

What is an aquifer?

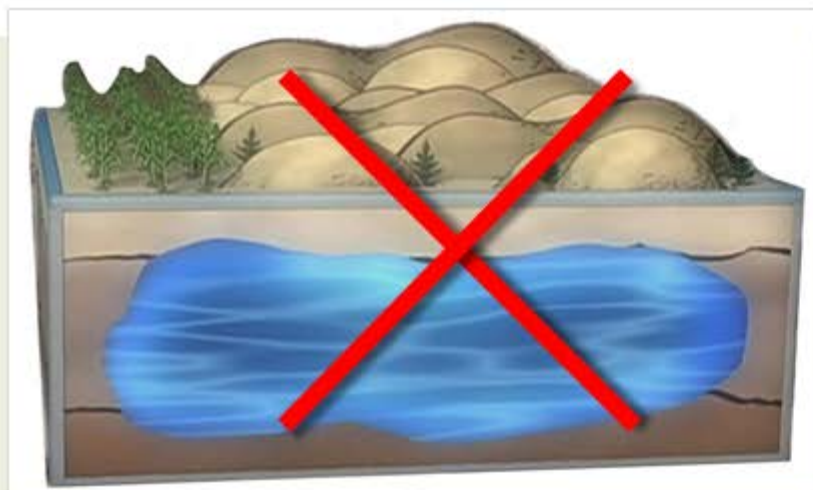


FIGURE 1

An aquifer is *not*
an underground river or lake.

Actually ...

An aquifer is a body of rock and sediment that's saturated—water is in it and around it. And water can move through it. It can be made of sand and gravel, sandstone, sandstone and carbonate, and other rocks. Each is made up of permeable material.

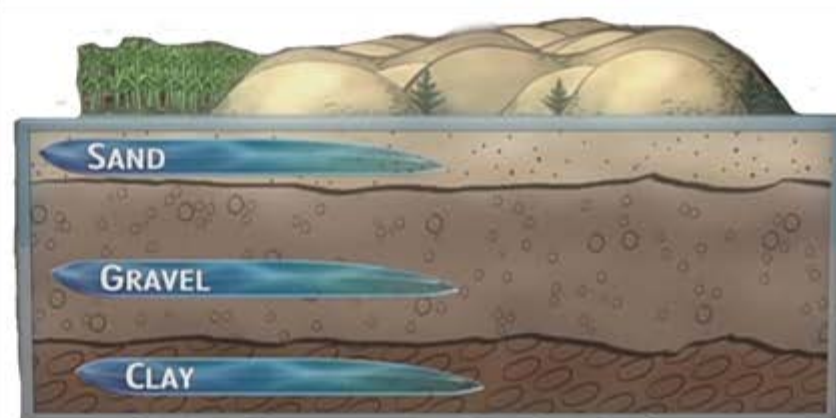
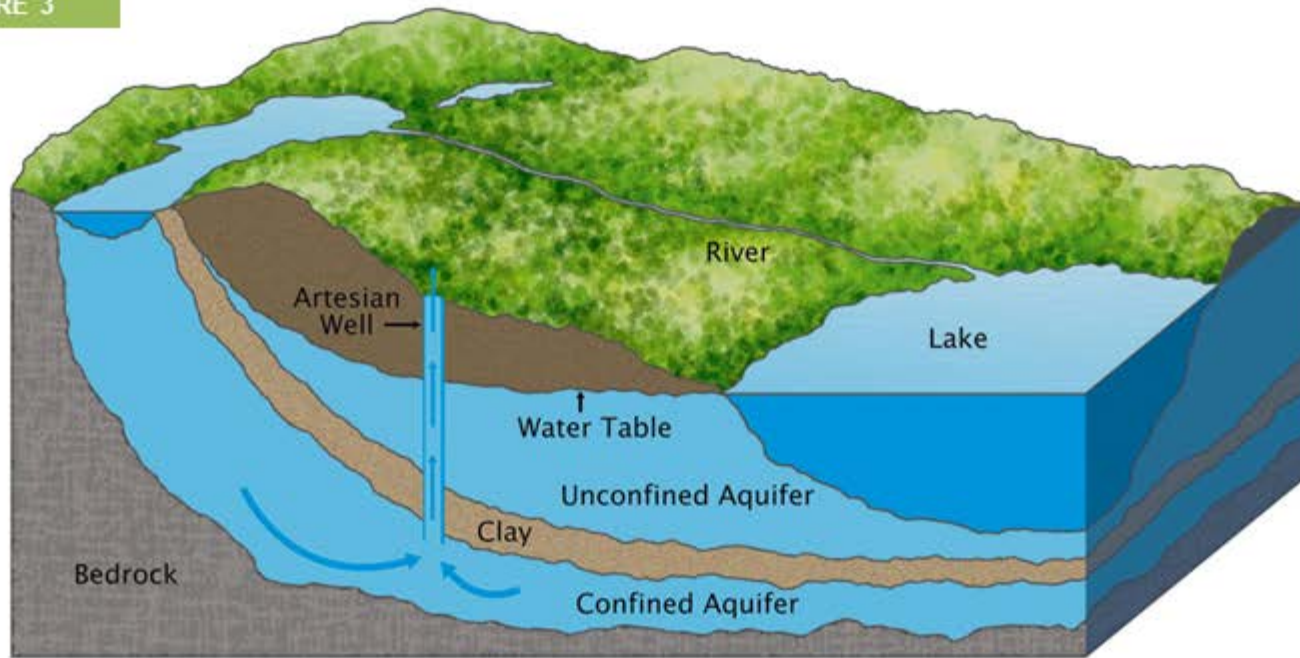


FIGURE 2

FIGURE 3



Aquifer anatomy

Aquifers can be confined or unconfined, depending on the layers above them. Water exists in most places under the earth's surface. Plants use the water nearest ground level. The water table begins below that. Aquifers form where material—especially rock—is permeable. You might have a layer of impermeable material between the aquifer and ground. That's a *confined* aquifer. If there's no impermeable layer, that's an *unconfined* aquifer.

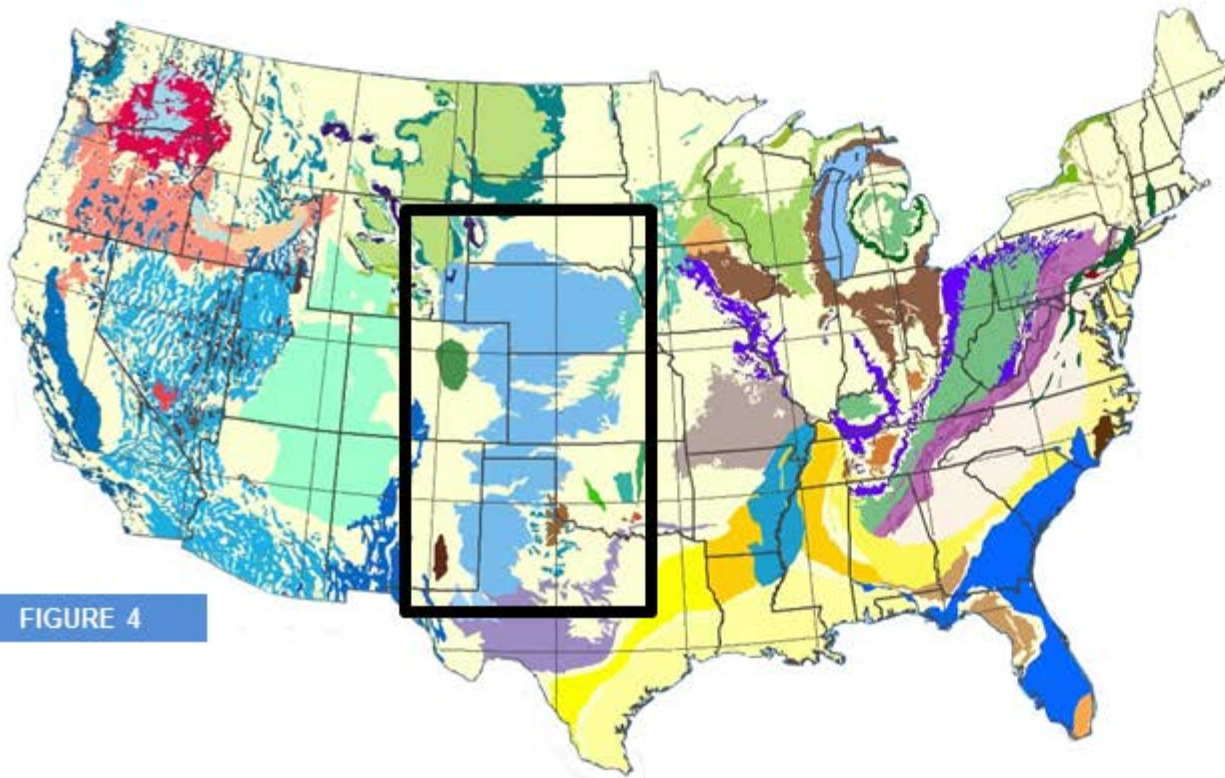


FIGURE 4

This map shows the 40 biggest aquifers in the U.S. There are many other smaller aquifers. In fact, aquifers pretty much run into each other, forming *systems* of aquifers.

The world's largest known aquifer is the High Plains Aquifer—also known as the Ogallala Aquifer

Aquifers are important because ...

- We can only use about 1 percent of earth's surface water.
- 99 percent of all usable water is actually groundwater.
- Aquifers provide 99 percent of all groundwater.
- 50 percent of all "potable" (suitable for drinking) water comes from aquifers

FIGURE 5

High Plains Aquifer

The High Plains Aquifer is an unconfined aquifer. Even though it's relatively shallow, it supplies 30 percent of the groundwater used for irrigation, as well as drinking water for 2.3 million people.

The High Plains Aquifer was formed more than 20 million years ago. It covers about 174 thousand square miles underneath eight states. It holds roughly 978 *trillion* gallons of water. But the High Plains Aquifer is shrinking, especially in its southern half.

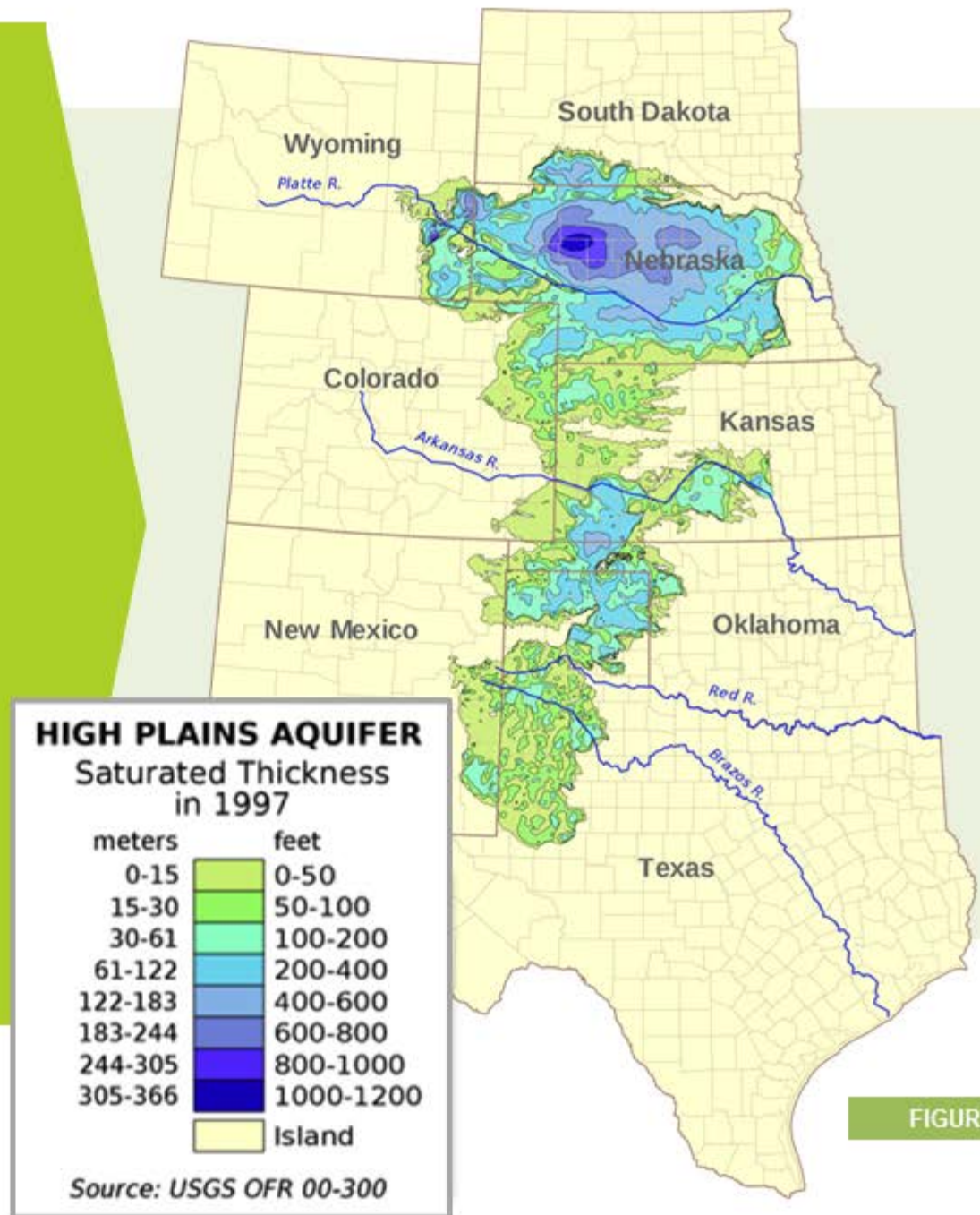
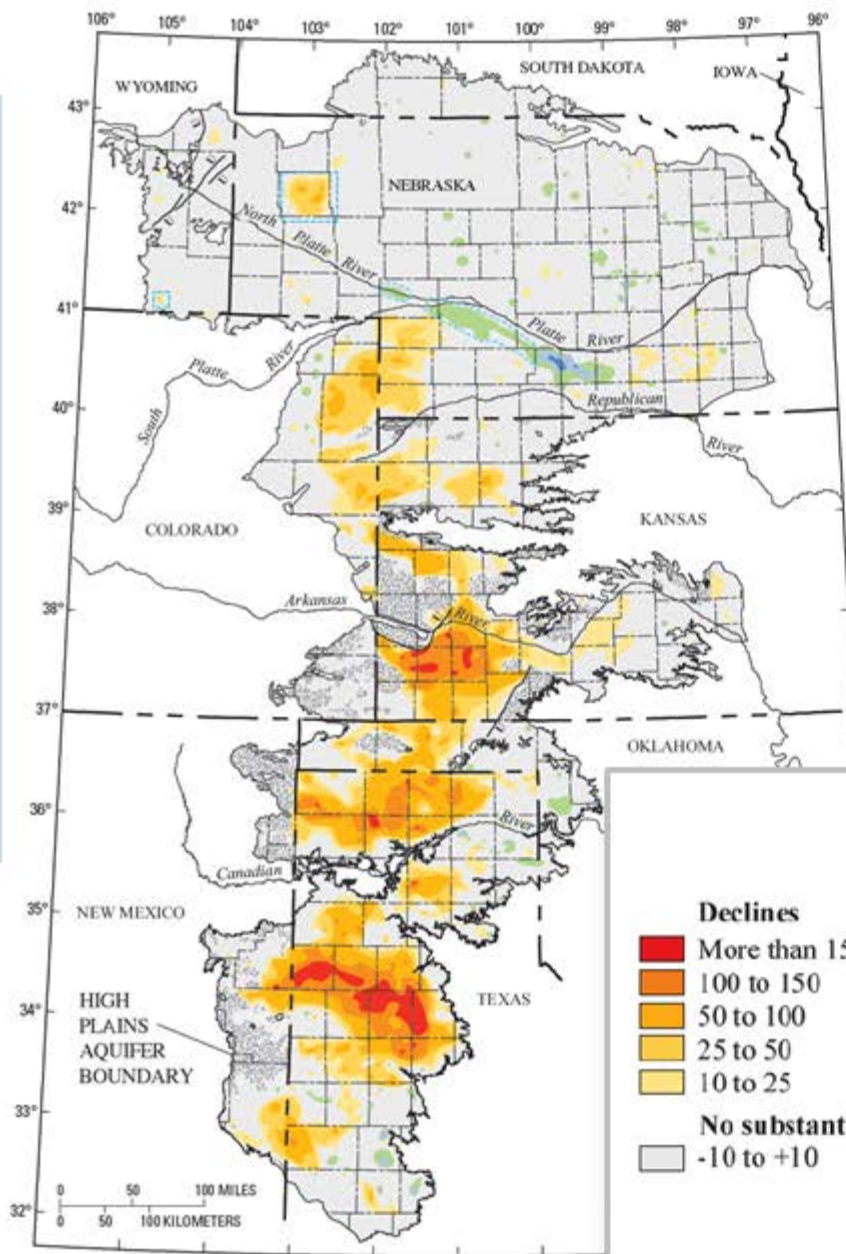


FIGURE 5



Depletion

The water levels in some parts of the aquifer have declined by more than 150 feet. Most of this drop in the water levels happened after people started using modern irrigation methods in the middle of the 20th century.

EXPLANATION

Water-level change, in feet

Declines

- More than 150
- 100 to 150
- 50 to 100
- 25 to 50
- 10 to 25

No substantial change

- 10 to +10

Rises

- 10 to 25
- 25 to 50
- More than 50
- Area of little or no saturated thickness
- Area of water-level changes with few predevelopment water levels

- Faults—U, upthrown side
- County line

FIGURE 6

Groundwater Depletion in the United States (1900-2008)

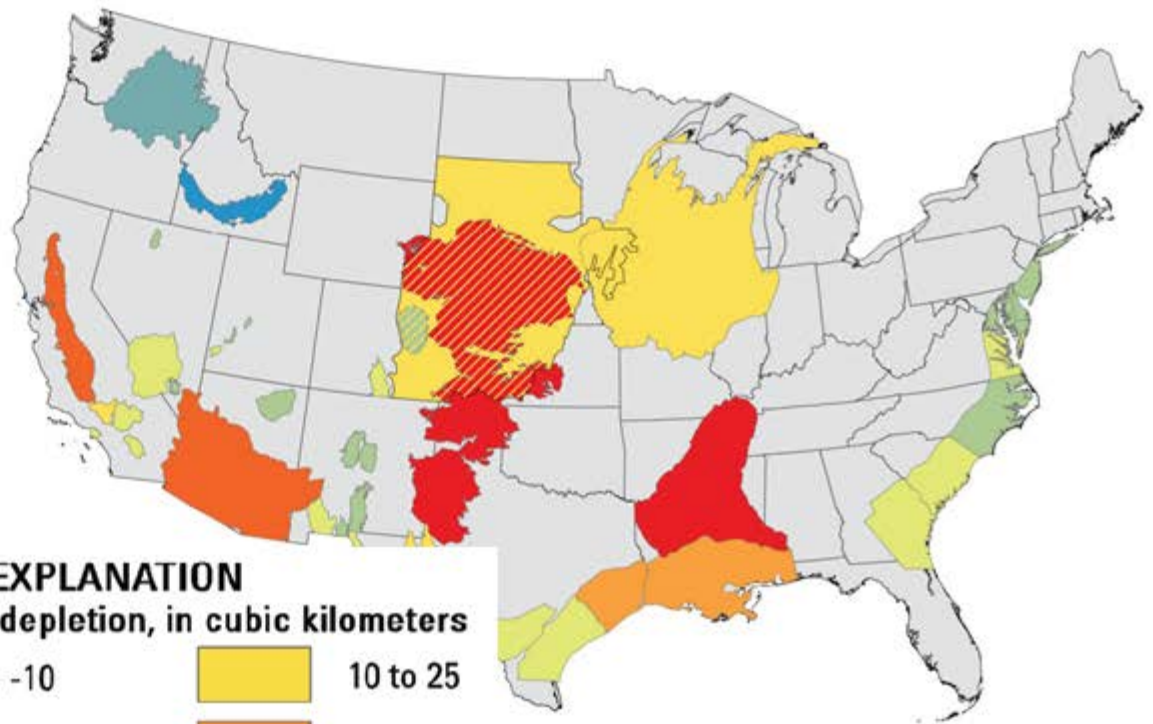
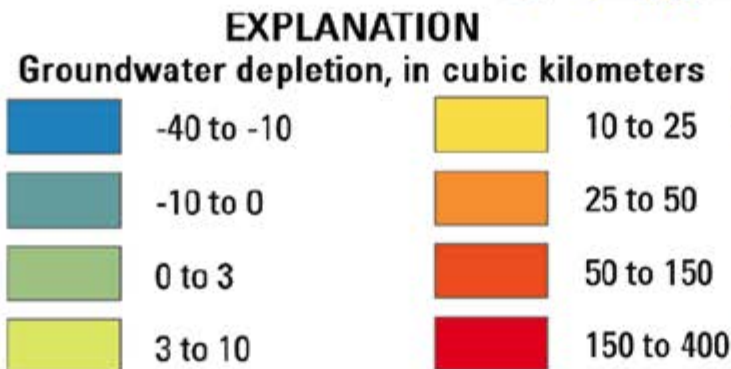
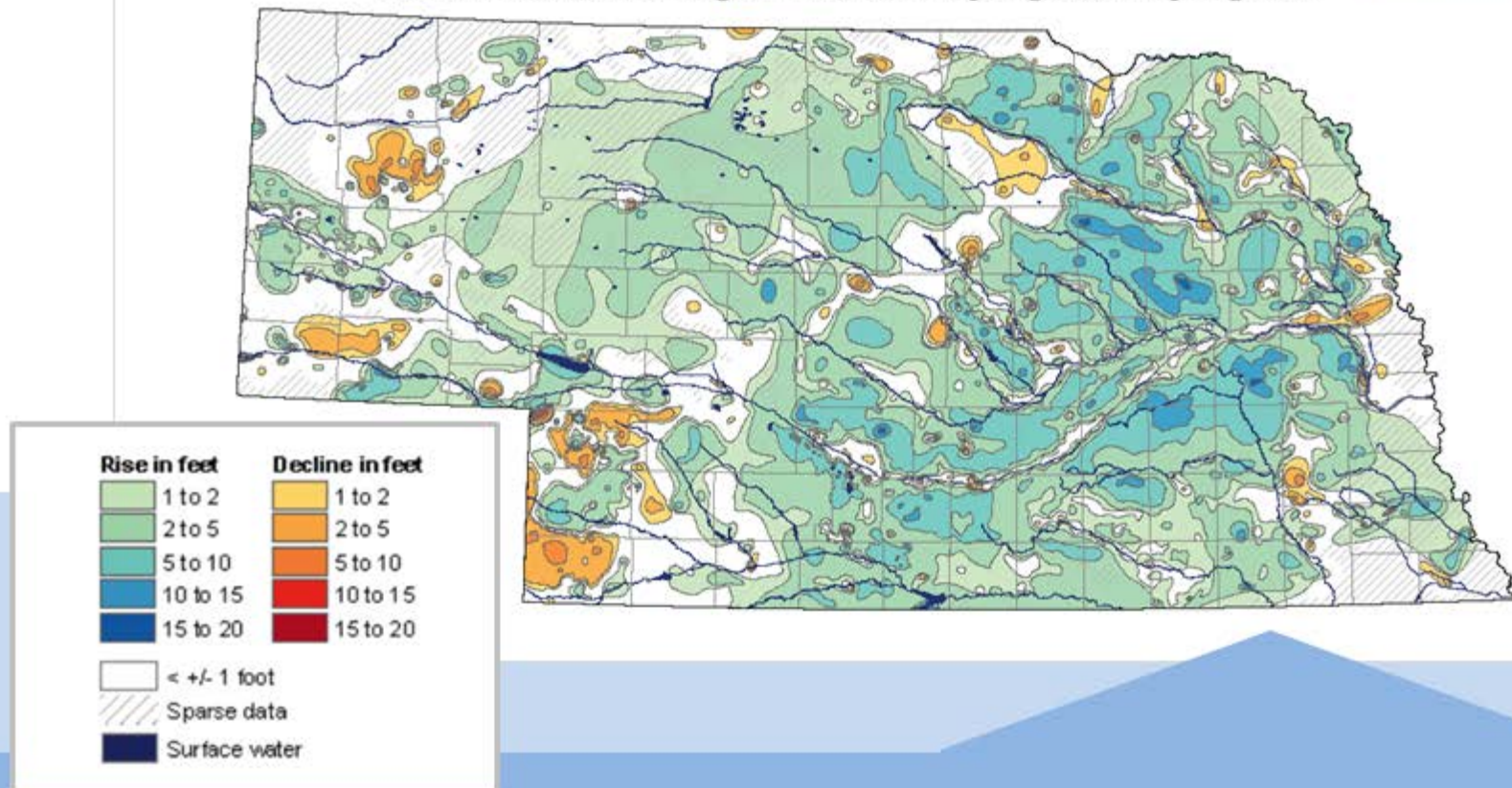


FIGURE 7

Unfortunately, this rapid depletion or drop in level is not just happening in the High Plains Aquifer. A recent study by the USGS (United States Geological Survey) looked at long-term groundwater depletion in 40 U.S. aquifers. The study showed that from 1900-2008, the equivalent of two Lake Eries—that's 1,000 cubic kilometers—had been used. And 25 percent of the overall depletion took place in just the last eight years of the study! This shows we're using up groundwater faster and faster. We can't keep going at this rate for much longer.

Groundwater-Level Changes in Nebraska - Spring 2007 to Spring 2012

FIGURE 8



Recharging

The good news is some aquifers have parts that can “recharge”—they can be replenished, mostly when precipitation increases to above-average levels. For example, part of the High Plains Aquifer lies under Nebraska, and from 2007-2012, heavy precipitation over much of the state raised water levels in parts of the aquifer. But overall, the long-term trend for aquifers is depletion, even in Nebraska. And for dry states like Texas and Kansas, even in the best of times, the rate of recharging is very low.

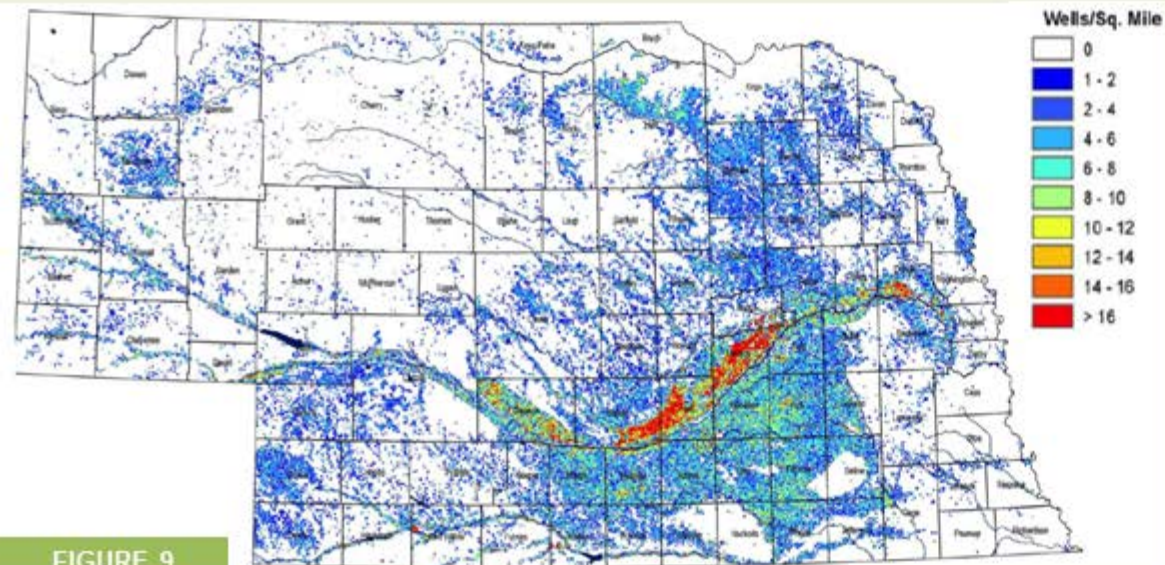


FIGURE 9

Generalized Nitrate Levels in Wells Sampled, 1974 - 2006

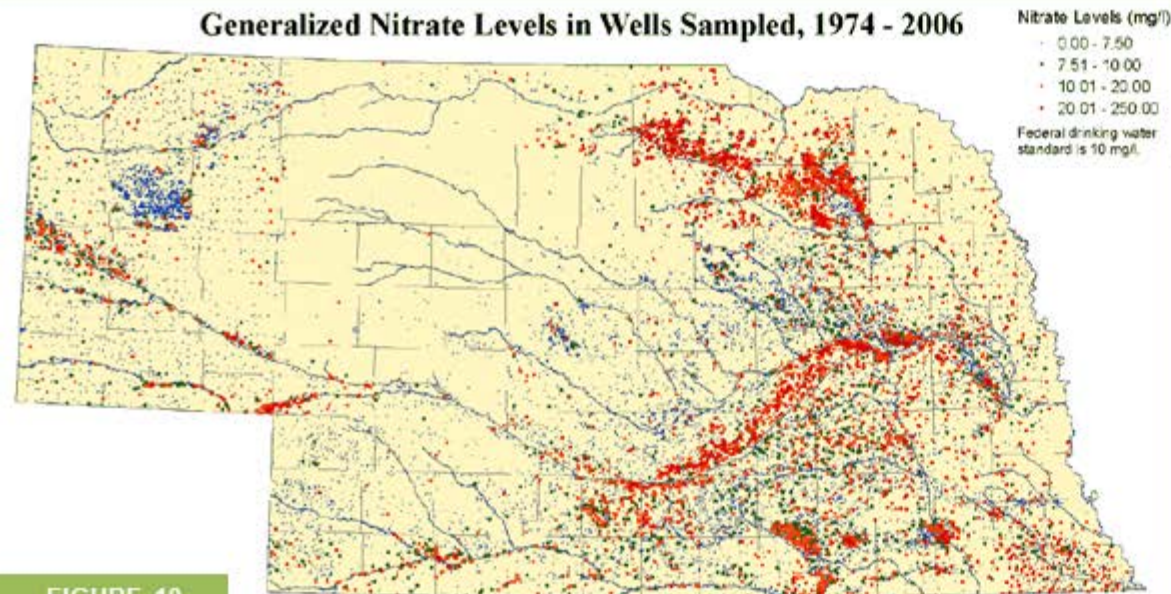


FIGURE 10

Effects of Irrigation

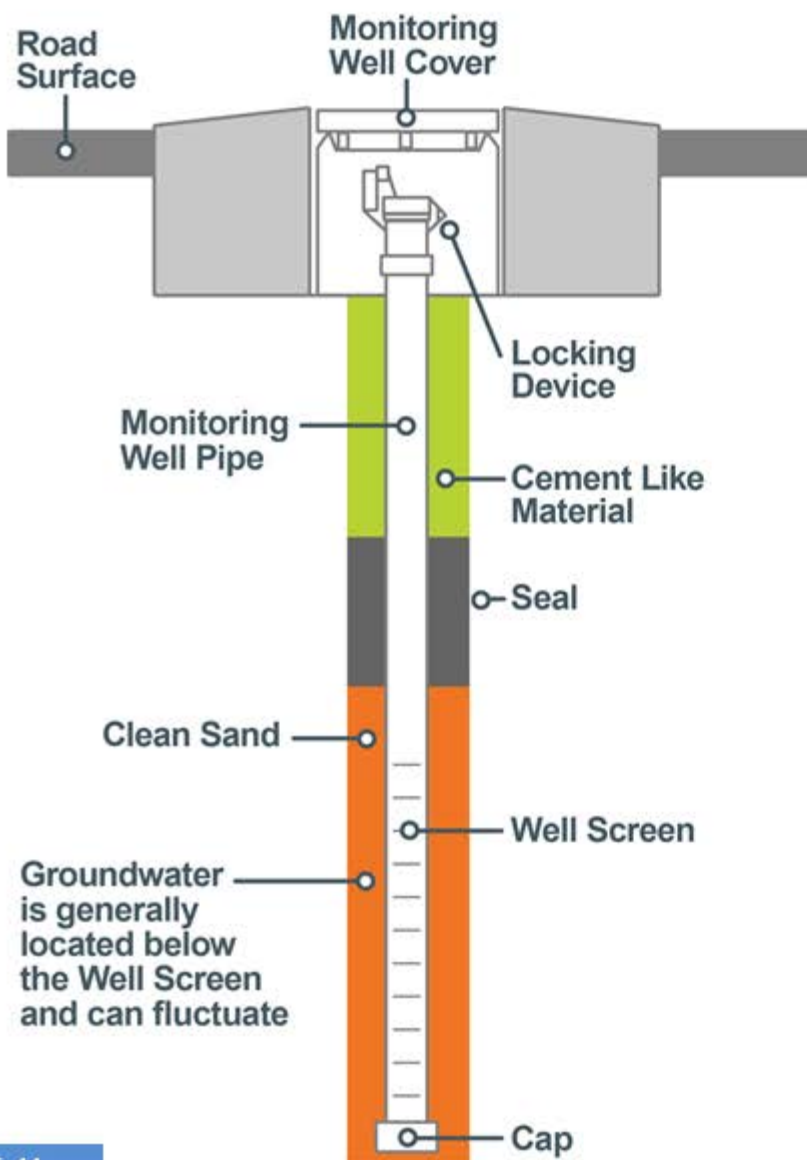
Nebraska has more irrigated land than any other state—8.5 million acres. By 2013, Nebraska had 94,000 irrigation wells. The farms using irrigation usually apply pesticides and herbicides, which soak into the soil, then down into the aquifers, where they pollute the water, especially near the aquifer surface.

As these maps show, it appears that in areas where a high amount of irrigation is going on, pollutants such as nitrate are found. This suggests there's a real need for a careful monitoring system.

There are more than 16,000 groundwater monitoring wells in Nebraska.

Potential Sources of Groundwater Contamination

- Pesticides
- Herbicides
- Storage Tanks
- Septic Systems
- Hazardous Waste
- Landfills
- Road Salts
- Atmospheric Contaminants



To protect the quality of Nebraska's water, several state agencies concerned about water take samples from irrigation wells, domestic wells, public water supplies, livestock facilities, and commercial/industrial facilities. In 2013, these agencies carried out nearly half a million tests.

FIGURE 11

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