HIVE: Enabling Common Language and Interdisciplinarity

EPA-NIEHS Advancing Environmental Health Data Sharing and Analysis: Finding a Common Language

June 25, 2013

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Overview

- Languages of aboutness
- Ontology
- Vocabulary challenge(s) *re* … scientific data
- HIVE—Helping Interdisciplinary Vocabulary Engineering
- Conclusions, Q & A

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Languages for aboutness

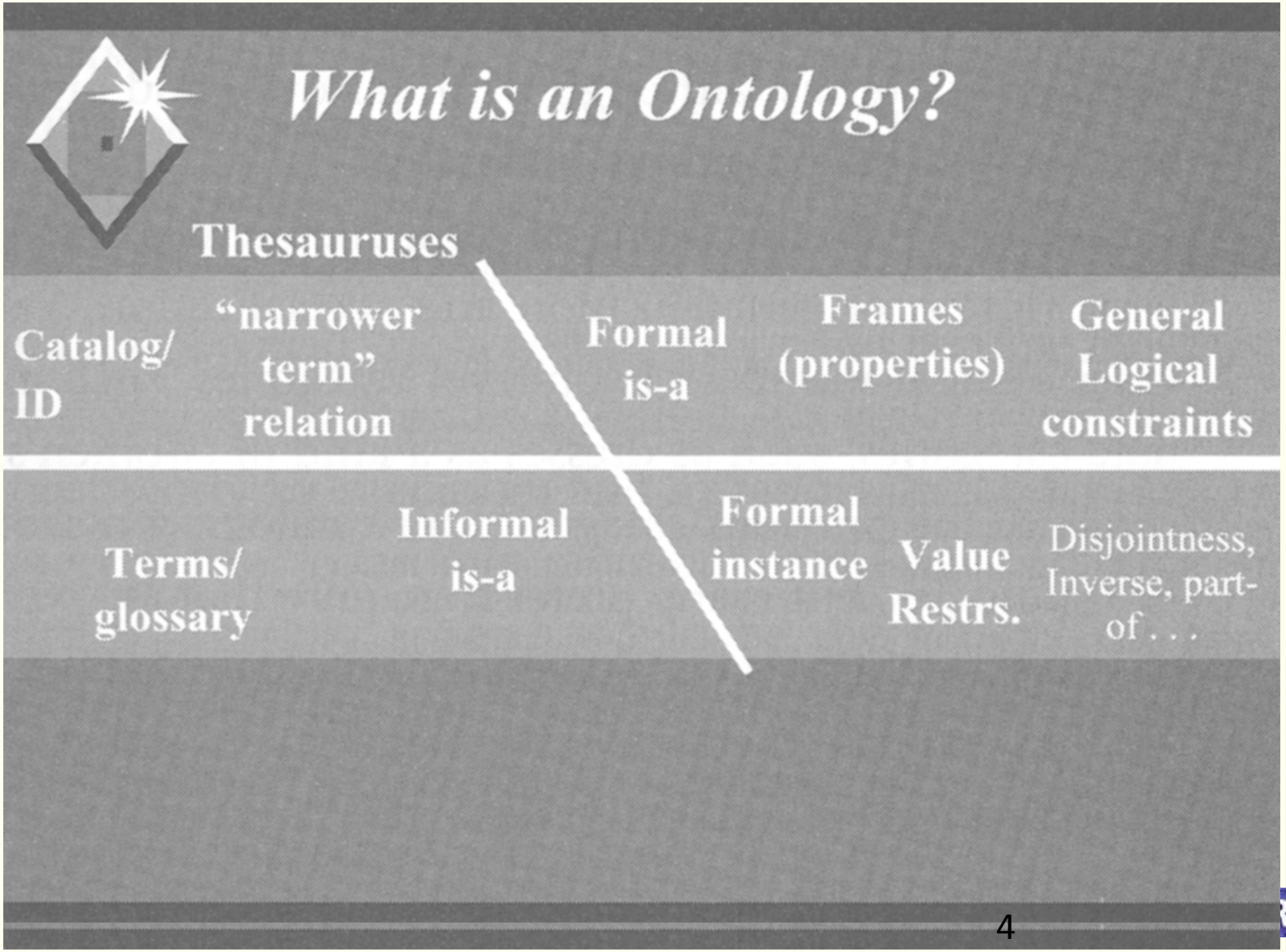
A Language

- A systematic arrangement of concepts
- What makes a language systematic?
- What makes an indexing language systematic?

Advantages & disadvantages

- Discovery
- Communication
- Interoperability
- Browsing, serendipity
- Context, grouping
- Overview of the scope of a service
- Partitioning / Segmenting (facets)
- Multilingual access
- Known by users
- Machine processing
- Costly
- Stagnant/difficulty in adding new concepts.

(McGuinness, D. L. (2003). Ontologies Come of Age. In Fensel, et al, *Spinning the Semantic Web*. (Cambridge, MIT Press), pp. 175. [see also, p. 181 + 189])



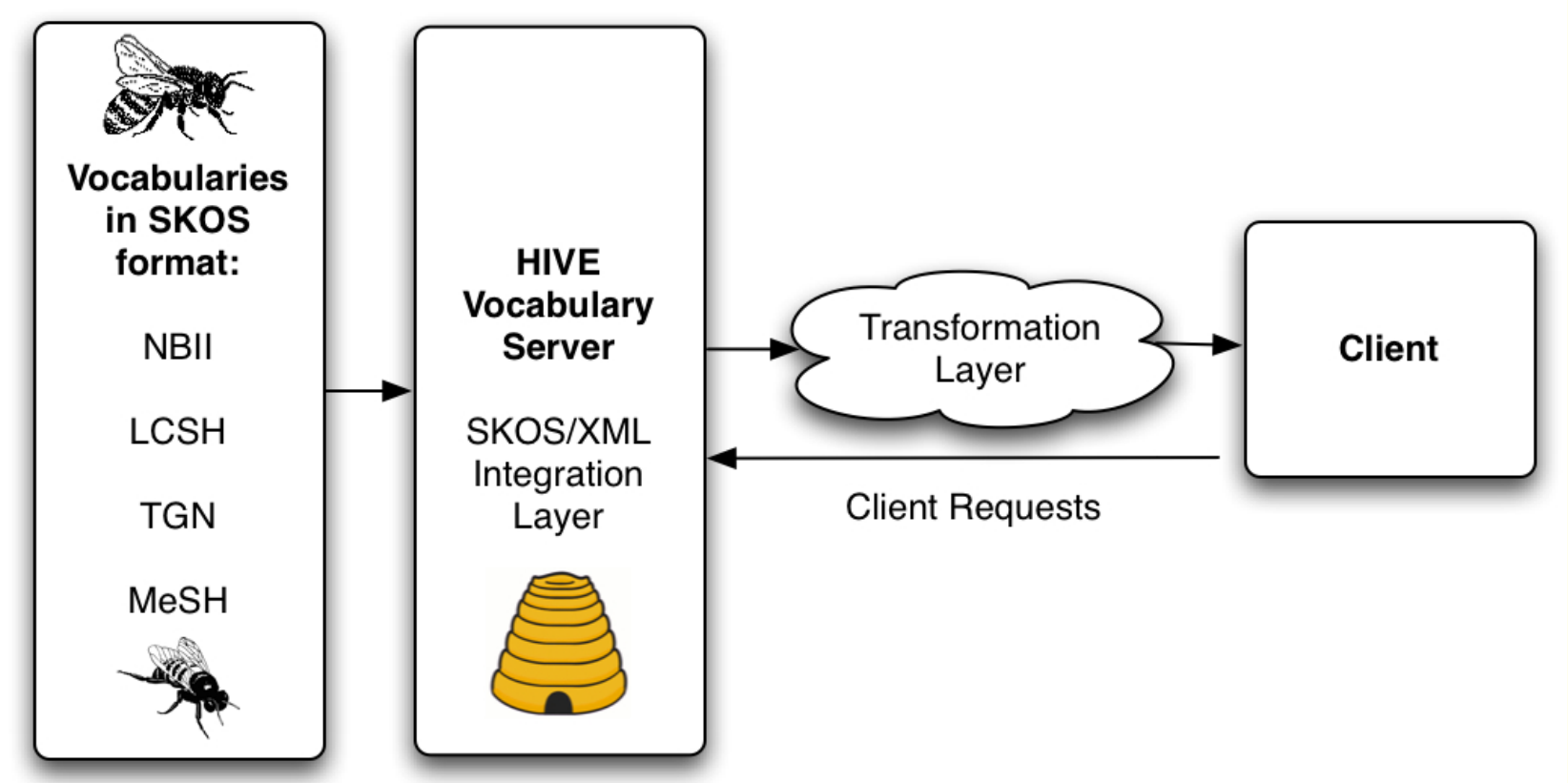
Vocabulary challenge(s) and scientific data management

- Research Challenge

  Apply standard vocabulary terms to data in collections to improve organization and discovery

- Applications needed to…
  - Help researchers select appropriate terms for describing data sets
  - Integrate terminology selection with data ingestion tools
  - Apply standard vocabularies and not reinvent the wheel

HIVE model



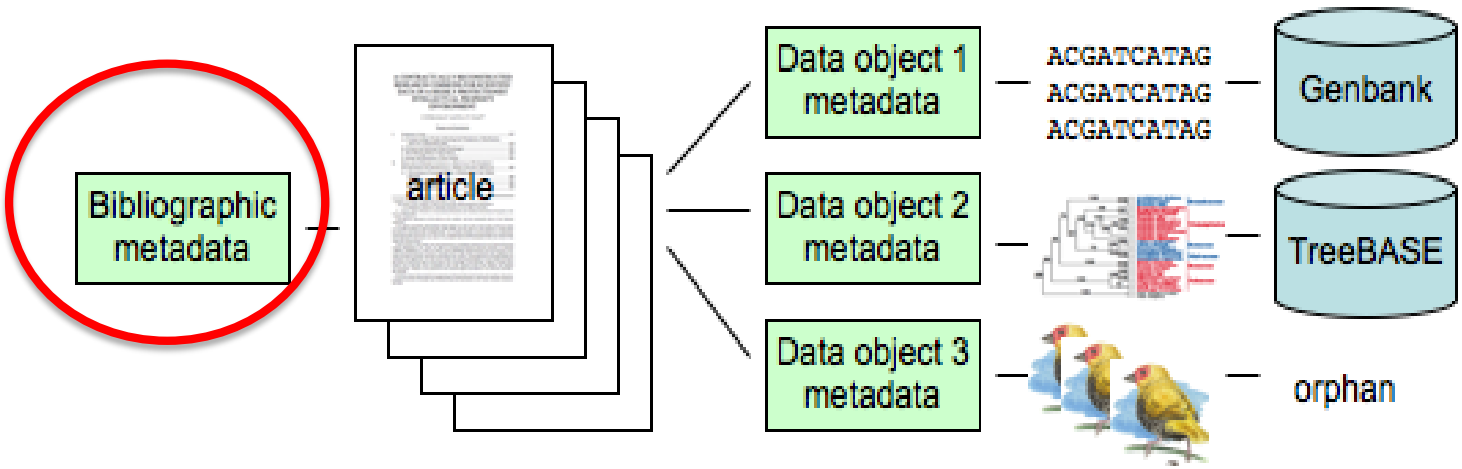
- <AMG> approach for integrating discipline CVs
- Model addressing C V cost, interoperability, and usability constraints (interdisciplinary environment)

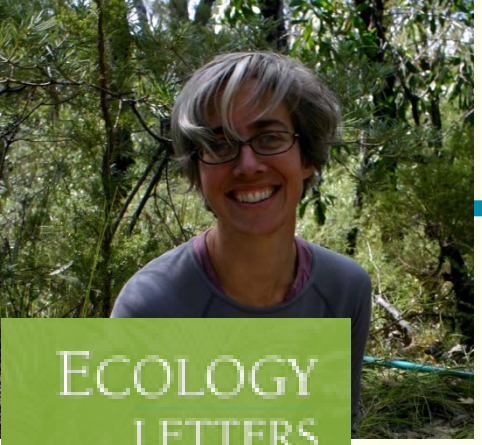
Dryad…nonprofit organization and an international repository of data underlying scientific and medical publications

Results from study with 600 keywords

- 431 **topical** terms, exact matches: NBII Thesaurus, 25%; MeSH, 18%
- 531 terms (**topical terms, research method and taxon**): LCSH, 22% found exact matches, 25% partial

Conclusion: Need multiple vocabularies





~~~~Amy

- Meet Amy Zanne. She is a botanist.
- Like every good scientist, she publishes, and she deposits data in Dryad.

Amy's data

Family	Binomial	A (mm^2)	F (mm^2/mm^2)	N (mm^-2)	S (mm^4)
Caprifoliaceae	Abelia biflora	0.002375829	0.924197654	389.0	6.10753E-06
Caprifoliaceae	Abelia dielsii	0.00115375	0.357418211	331.0	3.48565E-06
Caprifoliaceae	Abelia integrifolia	0.001134115	0.240432369	212.0	5.3496E-06
Caprifoliaceae	Abelia mosanensis	0.000855299	0.632065665	739.0	1.15737E-06
Caprifoliaceae	Abelia serrata	0.000706858	0.206402637	292.0	2.42075E-06
Caprifoliaceae	Abelia spathulata	0.000804248	0.230819095	287.0	2.80226E-06
Malvaceae	Abutilon fruticosum	0.001452201	0.137959114	95.0	1.52863E-05
Malvaceae	Abutilon pannosum	0.003117245	0.124689812	40.0	7.79311E-05
Fabaceae	Acacia albida	0.012271846	0.049087385	4.0	0.003067962
Fabaceae	Acacia ataxacantha	0.013069811	0.169907541	13.0	0.00100537
Fabaceae	Acacia borleae			15.0	0.000271434
Fabaceae	Acacia burkei			6.0	0.001498671
Fabaceae	Acacia caffra			21.0	0.000486049
Fabaceae	Acacia cyanophylla			22.0	0.000416404
Fabaceae	Acacia davyi	0.008332289	0.099987469	12.0	0.000694357
Fabaceae	Acacia erioloba	0.015174678	0.091048067	6.0	0.002529113
Fabaceae	Acacia erubescens	0.008824734	0.07059787	8.0	0.001103092
Fabaceae	Acacia exuvialis	0.001134115	0.018145839	16.0	7.08822E-05
Fabaceae	Acacia galpinii	0.012076282	0.096610257	8.0	0.001509535
Fabaceae	Acacia gerrardii	0.011574413	0.098023581	7.5	0.001543255
Fabaceae	Acacia grandicornuta	0.006503882	0.045527175	7.0	0.000929126
Fabaceae	Acacia haematoxylon	0.005026548	0.095504417	19.0	0.000264555

HIVE
Vocabulary Server

Helping with Interdisciplinary Vocabulary Engineering

Home | Concept Browser | Indexing

Opened vocabularies: ✕NBII ✕LCSH ✕AGROVOC +Add

wood Search

NBII | LCSH | AGROVOC

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [0-9]

- Abundance (organisms)
- Accidents
- Accumulation
- Action potential
- Activity
- Adherence
- Administration (drugs)
- Aeration
- Age (biology)
- Age (geology)
- Agents
- Agricultural products
- Agriculture
- Air masses
- Airports
- Algorithms
- Allergenicity
- Analysis
- Anesthesia
- Animal products
- Antigen-antibody complexes

Your search for wood returns following concepts:

AGROVOC Improved wood
LCSH Wood--Identification
LCSH Wood, Compressed
LCSH Compression wood
LCSH Wood distillation
LCSH Wood--Deterioration
LCSH Fireproofing of wood
LCSH Simulated wood
LCSH Wood--Color
LCSH Wood--Microbiology
LCSH Wood flour
LCSH Wood--Research
LCSH Wood--Utilization
NBII Wood pulp
AGROVOC Wood residues
AGROVOC Wood properties

Filter the result
- ☑ AGROVOC
- ☑ LCSH
- ☑ NBII

NBII->Wood pulp

View in SKOS

Preferred Label	Wood pulp
URI	http://thesaurus.nbii.gov/nbii#Wood-pulp
Alternative Label	Pulp (wood);
Broader Concepts	Wood
Narrower Concepts	This concept does not have narrower terms.
Related Concepts	Paper Pulp mills Sawdust Paper industry wastes

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HIVE vocabulary server provides functionality to identify concepts from given document or text. You need only two easy steps to get the concepts that are relevant to your document:

- Step 1:Select the vocabulary source
- Step 2:Upload your document **OR** Enter the URL of your document

HIVE Automatic Concepts Extractor

Step 1: Select vocabulary source ✕AGROVOC ✕LCSH ✕NBII Select

Step 2: Upload a document Browse... Upload

OR Enter the URL

Powered by KEA keyphrase extraction algorithm

Start Processing

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Ecology Letters, (2009) **12**: 351–366 doi: 10.1111/j.1461-0248.2009.01285.x

REVIEW AND SYNTHESIS

Towards a worldwide wood economics spectrum

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Abstract

Wood performs several essential functions in plants, including mechanically supporting aboveground tissue, storing water and other resources, and transporting sap. Woody tissues are likely to face physiological, structural and defensive trade-offs. How a plant optimizes among these competing functions can have major ecological implications, which have been under-appreciated by ecologists compared to the focus they have given to leaf function. To draw together our current understanding of wood function, we identify and collate data on the major wood functional traits, including the largest wood density database to date (8412 taxa), mechanical strength measures and anatomical

Extracted Concepts Cloud

AGROVOC
LCSH
NBII

Reaction wood Wood--Figure Wood--Discoloration Calavicci, Al (Fictitious character) Lāt, al- (Arabian deity) Murphy, Al (Fictitious character) Density Soils--Density Population density Recessive traits Traits (genetics) Dominant traits Associated species Species diversity Numbers of species Plant anatomy Plant litter Plant condition Leaf spots Leaf prints Leaf blowers Brushes, Carbon Electrodes, Carbon Carbon taxes Growth Fetus--Growth Growth (Plants) Infiltration water Water-- Color Drinking water

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About HIVE…

Goal	Plan	Vocabulary Partners	Workshop Hosts
• Provide efficient, affordable, interoperable, and user friendly access to multiple vocabularies during metadata creation activities • Present a **model** and an **approach** that can be replicated ▪—> not necessarily a service	Build Plan Evaluate	• Library of Congress: LCSH • Getty Research Institute (GRI): TGN (Thesaurus of Geo. Names) • United States Geological Survey (USGS): NBII Thesaurus, Integrated Taxonomic Information System (ITIS) • National Library of Medicine and the • National Agricultural Library • FAO	• Columbia Univ. • Univ. of California, San Diego • George Washington University • Univ. of North Texas • Universidad Carlos III de Madrid, Madrid, Spain

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Welcome to HIVE!

Helping Interdisciplinary Vocabulary Engineering(HIVE) is an IMLS funded project involving the Metadata Research Center (MRC) at the School of Information and Li University of North Carolina at Chapel Hill, and the National Evolutionary Synthesis Center (NESCent) in Durham, North Carolina. Below you will find our experim functioning HIVE system. You are welcome to try our SKOS-based system by browsing concepts from interdisciplinary vocabularies or experience a new approac metadata generation by using the indexing feature.

Search a Concept

Browse and search concepts in selected vocabularies.

Index a Document

Automatically extract document concepts for subject metadata creation.

This HIVE system is for demo purposes and may change in response to your feedback. Contact us

UNC SCHOOL OF INFORMATION AND LIBRARY SCIENCE
Metadata Research Center <MRC>
NESCent

Vocabulary Statistics

Vocabulary	Concepts	Relationships	Last Updated
AGROVOC	28174	83086	Jun 12, 2011
ITIS	391775	783438	Aug 21, 2011
LCSH	406631	541623	Aug 3, 2011
MeSH	25610	76649	Aug 21, 2011
NBII	8680	46432	Jun 12, 2011
TGN	895197	1799154	Jun 13, 2011

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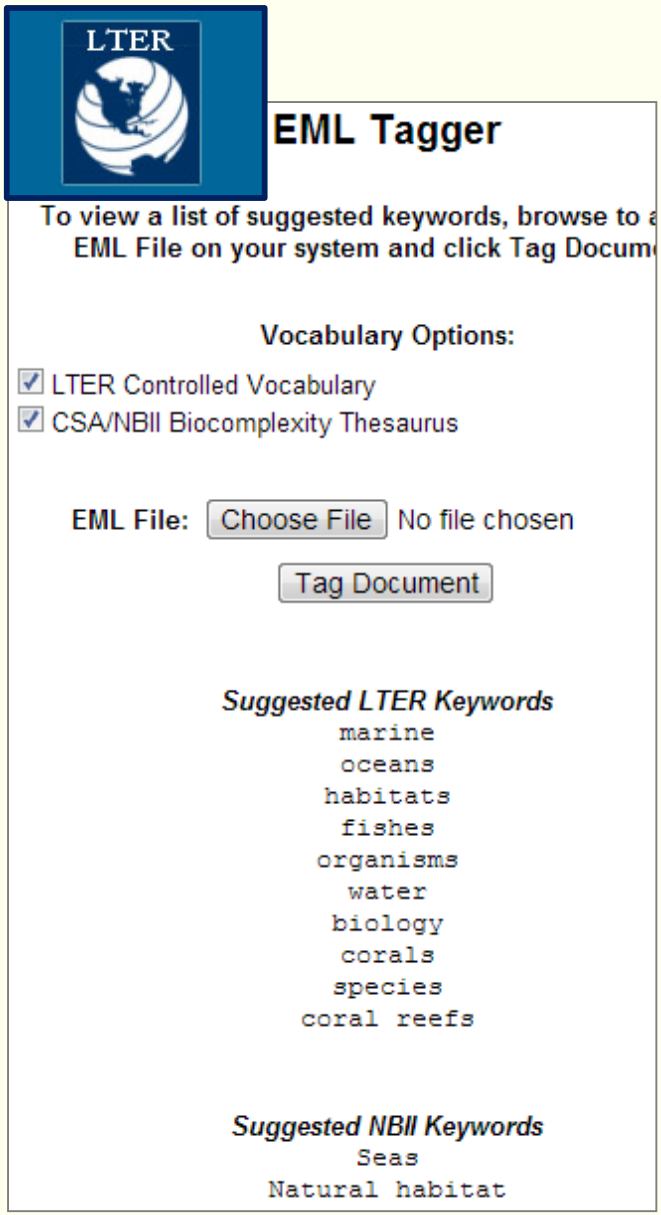
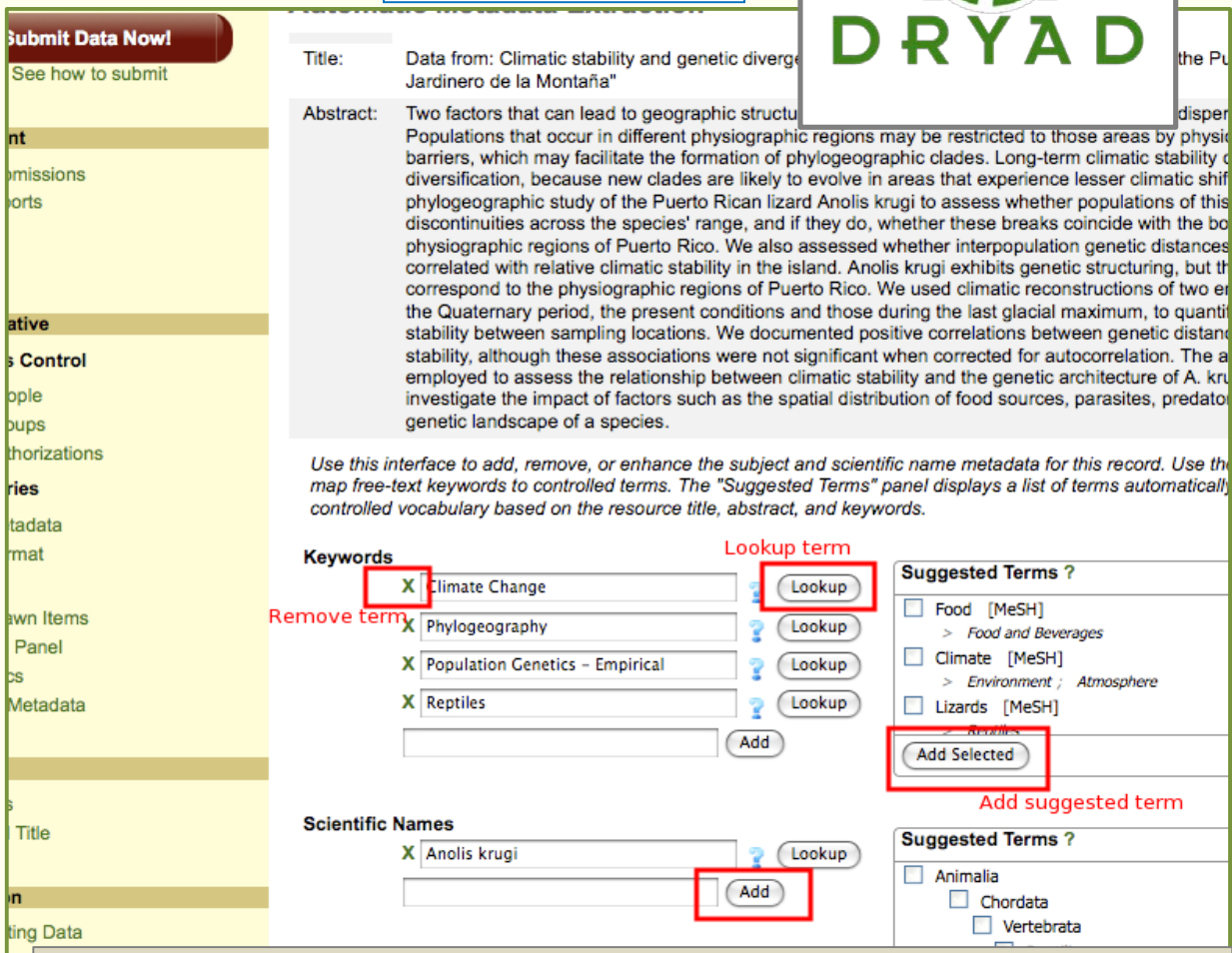
HIVE in LTER, Dryad,…





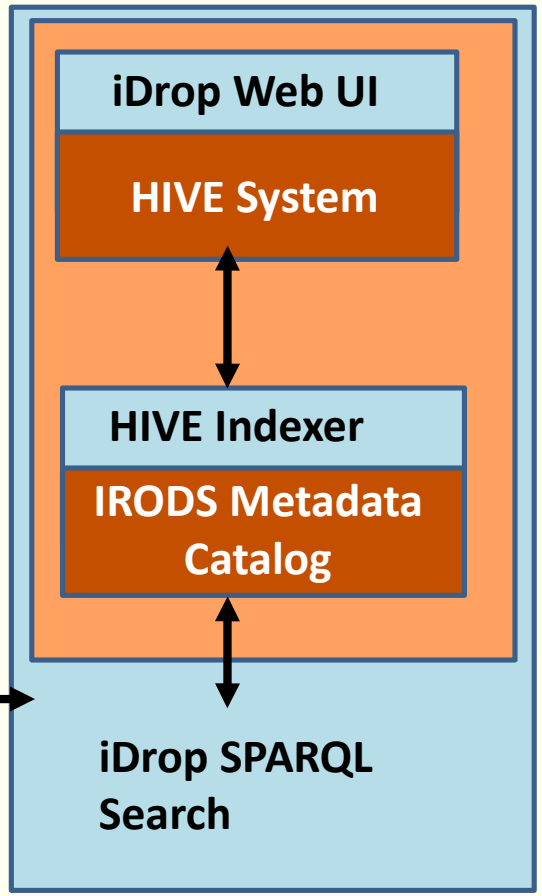
- Library of Congress Web Archives Minerva project
- Smithsonian Field Notebook project
- US Geological Survey, USGS Thesaurus
- Universidad Carlos III de Madrid (UC3M)
- Inst. Legal Information Theory & Techniques, NRC, Italy

HIVE/iRODS Integration

Demo

- https://vpn.renci.org/dana/home/index.cgi
- http://centos6.irods.renci.org:8080/idrop-web2
  1. Search HIVE
  2. Index with HIVE
  3. Query via HIVE

User uses SPARQL for rich metadata queries, displaying links to DFC files and collections.



HIVE Across the US DataNets

Survey ~ a framework studying controlled vocabulary use across all DataNets

1. Which controlled vocabularies?
2. Purposes that these controlled vocabularies serve (e.g. subject description of datasets or description of analytical processes or protocols that have been applied to certain datasets)
3. Facilitators and inhibitors of controlled vocabulary use by **data contributors, curators, NSF DataNet Partner administrators, and repository infrastructure developers**

https://unc.qualtrics.com/SE/?SID=SV_3fU0xOeRbH6jntb.

Conclusions

- Controlled vocabularies encourage consistent classification of data
  - With DFC (Datanet Federation Consortium) we'll be addressing findability of data on distributed grids
- HIVE (or the HIVE approach) allows users to search and apply terms from multiple vocabularies
- Common languages can be generated in different ways
  - Emphasize the benefits, and reduce the limitations

- Acknowledgements: Many people, students, IMLS, NSF, etc.

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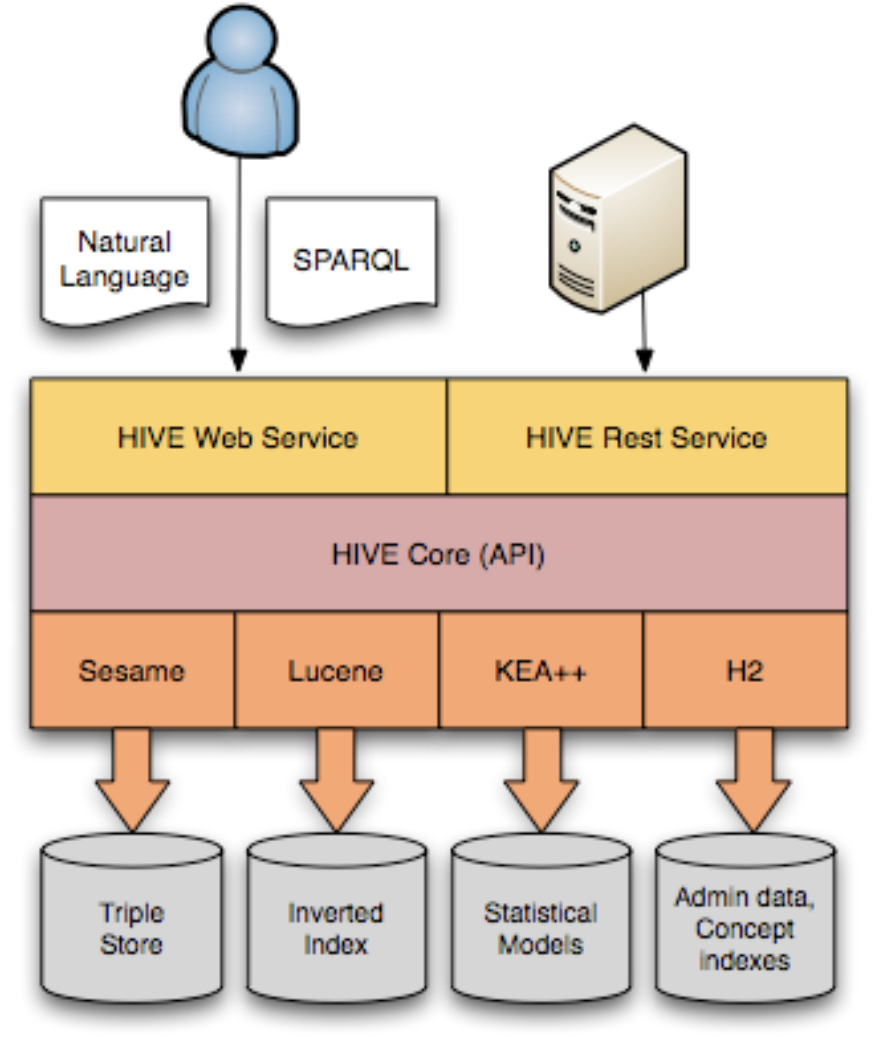
Technical overview and architecture

- HIVE combines several open-source technologies to provide a framework for vocabulary services.
- Java-based web services can run in any Java application server.
- Demonstration website @ RENCI and NESCent
- Open-source Google Code (http://code.google.com/p/hive-mrc/).