Environment Technical Panel

Facilitated Session Results

October 22, 2008

Environment: Future Characteristics/Vision

- Reliable diagnostics of environmental health
  - Quantitative, accurate, rapid, objective
  - Molecular to ecosystem scale (bar code of life)
  - Discovery
- Real time monitoring of environmental threats
  - Pathogens, toxins and ecological processes (sensors)
- Interoperable/networked IT systems that translate complex data into information useful for making decisions
- P4- type environmental assessments that are predictive, preventive, system specific, and linked to societal well-being

Vision Statement

Ecosystem health is measured reliably in near real time using measurement systems producing results that are valued by other sectors (commerce, healthcare, agriculture, energy) and useful for environmental decision making.

Environment: Highlights of Broad Challenges and Barriers

- Defining Ecosystem Health
  - No agreed upon definition of environmental/ecosystem health
    - Includes what to measure and how to measure it
  - Dynamic nature of natural systems
    - Non steady state, non-linear
  - Lack of appropriate reference materials and validated methods for system attributes (ecosystem services)

Environment: Highlights of Broad Challenges and Barriers

- Data integration and processing
  - Dynamic, heterogeneous data sets
  - Lack of mechanistic understanding
- Technology transfer to users
  - Research to applications difficulties
- Communications
  - Quantifying societal challenges
  - Bridging new and historical measurement approaches
  - Language barriers and knowledge transfer between disciplines
  - Absence of commercial sector

Environment: What We Need to Measure and Why

- Explanatory Variables
  - Bulk physical/chemical properties (e.g., T, flow, salinity)
  - Landscape attributes
- Biomarkers/System Indicators/Diagnostics & Threats
  - Measures of threats (exposure and effects, set thresholds, including multiple stressors)
  - Organism identity/species identification
  - Health of Sentinel Organisms (disease, physiological state)
  - Early warning/integrative/retrospective diagnostics of system attributes
- System Properties/Responses
  - Biodiversity (microbes to communities)
  - Rates for key processes (productivity)
  - Change in ecosystem services/function

Environment: Selected Priority Measurement & Standards Barriers

- Biomarkers/System Indicators/diagnostics & threats
  - Lack of relevant toxin/chemical standards (in appropriate matrices)
  - Absence of reliable and agreed sampling/processing methods/sensors
  - Lack of appropriate genetic markers for biota of interest
    - Standardized/validated
  - Lack of knowledge about multiple stressor effects & thresholds
- System Properties
  - Defining a biological species from a molecular perspective
  - Definition of a healthy ecosystem (dynamic, non steady state nature)
- Cross cutting
  - Integration of complex data across spatial and temporal scales
    - Relating new data to historical information

Environment: Selected Priority Measurement & Standards Barriers

- Biomarkers/System Indicators/Diagnostics or Threats
  - Lack of toxin standards & reference materials (in appropriate matrices)
  - Lack of knowledge about multiple stressor effects & thresholds
- System Properties
  - Defining a biological species from a molecular perspective
- Cross cutting
  - Functional & reliable data integration systems
    - Interoperability, analysis performance characteristics, ontology

Environment: Approaches to Selected Priority Measurement & Standards Barriers

- **Barrier:** Lack of data system interoperability, bioinformatics performance measures, & environmental ontology
  - Objective: an IT architecture that enables efficient and timely environmental data integration and analysis
  - Rationale: need for proactive decision making and forecating
  - Impacts: High
- **Barrier:** Lack of validated and appropriate diagnostics (biomarkers)
  - Objectives: Diagnosis of status of ecosystem condition for molecular to ecosystem scale
  - Rationale: Ensure public and environmental safety andhealth
  - Impacts: High
- **Barrier:** Agreement on the definition of a molecular-based biological species
  - Objective: Develop a process for defining a molecular-based biological species
  - Rational: Reliable measure of biodiversity
  - Impacts: High