Ecological Metadata Language (EML) and Morpho

Matthew B. Jones
jones@nceas.ucsb.edu

National Center for Ecological Analysis and Synthesis
University of California Santa Barbara

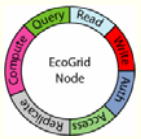
http://knb.ecoinformatics.org

KNB and SEEK Products

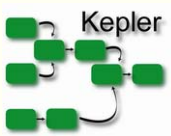
- Ecological Metadata Language (EML)

- Morpho
  - metadata and data management software

- Metacat
  - distributed metadata/data system
  - registries: KNB, UCNRS, OBFS, NCEAS, PISCO, LTSS



- EcoGrid
  - integrating distinct data systems and networks



- Kepler
  - grid-enabled scientific workflows

Ecological Metadata Language

- Metadata: a means to manage ecological data
  - Metadata is not an end, it's a means
- Many existing metadata standards
  - NBII Biological Data Profile (BDP), Dublin Core Element Set, ISO Geographic Metadata, GCMD Directory Interchange Format (DIF)
- EML initiative started in 1997
  - Common language for describing, archiving, and transporting data

EML In brief...

- Ecological Metadata Language
  - What is it? Documentation about data, aka metadata
  - Which data? Ecologically relevant data
    - Biodiversity surveys, hydrology, atmospheric chemistry, spatial data, behavioral experiments, ...
    - But really, any scientific data

Why do we need metadata?

- Ecologically relevant data are:
  - Heterogeneous
  - Dispersed
  - From many disciplines

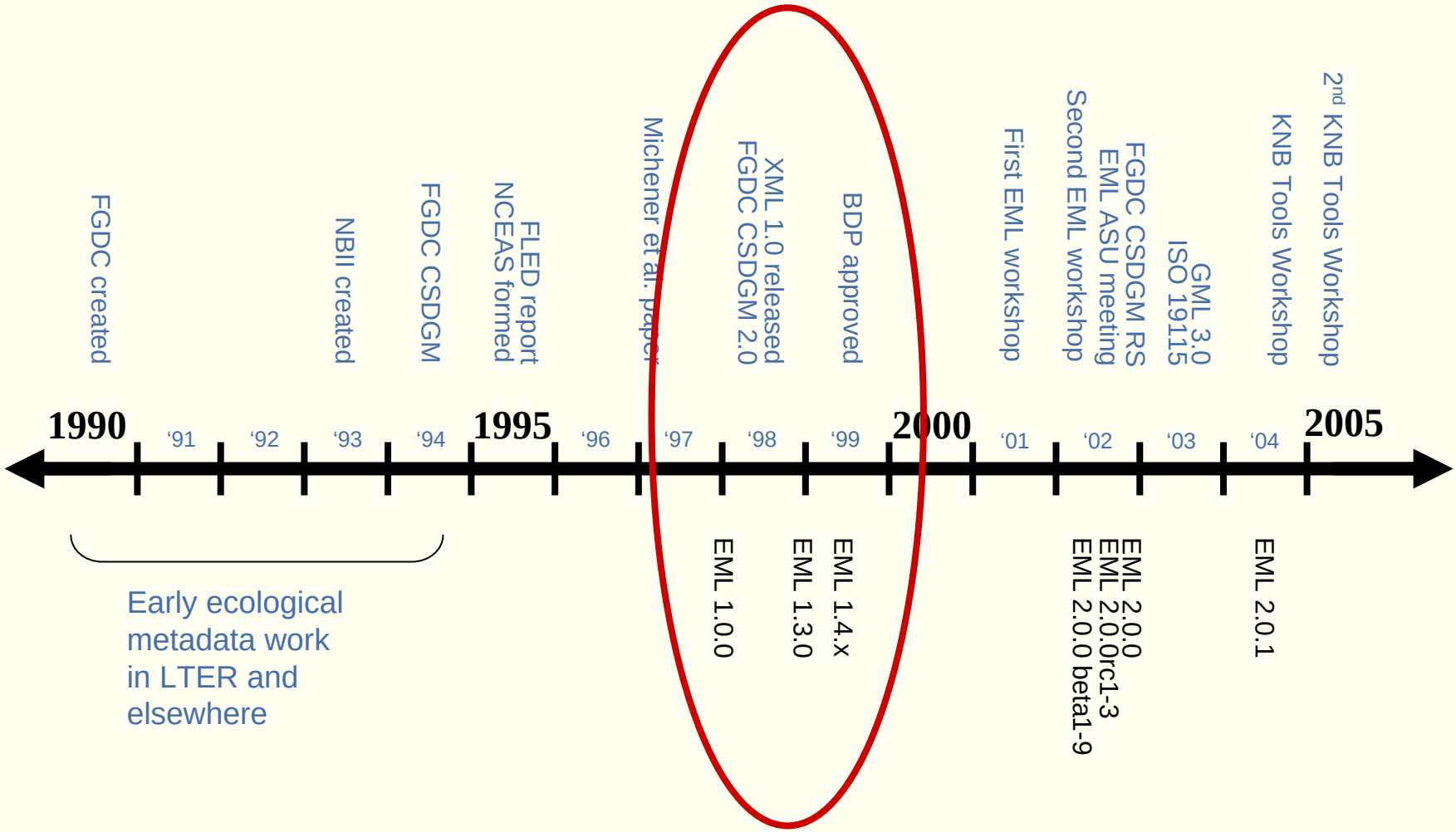
- Metadata: a means to manage ecological data
  - Accommodate heterogeneity and dispersion
    - There is no universal data model for ecology

- Data discovery
- Data interpretation
- Enable advanced analytical applications

Related metadata standards

- Dublin Core Element Set
  - Corresponds roughly to eml-resource
- Content Standard for Digital Geospatial Metadata (CSDGM)
  - Federal Geographic Data Committee (FGDC)
  - Corresponds to eml-spatialRaster, eml-spatialVector,eml-spatialReference
  - Overlaps in other modules (eml-resource)
- Biological Data Profile (BDP) of the CSDGM
  - Biological Data Working Group of the FGDC
  - Shares structure for taxonomicCoverage, geologicAge, and ascii table structures
- ISO 19115 Geographic information: Metadata
  - Incorporated in the eml-spatial* modules
  - Eml-party derived from ISO 19115
- Darwin Core
  - Partially overlaps with eml-coverage
- Geography Markup Language (GML)

Abridged History of EML



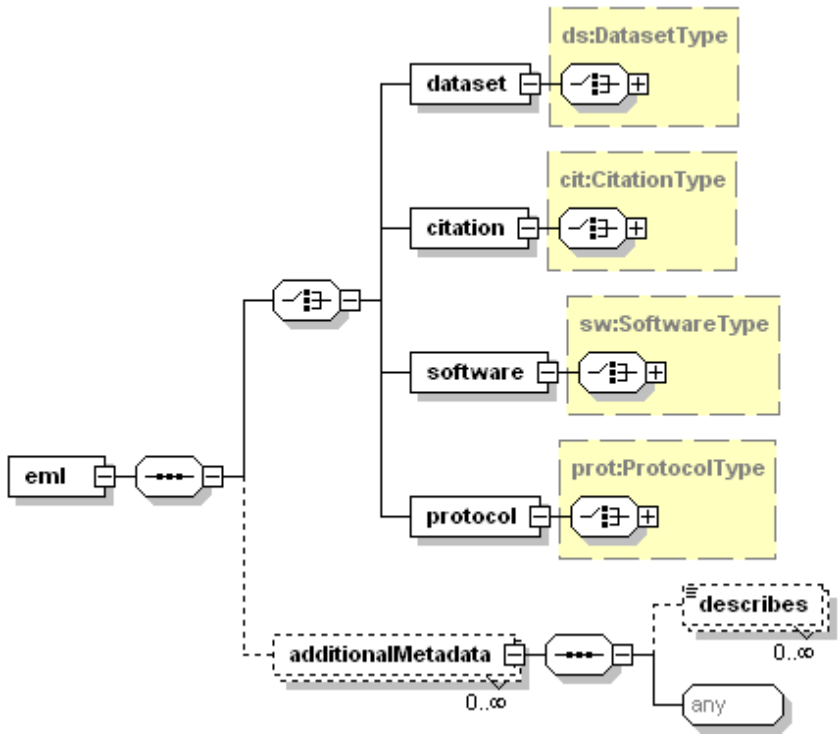
Conversion among standards

- Extensive overlap among all of these standards
- EML represents a superset of:
  - BDP
  - CSDGM
  - ISO 19115 (I think)
  - Dublin Core
- Can convert from EML to those
- Practically, have conversion script for:
  - EML → BDP
    - Uses XSLT so can be used in a variety of software

What does EML document?

- Scientific data sets
  - Tabular and relational data
  - Spatial images and GIS data
- Processing Software
- Literature citations
- Scientific Protocols

- Easily extensible
  - AdditionalMetadata



Information covered by EML

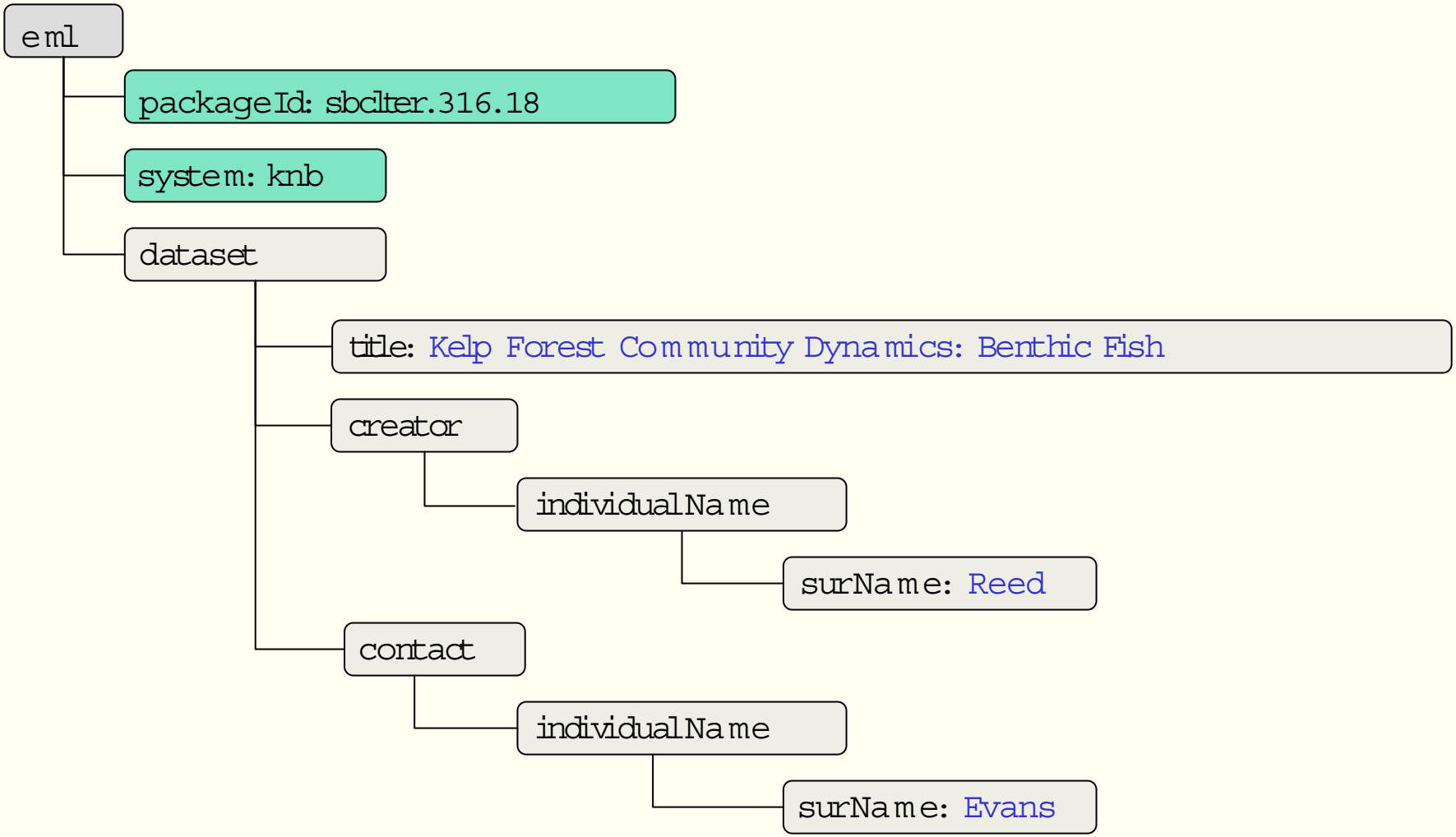
- Discovery information
  - Creator, Title, Abstract, Keyword, etc.
- Ownership and Citation information
- Intellectual property information
- Coverage
  - Geographic, temporal, and taxonomic extent
- Protocols and methods

Used in registries and catalogs

- Logical and physical data structure
  - Data semantics via unit definitions and typing

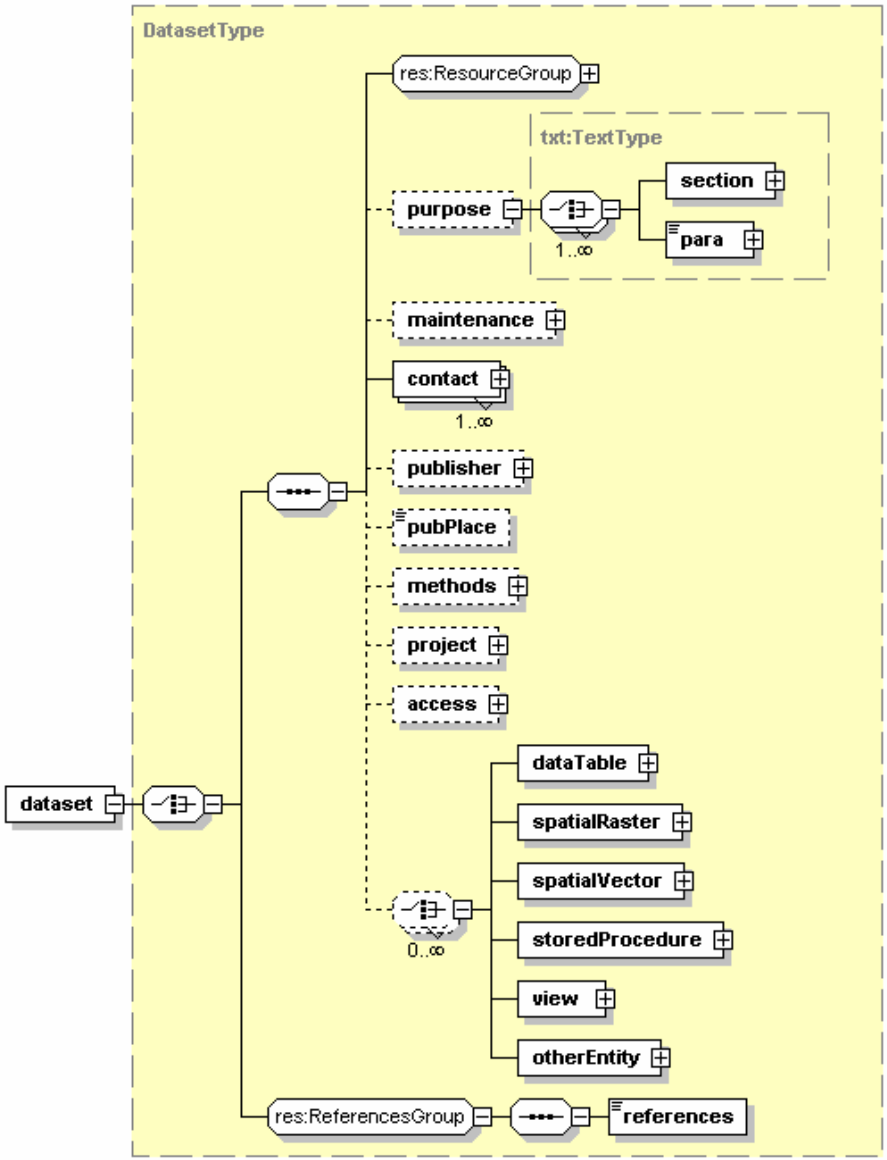
Used in Analytical applications

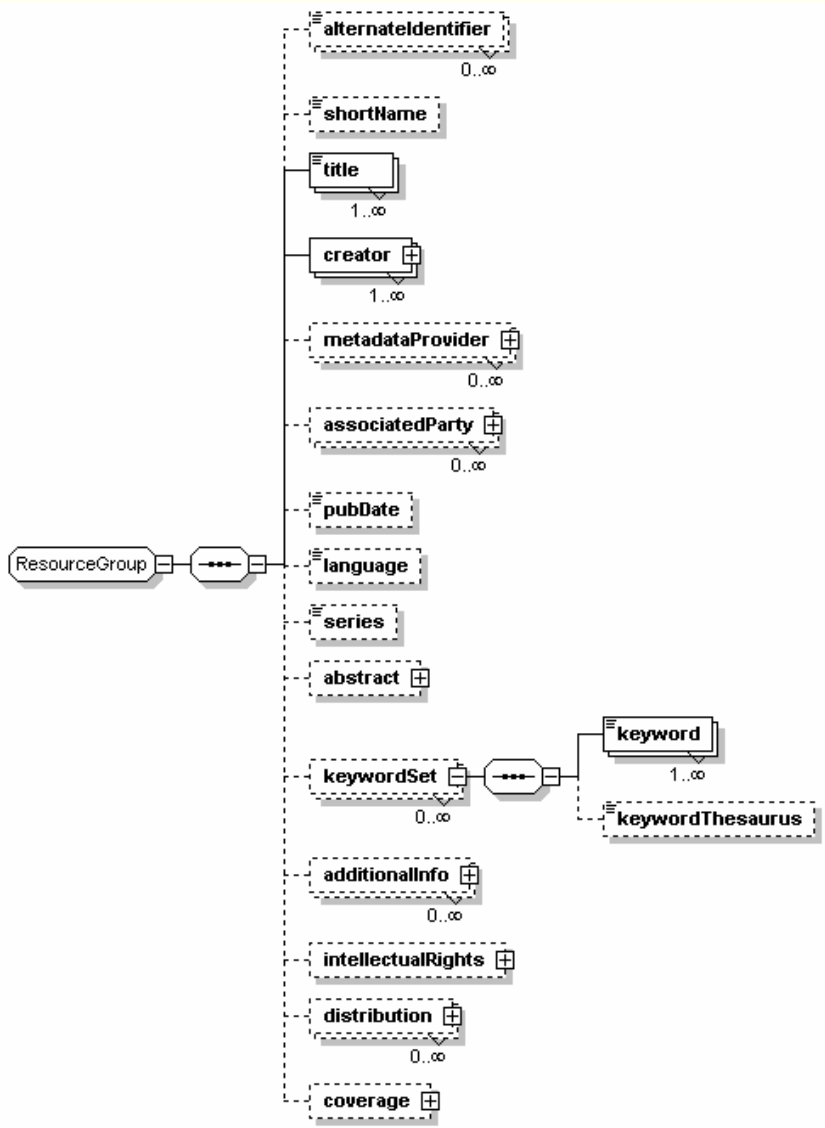
The simplest EML example



*barely enough information for 'identifying' the dataset

Identification: resource elements





EML Strengths

- EML is:
  - Designed for interoperability and portability
  - Supports validation and machine processing
- Modular
  - 24 modules for flexibility and reusability
- Extensible
  - Simple to add metadata from other standards or site-specific metadata
- Designed to support scientific analysis
  - Metadata details needed for analysis and models

EML uses open standards

- Uses Extensible Markup Language (XML)
  - Documents are cross-platform
  - EML documents support international languages
  - Excellent exchange lanuguage
- EML documents are human readable text
  - Therefore, archive friendly
- EML documents are fine-grained
  - Simpler conversion to other standards
  - More difficult to convert from coarse-grained standards like Dublin Core

An Example EML Document

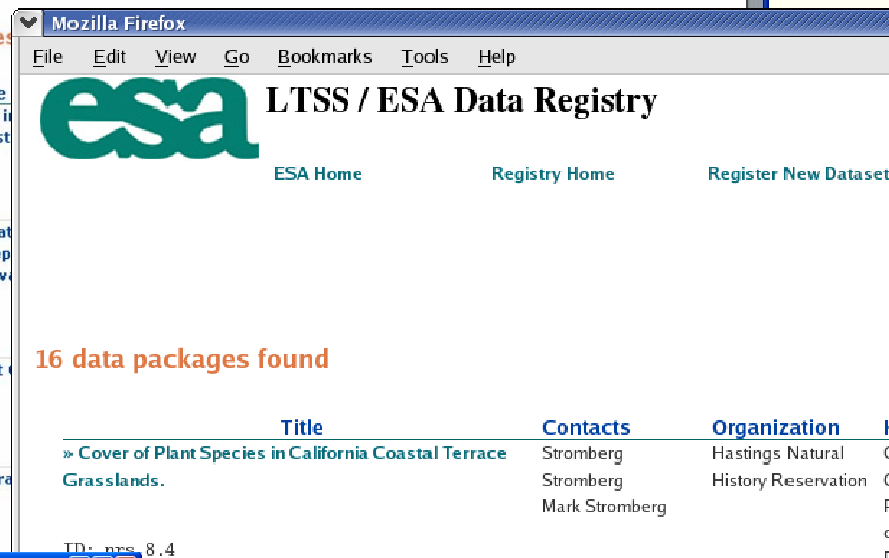
```
<?xml version="1.0"?>
<eml:eml packageId="piscoUCSB.5.20" system="knb"
xmlns:eml="eml://ecoinformatics.org/eml-2.0.0">
<dataset>
  <shortName>Alegria Temperatures</shortName>
  <title>PISCO: Intertidal Temperature Data:
      Alegria, California: 1996-1997</title>
  <creator id="C.Blanchette">
    <individualName>
      <givenName>Carol</givenName>
      <surName>Blanchette</surName>
    </individualName>
    <organizationName>PISCO</organizationName>
   <address>
    <deliveryPoint>UCSB Marine Science
      Institute</deliveryPoint>
    <city>Santa Barbara</city>
    <administrativeArea>CA</administrativeArea>
    <postalCode>93106</postalCode>
   </address>
  </creator>
  <abstract>
   <para>These temperature data were collected
     at Alegria Beach, California, and were ...
   </para>
  </abstract>
  <keywordSet>
   <keyword>OceanographicSensorData</keyword>
   <keyword>Thermistor</keyword>
  <keywordThesaurus>
     PISCO Categories
  </keywordThesaurus>
  </keywordSet>
  <intellectualRights><para>Please contact the
    authors for permission to use these data.
    Please also acknowledge the authors in any
    publications.</para>
  </intellectualRights>
  <contact>
    <references>C.Blanchette</references>
  </contact>
</dataset>
</eml:eml>
```

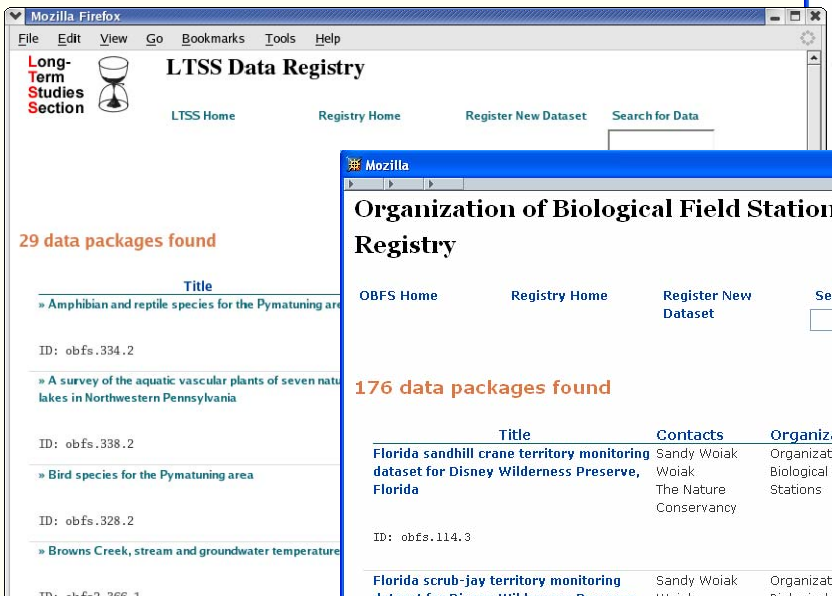
Transform

Data Registries

- Registries
  - UC NRS
  - OBFS
  - ESA LTSS
  - Spec Net
  - NCEAS

- Use metacat
- Web-based metadata entry





Morpho – Managing metadata and data

- Create and manage data and metadata using wizards
- Search and locate data
- Share data with colleagues

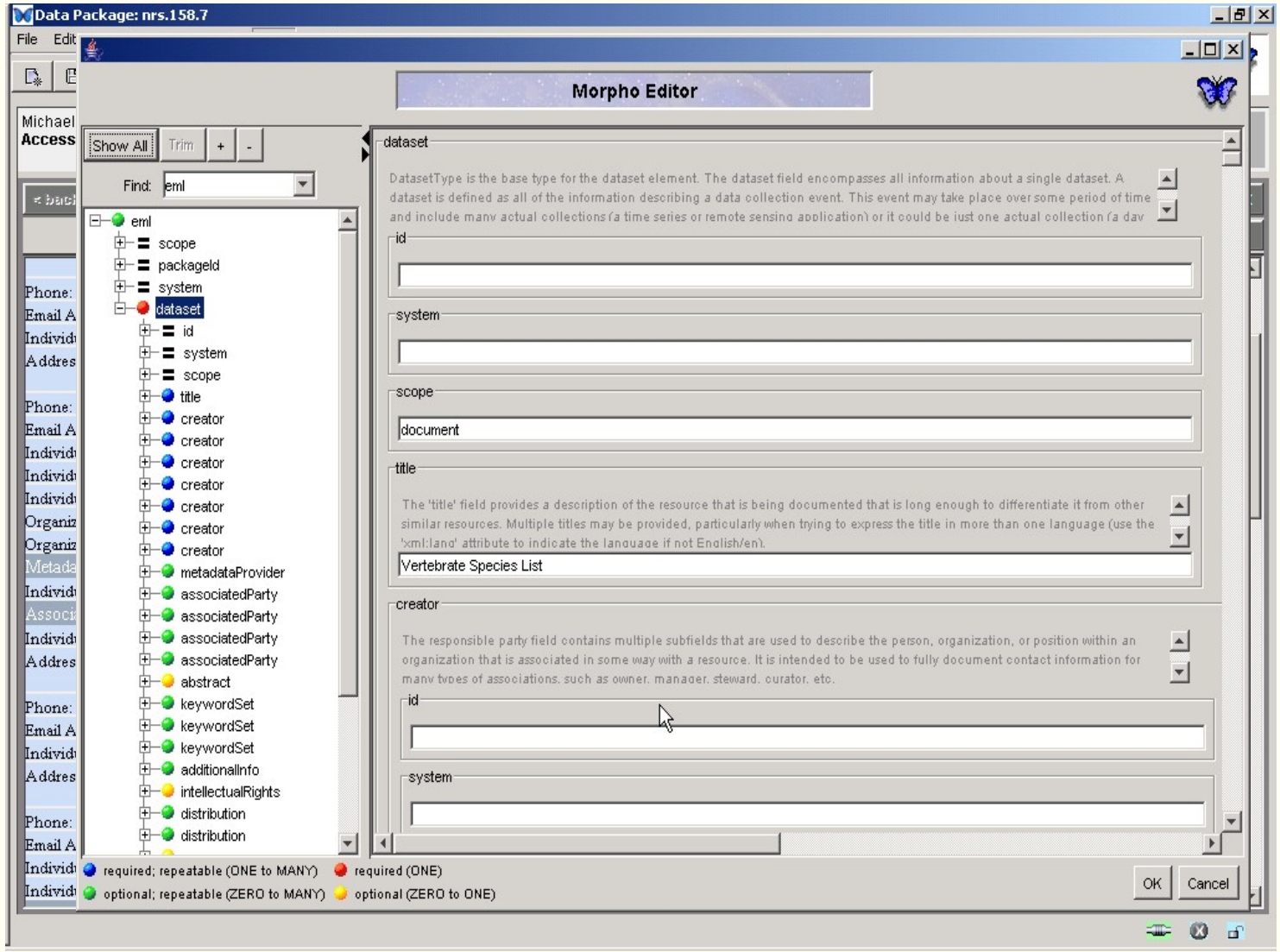
- Usable in field station environments
  - Can't assume a network connection is available always

- Can be run on Windows, Linux and Mac OS
- Is open source (GNU GPL)

What can Morpho do?

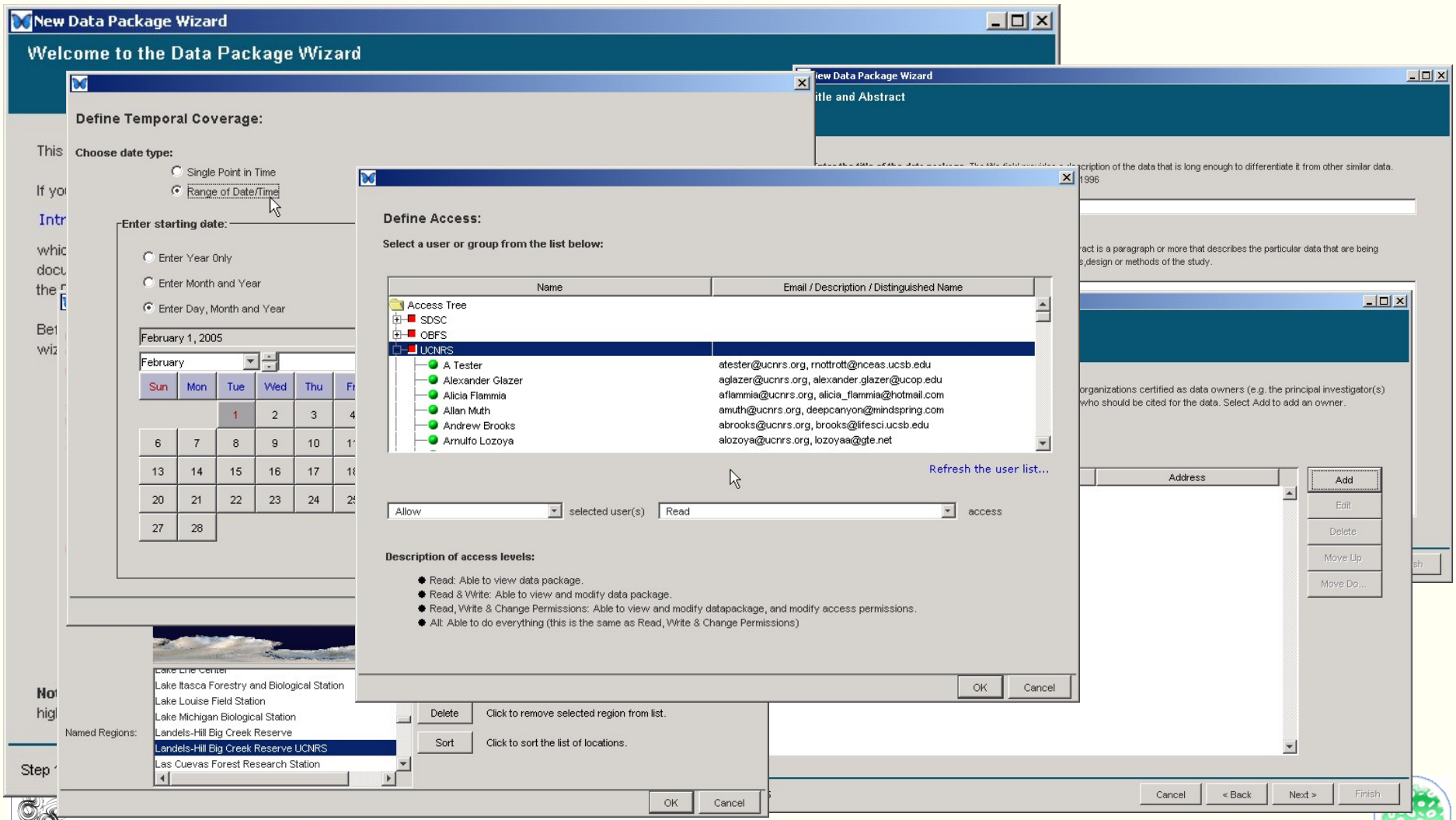
- Create EML data packages
  - Open and edit data packages, set access control
  - Import data into a data package
  - Save the EML and data
    - locally and to metacat servers
- Search for EML
  - locally and on metacat servers
- Export data packages

Morpho: Open and edit data packages



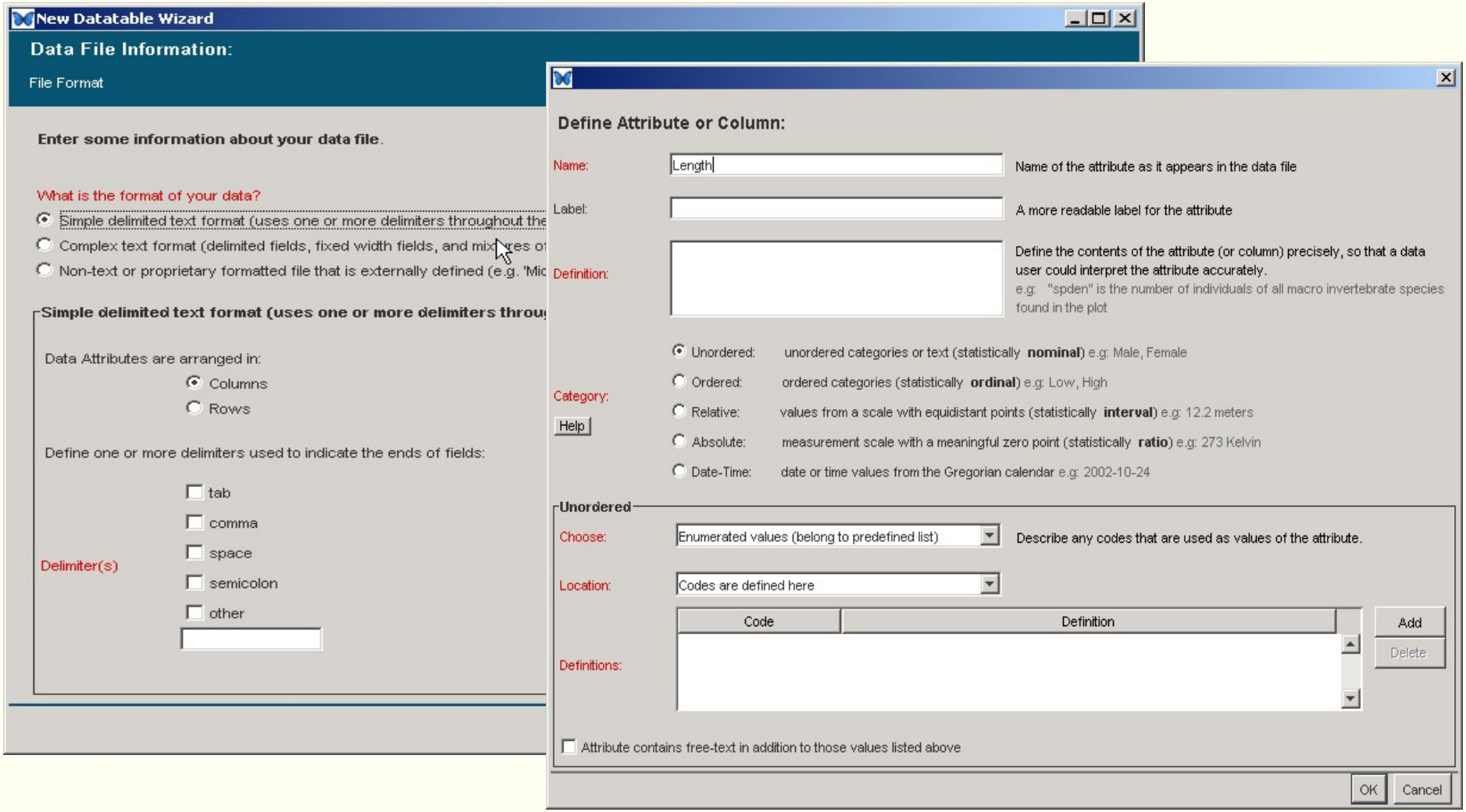
Morpho: Create data packages

- Data Package Wizard



Morpho: Import data

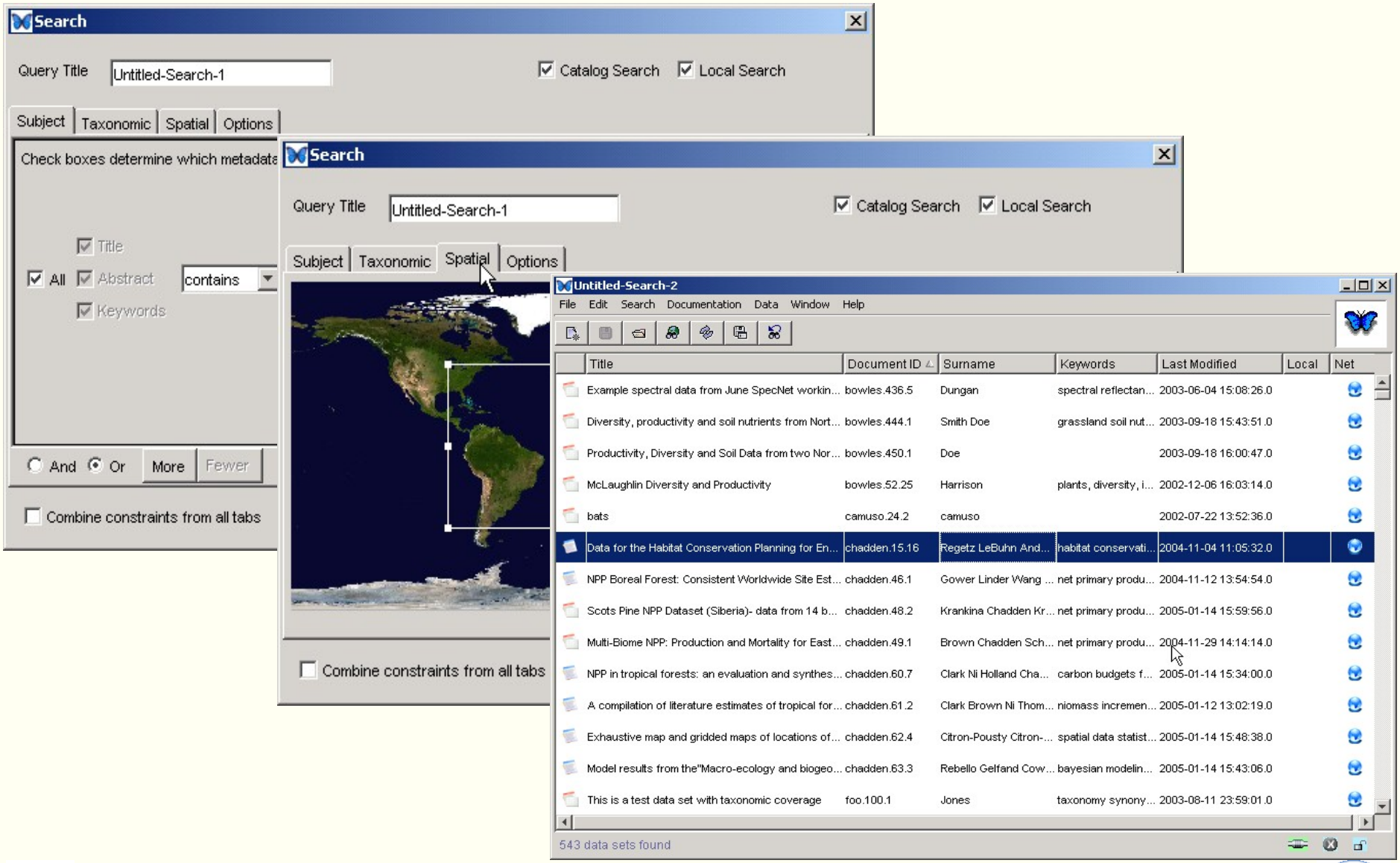
- New Data Table Wizard



Morpho: defining attributes

- Natural language description of each attribute
- Standardized measurement scales
  - Precisely define attribute domain
- Standardized measurement units
  - EML has unit dictionary with 140 pre-defined units
    - Relationship and conversion to base SI unit provided
  - Uses STMML to quantitatively define custom units

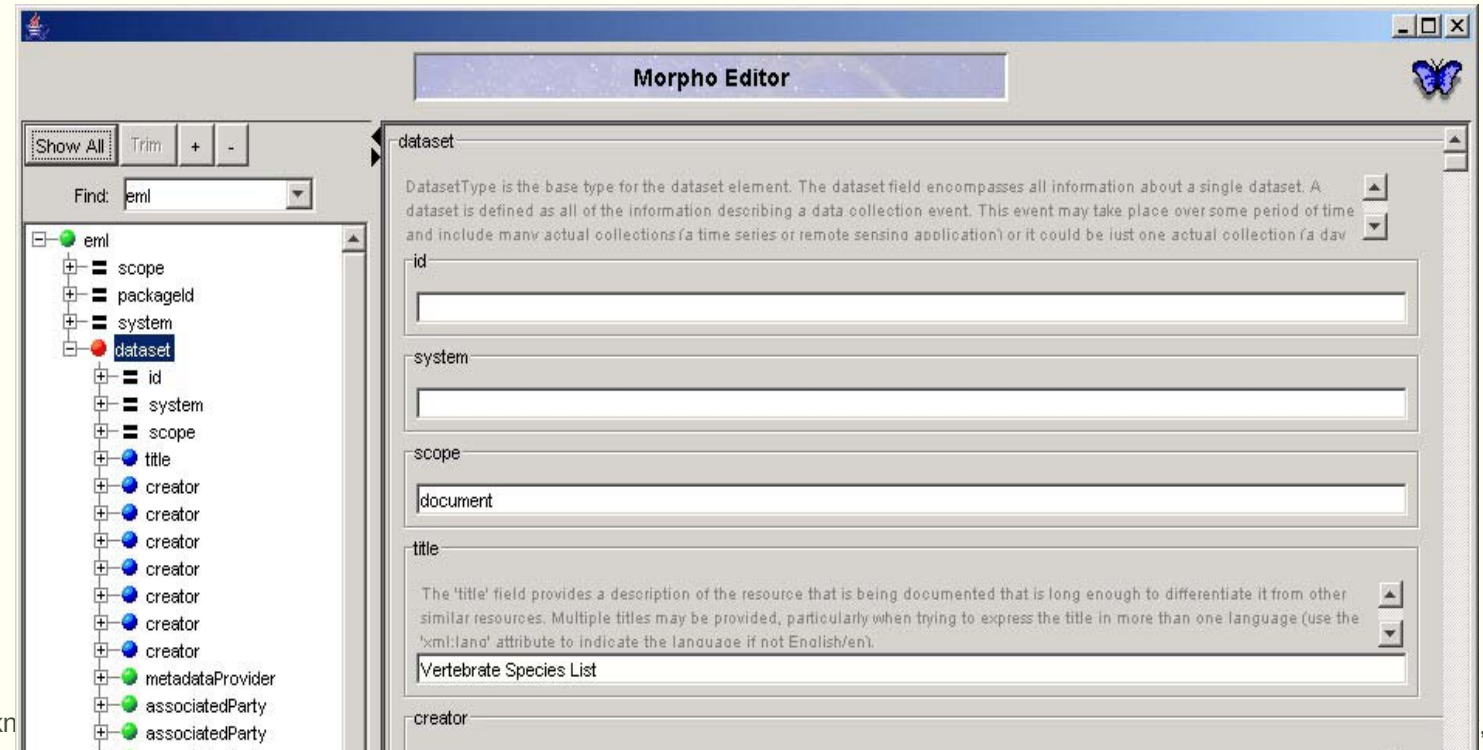
Morpho: Search for data packages



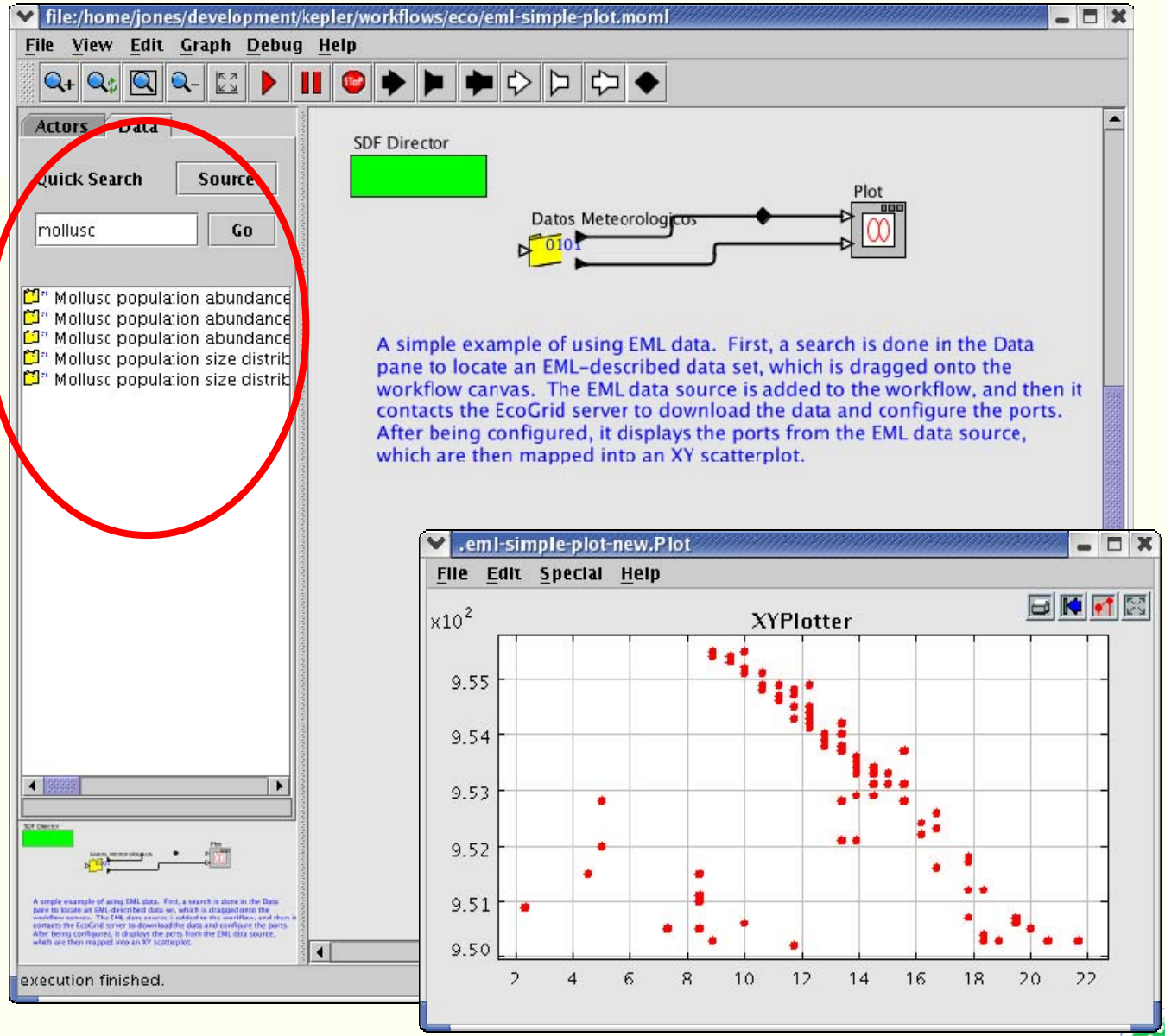
Morpho extensibility

- Originally designed to support multiple metadata standards
  - Later customized for ease-of-use for EML
  - Could be extended to support editing BDP or other standards

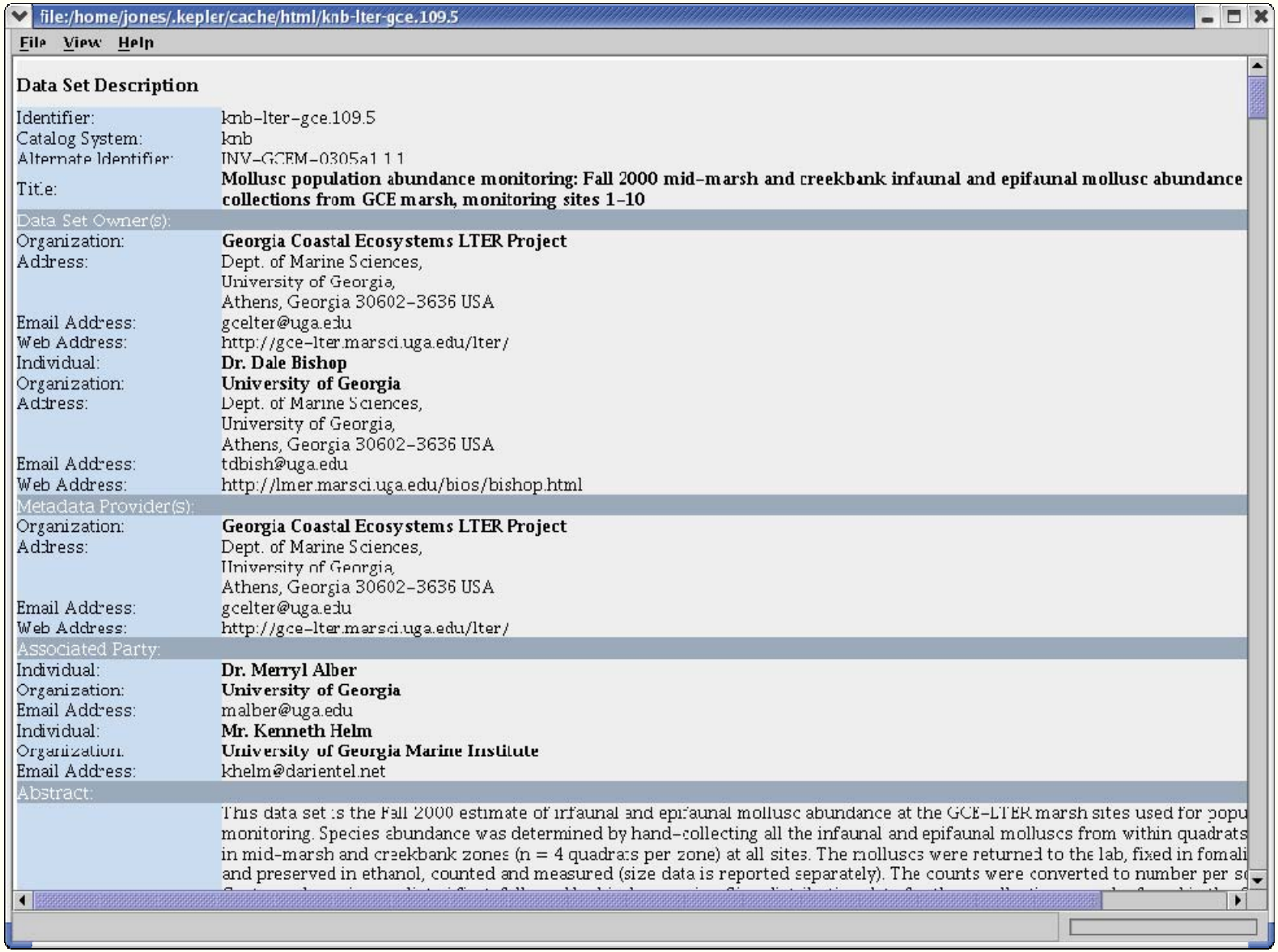
- Could add conversion capabilities to import/export BDP



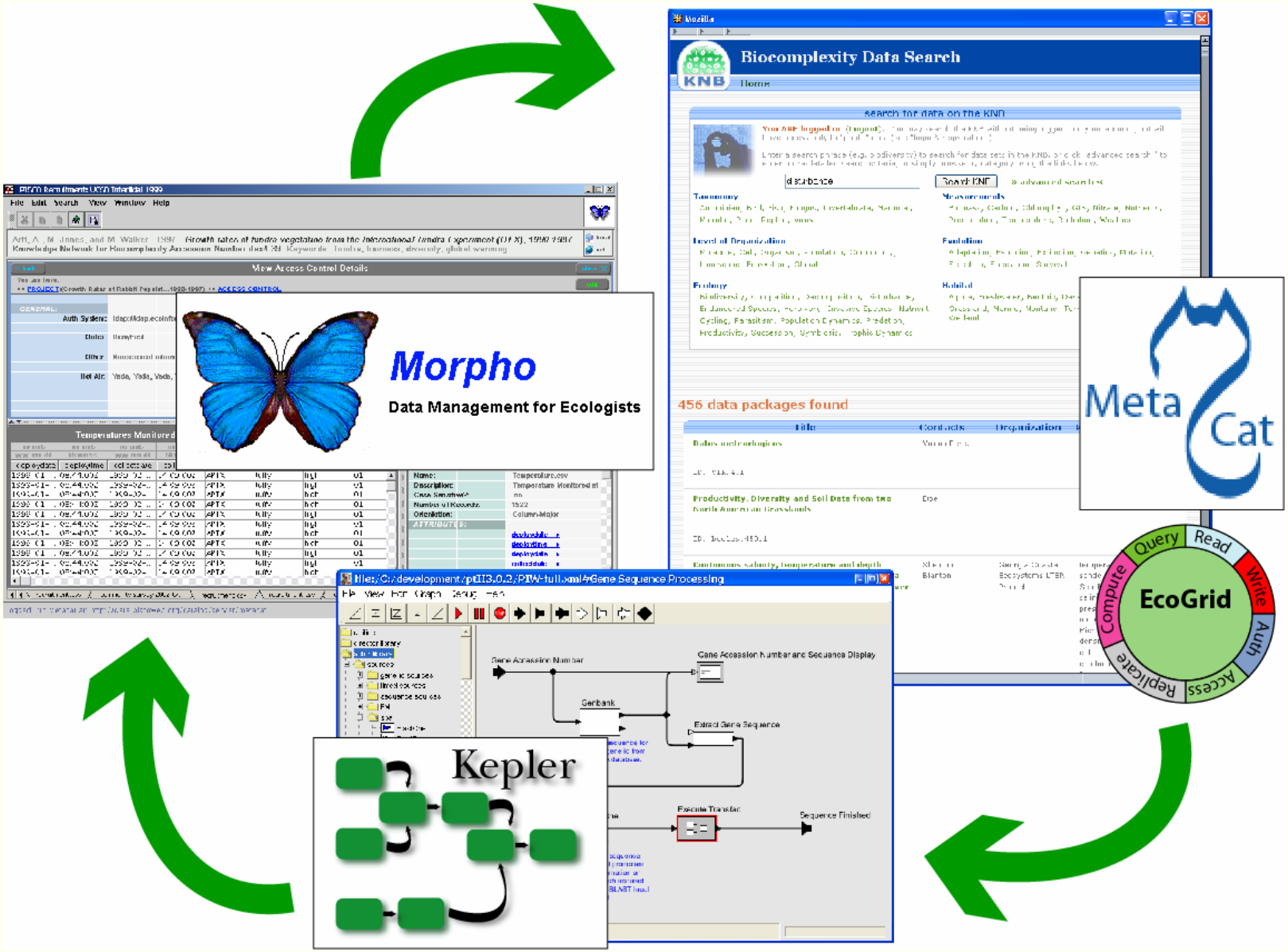
EML-driven analyses in Kepler



EML Metadata Display in Kepler



Metadata-driven analysis cycle



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