Summary of Current United States Geological Survey Drought Research in the Western States

Earl Greene, U.S. Geological Survey, External Research

Earl Greene is a U.S. Geological Survey Hydrologist with the National Research Program and Chief of External Research. Earl did his graduate work at the University of Idaho. He began his Federal career with the Research Branch of the US Forest Service in 1983 and moved to the USGS as a Research Hydrologist in 1986. Earl's research within the National Research Program is on modeling flow and transport of water in karst and fractured rock terrain. Earl is part of the USGS Senior Staff for Water and serves as the Coordinator for the Water Resources Research Institute Program for the USGS.

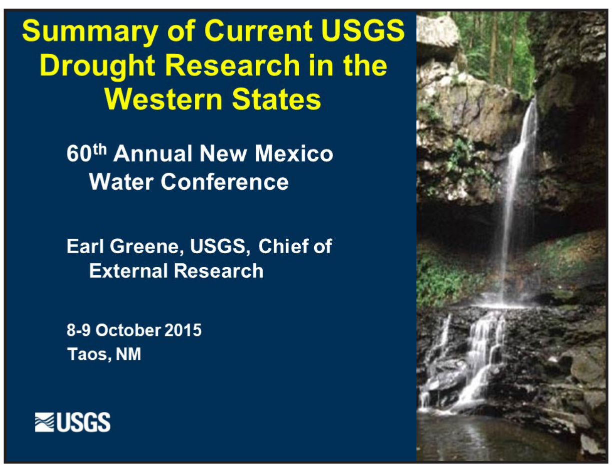


Figure 1. Introduction.

Figure 2. Water mission area, which is one of seven mission areas.

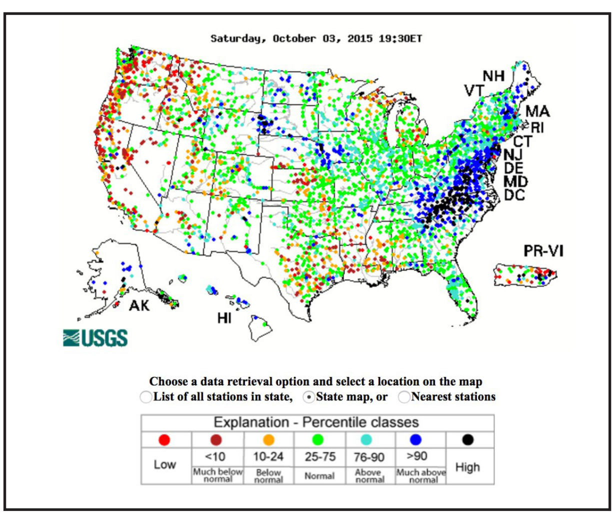


Figure 3. Data retrieval options.

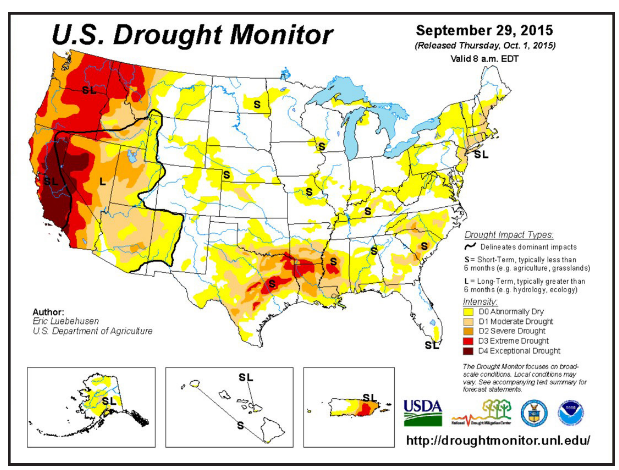


Figure 4. Observations: Water watch and drought watch.

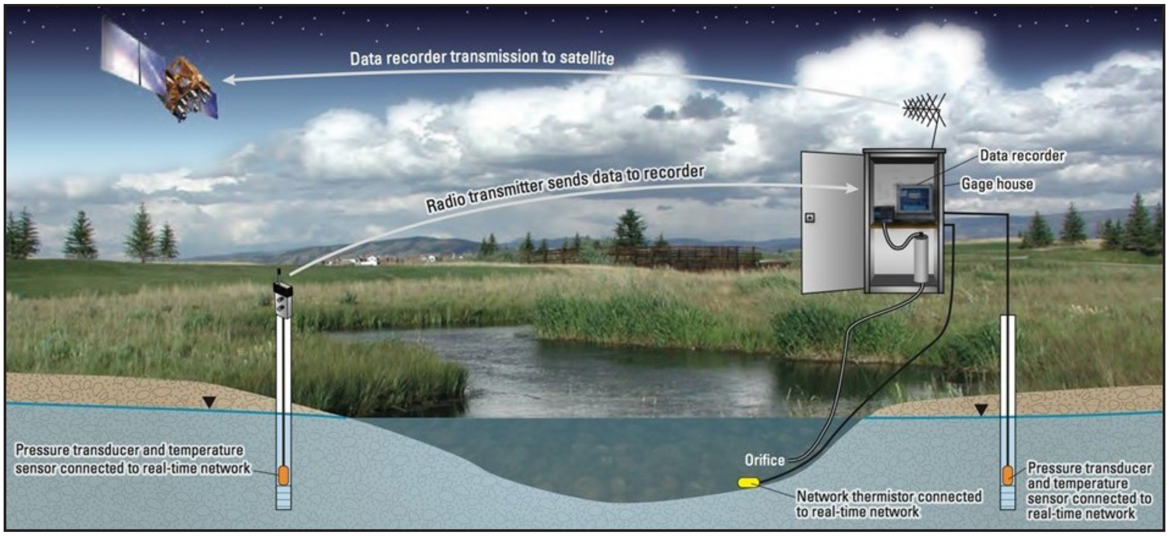


Figure 5. New groundwater streamgages.

Figure 6. Reports available from the New Mexico Water Science Center.

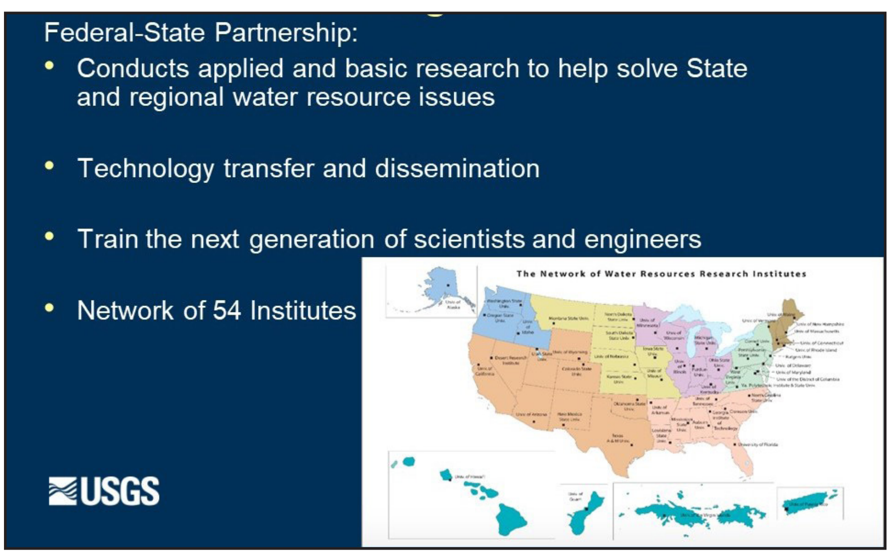


Figure 7. Water Resources Research Institute Program.

Figure 8. USGS National Research Program.

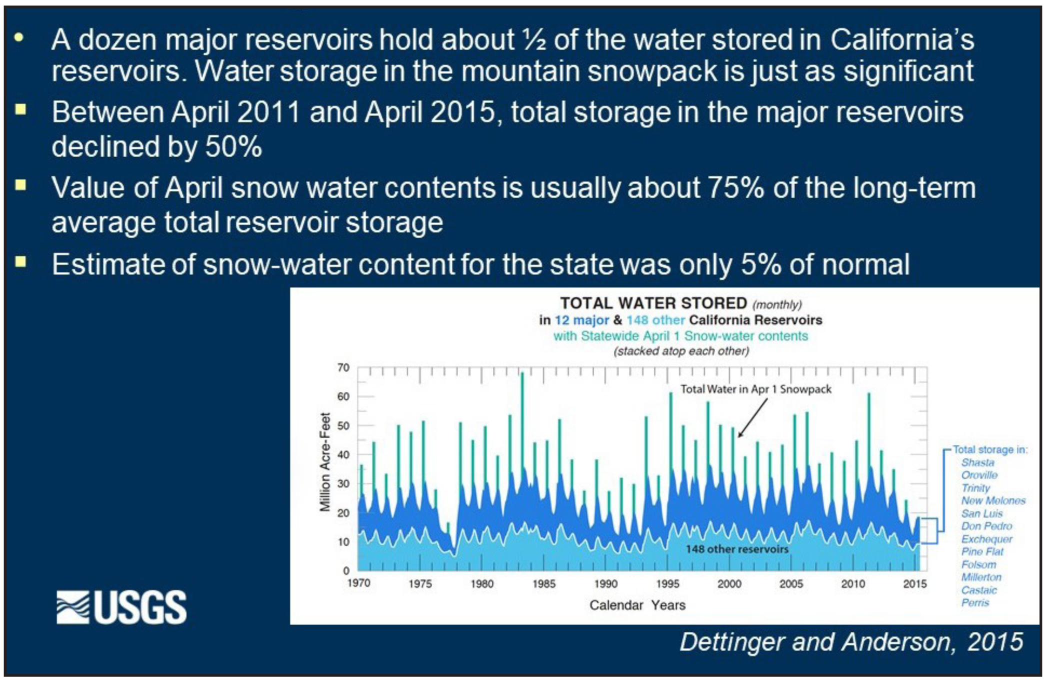


Figure 9. California's water storage in reservoirs and snowpacks.

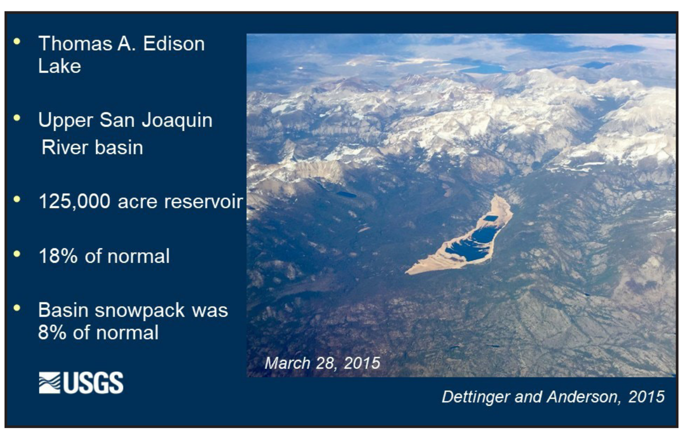


Figure 10. Upper San Joaquin River basin water storage on March 28, 2015.

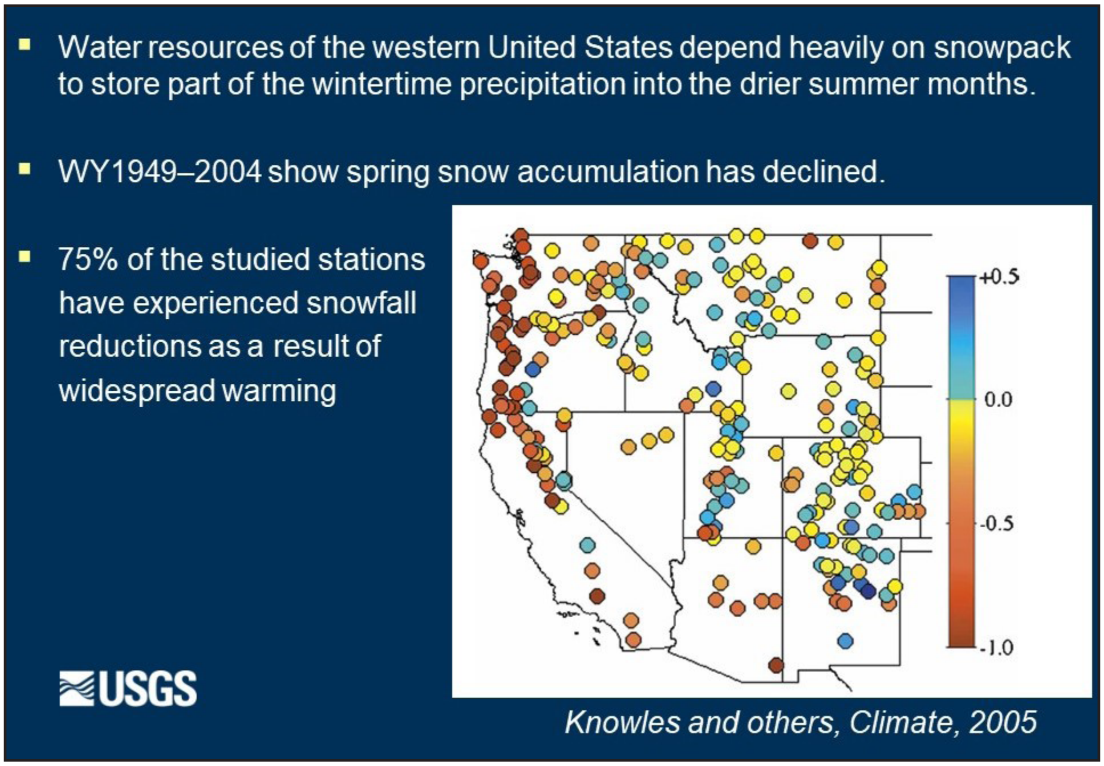


Figure 11. Western U.S. spring snow accumulation declined from 1949 to 2004.

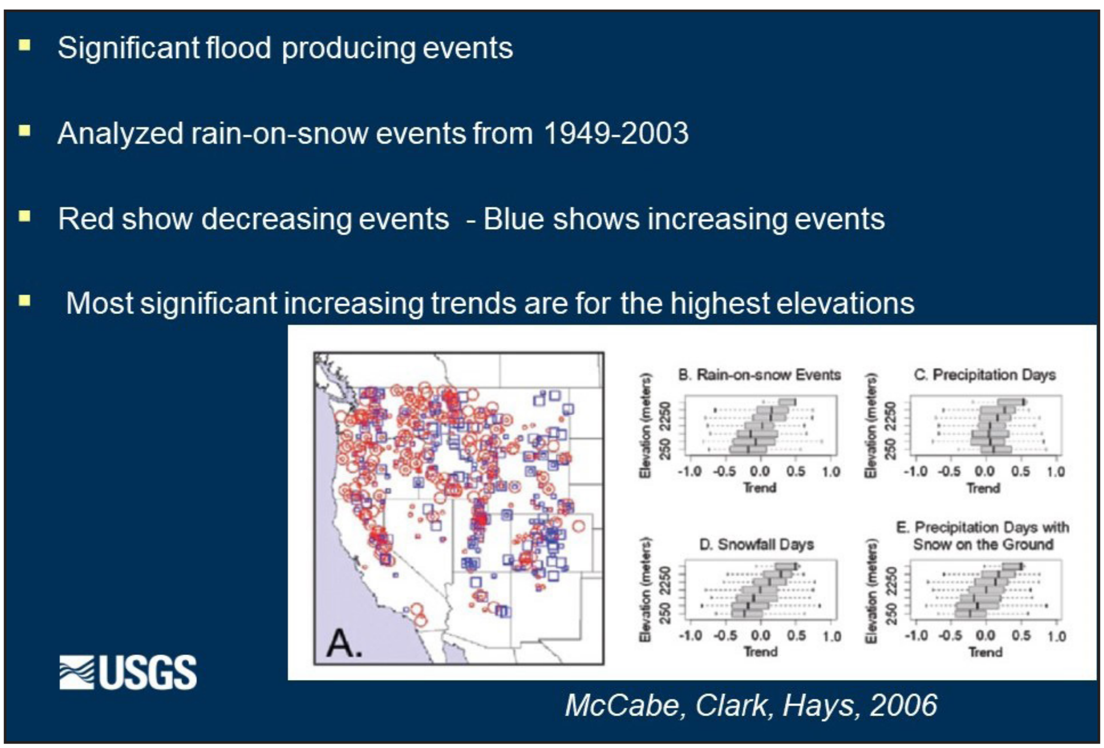


Figure 12. Rain-on-snow events from 1949 to 2003 in the West.

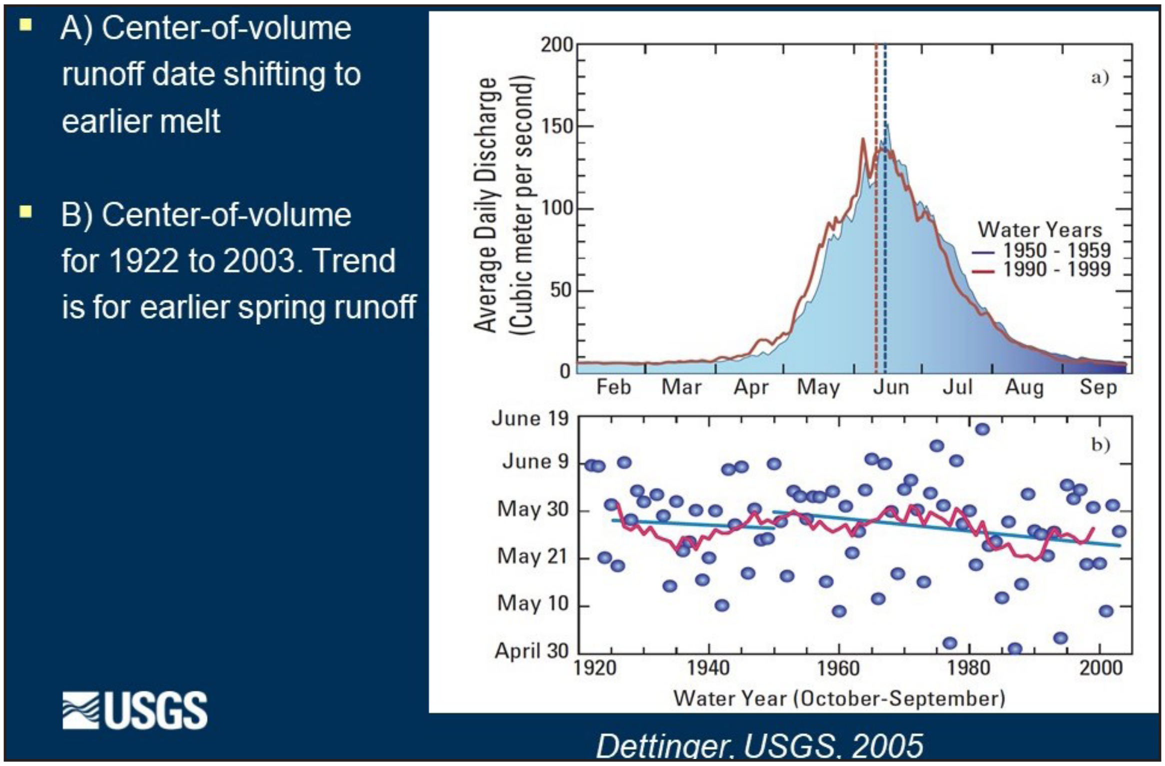


Figure 13. Trends in streamflow runoff in Wyoming for 1922 to 2003.

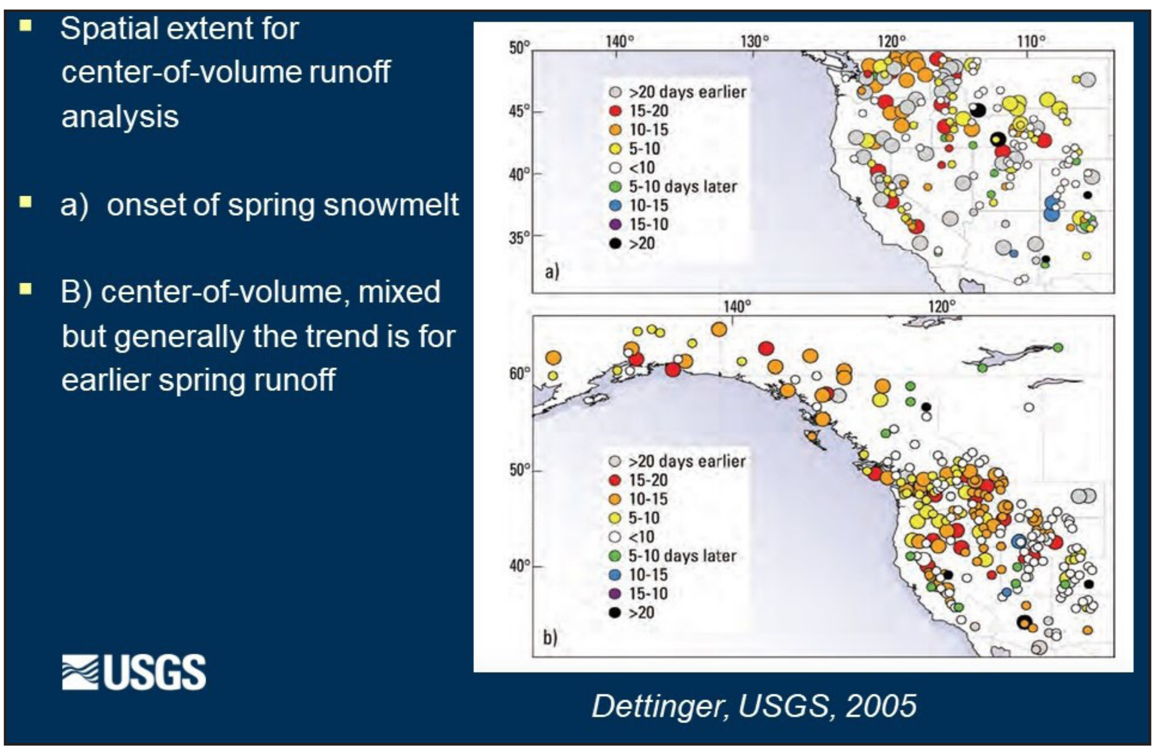


Figure 14. Trends in streamflow runoff across the West.

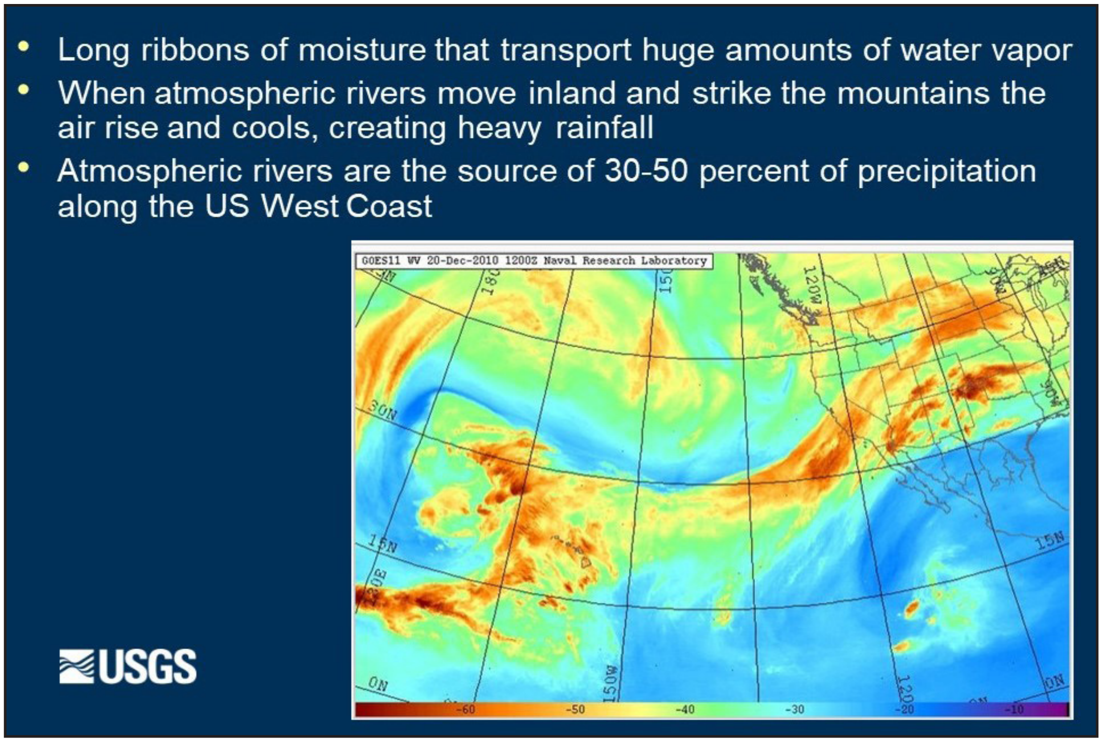


Figure 15. Atmospheric rivers.

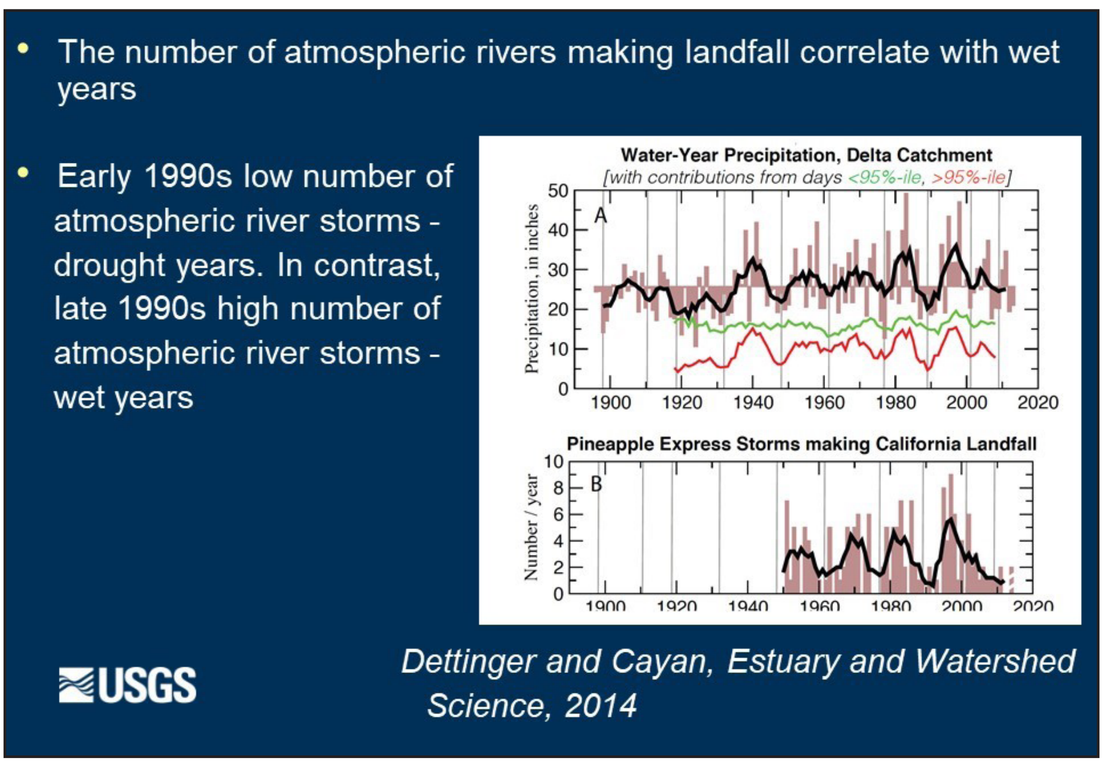


Figure 16. Water-Year Precipitation, Delta Catchment since 1900s.

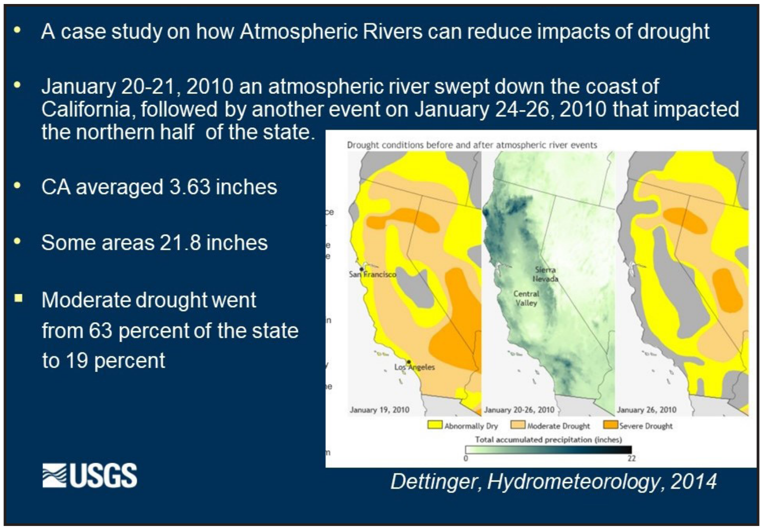


Figure 17. Atmospheric Rivers as drought busters.

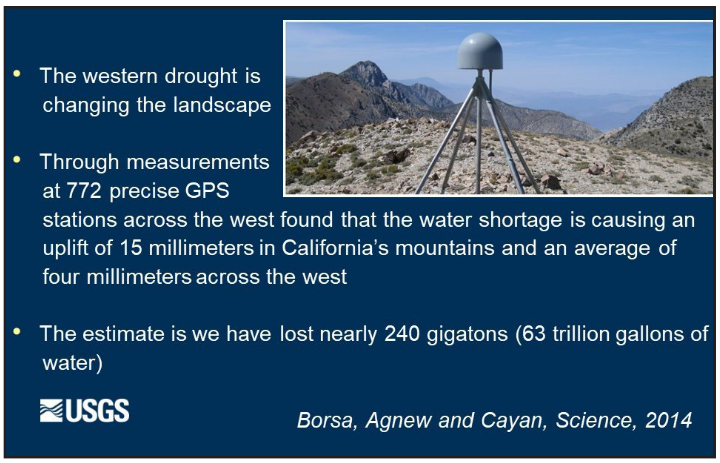


Figure 18. Uplift and quantifying water loss.

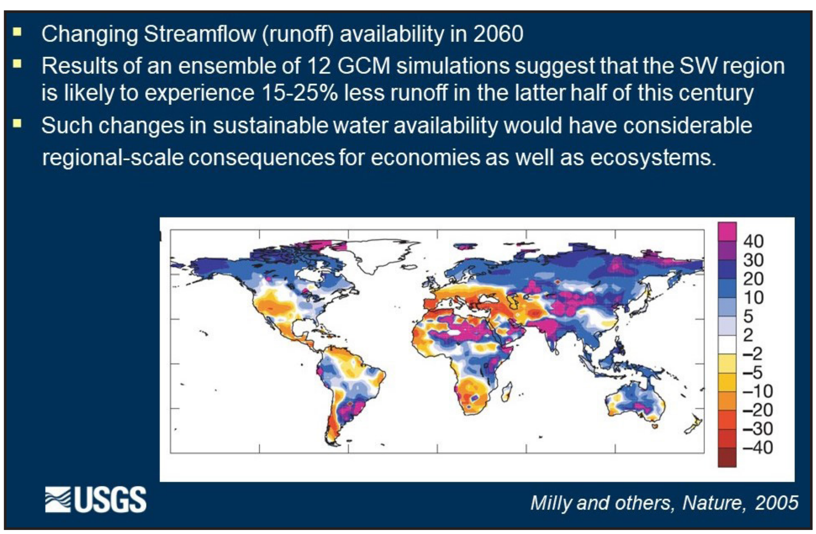


Figure 19. Regional scale forecasts.

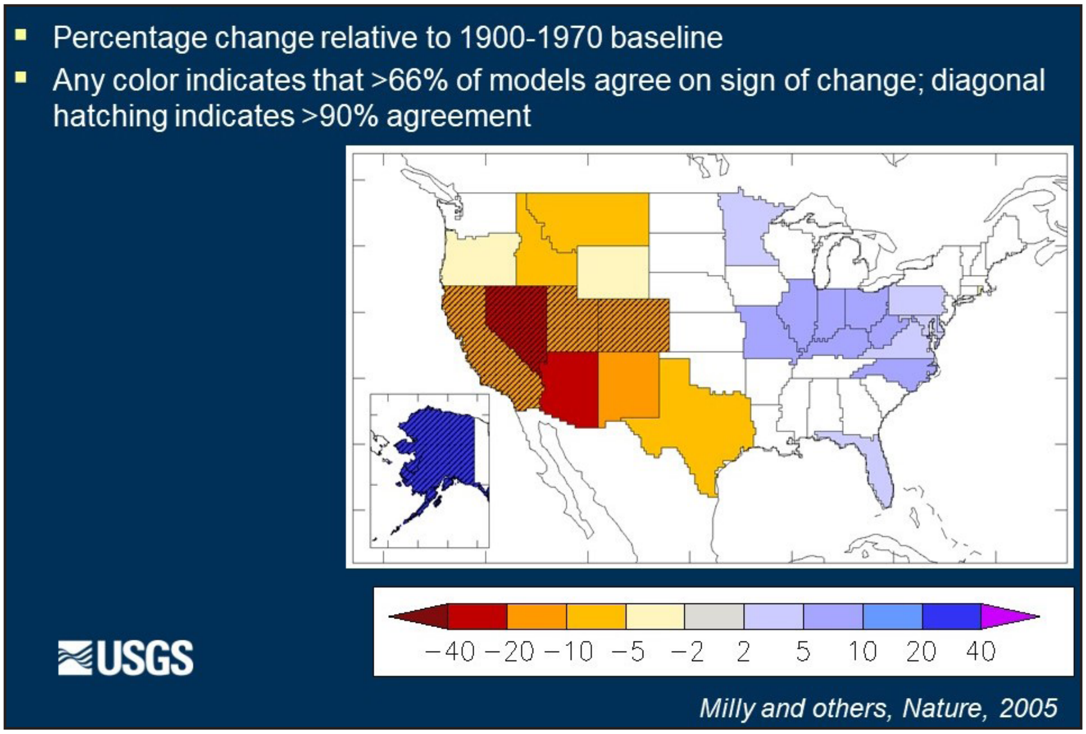


Figure 20. Regional scale forecasts for 2041-2060.

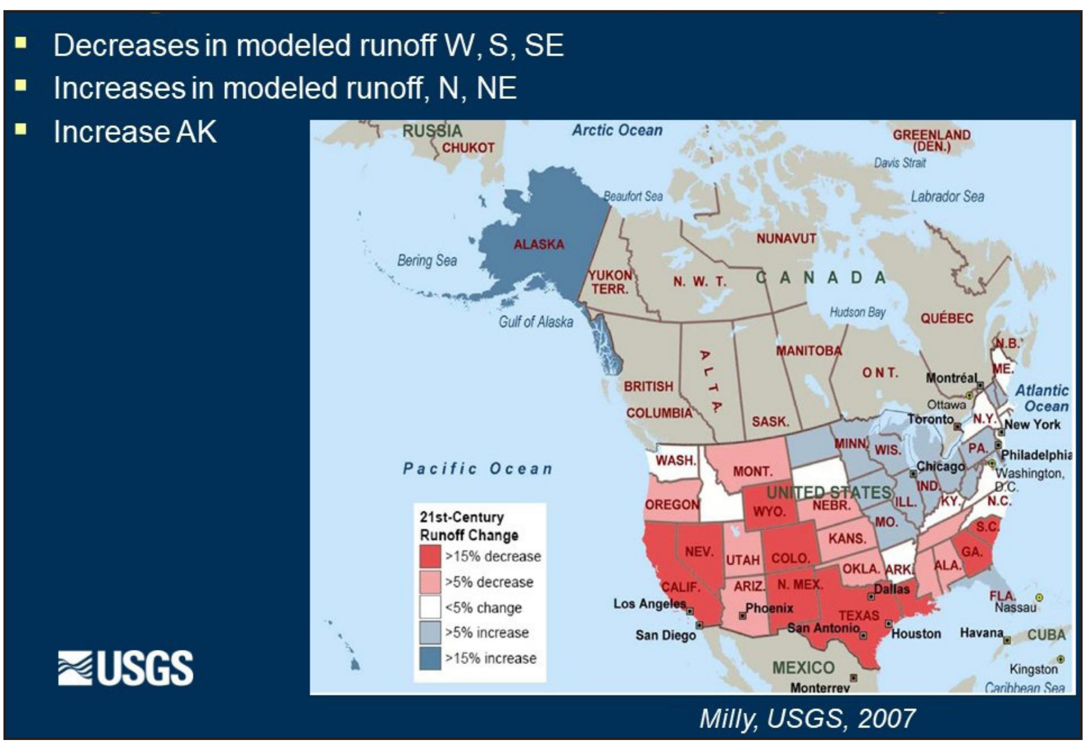


Figure 21. Regional scale forecasts for 21st century runoff change.

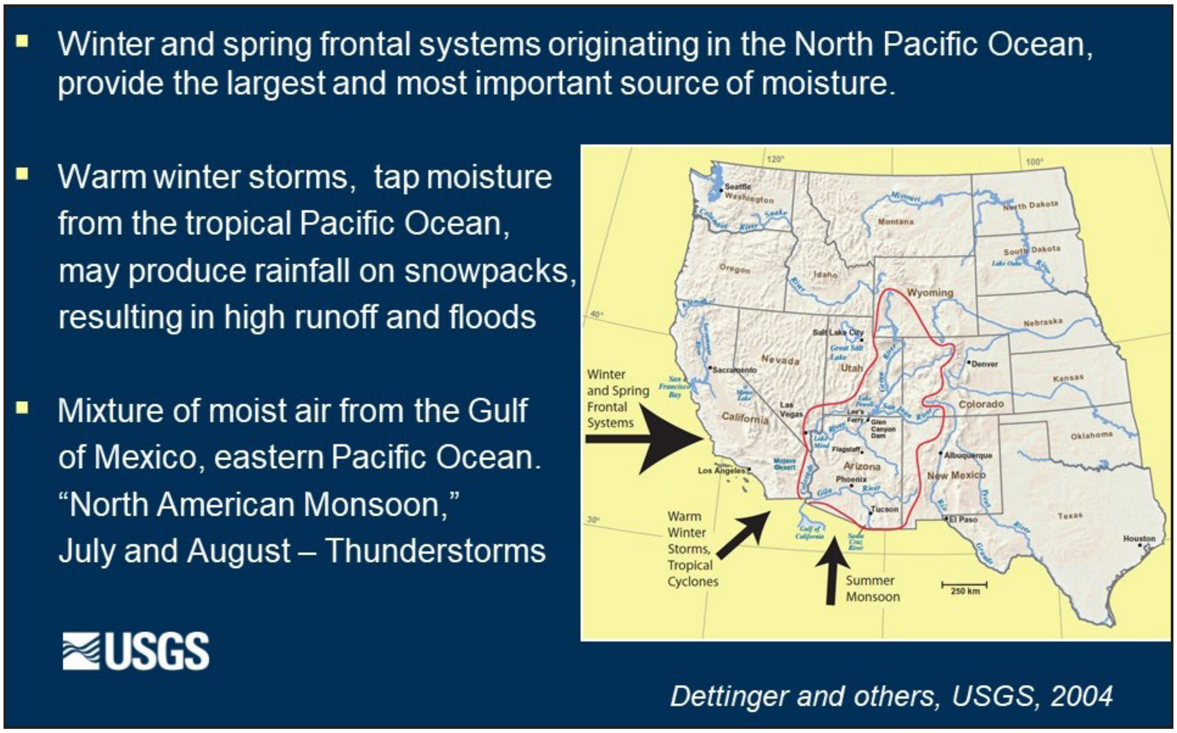


Figure 22. Colorado River Basin - climate controls.

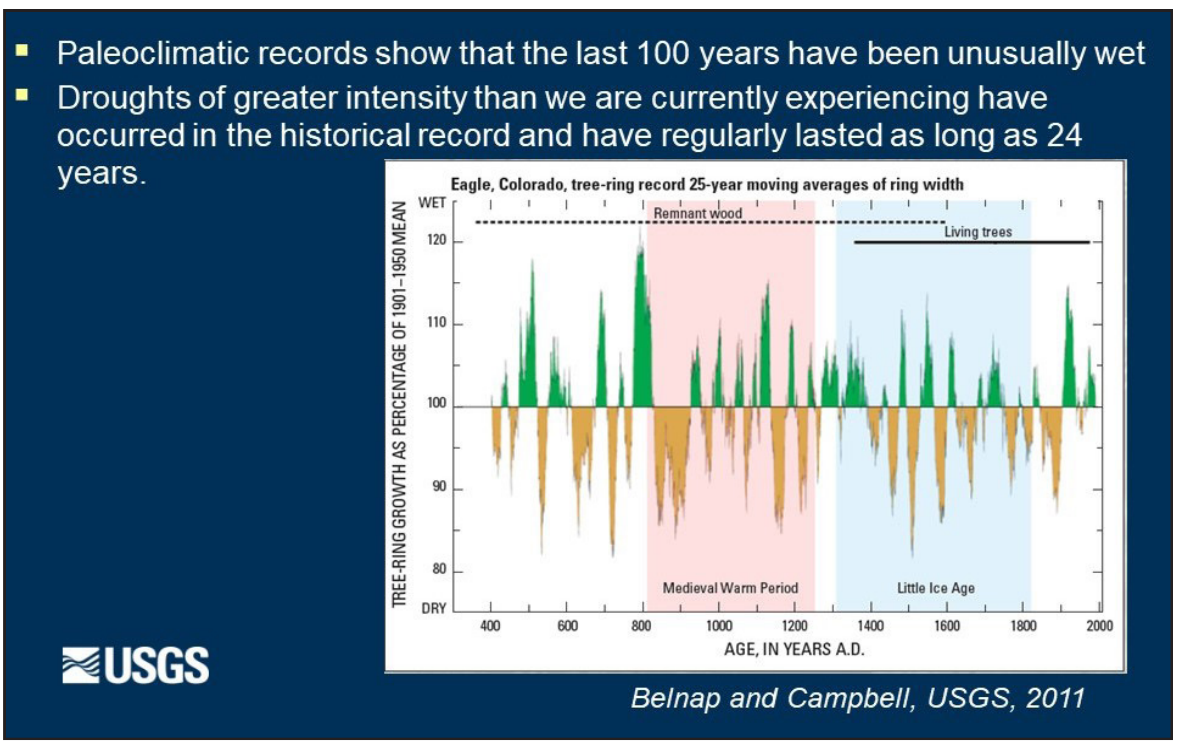


Figure 23. Colorado River Basin - paleoclimatic record.

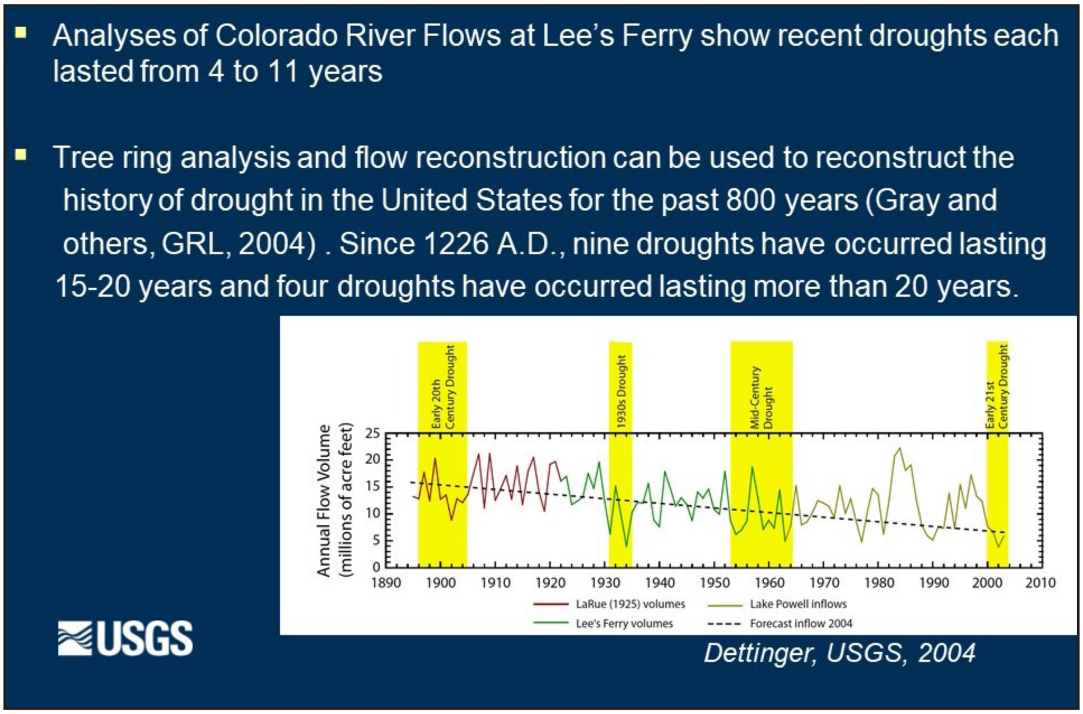
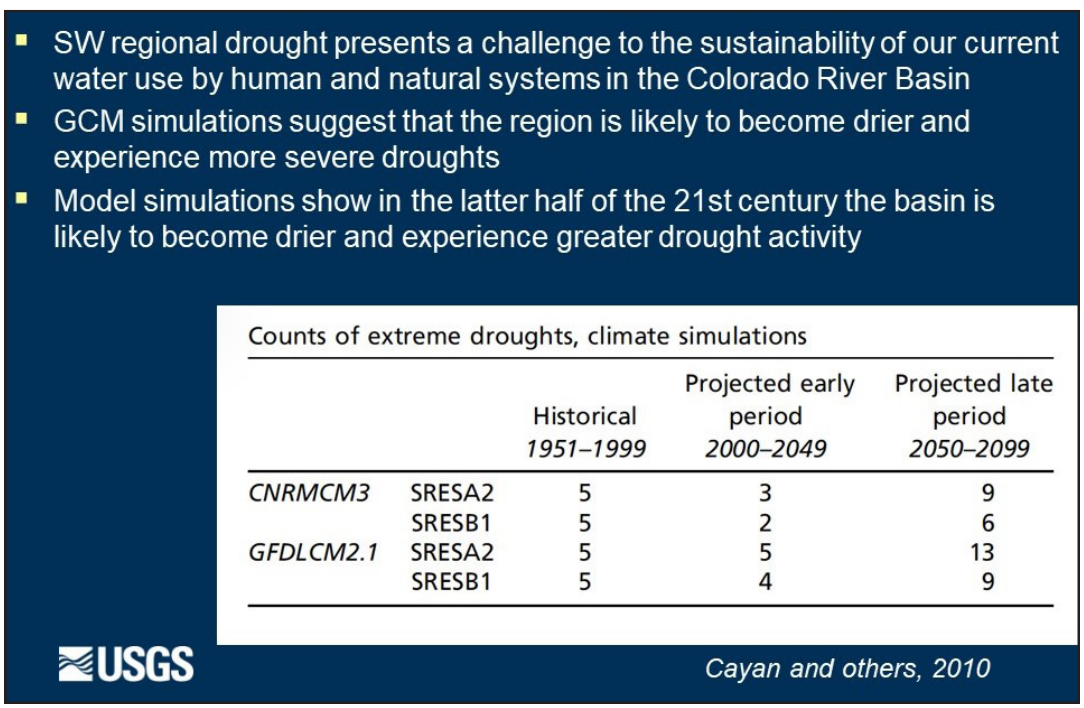


Figure 24. Colorado River Basin - drought duration.



		Historical *1951–1999*	Projected early period *2000–2049*	Projected late period *2050–2099*
CNRMCM3	SRESA2	5	3	9
	SRESB1	5	2	6
GFDLCM2.1	SRESA2	5	5	13
	SRESB1	5	4	9

Figure 25. Future drought in the Colorado River Basin.

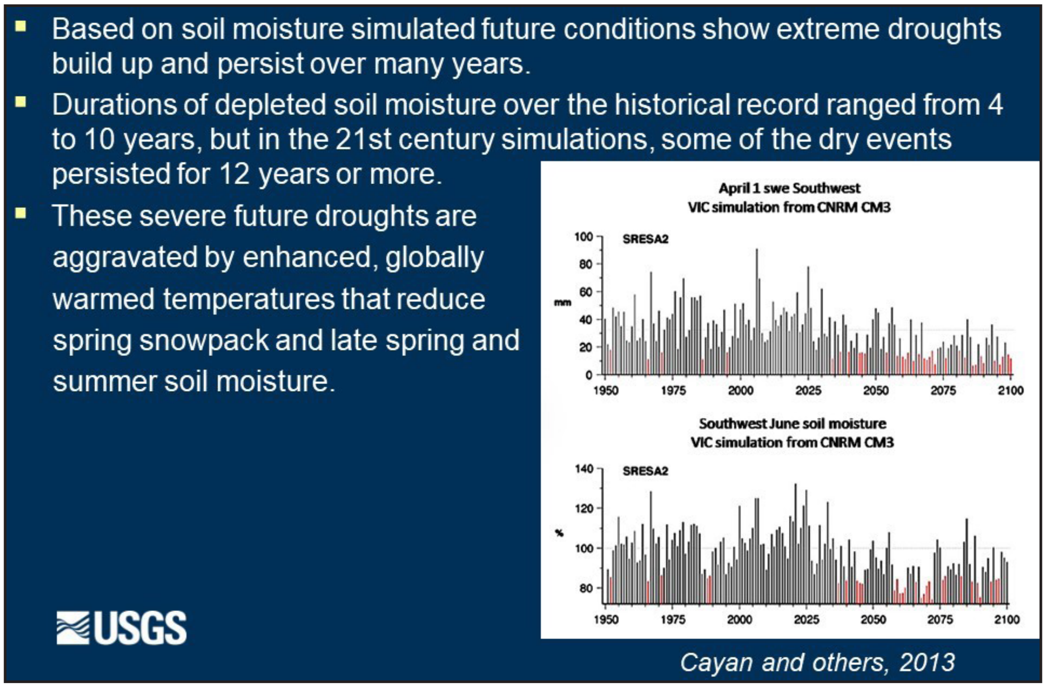


Figure 26. Future drought in the Southwest (cont.).

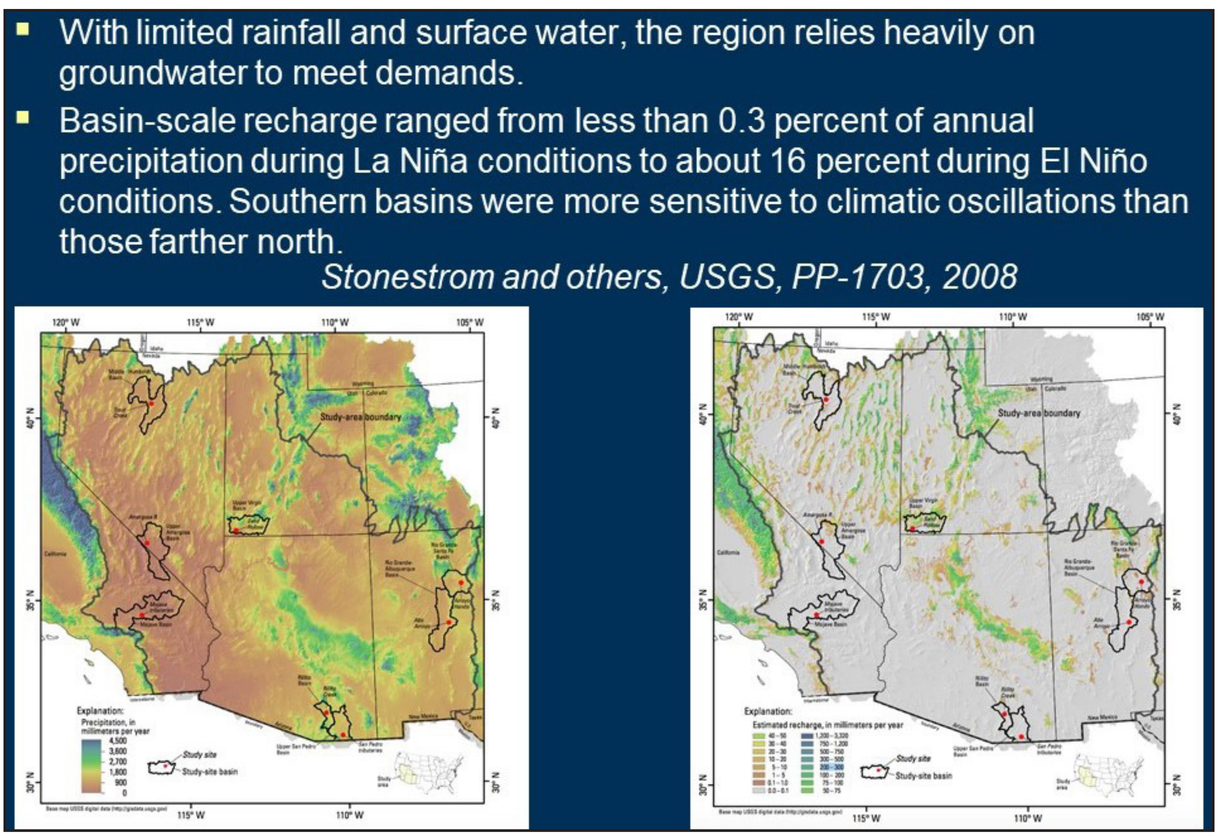


Figure 27. Climate and groundwater recharge in the Southwest.

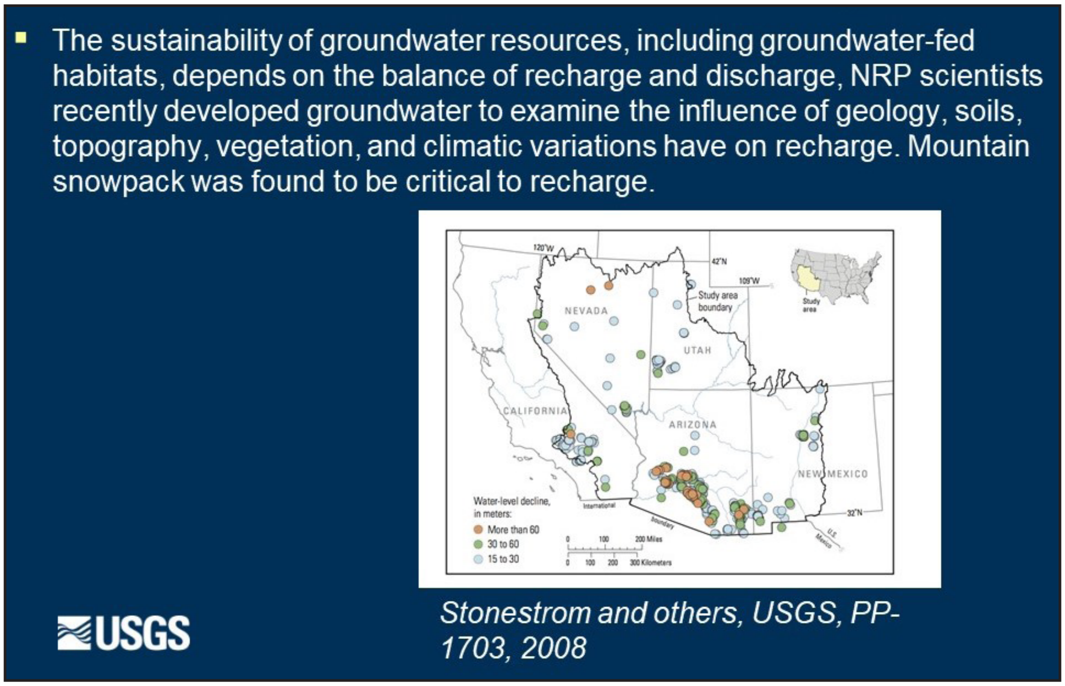


Figure 28. Climate and groundwater recharge in the Southwest (cont.).

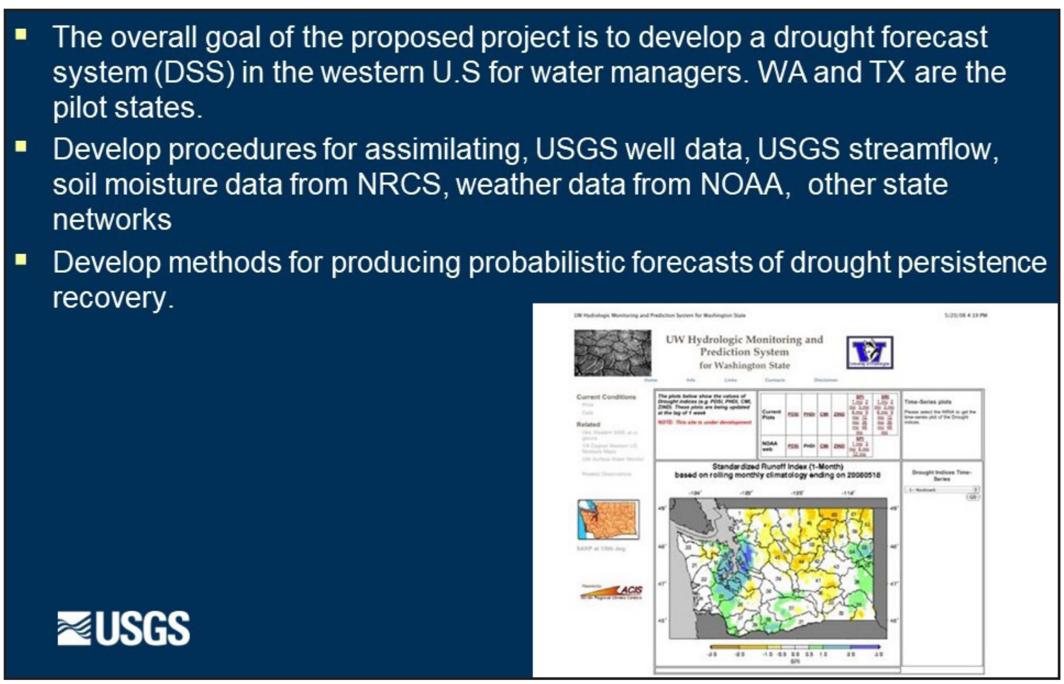


Figure 29. Drought forecasting - institute program.