

Digital tools and Ontology:

A Collaborative Pathway For Managing & Sharing Cocoa Data

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Cocoa agroforestry systems

- Cocoa is a **major global commodity**, and its production **involves millions of smallholder farmers**.
- Cocoa agroforestry systems also brings a wide range of ecological, biodiversity conservation benefits.
- The changing climate of the coming decades is expected to alter the suitability of many current cocoa production sites



The cocoa crisis: why the world's stash of chocolate is melting away

It's the world's favourite sweet treat - and this week one of the industry's biggest players warned that supplies could soon be running low. Guardian writers around the world report on the causes of the problem, from disease and crop failure to the rise of the chocolate crisp.



▲ Growing market... Domestic sales in China have doubled in the past decade, and an average each person eats 100g annually - but that pales in comparison to the UK, where per capita consumption is 6kg a year. Photograph: Instagram/Julian Sales

Challenges in in Cocoa Sector

- Many of Cocoa experimental datasets ended up in separate repositories in various formats often with **missing headings** and **contextual information**
- Lacks data **sharing protocols**, and collaborative re-use of data
- Creates barriers in data discovery, gathering, managing and harmonizing from different sources for better decision making
- Urgent need for FAIR data solutions to improve Cocoa economic, social and environmental sustainability

Objective

- The main objective is to develop digital solutions by combining local knowledge and mobile technologies, to support cocoa productivity and human well-being

Specific objectives:

- To design an integrated mobile based data collection, transmission and visualization system
- To standardize vocabulary, concepts and relations between cocoa agronomy and production processes through cocoa ontology
- To implement and operationalize the developed solutions in cocoa production site of Cote d'Ivoire, Ghana, Nigeria, and Cameroon

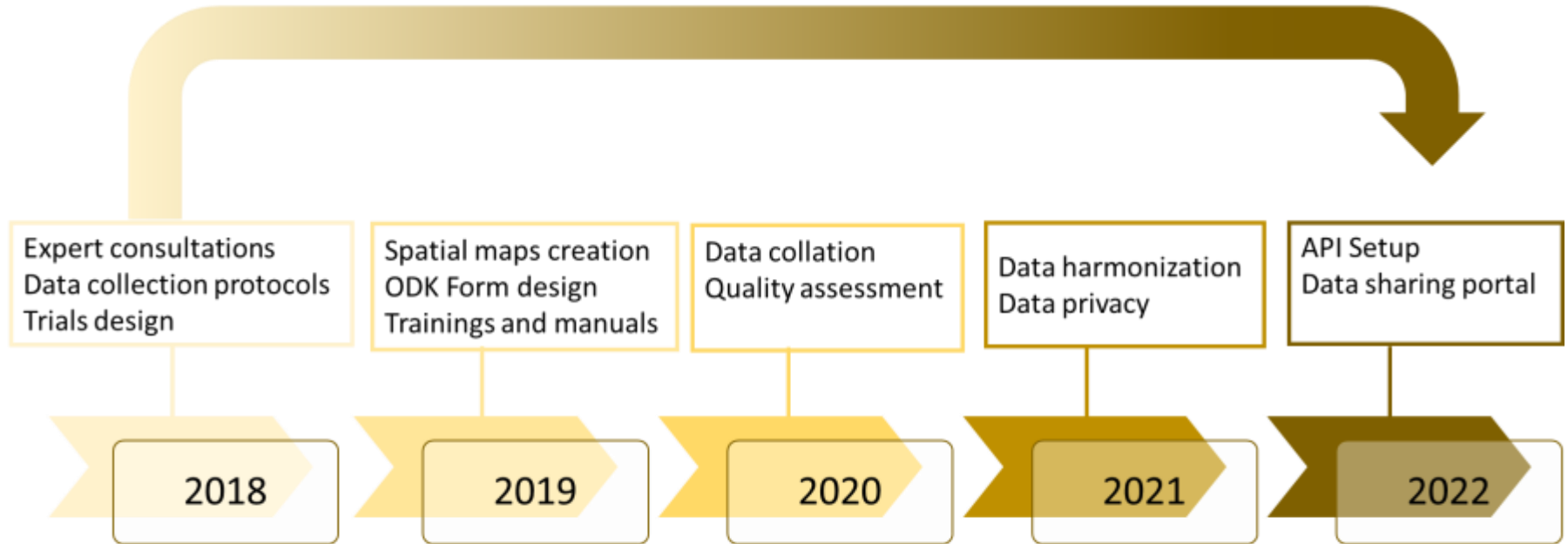
Implementation through CocoaSoils

- The CocoaSoils project aims to improve the efficiency and sustainability of cocoa production by focusing on the Integrated Soil Fertility Management (ISFM).
- This knowledge is not yet available, and therefore the partners of the CocoaSoils project will set up number of trials: core, satellite
- The program supports the multiple partners (i.e. government extension systems, the private sector, farmer organizations) and aim to empower 90,000 smallholder cocoa farmers directly



CocoaSoils data Journey

Cocoa ontology development

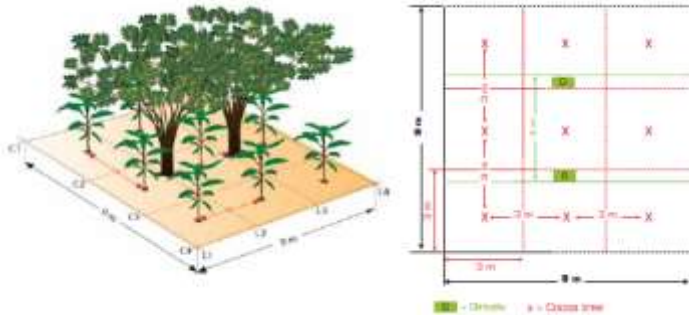


Setup of the project

- Cocoa plant



- Plot (15x15 grid)



Core / Satellite trials

Effect of:

- **fertilisers (N-P-K)**
- shading; organic fertilisers, pruning; weeding; pest control; seedling. etc
- 10 core trials sites (2 ha each) and ~ 393 satellite trials across 4 country

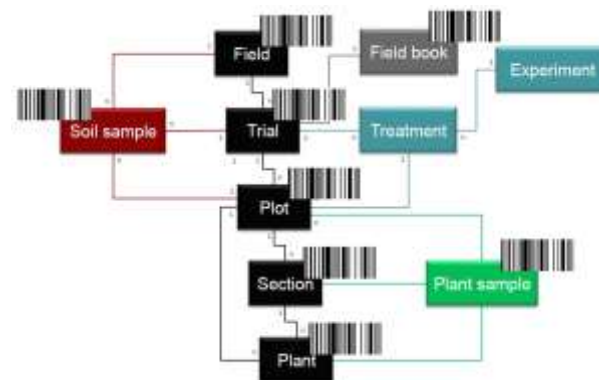


Labeling and data collection

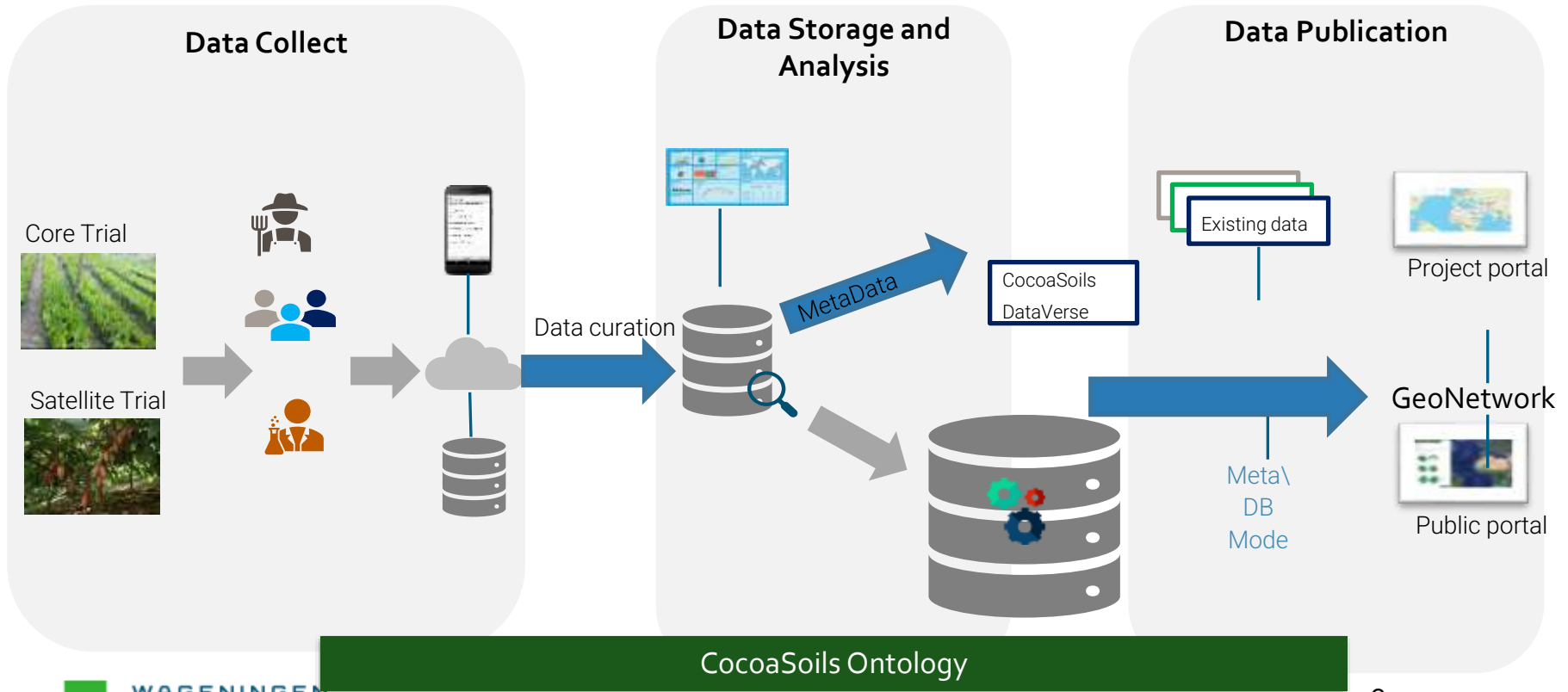


C0NI00100725

- C0 => stands for core trial
- NI => Country code
- 001 => Field ID
- 007 => Plot ID
- 25 => Tree ID



Ecosystem of data services



Data services

- More than 10,000 data points
- Scientific analysis facility: set of automated analytical procedures, API data import, Quality check, export, analysis
- Public and private data filtering facilities
- Data visualization platform - a facility to visualize in an attractive way the data for experts working in cocoa research and industry



The screenshot shows the CocoaSoils website interface. At the top left is the CocoaSoils logo, and at the top center is the text "Select a dataset to download". On the top right, there are navigation links for "Home", "Downloads", and "Ontology". Below the header, there are four filter fields: "Country:" with a dropdown menu showing "Cameroon", "Company:" with a dropdown menu showing "Ofam", "Dataset:" with a dropdown menu showing "Pod count", and "Date:" with two input fields labeled "from:" (containing "2021-05-01") and "to:" (containing "2022-05-01"). At the bottom of the form, there are two yellow buttons: "Download as CSV" and "Download as JSON".

Semantic enrichment- Cocoa Ontology

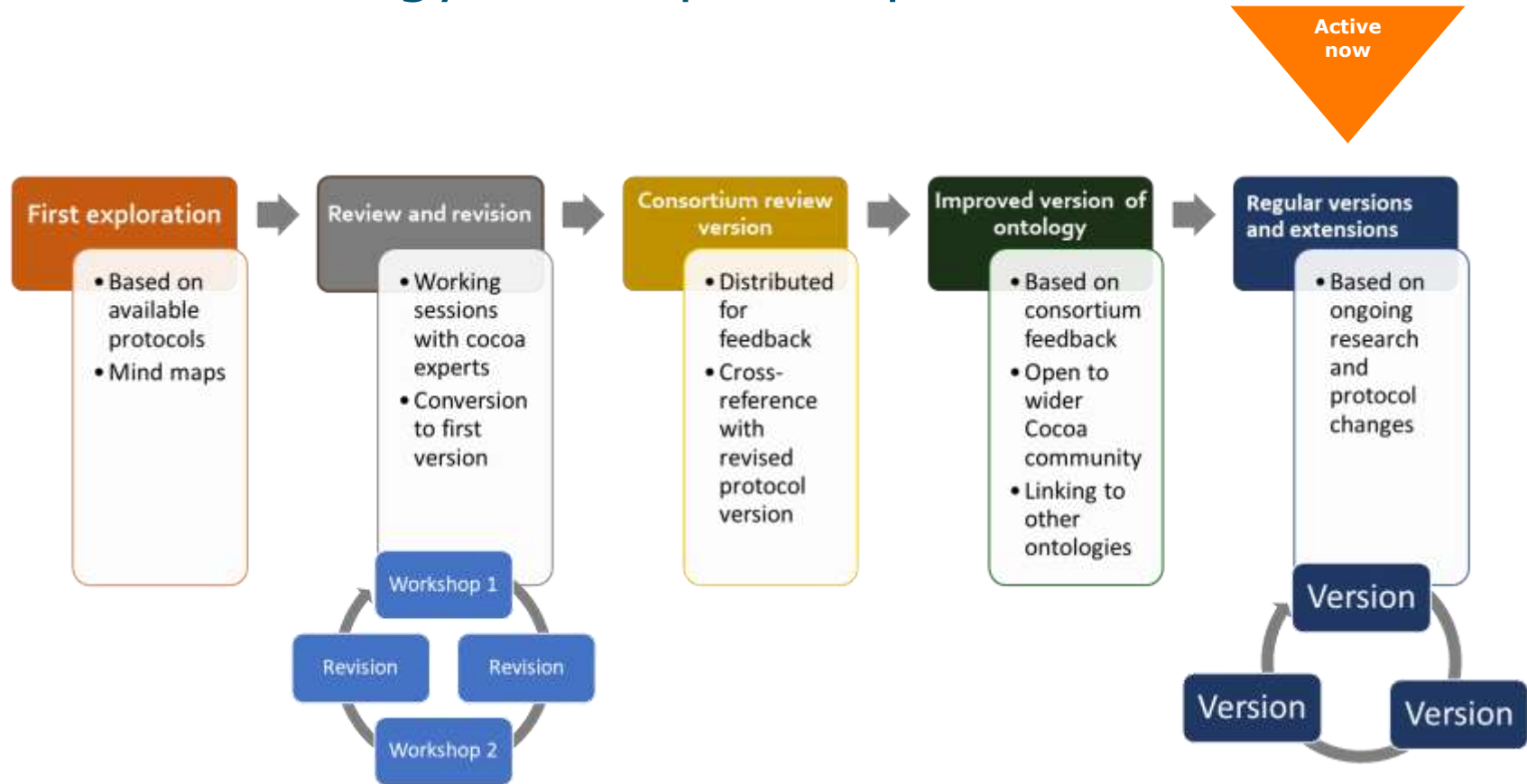
Main aim

Develop a cocoa Ontology **designed by all** and **accepted by all** and **used by all**.

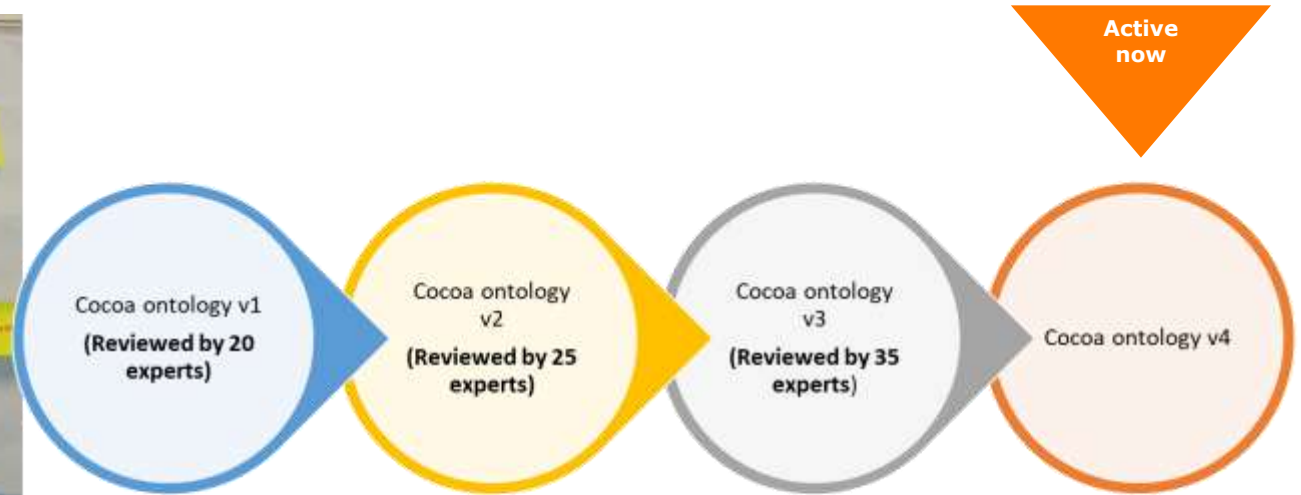
Sub aims

- Define, describe, and standardize vocabulary, concepts and relations between cocoa farming system and components;
- Formalize knowledge about cocoa agronomy and production processes; and
- Improve the communications among all stakeholders.

Cocoa Ontology development process

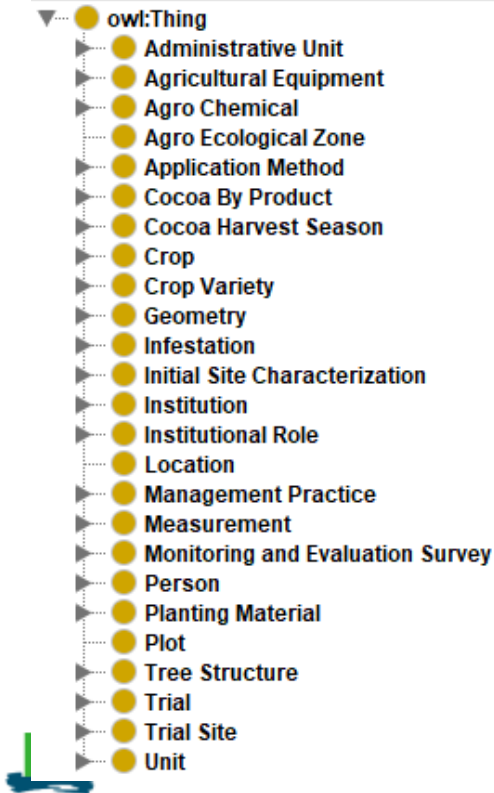


Review consolidations

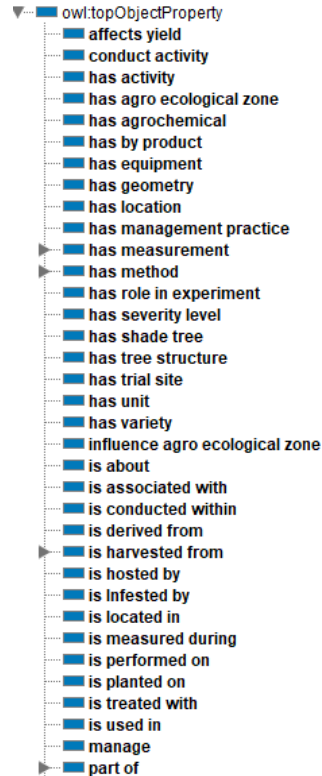


Cocoa Ontology

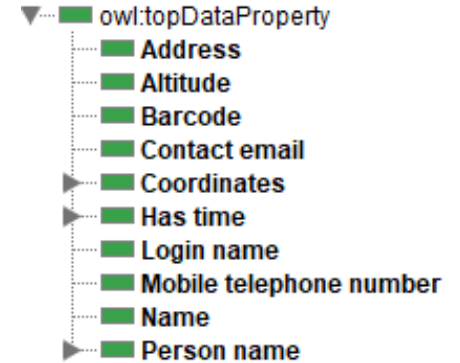
Domain of Cocoa Ontology



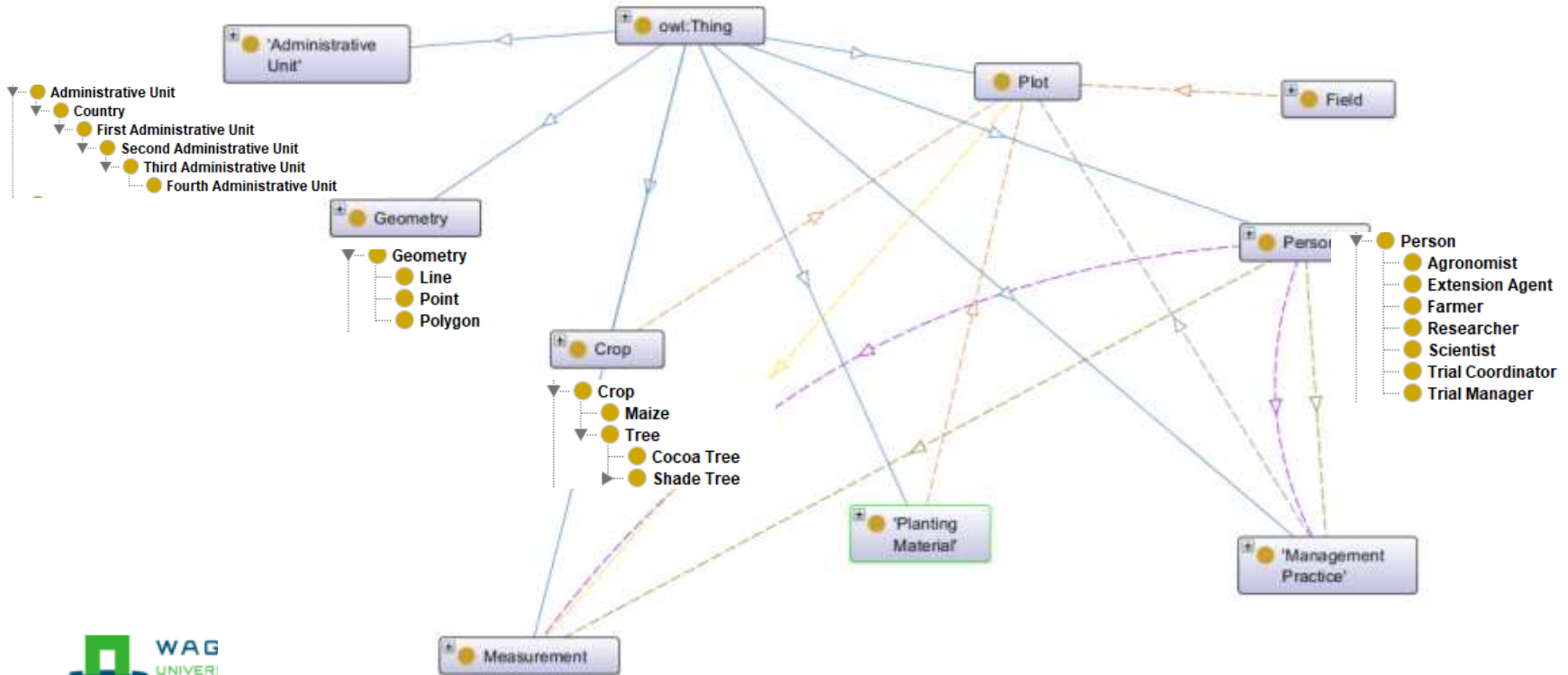
Object property



Data type property



Cocoa Ontology



Conclusion

- Data is essential for the sustainable cocoa production.
- We have developed and operationalize digital data collection workflow: from quality data collection to semantic interoperability as cocoa ontologies
- Chance to integrate cocoasoils data in wider research domains (i.e., crop growth modeling) through common set of vocabularies and ontologies
- Developed methods & technologies are open source and can be applied to other crops

Future Work

- CocoaSoils will continue till 2030
- Continuity of the data collection and Quality check
- Improvement on data sharing and feedback mechanism
- Educate the community on Cocoa Ontology to share data uniformly
- Continuous updates to integrate growing vocabulary and classes are crucial to ensure a sustainable long-term ontology.

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Thank you for your attention !

Feedback:

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