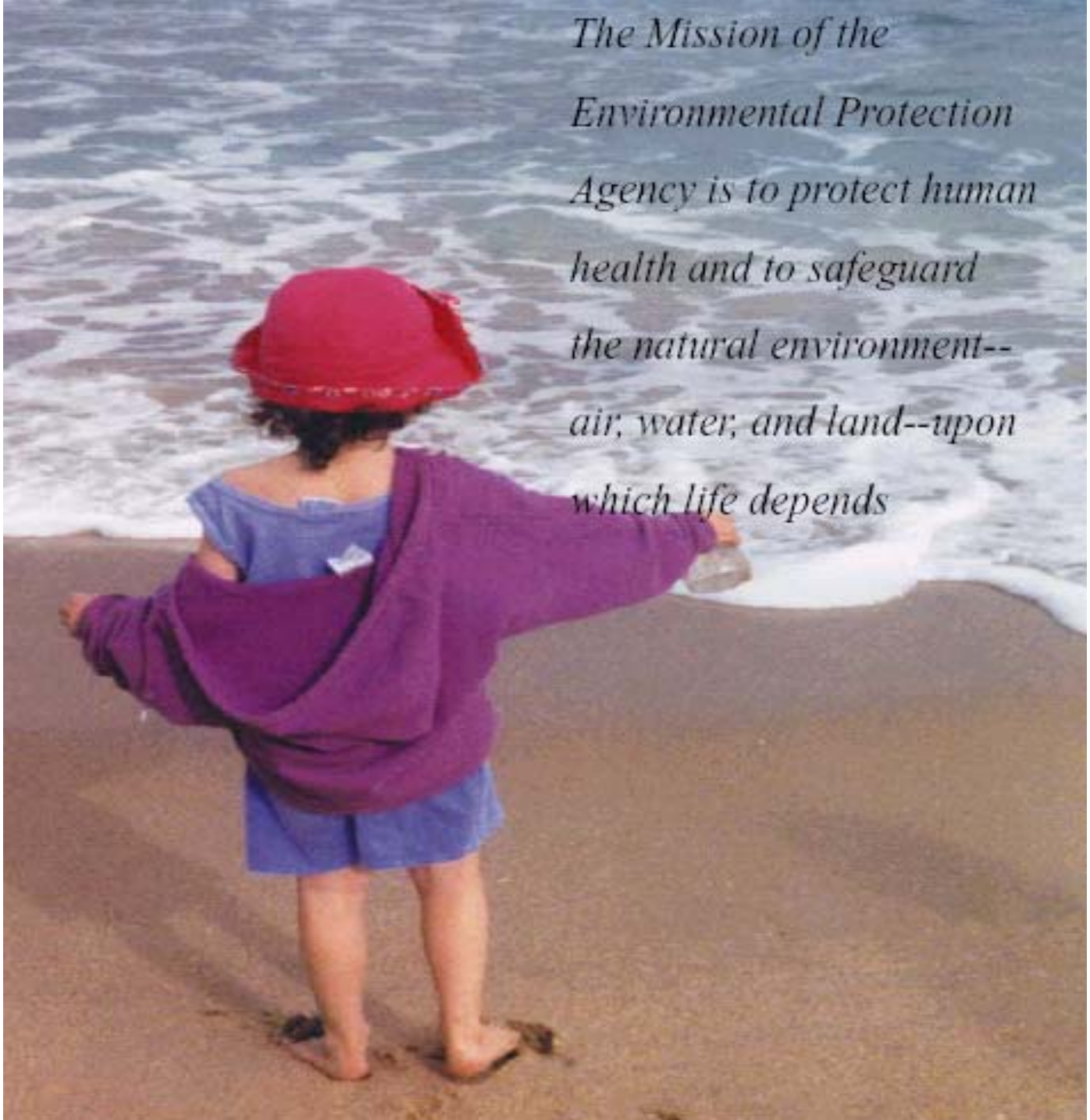
ORD's Environmental Monitoring and Assessment Program

Sound Science for Measuring Ecological Condition

- **Background**
- **Progress to date**
- **Future Directions**

Office of Research and Development



The Mission of the Environmental Protection Agency is to protect human health and to safeguard the natural environment--air, water, and land--upon which life depends

Agency Needs Condition Monitoring

- **Status**
  - EPA Administrator William Ruckelshaus (early 1980s) – ***"What do you mean you don't know how many acid lakes there are?"***

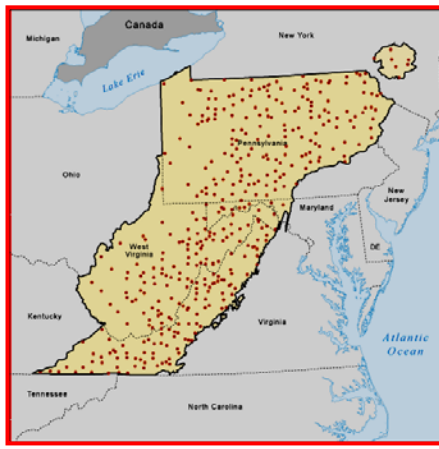
- **Trends**
  - EPA Administrator William Reilly (1989) – "***Good News - Based on my years in the environmental movement, I think the Agency does an exemplary job of protecting the nation's public health and quality of the environment.***
    Bad News - I can't prove it."

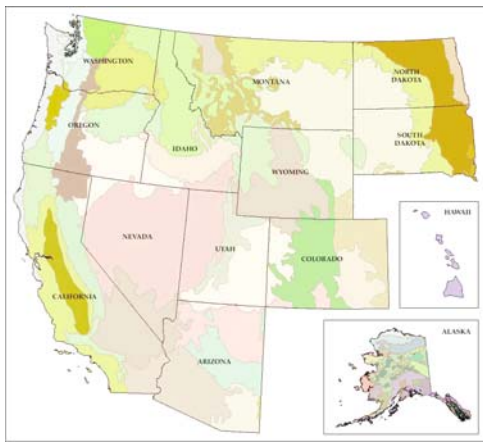
Key Agency Questions

- What are the current conditions of our ecosystems?
  - State of the Environment Report
- Where is the condition improving or declining?
- What stresses are associated with declines?
- Are our management programs and policies working (GPRA)?

GOALS of ORD's EMAP

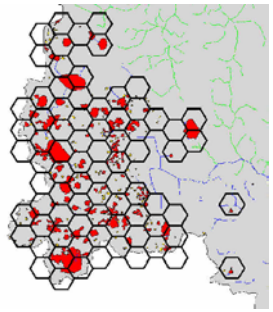
- Develop the scientific basis for consistent, unbiased, cost-effective measurement of the condition of the Nation's aquatic ecosystems
  - Status (State of the Environment Report)
  - Trends (GPRA)
- Build state capacity for monitoring condition and transfer our technology
- Make data generally available to all stakeholders (STORET)





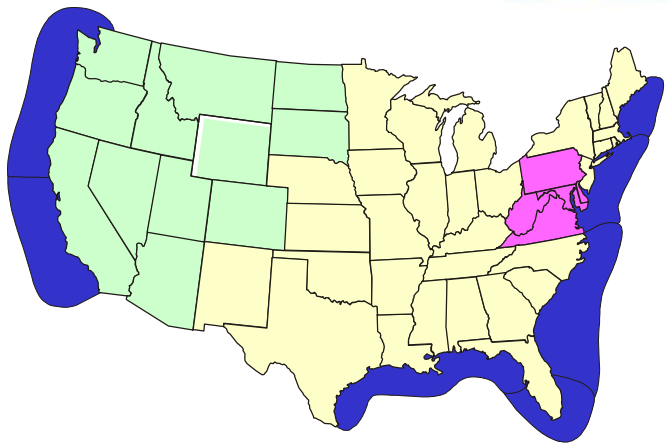
Key Elements of EMAP's Approach

- Statistical Design - Scientifically defensible, unbiased sampling



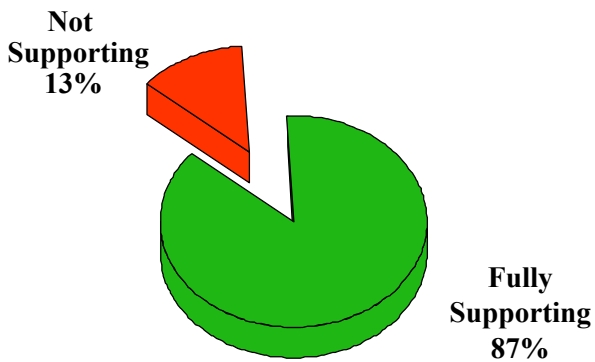
- Biological Indicators – Meaningful, direct measures of the biological condition

- Current Partnerships
  - 33 States
  - NOAA
  - USGS



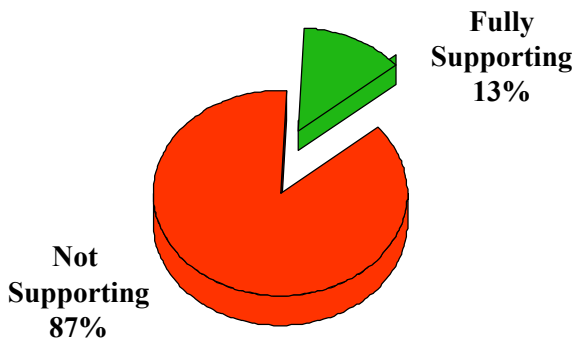
Importance of EMAP Design

Condition of a State's streams using different designs

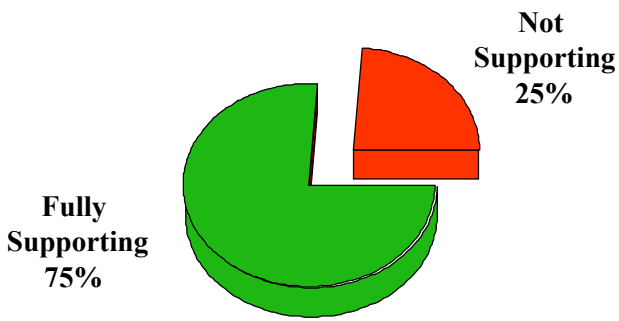


Traditional Targeted Monitoring

STATE A

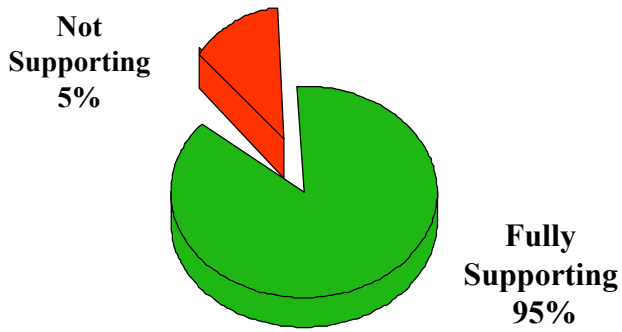


Probability Survey



Traditional Targeted Monitoring

STATE B



Probability Survey

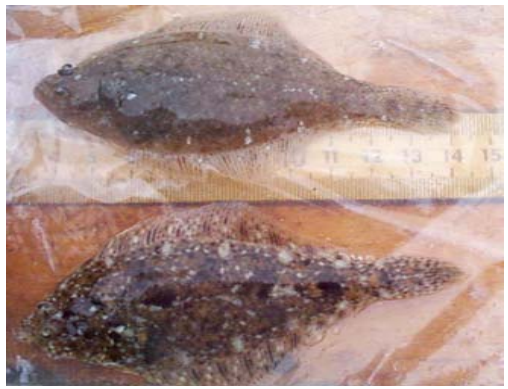
EMAP Uses Biological Indicators

- Biological Indicators – Integrate the effects of stressors and are a direct measure of the biology

EMAP Core Indicators

Estuarine Biological Indicators

Benthic community assemblage
Fish community assemblage
Fish pathologies
Fish tissue residues
Submerged vegetation



Stream Biological Indicators

Fish assemblage
Benthic invertebrate assemblage
Periphyton assemblage
Riparian vegetation

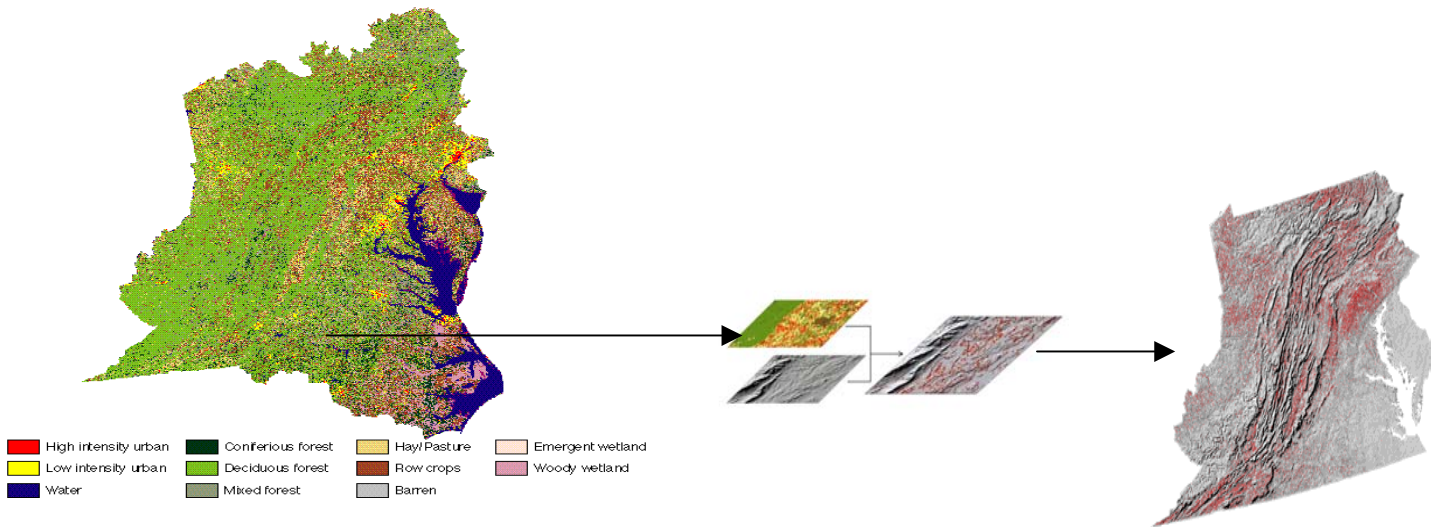
Stressors

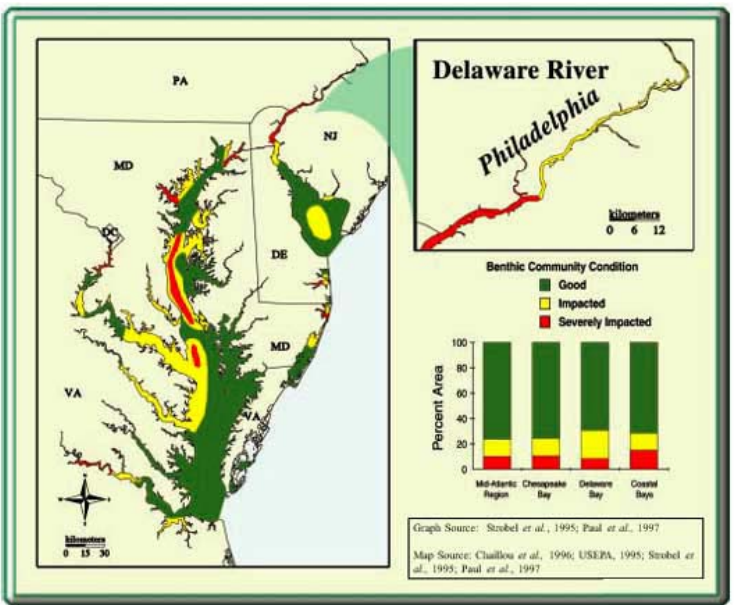
DO
Salinity
Temperature
Depth
pH
Nutrients
Sediments
Toxics

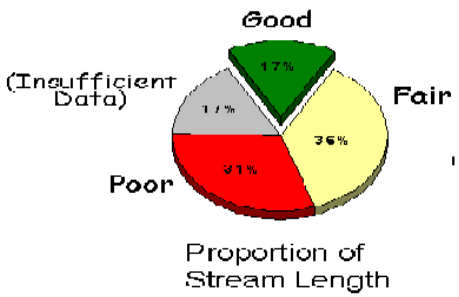
EMAP Accomplishments

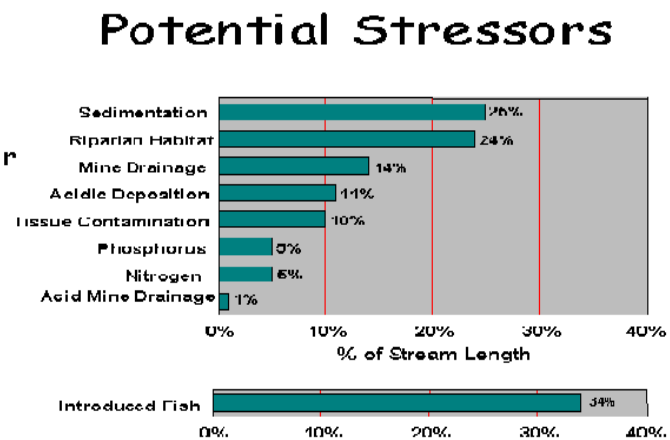
- Mid-Atlantic Integrated Assessment
  - An Ecological Assessment of the United States Mid-Atlantic Region: A Landscape Atlas (EPA 600/R-97/130)
  - Condition of the Mid-Atlantic Estuaries (EPA 600-R-98-147)
  - Mid-Atlantic Highlands Streams Assessment (EPA 903/R-00/015)

EMAP Accomplishments in MAIA



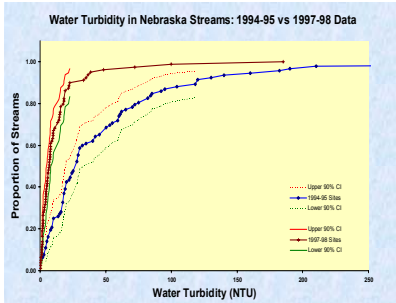




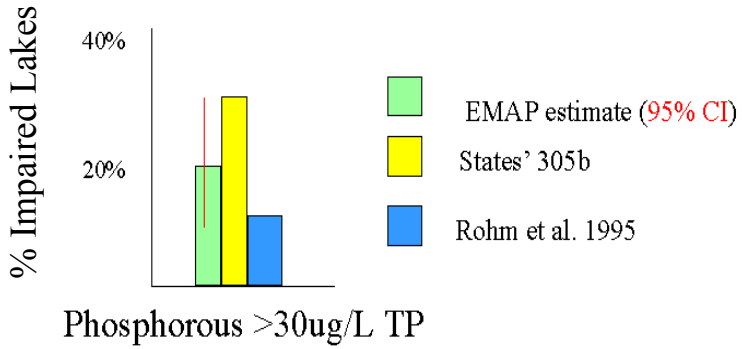


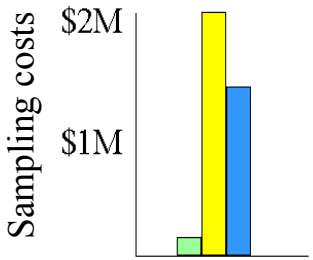
EMAP Accomplishments (Con't)

- Only means of detecting significant change in condition at a state or national level

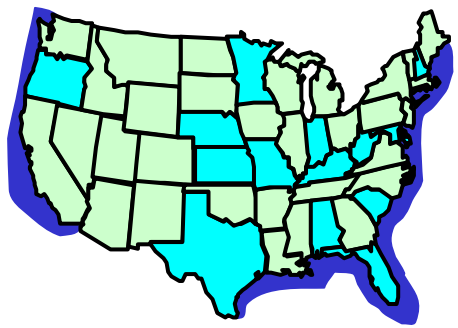


- Cost-effective monitoring for States





- 20 States have already adopted our approach



EMAP Awarded EPA's Silver Medal

- "For scientific contributions and leadership in developing the science and tools for monitoring and assessing the status and trends of the condition of our environment"

Roger Blair
Tom DeMoss
Dan Heggem
Bruce Jones
Bill Kepner
Harold Kibby

Rick Kutz
(Rick Linthurst)
Michael McDonald
Jay Messer
Daniel McKenzie
Douglas Norton
Anthony Olsen

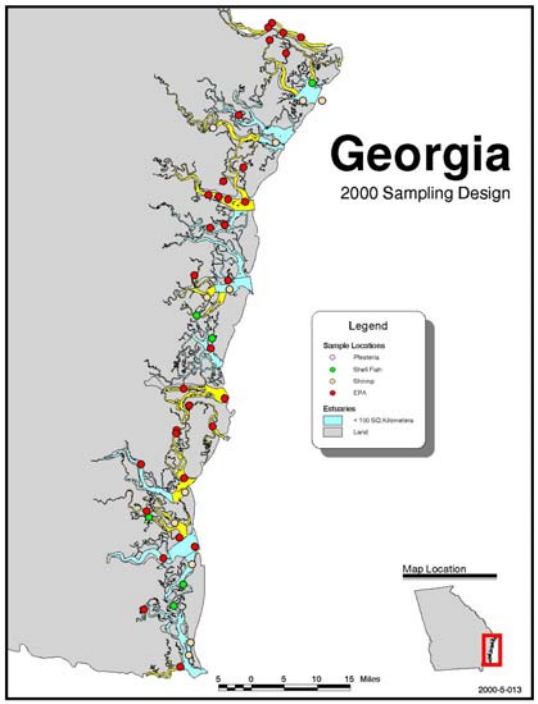
John Paul
Steven Paulsen
Denise Shaw
John Stoddard
Kevin Summers
(Gilman Veith)

Current EMAP Efforts

- National Coastal Assessment – First statistically-based determination of the health of any national aquatic resource
- Western Pilot – Develop baselines for streams and estuaries in western states
- STAR Grants – University-based research on focused topics

EMAP's National Coastal Assessment

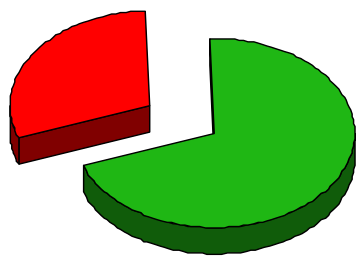
- Coastal States monitoring all the nation's estuarine waters with core EMAP design and indicators



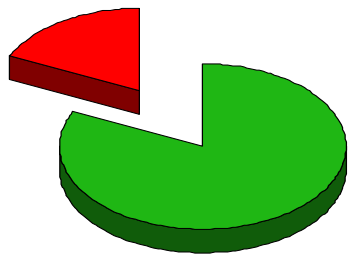
Estuarine Stressor Comparison

Benthic invertebrate condition

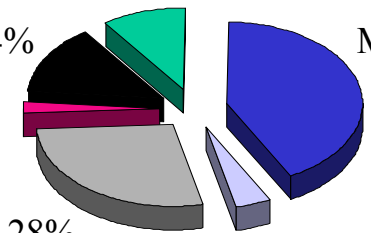
Louisianian Province

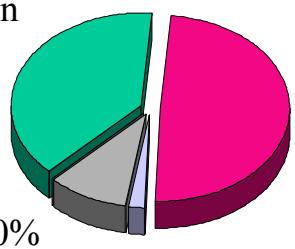


Virginian Province



Condition

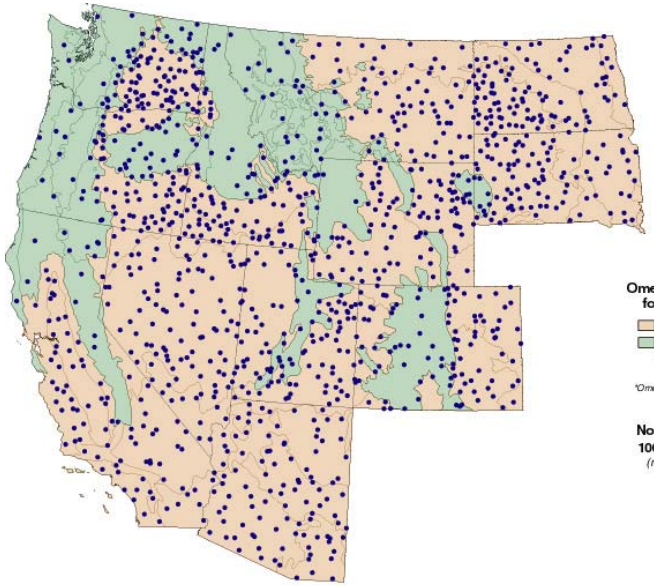




Stressors Associated with Degraded Condition

National Stream Condition

- Reducing scientific uncertainties
  - Western Pilot



EMAP West
Stream
and
River Survey
1999 - 2004

Omernik Level III Ecoregions*
for Use in Survey Design

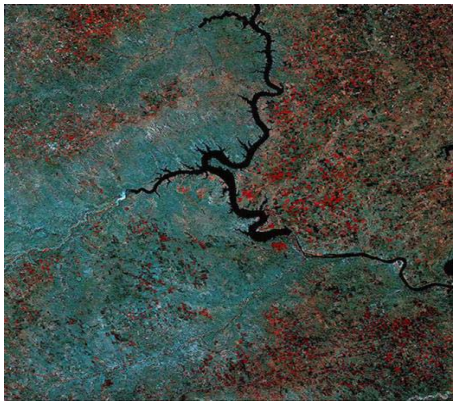
Ecoregions Designated Arid
Ecoregions Designated Humid or Mountainous

*Omernik Level III Ecoregions, January 1999

Non-perennial Sample sites
100 sites selected per state
(not intended for field sampling)

US EPA, NHEERL-WED
Corvallis, Oregon

August 4, 1999

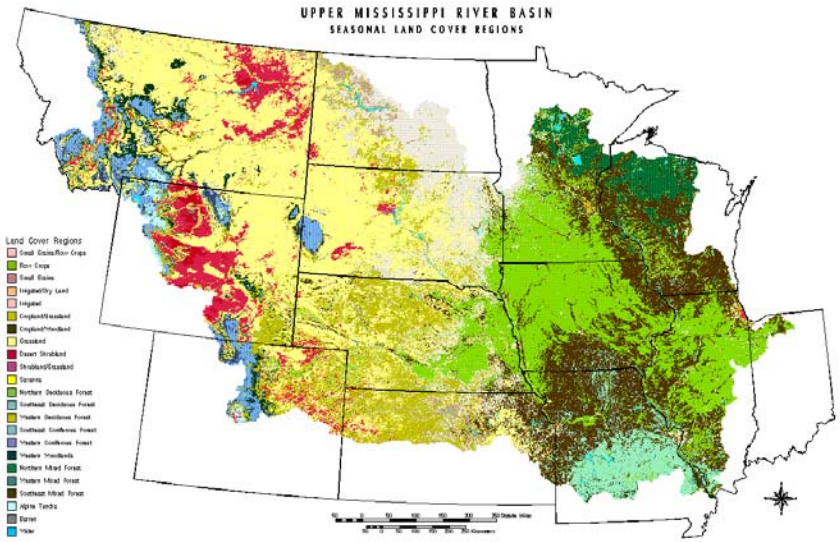


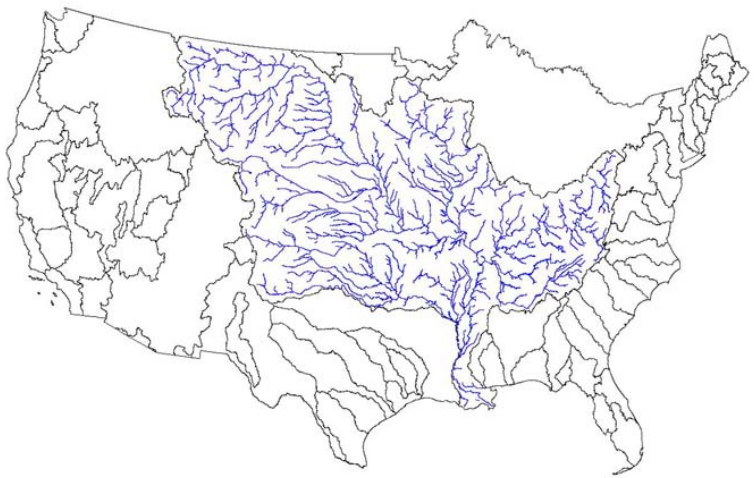
Academic Research Partnerships

- EMAP is integrated with academic scientists through ORD's STAR Grants Program
  - Design
  - Ecological Indicators

Future Directions for EMAP

- Develop the scientific basis for assessing the condition of large and Great Rivers
  - Link streams to rivers to estuaries
  - Add condition of large Great Rivers to State of the Environment Report





ORD's Sound Science for Condition

- Consistent, state-conducted approach for national monitoring of streams and estuaries is available
- Statistical detection of changes and trends in ecological condition is possible in support of GPRA
- Assistance to States for 305(b) designs is available
- The science for determining condition of the large/Great Rivers is being developed