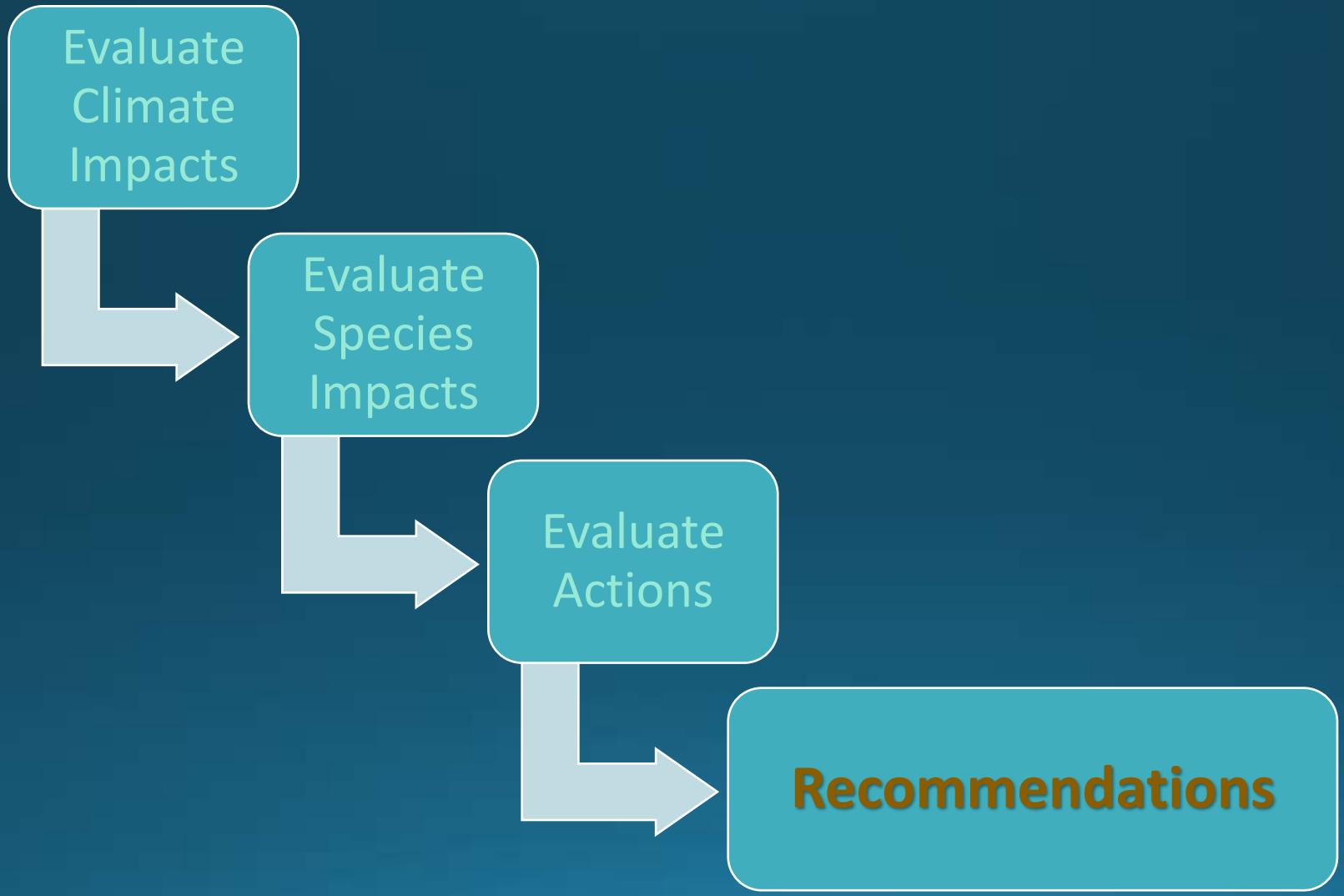
Y Positive Effect

N No Effect

Y/N Context-dependent Effect

Source: Workshop Summary, Final Draft Report, May 14, 2013, Restoring Salmon Habitat for a Changing Climate In the SFNR, Washington. Adapted from Beechie et al 2012.

QUALITATIVE ASSESSMENT



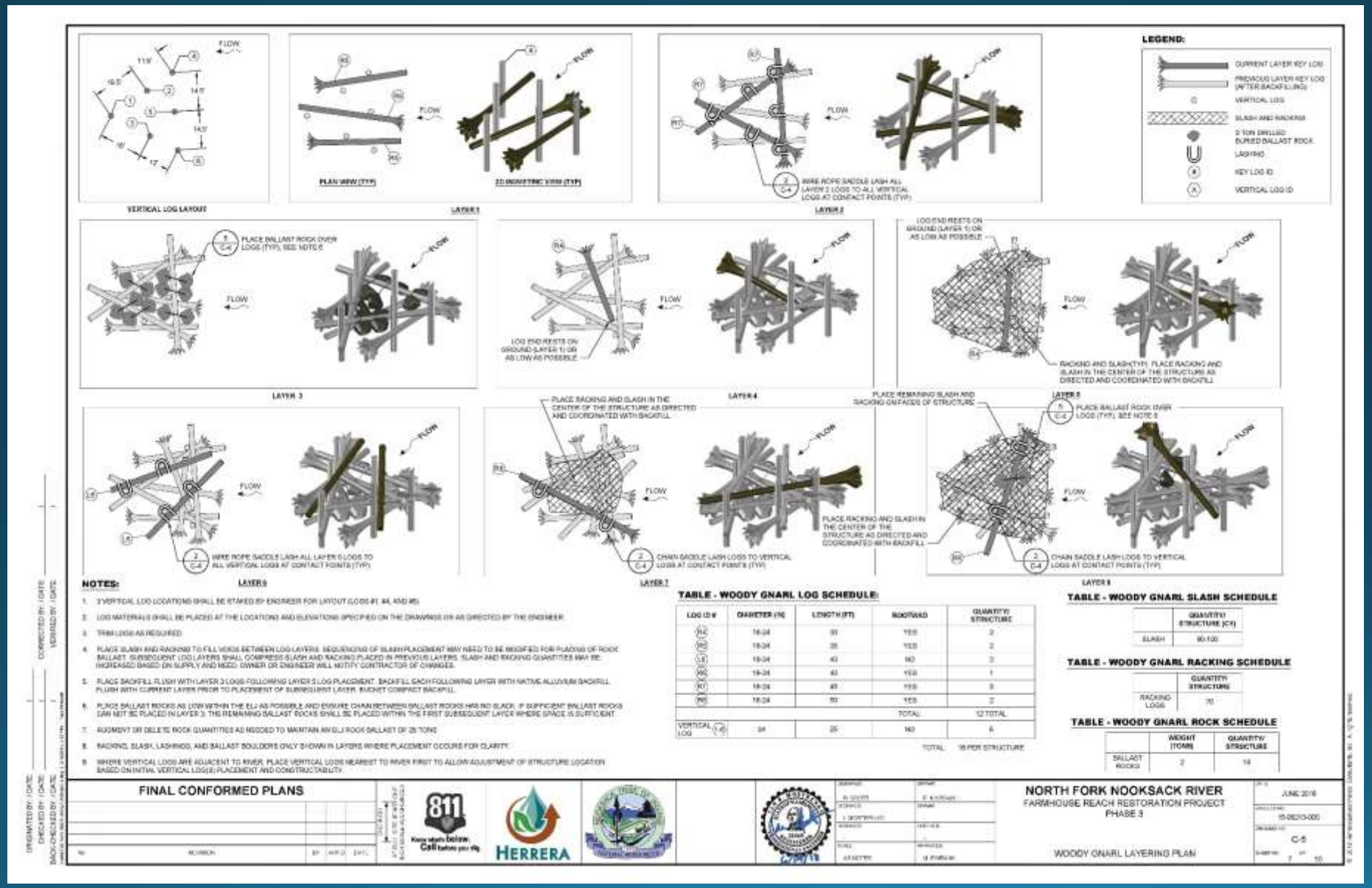
Coe, unpublished

ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

- RECONNECT RIVER TO FLOODPLAIN
- RESTORE RIPARIAN AREAS
- CONTINUE INSTREAM REHABILITATION/RESTORATION

More, bigger, faster

North Fork Farmhouse Phase 3 Logjam Detail



North Fork Farmhouse Phase 3 Logjam Construction

ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

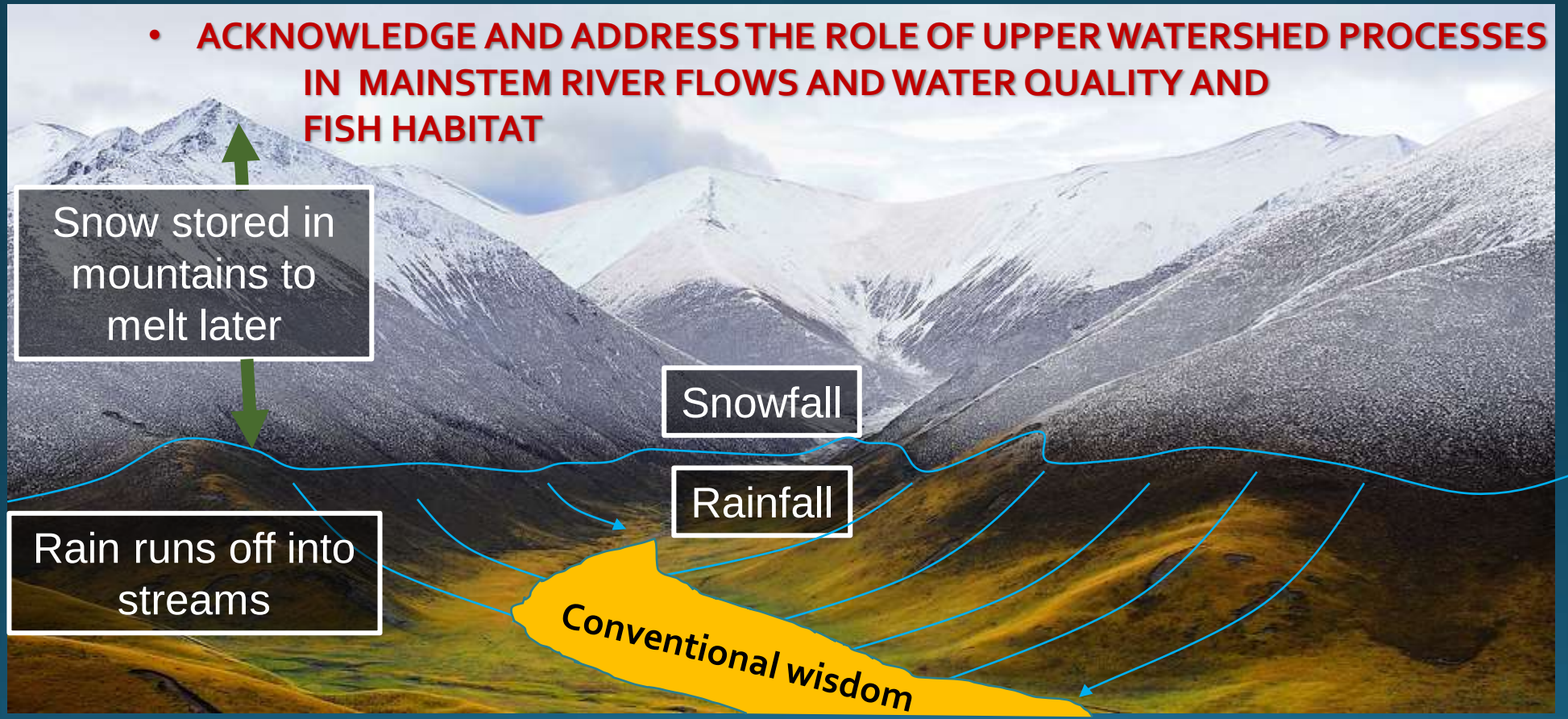
- RECONNECT RIVER TO FLOODPLAIN
- RESTORE RIPARIAN AREAS
- CONTINUE INSTREAM REHABILITATION/RESTORATION — More than this is needed to offset climate change
- RESTORE FLOW REGIMES — This strategy given little or no attention
- PROMOTE LONGITUDINAL CONNECTIVITY
- RECONNECT FLOODPLAINS TO THE RIVER
- REDUCE SEDIMENT DELIVERY

ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

- ADDITIONAL ACTIONS:

Motivation: Climate Change Effects on Streamflow

Current Climate



Slide courtesy of Karl Lapo, UW Mountain Hydrology Research Group
Photo: https://www.flickr.com/photos/reurinkjan/4462015331

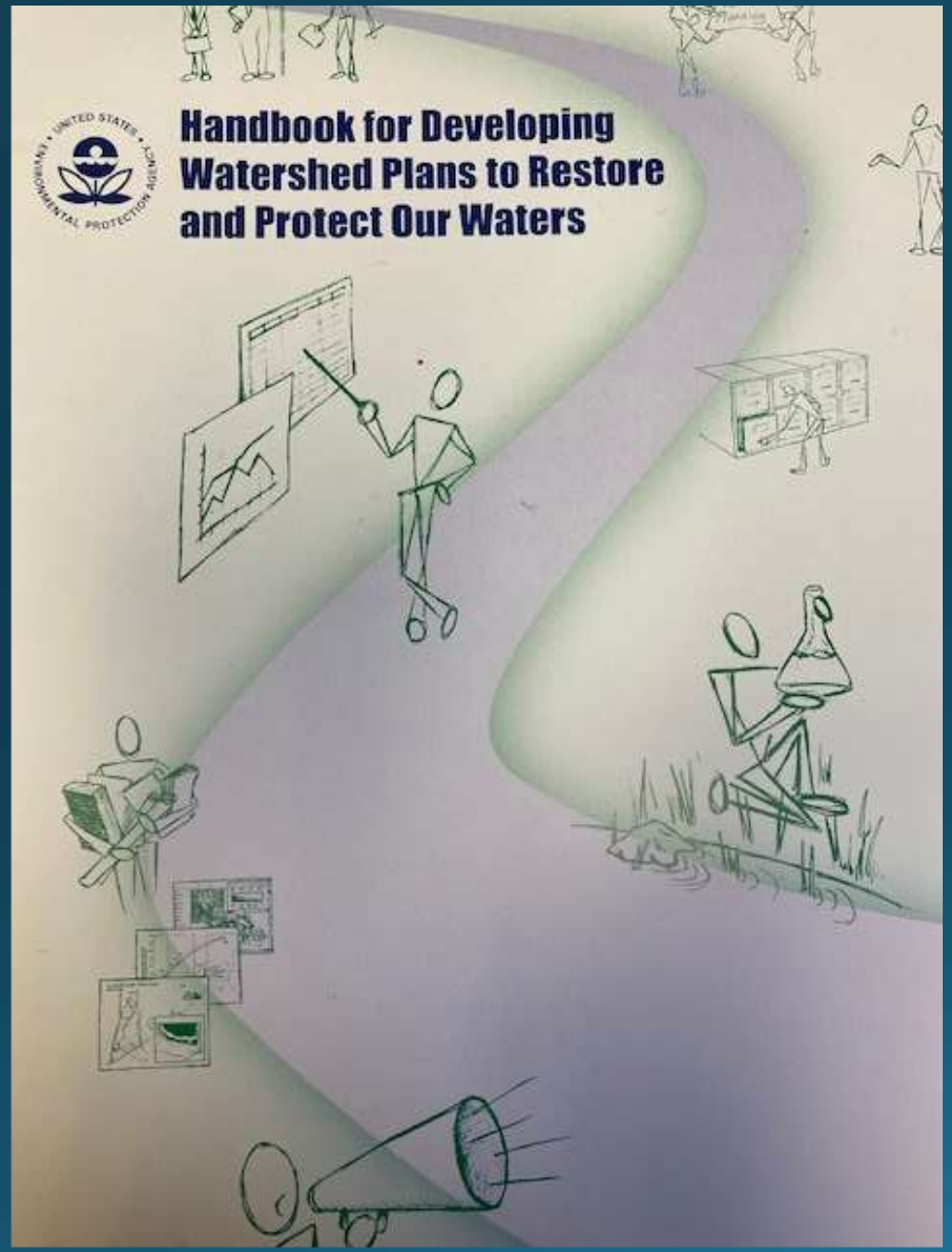
ACTIONS TO PROMOTE RESILIENCE TO CLIMATE CHANGE:

- **ADDITIONAL ACTIONS:**
  - ACKNOWLEDGE AND ADDRESS THE ROLE OF UPPER WATERSHED PROCESSES IN MAINSTEM RIVER FLOWS AND WATER QUALITY AND FISH HABITAT
  - DEVELOP A WATERSHED CONSERVATION PLAN THAT INCLUDES TOOLS THAT PROMOTE WATERSHED RESILIENCE IN THE FACE OF CLIMATE CHANGE
  - DESIGN AND IMPLEMENT WATERSHED RESTORATION TOOLS THAT SUPPORT AND SUPPLEMENT TRADITIONAL INSTREAM TOOLS
  - VOLUNTARY ACTIONS THROUGHOUT THE WATERSHED
    - Forestry
    - Transportation
    - Agriculture
    - Development
    - Government

Elements and Projects:

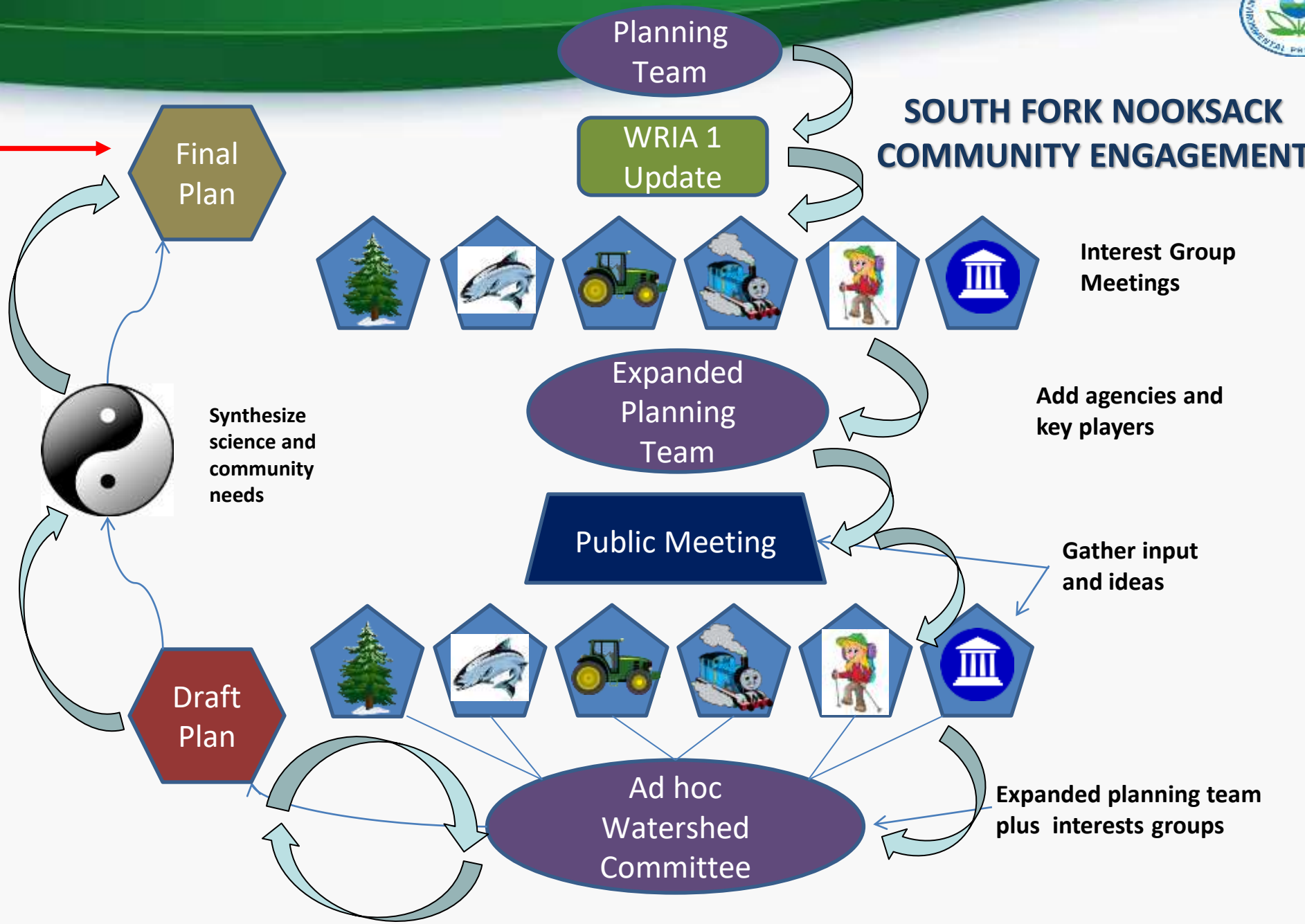
Elements and Projects:

- **SFNR Watershed Conservation Plan**
- **Both the SFNR TMDL and EPA Climate Change projects recommended that a comprehensive watershed conservation plan be developed that addressed legacy impacts, water quality impairments, and climate change, taking community values and interests into consideration.**
- **An intensive and extensive public outreach and stakeholder engagement process was implemented in preparing the plan.**
- **A draft plan was produced in 2017 and we are currently updating the plan for release in April or May 2022.**



- EPA's guidance on developing watershed plans to address point and non-point pollution.
- Focus is on urban and sub-urban watersheds with a predominance of point pollution.
- Focus of addressing non-point pollution is treating the impaired water body through instream structures, riparian restoration, etc.; almost no focus on watershed away from the water body.
- Almost no guidance on forested and natural resource-based watersheds (forestry) with non-point pollution issues.
- Essentially promotes a knowledge gap on the influence of natural resource management in the watershed on streamflows.

SOUTH FORK NOOKSACK COMMUNITY ENGAGEMENT



The missing piece of the overall watershed restoration puzzle:

Restore and enhance **UPPER** watershed hydrologic function

Why focus on upland watershed processes?:

- The convention in watershed restoration is to focus on the waterbody, riparian buffer, and floodplain; without much focus on the upper watershed.

- Most of our watersheds in western WA are forested with commercial forestry the primary land use.

- In WA, the forest practices act primarily focuses on water quality, very little focus on water quantity.

- Includes reference to “hydrologic maturity”; however, not routinely addressed or considered in Forest Practices Act permitting.

- Hydrologic maturity means “mature” vegetation has a canopy closure of 70 percent or more, and a diameter (dbh) of 9 inches or more.

Why focus on upland watershed processes?:

- Studies suggest that this definition of hydrologic maturity is unreasonable.

- Some focus on peak flows and flooding, not low flows.

- But what about baseflows during the low-flow season typically the most critical time for fish and water availability for other beneficial uses?

- Apparently no consideration in WA FPA of these potential influences.

- Modified management of our watersheds could address the cumulative impact of legacy land uses and continued future climate change on stream flow, including water supply.

- Legislative action would be required to update WA FPA to address the likely influence of forest harvest on late summer streamflows.

Why focus on upland watershed processes?:

- So, what is the basis of concern over the influence of forest harvest on summer low flows?

- Research starting in the late 1800's through today shows that there is an influence of forest management on streamflow.

- Typically, focus is on increased annual yield, but not on timing of flow increase or flow decrease, such as baseflows in the summer.

- Generally, forest harvest increases annual water yield through higher peak flows, but results in a narrower hydrograph base with reduced summer flows.

Why focus on upland watershed processes?:

- Research in the PNW (Oregon) suggests that timber harvest has an influence on late summer flows.

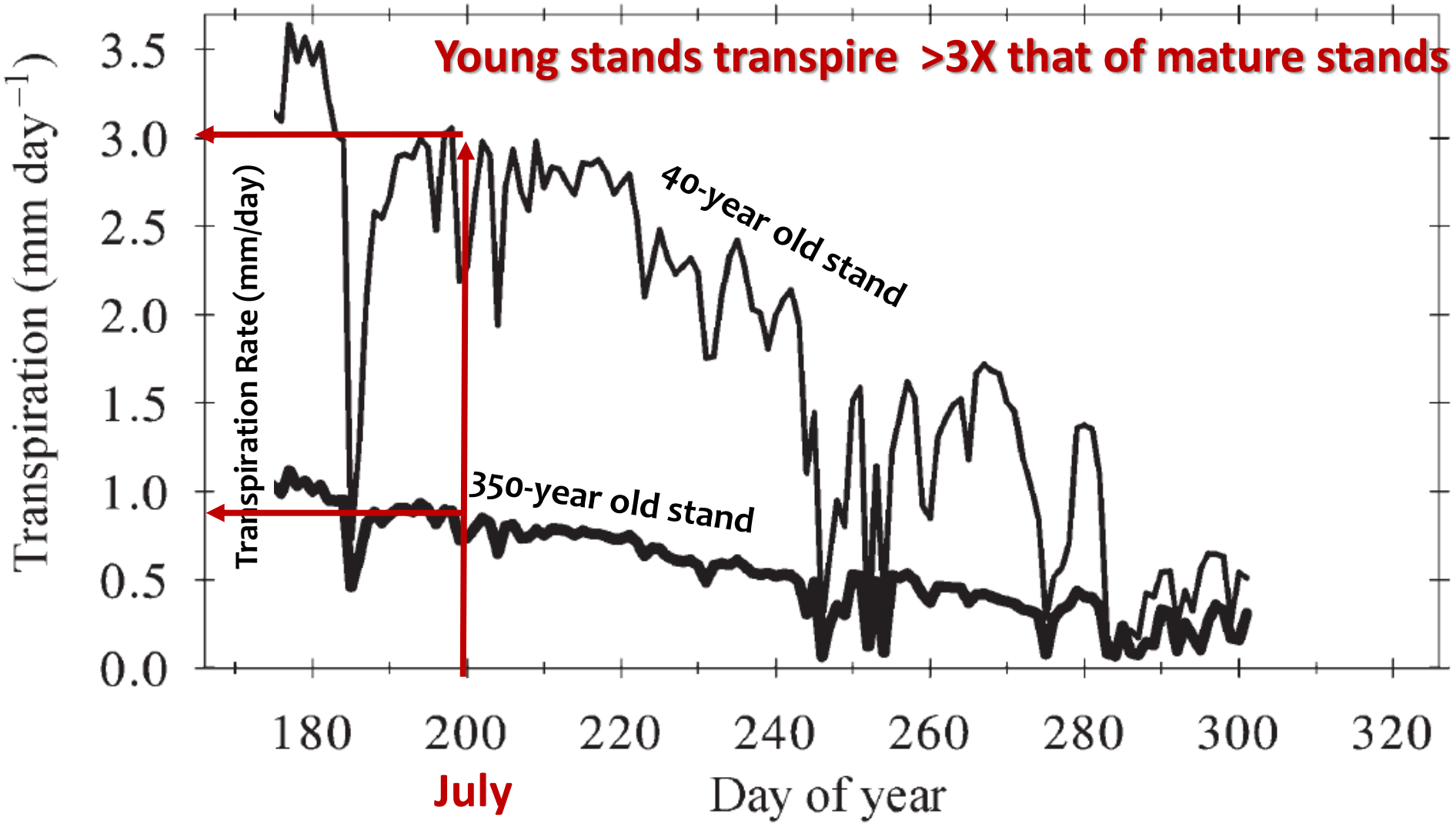
- A paired watershed study found that forest harvest and the age of regeneration has substantive influence on the hydrology of the watershed (Perry and Jones, 2016).

- They found that baseflows in logged watersheds may be reduced by 50 percent compared to watersheds with predominantly mature and old growth stands.

- The logged watersheds showed no sign of recovery from prolonged depletion of late season streamflows in watersheds logged 40-50 years ago, compared to unlogged watersheds with mature/old growth forest stands.

- Many factors are involved, but the higher transpiration rates of regenerating young forests compared to older forests appears to be the primary factor involved with the late summer flow reduction.

Soil Moisture: transpiration rates



Re-generating Doug Fir stands (~40 years old) transpire **3x more** than old growth stands

Moore et al. (2004): HJ Andrews Exp. Forest, OR

Why focus on upland watershed processes?:

- Similar research in the Oregon Coast Range (Segura et al. 2020) also suggests that timber harvest has an influence on reduced late summer flows.
- Cobble et al. (2020) evaluated several watershed studies in Oregon, Northern California, and Idaho and found variability in how a stream responds to forest harvest.
- They found decreased low flow was observed years after harvest in 16 of 25 watersheds.
- We found no specific information or research on the influence of forest management in the Nooksack River watershed.
- Given the importance of water supply and fish recovery in the watershed, we should know about such influences if they occur.

→ **Suggests a significant relevant knowledge gap.**

Why focus on upland watershed processes?:

- Through literature review on these topics, we identified this knowledge gap in regard to how commercial forestry might influence late summer streamflows in the Nooksack River watershed.

- Current forest harvest regulations and the CWA do not address this knowledge gap.

- Not reasonable to assume that these results for Oregon directly applies here in the Nooksack River watershed.

- As such, we identified the obvious hypothesis that needs to be tested: *"commercial forest harvest in the Nooksack River watershed has an influence on late summer streamflow."*

- Developed a research project to address this knowledge gap and test this hypothesis.

Why focus on upland watershed processes?:

- Evaluation of potential forest management influences on streamflow could inform us on strategies to facilitate late summer streamflows that address and potentially offset the added impact of continued climate change on streamflows and water quality, as well as current and future water demand issues.

- The Tribe and collaborators have recently completed such a pilot research project using BIA grant funding to model the effect of forest management on late summer flows in the SFNR, and thus test the above hypothesis. Susan Dickerson-Lange (NSD) and Bob Mitchell (WWU)

- Collaboration between the Tribe, Natural Systems Design, WWU, UW, and WWT.

- This also includes modeling snow accumulation and melt dynamics and to identify streamflow enhancement opportunities through small gap cuts compared to standard expansive clear-cuts.

- Develop a pilot watershed services exchange project for "water saved" or "produced water" through voluntary modifications of commercial forestry to monetize the produced water. (WWT)

- Legislative action would be required to give this produced water protection status.

South Fork Nooksack River Forest Hydrology Pilot Study

Susan Dickerson-Lange, Bob Mitchell, Julia Jay, Oliver Grah, and Jason Hatch

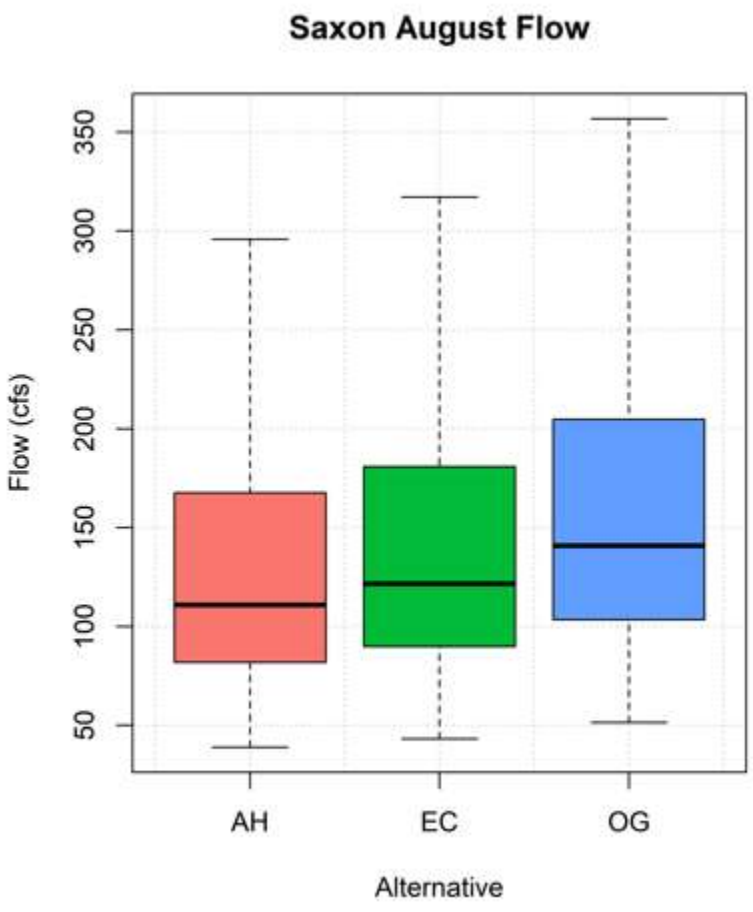
Nooksack Tribe of Indians — Fish and Wildlife

Western Washington University

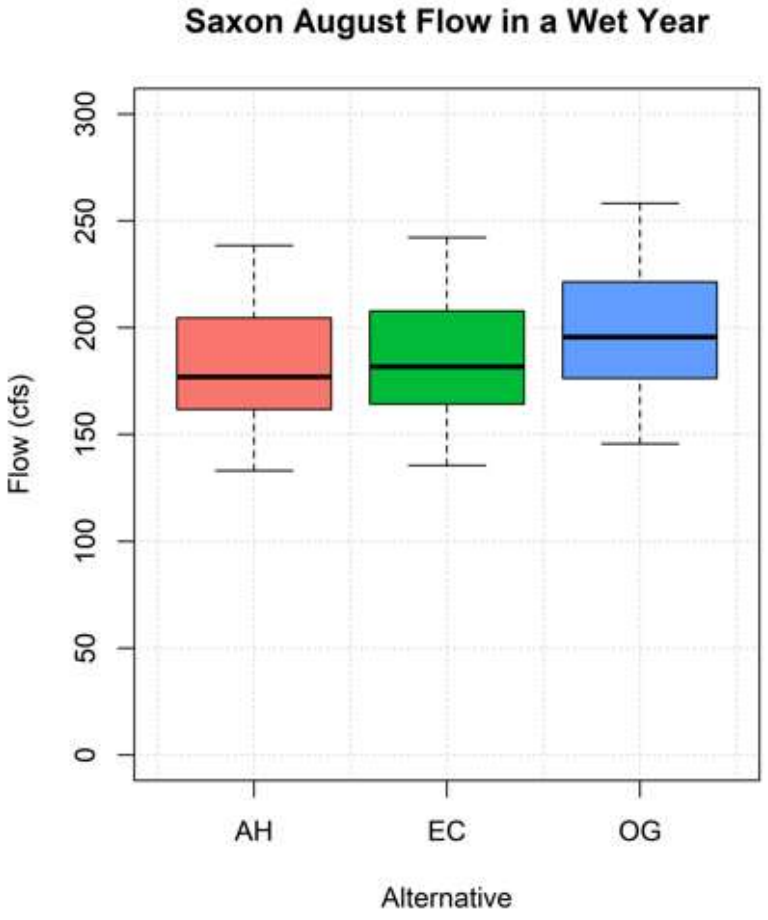
Washington Water Trust — Working to restore our state's rivers and streams.

Natural Systems Design

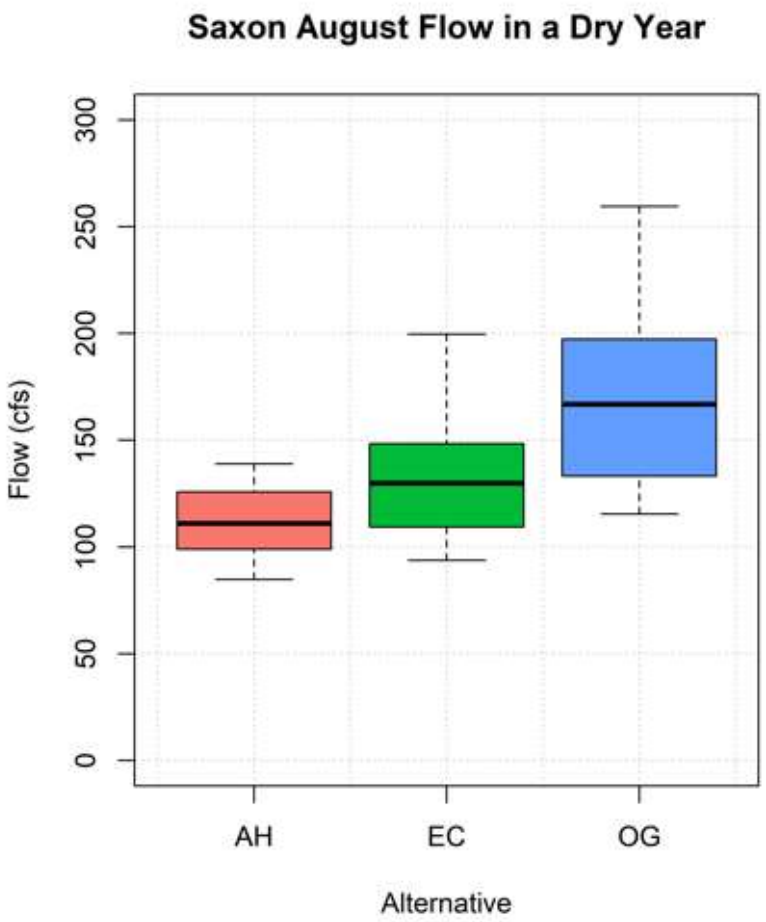
VELMA Experimental Results (PRELIMINARY)



OG vs AH: +30 cfs or 25% increase
OG vs EC: +25 cfs or 21% increase



OG vs AH: +20 cfs or 11% increase
OG vs EC: +15 cfs or 8% increase



OG vs AH: +60 cfs or 55% increase
OG vs EC: +40 cfs or 31% increase

RESULTS of GAP CUTS

- Gap cuts in the snow zone appear to modify snow redistribution and accumulation in a forest in the SFNR watershed.

- On the west slope of the North Cascades, marginally cold atmospheric temperatures melt snow caught on the forest canopy.

- Snow melt drips to the soil or snow surface and infiltrates and percolates to the water table thus leaving the snow accumulation “reservoir.”

- As such, relatively warm temperatures and dense forest canopies on the west side promote the loss of accumulated snow on the forest canopy. Thus, less snow accumulation.

- Small forest gap cuts, if sized and located optimally, capture more snow due to snow redistribution.

- The shading provided by the nearby solar buffering of tree canopy blocks solar radiation of the snow accumulated in the gaps, thus promoting later season snowmelt.

- Modeling the influence of using gap cuts in the snow zone of the SFNR as compared to expansive clear cuts suggests up to a 25 percent increase in late summer streamflow.

Summary of Research

- Our research suggests that the predominate land use in the SFNR watershed, commercial forestry, does have an influence on late summer stream flows, and therefore, stream temperatures.

- Comparing current conditions on commercial forestry lands to a “natural condition” pre-European settlement suggests a potential reduction of streamflow by as much as 25 percent.

- Gap cuts in the snow zone have the potential to increase summer streamflows by as much as 25%.

- We are trying to influence commercial forestry to shift management from strictly financial gains from short-term harvest rotations (less than 40 yrs) by setting up a payment for watershed services program based on monetizing the “produced water” from such changes in forest management.

- In the State of WA there is no special protection given to “produced water” or “salvaged water” that may result from these changes in forest management.

- Such water becomes subject to the existing water rights regulations based on “first in time, first in right.”

- Only through legislative action to provide protection to the produced water can such water be monetized as an incentive to modify forest management.

Elements and Projects:

- **Stewart Mountain Community Forest Initiative**

- The relevance and utility of a community forest in addressing legacy impacts as well as climate change impacts were recognized in the SFNR Watershed Conservation Plan, TMDL, and the EPA Climate Change Pilot Research Project.

- The Tribe has been a founding member in the development of the Stewart Mountain Community Forest that aims to address water quality and flow issues in the SFNR as well as offset forecast climate change impacts.

- Forest land ownership and/or management control through a community forest would allow a shift in forest management to facilitate "produced water" and streamflow enhancement without legislative action.

STEWART MOUNTAIN COMMUNITY FOREST

- If we are to act on these opportunities to modify forest harvest on a voluntary basis, we need to somehow have ownership and/or management control over a block of forest.

- Although we are hopeful that commercial forestry will voluntarily implement longer harvest rotations and/or gap cuts, it is unreasonable to rely on such voluntary actions when so much is at stake.

- The regulatory agencies understand the science behind our research, but any changes to the WA Forest Practices Act or CWA would take legislative action over a long period of time.

- We need to act now in order to offset climate change impacts on flow and water quality in the future.

- As such, we have been actively pursuing a community forest in the South Fork Nooksack River watershed for about eight years.

STEWART MOUNTAIN COMMUNITY FOREST

- The watershed planning process mentioned previously has lead to a team focused on establishing a community forest on the east side of Stewart Mountain.
- In 2017 a timber management investment organization called Conservation Forestry purchased 12,000 acres on Stewart Mountain.
- Conservation Forestry approached our Watershed Planning team with an offer to sell about half of their holding on Stewart Mountain, about 6,000 acres –to establish a Community Forest.
- The SMCF would be owned by the community and managed as a working forest that balances a wide variety of ecological, economic, and community benefits.
- Some of the primary objectives of the SMCF will be to restore natural watershed functions, increase summer streamflows, improve water quality, and recover salmon populations through improved forest management practices.
- SMCF would address much of the lack of regulatory authority of the TMDL and NPS programs.


THANK YOU!


THANKS!