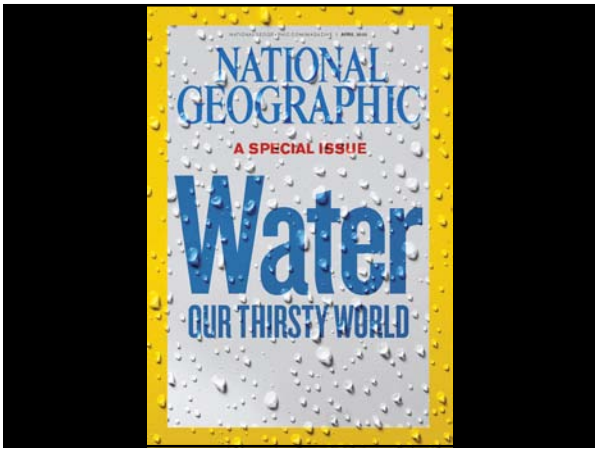
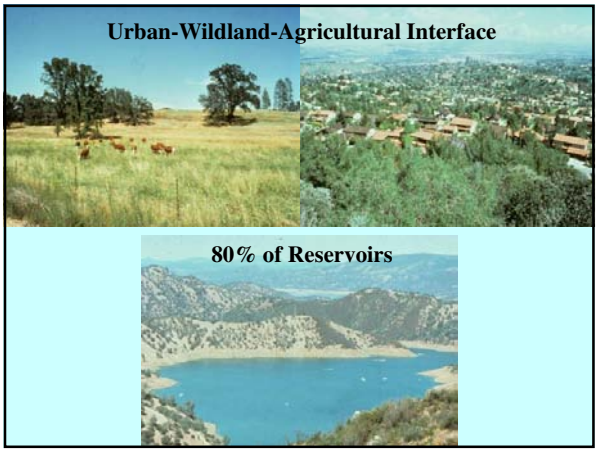
# Overview of Water Quality Issues on California Rangelands

Core Research Team

- Barbara Allen-Diaz
- Rob Atwill
- Randy Dahlgren
- John Harper
- David Lewis
- Toby O'Geen
- Mike Singer
- Ken Tate

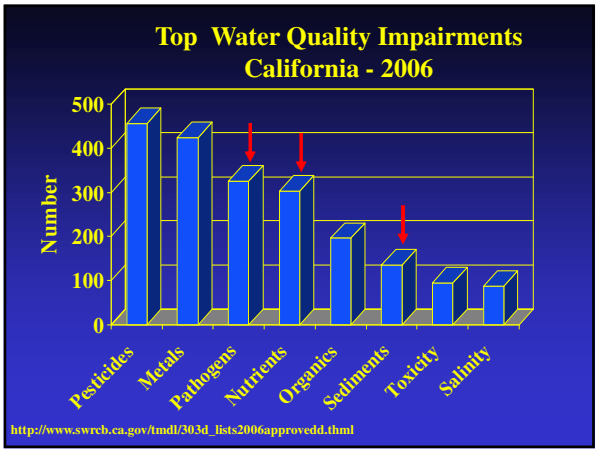


## Goal of Clean Water Act

- Restore and maintain the chemical, physical, and biological integrity of the Nation's waters
- Waters should be safe for swimming, fishing and as a source of drinking water

In June 1969, Cleveland's Cuyahoa River caught fire for the third time. The damning image of a river in flames is credited by many for passage of the Federal Water Pollution Control Act of 1972.



## Sources of Water Contaminants

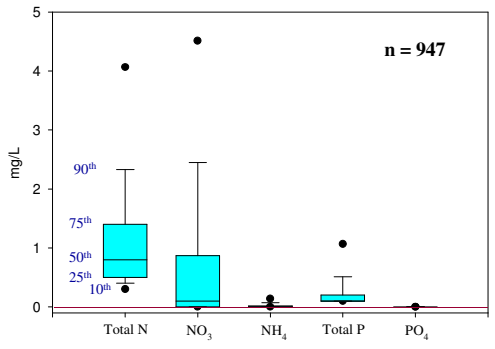
**Point source pollutants - originate from an identifiable source**

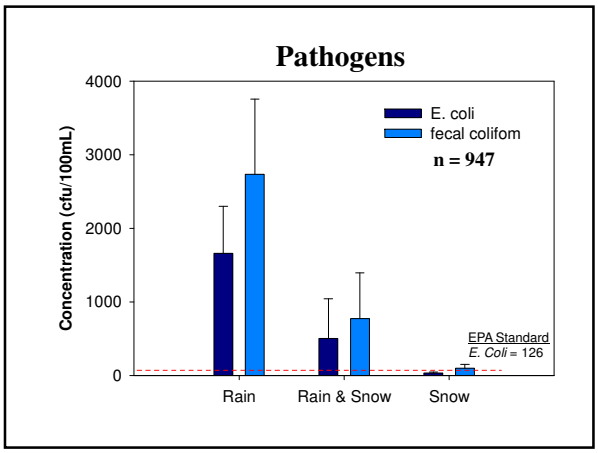
**Non-point source pollutants - originate from diffuse and hard-to-identify sources**

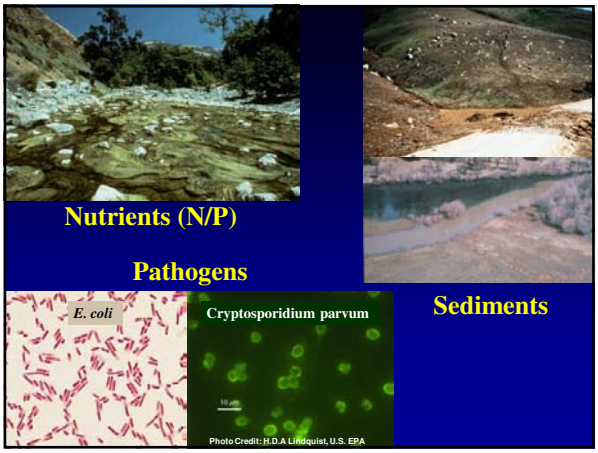
**Natural sources - originate from naturally occurring sources in the environment (sediment, nutrients, *E. coli*)**

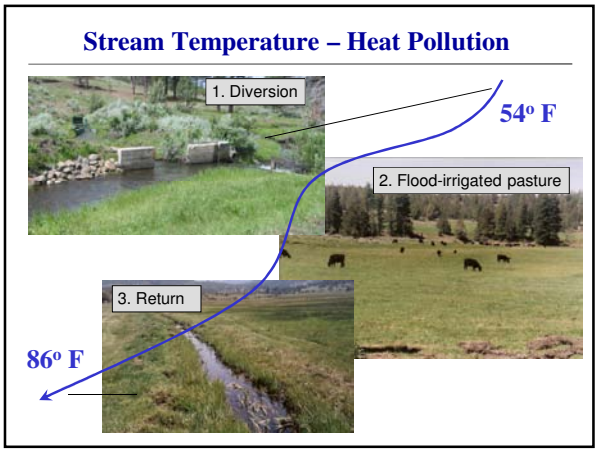
**State-wide Survey**
**24 streams**
**2000 and 2001 water years**

## Nutrient Concentrations




Pathogens
Concentration (cfu/100mL)
4000
3000
2000
1000
0
E. coli
fecal colifom
n = 947
EPA Standard
E. Coli = 126
Rain
Rain & Snow
Snow


Nutrients (N/P)
Pathogens
Sediments
E. coli
Cryptosporidium parvum
Photo Credit: H.D.A Lindquist, U.S. EPA


Stream Temperature – Heat Pollution
1. Diversion
54º F
2. Flood-irrigated pasture
3. Return
86º F

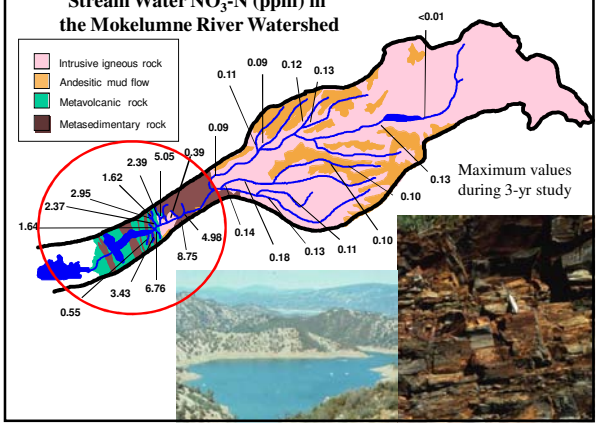
## Grazing and Stream Temperature/Habitat

**Excessive Grazing ⟶ Reduced Shade**

## Source of Microbial Pathogens?

**Both livestock and wildlife can be significant sources of waterborne pathogens**

**Stream Water $NO_3$-N (ppm) in the Mokelumne River Watershed**



## Thermal Spring Water from California's Coast Range

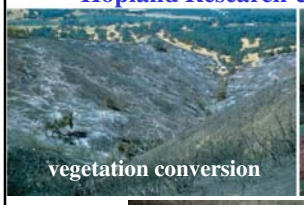
| | $NH_4$-N (ppm) |
|---|---|
| Sulfur Bank mine | 460 |
| Elgin mine | 271 |
| Wilbur springs | 266 |

## Sediment Generation in Northern Coast Ranges

99 % associated with historic land management or natural sources

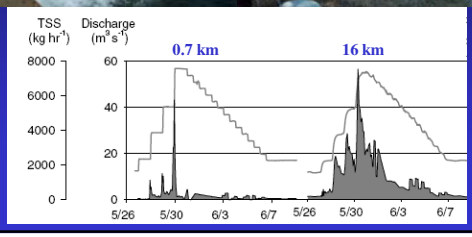
1% due to current management practices

## Hopland Research & Extension Center

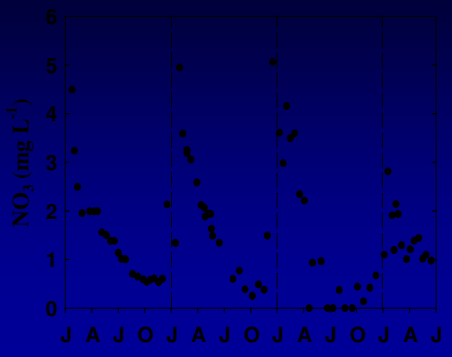




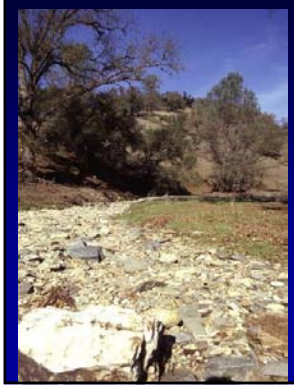
## Mokelumne River Controlled-Release Flood




## Seasonal Pattern in Streamwater Nitrate in California Oak Woodlands




## Low Nutrient Demand

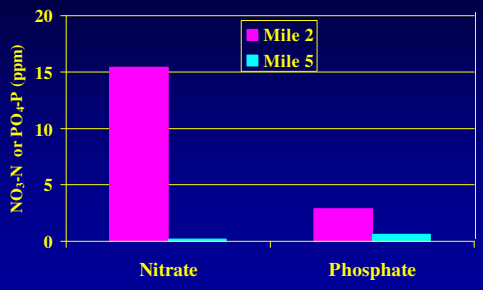


## High Nutrient Demand

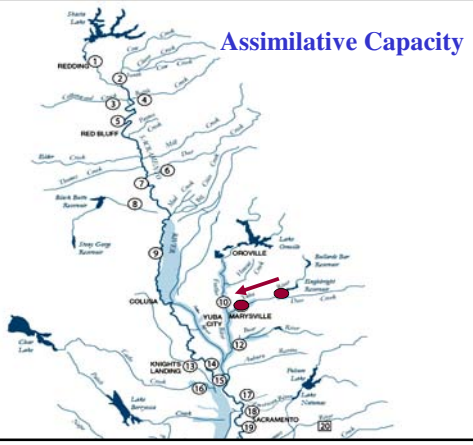
## Assimilative Capacity

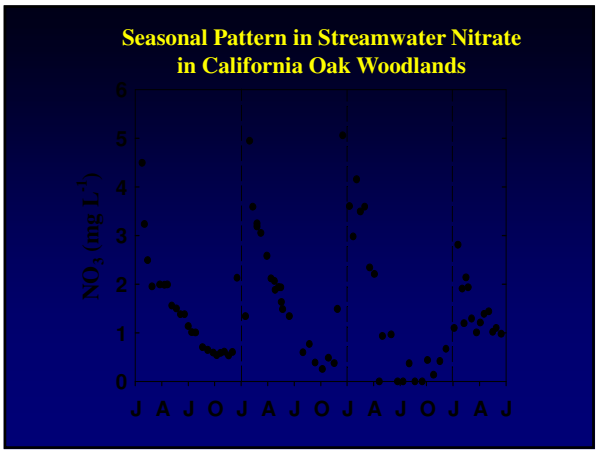
**Capacity of a water body to receive a pollutant, without harmful effects and damage to aquatic life and to humans who consume its water.**

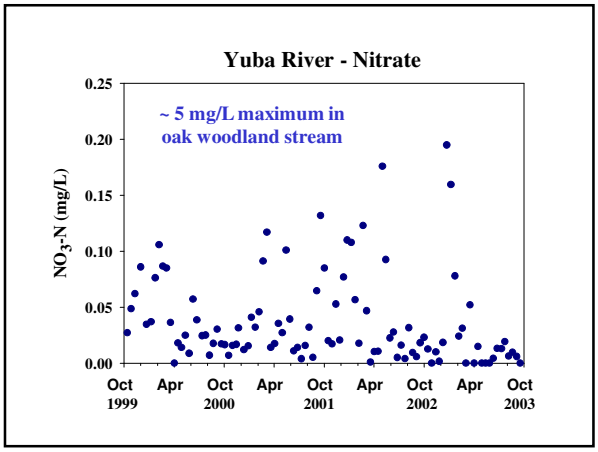

## Nutrient Attenuation – Deer Creek




## Assimilative Capacity






## Water Quality Monitoring Considerations

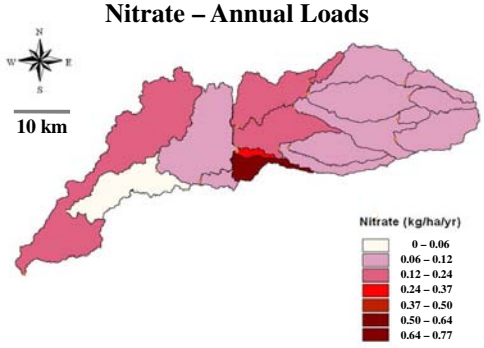
## Issues of Scale

**Regional scale**
- provides context

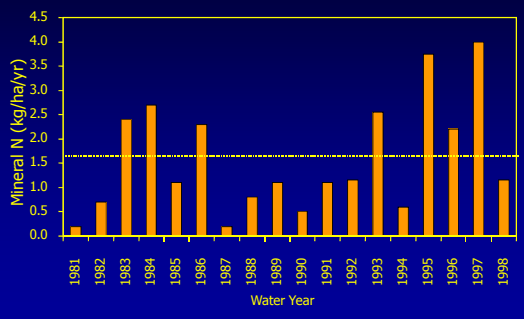
**Small watershed**
- management unit

**Hillslope/Plot/Soil horizon/Colloids**
- processes and mechanisms

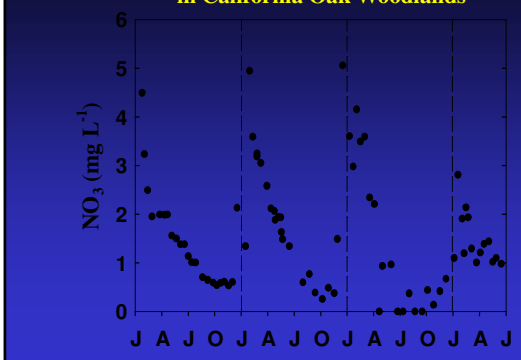
**Cosumnes River Watershed**
**Nitrate – Annual Loads**



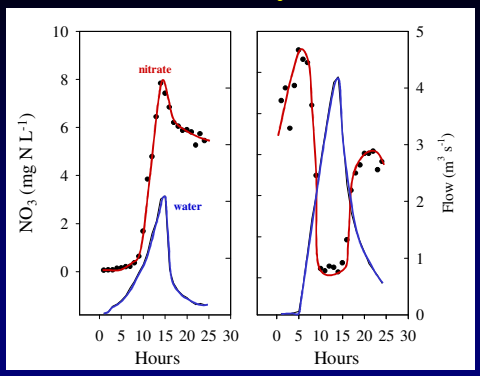

Schubert Watershed; Annual N Load



## Seasonal Pattern in Streamwater Nitrate in California Oak Woodlands




## Storm-Event Dynamics

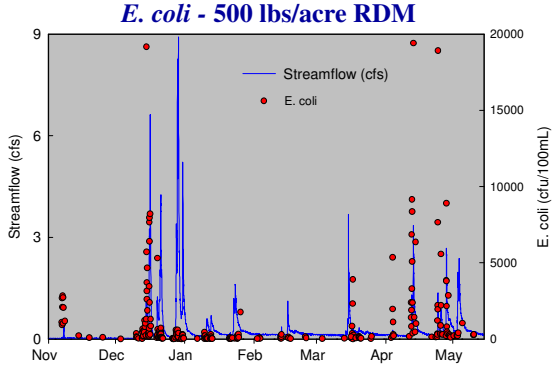



## Change in Suspended Sediments during Storm Event

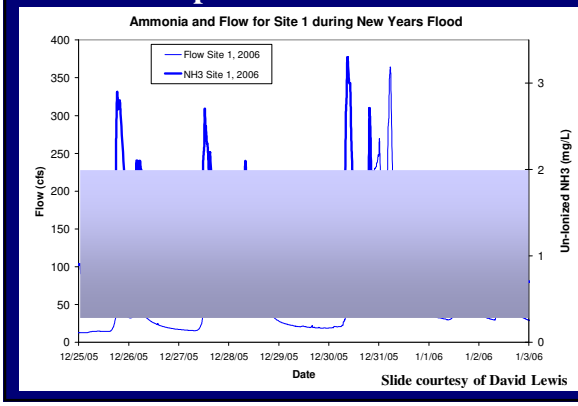
Pre-storm | Storm peak | Post-storm

Slide courtesy of David Lewis

## *E. coli* - 500 lbs/acre RDM

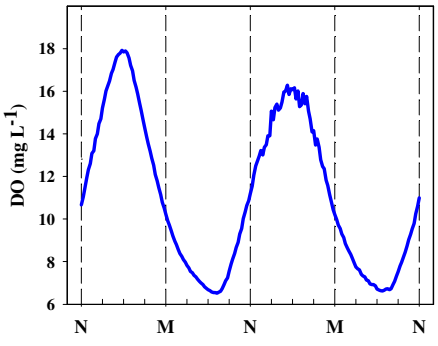



## Stemple Creek Ammonia




Slide courtesy of David Lewis

## Diel Cycle Dissolved Oxygen – San Joaquin River

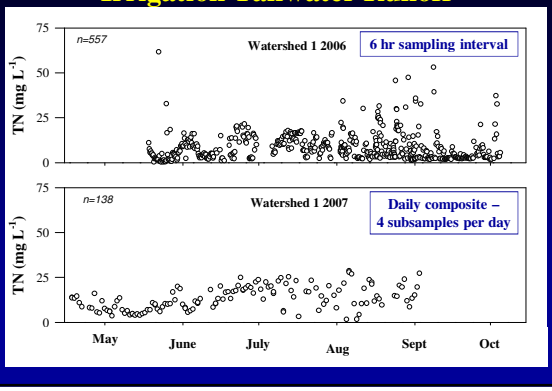


# Temporal Variability in Water Quality of Agricultural Tailwaters

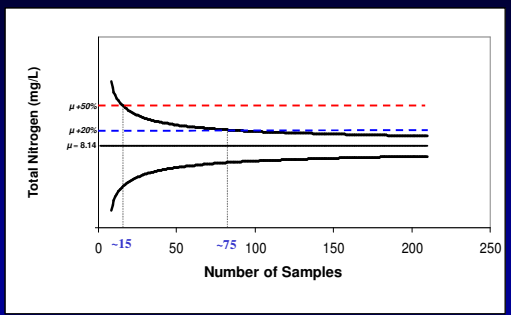
*Implications for Water Quality Monitoring*

***Neil Brauer* Anthony O'Geen and Randy Dahlgren***

## Irrigation Tailwater Runoff



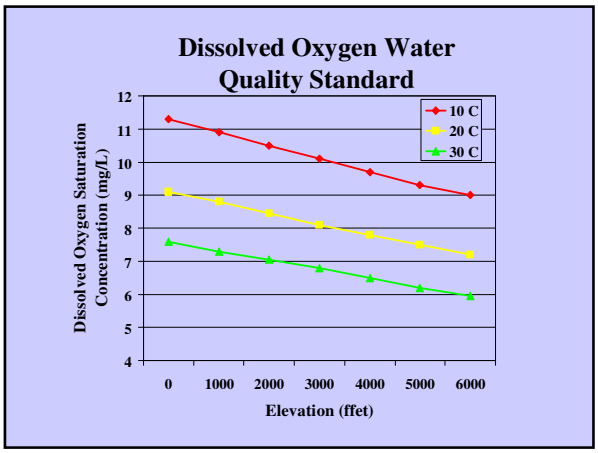

## 95 % Confidence Interval - Total N



## Water Quality Standards & Impairment

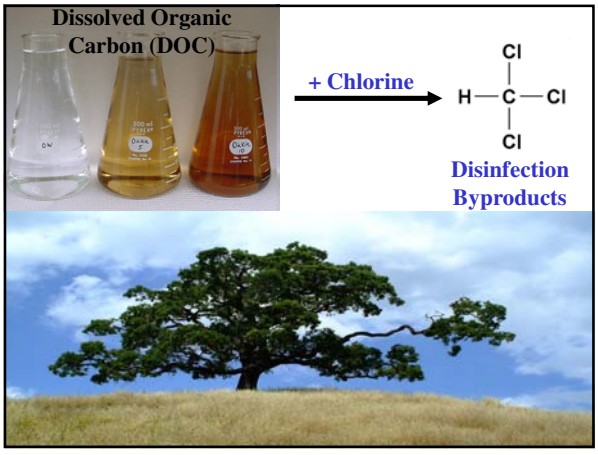
Water quality standards are developed for each water body to meet a designated use (e.g. drinking water, recreation)

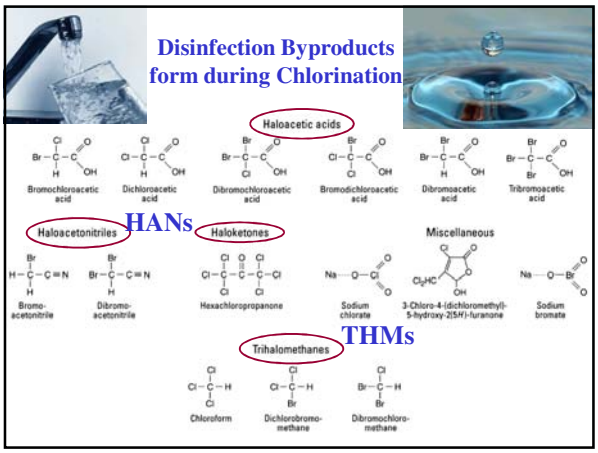
If water quality standards are not met, the water body is considered impaired




## Water Pollution

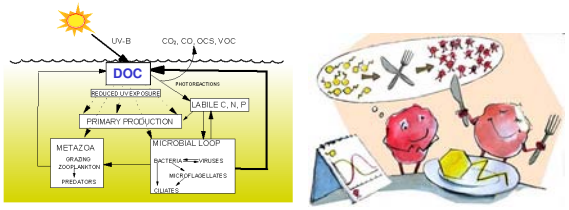
**Human-induced alteration of the chemical, physical or biological integrity of water**






## Instream DOC Dynamics

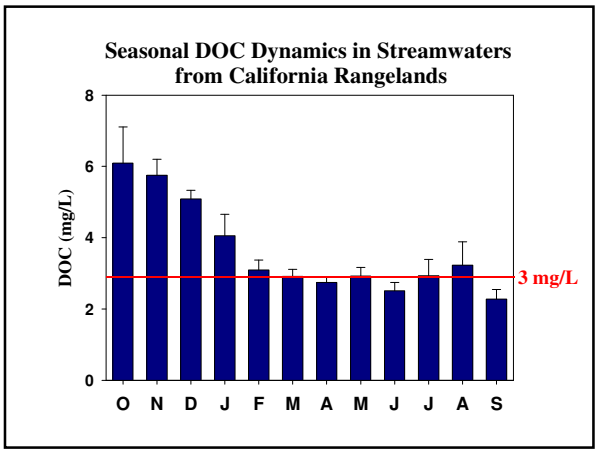
- Photodegradation
- Biodegradation
- Production - algae

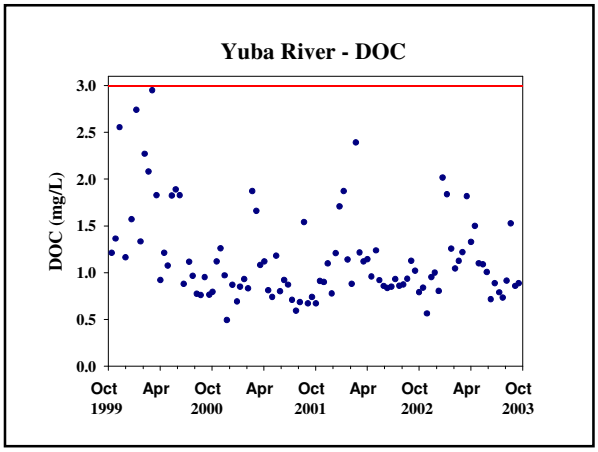


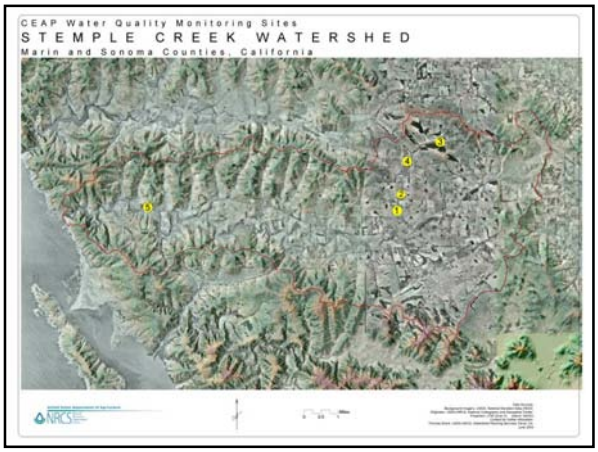



## Status of 303(d) List
### (California Surface Waters - 2006)

- ~ 779 listed waters
- ~ 2237 impairments
- ~ 167 pollutant categories
- ~ 26,700 river/coastal miles
- ~ 255,000 lake/reservoir acres


Seasonal DOC Dynamics in Streamwaters from California Rangelands
DOC (mg/L)
8
6
4
2
0
3 mg/L
O N D J F M A M J J A S


Yuba River - DOC
DOC (mg/L)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Oct 1999
Apr
Oct 2000
Apr
Oct 2001
Apr
Oct 2002
Apr
Oct 2003


CEAP Water Quality Monitoring Sites
STEMPLE CREEK WATERSHED
Marin and Sonoma Counties, California

## Stream Habitat