Climate Change and Arizona’s Rangelands: Management Challenges and Opportunities

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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)
Vegetation Response (growth, phenology, recruitment)

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)

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

![Seasonality Chart](chart.png)
Seasonal Precipitation Totals

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

Precip. (in)
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

Annual Average Statewide Total Precipitation and Temperature for Arizona

Dry Periods: PET>Precip

Wet Periods: Precip>PET

1950’s drought

1980’s ENSO Events

1980’s ENSO

Events

Climate Science Applications Program - Arizona Cooperative Extension
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

Figure 12. Temperature trend comparisons between 20th century observation and modeled scenarios of the 21st century. Compiled by: Benjamin Felzer, National Center for Atmospheric Research

Figure 13. Precipitation trend comparisons between 20th century observation and modeled scenarios of the 21st century. Compiled by: Benjamin Felzer, National Center for Atmospheric Research

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!

http://cals.arizona.edu/climate