# Precipitation Regime Classification for the Mojave Desert

## Implications for Fire Occurrence

Jerry Tagestad[1]
Valerie Cullinan[1]
Matt Brooks[2]
Janelle Downs[1]

1 - Pacific Northwest National Laboratory, Richland, WA
2 – USGS, Western Ecological Research Center

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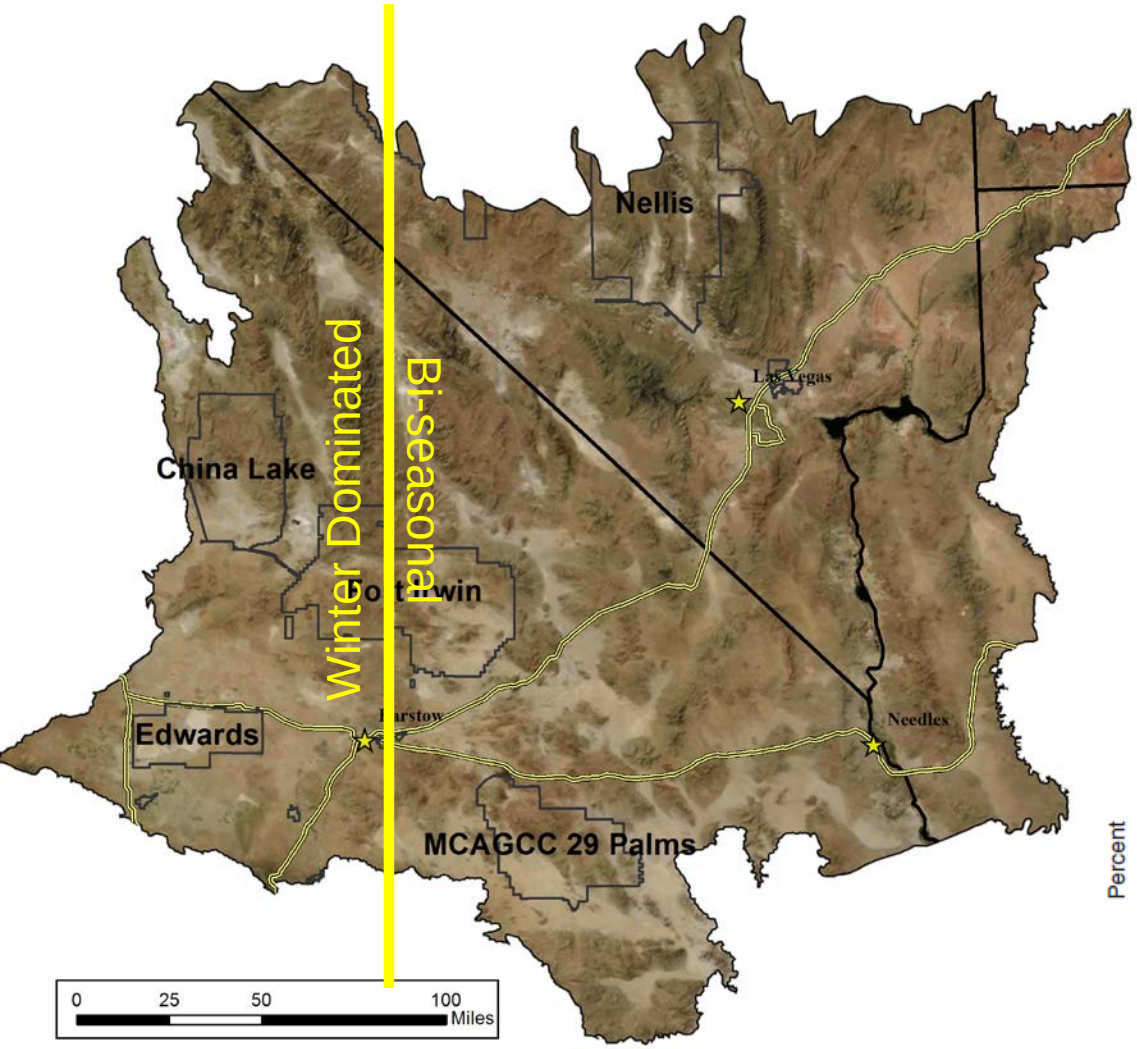
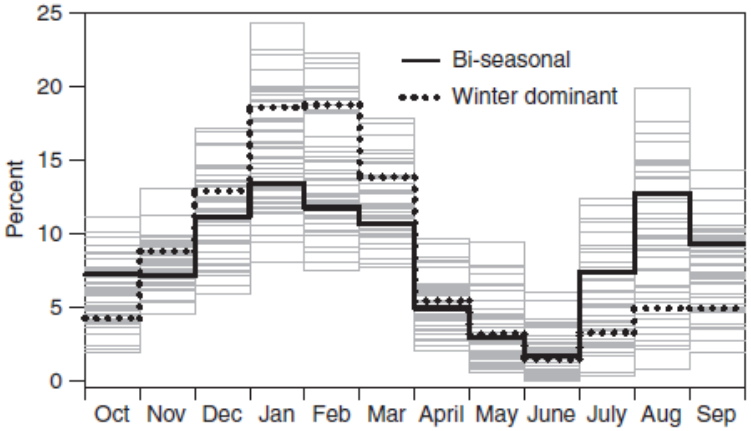
# Synopsis

- Precipitation patterns in Mojave
- Data Source
- Classification
- Results
  - “Current” precipitation zones
  - “Current” fire distribution patterns
  - Historic precipitation zones
    - Anecdotal fire
  - Future precipitation zones
    - Implications for fire

# Mojave Precipitation Patterns




- Distinctly bimodal with peaks during winter and summer
- Ratio of winter to summer precipitation increases from east to west across the bioregion (~ 117º W)




From R. Hereford et al. Journal of Arid Environments 67 (2006) 13–15

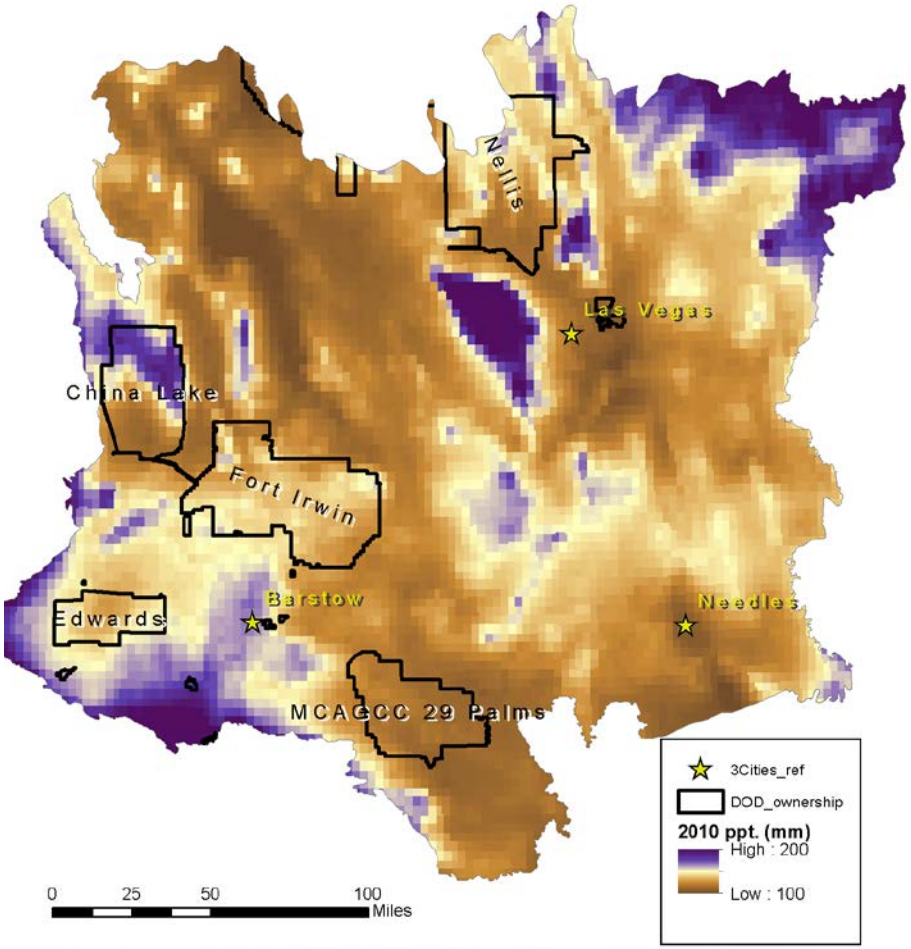
# Spatial Classification of Precipitation

- Objectives
  1. Derive a more detailed representation of the rainfall patterns in the Mojave
     - Classify the spatial extent and distribution of similar precipitation patterns
     - Use these datasets to better understand relationship between precipitation patterns and potential fire risk
  2. Compare the current precipitation regime and patterns with both historic patterns and predicted future patterns

# Data: Precipitation Grids (PRISM)

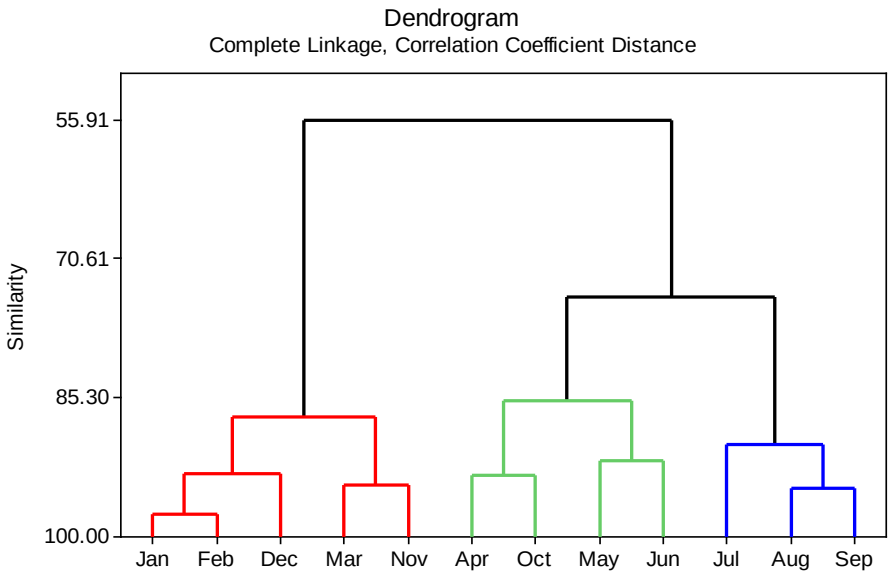
- Weather station data interpolated over 3 dimensions to create a continuous representation (PRISM algorithm Daly 1994)
- Gridded precipitation data acquired for every month from 1900-2010

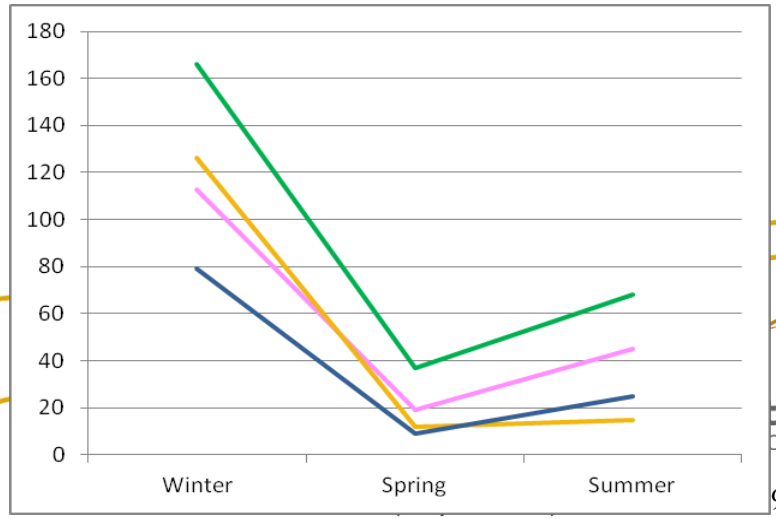
2010 Annual Precipitation

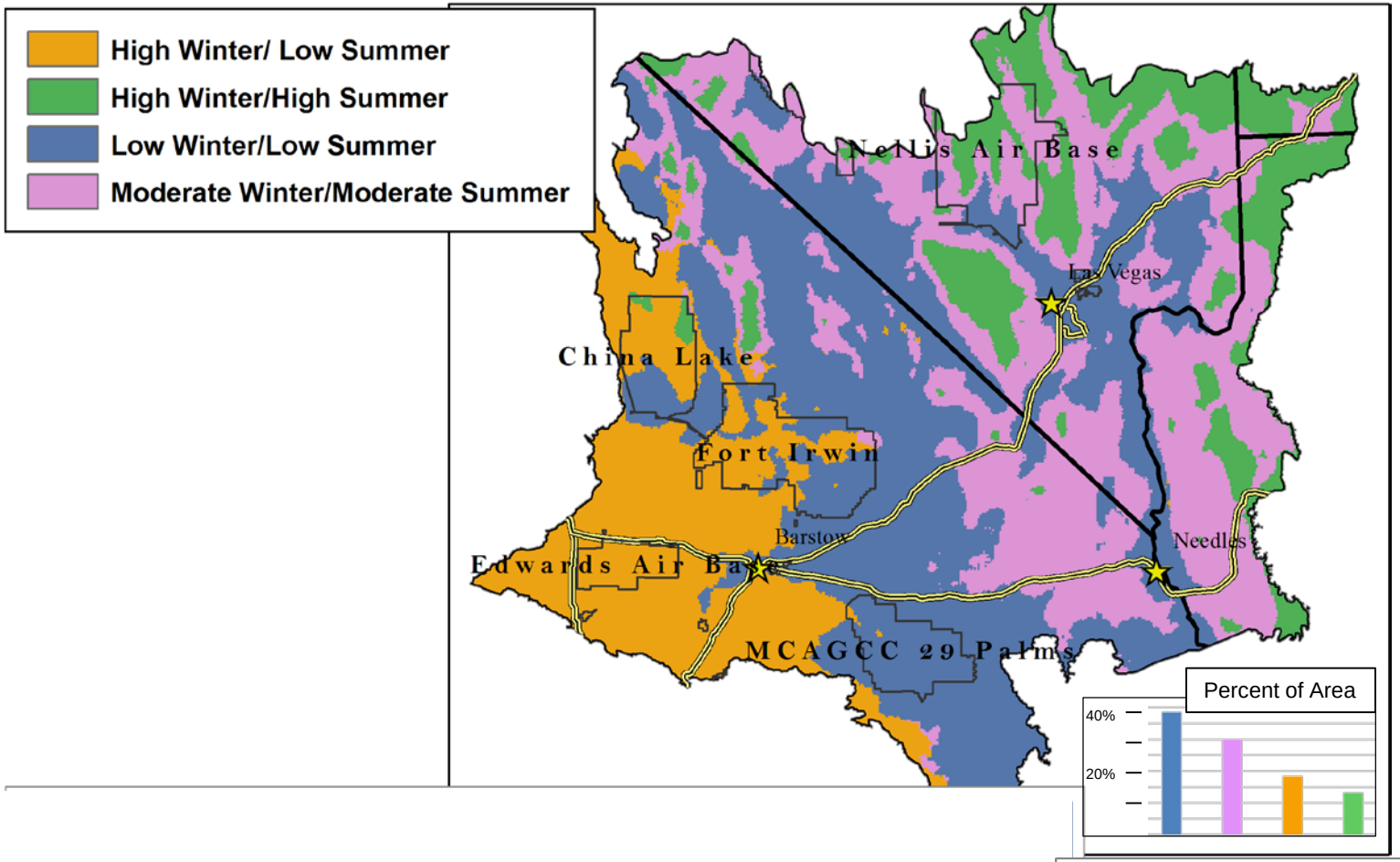


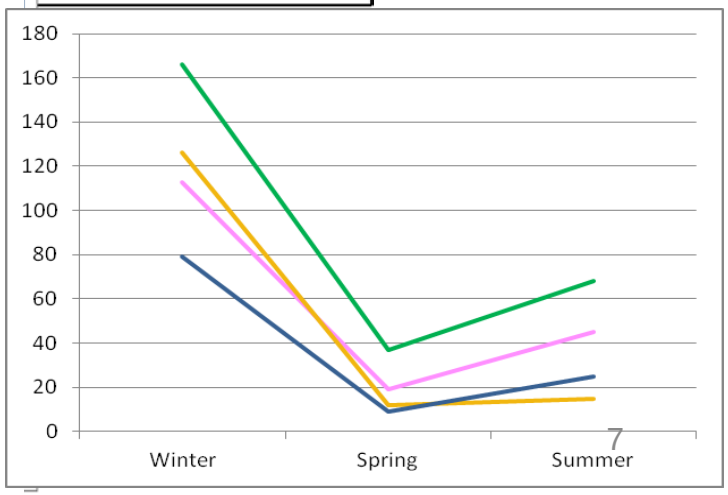
# Data: Classification

- Selected most recent 40-year period with multiple wet, dry and normal years
- Used K-means clustering to identify distinct seasons
  - Winter
  - Spring
  - Summer
- Classify seasonal data into 4 precipitation zones representing unique regimes

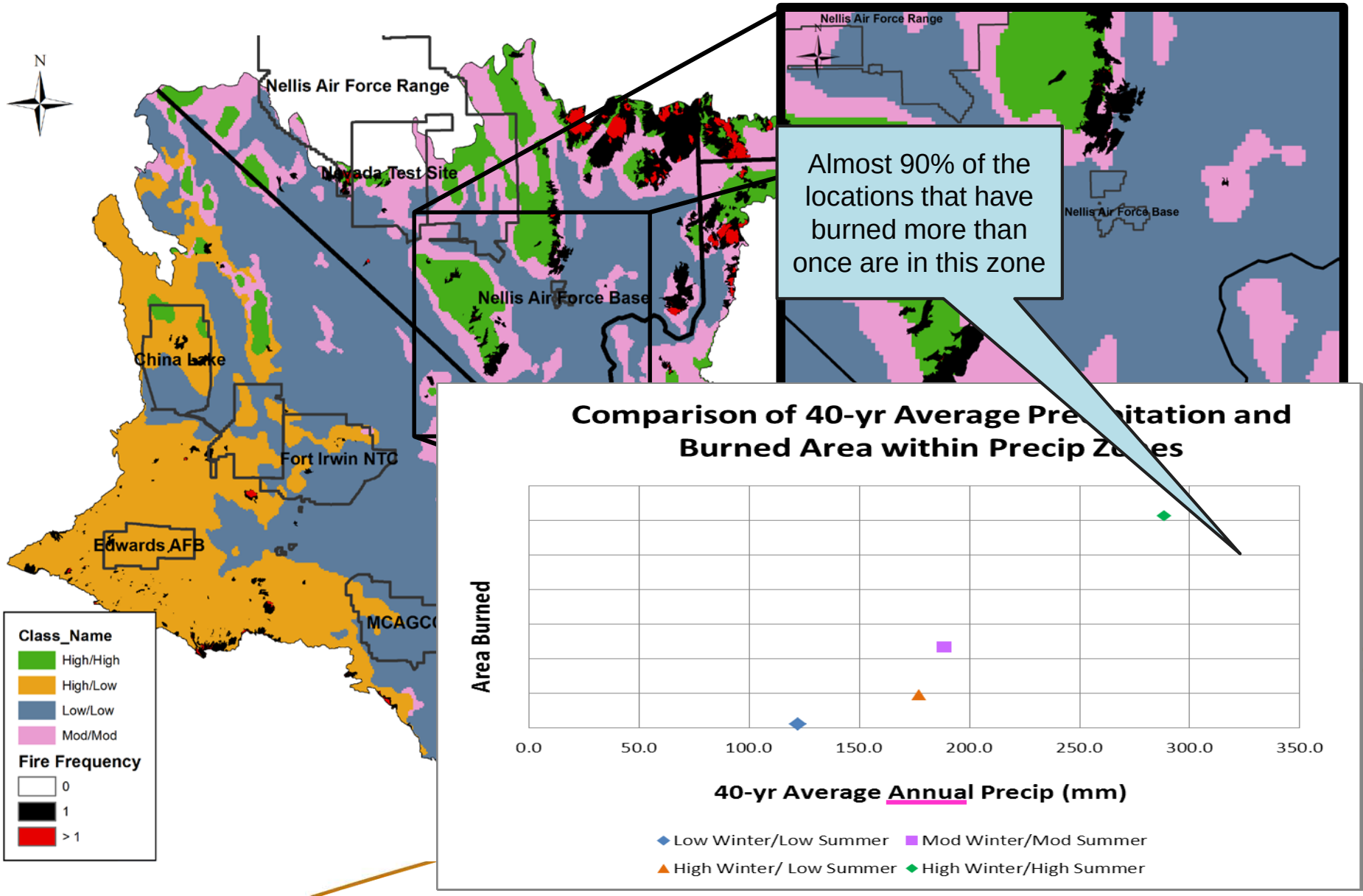


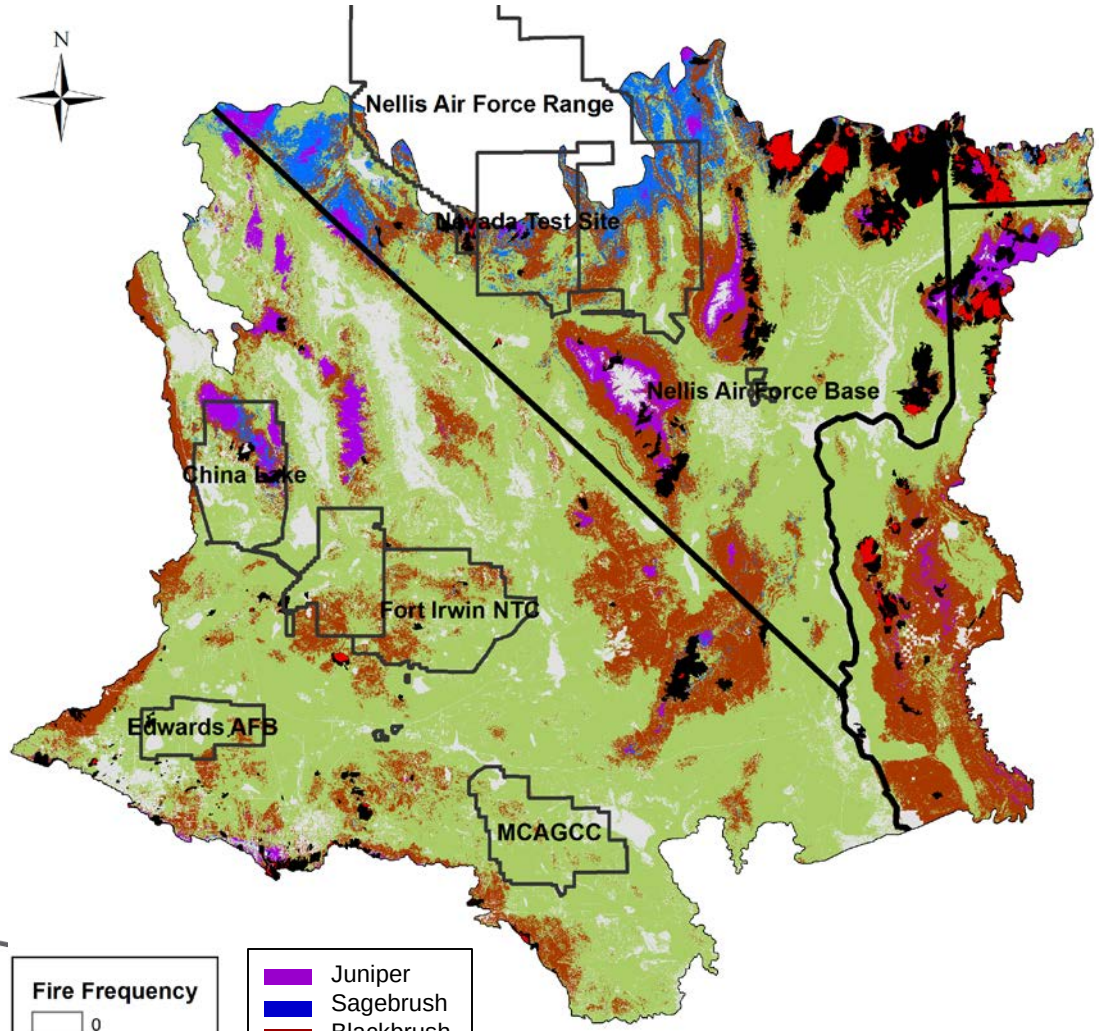

High Winter/ Low Summer
High Winter/High Summer
Low Winter/Low Summer
Moderate Winter/Moderate Summer
Nellis Air Base
Las Vegas
China Lake
Fort Irwin
Barstow
Needles
Edwards Air Base
MCAGCC 29 Palms
Percent of Area
40%
20%

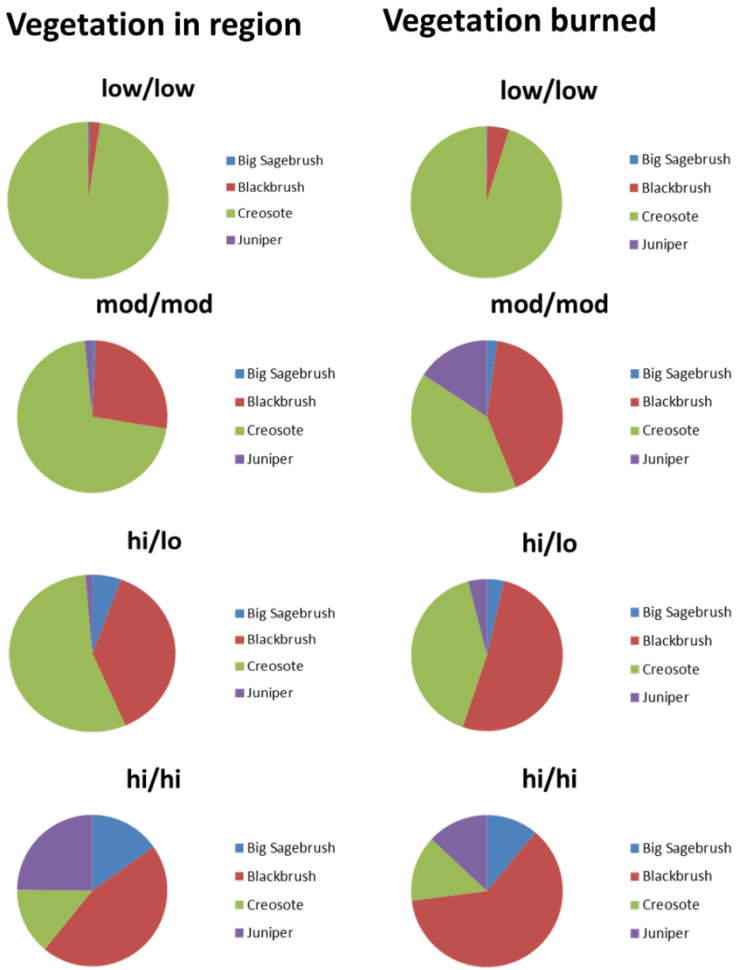

180
160
140
120
100
80
60
40
20
0
Winter
Spring
Summer

# Burn History by Precipitation Zone



# Burn History by Vegetation Type (and Precip)

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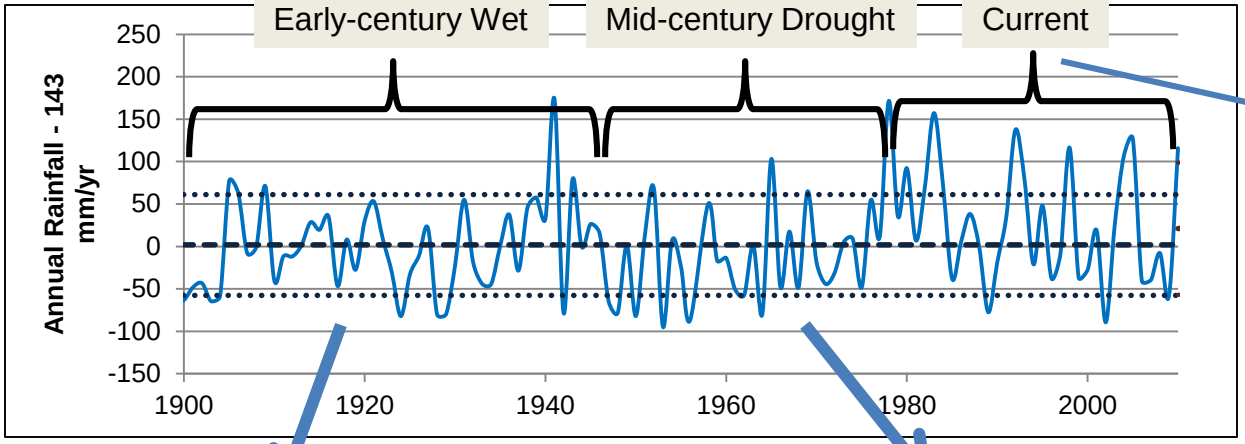
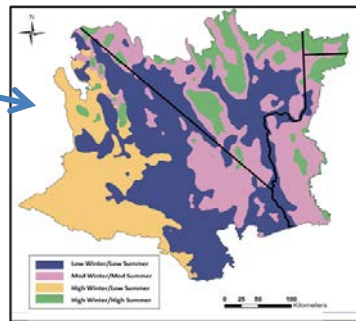
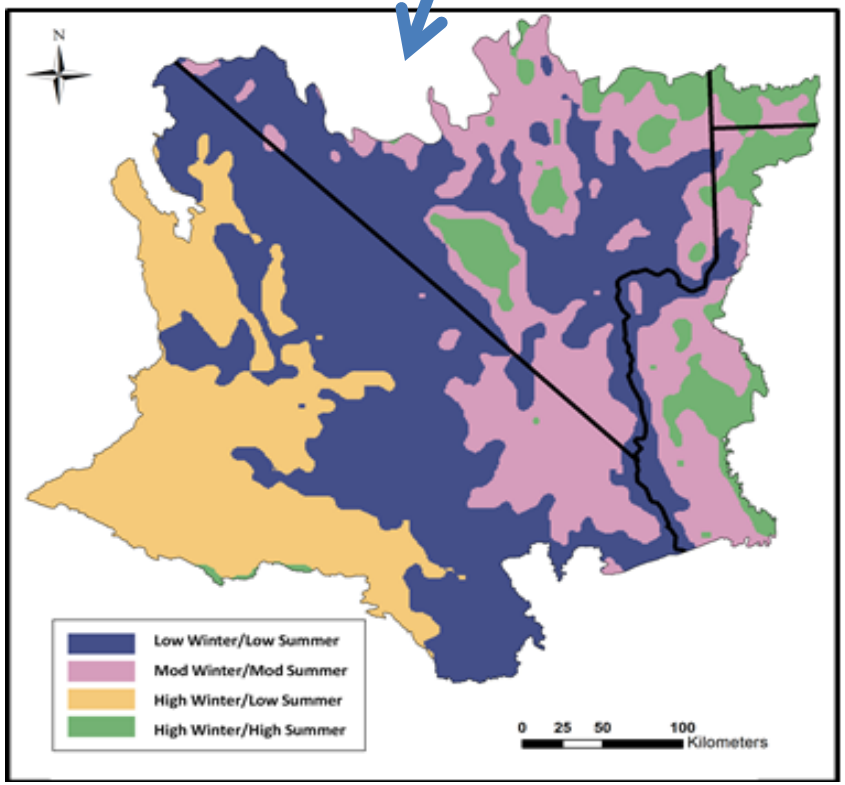
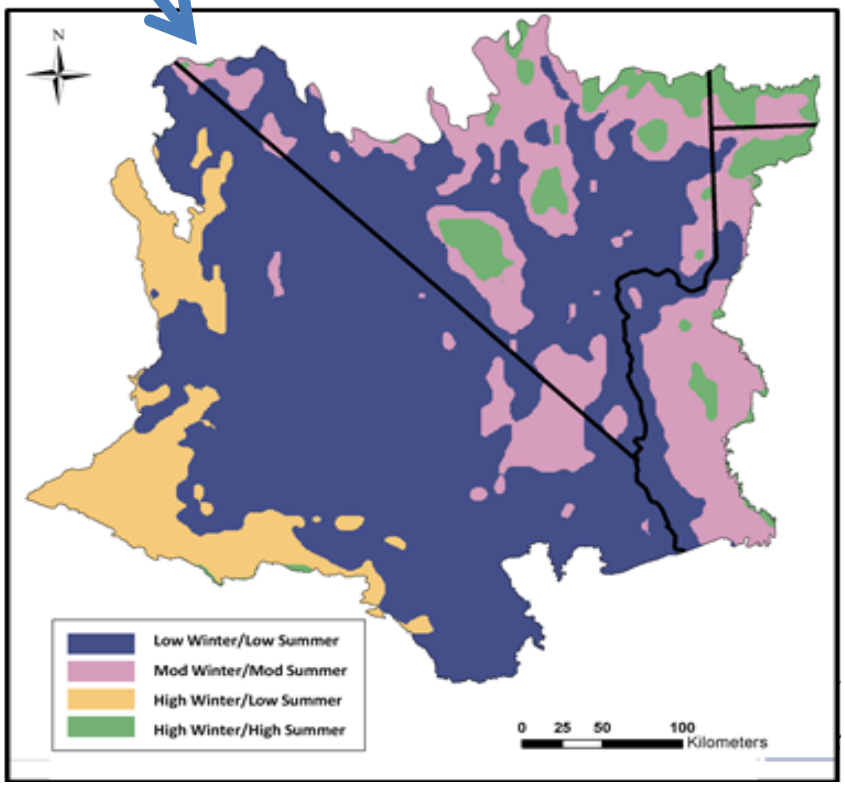
# Precipitation Zones for Historic Periods



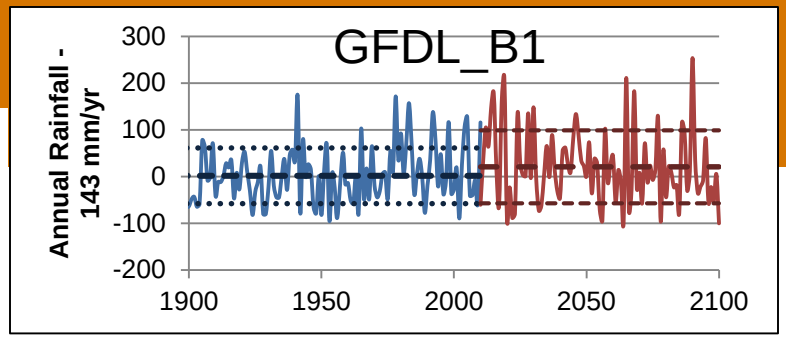


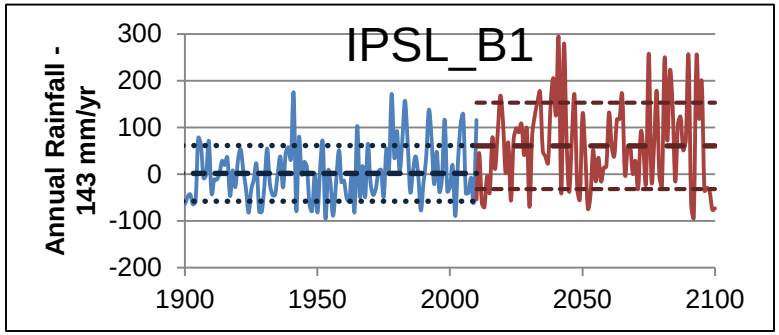



# Future Precipitation

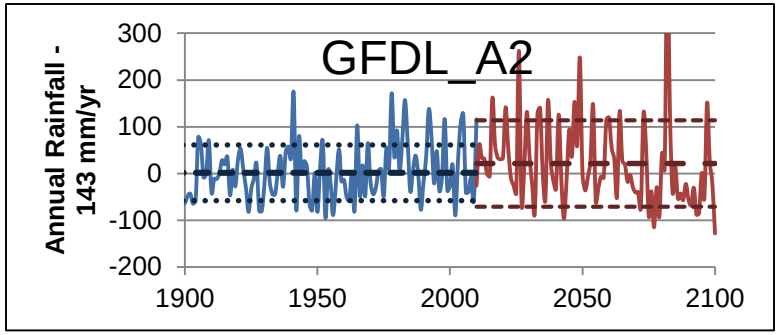
- Assessed results from 16 downscaled GCMs
  - Selected 2 models that best simulated the historic precipitation (IPSL_CM4 & GFDL_CM2.1)
  - Selected 2 scenarios that represent the extremes of human-caused emissions (A2 & B1)
- As compared to historic:
  - Larger range of variation
  - Numerous periods of above-average precip
  - Either winter or summer increase; spring constant or lower

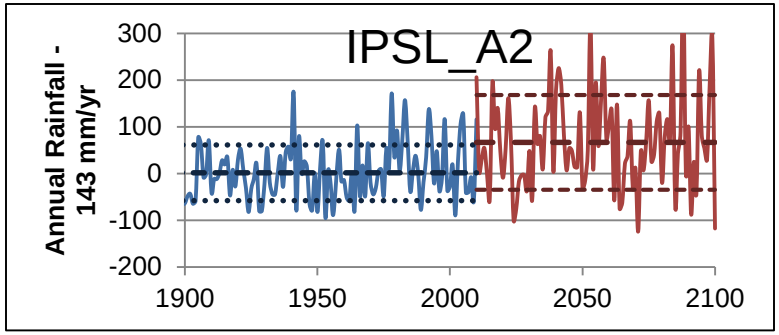
Lower GHG Emission



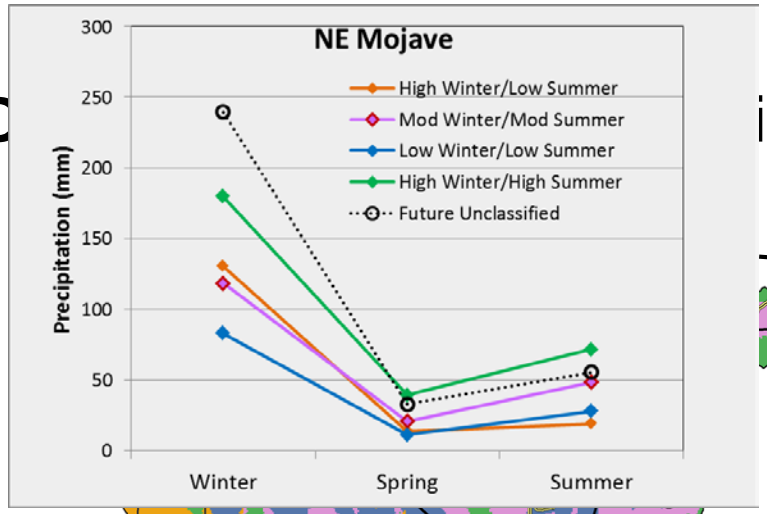

Higher GHG Emission

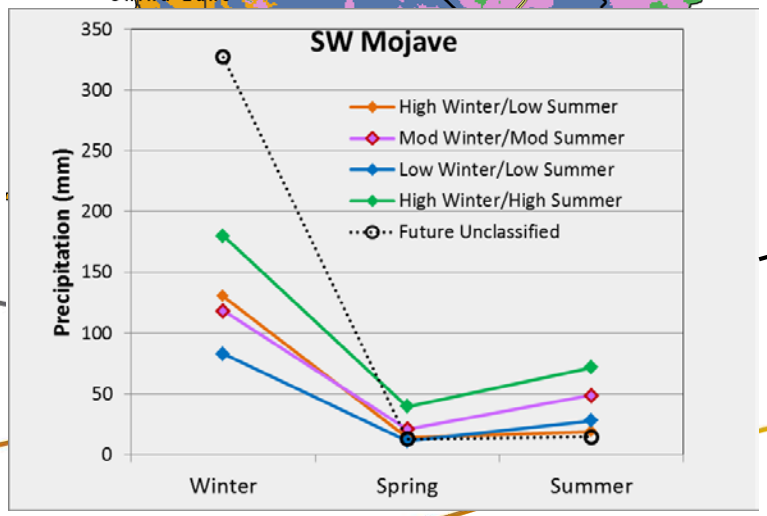


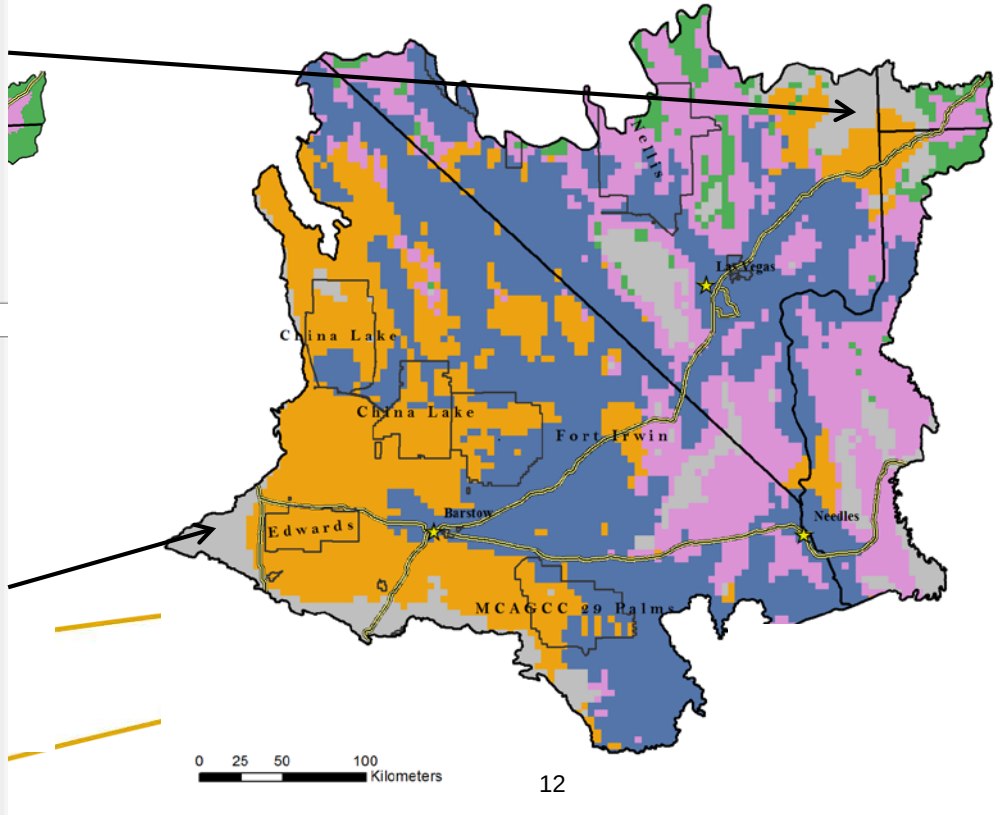



# Climate Evaluation: Bias-Corrected Statistical Downscaling GFDL CM2.1

## C…ime A2 Scenario—2010 to 2049



# Summary

- Precipitation classification reveals detailed spatial patterns
- Precipitation zones relevant to many ecological processes (fire)
  - The largest burns occur in the zones with summer precipitation
  - Most repeat burns occur in the zones with summer precipitation
  - Mid-elevation communities are burning proportionally more; regardless of precipitation zone
- Historic precipitation zones (wet and dry) periods align with understanding of historic burn patterns
- Future precipitation ***(from selected model/scenario and downscaling)***
  - Generally higher precipitation (available moisture?)
  - Winter increase
  - Some shifts outside the model envelope

# Acknowledgements


- US DoD Strategic Environmental Research and Development Program (SERDP) Program
- Environmental Staff at Fort Irwin, Nellis AFB, Edwards AFB and China Lake
- Randy McKinley USGS MTBS program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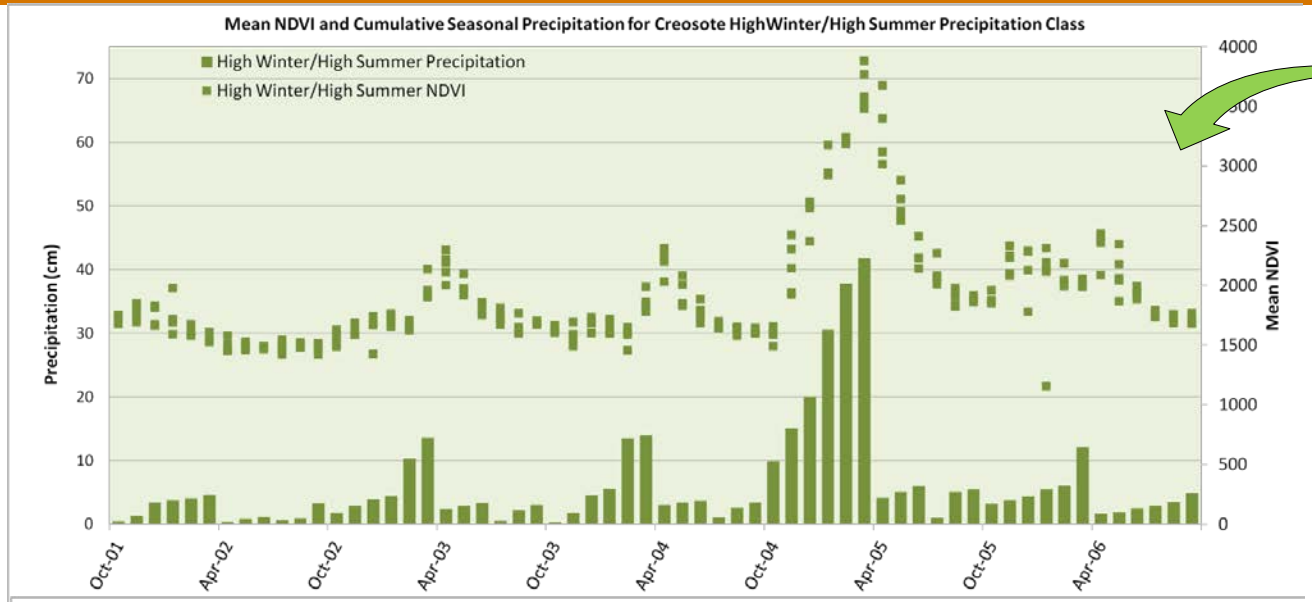
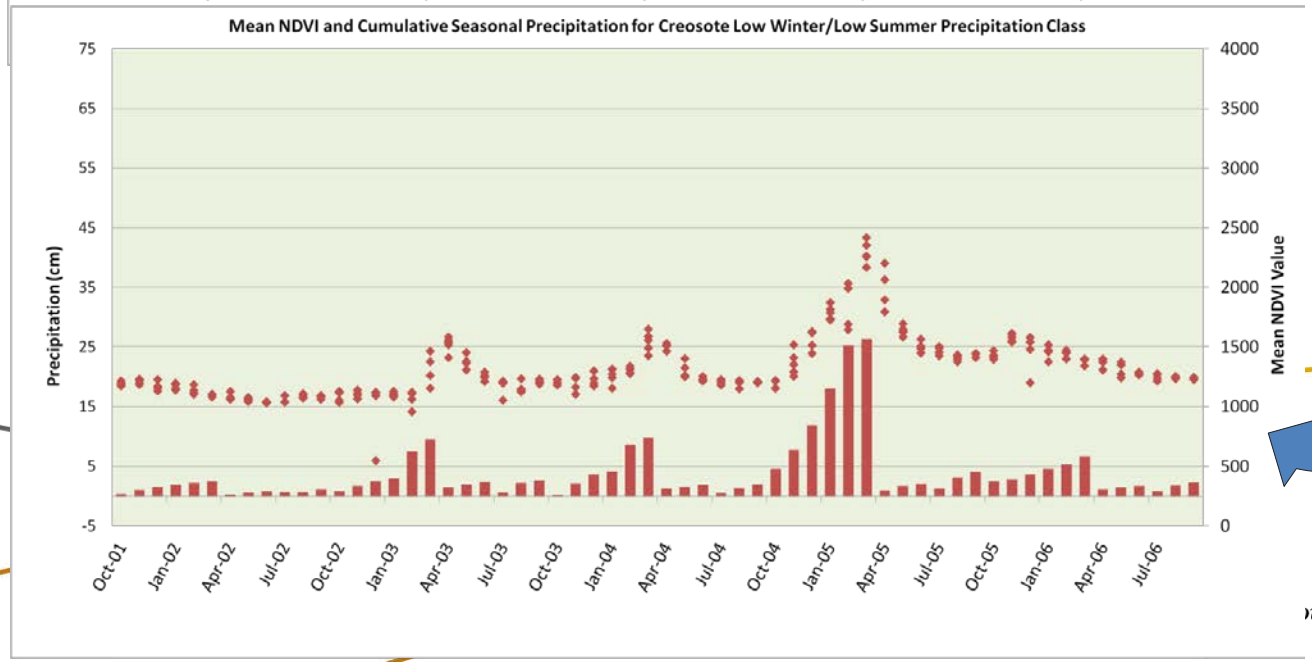
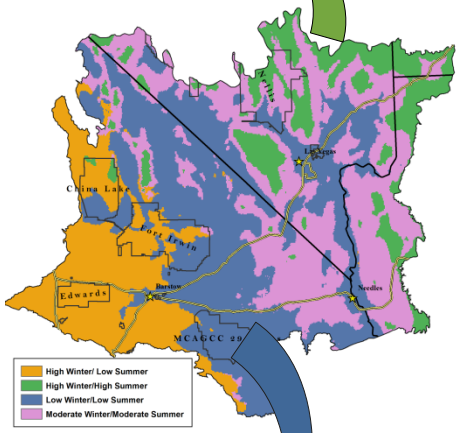
# Vegetation expression differs by zone

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