Monitoring for Current-Use Pesticides in Amphibians and the Water and Sediment in Their Habitat

William Battaglin, Kelly Smalling, Kathy Kuivila, Timothy Reilly, and Gary Fellers: all at USGS

With help from: lots of others

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Project People - I

- Cooperative project with the Toxics Substances Hydrology Program (Toxics) and Amphibian Research and Monitoring Initiative (ARMI)
  - On the biology side
    - Gary Fellers - CA
    - Erin Muths – CO
    - Jerry Longcore - ME
    - Hardin Waddle – LA
    - Jamie Barichivich-FL, GA
    - David Pilliod – ID
    - Laura Roberson-WV
      - Skin peptide work
    - Tara Chestnut-OR
      - Water, frogs, and PCR

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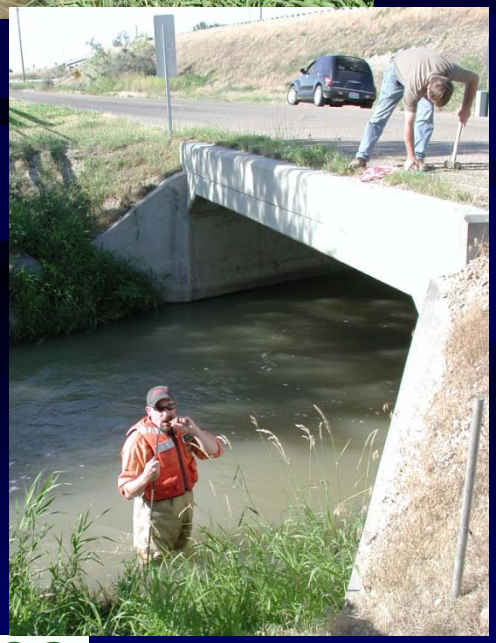
Project People - 2



- On the water side
  - Bill Battaglin-CO
  - Tim Reilly-NJ-ME-…
  - Jim Orlando-CA, ID, …
  - Ryan Todd-CA
  - Chauncey Anderson-OR
  - Dennis Demcheck-LA
  - Brian Hughes and Dan Calhoun-GA
  - Mark Hardy and others-ID
- On the chemistry side
  - Kelly Smalling-CA
  - Kathy Kuivila-CA
  - Mike Meyer-KS
  - Julie Kirshtein-VA

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Science Questions

- What current use pesticides are frogs exposed to in aquatic habitats?
  - What are the potential effects of that exposure?
- Is Bd (a fugal pathogen that can kill frogs) occurrence on frogs or in water related to pesticide occurrence
- Do pesticides affect frogs natural ability to resist Bd by affecting skin peptide production

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Study Hypothesis

- Water will contain a complex mixture of low level current-use pesticides
  - Including more soluble compounds and infrequently analyzed fungicides
- Sediments will contain a different mixture of pesticides
  - including pyrethroids, glyphosate, and other hydrophobic compounds
- Pesticides in frog tissue will reflect pesticides and degradates detected in ponds
- Bd will be detected more frequently in water and on amphibians from ponds with higher insecticide or herbicide concentrations

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Project Objectives

- Measure current-use pesticide concentrations in water, sediment, of pond habitat, and in frog tissue
- Measure the concentration of Bd in habitat water and on frogs
- Collect frog skin samples that can be used for skin peptide test
- Collect ancillary site and hydrologic information
- Collect this data from sites across the US

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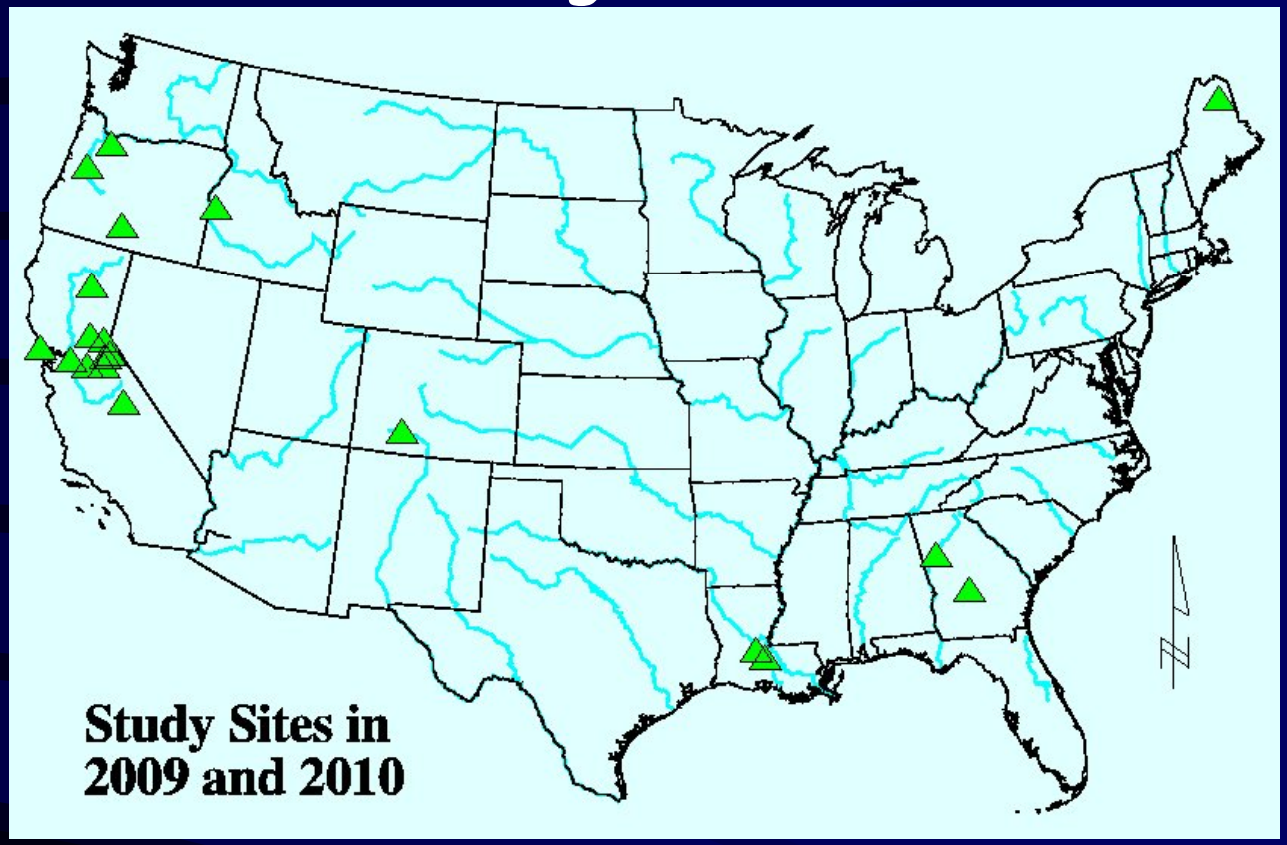
Study Sites I



- In 2009 sites in CA (10), ME(2), CO(2), and OR(3)
- In 2010 sites in CA (10), CO(2), OR(2), ID(2), GA(2), and LA(2)

Sites are typically vernal pools, small ponds or first order streams

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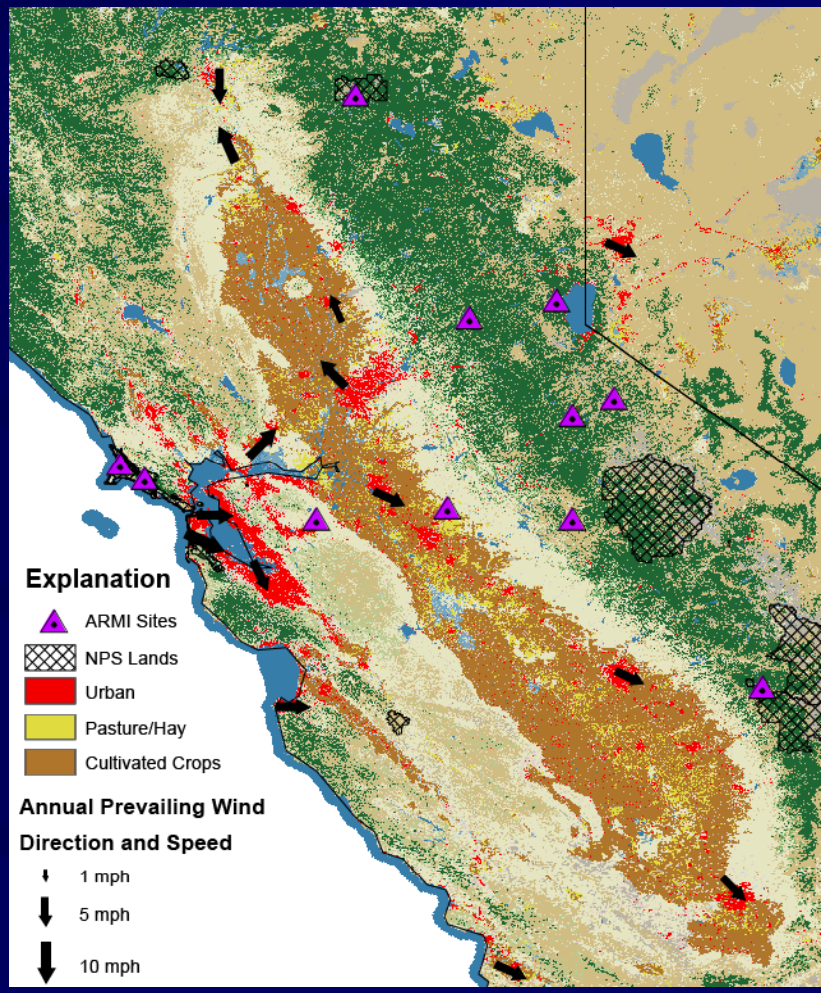
Study Sites II

- CA sites - E-W transect
  - Pt Reyes to Lake Tahoe
- CA sites – N-S transect
  - Lassen Volcanic NP – Sequoia NF
- Most in low development areas
  - E-W transect is downwind from Central Valley Ag



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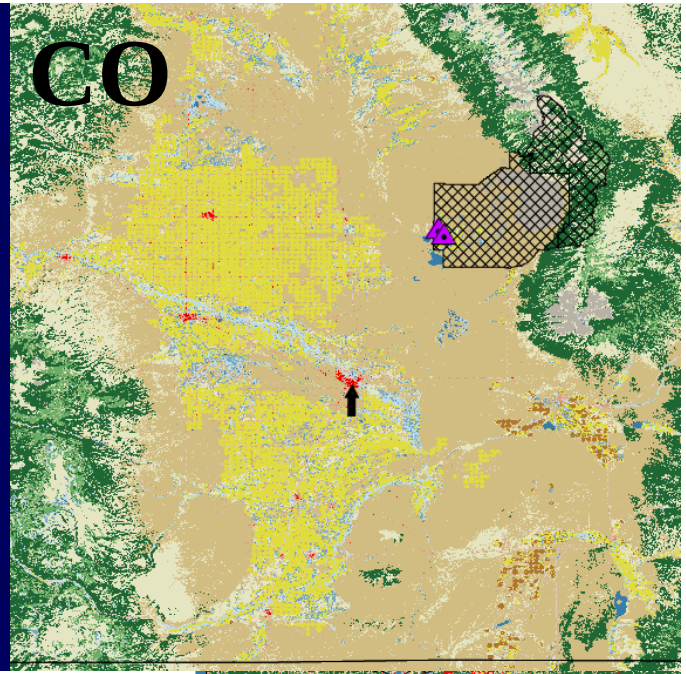
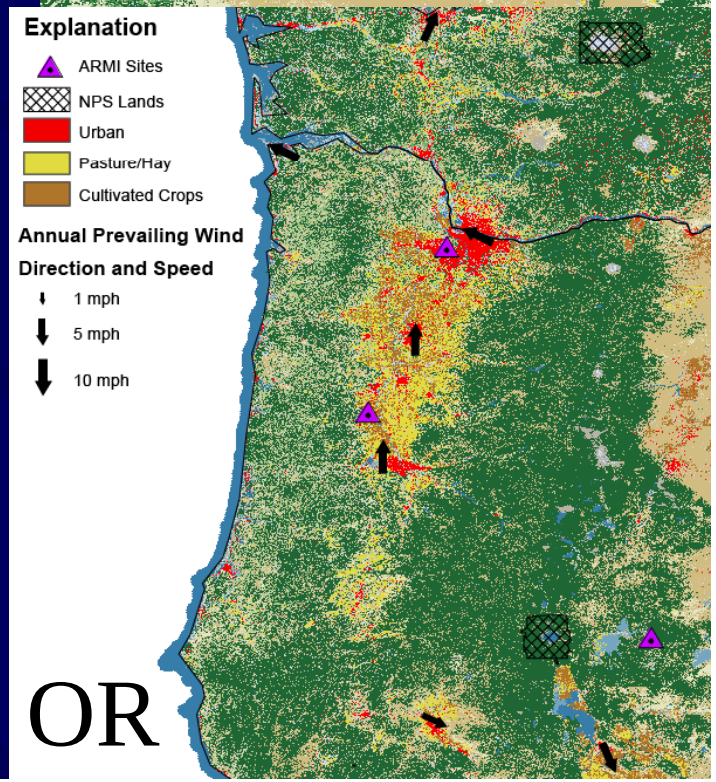
Study Sites III

- CO sites
  - near and downwind from San Luis Valley agriculture
    - Potatoes, barley
    - Great Sand Dunes NP
- OR sites near urban or agriculture
  - OSU Ag Research Station
- ME sites near Ag production
  - Aroostook Research Farm
- LA, GA, and ID are sites not final





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Monitoring Strategy I

- Work in teams of 2-3 and sample frogs and water concurrently
- Measure field parameters and collect water, sediment, Bd, and frogs samples during spring breeding season
  - two species of frogs
- Collect second round of field, water, and Bd samples 6-10 weeks later during pesticide use season

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Monitoring Strategy II

- Water and sediment samples analyzed for:
  - ~100 current use pesticides or pesticide degradates
  - OP oxon and diuron degradates, glyphosate
  - Nutrients, turbidity
- Water and frogs analyzed for:
  - Bd – swabs on 5 of each species
  - Skin samples for peptide work
  - Rest of frog for tissue analysis
    - Kelly will tell you more

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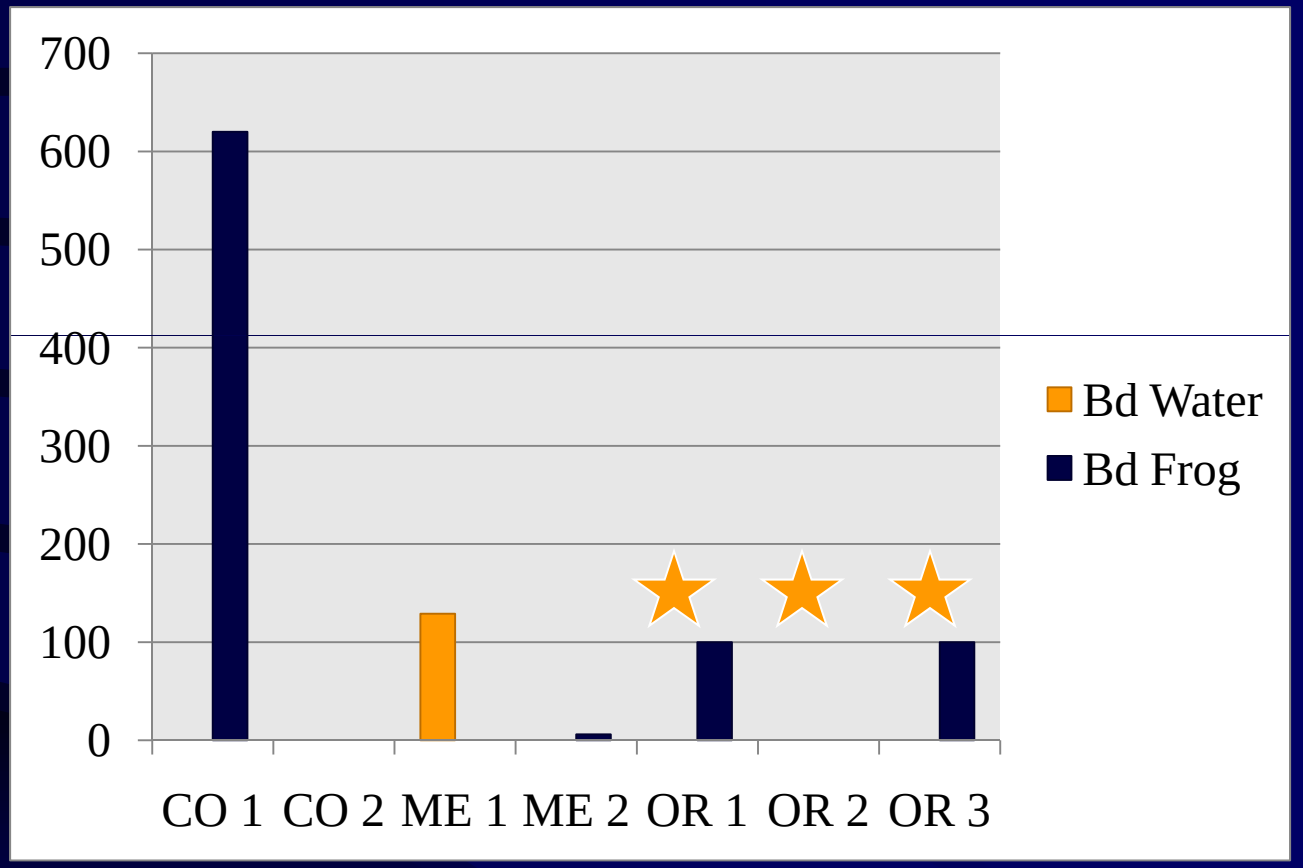
Results I– Bd in Water and on Frogs



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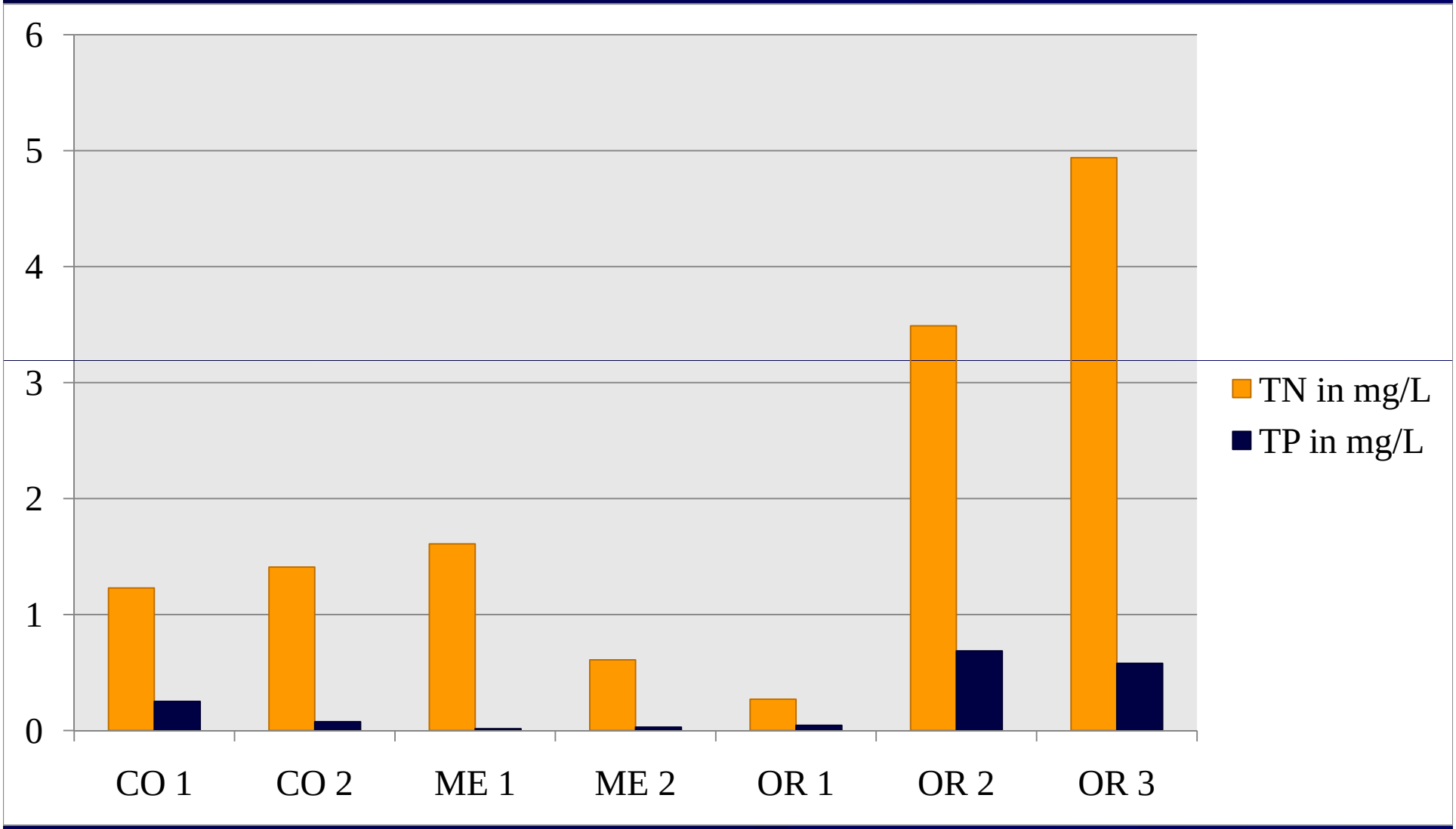
Results II – Nutrients in Water



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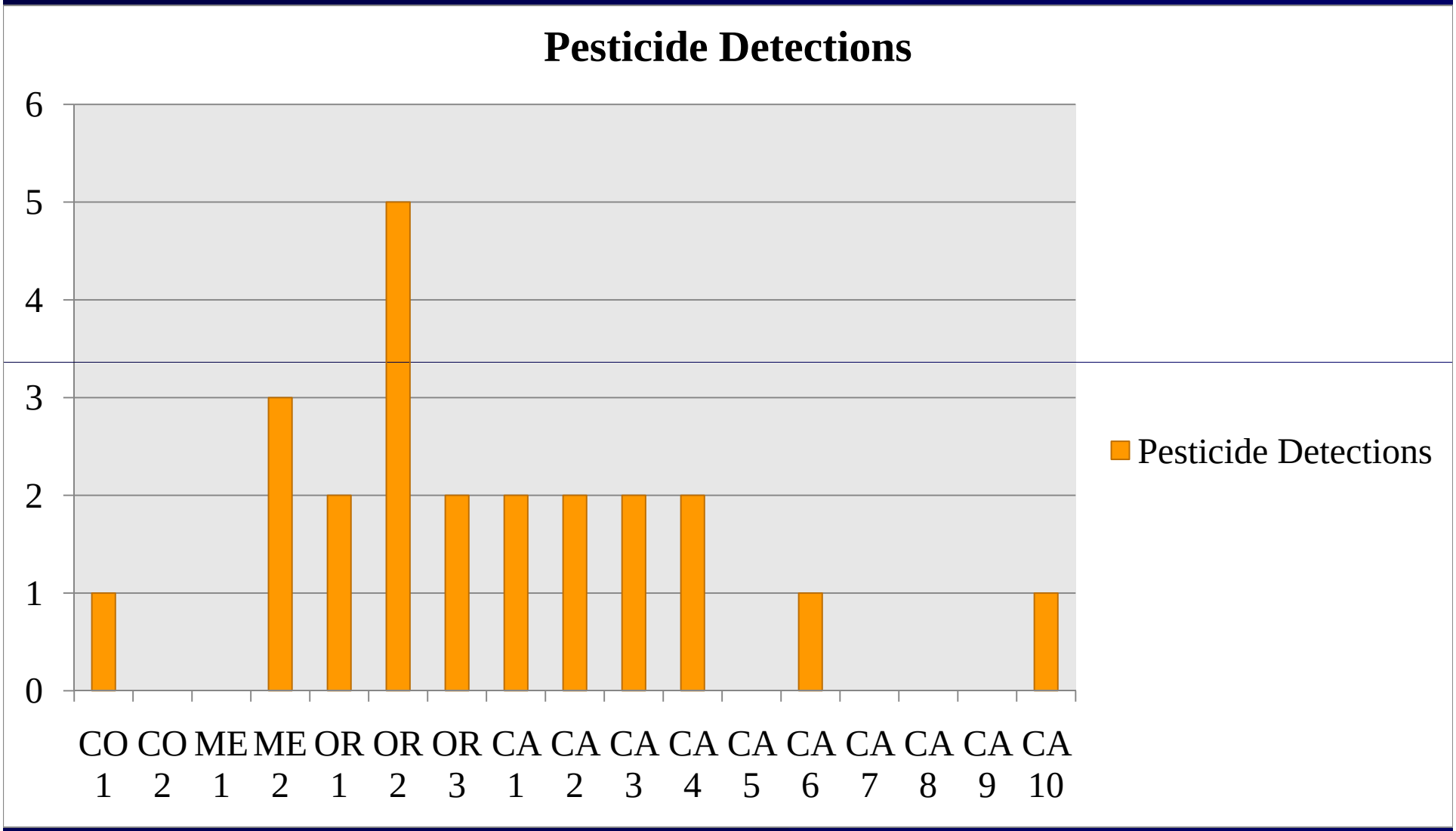
Results III – Pesticides in Water



glyphosate, AMPA, malathion, permethrin, atrazine, prometon, trifluralin

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Questions?

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