USGS Activities in the Russian River Basin:

Available Information to Support Adaptation and Mitigation of Impacts of Extreme Events

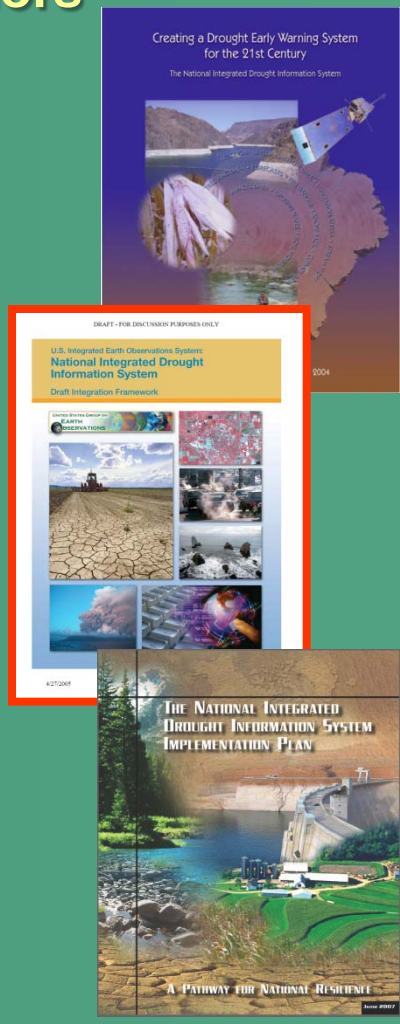
Lorrie Flint
U.S. Geological Survey
California Water Science Center

Activities in Russian River Basin

- USGS streamgaging network
- National Integrated Drought Information System (NIDIS): Russian River and North Bay Pilot Study to establish a drought early warning system
- Flood inundation mapping and floodplain sedimentation in the Laguna de Santa Rosa
- Future climate analysis
  - unimpaired flows for water management modeling of Russian River basin
  - climatic boundary conditions for GSFLOW surface water / groundwater model of Santa Rosa Plain

National Integrated Drought Information System

"No systematic collection and analysis of social, environmental, and economic data focused on the impacts of drought within the United States exists today" **Western Governors Association 2004**



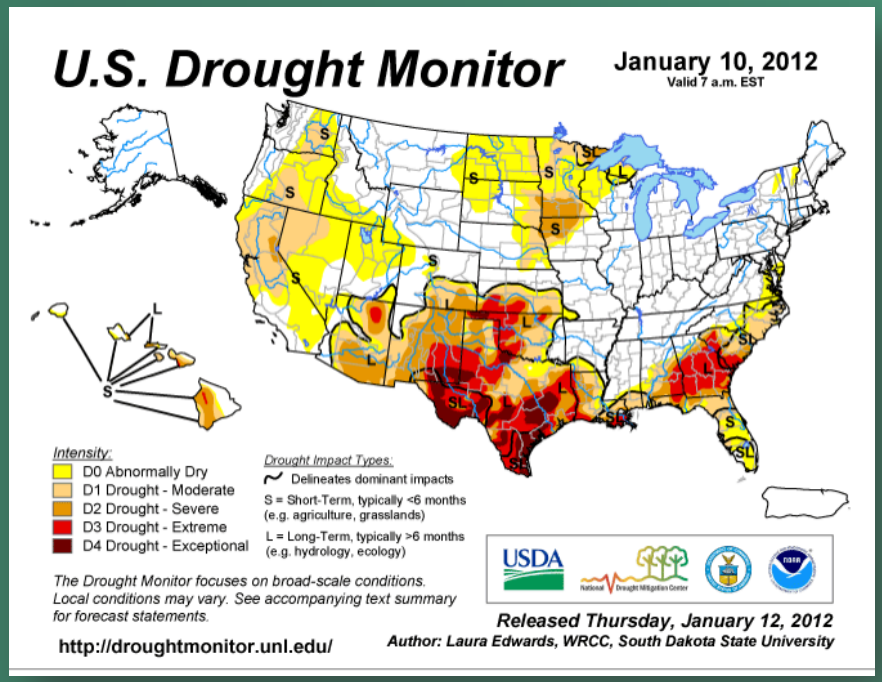
Public Law 109-430 (The NIDIS Act 2006)

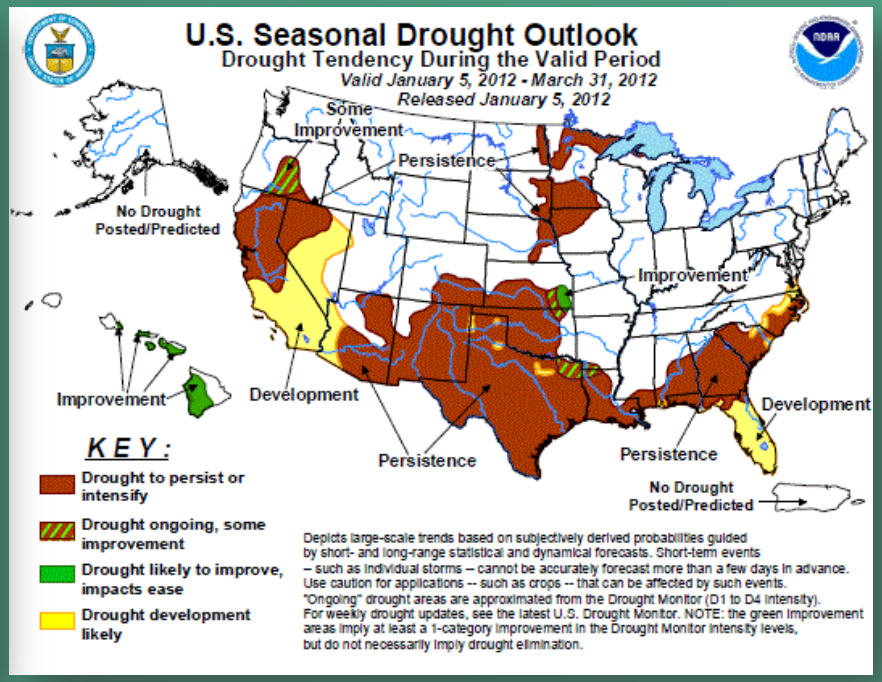
"Enable the Nation to move from a reactive to a more proactive approach to managing drought risks and impacts"

"better informed and more timely drought-related decisions leading to reduced impacts and costs"

(www.drought.gov)

Regionally Tailored Drought Monitor and Outlook





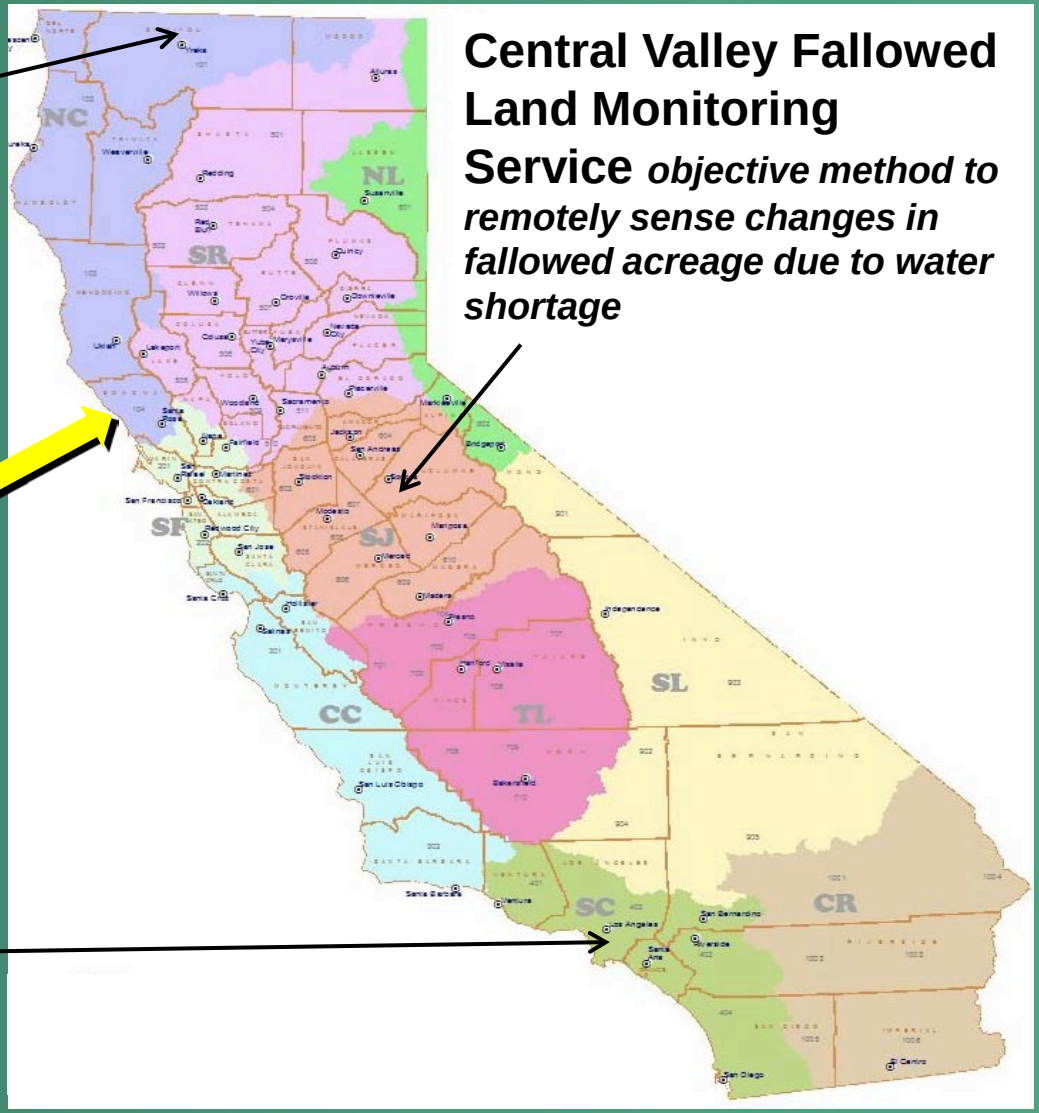
Challenge: NIDIS pilot design and implementation of meaningful monitoring and prediction products that effectively characterize and communicate regional drought information

Regional Drought Early Warning Information System: California Pilot Activities

Klamath River Basin-wide Hydroclimate Information System ***Regional Climate Center integrated information system to provide access to River Forecast Center hydroclimate data***

North Bay Counties and Russian River Valley ***focus on hydrologic extremes with droughts draining reservoirs and extreme precipitation events filling reservoirs***

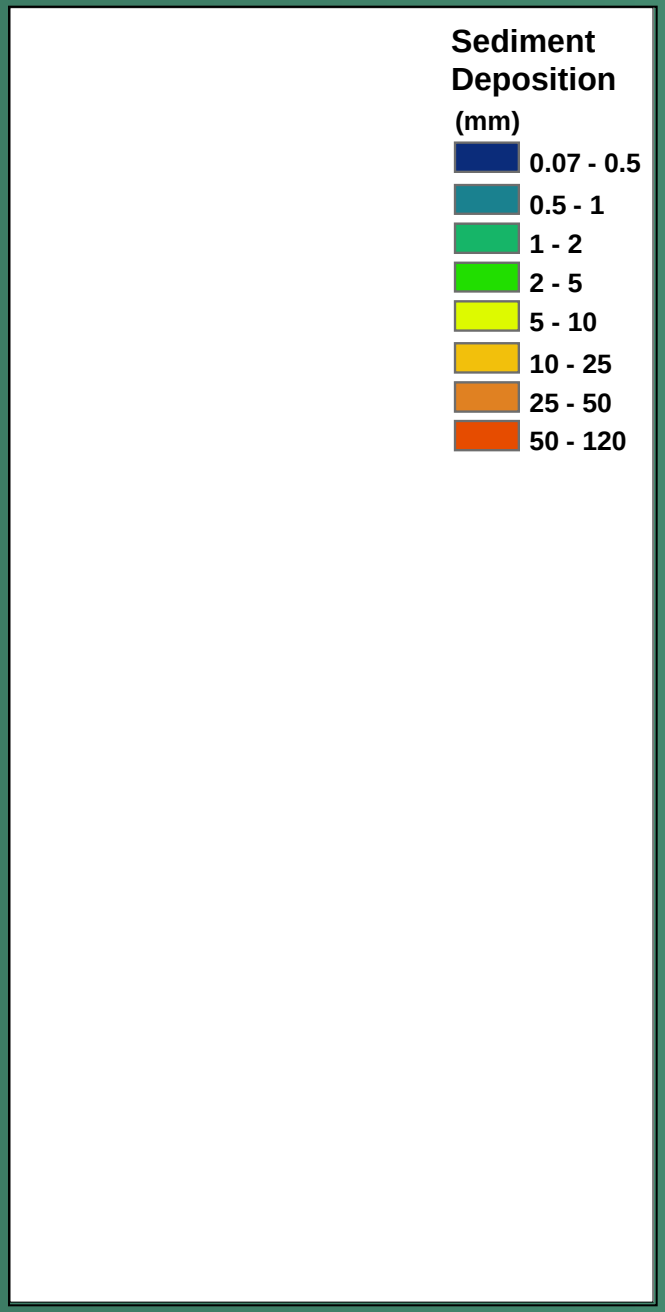
Southern California – Urban ***challenges of providing drought information in a well-plumbed system***



Central Valley Fallowed Land Monitoring Service ***objective method to remotely sense changes in fallowed acreage due to water shortage***

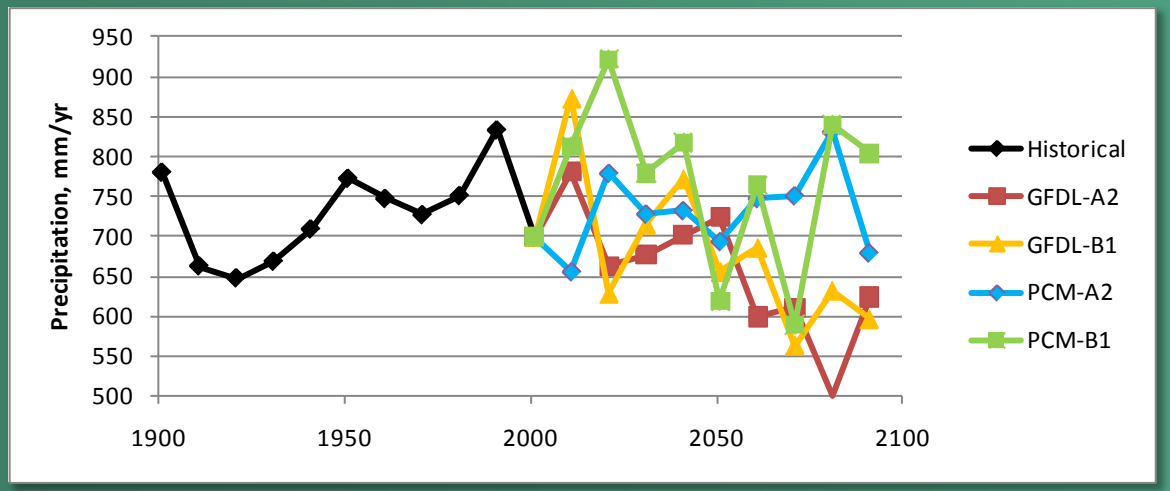
Floodplain Processes Laguna de Santa Rosa

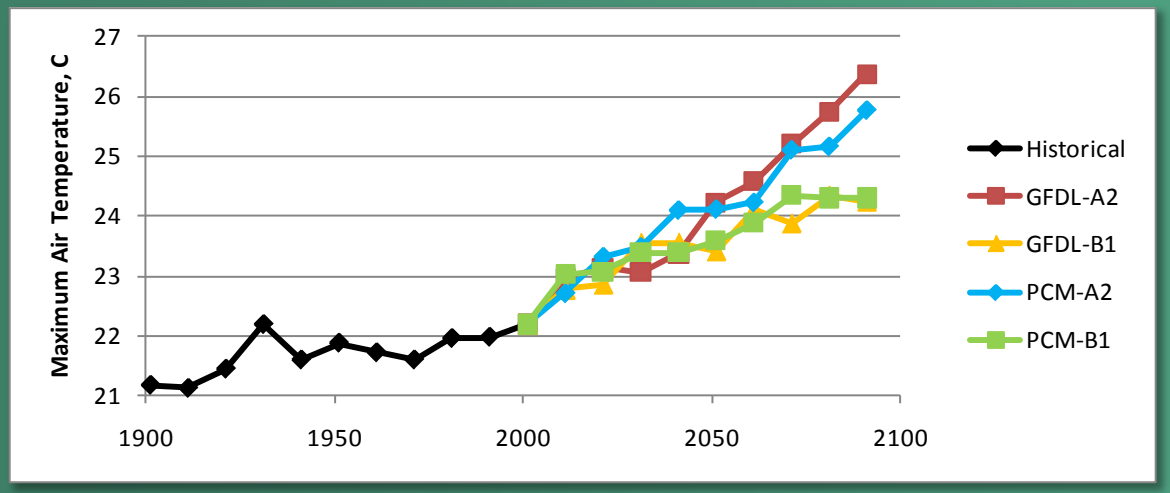
- Need to understand floodplain processes, sedimentation, and flood storage capacity
- New Year's Day flood 2006

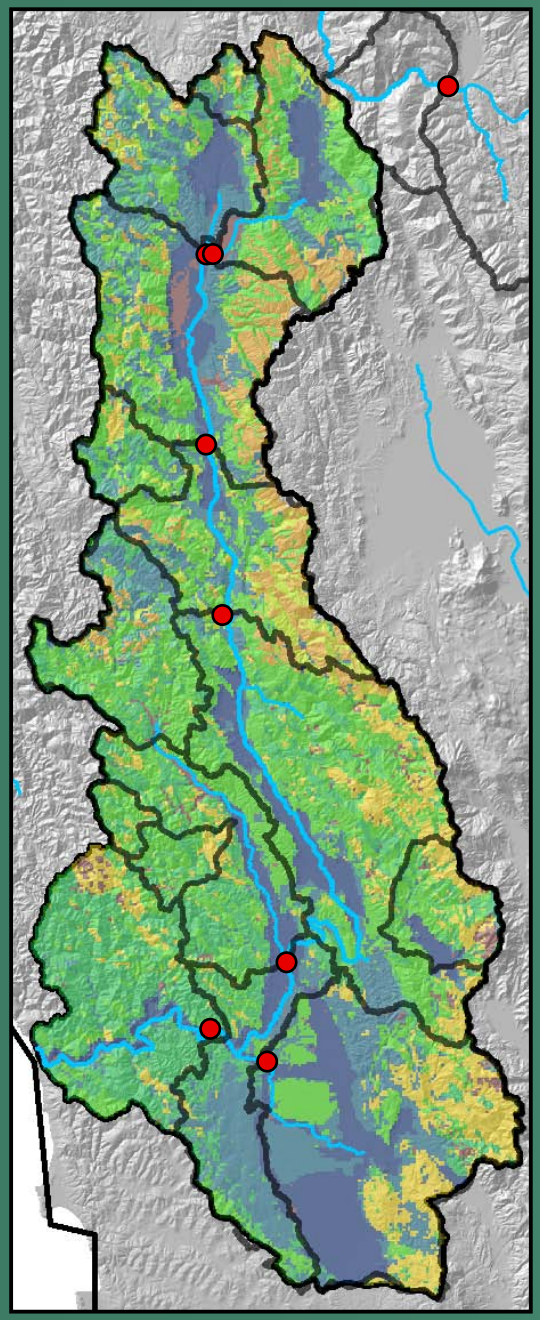


- Flood inundation mapping
- Sedimentation
  - Develop a conceptual model of floodplain processes, along with general sediment budgets and rates
  - Quantify spatially distributed sedimentation
  - Developed 2-D flow model

Climate for Sonoma County: current and future conditions – 4 scenarios





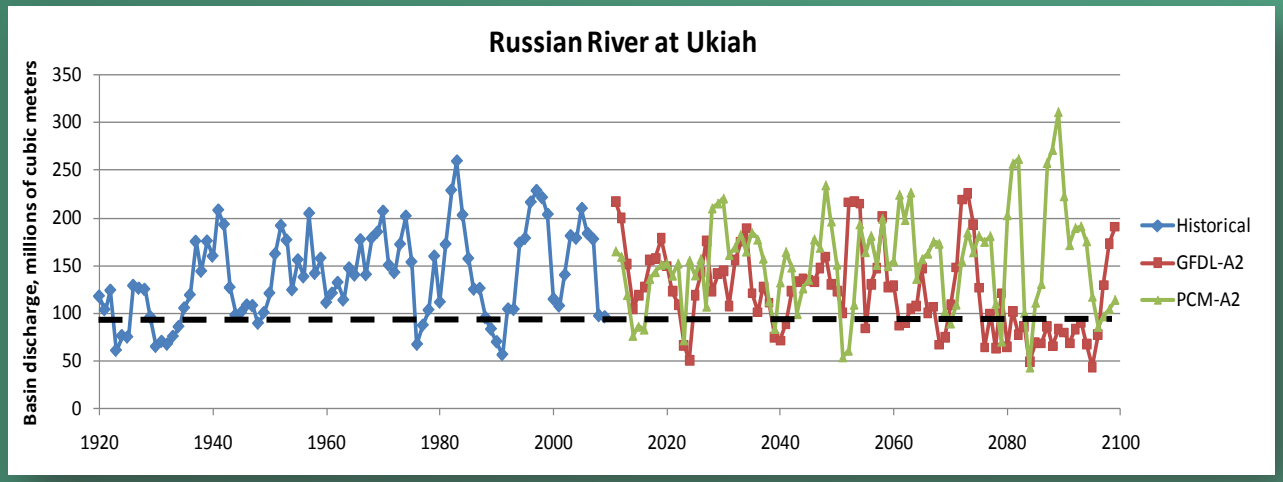


Soil Thickness
<meters>

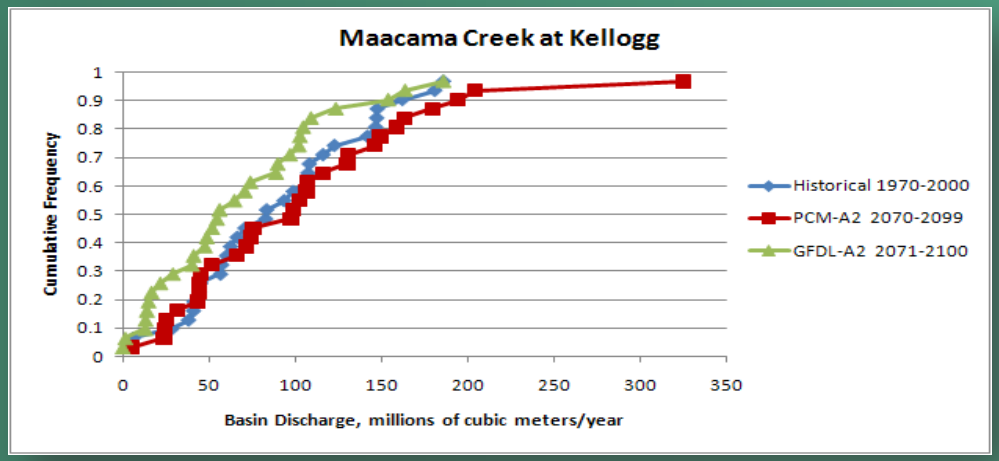
- 0
- 0 - 0.1
- 0.1 - 0.3
- 0.3 – 0.5
- 0.5 - 0.7
- 0.7 - 0.9
- 0.9 - 1.3
- 1.3 - 1.9
- 1.9 - 4.5
- 4.5 - 6

RESSIM Flow nodes

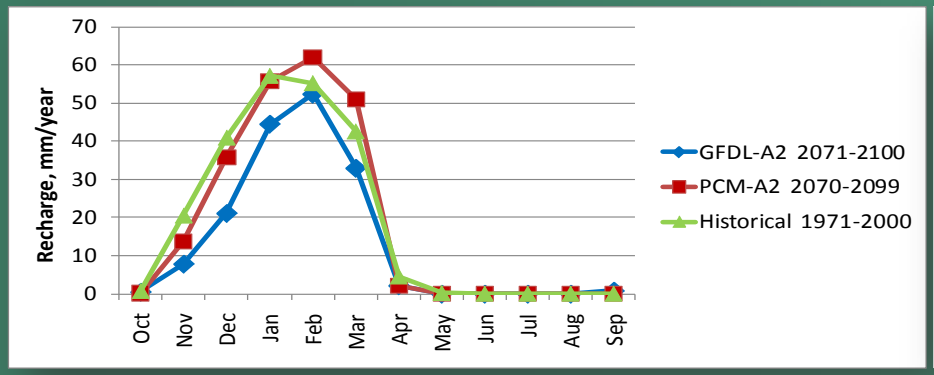
- Russian Future Climate
  - Downscale 4 future scenarios to 270-m, monthly/daily
  - Calibrate monthly BCM
  - Develop daily flow model for RESSIM nodes 1910-2009
  - Project daily scenarios 2000-2100

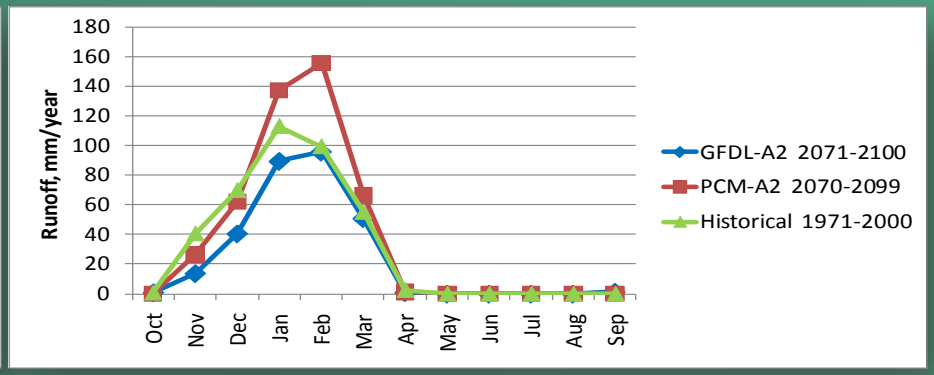


Future Streamflow Conditions



Seasonal Shifts in Recharge and Runoff

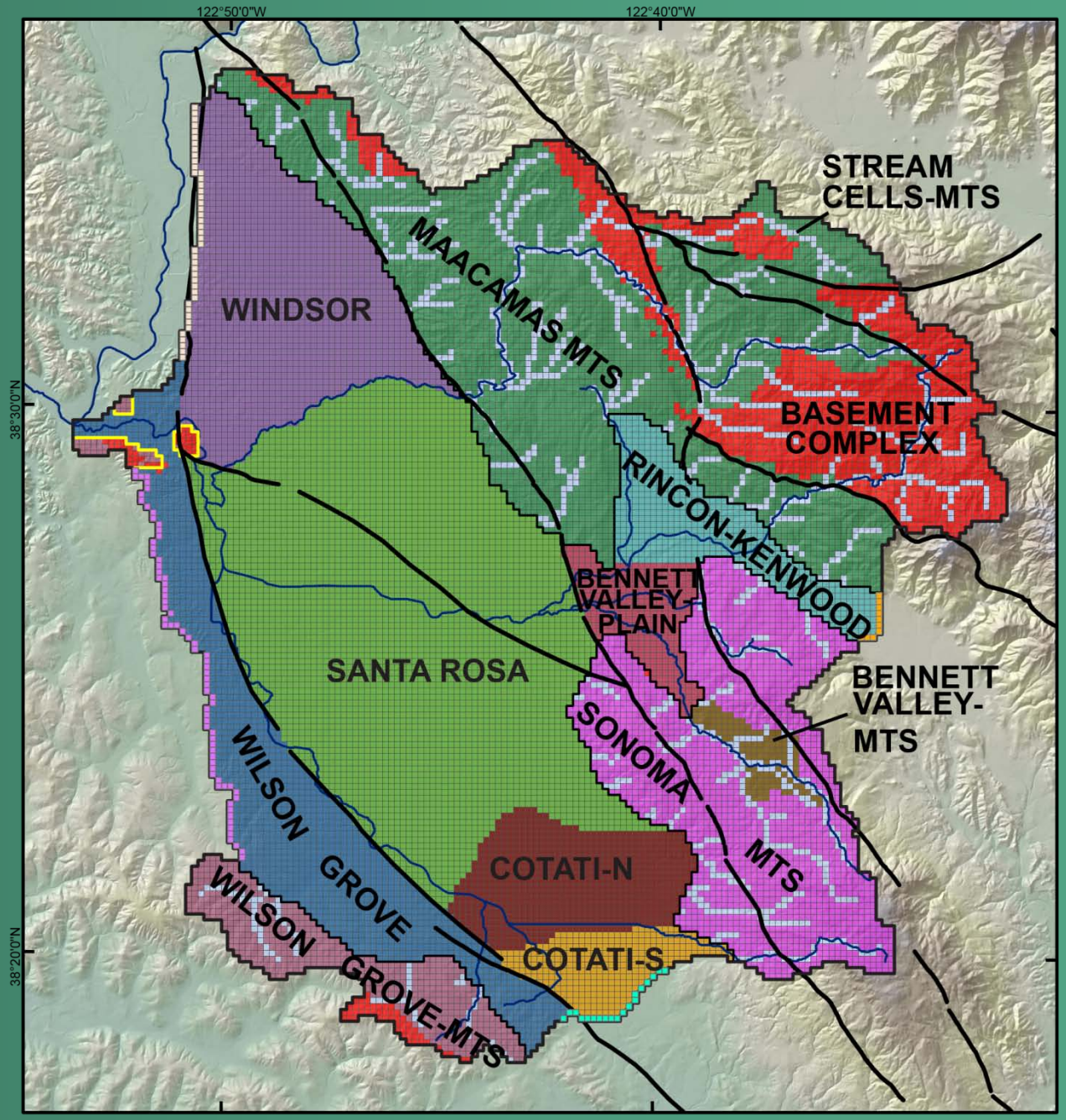




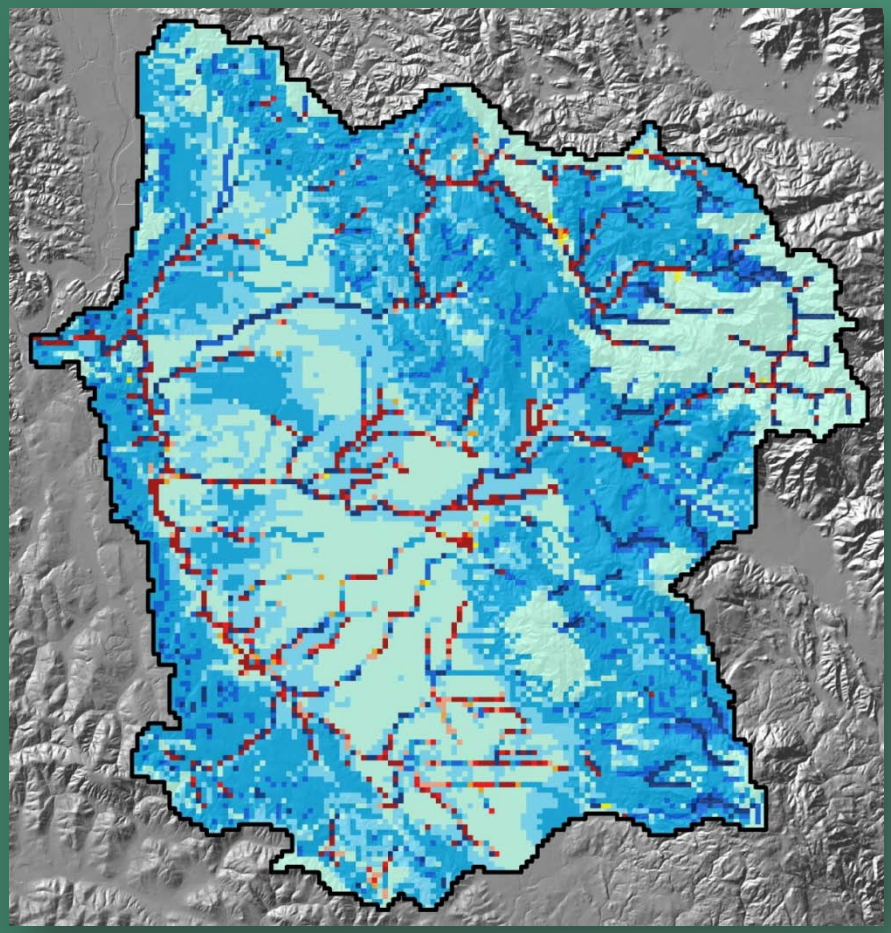
GSFLOW: surface water/groundwater model of Santa Rosa Plain

GENERAL-HEAD BOUNDARIES

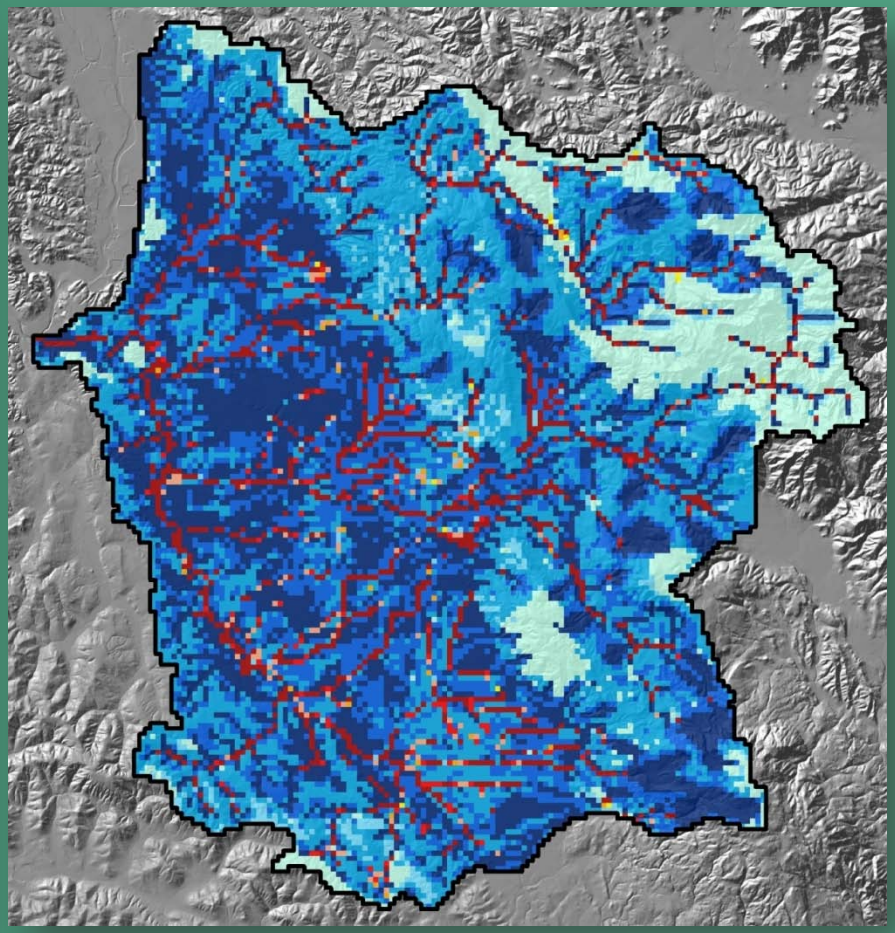
- COTATI
- WILSON GROVE
- RUSSIAN RIVER
- KENWOOD



Dry year (1977)



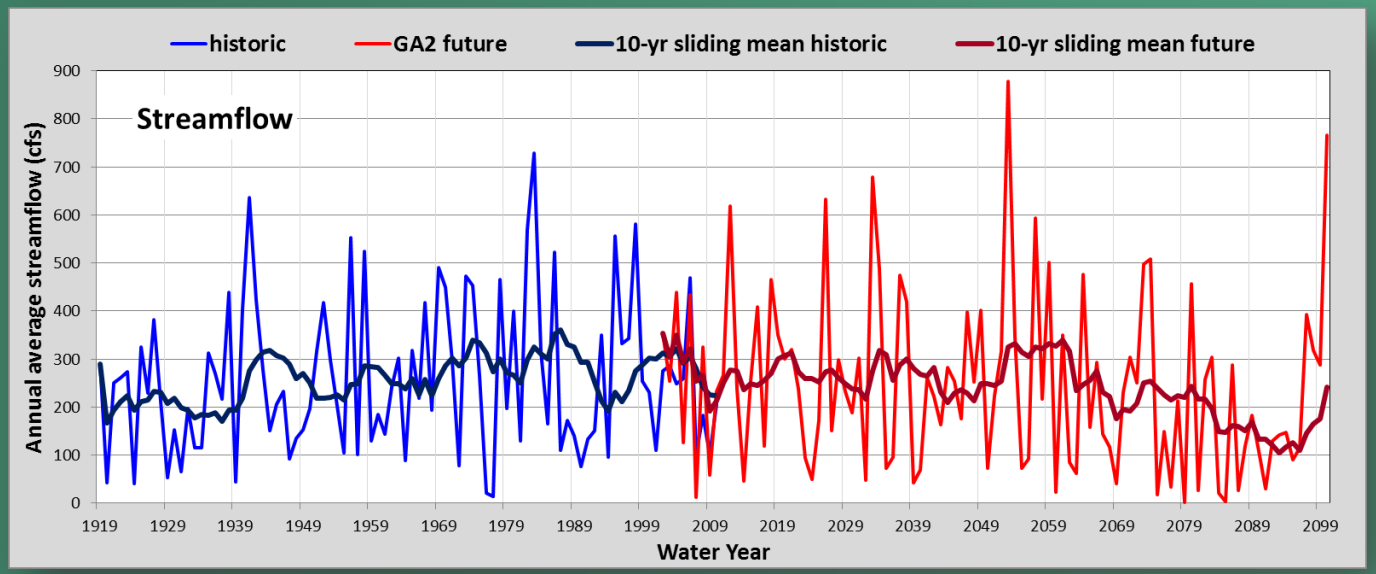
Wet year (1983)

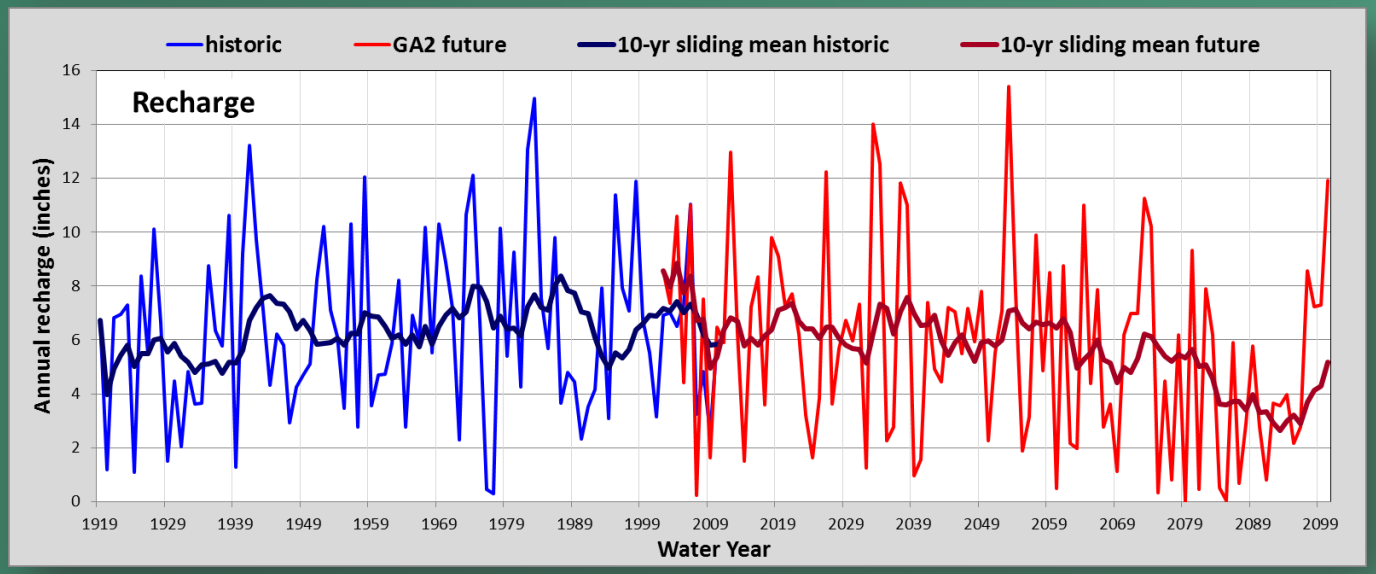


Net recharge (inches per year)

< -10	-5 - -1	-0.01 - 0	0.1 - 1	5 - 10
-9 - -5	-1 - -0.1	0 - 0.1	1 - 5	> 10

PRMS Rainfall-Runoff daily model: GFDL A2 scenario



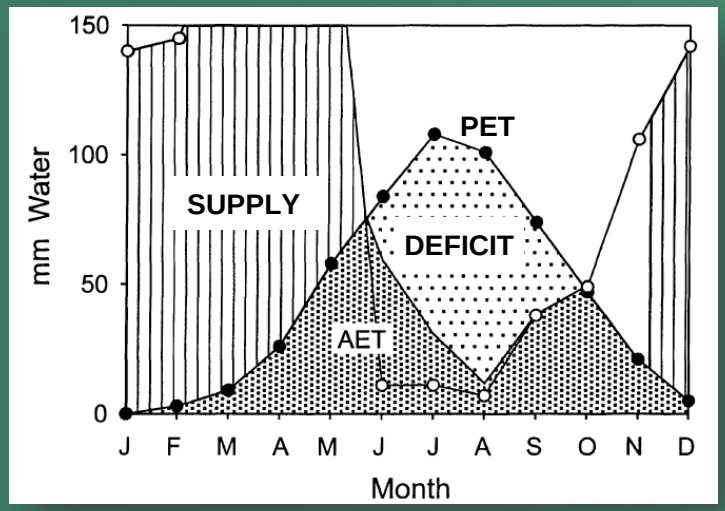


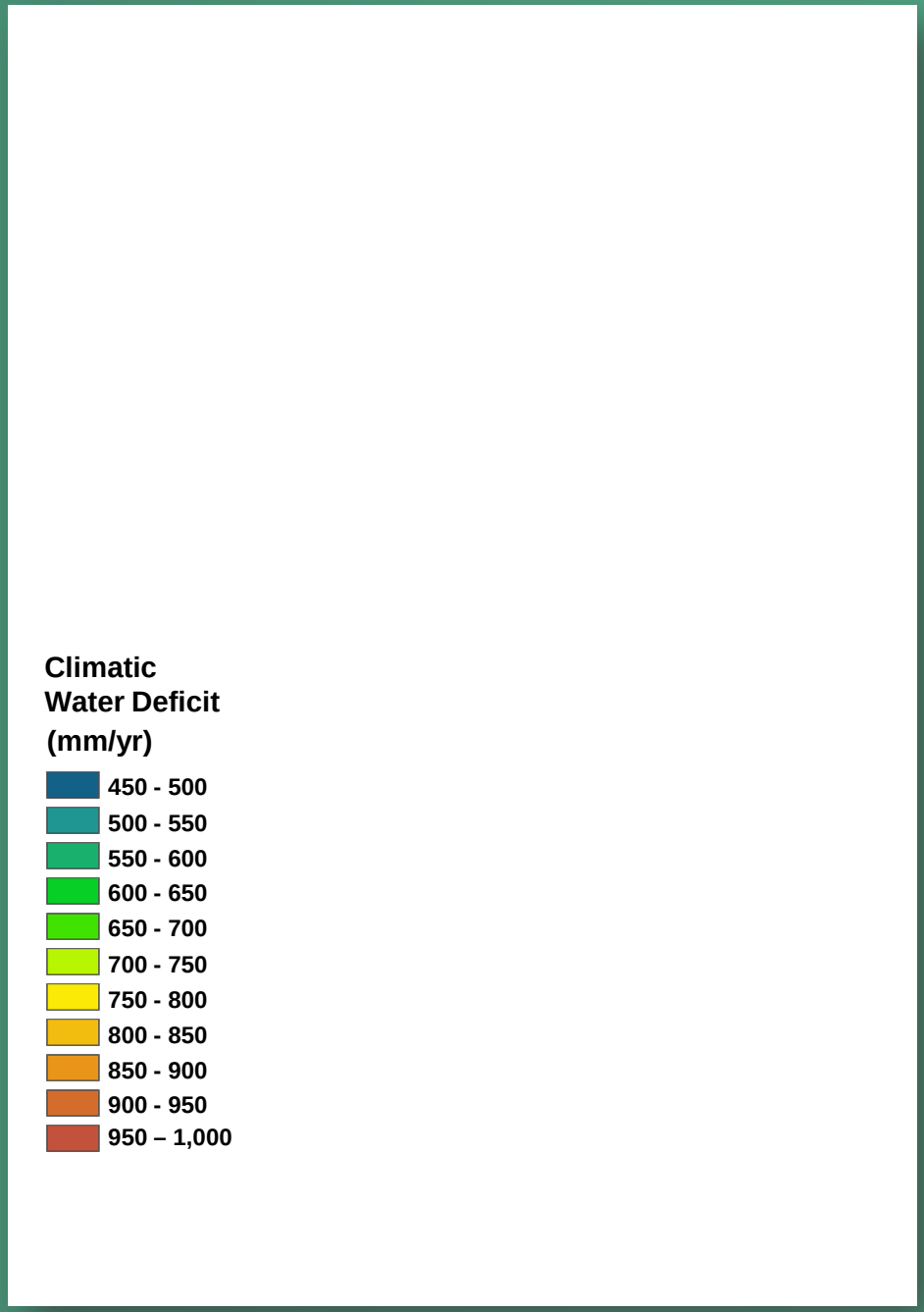
Climatic Water Deficit

Annual evaporative demand that exceeds available water

Potential – Actual Evapotranspiration

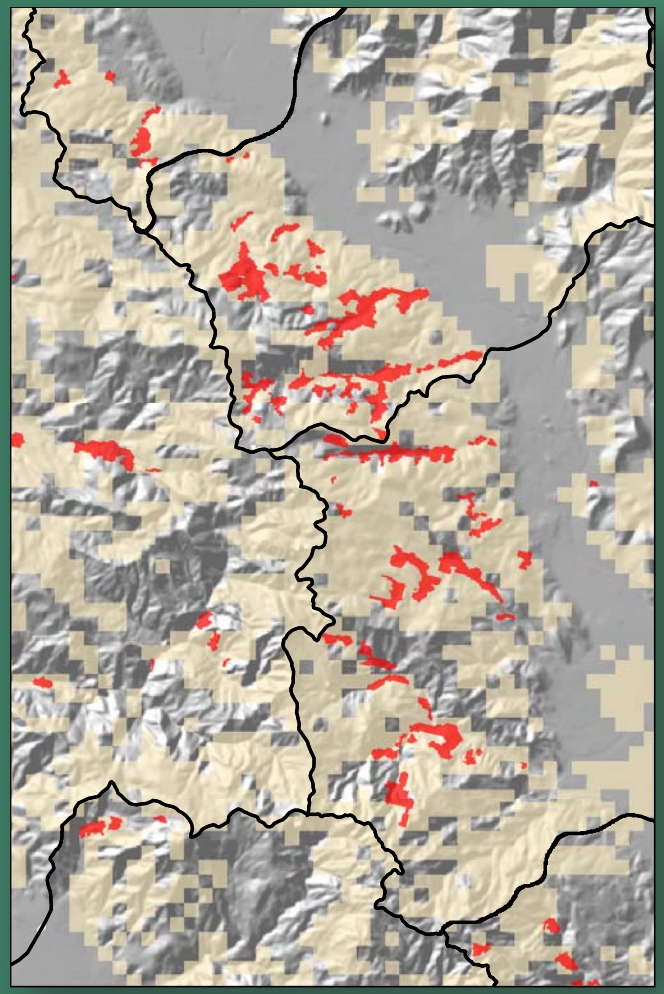
- Integrates climate, energy loading, drainage, and available soil moisture storage
- Vegetation independent (indicator)
- Address irrigation demand
- Generally increases with all future climate scenarios



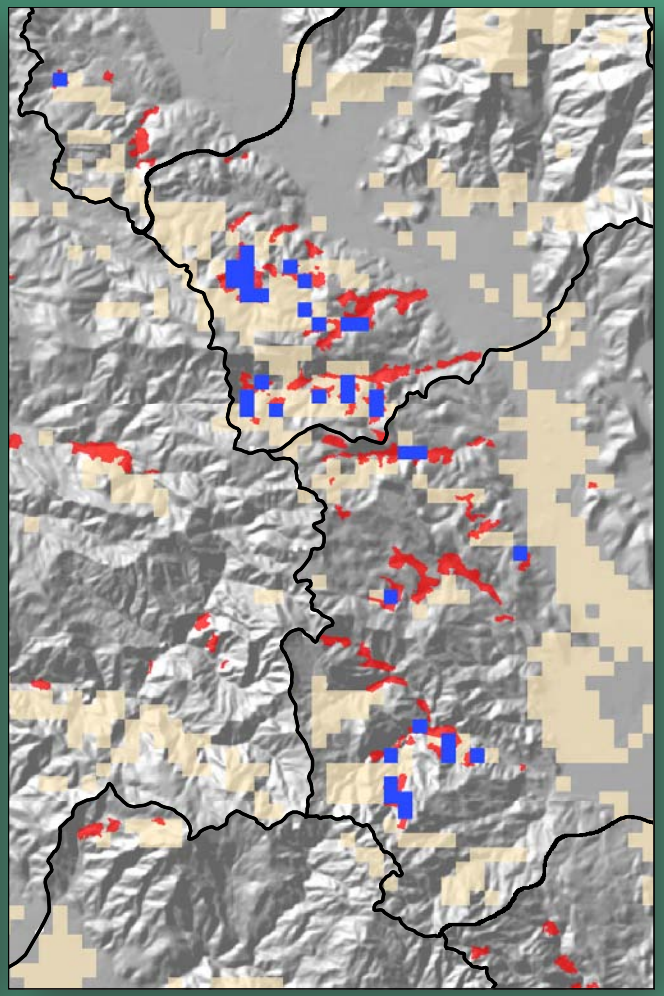


Distribution of Climatic Water Deficit for Redwoods

Current 1971-2000



Future 2071-2100



- Climatic water deficit where redwoods can live
- Where redwoods currently live
- Where redwoods could live in future

Entering
Hopland
Brutocao
CELLARS
SCHOOLHOUSE PLAZA
Mendocino
VISITOR CENTER