A semantic web faceted search system for facilitating building of biodiversity and ecosystems services

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INTRODUCTION



Context

- "Any morphological, physiological or phenological *feature measurable* at the *individual level*, from the cell to the wholeorganism level, without reference to the environment or any other level of organization" (Violle et al. 2007)
- Functional trait-based approaches are widely used to address biodiversity issues

Context

Functional traits

Seed mass Reproductive height Phenology

Vegetative height

Traits of living leaves NIRS spectrum

Root density Root diameter, length Root specific area



Functions

Fecundity Dispersal Recruitment

Light Interception Competitive ability

Resource acquisition/growth Litter decomposition

Absorption (nutrients, water, ...) Carbon fluxes (exsudation...) Underground competition

Garnier & Navas 2011

Organized in an unifying way the available data and data sources



Adapted from Kattge et al. 2010

Motivations

- Scientific experiments conducted in a collective and distributed way
- Need : organized in an unifying way the available data and data sources



TOP thesaurus

SKOS Thesaurus : stable reference resource

Around 1000 traits of plants (950 are well defined)

:Specific_leaf_area a skos:Concept; :prefUnit "m2kg-1[DM]"; rdfs:label "Specific_leaf_area"^^xsd:string; rdfs:subClassOf :Morphology; vs:term_status "testing"; skos:broaderTransitive :Morphology; skos:definition "The one sided area of a fresh leaf devided by its oven-dry mass"; skos:inScheme :Thesaurustrait; skos:related :Leaf_blade_thickness, :Leaf_mass_per_area; skosxl:prefLabel "Specific_leaf_area".

-Leaf

-Leaf area -Leaf mass -Seed -Seed mass -Seed color -Bark

-Bark thickness -Bark carbon content -Root -Root Length

-Root diameter







-Reproduction, Dispersion -Seed mass -Plant height -Absorption, Carbon Fluxes -Root length -Root diameter -Resources acquisition -Leaf mass -Leaf area -Root length -Root diameter





Unifying system of plant trait modelling



FACETED SEARCH

Definition

• "a technique for *accessing a collection of information*, allowing users to explore by *filtering* available information. A faceted classification system allows the *assignment of* multiple classification to an object, enabling the classification to be ordered in multiple ways, rather than in a single, pre-determined, taxonomic order"

source : http://www.mumia-network.eu/index.php/workinggroups/wg4

Faceted search main principle

:OrganFacet a skos:Collection; skos:member :Leaf; skos:member :Root;

> skos:member :Seed; skos:member :Flower .

:Leaf a skos:Collection; skos:member :LeafArea; skos:member :Specific Leaf Area;

skos:member :LeafLifespan .

:SizeFacet a skos:Collection; skos:member :Area; skos:member :Length; skos:member :Density; skos:member :Mass; skos:member :Volume.

:Area a skos:Collection; skos:member :LeafArea; skos:member :Specific Leaf Area;

skos:member :XylemArea .

Faceted search main principle

:OrganFacet a skos:Collection; :SizeFacet a skos:Collection;

skos:member :Leaf;
skos:member :Root;

...

skos:member :Seed; skos:member :Flower . skos:member :Area; skos:member :Length; skos:member :Density; skos:member :Mass; skos:member :Volume.



Users' feedbacks

- Facets have been proposed by experts during the collaborative building of the thesaurus (using the Thesauform tool)
- Results:
 - 6 facets have been implemented "manually"

Existing ontologies

Use ontological terms as facet elements

- Ex: PO can be used to build the plant part facet
- Cell -> Tissue -> Organ
- Collections can be ordered in SKOS
- Facets as the result of queries
 - Give me the traits that have been measured on Leaf or on a part of Leaf
 - The facet Leaf will be built from the part_of relationship expressed by PO

RESULTS



Faceted search benefits



Leaf boron content

Leaf area per

Leaf nitrogen

Leaf phosphorus

Leaf mesophyll

Facilitate
 the thesaurus
 appropriation by the
 end-users :

 Reorganize in an intuitive way the thesaurus terms

•Facets allow multiple classification of traits, depending

Main Architecture



Faceted search benefits



Access to
 disseminated
 data with a
 reorganization
 of the
 information

CONCLUSION



Conclusion and future work

Faceted search

- Facets ensure flexibility
- Facets address the needs expressed in ecology
- Data access and retrieval according to community preferences

Next developments

- Text Mining Approach to build facets. Knowledge Extraction from literature. Which functions are linked to which traits?
- iDiv project : Searching data for analysis : access TRY dataset lists from Thesaurus Of Plant traits using SPARQL enpoint and webservice



THANK YOU FOR YOUR ATTENTION

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