

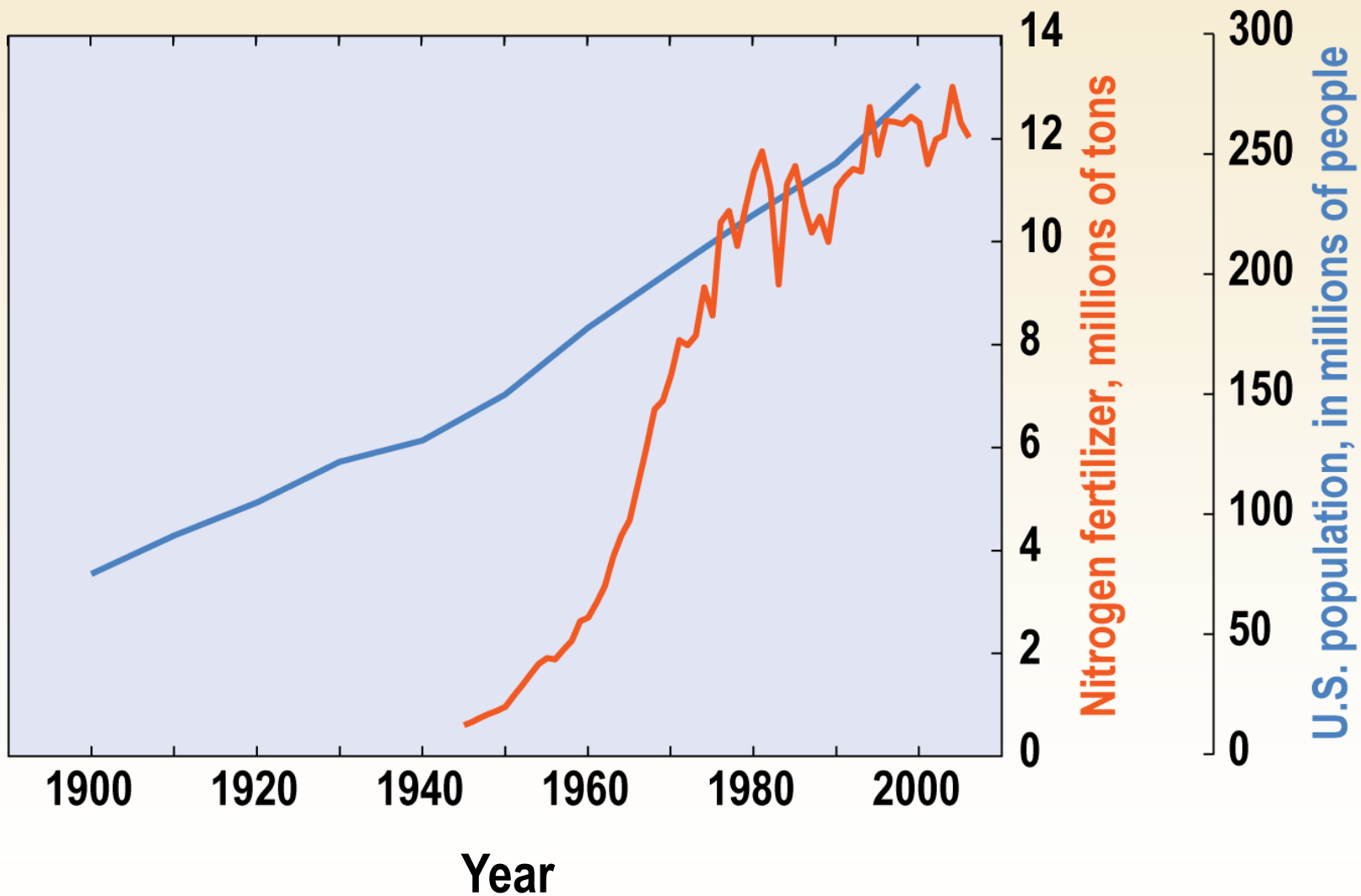


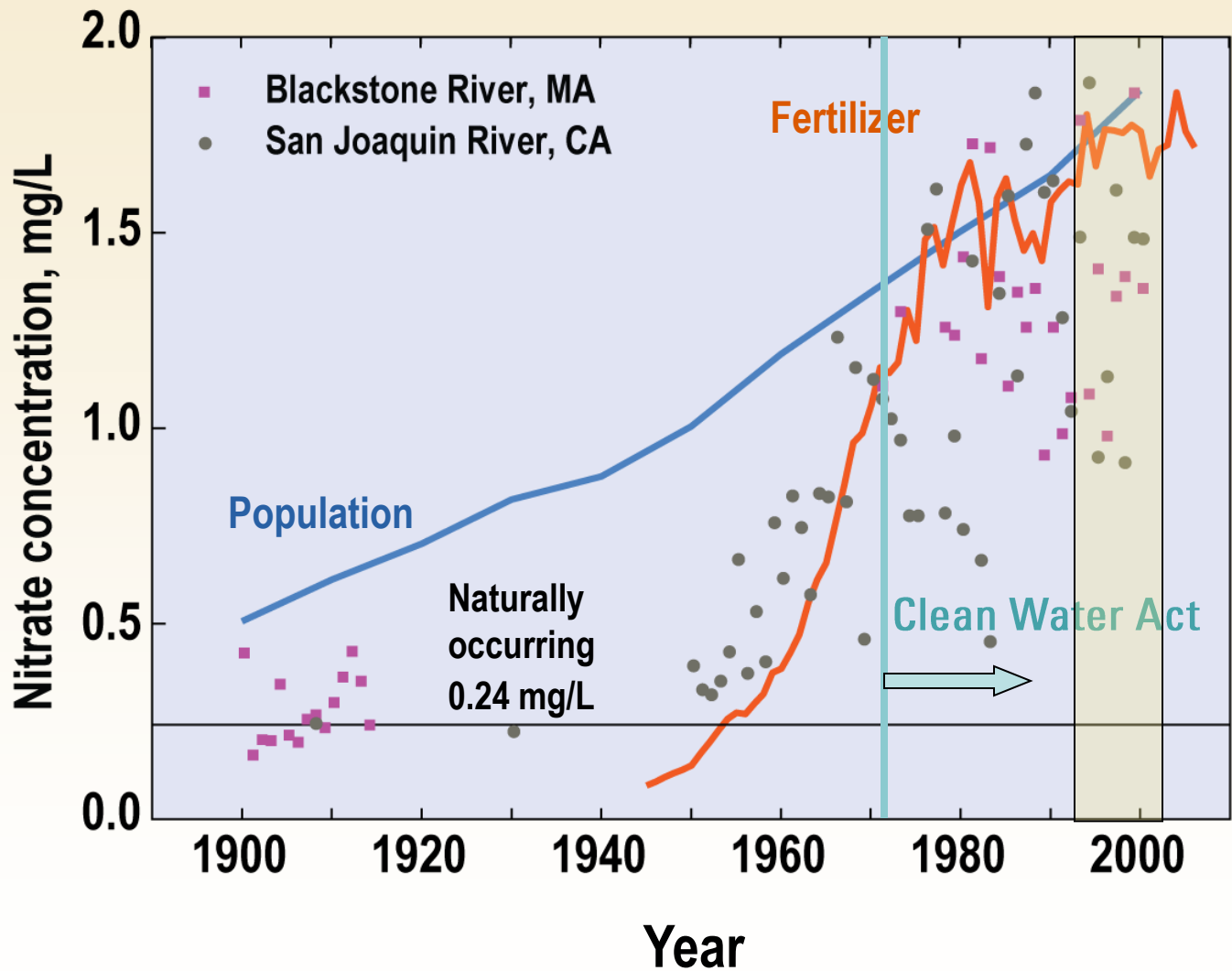
National Water-Quality Assessment (NAWQA) Program

# Nutrients in the Nation's Streams and Groundwater, 1992–2004

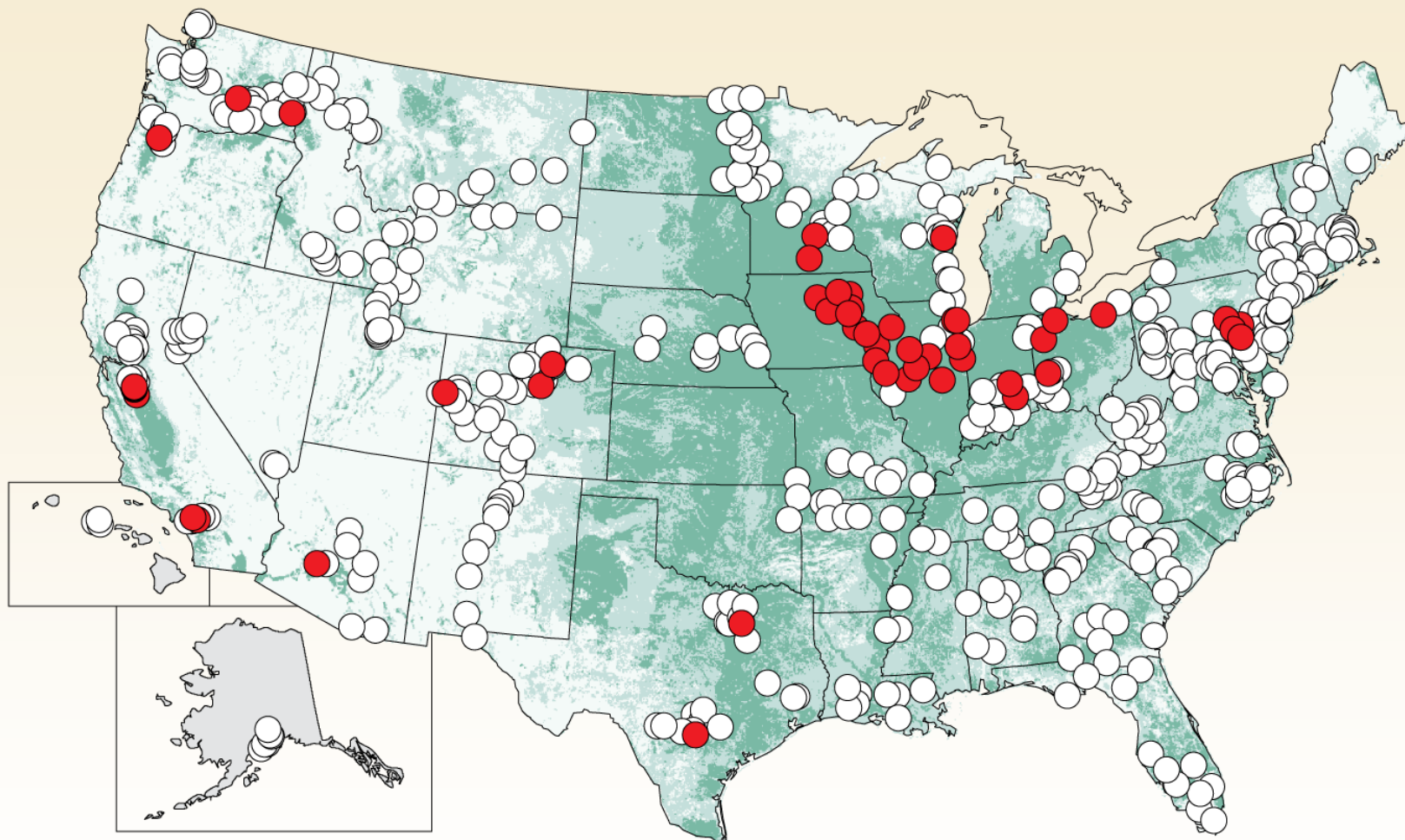
## Circular 1350





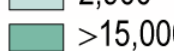






# Nitrate concentrations in streams



Nonpoint source nitrogen inputs,  
in pounds per square mile

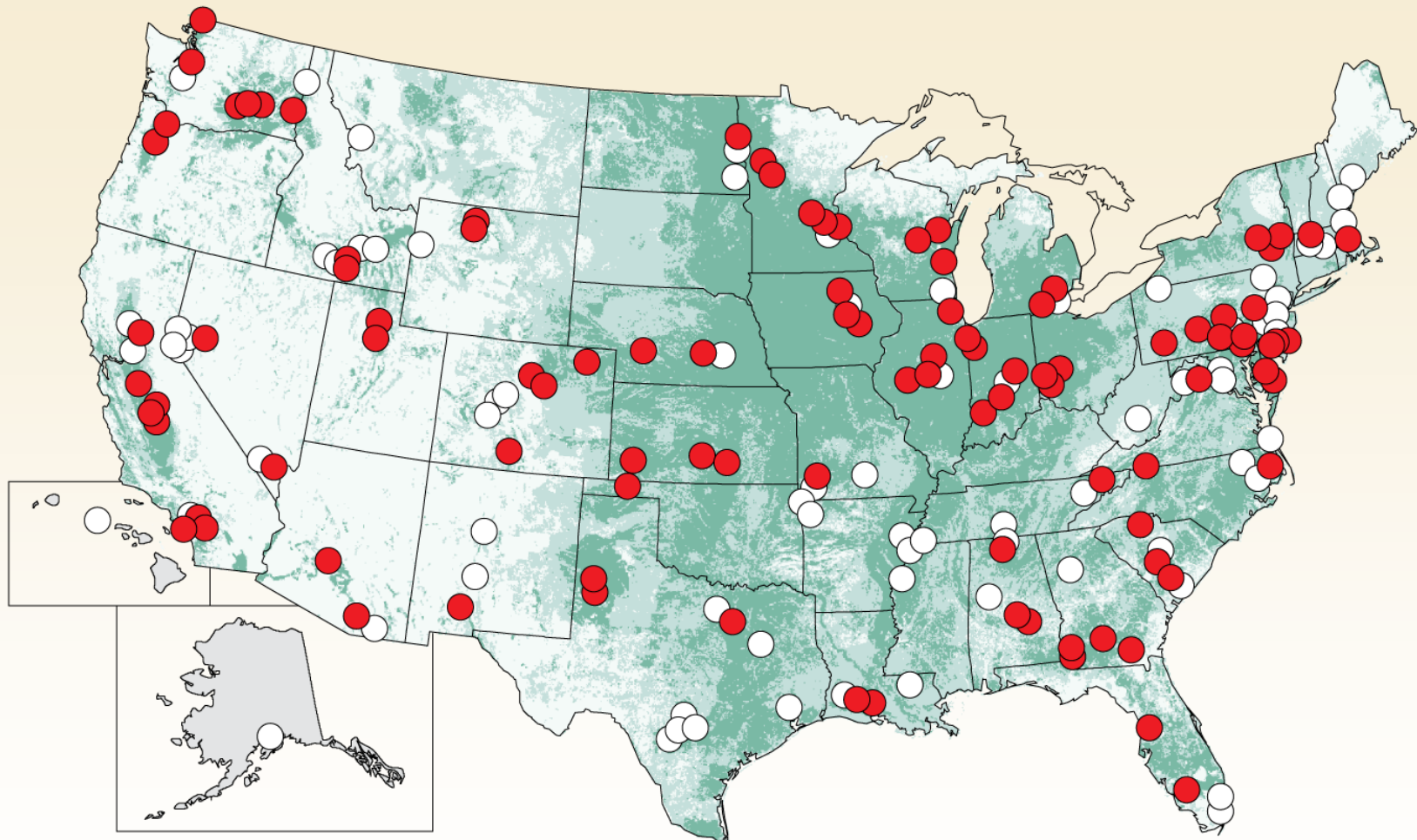
-  <2,900
-  2,900–15,000
-  >15,000

Maximum Contaminant Level - MCL



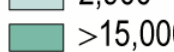
-  No exceedance of nitrate MCL
-  1 or more exceedance of nitrate MCL





# Nitrate concentrations in groundwater studies



Nonpoint source nitrogen inputs,  
in pounds per square mile

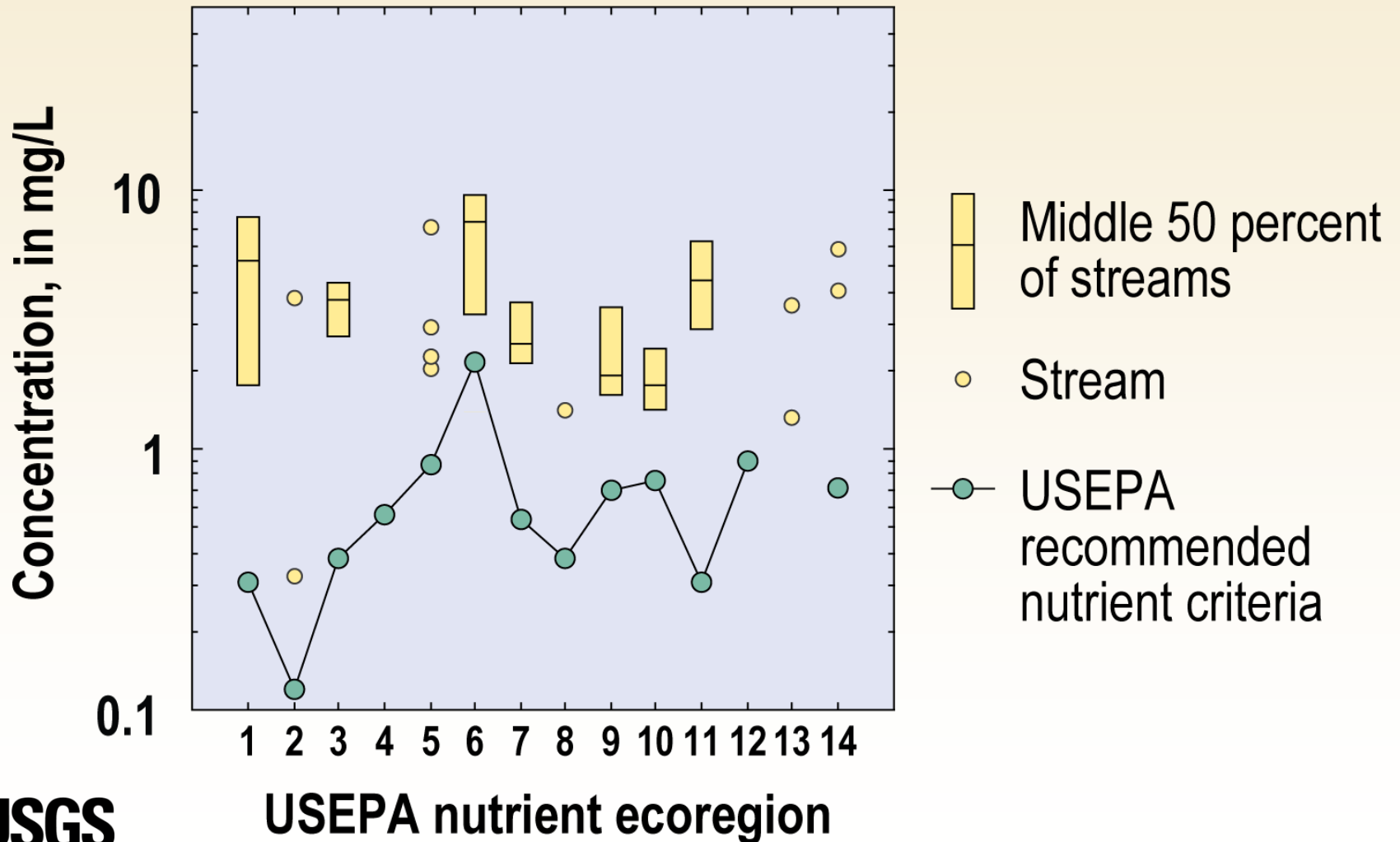
-  <2,900
-  2,900-15,000
-  >15,000

Maximum Contaminant Level - MCL

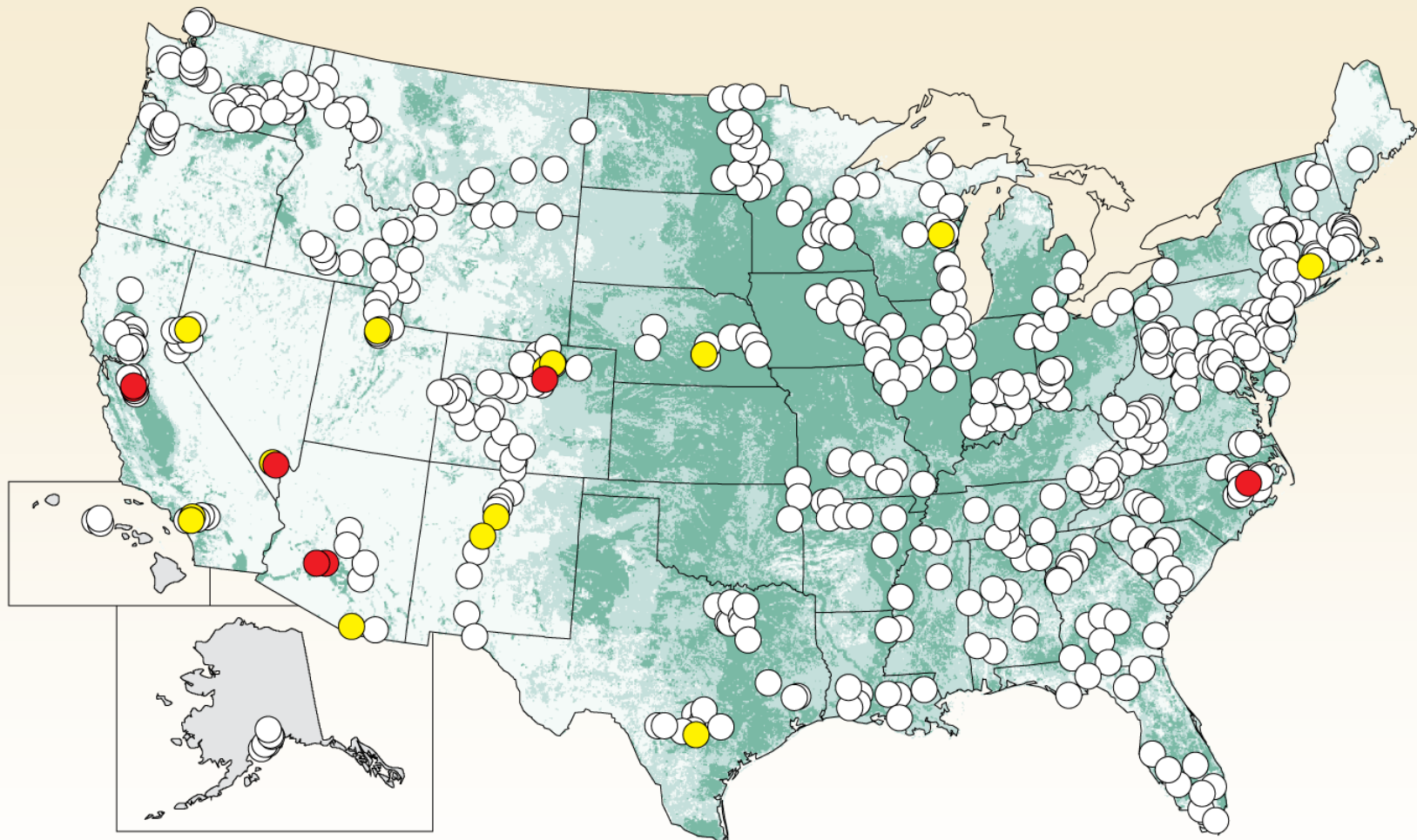
-  No exceedance of nitrate MCL
-  1 or more exceedance of nitrate MCL

# Agricultural streams


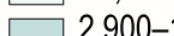
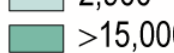
## Total nitrogen






# Exceedance of ammonia criteria in streams



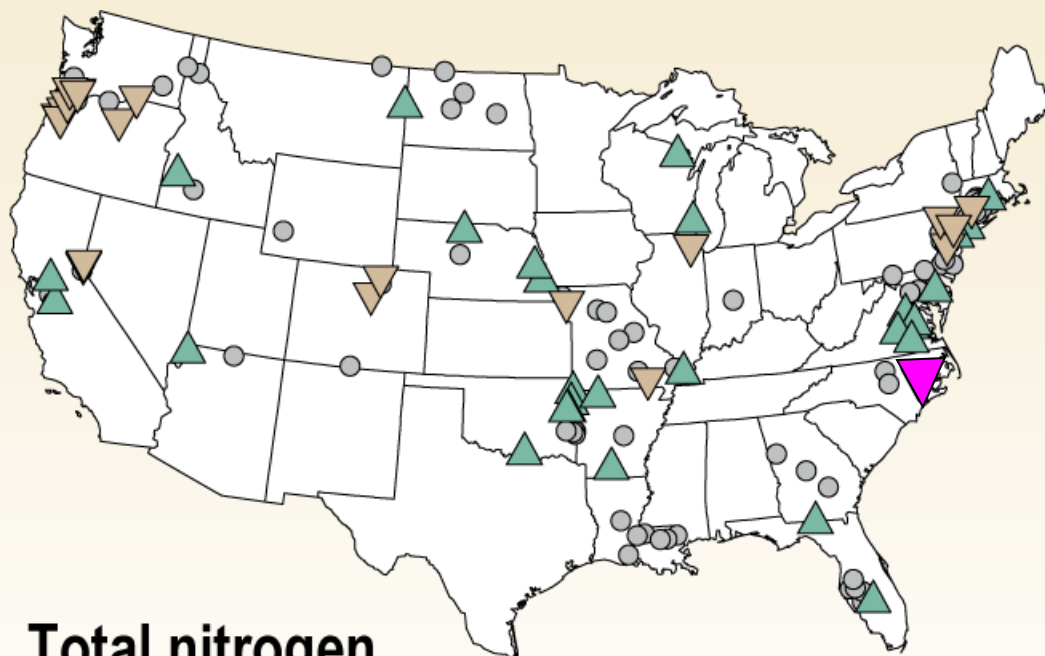
Nonpoint source nitrogen inputs,  
in pounds per square mile

-  <2,900
-  2,900–15,000
-  >15,000

Type of aquatic health criteria  
exceeded for ammonia

-  No exceedance
-  Chronic criteria exceeded
-  Acute criteria exceeded

# Change in total nitrogen concentration in streams, 1993-2003

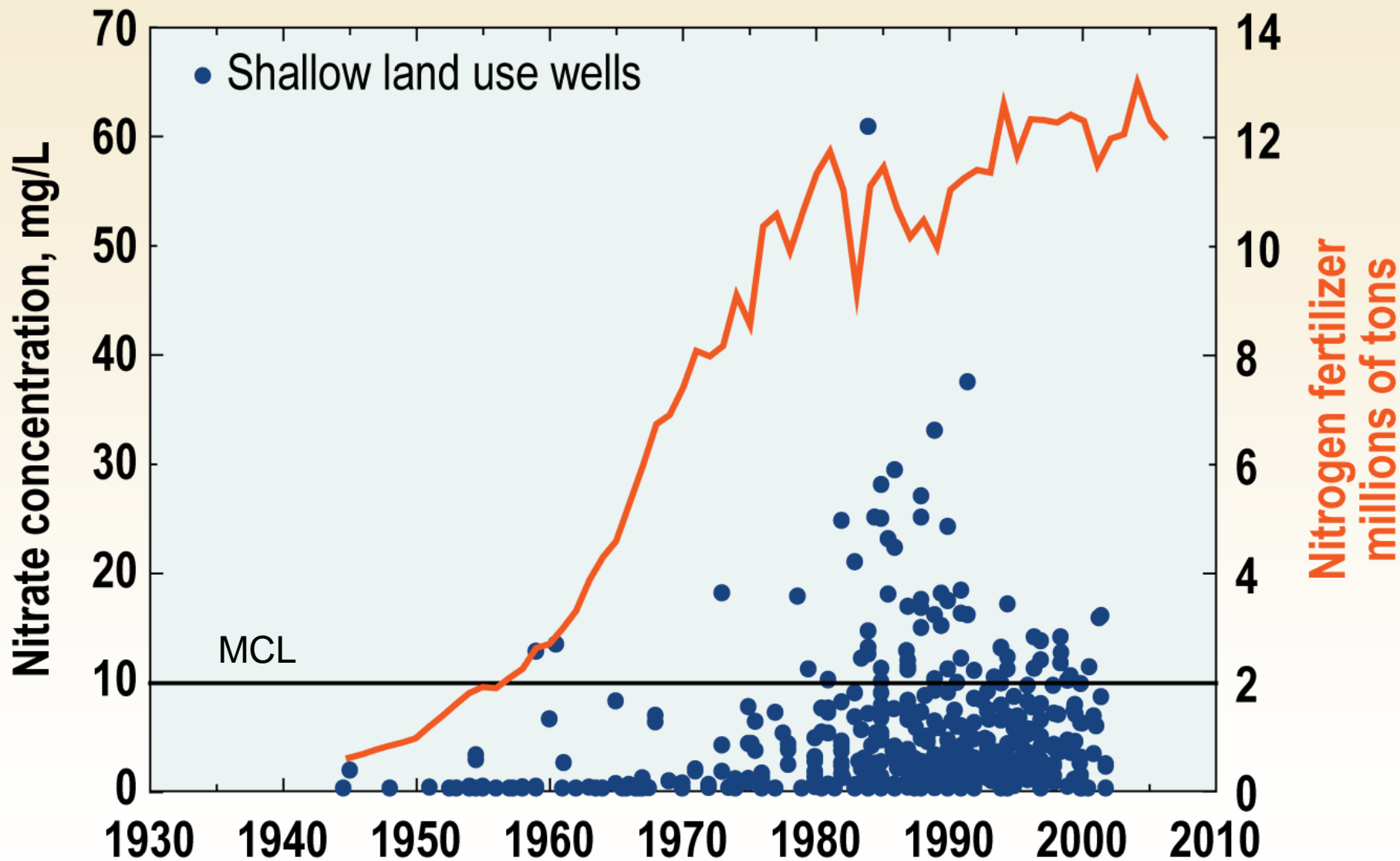


## Total nitrogen

- ▲ Upward trend
- No significant trend
- ▼ Downward trend



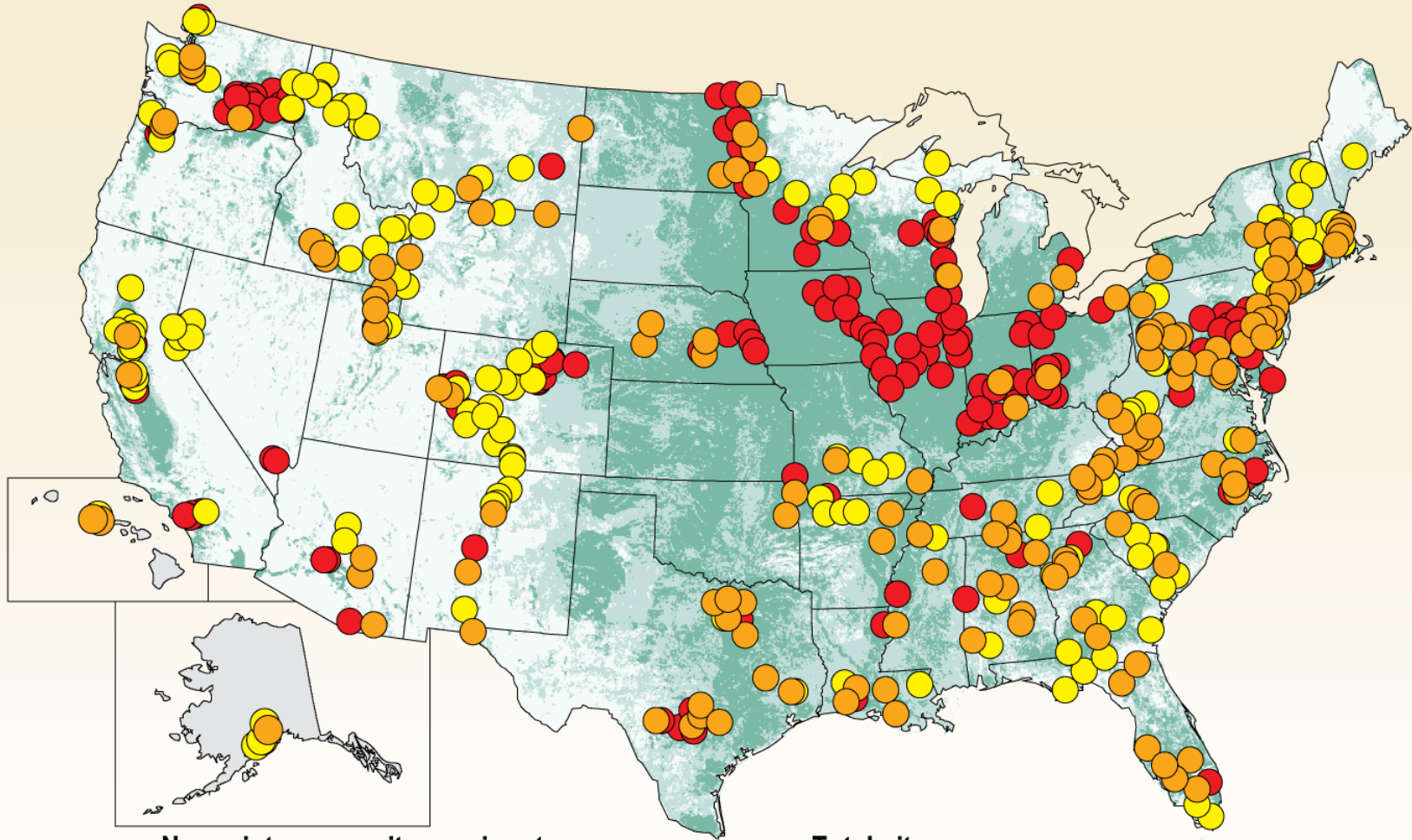
# Change in nitrate concentration in groundwater




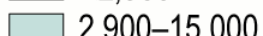
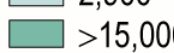
# Factors that Control Nutrients

- Sources
- Artificial drainage to streams
- Contribution of nitrate in groundwater to streams
- Biogeochemistry in groundwater
- Slow movement of groundwater




# Total nitrogen concentrations in streams



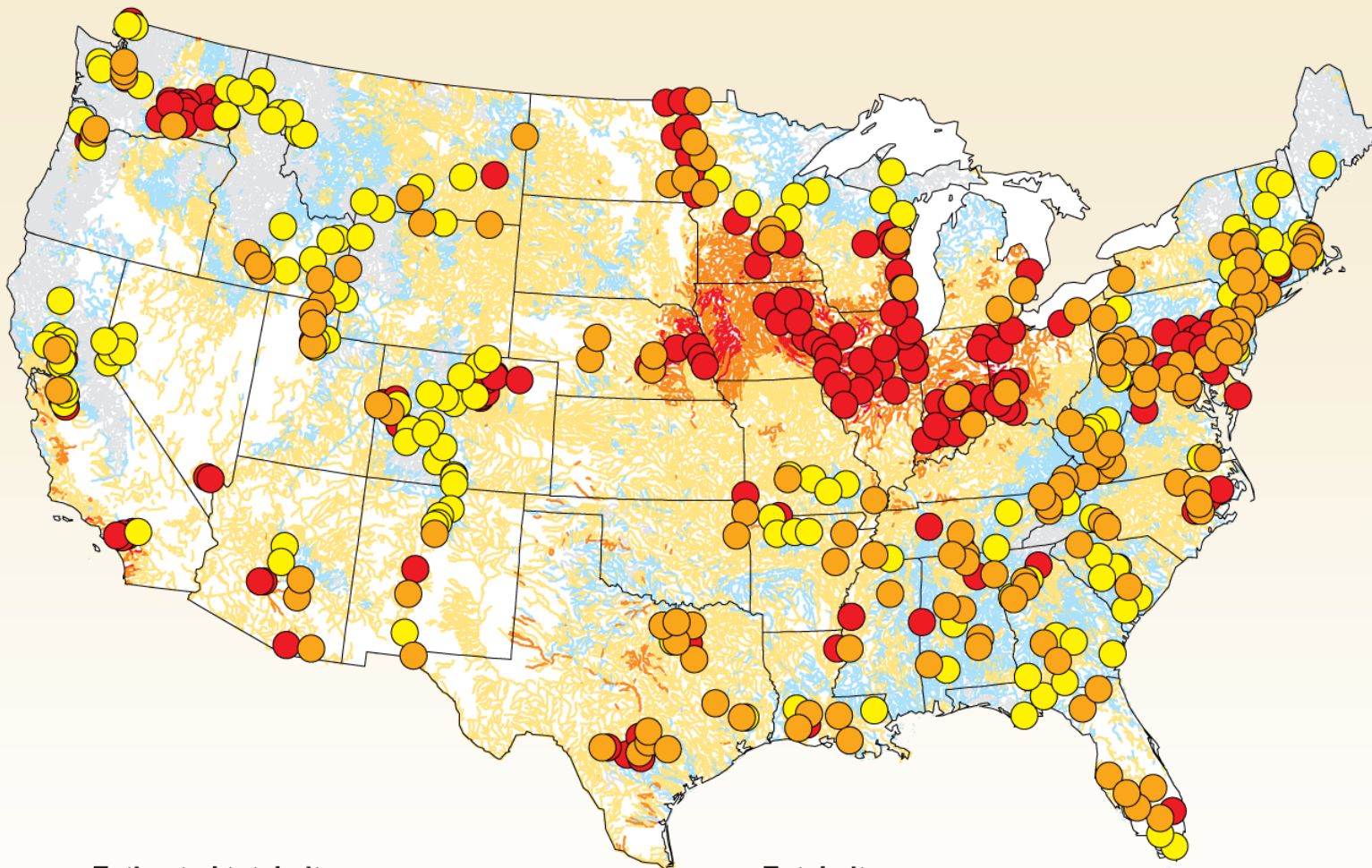
**Nonpoint source nitrogen input,  
in pounds per square mile**

-  <2,900
-  2,900–15,000
-  >15,000

**Total nitrogen  
concentration, in mg/L**

-  Low (<0.66)
-  Medium (0.66–3.17)
-  High (>3.17)

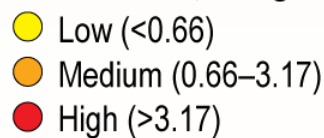
# Modeled total nitrogen in streams



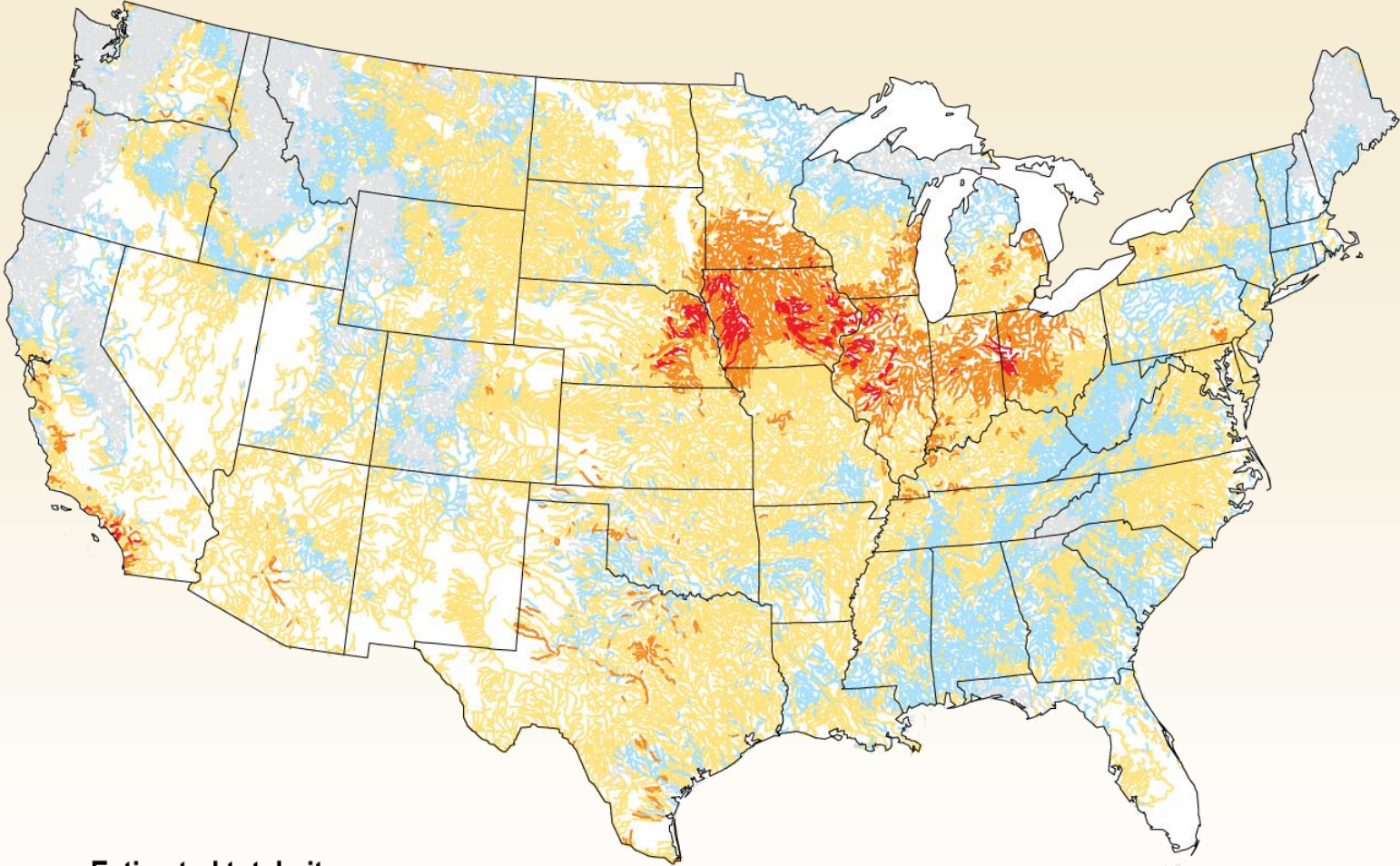
Estimated total nitrogen concentration, in mg/L



Total nitrogen concentration, in mg/L



# Modeled total nitrogen in streams



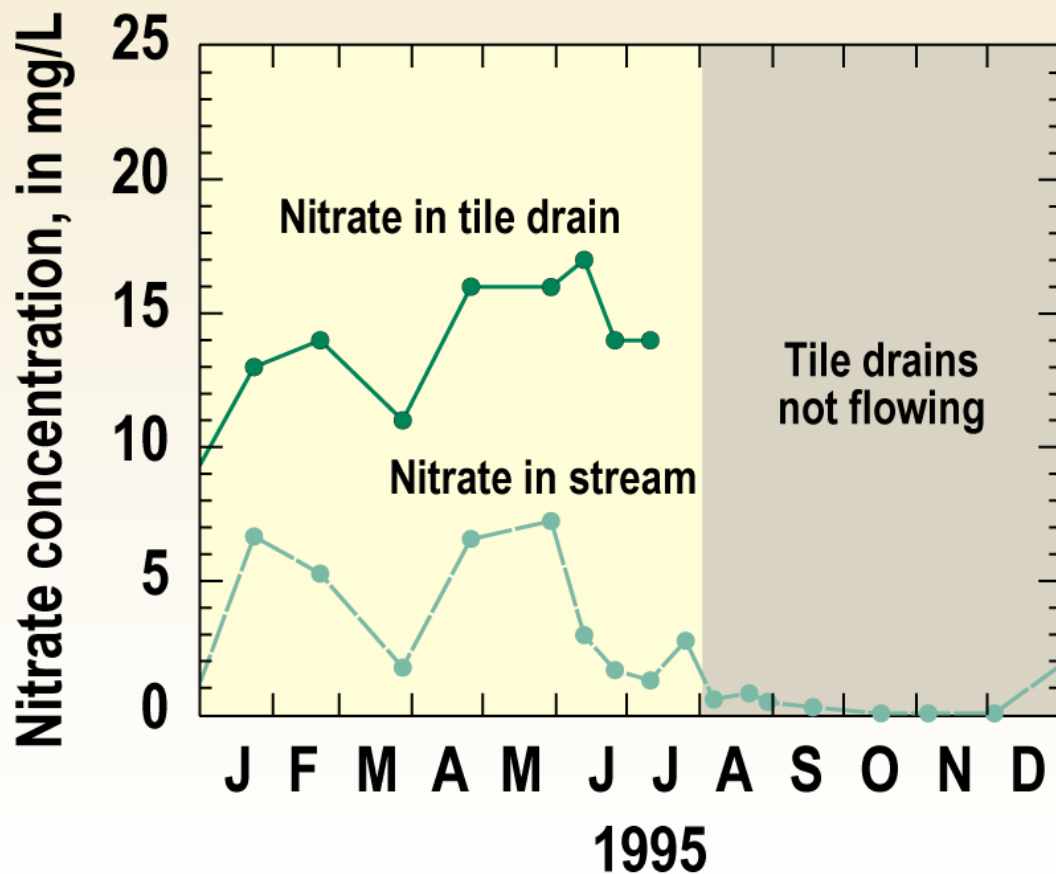
Estimated total nitrogen concentration, in mg/L

- |        |       |
|--------|-------|
| ≤0.5   | >5-10 |
| >0.5-1 | >10   |
| >1-5   |       |

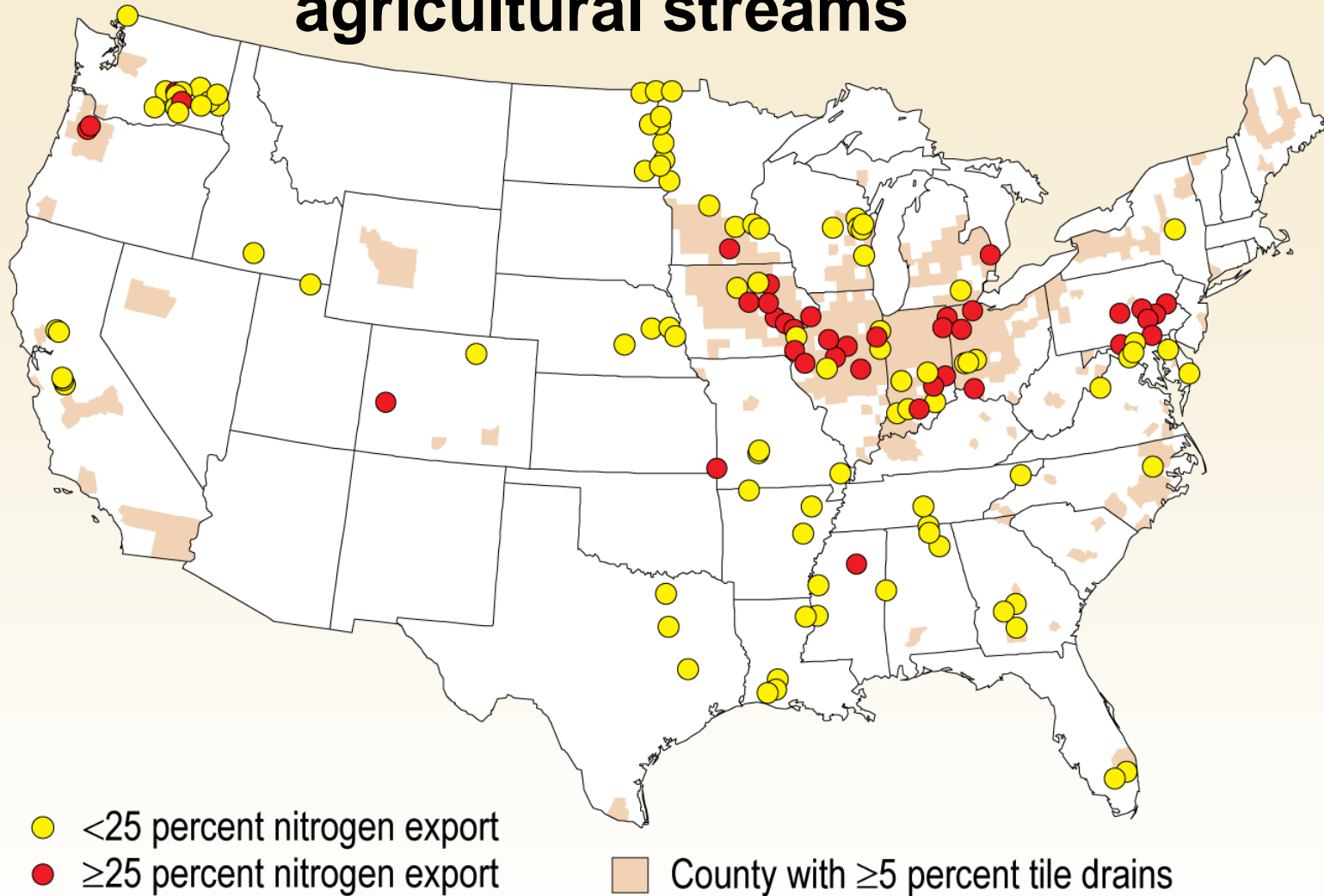
# Contribution of tile drains to nitrate in agricultural streams



# Contribution of tile drains to nitrate in agricultural streams

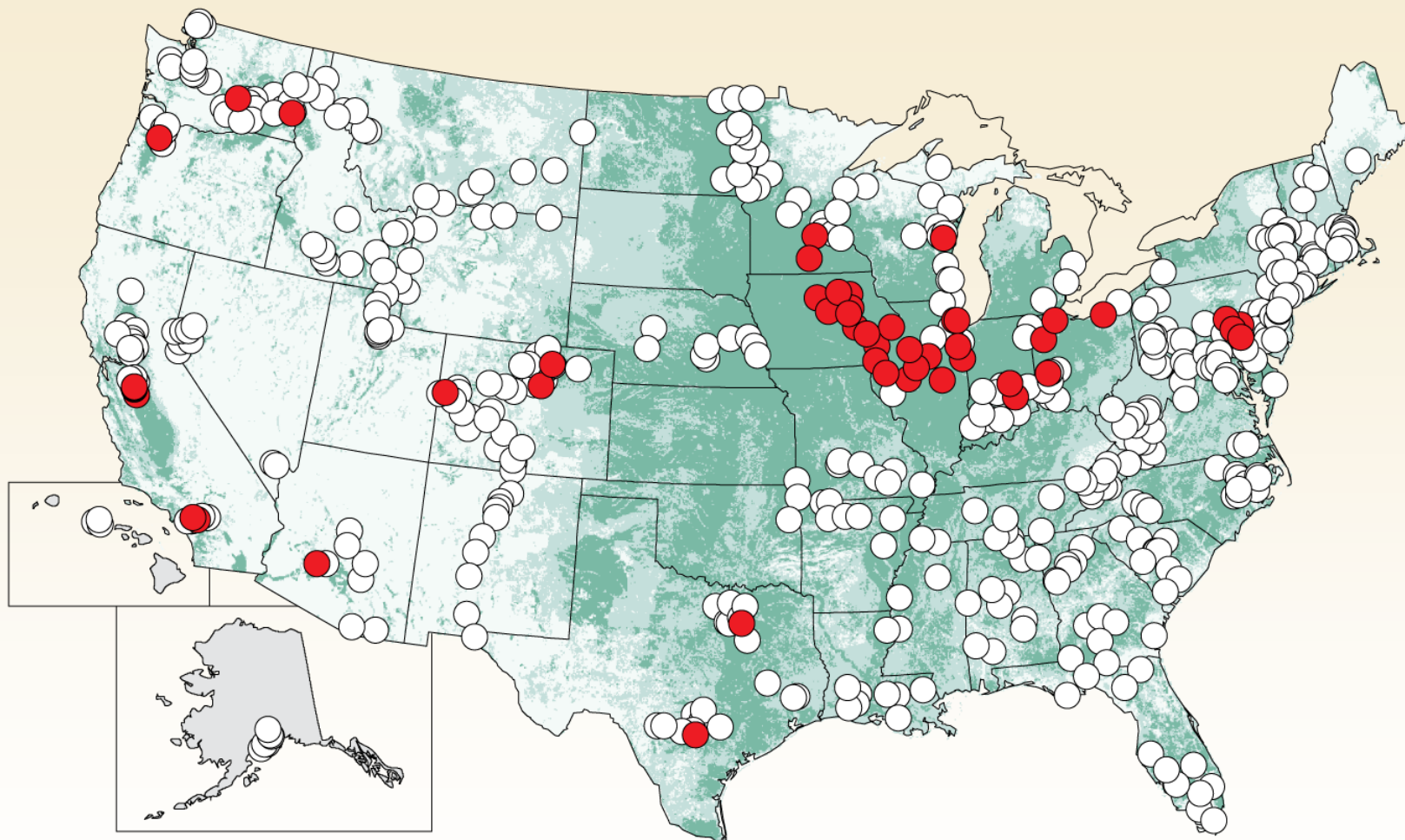


# Contribution of tile drains to nitrate in agricultural streams





# Nitrate concentrations in streams



Nonpoint source nitrogen inputs,  
in pounds per square mile

□ <2,900

■ 2,900–15,000

■ >15,000

○ No exceedance of nitrate MCL

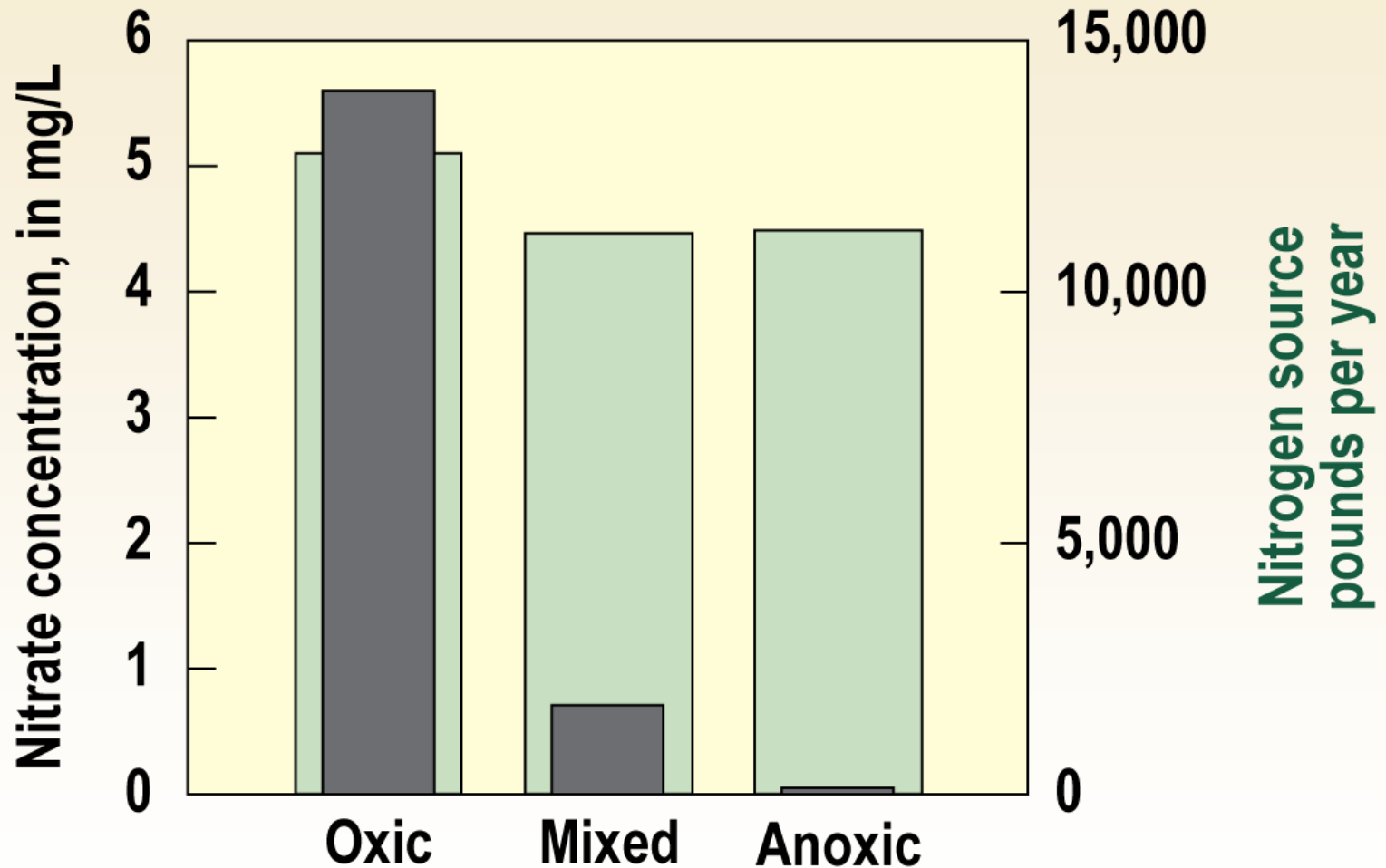
● 1 or more exceedance of nitrate MCL



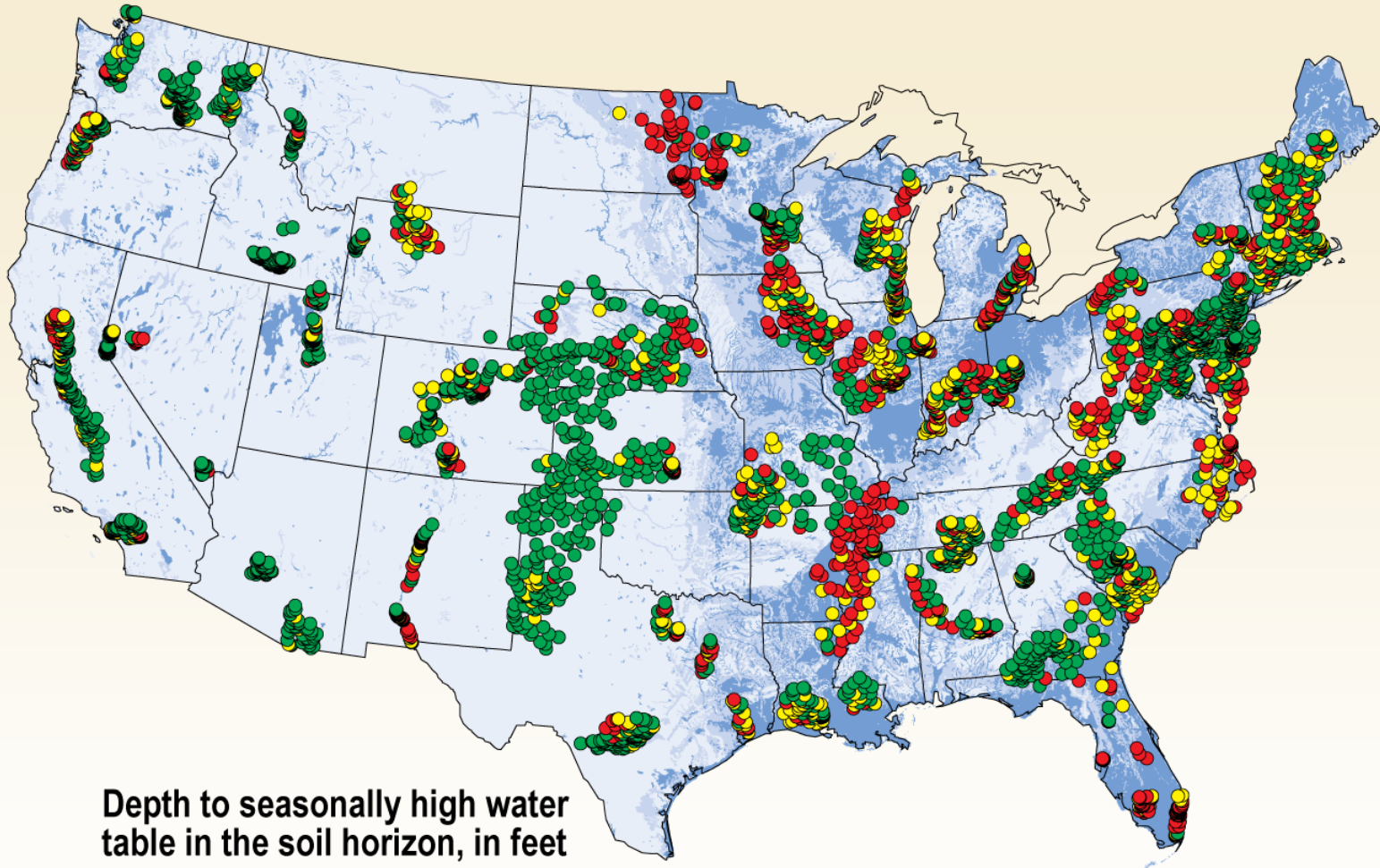
# Groundwater contributions to streams

# Biogeochemical control of nitrate

# Nitrate concentrations in shallow agricultural wells



# Biogeochemical condition of wells



Depth to seasonally high water table in the soil horizon, in feet

0-3

>3-5

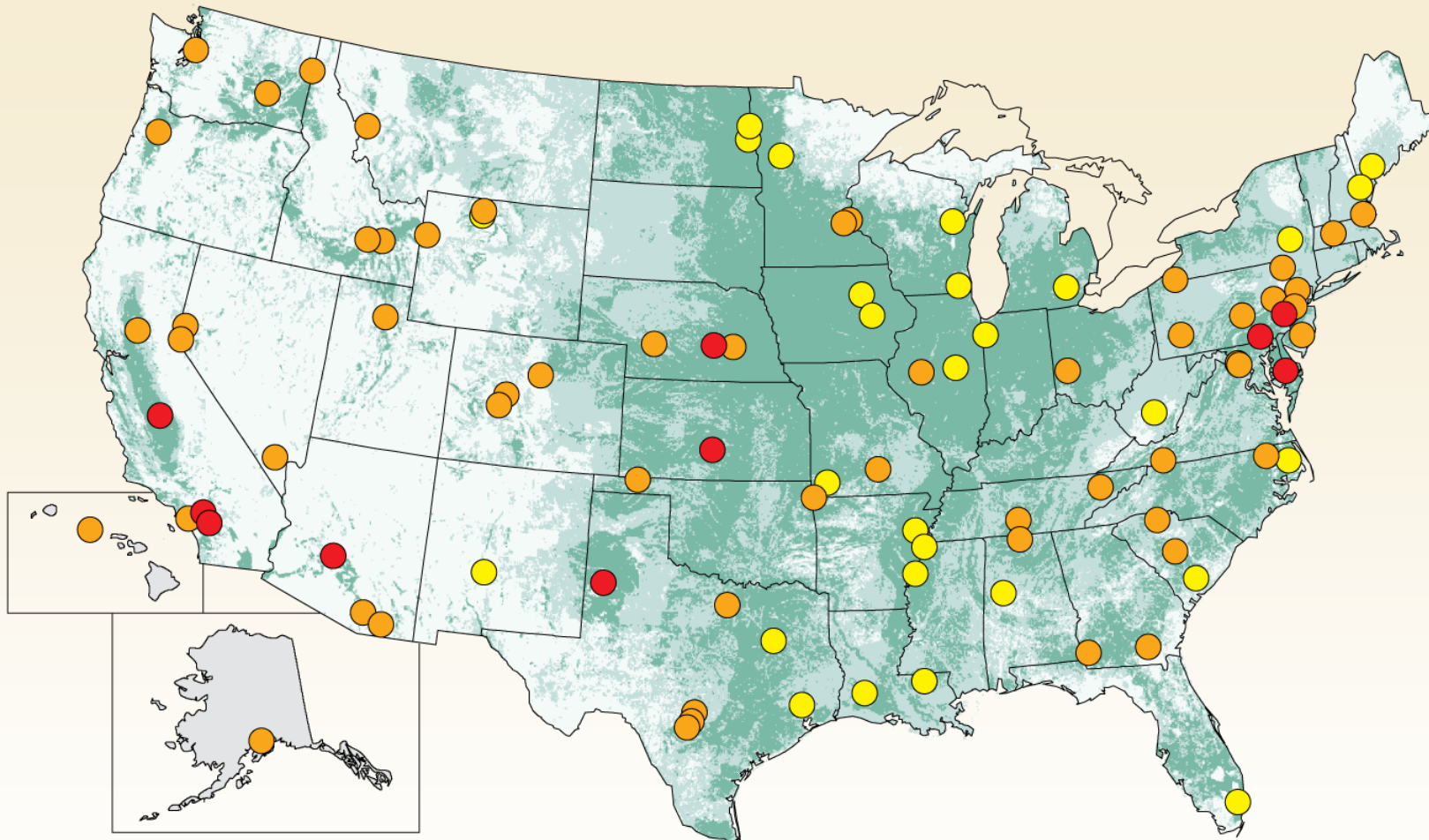
>5

• Anoxic

• Mixed

• Oxic

# Nitrate concentration in major aquifers



Nonpoint source nitrogen input,  
in pounds per square mile

- <2,900
- 2,900–15,000
- >15,000

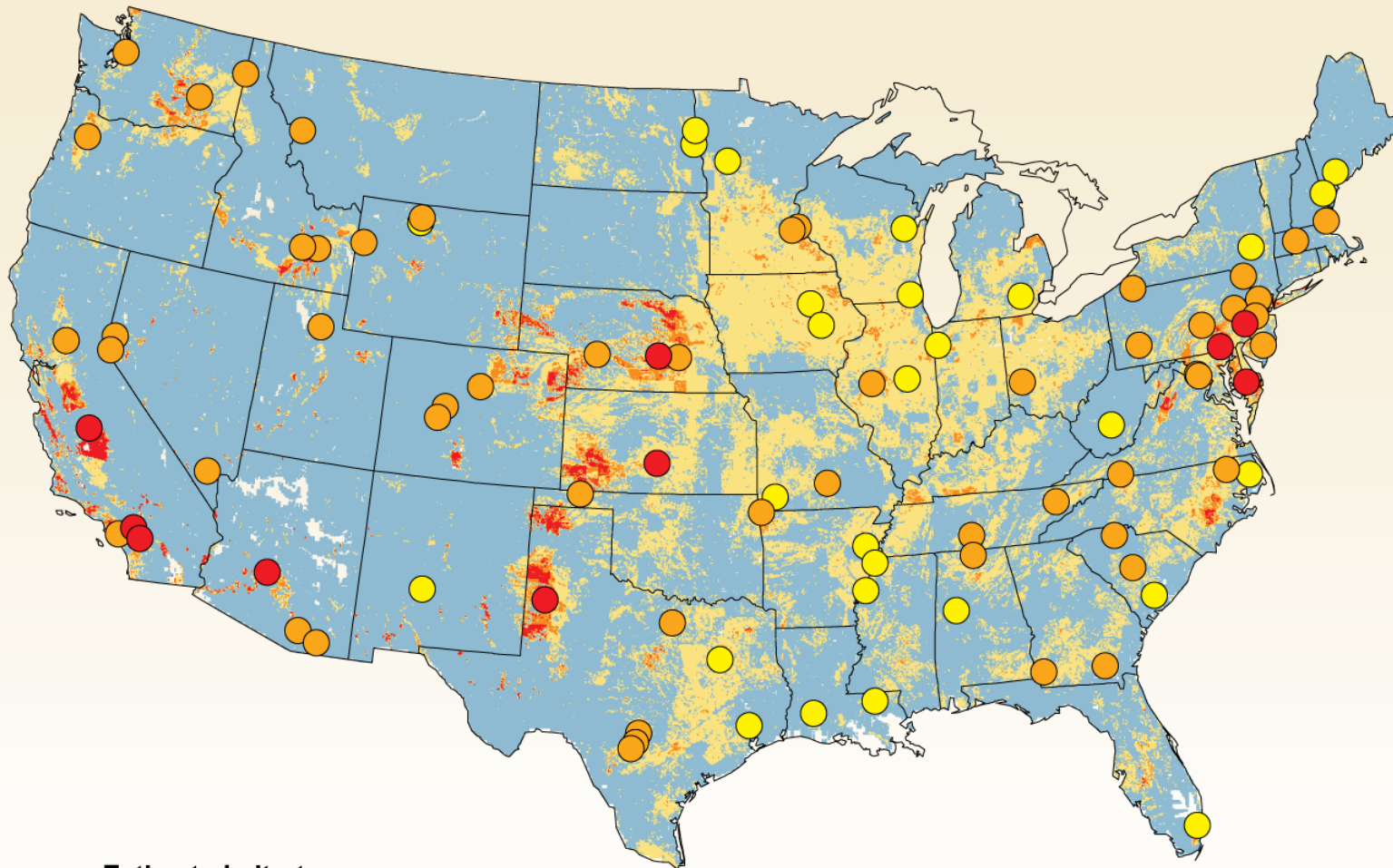
Major aquifers

- 
- 
- 






Median concentration  
of nitrate, in mg/L

- Low (<0.08)
- Medium (0.08–2.6)
- High (>2.6)




# Nitrate concentration in major aquifers



**Estimated nitrate concentration, in mg/L**

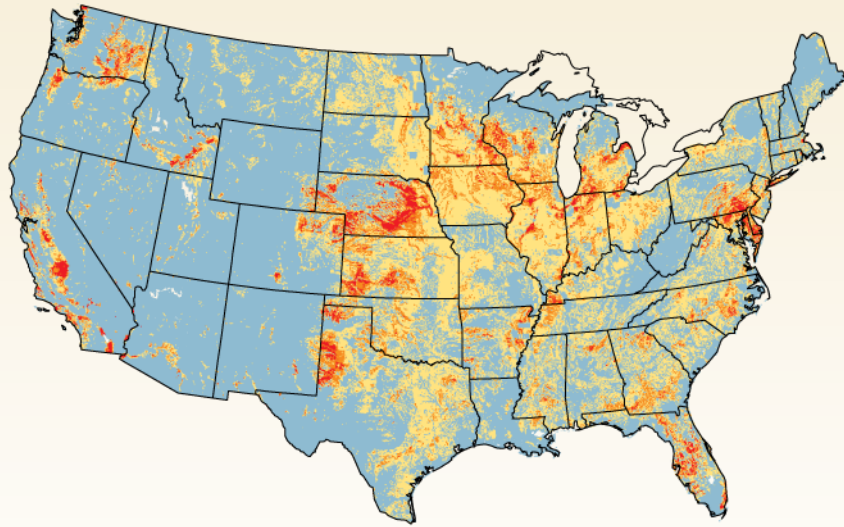
 $\leq 1$	 $> 10$
 $> 1-5$	 Missing data
 $> 5-10$	

**Major aquifers**

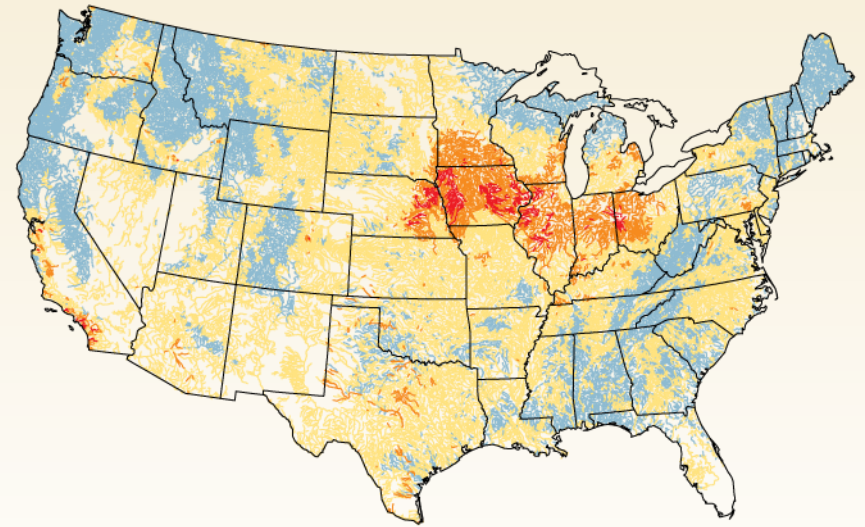
	Low ( $< 0.08$ )
	Medium ( $0.08-2.6$ )
	High ( $> 2.6$ )

# Modeled estimates of nitrate and total nitrogen in groundwater and streams

Estimated nitrate in shallow groundwater



Estimated total nitrogen in streams

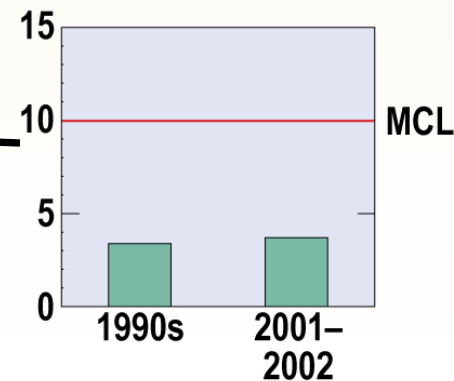
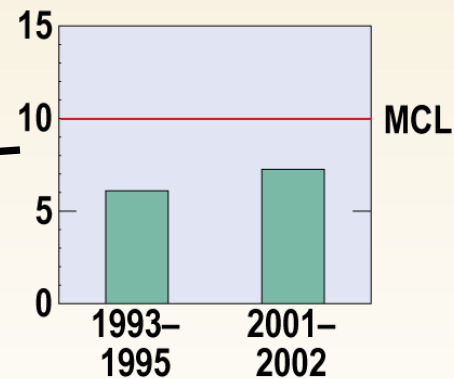
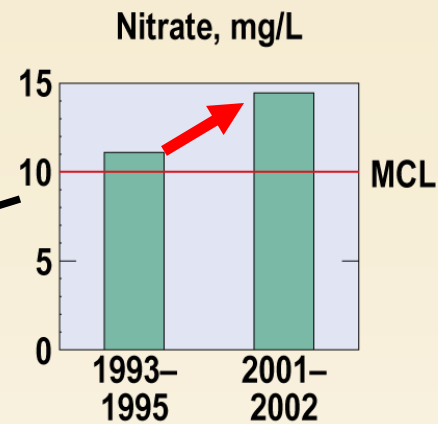
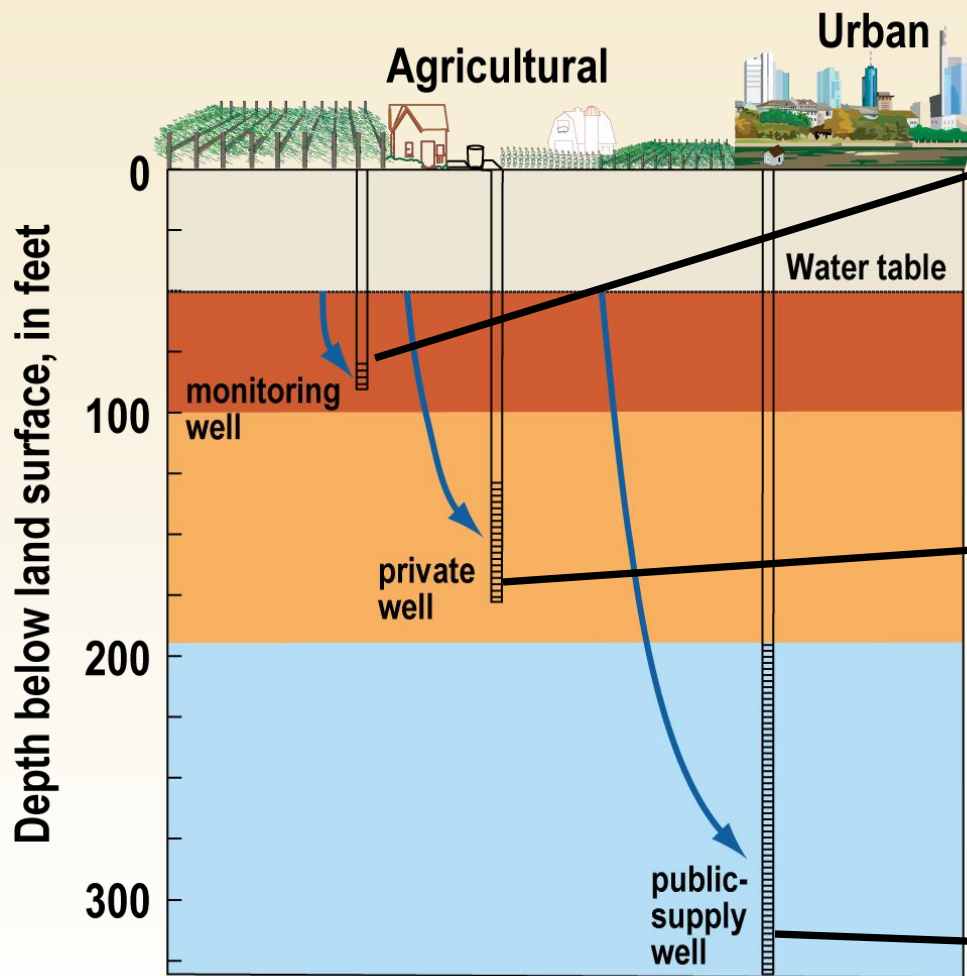


Concentration, in mg/L

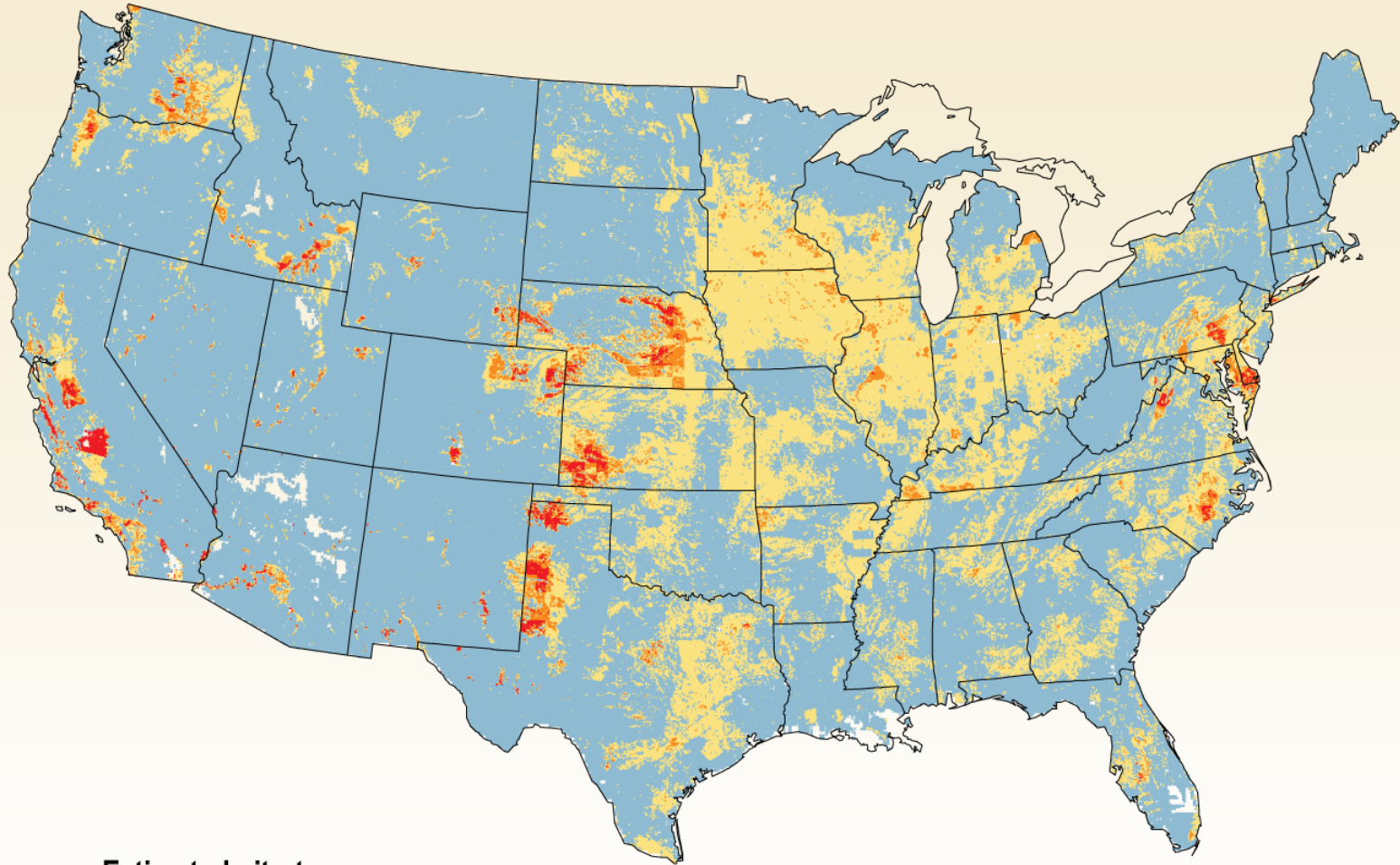




# Nitrate legacy in groundwater



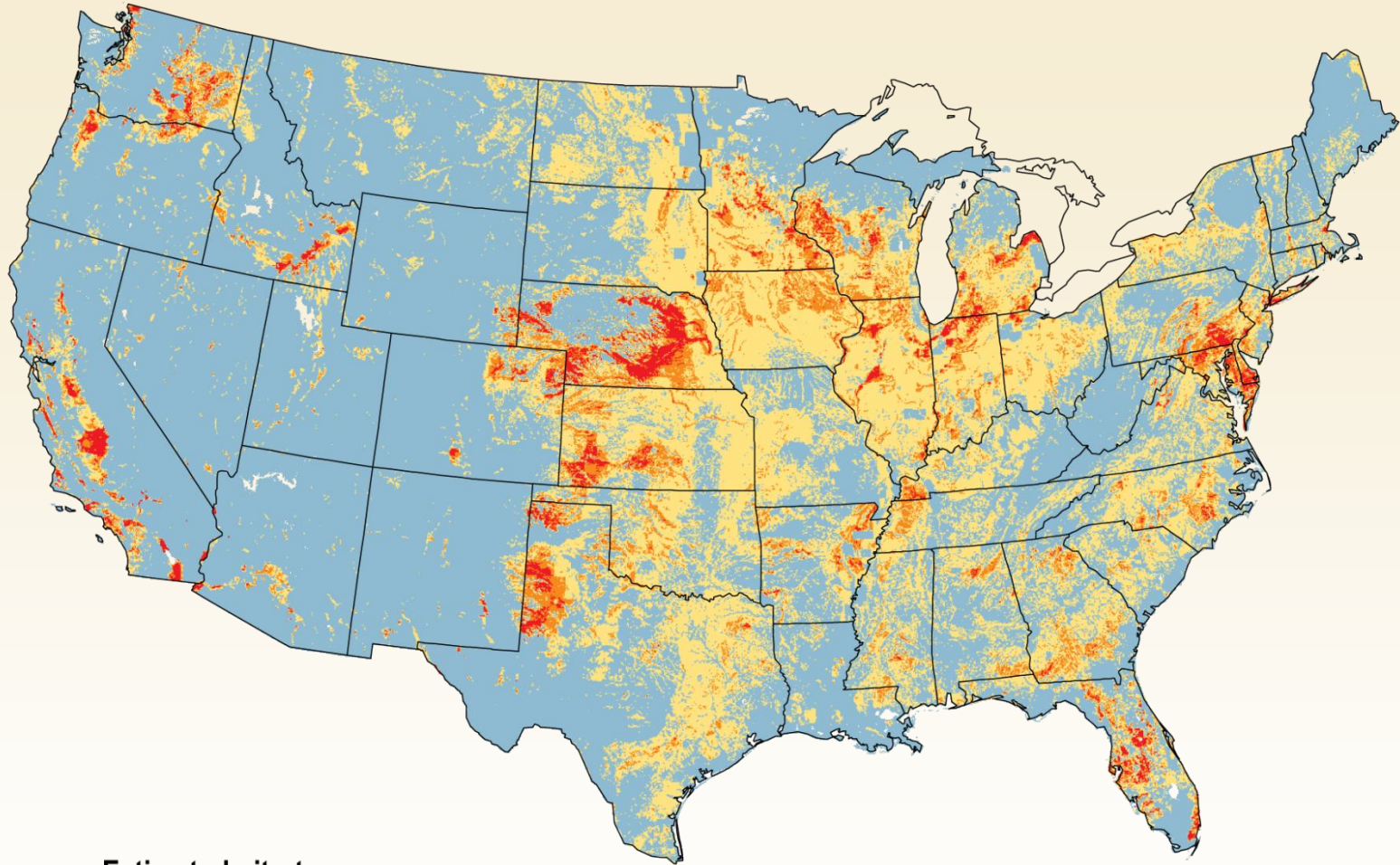
# Modeled nitrate concentrations in groundwater



Estimated nitrate  
concentration, in mg/L

Blue	≤1	Red	>10
Yellow	>1-5	White	Missing data
Orange	>5-10		

# Modeled nitrate concentrations in groundwater



Estimated nitrate  
concentration, in mg/L

Blue	≤1	Red	>10
Yellow	>1-5	White	Missing data
Orange	>5-10		