Oklahoma's Dependence on Groundwater

Governor's Water Conference 2005

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Director, USGS Oklahoma Water Science Center

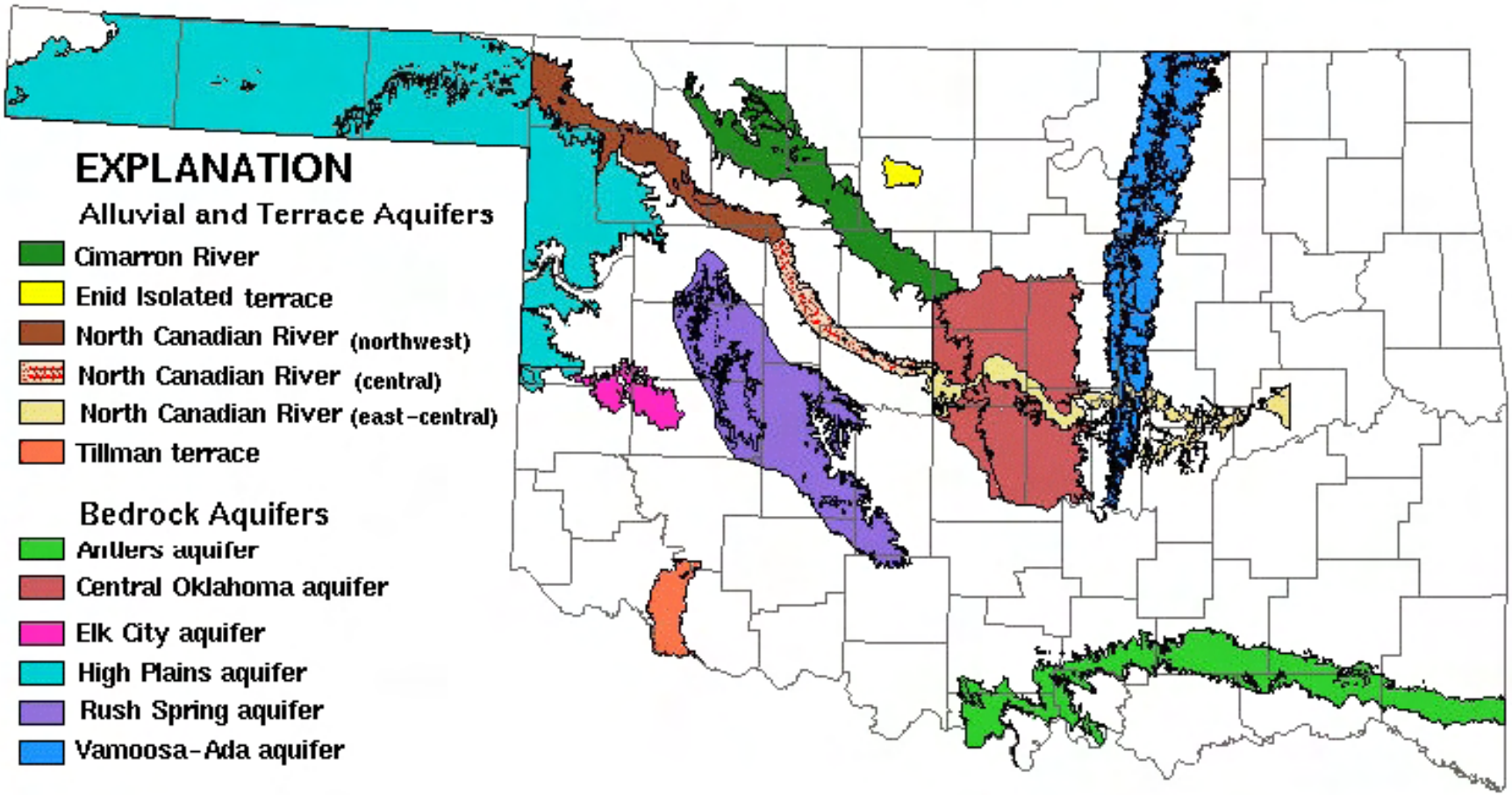
U.S. Department of the Interior
U.S. Geological Survey

Topics:

- Where is the ground water?
- How much do we use?
- How does it interact with surface water?
- Why should we care if it interacts with surface water?
- How do we measure and monitor how much water we have?

USGS

OKLAHOMA AQUIFERS WITH DIGITAL DATA SETS



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How much water is 1 million gallons per day (1MGD)?

- 1MGD is a volume = enough water to cover 1 acre about 3 ft deep each day

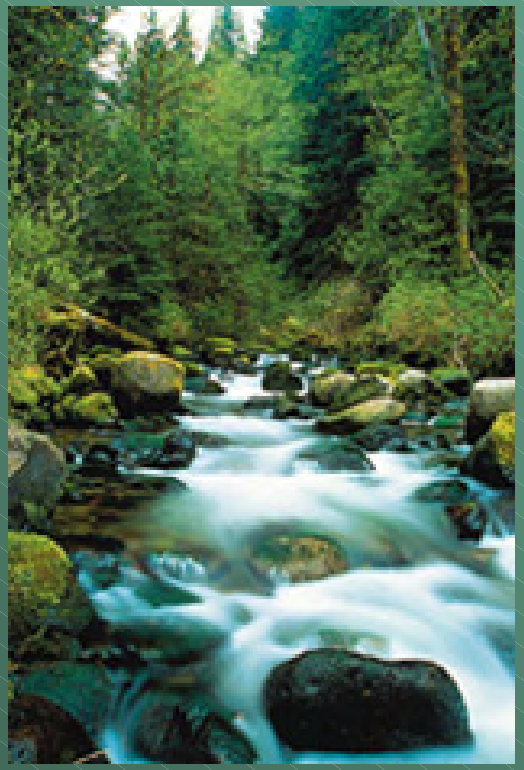
- Over the course of a year, 1MGD is enough to cover 1 acre to a depth of about 1100 ft!

USGS

How much water do we use?

- Ground Water

- Surface Water



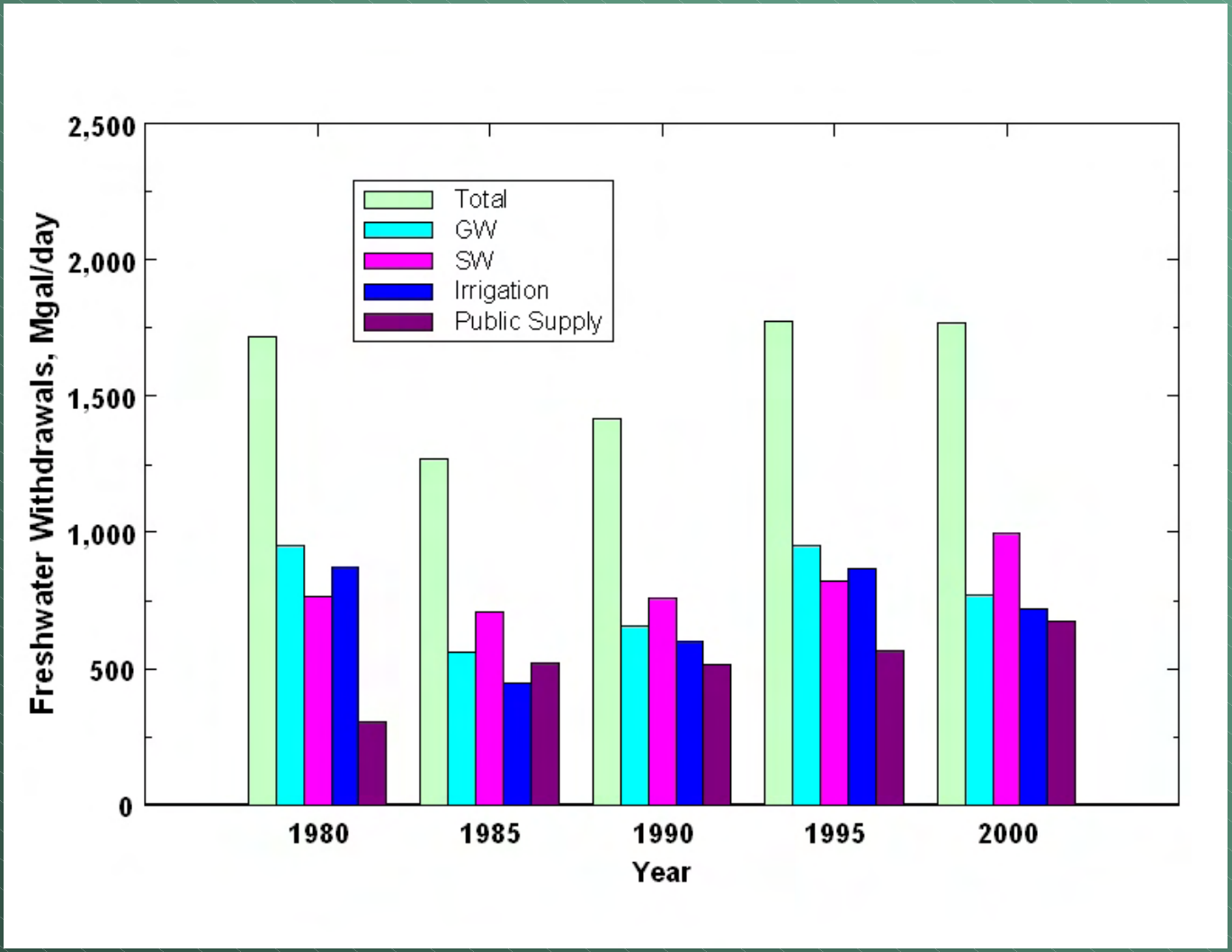
Freshwater Withdrawals 2000

- Oklahoma Water Use Year 2000:

  1,772 Million Gallons Per Day (MGD)
- Three Largest Use Categories:
  - Irrigation 40%
  - Public Supply 38%
  - Livestock 9 %

USGS

Comparison Oklahoma Water Use 1980-2000



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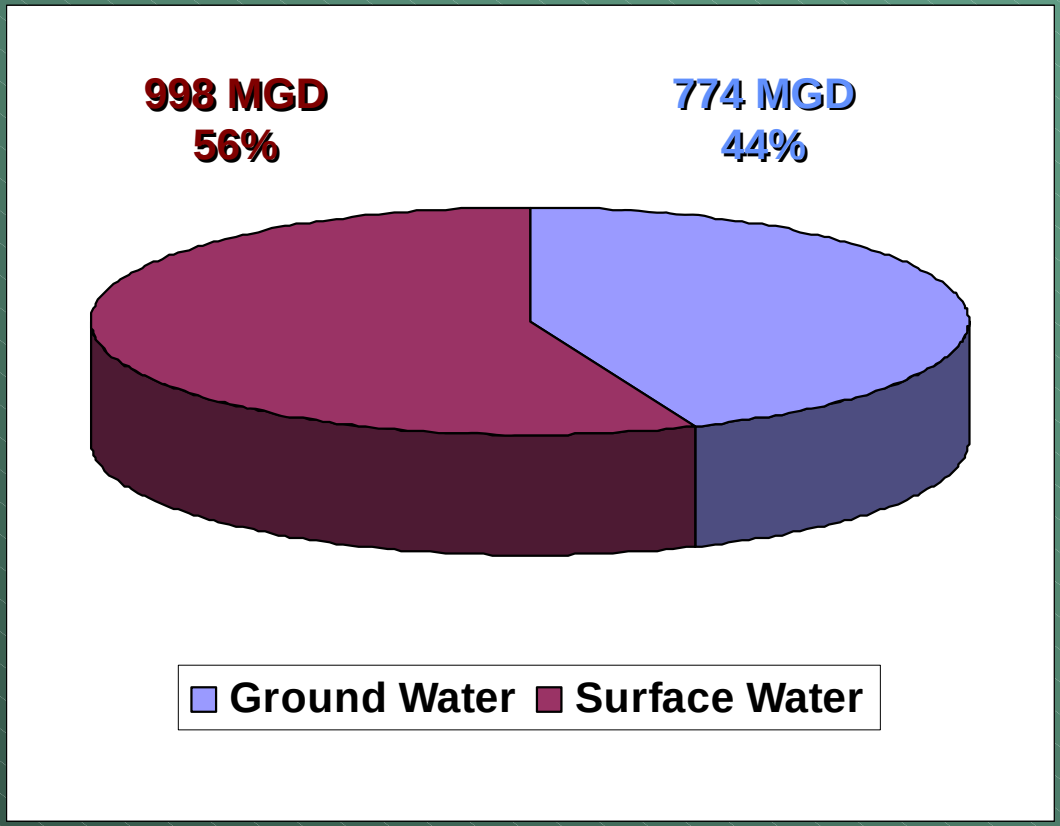
Freshwater Withdrawals 2000

1,772 Million Gallons Per Day



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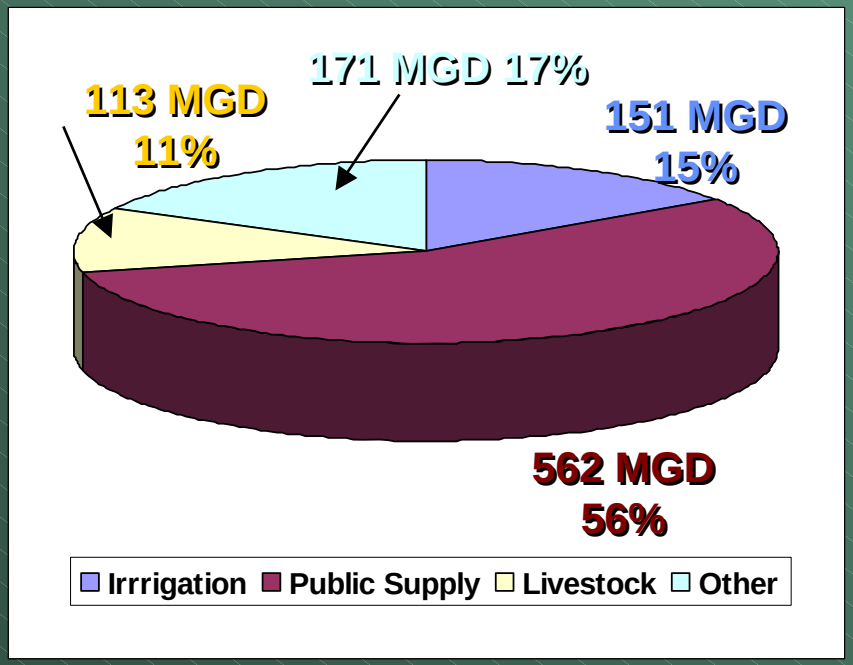
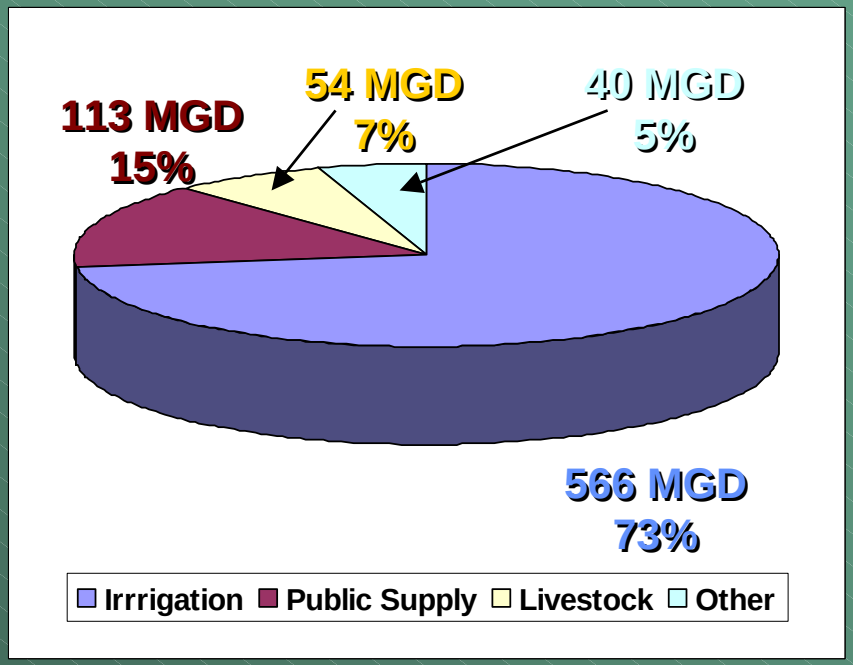
Water Withdrawals 2000

Surface



Ground



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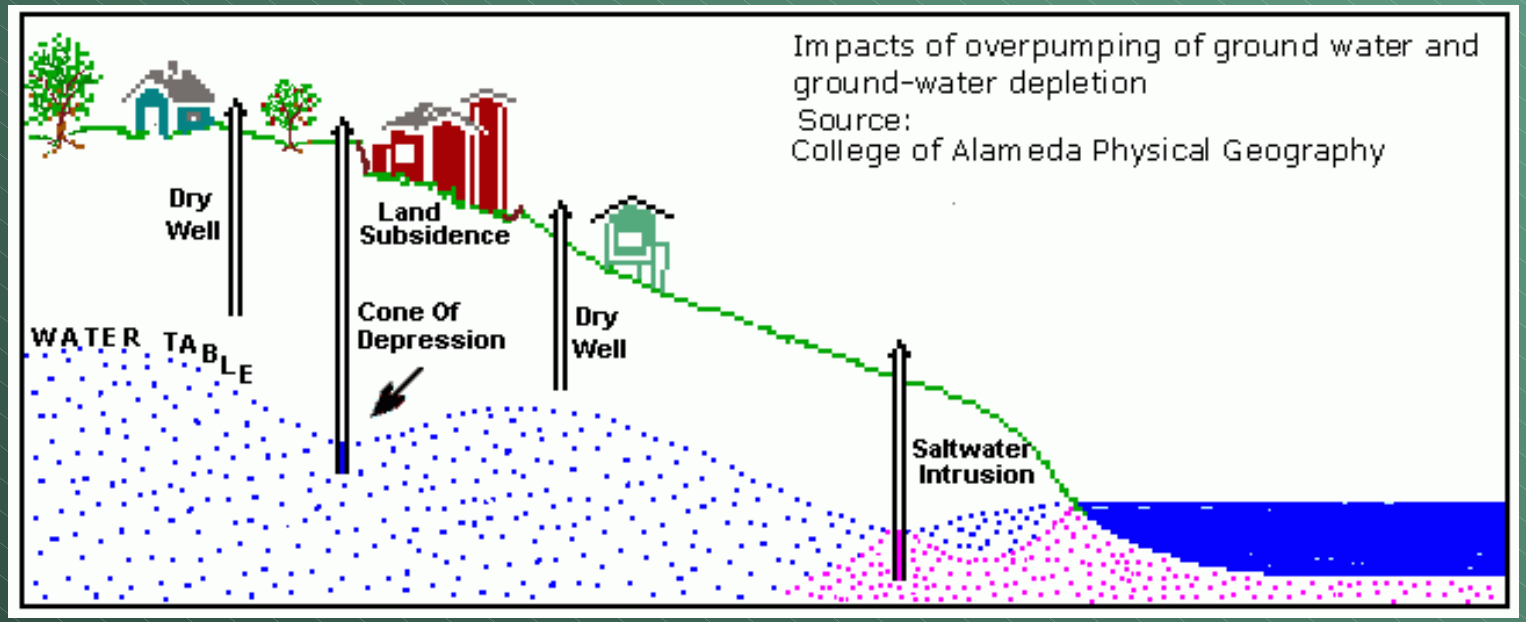
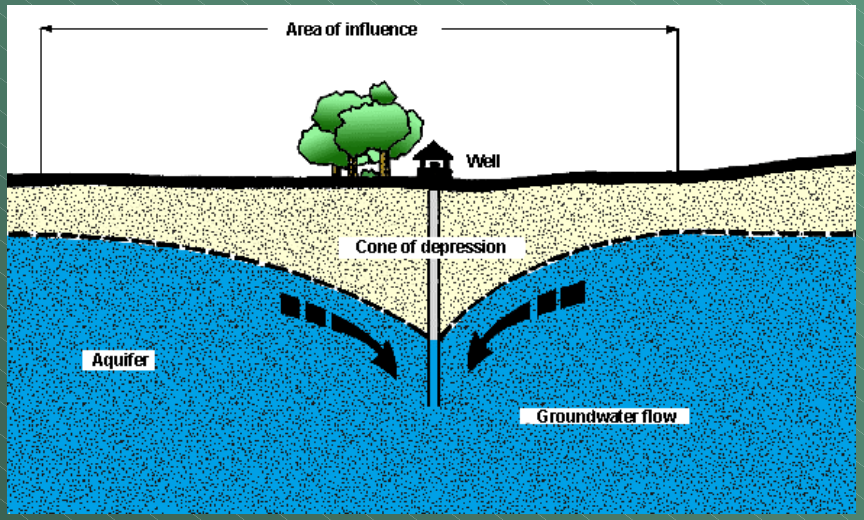
What are the effects of over pumping ground water?

- drying up of wells
- reduction of water in streams and lakes
- deterioration of water quality
- increased pumping costs
- land subsidence



Not All Ground Water Is Available For Use

- Hydrologic Issues
  - Low Permeability Zones
  - Unequal Distribution
- Water-Quality Issues
  - High Dissolved Solids
  - Natural Trace Contamination
  - Anthropogenic Contamination
  - Salt Water Intrusion
- Economic Issues
  - Increasing Lift
  - Cost of Energy



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Reconnaissance of the Hydrology, Water Quality, and Sources of Bacterial and Nutrient Contamination in the Ozark Plateaus Aquifer System and Cave Springs Branch of Honey Creek, Delaware County, Oklahoma, March 1999 - March 2000

Schlottmann, J.L., Tanner, Ralph, and Samadpour, Mansour

USGS WRIR 00-4210

In cooperation with the
State of Oklahoma Office of the Attorney General

USGS

http://pubs.usgs.gov/wri/wri004210/pdf/wri004210book.pdf

Caves Springs Branch – Types of contaminants and number of detects

(10 domestic wells, 7 surface water sites)

Compound Classes (47 analytes)	***Surface/Spring*** *water*		***Ground*** *water*	
	Types detected	*Total Detects*	*Types detected*	*Total Detects*
Detergent metabolites	4	9	--	**ND**
Disinfectants	2	7	2	2
Steroids	3	7	2	2
Fire retardants	1	4	1	2
Fragrance	1	2	1	2
Fumigants	2	6	--	**ND**
Stimulants	2	8	1	3
Plasticizers	**5**	**7**	**3**	**5**
Preservatives	2	9	1	1
PAHs	3	4	1	1

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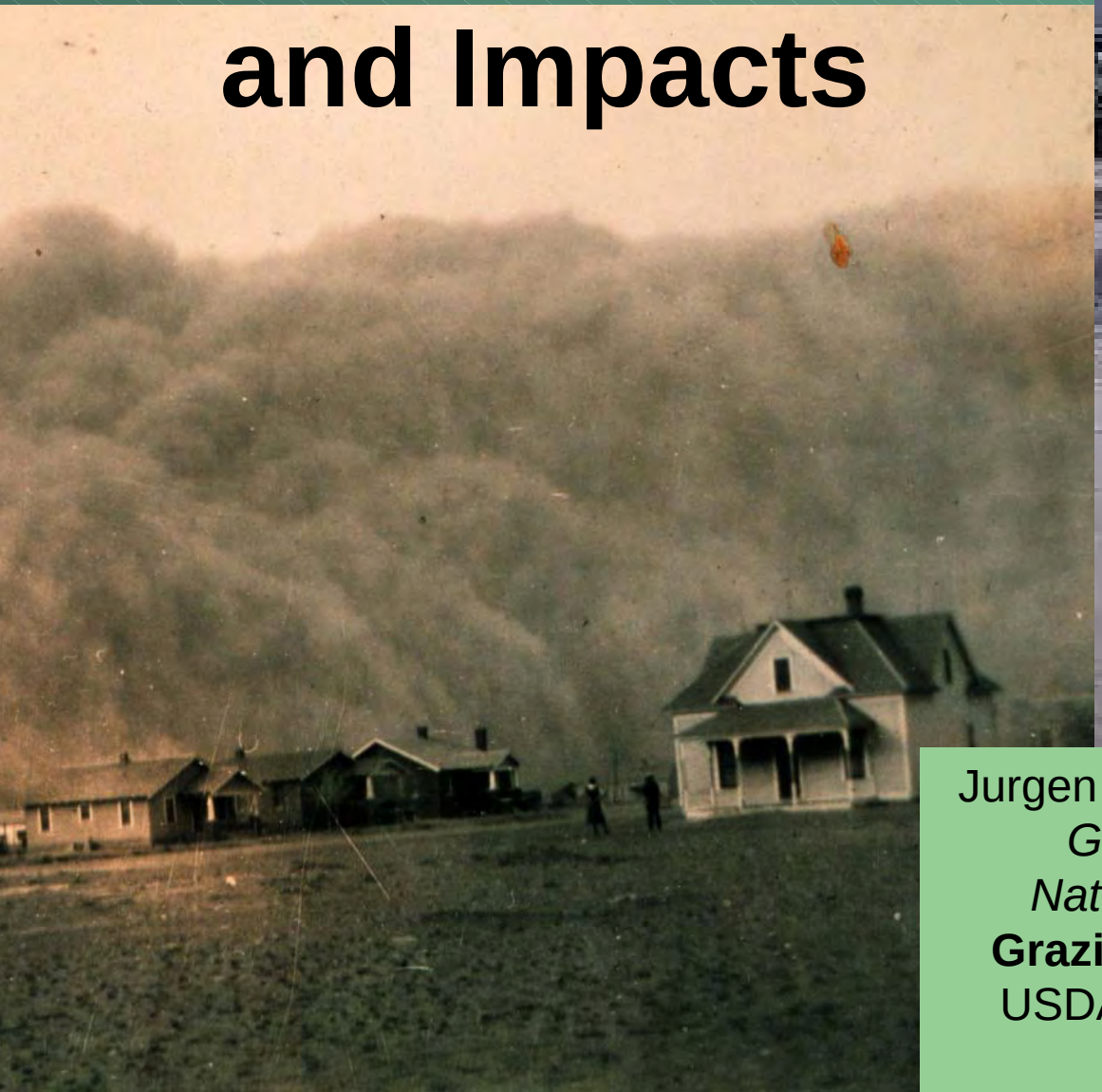
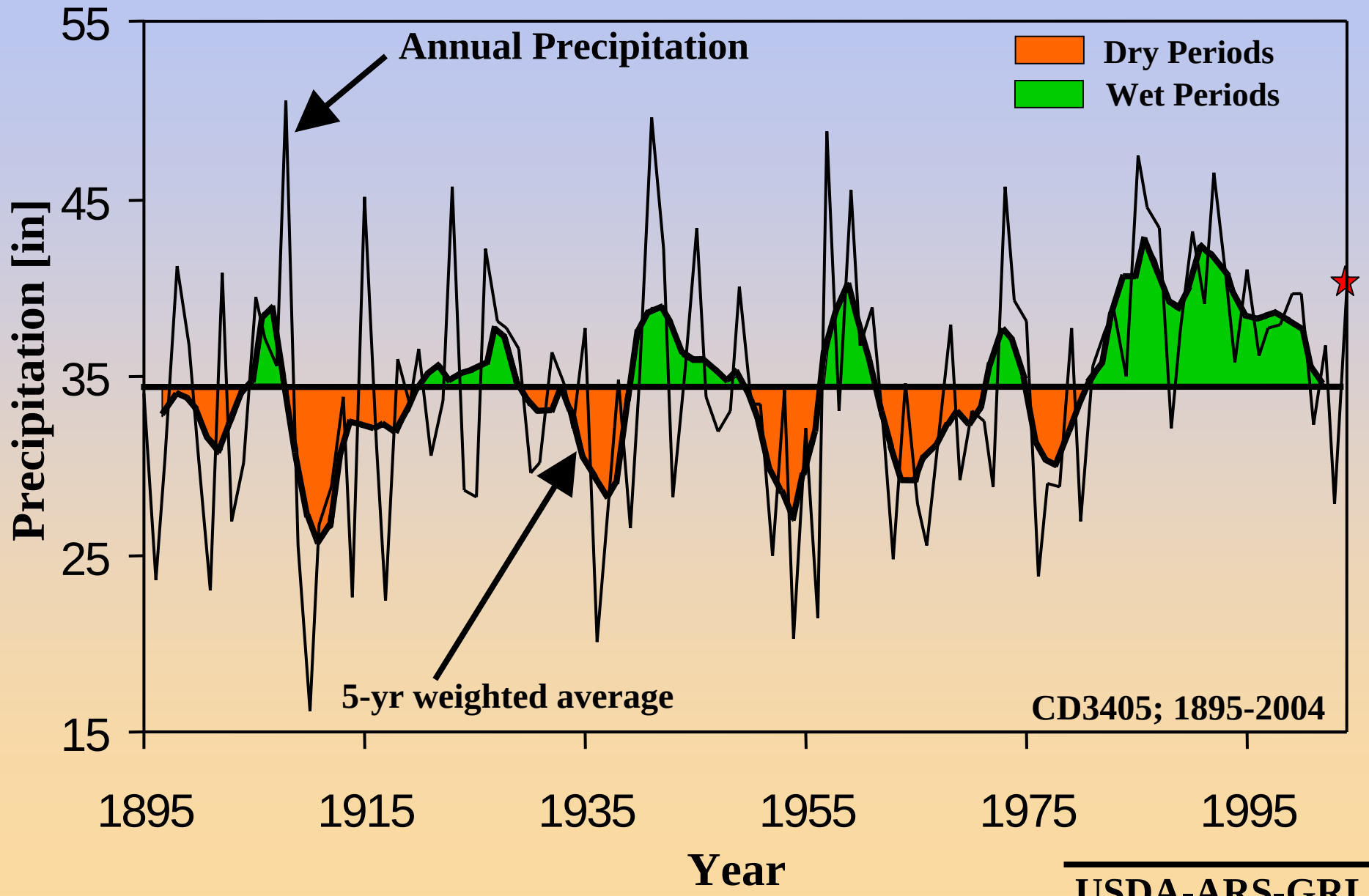
Decade Scale Climate Variations and Impacts



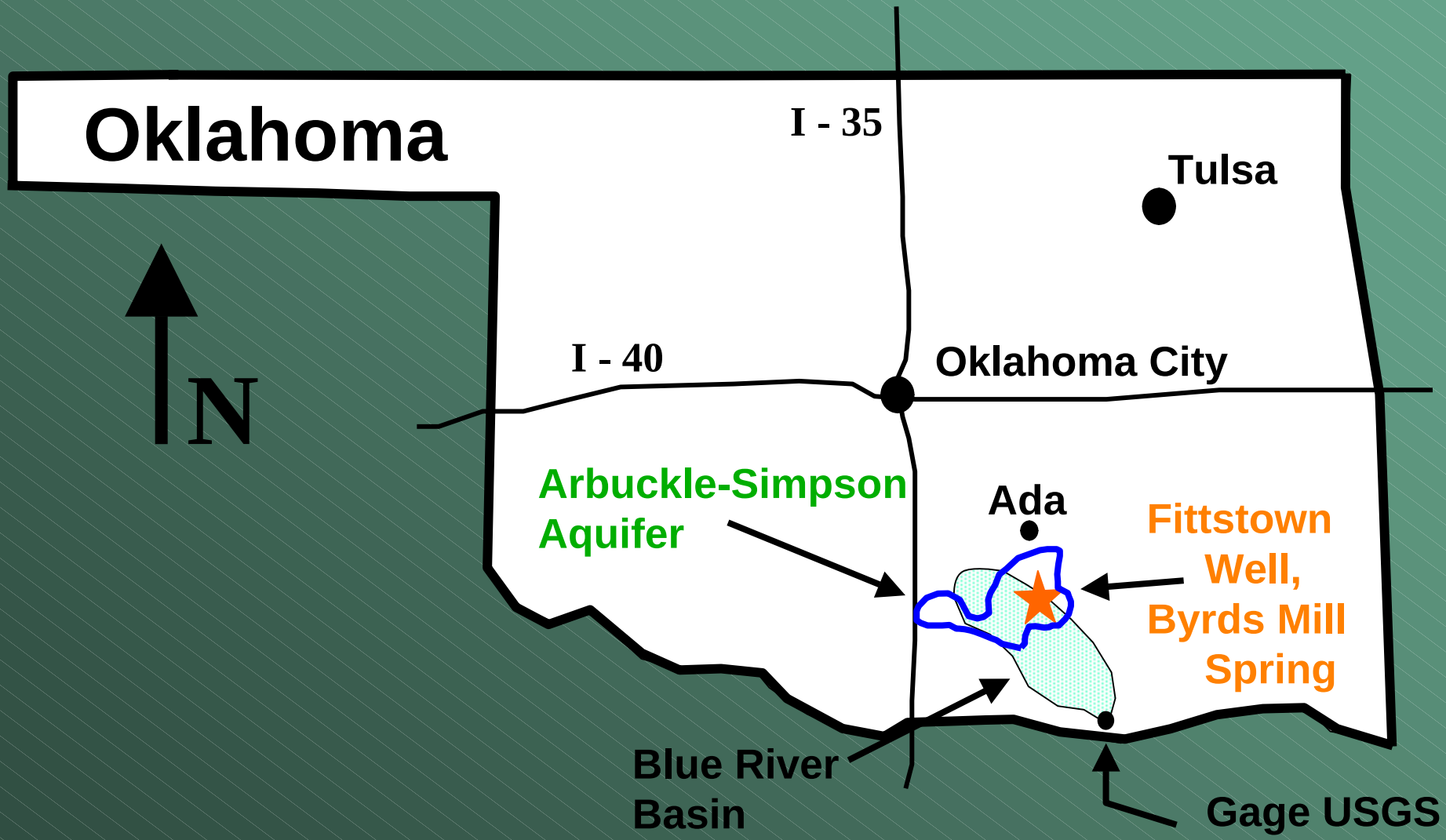
Jurgen Garbrecht and Jeanne Schneider
Great Plains Agroclimate and Natural Resources Research Unit
Grazinglands Research Laboratory
USDA Agricultural Research Service
El Reno, OK

Annual Precipitation in Central Oklahoma



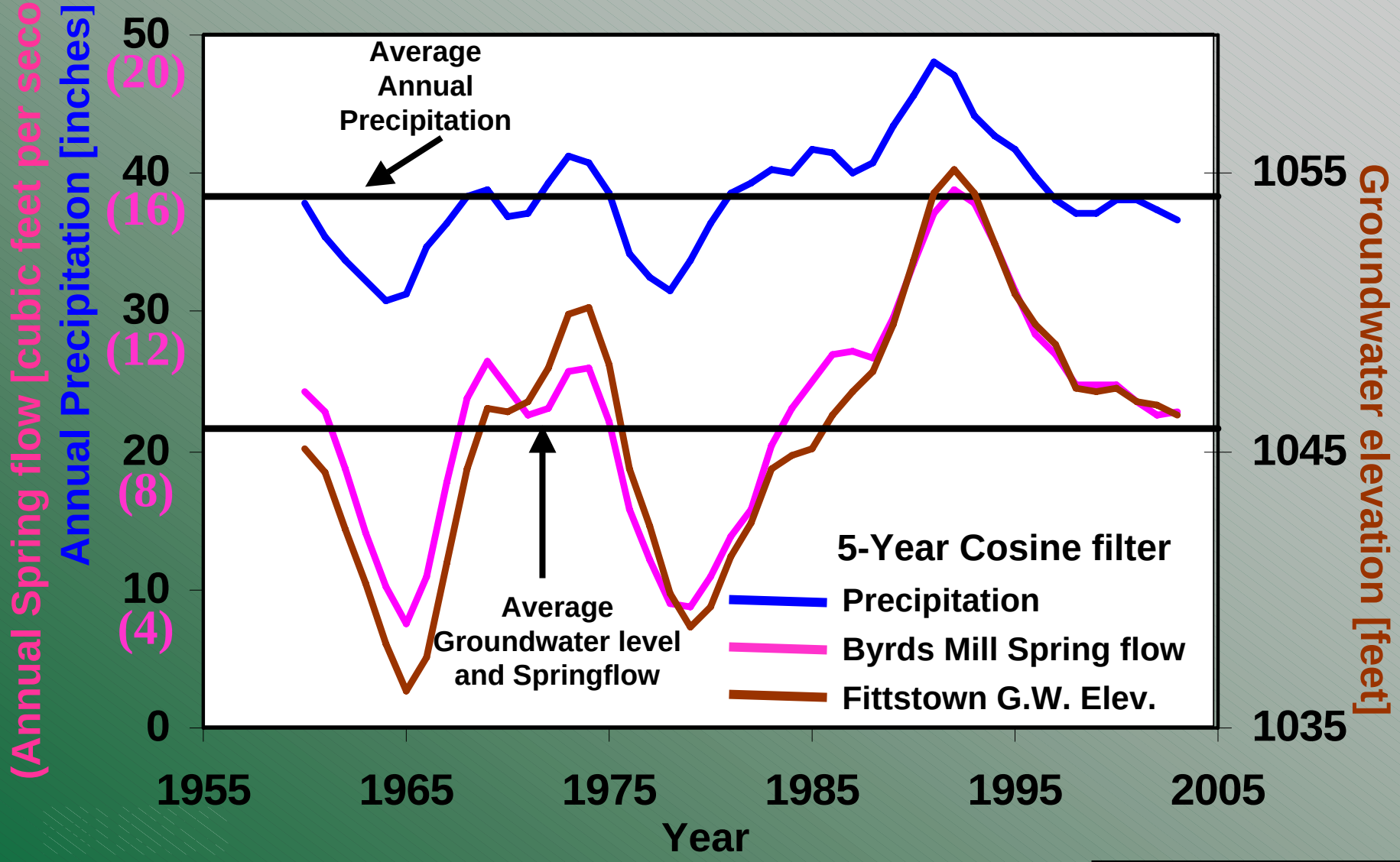
USDA-ARS-GRL

Situation Map



USGS USDA-ARS-GRL

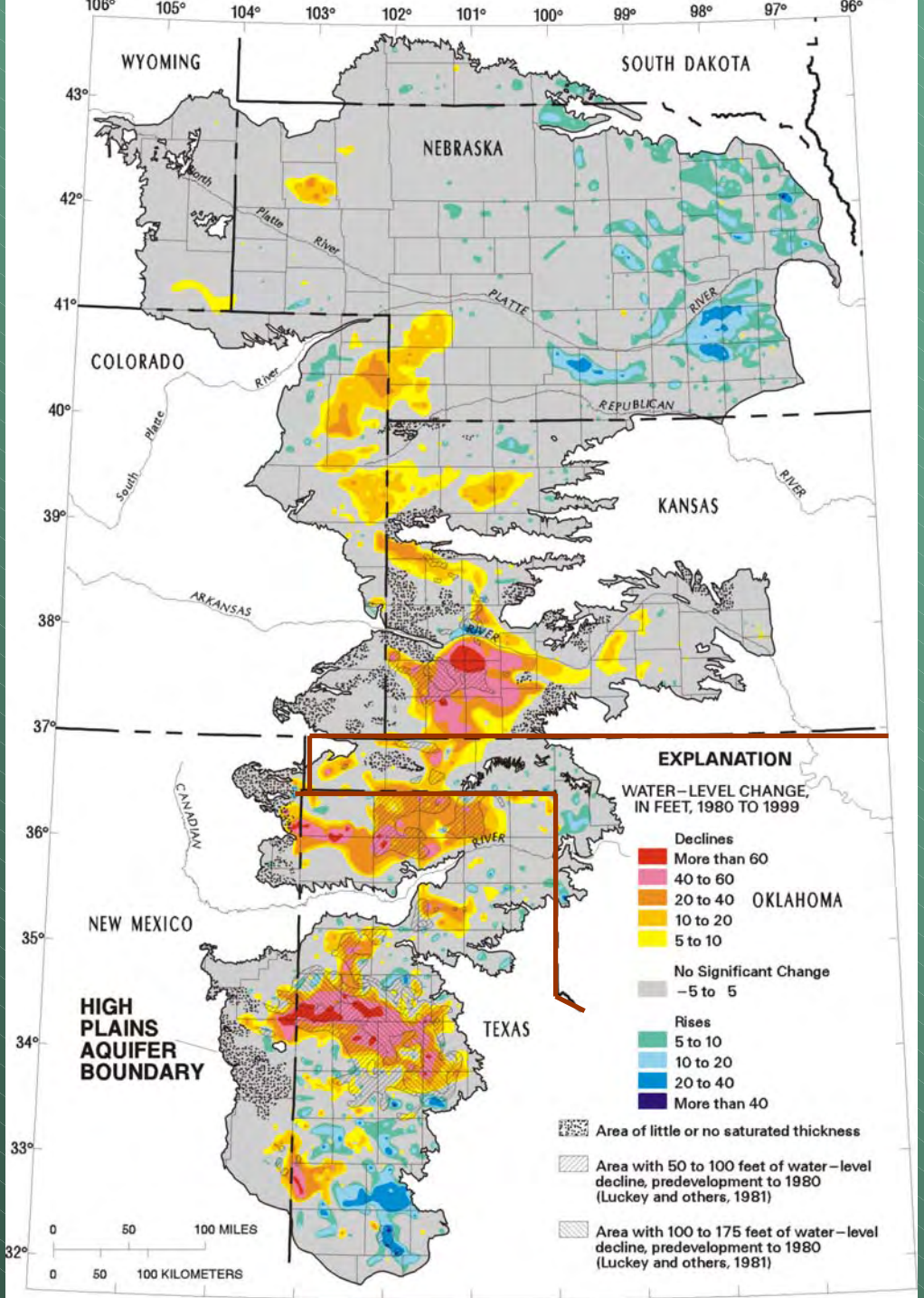
Fittstown Well and Byrds Mill Spring



Preliminary results, subject to revision.

USDA-ARS-GRL

Water-Level Change in the High Plains Aquifer 1980-99



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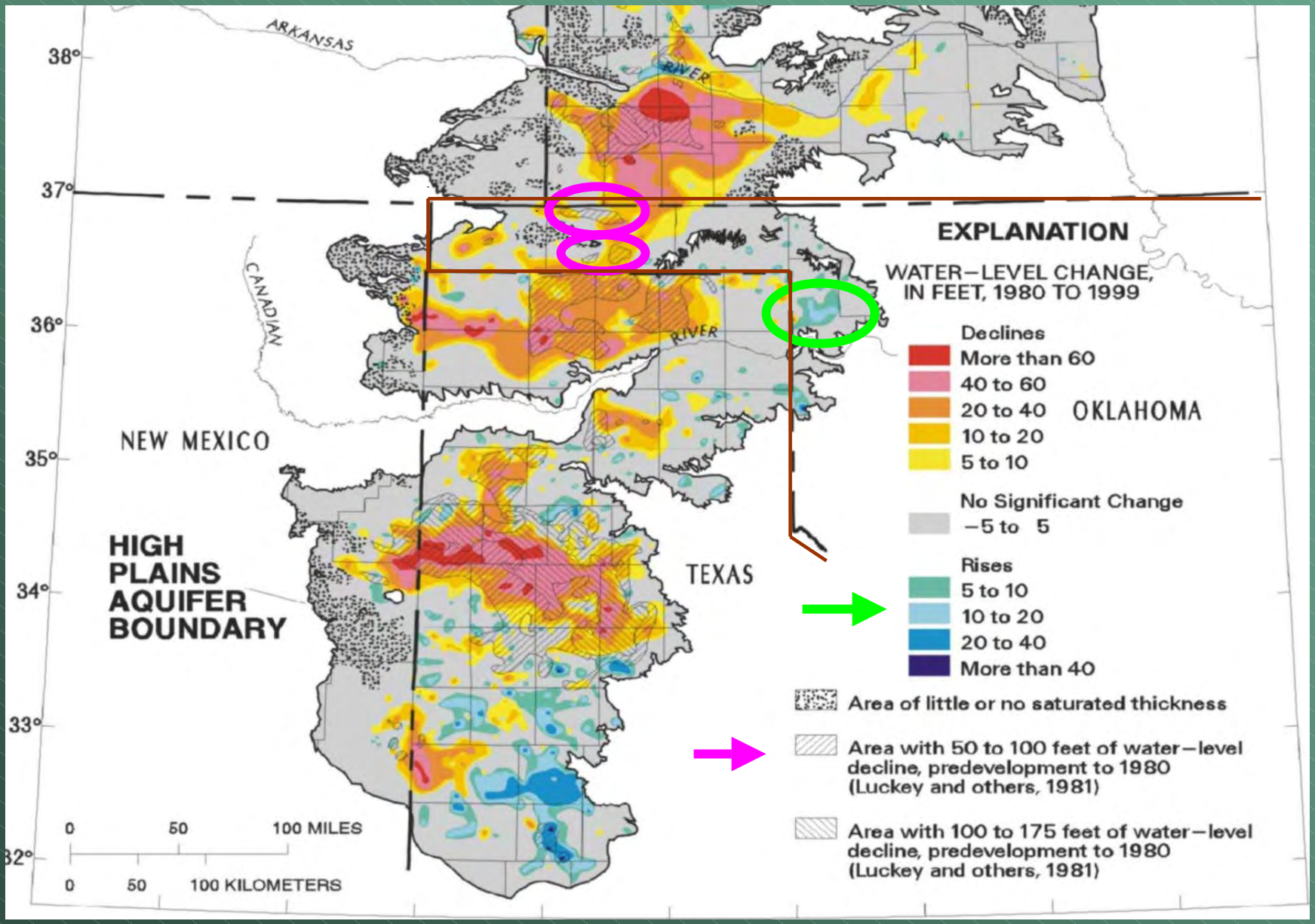
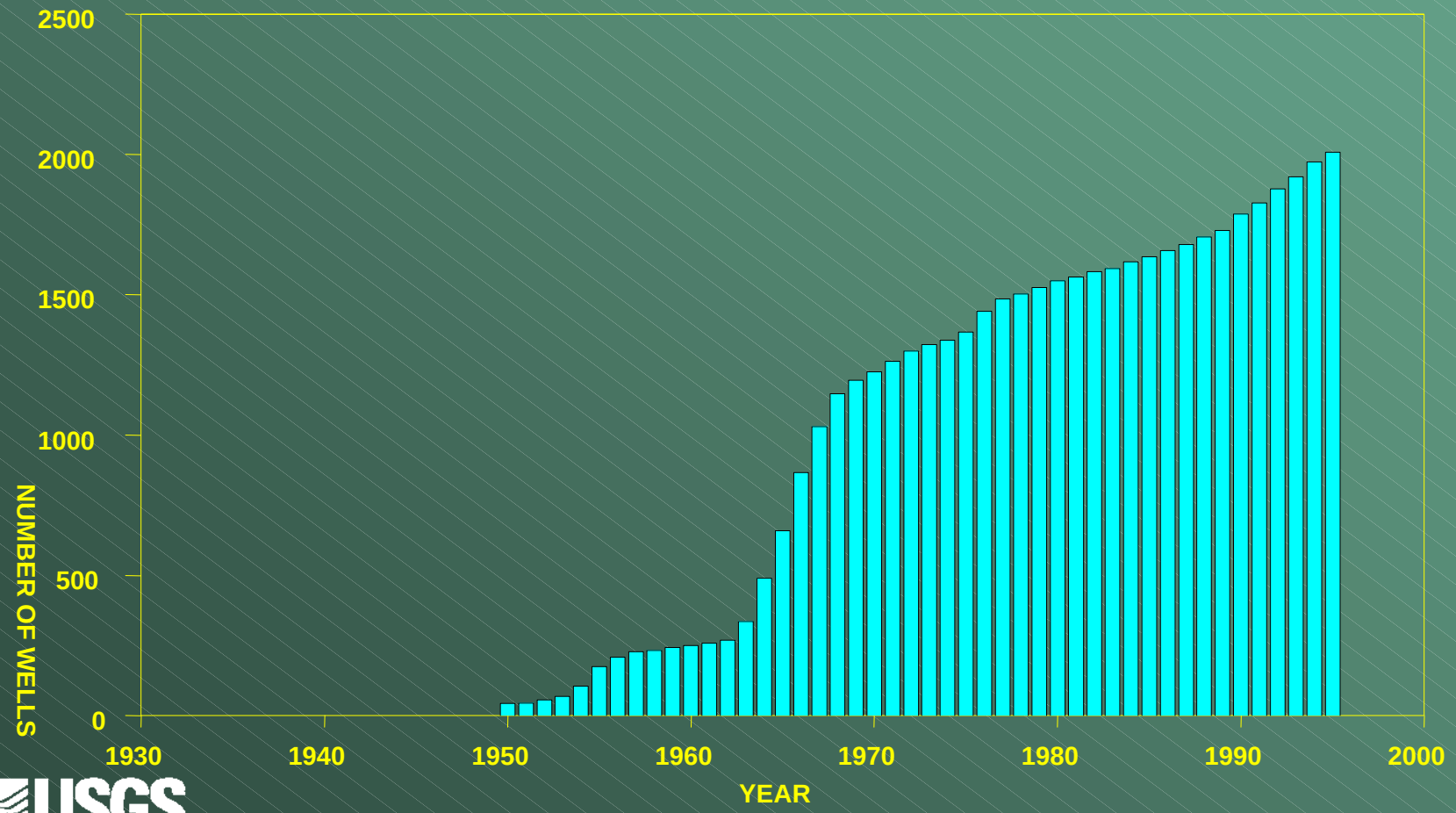

ARKANSAS
RIVER
CANADIAN
RIVER
NEW MEXICO
TEXAS
OKLAHOMA
HIGH PLAINS AQUIFER BOUNDARY
38°
37°
36°
35°
34°
33°
32°
0 50 100 MILES
0 50 100 KILOMETERS
EXPLANATION
WATER–LEVEL CHANGE, IN FEET, 1980 TO 1999
Declines
More than 60
40 to 60
20 to 40
10 to 20
5 to 10
No Significant Change
–5 to 5
Rises
5 to 10
10 to 20
20 to 40
More than 40
Area of little or no saturated thickness
Area with 50 to 100 feet of water–level decline, predevelopment to 1980 (Luckey and others, 1981)
Area with 100 to 175 feet of water–level decline, predevelopment to 1980 (Luckey and others, 1981)

USGS

Increases in Numbers of Large-Capacity Irrigation Wells in the Oklahoma Panhandle



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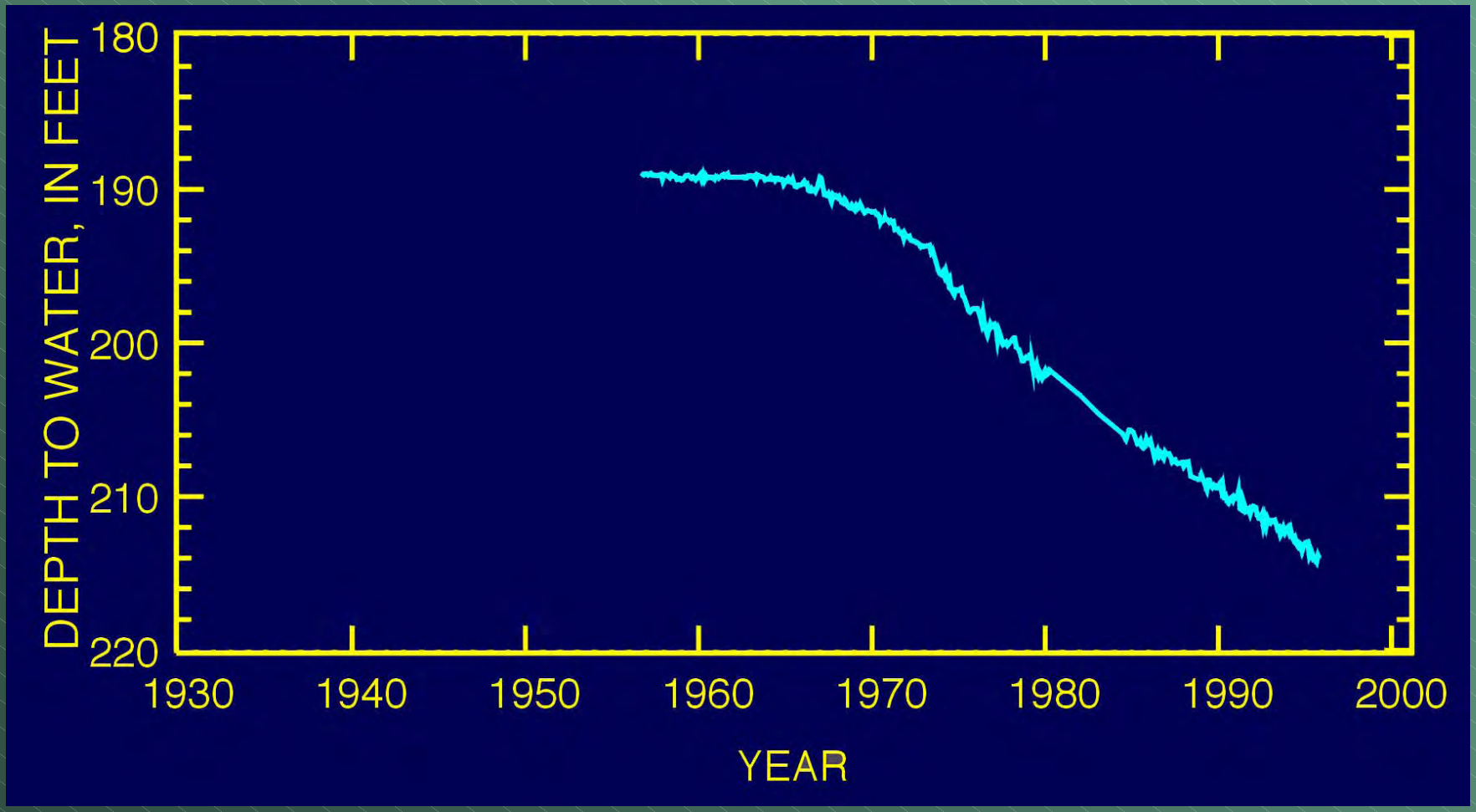
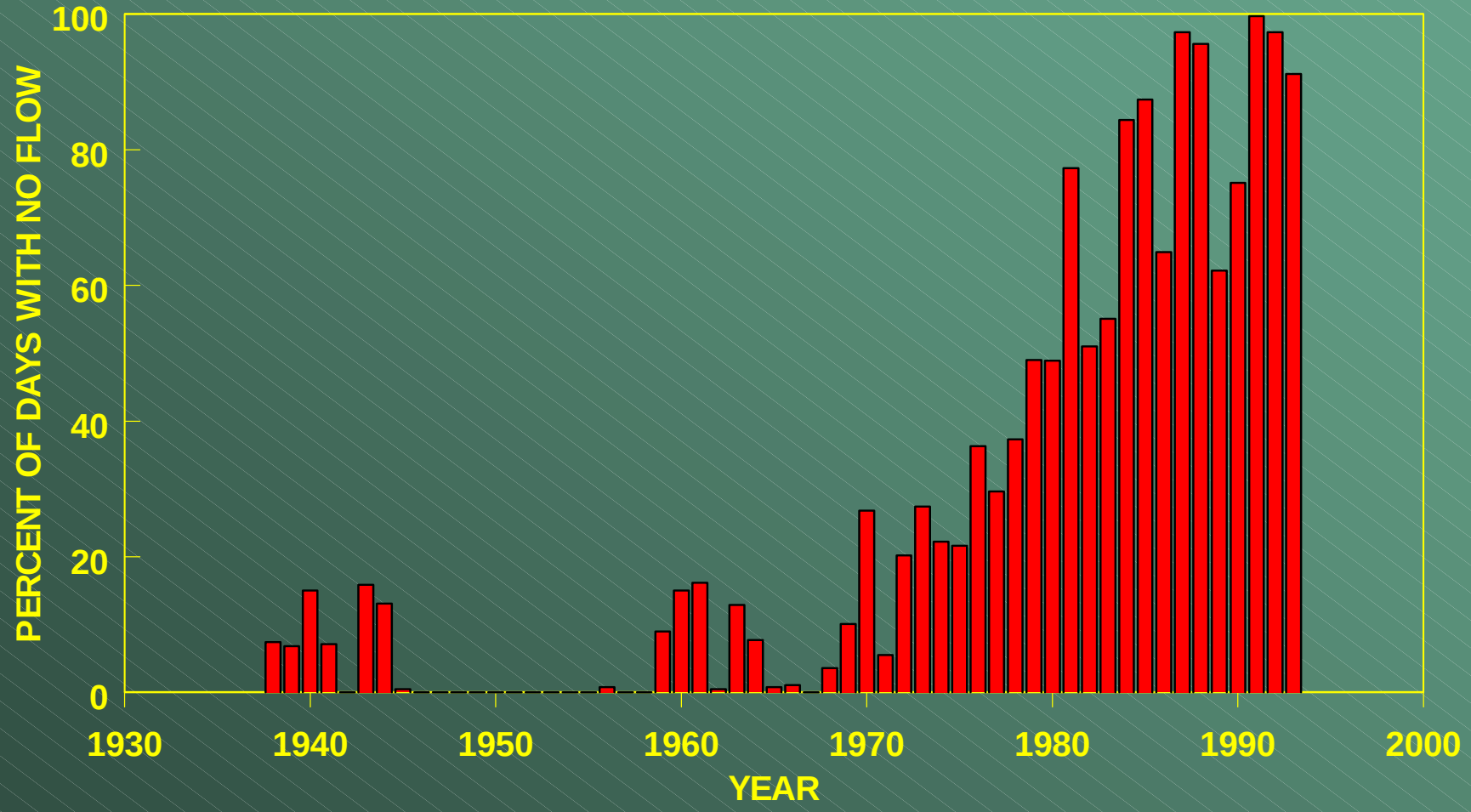
Depth to Water in a key Oklahoma Well in the High Plains Aquifer



USGS

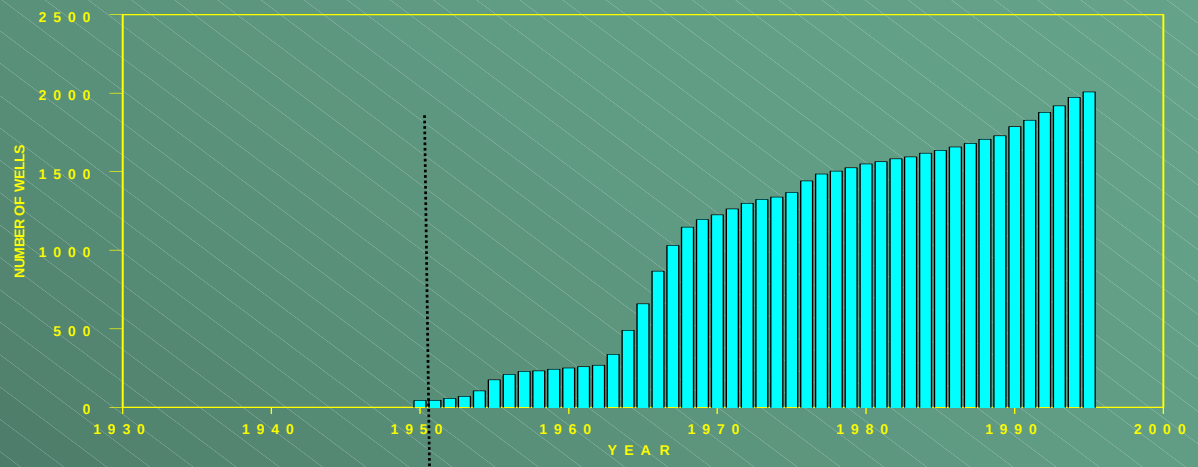
Percentage of no-flow days for the Beaver River near Guymon, OK



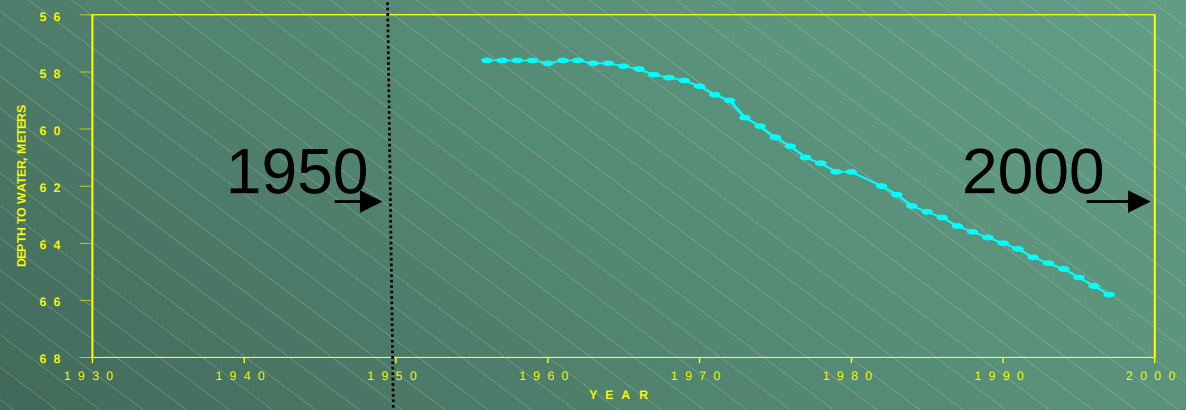
USGS

1930 - 2000

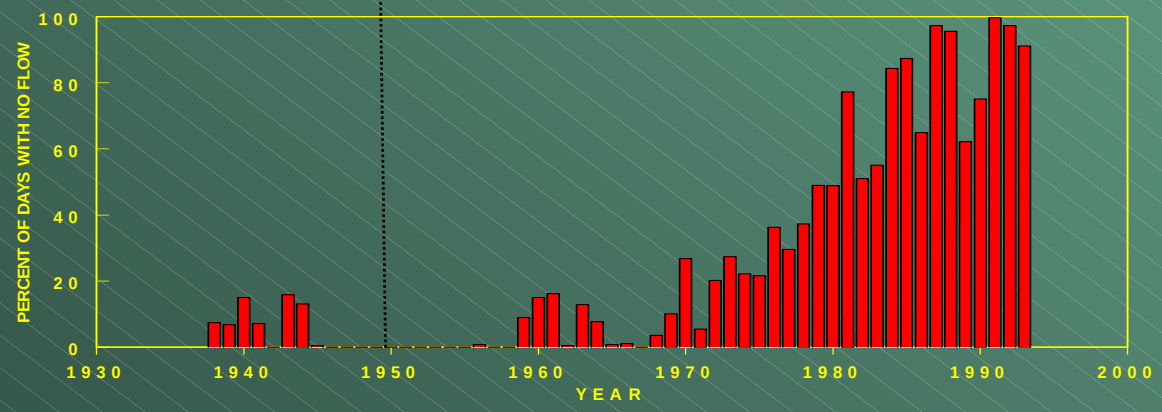
Increase in wells



Water level decline



Percent no flow days



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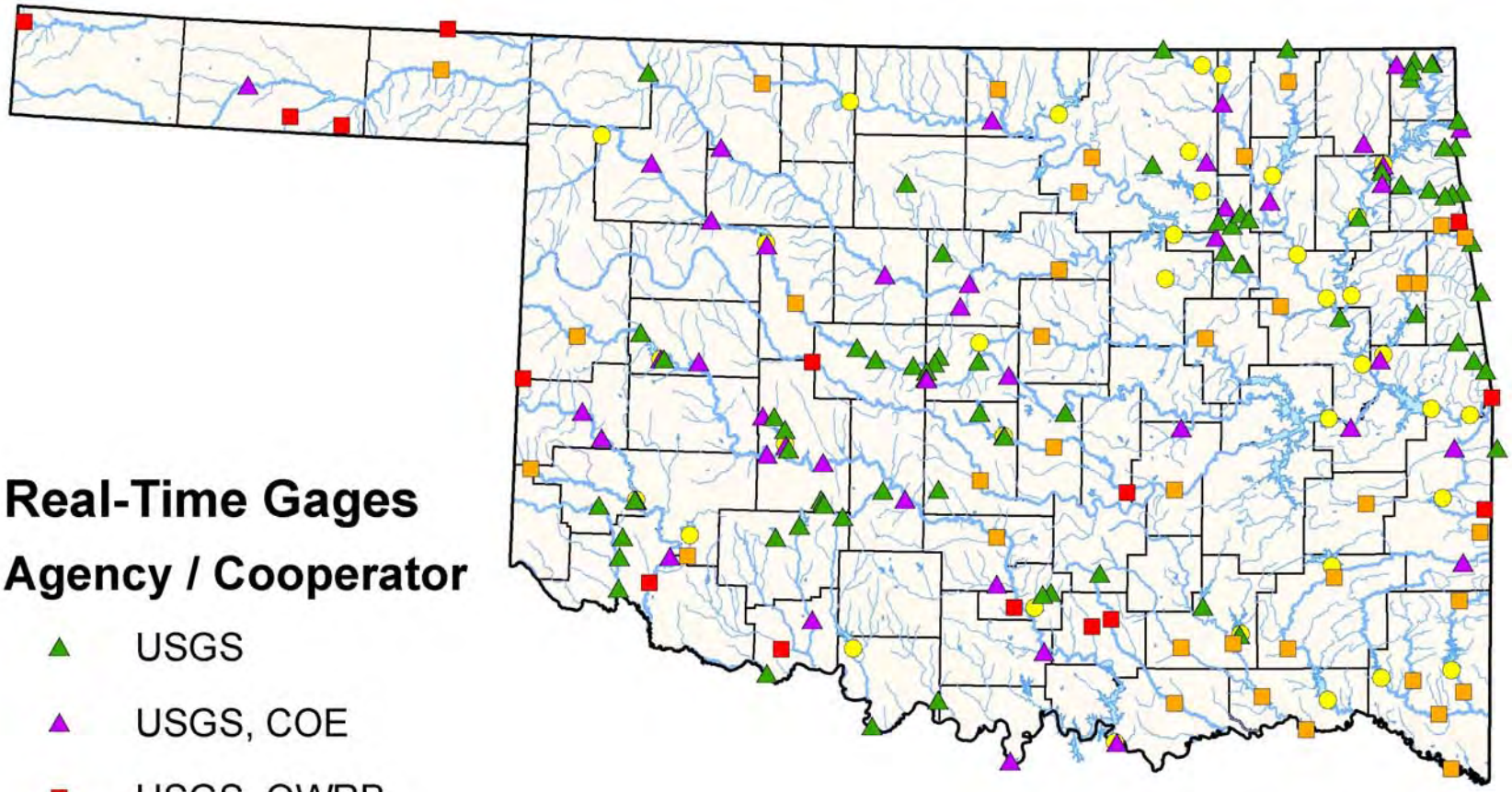
Real-Time Stream Gages in Oklahoma



Real-Time Gages

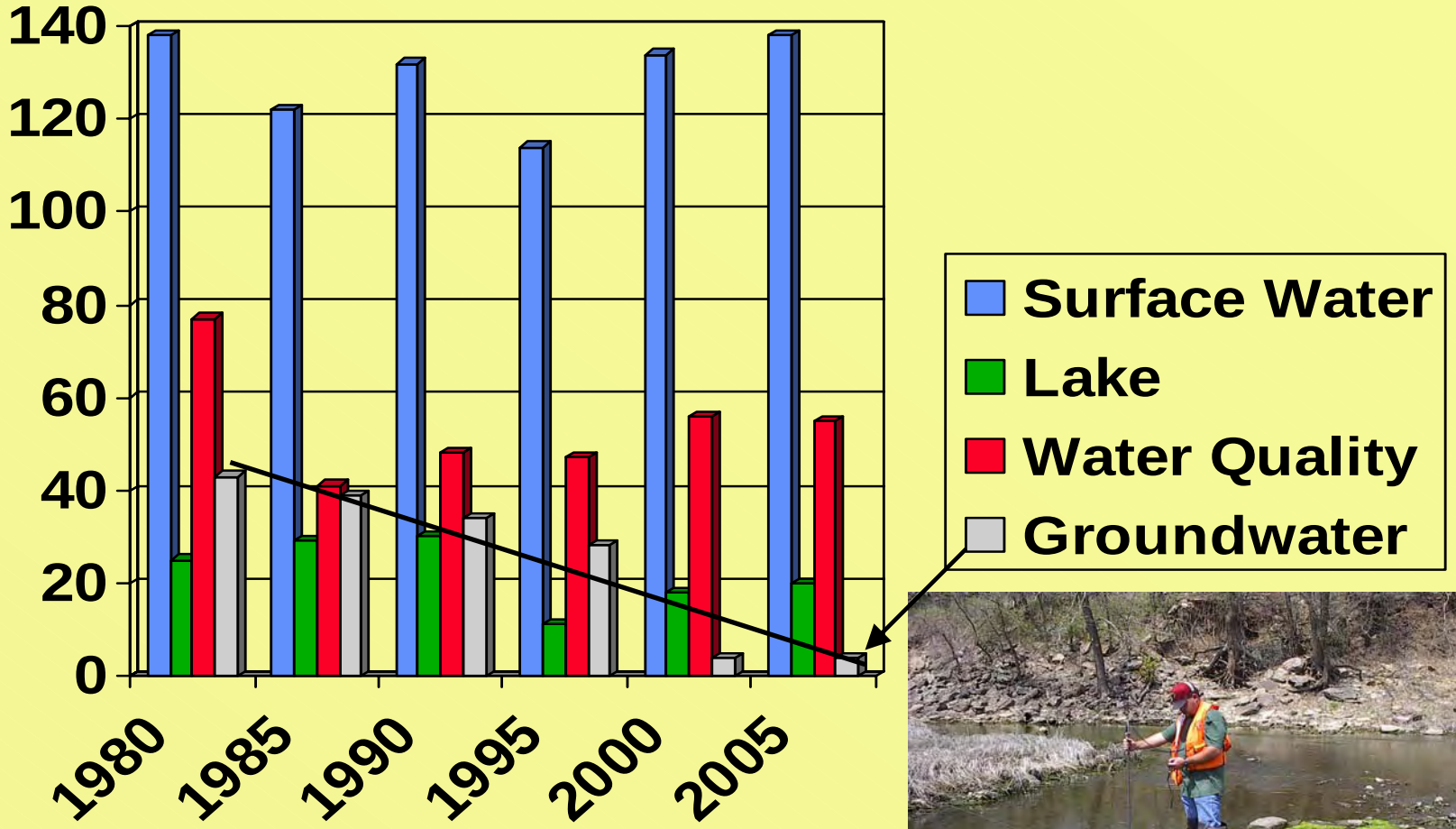
Agency / Cooperator

- USGS
- USGS, COE
- USGS, OWRB
- USGS, OWRB, COE
- COE Lake Gages

Note: OWRB includes tribes, cities, water districts, Master Conservancy Districts, and other local agency cooperators, including 20 gages for ODEQ

USGS

Status of Gaging Network 1980-2005



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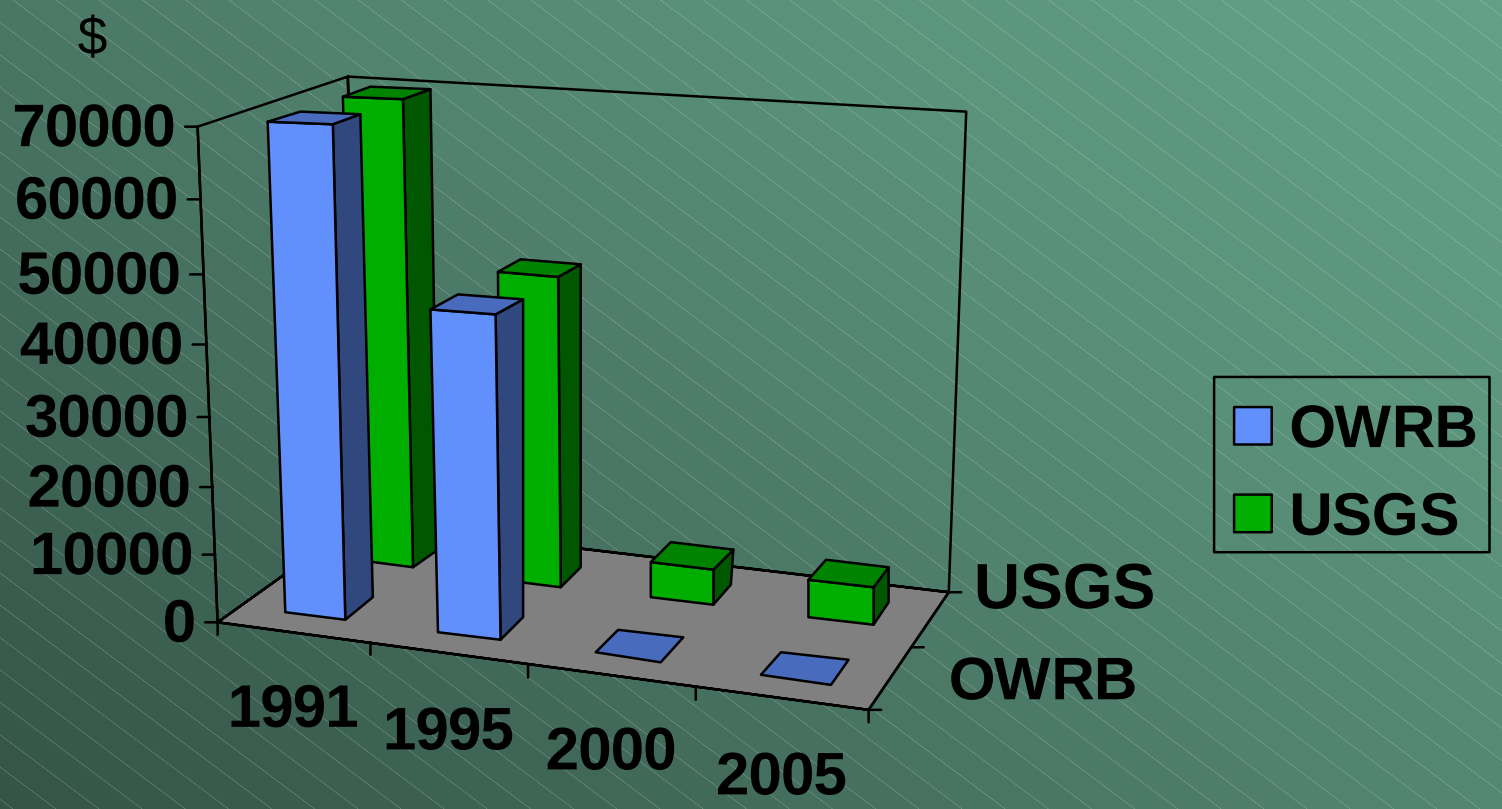
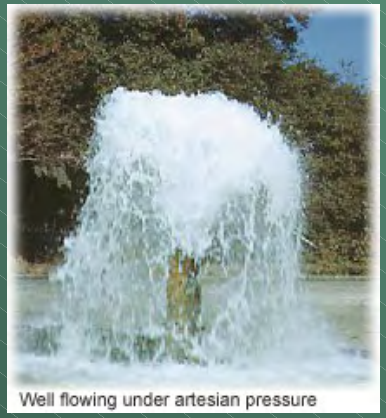
Historical Groundwater Funding Network 1991-2005



Summary:

- Ground water and surface water are important resources
- Groundwater and surface water are interactive
- They are fragile (contaminate one, possibly the other)
- Long term data and gaging networks (and the funding to support them) are critical for water planning for the future


Well flowing under artesian pressure

USGS