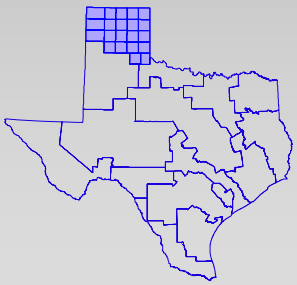
Surface Water Study

Groundwater

Land Cover

Panhandle Water Planning Area



Spencer Schnier

PWPG Meeting

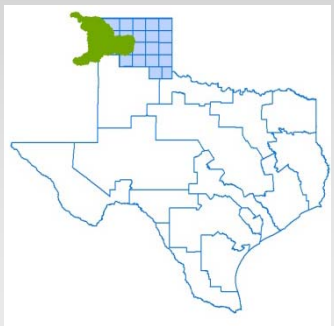
January 19, 2009

FREESE AND NICHOLS

Background

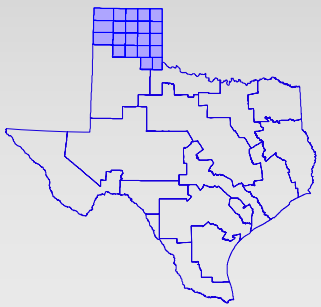
Study Area

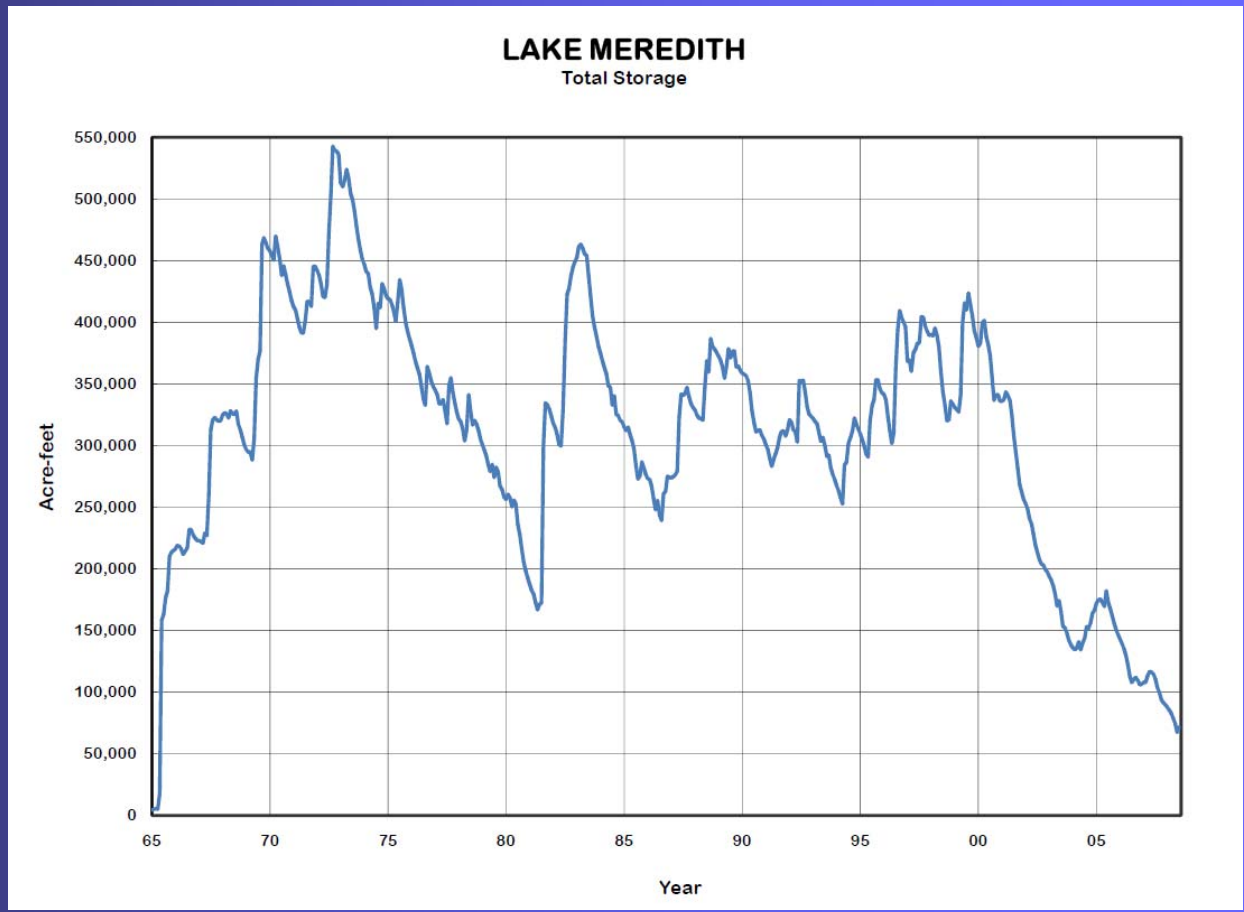
Panhandle Water Planning Area



Background

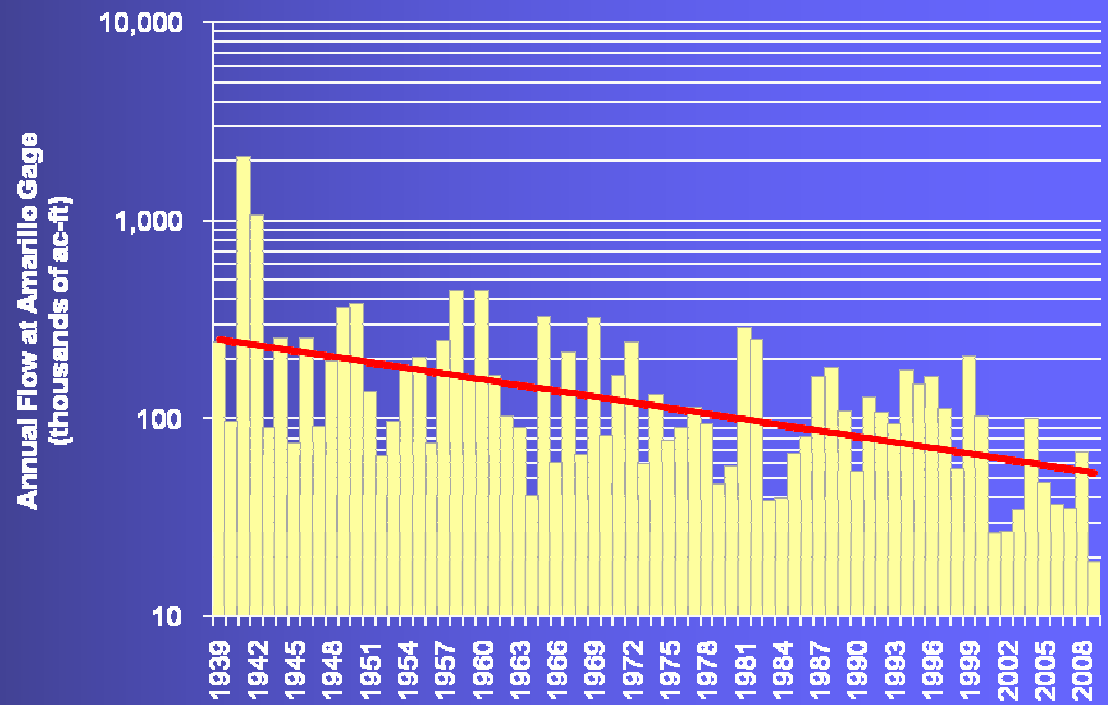
Panhandle Water Planning Area



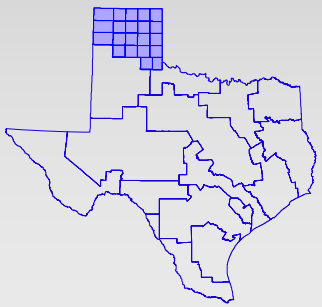


What is reducing the level in Lake Meredith?

- Decreased stream flow



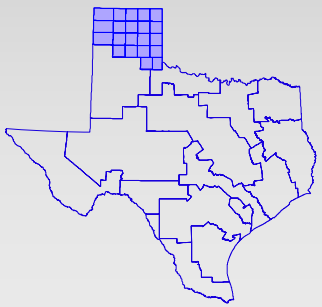
Panhandle Water Planning Area



What is reducing the level in Lake Meredith?

- Lack of rain
- Increased evaporation
- Decreased spring flows
- Increased infiltration
- Spread of salt cedar
- Increase in stock ponds
- Change in water use

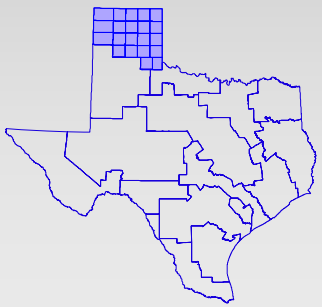
Panhandle Water Planning Area



Groundwater Levels Methods

- **Northern Ogallala Aquifer**
  - Dutton, 2004 Dataset
  - Time Period:1950 – 1998
- **Dockum Aquifer**
  - TWDB well data and water levels
  - IDW interpolation method
  - Time Period: 1950 – 2009

Panhandle Water Planning Area

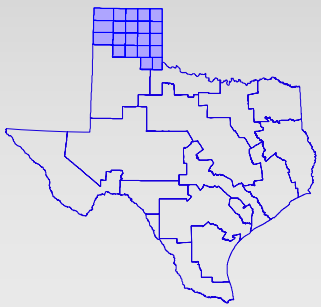


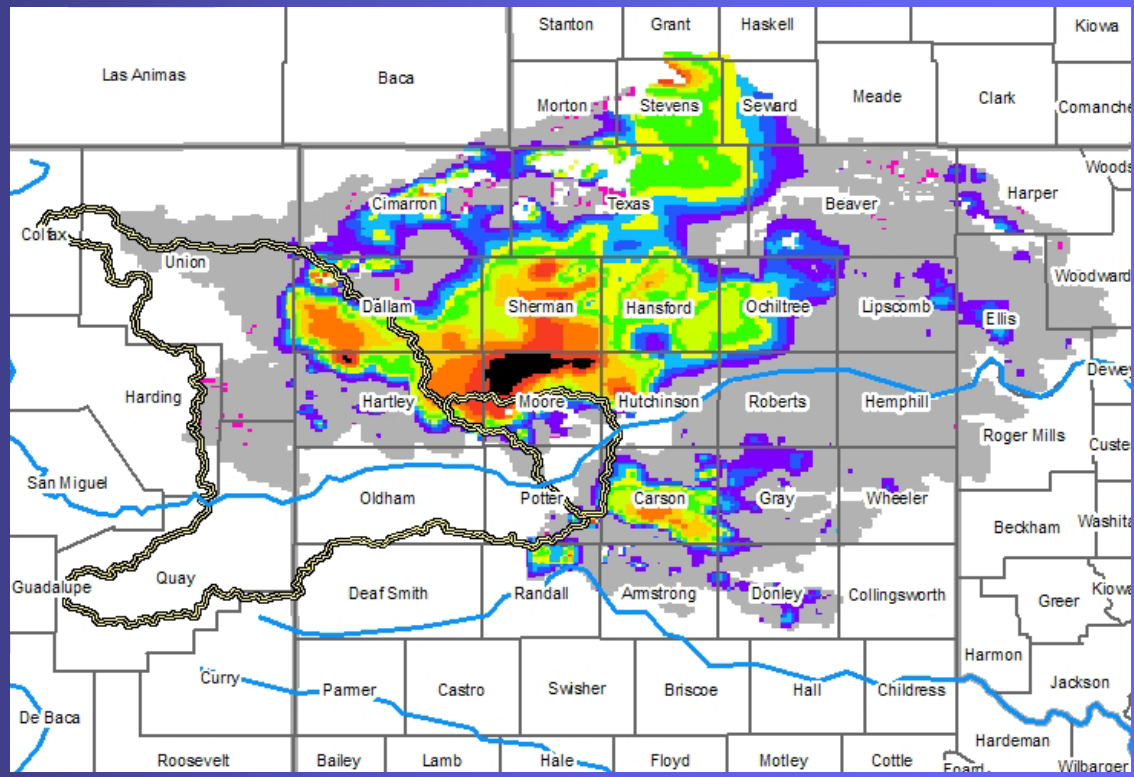
Groundwater Levels Change in N. Ogallala 1950 - 1998

Change (ft)

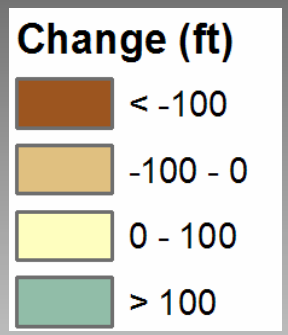
- -204 - -157
- -157 - -125
- -125 - -103
- -103 - -86
- -86 - -69
- -69 - -54
- -54 - -41
- -41 - -29
- -29 - -19
- -19 - -11
- -11 - 0
- 0 - 19

Panhandle Water Planning Area





Groundwater Levels Change in Dockum 1950s – 2000s



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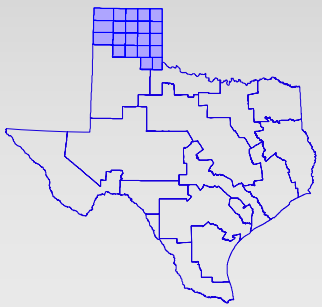

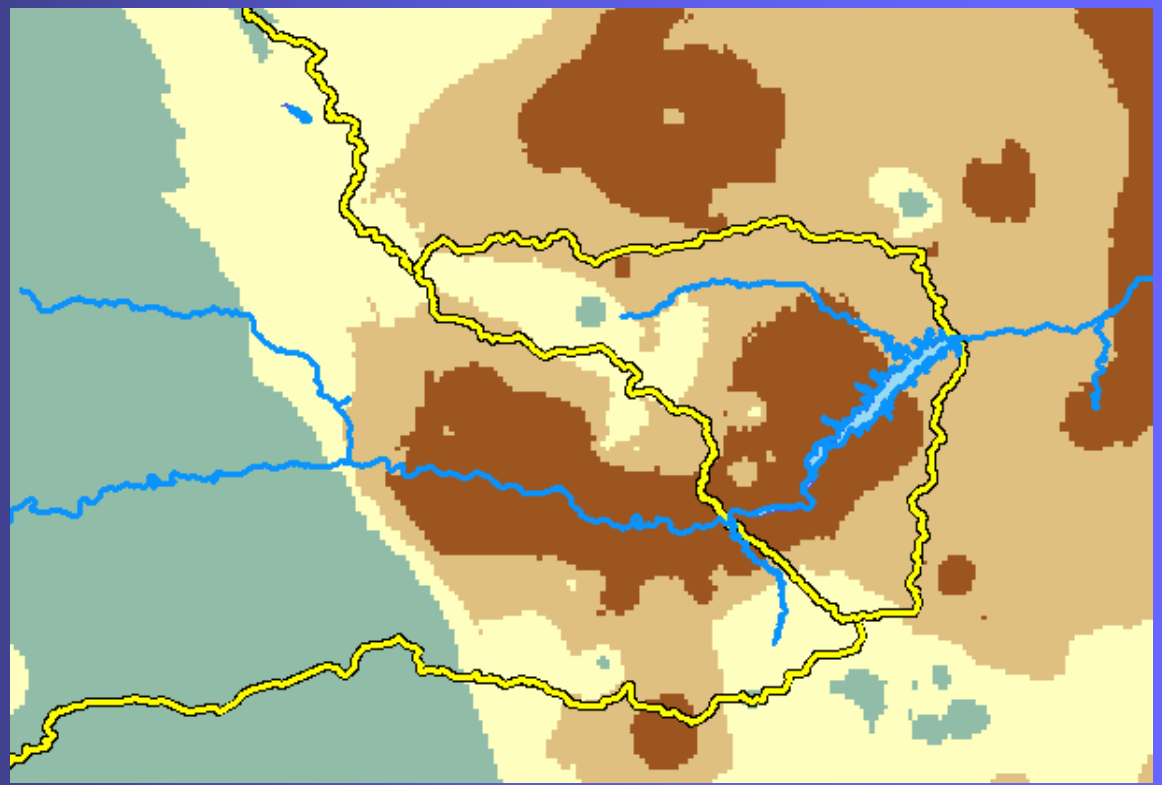

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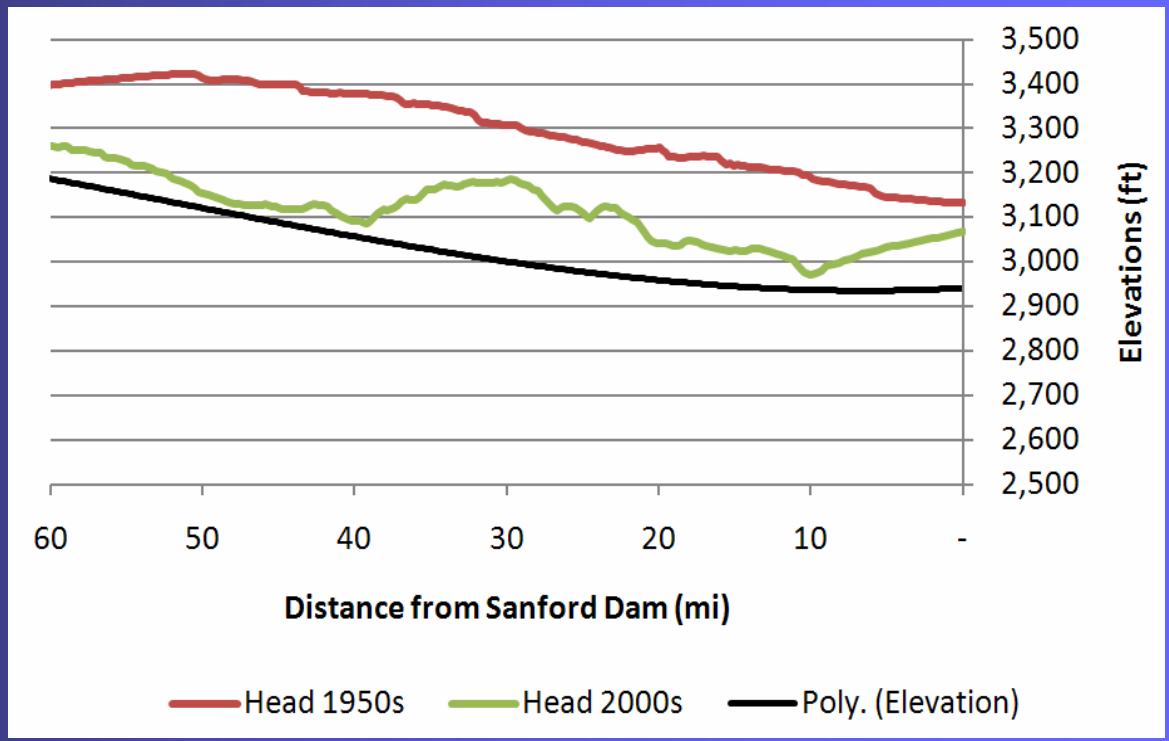

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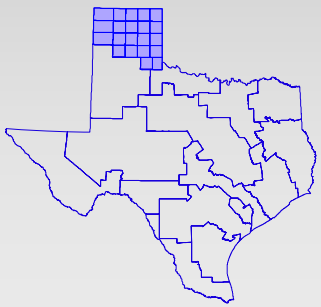
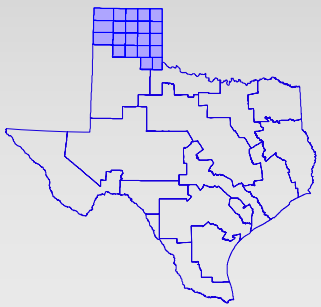


Groundwater Levels Conclusions

- **Spring flow can decrease with decreasing groundwater levels**
- **Northern Ogallala Aquifer**
  - Decreases of over 100 ft (Moore County)
  - Uncertain impact on spring flows
    - Most heavily impacted areas outside watershed
    - Could reverse GW flow direction

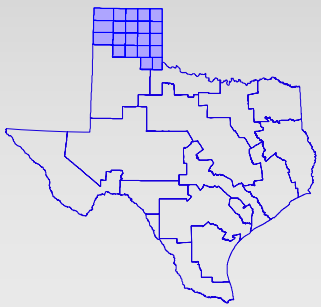
Panhandle Water Planning Area



Groundwater Levels Conclusions

- **Spring flow can decrease with decreasing groundwater levels**
- **Dockum Aquifer**
  - Decreases in groundwater levels are likely affecting the seepage face
  - Declining more rapidly in recent years

Panhandle Water Planning Area

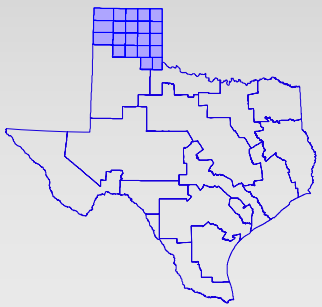


Land Cover Change Methods

- **Historical Land Cover Data**

YEAR	SCALE	CLASSES
1967	1:7,500,000	17
1970-1985	1:250,000 to 1:100,000	38
1992	30m	21
2001	30m	29

Panhandle Water Planning Area

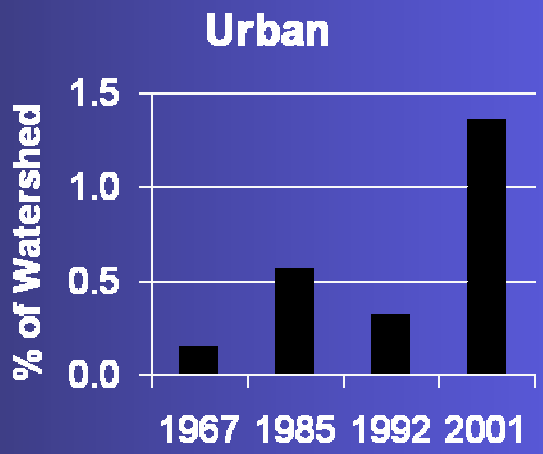


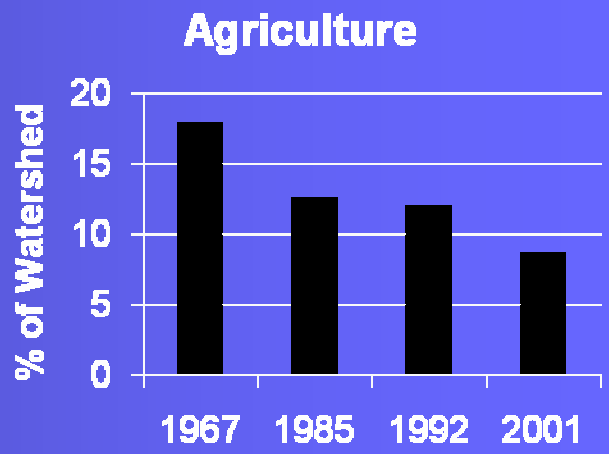
- **Reclassify into general categories**

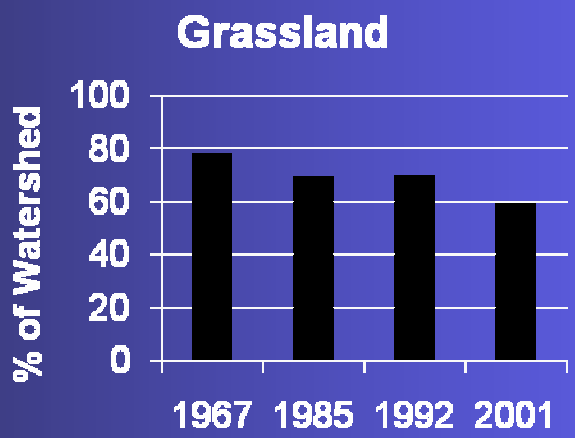
1	Urban
2	Agriculture
3	Grasslands
4	Shrubland

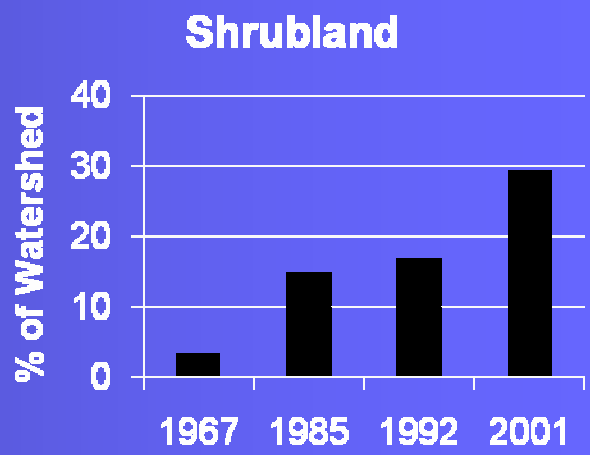
5	Forest
6	Wetlands
7	Open water
8	Barren Land

Land Cover Change Results









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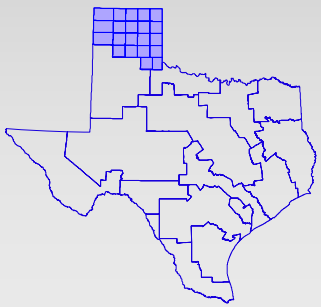
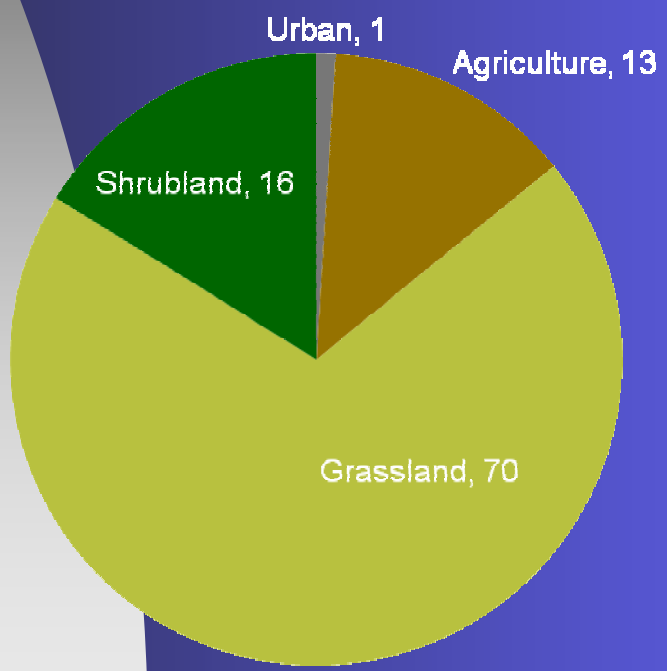


Land Cover Change Results

Historically



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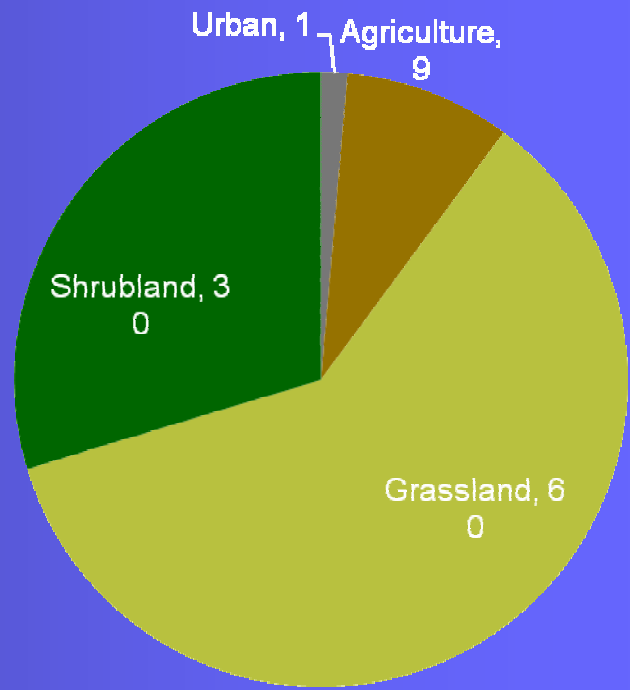

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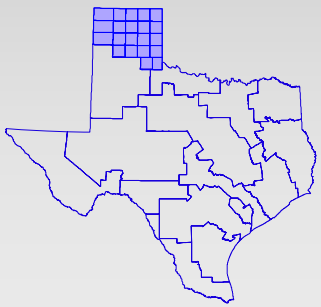
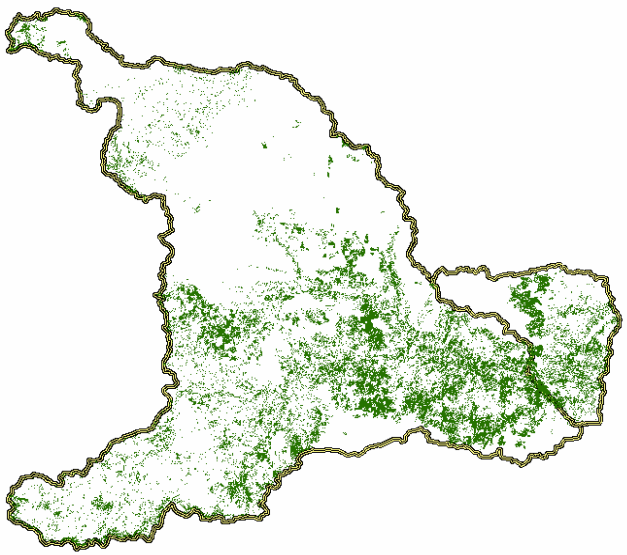


Land Cover Change Results

Shrubland

1992



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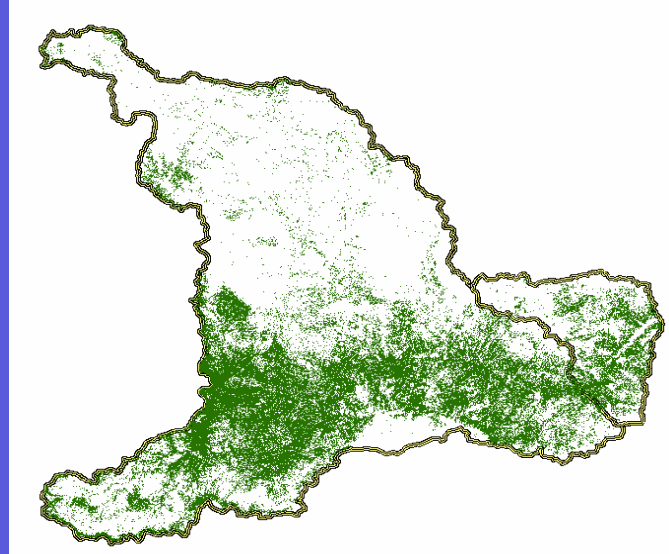

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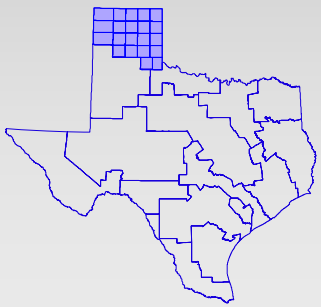
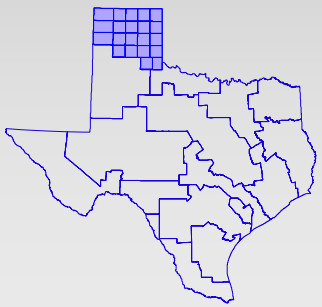


Land Cover Change Conclusions

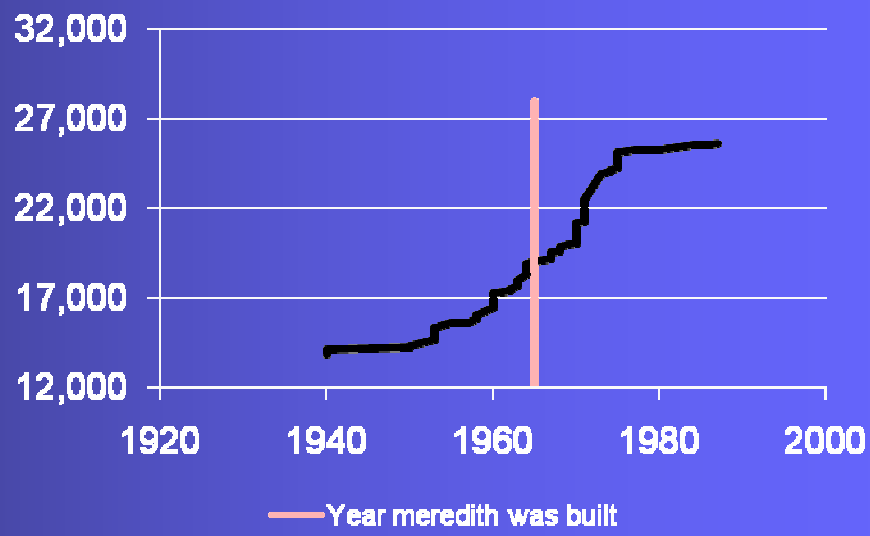
- **Land cover affects rates of infiltration, transpiration, and interception**
- **Shrubland has increased in SW**
  - SW has14 - 17 in/yr rainfall
  - Brush Management studies

Panhandle Water Planning Area



Increase in Stock Ponds

- **Data:** National Inventory of Dams
- Cumulative Capacity of Small Dams (ac-ft)



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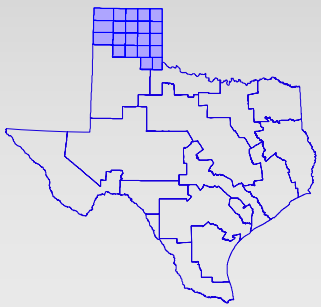
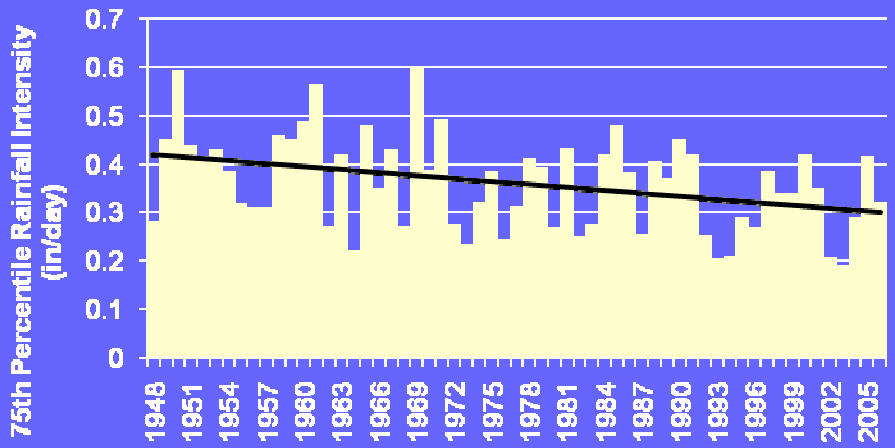


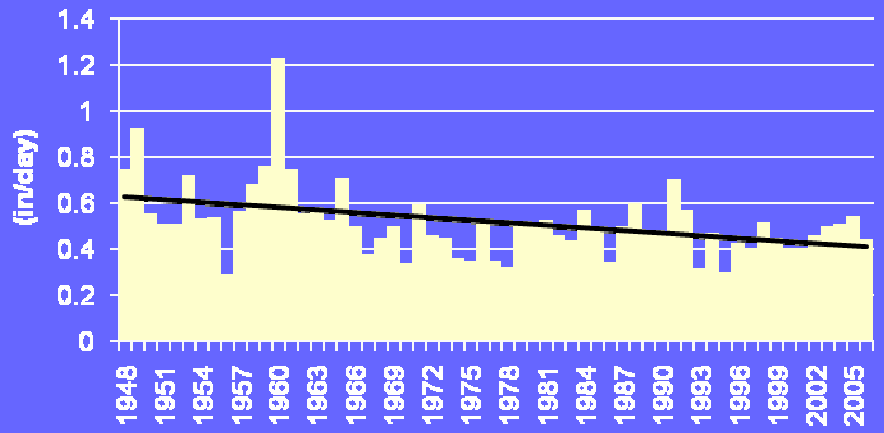
Decrease in Rainfall Intensity

- Data: NOAA, Daily Precip, 1948-2006

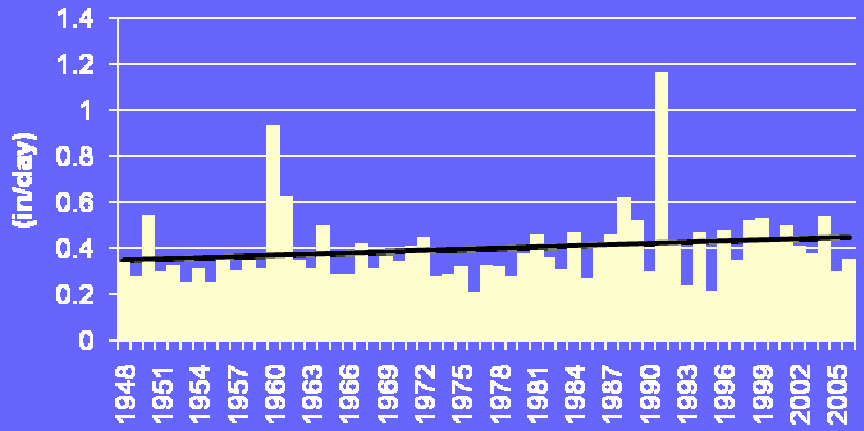
Pasamontes



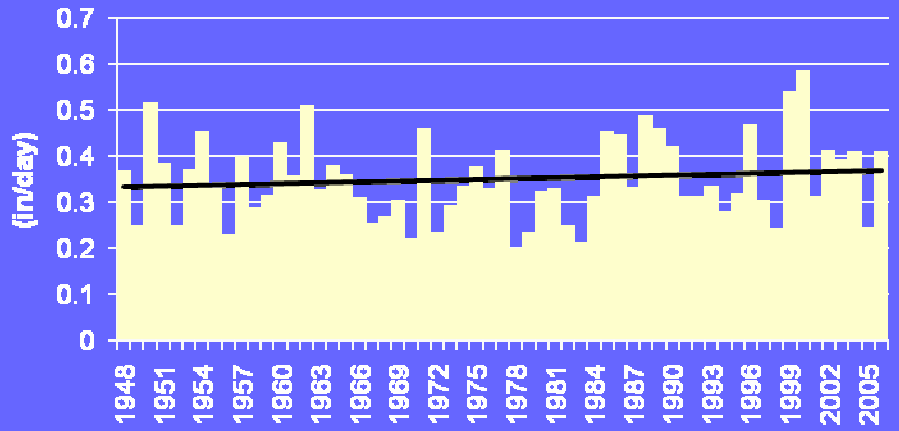
Bravo



San Jon



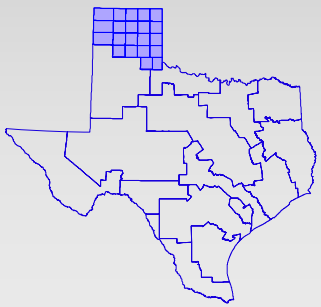
Amarillo



What is reducing the level in Lake Meredith?

- **Hydrologic Loss**
  - Decreased Precipitation Amounts? No
  - Decreased Precipitation Intensity? Inconclusive
  - Increased Potential Evaporation? No
- **Groundwater-Surface Water Interaction**
  - Declining Ogallala Levels? Possibly
  - Declining Dockum Levels? Probably
- **Land Use Change**
  - Increase in Shrub? Possibly
  - Decrease in Irrigated Agriculture? Not significant
  - Increase in Stock Ponds? Not significant

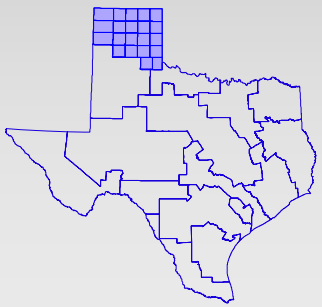
Panhandle Water Planning Area



Lake Meredith Study Conclusions

- Decreased streamflow does not appear to be meteorological in origin
- Groundwater-Surface Water Interactions are likely playing significant roles
- Land-use changes may be a factor

Panhandle Water Planning Area



Thank You

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Water Resources Planning

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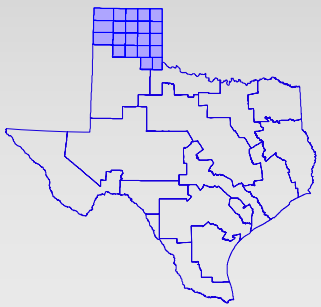

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Panhandle Water Planning Area