

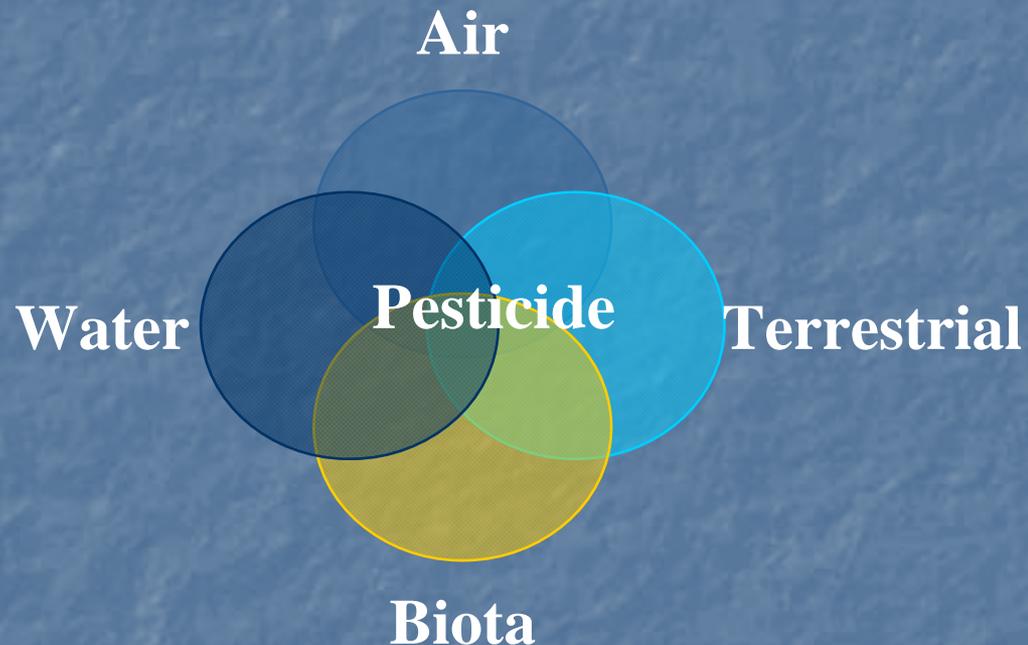
Sampling/Monitoring Pesticides in the Environment



ECS 3119 - Pesticides and Fish &
Wildlife Resources

Matrices for sampling/monitoring

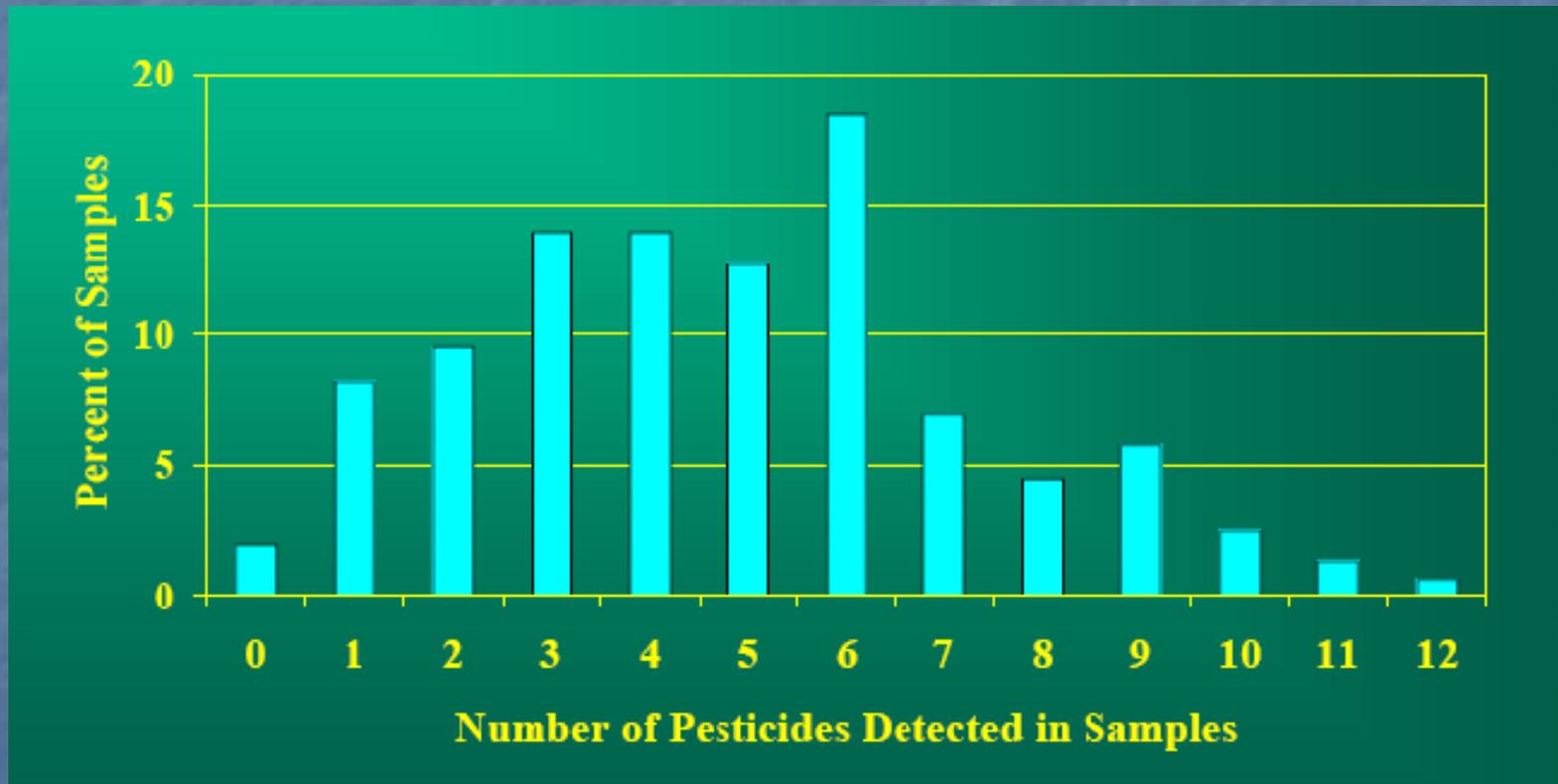
- Atmosphere
- Sediment/Soil
- Water
 - Surface/ground
- Biota
 - Fish/bivalves
 - Plants
 - Domestic animals/wildlife



Atmospheric Sampling of Pesticides

- Long-range movement of pesticides considered minimal until 1960's and discovery of DDT in the Arctic
- Ability to analytically distinguish between pesticide vapor, particles, precipitation and fog did not occur until the 1980's
- Standardized procedures available for sampling/analysis (ex. ASTM, USGS, EPA)
- Drift cards are inexpensive way to assess drift concerns

Frequency of detection for pesticides in air samples from Lompoc CA

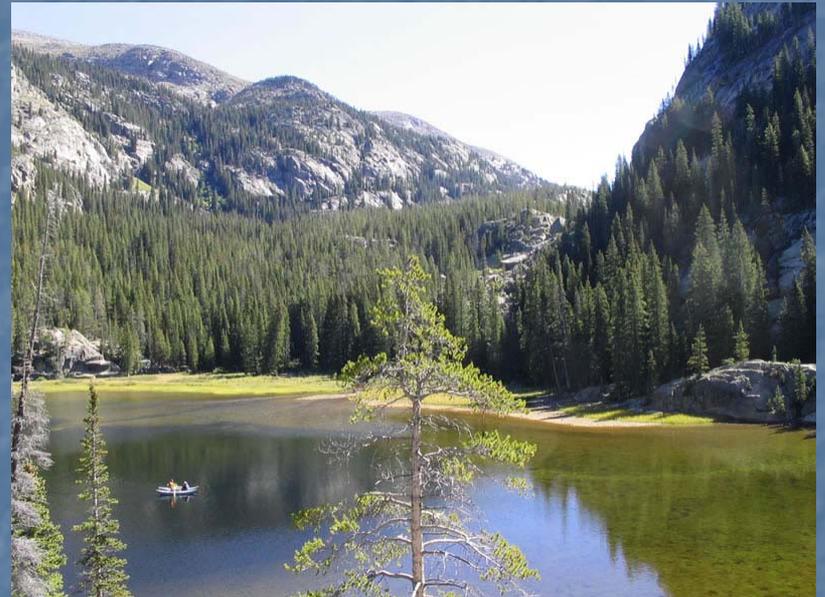


Western Airborne Contaminants Assessment Project

- NPS, USDA Forest Service, USGS, EPA, OSU, University of Washington
- Published January 2008
- Evaluate transport of contaminants into western national parks
 - Metals: Hg*, Cu, Zn, Pb, Cd, etc.
 - Semivolatile Organic Compounds (SOC's)
 - Current use pesticides – ex. Chlorpyrifos, Dacthal
 - Historical use pesticides – ex. Dieldrin, DDT
 - Industrial/urban use – ex. PCBs, PAHs
- http://www.nature.nps.gov/air/studies/air_toxics/wacap.cfm

National Parks in the WACAP

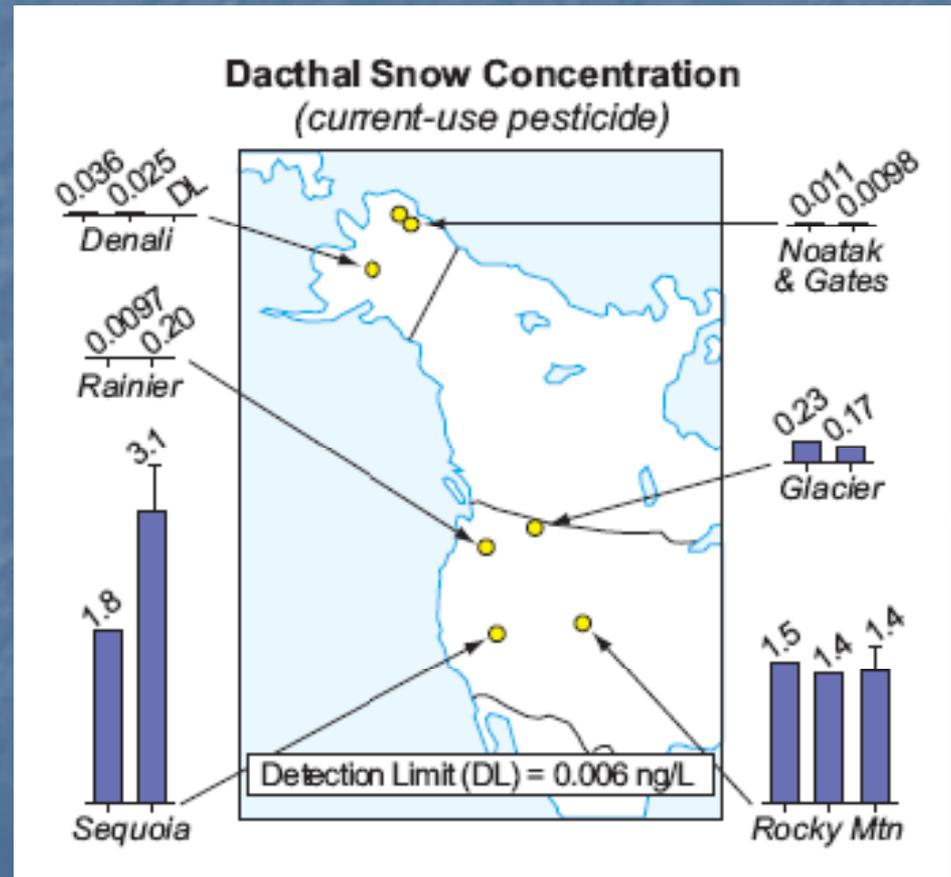
- Primary NP
 - Denali
 - Gates of the Arctic
 - Glacier
 - Mount Rainier
 - Noatak
 - Olympic
 - Rocky Mountain
 - Sequoia
- Secondary NP: 12



Lone Pine Lake : Rocky Mtn. NP

Measurement of contaminants in multiple matrices

- Measure contaminants in:
 - Snow
 - Fish
 - Water
 - Sediment
 - Lichen
 - Vegetation
 - Subsistence food

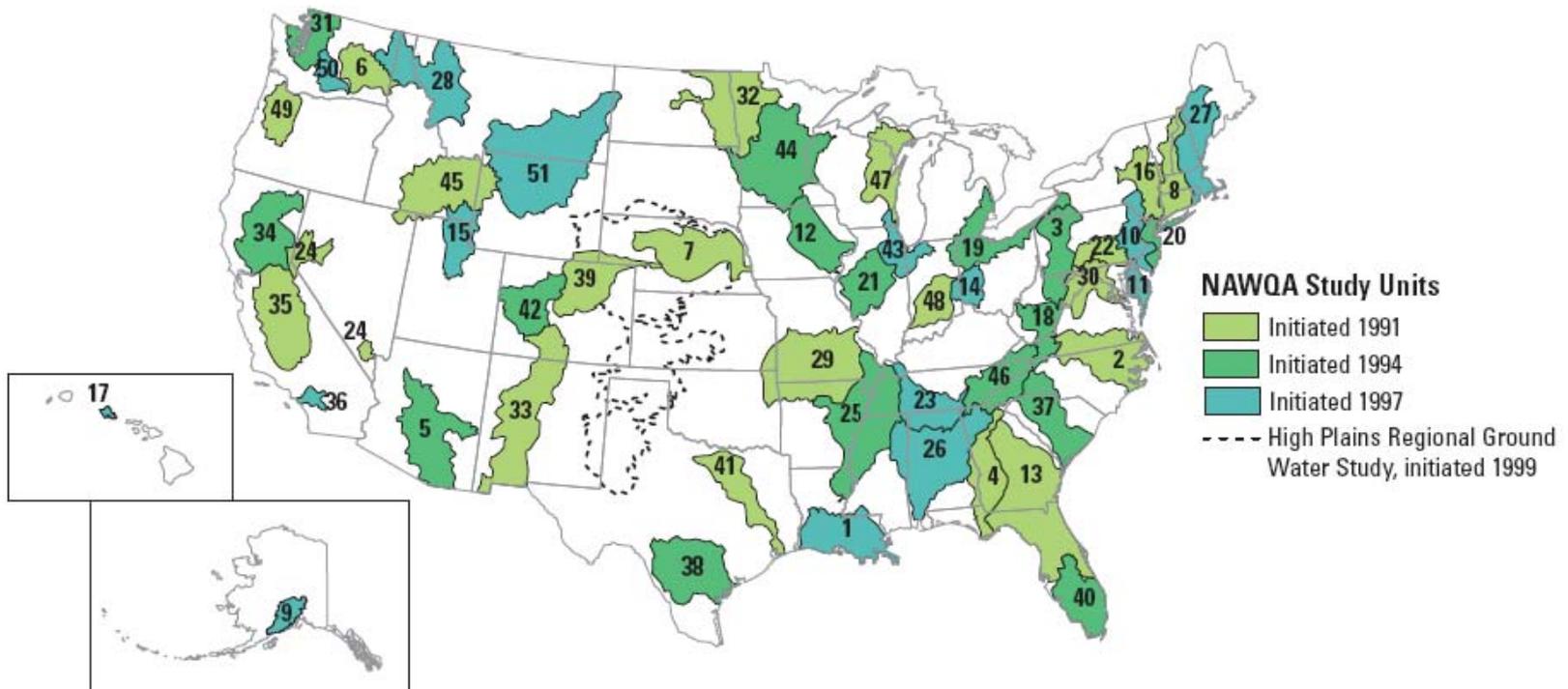


Source: WACAP 2005 Fact Sheet

Sources of monitoring data

- USDA – Forest Service, ARS, APHIS, AMS
- DOI – USFWS, USGS, NPS
 - NAWQA Pesticide National Synthesis Project
- EPA – OPP, OW
- NOAA
- State agencies
- Open literature
- Pesticide industry
 - Monitoring as a condition of registration

USGS NAWQA Study Units

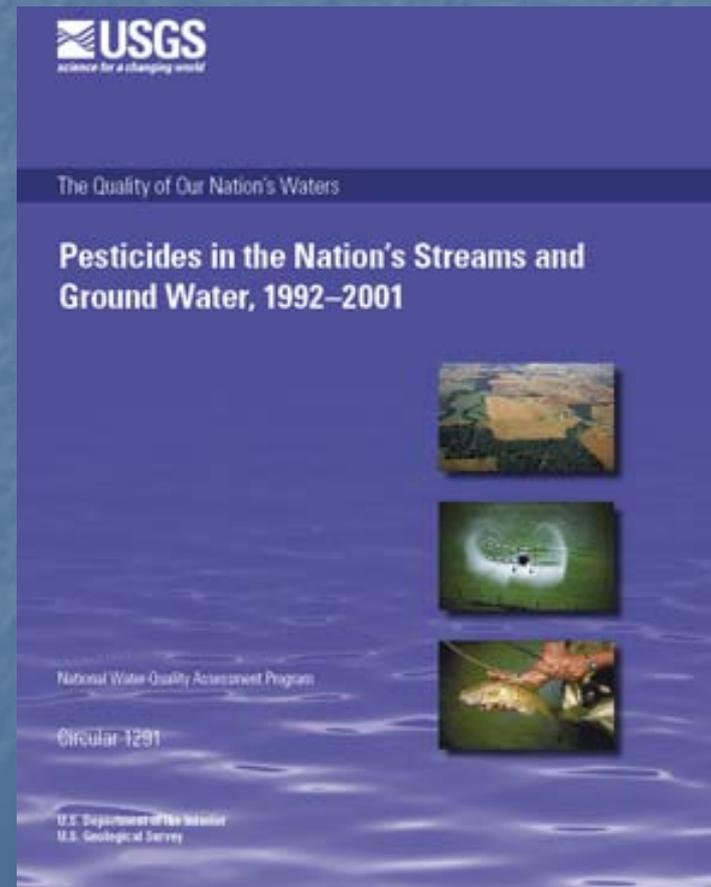


Parameters assessed in NAWQA Program

- Well features
- Field parameters
- Major ions
- Nutrients
- **Pesticides**
- Volatile organic compounds
- Trace elements
- Radionuclides and stable isotopes

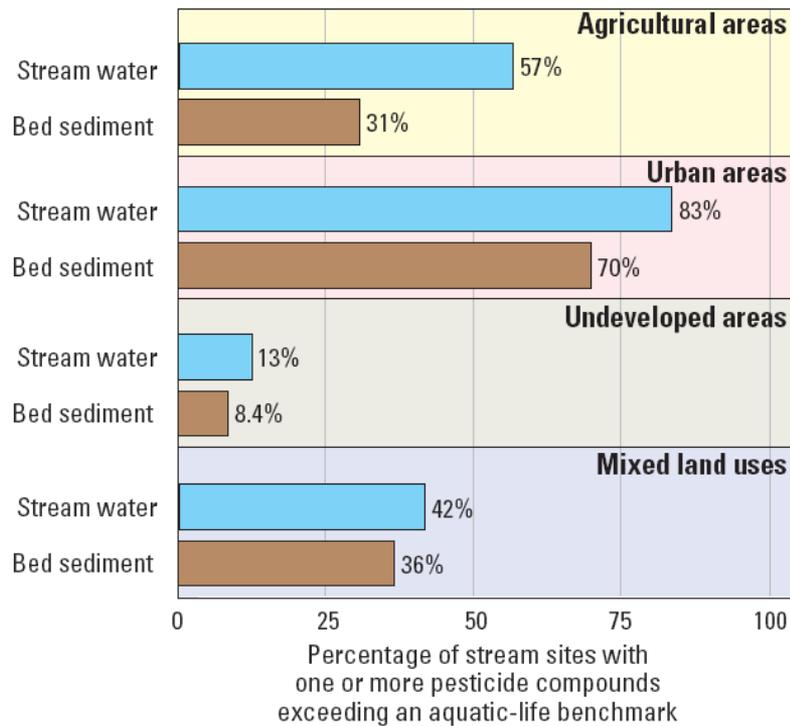
NAWQA Pesticide National Synthesis Project

- Provides pesticide use data by county
- Provides detailed information regarding pesticide levels in:
 - Surface water
 - Ground water
 - Sediment
 - Biota (fish/bivalves)
- <http://water.usgs.gov/na/wqa/pnsp/>

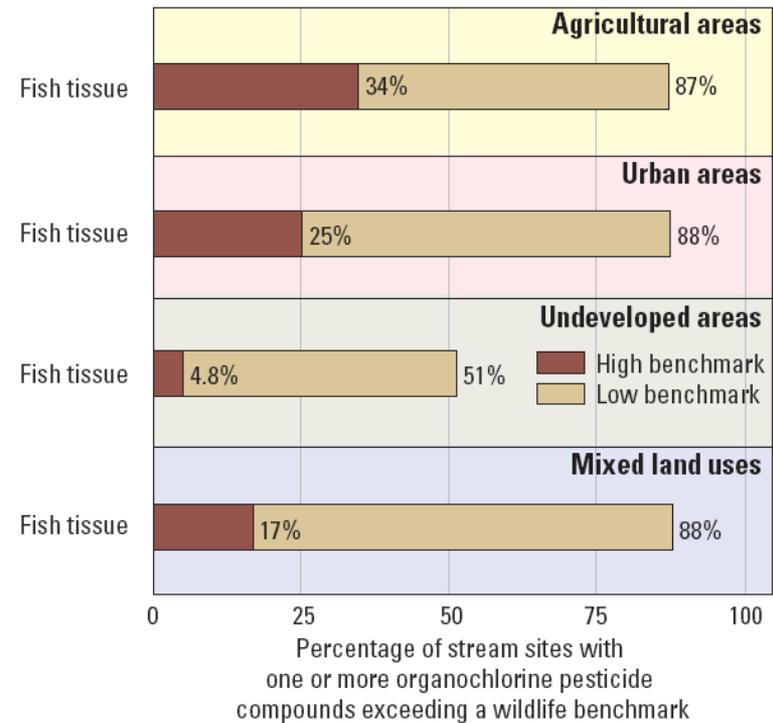


Frequency of exceedance of aquatic/wildlife benchmark values

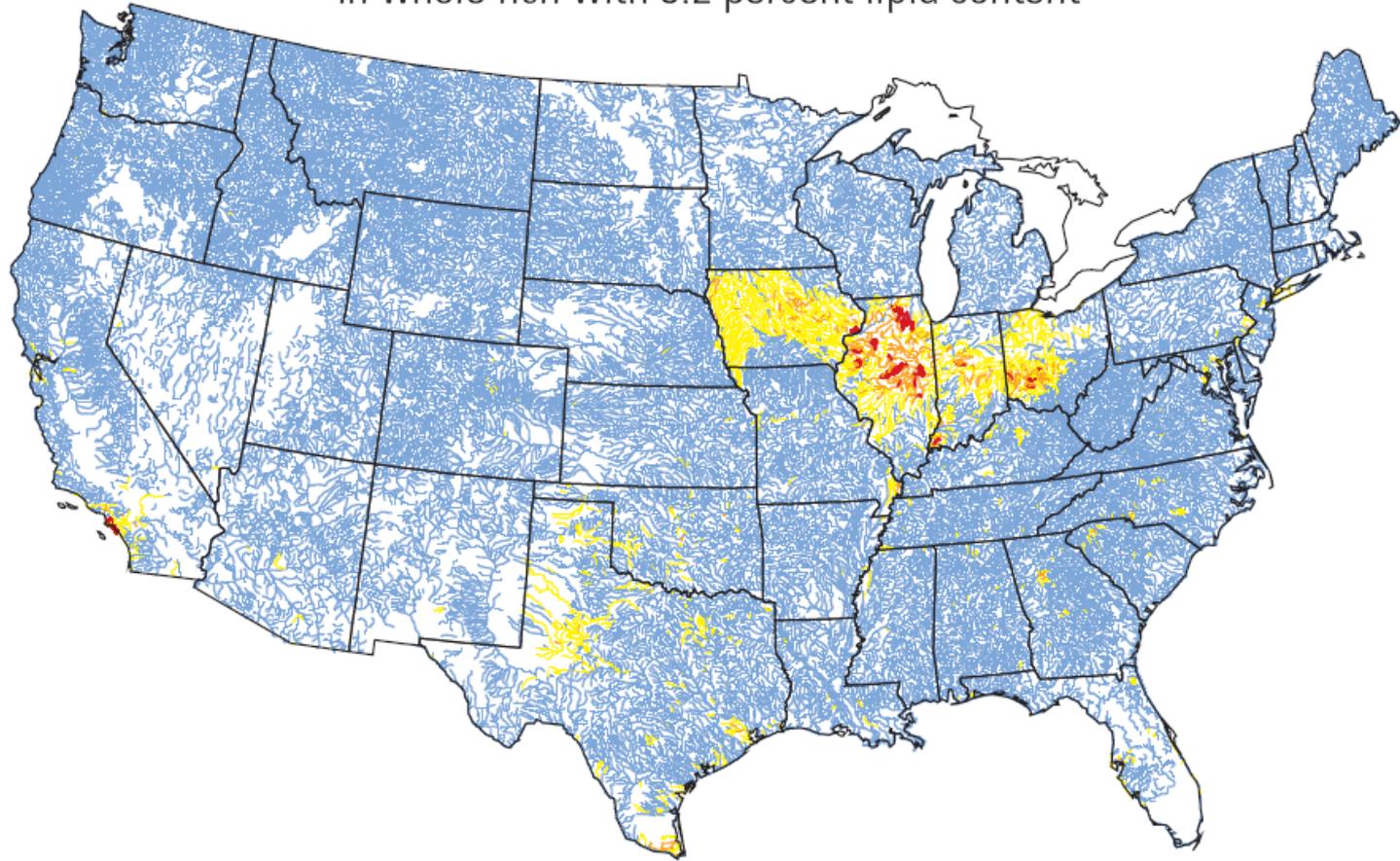
Concentrations greater than aquatic-life benchmarks



Concentrations greater than wildlife benchmarks



Probability of exceeding the wildlife benchmark for dieldrin
in whole fish with 6.2 percent lipid content



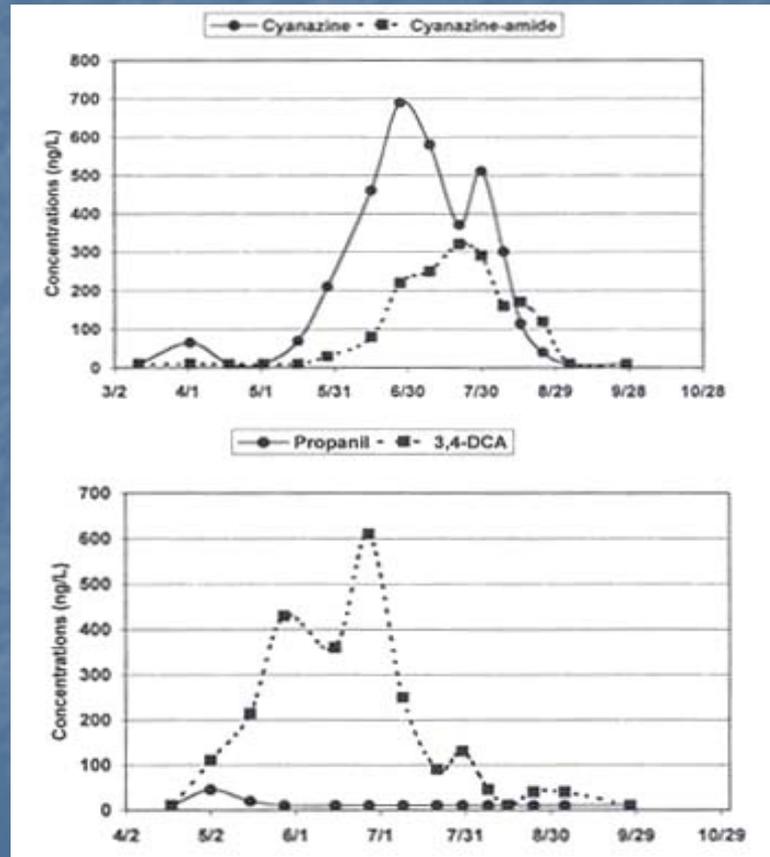
Probability of exceeding 120 micrograms per kilogram

- | | |
|-----------|--------------|
| — < 5% | — > 25 – 50% |
| — 5 – 25% | — > 50% |

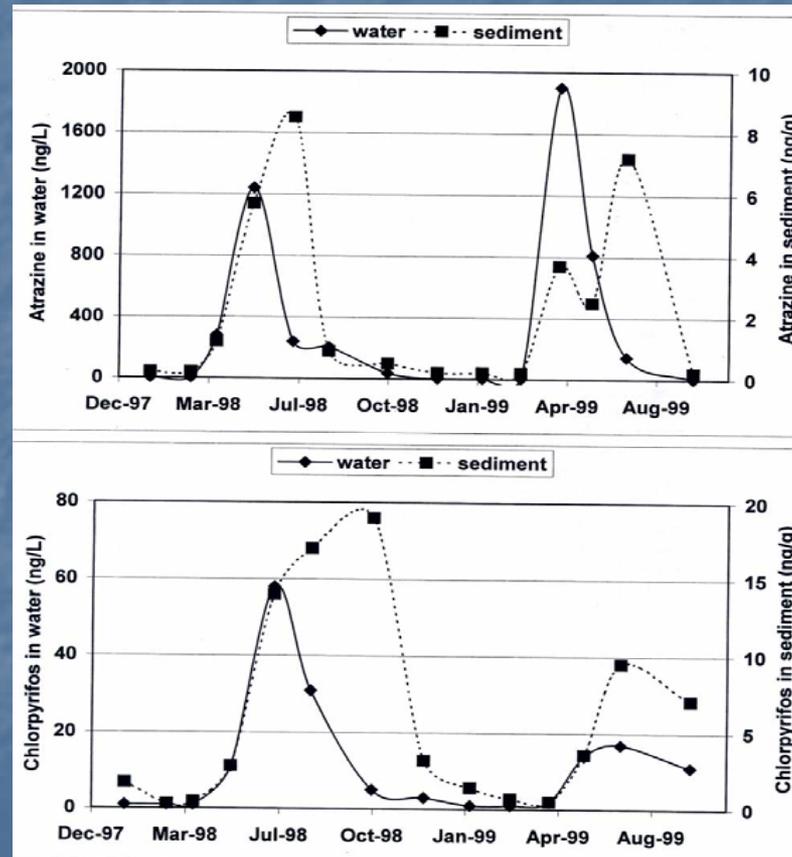
Factors to consider when using monitoring data

- Spatial/temporal variability
- Presentation of concentrations
 - Reporting below detection levels
- Environmental fate of pesticide
- Application method/formulation
- Other pesticides with similar modes of action

Temporal variability of cyanazine and propanil and associated metabolites



Temporal variability of atrazine and chlorpyrifos in water and sediment



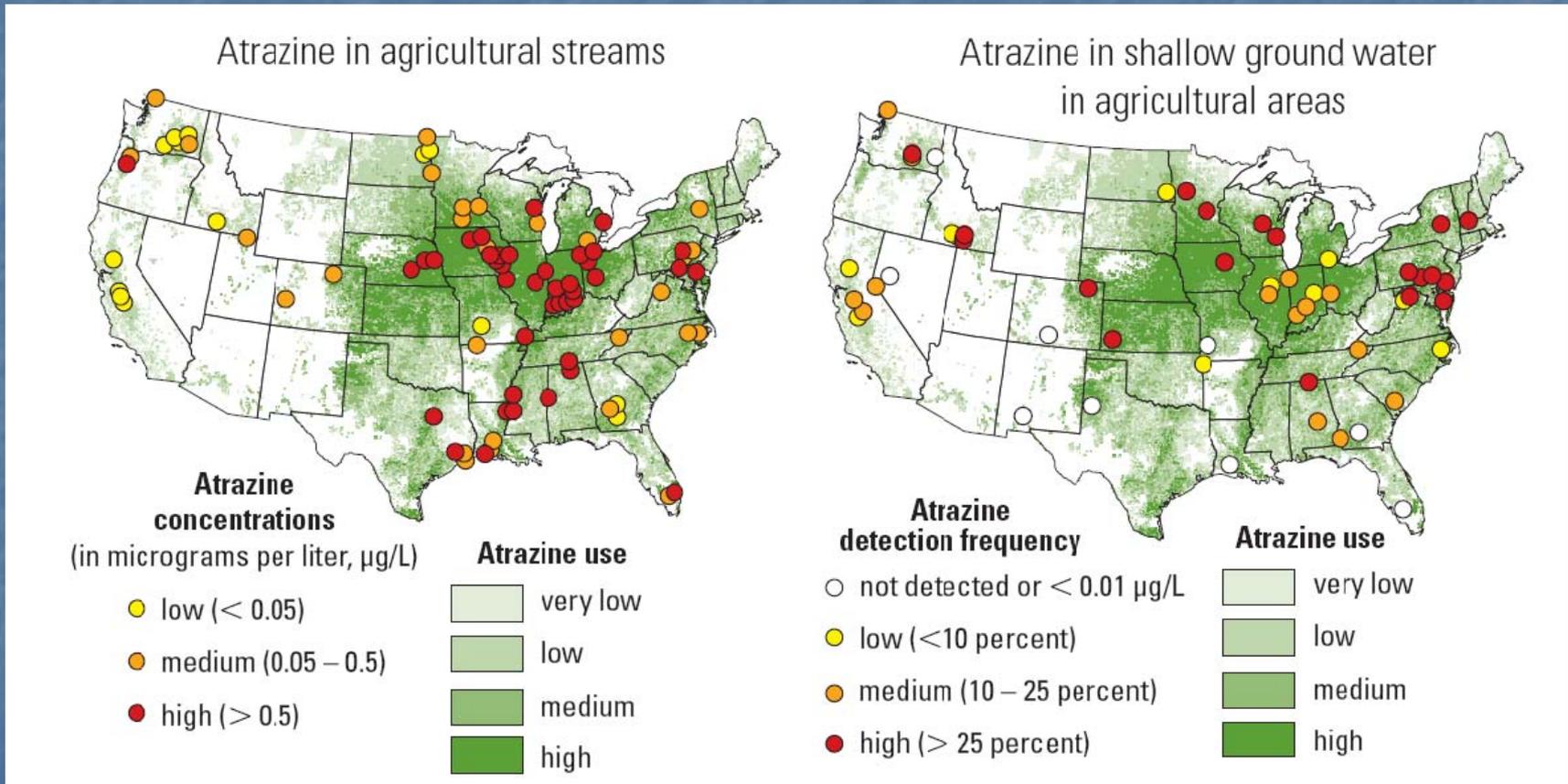
Statistics and test results before and after censoring data as non-detects

Procedure	Before censoring	Range after using substitution	Using censored methods
Estimating mean	198.1	72–258	191.3
Estimating std. dev.	52.4	41–106	54.0
Correlation coeff.	0.77	0.29–0.54	0.55
Regression slope	1.46	0.62–1.12	1.46
<i>t</i> -statistic	–2.74	–1.8 to –0.68	–1.81
<i>p</i> -value for <i>t</i>	0.009	0.08–0.50	0.07

Factors to consider when collecting samples

- Identify lab for cost/sample collection
- Pesticide use pattern for watershed
- Parent/metabolite concerns
- Known mixture concerns
- Adequate level of detection
- GLP technique for collection/analysis

Relating off-site pesticide levels with use patterns



Pesticide use patterns

- Pesticide Label
- Local
 - Applicators, Extension
- State
 - Agriculture-related agencies
- Federal
 - National Agricultural Statistics Service (NASS)



FWS



MSU



USDA National Agricultural Statistics Service - Quick Stats U.S. & All States Data - Chemical Usage

step 1 select data type

Field Crops
Fruit

step 2 select data items

Barley All
Corn All
Cotton Upland
Oats

step 3 select years

step 4 select location

Click the Add button to select Location(s). Select multiple locations by clicking on a location while pressing the Ctrl key, and then clicking on another location(s).

Select Years:
From:

1990

To:

2006

Interval:

1

Primary Location:

Select a State below
All Program States & Totals
Total of Program States
Alabama
Arizona
Arkansas
California
Colorado

Add

Location(s) Selected

Click Location to Remove
All Program States & Totals

Get Data

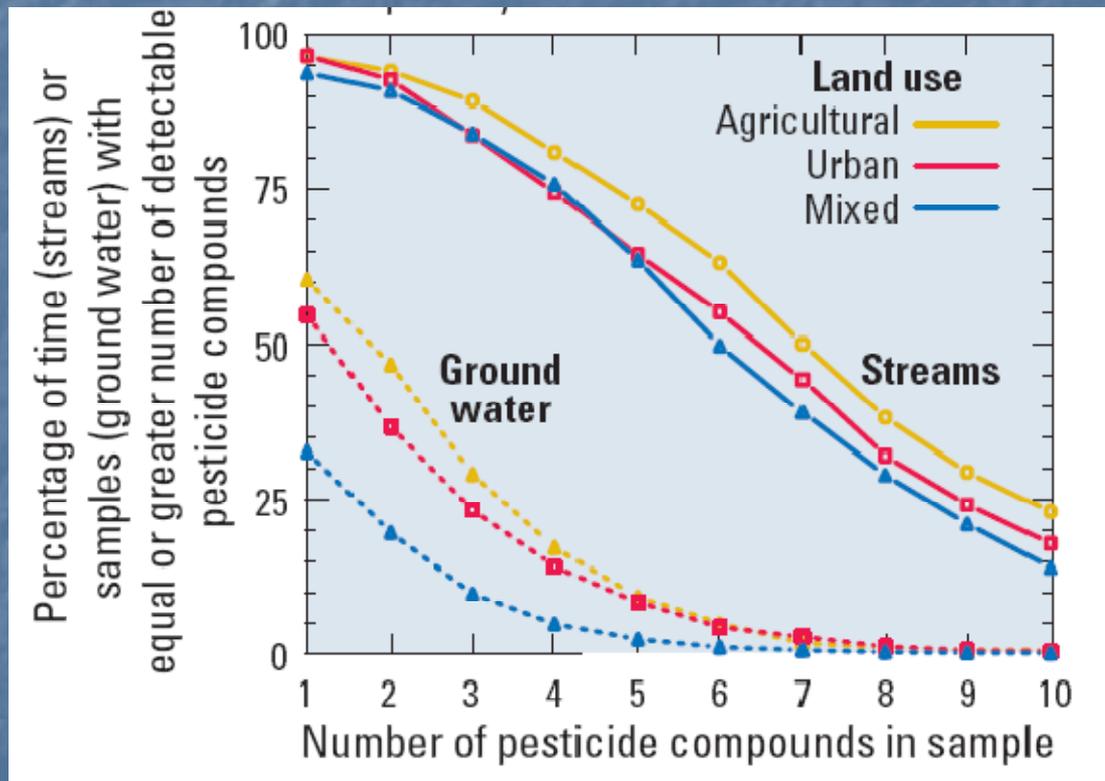
Get Data - Download Only

Available Data

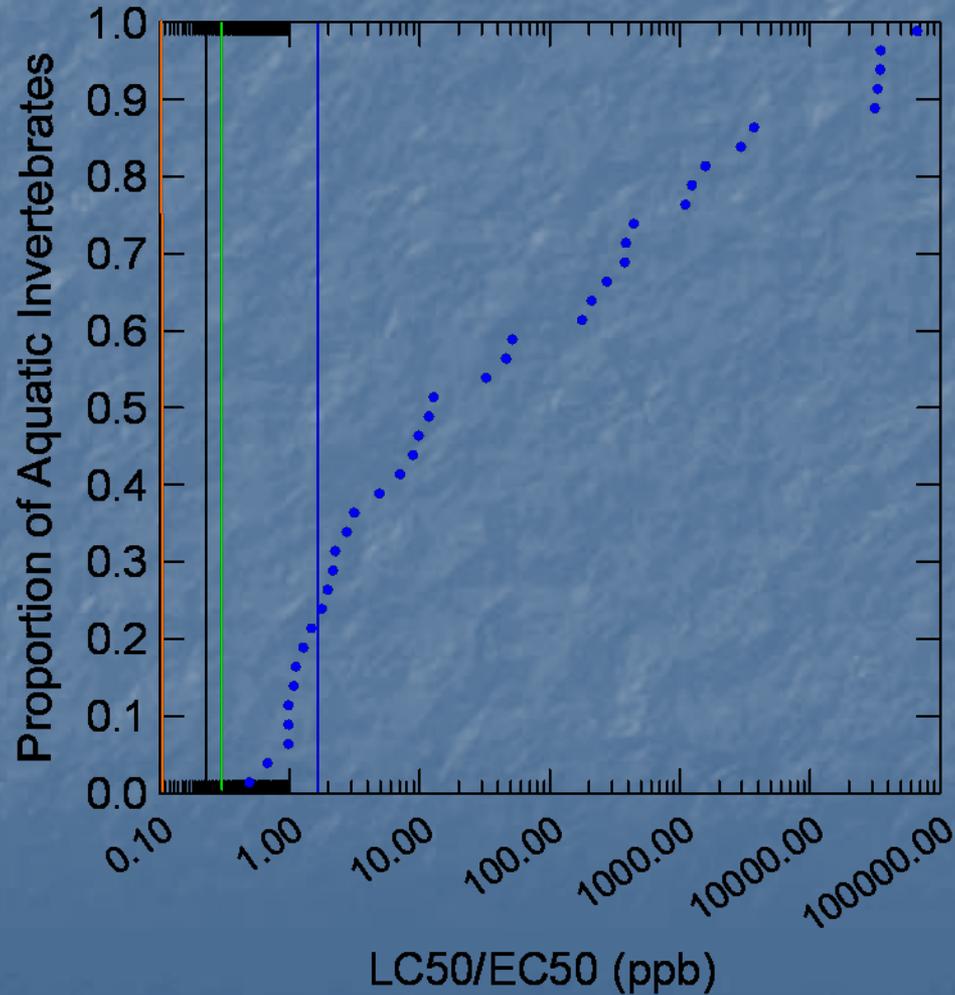
Main Menu

Reset

Frequency of pesticide mixtures in USGS collected water samples



Levels of detection and effects



Quality control in pesticide sampling

- Use GLP and standardized methods when collecting samples:
 - Field blanks (estimate of bias from contamination)
 - Replicates (estimate of variability)
 - Replicate field matrix spikes (estimate of bias and variability)
 - Recovery efficiency that validates analytical method
 - Possible pesticide degradation during shipment
 - Interferences in the sample

Sources for Standardized Methods in Collecting and Analyzing Pesticide Residues

- ASTM – American Society for Testing and Materials
- EPA – OPP
 - Residue analytical methods (RAM)
 - Environmental chemistry methods (ECM)
- EPA – OW
- USGS
 - <http://water.usgs.gov/techniques.html>
- National Environmental Methods Index
 - <http://www.nemi.gov>



NEMI

National Environmental Methods Index



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- ▶ [Browse all Methods in NEMI](#)

Partner Highlight



The [Alliance for Coastal Technologies \(ACT\)](#) is a NOAA-funded partnership of research institutions, resource managers, and private sector companies dedicated to fostering the development and adoption of effective and reliable sensors and platforms. In addition to conducting independent technology evaluations, ACT provides an [online searchable database](#) of in situ sensors/analyzer, platforms, and associated equipment for studying and monitoring aquatic environments (from rivers and streams to estuaries and the open ocean).

NEMI is maintained under the direction of the [Methods and Data Comparability Board](#), a partnership of water-quality experts from Federal agencies, States, municipalities, industry, and private organizations. The Methods Board is chartered under the [National Water Quality Monitoring Council](#), whose mission since its charter in May 1997 is to coordinate and provide guidance on implementation of a voluntary, integrated, nationwide monitoring strategy.

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