

# **Climate Change and Arizona's Rangelands: Management Challenges and Opportunities**

A photograph of a grassy rangeland with a weather station in the foreground and mountains in the background. The weather station is a tall metal pole with various sensors and a wind vane. The landscape is a vast, open field of green grass with some small shrubs. In the distance, there are rolling hills and mountains under a blue sky with scattered white clouds.

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The University of Arizona**

# Presentation Overview

**“Everybody talks about the weather, but nobody does anything about it.” – Mark Twain**

- Arizona Climate & Range Management
- Important Concepts in Arizona Climatology
- Climate Variability and Change: Tools for Range Managers



# Arizona Climate and Resource Management

- Diverse types of rangelands (grasslands ↔ forested areas)
- Quick response to changing conditions (species specific adaptations and strategies)
- Complex interactions between native/invasive species, disturbances, soil types, current and past management actions AND climate.



# Arizona Climate and Resource Management

Climate variability is important at many different scales

- Interannual variability, timing, duration, intensity of precipitation events
- Spatial coverage of precipitation
- Interactions between temperature and precipitation
- Climate-related disturbances (e.g. wildfire, insects, drought stress)



Precipitation  
(seasonality, duration,  
intensity, frequency)

Temperature  
(growing season  
length, freezing  
events)

Solar Radiation  
(photosynthetic rates,  
evapotrans.)

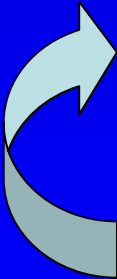
Wind  
(seed dispersal,  
erosion, evapotrans.)

Relative Humidity  
(evapotranspiration,  
diurnal temp. range)

Vegetation  
Response  
(growth, phenology,  
recruitment)

Landscape Features  
(Soils, topography,  
veg structure,  
nutrient fluxes)

# Ecological Climatology



# Arizona Climate and Resource Management

Tools/methods/strategies to reduce climate sensitivities

- Management options(?)
- Introduction of non-native species to increase cover (impacts on biodiversity, changing fire regimes)
- Other options??

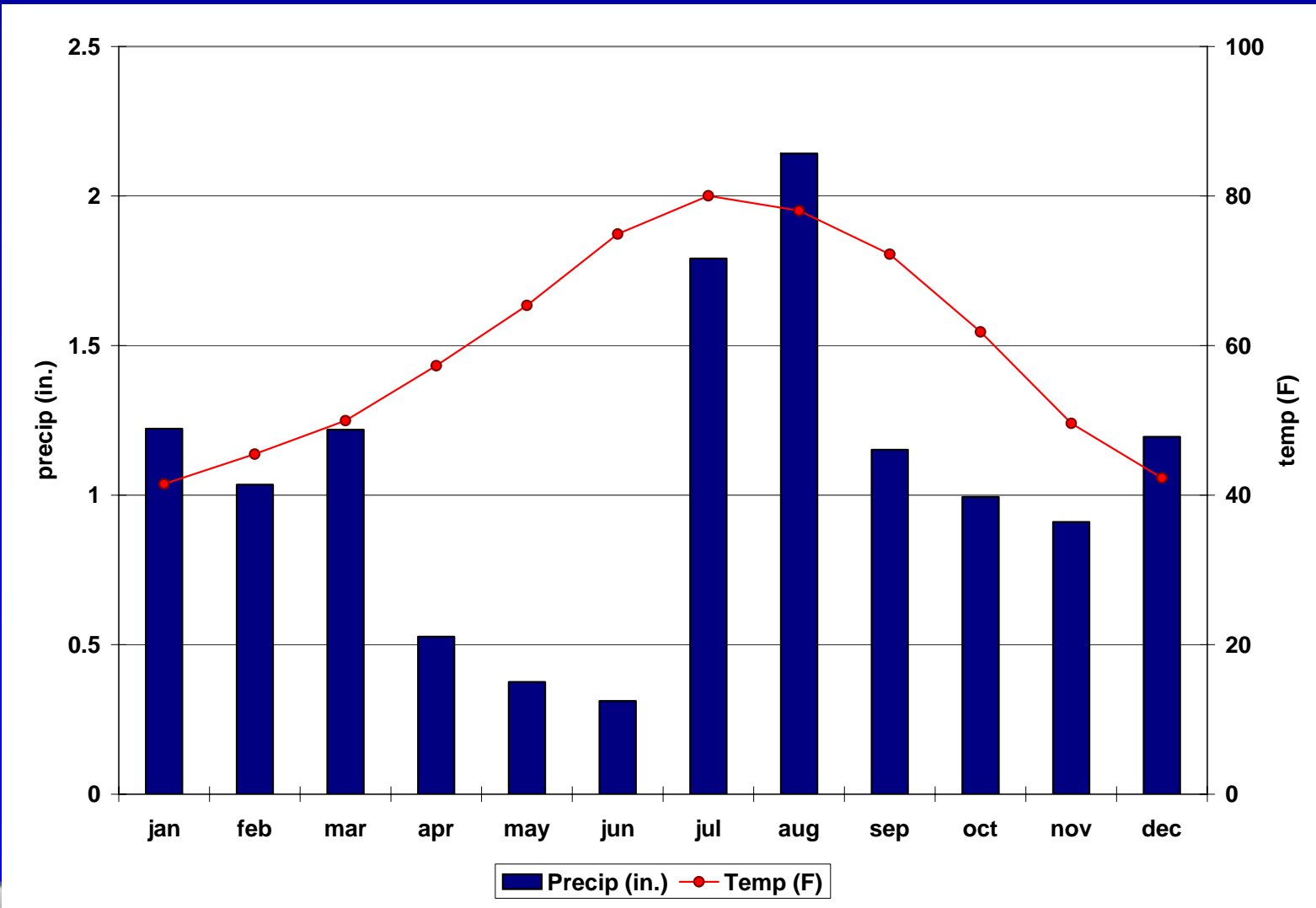


# Important Concepts in Arizona Climatology



# Seasonality: Arizona

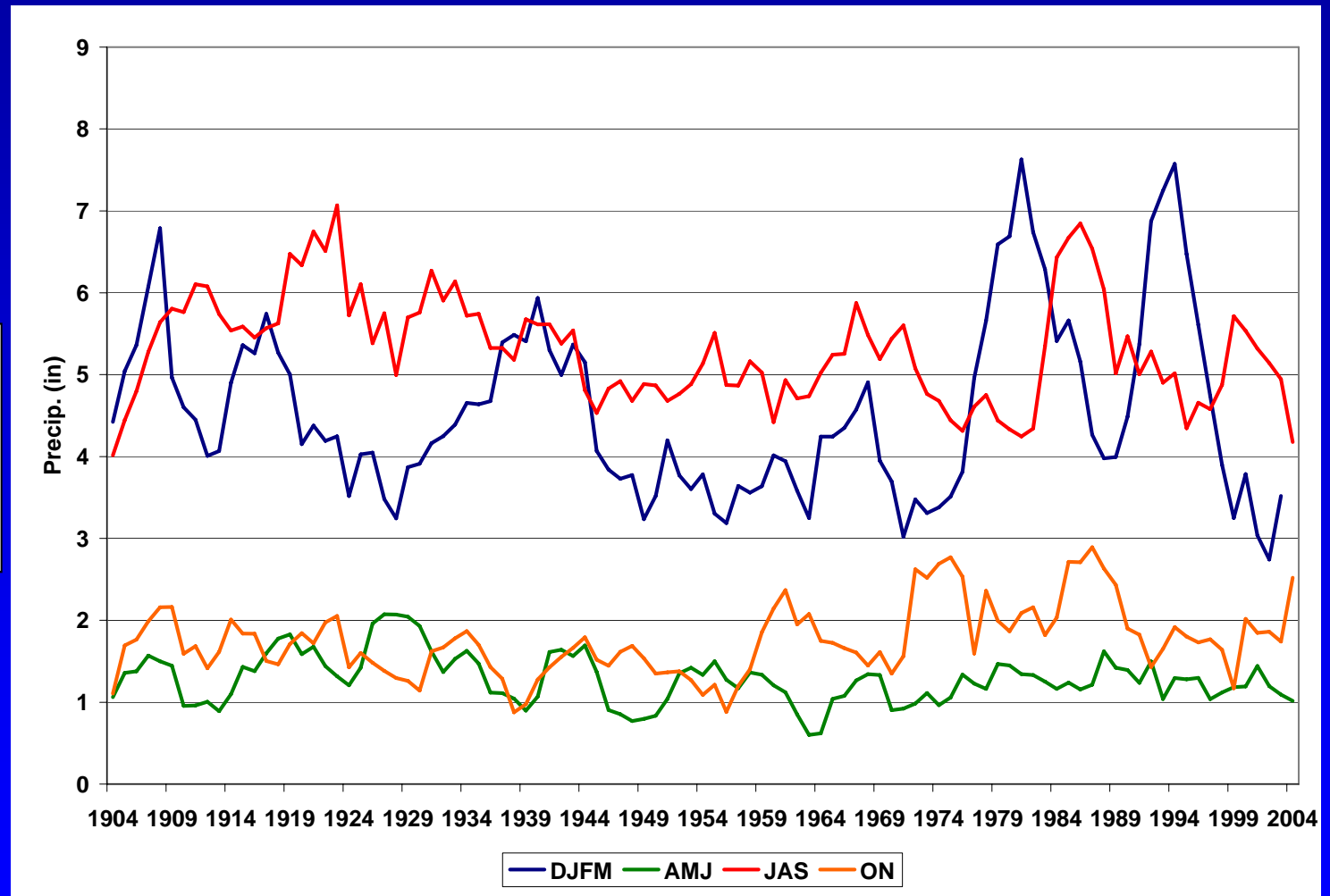
## Temperature and Precipitation



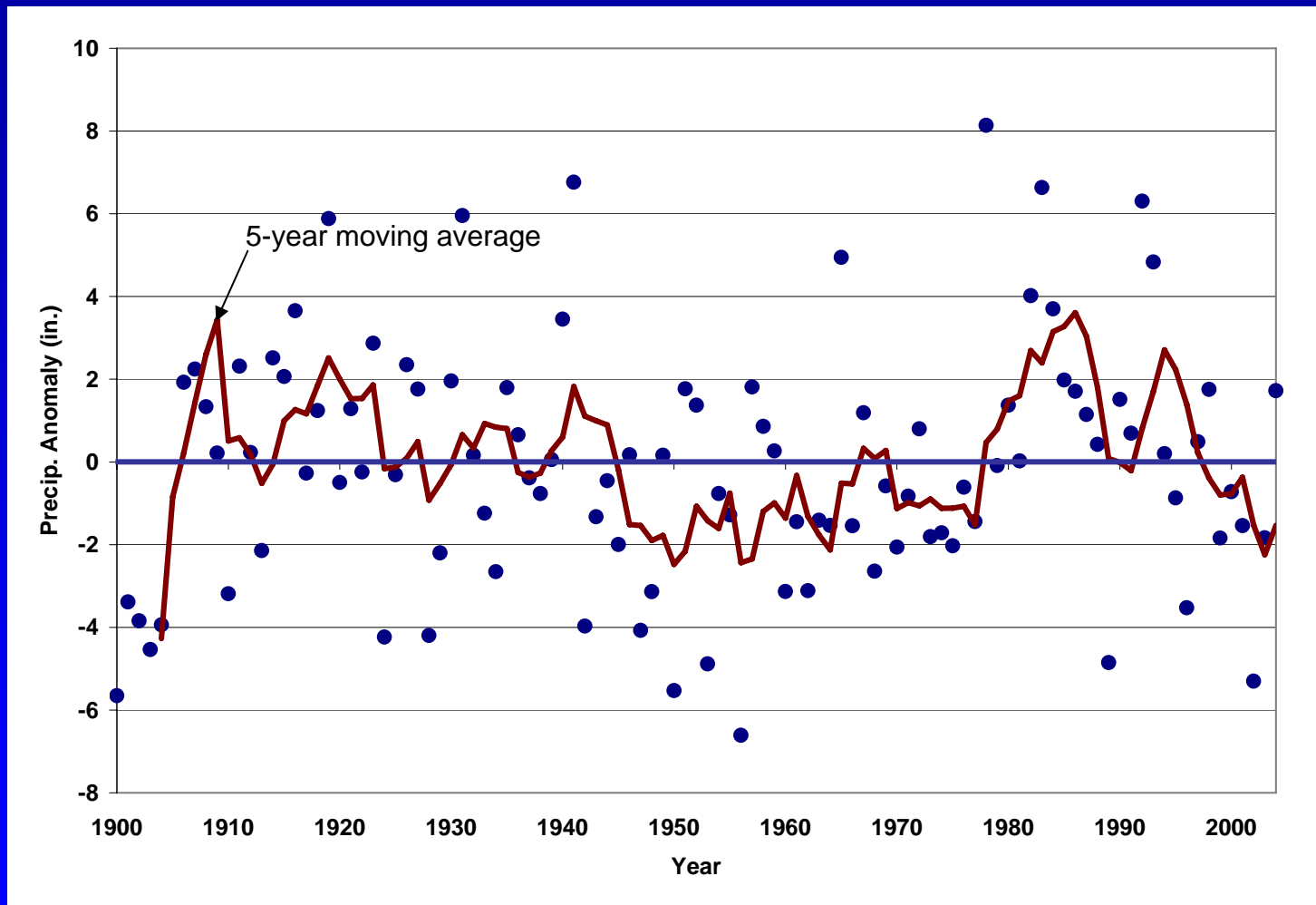


# Seasonal Precipitation Totals

Dec-Jan-Feb-Mar  
July-Aug-Sept  
Apr-May-Jun  
Oct-Nov



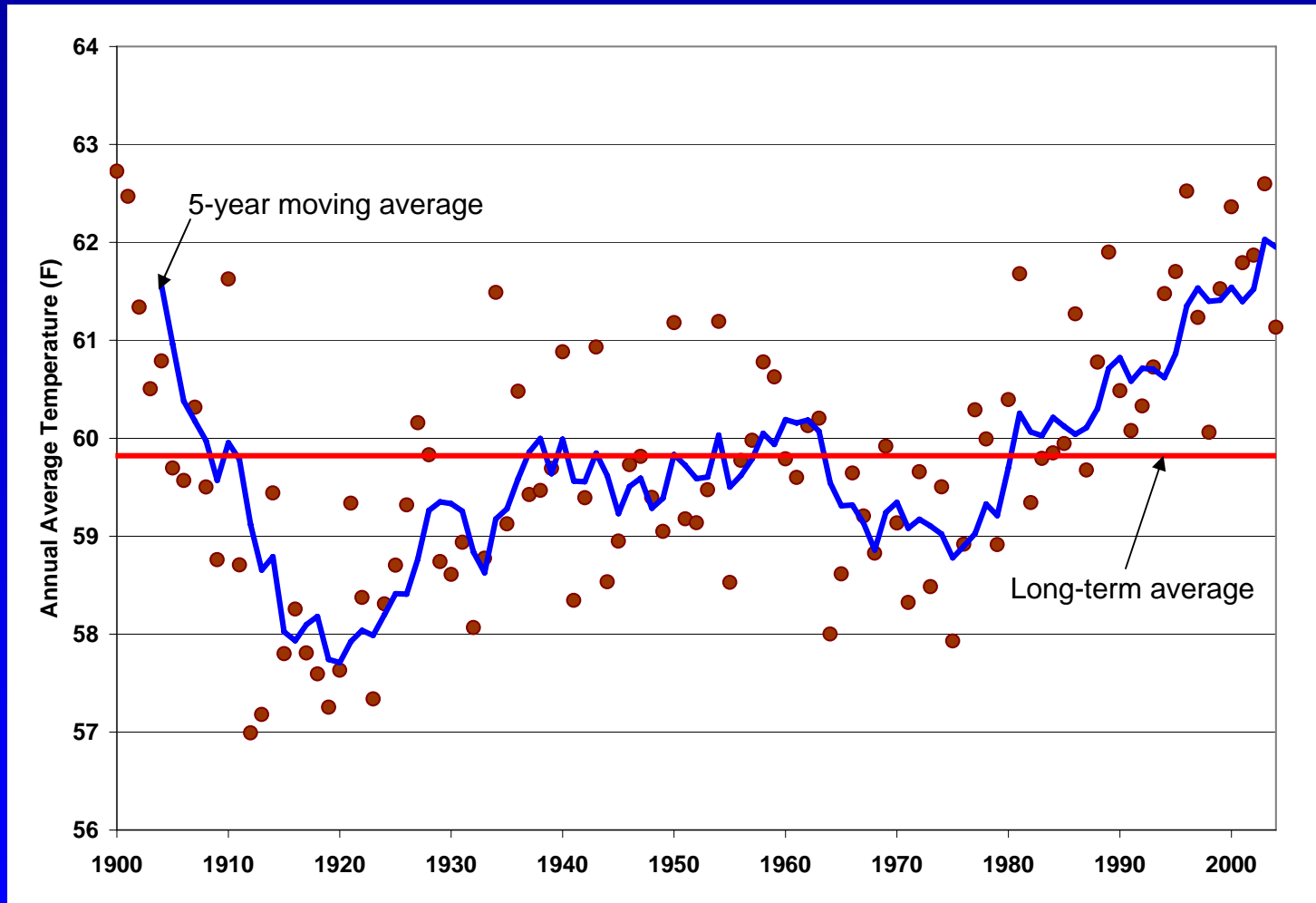
# Variability and Trend: Annual Precipitation Anomaly



Arizona statewide average annual total precipitation anomaly, long-term average: 12 inches



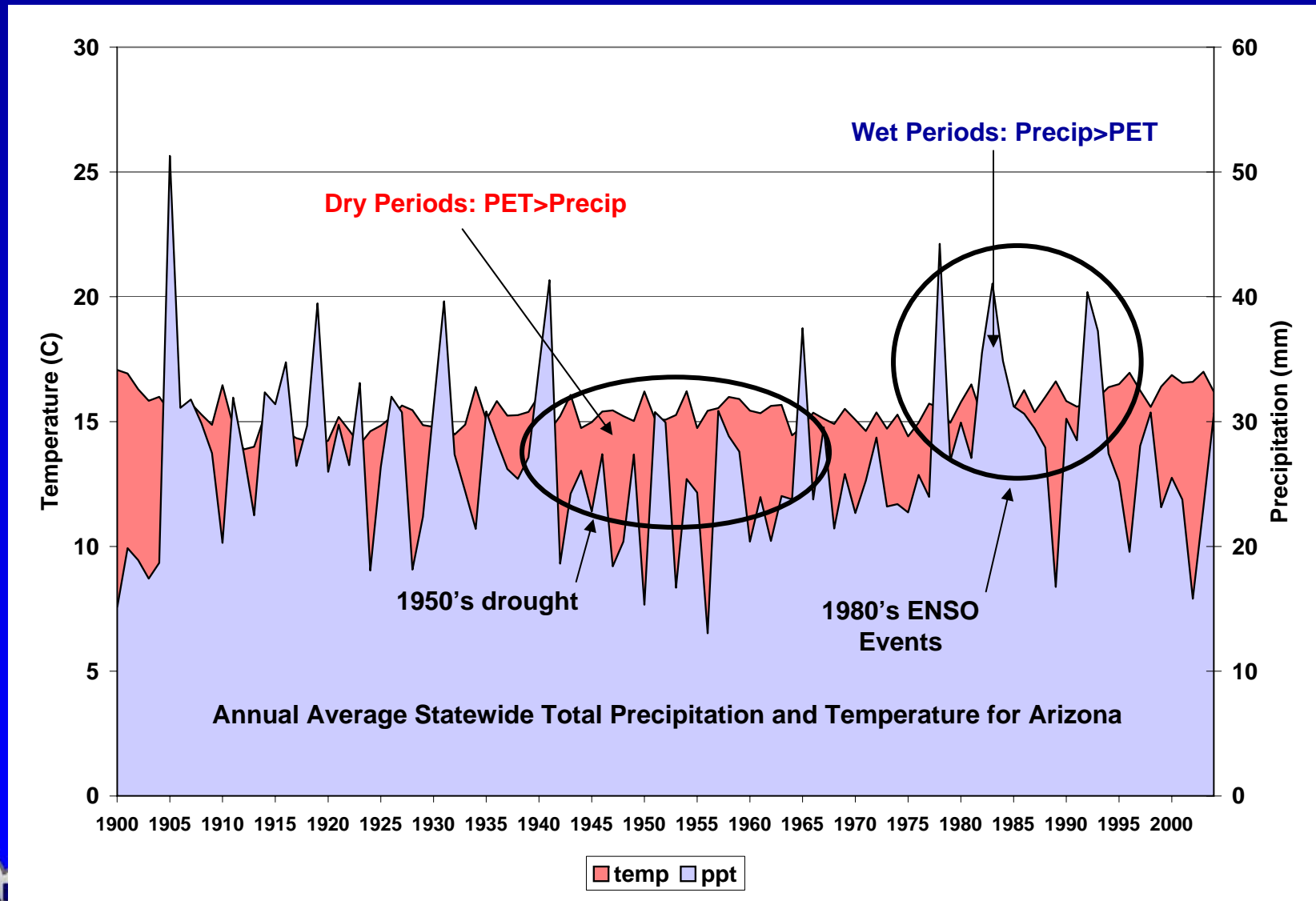
# Variability and Trend: Annual Average Temperature



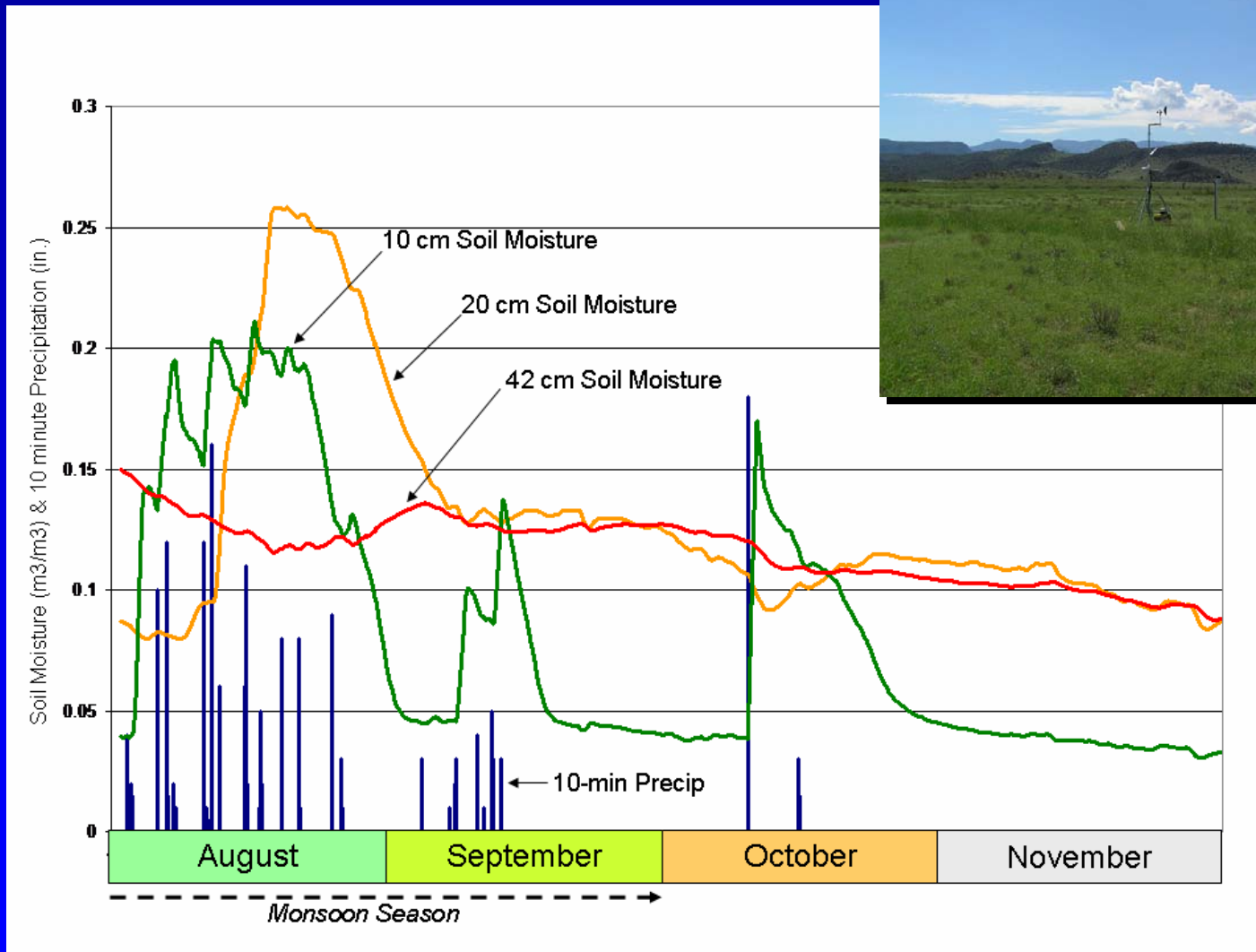
Arizona statewide average annual temperature, long-term average: 59.7 F



# Importance of considering precipitation AND temperature

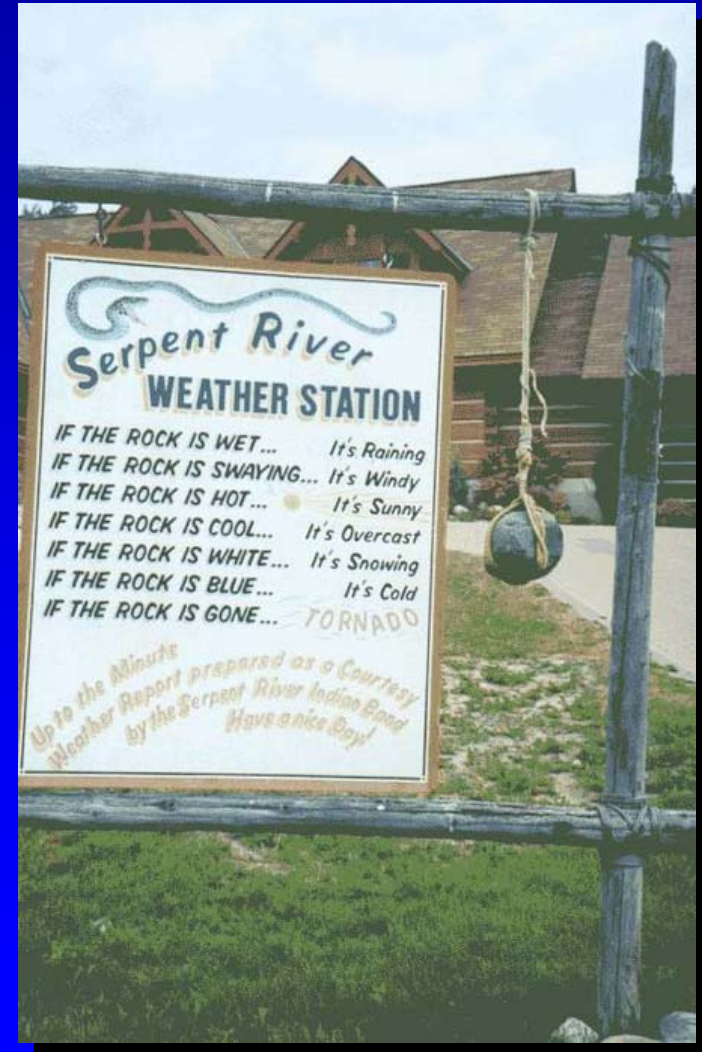


# Local Soil-Climate-Vegetation Interactions



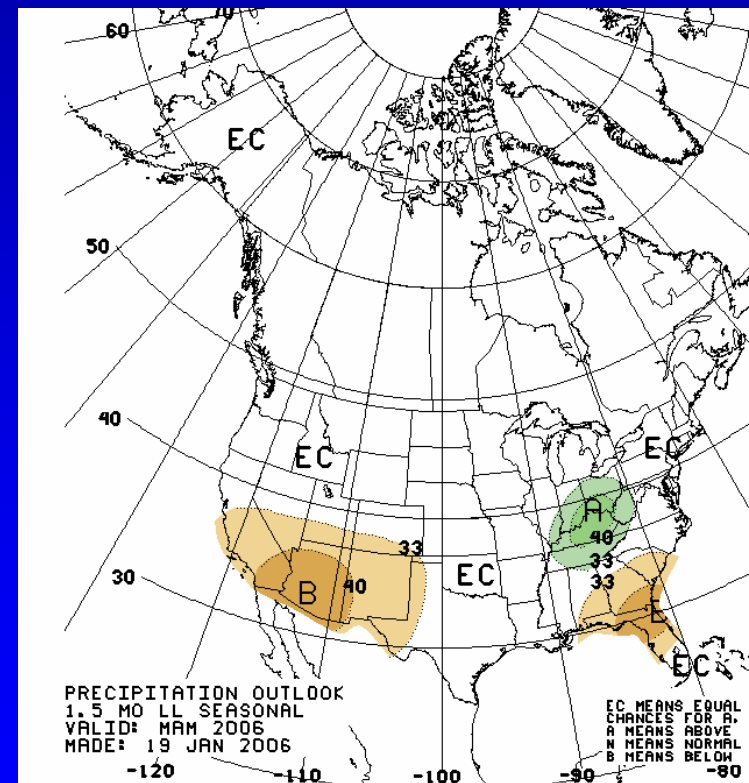
# Climate Variability and Change: Tools for Range Managers

- Monitoring & Diagnostic Tools
  - Range monitoring/climate data research & product development
  - Better drought impact assessments?
  - Better monitoring of precipitation?
  - RangeView with climate information, Southwest Climate Outlook



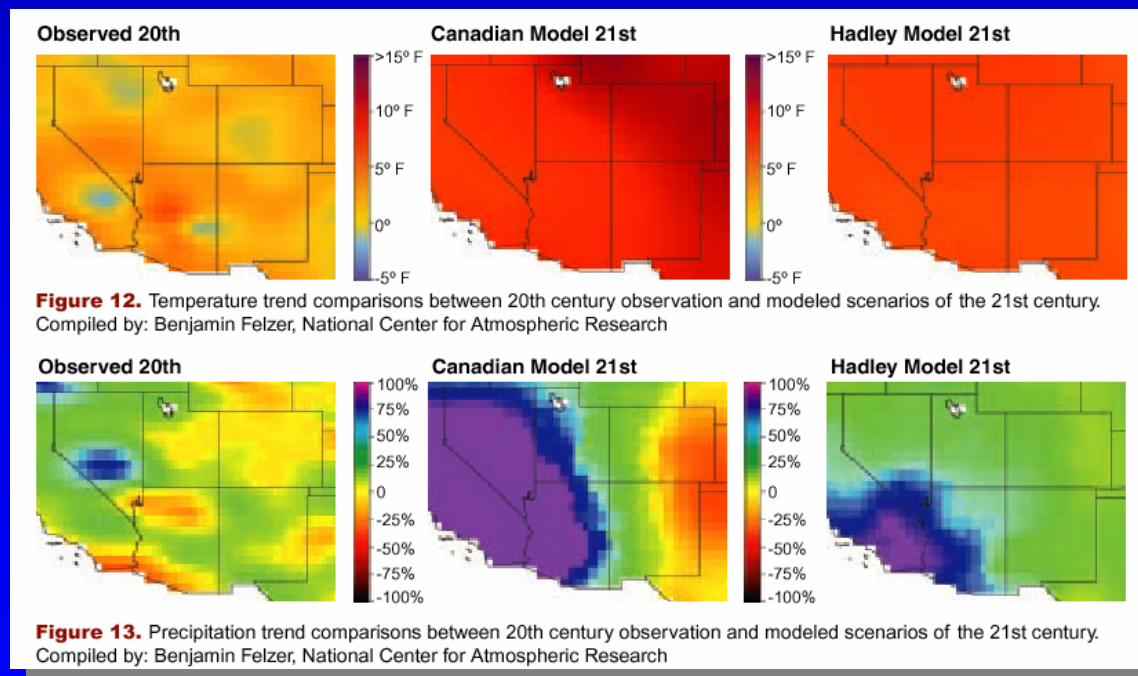
# Climate Variability and Change: Tools for Range Managers

- Seasonal Forecasts
  - Highest confidence with ENSO and winter precipitation
  - Monsoon season forecasts very difficult to make (weak teleconnections with ENSO, U.S. snow pack, soil moisture status)
  - How could seasonal forecasts be better utilized for range management?



# Climate Variability and Change: Tools for Range Managers

- Climate Change Projections
  - Dealing with uncertainty
  - More confidence in temperature projections than precipitation
  - Changes in variability, seasonality, extreme event frequencies



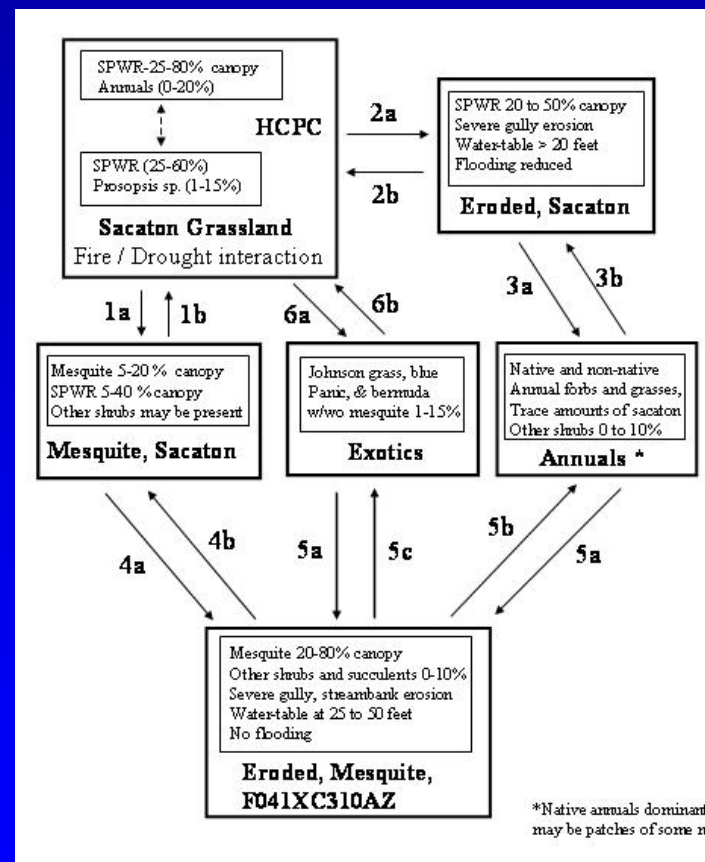
From: ISPE Southwest Regional Assessment





# Climate Variability and Change: Tools for Range Managers

- Integration with land management practices and ecological concepts/models
  - How can climate information be better integrated in range management decision making?
  - What new information is needed?
  - Can existing information be better utilized?

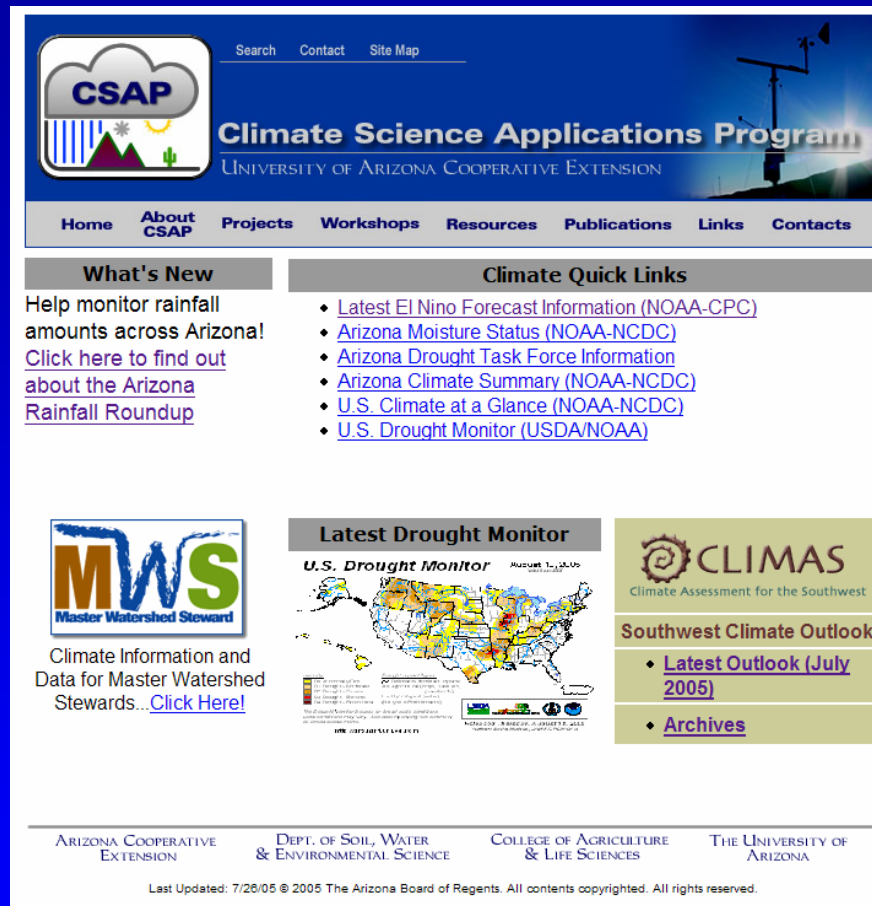


# Closing Points

- Rangelands are especially sensitive to climate variability and change
- Complex climate at many different scales through time and over space
- Opportunities to develop new ways of thinking about climate in range management (new tools, information, and conceptual models)



# Thank You!



The screenshot shows the homepage of the Climate Science Applications Program (CSAP) at the University of Arizona Cooperative Extension. The page features a navigation menu with links for Home, About CSAP, Projects, Workshops, Resources, Publications, Links, and Contacts. A search bar is located at the top right. The main content area is divided into two columns: 'What's New' and 'Climate Quick Links'. The 'What's New' section highlights a rainfall roundup for Arizona. The 'Climate Quick Links' section lists several key resources, including the latest El Niño forecast, Arizona moisture status, drought task force information, and the U.S. Drought Monitor. Below these sections are three featured boxes: 'Master Watershed Steward' (MWS) with a link to climate information and data; 'Latest Drought Monitor' featuring a map of the U.S. Drought Monitor for August 1, 2005; and 'Southwest Climate Outlook' with a link to the latest outlook for July 2005 and an archives link. The footer contains the names of the parent organizations: Arizona Cooperative Extension, Dept. of Soil, Water & Environmental Science, College of Agriculture & Life Sciences, and The University of Arizona. A copyright notice is also present.

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Climate Science Applications Program  
UNIVERSITY OF ARIZONA COOPERATIVE EXTENSION

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**What's New**

Help monitor rainfall amounts across Arizona!  
[Click here to find out about the Arizona Rainfall Roundup](#)

**Climate Quick Links**

- [Latest El Nino Forecast Information \(NOAA-CPC\)](#)
- [Arizona Moisture Status \(NOAA-NCDC\)](#)
- [Arizona Drought Task Force Information](#)
- [Arizona Climate Summary \(NOAA-NCDC\)](#)
- [U.S. Climate at a Glance \(NOAA-NCDC\)](#)
- [U.S. Drought Monitor \(USDA/NOAA\)](#)

**MWS**  
Master Watershed Steward

Climate Information and Data for Master Watershed Stewards...[Click Here!](#)

**Latest Drought Monitor**

*U.S. Drought Monitor* August 1, 2005

**CLIMAS**  
Climate Assessment for the Southwest

**Southwest Climate Outlook**

- [Latest Outlook \(July 2005\)](#)
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<http://cals.arizona.edu/climate>



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