California water issues and management solutions

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CALIFORNIA WATER CHALLENGES (2013 WATER PLAN)

Greater Drought Impacts — Unreliable Water Supplies

The well-being of all Californians has depended on the reliable storage and movement of large quantities of water throughout the state. It is now becoming increasingly difficult to move water great distances due to declining ecosystems (and related regulatory requirements), rising energy costs, and aging infrastructure. This is wholly apparent in the Sacramento-San Joaquin Delta (Delta). At the same time, the state's environment and economy are becoming increasingly susceptible to the effects of reduced water-supply reliability.

Competing Water Demands

California's changing and increasingly competing demands for water come from many sectors. All uses generally can be characterized as urban, agricultural, or environmental. The state's population continues to grow, and the trend has been toward faster growth in warmer inland regions. From 1990 to 2010, California's population increased from about 30 million to about 37.3 million. The California Department of Finance projects that this trend indicates a state population of roughly 51 million by 2050.

Increasing Flood Risk

Every Californian is exposed to the significant impacts that result from flooding, including disruption of commerce, response, and the secondary economic impacts that ripple through the state's economy (e.g., redirection of funding from other State government services).

Degraded Water Quality

The quality of groundwater and surface waters varies significantly throughout the state. Degradation has occurred and is continuing to occur in many locations naturally and as a result of human activities, further limiting usable supplies.

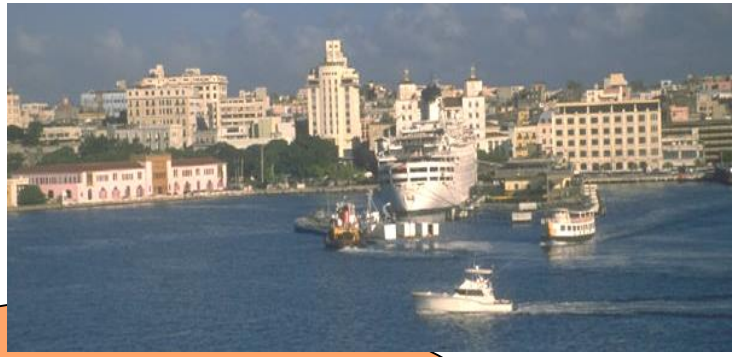
Declining Environmental Conditions

California has experienced decades of unacceptable habitat and species declines. The sustainability of habitats and the species they support are highly vulnerable to climate change, water quality degradation, land use decisions, and many other drivers.

Aging Infrastructure

California's water supply and flood protection systems, composed of aging infrastructure, have been further weakened by insufficient maintenance in some areas. State and federal governments have not implemented new large-scale infrastructure in decades.

COMPETITION FOR WATER SUPPLY AND WATER QUALITY IN CALIFORNIA



AGRICULTURE

URBAN / MUNICIPAL

ENVIRONMENT

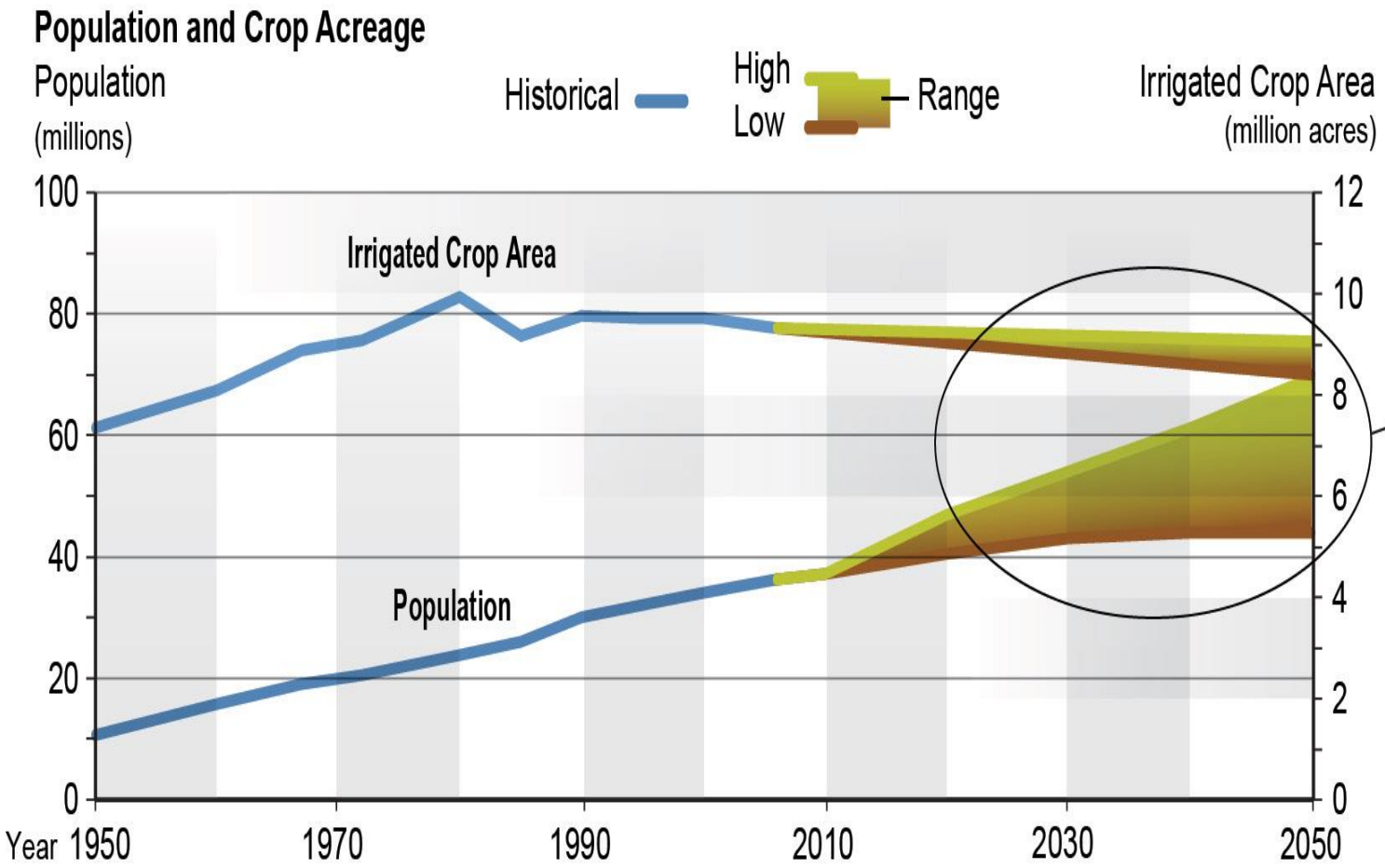
CALIFORNIA'S WATER INFRASTRUCTURE AND DEMANDS

Where California's Water Comes From
Most of California's water comes from rain and snow that falls in the northern and eastern parts of the state.

Only Some Is Available to Meet California's Water Demands
About half of the 200 million acre-feet (MAF) California receives is used by vegetation or goes to evaporation. Another 20 MAF stays in North and Central Coast streams.

Where California's Water Goes
About 65 MAF is available to meet California's agricultural, urban, and Central Valley environmental needs.

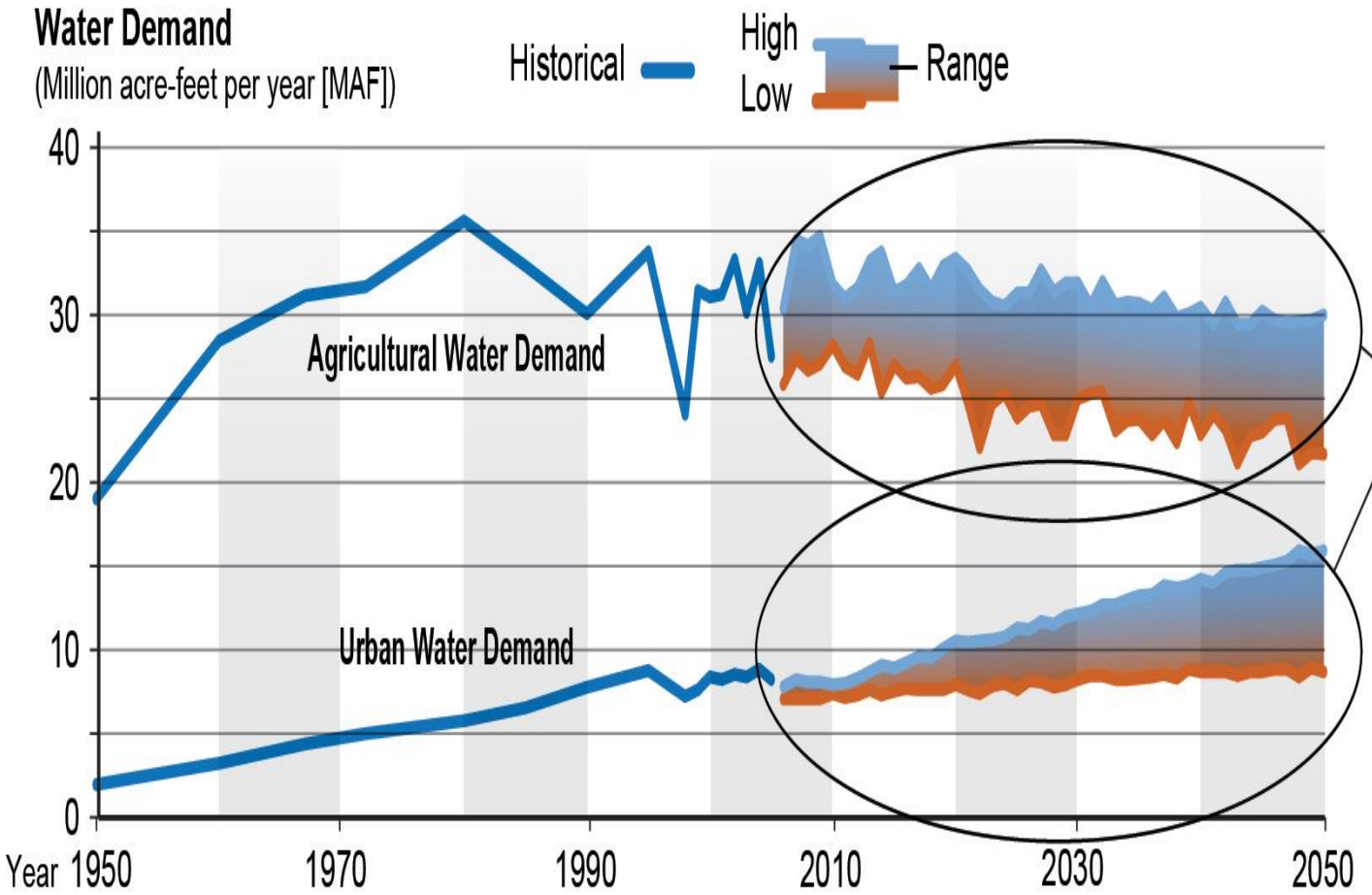
POPULATION GROWTH EXPECTATIONS AND CROP ACREAGE



Year 2050 scenarios considered population between 43.9 and 69.4 million people and irrigated crop area between 8.4 and 9.2 million acres.

Source: CA Water Plan 2013 update

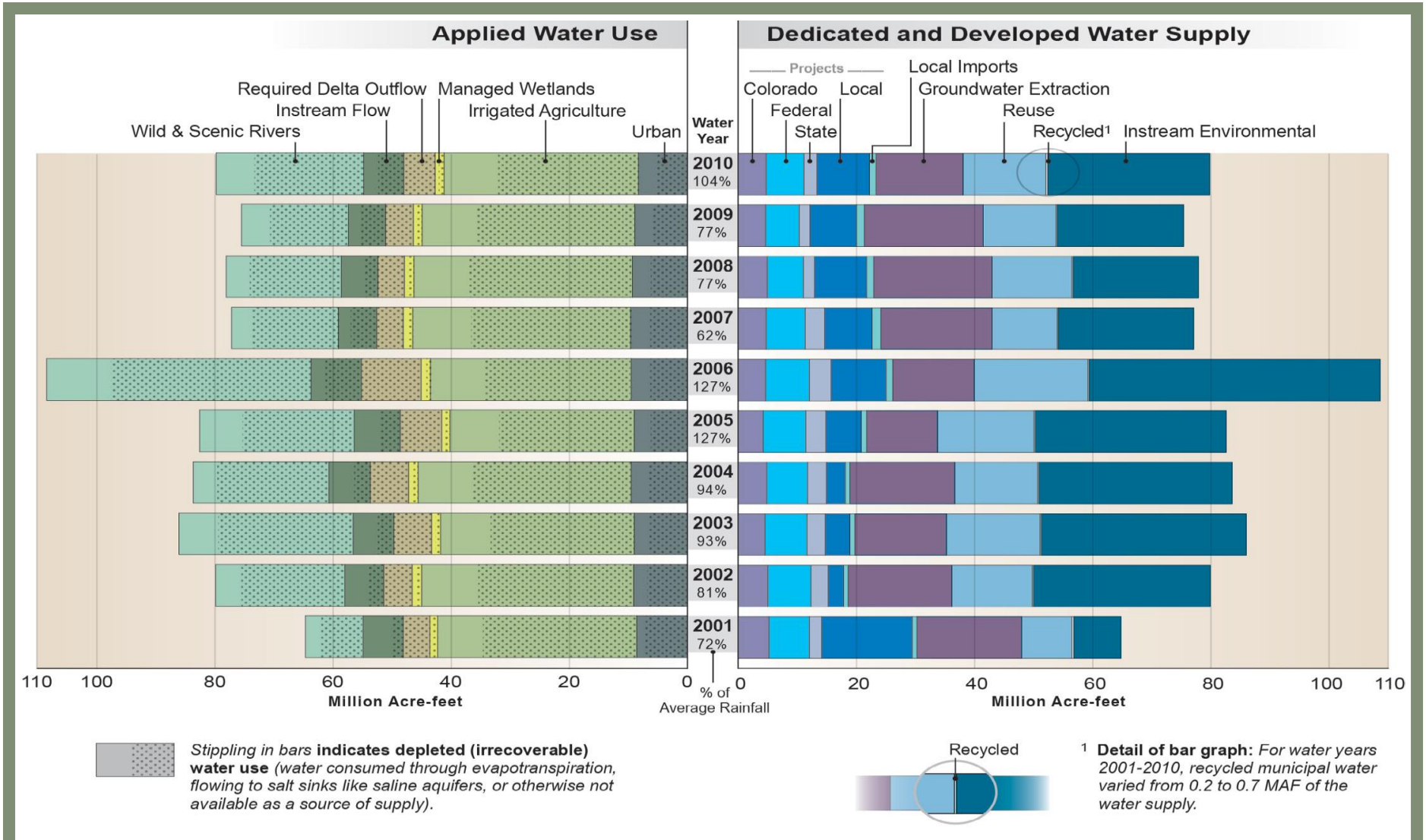
PROJECTING FUTURE WATER DEMAND FOR AG AND URBAN SECTORS



By 2050, urban water demand could increase by 1.0-6.7 MAF/yr, and agricultural demand could decrease by 2.0-5.9 MAF/yr.

Source: CA Water Plan 2013 update

UNDERSTANDING ANNUAL VARIABILITY OF STATEWIDE WATER USE

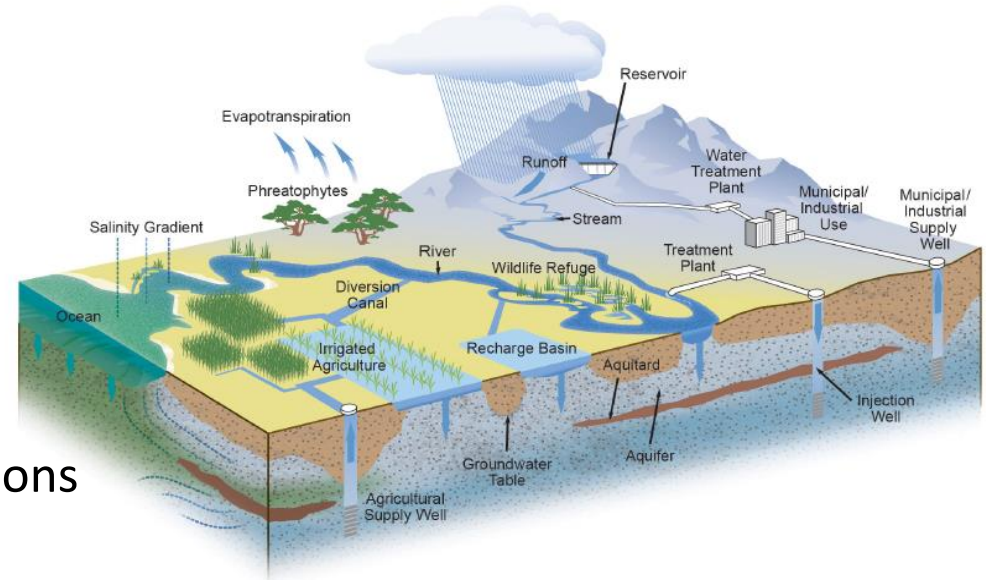


Source: CA Water Plan 2013 update

WATER SUPPLY ALLOCATIONS FROM AGENCY RESERVOIRS

Agency water supply allocations during drought consider:

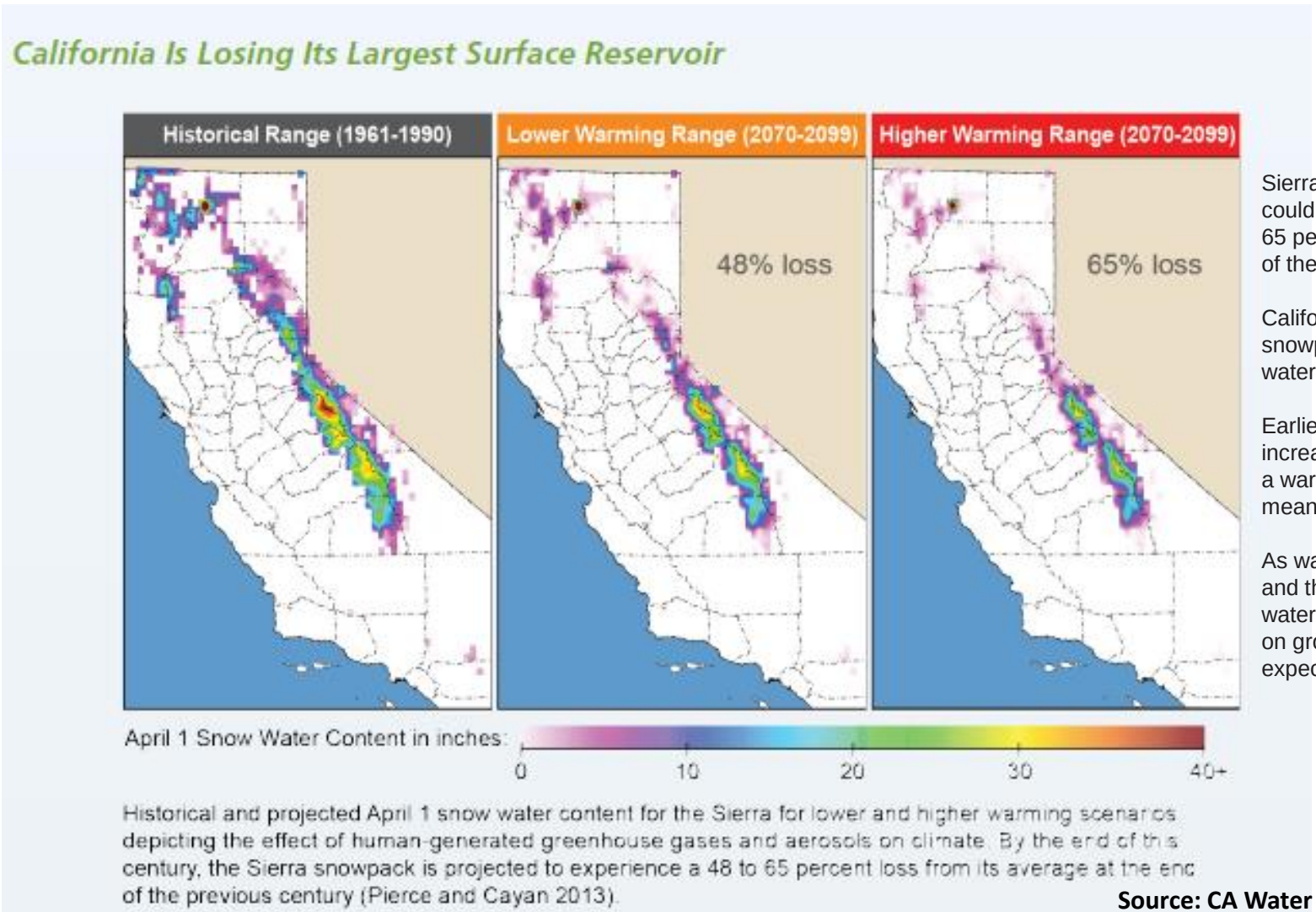
- hydrologic conditions
- reservoir storage levels
- specific operational criteria
- water quality requirements
- water rights priority
- contractual obligations
- endangered species protections
- Groundwater overdraft risk



In December 2013, the governor formed a multi-agency Drought Task Force to review expected water allocations, examine and coordinate water conservation priorities, coordinate water transfers, and develop groundwater monitoring programs, where necessary.

Source: CA Water Plan 2013 update

WATER STORAGE IN SIERRA SNOWPACK



Historical and projected April 1 snow water content for the Sierra for lower and higher warming scenarios depicting the effect of human-generated greenhouse gases and aerosols on climate. By the end of this century, the Sierra snowpack is projected to experience a 48 to 65 percent loss from its average at the end of the previous century (Pierce and Cayan 2013).

Sierra Nevada snowpack could be reduced by 48 to 65 percent by the end of the century.

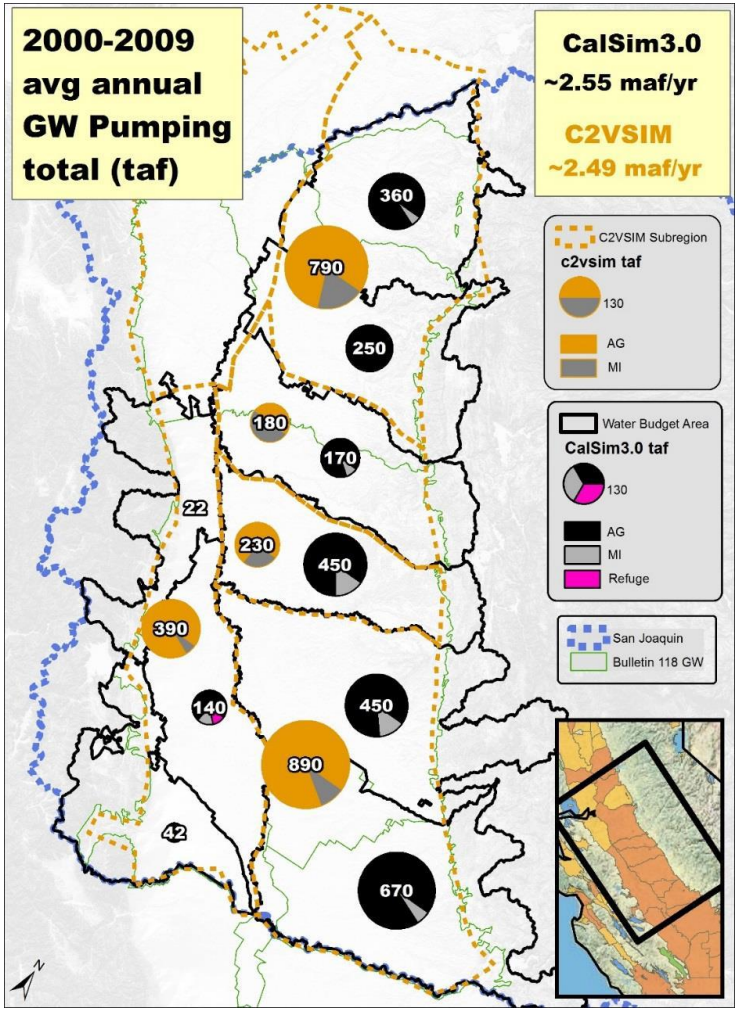
California relies on snowpack as a major water supply.

Earlier runoff timing and increased water demand in a warmer climate could mean greater water scarcity.

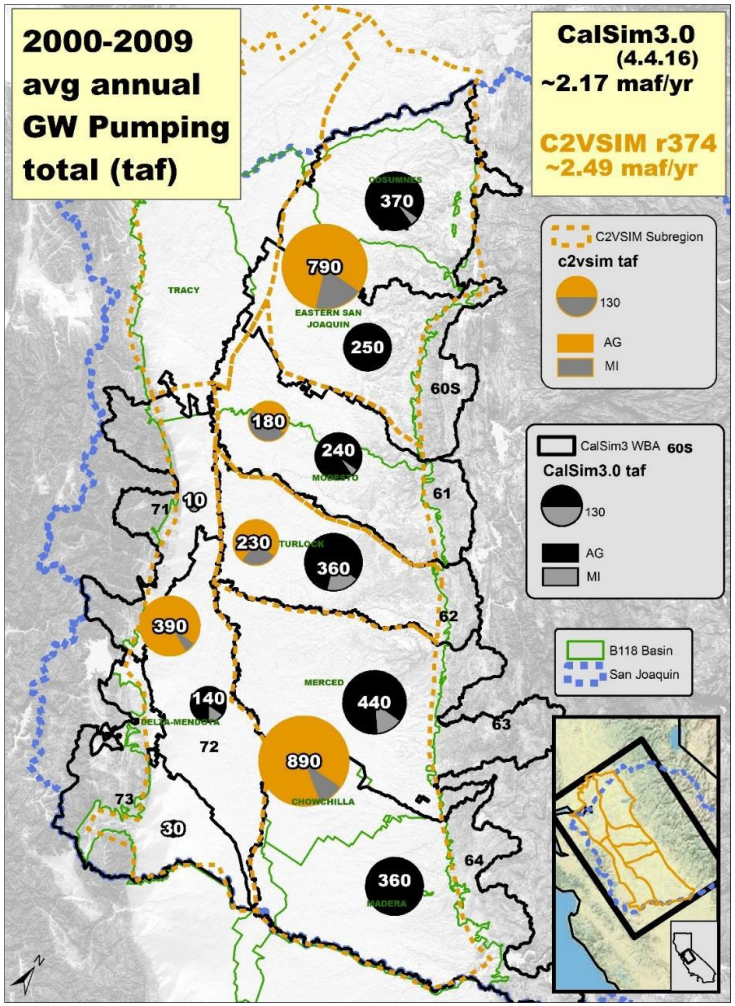
As water demands increase and the reliability of surface water is reduced, demands on groundwater are expected to increase.

Source: CA Water Plan 2013 update

GROUNDWATER INTEGRATION INTO AGENCY PLANNING TOOLS



2015 Stand-alone SJR

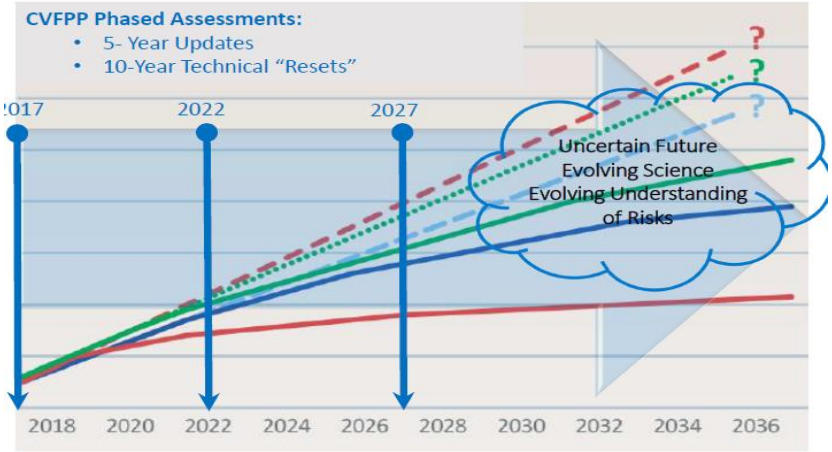


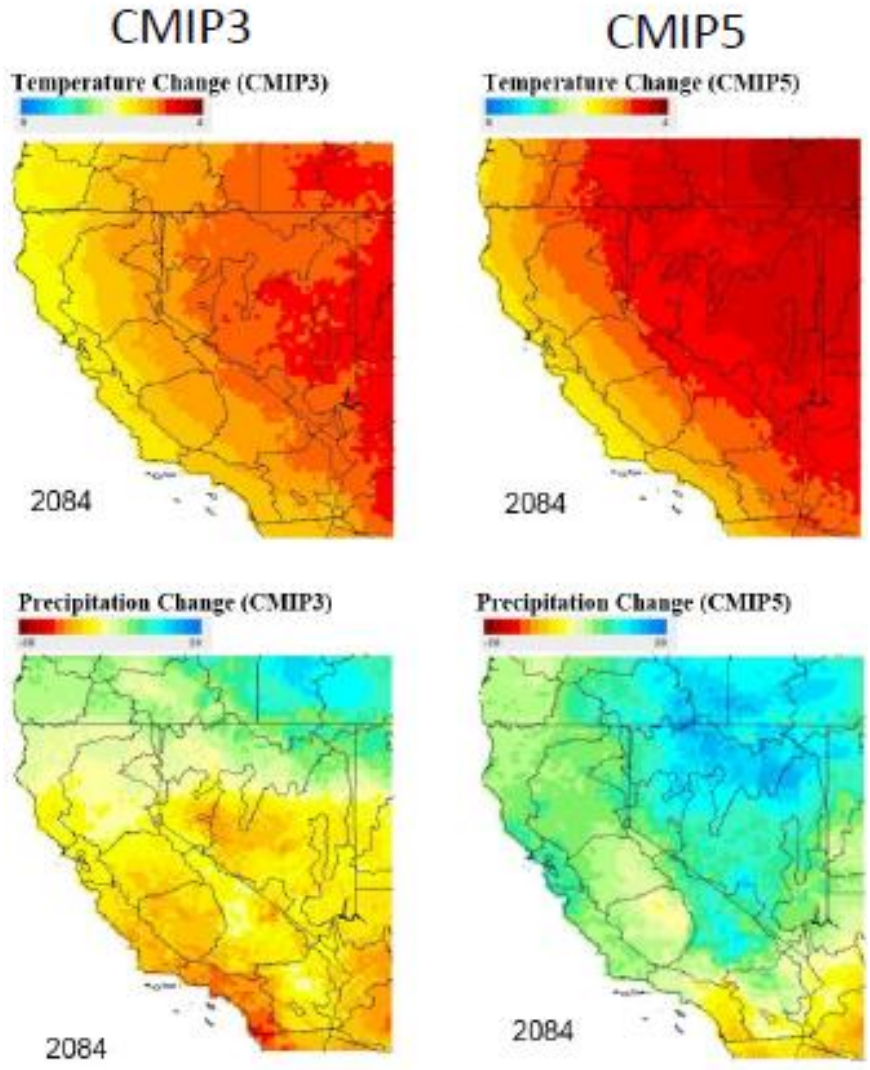
2016 Integrated SJR model

CLIMATE CHANGE SCIENCE EVOLUTION

INNOVATIONS

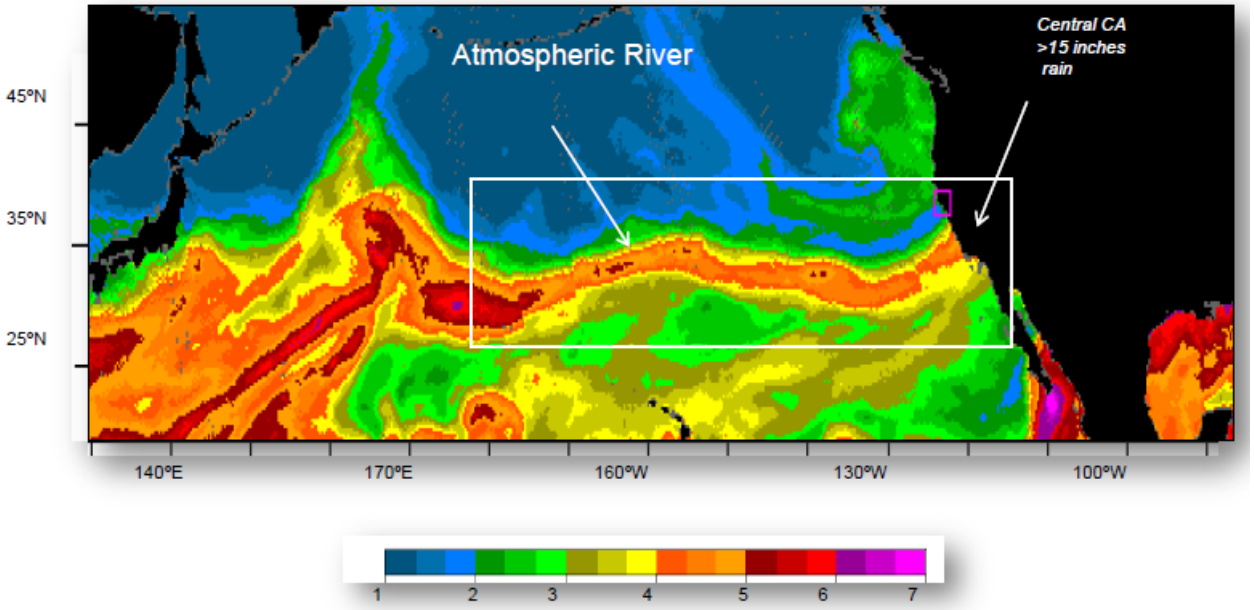
- Expand understanding of historic climate conditions related to flood risk
- Improve climate change analysis for the most recent future climate projections (CMIP5) *Ensembles, Individual projections*, *Downscaling*
- Improve understanding and modeling of hydrologic model at higher spatial resolutions
- Coordinate, review, and integrate existing and on-going DWR/USBR-supported climate science research





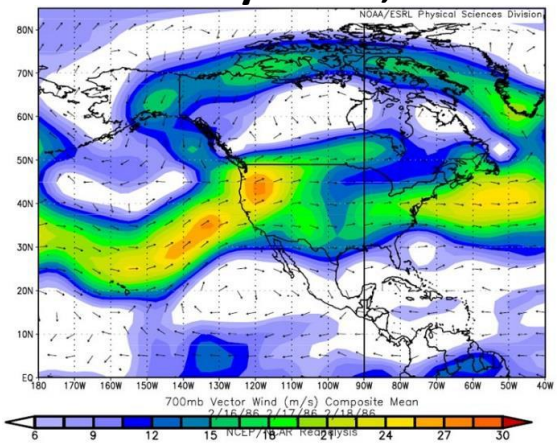
CALIFORNIA WATER MANAGEMENT ISSUES

Many Floods are Linked to Atmospheric River Events

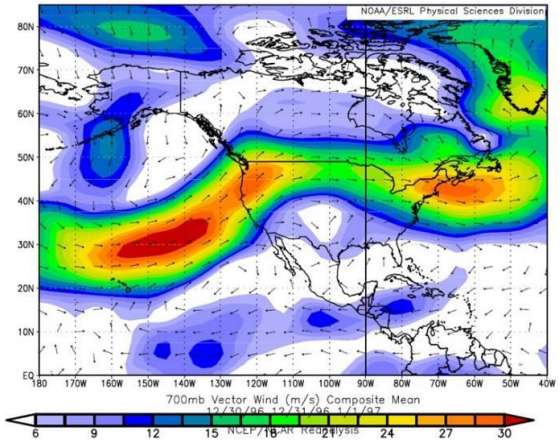


WINDS

February 16-18, 1986

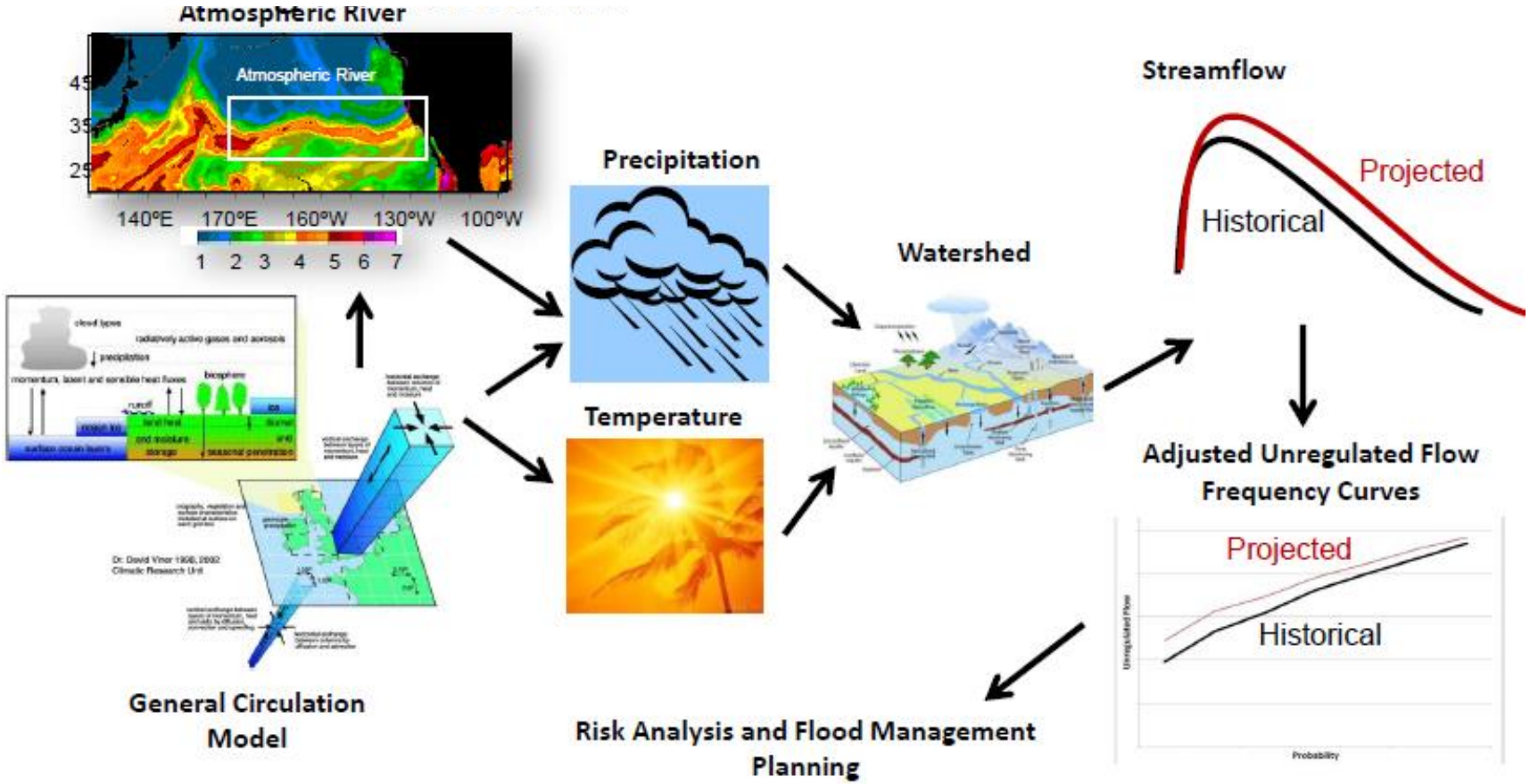


Dec 30, 1996 – Jan 1, 1997



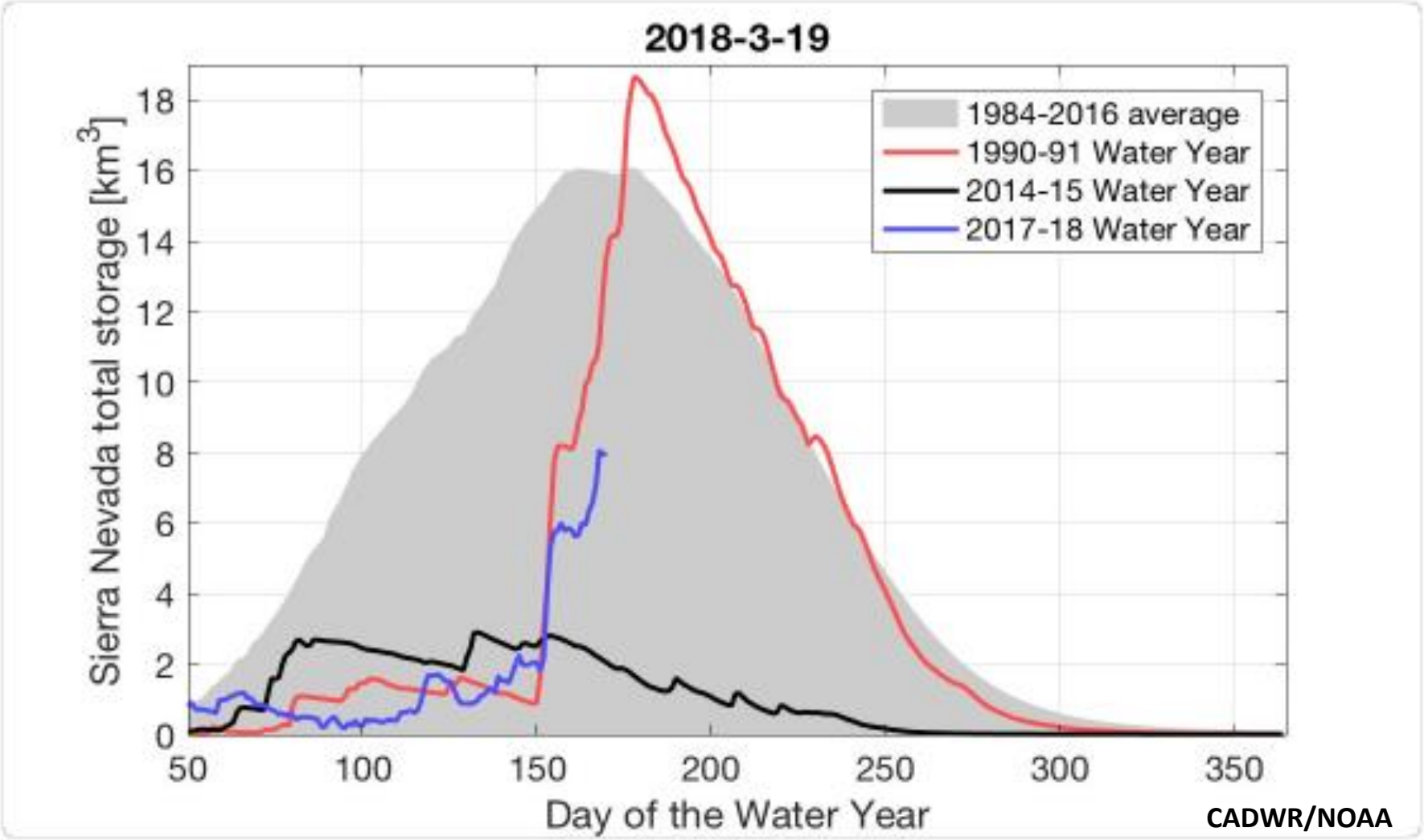
CLIMATE MODELING CAPABILITY IN AGENCY MODELS

Linking atmospheric processes, precipitation and temperature fields, and watershed conditions to inform changes in flood risk



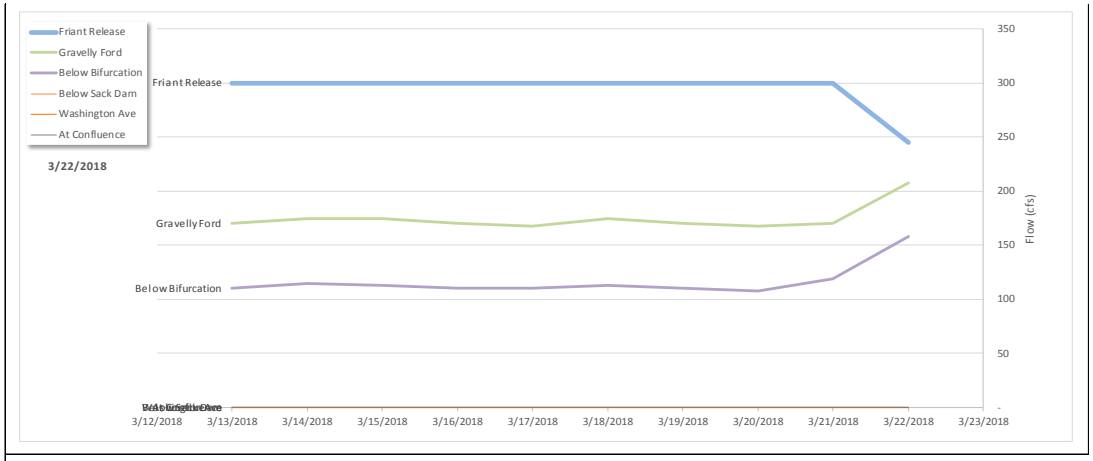
CH2M-Hill, CWEMF 2015

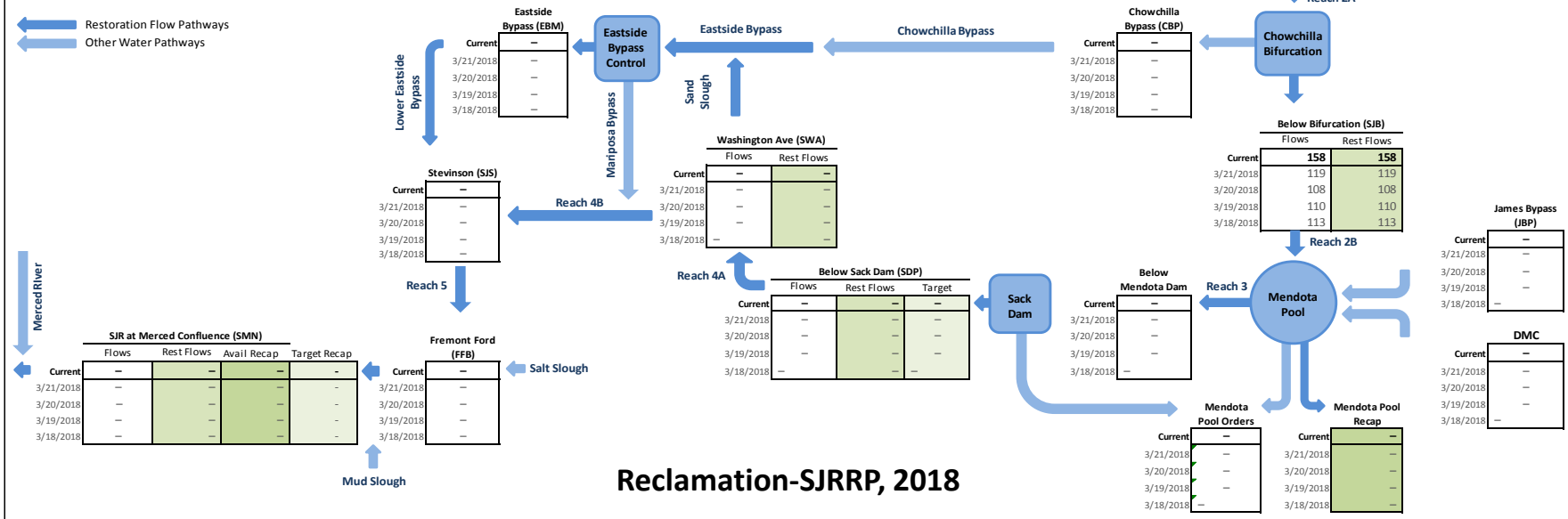
VISUALIZATION OF CURRENT TRENDS/EVENTS



CADWR/NOAA

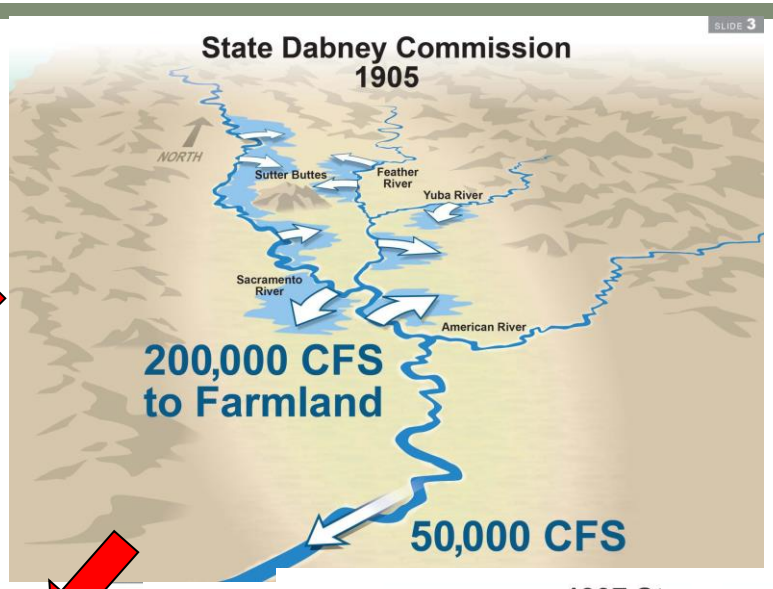
VISUALIZATION OF RIVER BASIN OPERATIONS AND FORECASTING

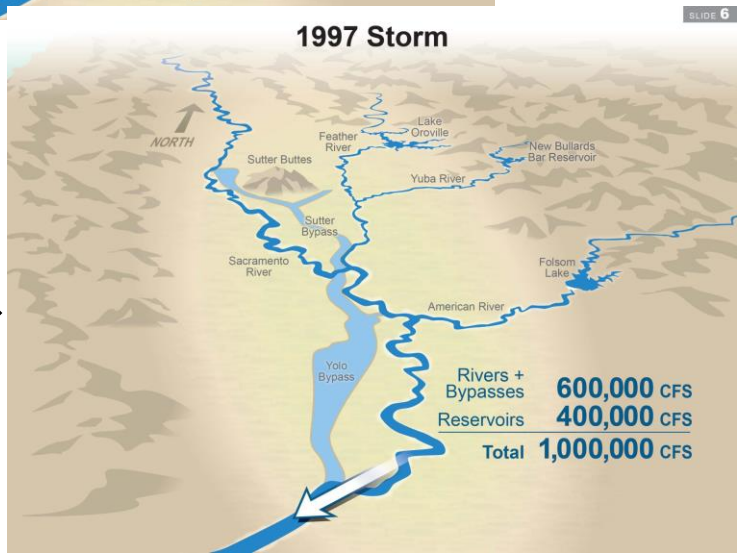




Reclamation-SJRRP, 2018

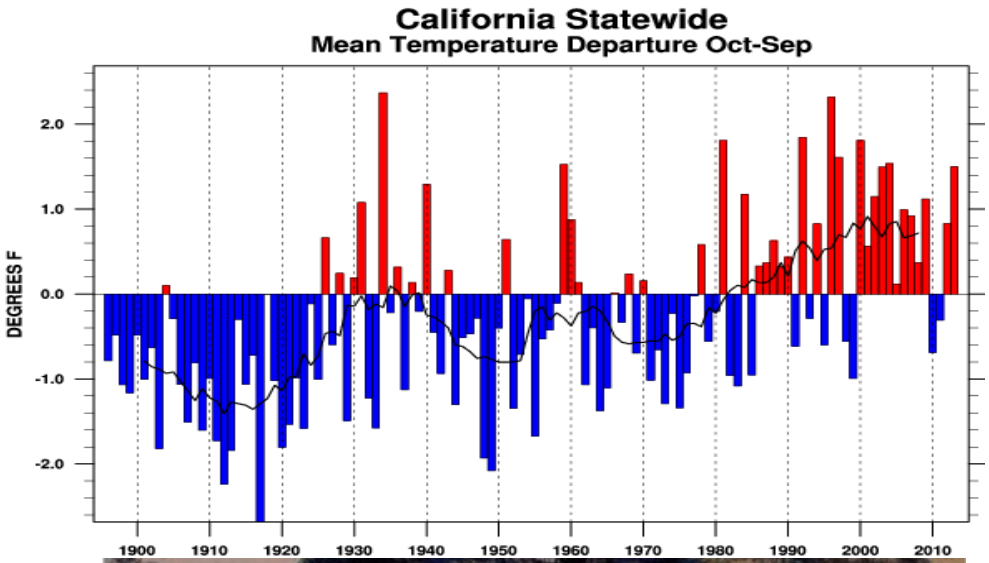
FLOOD CONTROL MEASURES OVER TIME (DWR, 2014)





CLIMATE CHANGE AND FLOOD PREDICTION

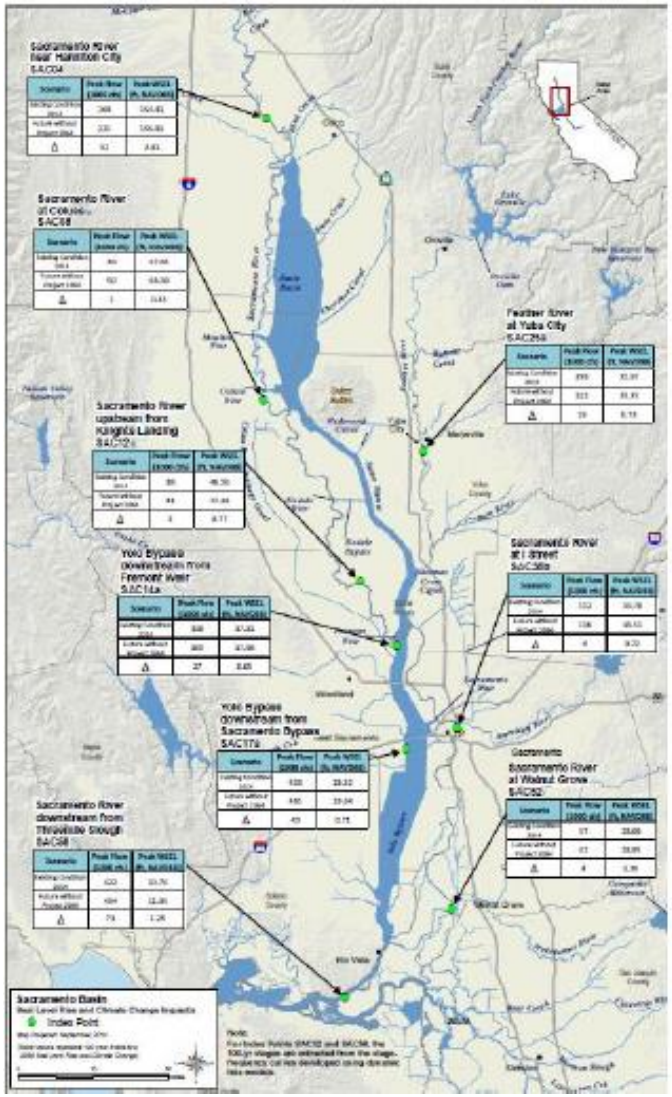
- Current flood management and flood risk analyses depend on historical estimates and statistics of flood hydrology
- Flood management infrastructure and policy decisions will likely be tested against climate variability and change not experienced in the past 100 years
- Our systems need to be resilient to accommodate a range of hydroclimate futures

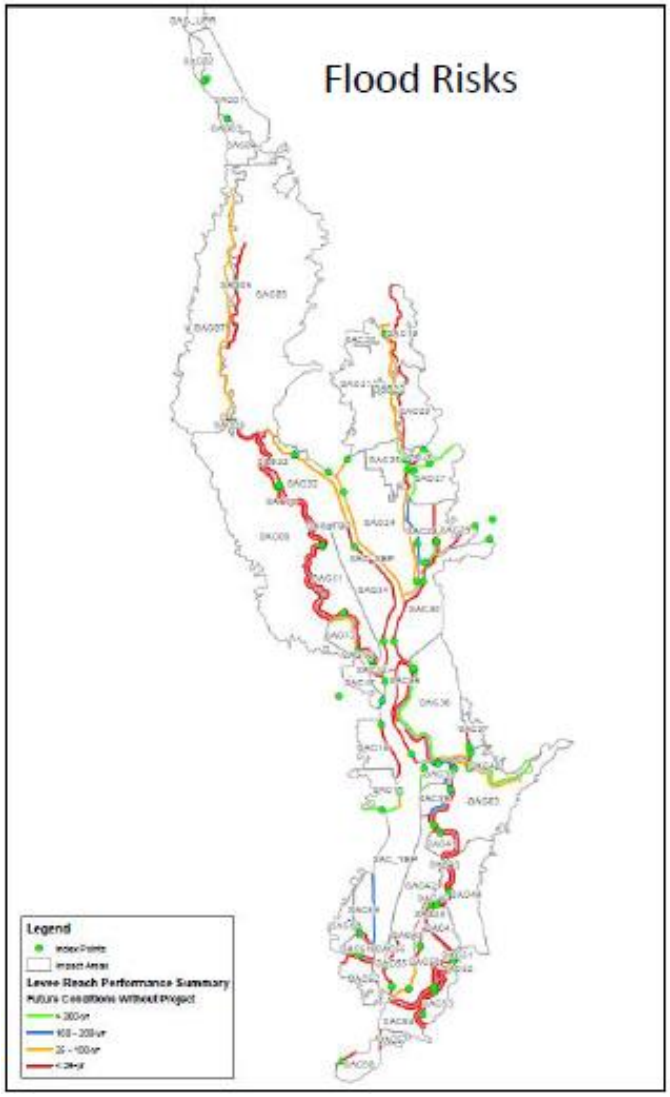


Source: CA Water Plan 2013 update

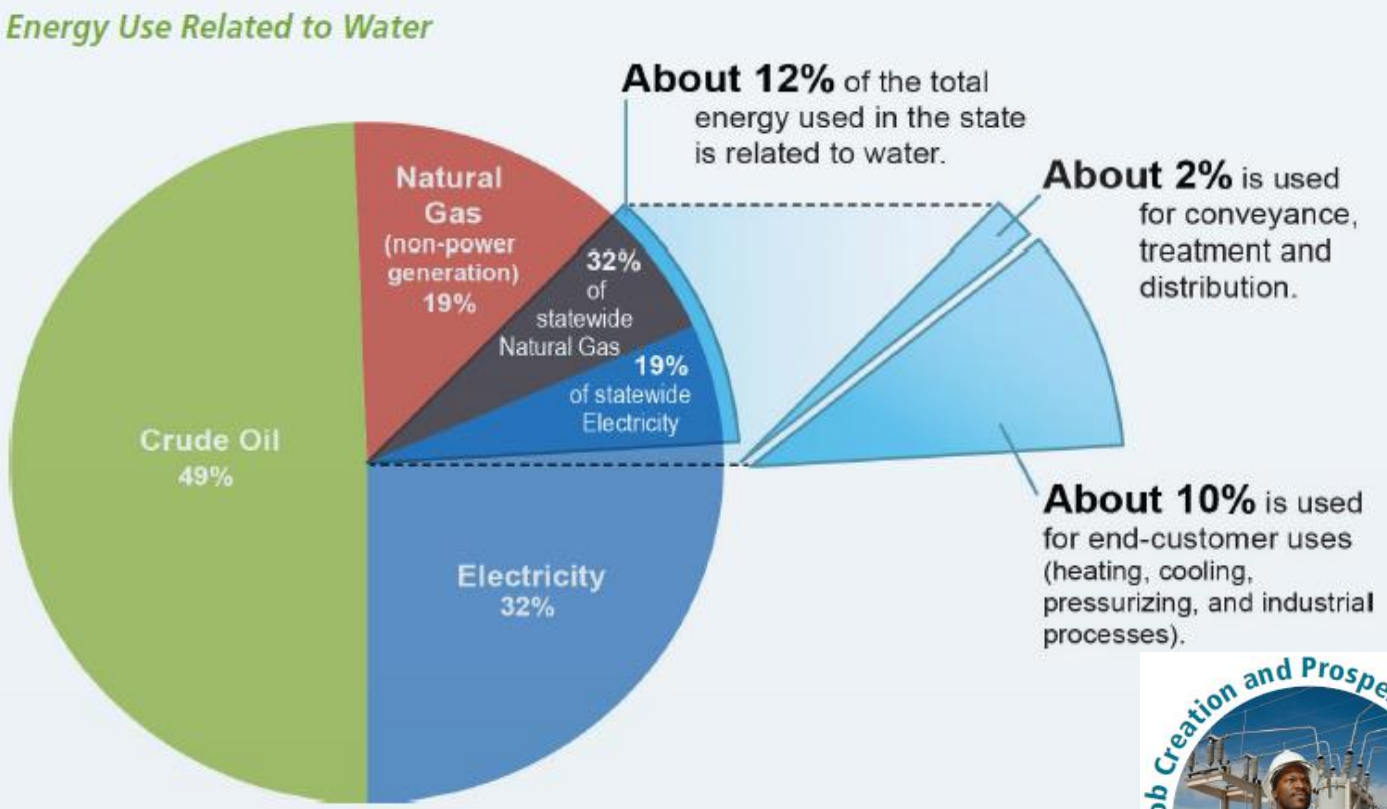
FLOOD CONTROL OPERATIONS AND EMERGENCY RESPONSE PLANNING

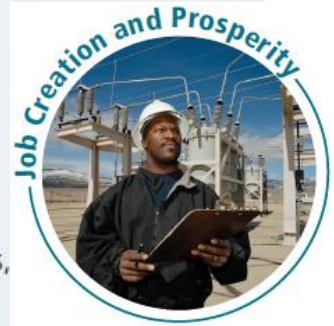
Regulated hydrology and hydraulics (peak flow and stage)





UNDERSTANDING THE WATER-ENERGY NEXUS





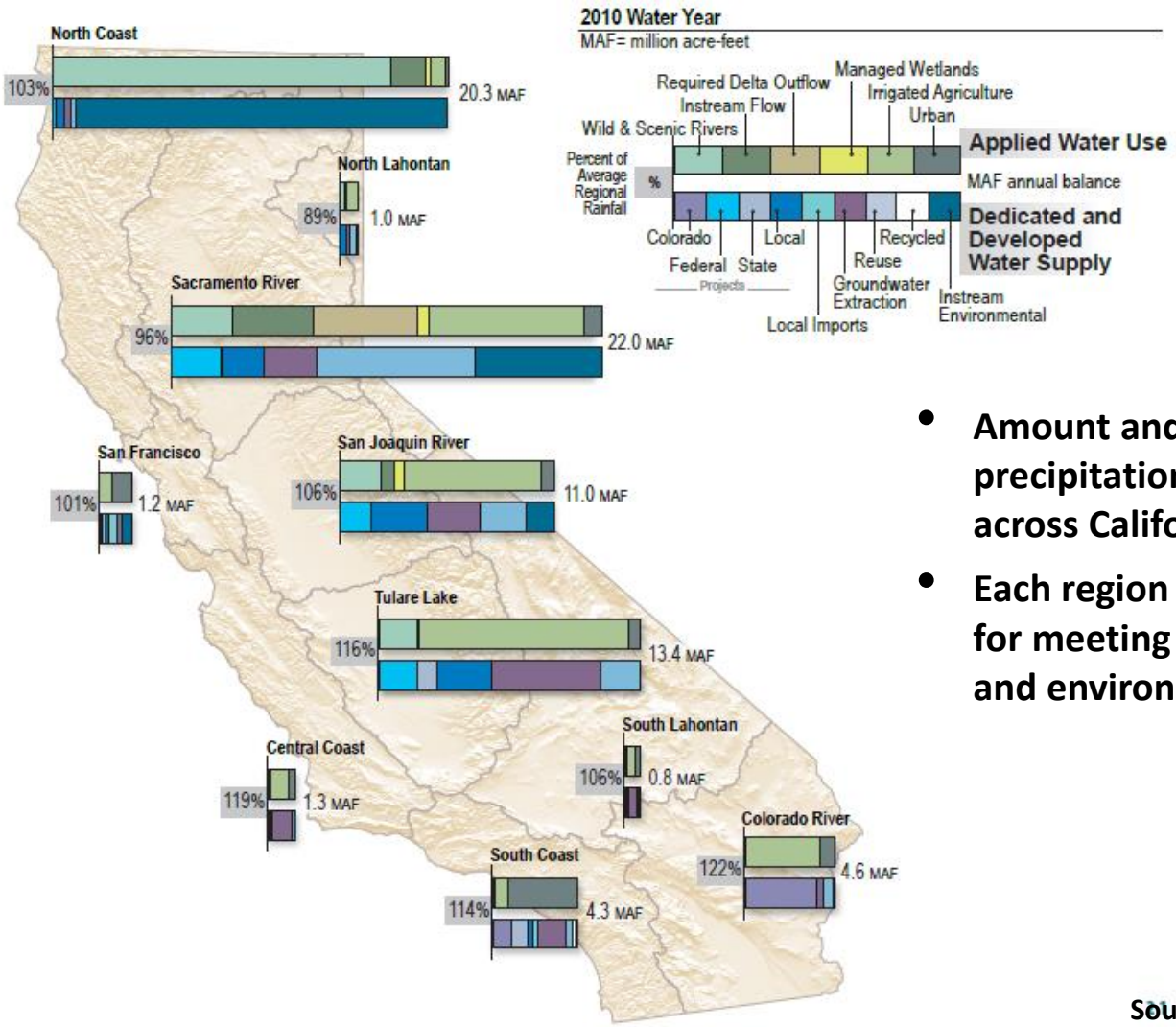
- Water is used by the energy sector, and energy is used by the water sector.
- The water-energy nexus provides opportunities for conservation of these natural resources, as well as reduction of GHGs.
- Customers have a large role to play in reducing energy and harmful greenhouse gases.

Source: CA Water Plan 2013 update

WATER MANAGEMENT AGENCY ACTIONS (DWR 2013)

- **Institutional Flexibility** – Work cooperatively with the Army Corps of Engineers to adapt management of reservoir operation rule curves for flood control and drought management
- **Water Demand** – Improve agricultural and urban water use efficiency through innovation and grant funding – WATERSMART, Title XVI, CALFED
- **Water Quality** – Develop a new suite of model simulation tools that incorporate water quality to improve compliance with State and Federal water quality objectives and that consider future climate change.
- **Watershed and Forest Management** – Work with State and Federal natural resource agencies to reduce wildfires, preserve forest health and assist forest management to augment snowpack retention and runoff.
- **Groundwater Management and Conjunctive Use** – Improve modeling tools for enhanced management of groundwater under SGMA and for storage and online sharing of groundwater pumping and storage data resources.
- **Water Deliveries** – Enhance cooperation between water agencies in investigation and planning of California WaterFix and other initiatives.

REGIONAL WATER PORTFOLIOS

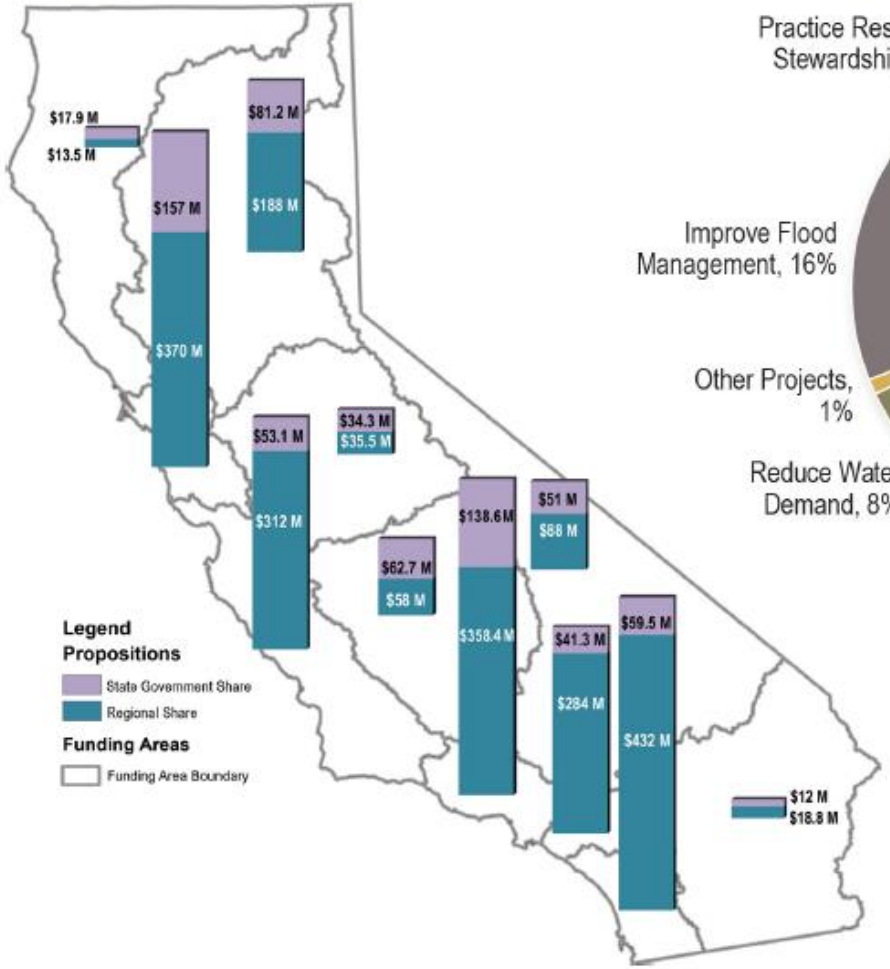


- **Amount and variability of precipitation changes dramatically across California**
- **Each region with unique challenges for meeting agricultural, urban, and environmental water demands**

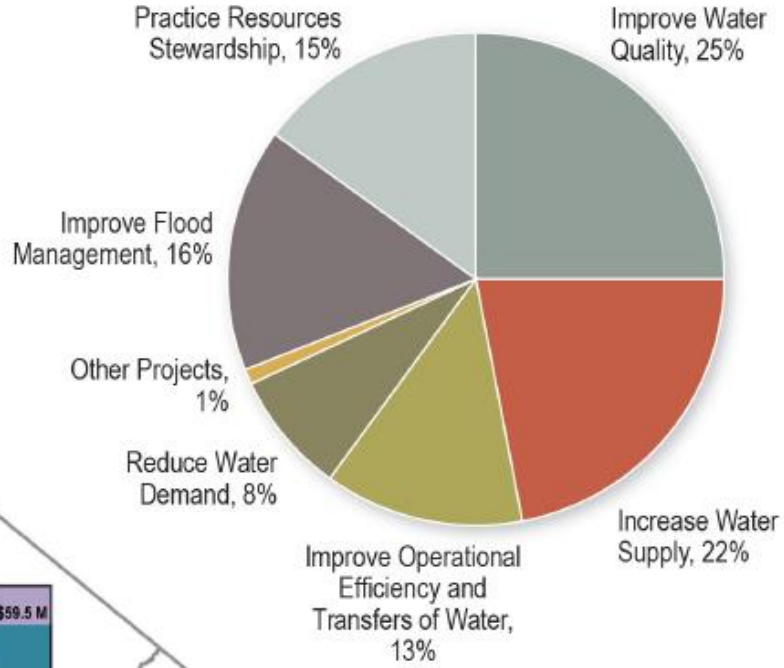
Source: CA Water Plan 2013 update

REGIONAL INVESTMENTS IN WATER PLANNING AND INFRASTRUCTURE

Investing in California's Regions



*Achieving Multiple Benefits**



*Types of projects implemented with IRWM and related grants.

Voter-approved bond measures, Props 50, 84, and 1E, to improve regional planning and implementation projects worth $750M has been awarded for 37 comprehensive management plans and 562 projects.

Source: CA Water Plan 2013 update

SUMMARY

- This is an exciting time to be working in water in California!
- Major projects such as SGMA, WATERFIX and implementing the 2018 Water Plan that will have significant implications for water resource sustainability in our State.
- UCANR has a key role to play in helping to develop scientifically sound and equitable solutions to California's water problems by facilitating communication among and between policy makers, modelers, farmers and the stewards of our environmental resources.