

# Challenges for Agriculture Based on Air Quality Issues

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# Why Do We Manage Manure?

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## Nutrients

- Chemical elements/compounds that have value as an input to biological systems
  - ▶ This value can be either positive or negative
  - ▶ If all nutrients are utilized, there is no potential for loss



## Where Can Nutrients Go?

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To the plant

Stay in the soil

Leach into the water system

Volatilize into the air



- Fixing a water problem can lead to a soil, air, etc., problem



# What Are the Nutrients that Affect Air Quality?

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Manure management for water quality is typically focused on N, P, and K

P and K are not usually volatilized

The main air quality emissions from manure management arise from C, N, and S



# Agricultural Air Emissions

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- Direct emissions of particulate matter (PM)
- Volatile organic compounds (VOCs)
- Ammonia
- Oxides of nitrogen (NO<sub>x</sub>)
- Odorous sulfur compounds
- Greenhouse gases
  - Carbon dioxide
  - Methane
  - Nitrous oxide





# Carbon-Based Air Emissions

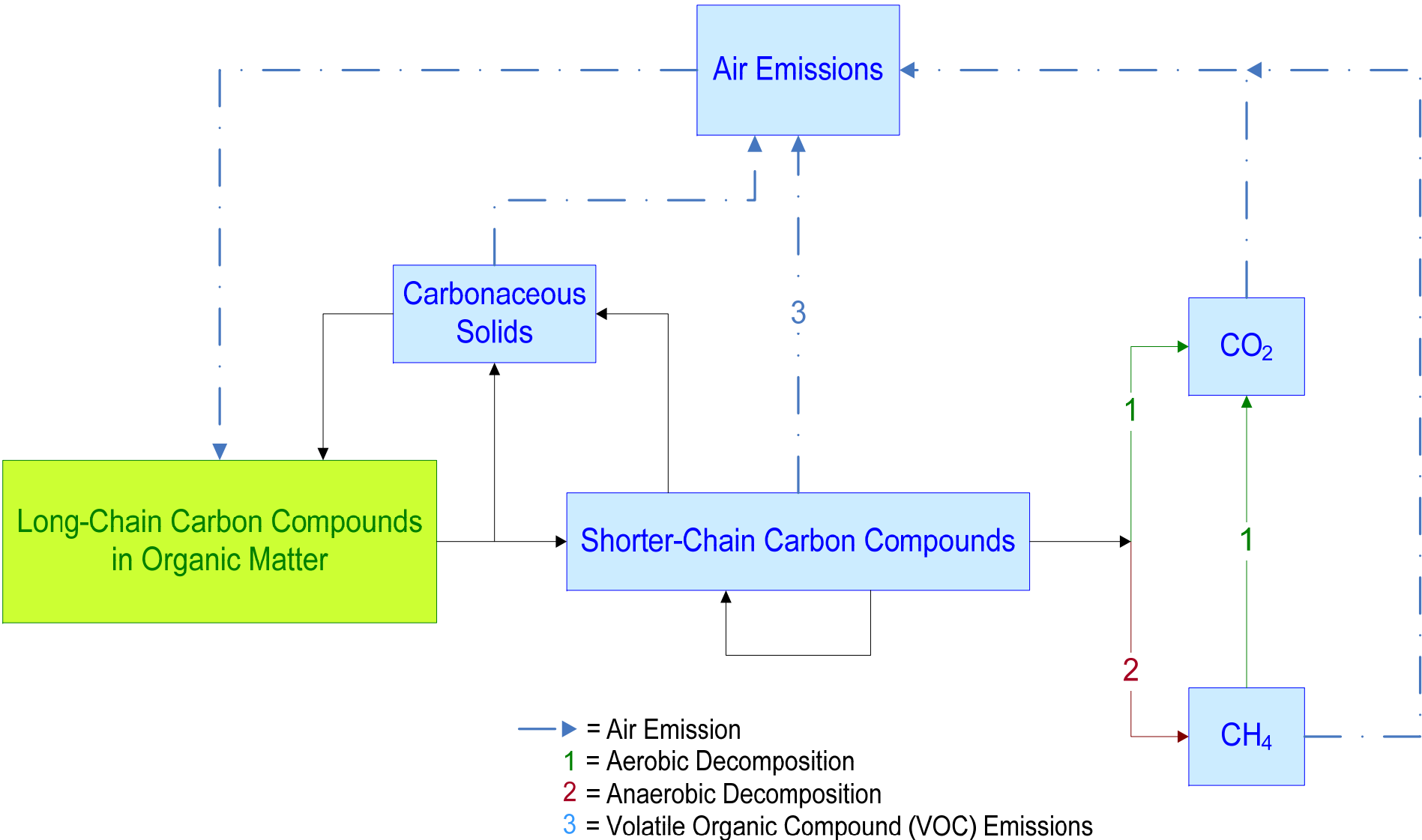
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Manure and other biological material contain long-chain carbon compounds

Long-chain carbon compounds are broken down through decomposition to shorter-chain carbon compounds

Shorter-chain carbon compounds are broken down eventually to  $\text{CO}_2$  or  $\text{CH}_4$  or released as volatile organic compounds (VOCs)

# Carbon Cycle for Air Emissions





# Nitrogen-Based Air Emissions

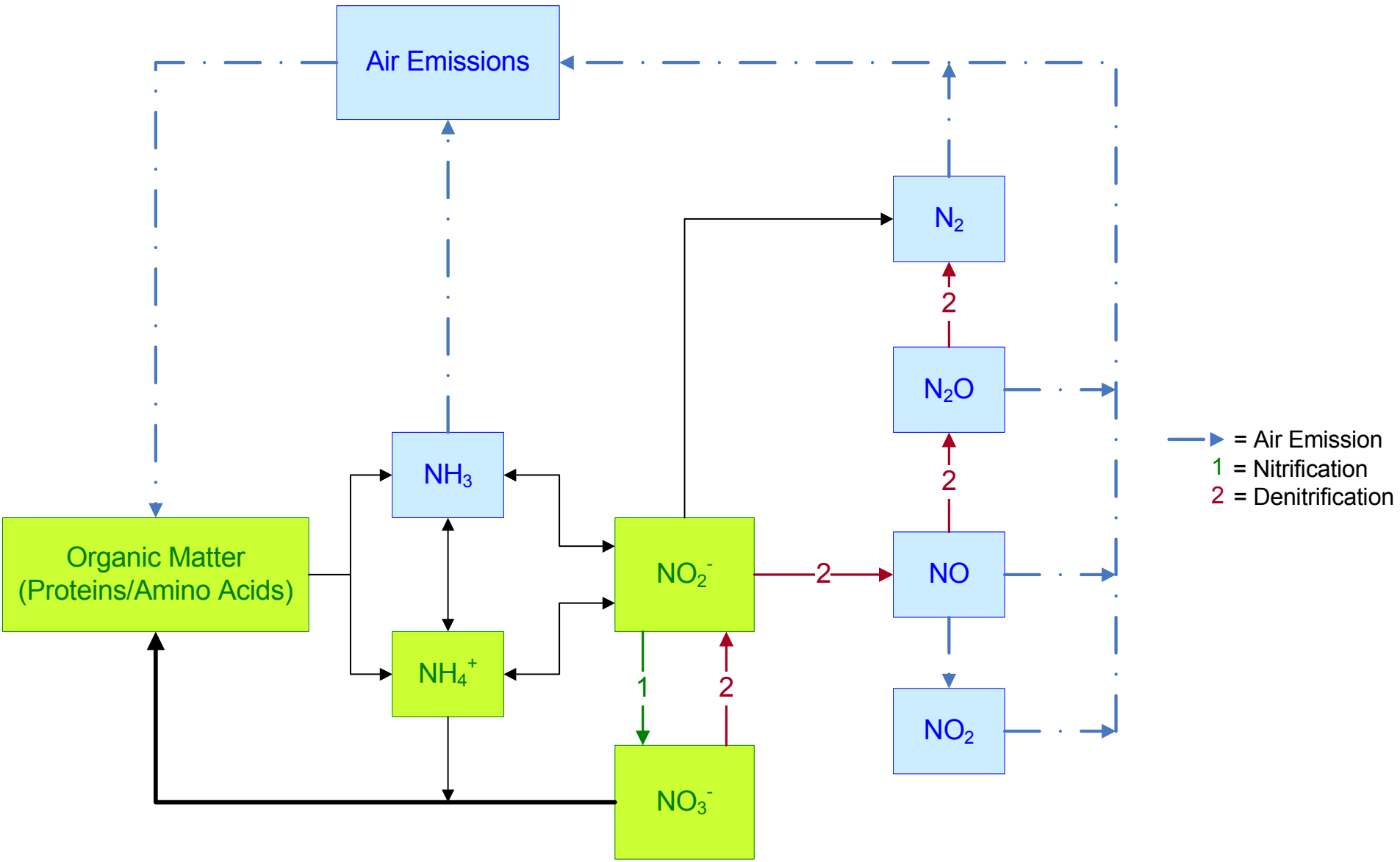
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Nitrogen in organic matter (proteins, amino acids, urea) generally converts to ammonium-N ( $\text{NH}_4^+$  or  $\text{NH}_3$ )

Ammonium-N can be converted through a variety of nitrogen oxidation and reduction reactions

Nitrogen can be volatilized as  $\text{NH}_3$ ,  $\text{N}_2\text{O}$ ,  $\text{NO}_x$ , or  $\text{N}_2$

# Nitrogen Cycle for Air Emissions





# Other Manure-Based Air Emissions

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Sulfur in feed, water, and manure can undergo conversion to odorous sulfur compounds

- H<sub>2</sub>S
- Mercaptans
- Dimethyl Disulfide, etc.

Solid manure particles and animal dander can be emitted as particulate matter

Liquid and gaseous pollutants can react or condense to form particulate matter

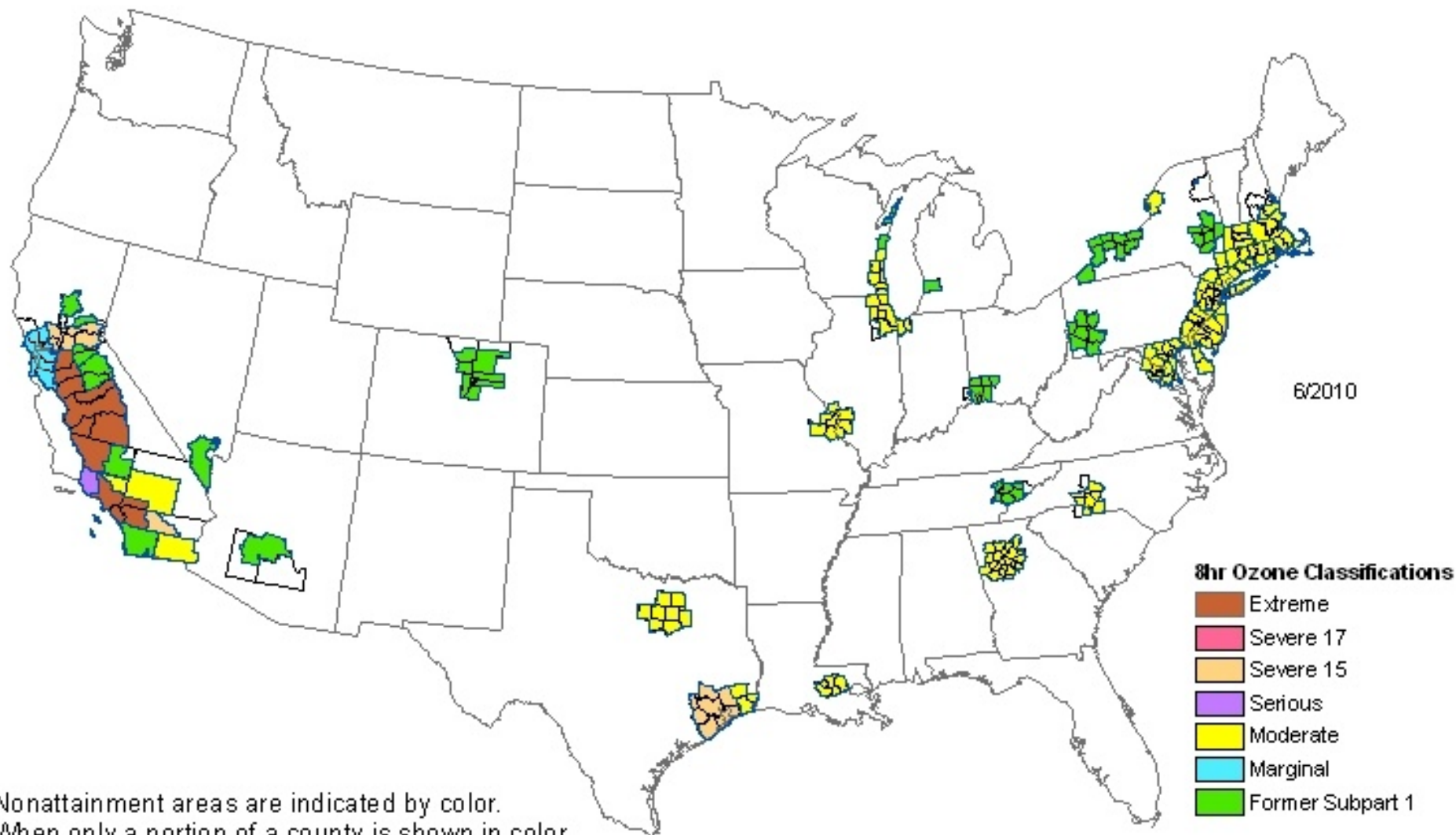


# Overview of Air Quality Issues

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- As people become more removed from the farm, but move closer to one, conflicts are likely to continue
- On the regulatory side, it's not going to get easier
  - Regulation of GHGs
  - More stringent ozone and PM standards

## 8-Hour Ozone Nonattainment Areas (1997 Standard)

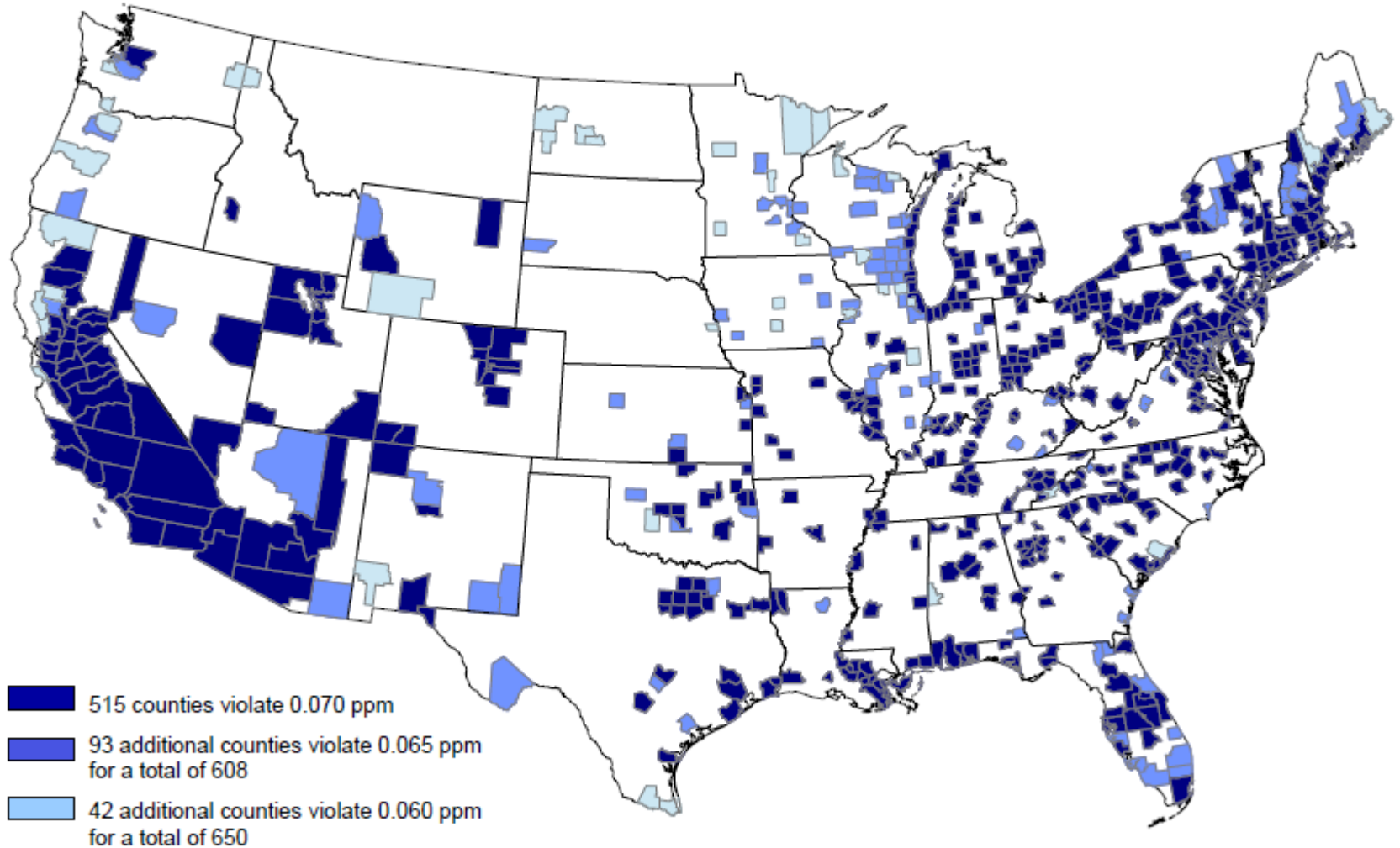


Nonattainment areas are indicated by color. When only a portion of a county is shown in color, it indicates that only that part of the county is within a nonattainment area boundary.

# Counties With Monitors Violating Proposed Primary 8-hour Ground-level Ozone Standards 0.060 - 0.070 parts per million

(Based on 2006 – 2008 Air Quality Data)

EPA will not designate areas as nonattainment on these data, but likely on 2008 – 2010 data which are expected to show improved air quality.



## Notes:

1. No monitored counties outside the continental U.S. violate.
2. EPA is proposing to determine compliance with a revised primary ozone standard by rounding the 3-year average to three decimal places.



# What Can We Do?

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Take a holistic view of nutrients in manure

Be efficient

Learn more



# Thank You!

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