

Improving Ecosystem Health

Challenges, Expected Results,
Research Needs, and Infrastructure &
Technology Needs
Sessions A-C

Challenges to Improving Ecosystem Health

- Understanding structure and functioning of marine ecosystems where natural & anthropogenic factors alter physical, chemical, biological, geological, and ecological processes that shape these systems. This includes investigating ecosystem productivity, diversity, and complexity as a function of within-system interactions (atmosphere, mixed layer, deeps, bottom) as well as forcing from systems outside (linkages between watersheds, estuaries, coastal and ocean systems) (3)
- Characterizing and predicting ecosystem status and change: limited information (e.g., long-term time series) to determine the properties and processes that govern stability and resilience as well as physical, biological, and human(2) forces that drive ecosystem dynamics over various temporal and spatial scales (3)
- Increasing capacity for *exploration & discovery* (2) of marine ecosystems to identify ecosystem products and services to enhance human life and provide goods and services (3)
- Determining and predicting individual and cumulative effects (multiple stressors) of human activities on ecosystem function and diversity, including humans as part of the ecosystem (3)
- Improving management and governance efforts across jurisdictional boundaries that includes socio-economic values and activities with natural factors to maintain health and sustainability of ecosystems. This requires improving abilities to communicate understandable information, educating receivers of the information, and addressing potential public health/economic concerns (CROSS-CUTTING THEMES) (2-3)
- Promoting CROSS-CUTTING education, awareness, and stewardship regarding ecosystem health, threats, structure, and function to enable effective ecosystem-based management (1)

Expected Results

- **Overarching Result: Human activities that are informed by scientific understanding that ensures the effective management and sustained productivity and diversity of marine ecosystems (3)**
- Through collected data, key ecosystem baseline conditions, parameters, processes, and meaningful, measurable indicators of marine ecosystem status/condition will be identified at appropriate scales (3)
- **Enhanced modeling capacities (e.g., ecosystem, population, bioaccumulation, etc. models) capable of assessing and predicting ecosystem dynamics and results of potential management strategies will result, leading to improved understanding, decision-making, ecosystem health, future minimization of adverse impacts on ecosystems, lower threats to human health, and a suite of socio-economic benefits (3)**
- **Effective transfer of scientific information will occur to facilitate stewardship and managed use of marine ecosystems (3)**
- **Usable products that integrate and synthesize available physical, chemical, geological, biological, socio-economic, and human use data for specific time periods and geographic areas will result (3)**
- **An integrated scientific observation and monitoring strategy at the spatial and temporal scales needed to assess indicators of marine ecosystem health will be produced (2)**
- **Methods and technologies will be identified for enhancing and restoring ecosystem health (1)**
- **New (WOW!) discoveries will abound (1)**

Research Needs

- **Overarching Need: Improved interdisciplinary research efforts and collaborations, national and international**
- Improve the basic understanding of the components and complexity of marine ecosystems at appropriate scales and their interactions and linkages in order to address the challenges through expanded modeling and prediction (3)
- Identify and develop measurable indicators of ecosystem status that can be used to guide research and restoration/enhancement strategies (2-3)
- Identify and characterize key ecosystem issues and threats to ecosystem status (e.g., climate change/regime shifts, thresholds/tipping points, contaminants and excess nutrients, hypoxia, diseases/pathogens, and invasive species) including the cumulative and relative effects of multiple stressors and distinguishing natural and anthropogenic signals (3)
- Identify and understand the role of biodiversity in maintaining and improving ecosystem health (3)
- Investigate and quantify, where possible, economic and social drivers (e.g., market and non-market resource valuation, land use, water use) in conjunction with natural processes that impact ecosystem health (3)

Infrastructural & Technological Needs

- Improvements in information technology and infrastructure will be essential to ensure that data assimilation, analysis, and modeling tools are available for standardized biological, socio-economic, and ecosystem data (3)
- The continued development and implementation of a CROSS-CUTTING integrated observing system (satellites, ships, platforms, buoys, AUVs, shore labs, etc.) is a key component for assessing physical, chemical, biological, and ecological properties of marine ecosystems and ocean exploration over time, as well as assessing human impact on key properties including productivity, diversity, and resilience (3)
- Additional and improved *in situ* and remote sensor capabilities (for use across appropriate spatial and temporal scales) are needed to gather information about the biological and chemical environment (including coastal watersheds, Great Lakes, and all ocean domains), and thereby provide a more complete understanding of ecosystem status and dynamics (3)
- Improved capabilities in modeling, forecasting, dissemination, and integration of results through research, industry partnerships, etc. are needed that will effectively inform (*distribution of useful, understandable information*) and assist management decisions and serve as the core for education strategies at international, federal, state, tribal, and local levels (3)
- Increasing capital investment in multiple areas, such as traditional taxonomy, science teachers, environmental managers, and science translators (1-2)
- A new, cross-jurisdictional governance entity to bring together and coordinate the ecosystem approach to ocean and coastal research and management (1)