

# Barriers to Adoption of Conservation Nitrogen Management Practices in California

UC Nitrogen Course – Module 8

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## Project Team:

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Research support from:





# Overview of Module

1. Objectives
2. Background
3. Approach
4. Findings
  - Adoption trends
  - Drivers of adoption
  - Barriers to adoption
  - Addressing barriers
  - Perspectives on N management
5. Take-aways

# Module Objectives

- 1. Develop understanding of N management conservation practice adoption trends across operations and growers in CA**
- 2. Understand barriers to adoption across different operations and different management practices**
- 3. Introduce opportunities and solutions to address barriers to adoption**
- 4. Provide grower perspective on the Irrigated Lands Regulatory Program (ILRP) and N management reporting**



# Background



# Background: 4Rs of Nutrient Stewardship



## RIGHT SOURCE

Matches fertilizer type to crop needs.



## RIGHT RATE

Matches amount of fertilizer type crop needs



## RIGHT TIME



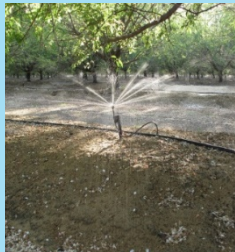
Makes nutrients available when crops need them



## RIGHT PLACE

Keep nutrients where crops can use them.

# Background: Nitrogen Management Practices to meet the 4Rs

	Fertility management	Soil management	Irrigation management
			
Right source	<ul style="list-style-type: none"> <li>Appropriate form of N fertilizer (organic, synthetic)</li> </ul>	<ul style="list-style-type: none"> <li>Appropriate C:N ratio of fertilizer</li> </ul>	<ul style="list-style-type: none"> <li>Well testing to account for N in irrigation water</li> </ul>
Right Rate	<ul style="list-style-type: none"> <li>Nitrogen Budget</li> <li>Leaf sampling to determine plant-nutrient status</li> <li>Variable rate application using GPS</li> <li>Slow-release fertilizers or nitrification inhibitors</li> </ul>	<ul style="list-style-type: none"> <li>Soil sampling to determine residual soil nitrate</li> <li>Cover crops</li> <li>Compost/ organic matter</li> </ul>	<ul style="list-style-type: none"> <li>Pressure chamber to measure plant water stress</li> <li>Moisture probe or soil sensors</li> </ul>
Right time	<ul style="list-style-type: none"> <li>Split fertilizer applications</li> </ul>	<ul style="list-style-type: none"> <li>Time of field mechanics (tillage, disk, etc.)</li> </ul>	<ul style="list-style-type: none"> <li>Use ET to schedule irrigation</li> </ul>
Right place	<ul style="list-style-type: none"> <li>Foliar N application</li> <li>Fertigation</li> </ul>	<ul style="list-style-type: none"> <li>Soil type</li> </ul>	<ul style="list-style-type: none"> <li>Check for distribution uniformity</li> </ul>



# Background: Influences on Practice Adoption

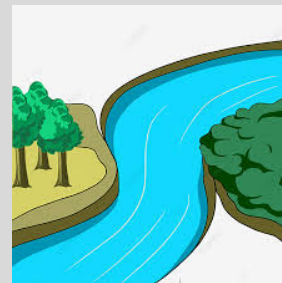
## Operation level:



Larger farm size



Greater farm revenue



Vulnerable land



Use of other conservation practices

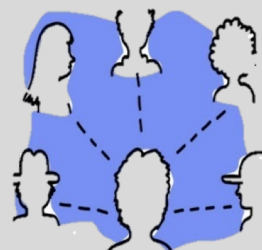
## Grower level:



Stewardship motivation



Pro-environmental attitudes



Learning from peers



Education & information about practices

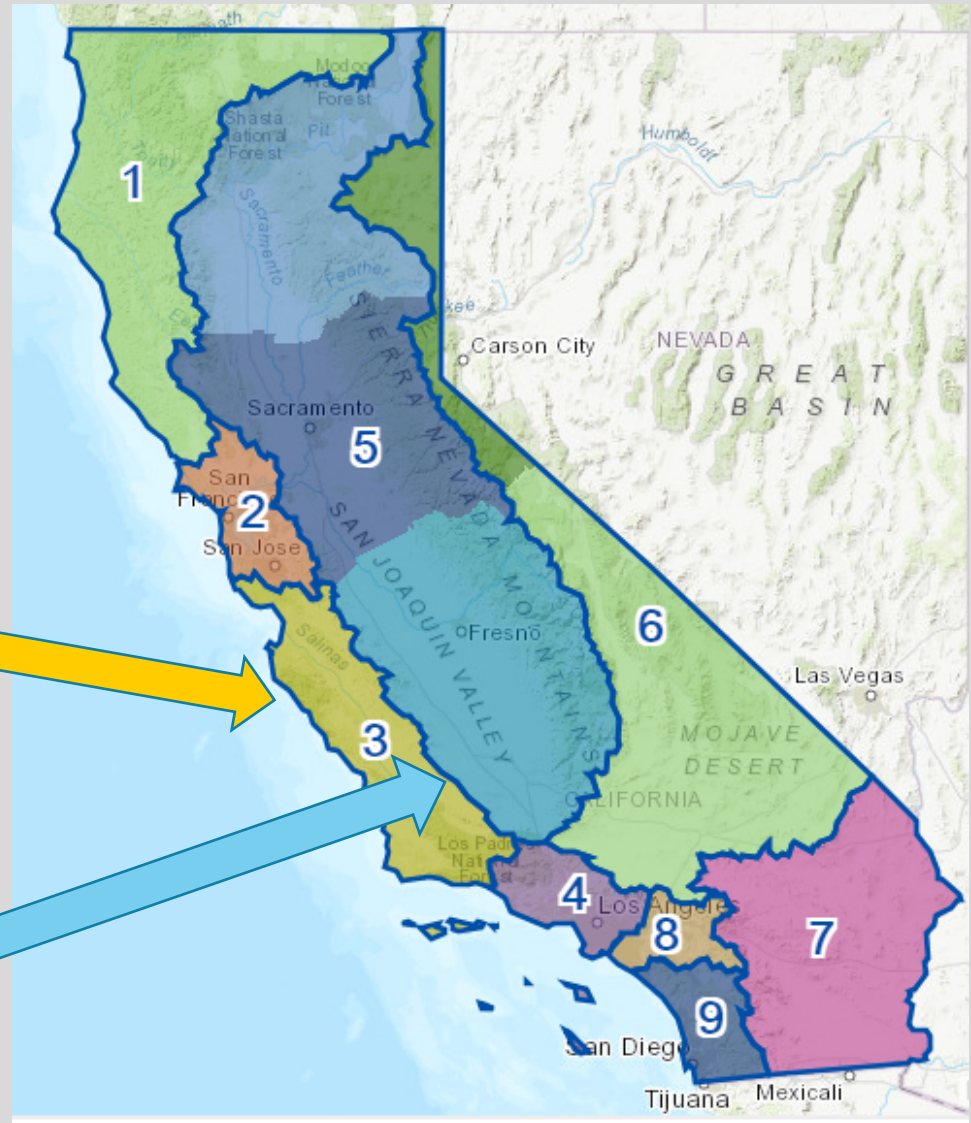
# California water quality policy

**State Water  
Resources Control  
Board**

**9 Regional Water  
Quality Control  
Boards**

**Central Coast  
Regional Board:**  
Board-to-farmer  
governance

**Central Valley  
Regional Board:**  
Governed through Water  
Quality Coalitions (WQCs)

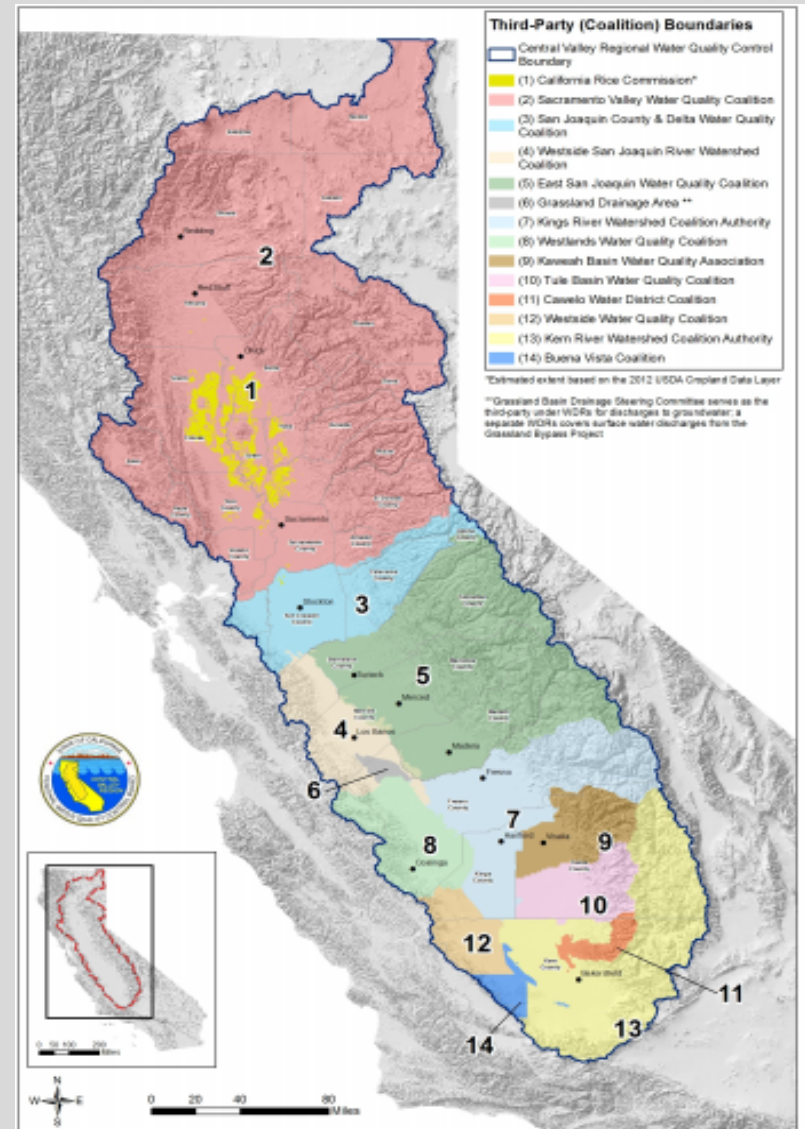




# Irrigated Lands Regulatory Program (ILRP)

## Requirements of Water Quality Coalitions:

- Surface and groundwater quality monitoring at representative sites across watershed
- Create regional 'Management Practices Evaluation Plans' that outline management approaches to reducing pollutants lost to surface and groundwater
- Assist growers in reporting requirements
- Offer continuing education to growers, including 'Self-Certification' course
- Aggregate growers' data to annual summary reports submitted to Regional Board
- Communicate programmatic and regulatory changes to growers, as requirements evolve with time



## Requirements of growers :

- IRRIGATION AND NITROGEN MANAGEMENT PLAN (INMP) WORKSHEET
- IRRIGATION AND NITROGEN MANAGEMENT PLAN (INMP) WORKSHEET
- Member ID: \_\_\_\_\_ INMP Field or MU: \_\_\_\_\_ Crop: \_\_\_\_\_ Total Acres: \_\_\_\_\_
- | IRRIGATION MANAGEMENT  |   |  |                         |
|--|---|--|-------------------------|
| <b>1. Irrigation Method*</b><br>(check one for Primary; if applicable, check one for Secondary) <div>             Primary    Secondary<sup>1</sup> </div> <div> <input type="checkbox"/> <input type="checkbox"/> Drip<br/> <input type="checkbox"/> <input type="checkbox"/> Micro Sprinkler<br/> <input type="checkbox"/> <input type="checkbox"/> Furrow<br/> <input type="checkbox"/> <input type="checkbox"/> Sprinkler<br/> <input type="checkbox"/> <input type="checkbox"/> Border Strip<br/> <input type="checkbox"/> <input type="checkbox"/> Flood           </div> |   | <b>Pre-Season Planning</b>   |                         |
|  |   | 2. Crop Evapotranspiration (ET, inches)                                  |                         |
|  |   | 3. Anticipated Crop Irrigation (inches)                                  |                         |
|  |   | 4. Irrigation Water N Concentration (ppm or mg/L, as NO <sub>3</sub> -N) |                         |
| <b>5. Irrigation Efficiency Practices*</b> (Check all that apply)  |   |  |                         |
| <div> <input type="checkbox"/> Laser Leveling<br/> <input type="checkbox"/> Use of ET in scheduling irrigations<br/> <input type="checkbox"/> Water application schedule to need<br/> <input type="checkbox"/> Use of moisture probe (e.g. tensiometer)           </div> <div> <input type="checkbox"/> Soil Moisture Neutron Probe<br/> <input type="checkbox"/> Pressure Bomb<br/> <input type="checkbox"/> Other: _____<br/> <input type="checkbox"/> Other: _____           </div>   |   |  |                         |
| HARVEST / YIELD INFORMATION  |   |  |                         |
| Harvest / Yield Information  |   | Expected (A)   | Actual (B)              |
| <b>6. Production Unit</b><br>(lbs, tons, etc.)   | <b>7. Harvested Yield*</b>  |  |                         |
| NITROGEN MANAGEMENT  |   |  |                         |
| <b>8. Nitrogen Efficiency Practices*</b><br>(Check all that apply)   | <b>Nitrogen Sources</b>   | <b>Recommended/<br/>Planned N (A)</b>                                    | <b>Actual N<br/>(B)</b> |
| <input type="checkbox"/> Split Fertilizer Applications<br><input type="checkbox"/> Irrigation Water N Testing<br><input type="checkbox"/> Soil Testing<br><input type="checkbox"/> Tissue/Petiole Testing<br><input type="checkbox"/> Fertigation<br><input type="checkbox"/> Foliar N Application<br><input type="checkbox"/> Cover Crops<br><input type="checkbox"/> Variable Rate Applications using GPS<br>Other: _____<br>Other: _____  | 9. Soil – Available N in Root Zone (Annualized, lbs/ac)<br><br><b>10. N in Irrigation Water*</b><br>(Annualized, lbs/ac)<br><br><b>11. Organic Amendments*</b><br>(Manure/Compost/Other, lbs/ac estimate)<br><br><b>12. Dry/Liquid Fertilizer N*</b> (lbs/ac)<br><br><b>13. Foliar Fertilizer N*</b> (lbs/ac)<br><br><b>14. TOTAL NITROGEN</b> (lbs/ac) |  |                         |
- <sup>1</sup> A secondary irrigation system could be used for crop germination, frost protection, crop cooling, etc.
- \*Bold Text Data to be reported to the Coalition on the INMP Summary Report, based on Actual Yield and Actual N.
- Plan Certifier Initials



# Approach: Surveying growers and PCAs & CCAs

# Approach: Data Collection

## Colusa-Glenn Subwatershed Program

- 377 grower surveys by mail

## San Joaquin County-Delta & East San Joaquin Water Quality Coalitions

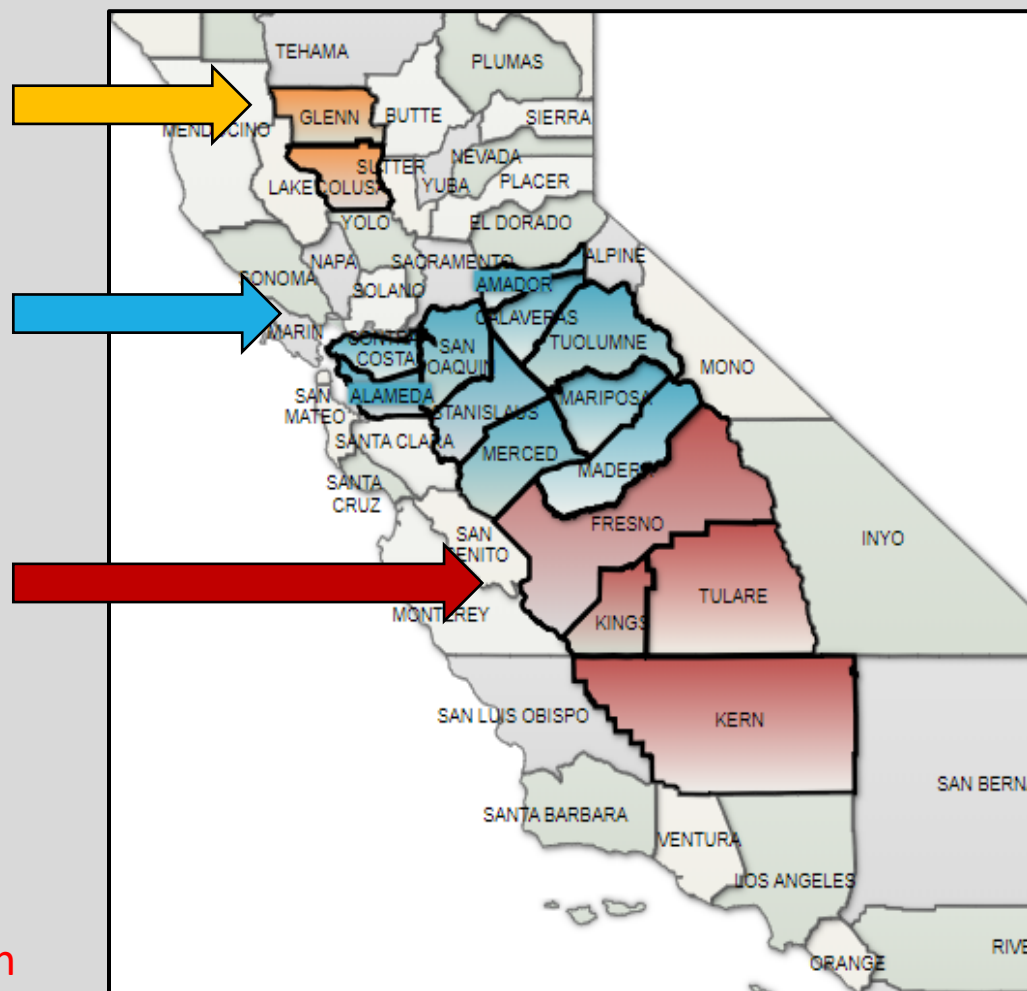
- 565 grower surveys in person
- 495 grower surveys by mail

## South San Joaquin Valley Water Quality Coalitions

- 528 grower surveys in person
- XX grower surveys by mail

## Statewide

- 150 PCA & CCAs surveyed in person
- 30 interviews with growers, farm advisors, water quality coalitions
- 6 grower field days





# Approach: Who responded to the surveys?

## Survey respondents' characteristics:

### Farm operation:

- Avg farm size: 355 acres
- Diversification: 64% have 1 crop, 36% report 2+ crops

### Land tenure:

- 79% land owners
- 8% tenants/ operators
- 5% in-house managers

### Water source:

- 40% groundwater only
- 44% surface water (riparian or district) only
- 16% both SW and GW
- 74% have pressurized irrigation (drip or micro-sprinklers)

### Crop types:

- Majority (>50%) grow nuts on at least some of operation
- Additional important crops: grapes, citrus, fruit, tomatoes, row crops (corn, alfalfa, wheat, oats), rice



**Grower Views on Nitrogen Management**

**General Instructions**

We seek your input to understand the perspective of California growers regarding nitrogen (N) management on irrigated agricultural lands.

This survey is intended for the individual(s) who holds the **primary responsibility** for on-farm decision making for the farming operation addressed on the survey envelope. If you are **not** the decision-maker then, please give this survey to the person who holds this responsibility.

Your privacy is our top priority. All results will remain anonymous and any publications developed by UC Davis will report data in aggregate. Your survey responses will not be associated with your personal information.

Please complete the survey (it should take about 20 minutes), fold it and mail it back in the enclosed pre-paid envelope at your earliest convenience.

We thank you for your time and participation.

**Conducted by:**  
**University of California Davis**  
College of Agricultural and Environmental Sciences

**Please direct any questions or concerns to:**  
Jessica Radnick  
Research Assistant  
University of California, Davis  
Department of Environmental Science & Policy  
jradnick@ucdavis.edu  
(314) 488-7646

**Please return your completed questionnaire in the enclosed envelope to:**  
Mark Lubell  
Professor  
One Shields Drive  
Department of Environmental Science & Policy  
University of California Davis  
Davis, CA 95616

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UNIVERSITY OF CALIFORNIA

**\*\*Sample determined to be representative of regions based on farm size & crop type**

# Findings: Practice Adoption Trends in CA