



Office of Research and Development

SAFE AND SUSTAINABLE WATER RESOURCES RESEARCH PROGRAM



Research Area 1 Overview:

Assessment, Monitoring and Management of Aquatic Resources

Presented to the Board of Scientific Counselors

October 28, 2020

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Research Area I:

Assessment, Monitoring, and Management of Aquatic Resources

- ◆ ORD will develop, improve, and apply tools, indicators, methods, and models
- ◆ Research supports EPA Office of Water, Regional Offices, States, Tribes to:
 - Proactively and adaptively manage aquatic resources
 - Effectively implement CWA 303(d), TMDL, nonpoint source, and stormwater programs and support the National Estuary Program

Output 1.1: Science to Support NARS (National Aquatic Resource Surveys)

Output 1.2: NARS Extension

Output 1.3: Tools & Information to Assess Biological Condition

Output 1.4: Microplastics

Output 1.5: Water Quality Models and Economic Analyses

Output 1.6: Research support for the San Juan Watershed Program



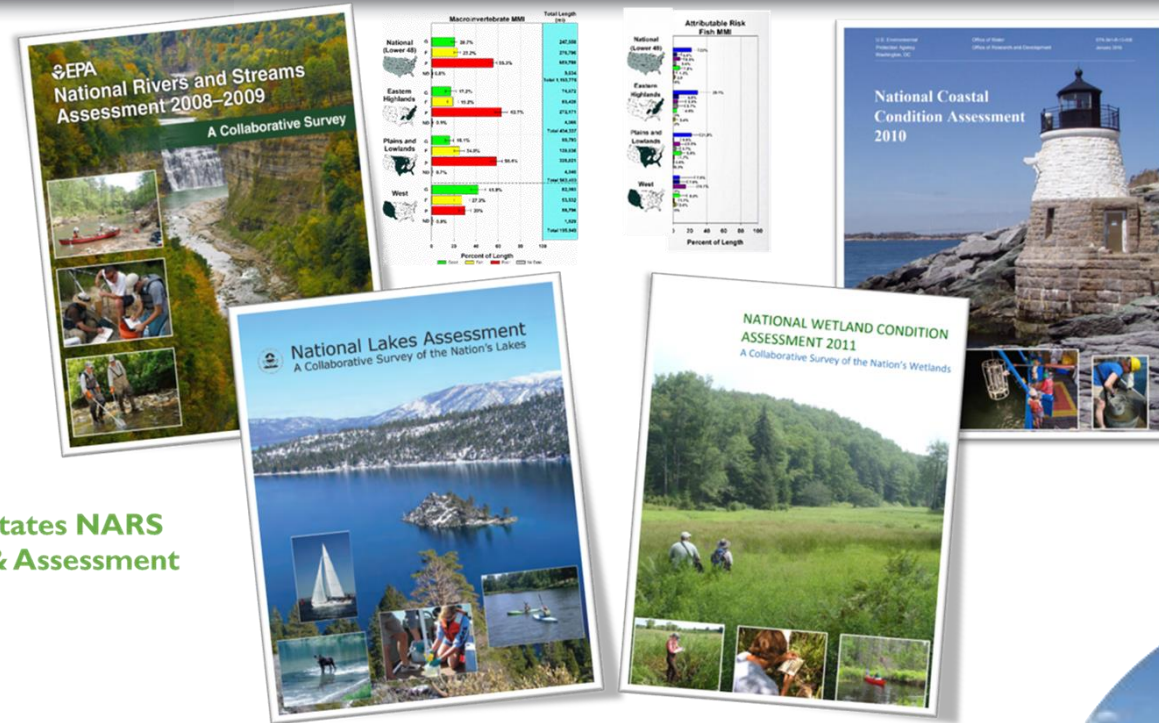


Science to Support NARS Survey Design, Indicator Development and Assessment Benchmarks, Methods Development, and Data Tools

Research Need:

- Research and technical expertise to help improve and implement NARS by applying high-quality, innovative science and transfer expertise to EPA's Office of Water and regions, states and tribes.

OW & States NARS Survey & Assessment



Product 1

Databases for the NARS surveys and national assessments

Product 2

Nationally consistent NARS indicator methods and assessment thresholds

Product 3

Interpretive NARS data assessments





Databases for the NARS Surveys and National Assessments

Current Indicators



Biological Indicators for condition

Chemical, physical, hydrological, biological indicators for stressors

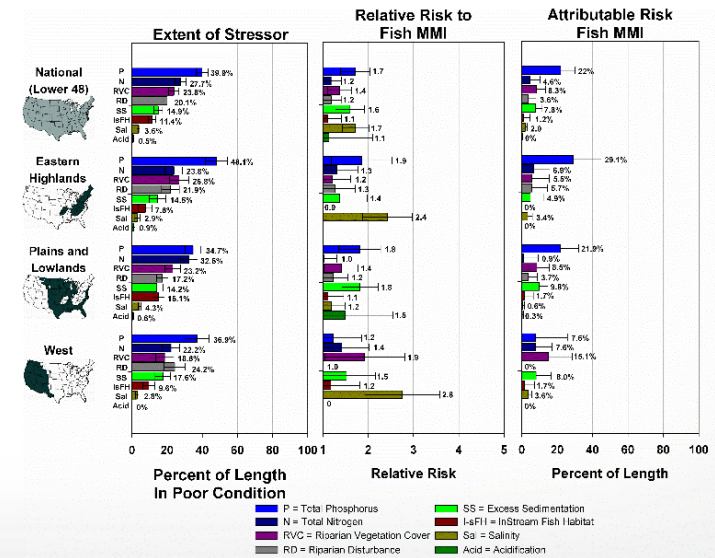
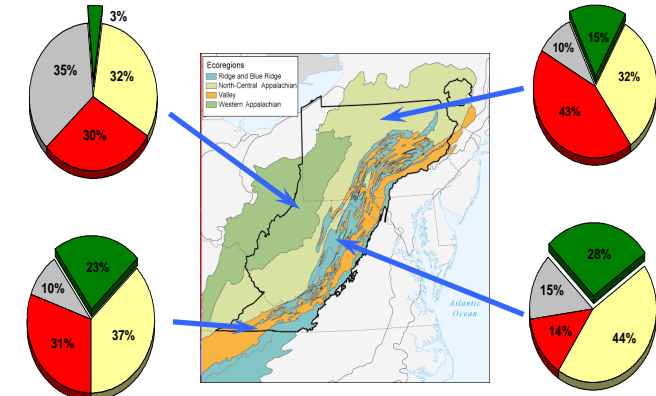
Current Designs



Status & Trends

Representativeness requires a probability survey design

Current Assessments

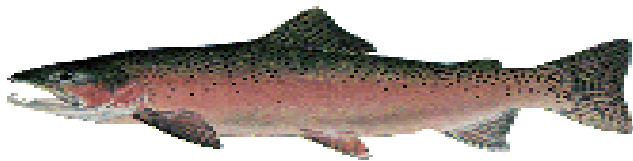




Nationally Consistent NARS Indicator Methods and Assessment Thresholds

- Biological Indicators for condition – Use of DNA
- Chemical, physical, hydrological, biological indicators for stressors

Improved Indicators

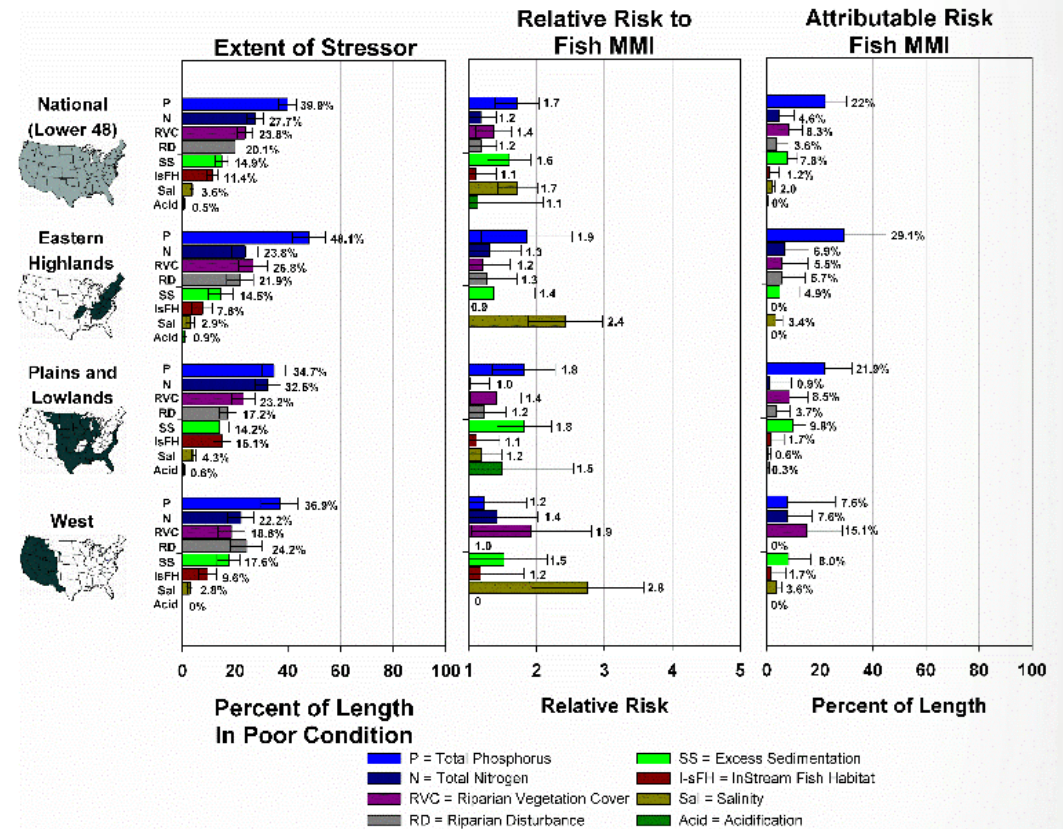
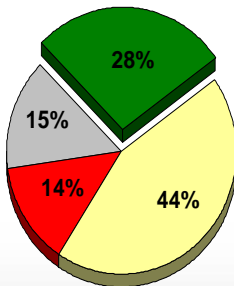
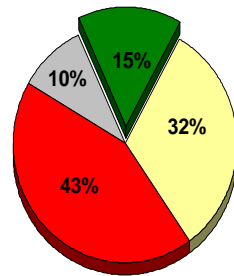
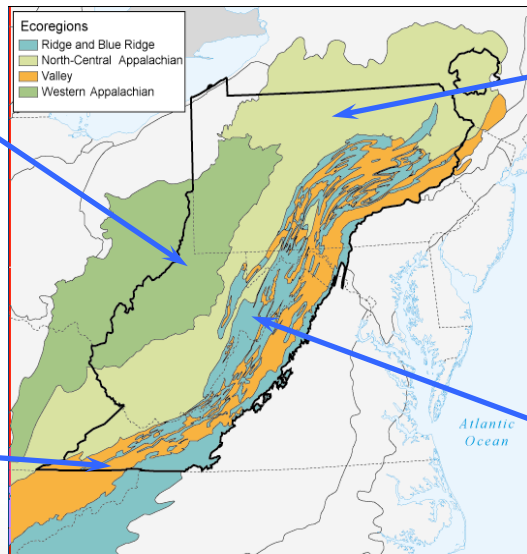
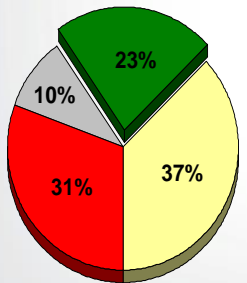
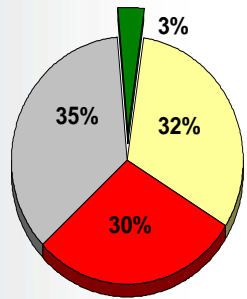




Interpretive NARS Data Assessments

- Improved Diagnostics
- Improved Thresholds
- Enhance Linkage to Management

Improved Assessments





Extended Applications of NARS Data and Approaches to Support Priority Setting and Management Actions

Output leverages and extends NARS data through integration with other data sources

- 💧 Development of new tools and models for condition assessment
- 💧 Extrapolation to unmonitored waters
- 💧 Development of stressor-response linkages for key response variables

Product 1

Geospatial applications of NARS data for state and regional needs

Product 2

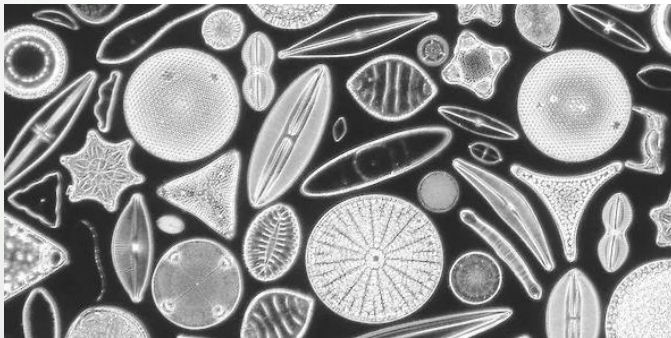
Interpolation and stressor-response analyses that extend the use of NARS data to support regulatory program needs



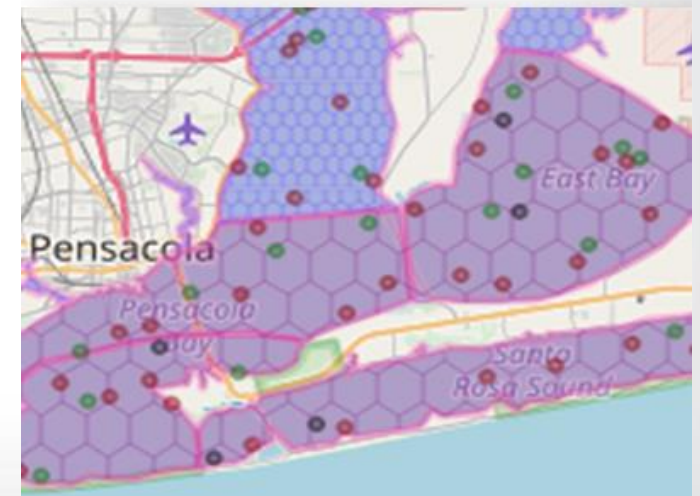
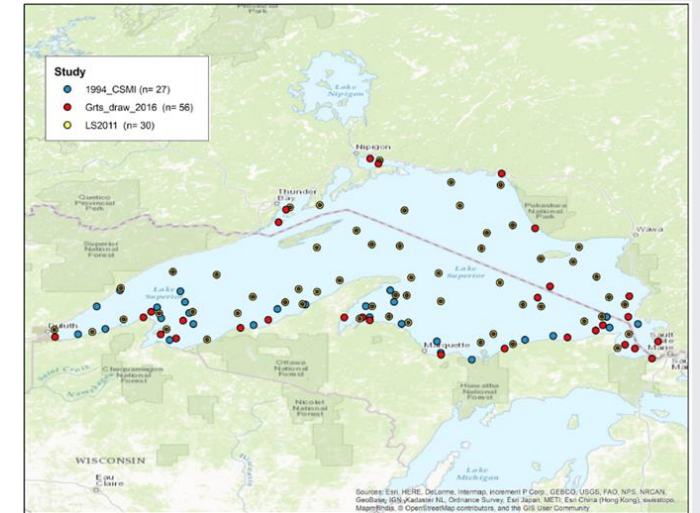


Geospatial Applications of NARS Data for State and Regional Needs

- Combining National Coastal Condition Assessment (NCCA) and Cooperative Science and Monitoring Initiative (CSMI) to better address Great Lakes management needs (nutrient and food web dynamics)
- Harmonization of diatom taxonomy in CO and WY to improve state monitoring
- Ecological Suitability for Gulf of Mexico estuaries
- Adapting NARS approaches to secondary data for local coastal management



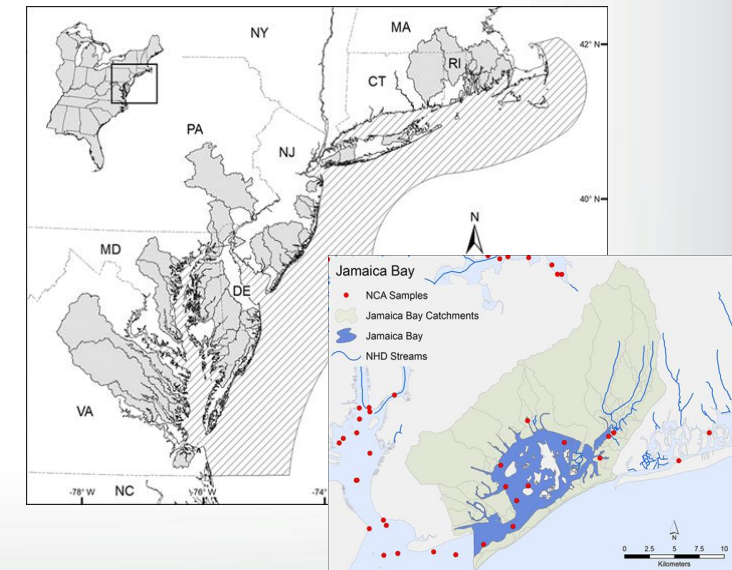
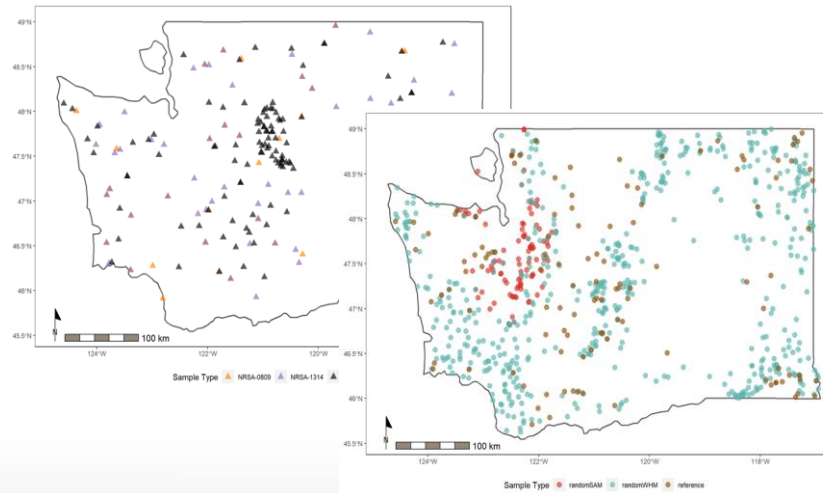
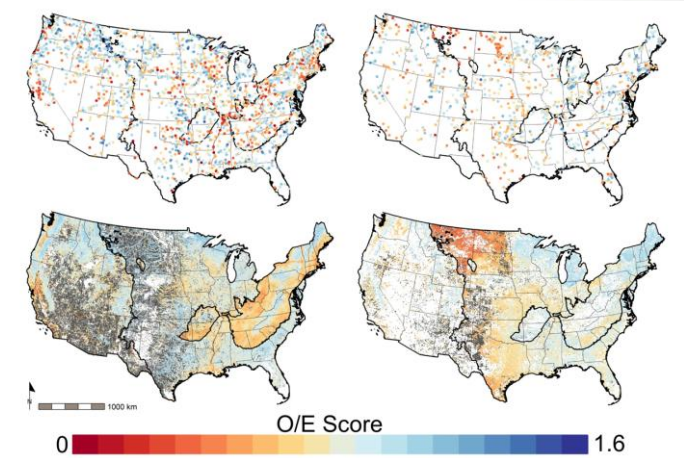
$$ESI_{spX} = HS_{spX} * (Eco_wt_{spX} + Soc_wt_{spX})$$





Interpolation and Stressor-Response Analyses that Extend the Use of NARS Data to Support Regulatory Program Needs

- Spatial Modeling and Interpolation of Observed/Expected macroinvertebrates
- Integrating State & NARS Data to Improve Interpolation
- Extrapolating condition in the Gulf of Mexico
- Estuary Stressor-Response Relationships





Tools, Indicators, and Information to Inform Water Quality Goals, Assess Biological Condition, and Support Effective Management of Diverse Water Bodies

Partners need information and tools to:

- ◆ Facilitate setting attainable biological goals for water resource protection and restoration.
- ◆ Develop and implement management actions and measure progress toward goals.

Expand the 'toolkit' of biological assessment to support protection and restoration of aquatic resources:

- ◆ Develop innovative monitoring methods across diverse waterbody types.
- ◆ Advance integrated watershed assessments.
- ◆ Characterize stressor-response relationships and conducting causal analysis.

Product 1

Methods and indicators for waterbody types and taxa that lack nationally consistent and reliable approaches

Product 2

Synthesis of approaches to biological condition assessment

Product 3

Summary of stressor-response relationships and causal analyses





Methods and Indicators for Waterbody Types and Taxa that Lack Nationally Consistent and Reliable Approaches

Develop approaches for underrepresented and rarely monitored ecosystems.

- Review current approaches and develop classification schemes to identify reference sites for blackwater ecosystems.
- Develop and evaluate condition assessment indicators for low-gradient freshwater and tidal systems.

Develop innovative condition indicators that improve application of taxonomic knowledge.

- Develop diatom-based metrics with strong responses to stressors and improve assessment of biological condition.
- Provide technical assistance to states on minimizing taxonomic errors and applying diatom datasets to assessment.





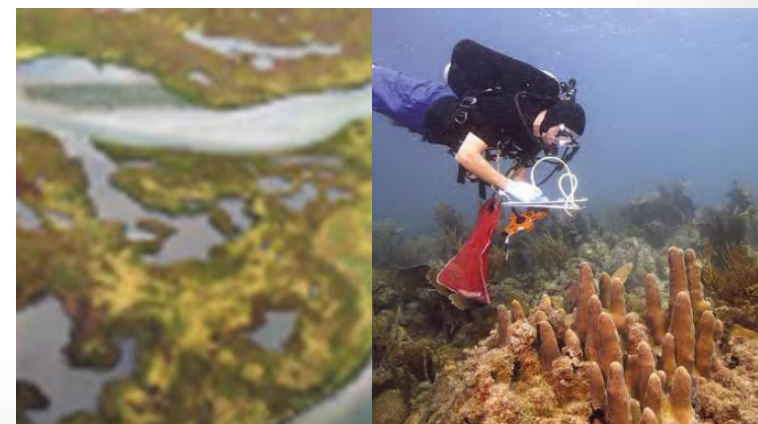
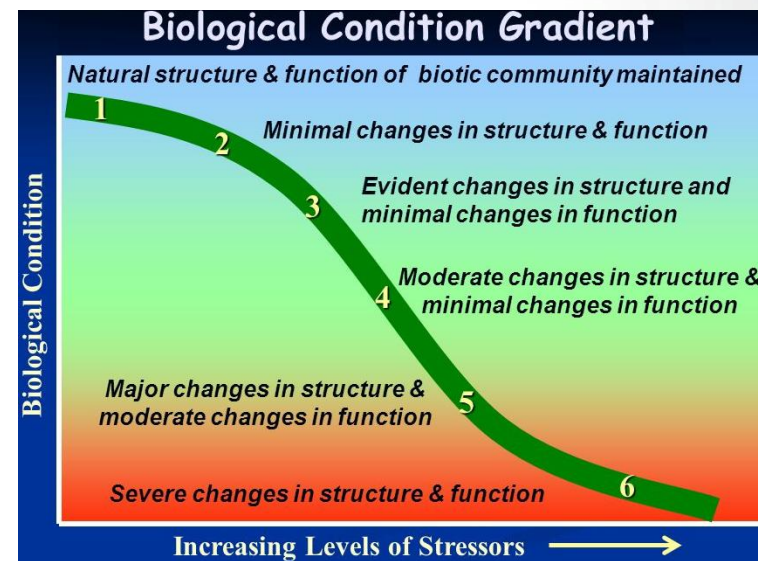
Synthesis of Approaches to Biological Condition Assessment

Expand Biological Condition Gradient (BCG) approaches to include innovative measures, multiple scales, and new regions

- Evaluate transferability of coral and estuarine BCGs to new regions and scales
- Develop innovative measures of biological condition using eDNA indicators to more rapidly measure change

Develop integrated approaches that consider biological condition in conjunction with stressor, landscape, and socio-economic data

- Develop future change expectations for Pacific NW maritime BCG based on thermal stressor thresholds
- Incorporate multi-scale stressors and watershed integrity into stream BCGs
- Develop screening assessments for relationships between stressor and resource data to identify priority stressors or areas for coral protection and restoration
- Integrate of socio-economic data with coral reef and estuarine BCGs





Summary of Stressor-Response Relationships and Causal Analyses

Compile and synthesize existing evidence

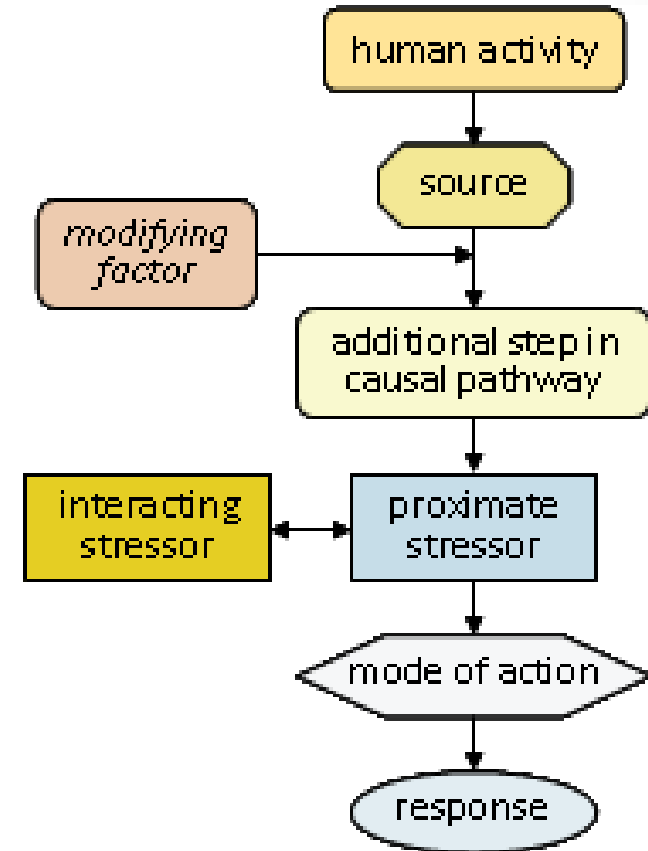
- Assemble publicly available stressor-response data
- Develop multivariate framework to estimate relative influences of stressors

Develop innovative approaches

- Streamline stressor identification, weight of evidence, and data visualization
- Develop statistical methods to evaluate stressor-response relationships
- Develop trait-based and stress-sensitivity-based approaches

Incorporate into existing decision support tools

- Develop technological and functional improvements to CADLink and related tools using test cases





Water Quality Models and Economic Analyses to Support Science-Based Water Quality Decisions

- Develop/improve water quality, watershed, and economic models to enable effective, science-based water quality decisions
- Contribute to EPA's Hydrologic and Water Quality System (HAWQS)- Benefits Spatial Platform for Aggregating Socioeconomics and H2O Quality (BenSPLASH) Integrated Assessment Model
- Provide decision-makers with ways to assess the consequences of actions/decisions
- Deliver Report/Summary

Δ Policy (or Local Action) \rightarrow Δ Water Quality \rightarrow Δ Benefits

Product 1 Improved national watershed and water quality model capability

Product 2 Economic methods/tools to estimate the benefits of water quality improvements

Product 3 Quantification of water quality-economic linkages





Improved National Watershed and Water Quality Model Capability

- Models and modeling systems are being developed/improved for watersheds and water bodies, including estuary and coastal waters to provide national modeling capability
 - Cloud-based watershed simulation models (HAWQS) that incorporate key source terms, nutrient/ sediment loadings and BMPs to mitigate loadings
 - Develop coastal modeling approach with reduced-form water quality model
- Deliver Report/summary (software packages, presentations, manuscripts)





Economic Methods/Tools to Estimate the Benefits of Water Quality Improvements

- Understand and estimate the benefits of water quality improvement, advance linkages between water quality and economics, and inform market-based policies.
- Research includes different waterbody types (rivers, lakes, estuaries and coasts) and uses (recreation, aesthetics, drinking water).
 - Hedonic module for BenSPLASH using a meta-analysis and a nationwide housing population dataset
 - Economic valuation models using data collected by a revealed preference survey of coastal recreation and water quality
- Deliver Report/summary:
 - Will be communicated through Website, manuscripts, presentations
 - Website ([Human Dimensions of Water Quality Research](#)) describes how end users can use the models and methods for the analysis of the economic benefits of policies and management actions to address surface water condition





Quantification of Water Quality-Economic Linkages

- Express water quality in economically meaningful terms
- Support translating the capabilities and future directions of EPA's modeling and monitoring efforts to the water quality needs of policy partners
 - Improved Water Quality Index (WQI) based on NARS data
 - Linkage of fish population/community models with economic models for scenario analysis, salmon populations and recovery
- Deliver Journal article/peer-reviewed.
 - Will be communicated through manuscripts, webinars, presentations, use case demonstrating linkages





Research Support for the San Juan Watershed Program



- ◆ A 2015 mine spill in the Animas River brought basin-wide attention to ongoing metals contamination of downstream waters by acid mine drainage
- ◆ Metals and other contaminants (sediment, nutrients and fecal matter) disrupt many beneficial uses
- ◆ Targeted monitoring is needed to identify contaminant sources, track potential impacts and guide multi-jurisdictional remediation and restoration



Product 1

Analysis of San Juan Watershed Monitoring project monitoring data for use by states and tribes

Product 2

Geochemical connectivity between the upper Animas headwaters and downstream waters, and potential benefits of reclamation of mining contamination



Analysis of San Juan Watershed Monitoring Project Monitoring Data for Use by States and Tribes

Actions

- Summarize/evaluate watershed-wide monitoring data
 - Compare results to state/tribe water quality standards
 - Co-develop innovative tools for public communication
- Assist partners in applying regression models/methods
 - Integrate real-time sonde information with tracer analytical models

Outcomes

- Data is translated into action plans
- Methods can be applied to other mining-impacted watersheds





Geochemical Connectivity Between the Upper Animas Headwaters and Downstream Waters, and Potential Benefits of Reclamation of Mining Contamination

Actions

- Track mine precipitates with geochemical tracers
- Associate geochemical and environmental data

Outcomes

- Results help managers efficiently and cost-effectively direct restoration efforts



Partners (coordinated through San Juan Monitoring Program)

- EPA - Office of Water, Regions 6, 8, 9
- States - Colorado, New Mexico, Utah, Arizona
- Tribes- Southern Ute Indian Tribe, Navajo Nation, Ute Mountain Ute Tribe
- Watershed Groups and NGO's



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QUESTIONS?



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