Precipitation in Southeastern Nevada

2001 Devil's Hole Conference

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Southern Nevada Water Authority

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Meinzer, 1923

Although the study of the earth is of vast scientific and practical importance, the science of hydrology, as such, has received comparatively little attention. This seems to be due to the fact that hydrology cuts across the grain, as it were, of several other sciences and its subject matter forms parts of these other sciences.

Recharge / Precipitation Divide

- Western edge of White River Flow System = Eastern Edge of Death Valley Flow System
- White Pine's, Grant's, Quinn Canyon's, Pahranaghat's, Sheep's and Spring's are major recharge areas for both systems

Nevada precipitation estimates prior to 1928

- L. H. Taylor
  - Sierra Nevada (Truckee River Basin)
  - 1.28 inches per 100 ft of rise
- W. O. Clark and C. W. Riddell
  - Elko and White Pine Counties (Steptoe Valley)
  - 0.45 inches per 100 ft of rise

Nevada Precipitation estimates Bixby and Hardman

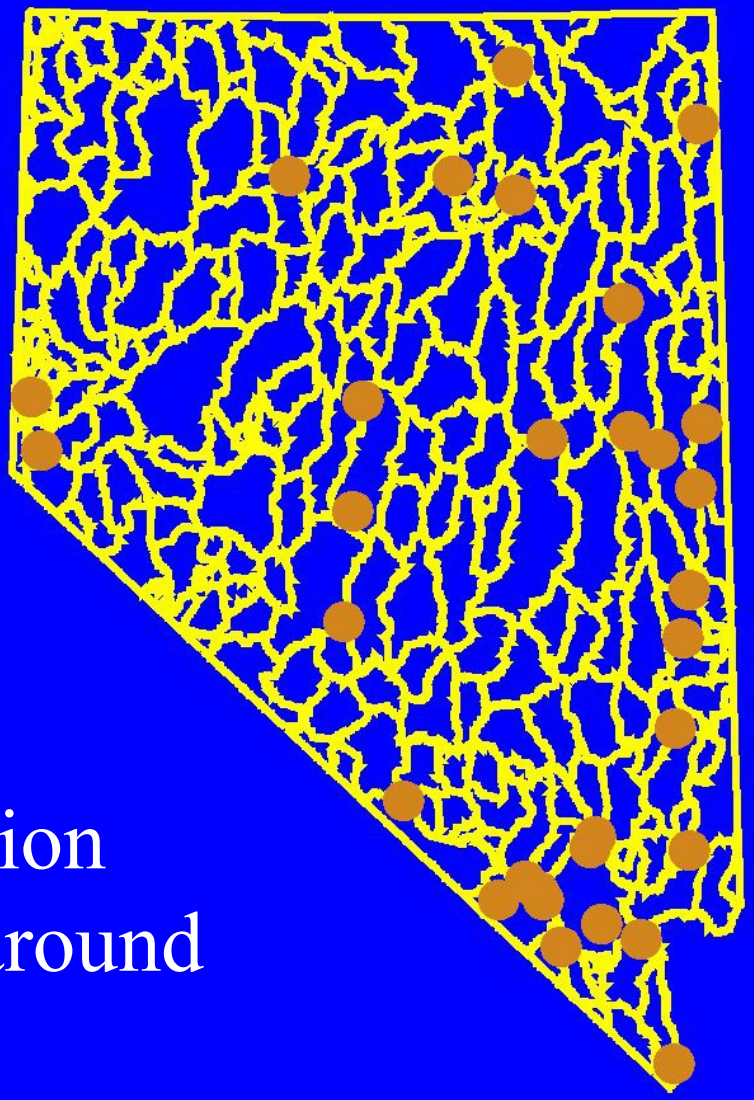
- 1928
  - Reported earlier work
  - Clark County
    - No orographic effect below 6,000
    - Altitude - precipitation relationship similar to Elko and White Pine Counties
    - 0.45 Inches per 100 ft of rise

Nevada Precipitation estimates Hardman with others

- 1936
  - Statewide map (original lost)
- 1949
  - Statewide map (published - 1936 Version ?)
- 1965
  - Statewide map (unpublished ?)
- 1971
  - NDWR version of 1965 map published

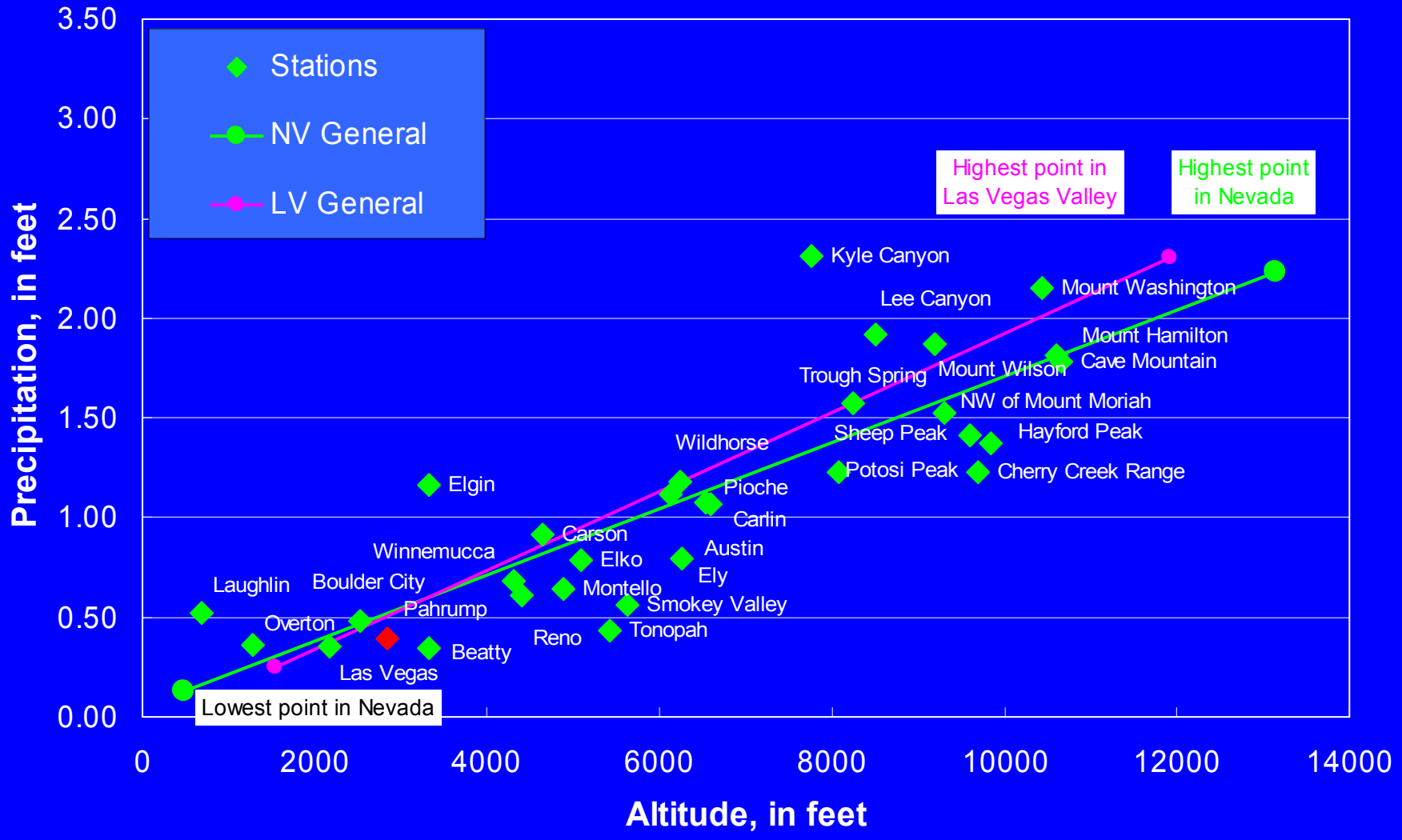
Precipitation maps used by USGS and NDWR for basin budgets

- Hardman, 1936
- Independent map of Las Vegas Valley, 1947
- Hardman, 1965



Selected Precipitation Stations around Nevada

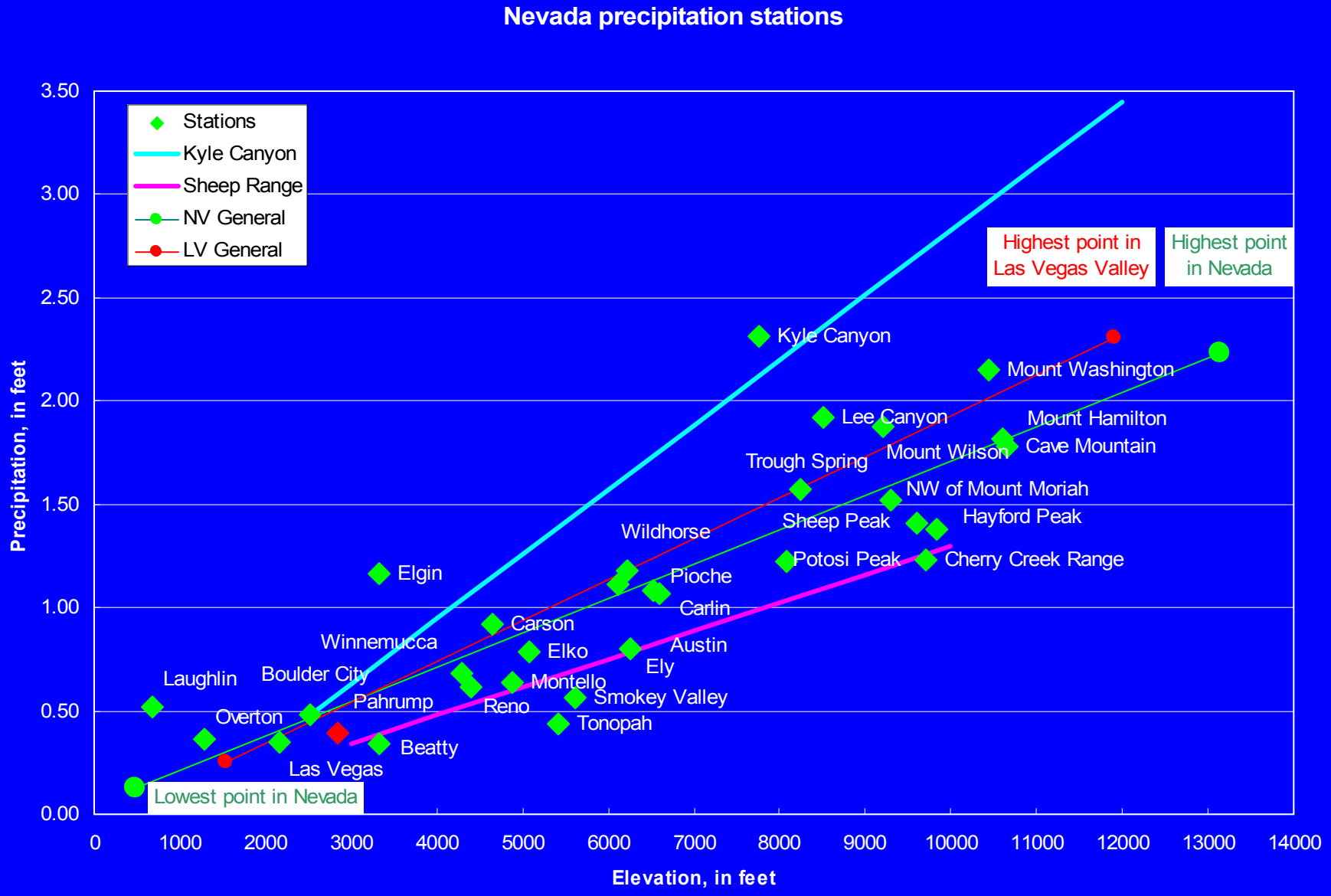
Nevada precipitation stations

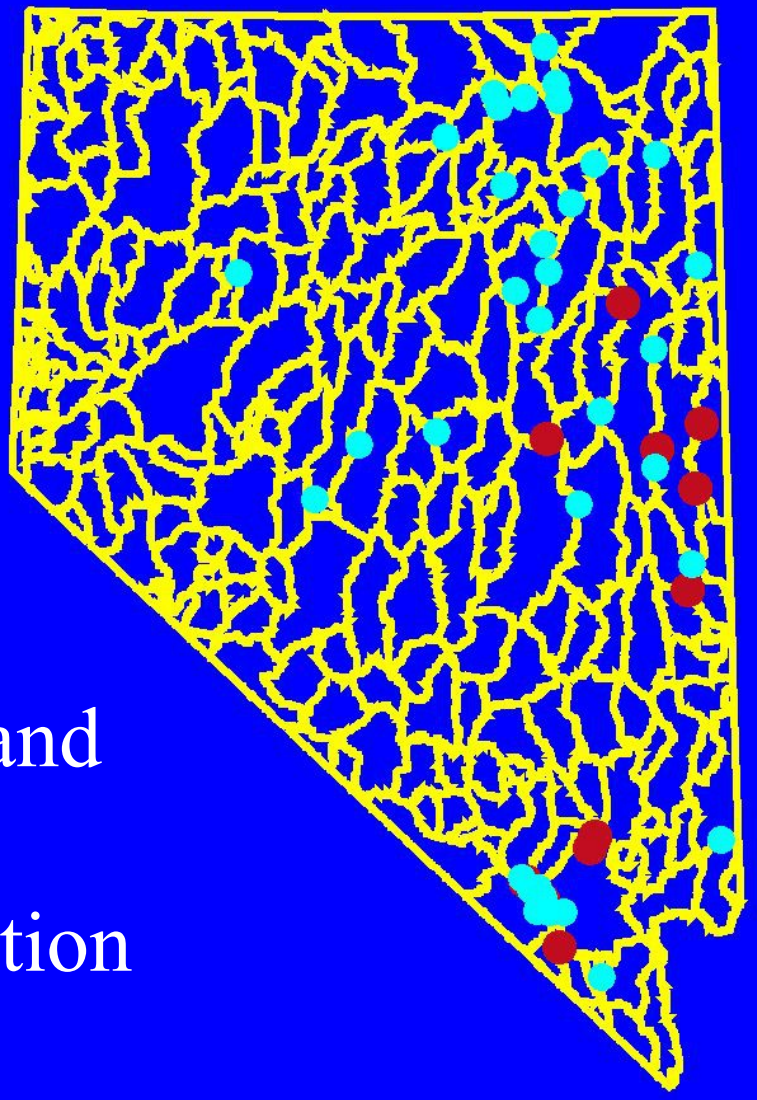


General Nevada Altitude-Precipitation Relationship

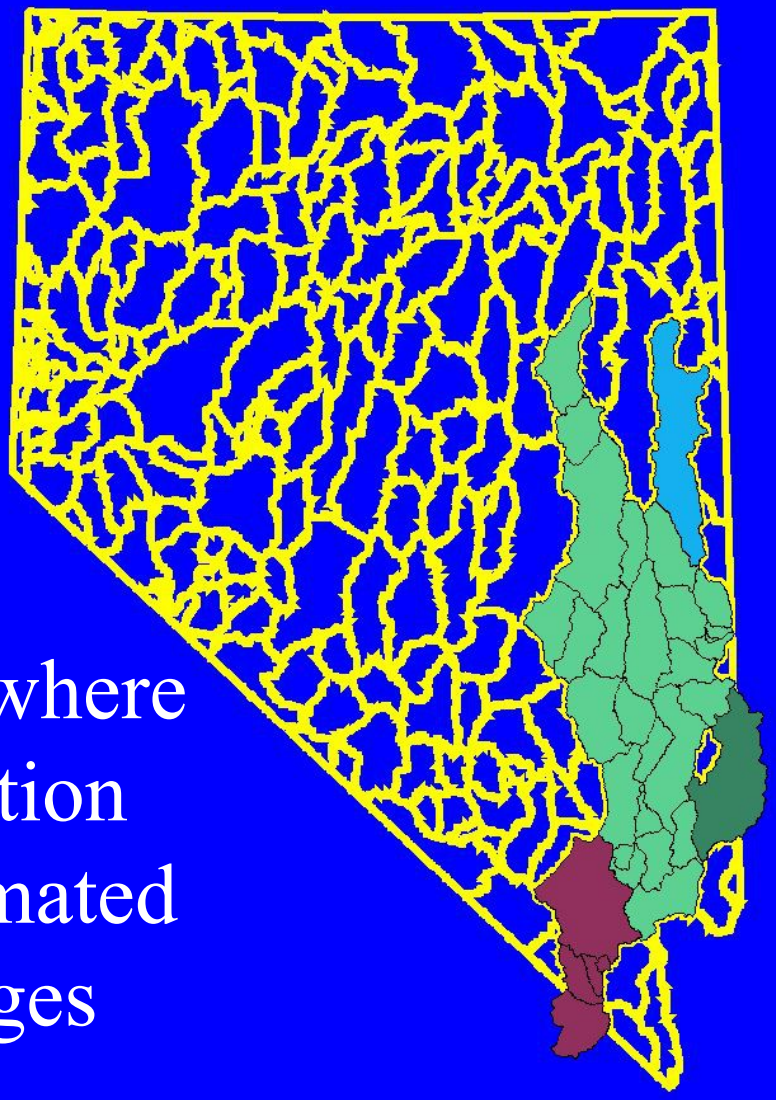
- 2 inches of precipitation per 1,000 feet of altitude rise plus 0.6 inches

- P = (((Altitude)/1000) X 2) + 0.6)

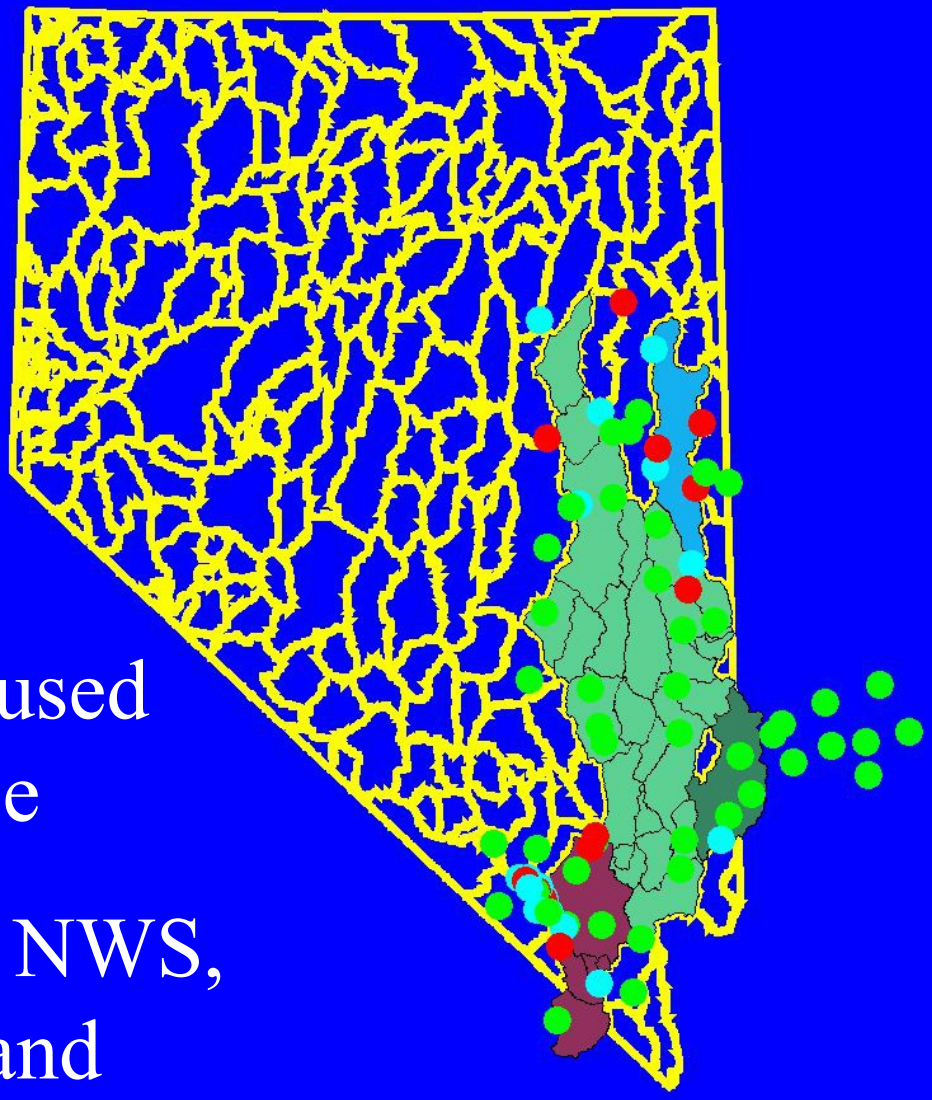

Nevada precipitation stations
Precipitation, in feet
Elevation, in feet
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
12000
13000
14000
Stations
Kyle Canyon
Sheep Range
NV General
LV General
Highest point in Las Vegas Valley
Highest point in Nevada
Lowest point in Nevada
Kyle Canyon
Mount Washington
Lee Canyon
Mount Hamilton
Cave Mountain
Mount Wilson
Trough Spring
NW of Mount Moriah
Sheep Peak
Hayford Peak
Potosi Peak
Cherry Creek Range
Wildhorse
Pioche
Carlin
Elgin
Carson
Winnemucca
Elko
Austin
Ely
Laughlin
Boulder City
Montello
Pahrump
Smokey Valley
Reno
Overton
Tonopah
Beatty
Las Vegas



NDWR and
USGS
Precipitation
Stations

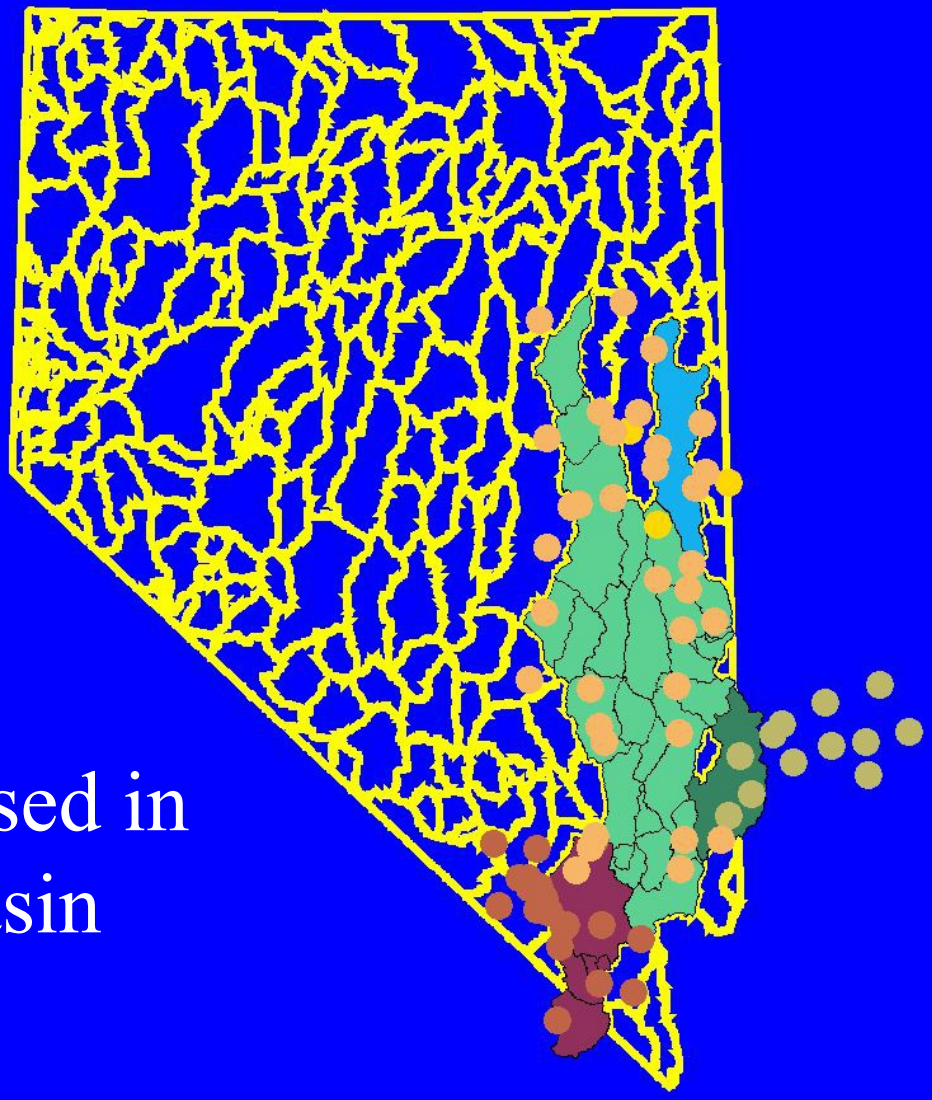


Valleys where precipitation was estimated using gages

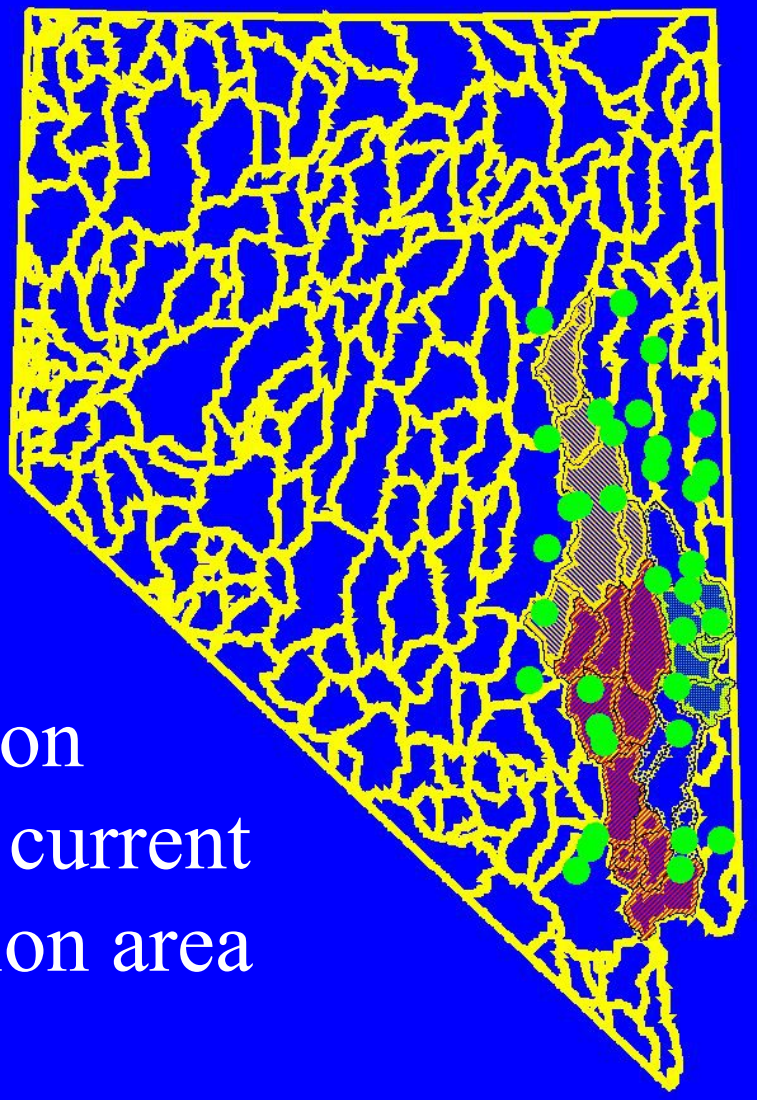


Stations used by Source

WRCC / NWS, NDWR and USGS



Stations used in various basin analysis

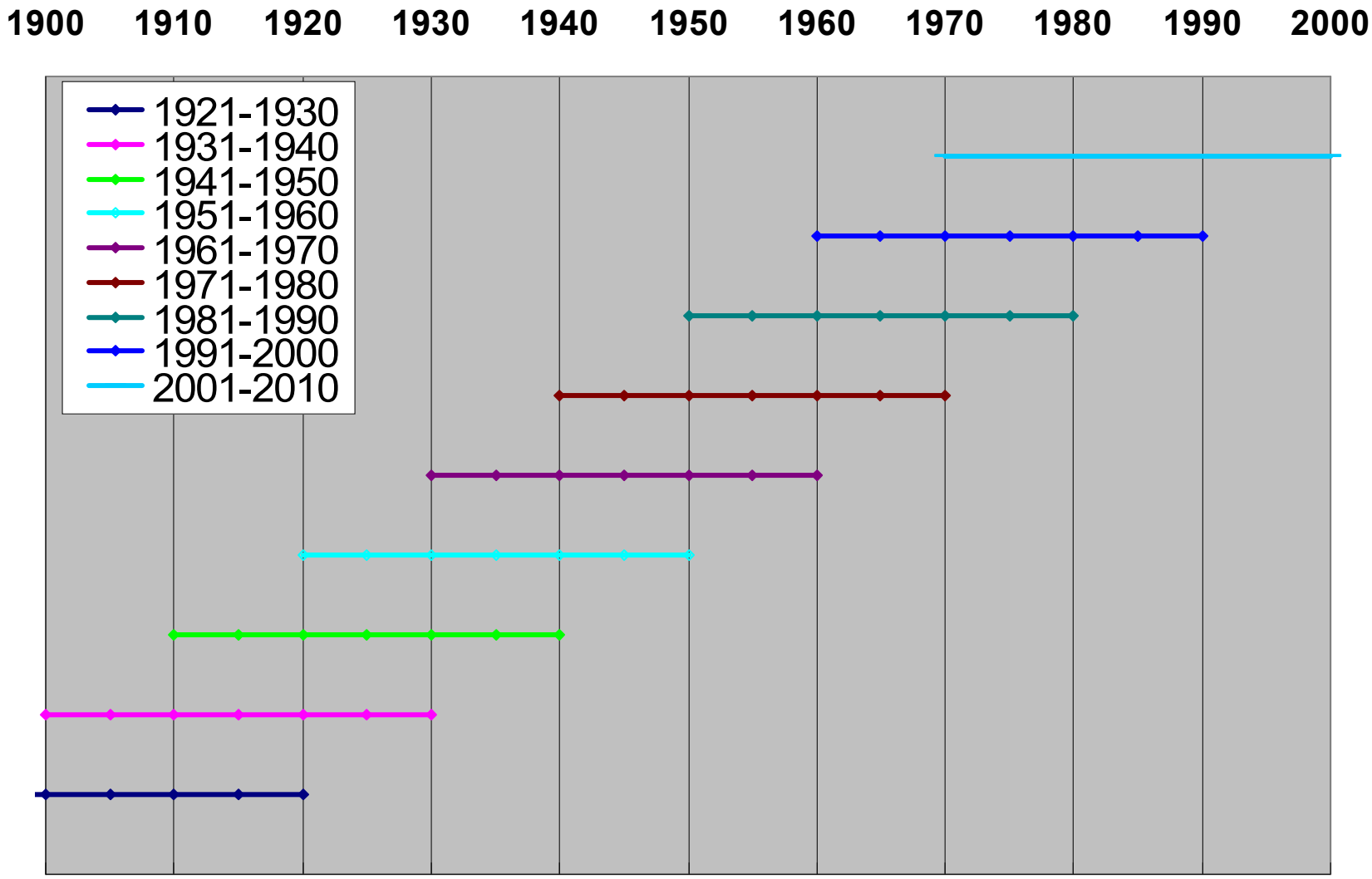


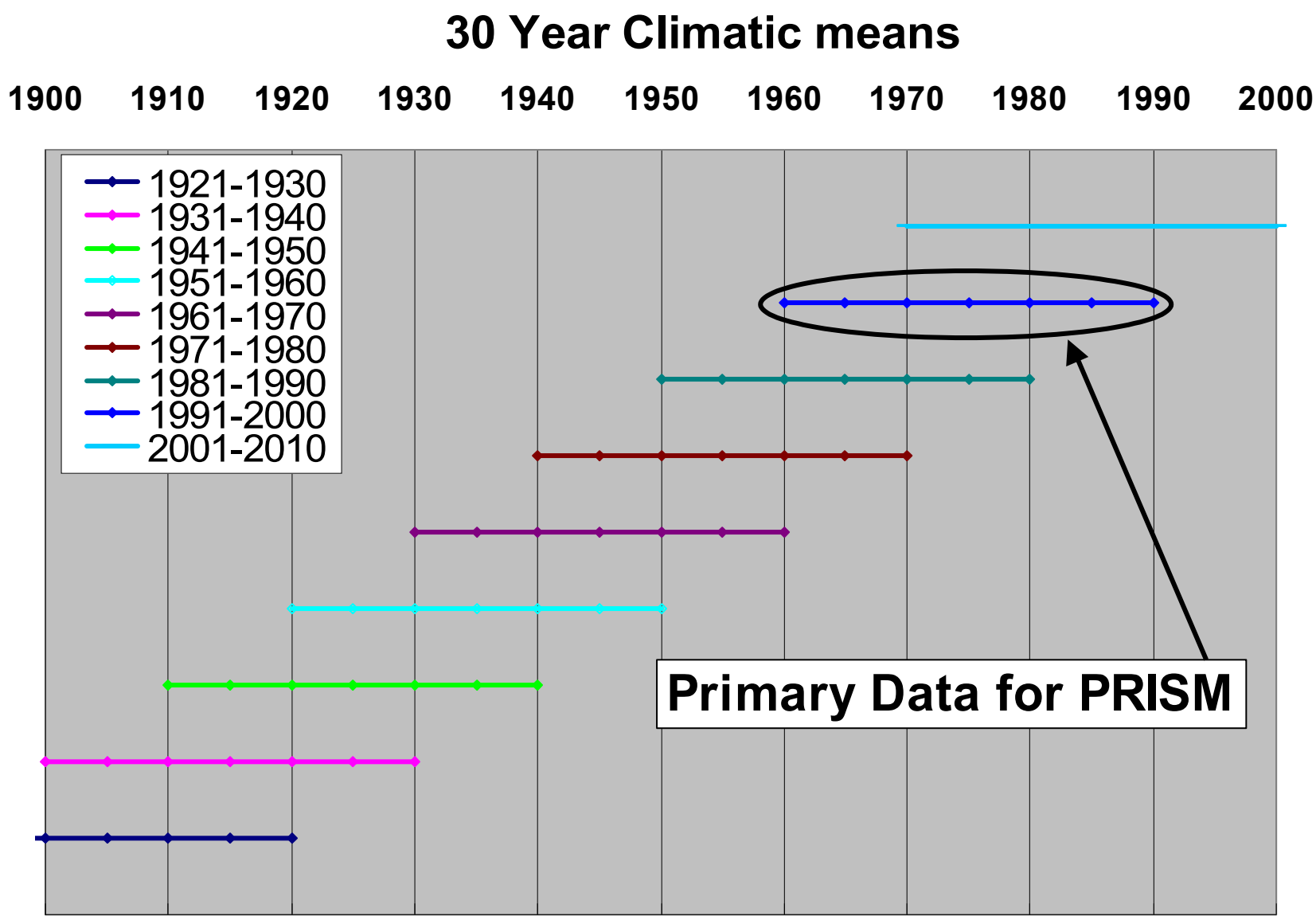
Precipitation regions in current investigation area

PRISM

- Developed by Oregon State Climatic Service (1994)
- Multiple Revisions
- Available through Internet in “ARC Ready Format”

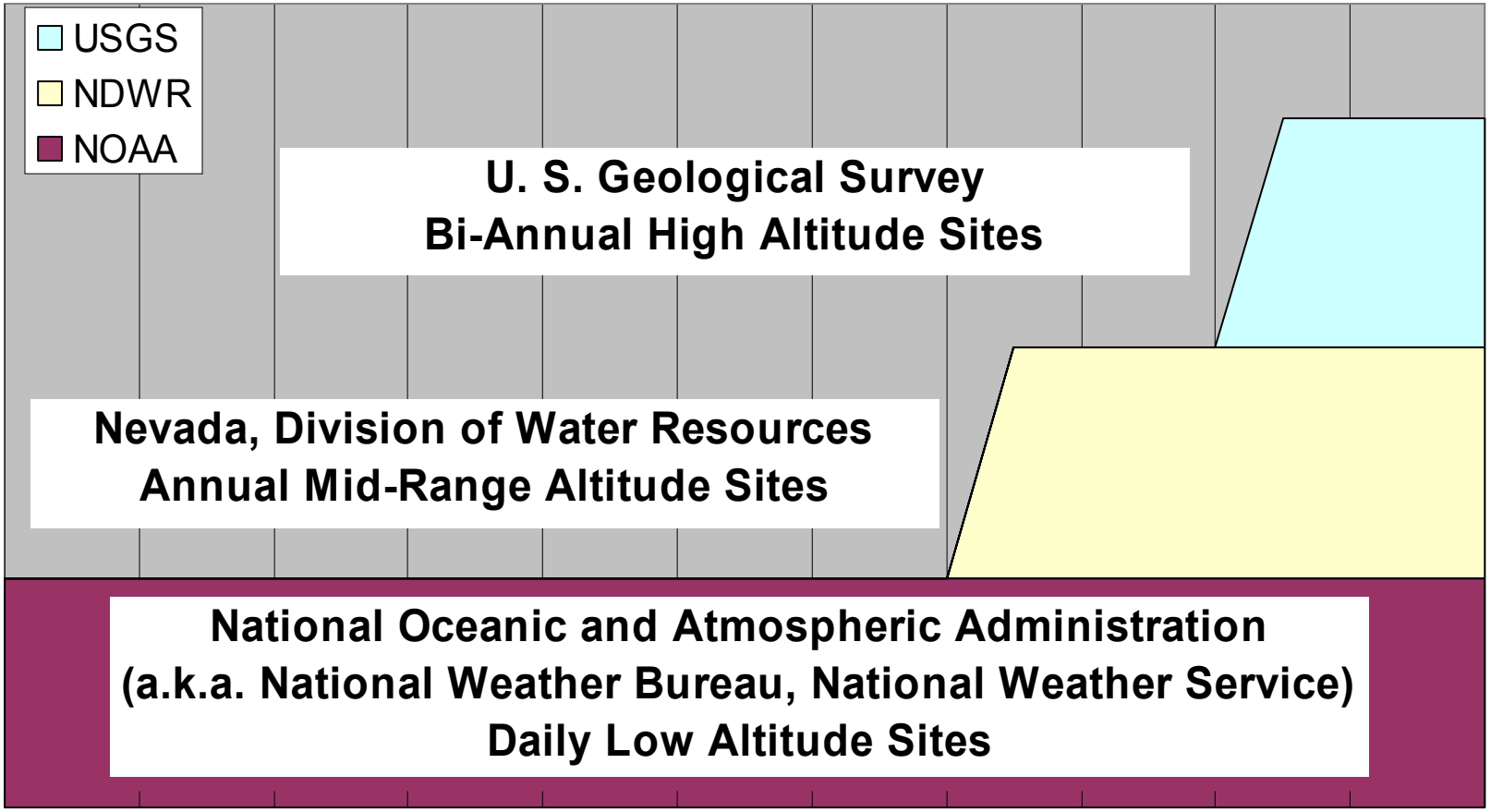
30 Year Climatic means



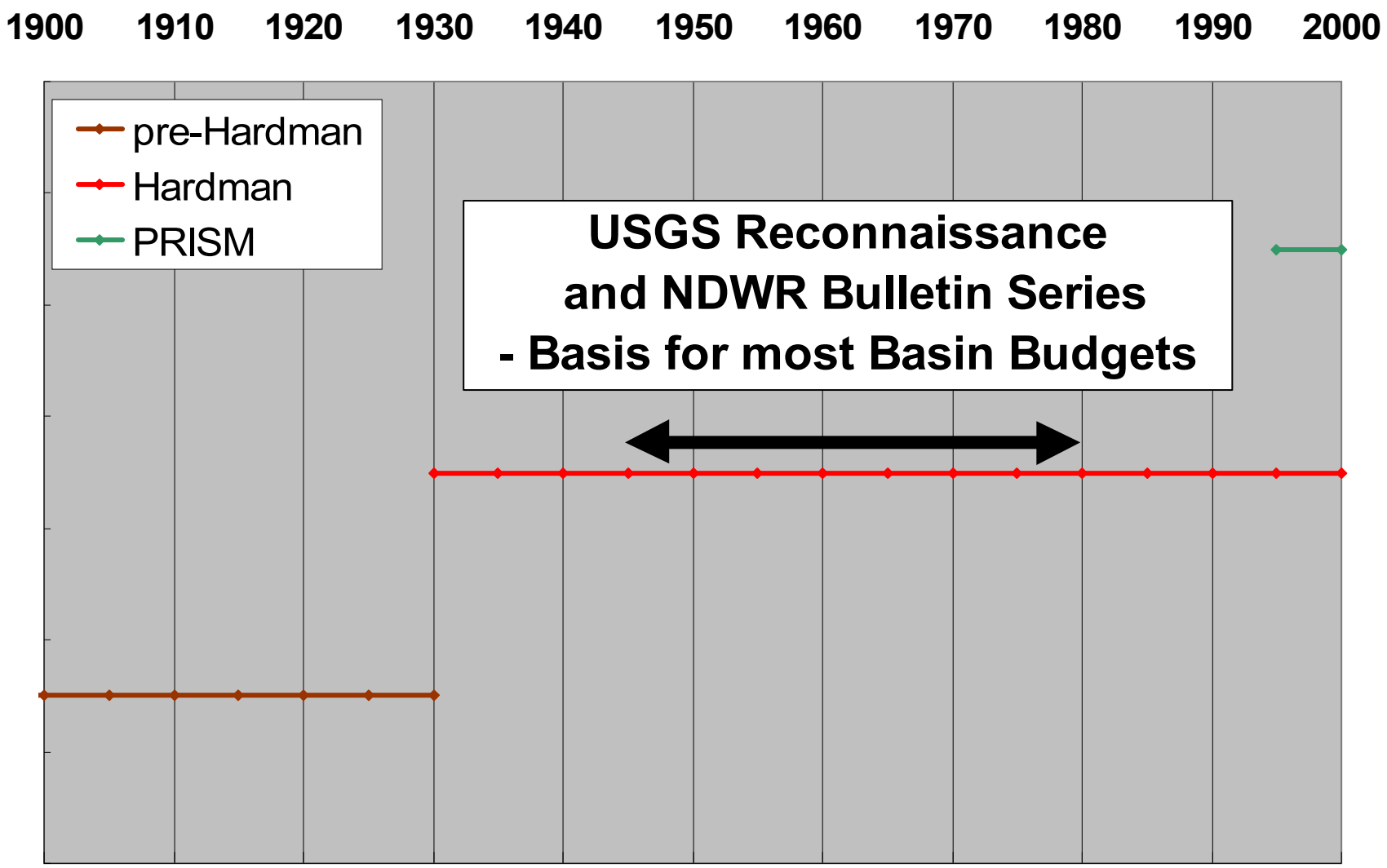

30 Year Climatic means
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
1921-1930
1931-1940
1941-1950
1951-1960
1961-1970
1971-1980
1981-1990
1991-2000
2001-2010
Primary Data for PRISM

Precipitation Gages in Nevada

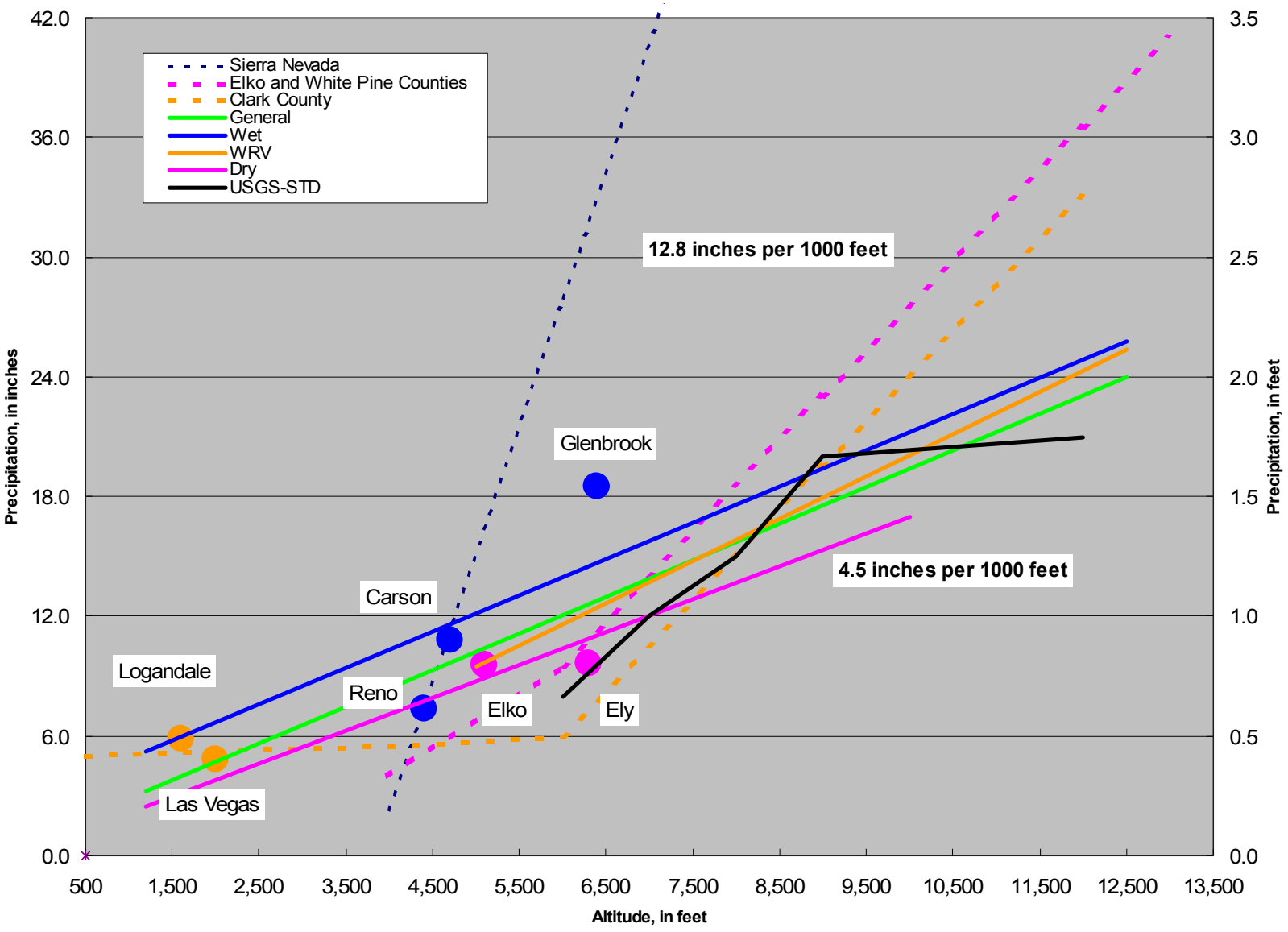
1890 1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000



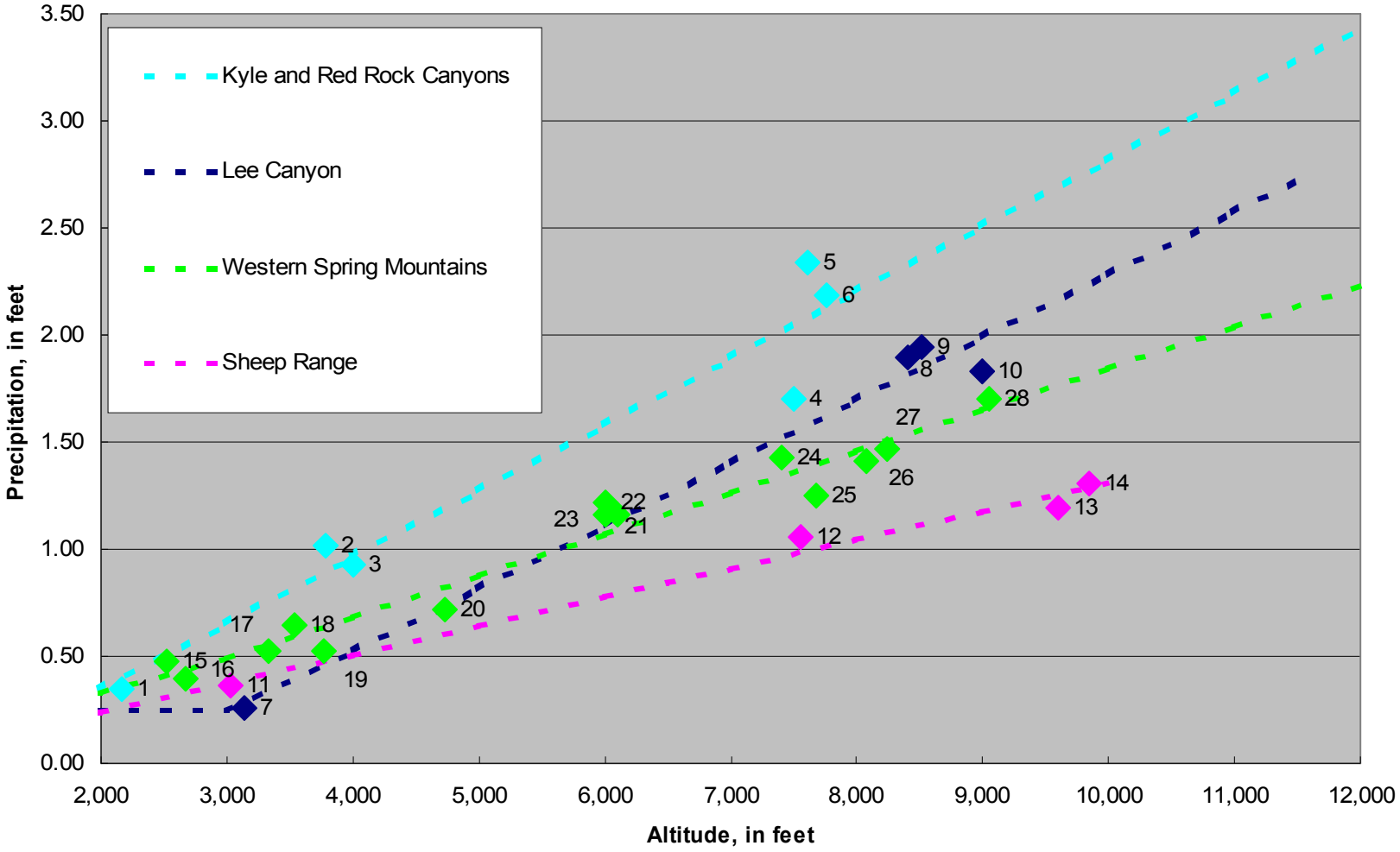
Nevada Precipitation Maps

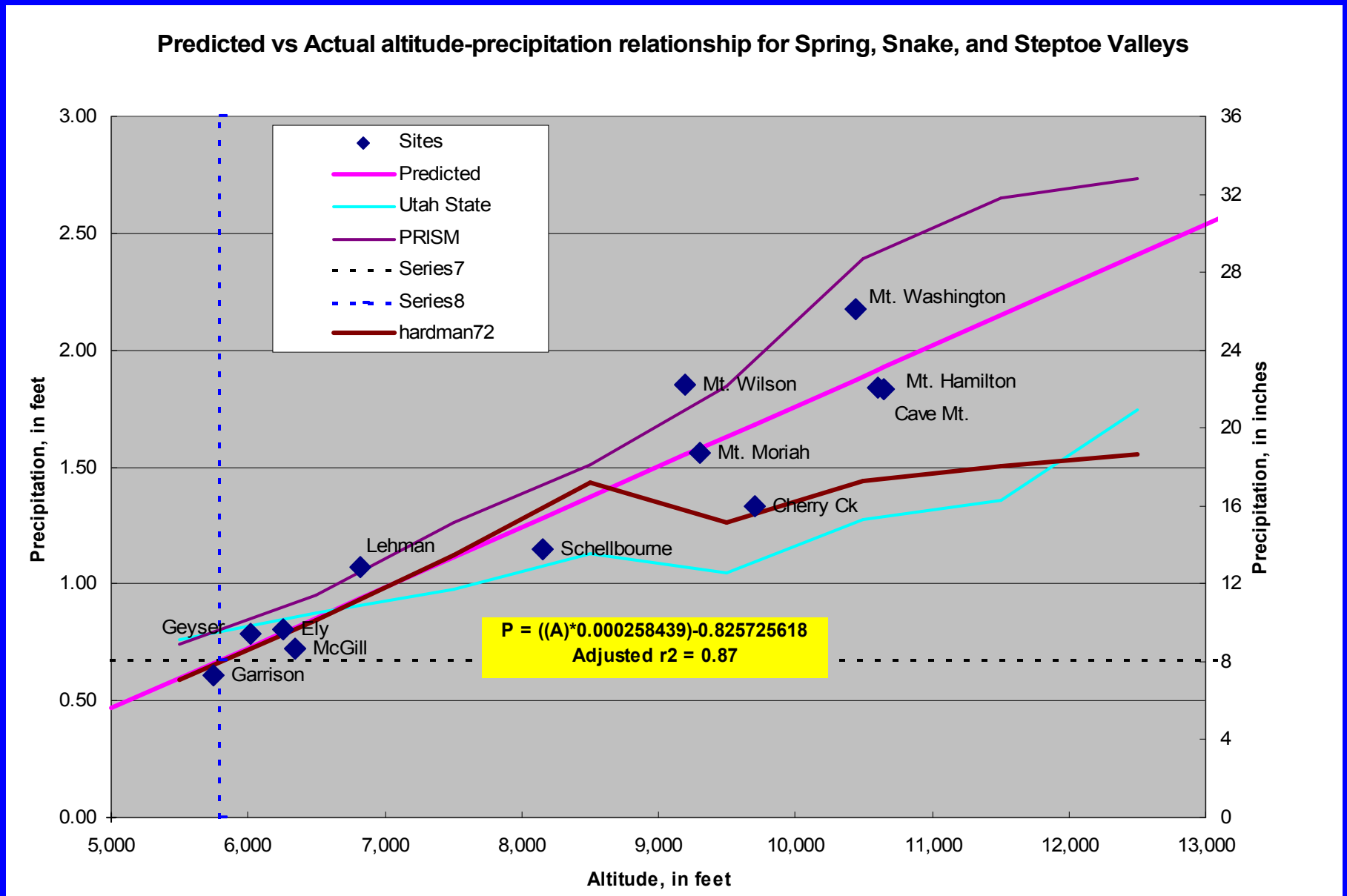


Precipitation estimates, Bixby and Hardman, 1928

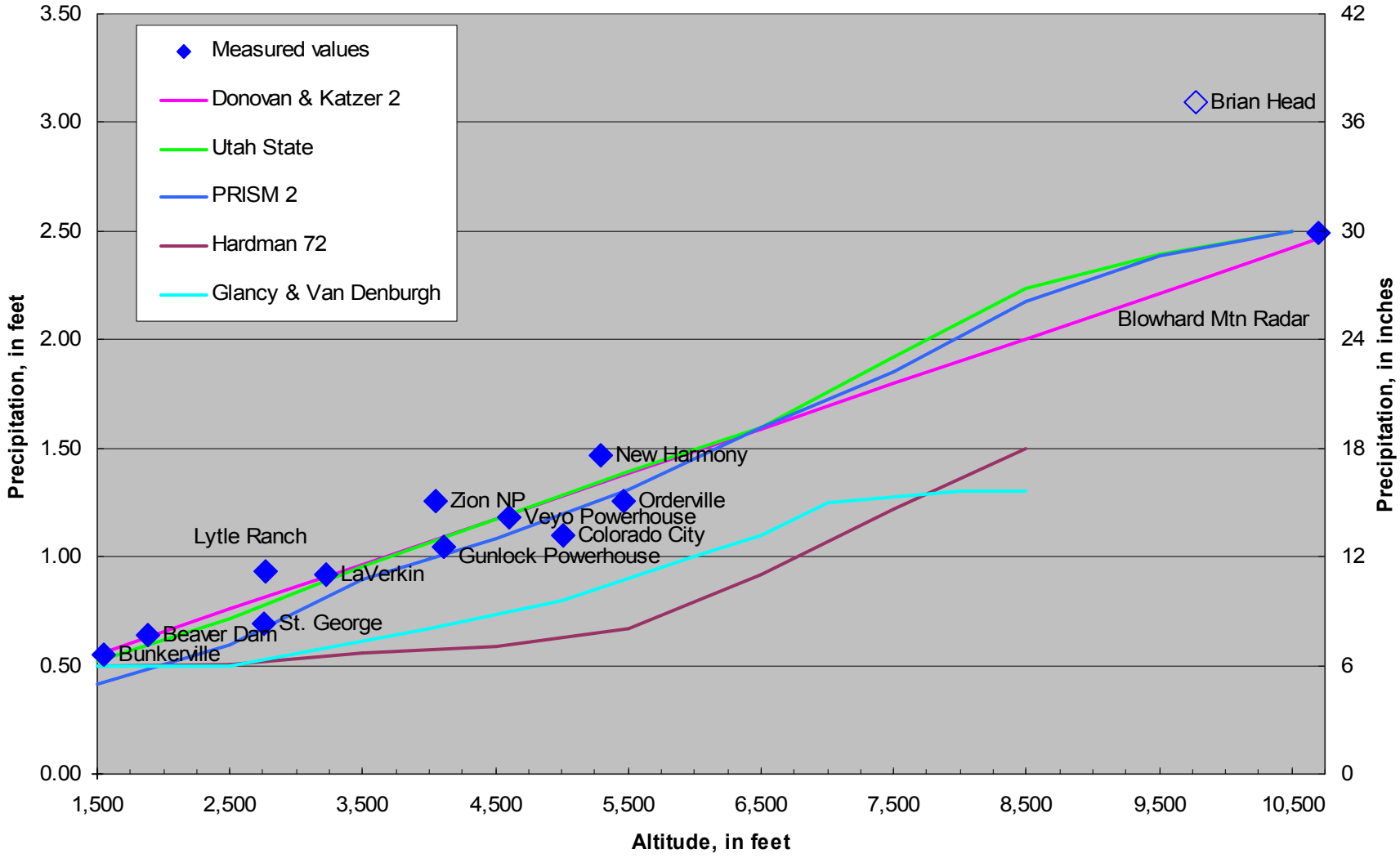


Precipitation data and altitude - precipitation trends in Las Vegas Valley

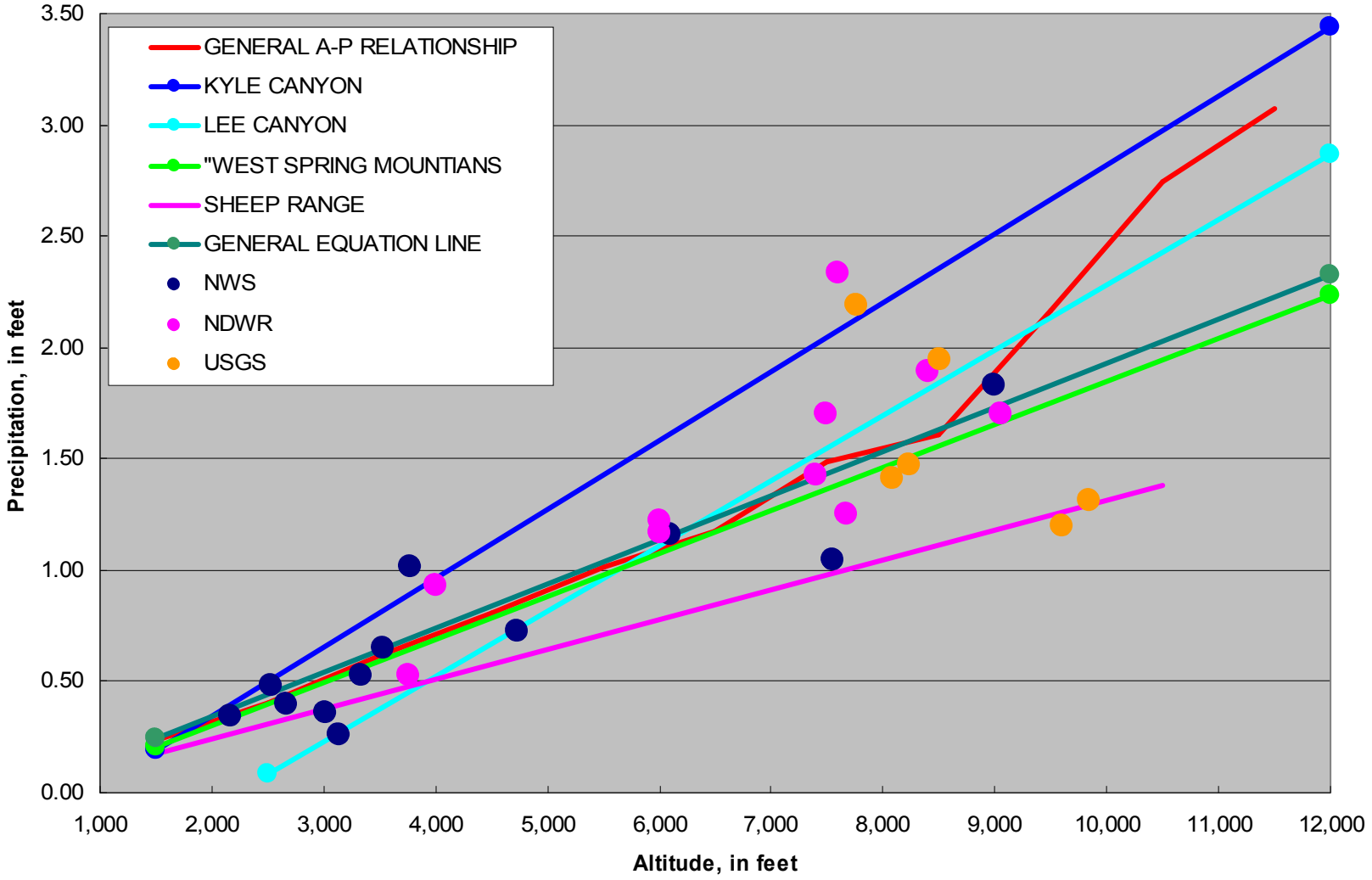



Predicted vs Actual altitude-precipitation relationship for Spring, Snake, and Steptoe Valleys
Sites
Predicted
Utah State
PRISM
Series7
Series8
hardman72
Mt. Washington
Mt. Wilson
Mt. Hamilton
Cave Mt.
Mt. Moriah
Cherry Ck
Lehman
Schellbourne
Geyser
Ely
McGill
Garrison
P = ((A)*0.000258439)-0.825725618
Adjusted r2 = 0.87
Precipitation, in feet
Precipitation, in inches
Altitude, in feet
3.00
2.50
2.00
1.50
1.00
0.50
0.00
36
32
28
24
20
16
12
8
4
0
5,000
6,000
7,000
8,000
9,000
10,000
11,000
12,000
13,000

Measured precipitation values vs predicted by various methods



Las Vegas Altitude Precipitation Relationship

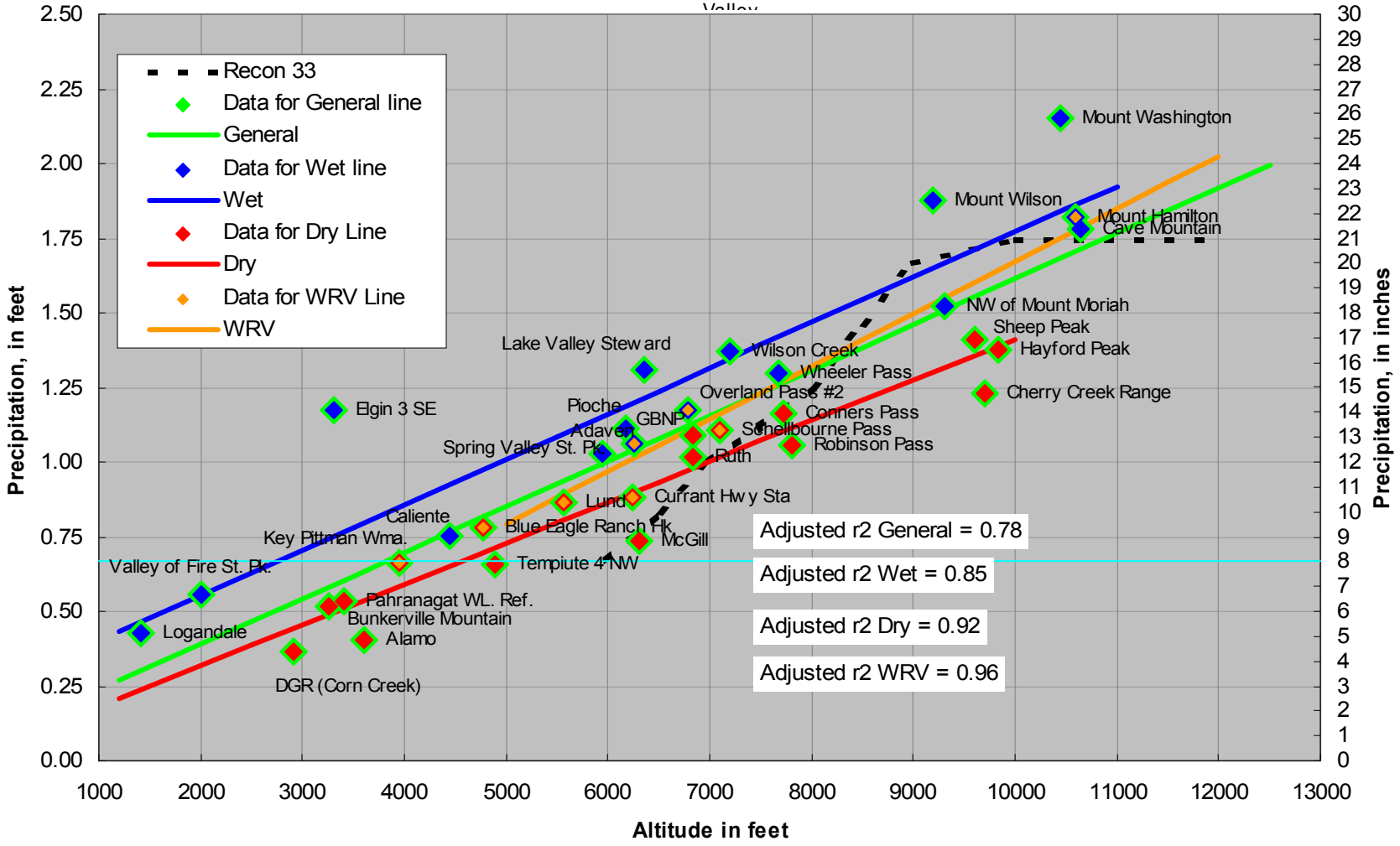


Precipitation stations in Eastern Nevada

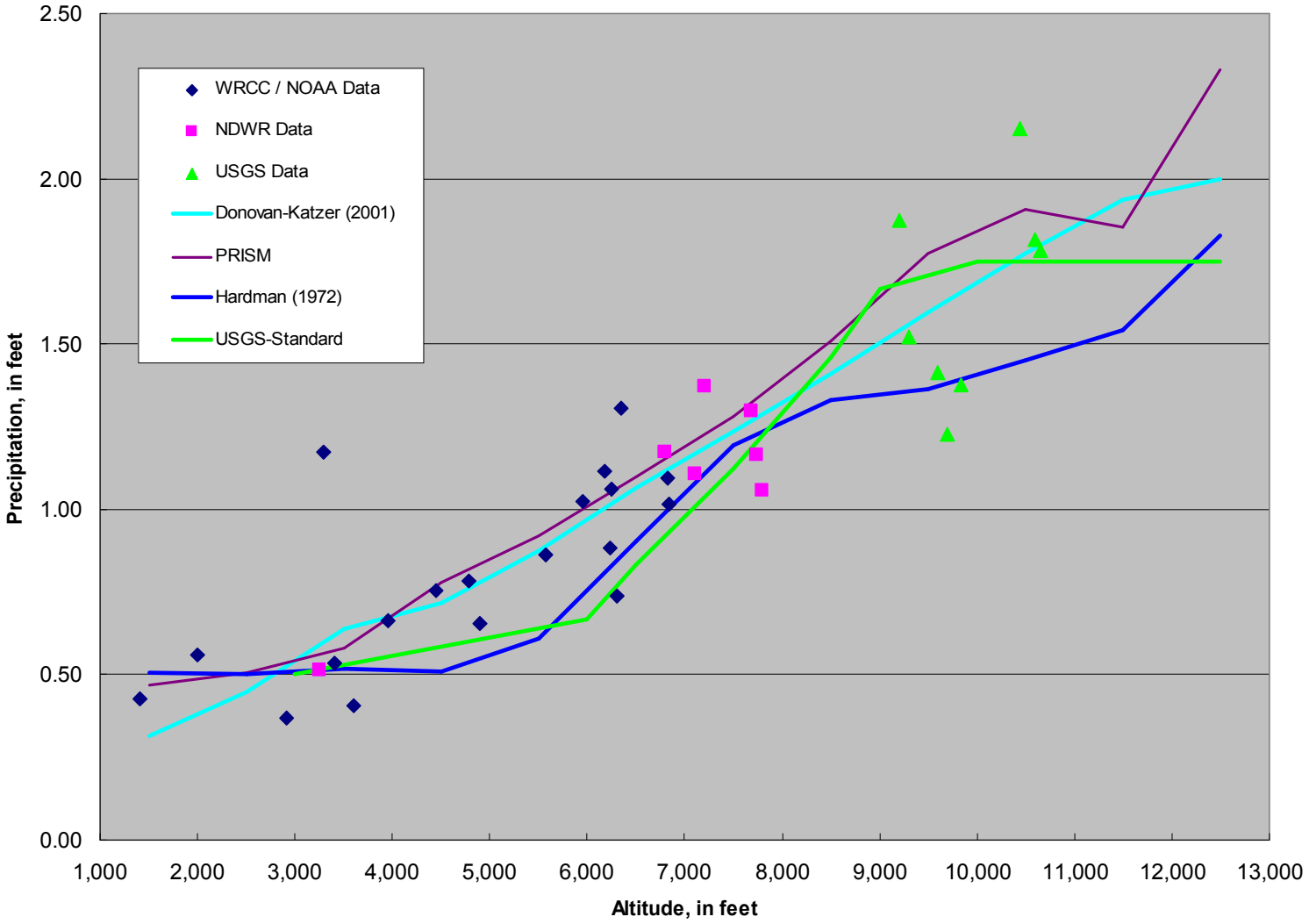
"Wet" line is associated with Meadow Valley Flow System, Quinn Canyon, Grant and White Pine Ranges and "Big" Spring Valley (WB184)

"Dry" line is associated with Sheep and Pahranagat Ranges, Southern White River Flow System and Steptoe Valley

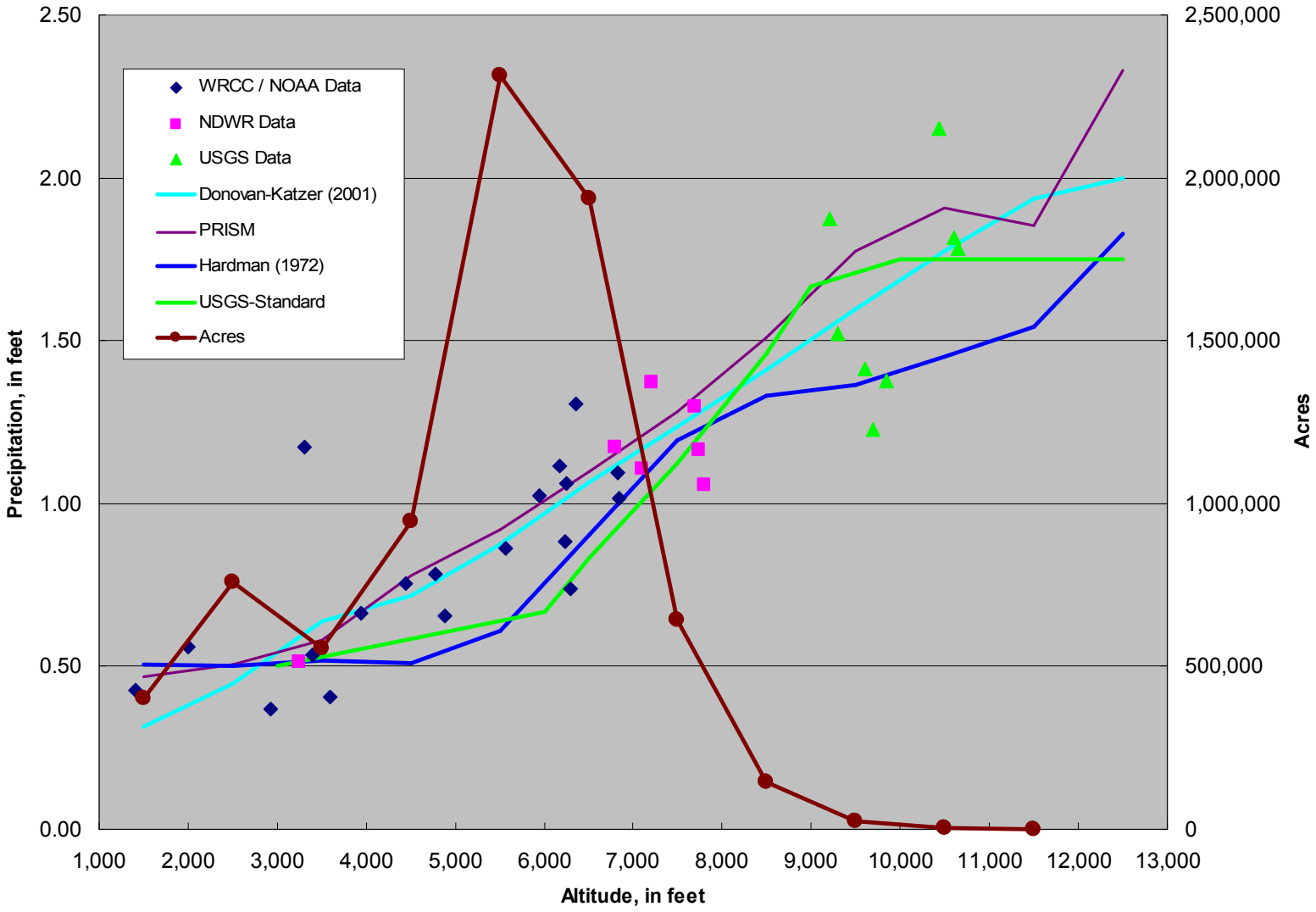
"WRV" line is associated with Quinn Canyon, Grant and White Pine Ranges, and Northern White River Flow System including White River Valley



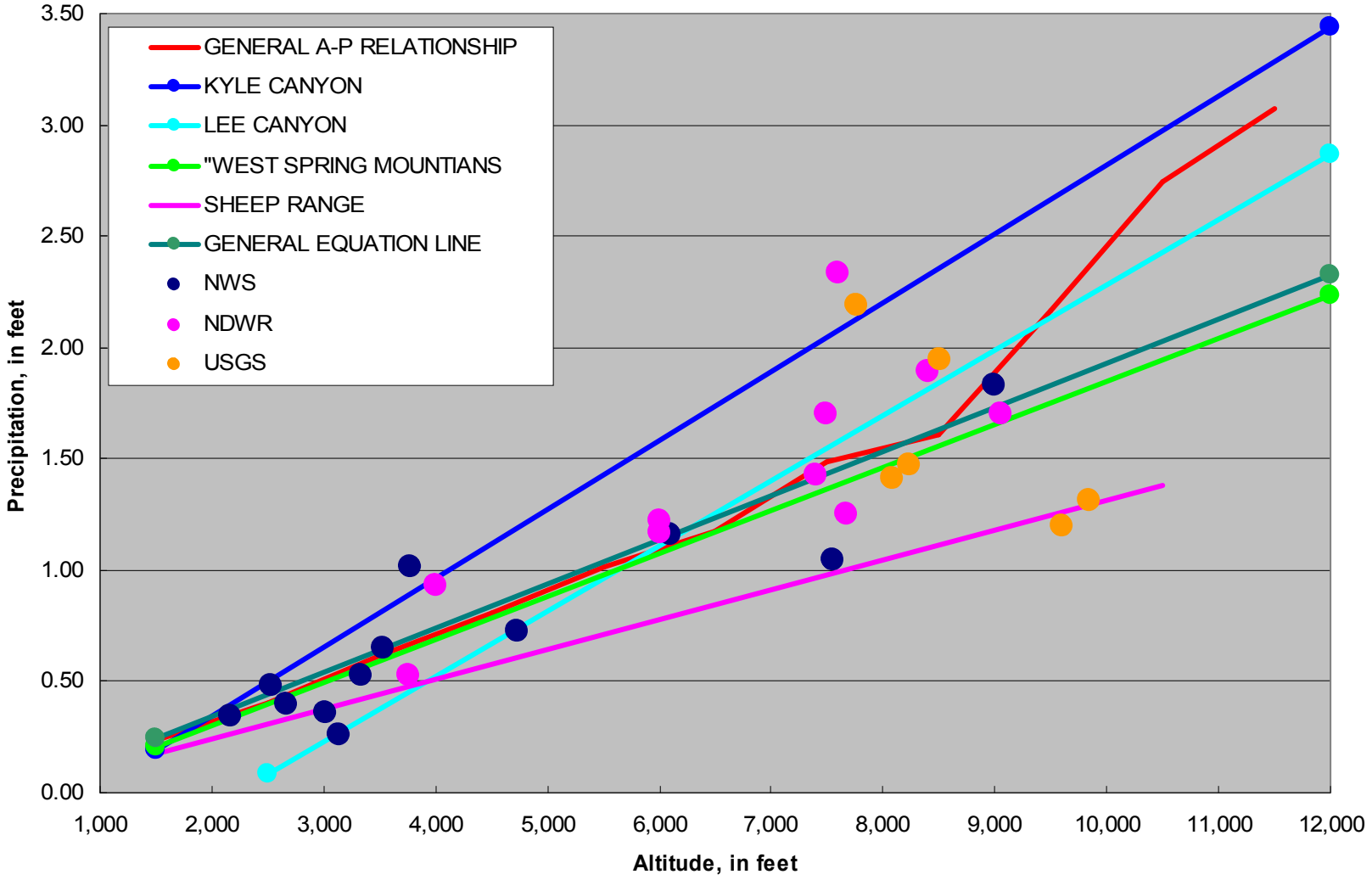
Altitude-Precipitation relationships in eastern Nevada.



Altitude-Precipitation relationships in eastern Nevada.



Las Vegas Altitude Precipitation Relationship



Precipitation Estimates Compared to Gages

- Hardman tends to be conservative
- PRISM tends to be generous
- Both methods have a complex Altitude-Precipitation relationship

Precipitation Data Availability

- WRCC Internet site
- USGS High Altitude Gages

Donovan-Katzer Estimates

- Developed from gage data
- Watershed Based
- Rainshadows / Areas of Concentrated Precipitation determined by gage
- Closely tied to altitude

USGS and NDWR Altitude-Precipitation Relationships

- Precipitation relationships in the interval between 6,000 and 9,000 feet are very similar to Hardman's 1928 estimate and is usually generous in this interval
- Tend to underestimate mountain ranges with significant acreage above 9,000 feet.

Precipitation Gages

- Usually require a minimum of 10 years of record to minimize unusual weather pattern and mechanical failures
- High altitude preferred but large parts of the White River Flow System have no gage data at all

Proposed High Altitude Gage Sites

- High Altitude Spring Mountain Gage
- Quinn Canyon Range
- Delamar Site
- Upper Kane Springs Wash
- Highland Peak Range

Maxey-Eakin Recharge Estimates

- Nevada Department of Water Resources
  - Water Resources Bulletin Series
  - All reports after 1949
- US Geological Survey
  - Water Resources Reconnaissance Series
  - 1960's through 1980's

Maxey-Eakin Natural Recharge Estimation Technique

- Developed in White River Flow System
  - NDWR Water Resources Bulletin 8 (1949)
- General applicability demonstrated
  - NDWR Water Resources Bulletin 12 (1951)
- General use
  - All later NDWR Water Resources Bulletins and USGS Water Reconnaissance Reports