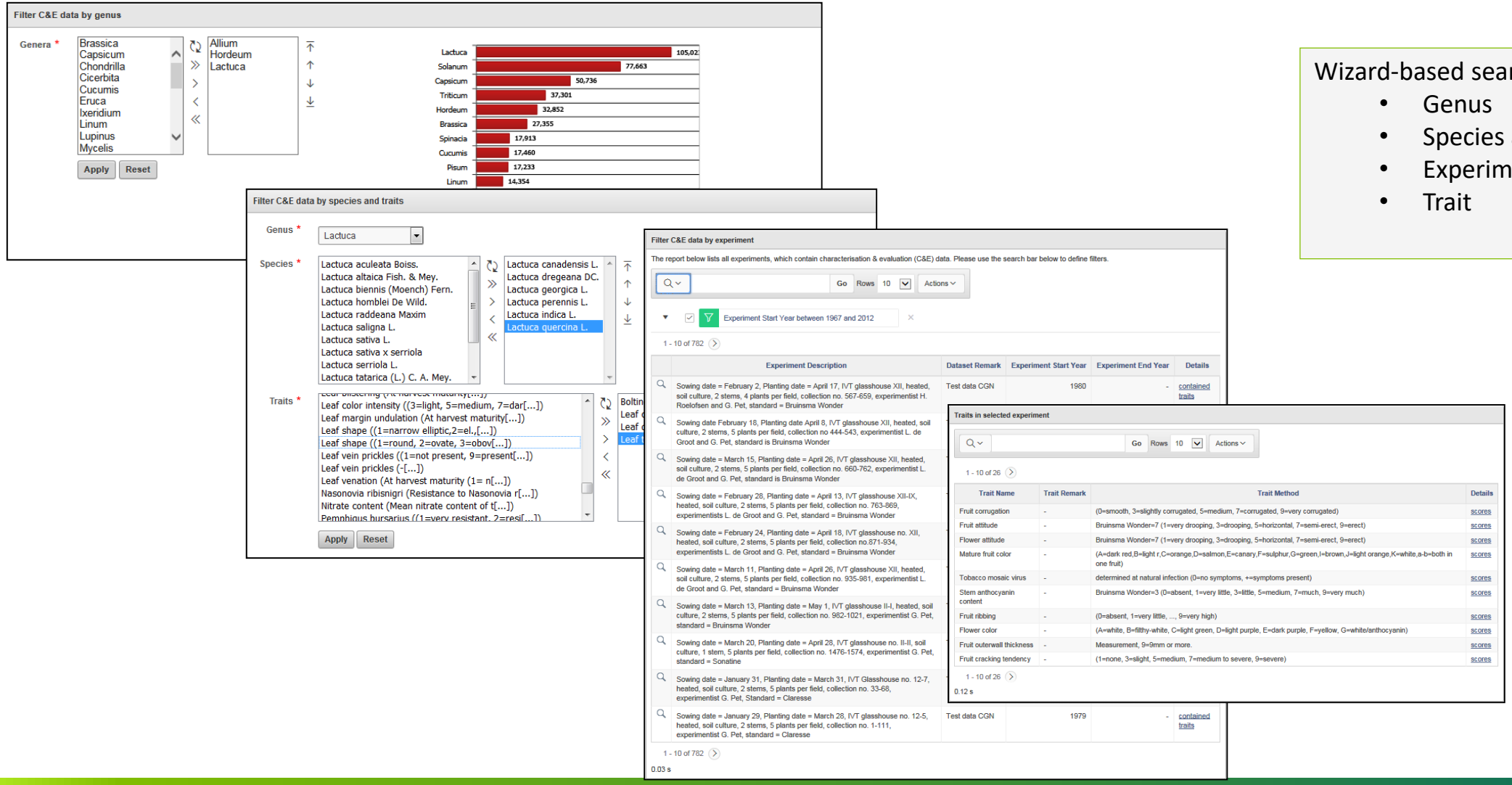
Stephan Weise

Phenotypic data in EURISCO

Status and plans

Third Meeting of the EURISCO Advisory Committee
7th July 2021

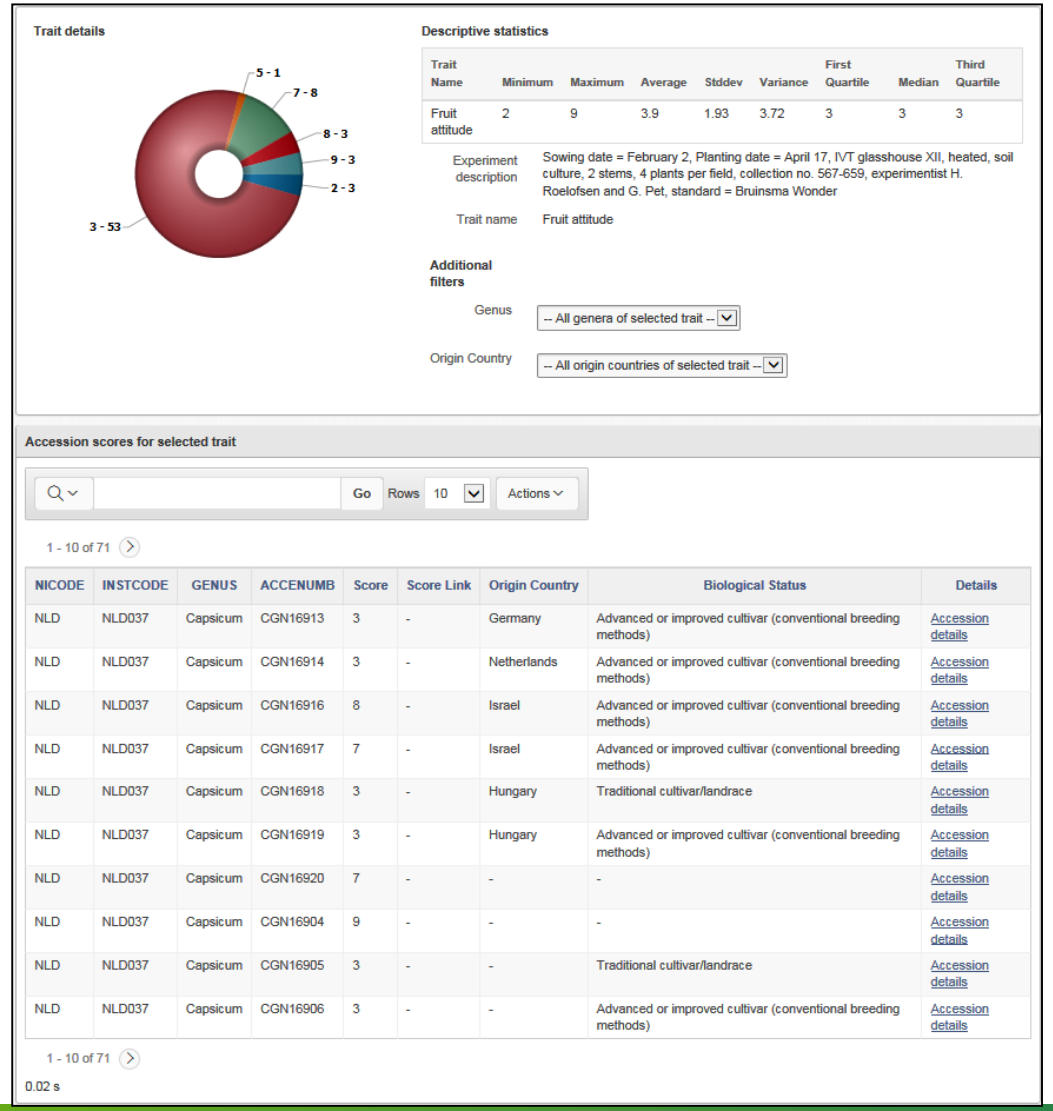
Phenotypic data search in EURISCO



Wizard-based searches for

- Genus
- Species and trait
- Experiment
- Trait

Phenotypic data search in EURISCO



Trait details

Descriptive statistics

Trait Name	Minimum	Maximum	Average	Stddev	Variance	First Quartile	Median	Third Quartile
Fruit attitude	2	9	3.9	1.93	3.72	3	3	3

Experiment description: Sowing date = February 2, Planting date = April 17, IVT glasshouse XII, heated, soil culture, 2 stems, 4 plants per field, collection no. 567-659, experimentist H. Roelofsen and G. Pet, standard = Bruinsma Wonder

Trait name: Fruit attitude

Additional filters

Genus: -- All genera of selected trait --

Origin Country: -- All origin countries of selected trait --

Accession scores for selected trait

Go | Rows 10 | Actions

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NICODE	INSTCODE	GENUS	ACCENUMB	Score	Score Link	Origin Country	Biological Status	Details
NLD	NLD037	Capsicum	CGN16913	3	-	Germany	Advanced or improved cultivar (conventional breeding methods)	Accession details
NLD	NLD037	Capsicum	CGN16914	3	-	Netherlands	Advanced or improved cultivar (conventional breeding methods)	Accession details
NLD	NLD037	Capsicum	CGN16916	8	-	Israel	Advanced or improved cultivar (conventional breeding methods)	Accession details
NLD	NLD037	Capsicum	CGN16917	7	-	Israel	Advanced or improved cultivar (conventional breeding methods)	Accession details
NLD	NLD037	Capsicum	CGN16918	3	-	Hungary	Traditional cultivar/landrace	Accession details
NLD	NLD037	Capsicum	CGN16919	3	-	Hungary	Advanced or improved cultivar (conventional breeding methods)	Accession details
NLD	NLD037	Capsicum	CGN16920	7	-	-	-	Accession details
NLD	NLD037	Capsicum	CGN16904	9	-	-	-	Accession details
NLD	NLD037	Capsicum	CGN16905	3	-	-	Traditional cultivar/landrace	Accession details
NLD	NLD037	Capsicum	CGN16906	3	-	-	Advanced or improved cultivar (conventional breeding methods)	Accession details

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Wizard-based searches for

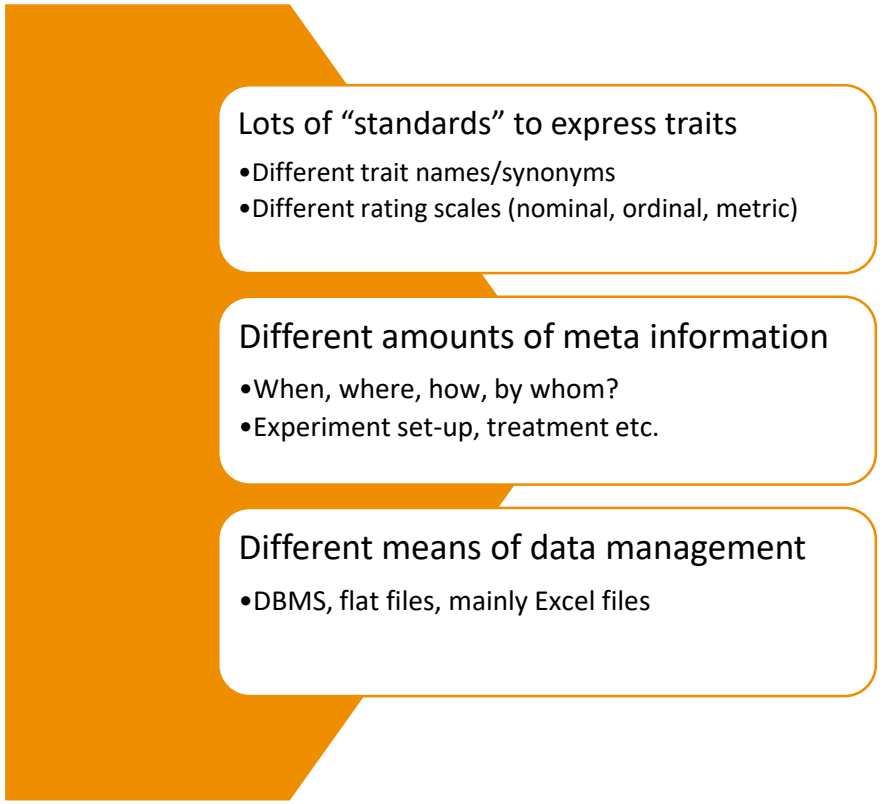
- Genus
- Species and trait
- Experiment
- Trait

Refine result

- Sort
- Filter
- Download
- Chart

Dealing with phenotypic data: Great diversity

- Phenotypic data
  - Determines value of germplasm for breeding and research
  - Crop-specific traits and methods
  - Many historical datasets
  - Usually no data from high throughput phenotyping
  - Data has to be aggregated or exchanged between organisations



Dealing with phenotypic data : Existing situation

Methods and Descriptors

- Crop-specific definitions of traits, methods etc. like IPGRI descriptor lists
- Often used in parts only and adapted to organisational needs

Exchange Formats

- E.g. Darwin Core germplasm extension (DwC-germplasm; Endresen et al. 2009)
- Great for computer scientists
- Difficult to handle for genebank curators

Ontologies

- Help to structure the (phenotypic) world
- Improve interoperability of data
- e.g. Crop Ontology (Arnaud et al. 2012)

Dealing with phenotypic data: Current approach

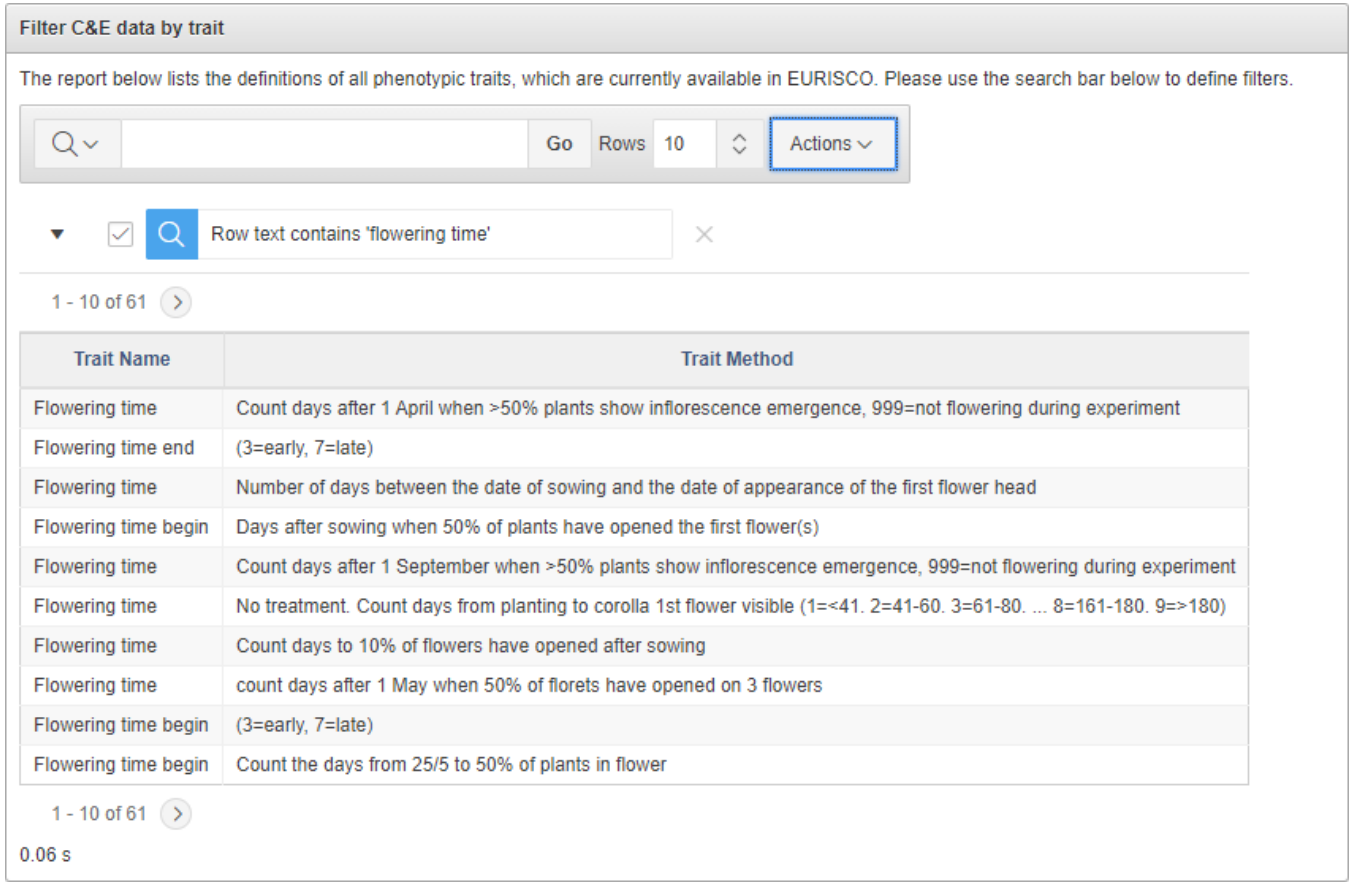
- Data standardisation
  - About 600 germplasm collections in Europe, around 400 in EURISCO
  - No standardisation of trait, scale or experimental design
  - Pragmatic approach: Import of existing data as-is to reach critical mass
- Data exchange
  - Only standardisation of exchange format
    - As simple as possible
    - As few fields as possible

  → “minimum consensus”
- Data management
  - Highly abstracted, following the single-observation concept (van Hintum et al. 1992)
  - Omitting fine-grained metadata

Dealing with phenotypic data: Data overview

- Extension available since 2016
- 2,680,511 records
- 90,569 accs. with phenotypic data
- 17 countries
- 68 phenotypic datasets
- 3,862 experiments
- 9,415 traits

- Increasingly accepted as repository, but limited comparability



Filter C&E data by trait

The report below lists the definitions of all phenotypic traits, which are currently available in EURISCO. Please use the search bar below to define filters.

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Row text contains 'flowering time'

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Trait Name	Trait Method
Flowering time	Count days after 1 April when >50% plants show inflorescence emergence, 999=not flowering during experiment
Flowering time end	(3=early, 7=late)
Flowering time	Number of days between the date of sowing and the date of appearance of the first flower head
Flowering time begin	Days after sowing when 50% of plants have opened the first flower(s)
Flowering time	Count days after 1 September when >50% plants show inflorescence emergence, 999=not flowering during experiment
Flowering time	No treatment. Count days from planting to corolla 1st flower visible (1=<41. 2=41-60. 3=61-80. ... 8=161-180. 9=>180)
Flowering time	Count days to 10% of flowers have opened after sowing
Flowering time	count days after 1 May when 50% of florets have opened on 3 flowers
Flowering time begin	(3=early, 7=late)
Flowering time begin	Count the days from 25/5 to 50% of plants in flower

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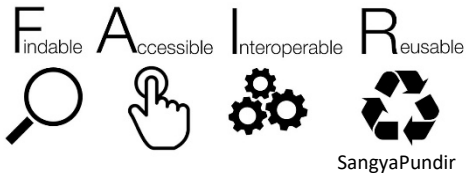
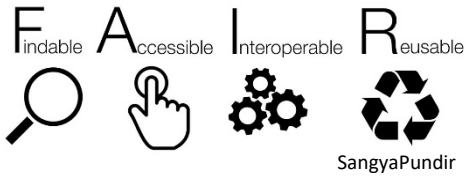
as of 2021-06-23

Dealing with phenotypic data: Towards FAIR data



- Data harmonisation
  - Experiment set-up, treatment etc.
  - Reach MIAPPE-compliance (Krajewski et al. 2015)
- Better structuring
  - Traits/methods/scales
    - Development of common vocabularies/approaches
    - Improve comparability
      - Mapping onto ontology terms
      - Ontology of choice: Crop Ontology (Arnaud et al. 2012)
      - Crux: Sustainability of ontologies
- Provide training + helpdesk
- Additional activities together with various partners, e.g. AGENT

AGENT as a blueprint



- Current limitations
  - EURISCO data exchange format represents a „minimum consensus“
  - Difficult to compile files manually
  - Very limited reproducibility and comparability
- AGENT approach
  - Simplification of data collection → one column per trait to support manual recording
  - Distinction in two types of data

Two “types” of phenotypic data

- Historical phenotypic data
  - Existing data, e.g. from seed multiplication
  - Collected over a long period of time
  - Relatively few metadata available
  - Focus on simple traits

- New experimental data
  - Desirable to describe the experiments as comprehensive as possible
  - Harmonisation of data of the various project partners
    - Traits
    - Methods
    - Experimental set-ups

Two “types” of phenotypic data (cont.)

- Historical phenotypic data
  - Simplified EURISCO-EVA templates should be sufficient

    →Already in use

- New experimental data
  - Templates presently used in EURISCO do not allow to collect additional metadata
    - Only very little information can be represented
    - Focussing on providers managing data in database management systems
  - Strive for increased user-friendliness
  - Consider more extensive metadata
  - Allow full MIAPPE compliance

    → Under development

Separate template for new data?

- Data to be collected
  - Actual observation data → relatively easy to handle
  - Metadata → can be compiled during a datathon
    - Experimental set-up (start and end, plot length and width, number of rows, distance between rows, seeds/m^2, experimental design, …)
    - Treatments (herbicide, fungicide, insecticide, fertiliser, growth regulator, …)
    - Experimental location (location/site name, coordinates, average values of precipitation, temperature, soil type, …)
    - Soil information (N, pH, K_2O, P_2O5, Mg, ….)
    - Traits
      - Definition (name, description, unit, type, method, ontology term)
      - Range of values (rating values, allowed min/max values)

M. Grau / IPK

Thank you for your attention