

When Normal Isn't Good Enough: Surface Water and Runoff Along the Colorado River of Western and Central Texas

John W. Nielsen-Gammon Texas State Climatologist Texas A&M University



Drought : Year 1





Drought, Year 2





Drought, Year 3





Drought, Year 3.5





Current Texas Reservoir Levels





Current Texas Reservoir Levels





Lake Travis





(our) Colorado River Basin













Inflow 0.7 Maf: New record





-0.7 Maf explained by precip





Why Record Low Inflows?

- Upstream water supply reservoirs
- Surface water capture
- Groundwater capture
- Land use changes
- Climate change
- Bad luck



Hypothesis

- Lack of flooding events is causing below-normal runoff
- Simple test of hypothesis:
 - Monthly precipitation from climate stations
 - Compute excess over amount required for soil saturation
 - 3" winter/spring, 5" summer, 4" transition
 - Sum over stations in basin











-0.5 Maf explained by excess p.





Errors: Negative → Positive





Residuals have downward trend

























Inflow: 0.7 Maf; Normal: 3.8 Maf

Low Precipitation

– 0.7 Maf

Unusually Regular Precipitation

– 0.5 Maf

Surface and groundwater capture, land use changes, climate change

– 1.0 Maf

- Unexplained
 - -0.9 Maf



Summary

- Highland Lakes 2011-2013: unexpectedly low inflow, even with drought
- Partly from unusual lack of extreme rainfall
- Partly from downward inflow trend, controlling for precipitation
- Partly unexplained



Rain gauge data

