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Managing Water in the West

Klamath River Basin Study Overview

**Klamath Basin Monitoring Program
General Membership Meeting,
November 6-7, 2013
Yreka, CA**



U.S. Department of the Interior
Bureau of Reclamation

Basin Study Program

- Reclamation implements Section 9503 of the Secure Water Act through the Basin Study Program.
- The Basin Study Program includes:
 - Implementation of Basin Studies
 - West-Wide Climate Risk Assessments
 - Landscape Conservation Cooperatives



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Basin Studies - Purpose & Elements

- **Purpose**
 - Work with state and local partners in 17 Western States to evaluate future water supply and demand imbalances in a changing climate
- **Elements**
 - Projections of future supply and demand, including the impacts of climate change
 - Analysis of how the basin's existing water operations and infrastructure will perform in response to the projections of future water supplies and demands
 - Development of adaptation strategies to reduce any identified imbalances in water supply and demand
 - Trade-off analysis of the options identified, findings, and recommendations as appropriate

Basin Studies - Assessment of Risk and Change

- Each Basin Study will assess specific risks to water supplies including:
 - Changes in snowpack
 - Changes in timing and quantity of runoff
 - Changes in groundwater recharge and discharge
- Each Basin Study will also assess changes in:
 - Demand for water due to increasing temperatures and population growth



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Basin Studies - Climate Change Impacts

- **Basin Studies may analyze the impacts of potential climate change to:**
 - **Fish & wildlife habitats**
 - **Existing infrastructure**
 - **Water-dependent recreation facilities**
 - **Water quality/salinity**
 - **Flood control management**
 - **Hydropower**
 - **Rates of reservoir evaporation**

Basin Studies – Adaptation Strategies

Adaptation strategies developed based on previous studies and input from tribes, stakeholders, and others. Examples may include, but are not limited to:

- Improved water management, facilities operations, or habitat management
- Water conservation measures
- Improved understanding of the watershed through use of hydrologic models/other decision support tools
- Modifications to reservoir storage

Basin Studies

- Appraisal level studies that are intended to build upon existing information
- Basin Study reports are not considered decision documents
- May lead to potential subsequent feasibility-level investigations



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Klamath River Basin Study Area

- Equal 50 percent cost share by Reclamation and non-federal cost-share partners
 - Oregon Water Resources Department
 - California Department of Water Resources



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Phases of the Klamath River Basin Study

Basin Study Elements

Phase 1:
Water Supply and
Demand Assessment

Assess current and projected water supply and demand, including the impacts of climate change

Phase 2:
System Reliability
Analysis

Analyze how the basin will respond to water supply and demand projections according to identified metrics

Phase 3:
Development of
Adaptation Strategies

Develop adaptation strategies to reduce any identified imbalances

Phase 4:
Evaluation of Adaptation
Strategies

Evaluate adaptation strategies, findings, and recommendations as appropriate

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Klamath River Basin Resources

- **The Klamath River supports the following, including:**
 - **Tribal Trust Resources**
 - **Fish, wildlife, and their habitats (including candidate, threatened, and endangered species)**
 - **Water allocations and deliveries**
 - **Water quality**
 - **Recreation**
 - **Flood control**
 - **Hydroelectric power generation**
- **The study will build on existing information and research in all resource areas**
- **The study will look at system reliability with respect to all resources**

Water Supply and Demand Assessments

- **Assess current and future “natural” water supply**
 - Inflow absent human activities
- **Assess current and future demands**
 - Examples: agricultural, evaporative, environmental, cultural, municipal and industrial
 - Utilize multiple scenarios of climate and demand
- **Focus on runoff and factors affecting runoff**
 - Examples: climate, snowpack, ET, landscape characteristics

Water Supply and Demand Conditions



Source: National Park Service

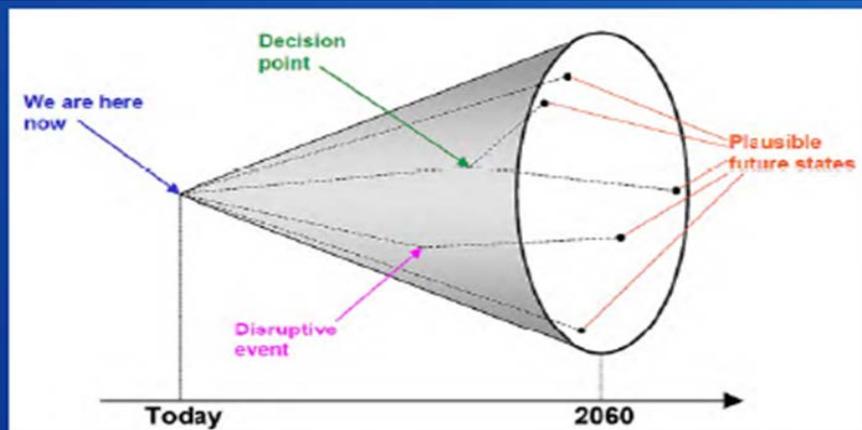


Source: Oregon Public Broadcasting

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Scenario Planning: Addressing an Uncertain Future

- Future influences on water supply and demand are uncertain
 - Influences include climate, population, land use, etc.
- The Klamath River Basin Study uses a scenario approach to explore the impacts of a range of climate futures and a range of potential adaptation strategies



(adapted from Timpe and Scheepers, 2003)

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Water Supply Assessment – Current Supply

- **Assess current supplies using historical climate (from 1950-1999)**
 - Basin-wide decline in mean annual runoff 2-13% depending on region
 - Basin-wide decline in April 1 snowpack about 22-44% depending on region

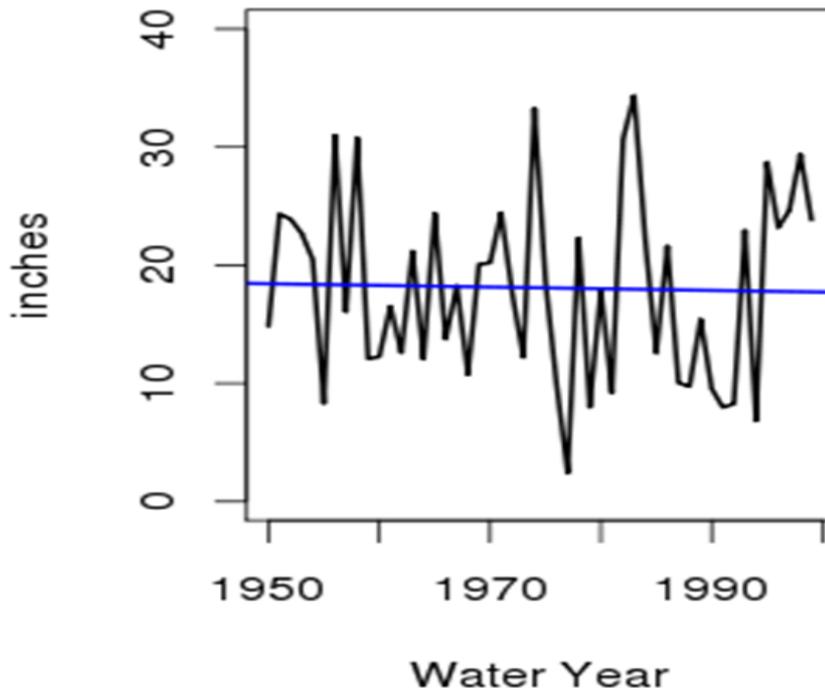


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Water Supply Assessment - Historical Annual Runoff Basin Wide

***Trend in Historical Annual
Runoff Basin Wide***

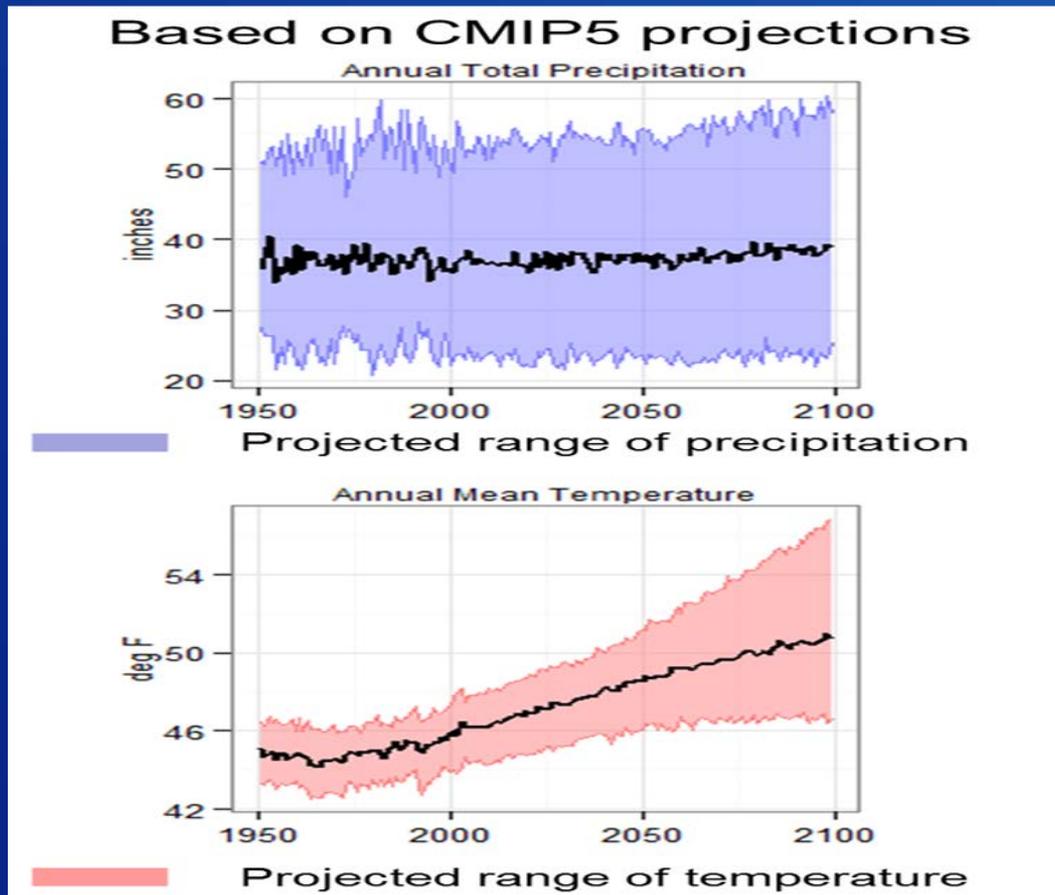
- Linear trend line
- Annual runoff (water year)



Water Supply Assessment – Future Supply

- **Develop future precipitation and temperature scenarios**
 - Based on West-Wide Climate Risk Assessment
- **Assess future water supply (SW & GW) under different scenarios**
 - **Ensemble of general circulation model (GCM) projections**
 - Characterize future trends and variability
 - **Paleo-conditioned streamflow**
 - Prehistoric wet/dry states provide context for projected periods of water surplus/drought

Water Supply Assessment - CMIP5 Projections



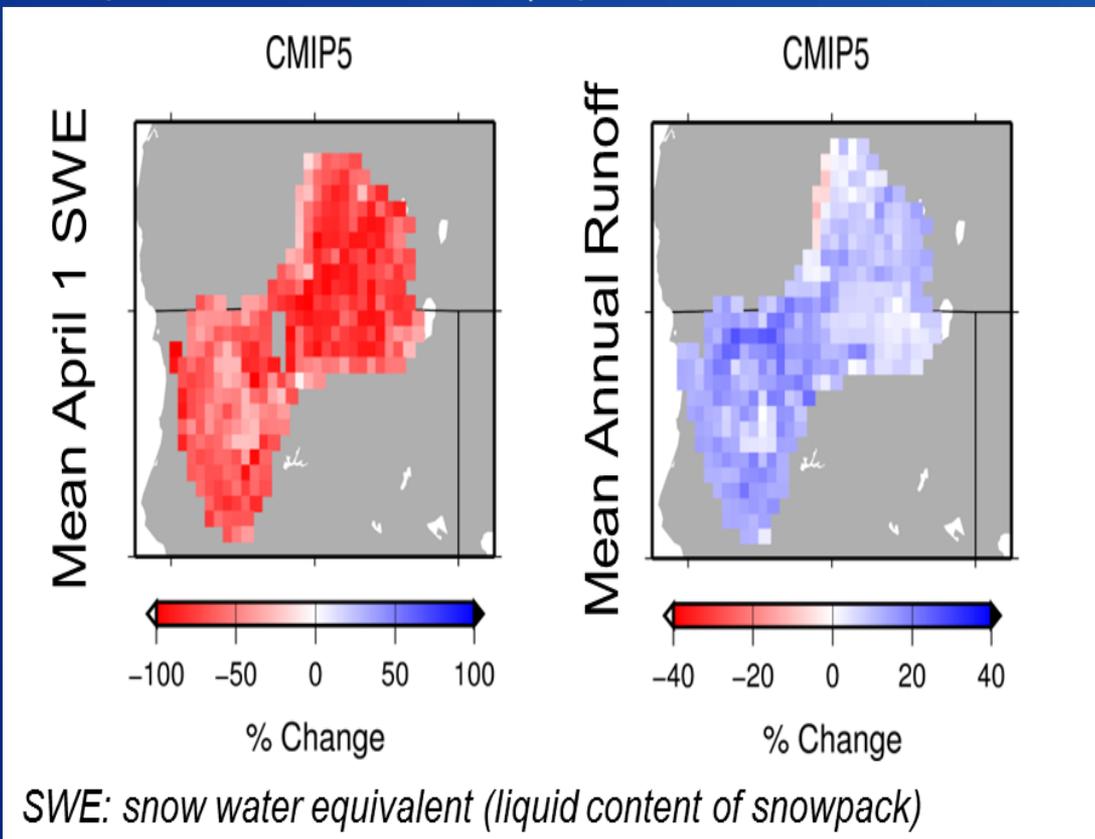
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Water Supply Assessment – Central Tendency

- **Central tendency projections basin wide:**
 - Decline in April 1 SWE is 40% by 2030s
 - Increase in mean annual runoff is 12% by 2030s
 - Decline in max length of drought and max deficit volumes. But, max surplus volume is estimated to be nearly equal to the historical maximum surplus (Klamath R. near Klamath)

Water Supply Assessment – Central Tendency Projections

*Projected change for 2030s (represented as mean of 2020-2049)
compared with historical (represented as mean of 1950-1999)*



Projections shown here are based on the central tendency scenario derived from downscaled CMIP5 projections

Water Demand Assessment

- **Assess current consumptive demands**
 - Using historical climate
 - Focus in environmental, cultural, agricultural, evaporative, recreational, and municipal and industrial demands
- **Assess future demands under different climate scenarios**

Water Demand Assessment Conditions



Source: USFWS



Source: US Forest Service

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System Reliability Analysis

Identify Reliability
Metrics

What is a metric?

Evaluation criteria that are used to determine baseline and future system reliability can be measured for a particular resource to quantify the reliability

Determine Baseline
System Reliability

**Develop an analytical framework for
evaluating reliability**

Project Future System
Reliability

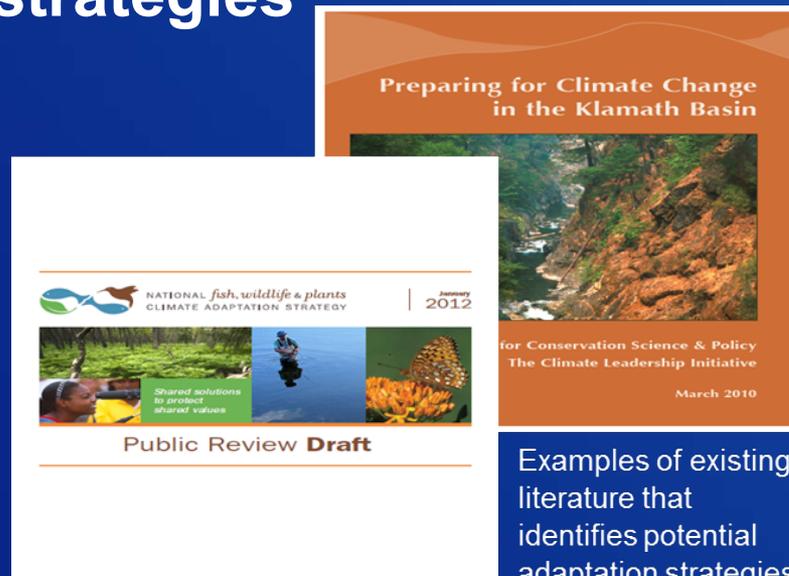
Projections of Future
Reliability with
Adaptation

**Develop adaptation strategies that
may improve system reliability**

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Identification of Adaptation Strategies Trade Off Analysis

- Compile identified strategies from existing studies and solicit additional potential strategies
 - Screen strategies for those that can be evaluated (qualitative and quantitative) in model framework
- Assess the multi-resource reliability of adaptation strategies



Examples of existing literature that identifies potential adaptation strategies

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Public, Stakeholder, and Tribal Involvement

- Identification of issues that should be considered during study development
- Assistance with identification of relevant past and ongoing studies
- Proposed adaptation strategies for reducing water supply/demand imbalances
- Participation in development of system reliability metrics
- Review and comment on Basin Study Report

Study Information

- Reclamation's Basin Study Website
 - [Reclamation's Basin Study Website](#)
- Klamath River Basin Study Website
 - [Klamath River Basin Study Website](#)
- Questions or comments
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