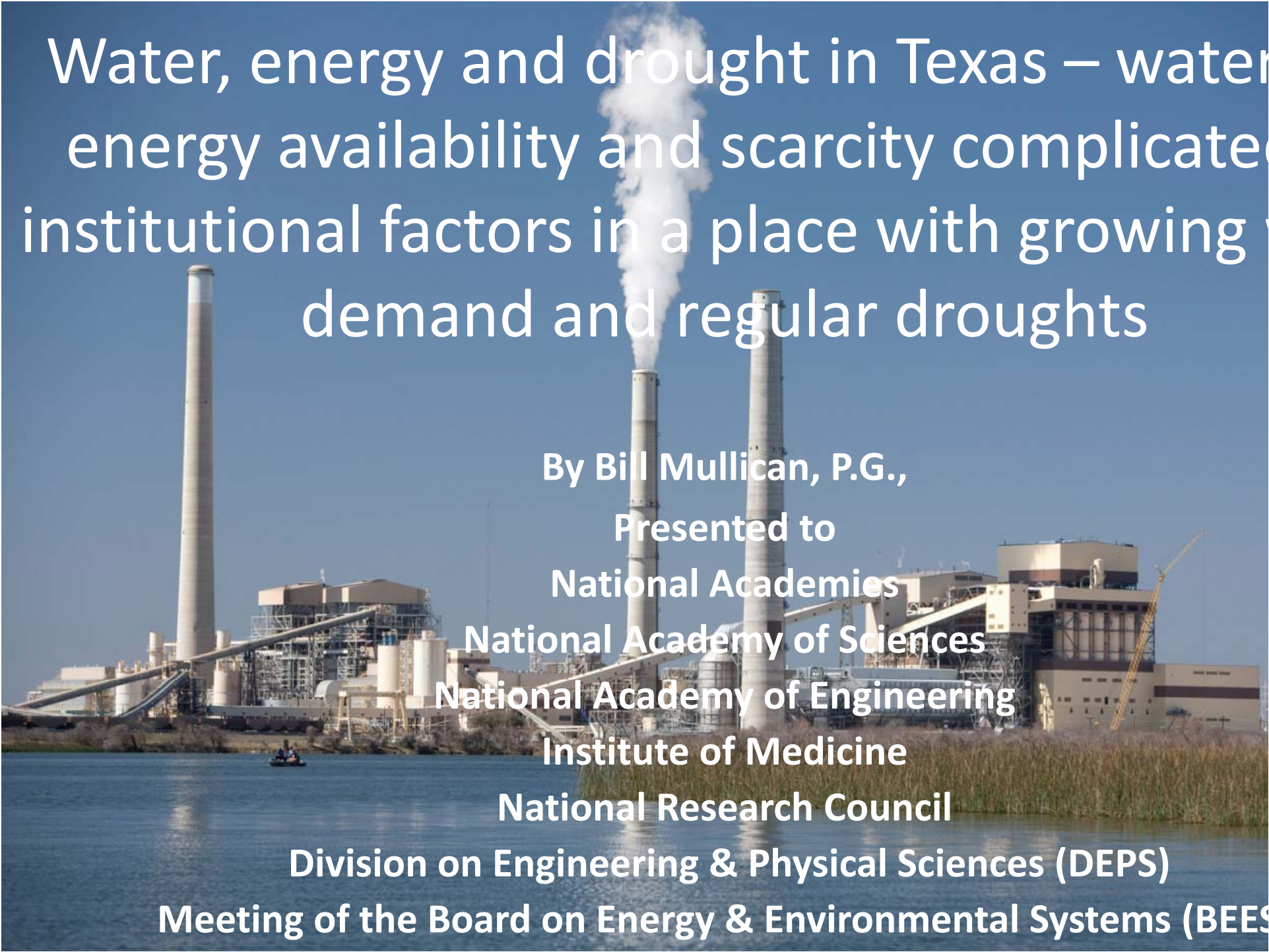




Water, energy and drought in Texas – water energy availability and scarcity complicated institutional factors in a place with growing demand and regular droughts

By Bill Mullican, P.G.,

Presented to

National Academies

National Academy of Sciences

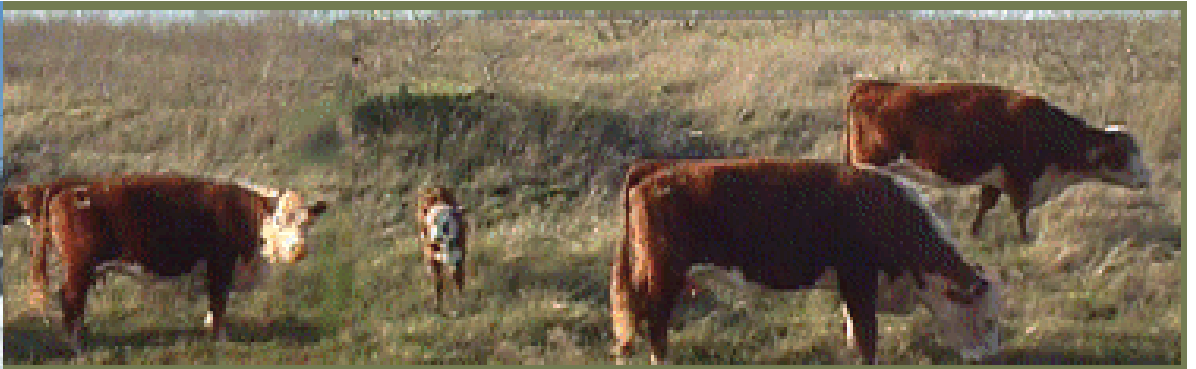
National Academy of Engineering

Institute of Medicine

National Research Council

Division on Engineering & Physical Sciences (DEPS)

Meeting of the Board on Energy & Environmental Systems (BEES)



*2012 Texas State Water Plan – Texas
Water Development Board*

*Drought and the Water Energy Nexus
in Texas – Dr. Bridget Scanlon and
others, Bureau of Economic Geology at
the U.T. Austin*



Why Plan?

Lake Meredith 1999



Why Plan?

Lake Meredith 2013

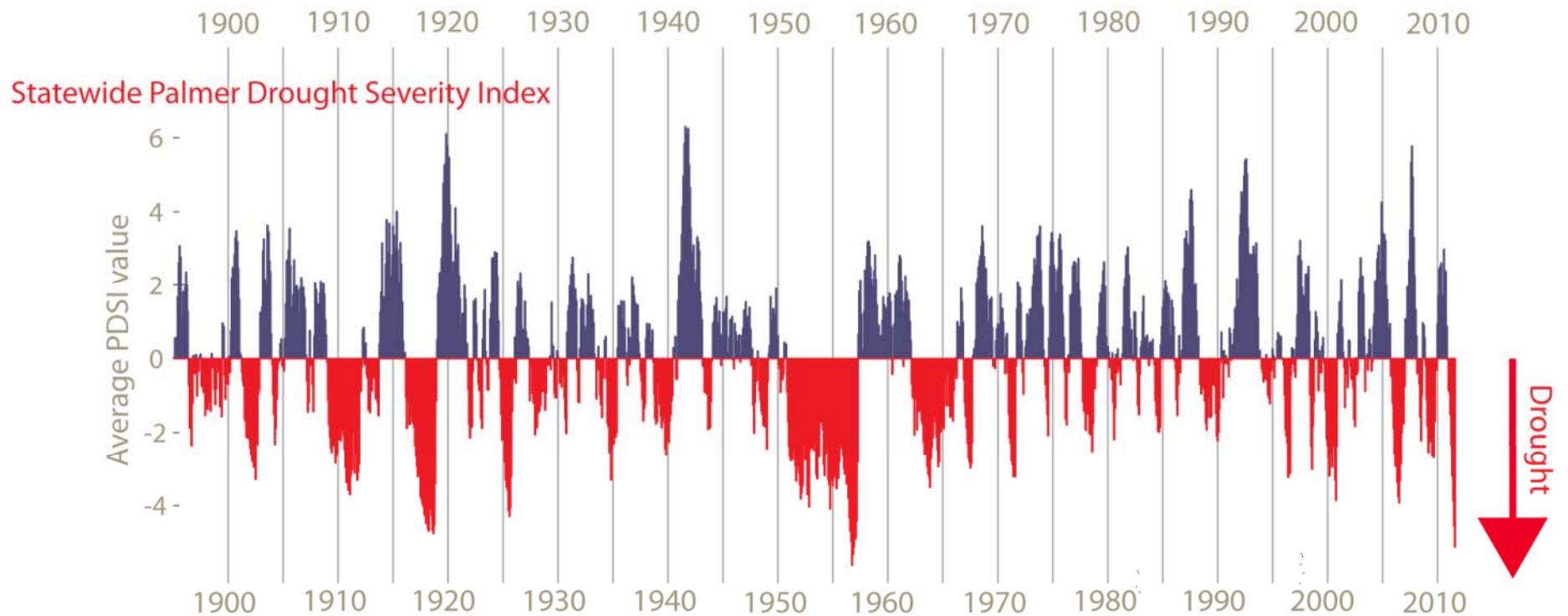
Water Supply for 11 Cities on the High Plains of Texas



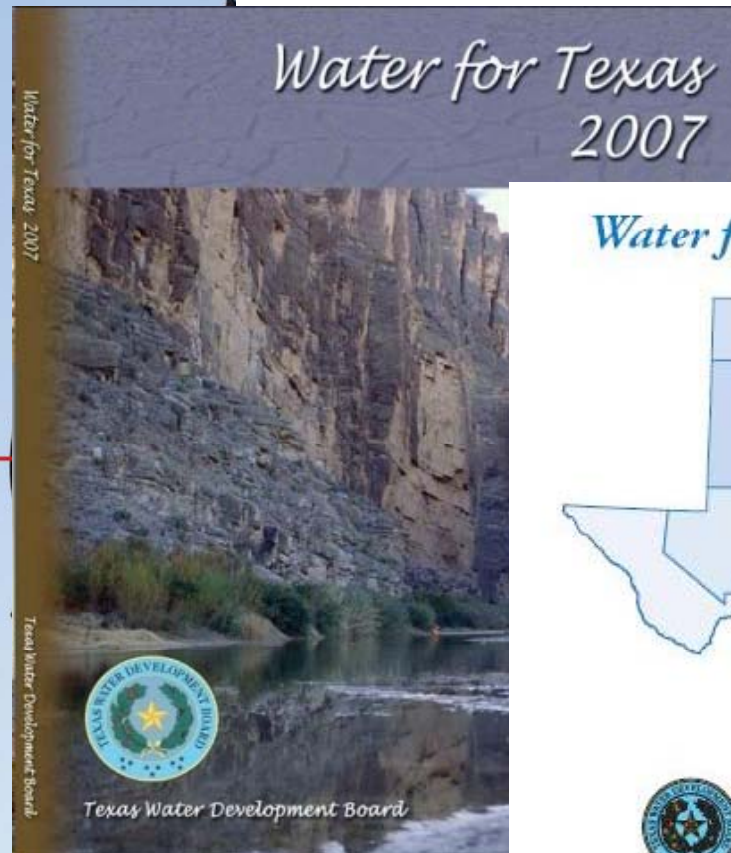
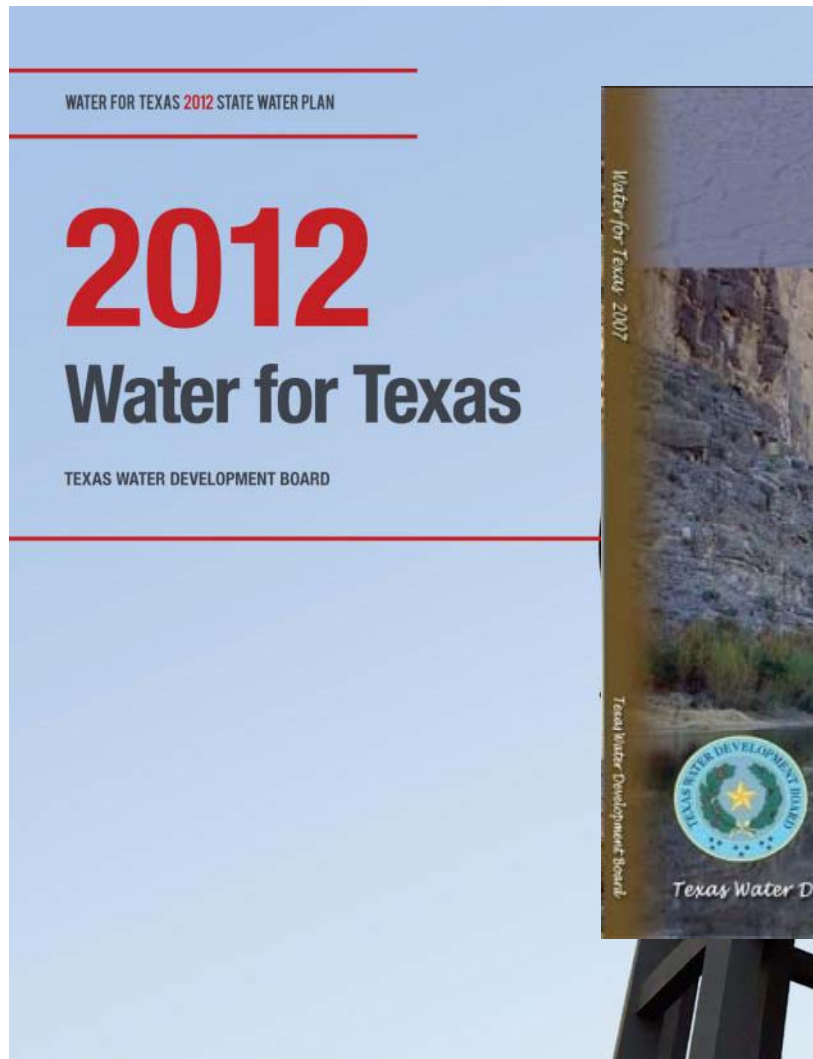
Spicewood Beach 2012



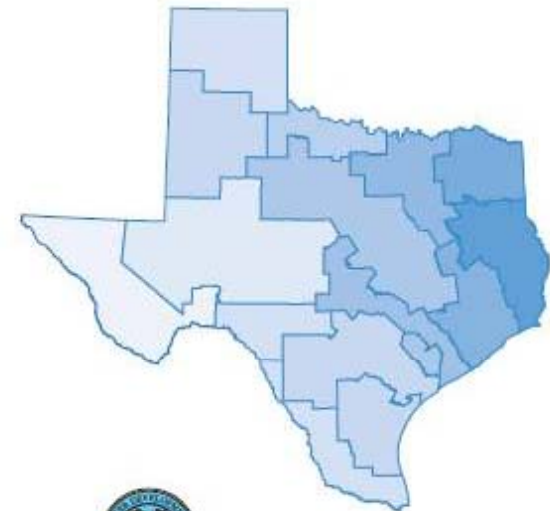
Texas 1900-2011 Extended Periods of Drought Interrupted by Occasional Floods



Regional and State Water Planning in Texas



Water for Texas – 2002



*Texas Water Development Board
January 2002*

Planning at the Local Level

Cities: 971 (>500 pop)

Utilities: 362

County-Others: 254

Manufacturing: 174

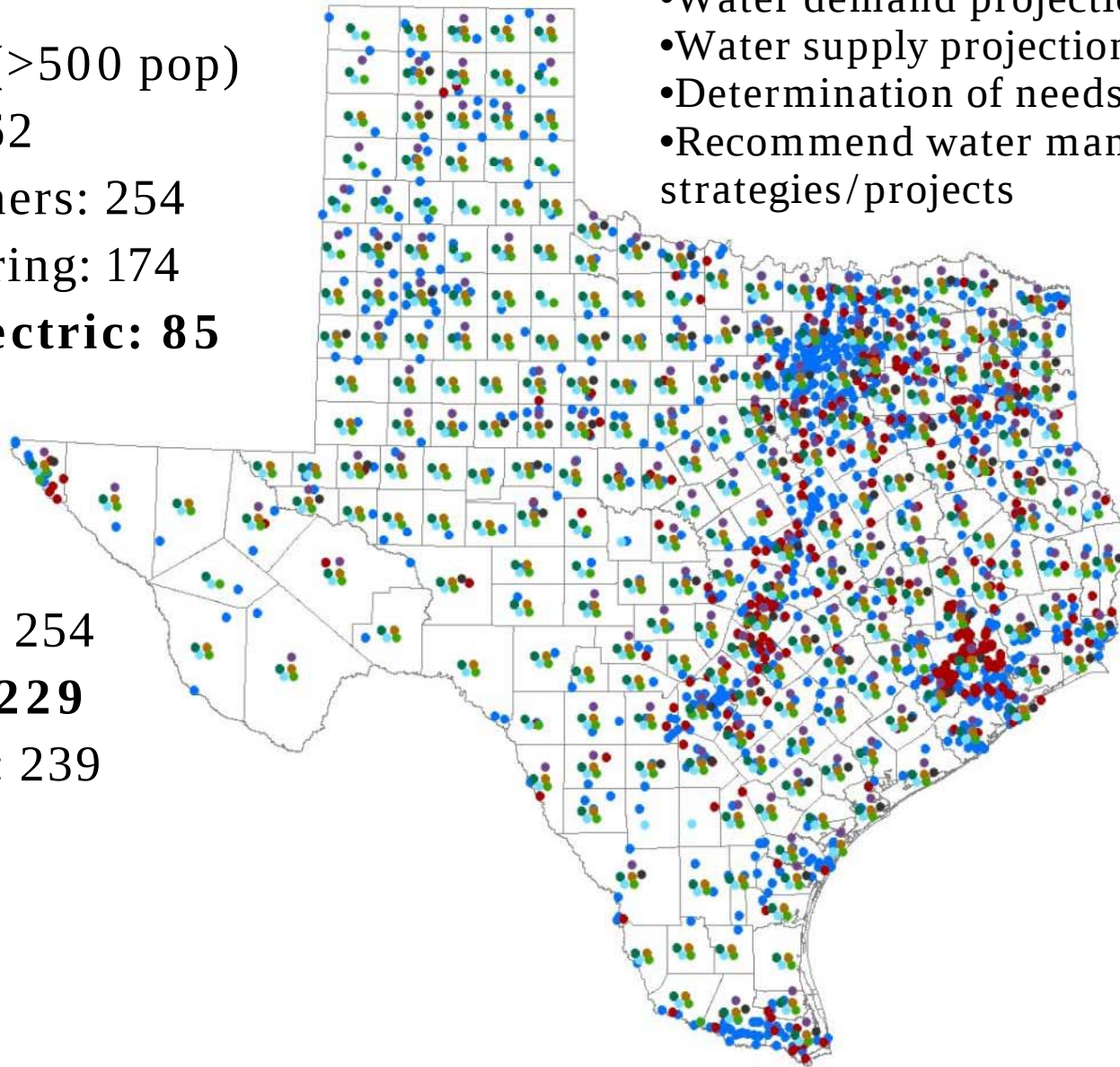
Steam-Electric: 85

Livestock: 254

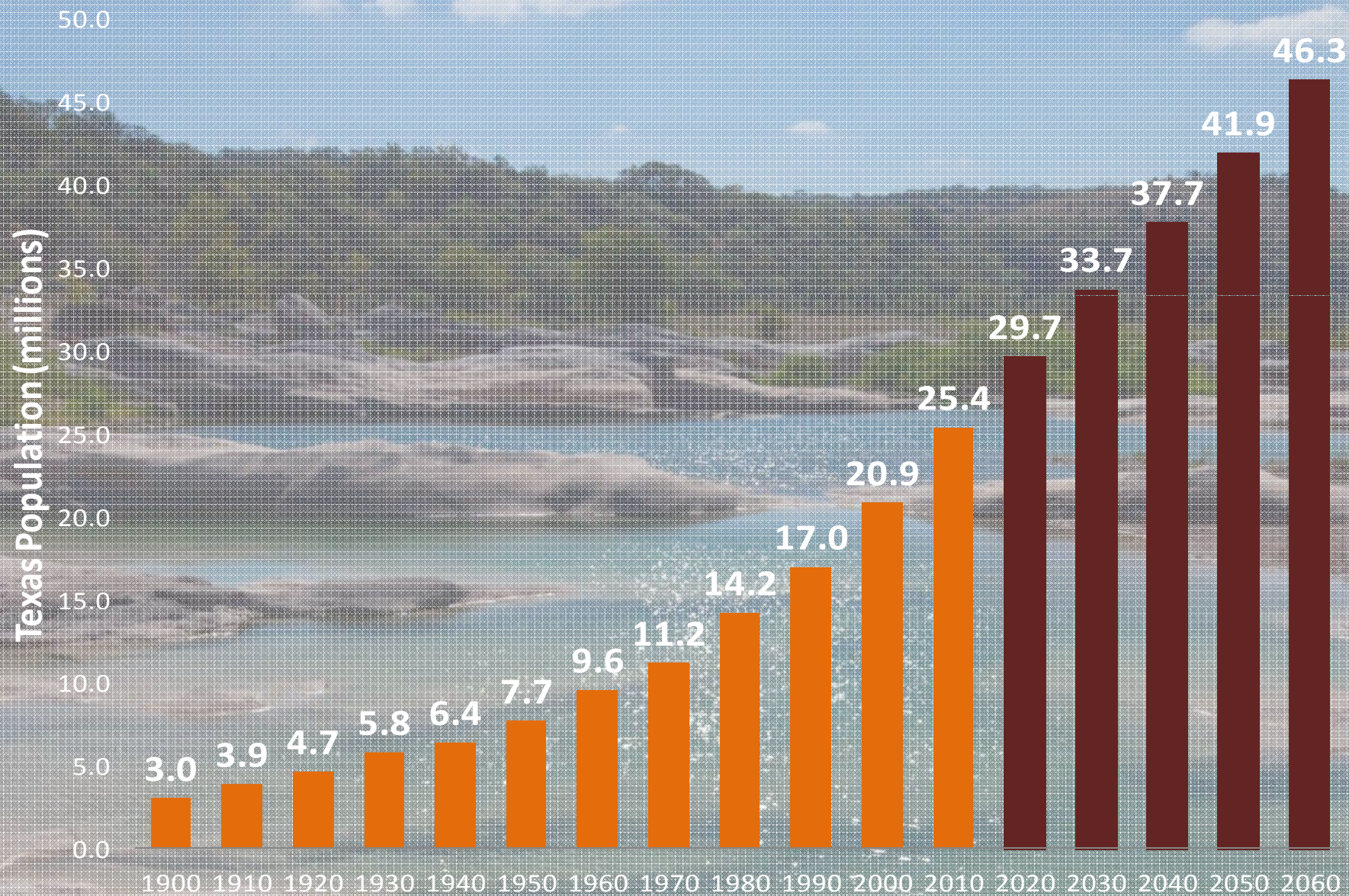
Mining: 229

Irrigation: 239

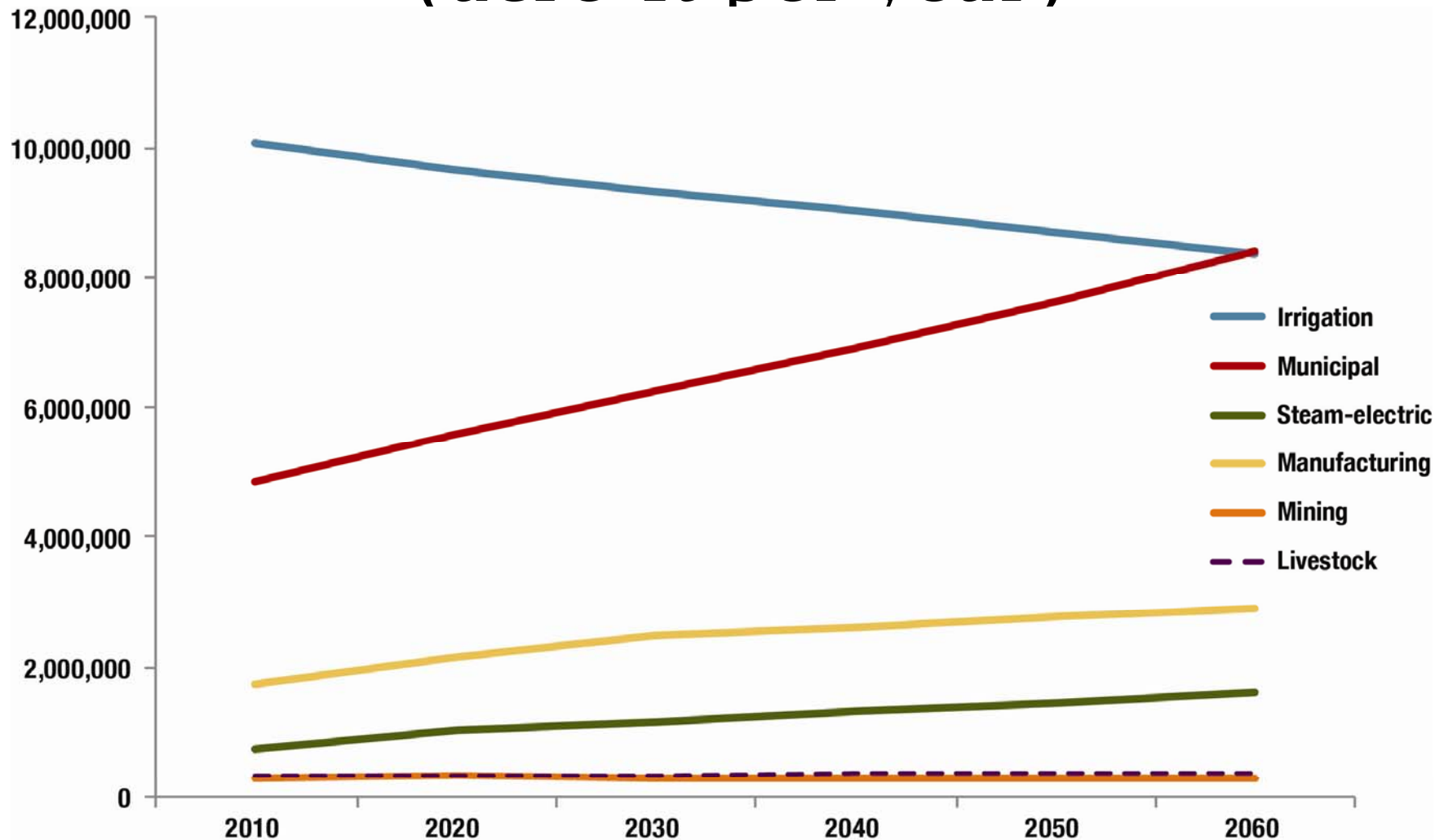
- 50-year planning horizon
- Population projections
- Water demand projections
- Water supply projections
- Determination of needs/gaps
- Recommend water management strategies/projects

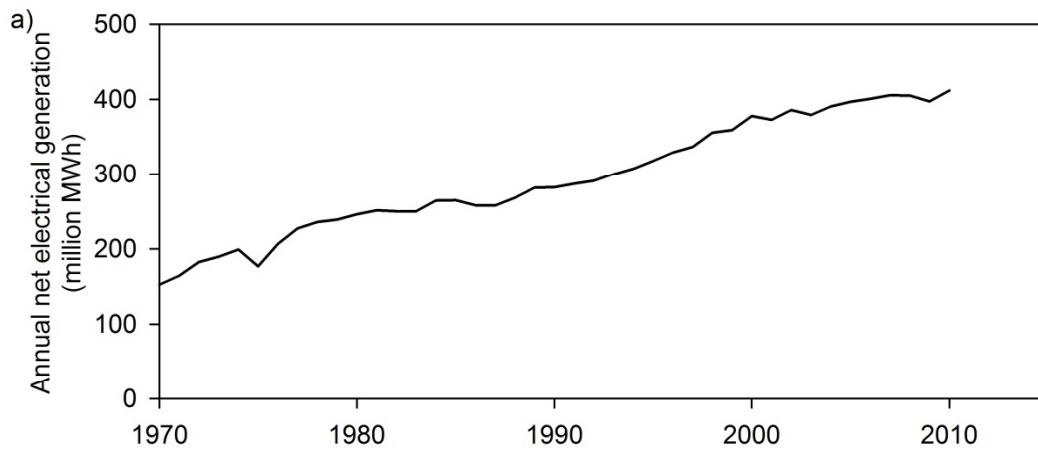


Historic and Projected Texas Population Growth

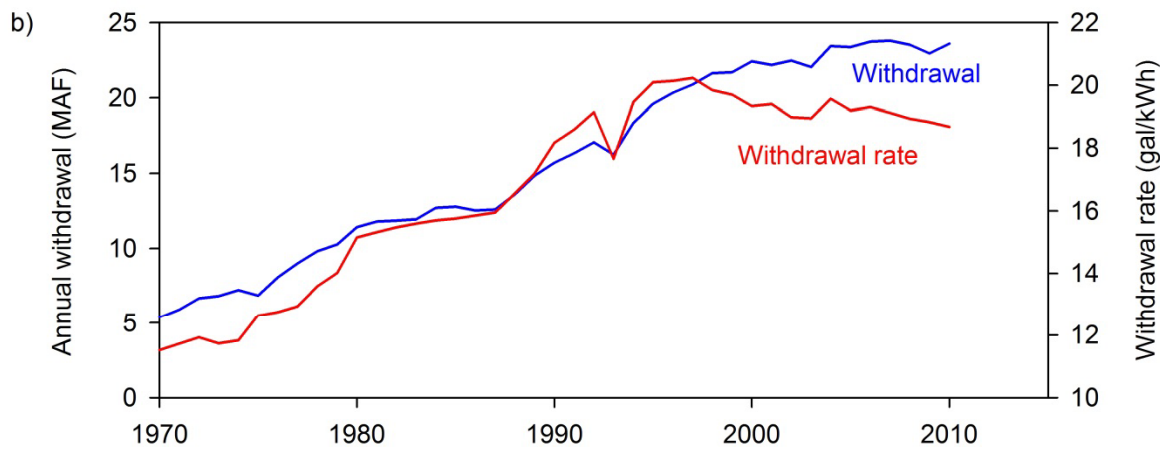


Water demand projections (acre-ft per year)

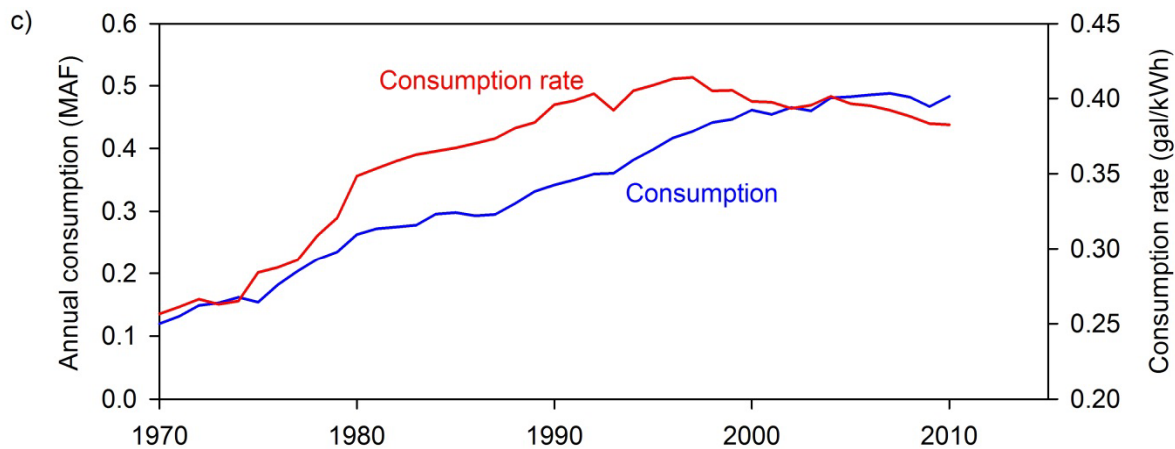




Net Electricity Generation

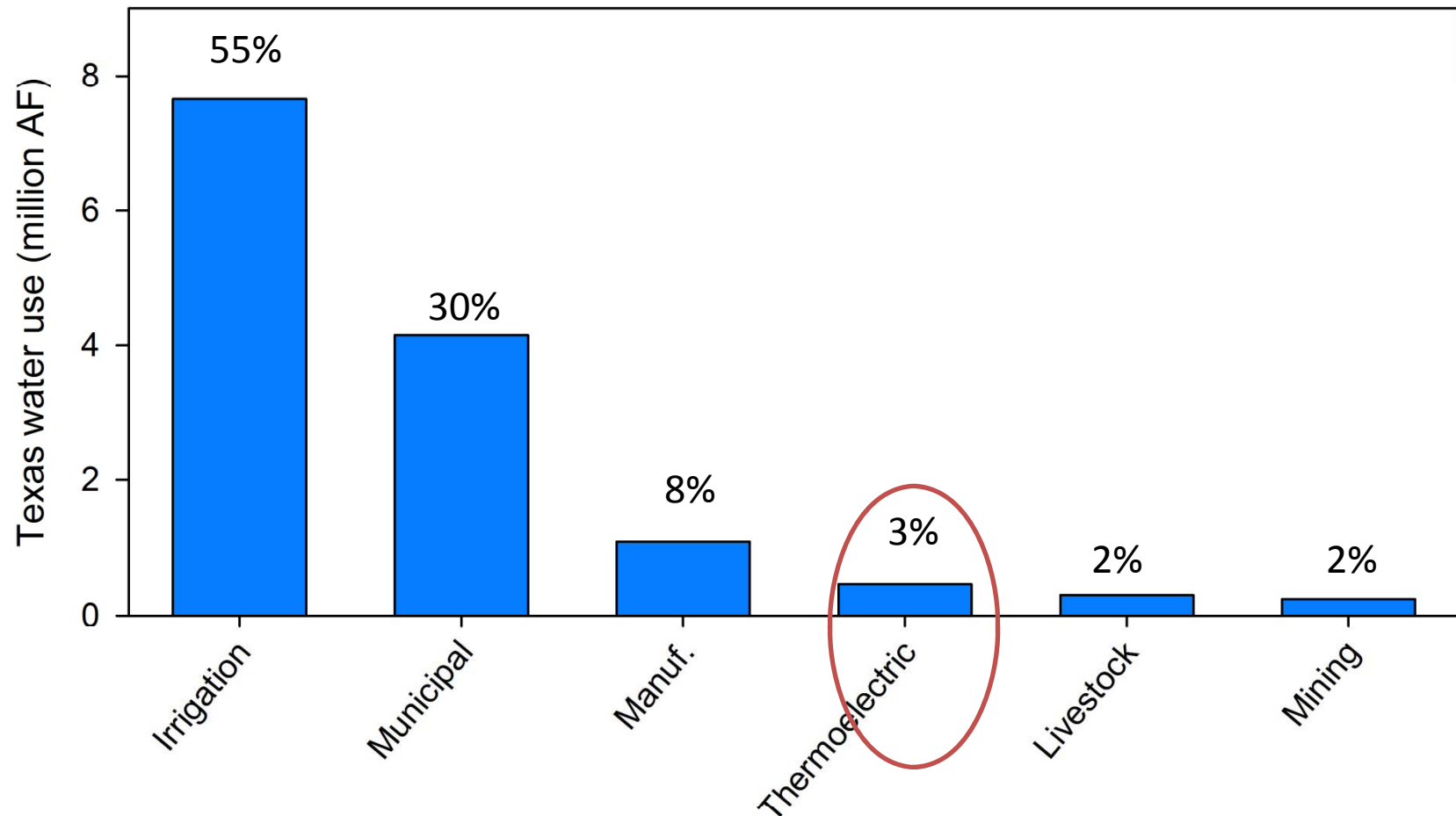


Withdrawal



Consumption

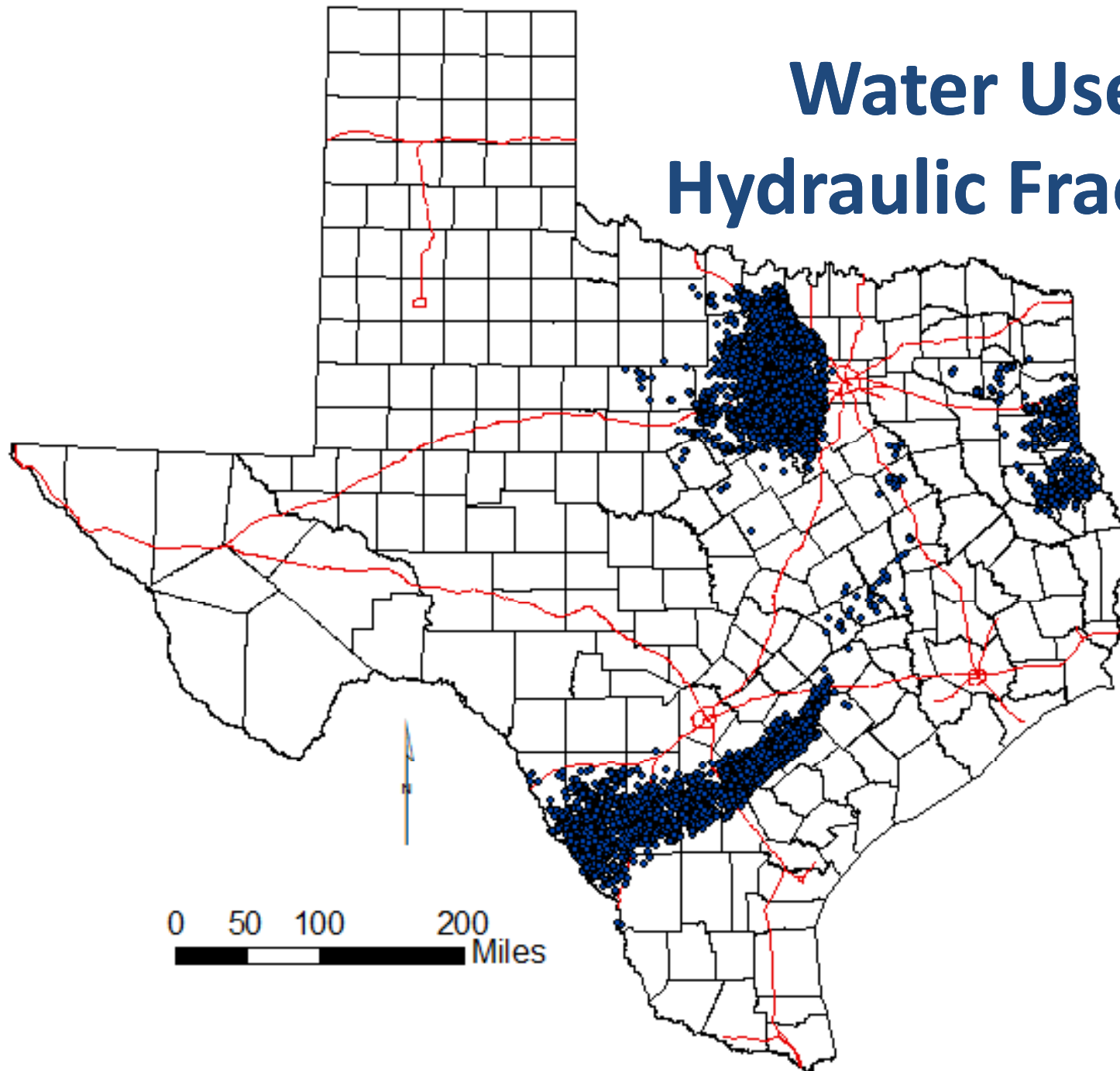
Water Consumption in Texas for Electricity Relative to Water Withdrawal for Other Sectors



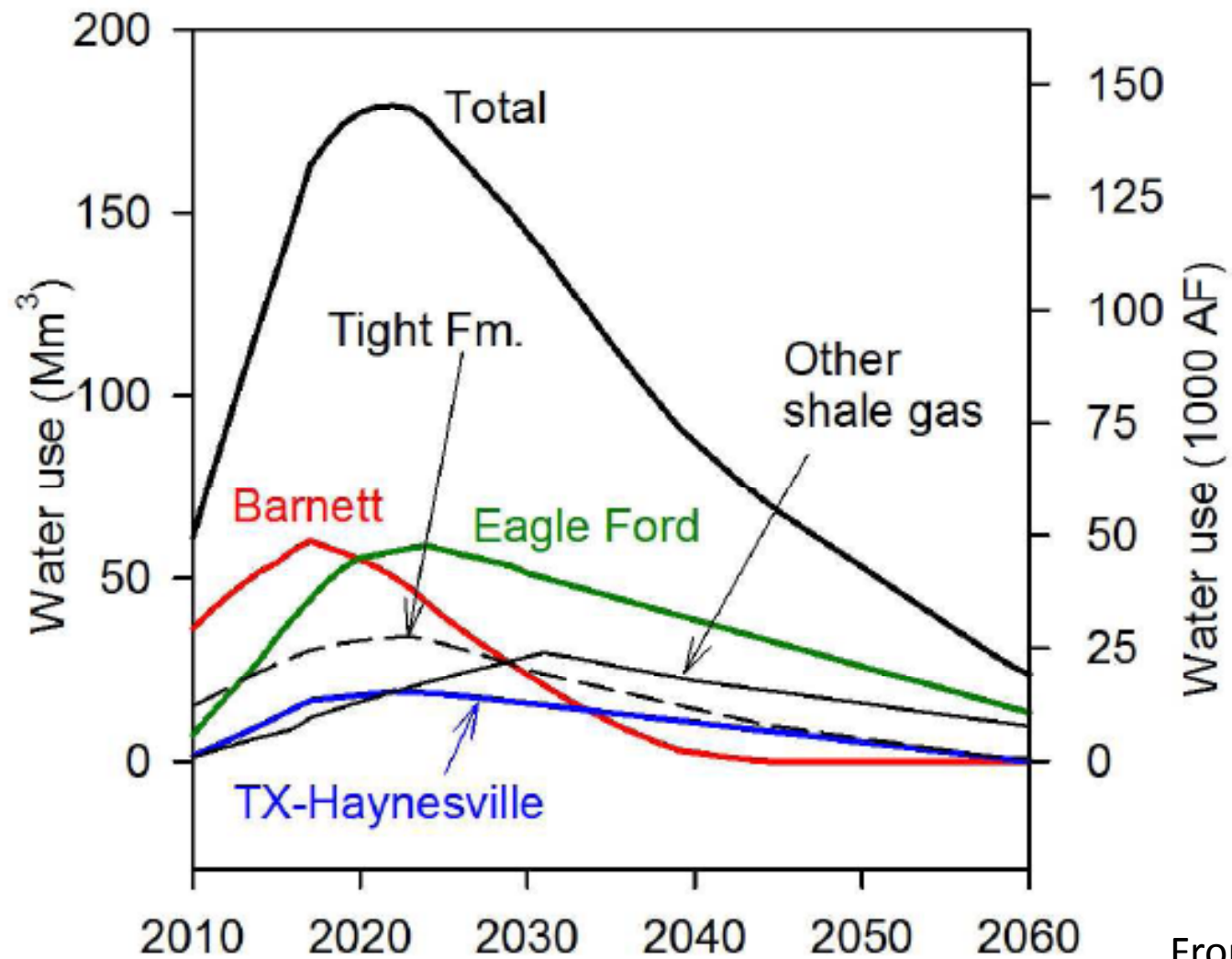
2011 water use for thermoelectricity 0.41 maf

2010 Texas total water withdrawal for other sectors, 14 maf

Water Use in Hydraulic Fracturing

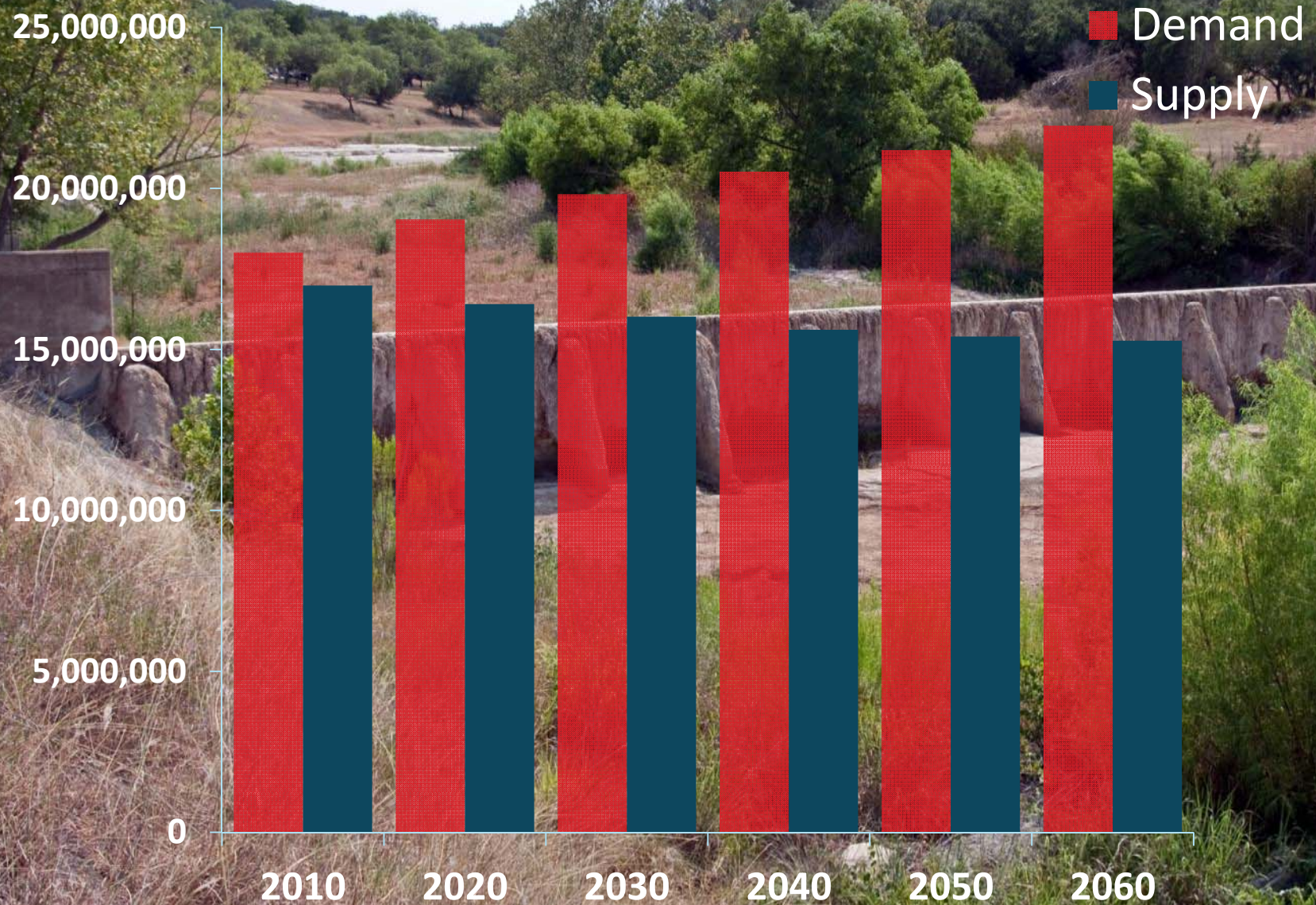


Tracking Water Use in Hydraulic Fracturing

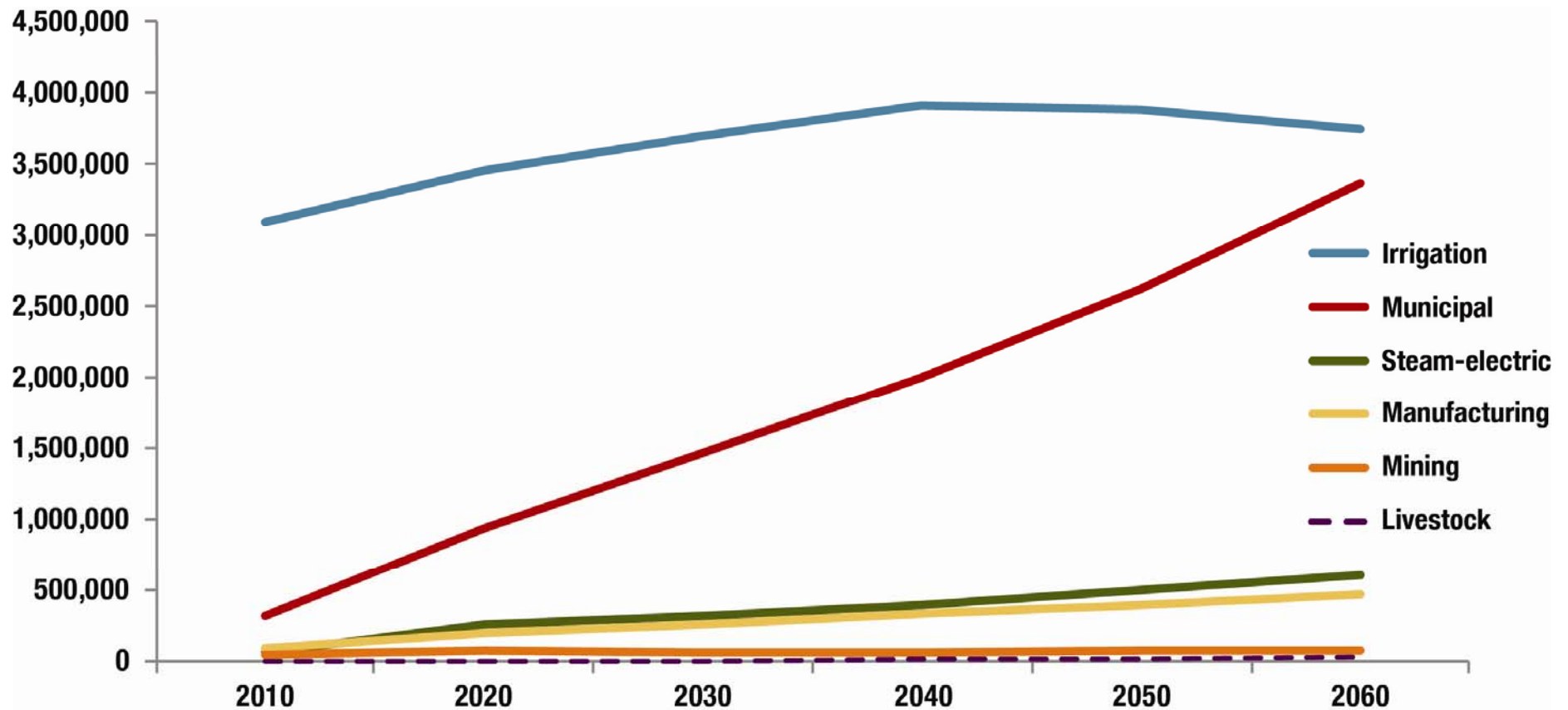


From J.P. Nicot,
2012

Projected Water Demand and Supplies (AFY)



Projected water needs/gap (AFY)



What happens if Texas does not implement water management strategies/projects in the 2012 State Water Plan?

Lost income:

- \$12 billion in 2010
- \$116 billion in 2060

Lost state and local business taxes:

- \$1 billion in 2010
- \$10 billion in 2060

Lost jobs:

- 115,000 in 2010
- 1 million in 2060

Lost population growth:

- 1.4 million in 2060

Energy – Water Nexus in Texas

Institutional Challenges

- Disconnected water laws
 - Surface water law
 - Groundwater law
- In most areas of the state, during drought of record, water resources have already been over appropriated

Confirmed Groundwater Conservation Districts

1. Anderson County UWCD
2. Bandera County River Authority & Ground Water District
3. Barton Springs/Edwards Aquifer CD
4. Bee GCD
5. Blanco-Pedernales GCD
6. Bluebonnet GCD
7. Brazoria County GCD
8. Brazos Valley GCD
9. Brewster County GCD
10. Brush Country GCD
11. Central Texas GCD
12. Clear Fork GCD
13. Clearwater UWCD
14. Coastal Bend GCD
15. Coastal Plains GCD
16. Coke County UWCD
17. Colorado County GCD
18. Corpus Christi ASRCD
19. Cow Creek GCD
20. Crockett County GCD
21. Culberson County GCD
22. Duval County GCD
23. Edwards Aquifer Authority
24. Evergreen UWCD
25. Fayette County GCD
26. Fox Crossing Water District
27. Garza County UWCD
28. Gateway GCD
29. Glasscock GCD
30. Goliad County GCD
31. Gonzales County UWCD
32. Guadalupe County GCD
33. Hays Trinity GCD
34. Headwaters UWCD
35. Hemphill County UWCD
36. Hickory UWCD No. 1
37. High Plains UWCD No. 1
38. Hill Country UWCD
39. Hudspeth County UWCD No. 1
40. Inon County UWCD
41. Jeff Davis County UWCD
42. Kenedy County GCD
43. Kintle County GCD
44. Kinney County GCD
45. Lipan-Kickapoo WCD
46. Live Oak UWCD
47. Llano Estacado UWCD
48. Lone Star GCD
49. Lone Wolf GCD
50. Lost Pines GCD
51. Lower Trinity GCD
52. McMullen GCD
53. Medina County GCD
54. Menard County UWCD
55. Mesa UWCD
56. Mesquite GCD
57. Mid-East Texas GCD
58. Middle Pecos GCD
59. Middle Trinity GCD
60. Neches & Trinity Valleys GCD
61. North Plains GCD
62. North Texas GCD
63. Northern Trinity GCD
64. Panhandle GCD
65. Panola County GCD
66. Pecan Valley GCD
67. Permian Basin UWCD
68. Pinerywoods GCD
69. Plateau UWC and Supply District
70. Plum Creek CD
71. Post Oak Savannah GCD
72. Prairielands GCD
73. Presidio County UWCD
74. Real-Edwards C and R District
75. Red River GCD
76. Red Sands GCD
77. Refugio GCD
78. Rolling Plains GCD
79. Rusk County GCD
80. San Patricio County GCD
81. Sandy Land UWCD
82. Santa Rita UWCD
83. Saratoga UWCD
84. South Plains UWCD
85. Southeast Texas GCD
86. Southern Trinity GCD
87. Starr County GCD
88. Sterling County UWCD
89. Sutton County UWCD
90. Texana GCD
91. Trinity Glen Rose GCD
92. Upper Trinity GCD
93. Uvalde County UWCD
94. Victoria County GCD
95. Wiles-Tex GCD
96. Winter Garden GCD

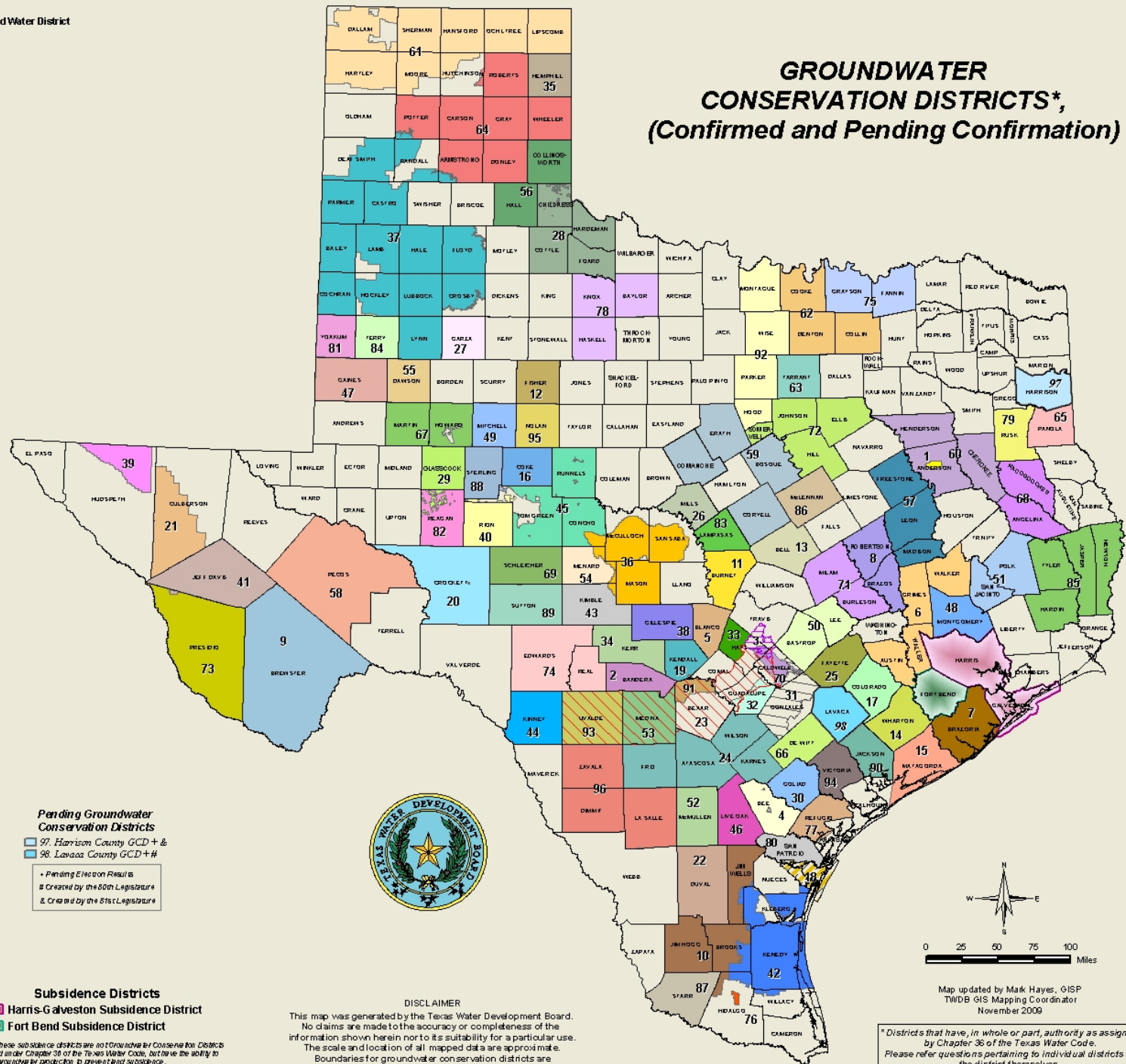
Pending Groundwater Conservation Districts

- 97. Harrison County GCD + #
 - 98. Lavaca County GCD + #
- + Pending Election Results
Created by the 80th Legislature
& Created by the 81st Legislature

Subsidence Districts

- Harris-Galveston Subsidence District
 - Fort Bend Subsidence District
- NOTE: These subsidence districts are not synonymous for Conservation Districts as defined under Chapter 38 of the Texas Water Code, but have the ability to regulate groundwater production to prevent land subsidence.
(Refer to Senate Bill 1337 from the 79th Legislative Session)

GROUNDWATER CONSERVATION DISTRICTS*, (Confirmed and Pending Confirmation)

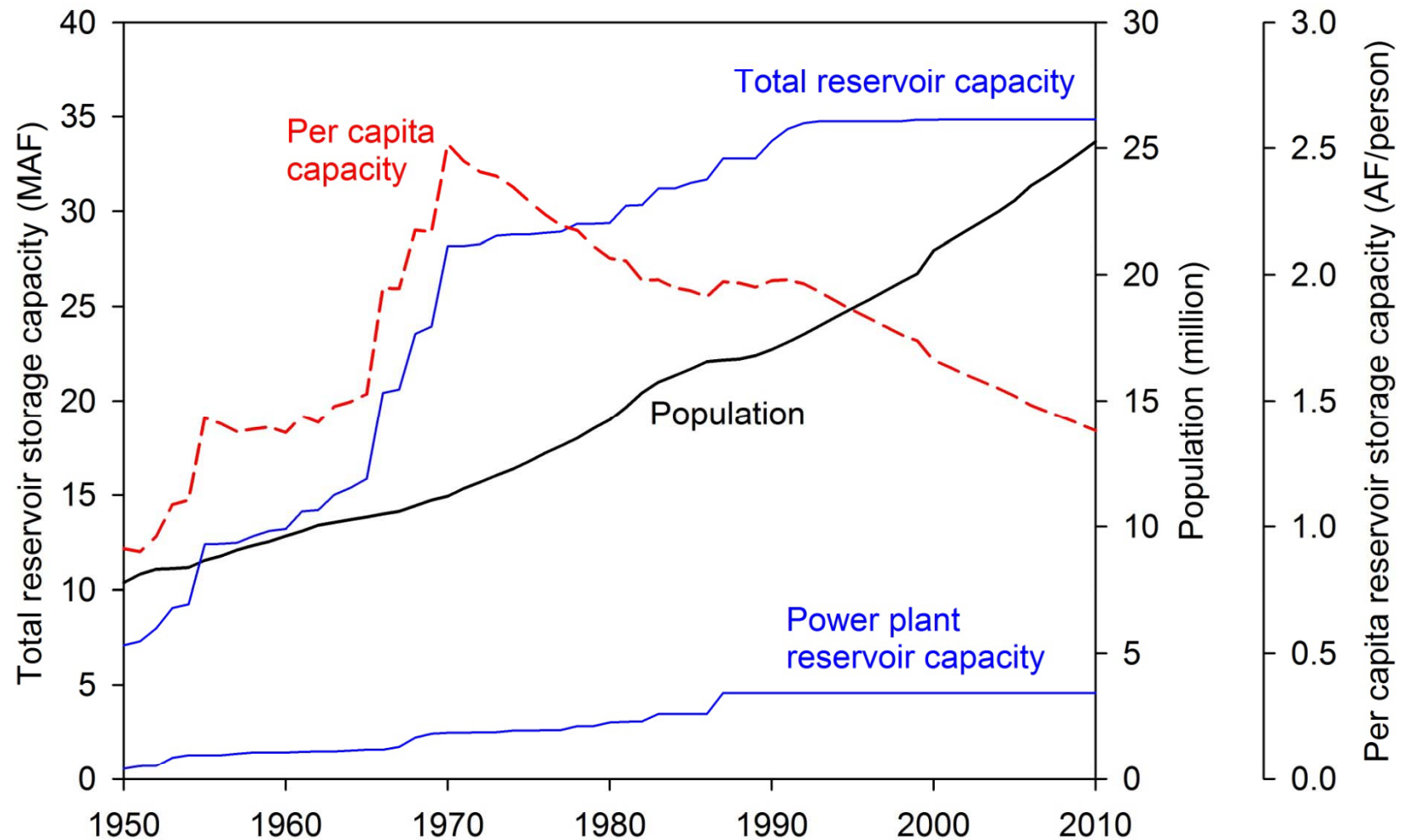


Energy – Water Nexus in Texas

Other Challenges

- Confusing terminology
 - Water use
 - Water withdrawals
 - Water consumption
- Lack of simple, robust source of data
- Cost of infrastructure
- Energy sector deregulated

Reduction in Per Capita Reservoir Storage since 1980



Energy-Water Nexus in Texas

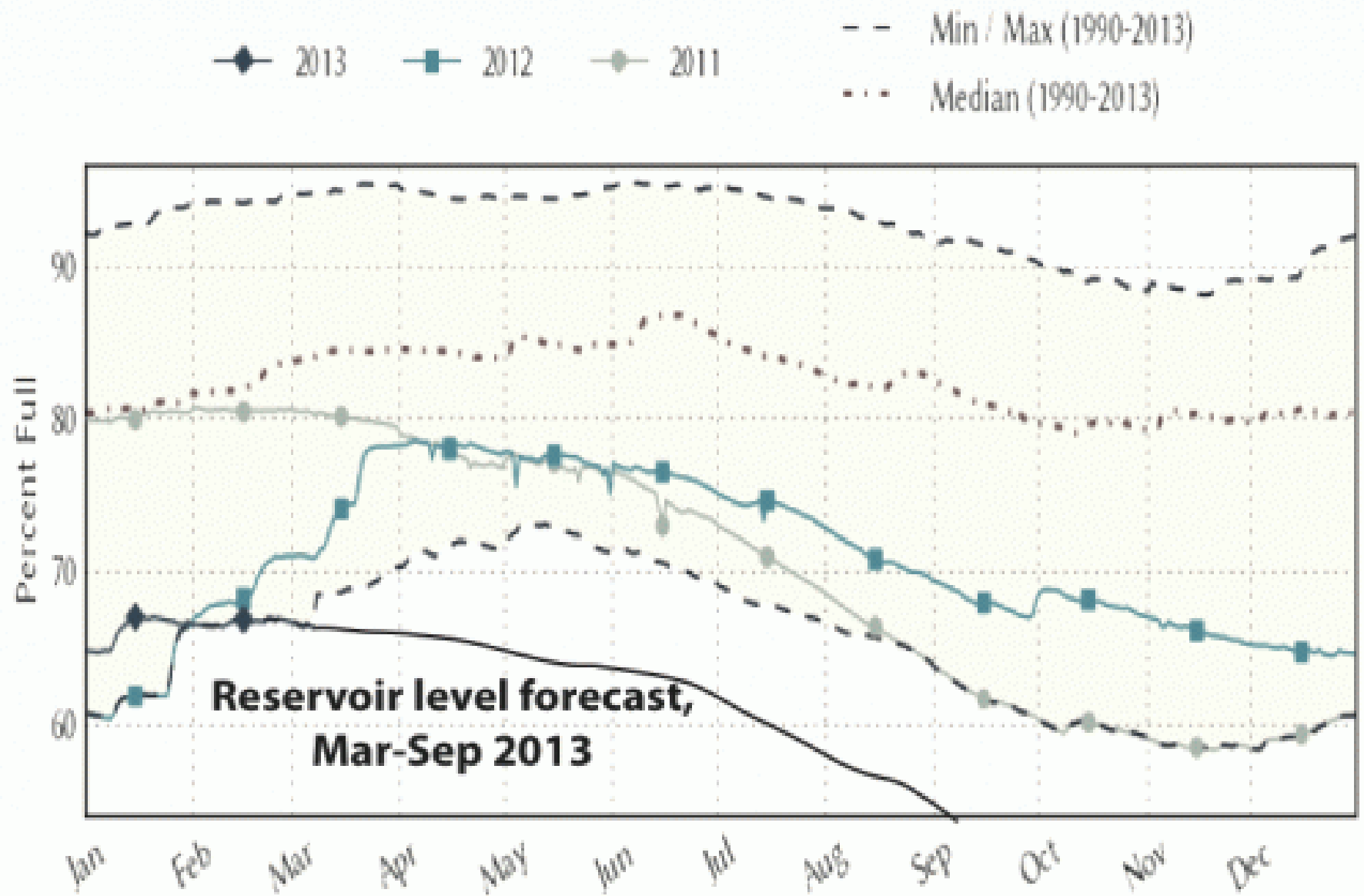
Takeaway Points

- The energy-water nexus is amplified during drought because electricity demands are maximized when water supplies are at a minimum
- Anything that reduces electricity generation capacity will exacerbate drought vulnerability
- Increasing electricity generation capacity can mitigate drought impacts caused by water shortages

Energy-Water Nexus in Texas

Takeaway Points

- Water consumption 2010 and 2011 are the same (0.44 maf)
- Electricity generation 6% higher in 2011
- Therefore, drought vulnerability does not result from increased water demand for thermoelectric generation but reduced water supplies caused by drought and increased water demand from other sectors (irrigation, municipal uses)



Thanks for the invite, and please, send some rain!
Questions!

