

# US EPA's Report on the Environment (ROE)

National Water Quality Monitoring Council  
1 Dec 2016

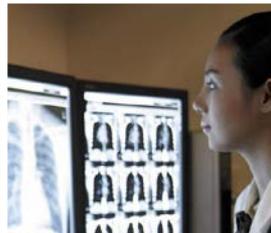
Presenter

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**Disclaimer-** The views expressed in this presentation are those of the authors and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.



# ROE History

2001

- Initiative of EPA Administrator

2003

- **Draft ROE 2003** released as published report on Status and Trends

2008

- **ROE 2008** released as published report on Status & Trends; electronic version (eROE) in late 2008

2015

- **2015 version**—web-based presentation of Status & Trends; greater transparency; interactive capabilities

2016

- **2016 planning**—enhance the ROE Program to advance decision making, planning, and communication

# ROE Purpose

We propose to do these We do these now

## Report Trends

- Status & Trends of human health and environment represented by 85 indicators

## Develop Indicators

- Develop indicators on important issues to EPA

## Inform EPA Priorities

- Inform development of Agency activities and priorities

## Communicate with Public

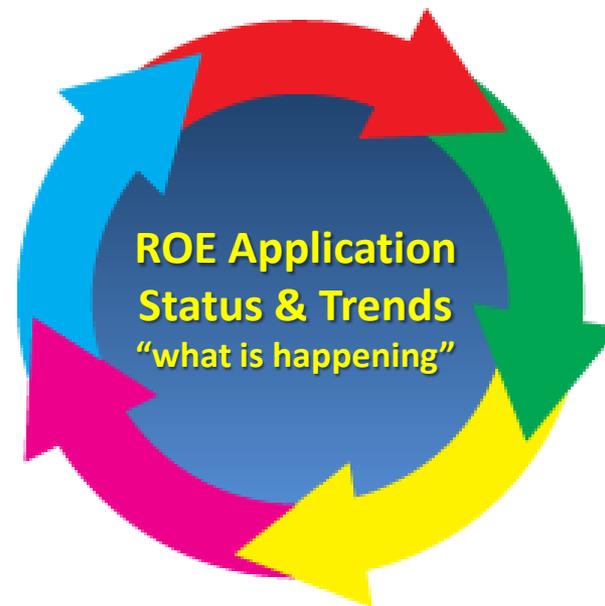
- Communicate the state of the nation's environment in an accessible way to the general public

At this time the ROE Program does not yet analyze or diagnose the reasons for, and relationships between, trends in stressors and environmental and health outcomes

# EPA's Report on the Environment (ROE)

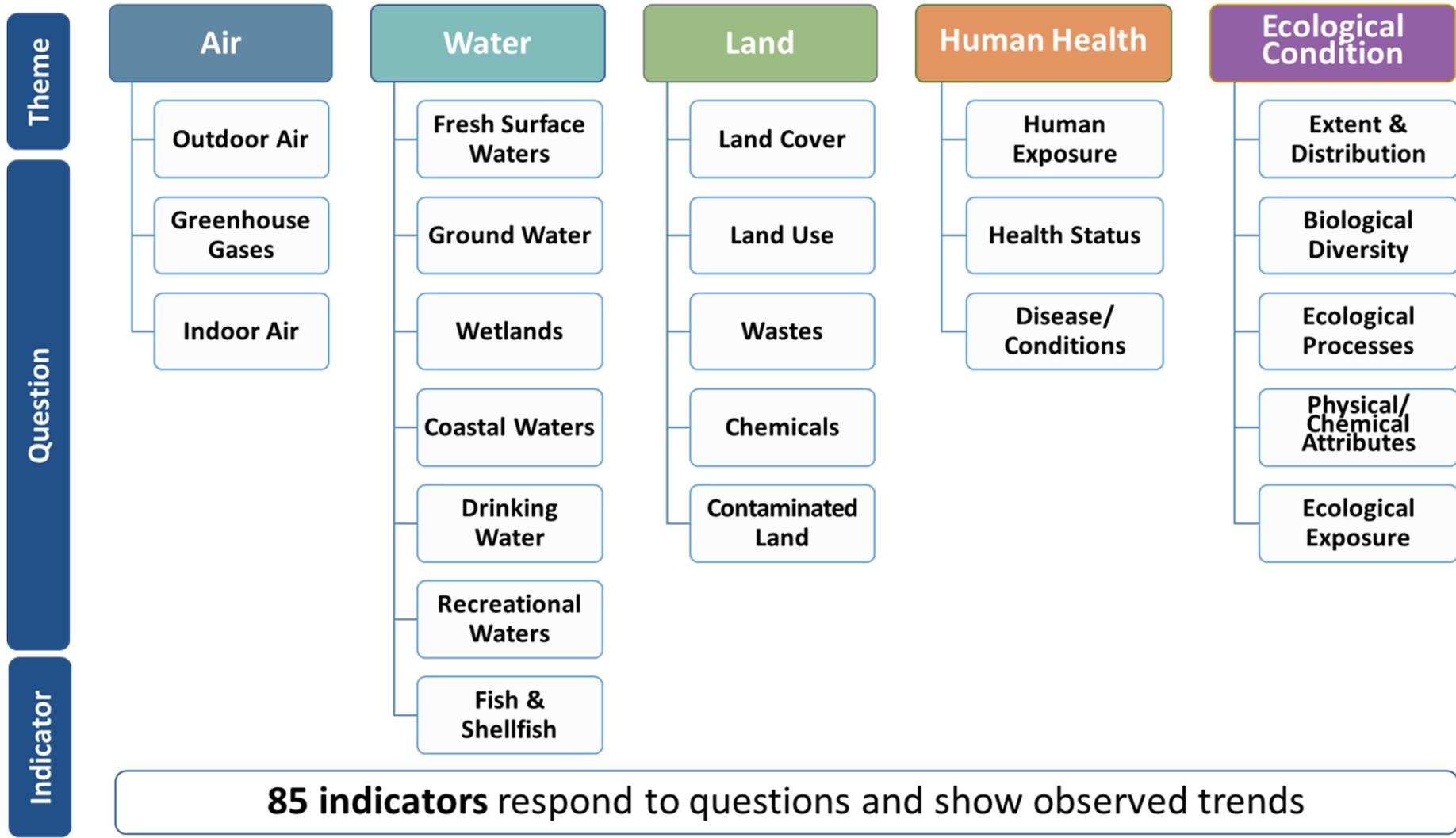
[www.epa.gov/roe](http://www.epa.gov/roe)

- ROE helps answer questions of critical importance to EPA's mission of protecting human health and the environment.
- Dynamic web-based platform that presently yields 85 indicators that describe the national and regional **Status & Trends** of the environment and human health in the United States.

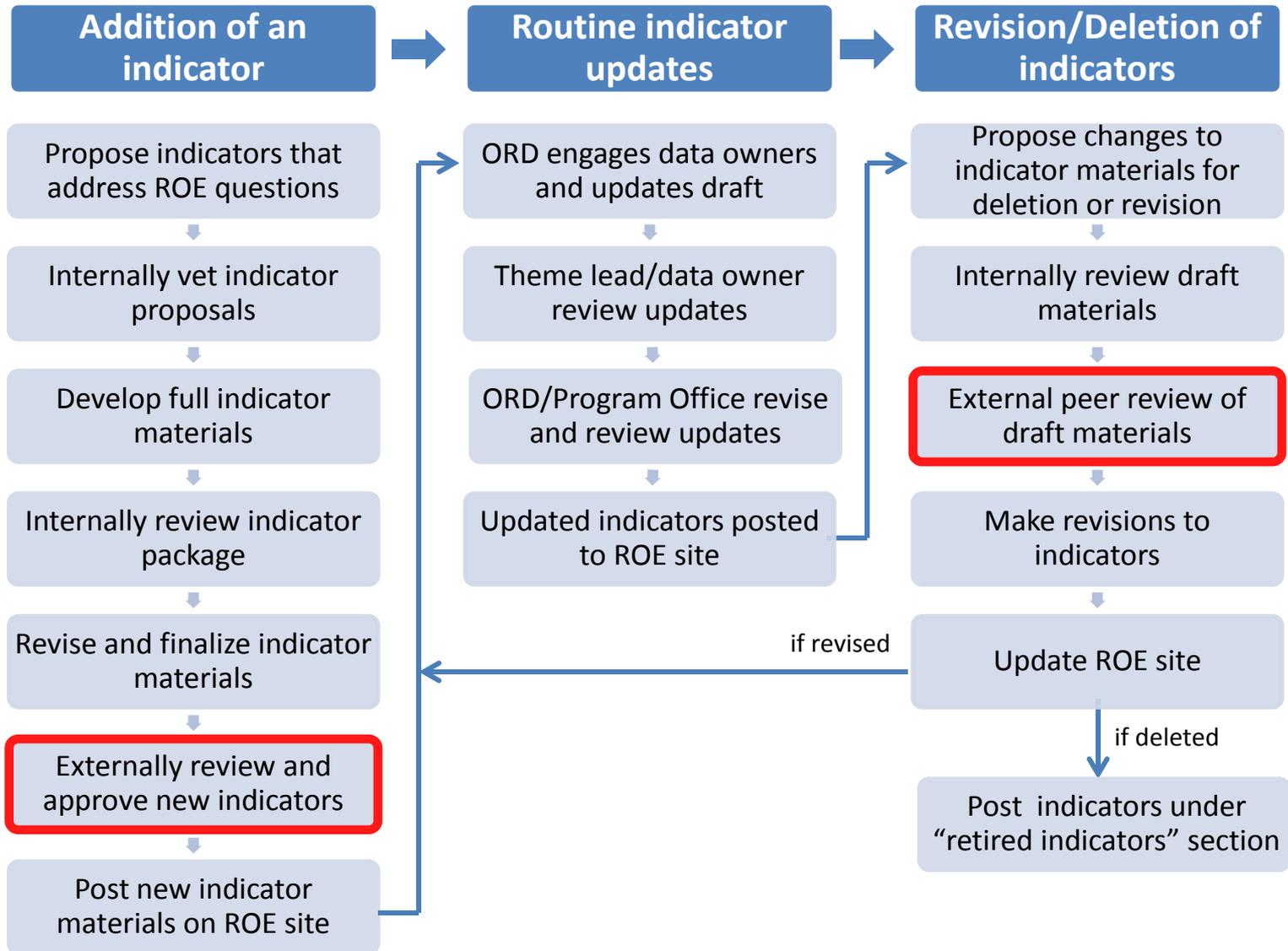


ROE: Status & Trends

# ROE Status & Trends Framework



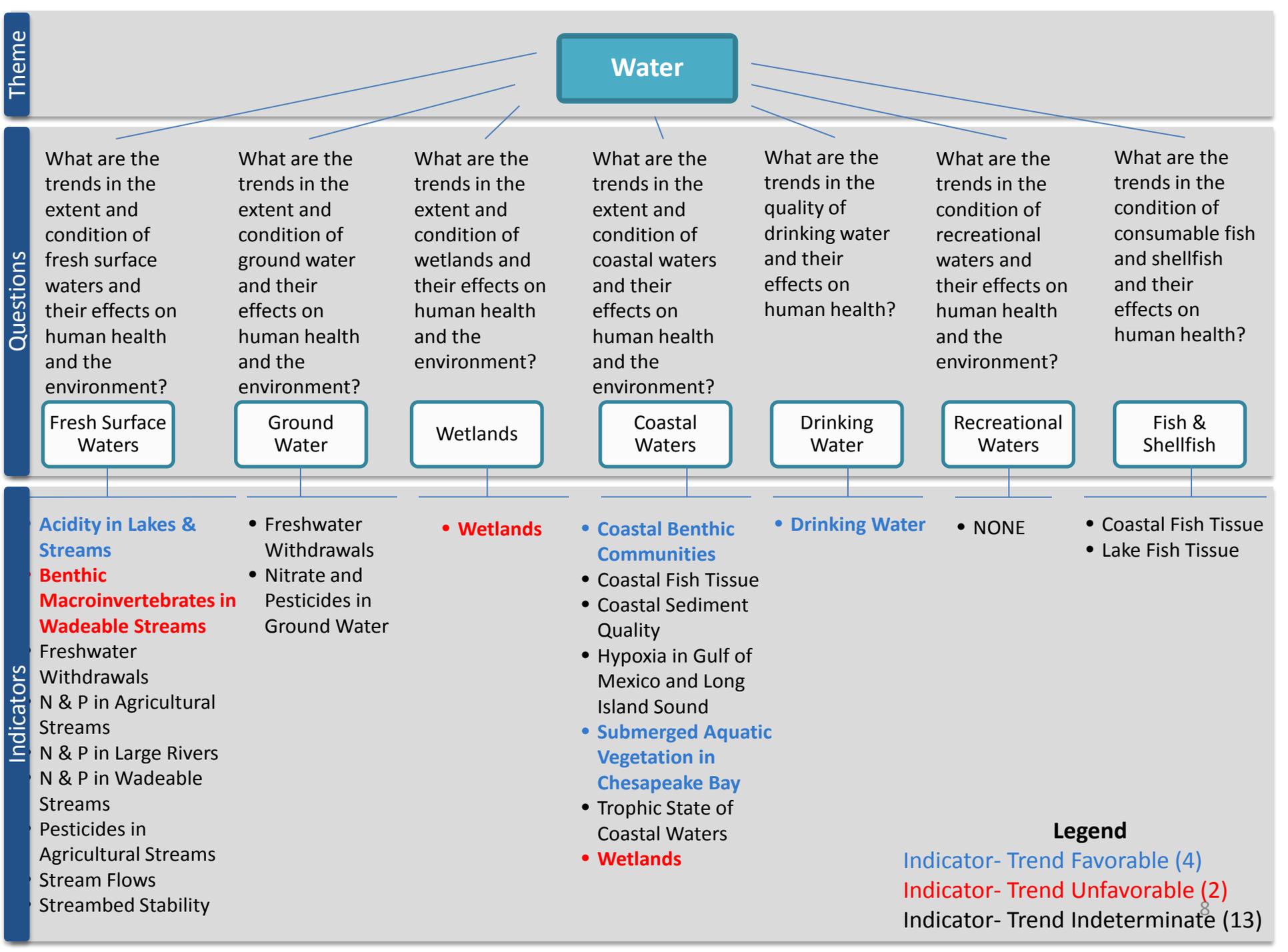
# ROE Indicator Process



# Summary of ROE Within Theme Trends

	Number of Indicators*	Improving	Declining	Indeterminate /Same
Air	31	21	6	4
Water	19	4	2	13
Land	12	5	1	6
Human Exposure & Health	19	6	4	9
Ecological Condition	27	5	7	15

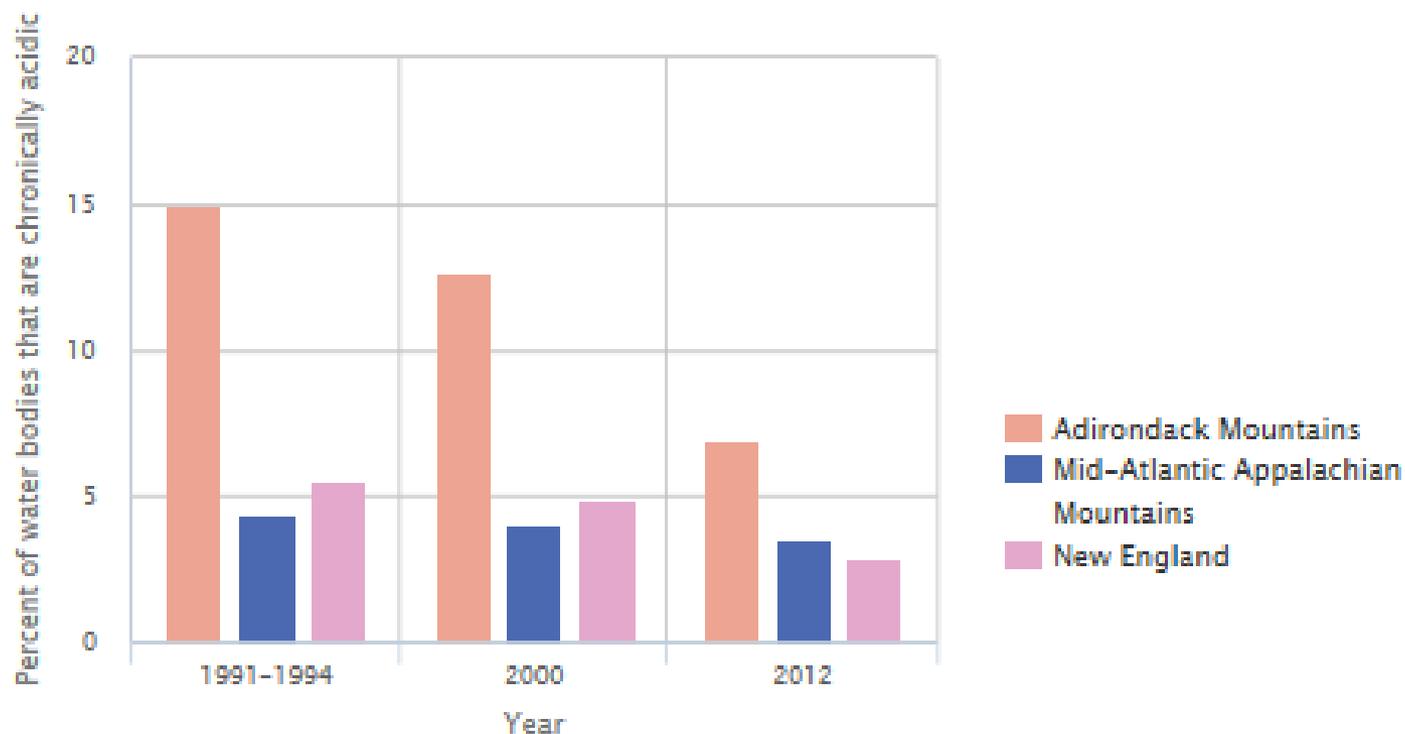
The summed indicators (108) is greater than 85 because an indicator can occur in multiple themes (e.g., Stream Flow is an indicator in **Water** and **Ecological Condition**)





# Indicator: Acidity in Lakes and Streams

**Exhibit 1. Lake and stream acidity in selected acid-sensitive regions in the U.S., 1991–2012**



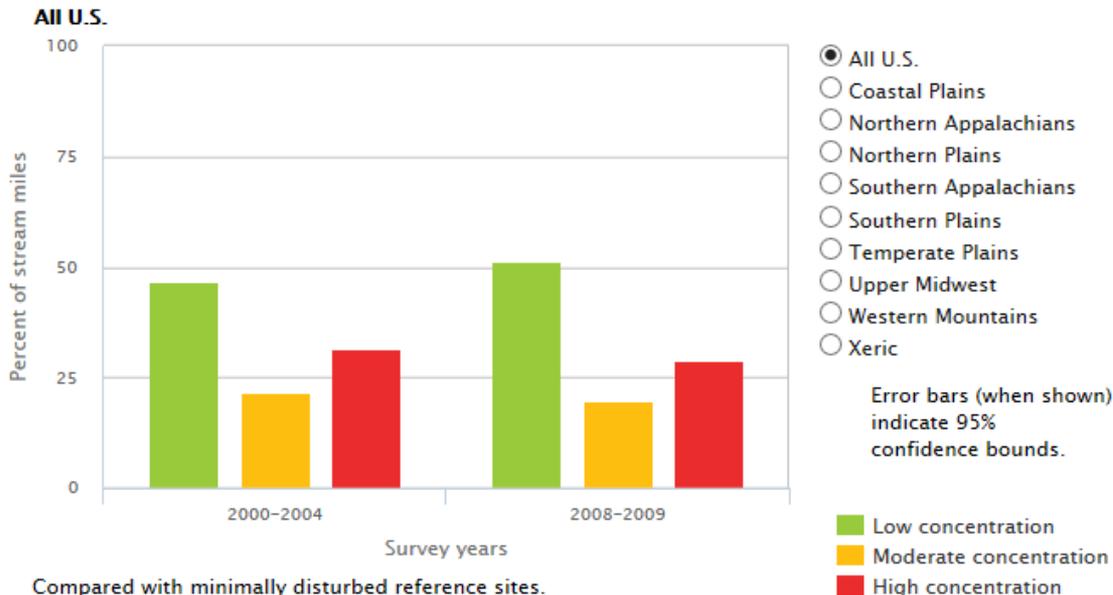
**Coverage:** 50 LTM and 43 TIME lakes in the Adirondack region, 26 LTM and 31 TIME lakes in the New England region, and 74 LTM and 56 TIME stream sites in the Mid-Atlantic Appalachian region.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** U.S. EPA, 2003, 2014a,b

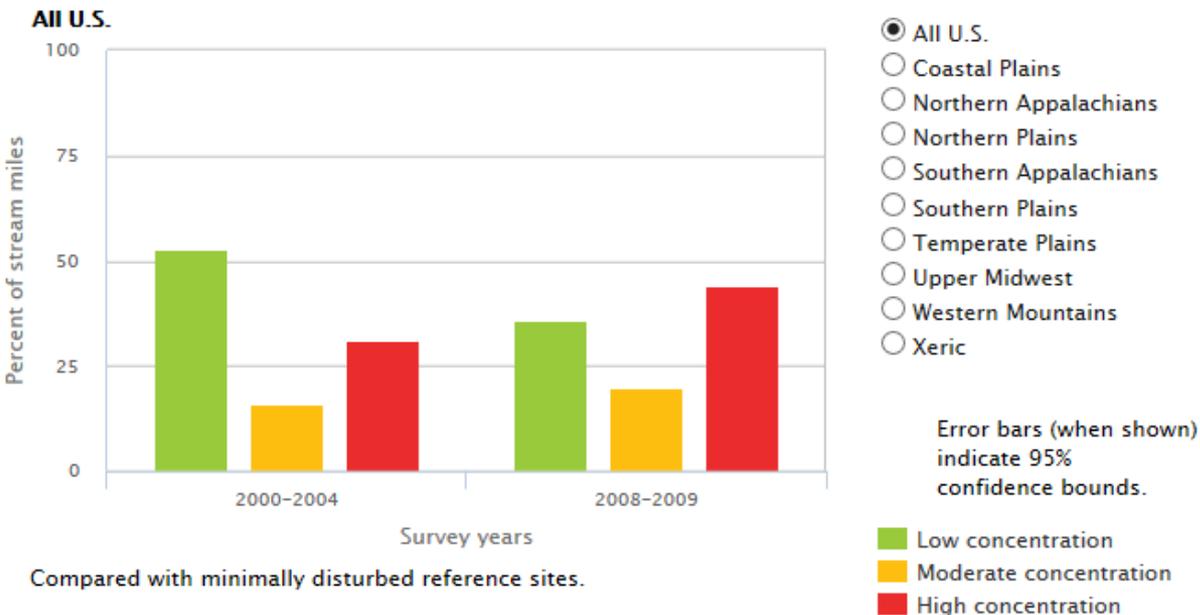
# Indicator: Nitrogen and Phosphorus in Wadeable Streams

**Exhibit 1. Nitrogen in wadeable streams of the contiguous U.S., 2000–2009**



Compared with minimally disturbed reference sites.

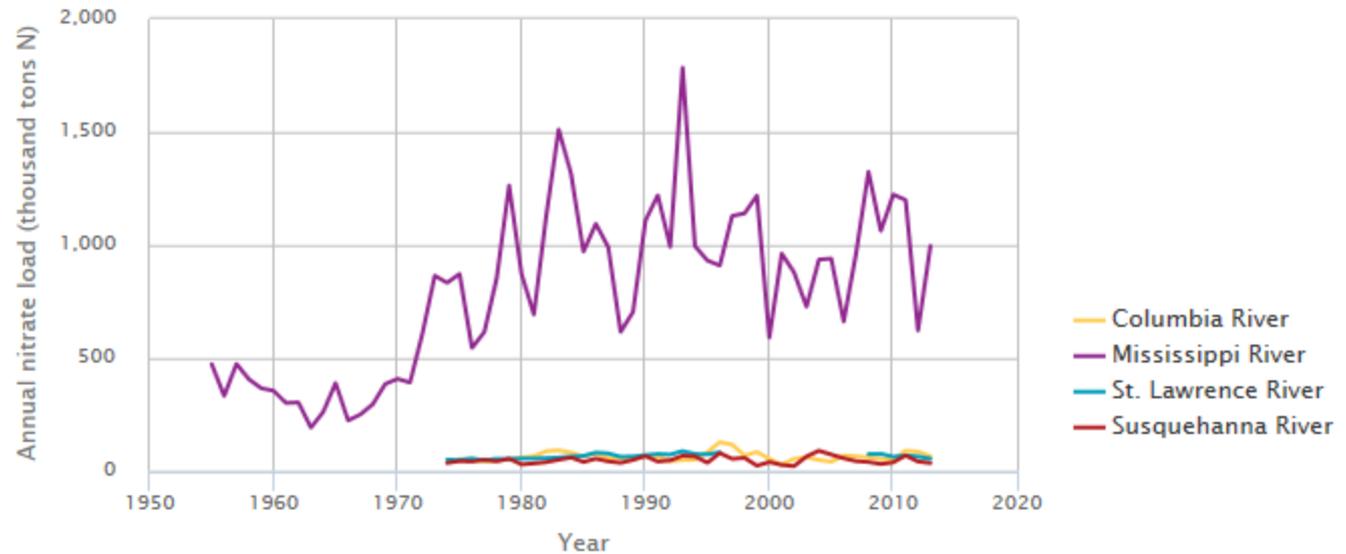
**Exhibit 2. Phosphorus in wadeable streams of the contiguous U.S., 2000–2009**



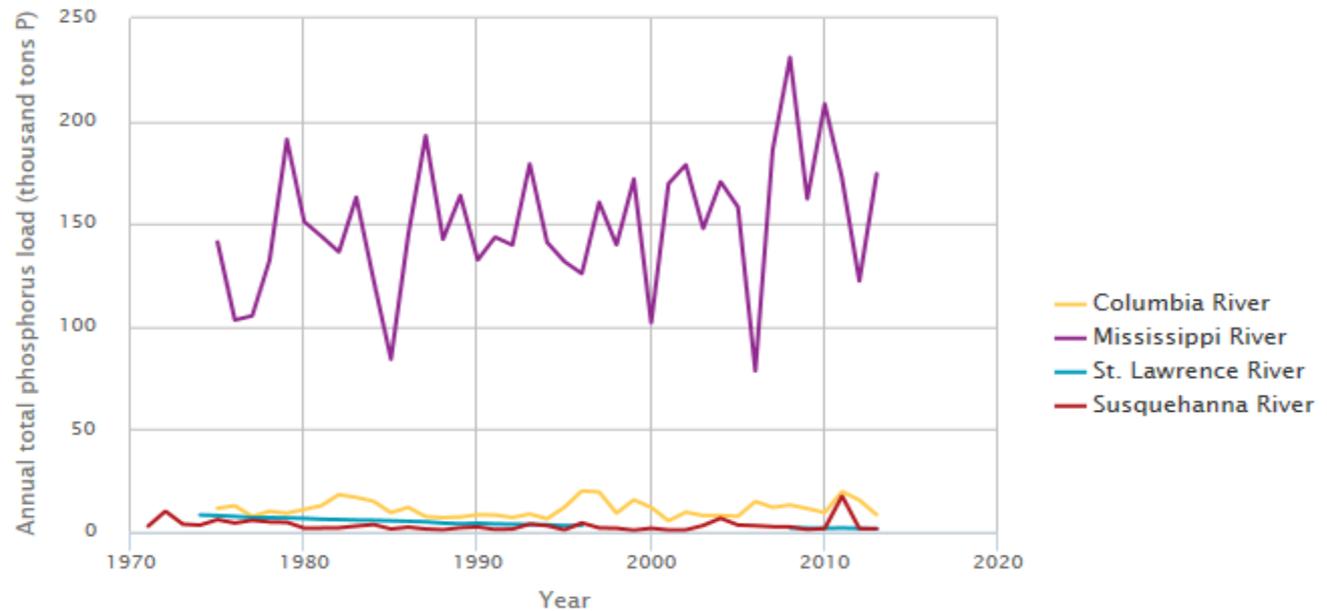
Compared with minimally disturbed reference sites.

# Indicator: Nitrogen and Phosphorus in Large Rivers

## Exhibit 1. Nitrate loads in four major U.S. rivers, 1955–2013



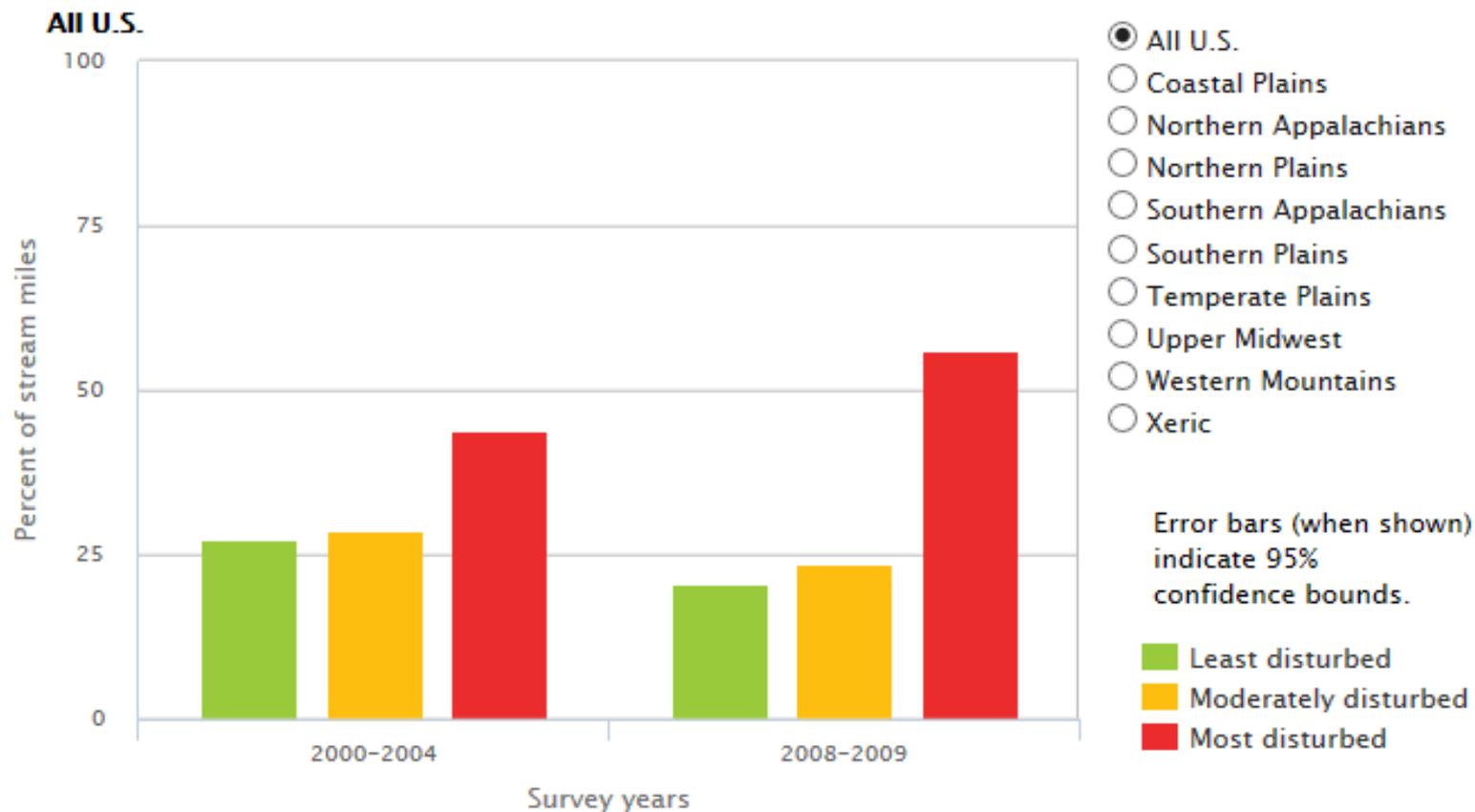
## Exhibit 2. Total phosphorus loads in four major U.S. rivers, 1971–2013





# Indicator: Benthic Macroinvertebrates in Wadeable Streams

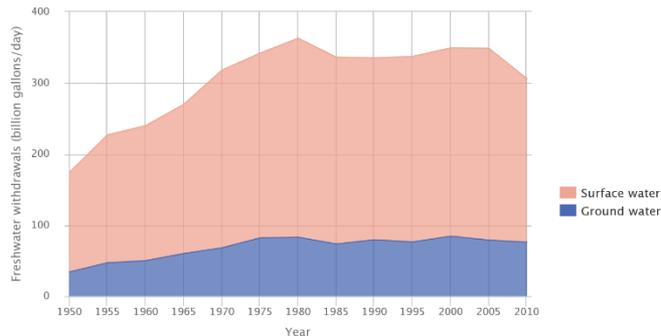
Exhibit 1. Multimetric Index (MMI) for benthic macroinvertebrates in wadeable streams of the contiguous U.S., by region, 2000–2009



Regions based on groupings of EPA Level III ecoregions (Omernik, 1987; U.S. EPA, 2007).

# Indicator: Fresh Water Withdrawals

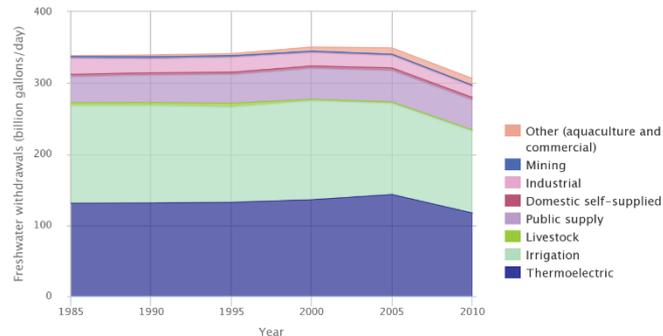
Exhibit 1. Total U.S. freshwater withdrawals by source, 1950–2010



Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: USGS, 2014

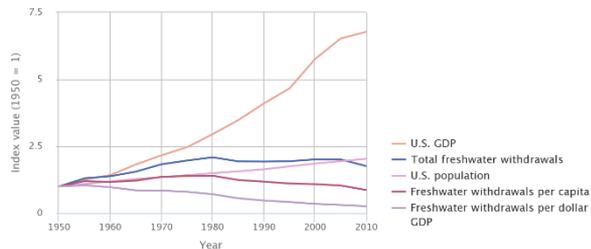
Exhibit 2. Total U.S. freshwater withdrawals by sector, 1985–2010



Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: USGS, 2014

Exhibit 3. Intensity of U.S. freshwater withdrawals, 1950–2010



Based on real (inflation-adjusted) GDP.

Data are plotted at 5-year intervals.

Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: USGS, 2014; Census Bureau, 2000, 2001, 2011, 2014; BEA, 2014

- Withdrawals per capita increased from 1950 through 1980 but have declined since, resulting in 2010 per capita withdrawals being lower than the 1950 level.
- Meanwhile, the U.S. economy grew nearly seven-fold from 1950 to 2010 (after adjusting for inflation), far outpacing the growth in water withdrawals.
- In 2010, the U.S. economy produced nearly four times as much value in goods and services per gallon of water as it did in 1950 (Exhibit 3).

<http://cfpub.epa.gov/roe/indicator.cfm?i=94>



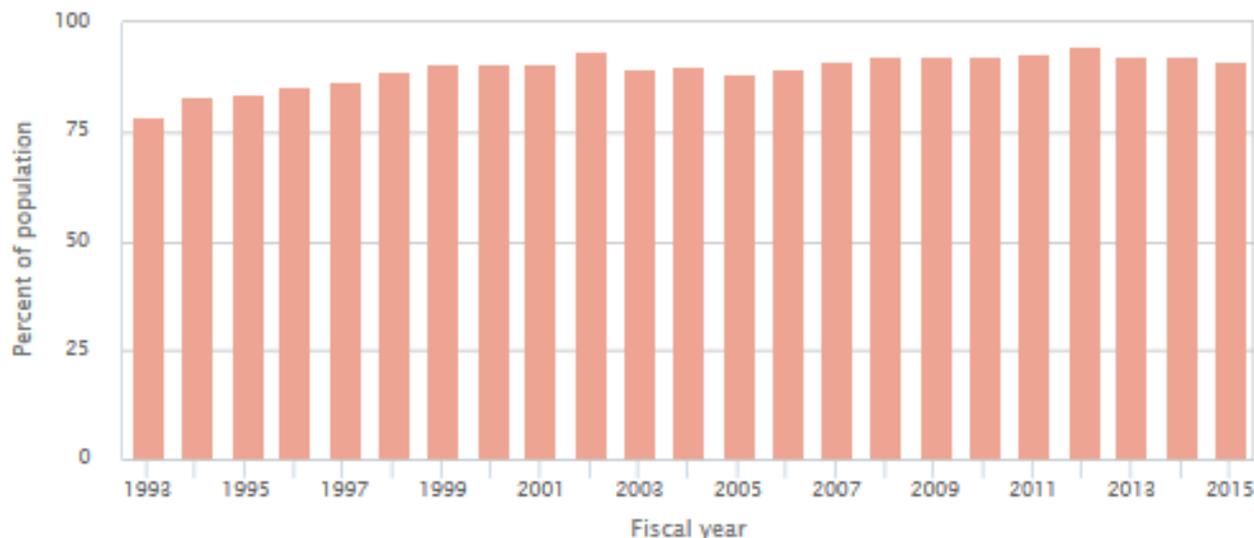
# Indicator: U.S. Population served by community water systems with no reported violations of EPA health-based standards

**Exhibit 1.** U.S. population served by community water systems with no reported violations of EPA health-based standards, fiscal years 1993–2015

**Exhibit 2.** U.S. population served by community water systems with no reported violations of EPA health-based standards, by EPA Region, fiscal years 1993–2015

**Exhibit 3.** U.S. population served by community water systems with reported violations of EPA health-based standards, by type of violation, fiscal year 2015

**Exhibit 1. U.S. population served by community water systems with no reported violations of EPA health-based standards, fiscal years 1993–2015**



**Coverage:** U.S. residents served by community water systems (CWS) (approximately 94% of the total U.S. population).

Several new standards went into effect during the time period shown.

Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** U.S. EPA, 2016



← Hover your mouse over the display to reveal data.

Introduction ▶

What the Data Show ▶

Limitations ▶

Data Sources ▶

# ROE Purpose

We propose to do these We do these now

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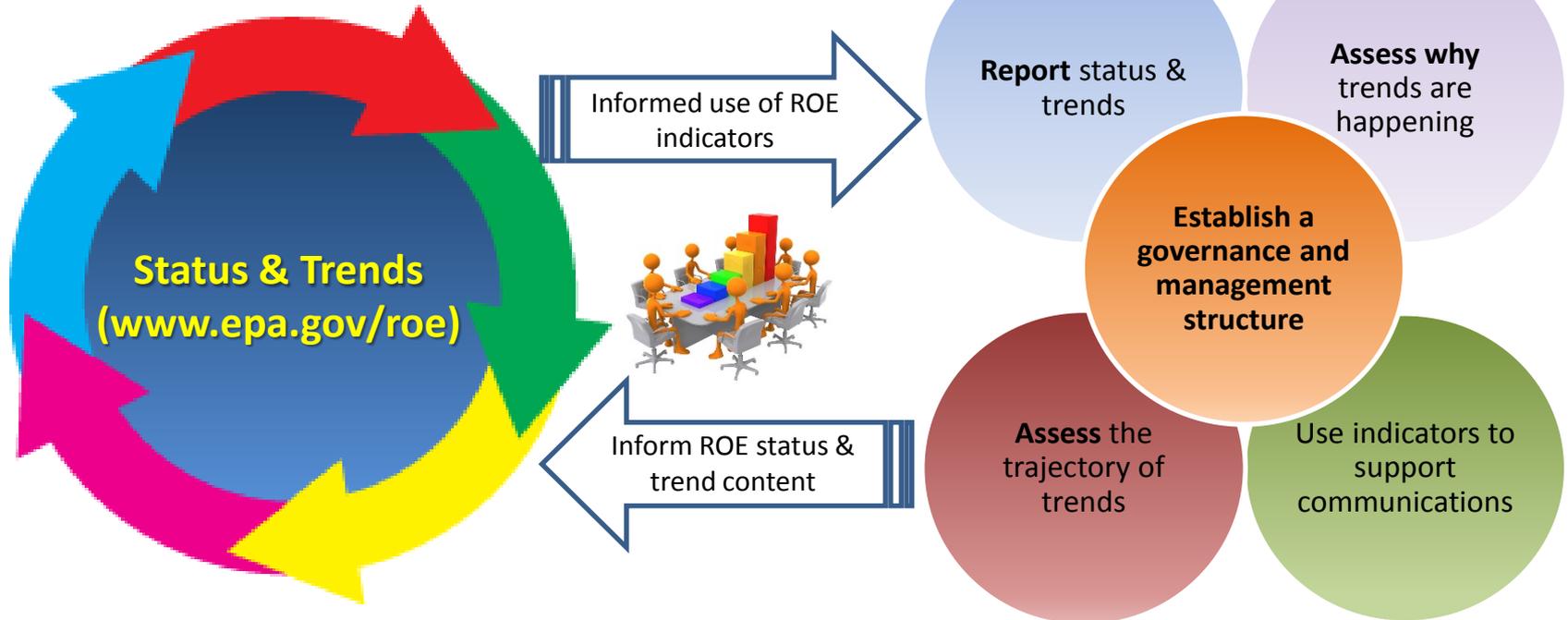
At this time the ROE Program does not yet analyze or diagnose the reasons for, and relationships between, trends in stressors and environmental and health outcomes

# Report on the Environment Programmatic Elements

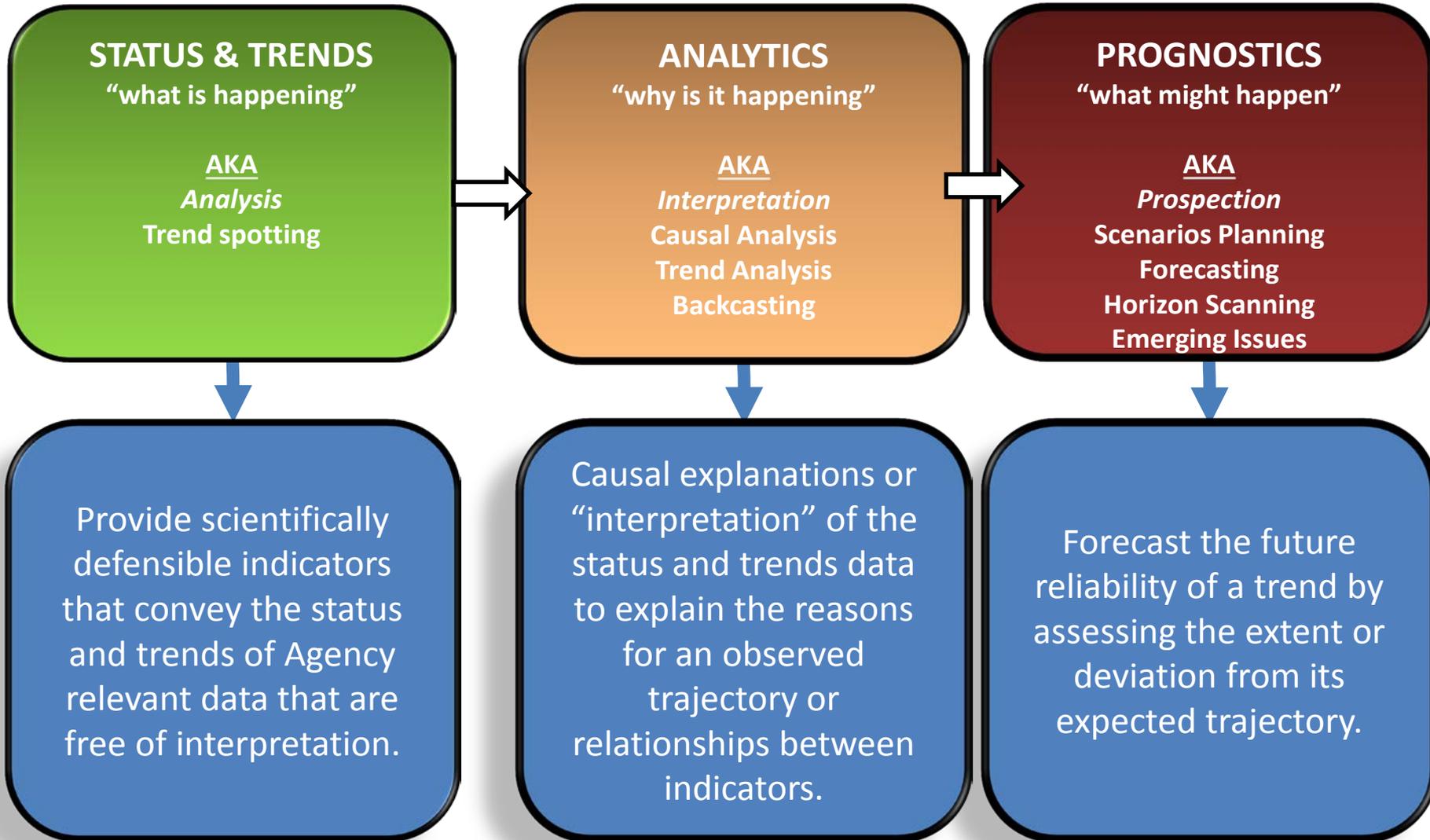
1) Maintain existing functionality

2) Partner with Program and Regional Offices

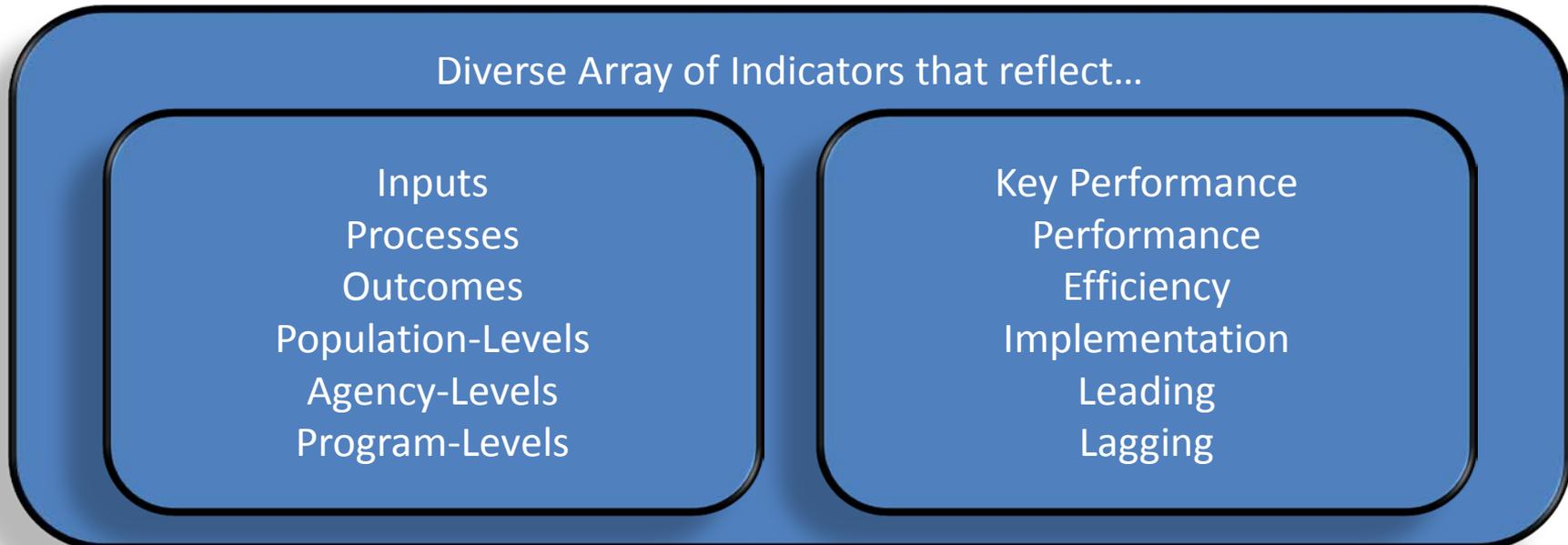
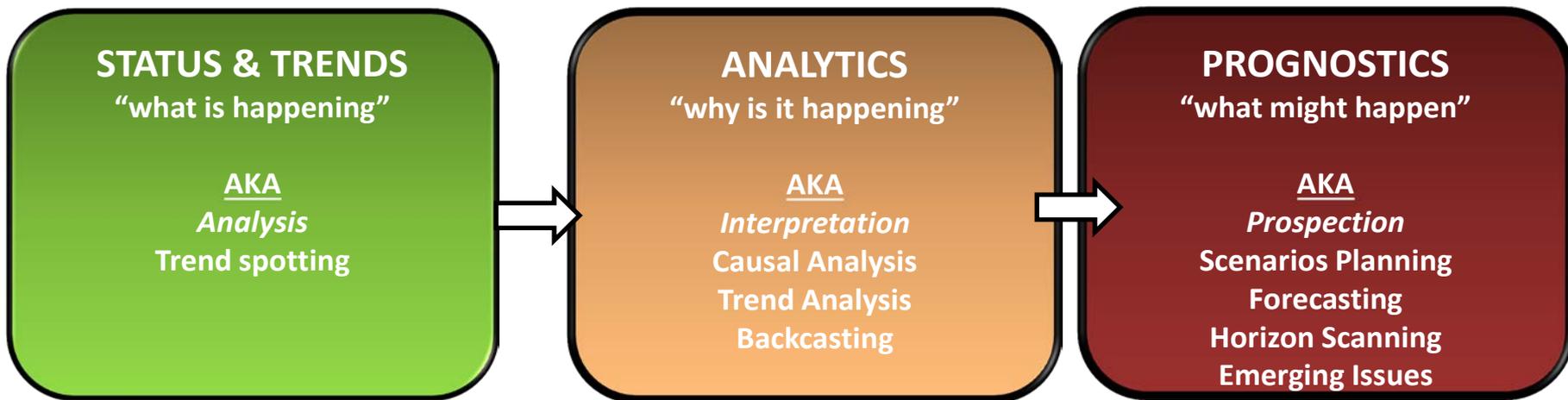
3) Advance the use of ROE



# Functional Elements



# Assessments Dependencies: Indicators



# Assessments Dependencies: Framework



## Effective Assessments

### Critical Elements

- Scoping
- Problem Formulation
- Transparency
- Objective
- Collaborative

### Frameworks

- Causal Analysis (CADDIS)
- Driving Forces, Pressure, State, Impact, Response (Eco-Health DPSIR)
- Systematic Review

# Indicator Use: Approach & Types

To effectively assess outcomes (i.e., the desired result), Issue-Specific Indicators and a classification structure are required that measure different aspects of a program or process

## Holistic Approach Required

- Identify all Issue-Specific Indicators housed within the ROE
- Identify all Issue-Specific Indicators within Agency domains (e.g., EPA)
- Identify within Agency Domains, the responsible programs for each indicator

## Common Classification of Indicator Types

- Input Indicators: resources devoted to a program and/or population characteristics
- Process Indicators: quantity of goods, services produced, efficiency of production.
- Outcome Indicators: broad results achieved through provision of goods and services
  - Population-Level: changes in condition or well-being. Provides context.
  - Agency-Level: results for which an agency is responsible
  - Program-Level: results for which a program is responsible. Narrowly defined population.

# Outcome Indicators: Air Example

What are the trends in outdoor air quality and their effects on **human health** and the environment?

## Outdoor Air Quality

- Air Toxics Concentrations
- Air Toxics Emissions
- CO Concentrations
- CO Emissions
- Energy Use
- **Lead Concentrations**
- **Lead Emissions**
- Mn Concentrations in Region 5
- Mercury Emissions
- NO<sub>2</sub> Concentrations
- Nitrogen Oxide Emissions
- O<sub>3</sub> Concentrations
- O<sub>3</sub>-Depleting Substances Concentrations
- PM Concentrations
- PM Emissions
- Regional Haze
- Stratospheric O<sub>3</sub>
- SO<sub>2</sub> Concentrations
- SO<sub>2</sub> Emissions
- VOC Emissions

What are the trends in human exposure to environmental contaminants; human disease and conditions for which environmental contaminants may be a risk factor; health status in the United States?

## Human Exposure

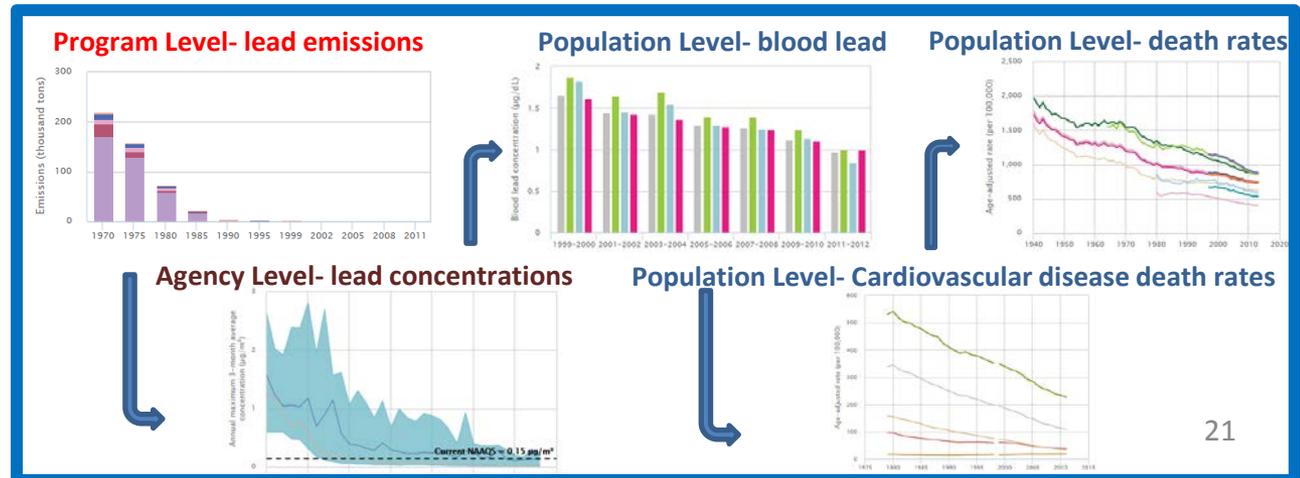
- Blood Cadmium
- **Blood Lead**
- Blood Mercury
- Serum Cotinine
- Serum Persistent Organic Pollutants
- Urinary Pesticides
- Urinary Phthalates

## Disease/ Conditions

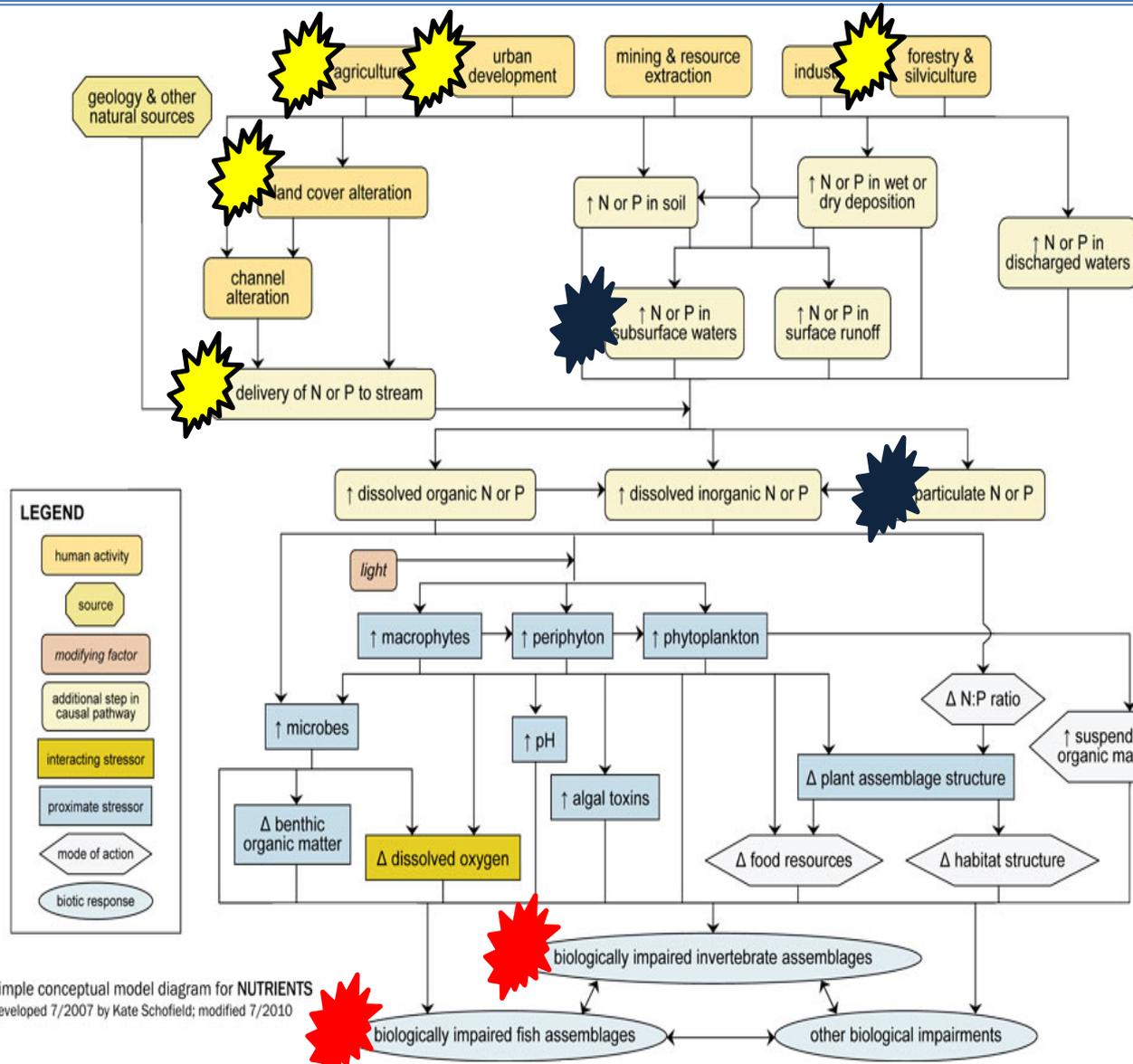
- Asthma
- Birth Defects
- Cancer
- **Cardiovascular Disease**
- Childhood Cancer
- Chronic Obstructive Pulmonary Disease
- Infectious Diseases
- Low Birthweight
- Preterm Delivery

## Health Status

- **General Mortality**
- Infant Mortality
- Life Expectancy



# Outcome Indicators: Water Example



- Program-Level**
- Nitrogen & Phosphorus in Streams in Agricultural Watersheds
  - Nitrogen & Phosphorus in Wadeable Streams
  - Nitrogen & Phosphorus Loads in Large Rivers
  - Nitrogen & Pesticides in Shallow Ground Water in Agricultural Watersheds

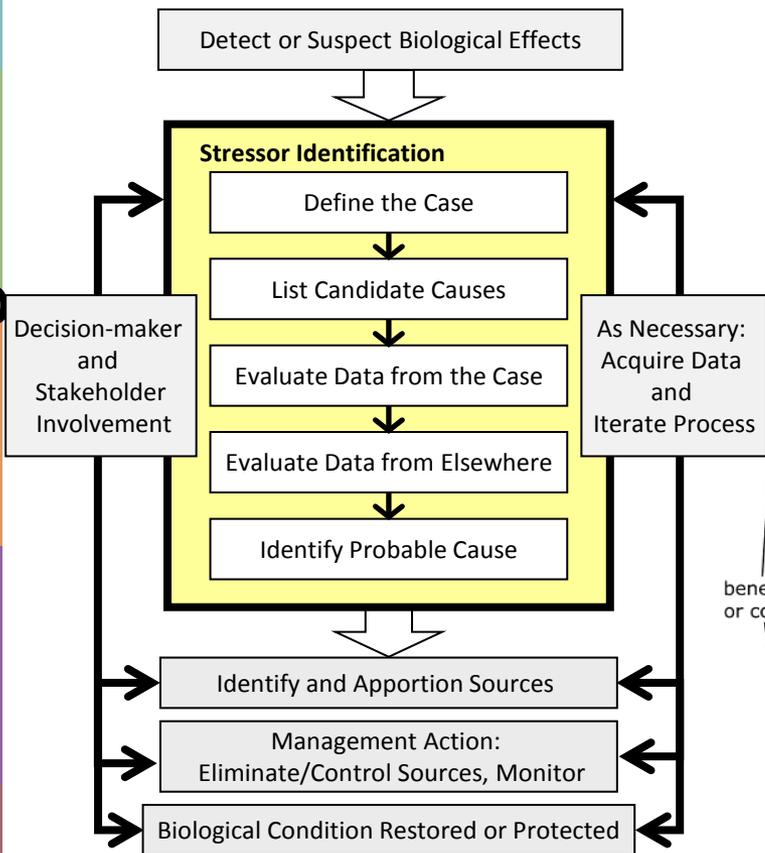
- Agency-Level**
- Benthic Macroinvertebrates in Wadeable Streams
  - Fish Faunal Intactness

- Population-Level**
- Forest Extent & Type
  - Forest Fragmentation
  - Land Cover
  - Land Use
  - Fertilizer Applied for Agricultural Purposes
  - Urbanization & Population Change
  - High & Low Stream Flows
  - Freshwater Withdrawals
  - Streambed Stability in Wadeable Streams

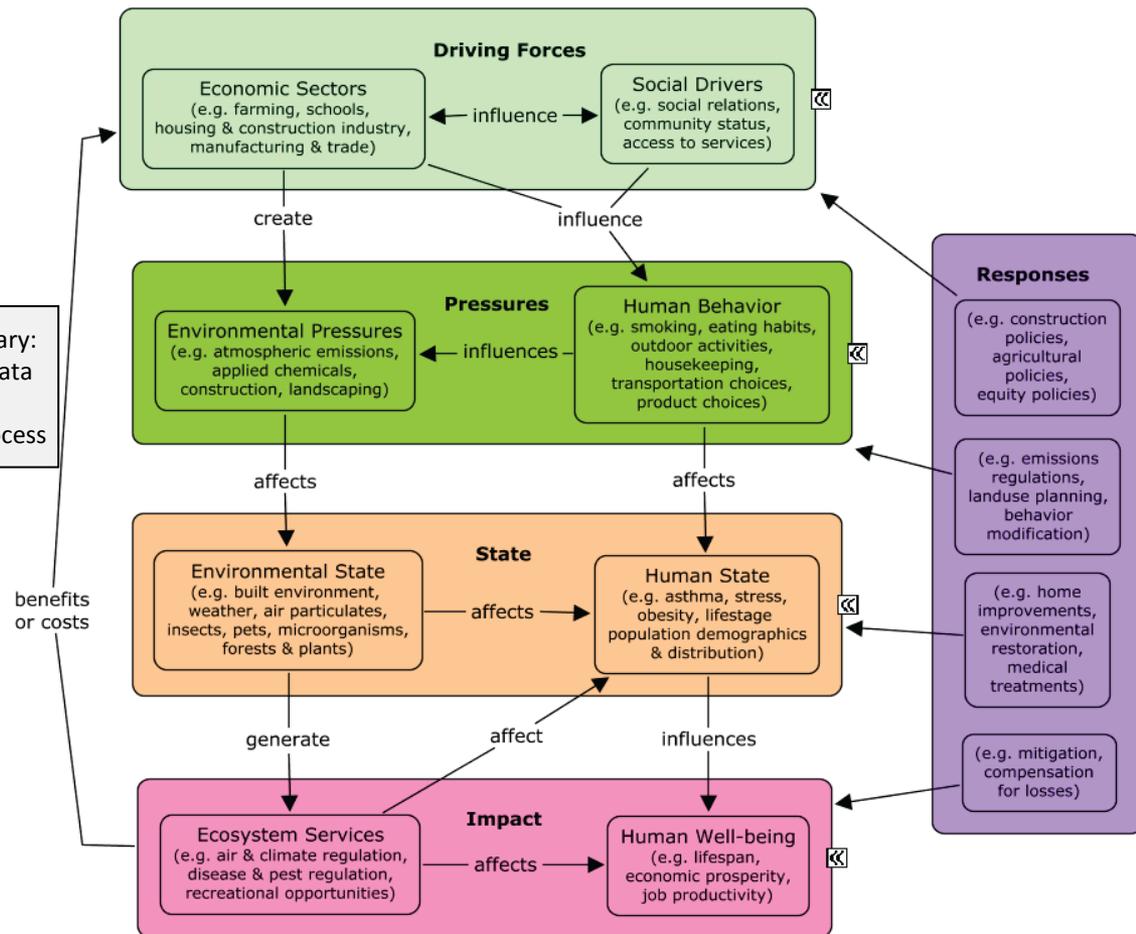
Simple conceptual model diagram for NUTRIENTS  
 Developed 7/2007 by Kate Schofield; modified 7/2010

# Assessment Frameworks

EPA's Casual Assessment Framework



Eco-Health DPSIR Framework





# Conclusions

- 1) EPA's Report on the Environment reports Status & Trends via a web-based application
- 2) The ROE presents 19 national water relevant indicators
  - 1) Will be expanded to include Status & Trends from the National Aquatic Survey
  - 2) Will be expanded to include Status & Trends for Recreational Waters
- 3) Strategic Plan being developed to enhance the ROE Program to advance decision making, planning, and communication
  - establishes an Agency-based Governance Structure to provided strategic guidance.
  - develops an approach and classification for using indicators
  - develops approaches to better assess why trends are happening and what the trajectories of trends might be.
  - identifies communication opportunities.
  - becomes a national and international recognized leader on the use of indicators to support health and environmental decisions.

# For more information

Engage with EPA's ROE at  
[www.epa.gov/roe](http://www.epa.gov/roe)

**Scot Hagerthey, Ph.D.**

**ROE Lead**

**Office of Research & Development**

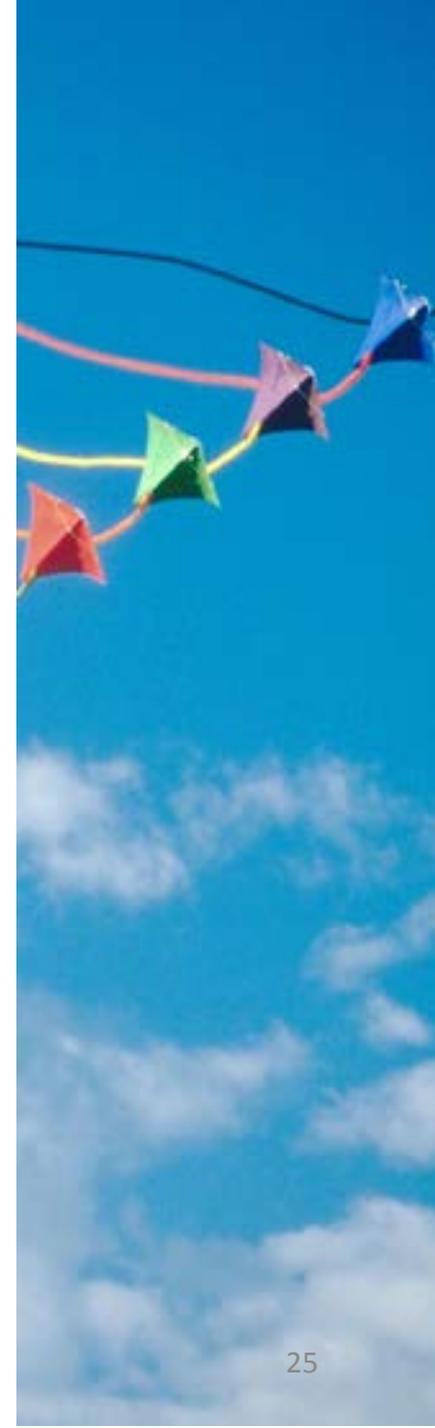
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**Joe Flotemersch, Ph.D.**

**ROE Project Coordinator**

**Office of Research & Development**

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### Exhibit 3. U.S. population served by community water systems with reported violations of EPA health-based standards, by type of violation, fiscal year 2015

	Population served	Percent of CWS customers
<b>Any violation</b>	26,860,020	8.8
<b>Selected violations</b>		
Stage 2 Disinfectants and Disinfection Byproducts Rules	9,936,628	3.3
Surface Water Treatment Rules	8,951,607	2.9
Total Coliform Rule	12,024,733	4.0
Arsenic	410,831	0.1
Nitrate	1,295,844	0.43

**Coverage:** U.S. residents served by community water systems (CWS) (approximately 94% of the total U.S. population).

Some CWS violated more than one of the selected rules.

Trend analysis has not been conducted because these data represent a single snapshot in time. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

**Data source:** U.S. EPA, 2016