Snover – Part 1

Local climate impacts

Climate change impacts in Chelan County

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Chelan Resilience
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Image Amy Snover

Dealing with climate change means...

Addressing the root cause

Reduce atmospheric greenhouse gases

Preparing for the consequences

Reduce vulnerabilities and build resilience

How much has our climate already changed?

The average year in the NW is 1.54°F warmer than during the first half of the 20th century

Climate Science Special Report 2017

1986–2016 relative to 1901-1960

The coldest day of the year is 4.78°F warmer

NCA, 2018

1986–2016 relative to 1901-1960

The frost-free season is 16 days longer

NCA 2014

1991-2012 relative to 1901-1960

Washington Cascades snowpack decreased ~25% between the mid-20th century & 2006

Source: Stoelinga et al. 2009; Mote et al. 2008

Peak streamflow from snowmelt is occurring up to 20 days earlier (1948-2002) in the Northwest

Source: Snover et al. 2013

The number of large fires and area burned in the Northwest increased from 1973 to 2012

Source: Westerling 2016

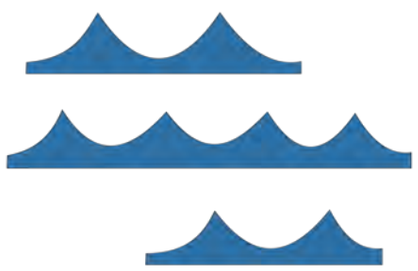
What’s expected for the future?

Projected climate changes in WA state

Warming

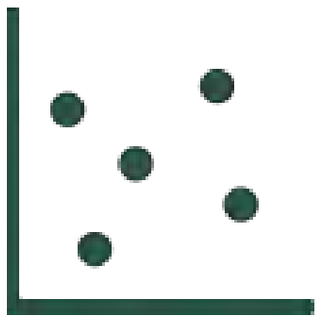
Heavier rains

Less snow,
earlier melt



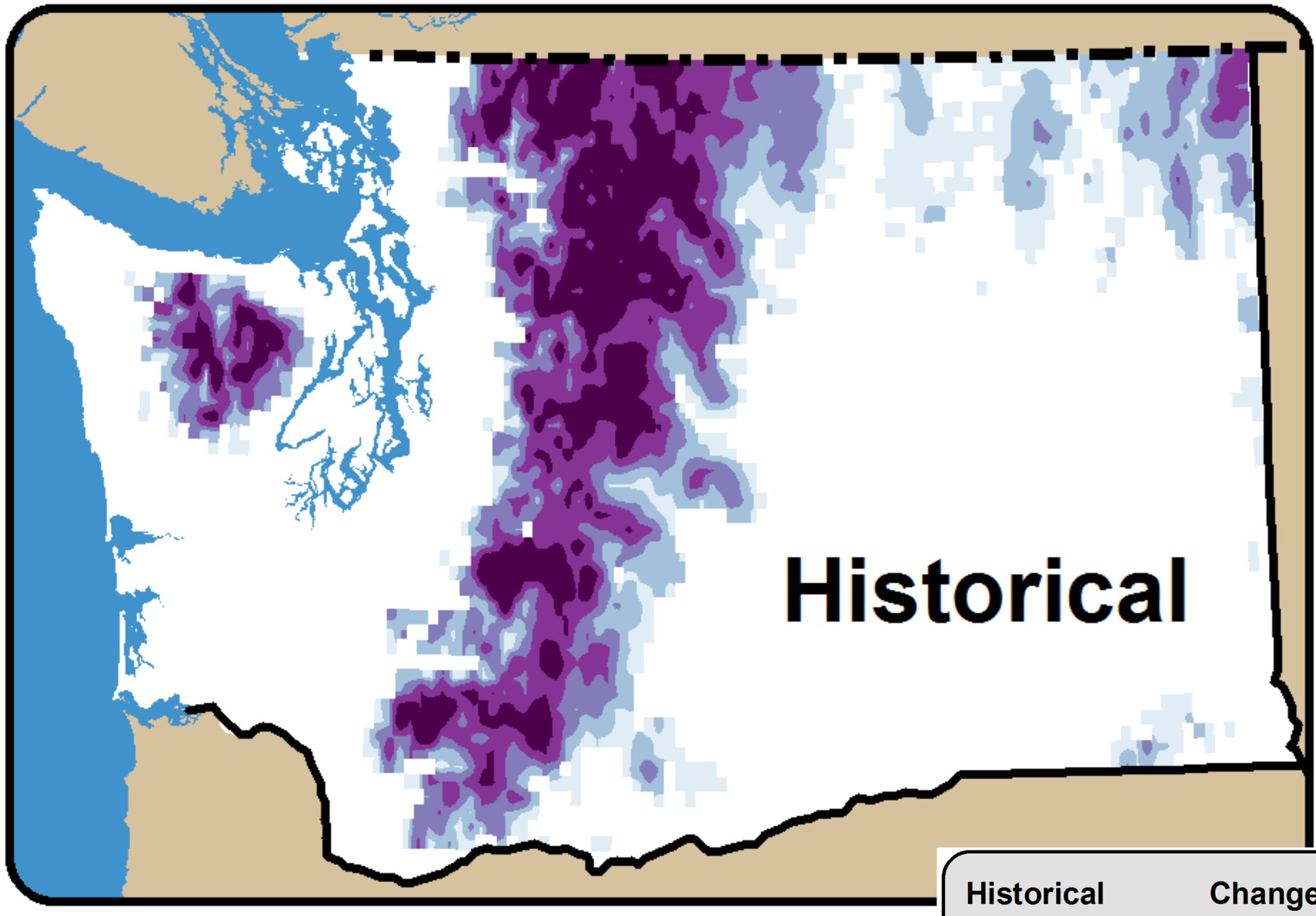
Rising seas

Streamflows:
Higher highs
Lower lows



Natural
variability

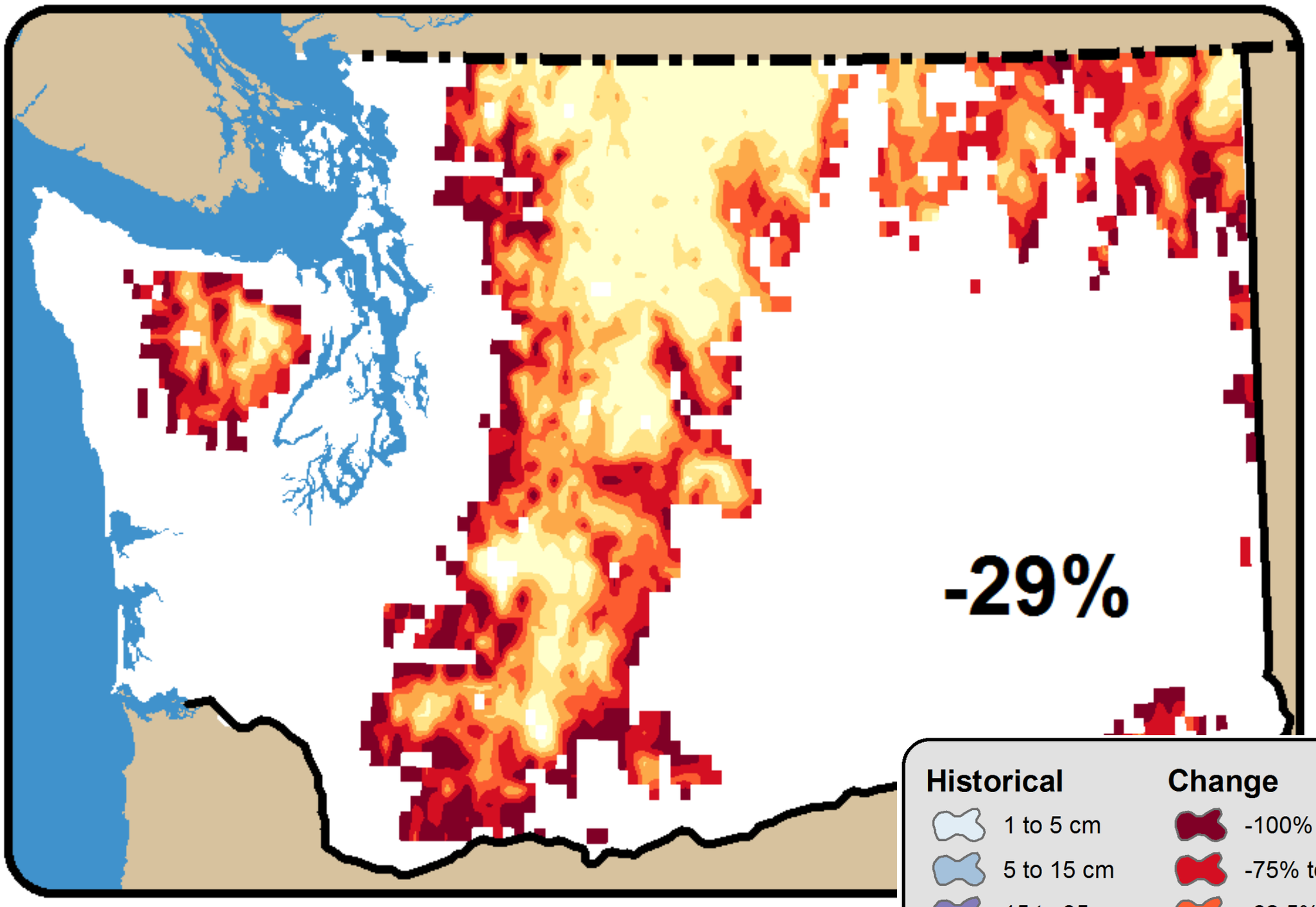
Snover et al. 2013, Mauger et al. 2015.



April 1 Snow Water Equivalent

Elsner et al. 2010

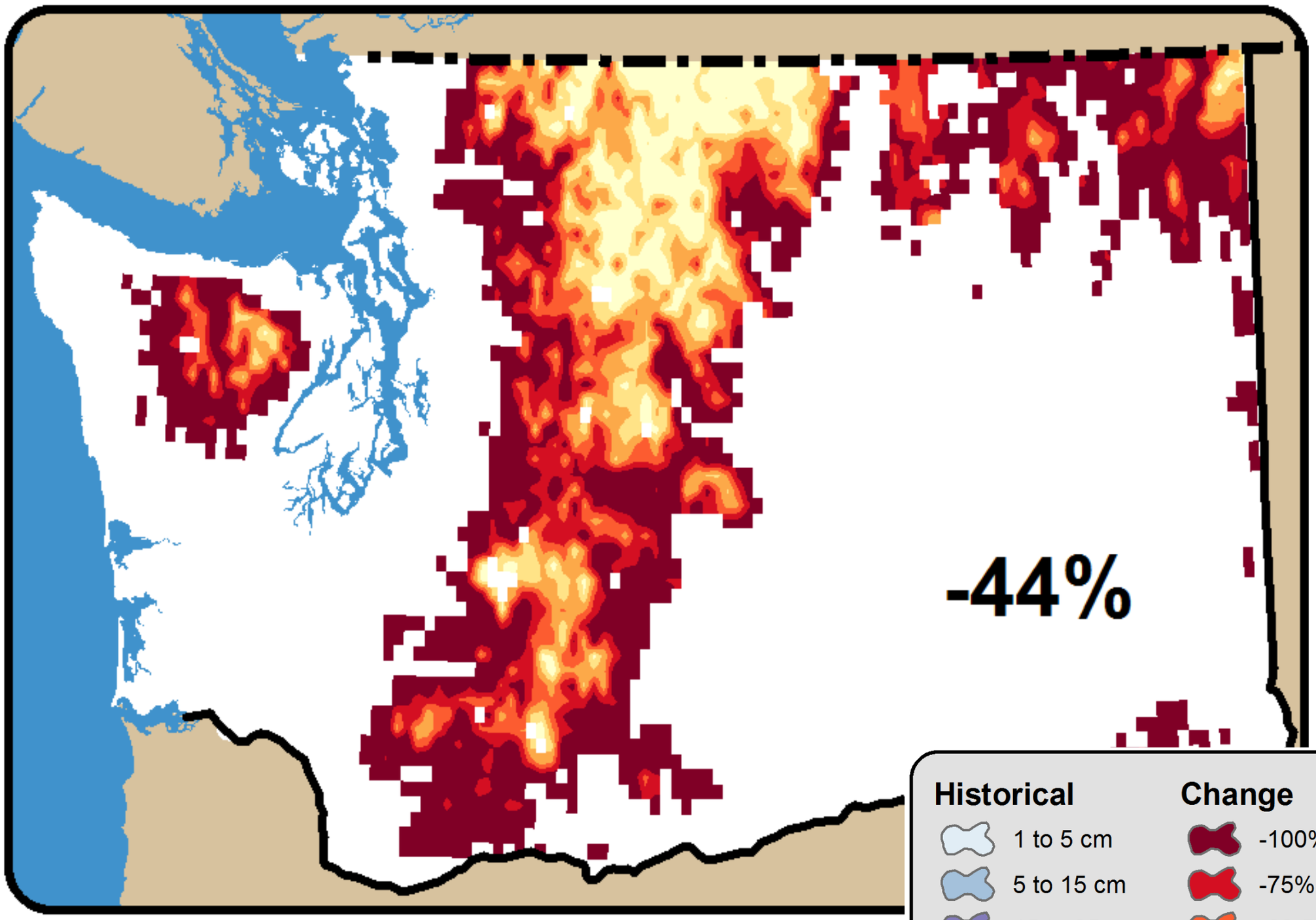
2020s



April 1 Snow Water Equivalent

Elsner et al. 2010

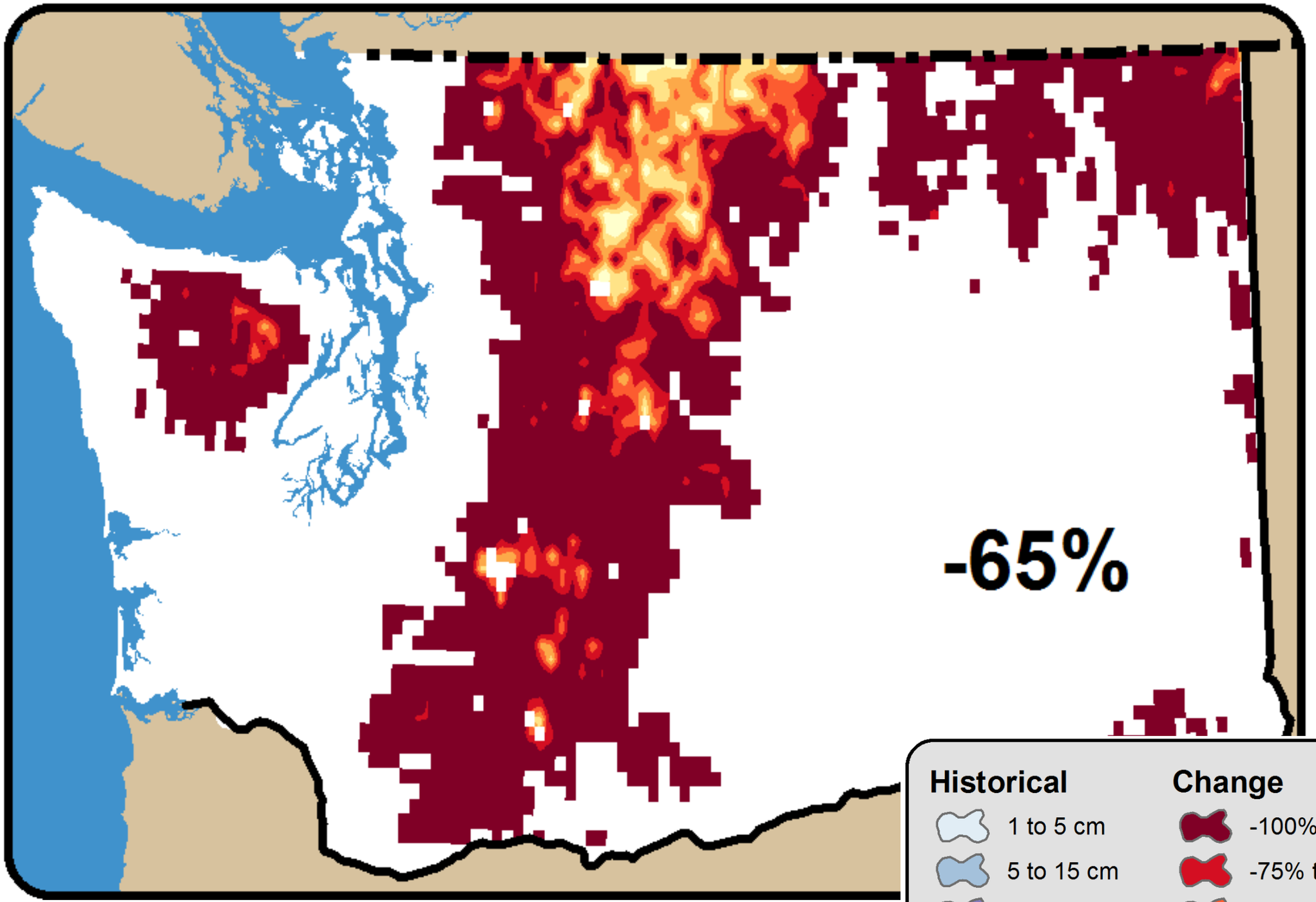
2040s



April 1 Snow Water Equivalent

Elsner et al. 2010

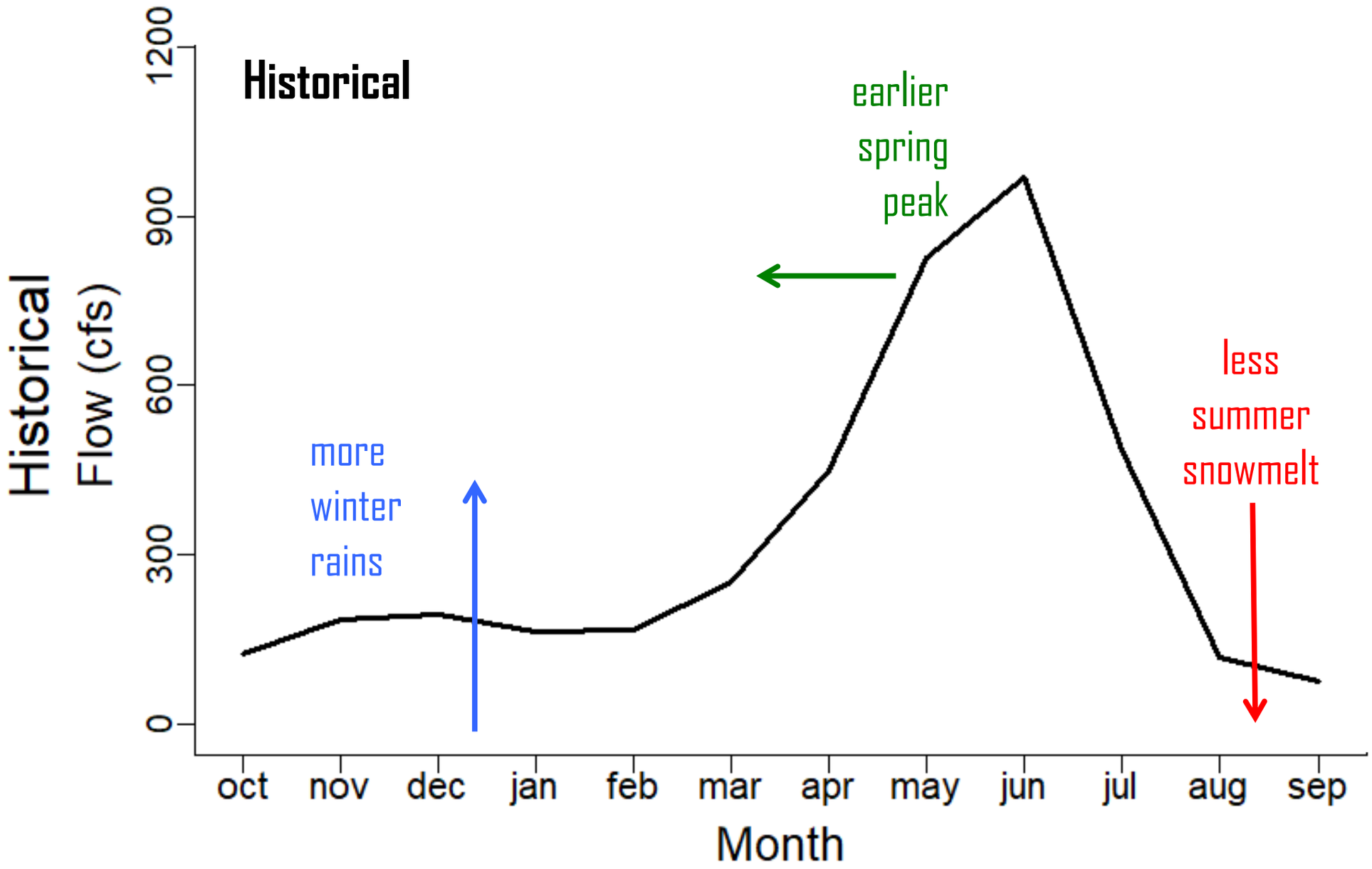
2080s



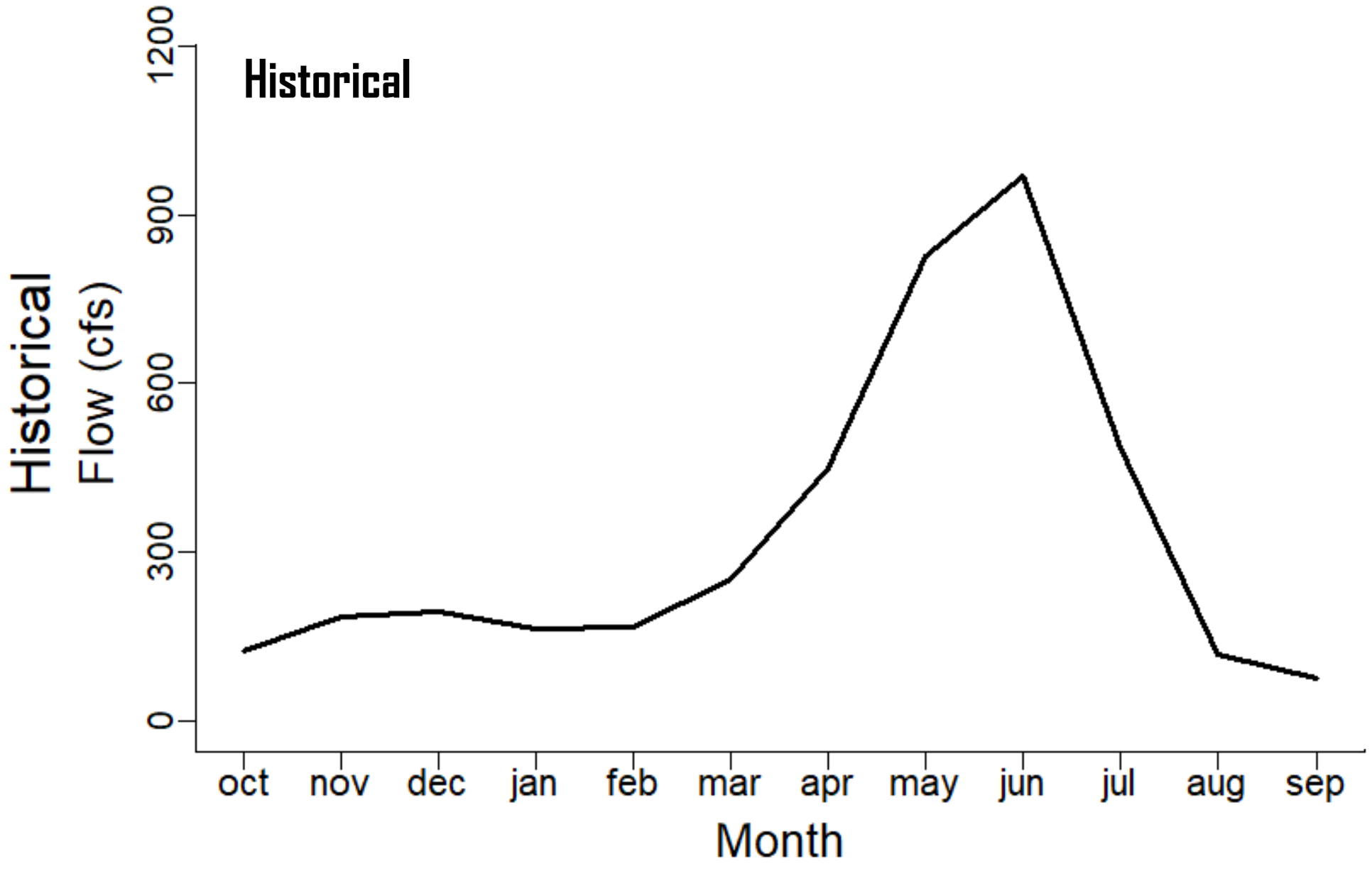
April 1 Snow Water Equivalent

Elsner et al. 2010

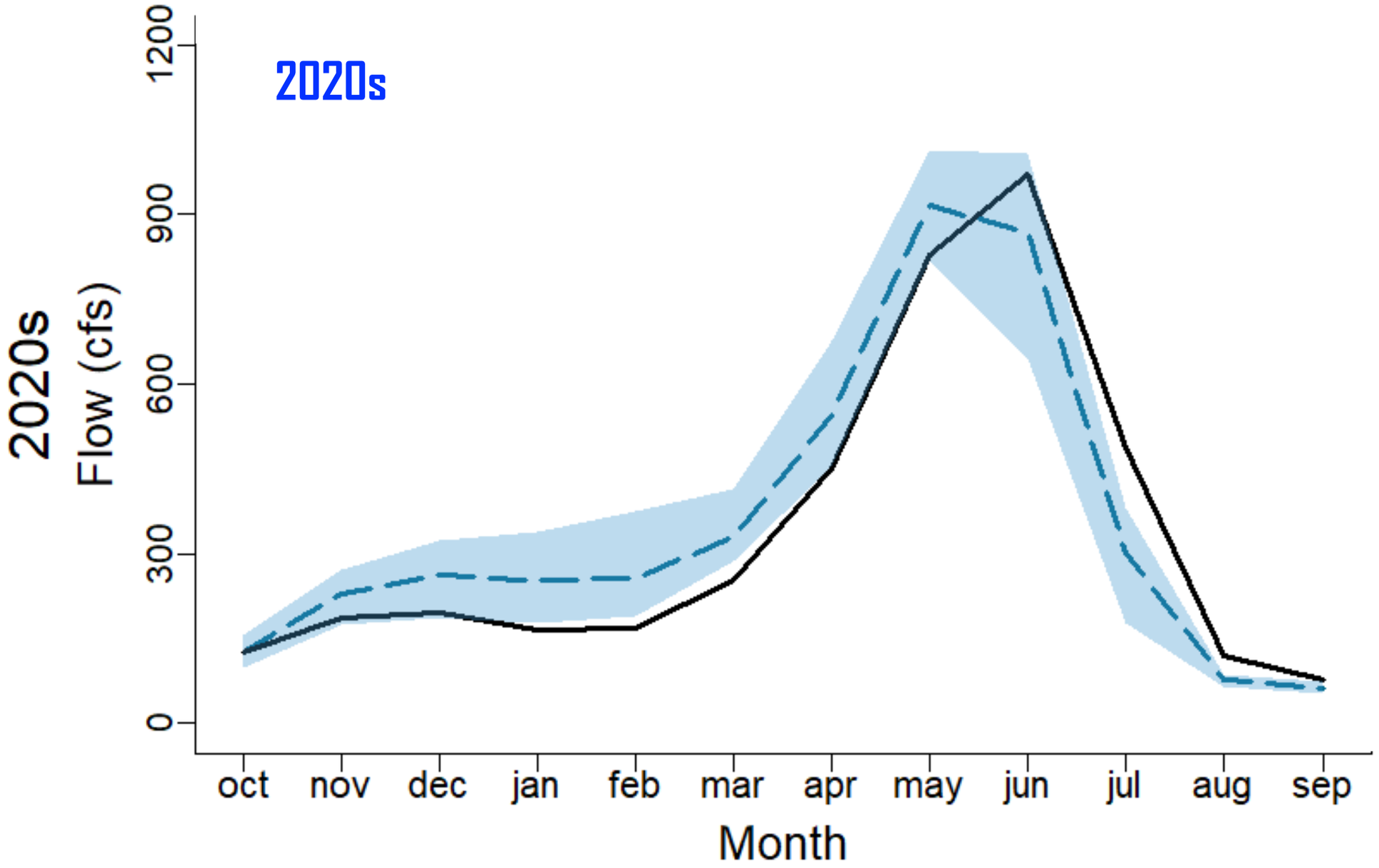
Shifting streamflow: Entiat River



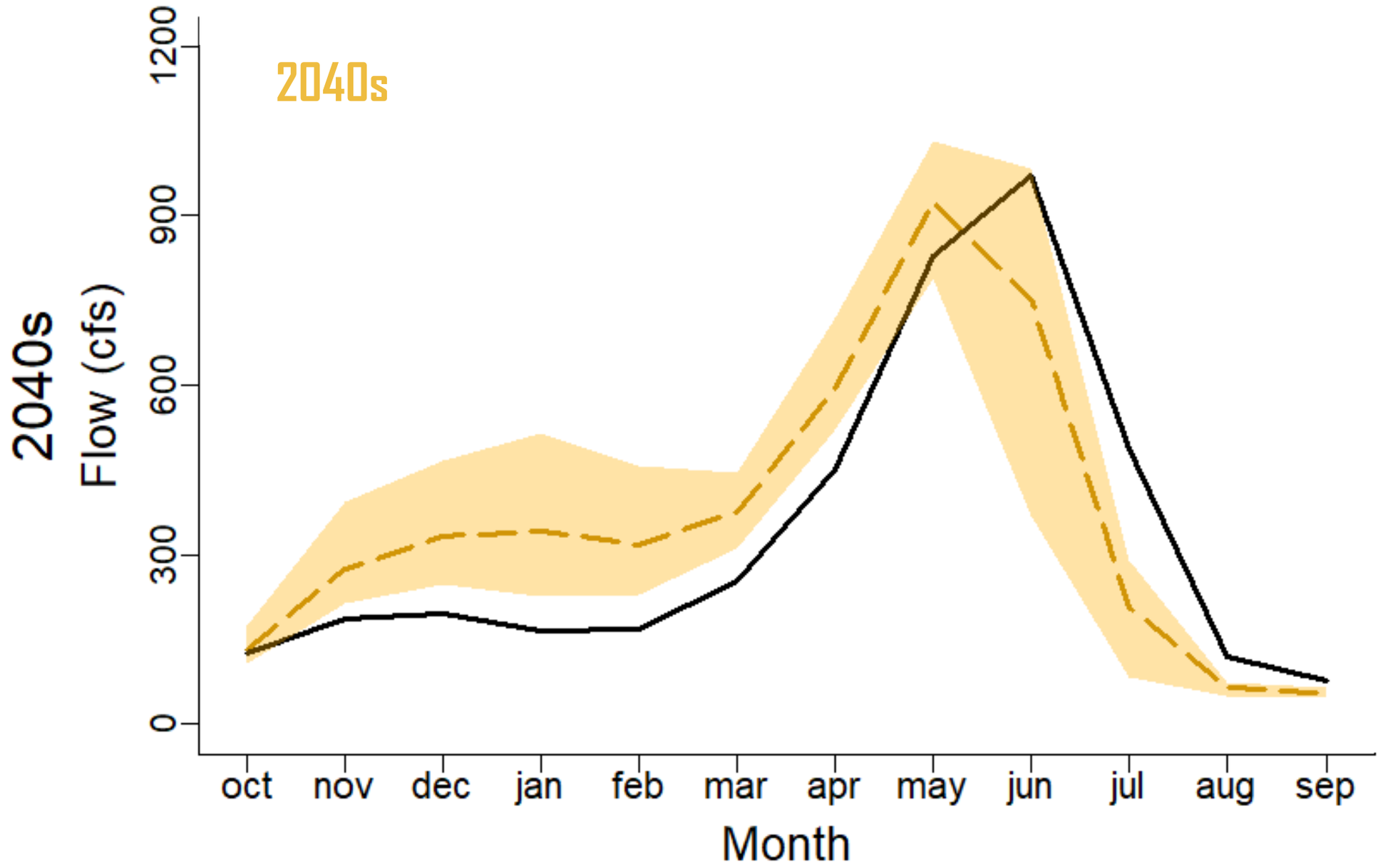
Shifting streamflow: Entiat River



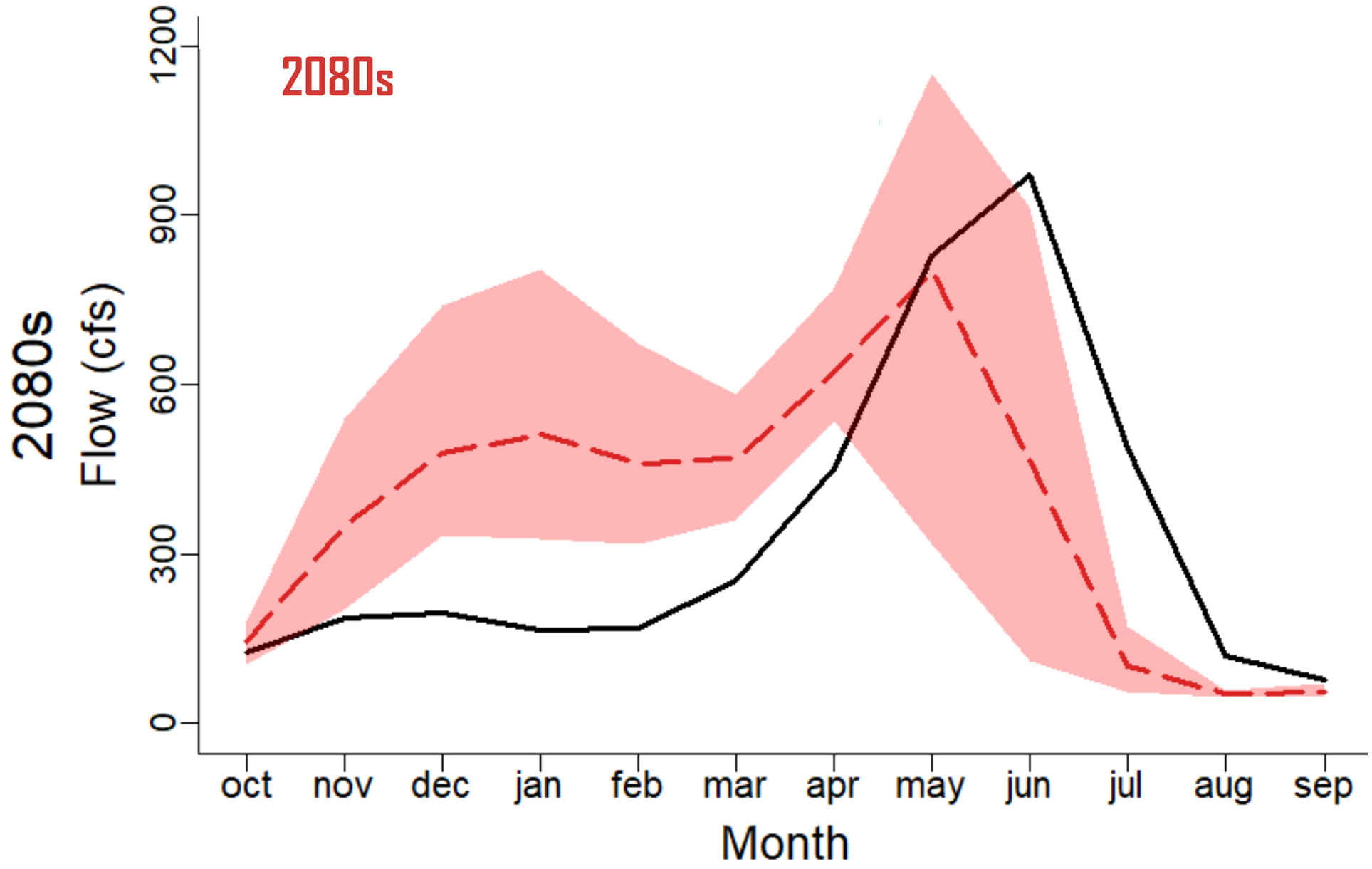
Shifting streamflow: Entiat River



Shifting streamflow: Entiat River



Shifting streamflow: Entiat River



Increased wildfire risk

Area burned by fire in the Columbia River Basin is projected to double by 2020s, triple by 2040s, x5 by 2080s

Relative to 1916-2006 median; medium emissions scenario

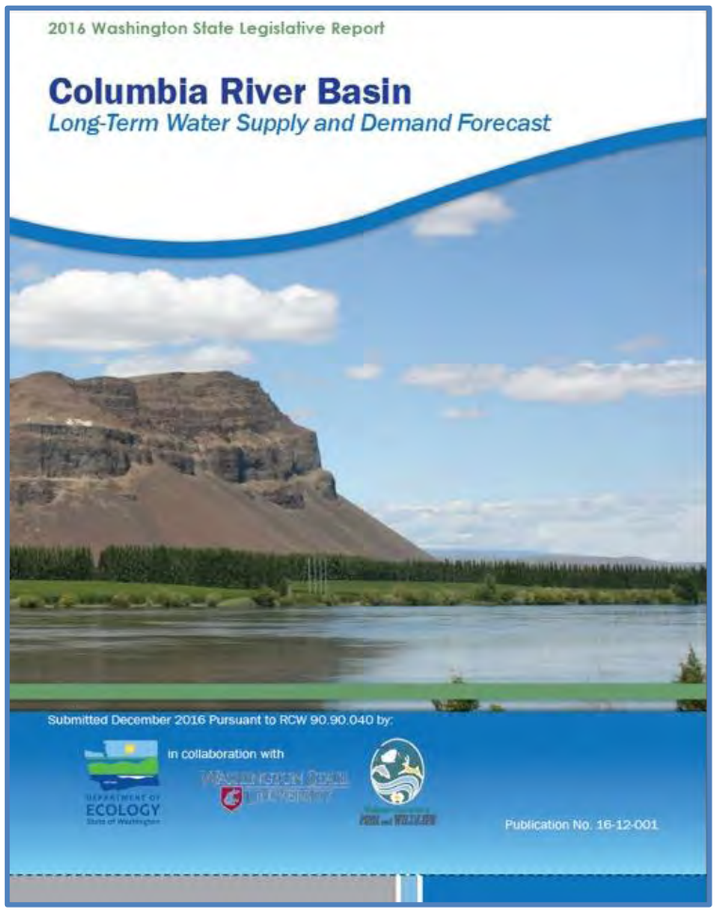
Littell et al. 2010, 2012

Discovery Fire burns near volatile stands of insect-damaged trees, 2009, DNR

Natural Systems

Food & Agriculture

Climate impacts on WA agriculture depend on location, season & crop



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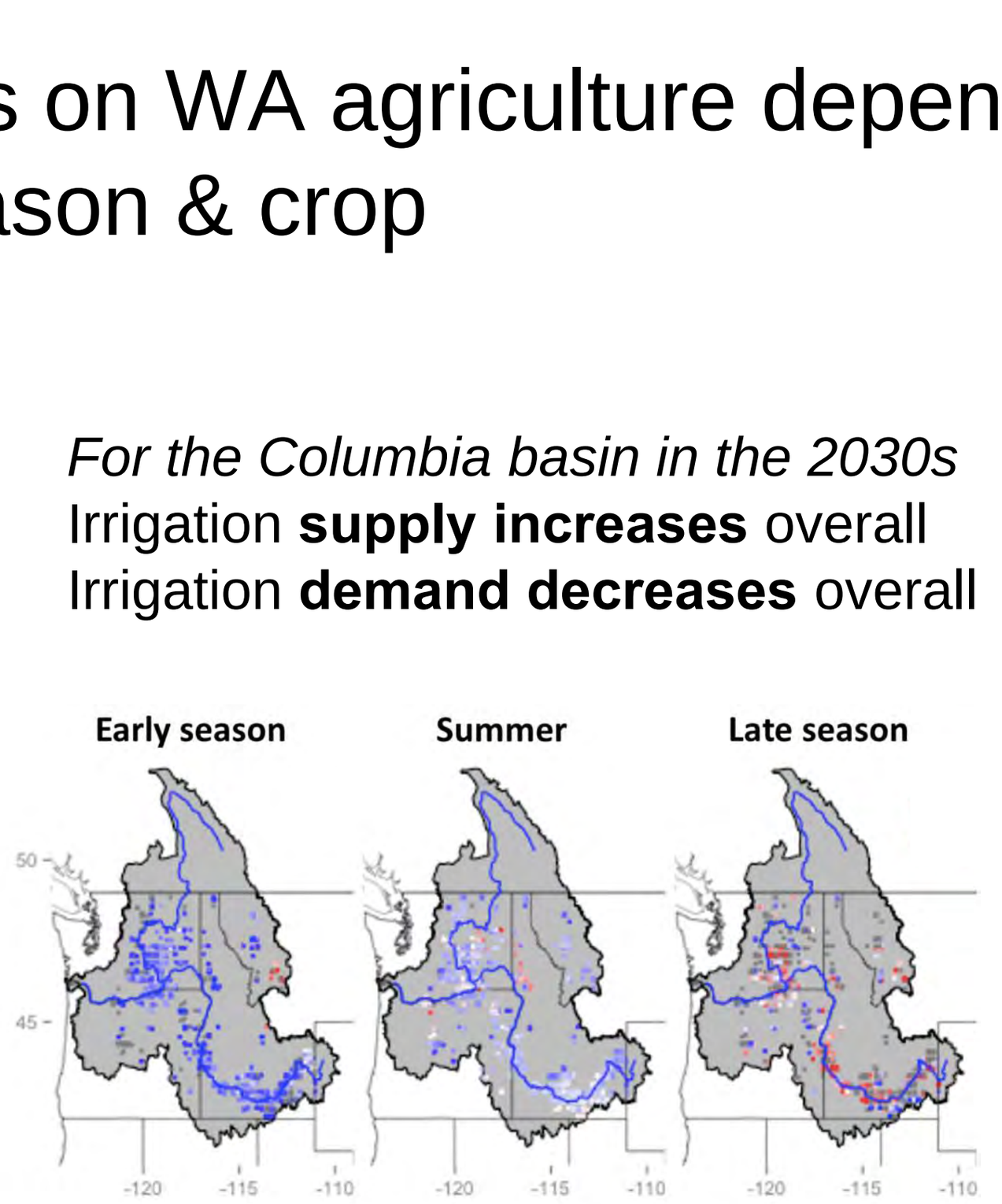
For the Columbia basin in the 2030s
Irrigation **supply increases** overall
Irrigation **demand decreases** overall



% change in 2030s irrigation demands compared to historical

Hall et al. 2016; Rajagopalan et al. in review.

Infrastructure

Health & Well-Being

Recreation

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Snover – Part 2

Local resilience activities

Who’s preparing for these changes?

Joint vulnerability assessment

NPS: fire management plan considers climate change and increasing fire risk

USFS: climate-altered restoration targets

"We use the next warmer, drier ecological subregion as a proxy for reference conditions under climate change."

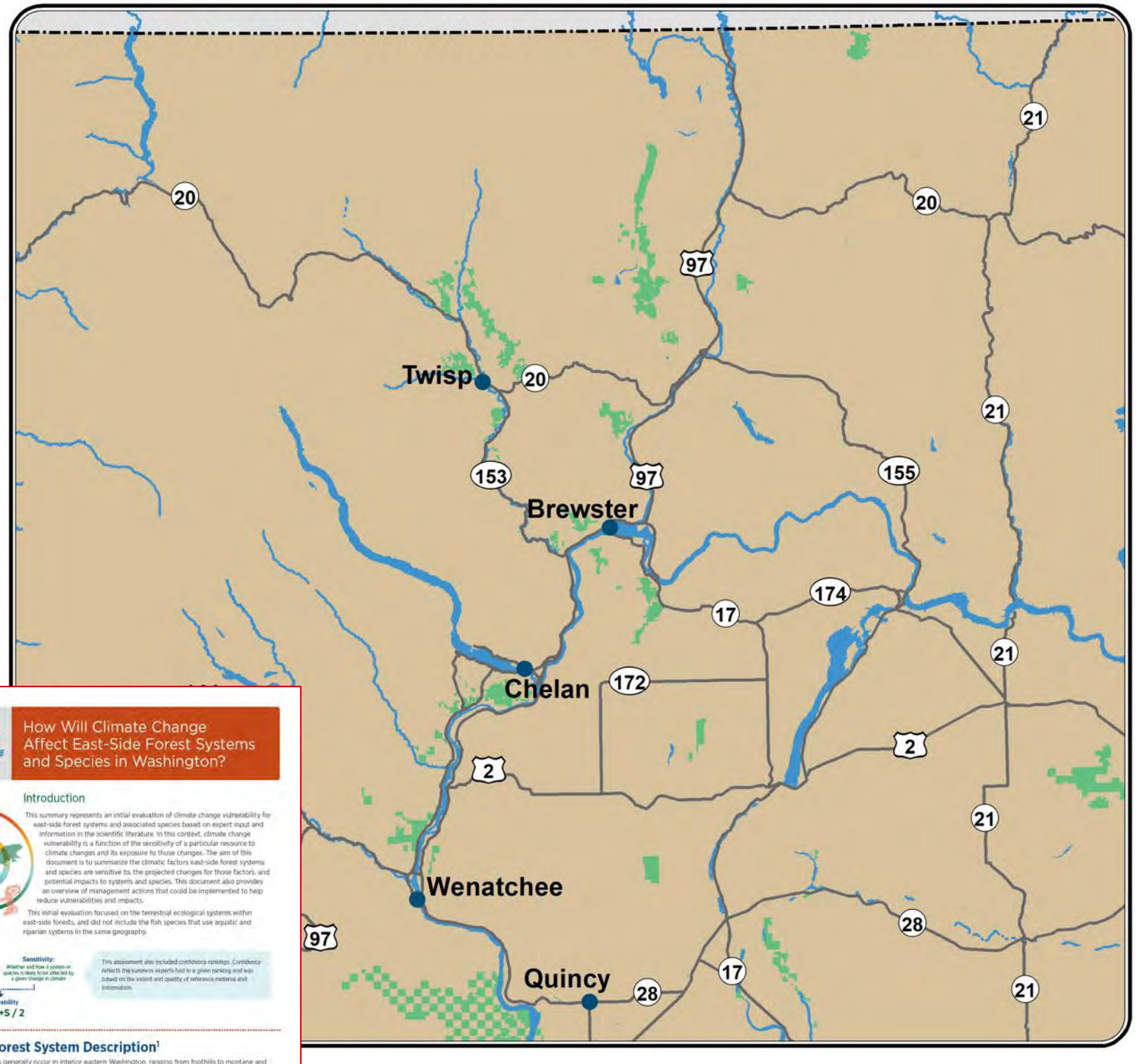
Climate-resilient floodplain restoration

Reintroducing upland beavers

Increasing aquatic connectivity

Promoting climate-resilient culverts

Identifying vulnerable species



How Will Climate Change Affect East-Side Forest Systems and Species in Washington?

Introduction

This summary represents an initial evaluation of climate change vulnerability for east-side forest systems and associated species based on expert input and information in the scientific literature. In this context, climate change vulnerability is a function of the sensitivity of a particular resource to climate changes and its exposure to those changes. The aim of this document is to summarize the climatic factors east-side forest systems and species are sensitive to, the projected changes for those factors, and potential impacts to systems and species. This document also provides an overview of management actions that could be implemented to help reduce vulnerabilities and impacts.

This initial evaluation focused on the terrestrial ecological systems within east-side forests, and did not include the fish species that use aquatic and riparian systems in the same geography.

Exposure: How much of a change in climate a system or species is likely to experience

Sensitivity: Whether and how a system or species is likely to be affected by a given change in climate

Vulnerability

V = E+S / 2

This assessment also included confidence rankings. Confidence reflects the consensus experts had in a given ranking and was based on the extent and quality of reference material and information.

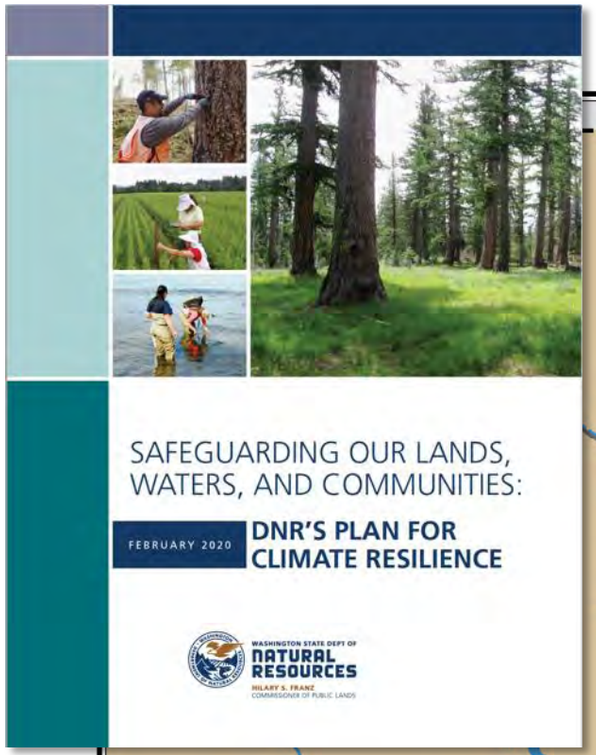
East-Side Forest System Description[1]

East-side forest systems generally occur in interior eastern Washington, ranging from foothills to montane and subalpine areas. They typically feature coniferous canopy components and a shrub, grass, or forb understory, with understory composition and cover being influenced by canopy cover, soil conditions, and moisture. Historically portions of these forests featured more open, low density forest structure and high landscape heterogeneity maintained by higher frequency, lower severity fire. Current non-climate stressors include fire suppression, timber harvest, excessive grazing, roads, urban and agricultural development, recreation, and forest pathogens and insects, all of which are contributing to altered fire regimes and shifts in forest structure, species composition, and distribution.

[1] Information in this section comes from (1) Washington Department of Fish and Wildlife. 2015. Washington's State Wildlife Action Plan: 2015 Update. Washington Department of Fish and Wildlife, Olympia, Washington, USA; and (2) Rocchio, F.J. and R.C. Crawford. 2015. Ecological Systems of Washington State: A Guide to Identification. Washington State Department of Natural Resources, Report 2015-04. 397 pp.

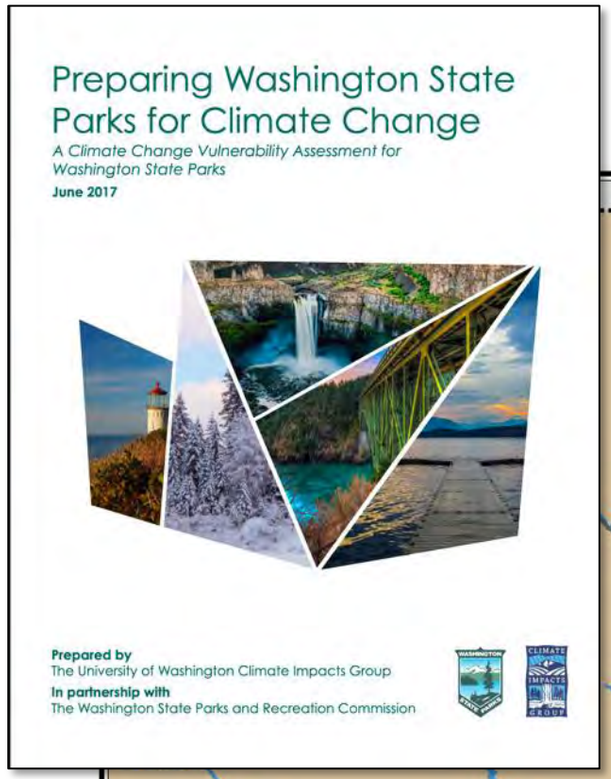
Agency-wide climate resilience plan

Supporting community resilience



Statewide Parks climate vulnerability assessment and adaptation plan

Concerns: shorter snow season, flood damage to infrastructure & trails, wildfire closures & damage, bugs/mosquitos

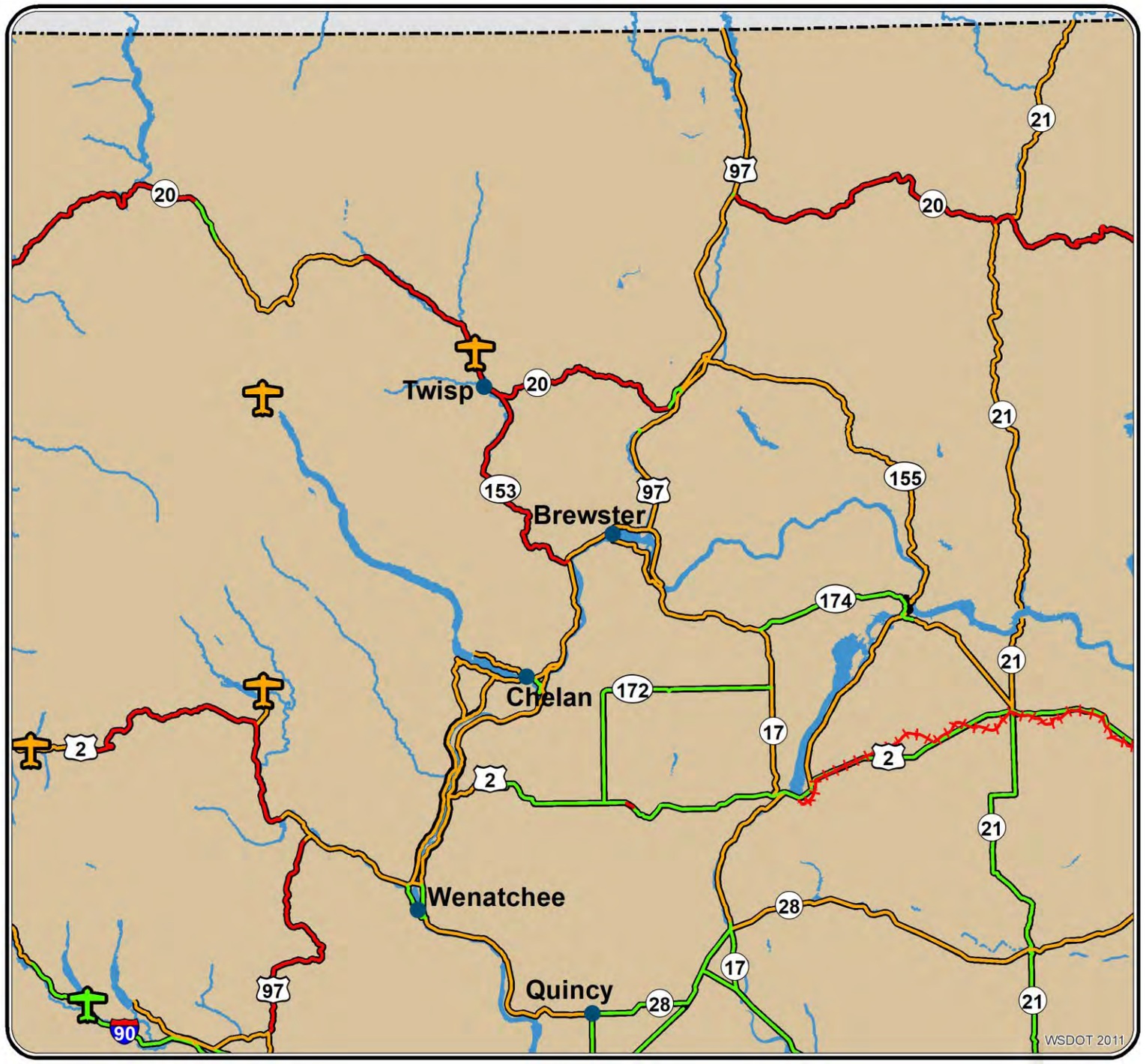


Assessed vulnerability of state highways, bridges, railroads, airports, ferry terminals

Steel guardrail posts in fire prone areas

Fire/slope failure catchment basins on SR 153 & US 20

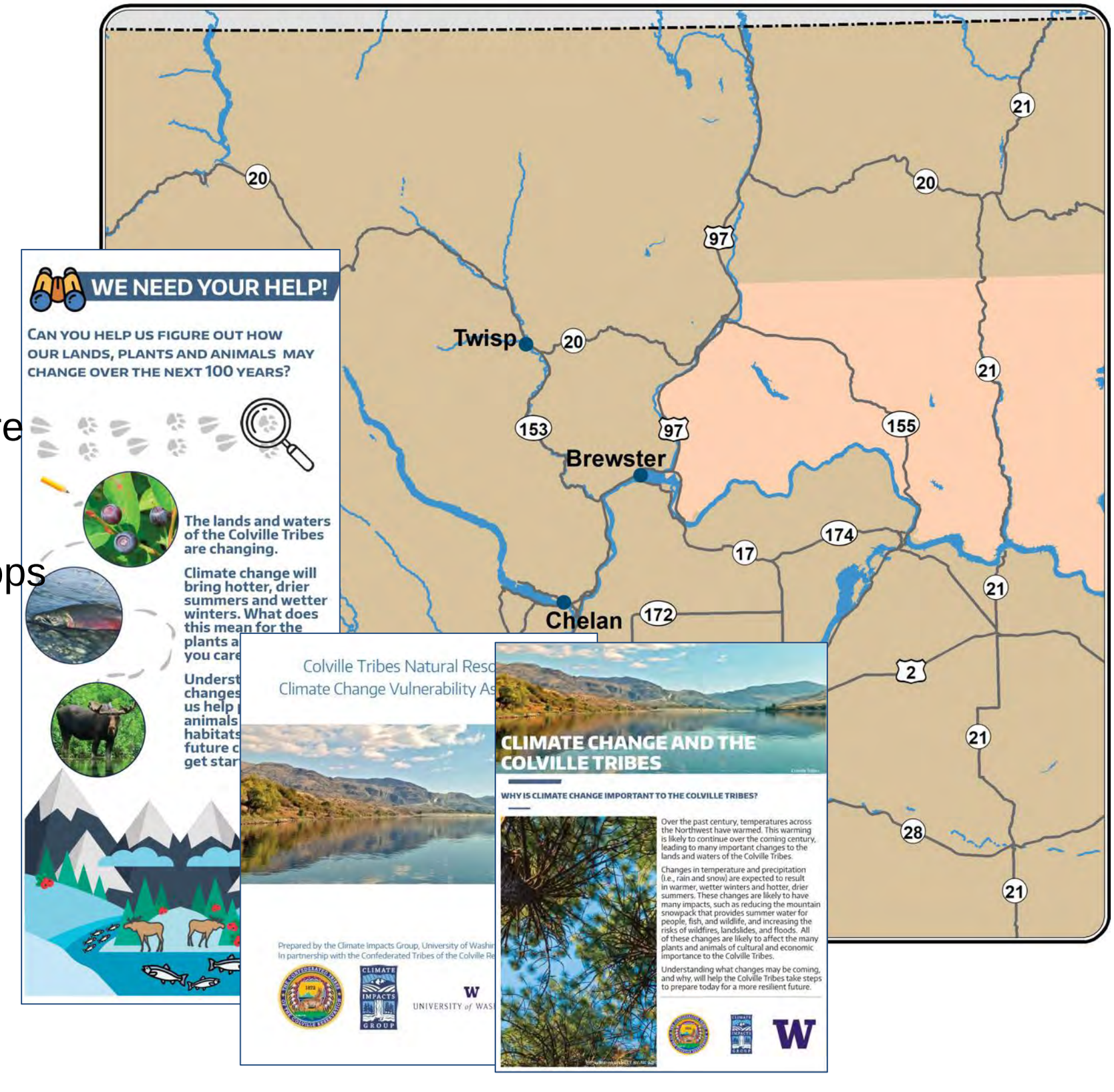
Root balls & trees (large woody debris) in and along streams



WSDOT

Climate-smart culvert replacement for fish passage

Natural resources vulnerability assessment
Community brochure
Youth activity &
Teaching guide
Adaptation workshops



Natural Resources: Icicle Creek addressing low summer flows worsened by climate change

Emergency Management: Climate change worsens important hazards

P.U.D.

CHELAN COUNTY

Assessed climate risks to Lake Chelan ops, Rocky Reach power generation, distribution loads, transmission

Chelan, Cashmere, Plain/Lake Wenatchee identified as high-risk areas

Managing Lake Chelan for climate-altered inflows

Hardening transmission infrastructure to fire


Ranald
McDonald's Grave
Curlew Lake
Conconully
Lake
Conconully
Old Ruby
Pearrygin
Lake
Twisp
Lake
Chelan
Basin
Brewster
Alta Lake
Bridgeport
Crown Point
Twenty-Five
Mile Creek
Ice Caves
Lake Wenatchee
Lake
Chelan
Chelan
Steamboat
Rock
Daroga
Lake
Lenore
Caves
Sun Lakes-Dry
Falls
Peshastin
Pinnacles
Icicle
Creek
Grant County
Grant
County Sportsmen
Wenatchee
Confluence
Lincoln
Rock
Wenatchee
Squilchuck
Quincy
Lake Easton
20
97
21
155
153
174
172
17
2
28
90
WSDOT 2011