Ontology Repositories with the OntoPortal Technology

& a deeper look into AgroPortal

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Embrapa Colloquium - April 24th 2024

Info about this presentation

- ISWC 2023, Athens, Greece
  ➔ November 9th 2023

ISWC 2023
NOVEMBER 6-10
ATHENS-GREECE

- Vocabulary Symposium 2023
  ➔ November 15th 2023


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Ontology Repositories and Semantic Artefact Catalogues with the OntoPortal Technology

Conference paper | Open Access | First Online: 27 October 2023

pp 38–58 | Cite this conference paper

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The Semantic Web – ISWC 2023

(ISWC 2023)

Clement Jonquet, John Graybeal, Syphax Bouazzouni, Michael Dorf, Nicola Fiore, Xeni Kechagioglou, Timothy Redmond, Ilaria Rosati, Alex Skrenchuk, Jennifer L. Vendetti, Mark Musen & members of the OntoPortal Alliance

Part of the book series: Lecture Notes in Computer Science ((LNCS,volume 14266))

Included in the following conference series: International Semantic Web Conference

1381 Accesses 3 Citations

Sections | Figures | References

slideshare

https://fr.slideshare.net/jonquet/ontology-repositories-and-semantic-artefact-catalogues-with-the-ontoportal-technology

Overview

A word on the funding projects and context

A few elements on ontology repositories

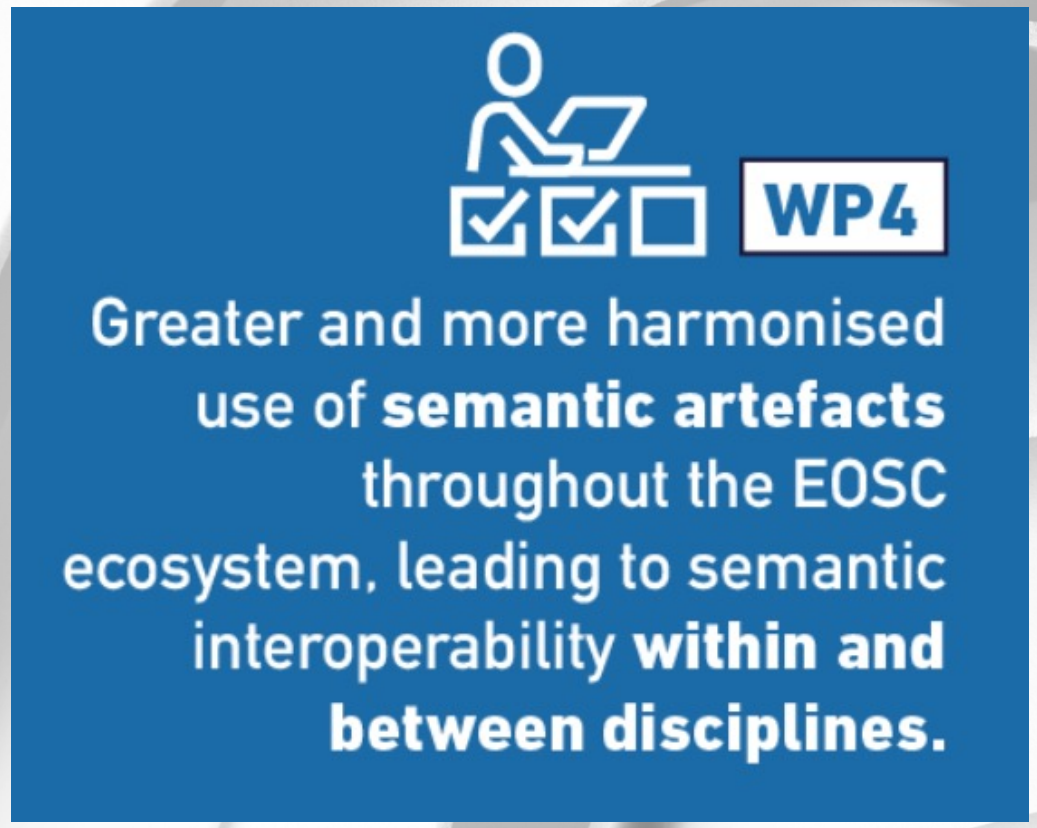
OntoPortal Alliance dedicated to promoting semantic services

A deeper look into AgroPortal

ANR Project D2KAB: Data to Knowledge in Agronomy and Biodiversity (2019-2024)

*Create a framework to **turn agronomy and biodiversity data into knowledge –semantically described, interoperable, actionable, open–** and investigate scientific methods and tools to exploit this knowledge for applications in science & agriculture*

- How: Ontologies & Linked Open Data
  - 1 work-package on building and harnessing knowledge graphs
  - 2 work-packages of driving ag & biodiv projects (food packaging, agro-agri linked data, wheat phenotype, ecosystems & plant biogeography)



eosc | FAIR-IMPACT
Expanding FAIR solutions across EOSC

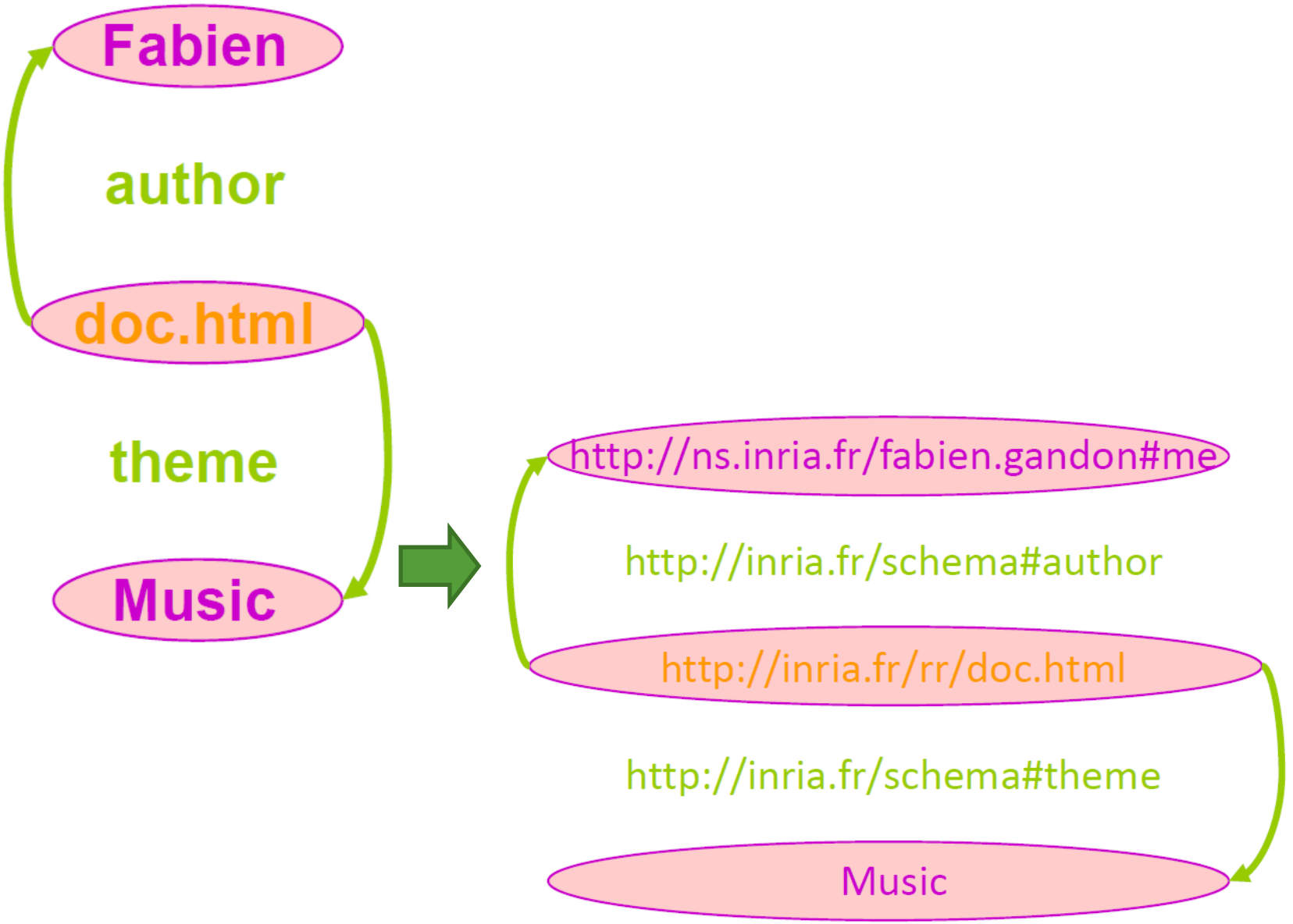
WP4 Metadata and Ontologies

*WP4 will develop and foster the uptake of a semantic **framework** for the governance, creation, mapping, sharing, reuse, FAIRness assessment and interoperability of **semantic artefacts** for EOSC.*

Funded by the European Union

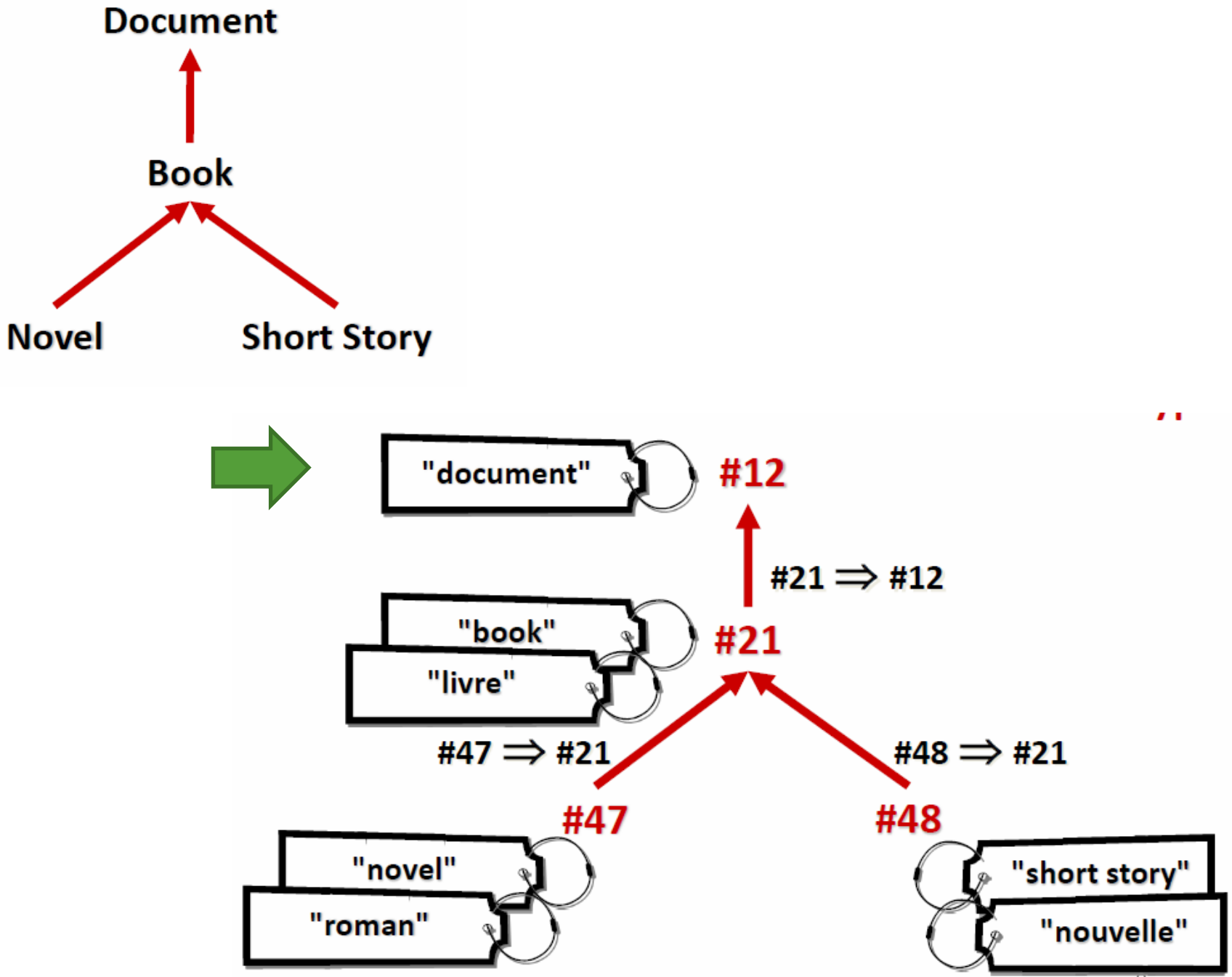
A few elements on ontology repositories

The Semantic Web relies on RDF



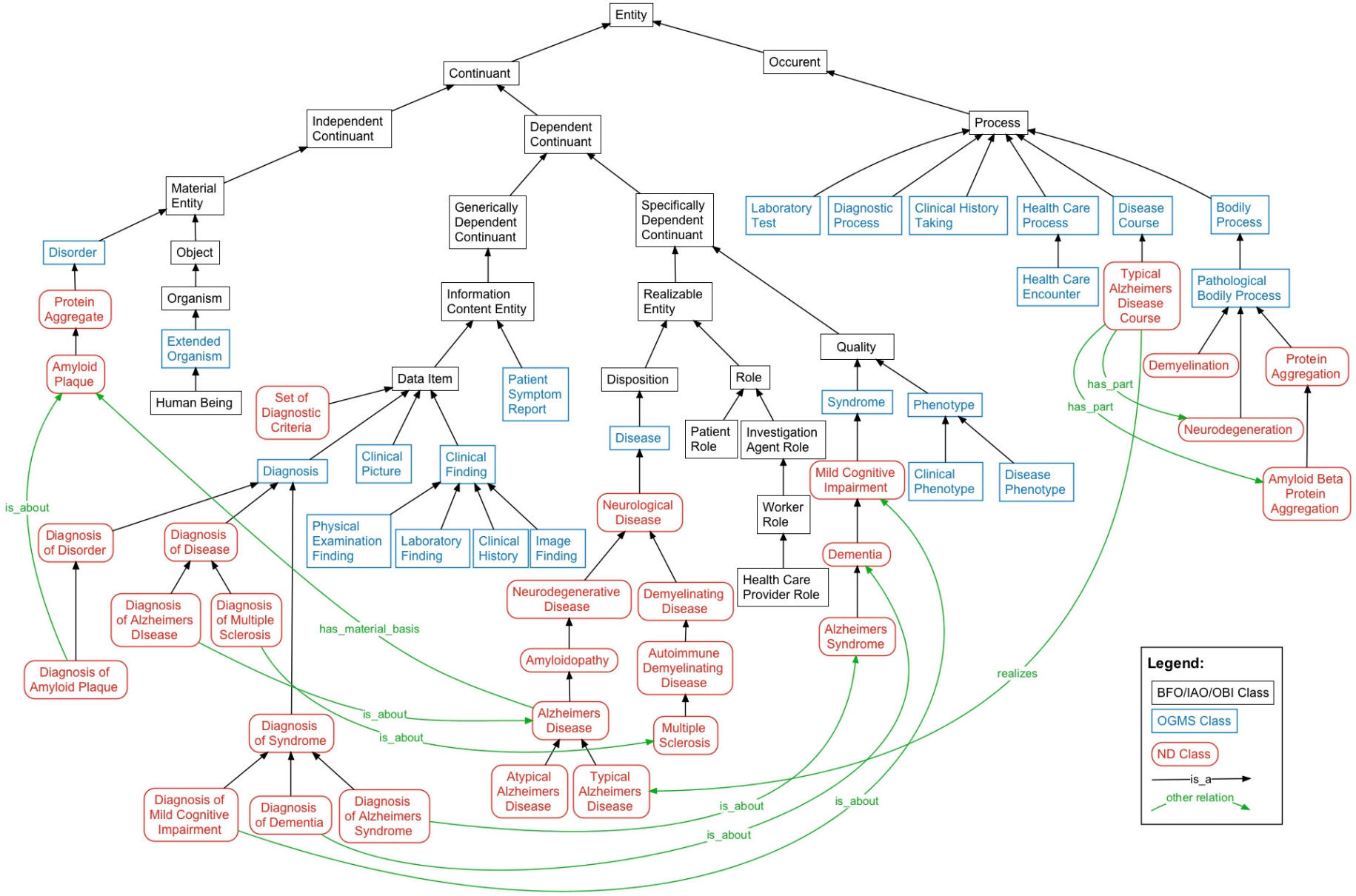
Credit: F. Gandon (Inria)

Ontologies (small)



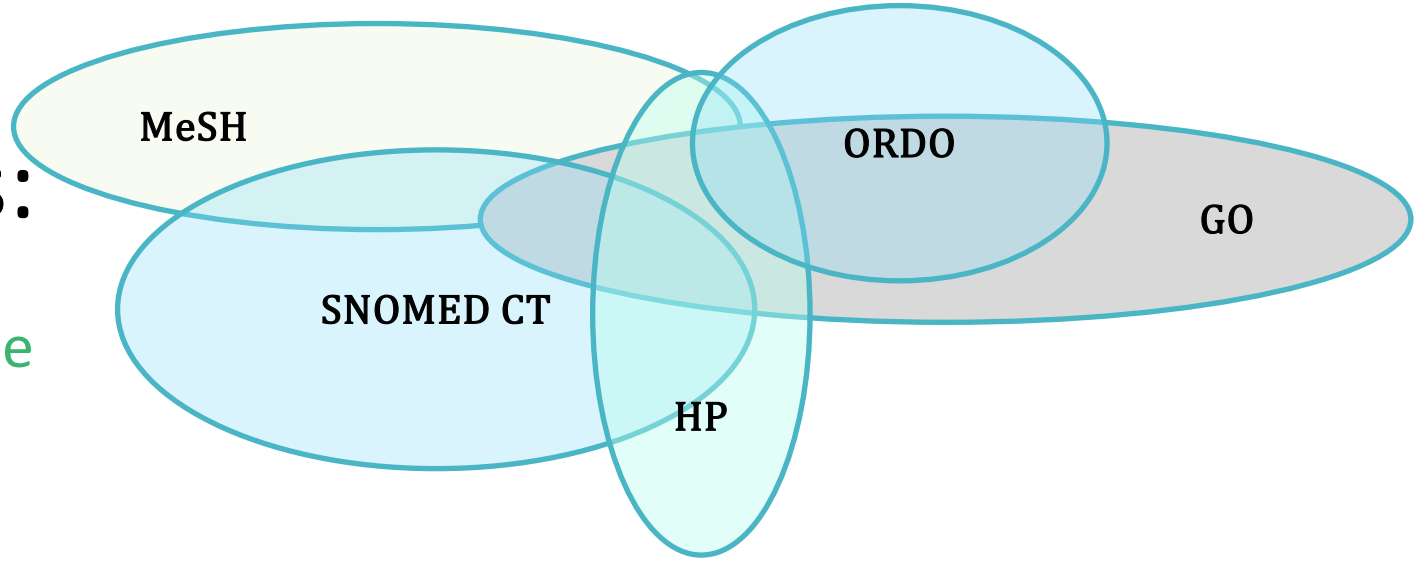
Credit: F. Gandon (Inria)

Ontologies (big)

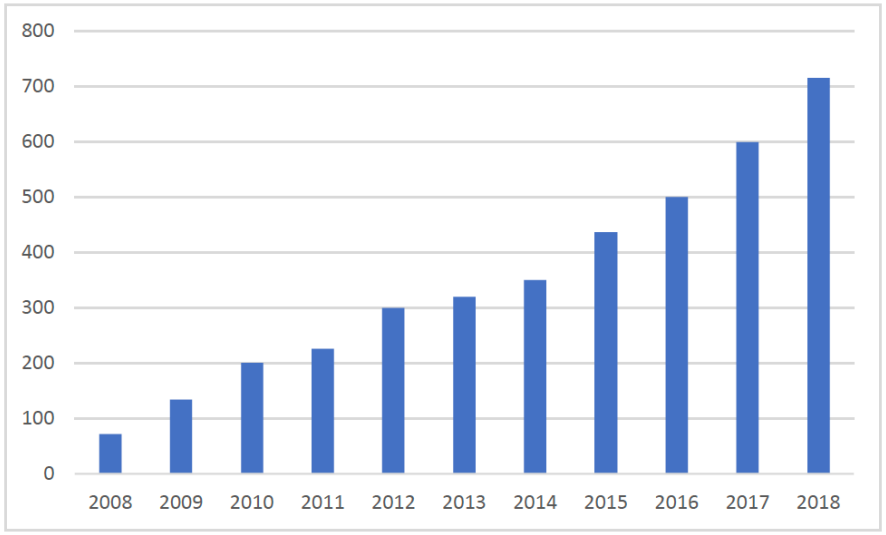


Issues with ontologies:

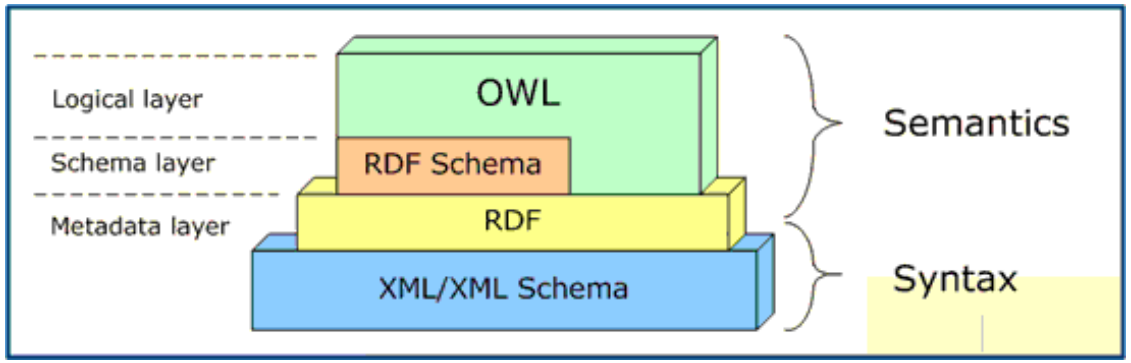
- spread out,
- in different formats, of different size
- with different structures
- increasing number
- overlapping



Overlapping ontologies



Number of ontologies in the NCBO BioPortal



Variety of representation languages

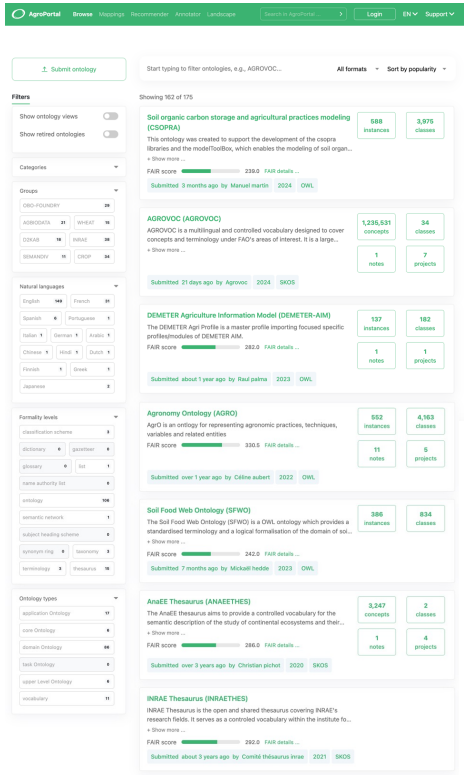
Why ontology repositories are important?

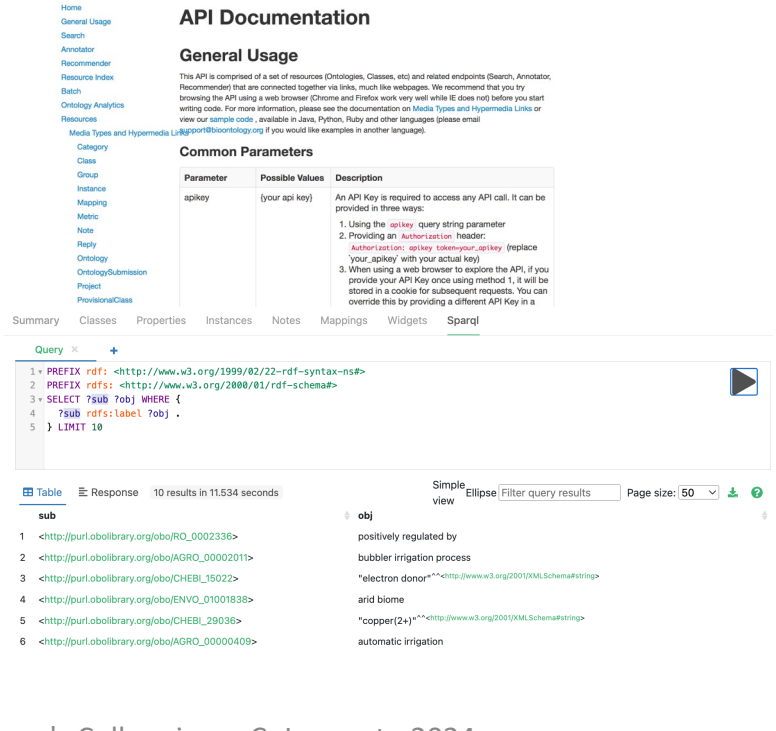
- You've built an ontology, how do you let the world know?
- You need an ontology, where do you go to get it?
- How do you know whether an ontology is any good?

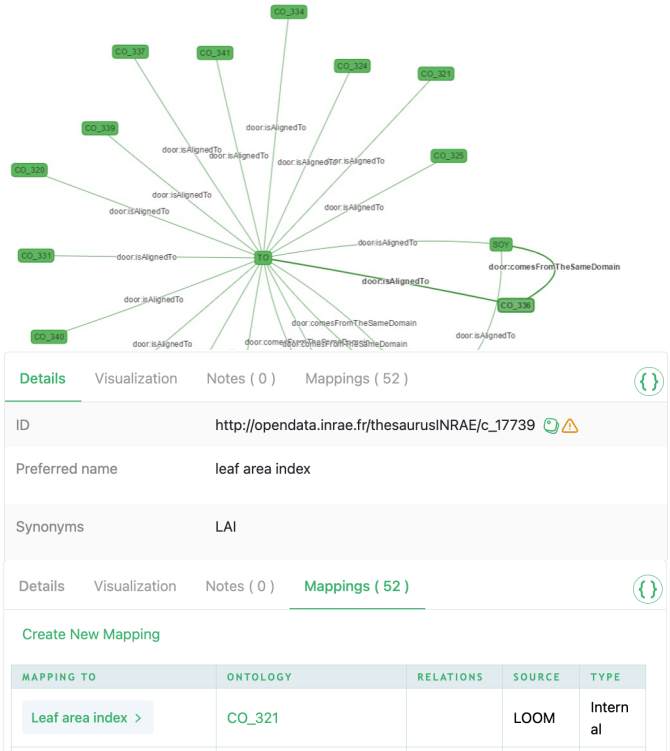
- How do you find data resources that are relevant to the domain of the ontology?
- How could you leverage your ontology to enable new science?
- How could you use ontologies without managing them ?

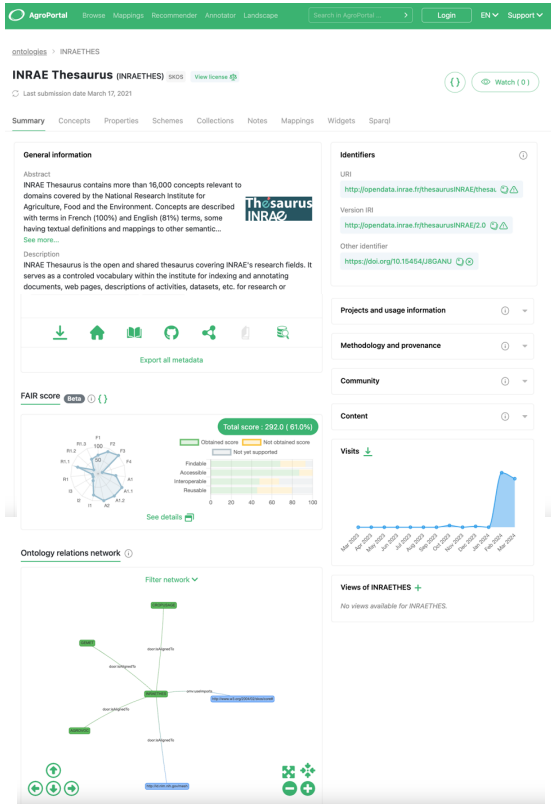
Ontology repositories help to make ontologies FAIR

Findable **A**ccessible **I**nteroperable **R**e-usable



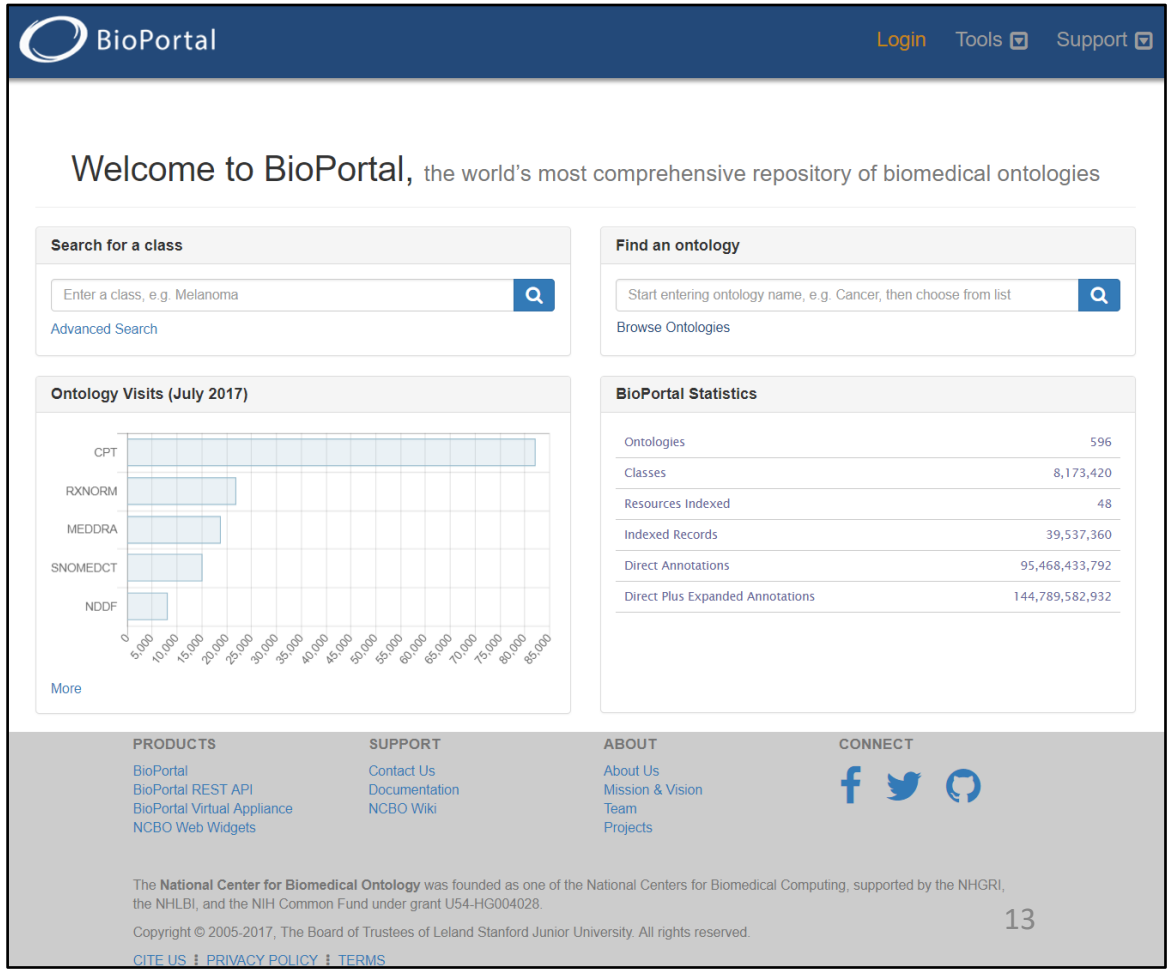


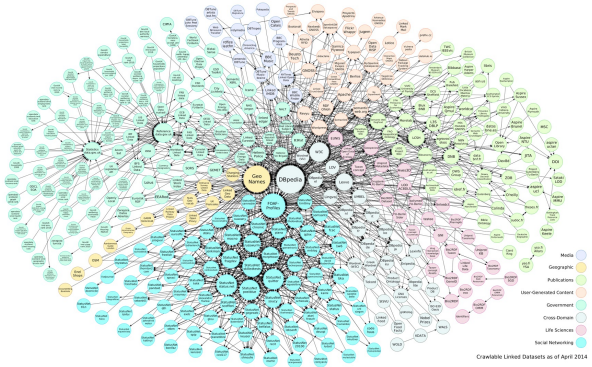




BioPortal : a “one stop shop” for biomedical ontologies

- Web repository for biomedical ontologies
  - Make ontologies accessible and usable – abstraction on format, locations, structure, etc.
  - Users can publish, download, browse, search, comment, align ontologies and use them for annotations both online and via a web services API.

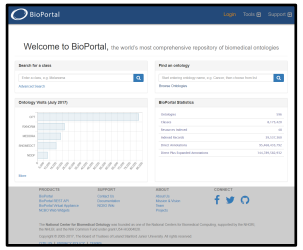




Legend
- Cross Domain
- Geography
- Government
- Life Sciences
- Linguistics
- Media
- Publications
- Social Networking
- User Generated
- Incoming Links
- Outgoing Links

NCBO BioPortal data as of 2013

http://lod-cloud.net



http://bioportal.bioontology.org

Ontology Services
- Search
- Traverse
- Comment
- Download

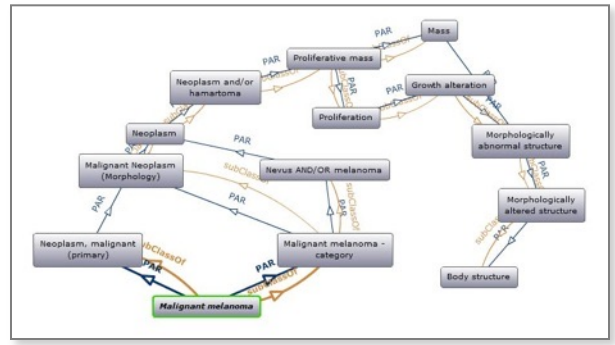
Mapping Services
- Create
- Upload
- Download

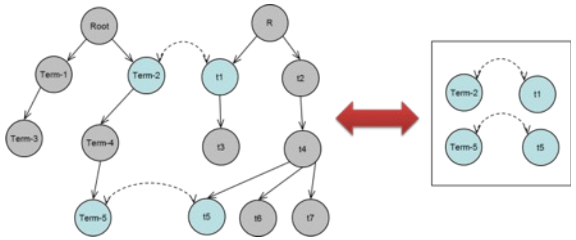
Widgets
- Tree-view
- Auto-complete
- Graph-view

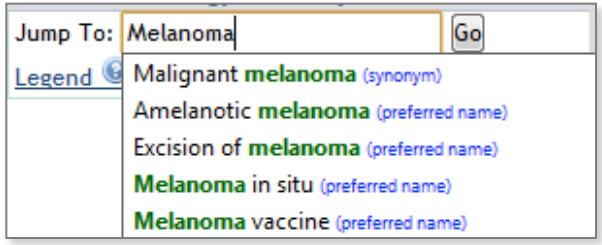
Annotation → Term recognition

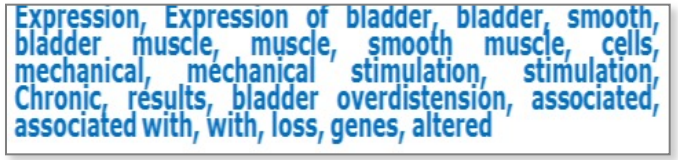
Data Access → Search "data" annotated with a given term

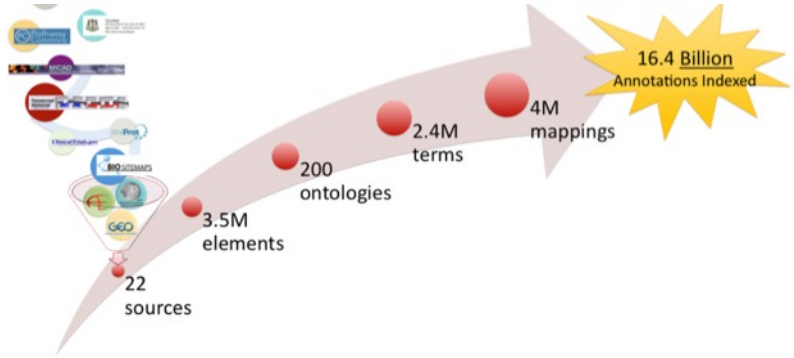
http://data.bioontology.org





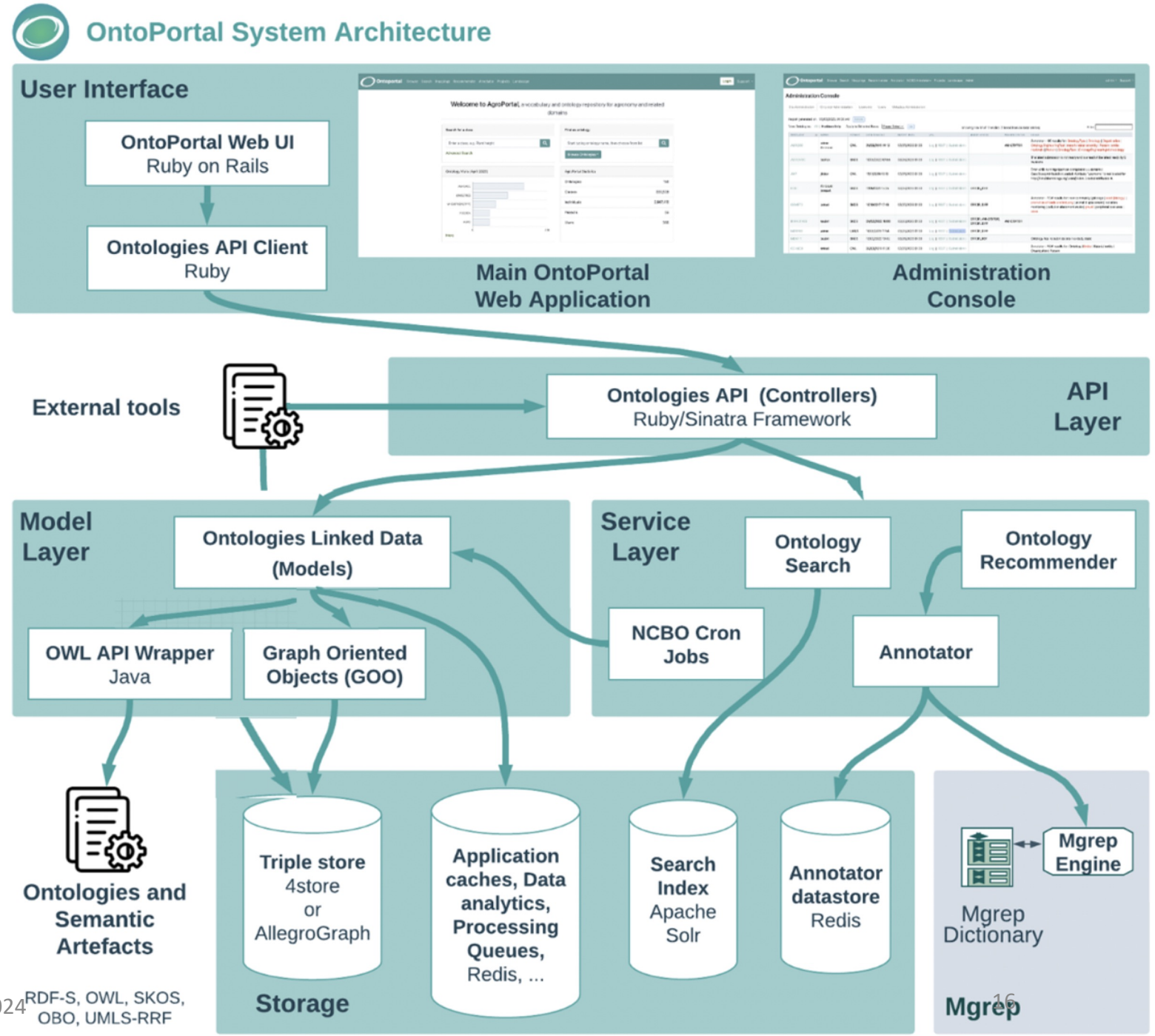






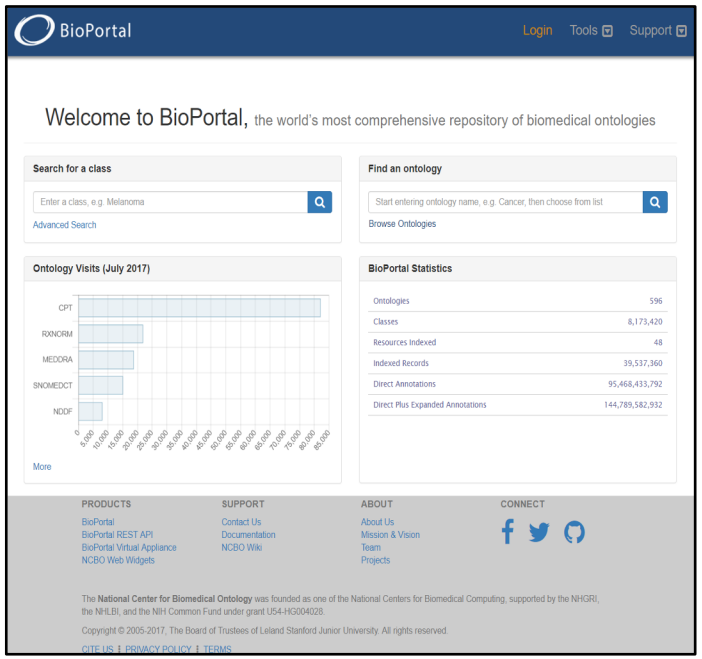
Architecture

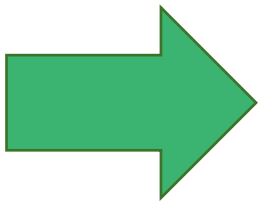
Every component is available on GitHub and all is regularly packaged within the *OntoPortal Virtual Appliance*

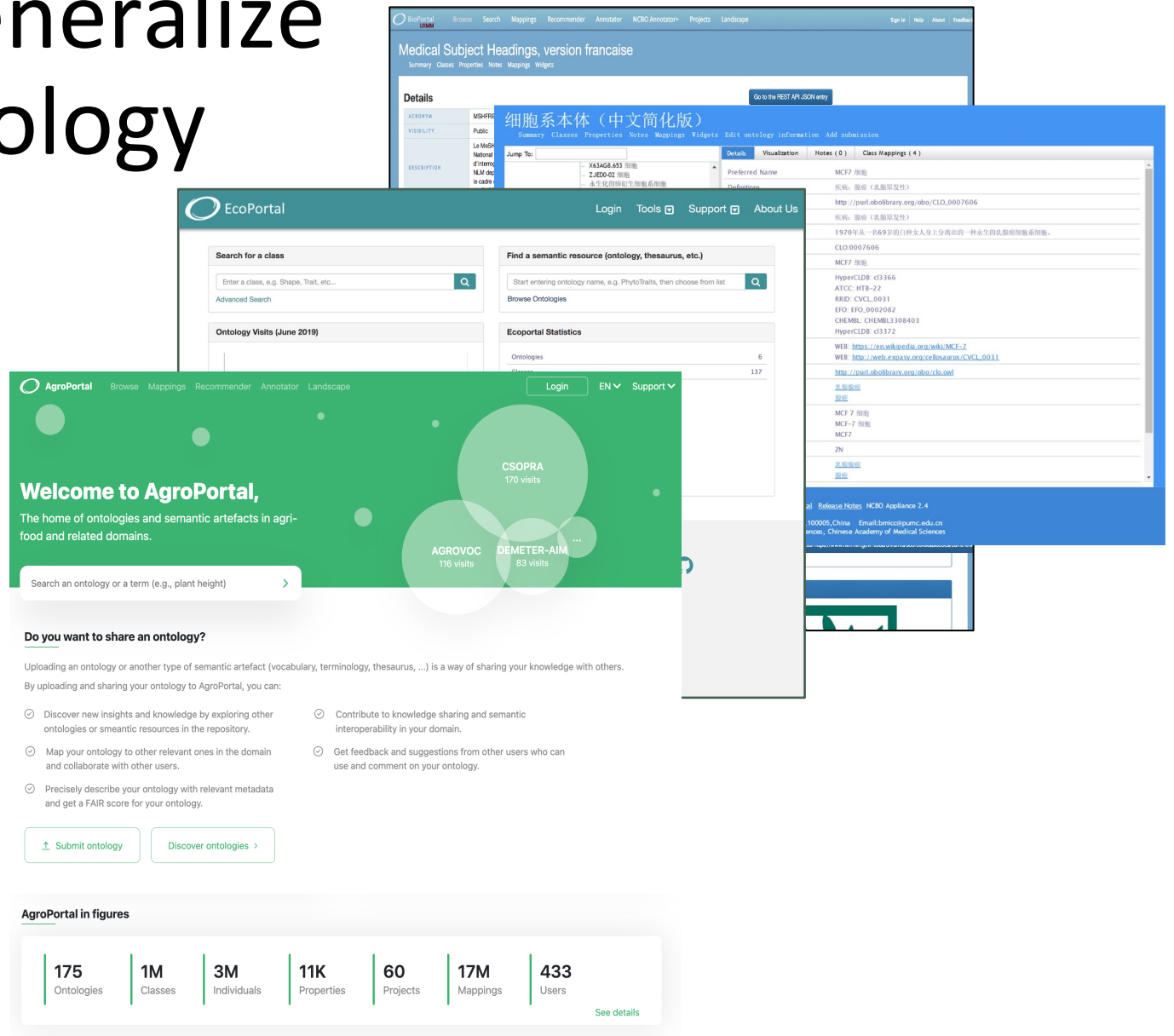


OntoPortal Alliance: dedicated to promoting semantic services

OntoPortal Alliance: Generalize and reuse a shared ontology repository technology







OntoPortal history

- NCBO BioPortal open source (2005)
- NCBO technology used by the Open Ontology Repository (OOR) inititative (2008-2012)
- BioPortal Virtual Appliance (2012)
- OntoPortal Alliance created (2018)
  - OntoPortal Appliance v2.5
  - 2 posters during RDA plenaries
- OntoPortal Alliance kicked-off, online (May 2020)
  - 10 participants
  - OntoPortal Appliance v3.0
- 1st OntoPortal Workshop, Montpellier (Sept. 2022)
  - 20 participants
- OntoPortal resource paper at ISWC 2023
- 2nd OntoPortal Workshop, Lecce (Sept. 2023)
  - 30 participants

NCBO BioPortal

A few installs (NCI, MMI, ESIP, …)

OOR

SIFR BioPortal, AgroPortal

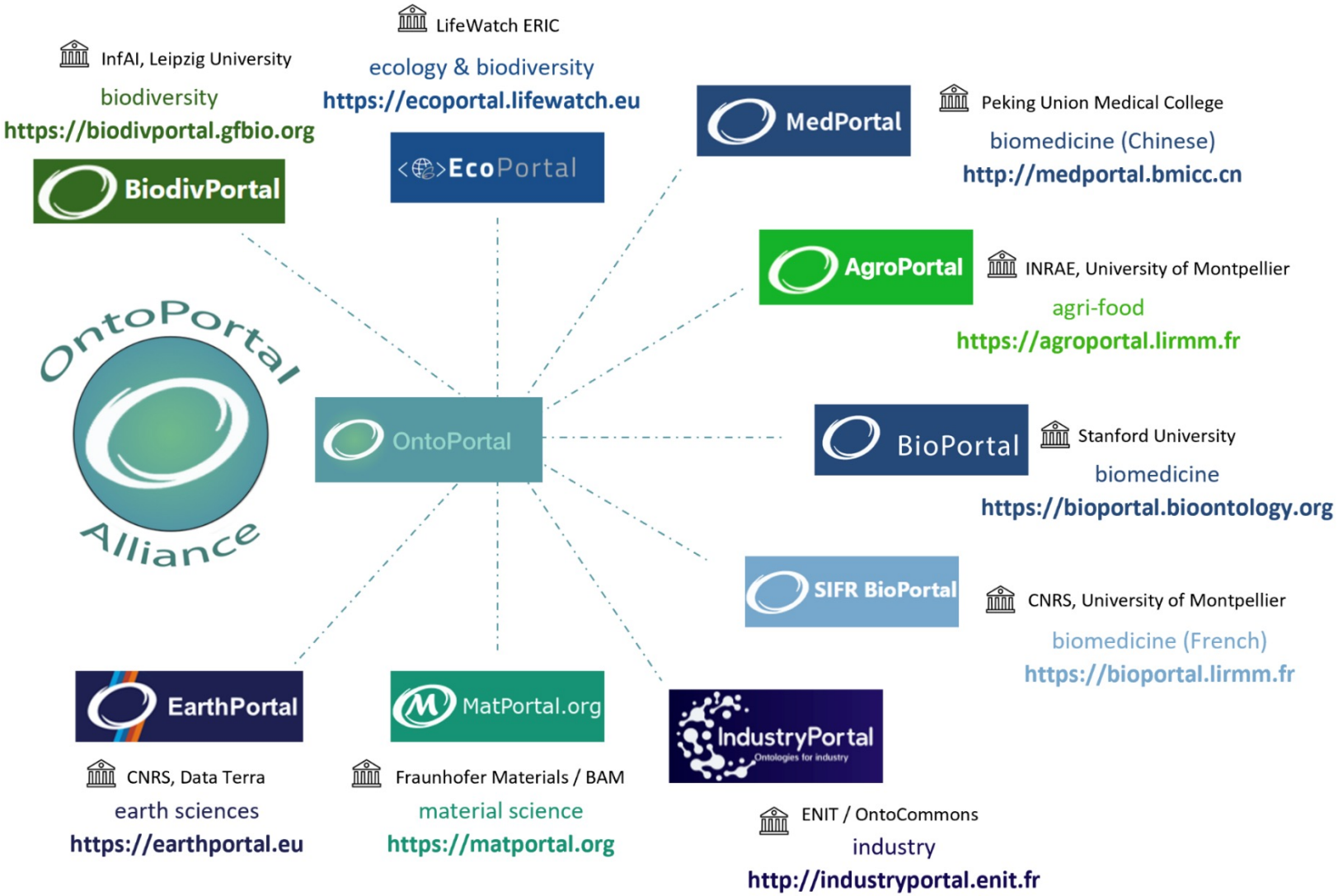
EcoPortal
MedPortal
MatPortal

IndustryPortal

EarthPortal
BioDivPortal

…

OntoPortal Alliance: Synchronizing and mutualizing research and development efforts



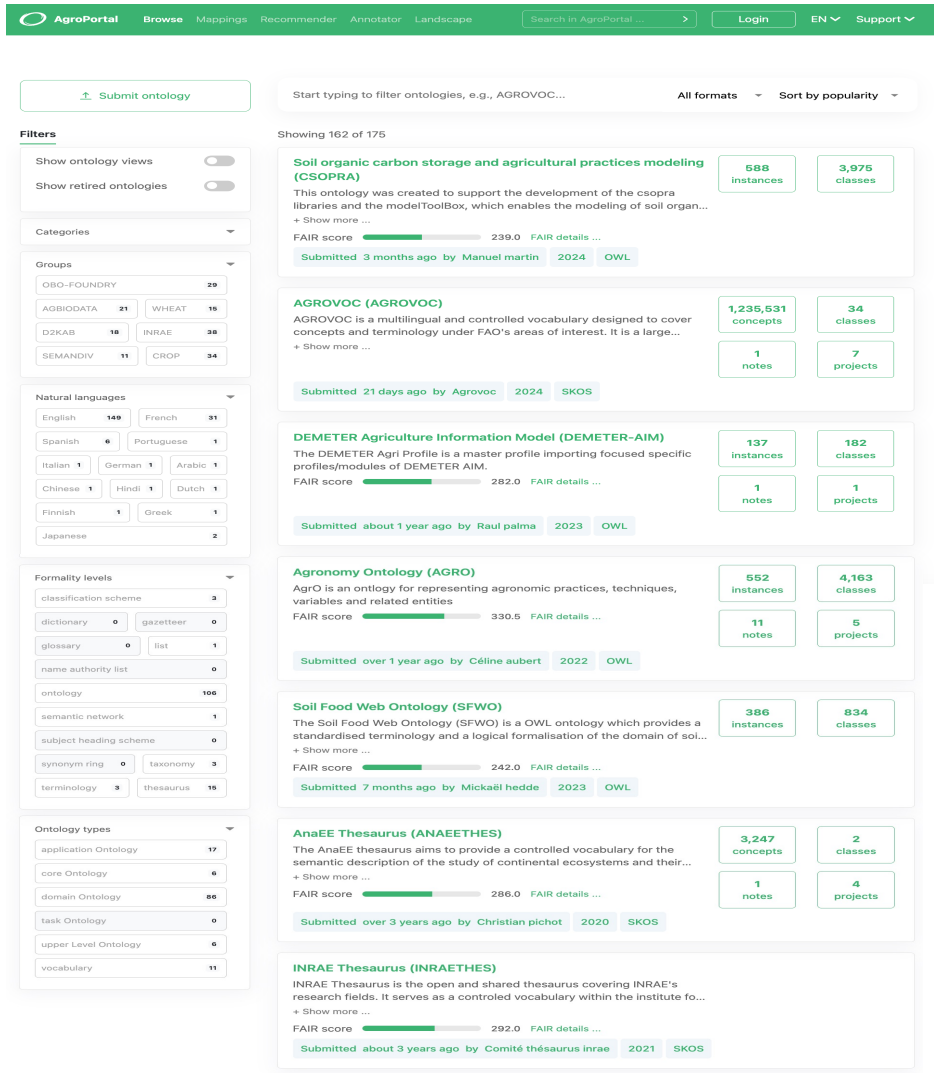
Representing OntoPortal adopters and end users

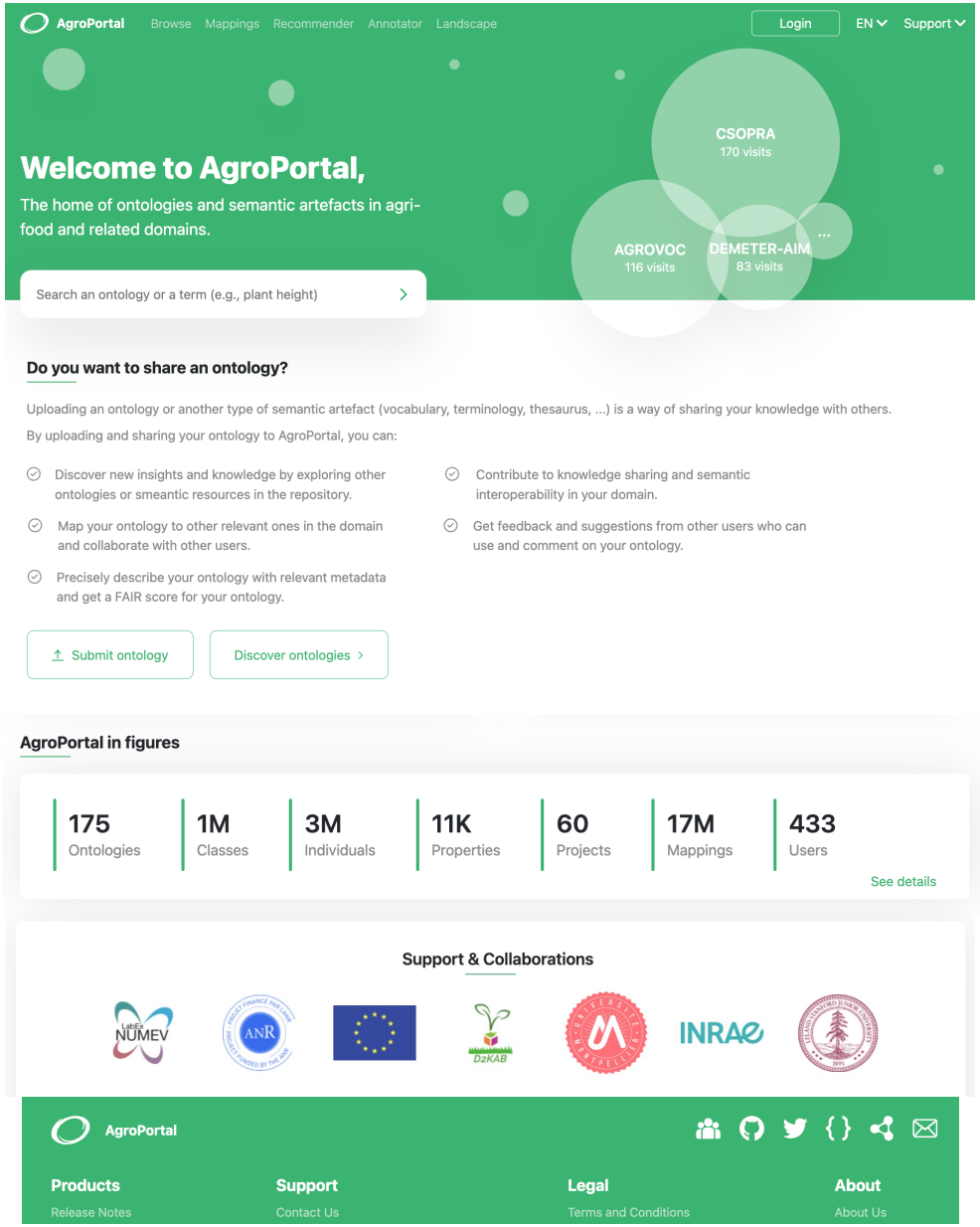
- to maximize OntoPortal value (state-of-the-art service portfolio)
- to improve OntoPortal software while managing several parallel and different installations
- to increase semantic uptake in science communities and facilitate adoption of the FAIR principles
- to increase the ecosystem's long term operational and financial health

AgroPortal an ontology repository for agri-food

http://agroportal.lirmm.fr

- Publish, search, download
- Browse, visualize
- Peer review
- Versioning
- Annotation
- Recommendation
- Mapping
- Notes
- Projects

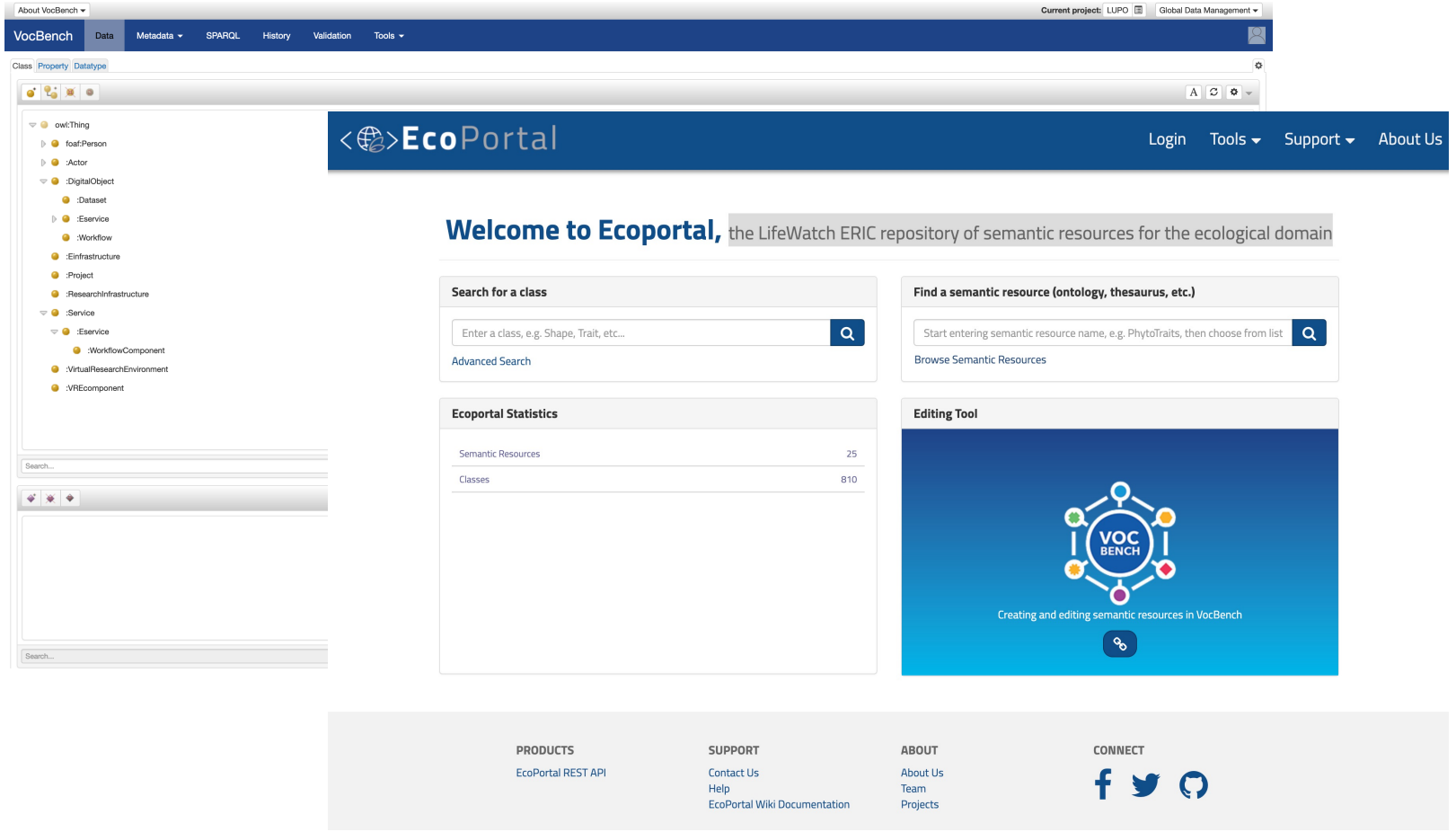




- 175 semantic artefacts, 200 candidates
- ~433 registered users

C. Jonquet, A. Toulet, (...) P. Larmande. **AgroPortal: an ontology repository for agronomy**, *Computers and Electronics in Agriculture*. Jan 2018. 144, pp.126-143. Elsevier.

EcoPortal



FINDABLE

ACCESSIBLE

INTEROPERABLE

REUSABLE

http://ecoportal.lifewatch.eu

A common repository for FAIR ontologies in industry 4.0 (D03)

IndustryPortal
Ontologies for industry

SUPPORTED AND COLLABORATED BY:

ONTO COMMONS — ONTOLOGY-DRIVEN DATA DOCUMENTATION FOR INDUSTRY COMMONS

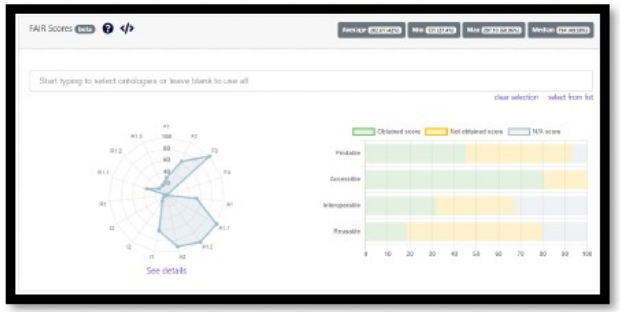
INP TOULOUSE — ÉNIT ÉCOLE NATIONALE D'INGÉNIEURS DE TARBES

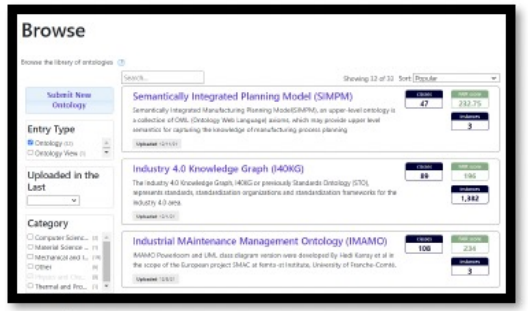
PICS — Planning Interoperability ordination for Dynamic Syster

LIRMM

IndustryPortal helps ontology developers and users …

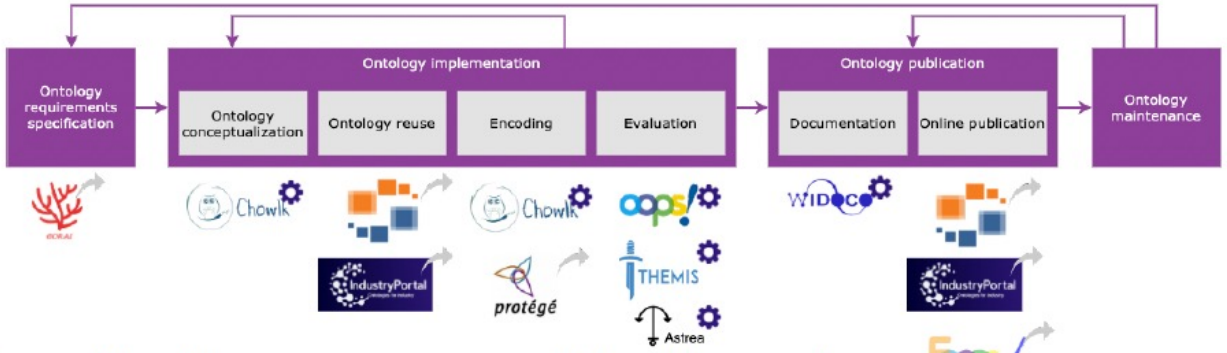
- To submit an ontology and maintain version
- To edit various ontology metadata
- To evaluate the FAIRness of an ontology
- To categorise an ontology as per topics
- To search and browse terms across all hosted ontologies
- To annotate a piece of text with all hosted ontologies
- To store and serve ontology mappings in SSSOM format

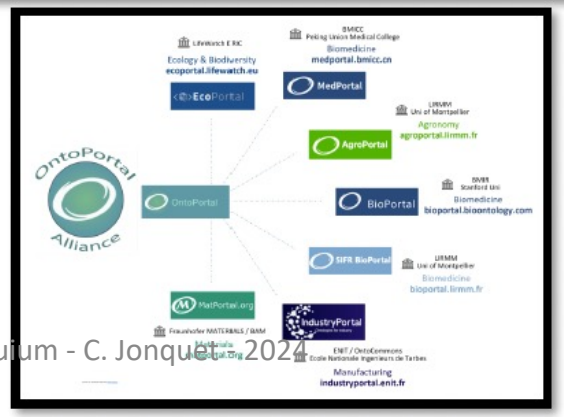




http://industryportal.enit.fr

Use of IndustryPortal in Ontology Engineering





https://tooling.ontocommons.linkeddata.es/

EarthPortal

DATA TERRA

EarthPortal, a semantic artefact catalog for the Earth system and Environment

Guillaume ALVISET

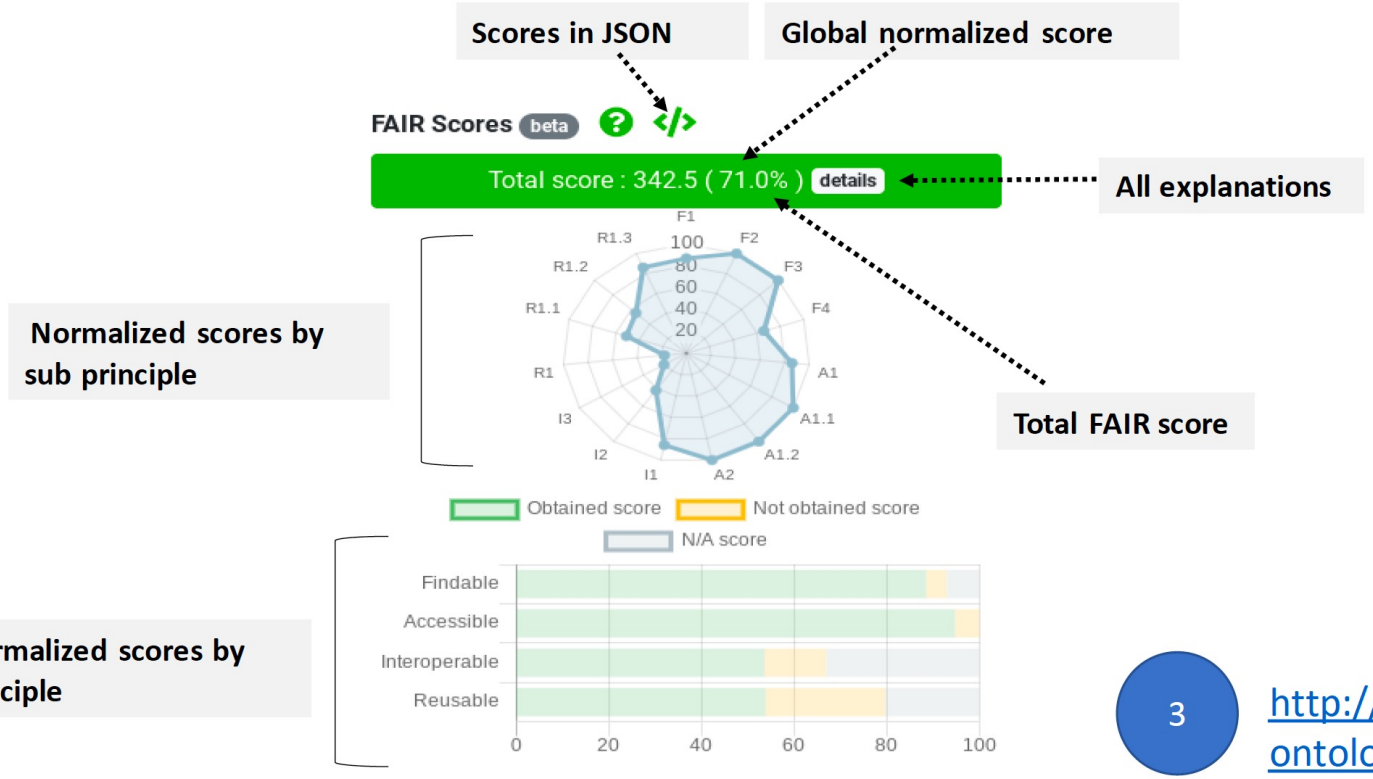
Christelle PIERKOT

Always in-line with the OntoPortal technology but with many added features…

- Customization of group, categories, look-and-feel
- Change default language
- Slices fix, sync of group and slices
- New metadata model
- New metadata user interfaces (browse, summary, landscape)
- Annotator enhancements (French ConText, formats, scoring, etc.)
- NCBO Annotator+
- Internal/external mappings + multiple mapping properties
- User admin page
- Support instances
- FAIRness assessment O'FAIRe
- Repair notifications and subscriptions
- Better multilingual support
- Large file processing
- Enhanced SKOS support
- SSSOM mappings import
- Metadata edition in batch

O'FAIRe: Ontology FAIRness Evaluator

Get a FAIRness score for a given ontology



3 http://agrop ontologies/A

E. Amdouni, S. Bouazzouni, C. Jonquet. **O'FAIRe: Ontology FAIRness Evaluator in the AgroPortal semantic resource repository**. *ESWC 2022 - 19th Extended Semantic Web Conference, Poster and demonstration*, May 2022, Hersonissos, Greece. ⟨10.1007/978-3-031-11609-4_17⟩

deployments:

AgroPortal

SIFR BioPortal

IndustryPortal
Ontologies for industry

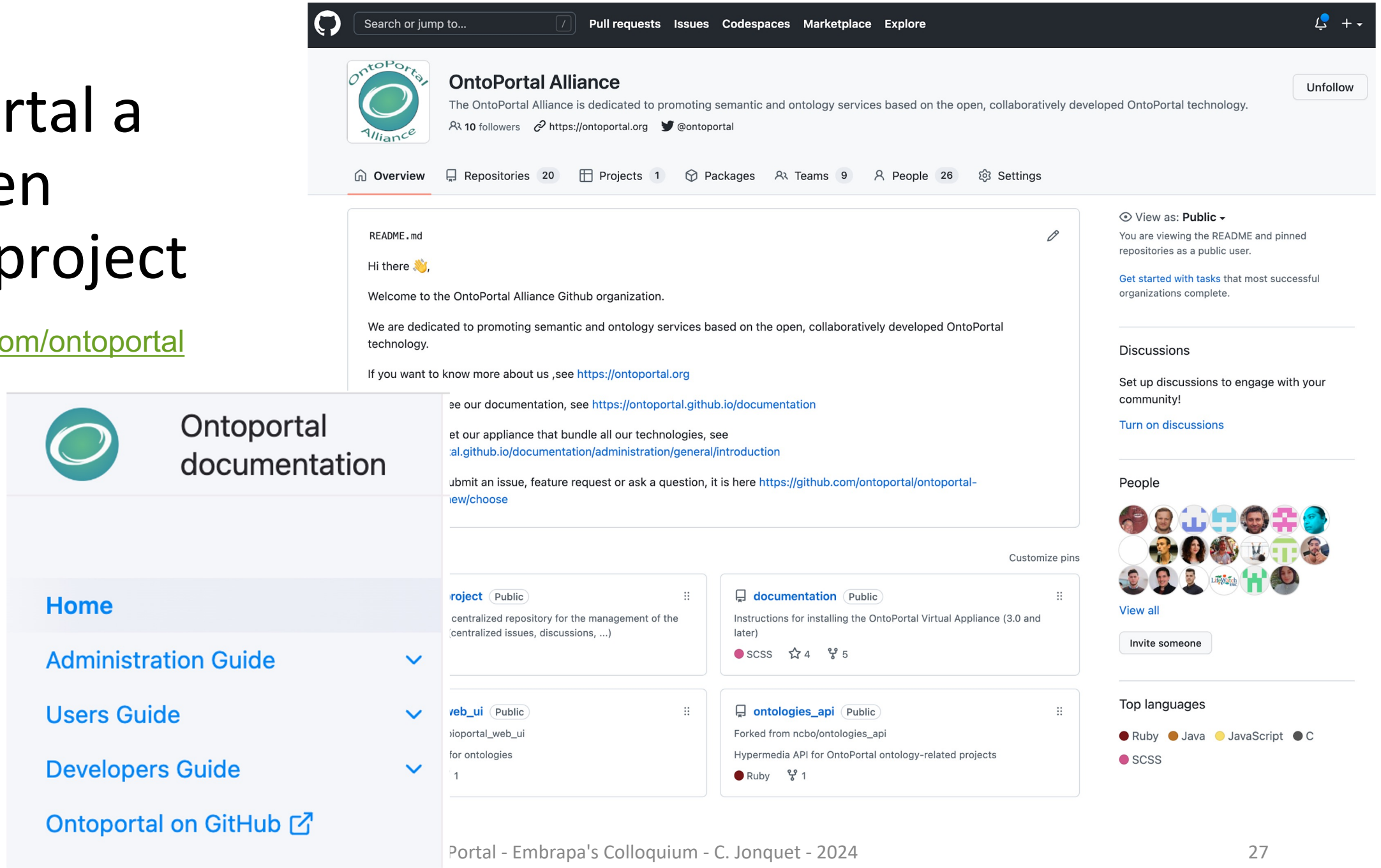
EcoPortal

EarthPortal

BiodivPortal

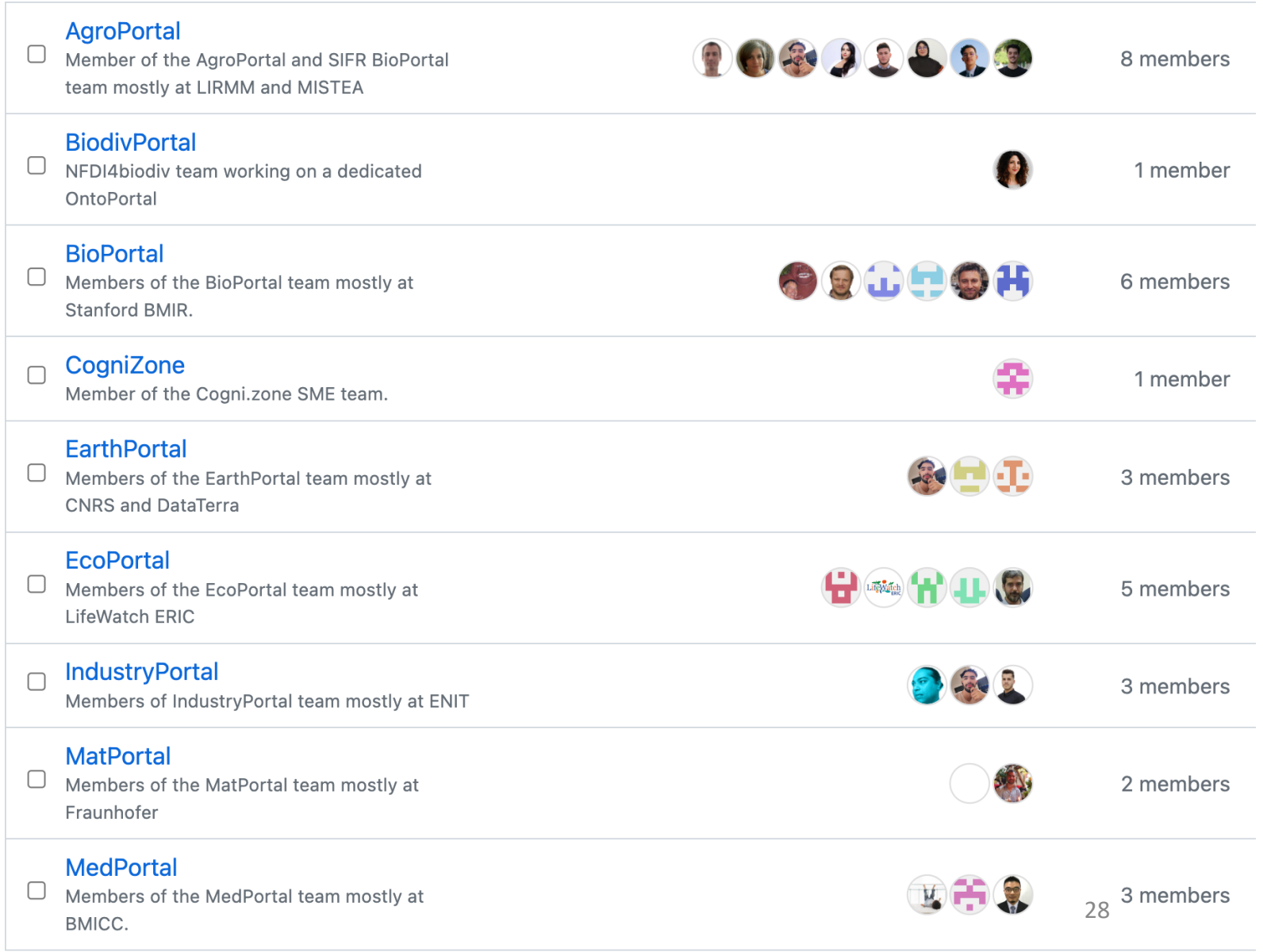
Making OntoPortal a real open source project

https://github.com/ontoportal



Membership increasing

- 9 existing public repositories. 1 other in the pipe
- 1 active commercial participant (Cogni.zone)
- Multiple interested parties beyond that
  - Known in use: 31 appliances 'called home' in September 2022 v2.5 = 3 v3.0.x = 14 v3.1.x = 14
  - 60 unique appliance IDs called home overall in 2022
  - 19 active machine instances in AWS (included in 31 calling home)



OntoPortal Alliance and Workshops

2020, online

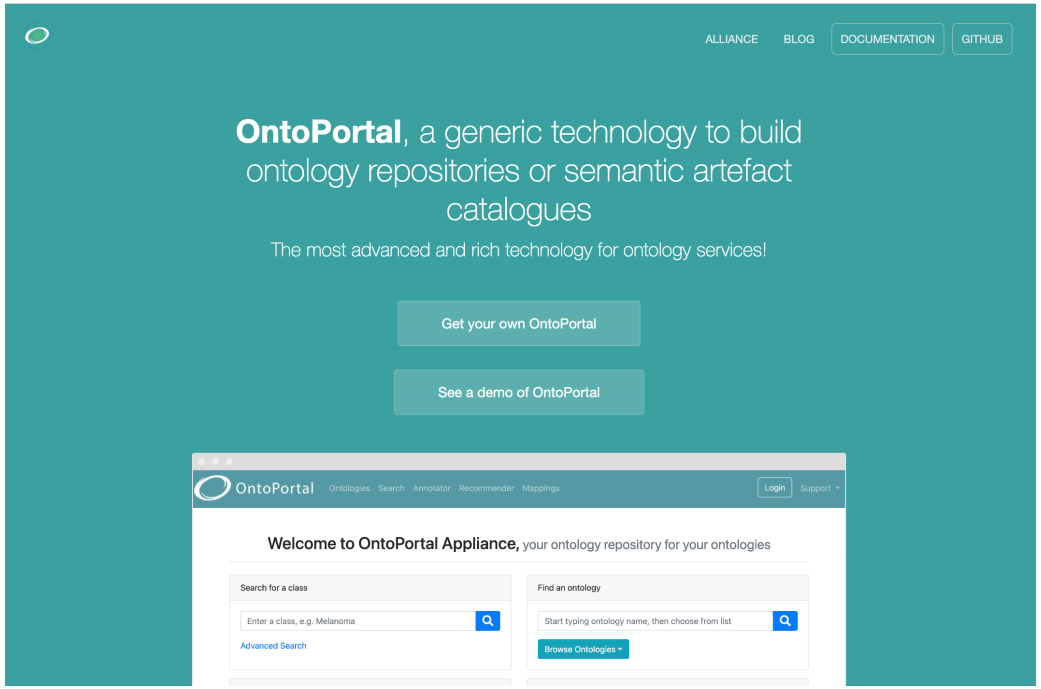
2022, Montpellier

2023, Lecce

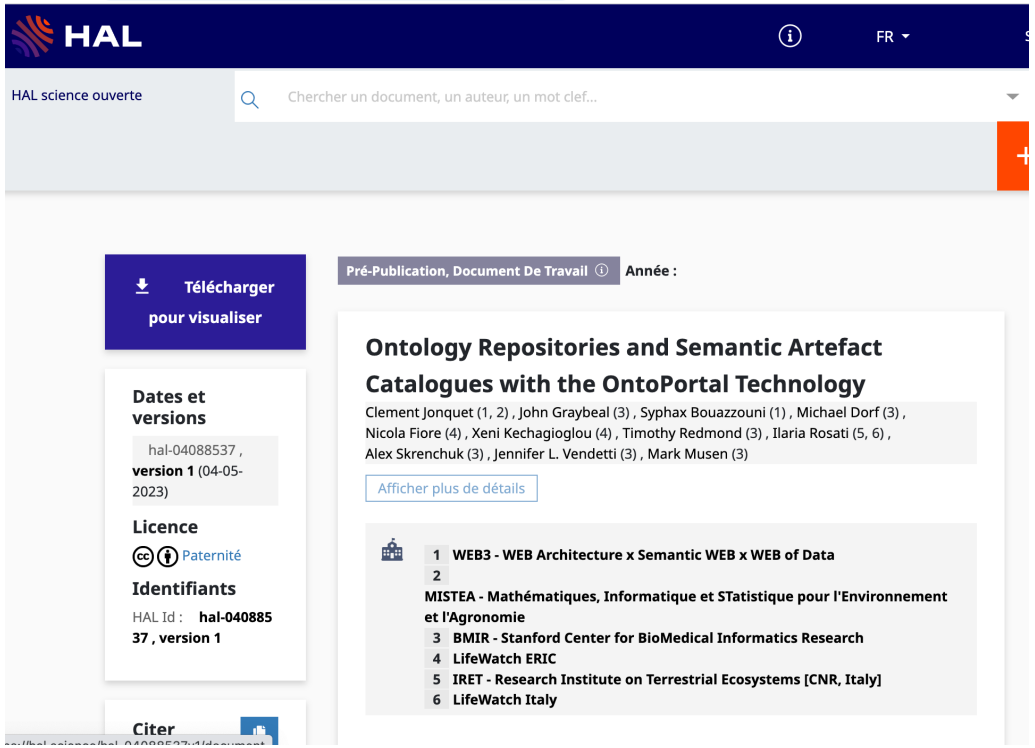
2024, Stanford

More information

Web site and documentation:
https://ontoportal.org



ISWC 2023 Resource paper:
https://hal.science/hal-04088537



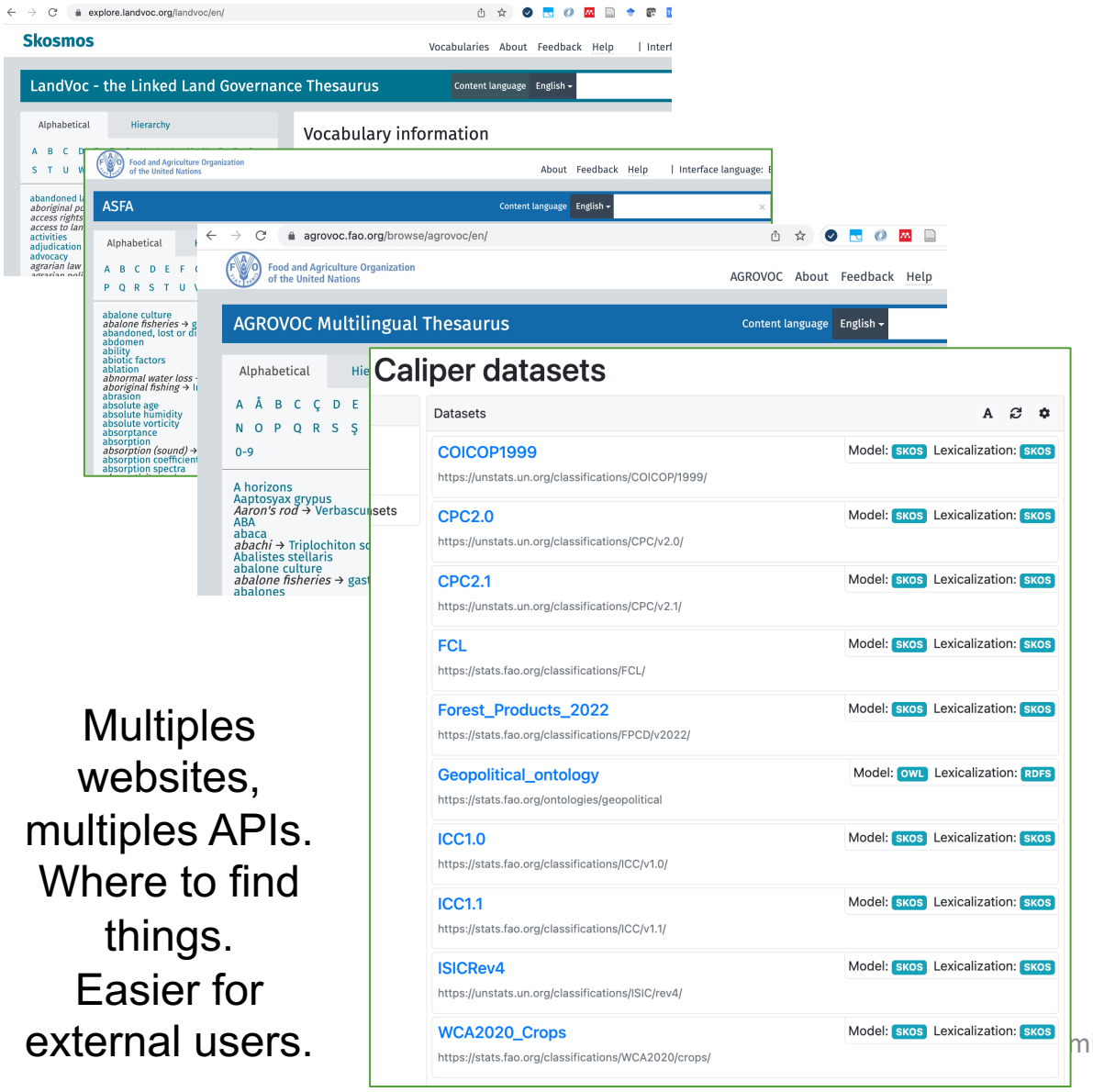
A deeper look into AgroPortal

AgroPortal: a vocabulary and ontology repository for agronomy

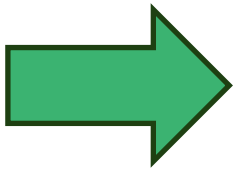
http://agroportal.lirmm.fr

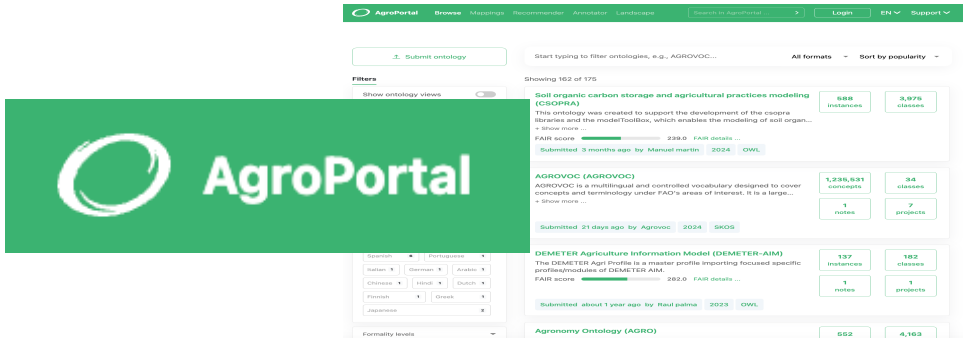
- Develop and support a reference ontology repository
  - Primary focus on the agronomy & close related domains (plant sciences, food and biodiversity)
- Reusing the NCBO BioPortal technology
  - Avoid to re-implement what has been done, facilitate interoperability
  - Reusing the scientific outcomes, experience & methods of the biomedical domain
- Enable straightforward use of agronomic related ontologies
  - Respect the requirements & specificities of the agronomic community
  - Fully semantic web compliant infrastructure
  - Enable new science

Offering a global service (for all semantic resources)



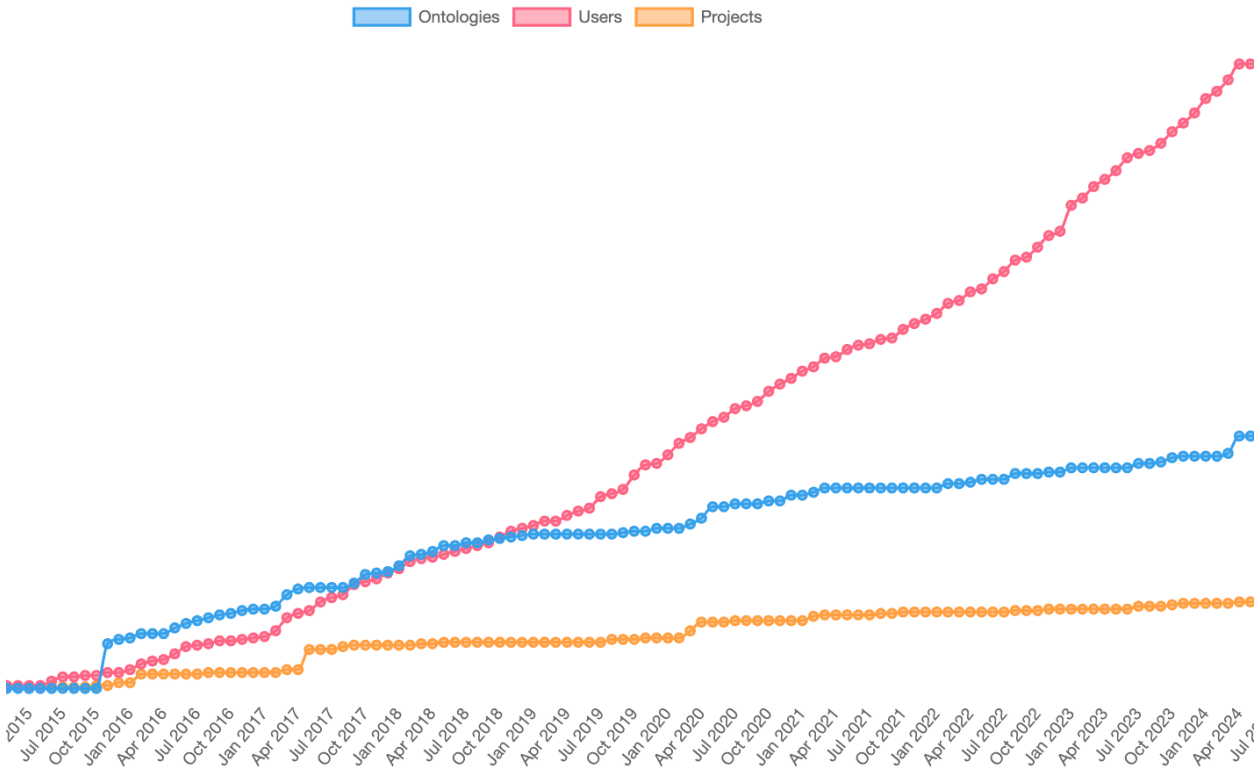
Multiples websites, multiples APIs.
Where to find things.
Easier for external users.





One web application.
One endpoint, one API.
One search service.
Unique user account.
Social functionalities
More visibility.
Easier for external users.
Mappings.
Relations btw semantic resources
....

A growing interest in the community



- RDA Agrisemantics WG
- GO-FAIR Food System Implementation Network
- Adoptions by projects e.g., PHIS, AgroLD
- SemanDiv CNRS WG
- AgroHackathons
- D2KAB ANR project
- Arround 40 accounts @inrae.fr
- Related:
  - IC-FOODS initiative
  - ELIXIR F&N community
  - AgBioDatabases
- EOSC projects: FAIR-IMPACT, FAIR-EASE

AgroPortal model

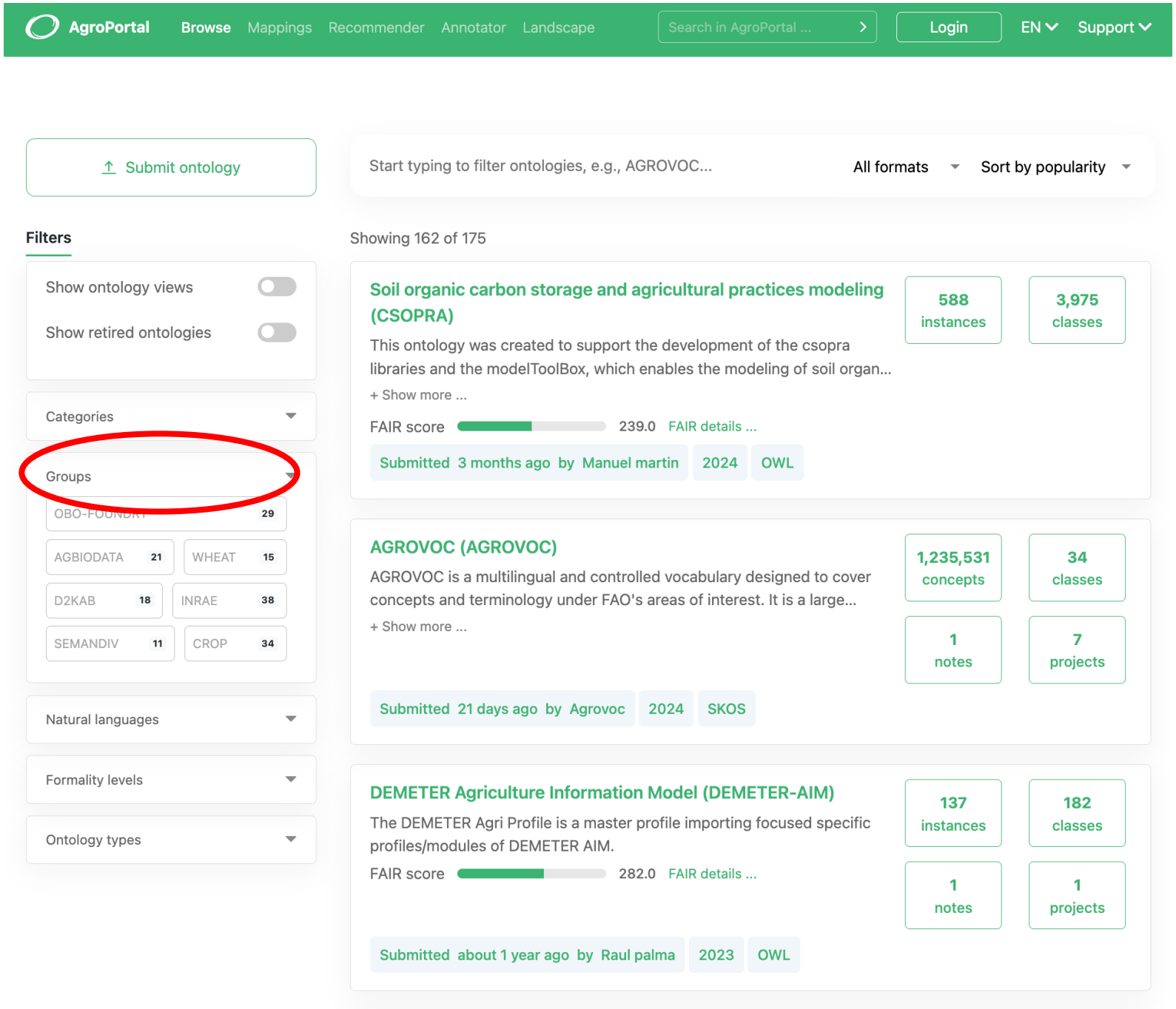
- We adopt an “open approach” (users can upload themselves)
- Our editorial line: be related or of use for agri-food
- At the beginning we would load most of the ontologies, then less, then less
- We do curation of metadata, but not data
- We customize the ontology repository to address our community needs
- We use the portal to do science in informatics (semantics, annotation, metadata, etc.) and application domains

Examples of ontologies uploaded in AgroPortal

Title	Format	Groups	Size
IBP Rice Trait Ontology (CO_320)	OWL	CROP, RICE	~2K
IBP Wheat Trait Ontology (CO_321)	OWL	CROP, WHEAT	~1K
IBP Wheat Anatomy Ontology (CO_121)	OBO	CROP, WHEAT	~80
IBP Crop Research (CO_715)	OBO	CROP	~250
Multi-Crop Passport Ontology (CO_020)	OBO	CROP	~90
Biorefinery (BIOREFINERY)	OWL	LOVINRA	~300
Matter Transfer (TRANSMAT)	OWL	LOVINRA	~1.1K
Plant Ontology (PO)	OWL	WHEAT, RICE, OBOF	~2K
Plant Trait Ontology (TO)	OWL	WHEAT, RICE, OBOF	~4.4K
Durum Wheat (DURUM_WHEAT)	OWL	LOVINRA	~130
Agricultural Experiments (AEO)	OWL	LOVINRA	~60
Environment Ontology (ENVO)	OWL	WHEAT, OBOF	~6.3K
NCBI Organismal Classification (NCBITAXON)	RRF	WHEAT	~900K
AnaEE Thesaurus (ANAEE)	SKOS	LOVINRA	~3.3K
French Crop Usage (CROPUSAGE)	SKOS	none	~300
Agrovoc (AGROVOC)	SKOS	none	~32K
Food Ontology (FOODON)	OWL	OBOF	~10K
National Agriculture Library Thesaurus (NALT)	SKOS	none	~67K

Browse and select ontologies

- Allows to search, order and select ontologies using a facetted search approach, based on the metadata



AgroPortal Browse Mappings Recommender Annotator Landscape Search in AgroPortal ... Login EN Support

leaf area index

Search

Match in 25 ontologies

{ } Show options

leaf area index - Plant Trait Ontology (TO)

http://purl.obolibrary.org/obo/TO_0012001

Leaf Area Index (LAI) is the ratio of total upper leaf surface of vegetation divided by the surface area of the land on which the vegetation grows.

Details Vizualize 7 more from this ontology

Leaf area index - Common Bean Ontology (CO_335)

https://cropontology.org/rdf/CO_335:0000772

The leaf area index (LAI) is a dimensionless quantity that characterizes plar
area.

Details Vizualize 5 more from this ontology

Leaf area index - Sweet Potato Ontology (CO_331)

https://cropontology.org/rdf/CO_331:0001105

Defined as total surface area of foliage per unit ground area

Details Vizualize 1 more from this ontology

Leaf area index - Oat Ontology (CO_350)

https://cropontology.org/rdf/CO_350:0000123

A dimensionless quantity that characterizes plant canopies and defined as

Details Vizualize 12 more from this ontology

Leaf area index - Wheat Ontology (CO_321)

https://cropontology.org/rdf/CO_321:0000184

It is a dimensionless quantity that characterizes plant canopies and defined as the leaf area per unit ground surface area.

Details Vizualize 4 more from this ontology

leaf area index - AnaEE Thesaurus (ANAEETHES)

Jump To

Type a class name from TO and jump to it in AgroPortal

Autocomplete

Fill your form fields with classes from TO

Widget See code { }

Jump To: leaf area Go to AgroPortal

- **leaf area** index
- **leaf area** to spikelet number ratio
- **leaf area** duration
- **leaf area** trait
- specific **leaf**let **area**
- **leaf**let **area**
- flag **leaf area**
- specific **leaf area**
- relative **leaf area**
- large vascular bundle number to **leaf area** ratio

Results provided by LIRMM AgroPortal

Example 1 (start

Identify concepts to describe your data

AgroPortal Browse Mappings Recommender Annotator Landscape Search in AgroPortal ... Login EN Support

ontologies > SDGIO

Sustainable Development Goals Interface Ontology (SDGIO) OWL

No license

Last submission date August 11, 2018

{ } Watch (0)

Summary Classes Properties Instances Notes Mappings Widgets Sparql English

Jump to

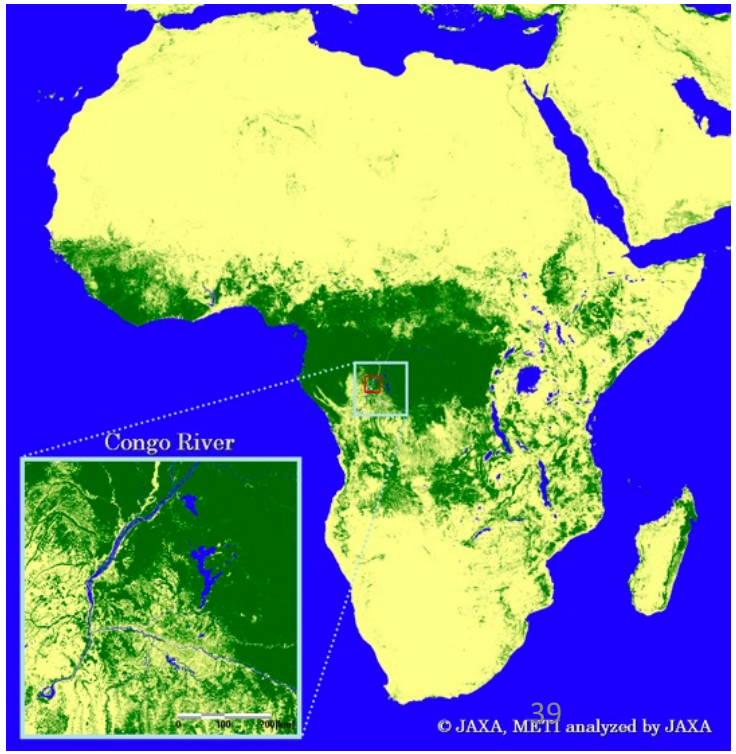
- material intensity
- material trade balance
- material trade balance per capit a
- measurement datum
- net permanent forest loss
- resource consumption
- sustainable development goal ind cator value
  - Agricultural export subsidies
  - Aid for Trade commitments a nd disbursements
  - Amount of water- and sanitati on-related official developme nt assistance that is part of a

Details Instances (0) Visualization Notes (0) Mappings (0) { }

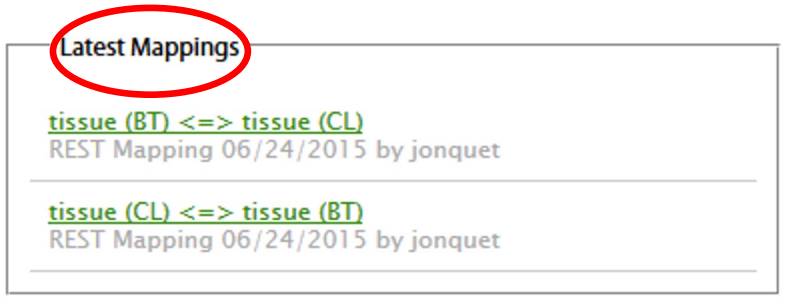
ID	http://purl.unep.org/sdg/SDGIO_00020174
Preferred name	Forest area as a proportion of total land area

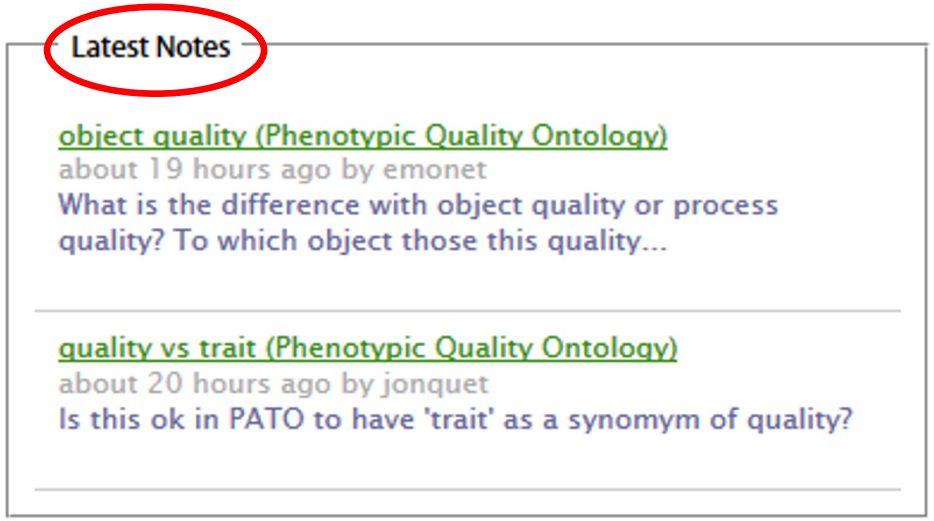
Raw data

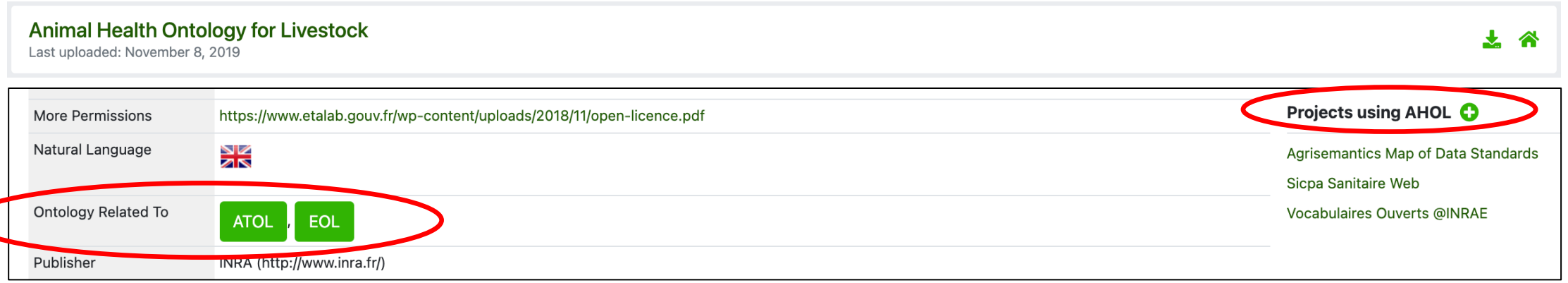
rdf:type	http://www.w3.org/2002/07/owl#Class
rdfs:label	Forest area as a p
rdfs:subClassOf	http://purl.unep.



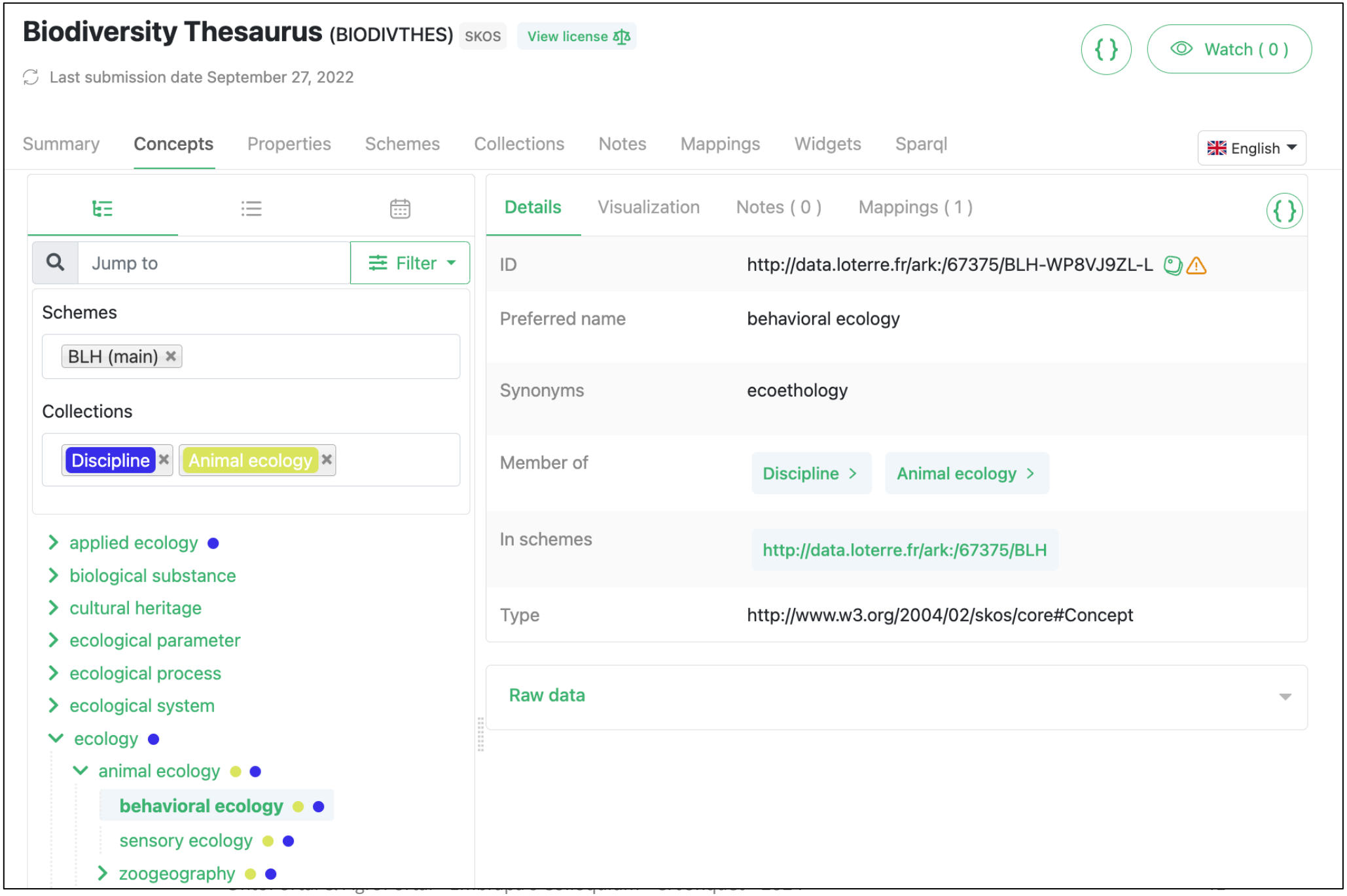
Community based functionalities



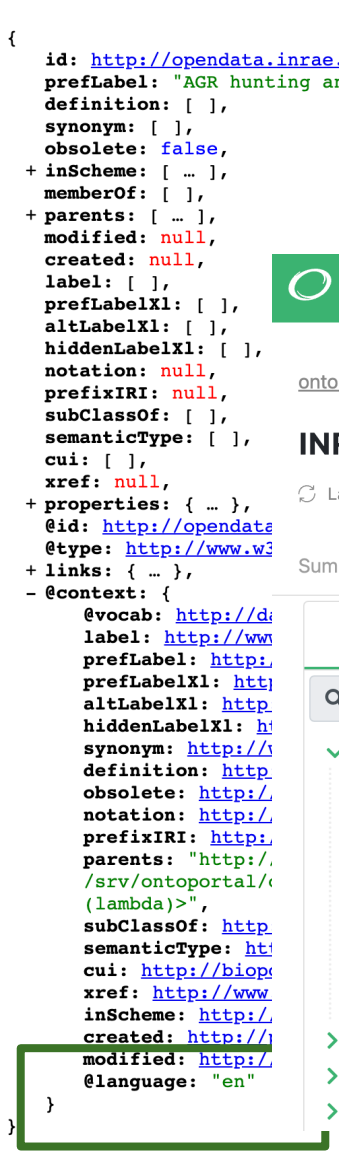


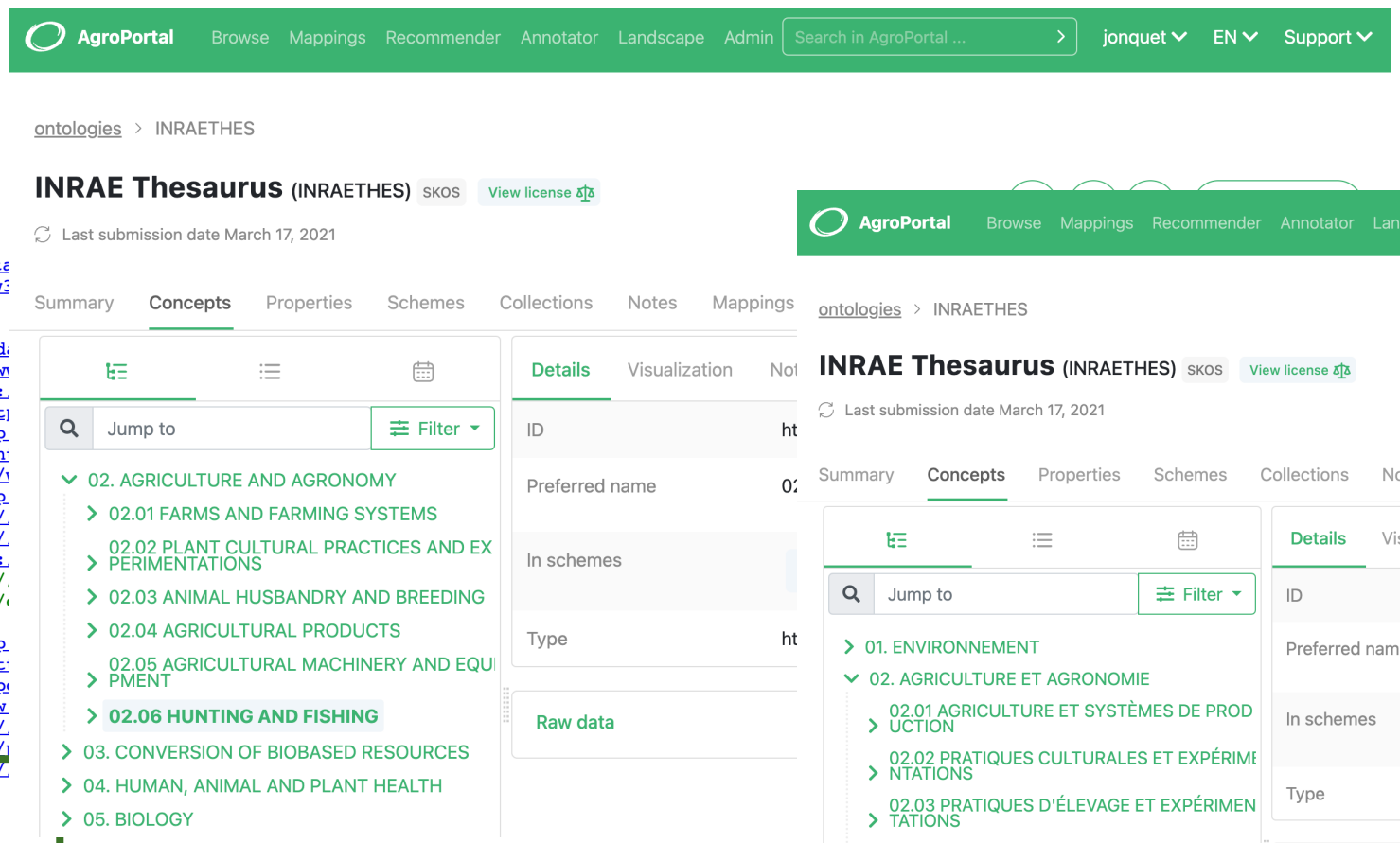


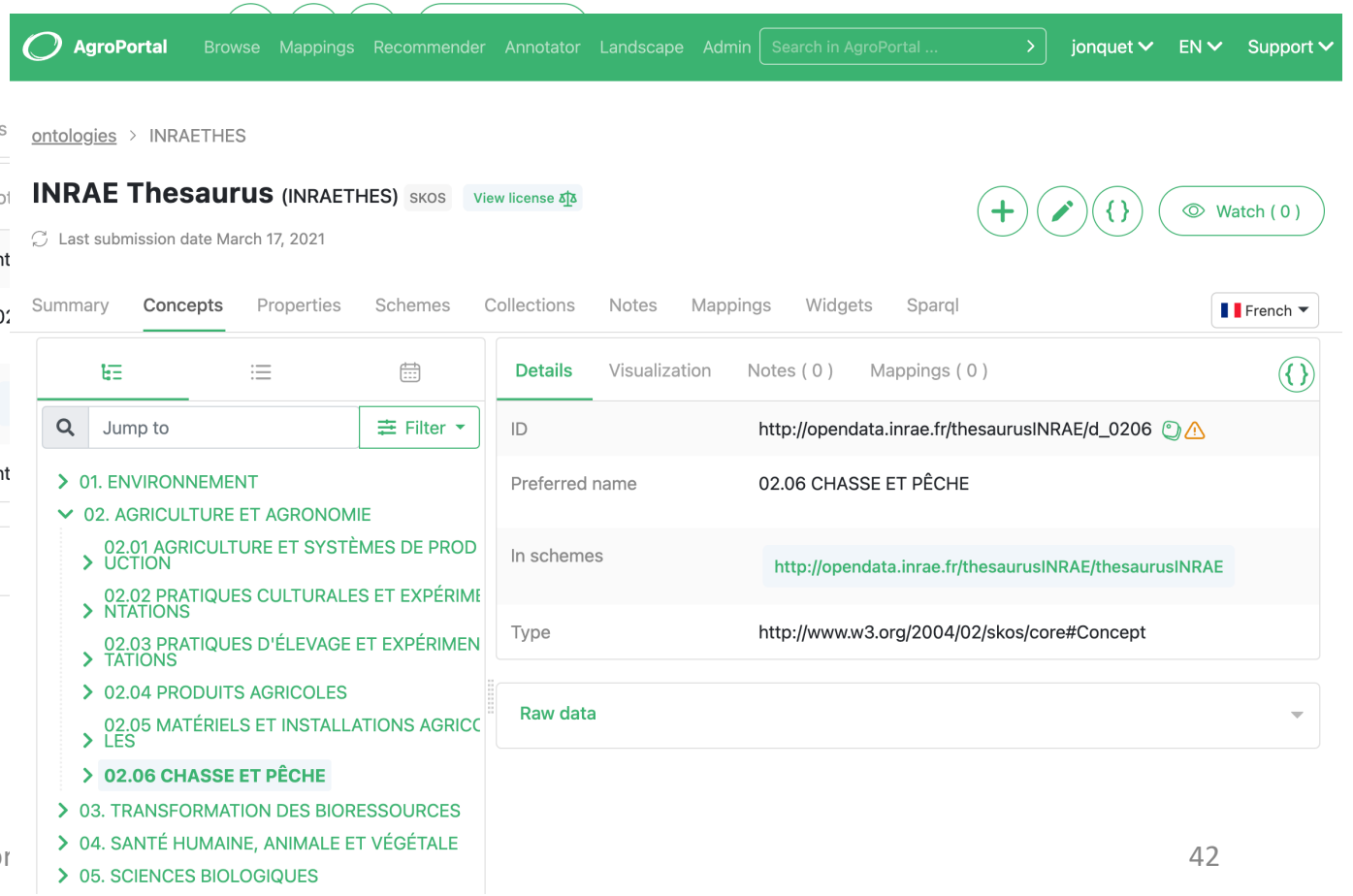
Browse Schemes and Collections defined in a SKOS resource simultaneously



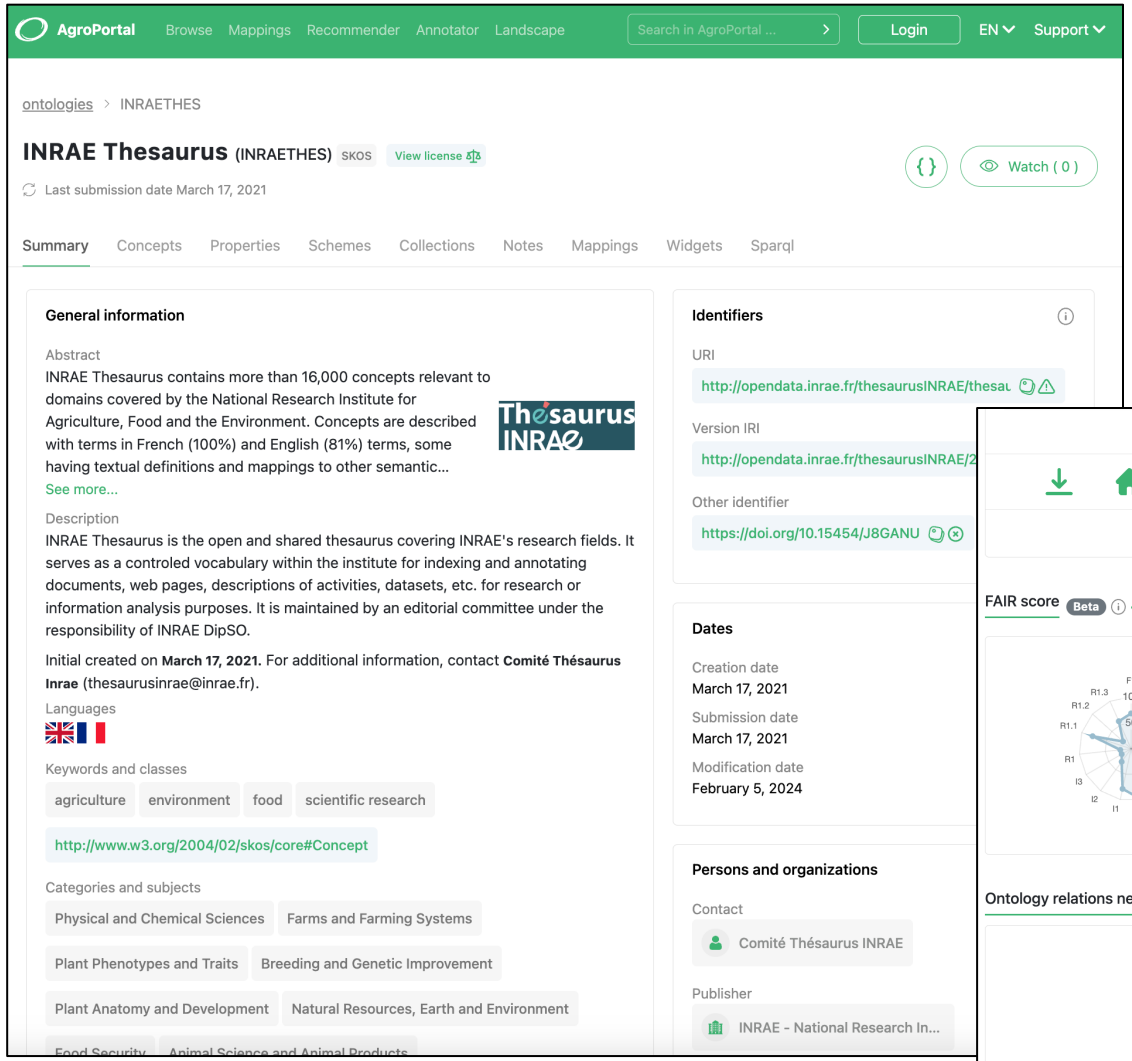
Multilingual support

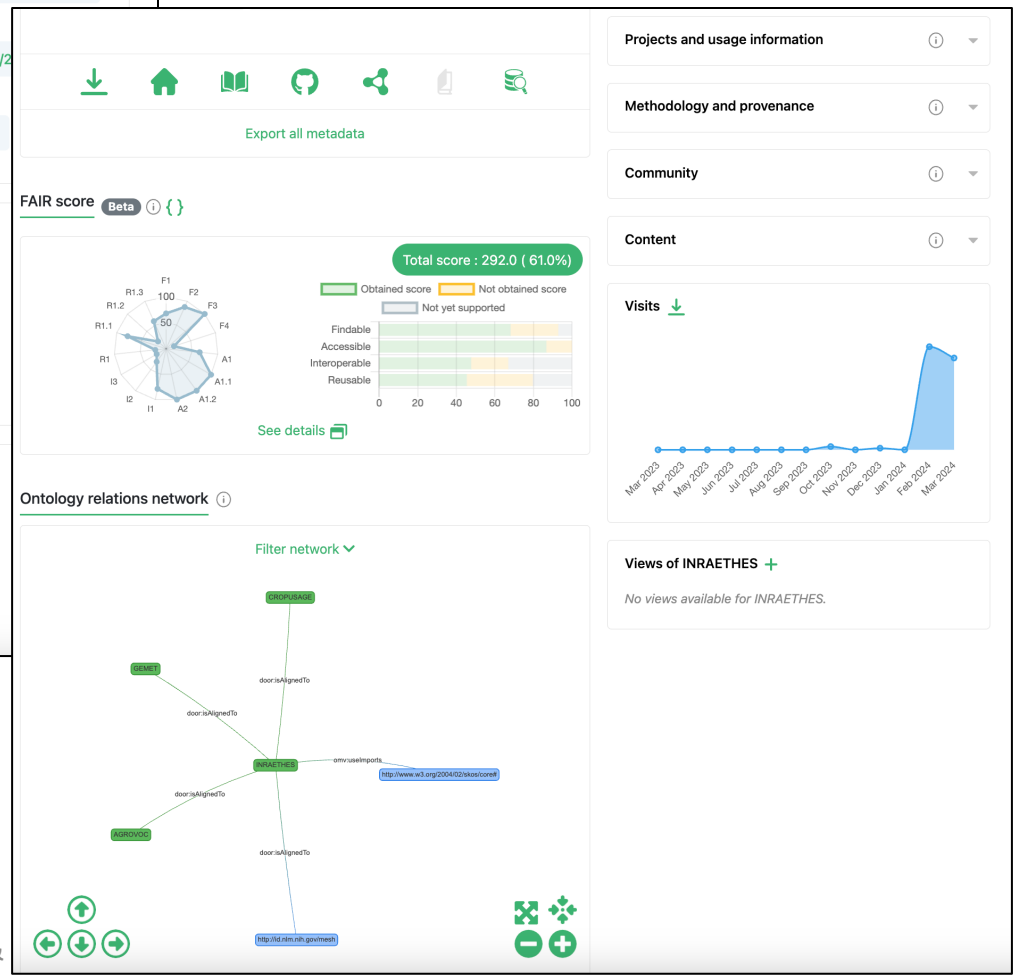


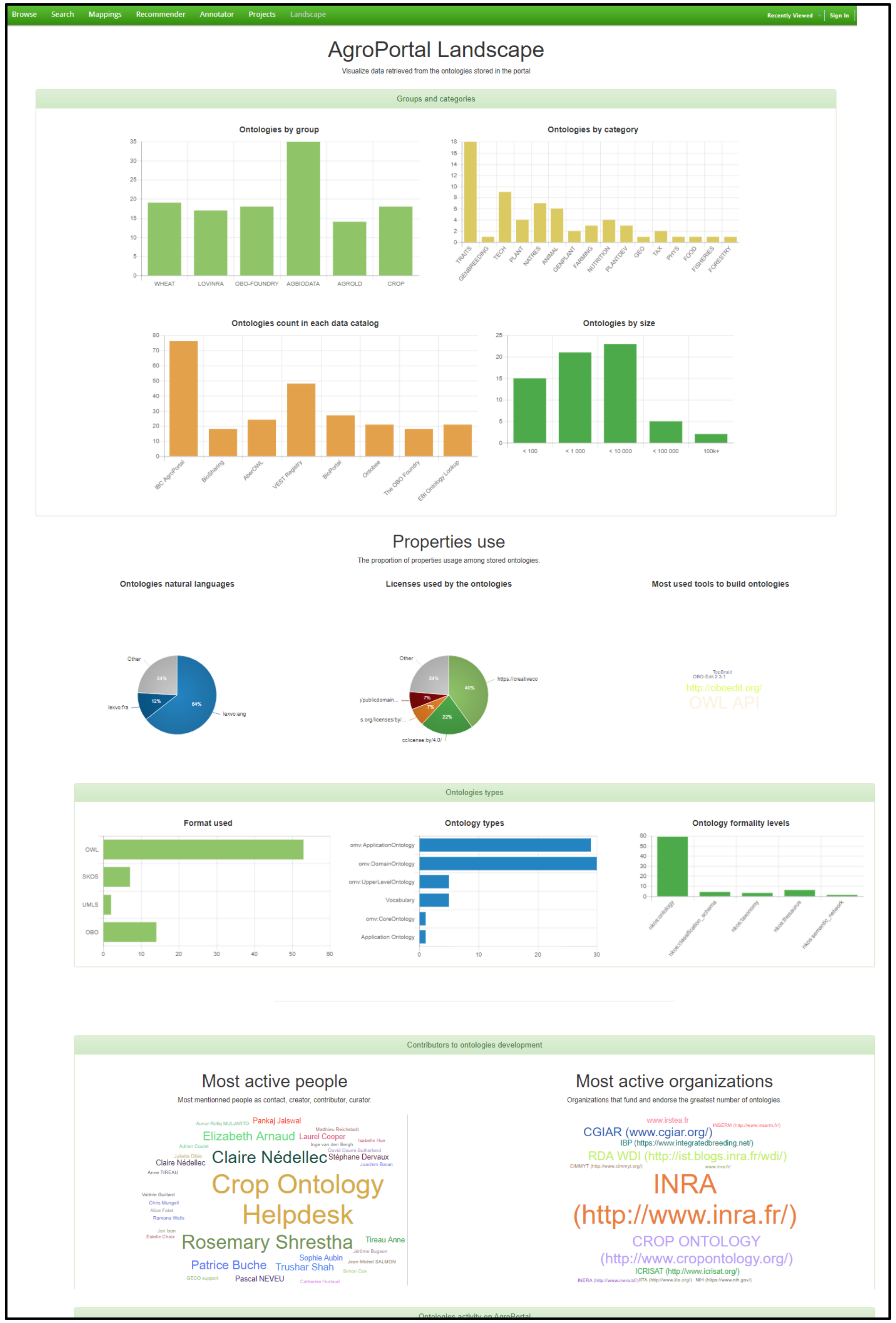




Describe the ontologies with metadata







AgroPortal landscape page

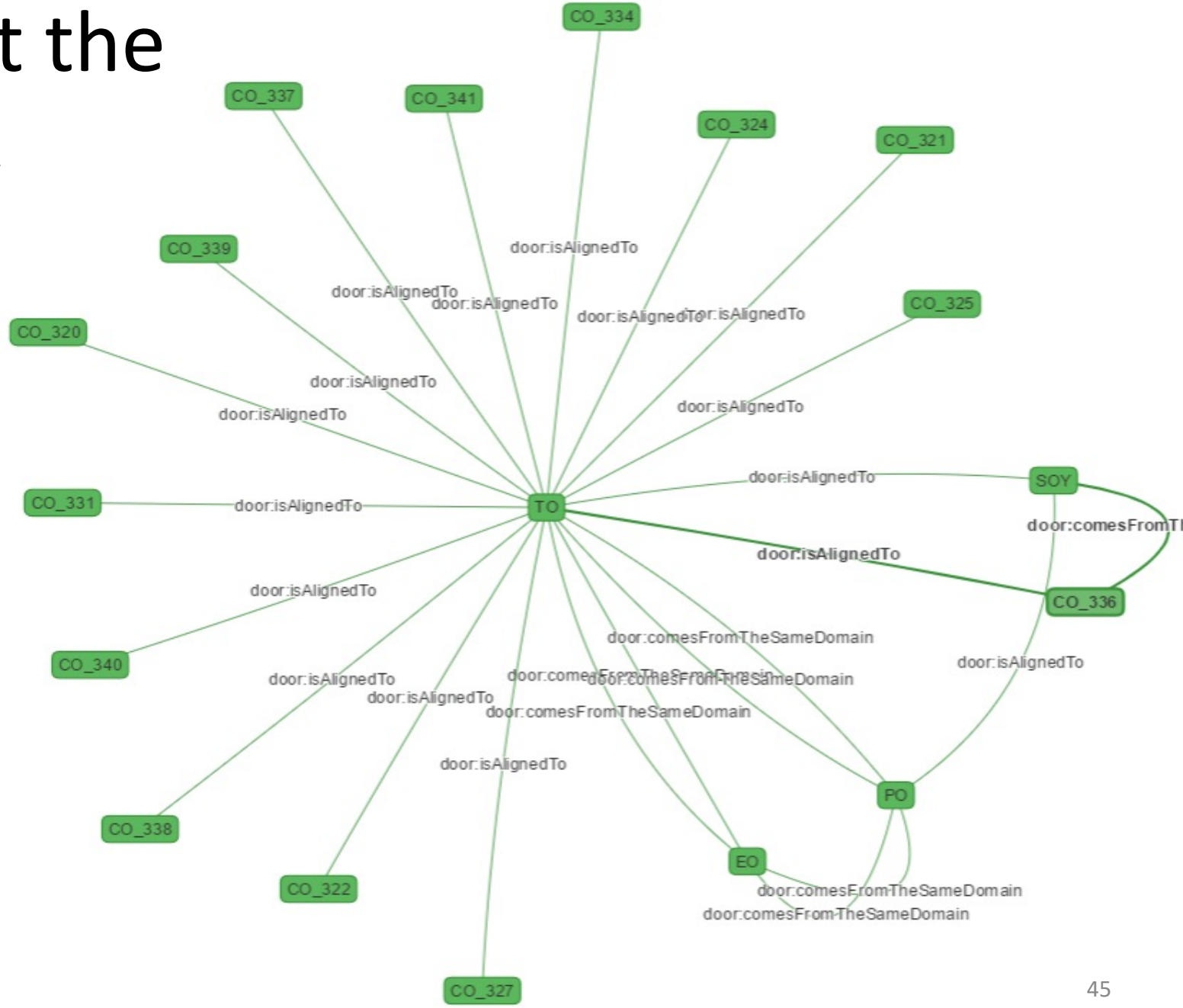
- Display “per property”
  - Global presentation of the properties
  - Synthesis diagrams & listing
- Allows to explore the agronomical ontology landscape by automatically aggregating the metadata fields of each ontologies in explicit visualizations (charts, term cloud and graphs).

Clement Jonquet, Anne Toulet, Biswanath Dutta, Vincent Emonet. **Harnessing the power of unified metadata in an ontology repository: the case of AgroPortal**. *Journal on Data Semantics*, Springer, 2018, pp.1-31.

Information about the ontology network

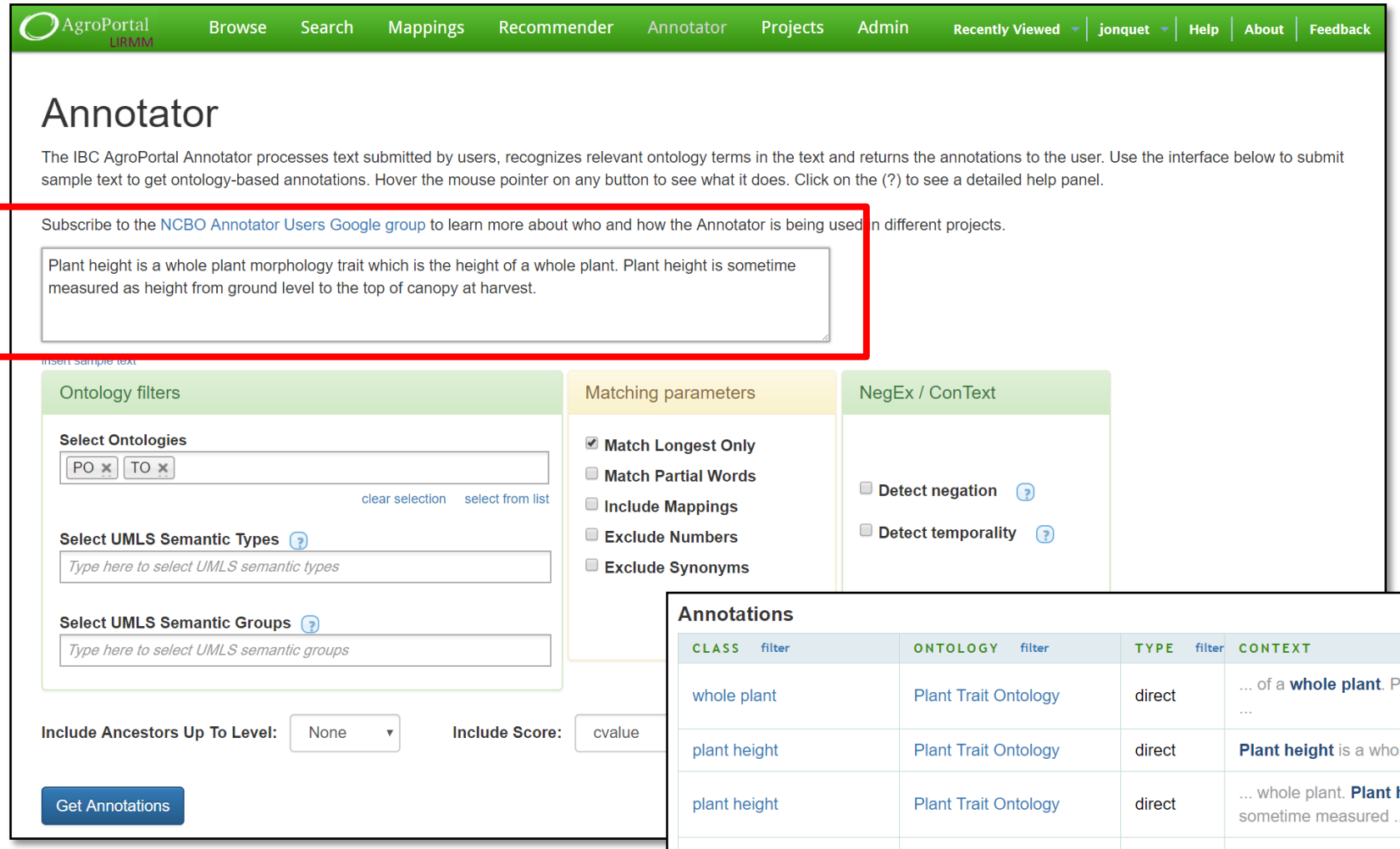
- [ ] omv:useImports
- [ ] door:isAlignedTo
- [x] door:ontologyRelatedTo
- [ ] omv:isBackwardCompatibleWith
- [ ] omv:isIncompatibleWith
- [x] door:comesFromTheSameDomain
- [x] door:similarTo
- [ ] door:explanationEvolution
- [ ] voaf:generalizes
- [ ] door:hasDisparateModelling
- [ ] dct:hasPart
- [ ] voaf:usedBy
- [ ] schema:workTranslation
- [ ] schema:translationOfWork

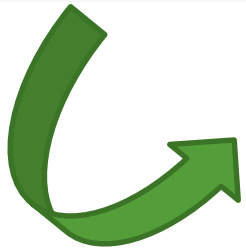
Filter Network



AgroPortal Annotator

identifies ontology concepts within plain text for semantic indexing





Annotations

total results 7 (direct 7 / ancestor 0 / mapping 0)

CLASS filter	ONTOLOGY filter	TYPE filter	CONTEXT	MATCHED CLASS filter	MATCHED ONTOLOGY filter	SCORE
whole plant	Plant Trait Ontology	direct	... of a **whole plant**. Plant height is ...	whole plant	Plant Trait Ontology	10.000
plant height	Plant Trait Ontology	direct	**Plant height** is a whole ...	plant height	Plant Trait Ontology	8.644
plant height	Plant Trait Ontology	direct	... whole plant. **Plant height** is sometime measured ...	plant height	Plant Trait Ontology	8.644
whole plant morphology trait	Plant Trait Ontology	direct	... is a **whole plant morphology trait** which is the ...	whole plant morphology trait	Plant Trait Ontology	6.644
whole plant	Plant Ontology	direct	... of a **whole plant**. Plant height is ...	whole plant	Plant Ontology	6.644
height	Plant Trait Ontology	direct	... is the **height** of a whole ...	height	Plant Trait Ontology	4.322
height	Plant Trait Ontology	direct	... measured as **height** from ground level ...	height	Plant Trait Ontology	4.322

Format Results As: JSON

Sprouting
Initial Vigor
Color of unexpanded apical leaves
Color of first fully expanded leaf
Leaf vein color
Apical Pubescence
Length of stipules
Number of leaf lobes
Leaf lobe position
Angle of petiole insertion
Petiole length
Petiole color
Anthocyanin pigmentation
Growth habit of young stem
Pubescence of young stem
Stem color
Leaf scar prominence
Apical branching
Branching levels
Branching Angle
Height of first apical branch
Height of plant
Total fresh weight foliage and stems
Total fresh weight foliage

Number harvested
Root number
Fresh weight of storage root
Fresh root yield
Dry yield
Harvest index
Proportion of lodged plants
Leaf retention
Plant architecture
Flowers (50%)
Sepal Color
Disc Color
Sigma color
Ovary color
Anther color
Female stamenoids
Male Sterile
Days to Flower
Fruit set
Fruit Exocarp
Root surface texture

AgroPortal LIRMM Browse Search Mappings

Annotator

The IBC AgroPortal Annotator processes text submitted by user
on any button to see what it does. Click on the (?) to see a detai

Subscribe to the NCBO Annotator Users Google group to learn

Plant architecture
Flowers (50%)
Sepal Color
Disc Color

Cassava Trait Ontology

Ontology filters

Select Ontologies

CO_334 ×

clear selection select from list


```
- {
  - annotatedClass: {
      @id: "http://www.cropontology.org/rdf/CO_334:0000386",
      @type: "http://www.w3.org/2002/07/owl#Class"
    },
    hierarchy: [ ],
  - annotations: [
    - {
        from: 11,
        to: 23,
        matchType: "PREF",
        text: "INITIAL VIGOR"
      }
    ],
```

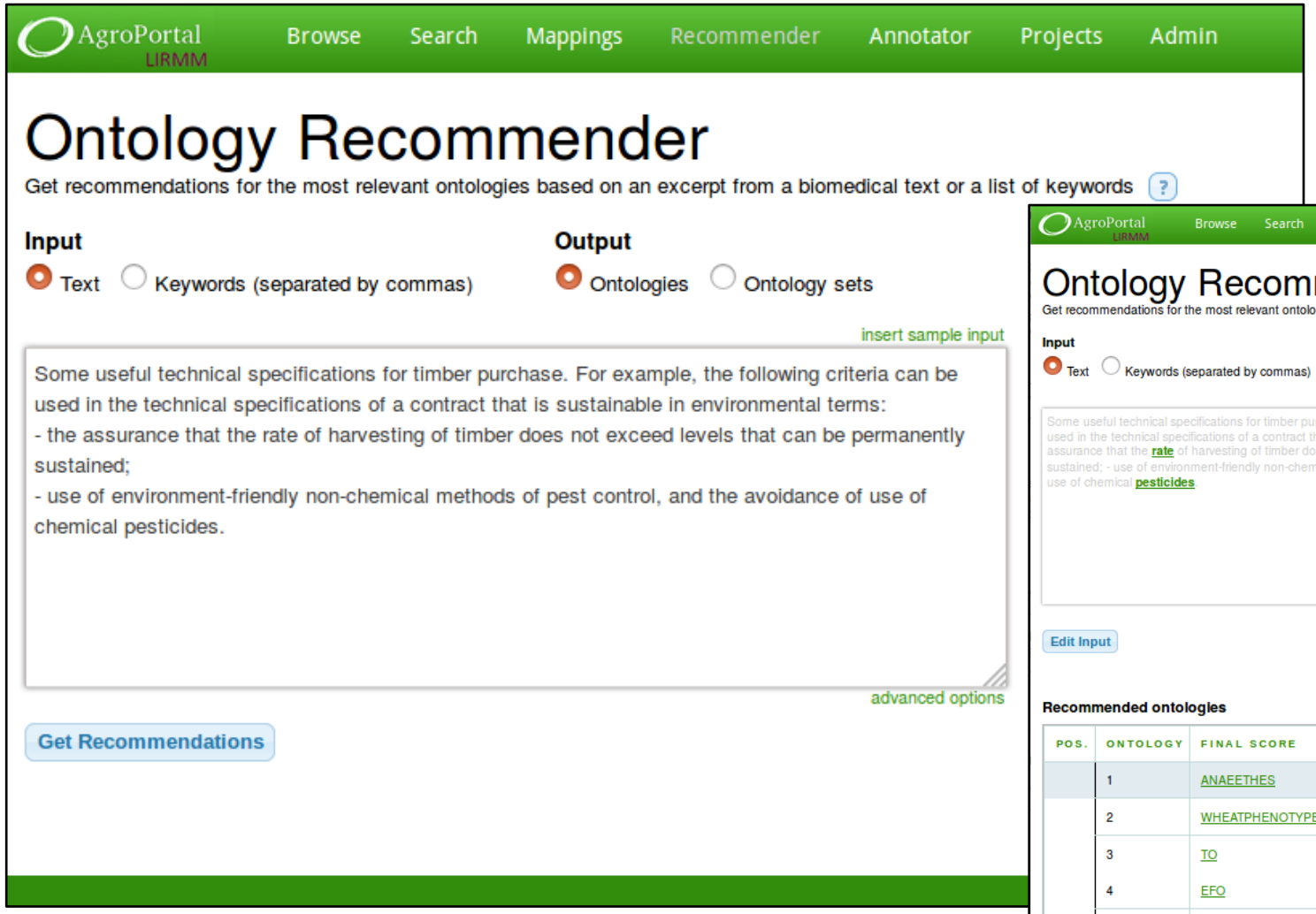

Cassava Trait Ontology

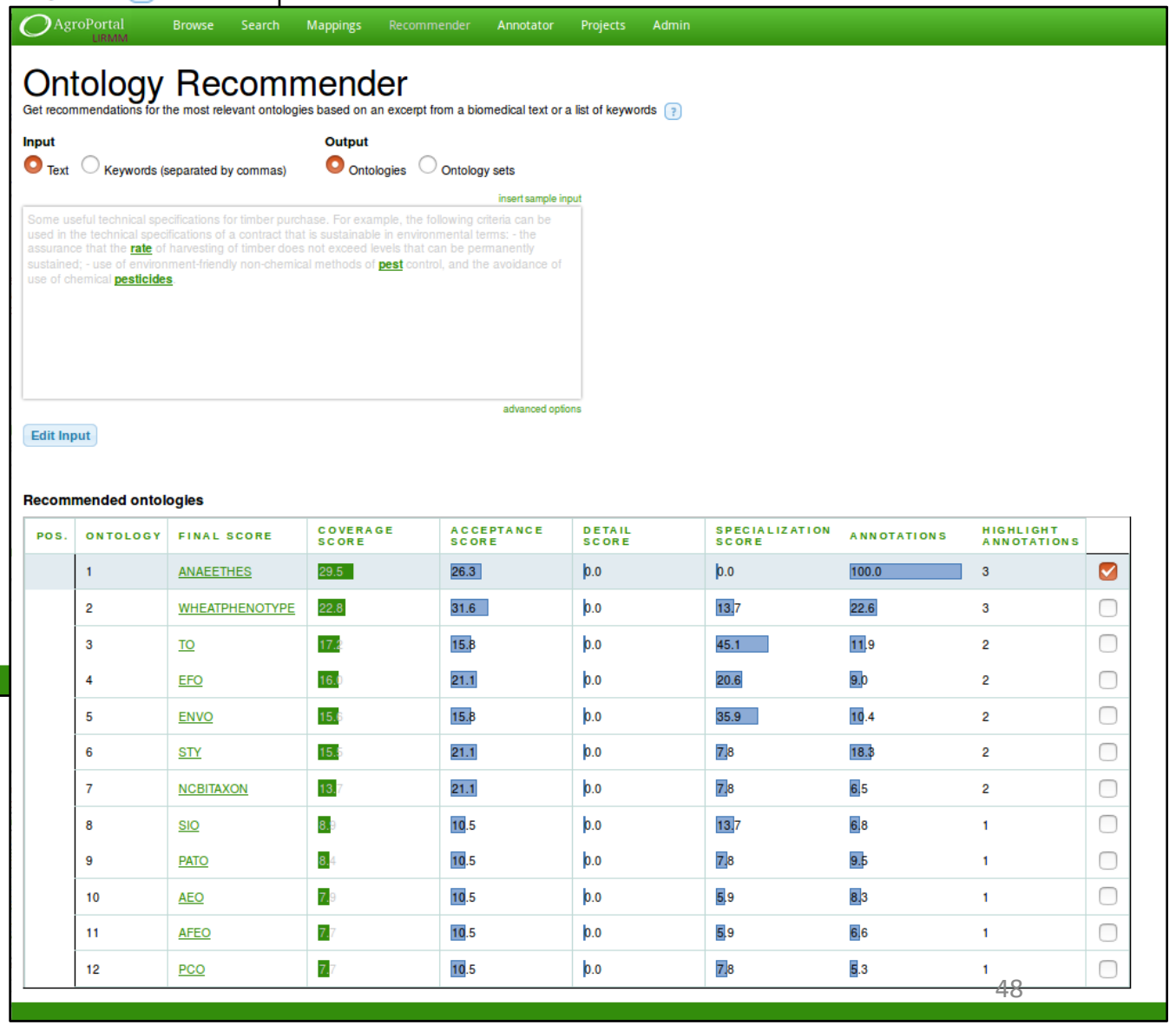
Summary Classes Properties Notes Mappings Widgets

Jump To:

- Cassava trait
  - Agronomical trait
    - Anthocyanin Pigmentation
    - Ease of Harvest
    - Female Stamenoids
    - Fresh Shoot Weight
    - Fruit Exocarp Texture
    - Fruit set presence
    - **Initial Vigor**
    - Leaf weight
    - Male Sterile
    - Marketable root number

Preferred Name	Initial Vigor
Synonyms	Initial plant vigor
Definitions	Initial plant vigor at one month after planting

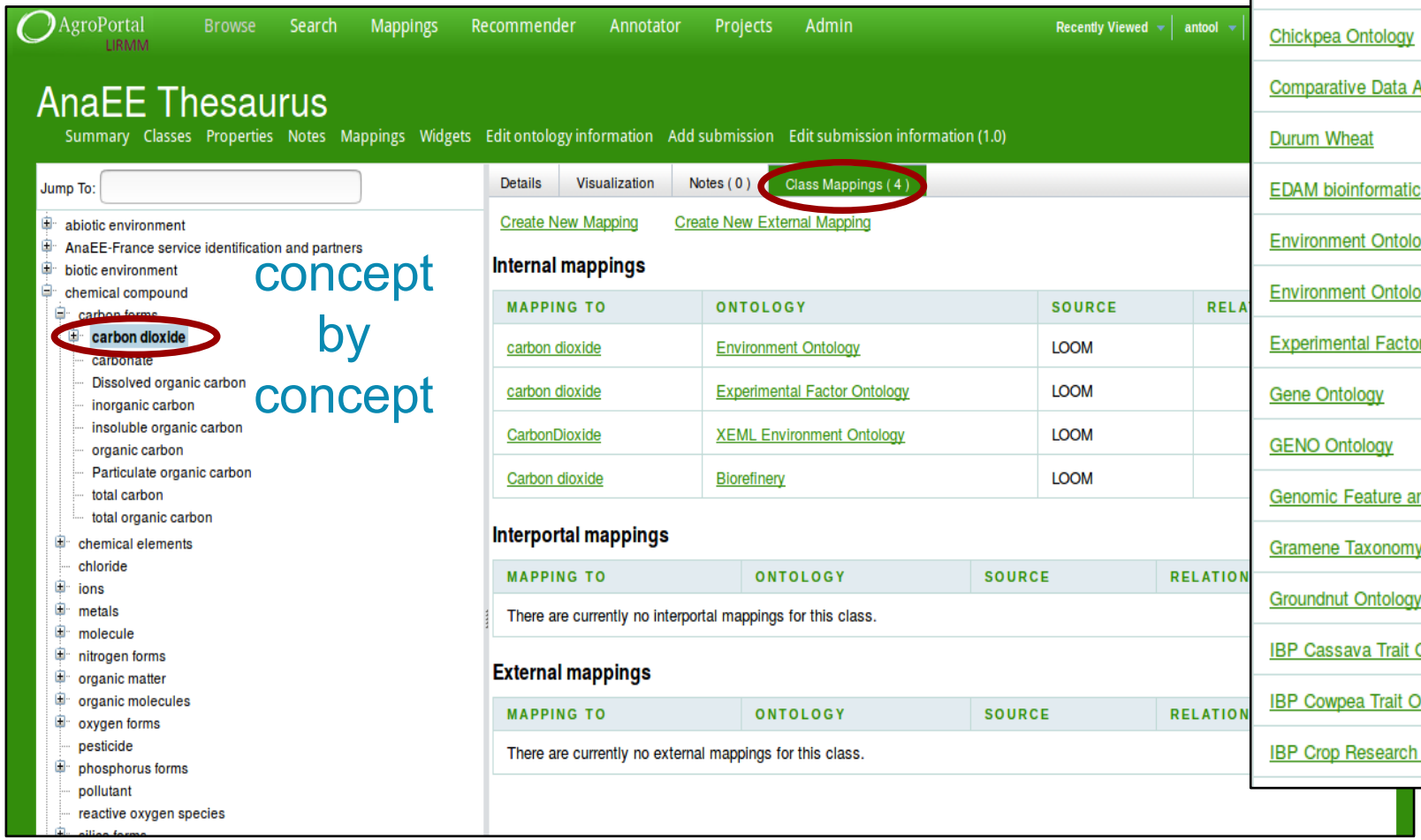




AgroPortal Recommender

get the most relevant ontologies for your data

Align ontologies one another

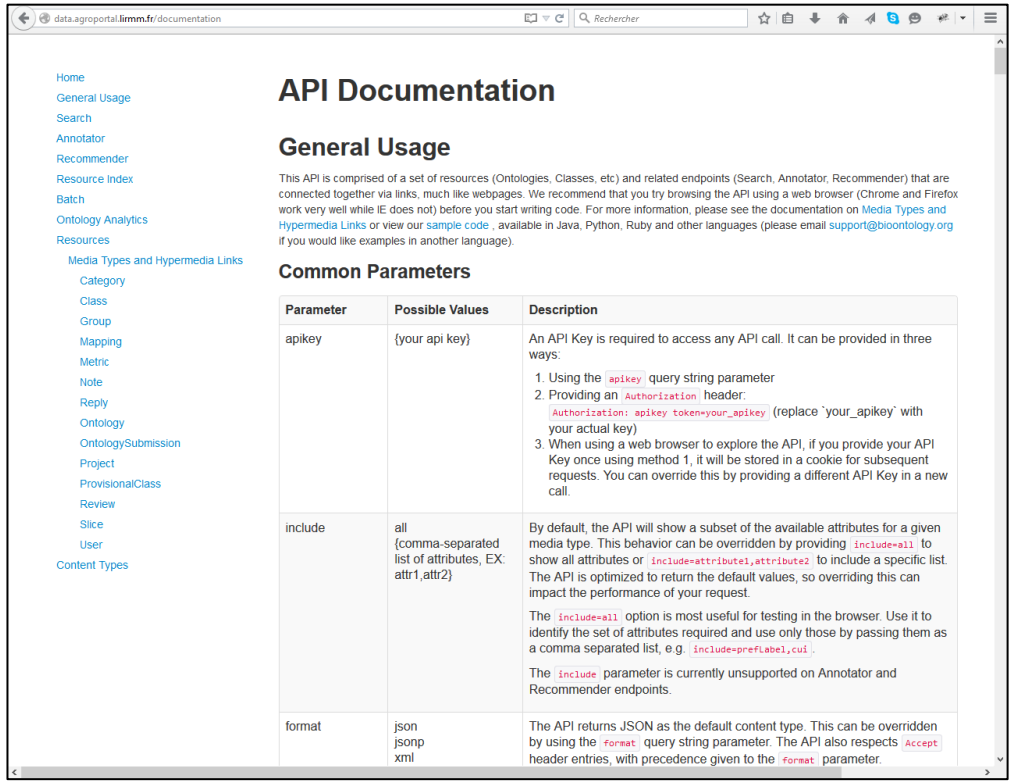


Mappings

ONTOLOGY	MAPPINGS
Agri-Food Experiment Ontology	1
Agricultural Experiments Ontology	5
Banana Anatomy	2
Basic Formal Ontology	1
Biorefinery	13
Cell Ontology	4
Chickpea Ontology	14
Comparative Data Analysis Ontology	3
Durum Wheat	2
EDAM bioinformatics operations, data types, formats, identifiers and topics	25
Environment Ontology	72
Environment Ontology for Livestock	10
Experimental Factor Ontology	93
Gene Ontology	5
GENO Ontology	5
Genomic Feature and Variation Ontology	5
Gramene Taxonomy Ontology	3
Groundnut Ontology	16
IBP Cassava Trait Ontology	23
IBP Cowpea Trait Ontology	25
IBP Crop Research Ontology	22

REST Service API:

http://data.agroportal.lirmm.fr/documentation

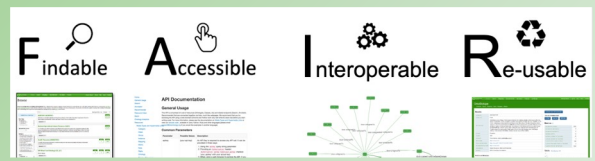


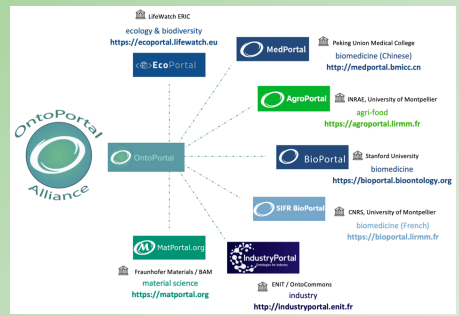
SPARQL endpoint:

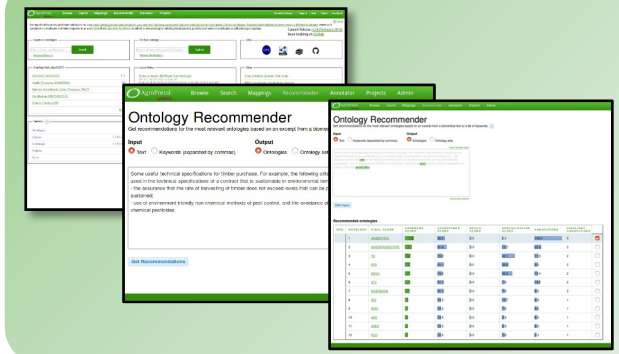
http://sparql.agroportal.lirmm.fr

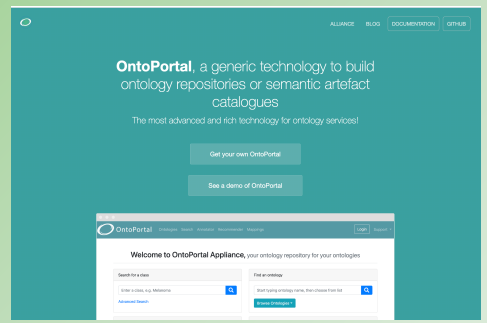
Conclusion

- Feedback welcome: support@ontoportal.org or agroportal-support@lirmm.fr
- Proposition to make OntoPortal deployable at the click of the mouse for a project or community
- Every new community, every new use cases brings new ideas. Participate. Join.
- Federated portals: yes, we are working on it.
- Exchanges with other communities: astronomy, social sciences & humanities, environment agencies, archeology, etc.









Summary

Questions ?