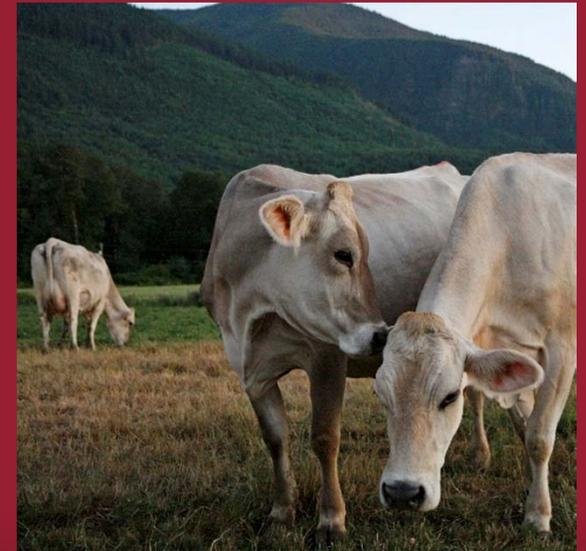


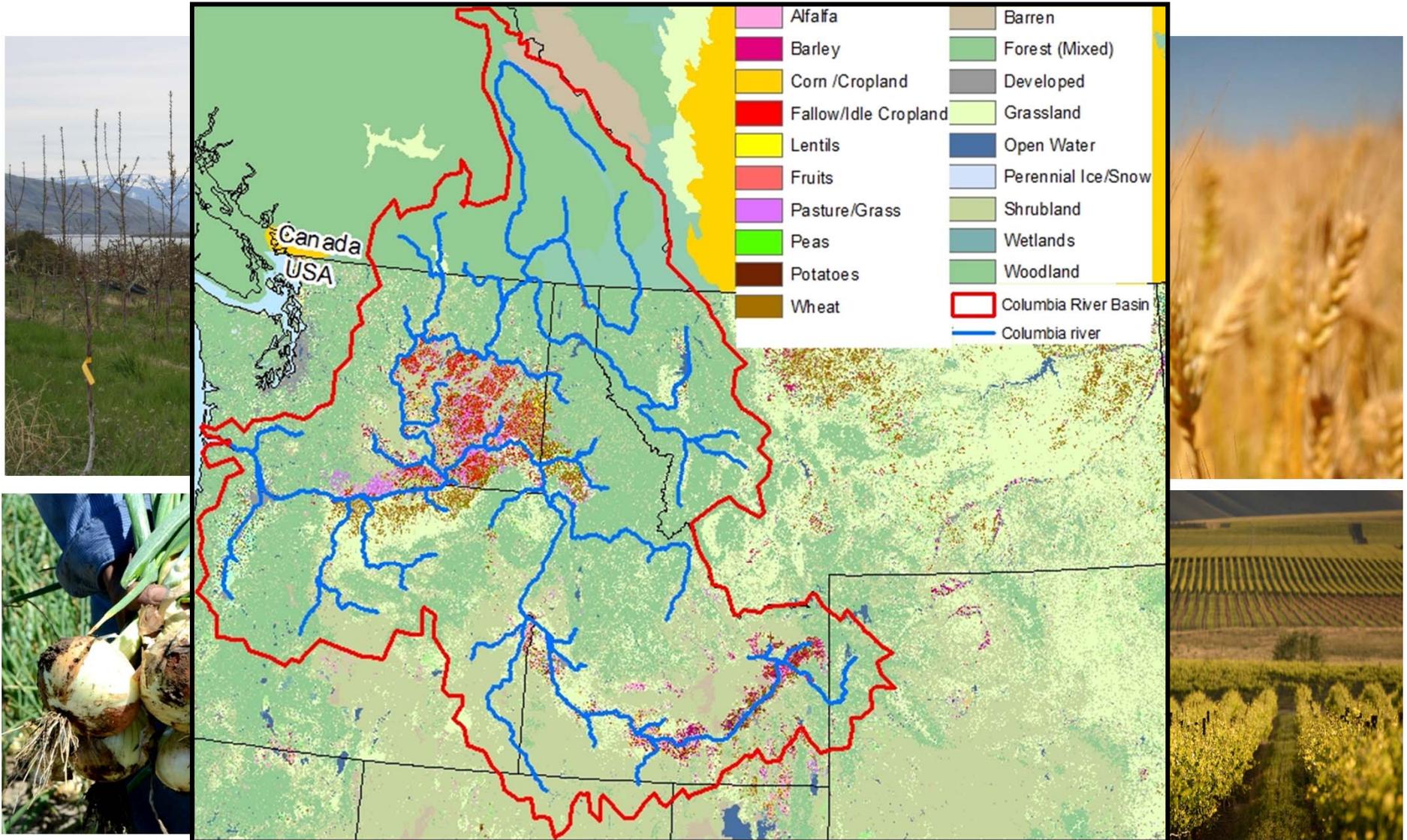
Farmer Responses to Climate Change in the Northwest US

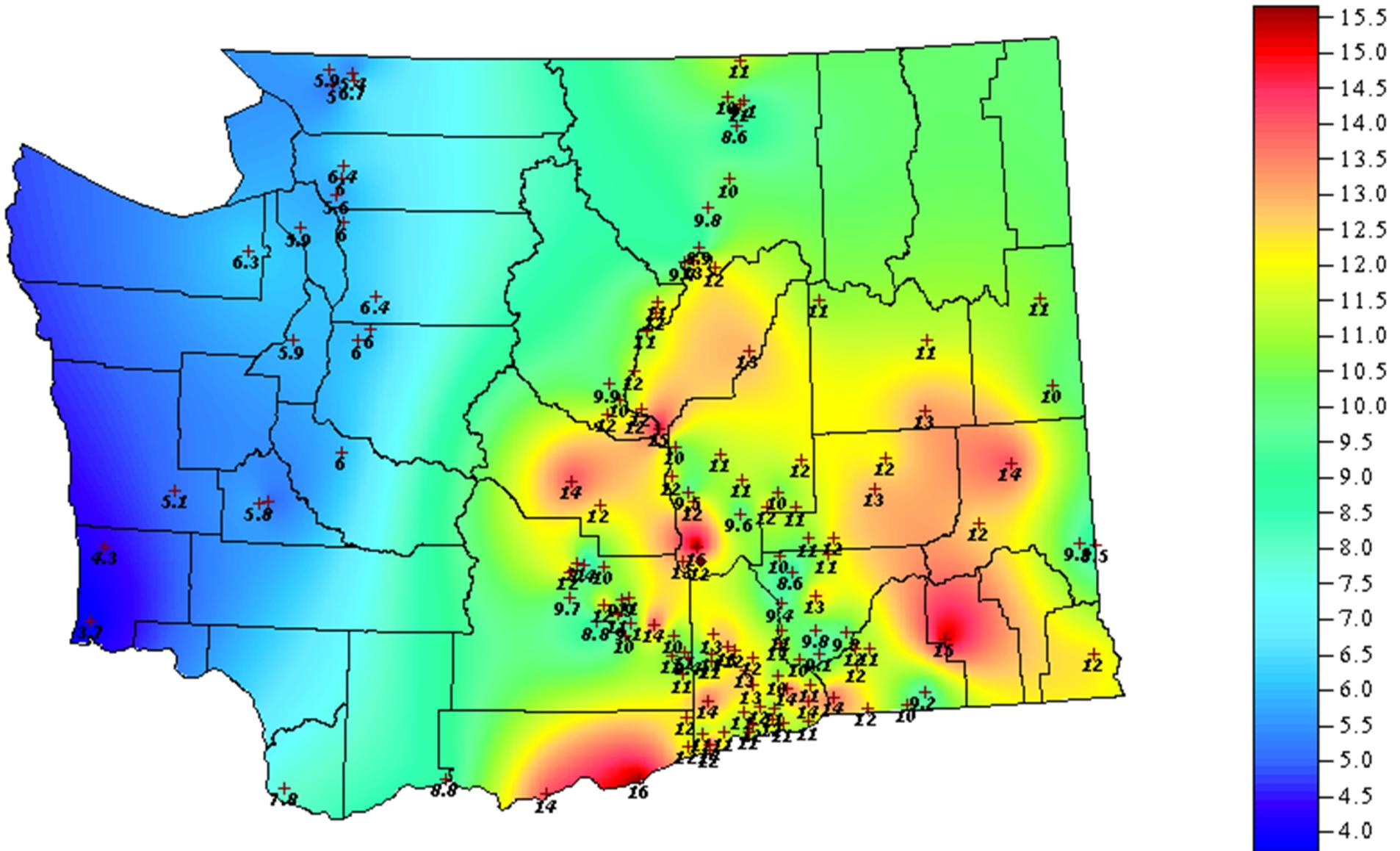


Chad Kruger, WSU
Center for Sustaining Agriculture & Natural Resources
USDA Agricultural Outlook Forum
February 24, 2017



A region characterized by diverse climate & agricultural systems

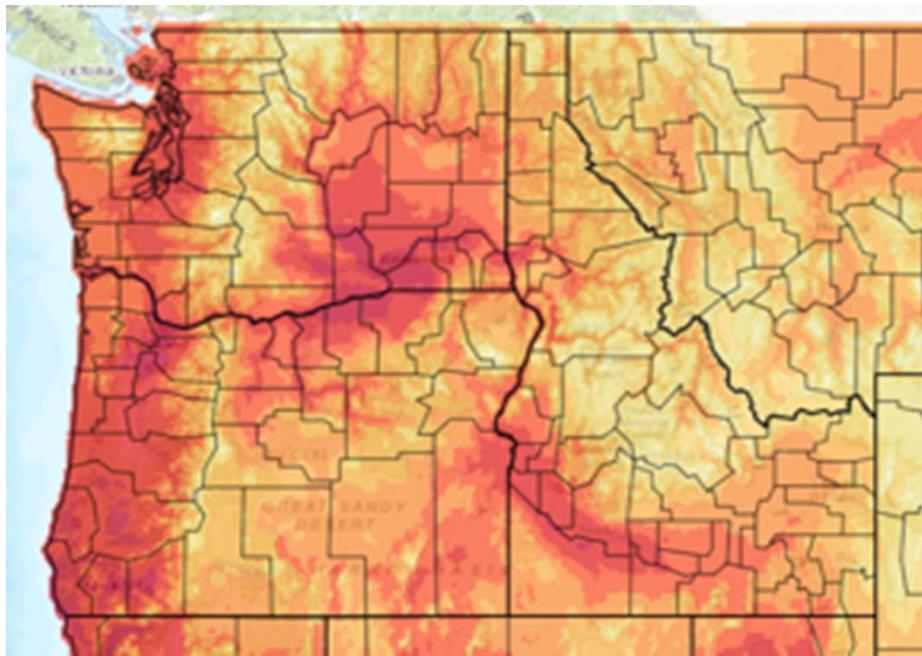




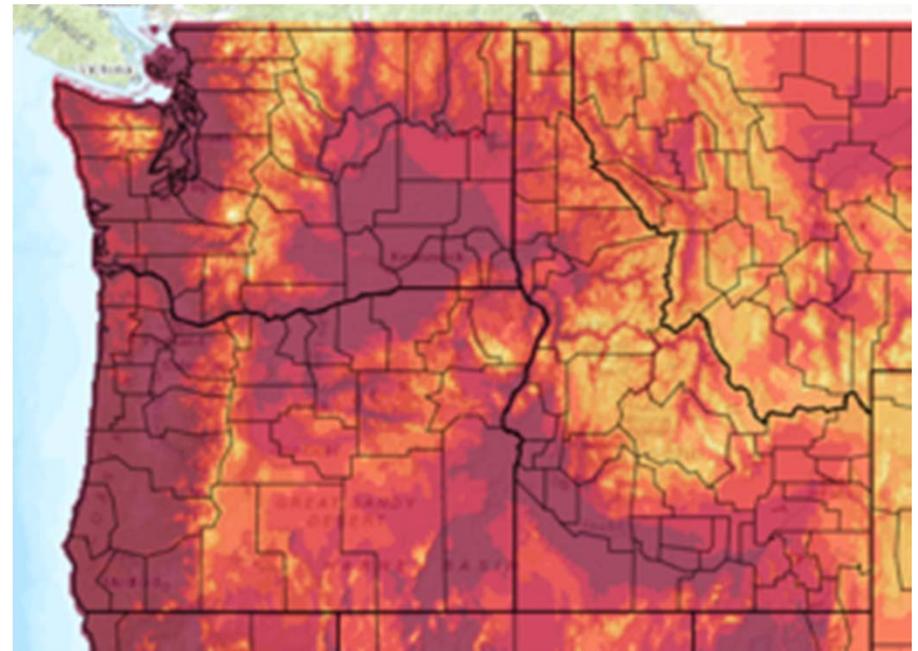
Accumulated Evapotranspiration (in) for Jul-01 to Jul-31-2013 – WSU Ag Weather Net

Emerging climate challenges for producers

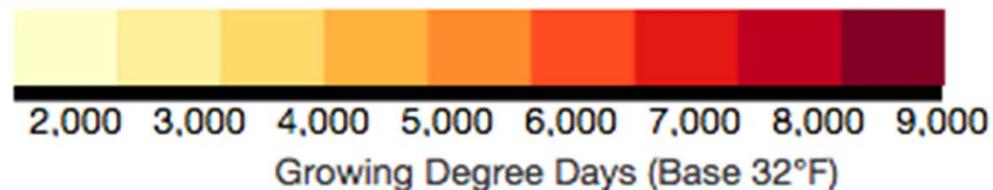
- Longer growing seasons and frost-free periods
- Increased heat and *snow* drought stress
- Changing biotic stressors



1971 - 2000



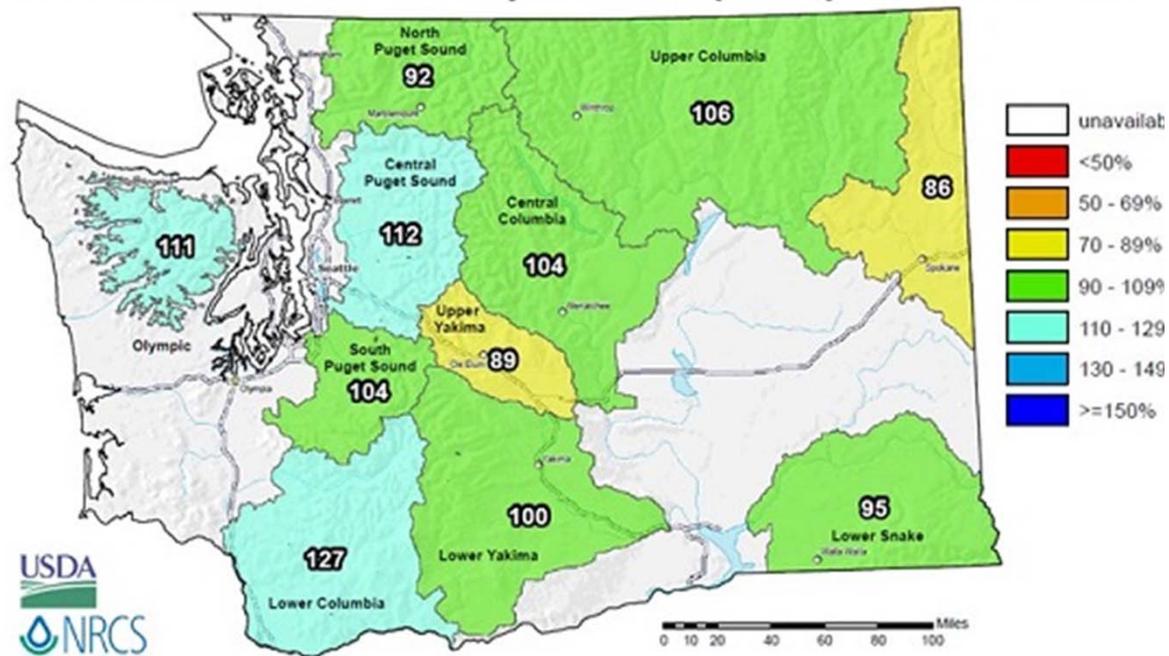
2040 - 2069 under RCP 8.5





Washington SNOTEL

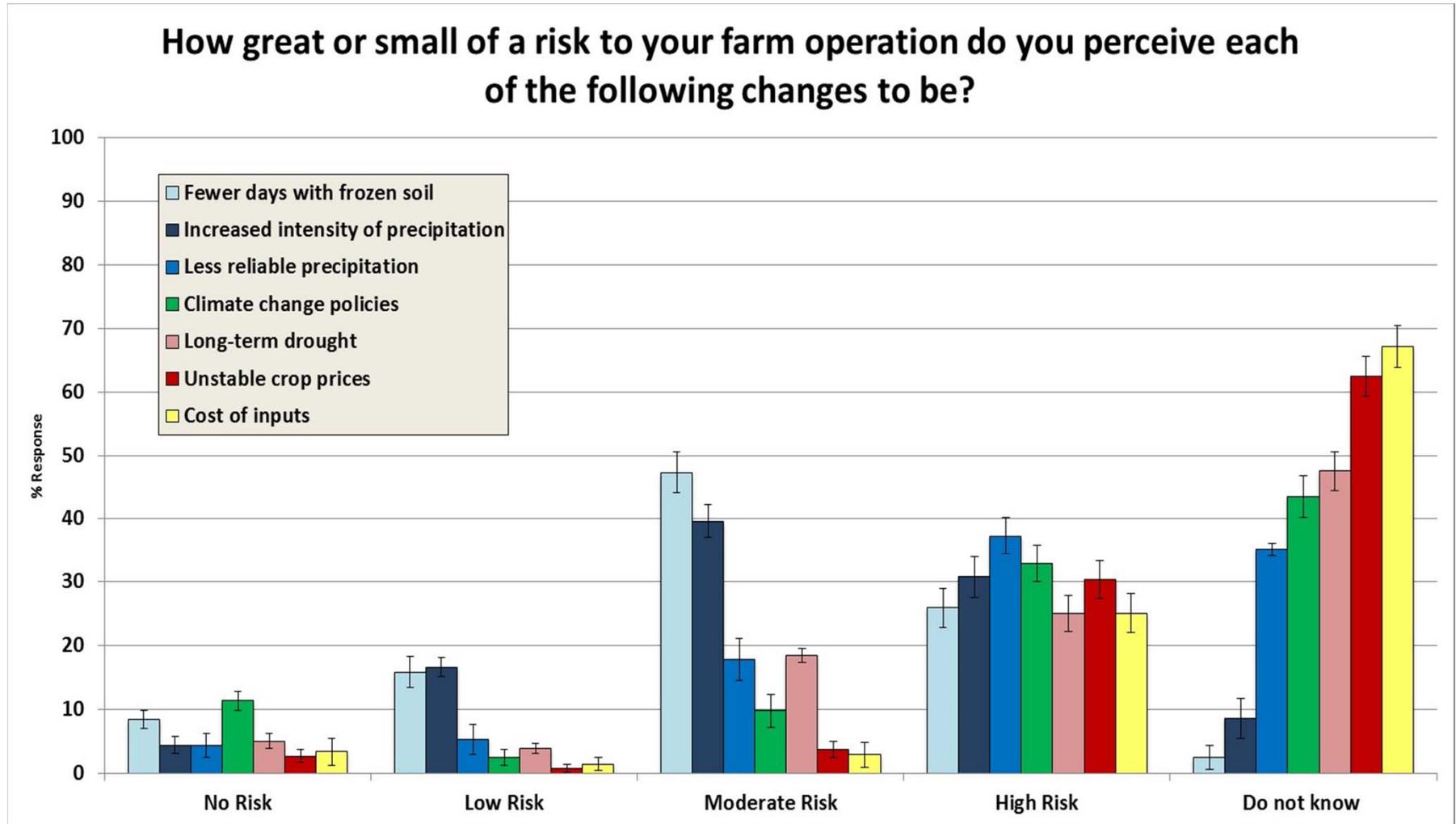
Current Snow Water Equivalent (SWE) % of Normal





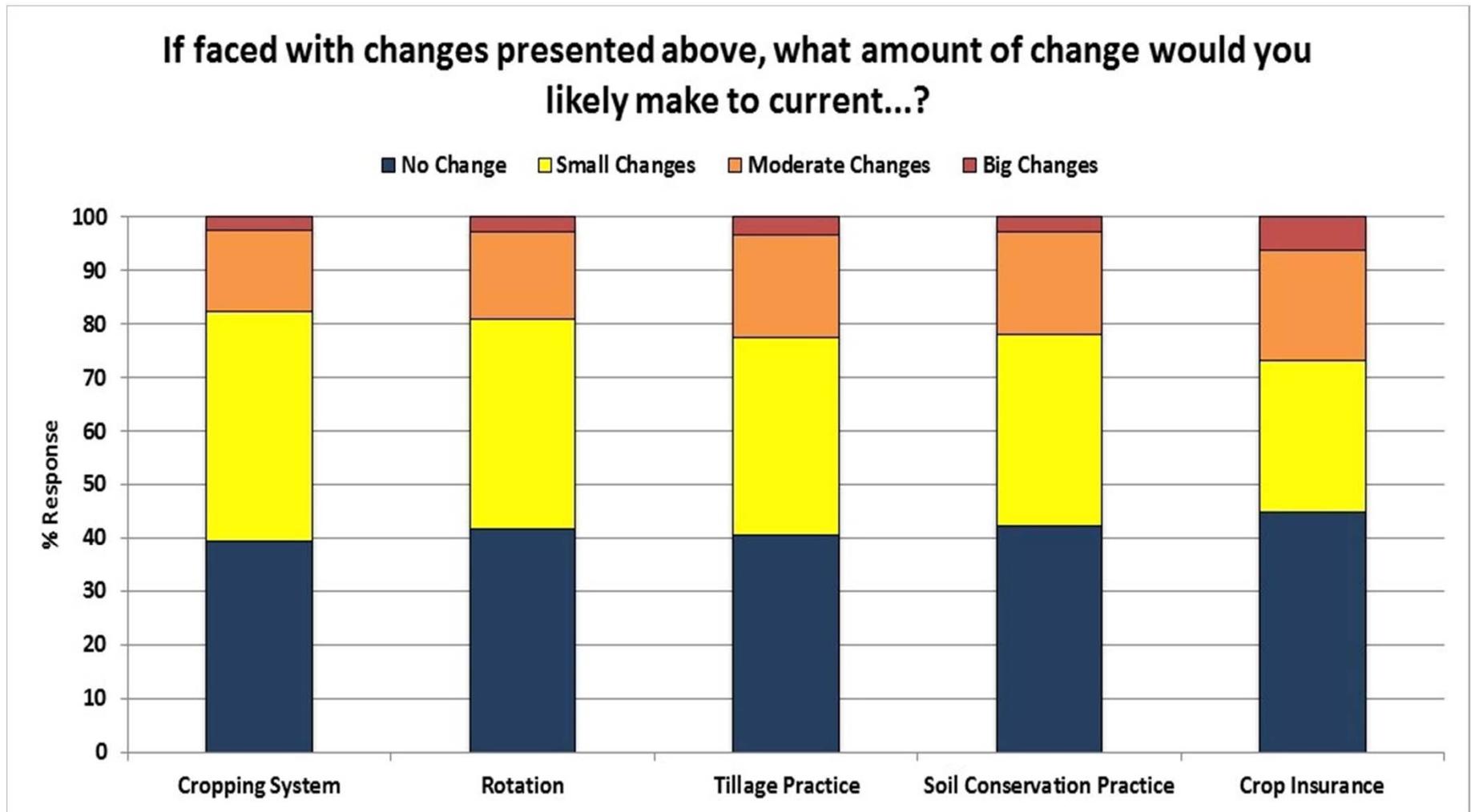
21st century farmers are experienced in managing a dynamic system with multiple uncertainties

Do Northwest farmers perceive climate change to be a risk?



Yorgey et.al. 2014

Do NW farmers think they can adapt to climate change?



Yorgey et.al. 2014

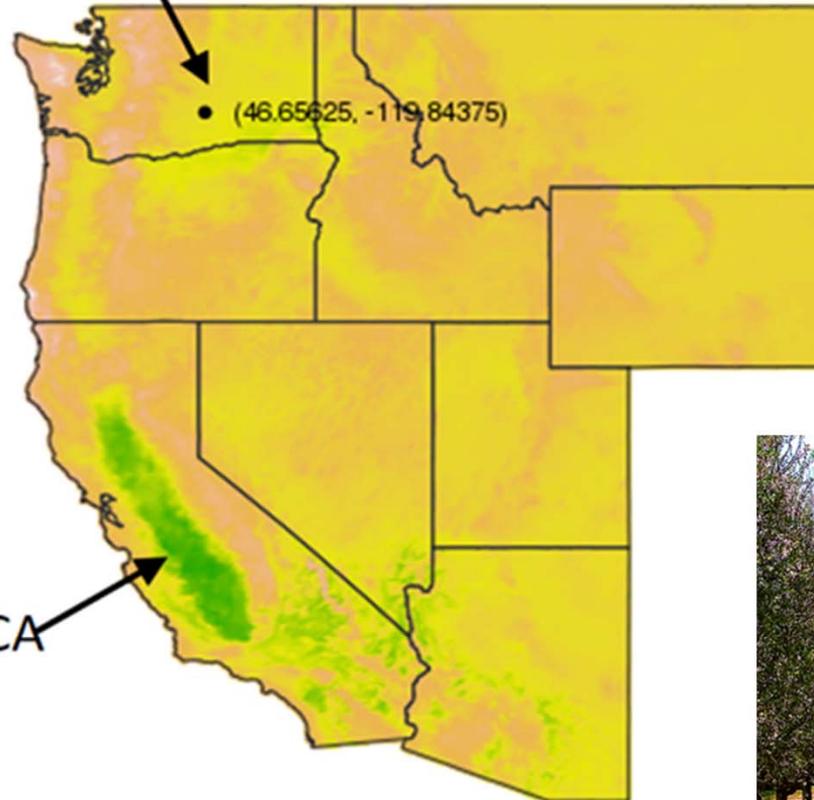






Managing for the future with growing condition analogs

Appletown, WA



Warmsville, CA

2060s growing conditions
(average of 2045 to 2075)



Securing Water for Agriculture



2011 Washington State Legislative Report

Columbia River Basin Long-Term Water Supply and Demand Forecast

Lower Yakima, Naches & Upper Yakima

WRIA 37, 38 & 39

Management Context

Supplies and demands are defined as described in the next two "Definitions of Water Supply and Water Demand Used in the 2011 Forecast." The regulated tributary surface water supply forecast for the Yakima is characterized by increases from late fall through early spring. Decreases are visible in the late spring and early summer under all flow conditions, continuing through the summer into mid-fall under average and wet flow conditions.

Inception is the primary source of demand in these WRIAs. Federal flow targets, shown for Yakima River at Pasco for both the historical and the future case, are also important. This study, in cooperation with irrigation demands, estimated demands are significantly larger than most other WRIAs of eastern Washington. Assuming no change in irrigated acreage, irrigation demand is forecasted to increase in most months in the future with small reductions in the magnitude of the future increase when alternative future summer scenarios are considered. Municipal demand is projected to grow by 25% by 2050.

If provided, additional water capacity as specified by the proposed projects in the Office of Columbia River "useful" scenario is anticipated to increase agricultural irrigation water demand in the WRIA compared to 2050 irrigation water demand under the scenario base case in absence of an additional capacity. Additional capacity will increase demand in all WRIAs where water is provided for new irrigated land.

In 2050, unmet municipal and surface water irrigation demands and federal flow targets are projected to outstrip regulated tributary supply at the watershed scale during most years for June through October. Monthly of curtailment of non-essential irrigation water rights is indicated that it occurs in 45% of years between 2077 and 2095. The resulting unmet demand ranged from 700 to 75,000 ac-ft per year depending on specific flow conditions, with an average of 100,000 ac-ft per year. Satisfaction of future curtailment suggested that in wet years in 80% of years for the middle climate scenario. The resulting unmet demand ranged from 14,500 to 424,000 with an average of 104,000 ac-ft per year. Due to data and resource constraints, the modeling of unmet demand did not consider curtailment of use water use in terms of whether users secure water rights holder. Although not shown here, unmet demands due to a failure to meet federal flow targets are shown in the technical report. Water shortages outside the scope of this analysis were also noted in localized areas, and low flow periods within months.

Yakima resource allocation study was part of the EPA-Threatened Mid-Columbia steelhead listing case. Jurisdiction over many two-creek and sub-creek portions is shared by the State, Odeh and others are being re-authorized in the Yakima system. That trust in the Yakima basin was part of the Middle Columbia 2012 listing case.

July 2012 2012-11, submitted by the Washington Department of Ecology

Lower Yakima, Naches & Upper Yakima

Supply

WRIA 37, 38 & 39

Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep

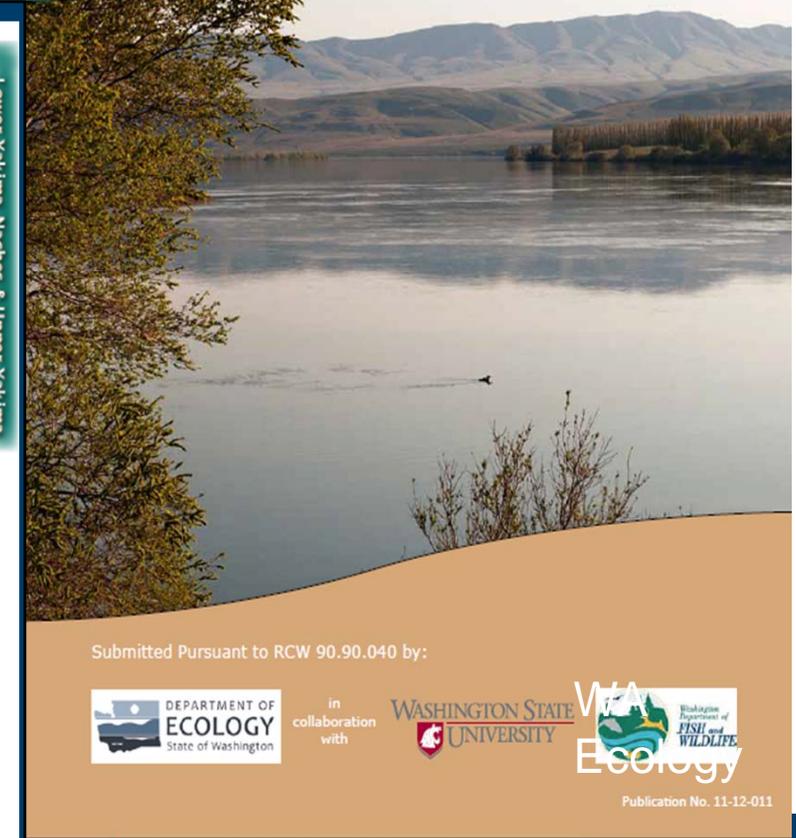
Thousands of Acre feet/month

— Historical
■ 2030 Range

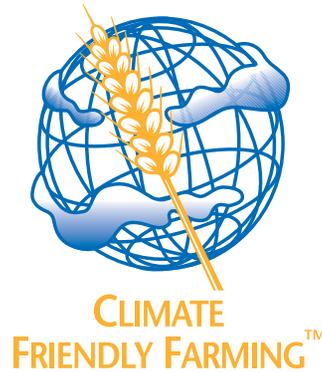
Submitted Pursuant to RCW 90.90.040 by:

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Publication No. 11-12-011



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WA Ecology: Columbia River Forecast

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National Climate Assessment



Center for

Sustaining Agriculture & Natural Resources

WASHINGTON STATE UNIVERSITY

*Science in Action to Improve the Sustainability of
Agriculture, Natural Resources and Food Systems*



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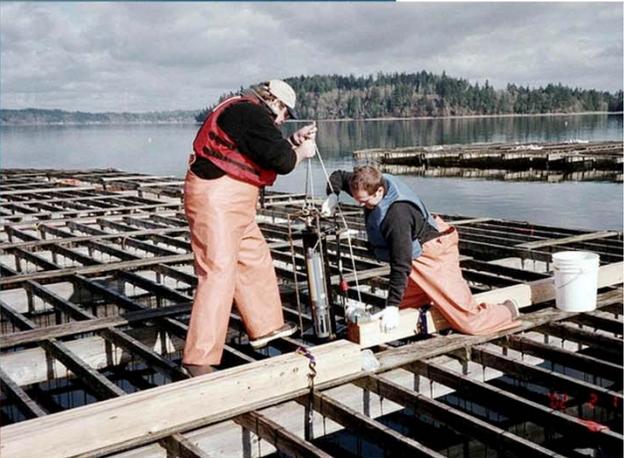
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