

# Climate change analysis in the inyo-mono irwm region

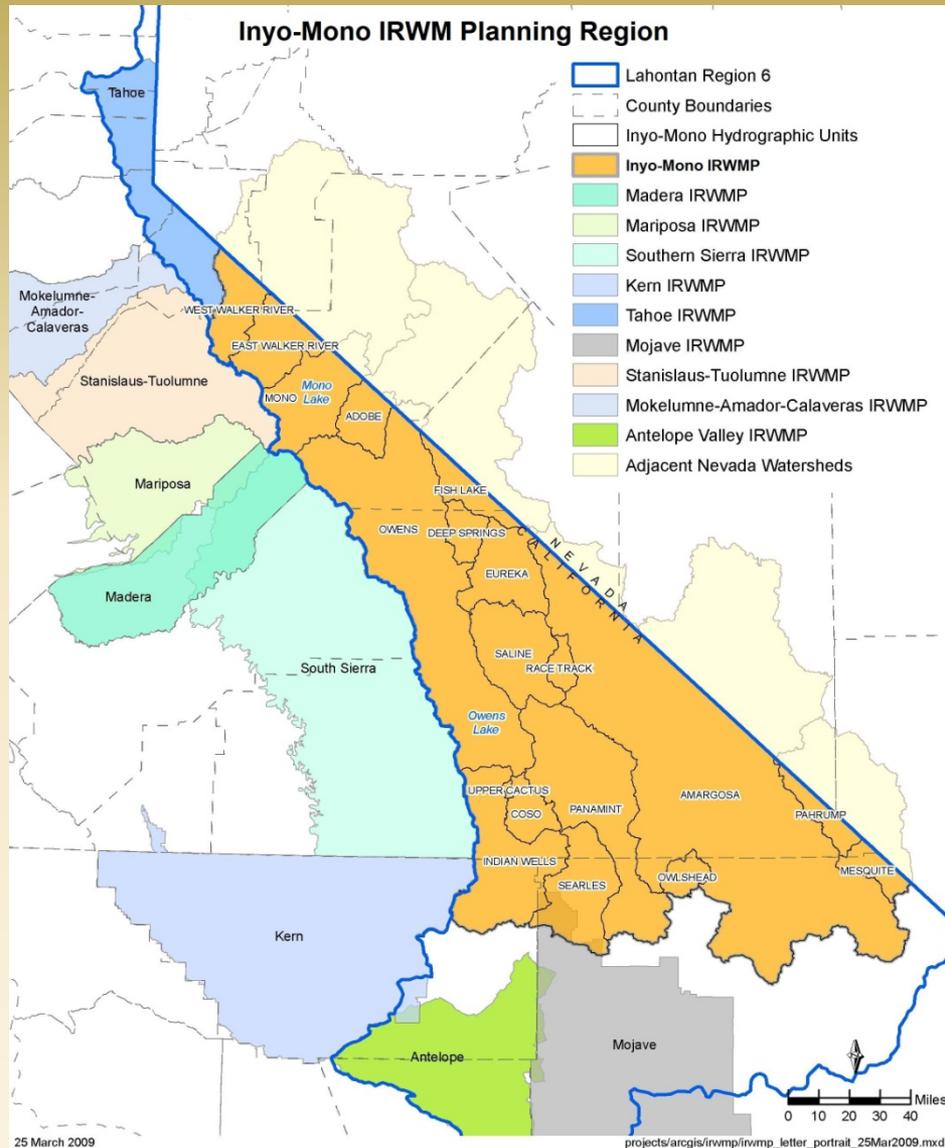


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Presentation to cctag  
September 14, 2012

# Outline

- I. Inyo-Mono IRWM Region
- II. Using the Climate Change Handbook for Regional Water Planning
  - ❖ Vulnerability Analysis
  - ❖ Measuring Impacts
  - ❖ Adaptation Strategies
  - ❖ Mitigation
- III. Lessons Learned, Resources Needed

# I. Inyo-Mono IRWM Region



# I. By the Numbers

- ~ 63,000 people
- 3 incorporated towns
- Recreation tourism-based economy (& military)
  - Skiing
  - Fishing
  - Watersports
- Several Native American Tribes
- Biggest minority: Latinos



# I. Challenges

- 32 economically disadvantaged communities
- Rural & remote nature of region
- Isolated from State-level water & climate change planning
- Limited access to information
- Lack of institutional/human capacity



# I. Climate

- Two distinct areas: mountains and desert
- Mountains: cool, wet winters; warm, dry summers; precip falls primarily as snow
- Desert (high & low): cool winters; hot summers; precip falls as winter rain (some monsoon moisture)



# I. Water Resources & Mgmt.



- Water exports & history of water conflict
- Small water districts & regulatory compliance
- Outdated water infrastructure
- Groundwater
- Water quality issues

# I. Inyo-Mono RWMG

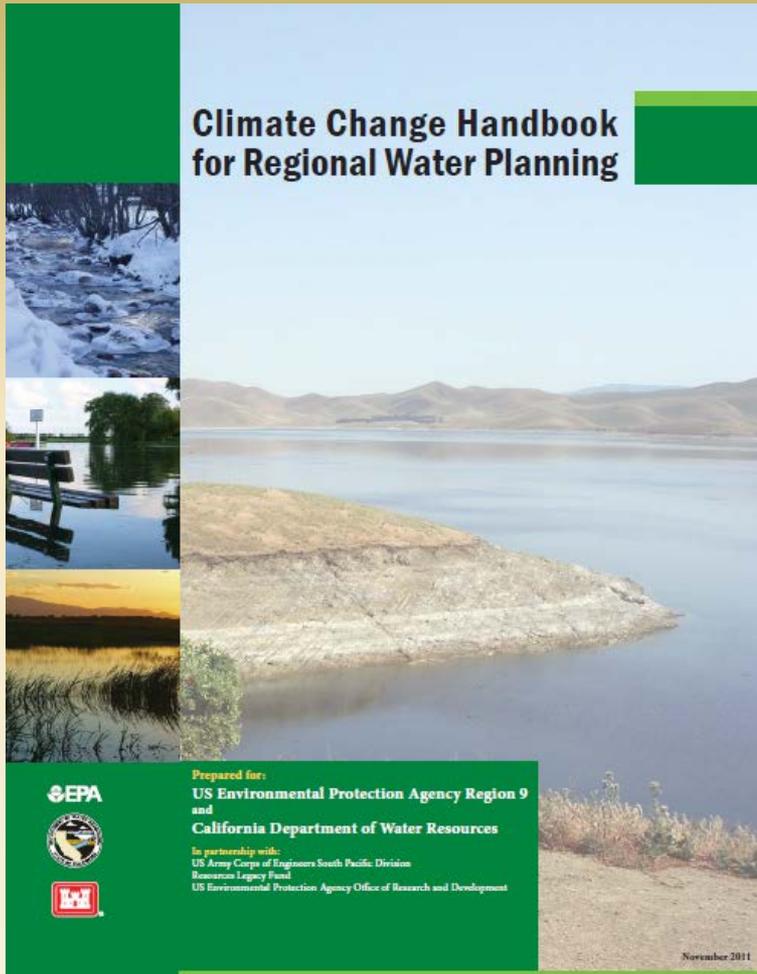
- Water suppliers (two urban)
- Towns
- Counties
- Federal & state agencies
- Tribes
- Conservation & advocacy groups
- Schools



## II. Climate Change Analysis

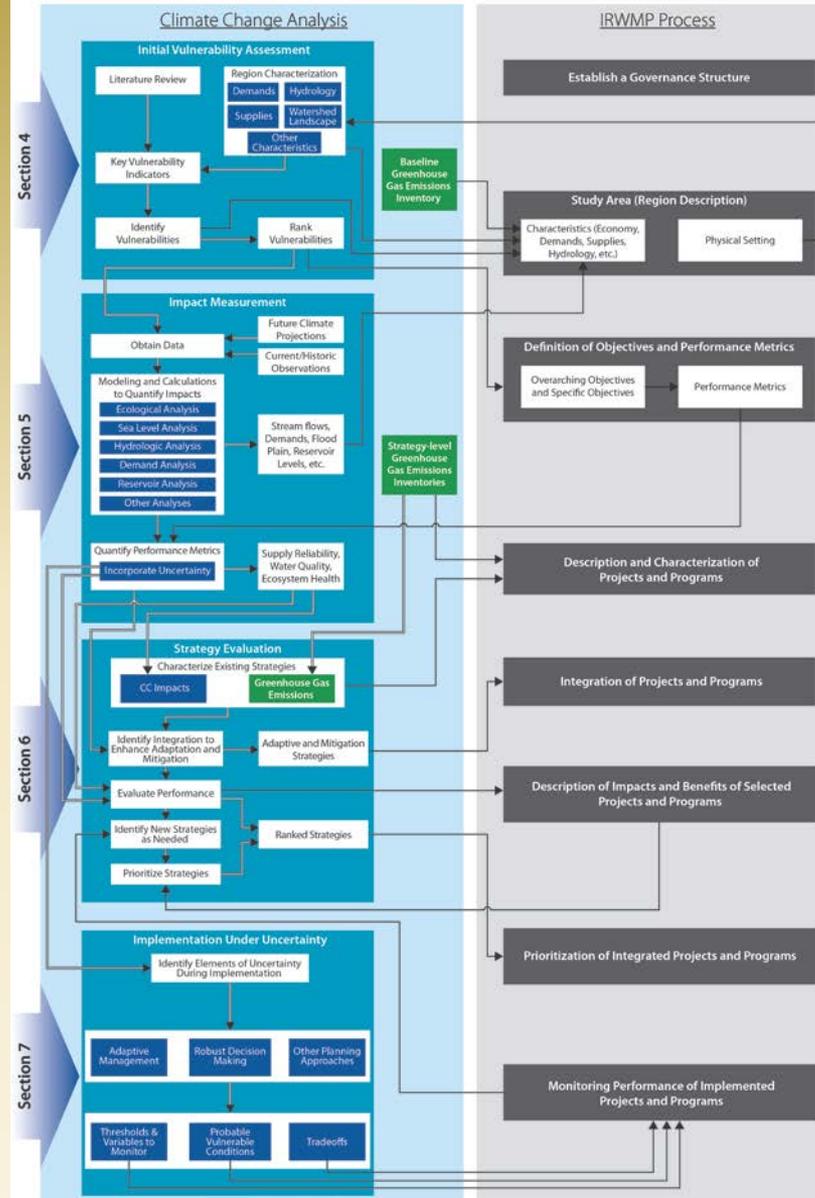
- Upgraded Plan Standard (2012) for IRWM Plans:
  1. Vulnerability assessment
  2. Prioritize vulnerabilities
  3. Identify climate change impacts
  4. Identify & develop adaptation strategies
  5. Encourage mitigation & GHG reduction in water projects
- Climate Change Handbook for Regional Water Planning

# II. Climate Change Handbook

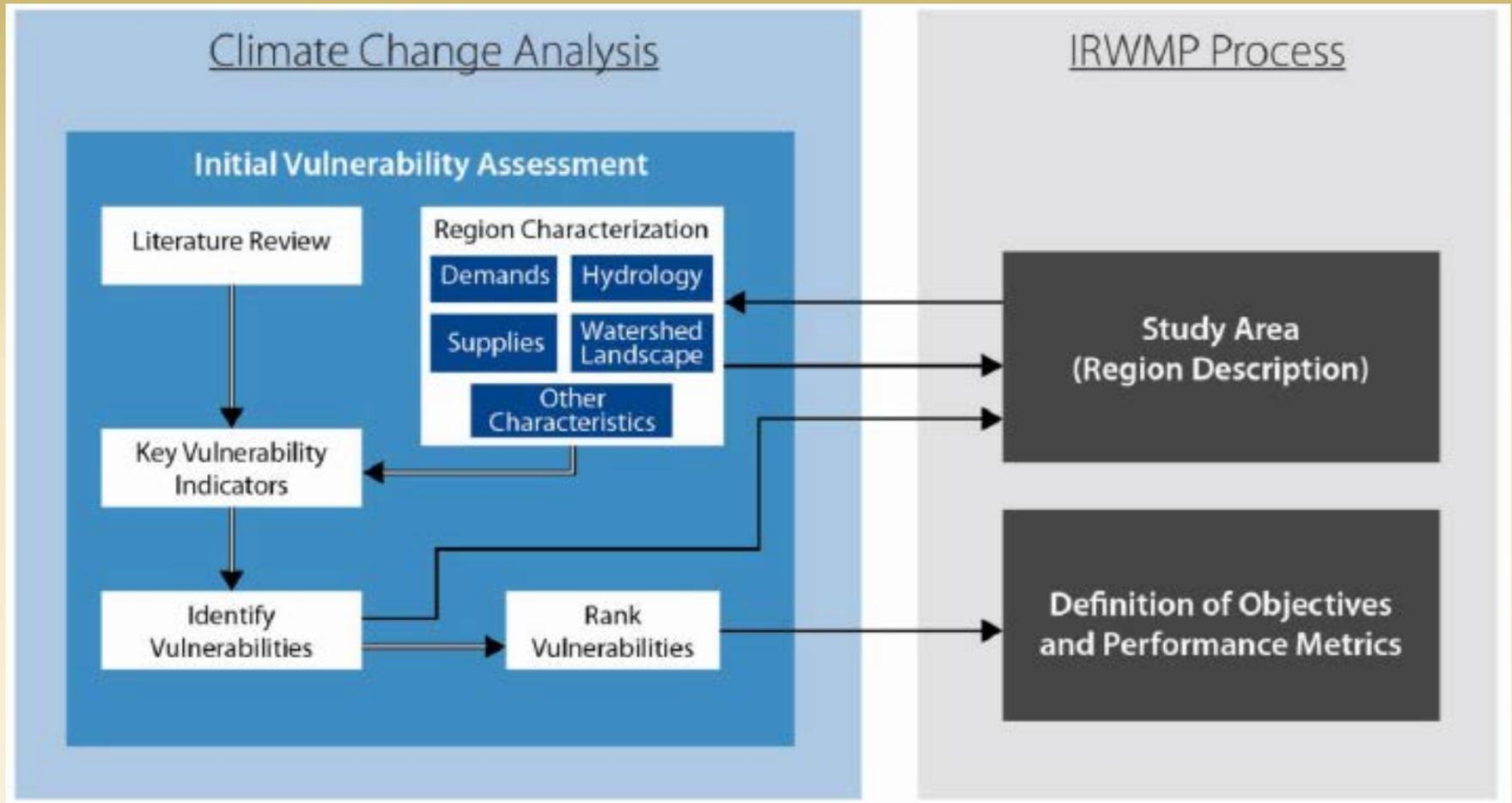


- Guidance
- Tools
- Leading Questions
- Layperson Language
- Various levels of analysis
- Integrated with IRWM

# Detailed Decision-Support Framework



# II. Vulnerability Analysis



# II. Vulnerability Analysis

- Steps:
  1. Characterize the region (✓)
  2. Assess climate change impacts
    - Water supply, water demand, water quality, flooding, ecosystems
  3. Identify vulnerabilities
    - Water supply, water demand, water quality, flooding, ecosystems
  4. Prioritize vulnerabilities (later)



# II. Vulnerability Analysis: Climate Change Impacts

## Water Demand

- Local water demand
  - Small but fluctuates
  - Higher in summer with landscape irrigation
  - Longer, drier summers
- Los Angeles
  - Demand without c.c. expected to rise & level out around 2030
  - No analysis of demand with c.c.
  - ↑ demand relative to other sources

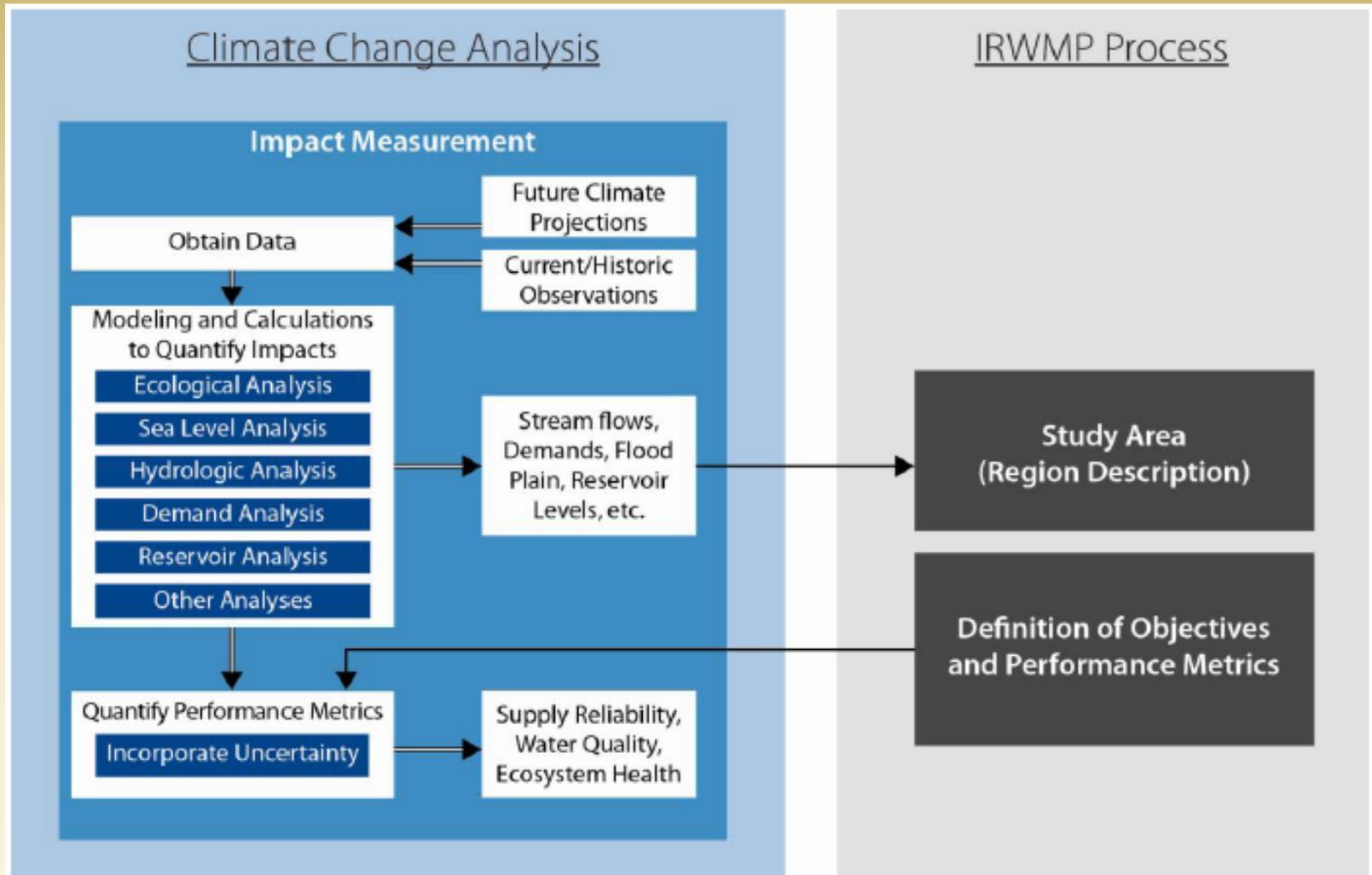
## II. Vulnerability Analysis: Identifying Vulnerabilities

### Water Demand

- **Are there major industries that require cooling/process water in the planning region?**
- **Does water use vary by more than 50% seasonally in parts of the region?**
- **Are crops grown in the region climate sensitive?**
- **Do groundwater supplies in the region lack resiliency after drought events?**
- **Are water use curtailment measures effective in the region?**
- **Are there export demands from the region?**

Category	Impacts	Vulnerabilities
Water Supply	<ul style="list-style-type: none"> <li>• Changes in amount of snowpack, SWE</li> <li>• Timing of snowmelt, runoff and streamflow</li> <li>• Increased rain-on-snow events</li> <li>• Extreme precipitation events</li> <li>• More rain, less snow</li> <li>• Groundwater recharge</li> </ul>	<ul style="list-style-type: none"> <li>• Snowpack</li> <li>• Storage capacity</li> <li>• Drought tolerance</li> </ul>
Water Demand	<ul style="list-style-type: none"> <li>• Longer, drier summers</li> <li>• Increase in summer water demand</li> <li>• Increased demand from City of L.A.</li> </ul>	<ul style="list-style-type: none"> <li>• Solar energy developments</li> <li>• Agriculture</li> <li>• Landscape irrigation</li> <li>• City of Los Angeles</li> <li>• Water conservation</li> </ul>
Water Quality	<ul style="list-style-type: none"> <li>• Intensified summer recreation</li> <li>• Longer grazing seasons</li> <li>• Unknown impacts to groundwater quality</li> </ul>	<ul style="list-style-type: none"> <li>• Wildfires</li> <li>• Erosion</li> <li>• Stormwater/flooding</li> <li>• Recreation</li> <li>• Seasonal low flows</li> <li>• Groundwater contaminants</li> </ul>
Flooding	<ul style="list-style-type: none"> <li>• Increased rain-on-snow events</li> <li>• Extreme precipitation events</li> <li>• Increased wildfire incidence</li> <li>• Unknown impacts of altered snowpack, snowmelt, and streamflow</li> </ul>	<ul style="list-style-type: none"> <li>• Lack of, inadequate, or aging infrastructure</li> <li>• Wildfires</li> </ul>
Terrestrial and Aquatic Ecosystems	<ul style="list-style-type: none"> <li>• Changes to species distributions</li> <li>• Novel and unpredictable species relationships and interactions</li> <li>• Competitive advantage of invasive species</li> <li>• Hydrological impacts – changes to water temperature, pH, DO, turbidity, and flow regimes</li> </ul>	<ul style="list-style-type: none"> <li>• Aquatic habitats</li> <li>• Meadows, wetlands, estuaries</li> <li>• Climate sensitive species</li> <li>• Threatened and endangered species</li> <li>• Species distributions</li> <li>• Reliance on aquatic ecosystems for recreation and livelihoods</li> <li>• In-stream environmental flow requirements</li> </ul>

# II. Measuring Impacts



# II. Measuring Impacts: Future Climate Projections

Webpage Screenshot



## Bias Corrected and Downscaled WCRP CMIP3 Climate and Hydrology Projections

*This site is best viewed with [Chrome](#) (recommended) or [Firefox](#). Some features are unavailable when using Internet Explorer. Requires JavaScript to be enabled.*

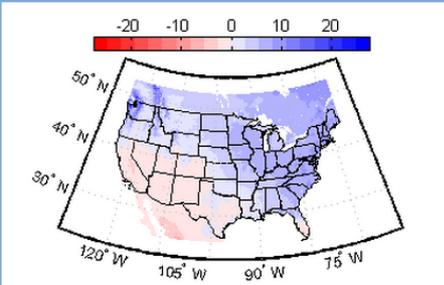
Welcome
About
Tutorials
Projections: Subset Request
Projections: Complete Archives
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### Summary

This archive contains fine spatial-resolution translations of:

- climate projections over the contiguous United States (U.S.) developed using two downscaling techniques (monthly BCSD Figure 1, and daily BCCA Figure 2), and
- hydrologic projections over the western U.S. (roughly the western U.S. Figure 3) corresponding to the monthly BCSD

*Figure 1: BCS D CMIP3 Monthly Climate Analysis example - Median projected change in average-annual precipitation (cm/year), 2041-70 versus 1971-2000.*

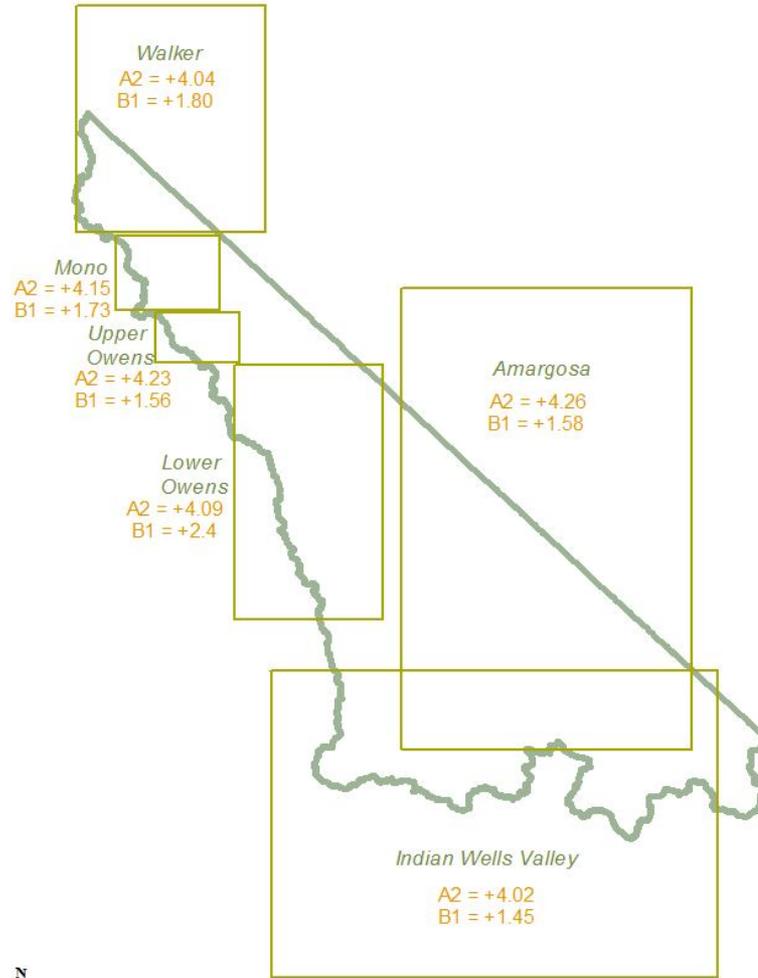


No.	Model name; modeling group, country	Model identification	Primary reference year
1	Parallel Climate Model; National Center for Atmospheric Research (NCAR), USA	PCM	2000
2	Geophysical Dynamics Laboratory model version 2.1; US Dept. of Commerce / National Oceanic and Atmospheric Administration (NOAA) / Geophysical Fluid Dynamics Laboratory (GFDL), USA	GFDL-CM2.1	2006
3	Community Climate System Model; National Center for Atmospheric Research (NCAR), USA	CCSM3	2006
4	Max Planck Institute (MPI) for Meteorology, Germany	ECHAM5/ MPI-OM	2006
5	Center for Climate System Research (University of Tokyo), National Institute for Environmental Studies, and Frontier Research Center for Global Change (JAMSTEC), Japan	MIROC3.2 (medres)	2004
6	Meteo-France / Centre National de Recherches Meteorologiques (CNRM), France	CNRM-CM3	2005



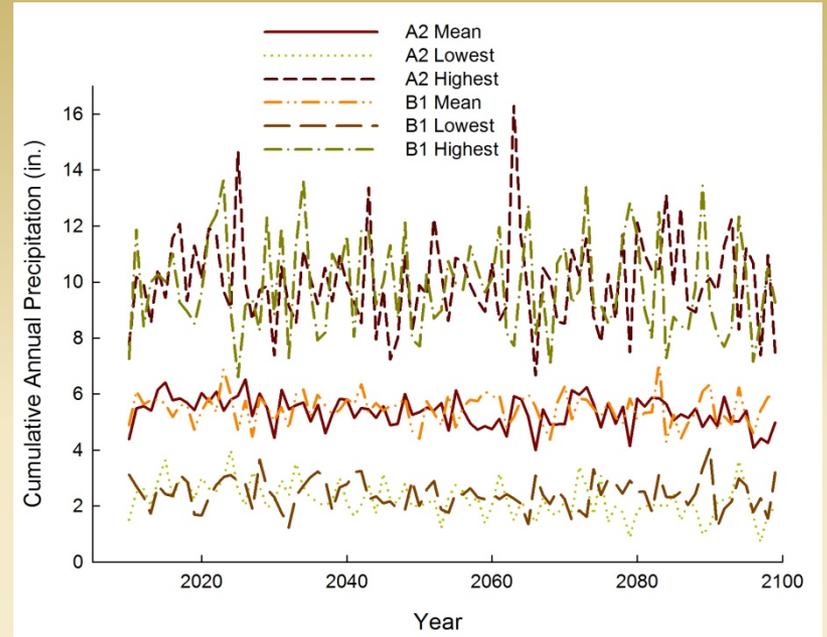
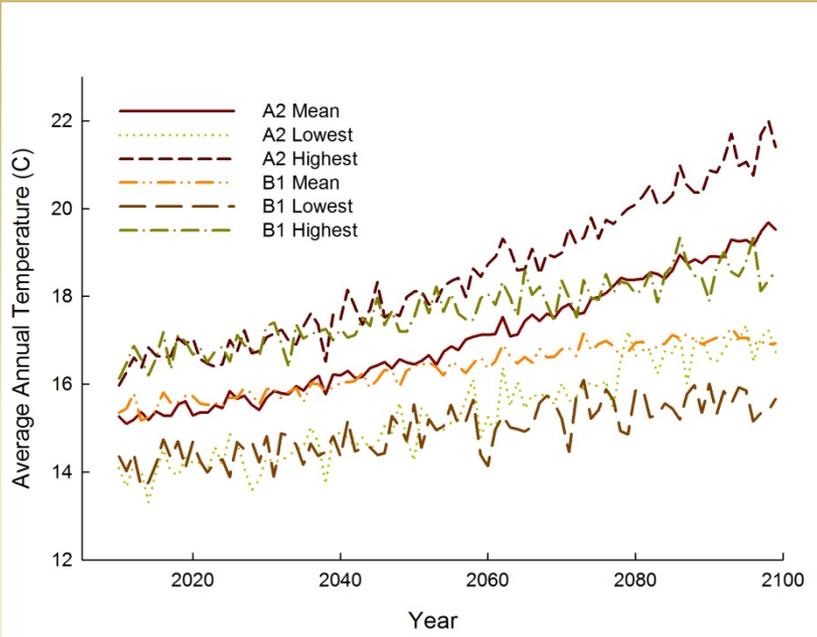
# Regional Climate Change Scenarios Summary

Examining two Emissions Scenarios for the Inyo-Mono Region  
All temperatures in Degrees C



Source Data: Bias Corrected and Downscaled WCRP  
CMIP3 Climate and Hydrology Projections run by Holly Alpert

Map by: J.Hatfield 5/2012



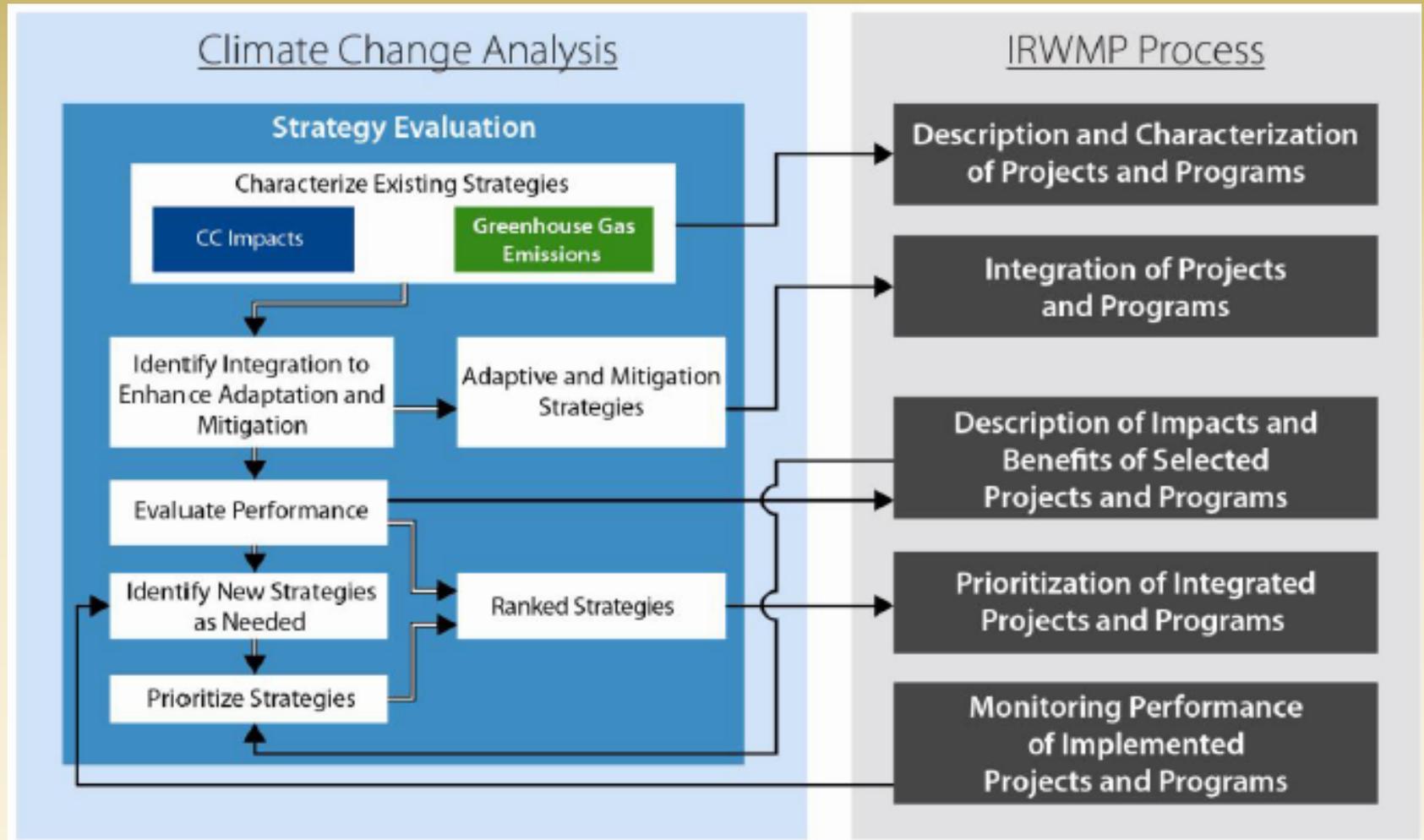
# Amargosa watershed

## II. Measuring Impacts

Quantifying Impacts (ecological, hydrological, demand, etc.):

### Assistance Needed

# II. Evaluating Strategies



# II. Evaluating Strategies: Adaptation

## From “Managing an Uncertain Future” (2008)

- Provide sustainable funding for statewide and integrated regional water management
- Fully develop the potential of integrated regional water management
- Aggressively increase water use efficiency
- Practice and promote integrated flood management
- Enhance and sustain ecosystems
- Expand water storage and conjunctive management of surface and groundwater resources
- Fix Delta water supply, quality, and ecosystem conditions
- Preserve, upgrade, and increase monitoring, data analysis, and management
- Plan for and adapt to sea level rise
- Identify and fund focused climate change impacts and adaptation research and analysis

## II. Evaluating Strategies: Mitigation

- Carbon sequestration
- GHG reduction

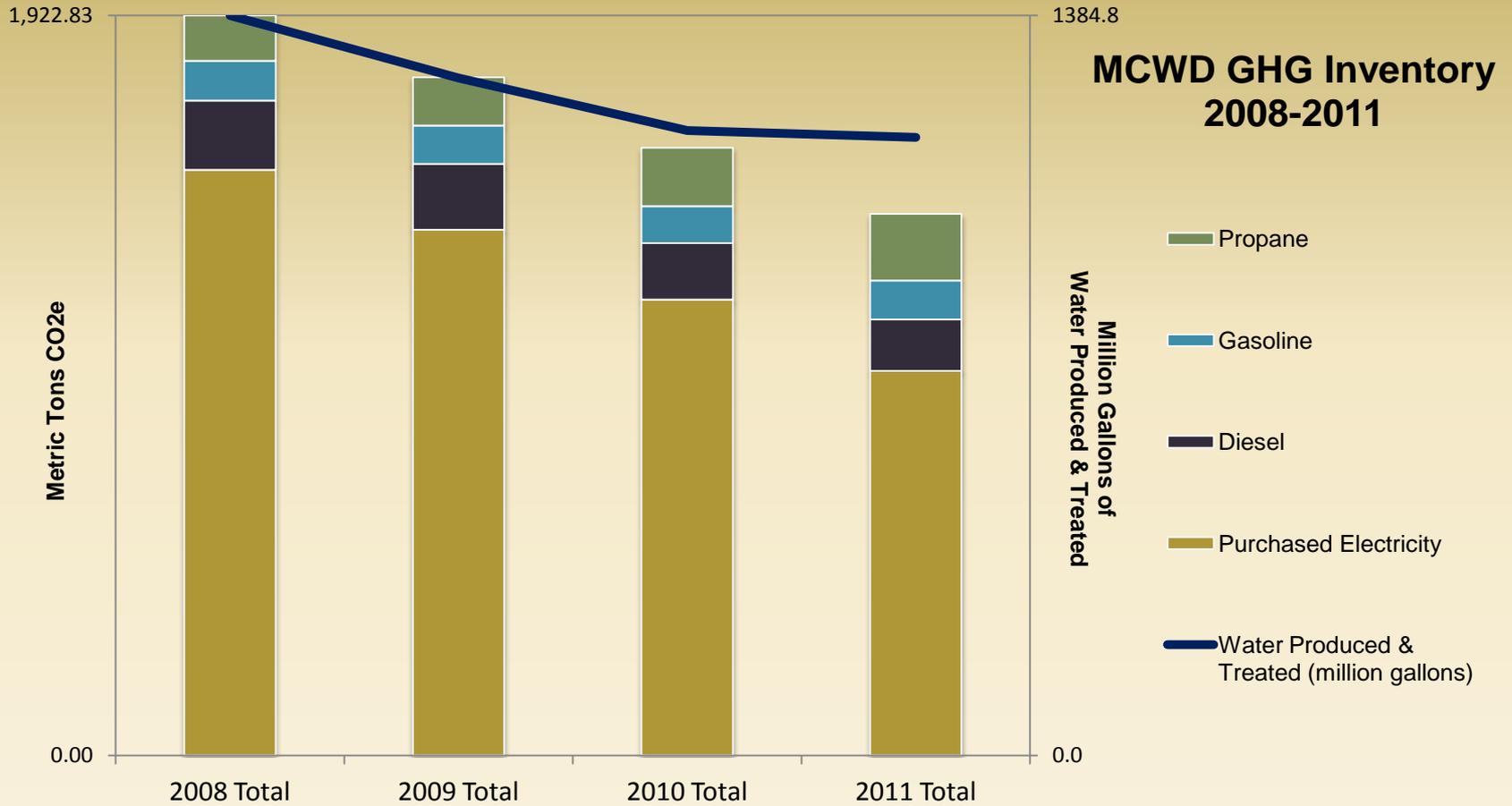


# II. Evaluation Strategies: Mitigation

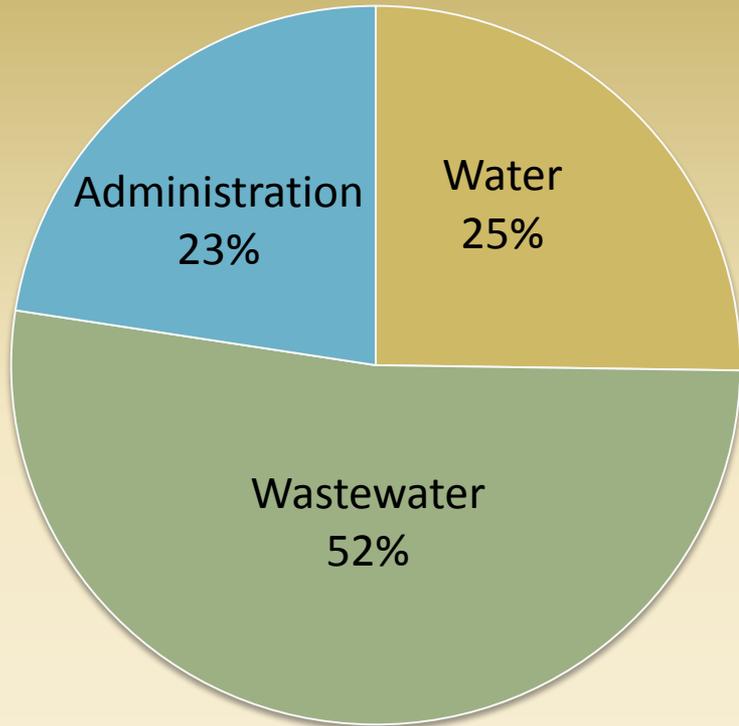
- GHG Inventory Analyses
  - June Lake PUD
  - Mammoth Community Water District
  - Indian Wells Valley Water District (Ridgecrest)

Emissions Type	Source Sector	Source Category
Direct (Scope 1)	Transportation	On-road mobile sources (motor vehicles: passenger cars, trucks, buses)
		Off-road vehicles (boats, snowmobiles, lawn and garden equipment, etc.)
	Fuel combustion	Natural gas combustion (residential and commercial)
		Other fuel combustion (propane, wood, etc.)
Waste	Wastewater treatment	
Indirect (Scope 2)	Energy	Electricity consumption
		Wastewater treatment

# Mammoth Community Water District



## MCWD GHG Inventory by Activity 2011



# III. Lessons Learned

- Bigger “perceived” fish to fry than climate change
- Stakeholders don’t “believe” in climate change
- Limited access to information
- Overwhelmed by information, different models, efforts, etc.
- Specialized regional concerns

# III. Resources Needed

- Information at scales appropriate for planning and tailored to region
- Technical assistance with modeling, information gathering, quantitative analysis
- Tools, guidance, one-stop information shop
- Better dissemination of information from State agencies
- Incentives for including climate change among other high local/regional priorities

# Thank You



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