Water Challenges on the Colorado River

SFPUC Water Utility Climate Change Summit 2007
Scenarios and Strategies: Current State of Knowledge

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Images: Lee's Ferry ~ 1880 and John D. Lee

Western Water Assessment

Colorado
University of Colorado at Boulder

NOAA

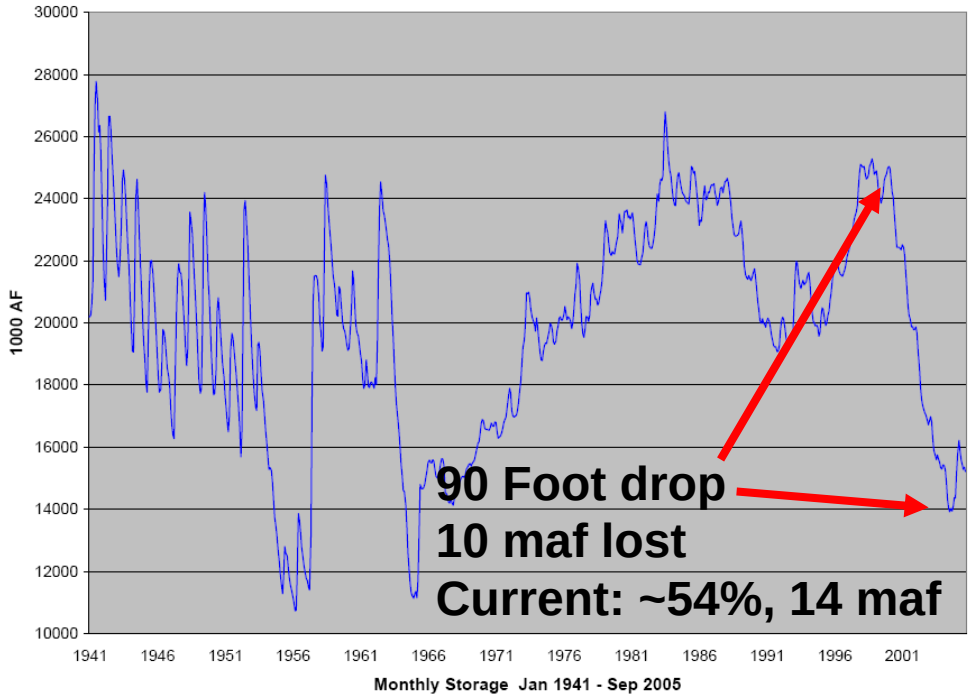
Colorado River Basin Overview

Source:Reclamation

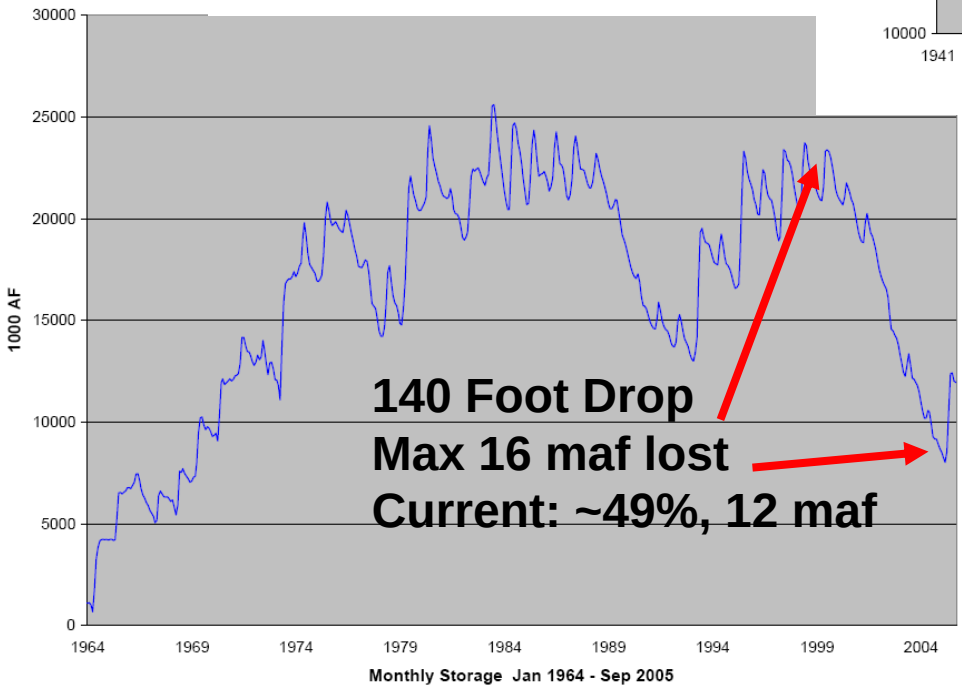
- 7 States, 2 Nations
- Fastest Growing Part of the U.S.
- Over 1,450 miles in length
- Basin makes up about 8% of total U.S. lands
- 60 MAF of total storage
- Highly variable Natural Flow which averages 15 MAF
- Irrigates 3.5 million acres
- Serves 30 million people
- Very Complicated Legal Environment

Declining Lakes Mead and Powell

Lake Mead 1941-2006



Lake Powell 1964-2006



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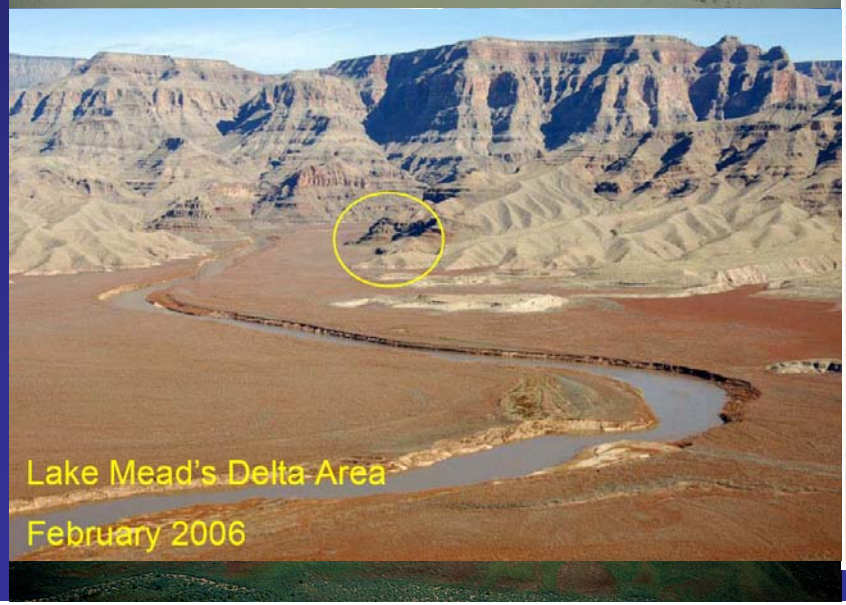
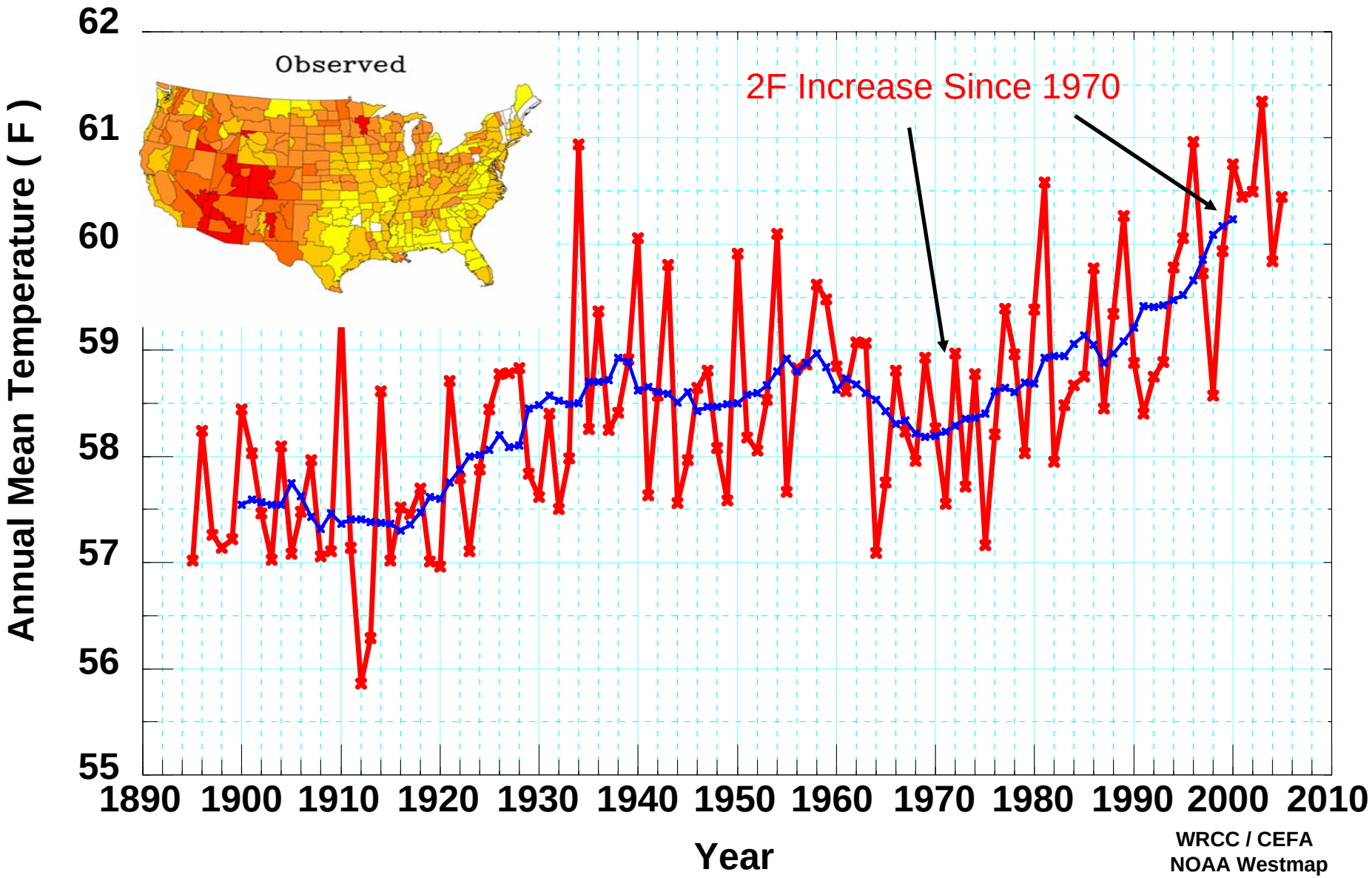
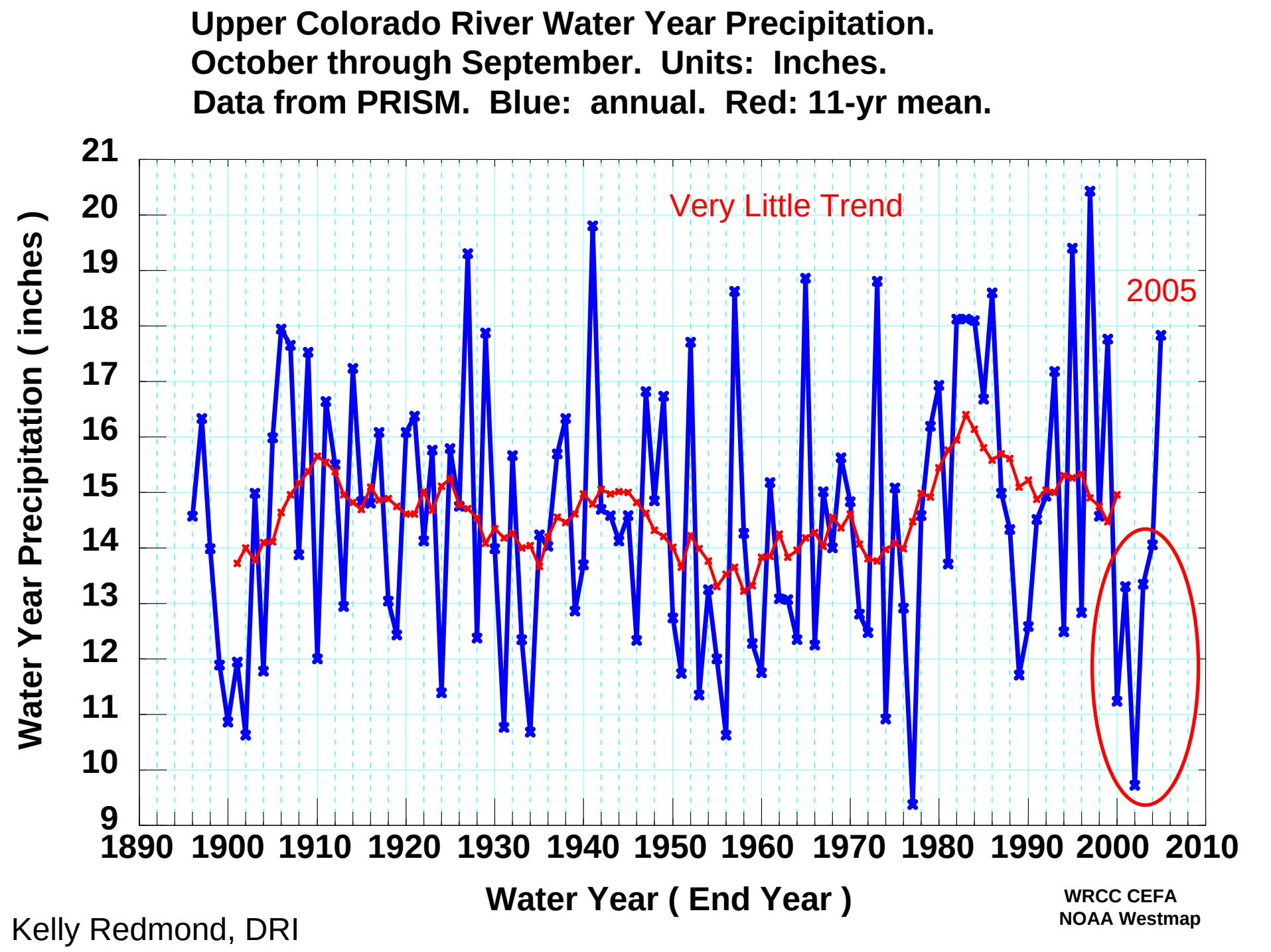


Source: USGS, Reclamation

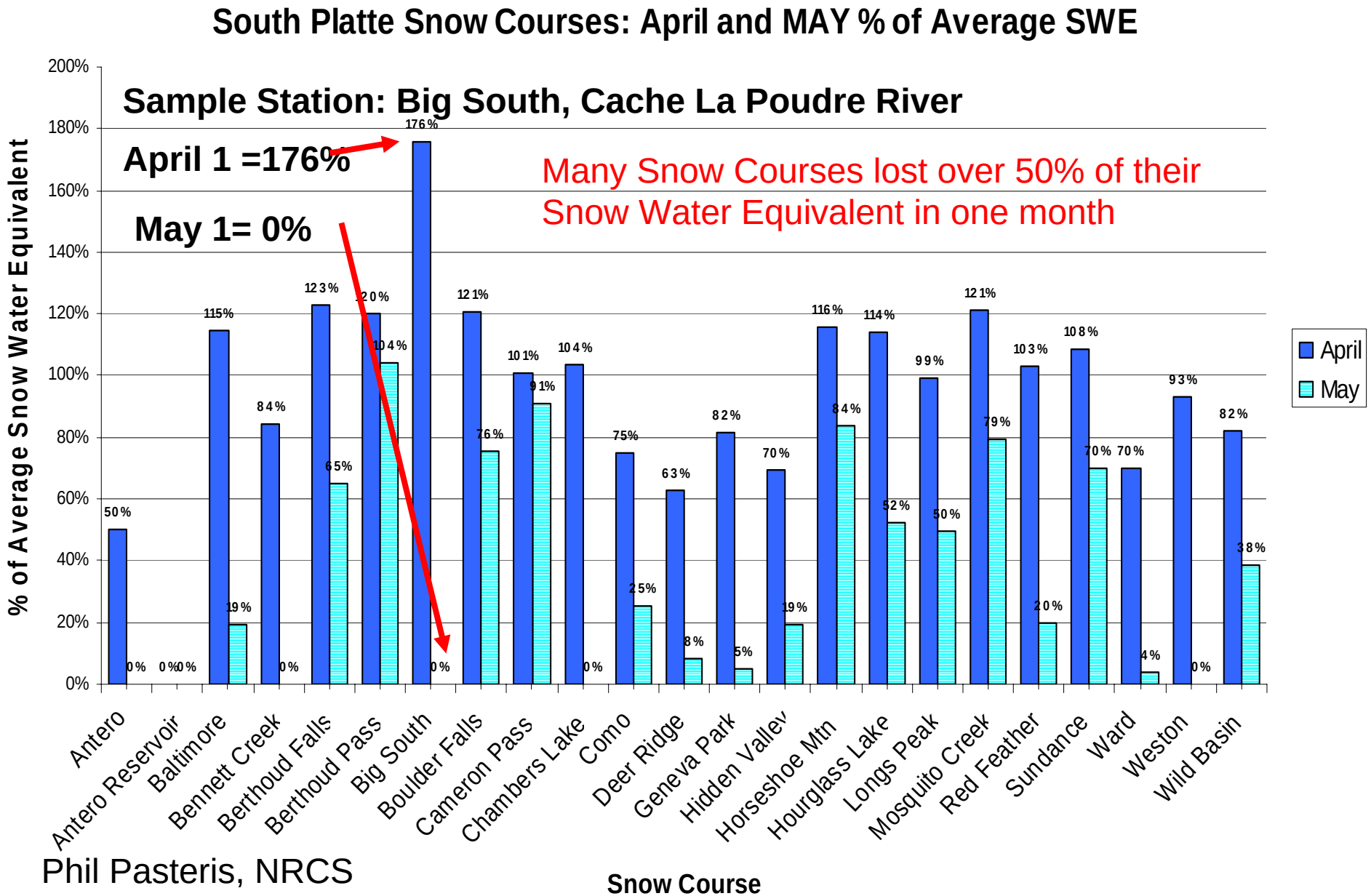
Lower Colorado Basin Mean Annual Temperature.
Units: Degrees F. Annual: red. 11-year running mean: blue
Data from PRISM: 1895-2005.



Kelly Redmond, DRI

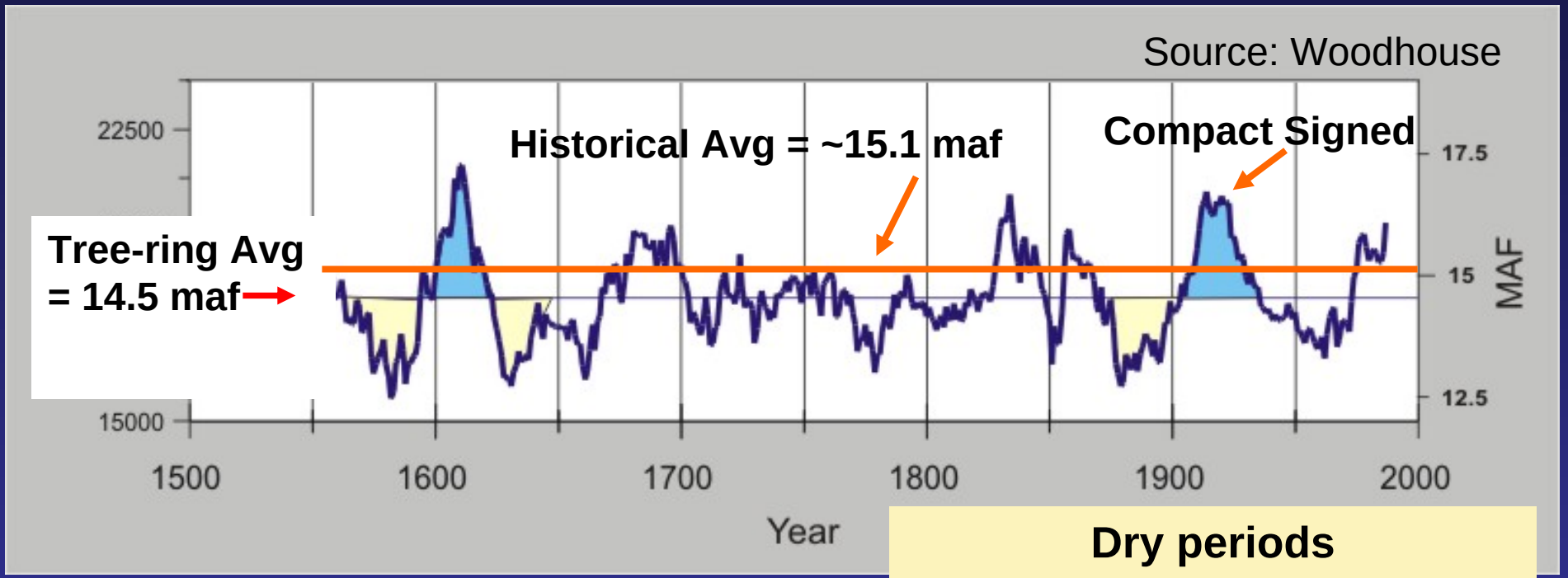

Upper Colorado River Water Year Precipitation.
October through September. Units: Inches.
Data from PRISM. Blue: annual. Red: 11-yr mean.
Very Little Trend
2005
Water Year Precipitation (inches)
Water Year (End Year)
21
20
19
18
17
16
15
14
13
12
11
10
9
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
2010
WRCC CEFA
NOAA Westmap
Kelly Redmond, DRI

2006 Snowpack Vanishing Act



Phil Pasteris, NRCS

Woodhouse, Meko, Gray New Reconstruction of Lees Ferry Streamflow, 20-year moving average, 1536-1997



Note that 20th Century Dry Periods are not especially dry….

Dry periods

Lowest 20-yr avg.	Lowest 25-yr avg
1573-1592 (1)	1622-1646 (1)
1622-1641 (3)	1623-1647 (2)
1870-1889 (4)	1878-1902 (3)
1953-1972 (35)	*1953-1977 (28)*

Colorado River Climate Change Studies

- About 10 Studies since 1979
- Some Studies use Statistics, Some Climate Models, Some Combined
- Many different assumptions about future GHG emissions
- Most studies show some future **reduction** in flow
- “National Assessment” and IPCC (~ 2001) suggested more precipitation possible
- Current IPCC AR4 models show little change in total precipitation**
- Increases in Precipitation are needed to counteract Drying Trend from Warming
- ***Depending on analysis*** most recent studies show small (-5%) or quite large (-50%) reductions in flow

A Current Problem in the Lower Basin

- Avg Lake Mead Inflows = 9.0 maf
  - 8.23 maf from Powell (Current Operating Rules)
  - 0.77 maf tributaries below Powell
- Avg Lake Mead Outflows = 10.4 maf
  - 7.5 maf LB States (4.4 CA, 2.8 AZ, 0.3 NV maf)
  - 1.5 maf Mexico
  - 1.4 maf Evap + Delivery Losses
- Net Balance = -1.4 maf/year
  - (Mead at 14 maf now)

A Lurking Problem in the Upper Basin

- How Much Water Left to Develop?
  - Current uses: ~4.7maf per year
  - At 13.5 maf avg , ~0.5 maf left to develop
  - At 15.0 maf avg, ~1.5 maf left to develop
- ‘Hydrologic Leftovers’ Creates Uncertainty
- Upper Basin Compact penalizes for overuse, but only determined after the fact
- Terror over Compact ‘Call’ Ramifications

Reclamation EIS Underway

- 2 Purposes
  - Coordinated Mead/Powell Operations
  - Shortage Criteria for Lower Basin (AZ junior issues)
- Finish late this year
- Rules to be in place through 2025
- Modeling uses historical hydrology, BUT a paleo hydrology appendix
- Feb ‘06 Innovative Basin States’ Proposal
  - Water Banking in Mead
  - Shortages at certain reservoir levels agreed upon
  - New Rules for Operating Mead and Powell

Concluding Thoughts

- Population Growth and Climate Change Are Creating Major Stresses…

- Lower Basin Shortages Likely
  - Arizona first to receive reductions – 1968 Act Agreement
  - Nevada small allocation (2%) and little capacity to absorb shortage
  - S. California now depends less than half on CR water
- Upper Basin Shortages Possible
  - Tremendous uncertainty re future hydrology and LB deliveries
  - Colorado Front Range Municipalities 30+% Dependent on CR
  - UB growth depends on using additional water
- Salton Sea, Endangered Species, and Colorado River Delta Environmental Issues