INTEROPERABILITY FRAMEWORK

National Ecological Observatory Network

Why Interoperability?

- The ***rapid pace of large-scale environmental global changes*** underscores the value of accessible long-term data sets.
- Natural, managed, and socioeconomic systems are subject to complex interacting stresses that play out over extended periods of time and space.
- A***n era of large-scale, interdisciplinary science*** fueled by large data sets.
- Data Interoperability ***enhances the value of current scientific efforts and investment***.
- ***Interoperability is needed to forecast future conditions*** for basic understanding, and for future planning, policy, and societal benefit.
- Currently, ***there is no accepted approach to make large datasets interoperable***
- ***Provides new leadership opportunities*** for Scientists globally

Interoperability is Focused on 3 types of Infrastructure

Information Infrastructure

End-to-end data flows that includes: how the measurement was made, its metadata, traceability, data formats, research questions, and archival and retrieval processes.

Physical Infrastructure

All the physical components and design elements that contribute towards a measurement, i.e., hardware physical integration, site design, and associated uncertainties, etc.

Support Infrastructure

Defined as: i) all the support systems to manage the construction and operation of a research infrastructure (budget, risk, schedule, scope integration), ii) structures to disseminate data (web portals), and iii) education and engagement structures.

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Example: Interoperability for Information Infrastructure

1. Distilling Science Questions and Hypotheses into Requirements	• Mapping Questions to 'what must be done' • Defining Joint Science Scope • Requirements can define interfaces among respective datasets
2. Traceability of Measurements	• Use of Recognized Standards • Traceability to Recognized Standards, or First Principles • Known and managed signal:noise • Managing QA/QC • Uncertainty budgets
3. Algorithms/Procedures	• What is the algorithm or procedural process to create a data product? • Provides "consistent and compatible" data • Managed through intercomparisons • What are their relative uncertainties?
4. Informatics	• Standards - Data Formats • Standards - Metadata formats • Persistent Identifiers / Open-source • Discovery tools • And in the case of Biodiversity: Ontologies, semantics and controlled vocabularies

The degree to which Observatories are truly interoperable is the degree to which these four elements are adopted by collaborative facilities

Signal:noise and uncertainty estimates must also be known in order for data to have broader, global utility and prognostic capability (ecological forecasting)

This Interoperability Framework is currently being implemented as part of a joint EU FP7 and US NSF Project called CoopEUS (www.coopeus.eu)

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