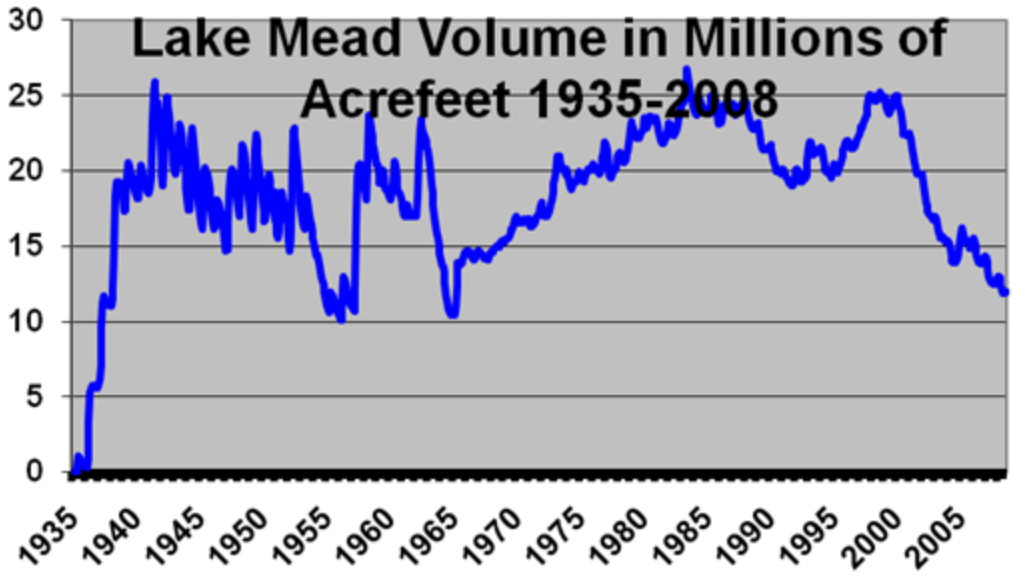
# Lake Mead: A Popular Topic



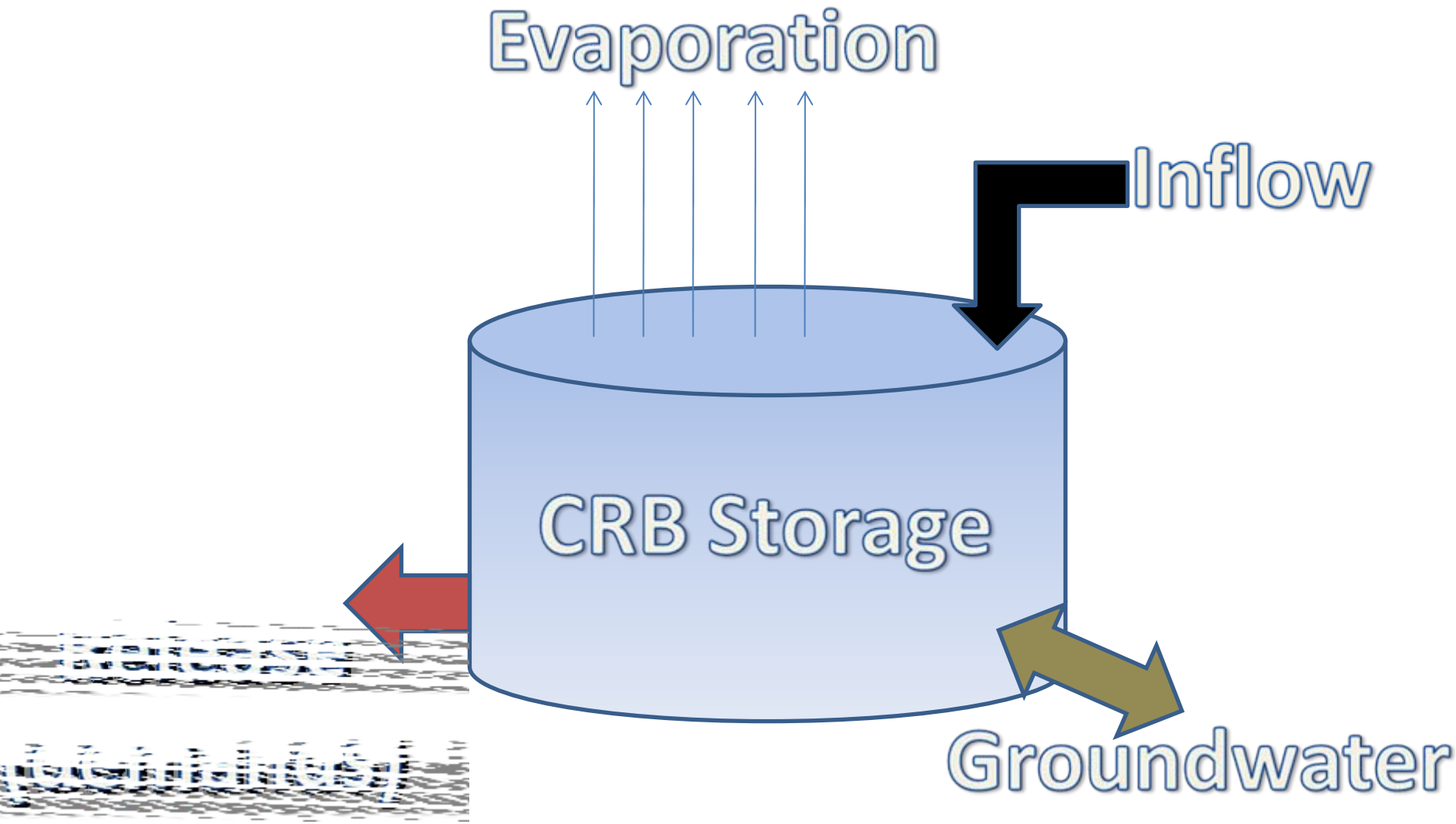

Kenneth Nowak

Western Water Assessment

CADSWES

New York Times Sunday Magazine,
October 21, 2007

# The general “system” approach



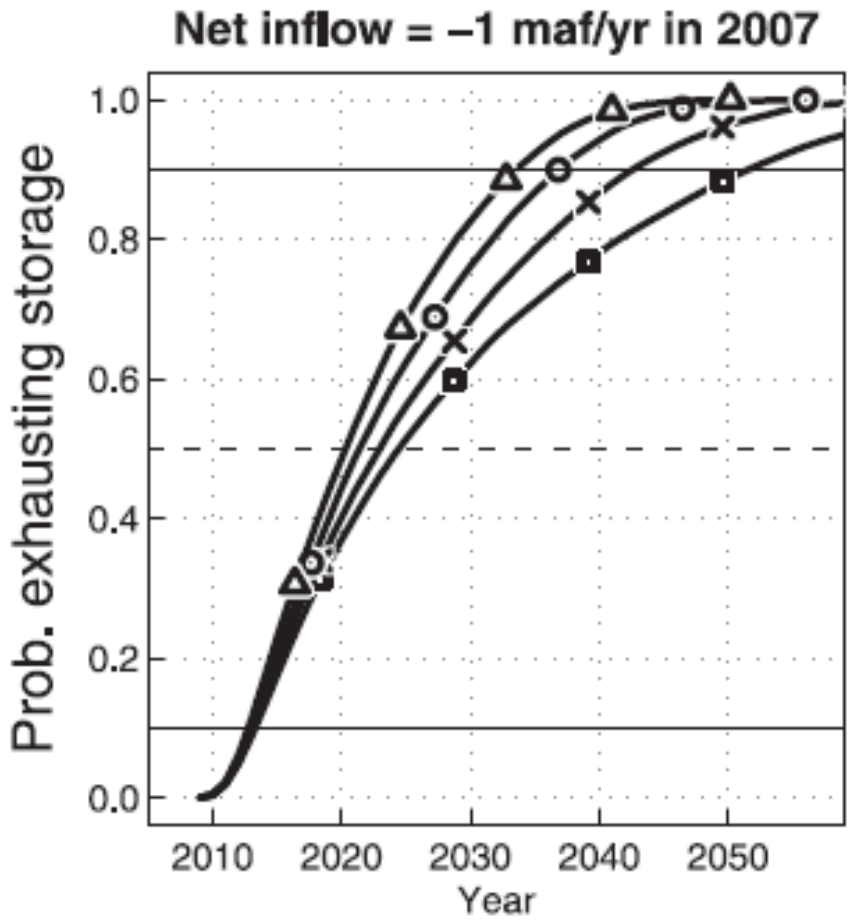

Annual time-step

# Caveats (better now than later)

- “System scale” studies can not identify specific vulnerabilities
  - Can not model complex operations and obligations
  - “All water” is available to meet “all demands”
- Annual time step does not address changes in run-off timing, only volume
- Impact of climate change on flow???

# When Will Lake Mead Go Dry? Scripps Institution of Oceanography, 2008

- Current system
  - Defined as long-term mean flow minus the demand and evaporation/infiltration
  - Current net inflow
    - 14.2 MaF
  - Climate projections
    - Reduce flow
- Results With 20% Reduction
  - 50% Chance Live Storage Gone by 2021
- Is that so?
  - No flow below Lees Ferry
  - Evaporation/infiltration term
  - “system storage” = 50 MaF
  - No shortage policies
  - Risk profile



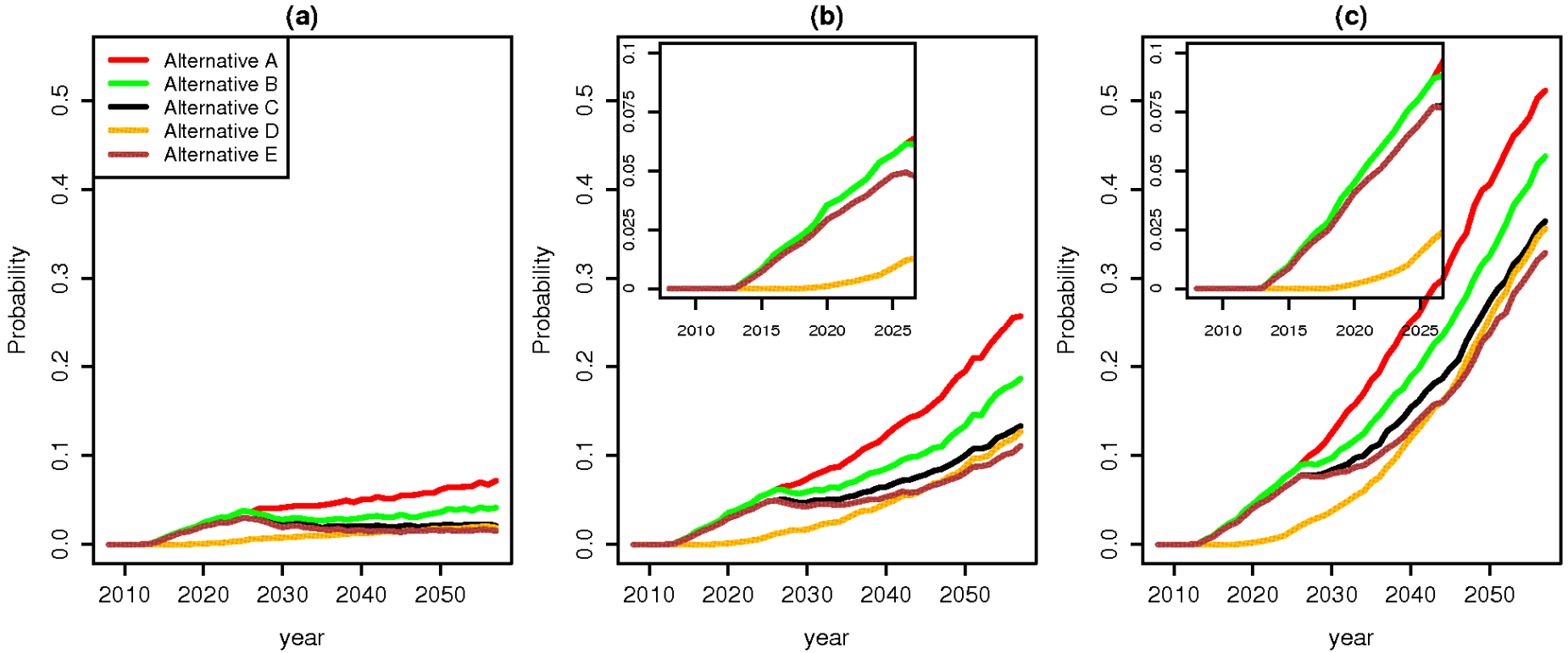
# Water Supply Risk on the Colorado River: Can Management Mitigate? Rajagopalan, 2009

| System Component | Value (MAF) |
|---|---|
| Upper Basin Natural Flow (Lee's Ferry) | 15.0 |
| Demands | -13.5 |
| Reservoir Evaporation | -1.4 |
| Inflow Between Powell and Mead | 0.86 |
| Losses Below Hoover Dam | -1.0 |
| Inflow Below Hoover Dam | 0.45 |
| **Net System Balance** | **0.4** |

*Total system storage assumed to be 60 MaF

# Water Supply Risk on the Colorado River: Can Management Mitigate? Rajagopalan, 2009

## Risk of Drying in a Given Year



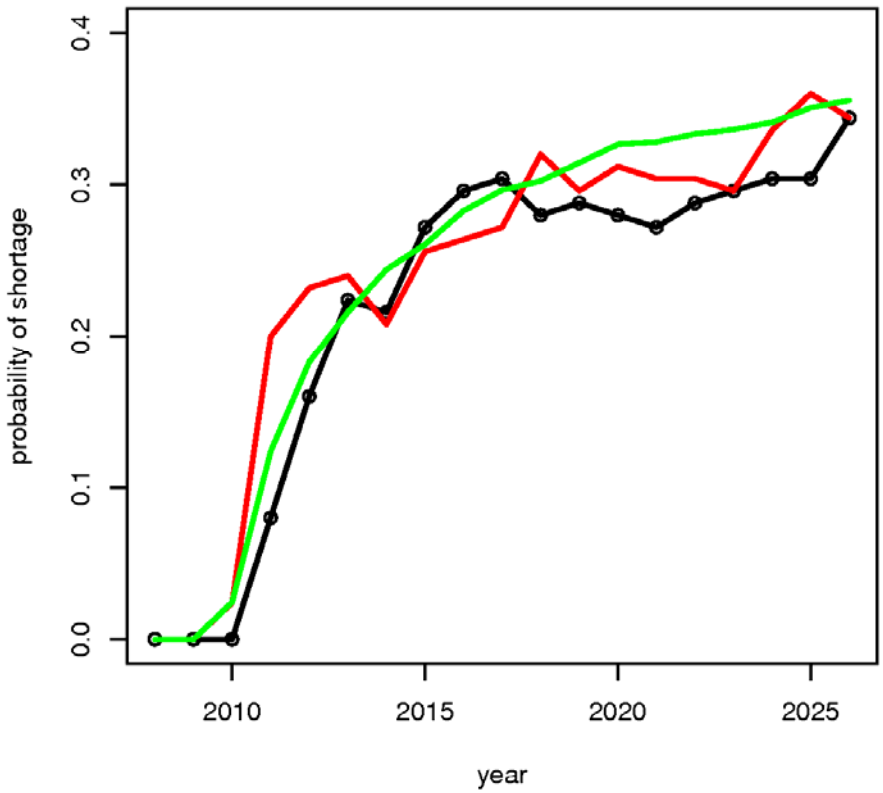

Natural variability

10% Flow reduction by 2056

20% Flow reduction by 2056

# Model Validation – Interim Period

## Rajagopalan, 2009




- Black line is CRSS probability of operating under shortage conditions based on 125 paleo-conditioned traces
- Green line is our model probability of operating under shortage conditions based on 10,000 paleo-conditioned traces
- Red line is our model probability of operating under shortage conditions based on 125 randomly selected paleo-conditioned traces
- Validation limitations of lump model – individual reservoir conditions can not be compared

# Sustainable water deliveries from the Colorado River in a changing climate Scripps Institution of Oceanography, 2009

- Water Budget Corrections
  - No inflow below Lee's Ferry
  - Static 1.7 (MAF/yr) ET/bank loss term
  - No shortage policy included

- Frames problem as shortage needed to protect 1000' at Lake Mead

- Results show that by mid century, high probability of not meeting full demand in order to protect 1000' at Lake Mead
  - Intuitive based on intersection of growing demand and decreasing flow
  - Sustainable deliveries found to be 11-13.5 MaF/yr

- Model validated with USBR EIS results

# Model Validation

## Scripps Institution of Oceanography , 2009

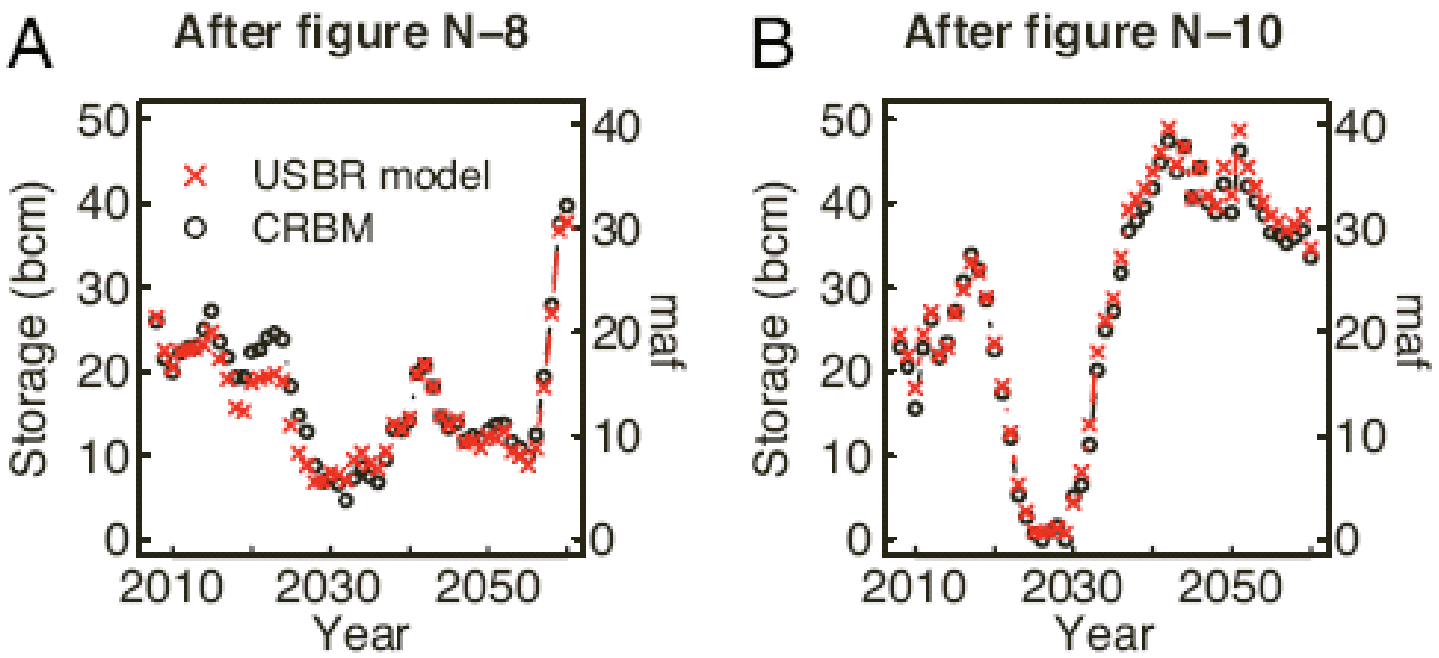



**Fig. 1.** Model simulations of total active storage in Lakes Mead and Powell for the CRBM model used here (black circles) and the full USBR Colorado River model (red crosses). The 2 inflow sequences and USBR model results (*A*, after figure N-8; *B*, after figure N-10) are taken from ref. 16, appendix N, figures 7–10 with elevations converted to total active storage.

# Summary

- “Climatic Regime” is largest risk driver
- System is on “knife’s edge”
- Management can help to reduce risk
- Questions remaining:
  - What is long term mean?
  - Has climate change already impacted flow?

Questions?