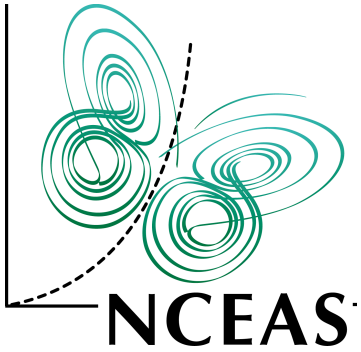
Data Management for Synthesis

Ben Leinfelder
Matthew B. Jones

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

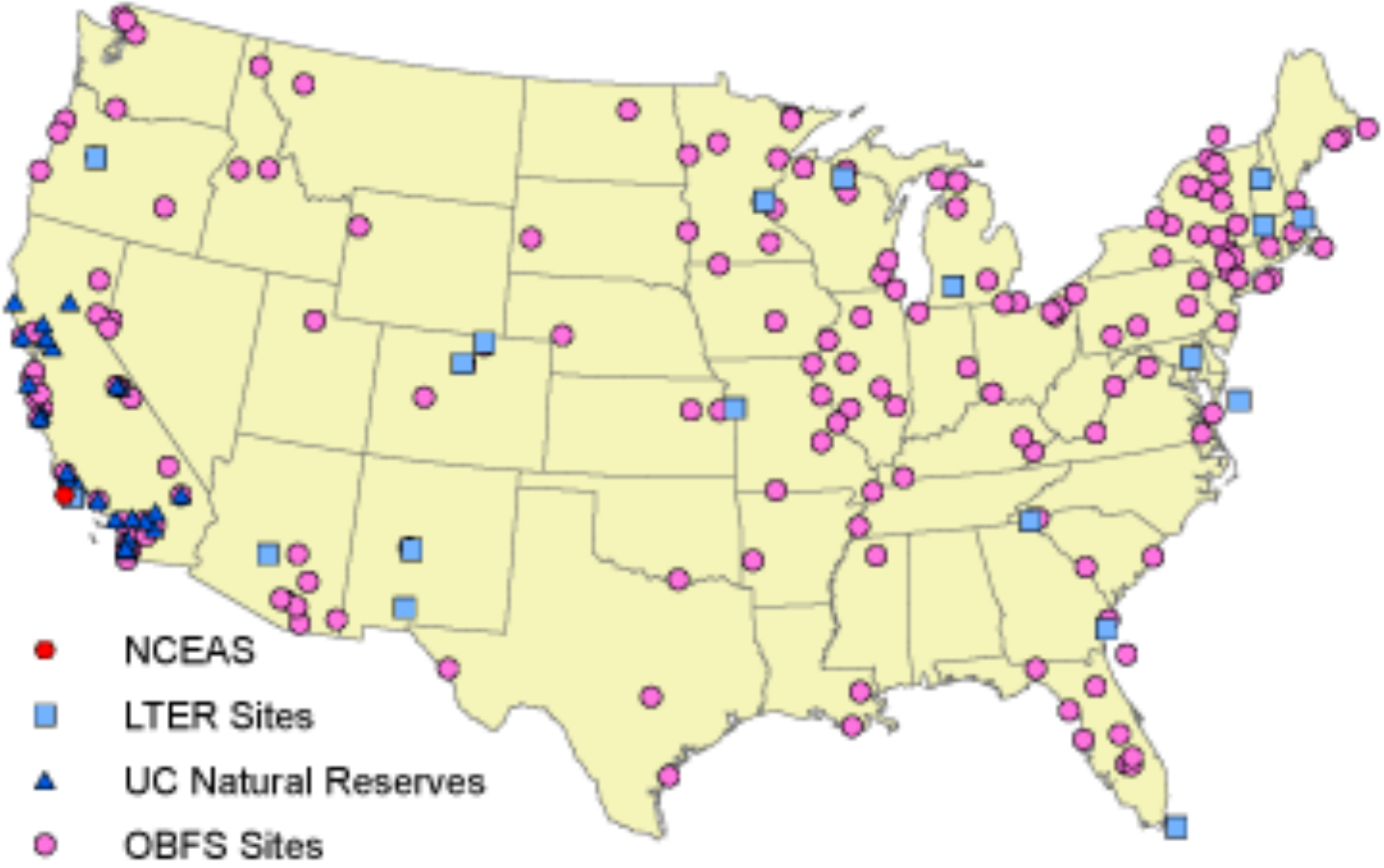


GLEON 16 Data workshop
October 27, 2014

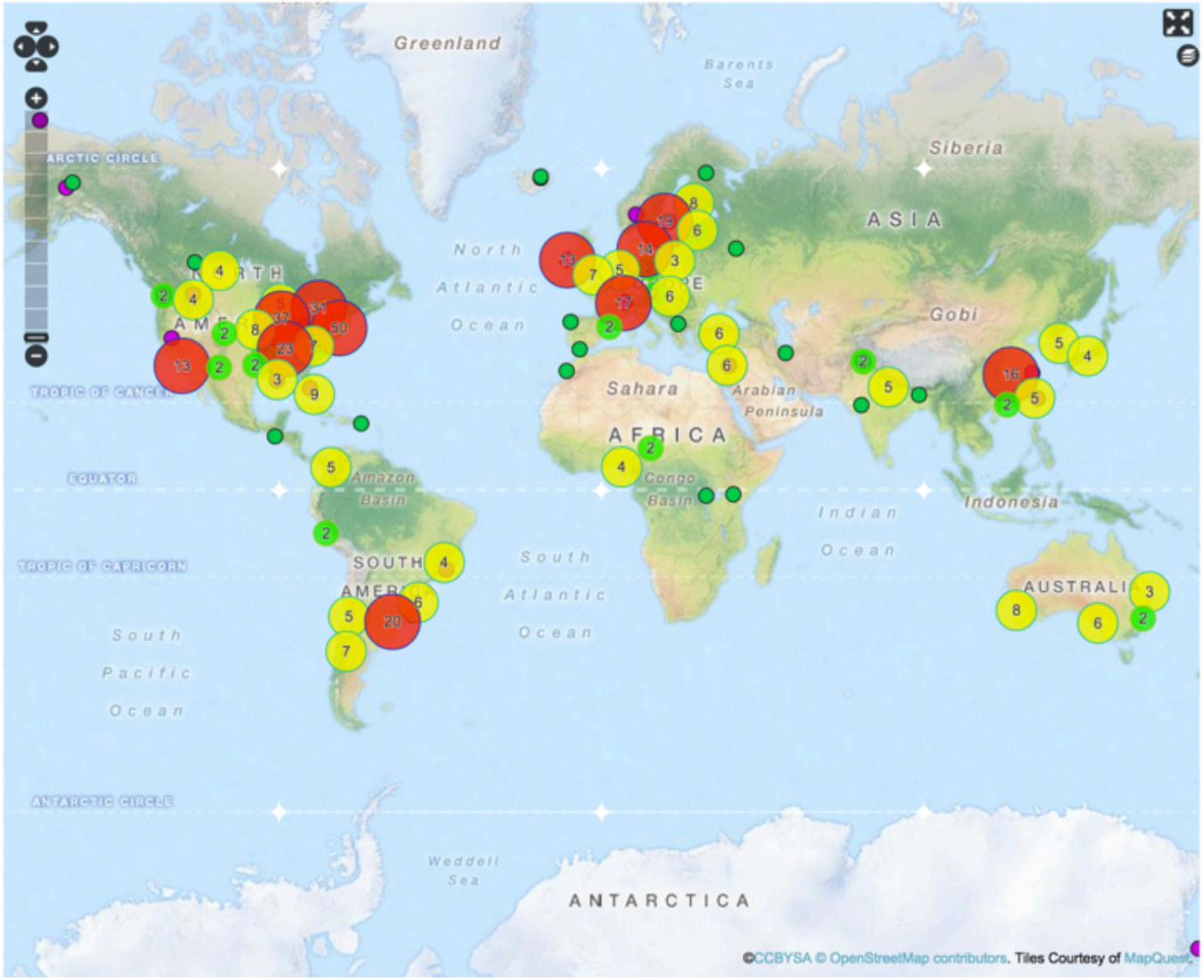
Barriers to Synthesis

- Data not preserved
  - Tiny proportion of ecological data are readily available
- Dispersed, isolated repositories
  - Each community has its own; disconnected; underutilized
- Lack of software interoperability
  - Metacat, DSpace, Mercury, iRODS, XMCat, OPeNDAP, ...
- Heterogeneous data
  - Many data formats, metadata formats, and varying semantics

Dispersed data from field stations



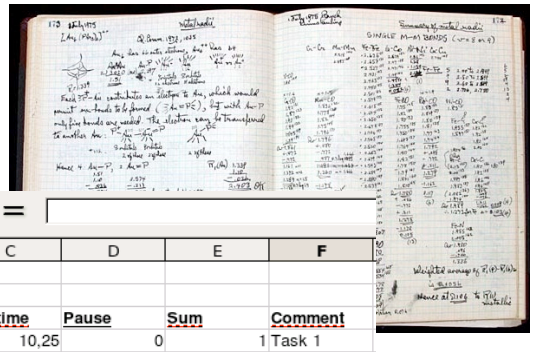
GLEON Sites



"...understand, predict and communicate the role and response of lakes in a changing global environment"

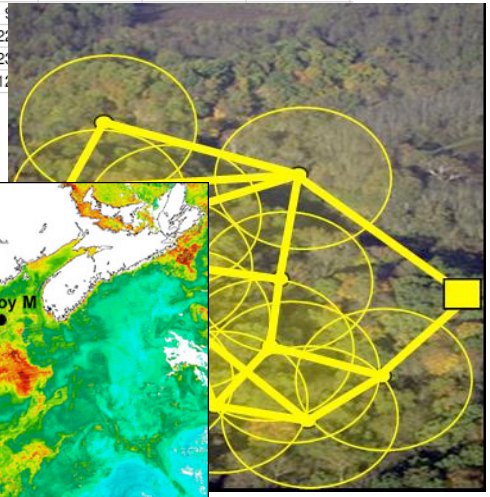
What data are in scope?

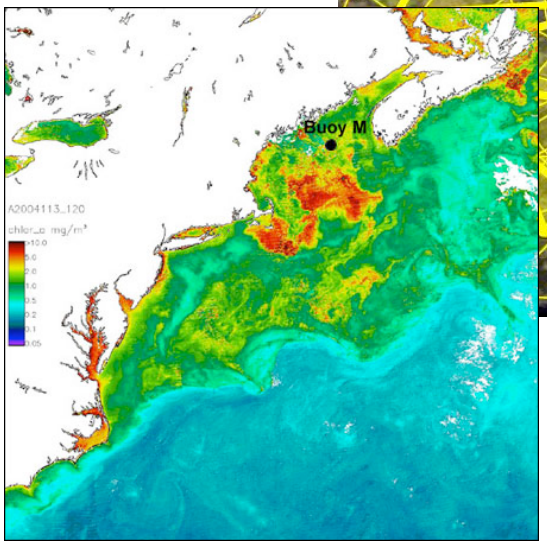
- Biological
  - e.g., Ecosystem, Organism, Population, Species, Community, Biome, Gene
- Environmental
  - e.g., Atmospheric, Chemical, Ecological, Hydrological, Oceanographic, Physical
- Social
  - e.g., Land use, human population
- Economic
  - e.g., trade, ecosystem services, resource extraction



F16 $f(x)$ Σ =

	A	B	C	D	E	F
1						
2						
3	Date	Start time	End time	Pause	Sum	Comment
4	2007-05-07	9,25	10,25	0	1	Task 1
5	2007-05-07	10,75	12,50	0	1,75	Task 1
6	2007-05-07	18,00	19,00	0	1	Task 2
7	2007-05-08	9,25	10,25	0	1	Task 2
8	2007-05-08	14,50	15,50	0	1	Task 3
9	2007-05-08	8,75				
10	2007-05-14	21,75				
11	2007-05-14	22,50				
12	2007-05-15	11,75				





Metadata and data heterogeneity

- Every community has
  - many data schemas
    - one for each project and person
  - many data formats
    - ASCII, NetCDF, HDF, GeoTiff, ...
  - many metadata schemas
    - Biological Data Profile, Darwin Core, Dublin Core, Ecological Metadata Language, Open GIS schemas, ISO Schemas, ...
- Accepting this heterogeneity is critical

Biodiversity data heterogeneity

Space Time Taxa

(a) Georgia Coastal Ecosystems LTER (EML)

Site	Community	Treatment	Replicate	Species_Code	ITIS_TSN	Plant_Mass	Plant_Mass_m2
GCE6	BorJun	N	1	JROM	39238	75.13	300.5
GCE6	BorJun	N	2	JROM	39238	179.81	719.2
GCE6	BorJun	N	3	JROM	39238	443.20	1772.8
...	...	...	...	...	...	...	...

(b) *Mephitis mephitis* specimen record (DarwinCore)

Cat	Code	Year	Collector	Long	Lat	Cat	Sci_Name	Institution	Species
4815	Mamm	1947	DOWNEY,J.	-109.34	37.86	null	Mephitis mephitis	ESTOR UMNH	mephitis
6767	Mamm	1948	NEILSON,L.	-109.52	40.41	null	Mephitis mephitis	ESTOR UMNH	mephitis
6768	Mamm	1948	NEILSON,L.	-109.52	40.41	null	Mephitis mephitis	ESTOR UMNH	mephitis
...	...	...	...	...	...	...	...	...	...

(c) NOAA Ocean Buoy Data (Station 46069 - South Santa Rosa Island, CA)

YYYY	MM	DD	hh	mm	WD	WSPD	GST	WVHT	DPD	APD	MWD	BAR	ATMP	WTMP	DEWP	VIS	TIDE
2006	01	01	00	00	284	6.9	8.2	3.50	13.79	8.11	275	1013.2	15.5	14.3	999.0	99.0	99.00
2006	01	01	01	00	287	6.0	7.6	3.13	13.79	8.08	271	1013.5	15.3	14.3	999.0	99.0	99.00
2006	01	01	02	00	276	4.3	5.6	3.20	13.79	8.49	272	1013.7	14.9	14.4	999.0	99.0	99.00
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...

(d) Macroecological data for fossil occurrences (Paleobiology Database)

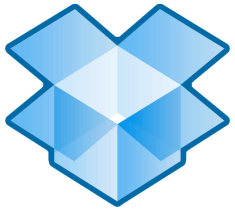
coll_no	genus_name	occ_no	locomot	life_habit	diet1	composition	10mybin	
1	Australosutura	1	mobile	epifaunal	detritivore	chitin	Carboniferous	1
1	Carbonocoryphe	2	mobile	epifaunal	detritivore	chitin	Carboniferous	1
1	Thigriffides	3	mobile	epifaunal	detritivore	chitin	Carboniferous	1
...	...	...	...	...	...	...	...	

Synthesis requires sharing data

- NCEAS' approach to data sharing
  - Deal with data heterogeneity
  - Distributed data management
  - Centralized search
  - Semi-automated analysis tools

- A grass-roots network with global partners
  - NCEAS, LTER, iLTER, PISCO, ESA, SanParks, SAEON, TERN, TEAM, ...

Software diversity



GMN

Solutions

- Preserve data
- Adopt standards

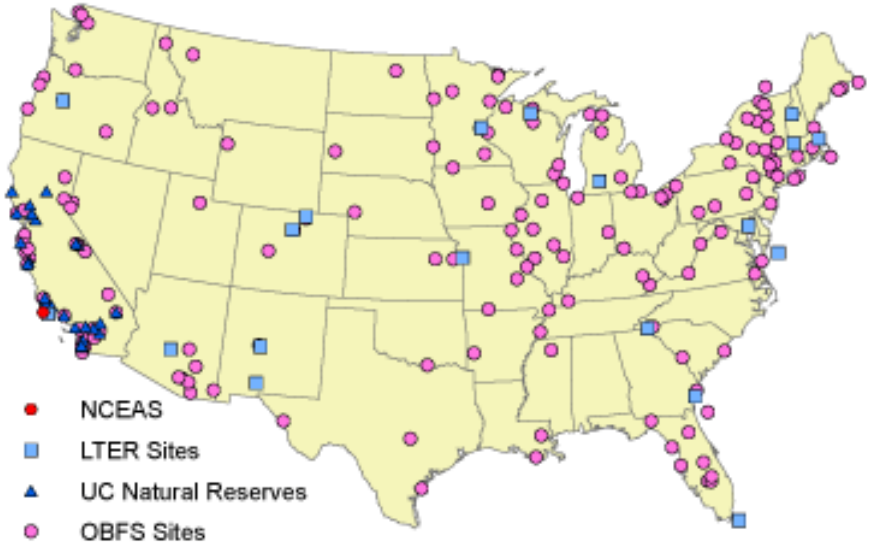
<EML/>

- Create networks
- Create interoperable software

NCEAS

PRESERVE DATA

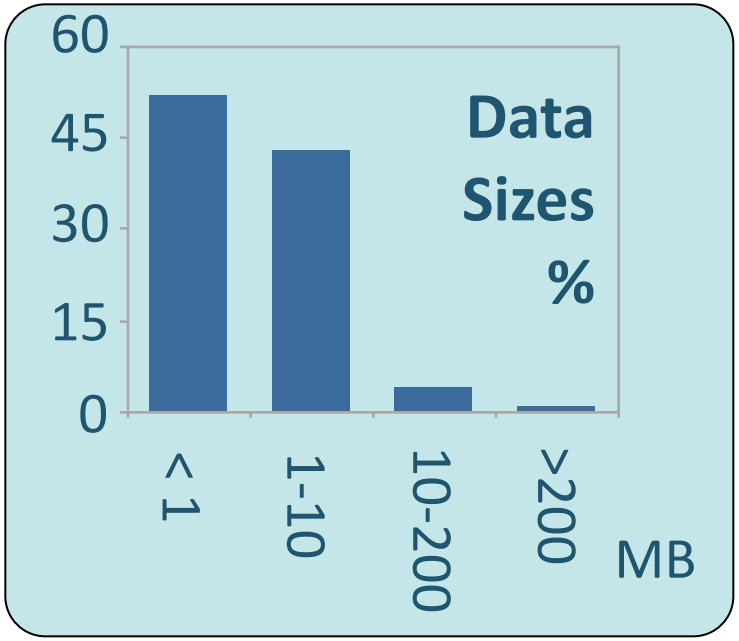
Data in the KNB



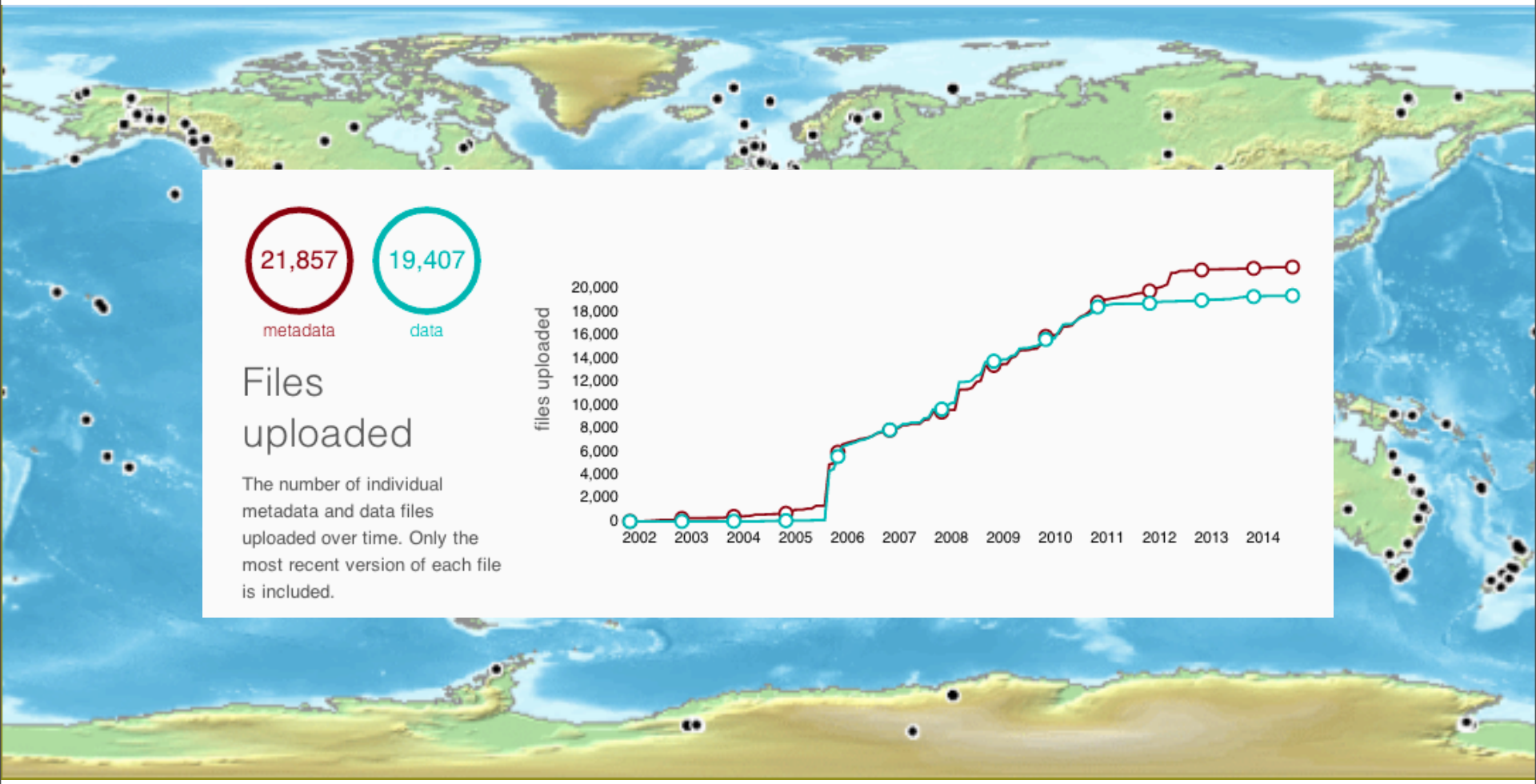
Data Types

- Ecological
- Environmental
- Demographic
- Social/Legal/Economic

- **Diverse Contributors**
- Individual investigators
- Field stations and networks
- Government agencies
- Non-profit partnerships
- Scientific Societies
- Synthesis centers



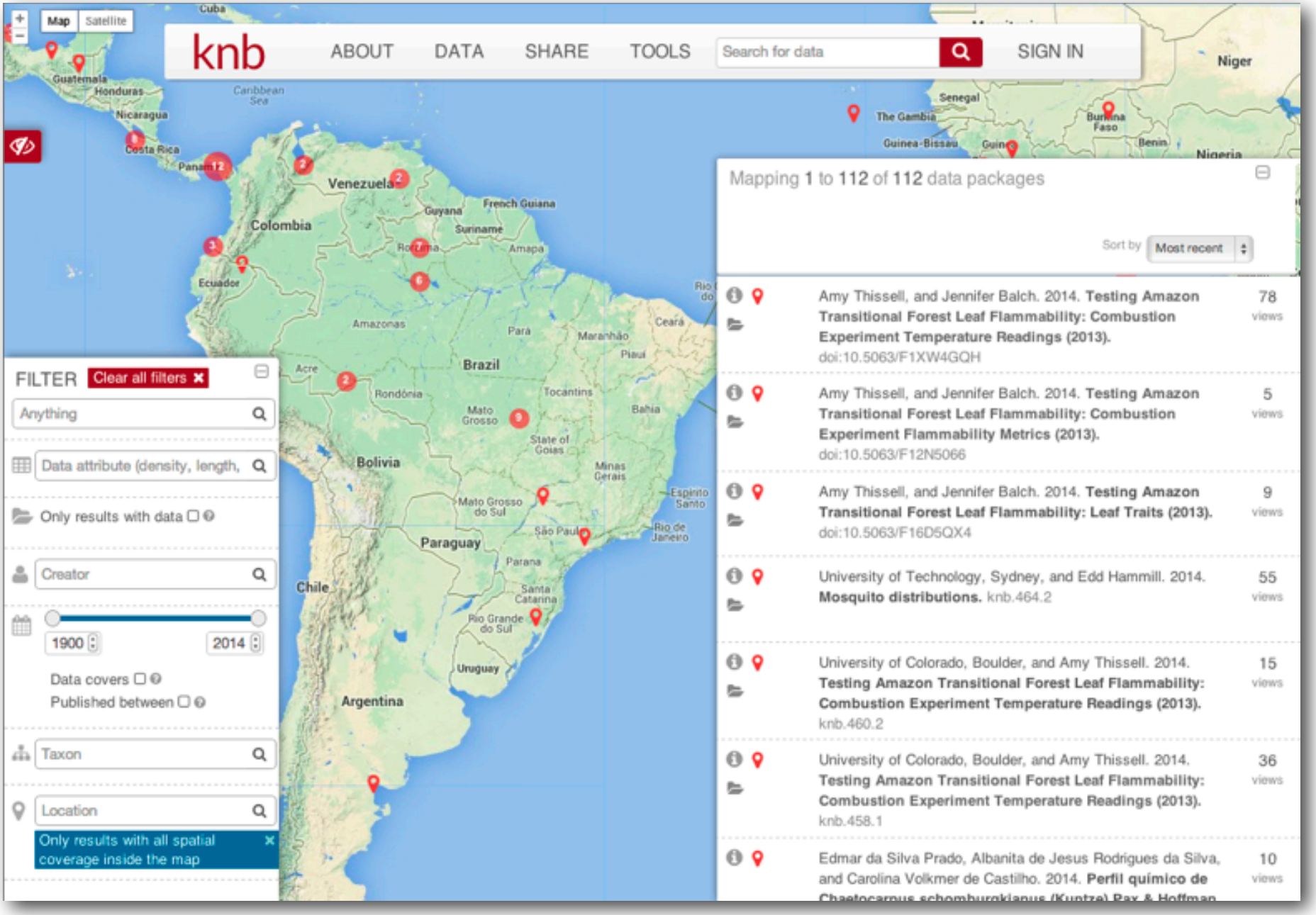
KNB Data Distribution



Metacat Data Server

- Data and metadata management
- Store, search, and document data
- Customizable web-based search interface
- Web metadata entry tool
- DOI Support

- Runs on Linux, Windows, MacOS
- Replication capabilities
- Postgres or Oracle backend
- OAI-PMH harvester
- GPL open source license


knb
ABOUT
DATA
SHARE
TOOLS
Search for data
SIGN IN
Map
Satellite
Mapping 1 to 112 of 112 data packages
Sort by
Most recent
FILTER
Clear all filters
Anything
Data attribute (density, length,
Only results with data
Creator
1900
2014
Data covers
Published between
Taxon
Location
Only results with all spatial coverage inside the map
Amy Thissell, and Jennifer Balch. 2014. Testing Amazon Transitional Forest Leaf Flammability: Combustion Experiment Temperature Readings (2013).
doi:10.5063/F1XW4GQH
78 views
Amy Thissell, and Jennifer Balch. 2014. Testing Amazon Transitional Forest Leaf Flammability: Combustion Experiment Flammability Metrics (2013).
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10 views
Brazil
Venezuela
Colombia
Ecuador
Bolivia
Paraguay
Chile
Argentina
Uruguay
Peru
Guyana
Suriname
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Amazonas
Para
Maranhão
Ceará
Piaui
Tocantins
Bahia
Mato Grosso
State of Goias
Minas Gerais
Espirito Santo
Rio de Janeiro
São Paulo
Mato Grosso do Sul
Parana
Santa Catarina
Rio Grande do Sul
Rondônia
Acre
Amapa
Roraima
Cuba
Guatemala
Honduras
Nicaragua
Costa Rica
Panama
Caribbean Sea
Senegal
The Gambia
Guinea-Bissau
Burkina Faso
Benin
Niger
Nigeria

Data Citation

Data Set Citation:

When using this data, please cite the data package:

Kline T.
SEA: Confirming Food Web Dependencies with Stable Isotope Tracers: Food Webs of Fishes-Prince William Sound, Alaska (1994-1998)
couture.9.15 (http://evos.nceas.ucsb.edu/evos/metacat/couture.9.15/default)

- Facility to issue DOI identifiers for publicly archived data sets:

  doi:10.xxxx/AA/gleon.9.15

- Always resolve to the data set
- Used in journals to cite data usage

NCEAS

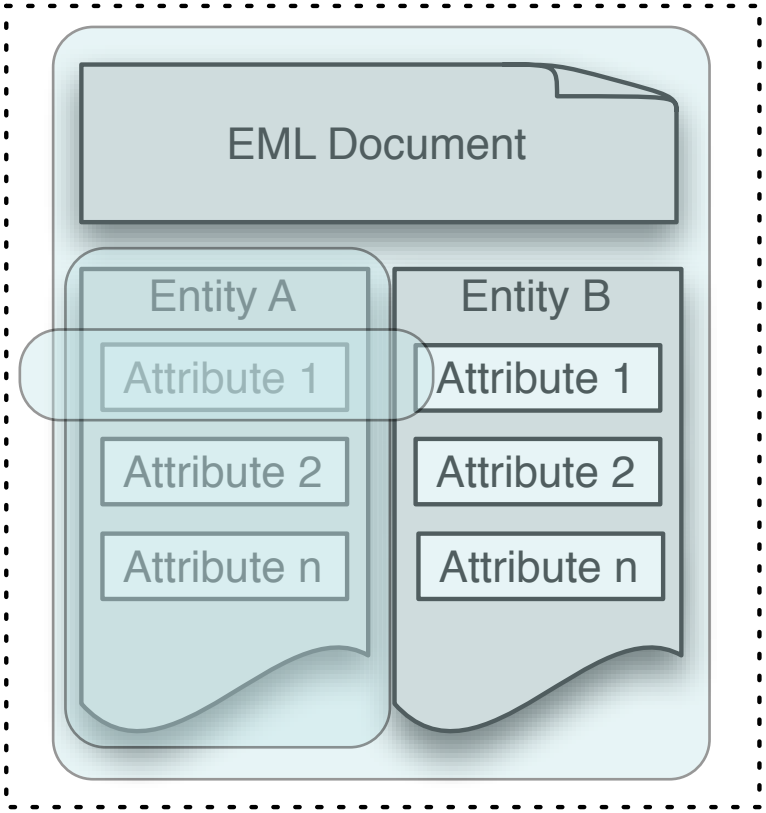
ADOPT STANDARDS

Metadata and data heterogeneity

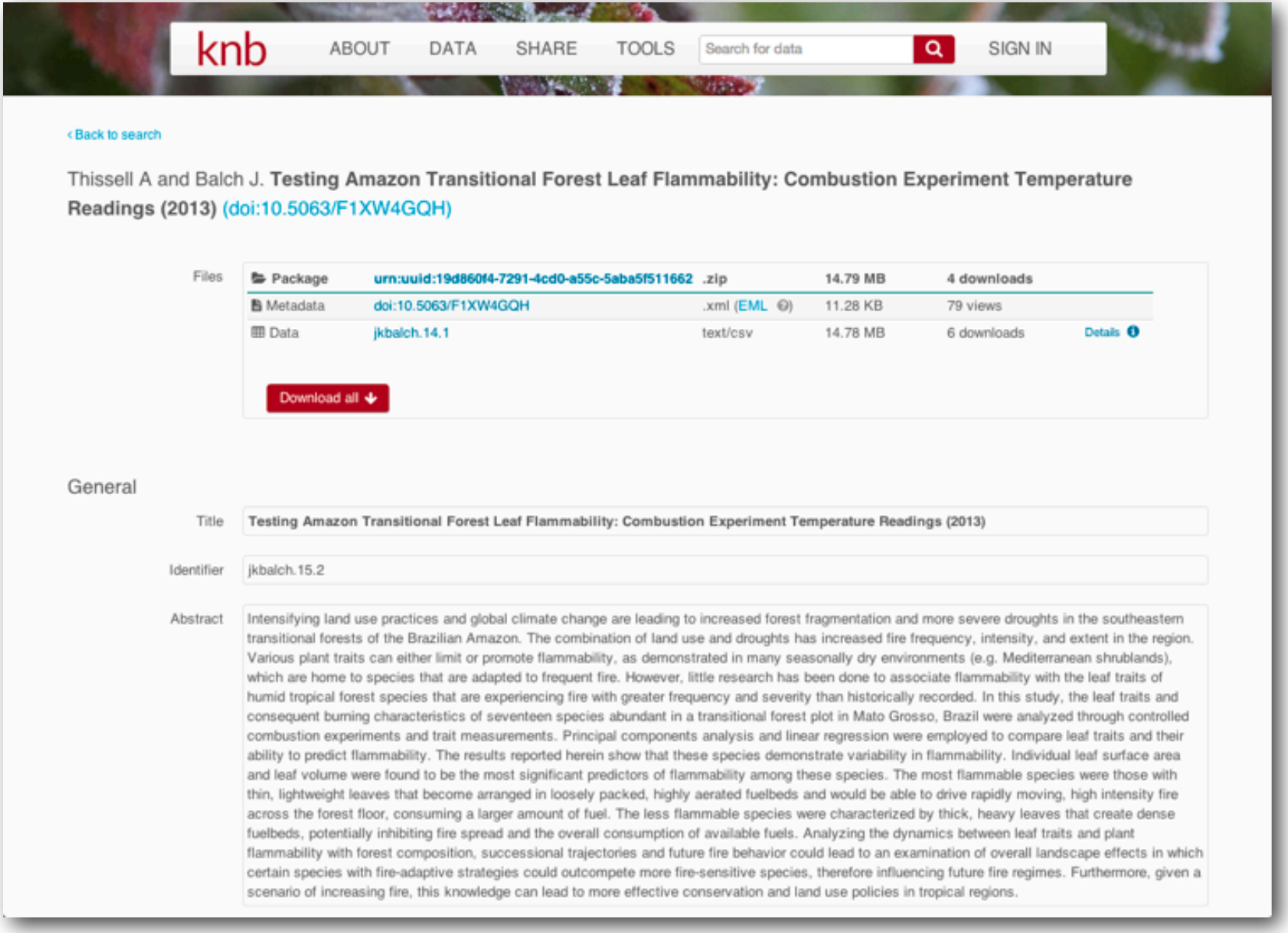
- Every community has
  - many data schemas
    - one for each project and person
  - many data formats
    - ASCII, NetCDF, HDF, GeoTiff, ...
  - many metadata schemas
    - Biological Data Profile, Darwin Core, Dublin Core, **Ecological Metadata Language (EML)**, Open GIS schemas, ISO Schemas, ...
- Accepting this heterogeneity is critical

EML Data Package

- Data Package (eml-dataset)
  - collection of data Entities
- Entity (eml-dataTable)
  - tabular data
  - other
- Attribute
  - data column



Metadata



knb ABOUT DATA SHARE TOOLS Search for data SIGN IN

‹ Back to search

Thissell A and Balch J. **Testing Amazon Transitional Forest Leaf Flammability: Combustion Experiment Temperature Readings (2013)** (doi:10.5063/F1XW4GQH)

Files

Package	urn:uuid:19d860f4-7291-4cd0-a55c-5aba5f511662	.zip	14.79 MB	4 downloads	
Metadata	doi:10.5063/F1XW4GQH	.xml (EML)	11.28 KB	79 views	
Data	jkbalch.14.1	text/csv	14.78 MB	6 downloads	Details

Download all

General

Title: **Testing Amazon Transitional Forest Leaf Flammability: Combustion Experiment Temperature Readings (2013)**

Identifier: jkbalch.15.2

Abstract: Intensifying land use practices and global climate change are leading to increased forest fragmentation and more severe droughts in the southeastern transitional forests of the Brazilian Amazon. The combination of land use and droughts has increased fire frequency, intensity, and extent in the region. Various plant traits can either limit or promote flammability, as demonstrated in many seasonally dry environments (e.g. Mediterranean shrublands), which are home to species that are adapted to frequent fire. However, little research has been done to associate flammability with the leaf traits of humid tropical forest species that are experiencing fire with greater frequency and severity than historically recorded. In this study, the leaf traits and consequent burning characteristics of seventeen species abundant in a transitional forest plot in Mato Grosso, Brazil were analyzed through controlled combustion experiments and trait measurements. Principal components analysis and linear regression were employed to compare leaf traits and their ability to predict flammability. The results reported herein show that these species demonstrate variability in flammability. Individual leaf surface area and leaf volume were found to be the most significant predictors of flammability among these species. The most flammable species were those with thin, lightweight leaves that become arranged in loosely packed, highly aerated fuelbeds and would be able to drive rapidly moving, high intensity fire across the forest floor, consuming a larger amount of fuel. The less flammable species were characterized by thick, heavy leaves that create dense fuelbeds, potentially inhibiting fire spread and the overall consumption of available fuels. Analyzing the dynamics between leaf traits and plant flammability with forest composition, successional trajectories and future fire behavior could lead to an examination of overall landscape effects in which certain species with fire-adaptive strategies could outcompete more fire-sensitive species, therefore influencing future fire regimes. Furthermore, given a scenario of increasing fire, this knowledge can lead to more effective conservation and land use policies in tropical regions.

Owner and Contact Metadata

People and Associated Parties

Data Set Creators	Individual	**Amy Thissell**
	Organization	**The Pennsylvania State University**
	Position	Primary Data Set Owner
	Individual	**Dr. Jennifer Balch**
	Organization	**University of Colorado**
	Position	Co-Owner
	Address	Guggenheim Building, 260 UBC, Room 110, University of Colorado, Boulder, Colorado 80309 USA

Data file metadata

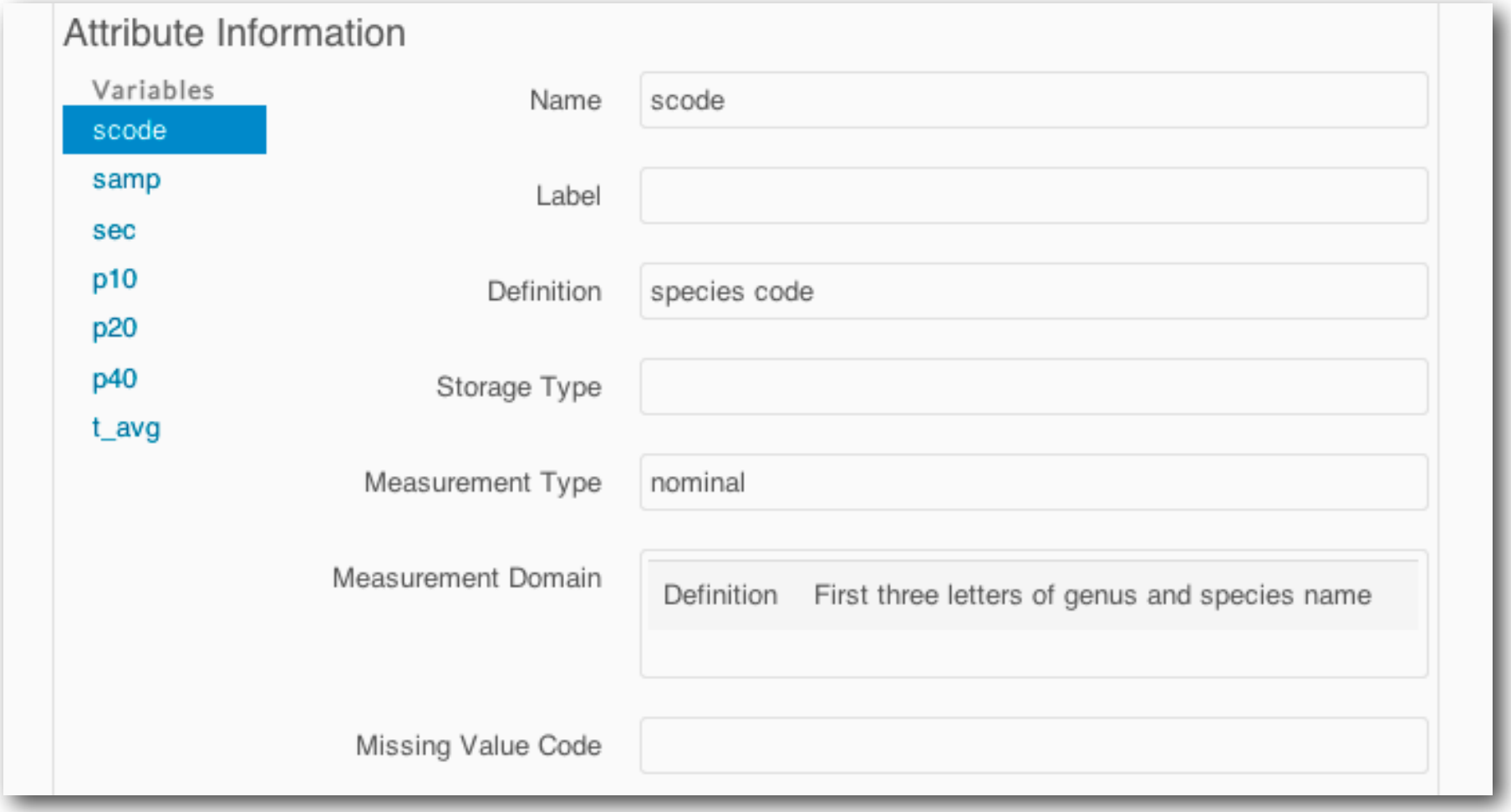
Data Table, Image, and Other Data Details

Technical Metadata	Ecological Metadata Language (EML) File	
Data Table	Entity Name	**alltemps_Thissell_2013.csv**
	Object Name	alltemps_Thissell_2013.csv
	Online Distribution Info	jkbalch.14.1
	Size	15500059 byte
	Text Format	

Number of Header Lines	1
Record Delimiter	#x0A
Attribute Orientation	column
Simple Text	
Field Delimeter	,

	Number Of Records	214569

Column metadata

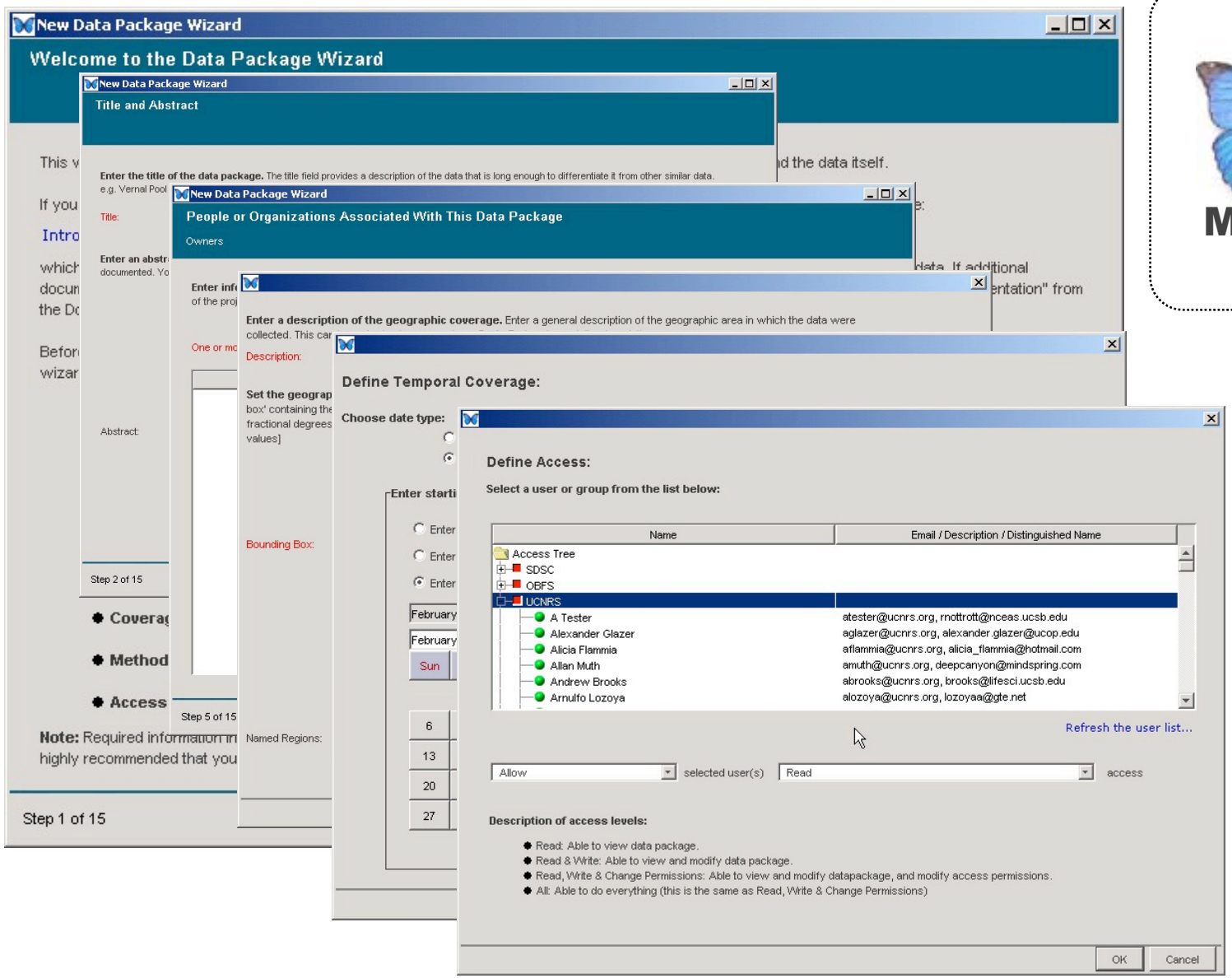


Morpho highlights

- Create metadata in EML format
- Manage data in EML packages
- Save, publish, and share data

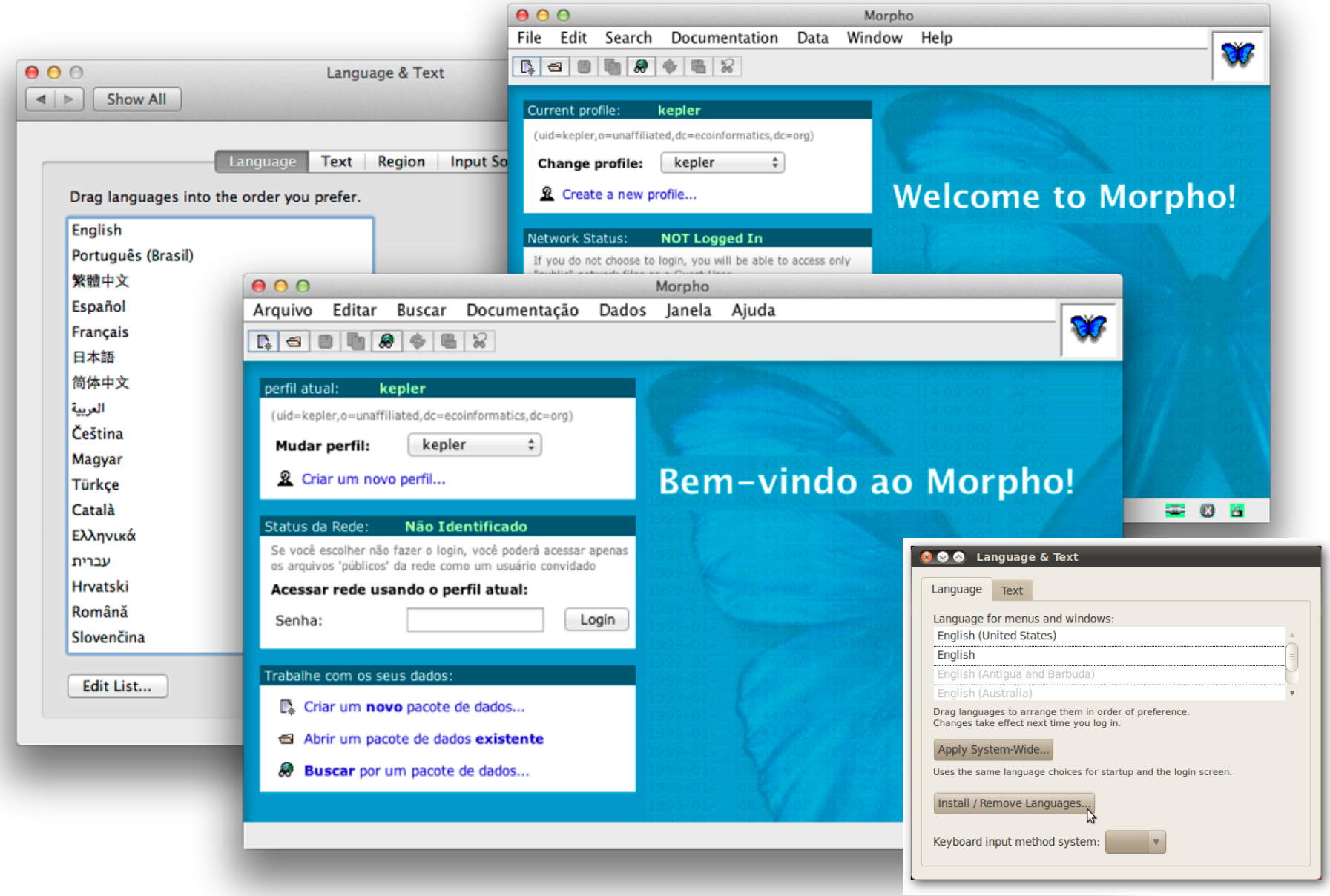
- Search for data
- Multi-language
  - English, Spanish, Chinese, French, **Portuguese**, Japanese
- Export data and metadata
- Cross-platform, and open source

Wizards to create metadata



Morpho

Multilingual support

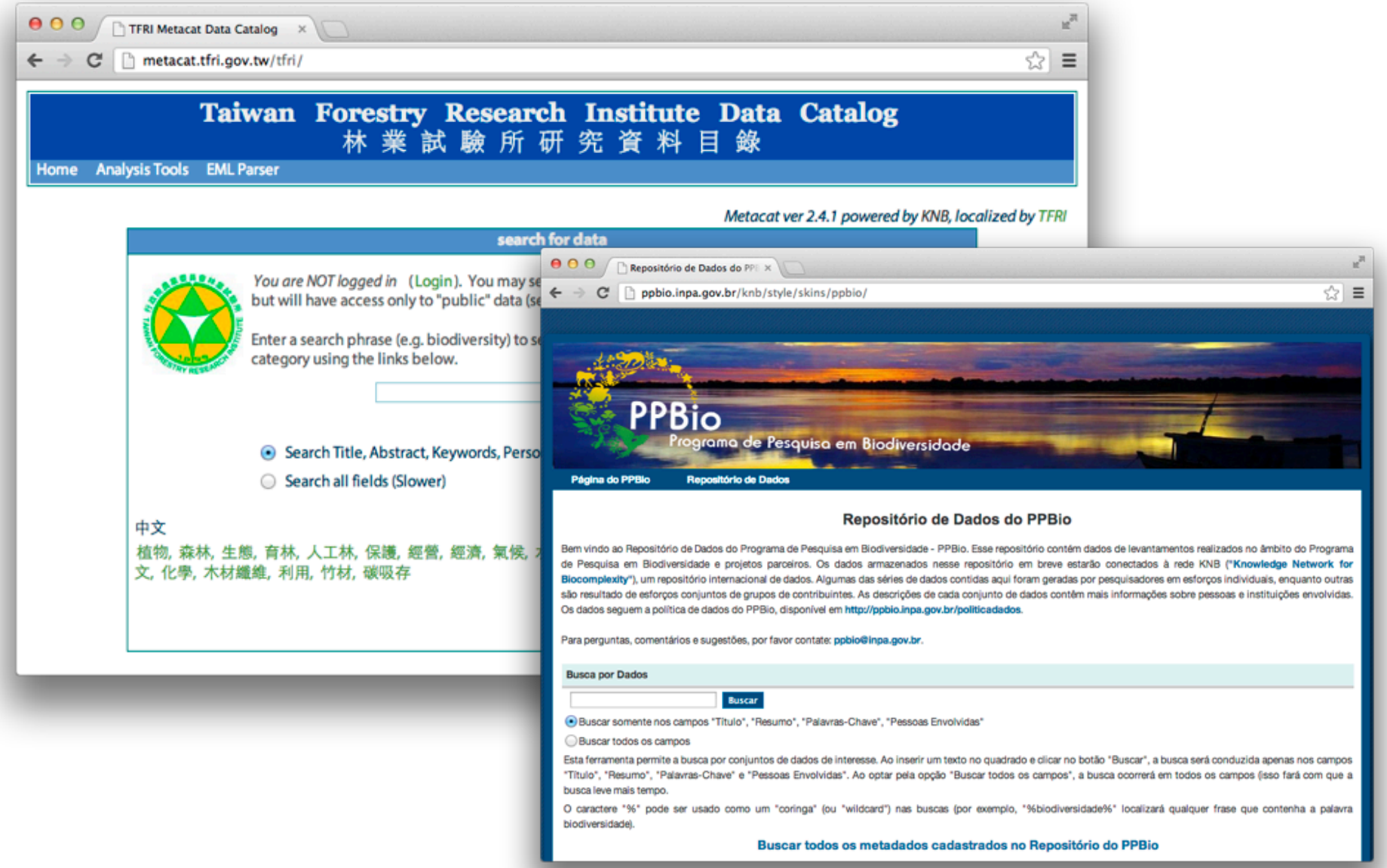


NCEAS

CREATE NETWORKS

Global Metacat deployments

NCEAS


TFRI Metacat Data Catalog
metacat.tfri.gov.tw/tfri/
Taiwan Forestry Research Institute Data Catalog
林業試驗所研究資料目錄
Home
Analysis Tools
EML Parser
Metacat ver 2.4.1 powered by KNB, localized by TFRI
search for data
You are NOT logged in (Login). You may se
but will have access only to "public" data (se
Enter a search phrase (e.g. biodiversity) to s
category using the links below.
Search Title, Abstract, Keywords, Perso
Search all fields (Slower)
中文
植物, 森林, 生態, 育林, 人工林, 保護, 經營, 經濟, 氣候,
文, 化學, 木材纖維, 利用, 竹材, 碳吸存
Repositório de Dados do PP
ppbio.inpa.gov.br/knb/style/skins/ppbio/
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Página do PPBio
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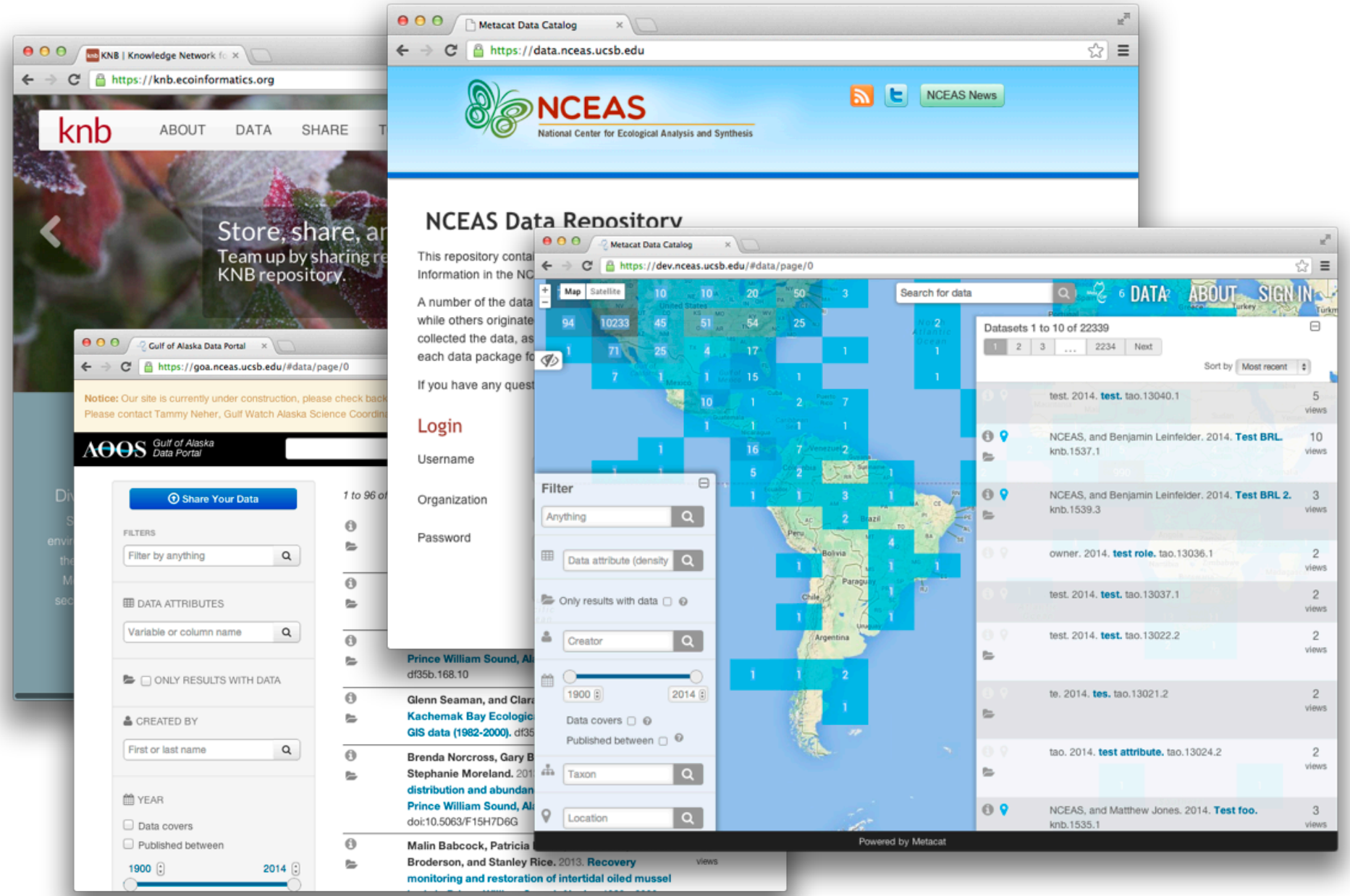
Para perguntas, comentários e sugestões, por favor contate: ppbio@inpa.gov.br.
Busca por Dados
Buscar
Buscar somente nos campos "Título", "Resumo", "Palavras-Chave", "Pessoas Envolvidas"
Buscar todos os campos
Esta ferramenta permite a busca por conjuntos de dados de interesse. Ao inserir um texto no quadrado e clicar no botão "Buscar", a busca será conduzida apenas nos campos "Título", "Resumo", "Palavras-Chave" e "Pessoas Envolvidas". Ao optar pela opção "Buscar todos os campos", a busca ocorrerá em todos os campos (isso fará com que a busca leve mais tempo.
O caractere "%" pode ser usado como um "coringa" (ou "wildcard") nas buscas (por exemplo, "%biodiversidade%" localizará qualquer frase que contenha a palavra biodiversidade).
Buscar todos os metadados cadastrados no Repositório do PPBio

UI Themes


KNB | Knowledge Network
https://knb.ecoinformatics.org
knb
ABOUT
DATA
SHARE
Store, share, ar
Team up by sharing re
KNB repository.
Gulf of Alaska Data Portal
https://goa.nceas.ucsb.edu/#data/page/0
Notice: Our site is currently under construction, please check back
Please contact Tammy Neher, Gulf Watch Alaska Science Coordin
AOOS Gulf of Alaska Data Portal
Share Your Data
FILTERS
Filter by anything
DATA ATTRIBUTES
Variable or column name
ONLY RESULTS WITH DATA
CREATED BY
First or last name
YEAR
Data covers
Published between
1900
2014
Metacat Data Catalog
https://data.nceas.ucsb.edu
NCEAS
National Center for Ecological Analysis and Synthesis
NCEAS News
NCEAS Data Repository
This repository contai
Information in the NC
A number of the data
while others originate
collected the data, as
each data package fo
If you have any quest
Login
Username
Organization
Password
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Glenn Seaman, and Clara
Kachemak Bay Ecologic
GIS data (1982-2000). df35
Brenda Norcross, Gary B
Stephanie Moreland. 201
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Prince William Sound, Al
doi:10.5063/F15H7D6G
Malin Babcock, Patricia
Broderson, and Stanley Rice. 2013. Recovery
monitoring and restoration of intertidal oiled mussel
views
Metacat Data Catalog
https://dev.nceas.ucsb.edu/#data/page/0
Map
Satellite
Search for data
DATA
ABOUT
SIGN IN
Datasets 1 to 10 of 22339
1
2
3
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2234
Next
Sort by
Most recent
test. 2014. test. tao.13040.1
5 views
NCEAS, and Benjamin Leinfelder. 2014. Test BRL.
knb.1537.1
10 views
NCEAS, and Benjamin Leinfelder. 2014. Test BRL 2.
knb.1539.3
3 views
owner. 2014. test role. tao.13036.1
2 views
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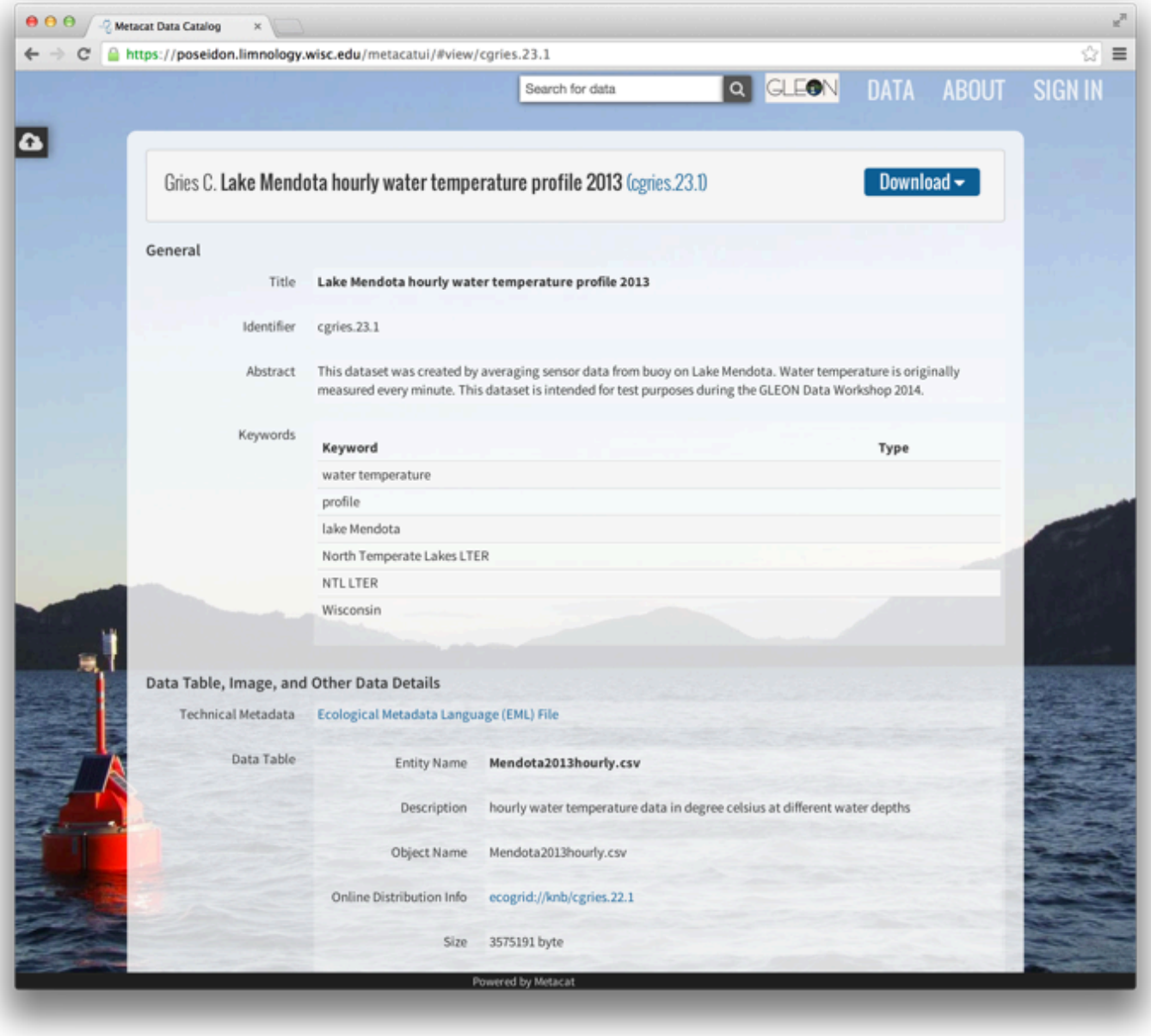
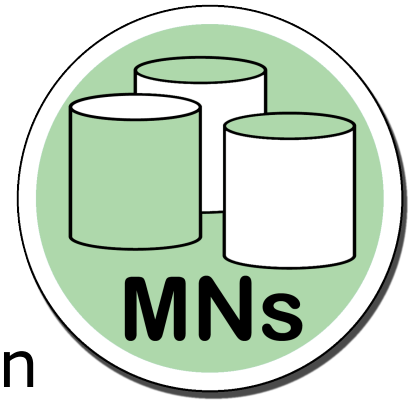
2 views
NCEAS, and Matthew Jones. 2014. Test foo.
knb.1535.1
3 views
Filter
Anything
Data attribute (density
Only results with data
Creator
1900
2014
Data covers
Published between
Taxon
Location
Powered by Metacat

GLEON Data Catalog

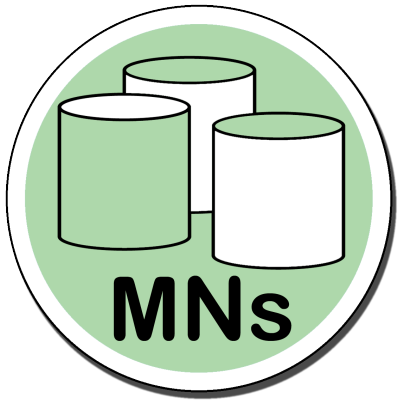


Member Nodes



- **Authoritative** members of the Federation
- **Curate** data holdings
  - *Provide unique identifiers for each object*
  - *Ensure availability, quality, and reliability*
- **Replicate** holdings for other MNs
- Provide access and **access control**
- **Log** and report accesses to objects
- Engage with DataONE community
- Deploy DataONE-compatible software systems

Member Nodes



Avian Knowledge Network

...and many more!

DataONE

About | Participate | Resources | Education | Data

ONEMercury — *A DataONE Search Tool for Scientific Data*

Search For:

Hint: boolean operators and phrases are allowed. ex: precipitation or (rain and "moisture content")

Results/Page: 10 SEARCH

Show/Hide Advanced Options | Help

Fielded Search

FullText | OR
FullText | OR
FullText

Help | clear

Date Search

Collection Date / Publication Date / Either

during — thru

mm/dd/yyyy — mm/dd/yyyy

Help | clear

Geographic Search

List Areas in: USA / WORLD

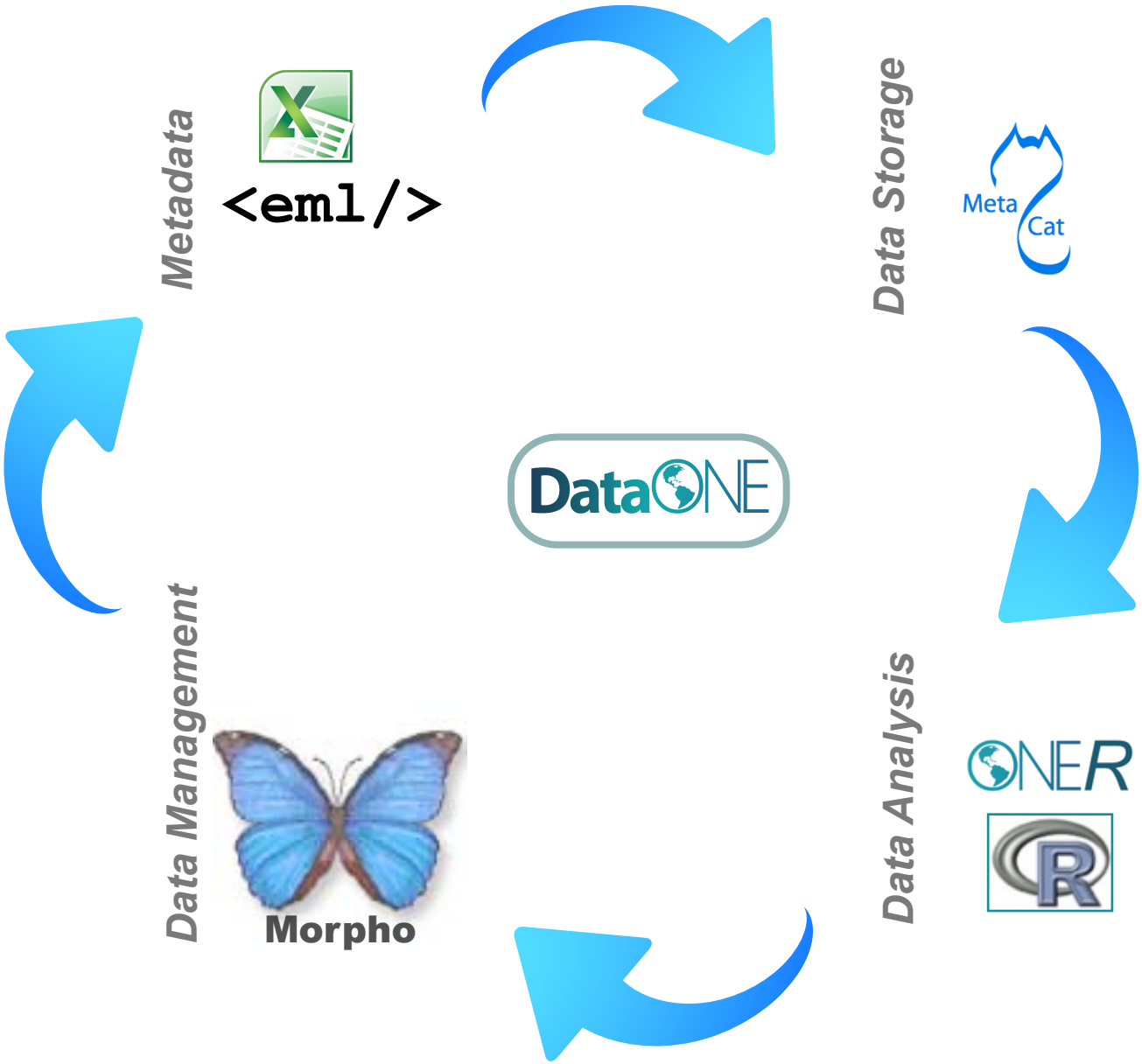
Select from list

Search Area: overlaps / encloses

North

CREATE INTEROPERABLE SOFTWARE

Data life-cycle



KNB System Components

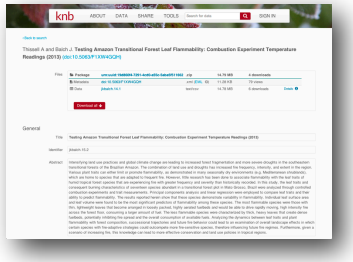
Document → **Share** → **Analyze** → **Communicate**

Morpho

Meta Cat

ONE*R*

W E B



Metadata → **Data** → **Workflows** → **Results**

Data Registration Activity

- Create an account
  - https://poseidon.limnology.wisc.edu/metacatui/#signup
  - or
  - https://identity.nceas.ucsb.edu/

- Register a dataset!
  - https://poseidon.limnology.wisc.edu/metacatui/#share

Questions?

- Contact:
  - Ben Leinfelder <leinfelder@nceas.ucsb.edu>
  - Matt Jones <jones@nceas.ucsb.edu>

- Links
  - http://www.nceas.ucsb.edu/ecoinfo/
  - https://knb.ecoinformatics.org/
  - http://www.dataone.org