

US EPA ARCHIVE DOCUMENT

Source Water Protection: Dairies, Irrigated Agriculture, and Groundwater

Thomas Harter, Ph.D.
Hagan Chair in Water Management and Policy

University of California, Davis

ThHarter@ucdavis.edu

<http://groundwater.ucdavis.edu>

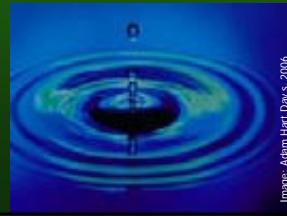


Image: Adam Hart-Davies, 2006

Acknowledgments

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funding provided by:

CALFED
BAY-DELTA
PROGRAM

Water Boards

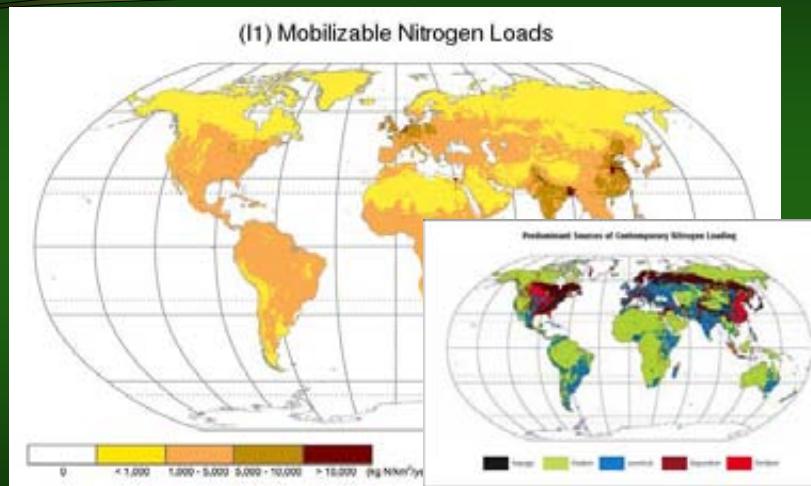
Motivation

- Worldwide dependence on groundwater
 - 2-3 billion people
 - > 60% of gw use towards farming in arid/semi arid regions
- Surge of groundwater use over past 50 years (turbine pump, cheap energy, food demands)
- Increasing intensity of landuse (crops, animals, industry, urban)

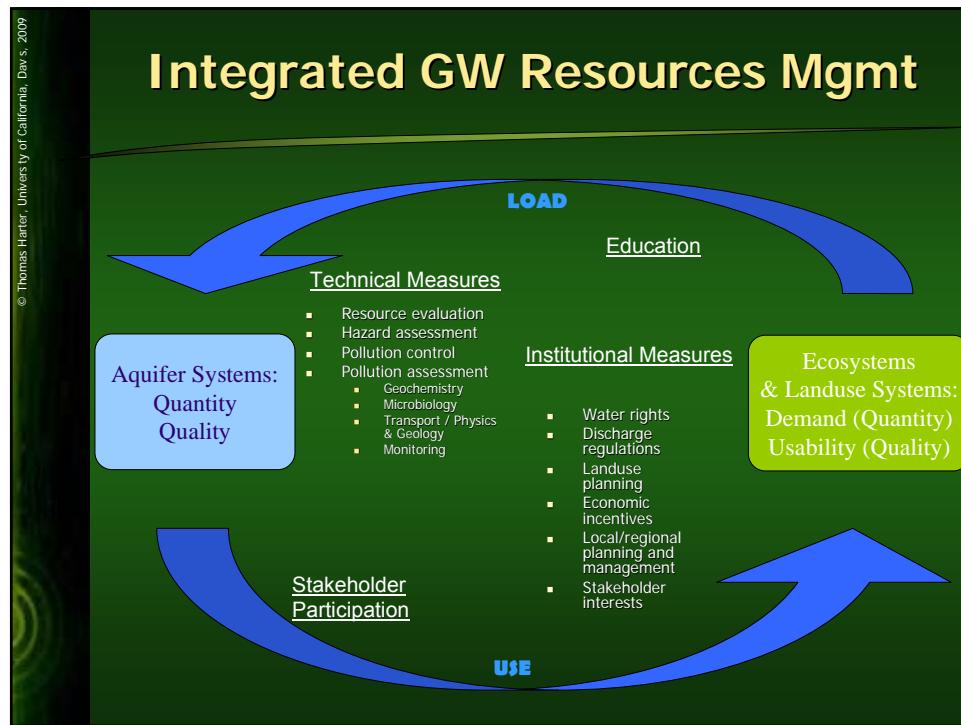
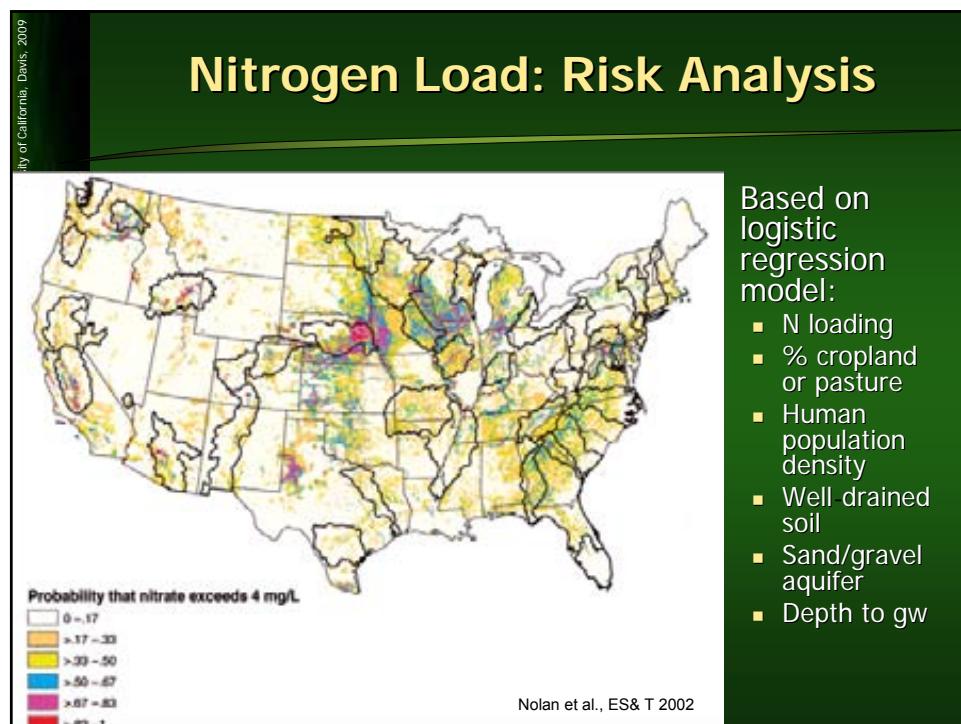
↑ dependency on gw & ↑ contamination

SUSTAINABILITY?

Pervasive GW Pollutant: NO₃



UN World Water Development Report II, 2006



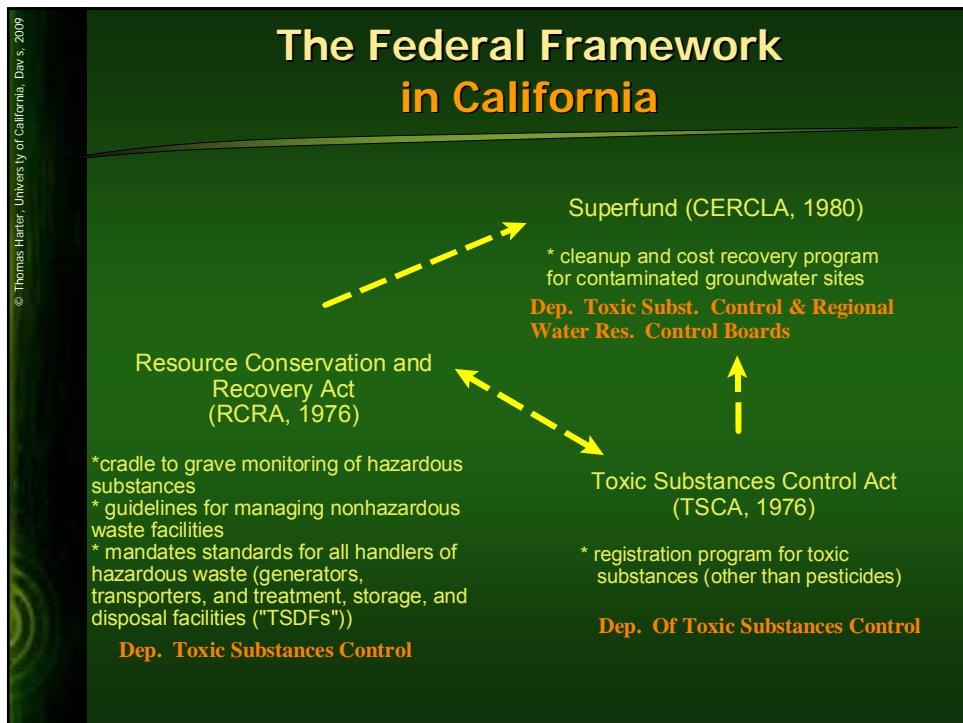
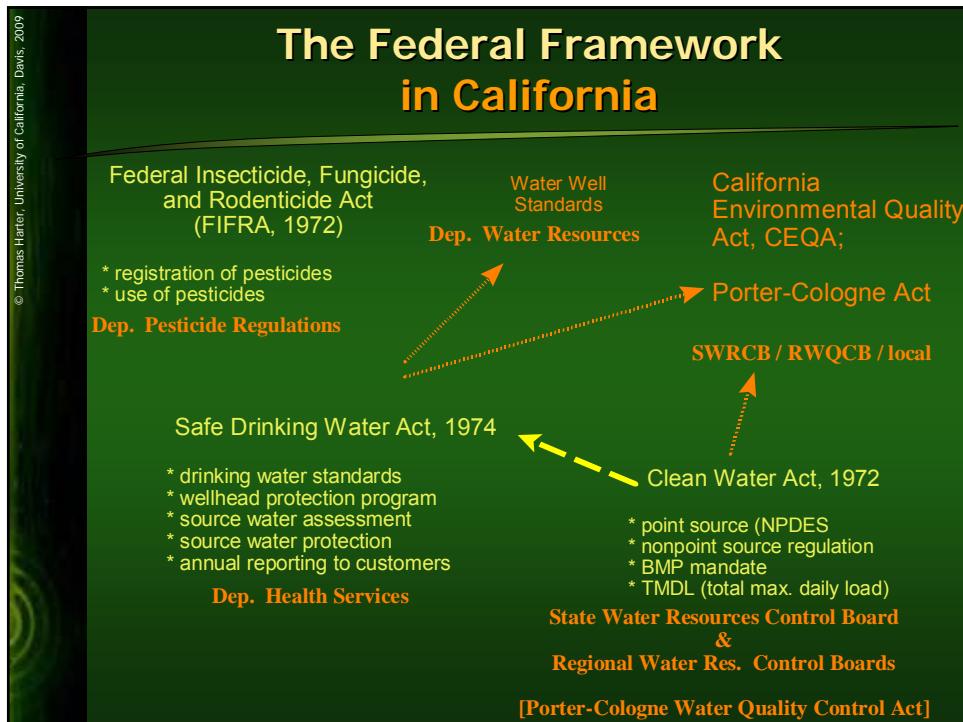
Perspectives on NPS Pollution for Successful Source Protection

- Understanding NPS Sources
 - here: dairies/(C)AFOs]
 - source control
 - management practices
- Understanding pollutants
 - physics/chemistry of environmental fate
 - Transport
 - Sorption
 - Degradation
 - analytical methods
 - assessment models
- Policy
 - regulatory programs
 - management programs
 - role of monitoring / feedback

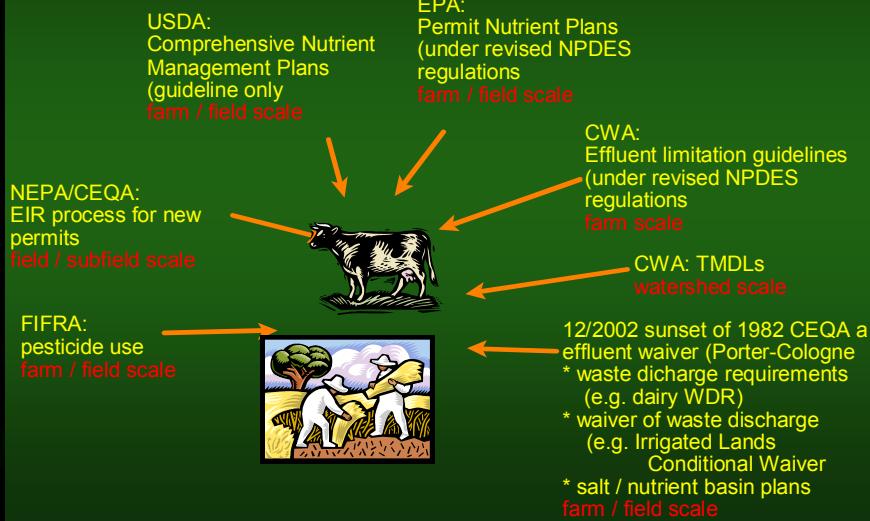
Agricultural NPS Pollutants

- Salinity
- Nitrate
- Pesticides
- Emerging contaminants in animal farming:
 - Pathogens (*E. coli* H7 O157, *Campylobacter*, *Salmonella*, *Cryptosporidium*)
 - Antibiotics & other pharmaceuticals
 - Steroid hormones

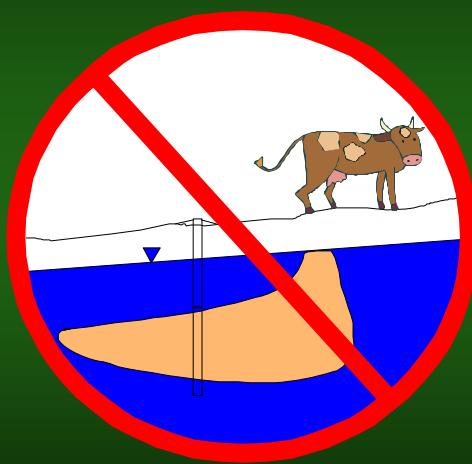




Major Water Quality Regulations related to Farming

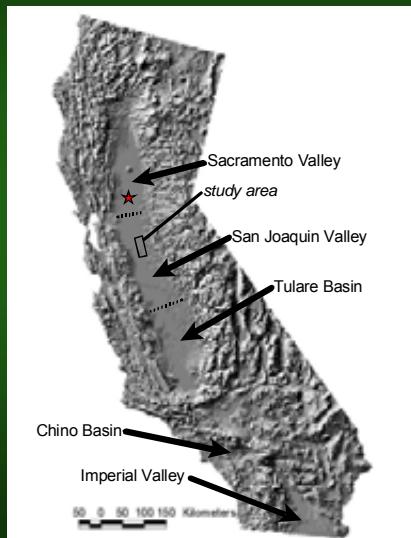


Understanding GW NPS Pollution: The Challenge



Farm Contaminant Sources: Basin Scale

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- Geology
- Landuse
- Climate

Irrigated Agriculture as N Source

Irrigated Acreage (Year 2000):
9.5 million acres

Water Use:
27 – 35 MAF

N fertilizer Use (2007):
740,000 tons
On
6.7 million acres
+
240,000 tons
field applied
from dairy animal manure

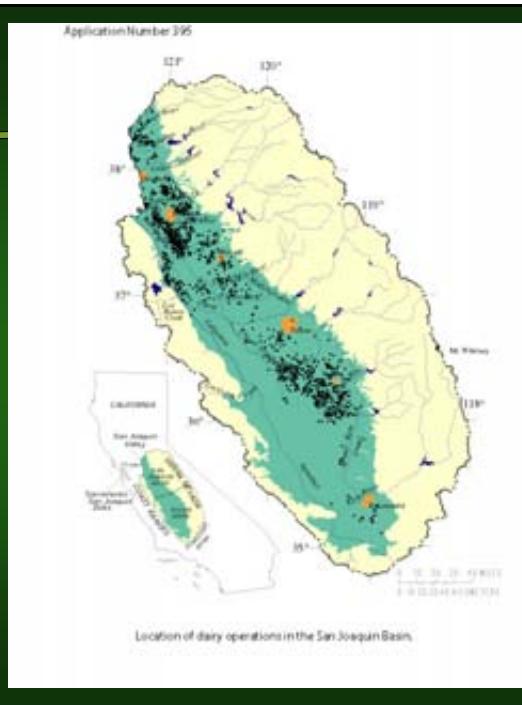
MAF = million acre feet

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Dairies in the San Joaquin Valley

- ~1,500 dairies
- ~1.5 million milking cows
- trend to > 2 million milking cows
- additional support stock: 1.5 million
- 1 cow = 20 – 40 humans in waste production (solids, BOD, N)



Farm Contaminant Sources: Regional Scale



- Source of N (2007):
 - Fertilizer use (varies with farm / farming practices) **740,000 tons**
 - Animal Manure **240,000 tons**
 - Septic leach fields **27,000 tons**
 - Irrigation water source & mgmt.
 - Treated municipal effluent **31,000 tons**

Farm Contaminant Sources: Dairy Farm Scale

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Sources of N:

- Feedlot
- Lagoon
- Storage areas
- Manured fields
- Fertilized fields
- Various crops
- Septic system

Overview of dairy farms

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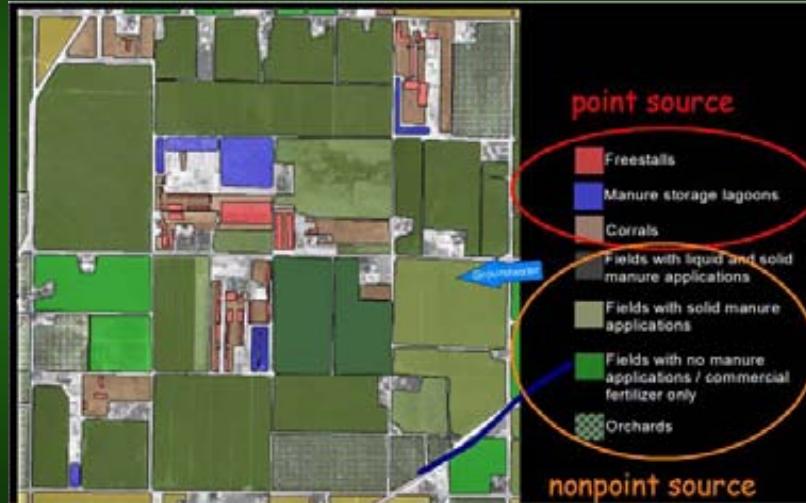
Dairy Nutrient Cycling

- <http://www.youtube.com/watch?v=G6QliWbvBwI>
- <http://ucanr.org/spotlight/groundwater.shtml>



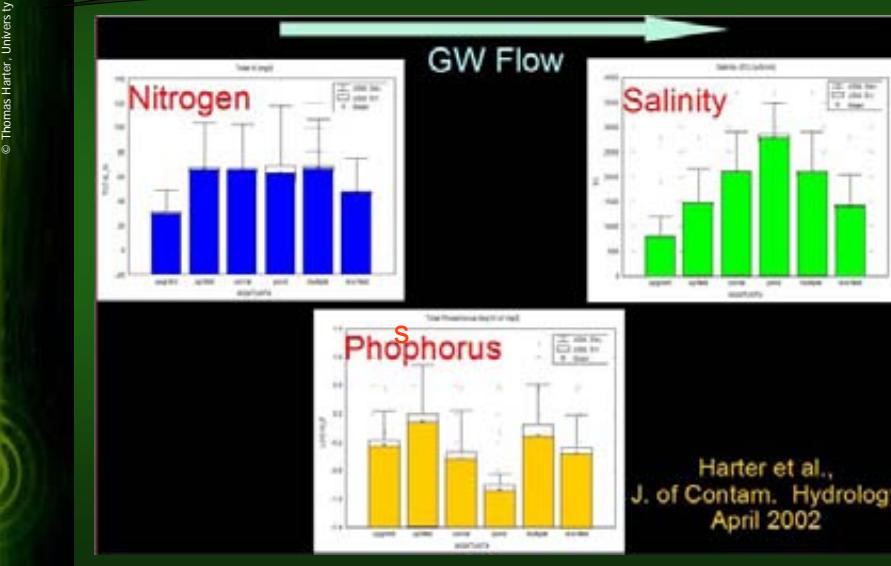
Dairy Farm Contaminant Sources: Management Units

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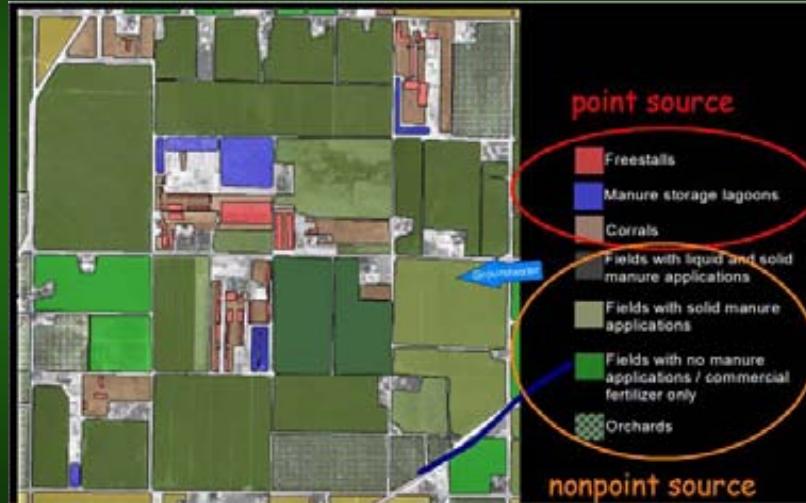
Statistical Analysis: By Management Unit

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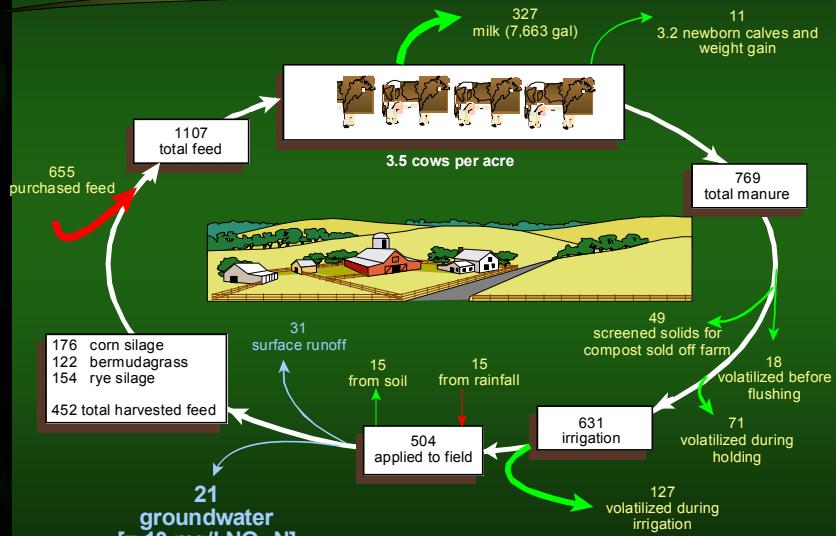
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Dairy Farm Contaminant Sources: Management Units



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Farm Nutrient Management

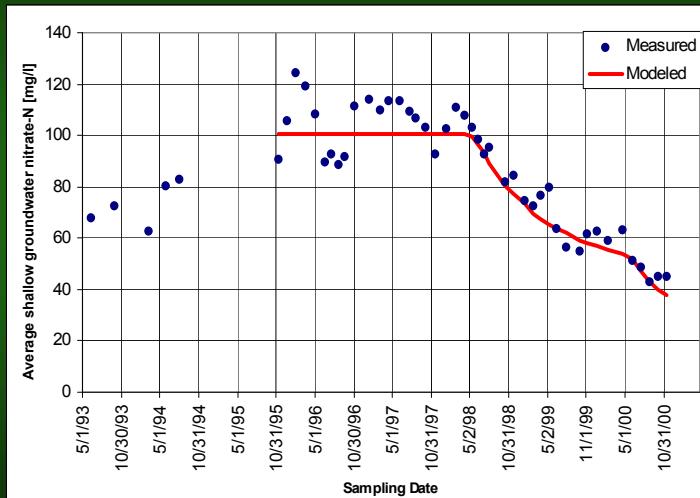


adopted from: Van Horn et al., Journal of Dairy Science, Vol. 77(7), 1994, 2008-2030

Nitrogen Management Case Study



NMPs: Balancing Nitrogen Application and Uptake



for publications: http://groundwater.ucdavis.edu/gw_201.htm

Central Valley Regional Water Quality Control Board Dairy Waste Discharge Requirements

- Preliminary Dairy Facility Assessment
 - Existing nutrient management
 - Existing waste management conditions
 - Existing water quality conditions
- Nutrient management plan (crop land)
- Waste management plan (animal facilities, waste storage facilities)
- Groundwater monitoring

The poster features a collage of images: a windmill on a hill, a close-up of soil with water droplets, and a field of green plants. The title 'Toward Sustainable Groundwater in Agriculture' is prominently displayed in blue and brown text. Below it, a subtitle reads 'An International Conference Linking Science and Policy'. The event details 'San Francisco, 15-17 June 2010 (tentative date)' are shown. Logos for the University of California Davis and the Water Education Foundation are at the bottom.

Toward Sustainable
Groundwater
in Agriculture

An International Conference
Linking Science and Policy

San Francisco, 15-17 June 2010
(tentative date)

For information and updates, check:
<http://groundwater.ucdavis.edu/calendar.htm>
<http://www.ag-groundwater.org>

WATER EDUCATION FOUNDATION