



University of California

# Nitrogen Management Training

for Certified Crop Advisers

## MODULE 1

# California's Nutrient Management Regulations – Frequently Asked Questions

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# Introduction



- Certified Crop Advisers (CCAs) have been chosen, following training and certification, to sign off on nitrogen (N) management plans for California growers.
- This presentation addresses questions CCAs may have regarding their role in the future of N management plans.



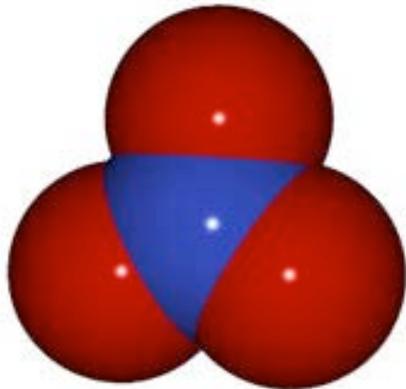
# What is the Problem?

- Nitrate in Drinking Water
  - Federal/CA Maximum Contaminant Level is 45 mg NO<sub>3</sub> /L (10 mg NO<sub>3</sub>-N /L).
  - Concentrations in drinking water of some CA aquifers exceed this level.
  - CA State Water Resources Control Board noted that 8% of drinking water wells exceed the nitrate threshold.

# Measuring Nitrate and Nitrate-N Concentrations

Measuring Nitrate:

45 mg NO<sub>3</sub><sup>-</sup>/L (measure **N + O**)



Measuring Nitrate-N:

10 mg NO<sub>3</sub><sup>-</sup>-N/L (measure **N** only)





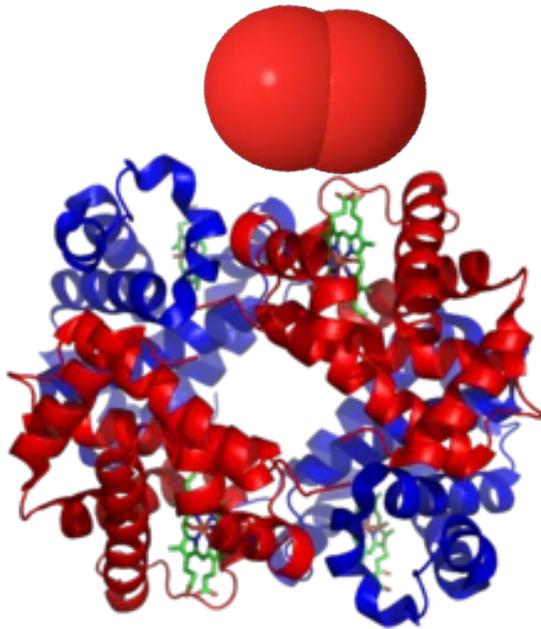
## Impact of Nitrate Polluted Water on Health

Nitrate ( $\text{NO}_3^-$ ) and nitrite ( $\text{NO}_2^-$ ) effects are related:

- Oral ingestion can lead to methemoglobinemia, “blue baby syndrome” in infants.
  - First described in 1945
  - Reference Dose established 1991
  - Basis of nitrate and nitrite Maximum Concentration Levels
- Not a human carcinogen (2002)

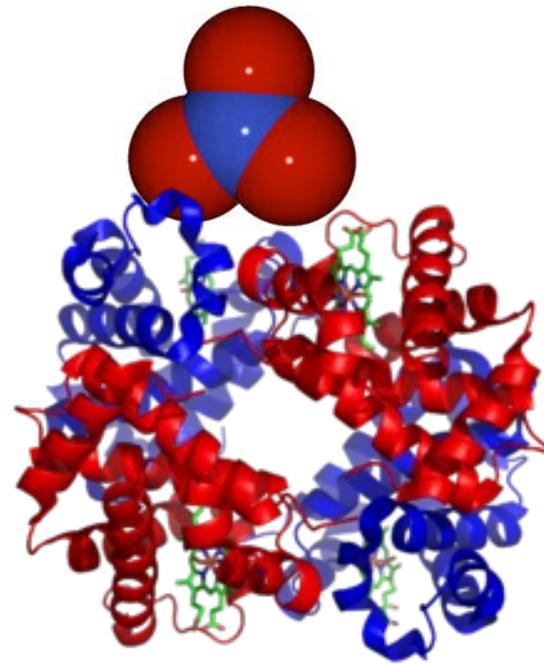
# What is Methemoglobinemia?

Healthy:



Hemoglobin binds with oxygen in blood.

Methemoglobinemia:



Hemoglobin binds with nitrate in blood, which blocks oxygen.

# What is Methemoglobinemia?

- Known as Blue Baby Syndrome
- Normal hemoglobin is converted to methemoglobin, which cannot carry oxygen.
  - 0-20% methemoglobin yields bluish skin (cyanosis)
  - 25-40% yields hypotension, rapid pulse and breathing
  - > 50% can be fatal
- Can be caused by several agents including nitrate



# Methemoglobinemia in California

- Agency for Toxic Substances and Disease Registry did an assessment at the request of CA DHS in 2000.
- 42 total methemoglobinemia cases over 13 years studied
  - None specifically associated with nitrate
  - Four located in areas where wells are used
- National figures similar- rare to find a clear, unique association with drinking water nitrate



# Is Nitrate a Human Carcinogen?

- USEPA does not currently believe so, based on lack of supporting data and substantial negative data
  - Theory is that  $\text{NO}_3^- \rightarrow \text{NO}_2^- \rightarrow \text{Nitrosamines}$
- Animal toxicity studies show nitrosamines cause cancer, but not nitrate or nitrite alone
- Human epidemiology studies are not clear



## Where Does Nitrate Pollution Occur?

- Nitrate is the most common pollutant in drinking water worldwide.
- USEPA estimates 52% of US community water wells and 57% of domestic wells have levels in excess of 2 mg NO<sub>3</sub><sup>-</sup> /L (considered background levels).
- USGS estimates up to 15% of wells exceed MCL.
- Problem Areas in California:
  - San Joaquin Valley, Santa Ana Valley and Salinas
  - In CA, nitrate contamination results from intensive agriculture combined with a shallow aquifer.

## Where is Nitrate a Problem in California?

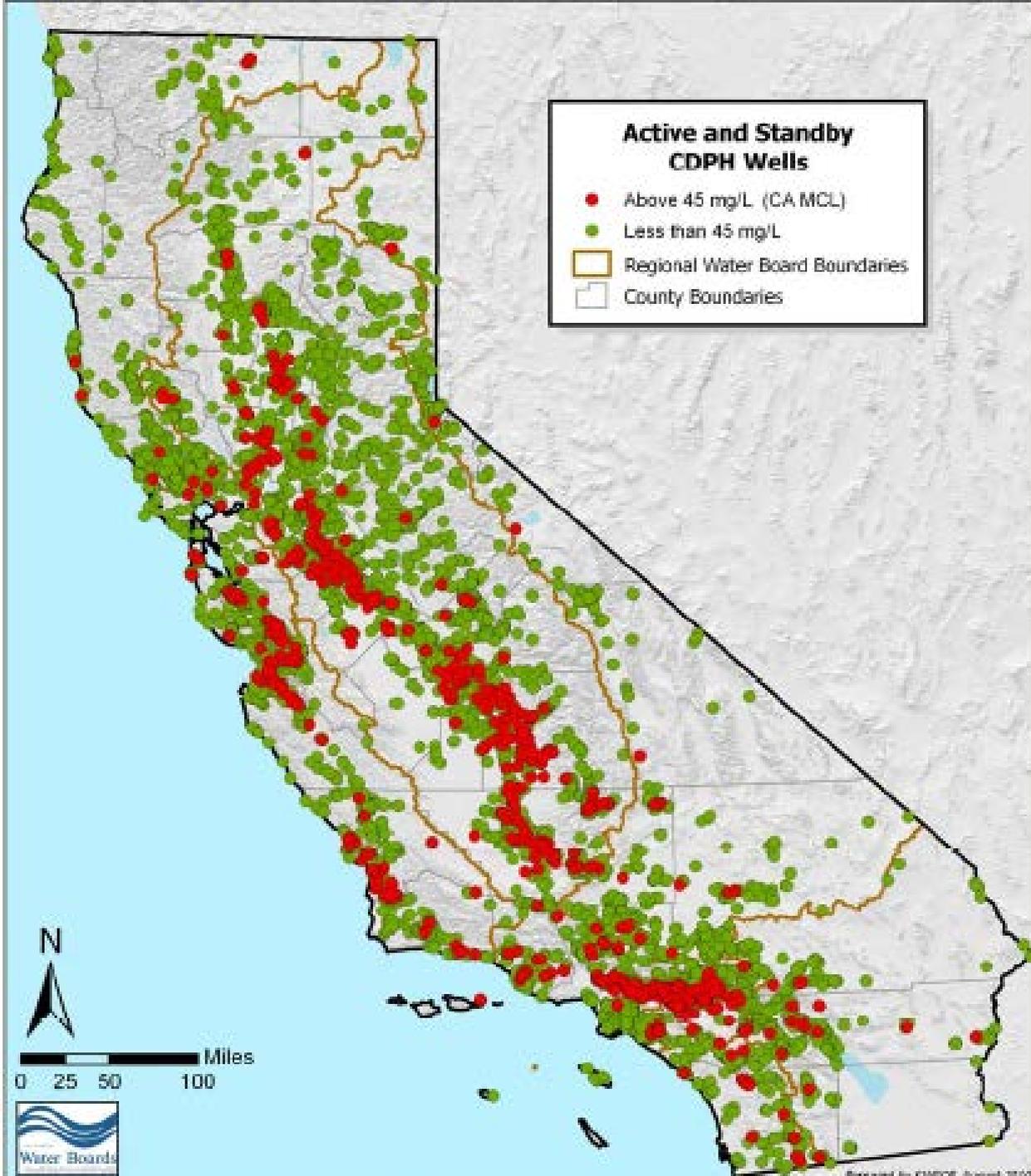
- Most nitrate contaminates groundwater, but the California coast has excess nitrate in surface water, causing hypoxia in Monterey Bay.
- Los Angeles, San Bernardino and Tulare counties have the most drinking water violations.
- Nitrate polluted wells occur mainly where there is shallow groundwater.
- Rivers have elevated nitrate concentrations, especially along the coast.

# Nitrate Problem Areas in California

Areas with shallow groundwater and intensive agriculture are vulnerable to nitrate contamination

● Above MCL

● Below MCL

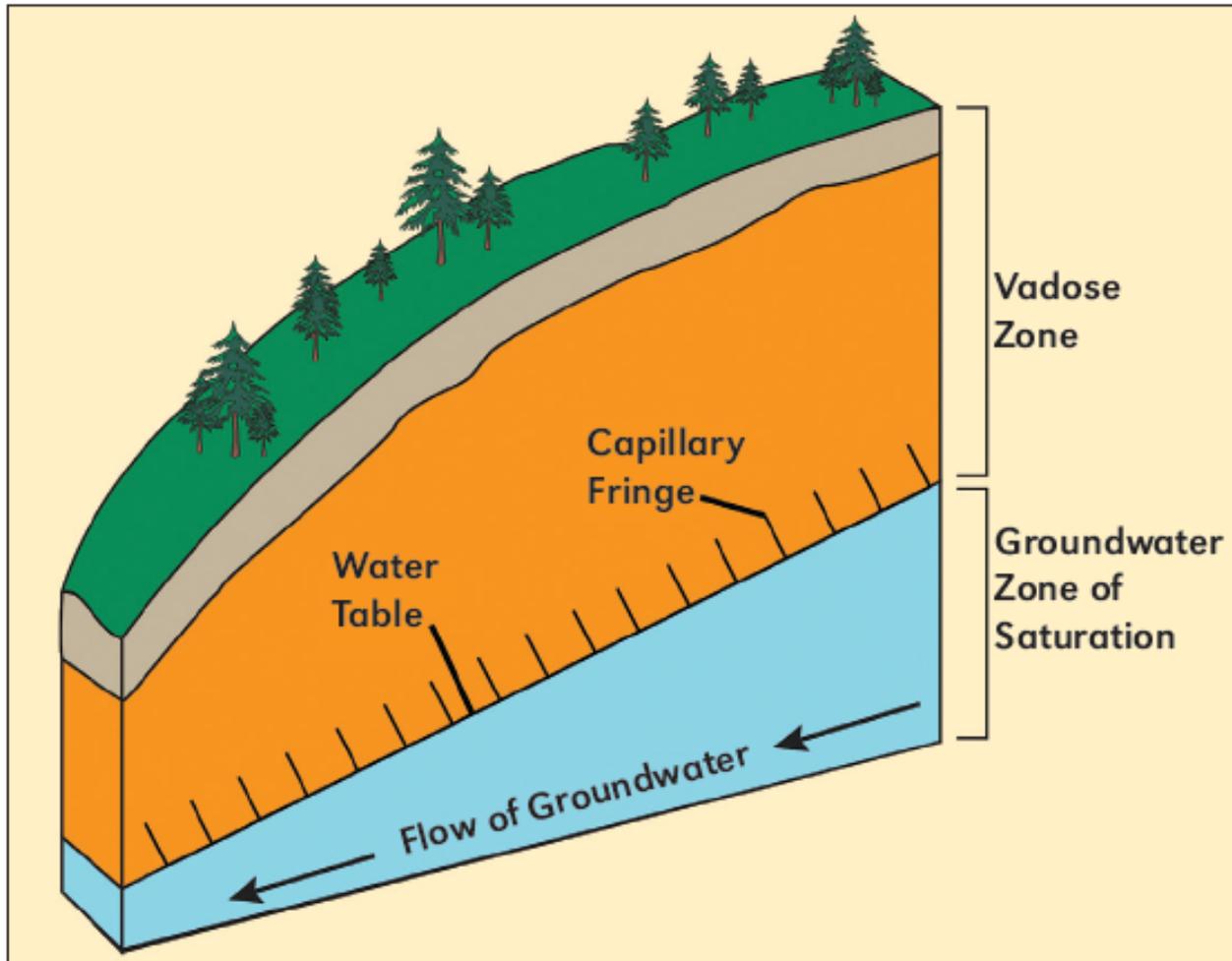




## Why is Shallow Groundwater Most Affected?

- Nitrate is an anion and is not retained by soil. It moves with the wetting front.
- Water moving below the root zone carries nitrate with it.
- Nitrates from septic systems can be a local problem.
- After years of downward flow with water, nitrate eventually reaches the aquifer.
- The farther from the source, the longer nitrate takes to reach the groundwater.

# What Happens Once Nitrate Moves Below the Rootzone?



Nitrate moves with water through the “Vadose Zone” until it reaches groundwater.



## How Did Nitrate Become a Problem?

- In nature, nitrogen cycles through soil, water, and plants at low concentrations.
- California agriculture has a long history of N use, with cropped acreage, N fertilization rates, dairy production, and irrigated land increasing in the last 50 years.
- Agriculture requires high N input to produce profitable crops.
- Inefficiency of irrigation and N application leads to nitrate leaching losses.

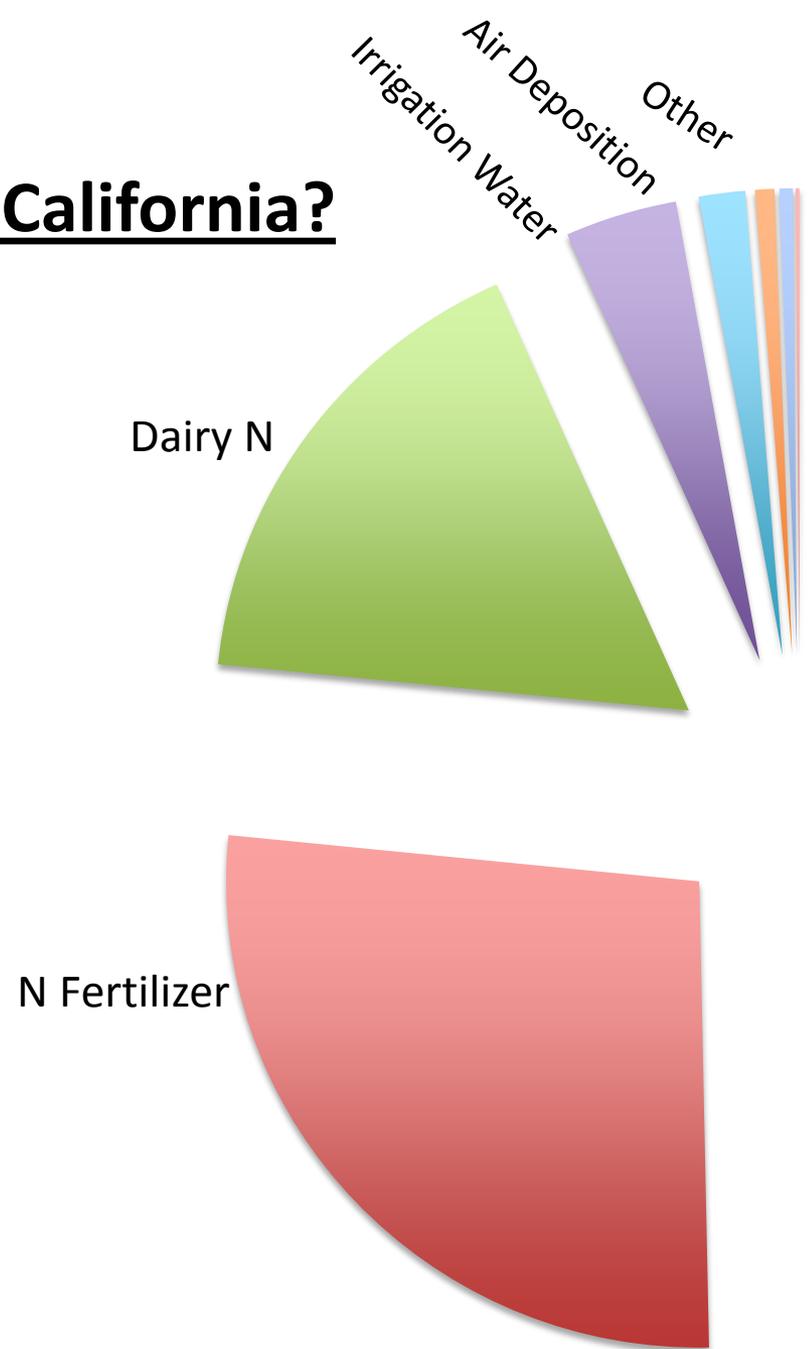


# Where is Nitrate Coming From in California?

The two major N inputs on cropland are:

- Synthetic fertilizer **53%**
- Dairy Manure **33%**

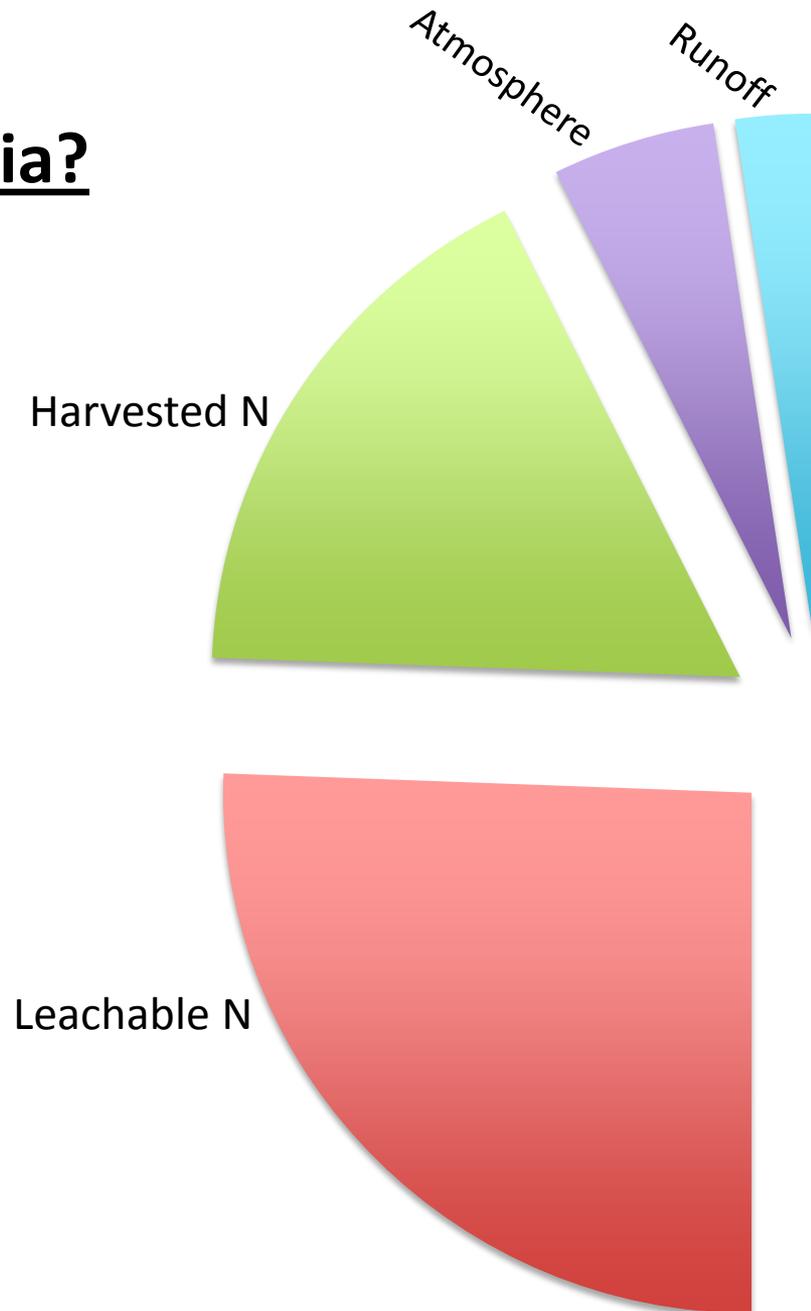
Data from Salinas Valley and Tulare Lake Basin





# Where is Nitrate Going in California?

- **34%** removed in harvest
- **10%** gaseous loss
- **5%** runoff
- **51%** available to leach to groundwater



Data from Salinas Valley and Tulare Lake Basin



# What are the Impacts of Nitrate Pollution?

- Nitrate in drinking water poses two problems:
  - Public health
    - In Tulare Lake Basin and Salinas Valley, 254,000 people at risk for drinking nitrate-contaminated water.
    - 220,000 people drink from public water systems
    - 34,000 drink from domestic wells.
  - Financial
    - Expense of treating contaminated water or providing an alternate source of clean water.



## What are the Financial Consequences?

- Large municipalities can afford to find unpolluted water sources or treat drinking water.
- Small agricultural communities cannot afford to treat their contaminated water nor buy purified water.
- No inexpensive method exists to remove nitrate.
- Inefficient use of N fertilizer wastes grower resources.



# What are the Regulatory Consequences?

- Irrigated Lands Regulatory Program (ILRP)
  - Managed by Regional Water Quality Control Boards
  - Applies to all growers who irrigate, except dairies
  - Boards use Waste Discharge Requirements (WDR) to specify what growers and coalitions must implement to protect groundwater and surface water.



## Regulations: Waste Discharge Requirements

- Growers with irrigated lands must either join regional coalitions or meet WDR requirements individually.
- Coalition Tasks in the Central Valley:
  - Groundwater quality assessments and plans
  - Monitoring long term groundwater quality trends
  - Assess which BMPs protect groundwater quality
  - Surface water quality monitoring
  - Compilation of data submitted by growers and reports to Regional Water Board

# Regulations: Waste Discharge Requirements

- Growers are responsible for:
  - Annual Farm Management Plans
    - Review whole operation for possible impacts on ground and surface water
  - Annual Nitrogen Management Plans
    - Will require CCA sign off if in vulnerable zone
  - Sediment and Erosion Management Plans where needed
  - Submitting data to Coalition or Water Board
  - Fees to pay for Coalition activities as well as Water Board staff time
- Implementation timing depends on location
  - Center Coast growers are in process of implementing
  - East San Joaquin Coalition members in process, with N management plan delayed to 2015
  - South SJV, West SJV, Sacramento Valley Coalition, etc. by 2015
  - In Central Valley, Nitrogen Management Plans signed off by CCAs will be required early 2015

## What Do CCAs need to do?

- The rest of this program will give you the background necessary to understand nitrogen management plans (NMP) and how to complete them.
- Your signature on the NMP verifies the grower is aware of the Management Practices to reduce the potential of nitrate loss.

## The Power of CCAs



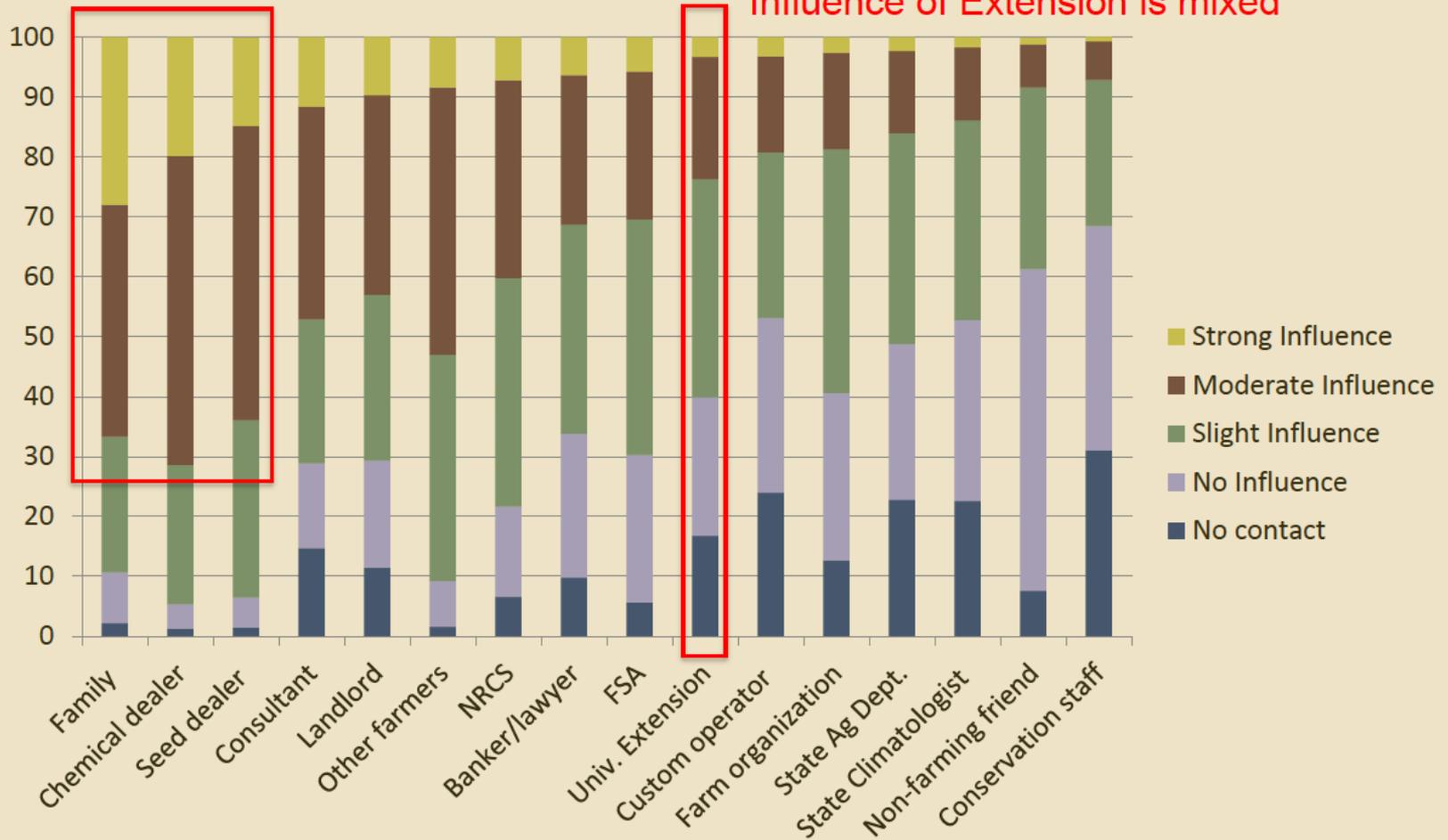
The role of CCAs in these regulations is to deliver information to farmers. The following examples demonstrate how important CCAs are in getting information to farmers.

# The Power of CCAs: Indiana Example



Please indicate how influential the following groups and individuals are when you make decisions about agricultural practices and strategies. (16 options)

Family, chemical dealers, and seed dealers are most influential  
Influence of Extension is mixed



# The Power of CCAs: Minnesota Example



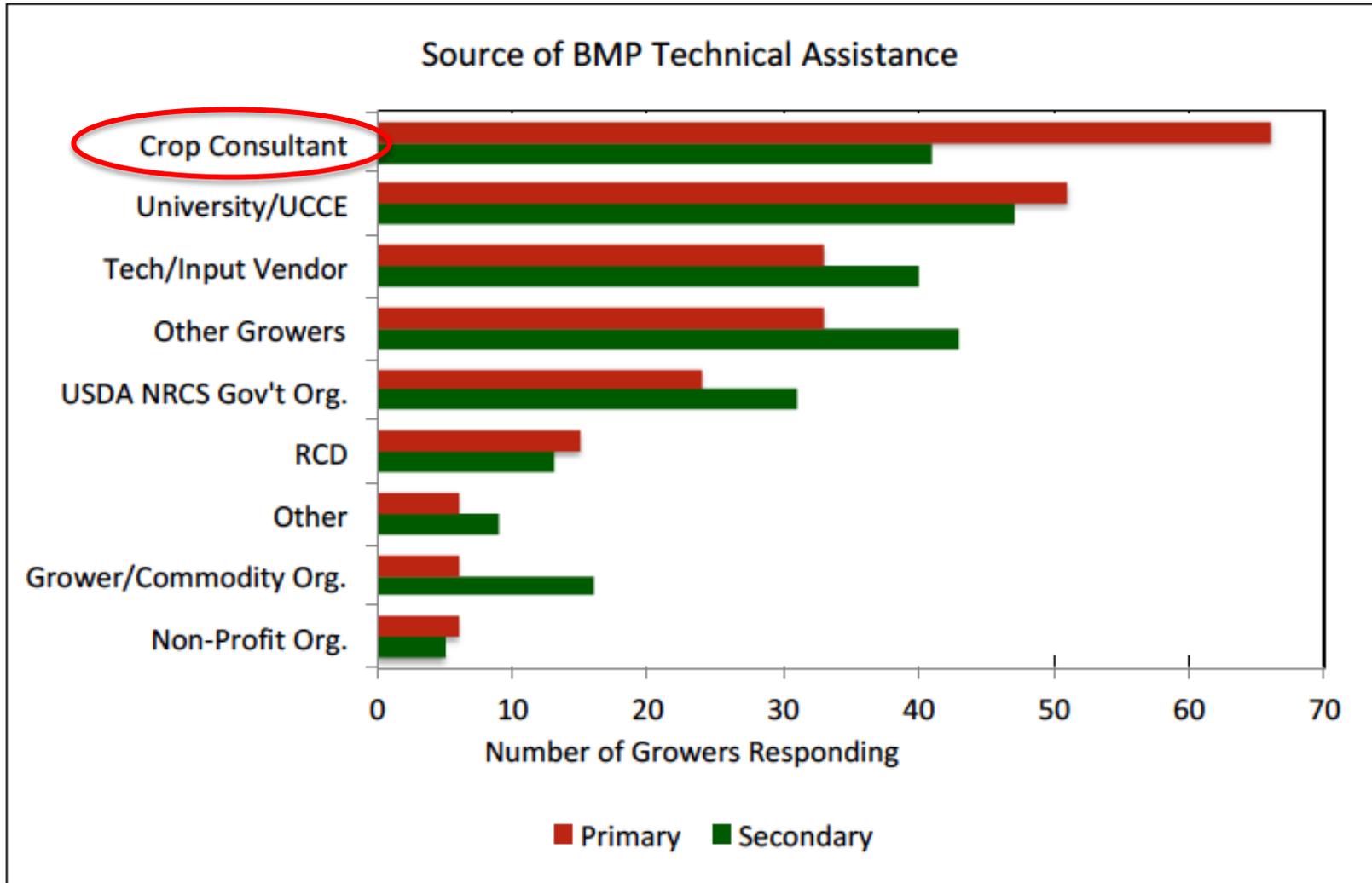
Survey asked farmers about the primary decision influencer for the decision maker.

**Overwhelmingly, this was the "fertilizer dealer"**

(Mike Schmitt, Univ Minn)

# The Power of CCAs: California Example

Crop Advisors are the most consulted source of technical assistance in helping farmers change management practices in California.



# Certified Crop Advisors Can Facilitate Change

CCAs have the relationship with farmers to help them improve their practices... everyone can improve!

CCAs have been empowered by the Water Board to take the lead in changing nutrient management practices:

- Get Educated!
- Get Busy!



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# Nitrogen Management Training

for Certified Crop Advisers

Course materials available at:

[ciwr.ucanr.edu/NitrogenManagement](http://ciwr.ucanr.edu/NitrogenManagement)

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