AgriGIS and the GRASP platform: a framework to embed precision agriculture data and processes?

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East Midlands Satellite Applications Centre of Excellence (EMBRACE)
***"Spatial solutions for precision farming"* workshop**

11th of May 2016

BGS, Keyworth, UK

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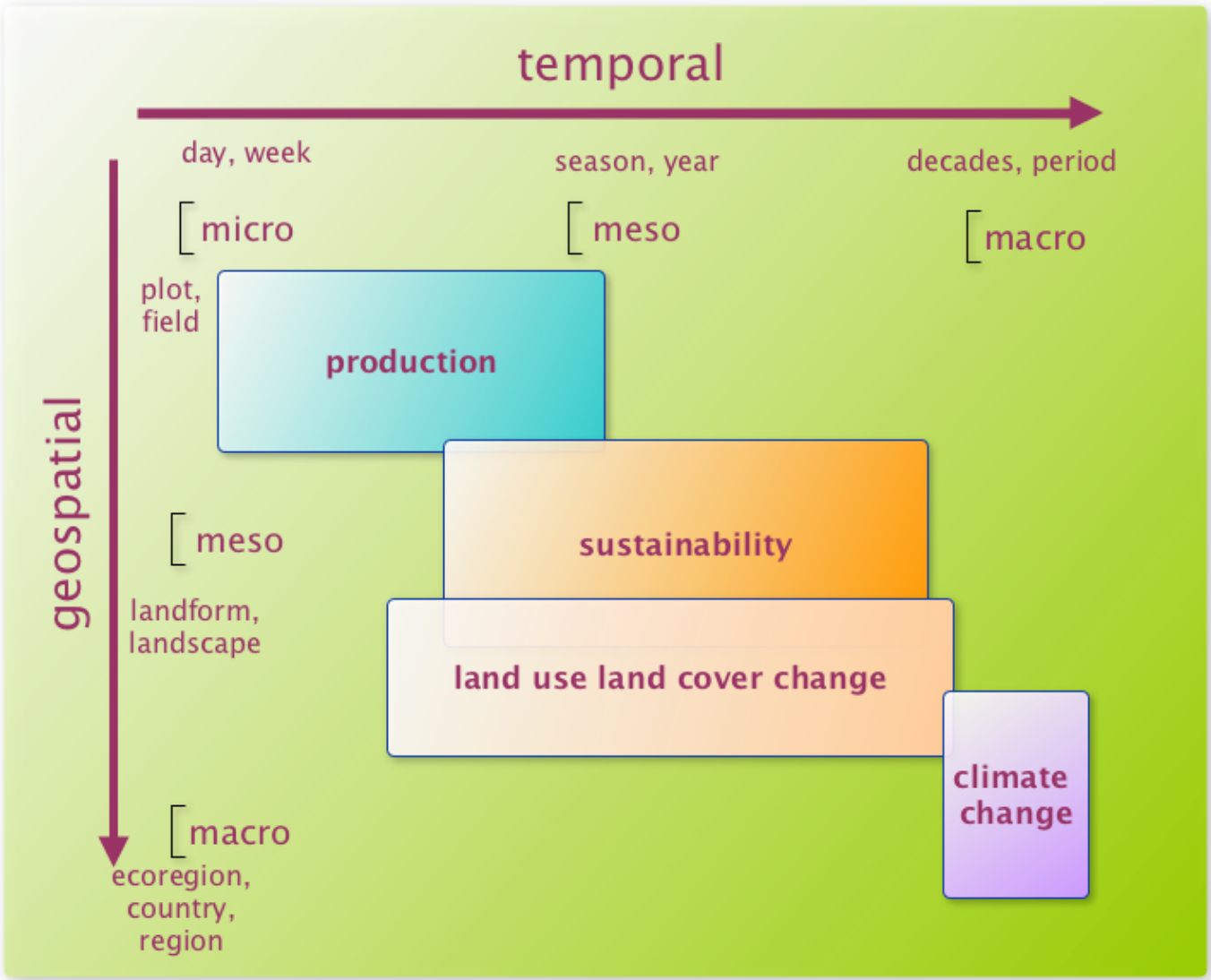
Agricultural modelling



GRASP

Geospatial Resource for Agricultural Species and Pests

BBSRC bioscience for the future

a multidisciplinary project between

Crop sciences / Plant Sciences /Agronomy
& Geospatial Sciences

- genetic & phenotypic & trait information
- agricultural & environmental information
- geospatial architecture & data & models management

"Geospatial Resource for Agricultural Species and Pests with integrated workflow modelling to support Global Food Security (GRASP-GFS): a prototype"

BBSRC TRDF call 2 Support for Development of Bioinformatic Tools and Computational Approaches to the Biosciences 2013

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"Geospatial Resource for Agricultural Species and Pests with integrated workflow modelling to support Global Food Security (GRASP-GFS)"

BBSRC bioscience for the future

Interoperability from data integration to geocomputational forecasts

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Dr. Rumiana Ray, Dr. Sean Mayes, Pr. Charlie Hodgman,

Pr. Sayed Azam-Ali

University of Nottingham, Crop Science / CPIB,

CFFRC (Malaysia)

and other partners UK, Australia,…

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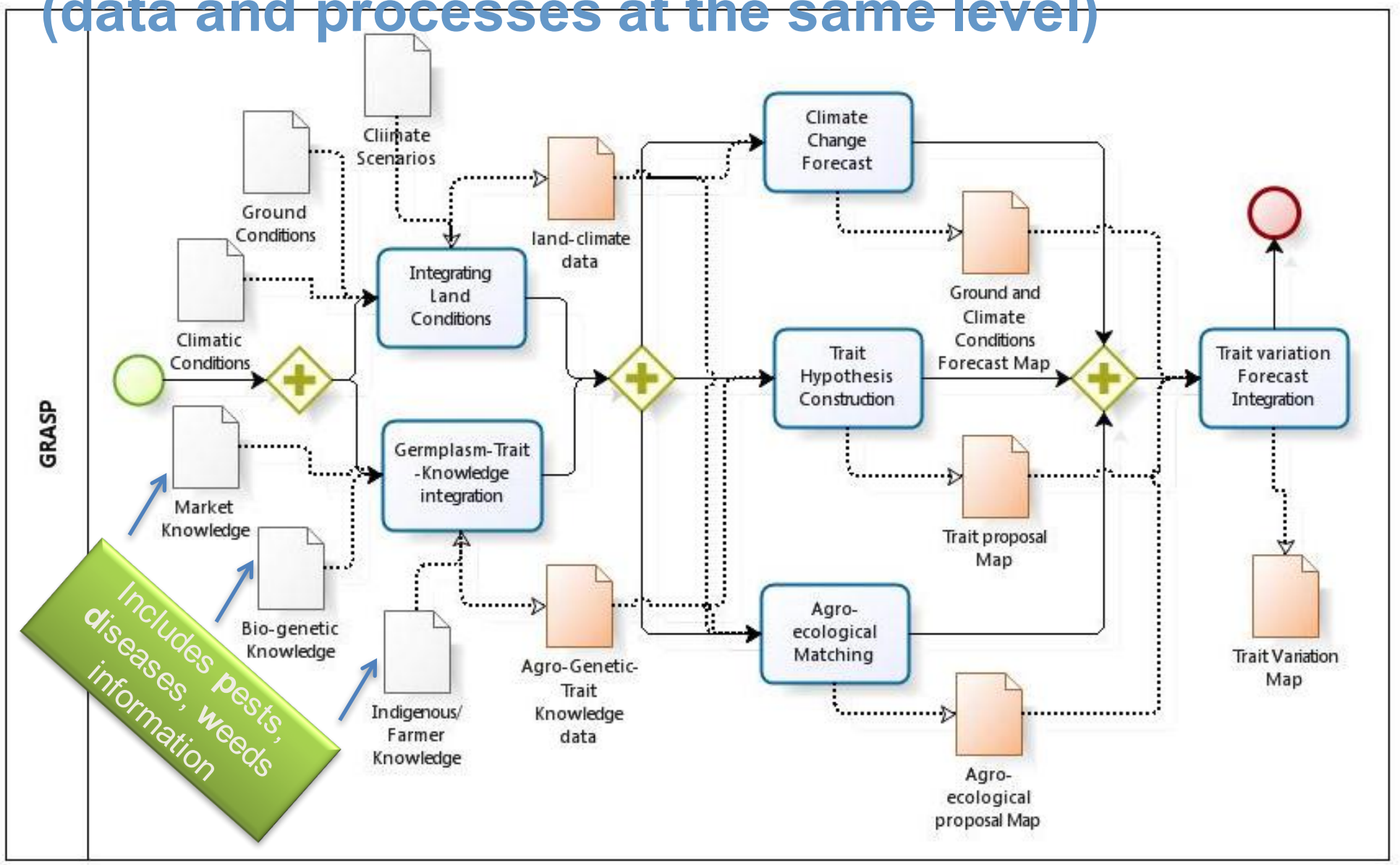
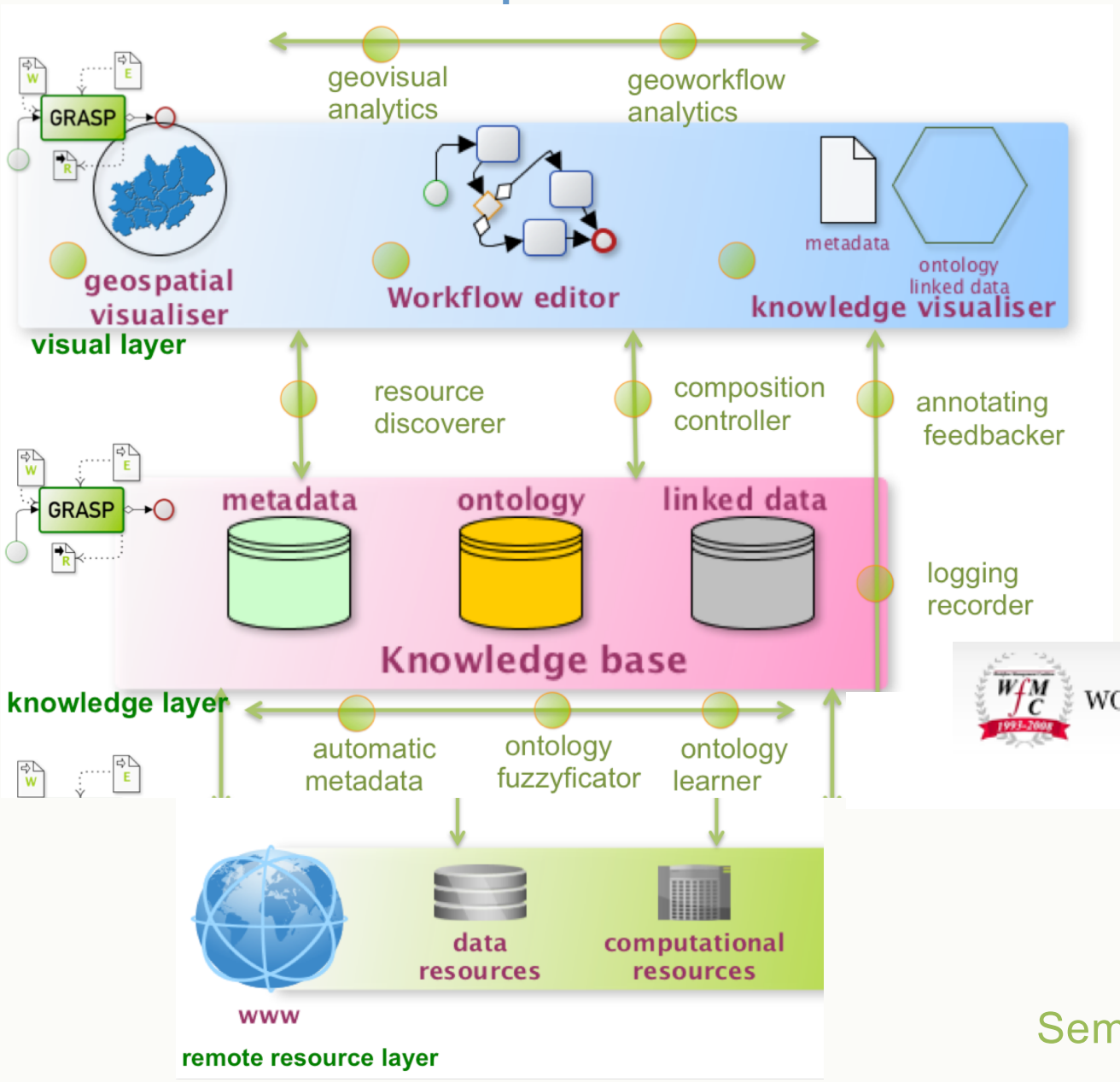
Generic workflow of the GRASP project
use and reuse of available information
(data and processes at the same level)



Workflow composition of Data & Processes



OGC®
Open Geospatial Consortium, Inc.

ISO/TC 211
Geographic information/Geomatics

WPS, WFS, WCS
CSW …

OMG
WE SET THE STANDARD

WFMC 1993-2008
WORKFLOW MANAGEMENT COALITION

BPMN 2.0

W3C®

Semantic Framework…

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Spatial Data Infrastructure

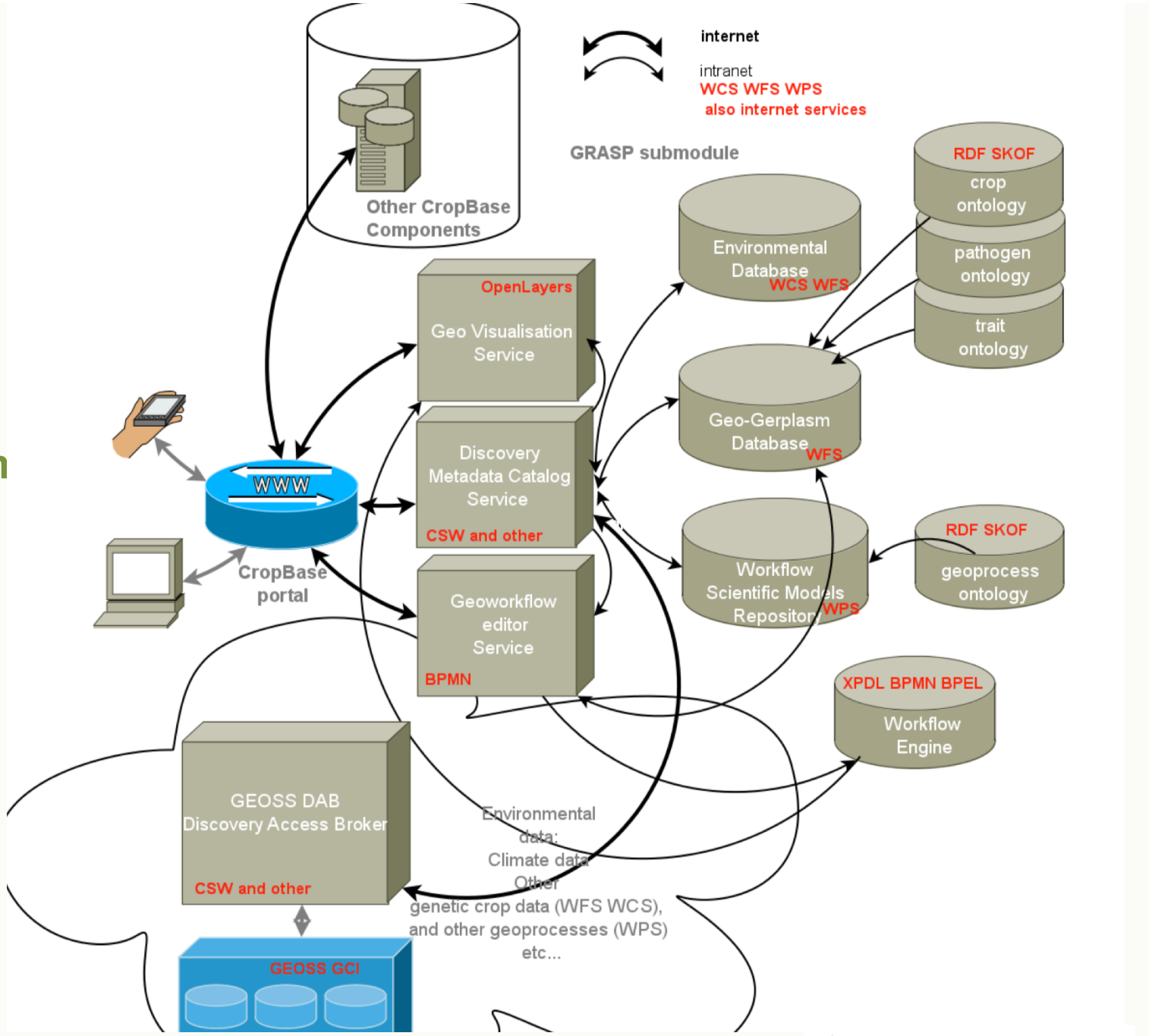
- GeogermplasmDB → genotypic variations
  CropStoreDB + OpenGIS (using PostGIS)
- Workflow composition → crop modelling
  e.g. coupling a disease model with APSIM
- Quality & error propagation → metadata & decision
  classical error propagation (multiple-run)
  meta-propagation of uncertainty (WPS)

major crops (wheat) and underutilised crop (Bambara groundnut)

GRASP platform

CropBASE system (CFFRC)

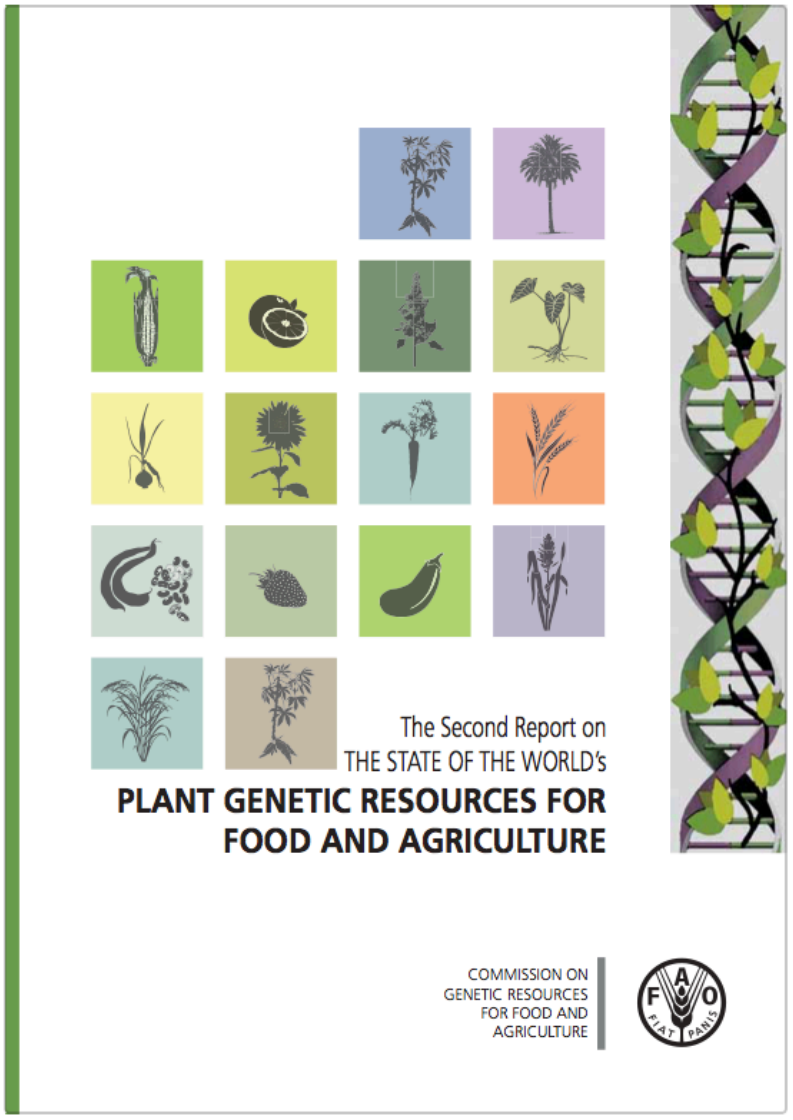
GEOSS



Current GRASP & H2020

- PhDs
  - Roberto Santos *Genetic and Environmental information (see next)*
  - Masoud Al –Azri *Disease modelling & crop growth integration*
  - Dai Huynh *Crowdsourcing under-utilised crops*
- H2020 past, present & future?
  - Einfra-9 2015 *GRASP-WRE* (failed)
  - Enfra22.1 2016 *GeoHeaVVen* reusing the workflow framework (submitted March 2016)
  - in Food Security …
- Links with CFF (Malaysia)
- AgriGIS / OSGIS workshops

The State of the World's Plant Genetic Resources for Food and Agriculture



1.2.3.2 Geographic Information Systems

New geographic methods are also proving to be of significant value in the management of plant genetic resources. Global Positioning Systems (GPS) are highly effective at pinpointing the exact location where a plant was collected in the field. Such data is invaluable, especially when combined with other georeferenced data, e.g. on topography, climate or soils, and analysed using GIS software. This information can greatly facilitate decisions on what to collect and where, and can help elucidate relationships between crop production, genetic diversity and various agro-ecological parameters. Such techniques can also be used to draw up agro-ecological models that can predict, for example, the impact of climate change on different crops and in different locations. These methods have demonstrated through the Focused Identification of Germplasm Strategy (FIGS) that they have a significant impact on the effectiveness and efficiency in 'mining' germplasm for specific adaptive traits for crop improvement.[25]

No country report indicates the extent to which geographic information tools are available and used within the country concerned and most of the reports

- http://www.fao.org/docrep/013/i1500e/i1500e.pdf

Spatial Patterns in the genetic variation of Bambara groundnut

How environmental and anthropocentric factors affected the genetic variation of Bambara groundnut?

Approach: molecular markers, environmental data and linguistic data;

Spatial Patterns in the genetic variation of Bambara groundnut

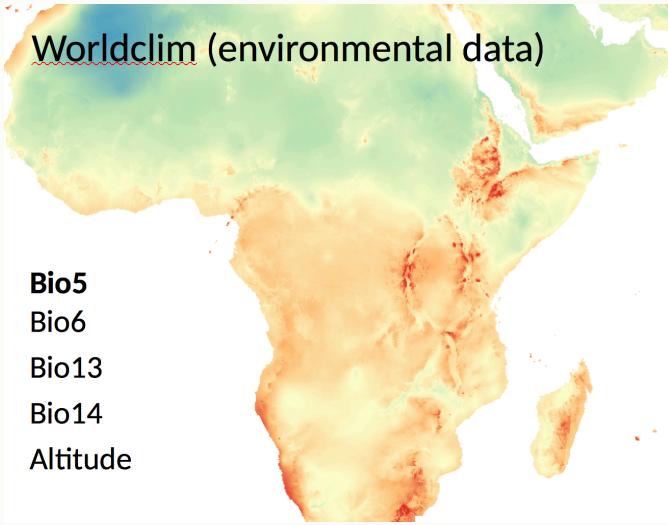
Single Sequence Repeats Markers or Microsatellites

Plant A … C A G T A G T T A T G A C … (1 repetition)

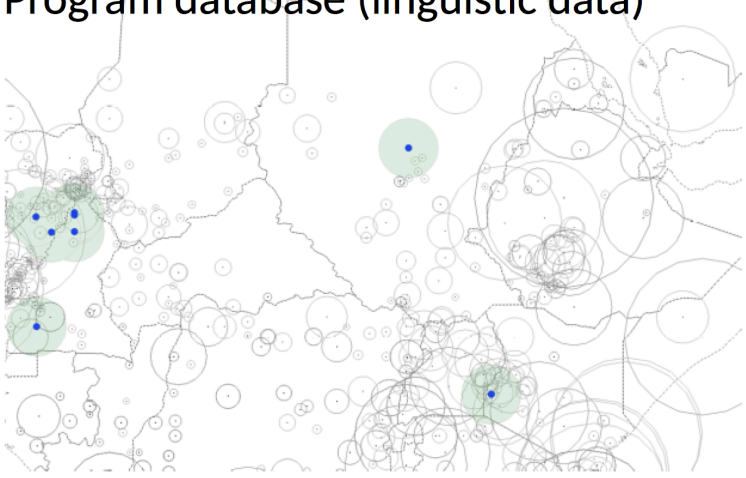
Plant B … C A G T A A T G A T G A C … (2 repetitions)

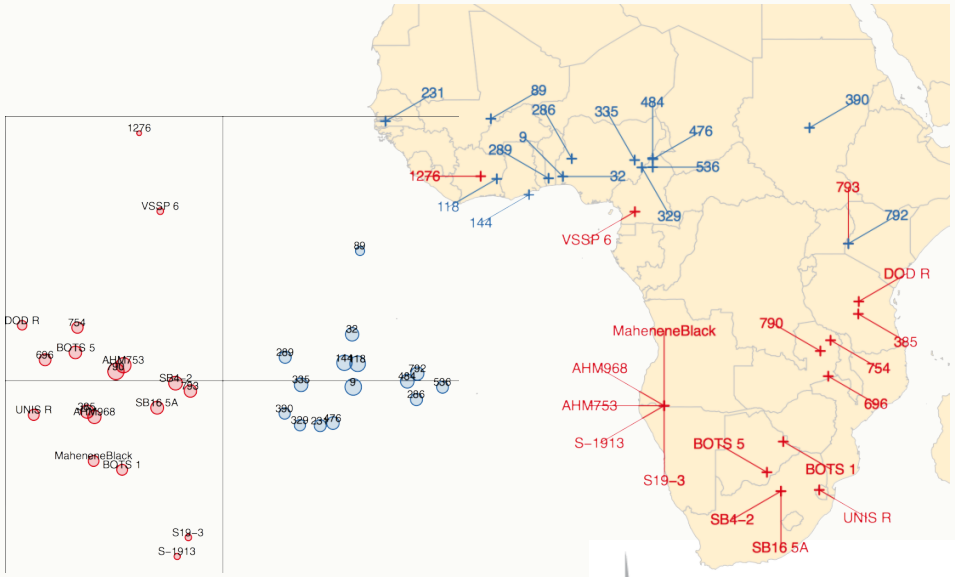
Plant C … C A A T G A T G A T G A C … (3 repetitions)

SSRs are most found between genes and usually do not alter proteins / functions



Automated Similarity Judgment Program database (linguistic data)





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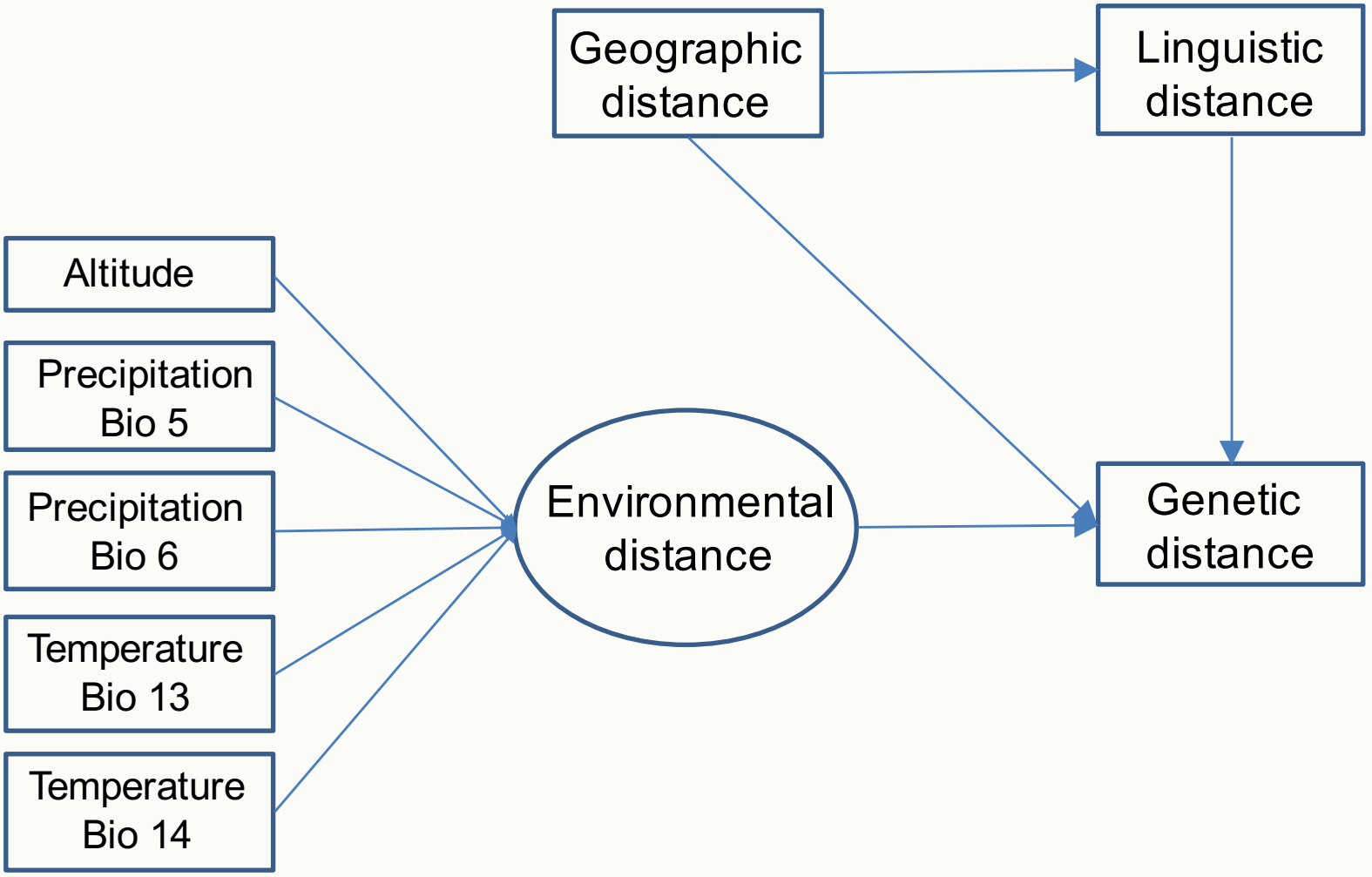
Spatial Patterns in the genetic variation of Bambara groundnut



PhD Dai Huynh: Crowdsourcing under-utilised crops

example of Moringa crop

- The greatest body of **knowledge** often lies with the farmers who have grown the crops.
- **Crowdsourcing** is a potential method to collect such knowledge (data).
- How can the **quality** of crowdsourced data be assessed in situations where there is **no or limited ground-truth**?
- Proposed approach: assessing thematic quality (knowledge) of contributor as a **proxy** for quality of data.