2015 International Year of Soils

wageningen soil conference

SOIL SCIENCE IN A CHANGING WORLD

WAGENINGEN UNIVERSITY
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Soil Science in a Changing World

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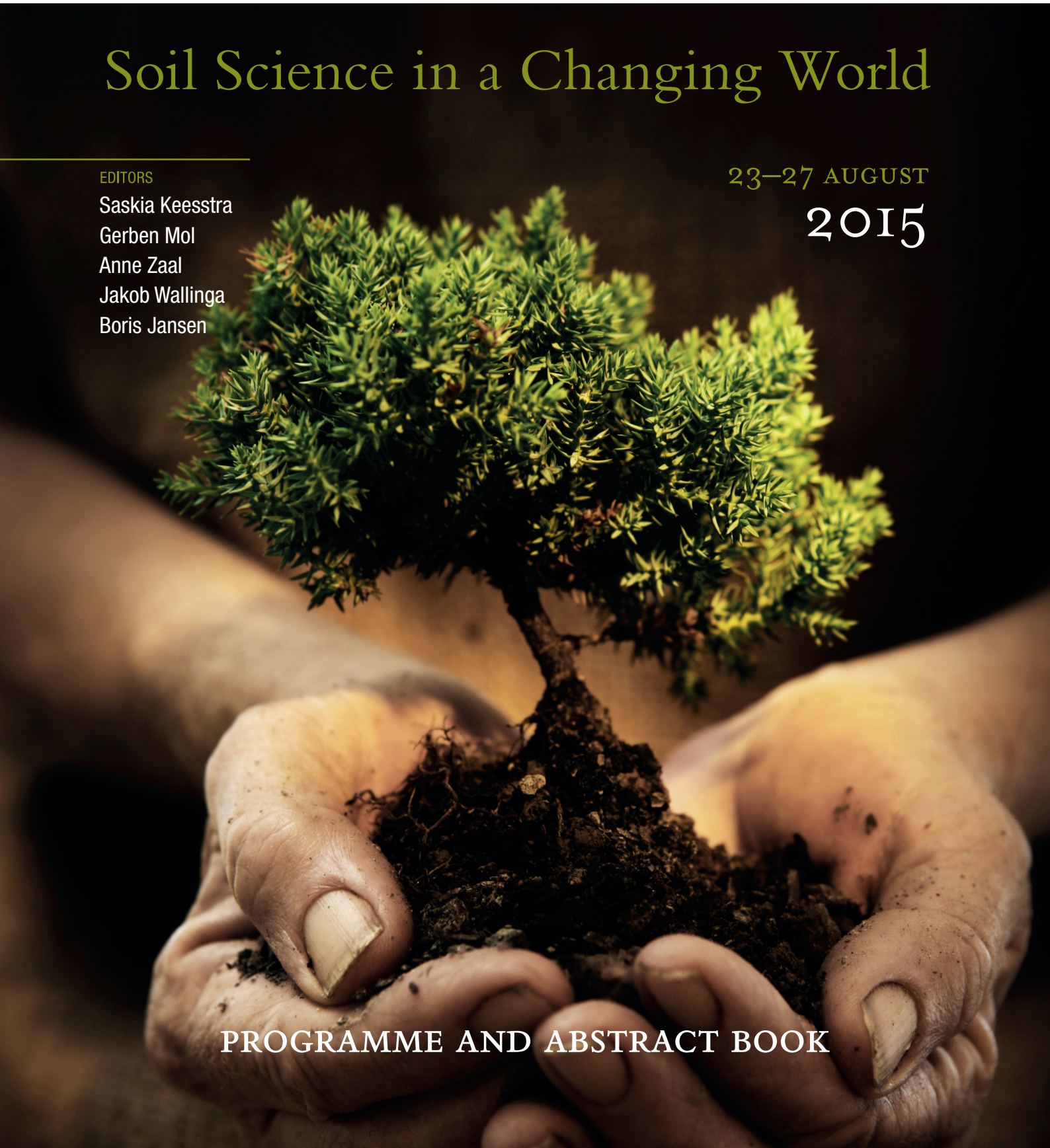
23–27 AUGUST
2015



PROGRAMME AND ABSTRACT BOOK

NEW GRIDDED DATA SETS FOR GLOBAL SUSTAINABILITY STUDIES — WISE30SEC AND SOILGRIDS

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ISRIC – World Soil Information (WDC-Soils), The Netherlands

There is a growing demand for quality-assessed soil information in support of studies of environmental, societal and economic sustainability. Nonetheless, soil remains one of the least well described data in global land models and uncertainties remain large. To address this gap, with (inter)national partners, ISRIC is developing a range of derived soil products that take into consideration differences in user needs. This work is underpinned by a growing selection of quality-assessed, geo-referenced soil profiles that are managed in ISRIC's centralised database (WoSIS); both conventional and digital soil mapping approaches are being developed. The former consider the soil-geographical delineations of the Harmonised World Soil Database (HWSD) and taxotransfer procedures that draw on statistical analyses of harmonised soil profiles held in WoSIS. Unlike the HWSD, the forthcoming WISE30sec[a] product will include estimates of the uncertainty in the predictions (mean ± std) for 7 layers up to 2m depth. Complementary to these efforts, major progress has been made with the development and implementation of the Global Soil Information Facilities (GSIF), a framework for collaborative digital soil mapping. The initial global product (SoilGrids1km)[b] drew on analytical data for ~110,000 soil profiles and ~75 covariate layers representing soil-forming factors; global regression models were used to predict property estimates (mean and 90%-interval) to 2m depth. Subsequently, for Africa, predictions have been generated with significantly higher accuracy and spatial detail (SoilGrids250m)[c]. As GSIF serves as a framework for collating/harmonising soil data it allows for regular updates of world soil information, at user-defined resolutions (from 250m to 50km), using increasingly large data sets and evolving models. The international community can help to **improve the methodologies and products by submitting validation reports, sharing additional geo-referenced soil profile and covariate data and by expanding the present range of models, thus sharing ownership.**

[a] http://www.isric.org/projects/world-inventory-soil-emission-potentials-wise
[b] http://www.isric.org/content/soilgrids
[c] http://www.isric.org/content/next-generation-soil-information-system-africa-250-m-resolution-published

New gridded data sets for global sustainability studies

(WISE30sec and SoilGrids)

Niels Batjes, Jorge Mendes de Jesus, Gerard Heuvelink, Eloi Carvalho Ribeiro, Bas Kempen, Johan Leenaars, Tom Hengl, Maria Ruiperez Gonzalez, Ad van Oostrum, and Rik van den Bosch

ISRIC World Soil Information

Session: "Optimizing soil information services for solving global issues"
Wageningen Soil Conference 2015 (23-27 August 2015)

World Data Centre for Soils WDC Wageningen — ICSU WORLD DATA SYSTEM

2015 International Year of Soils

GLOBAL SOIL PARTNERSHIP

Source infographic: FAO 2015

ISRIC mission:
"To serve the international community with information about the world's soil resources to help addressing major global issues"

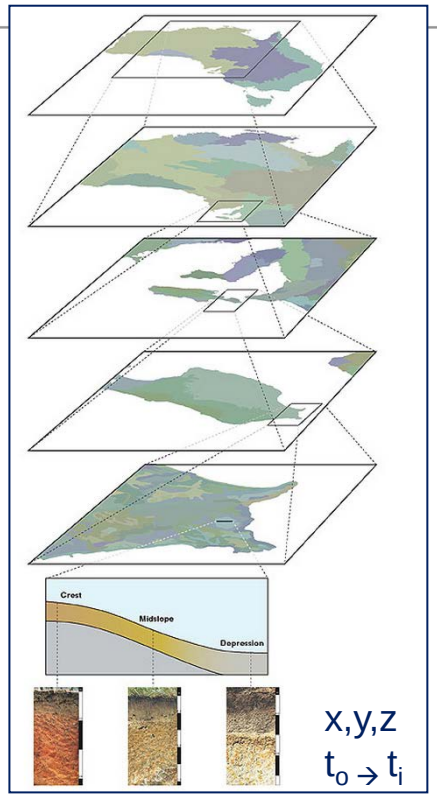
Three priority areas:

- *soil data and soil mapping*
- *application of soil data in global development issues*
- *training and education*

Source infographic: FAO 2015

User needs vary at different scales/resolutions

Scale
1: 5,000,000
1: 250,000
1: 5,000
1:1



Global assessments

Regional studies

National studies

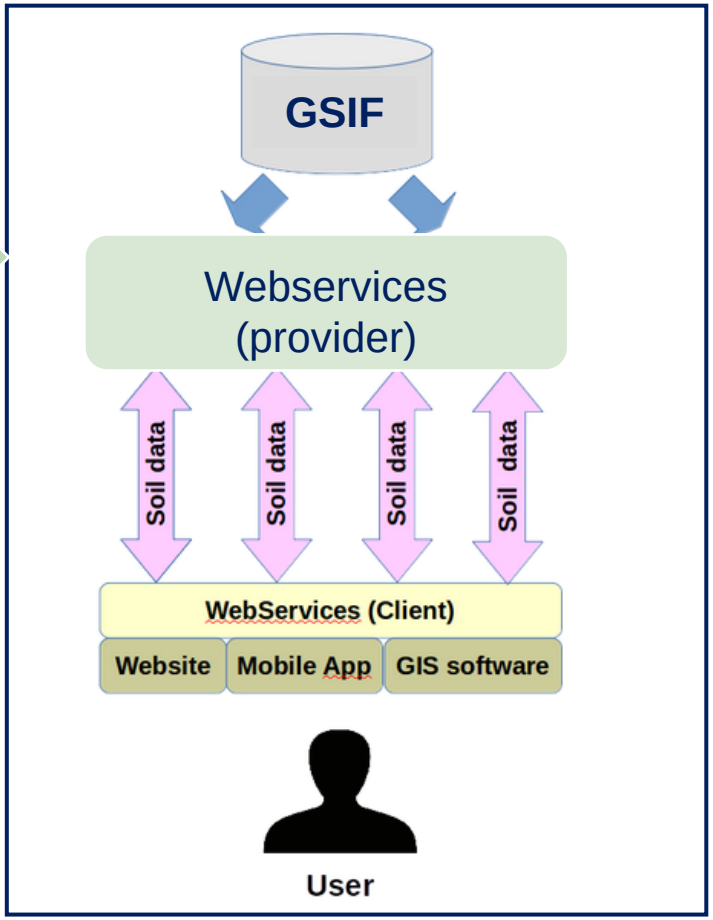
Spatial planning
Precision farming

Soil monitoring

'There is no magic single resolution that serves all purposes'
(HarvestChoice, 2011)

Towards global web services

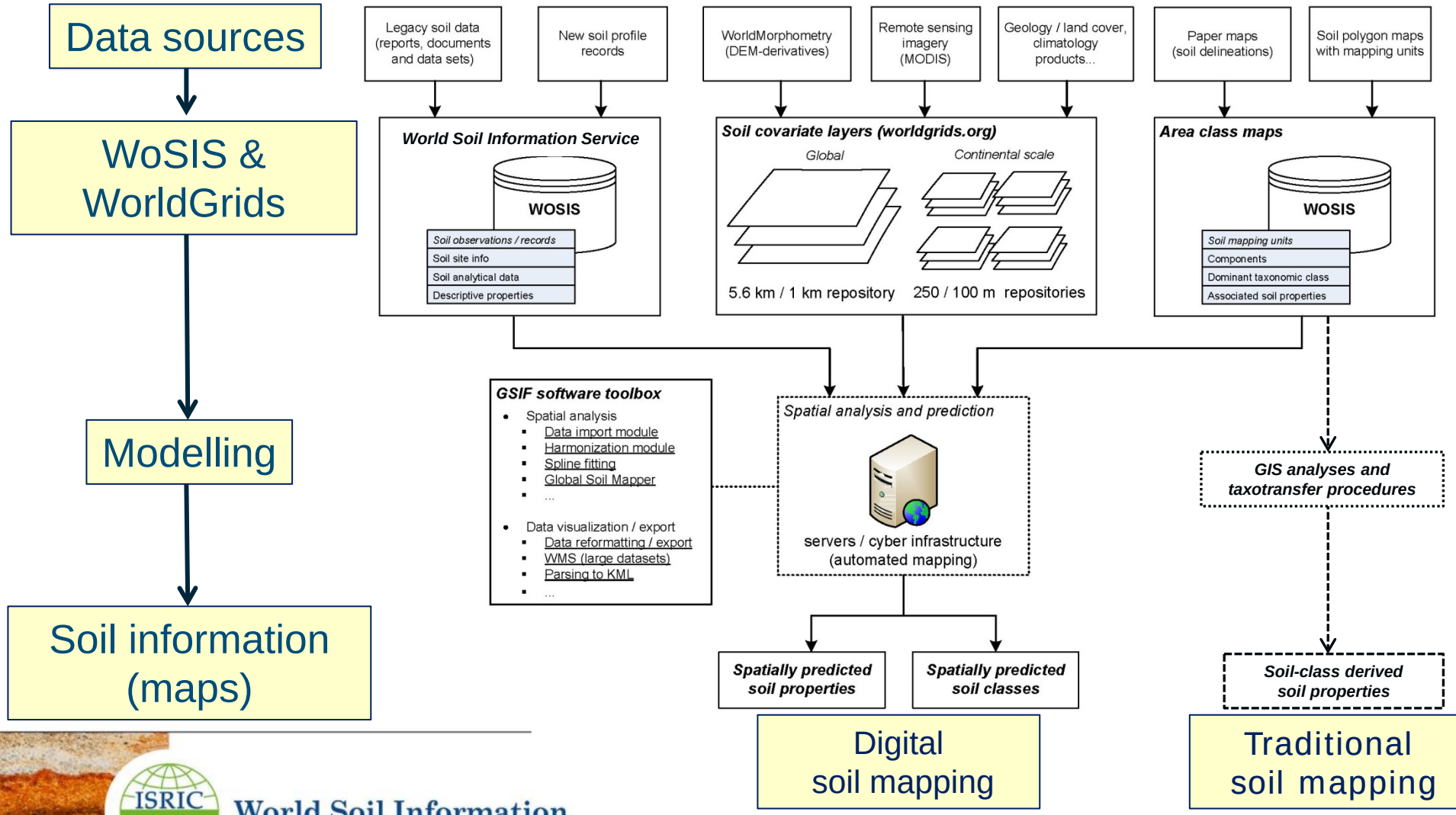
Decision makers and managers must have access to the information they need, when they need it, and in a format they can use (GEO, 2010)



GSIF – Global Soil Information Facilities
'A framework for processing of soil data and information' (Hengl et al.)

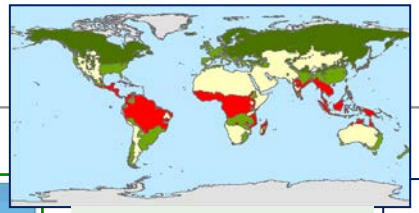
work in progress ...

GSIF - Global Soil Information Facilities



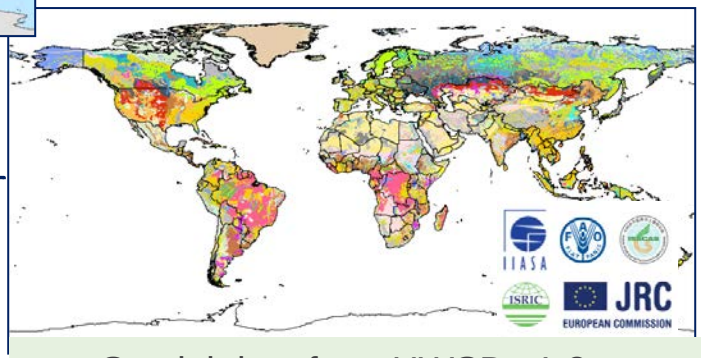
ISRIC World Soil Information

Traditional soil mapping



Climate zones

- quality-assessed profile data (WISE, >20,000)
- Harmonised to FAO revised legend



- Spatial data from HWSD v1.2
- Compound mapping units
- Harmonised to FAO revised legend

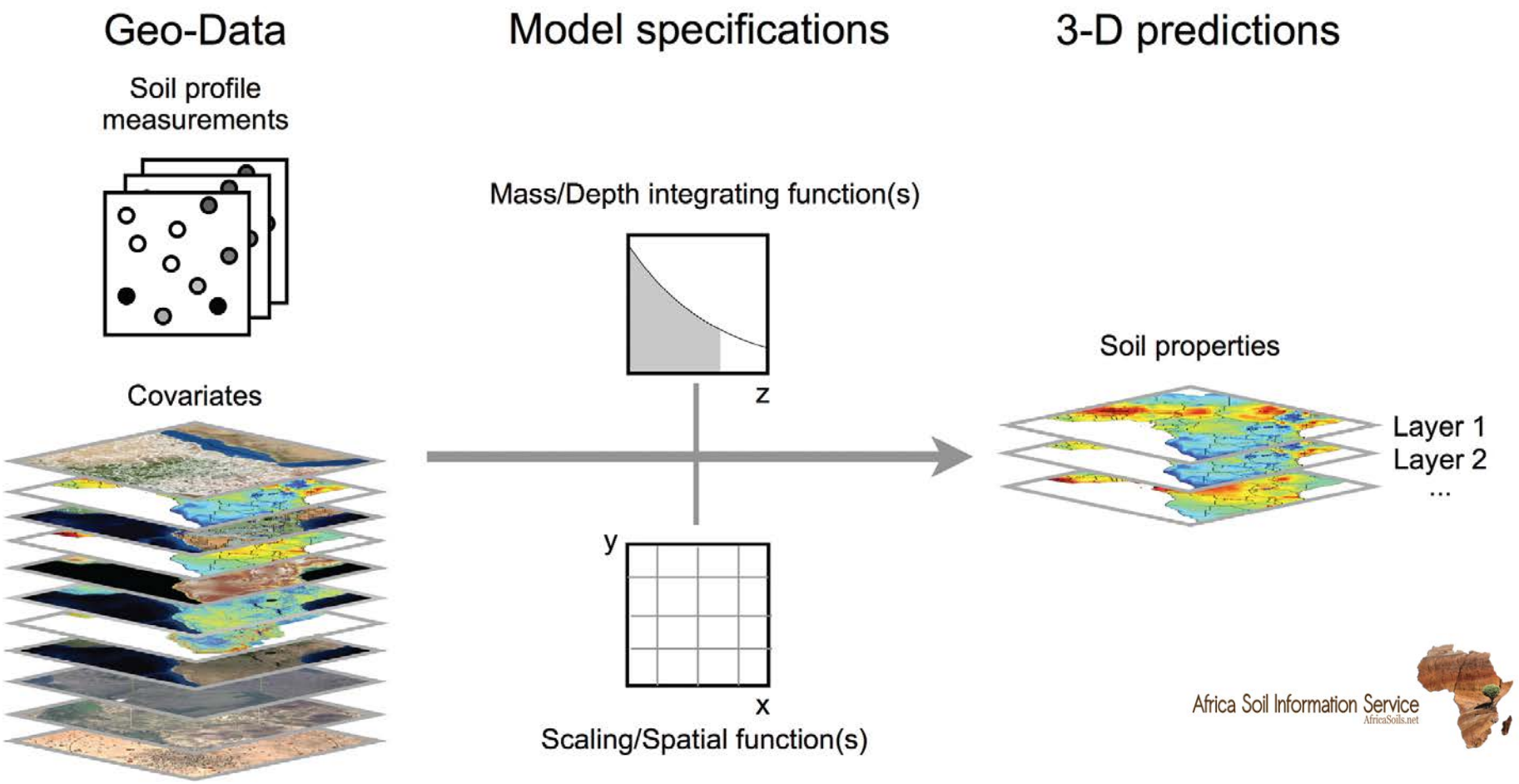
Soil classes used as “carriers of soil information”:

- 7 depth layers (up to 2 m depth)
- 20 soil properties
- uncertainty estimates (mean ± std)

Grid-based soil property maps (WISE30sec)

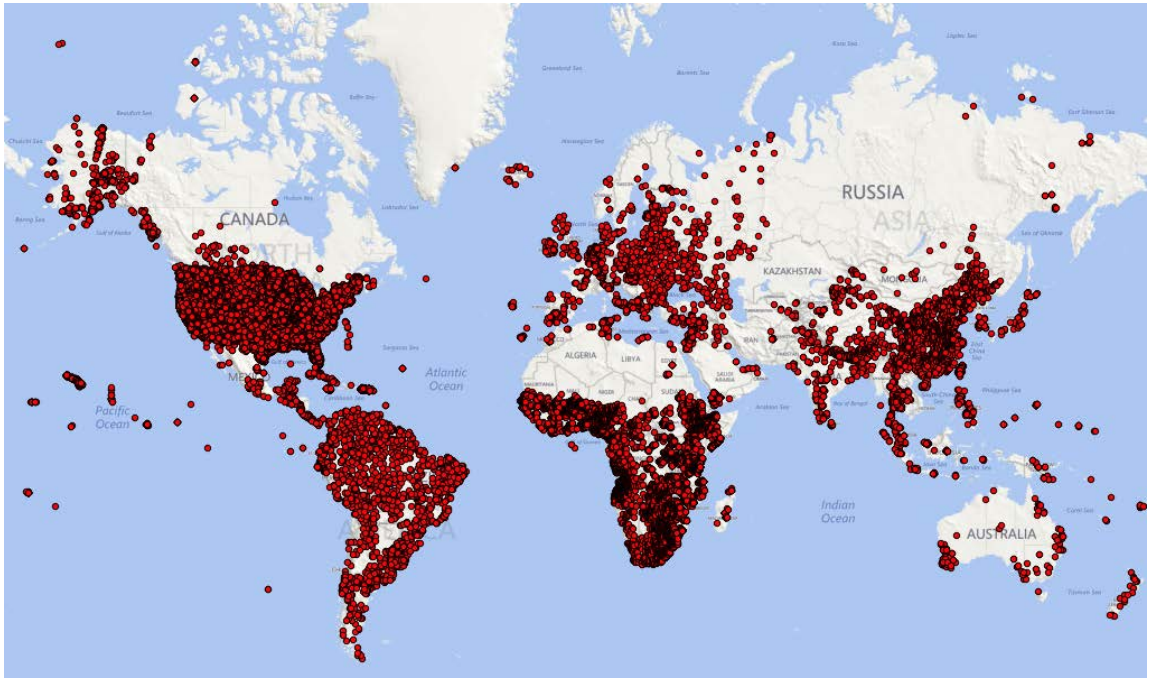
ISRIC Report (Q3-2015)

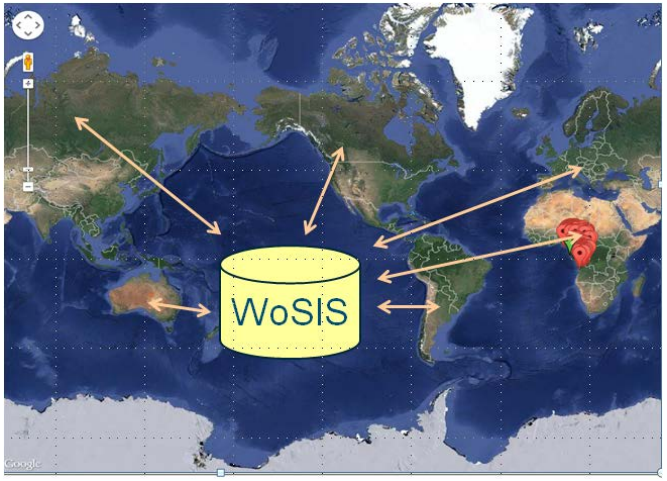
Digital Soil Mapping (SoilGrids)



'apply statistical models to predict soil functional properties at unobserved locations in the landscape'

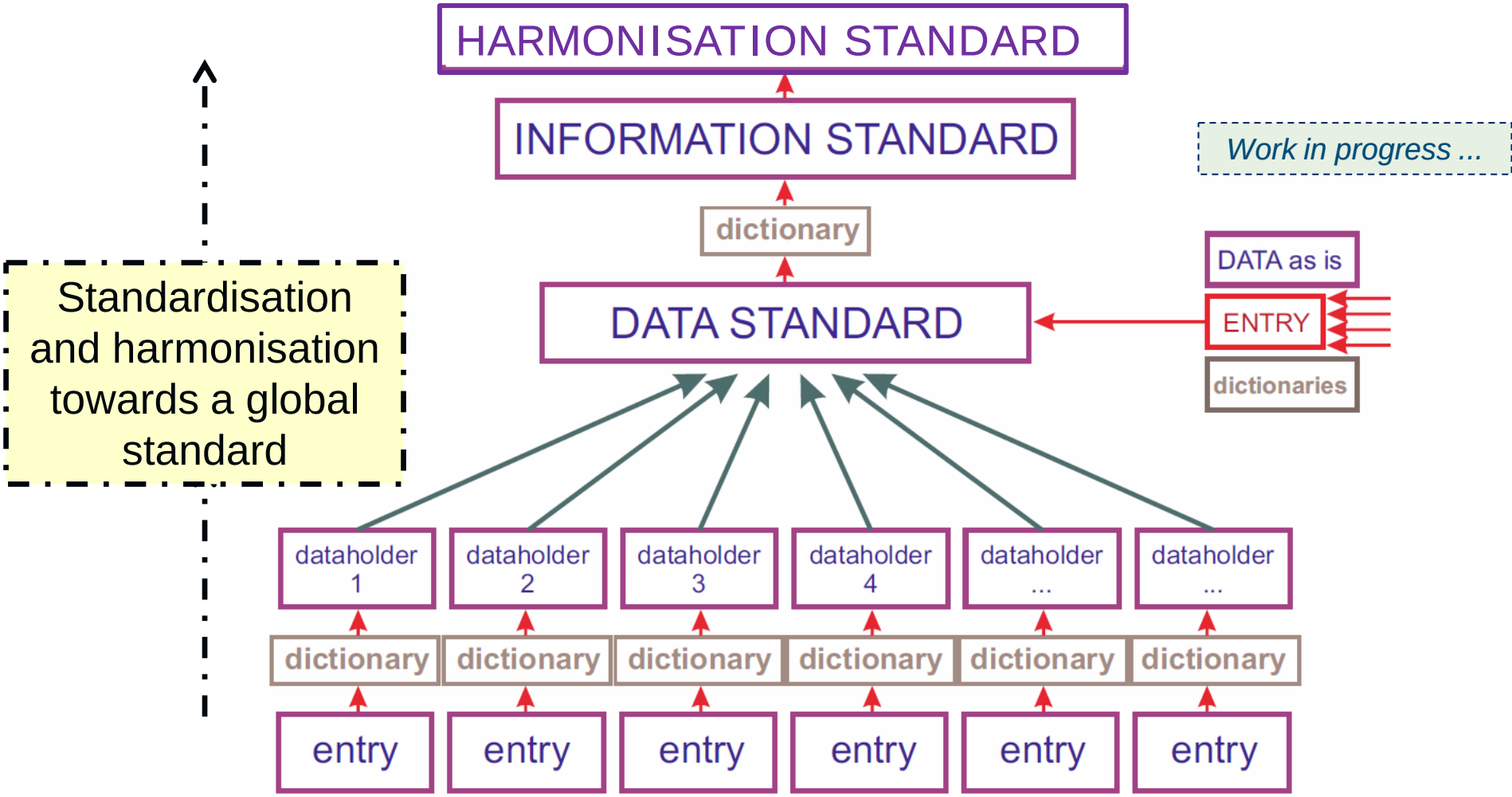
Geo-DATA: Soil profile measurements





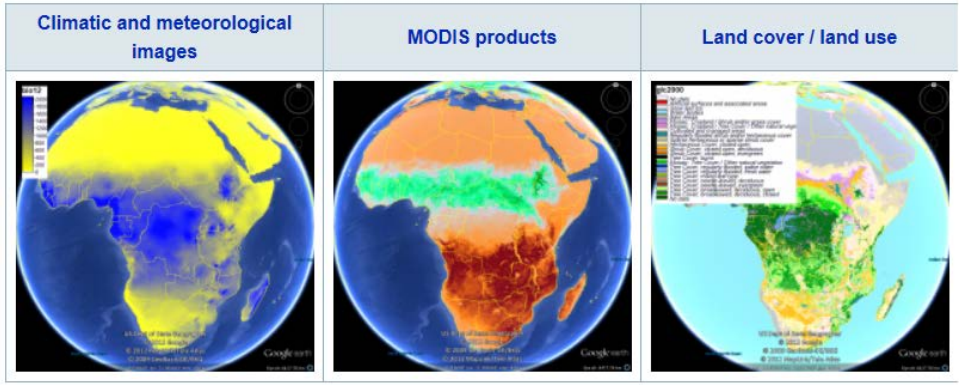
- Draws on soil profile data provided by a wide range of international partners
- Not all profile data are freely accessible due to inherited restrictions (licences)
- Access rights and lineage are managed in WoSIS (v2.0 *in prep.*)

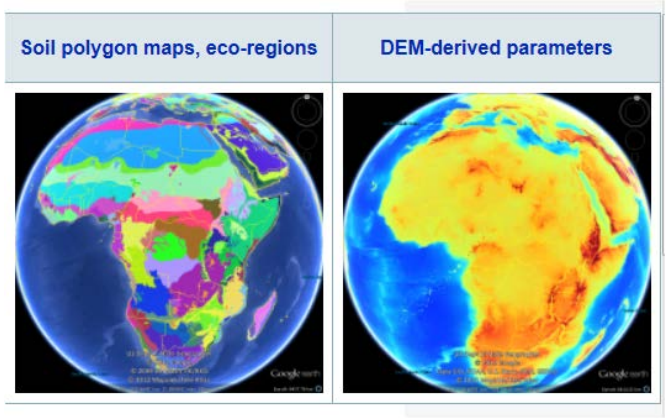
WoSIS - World Soil Information Service



Geo-DATA: Co-variate layers

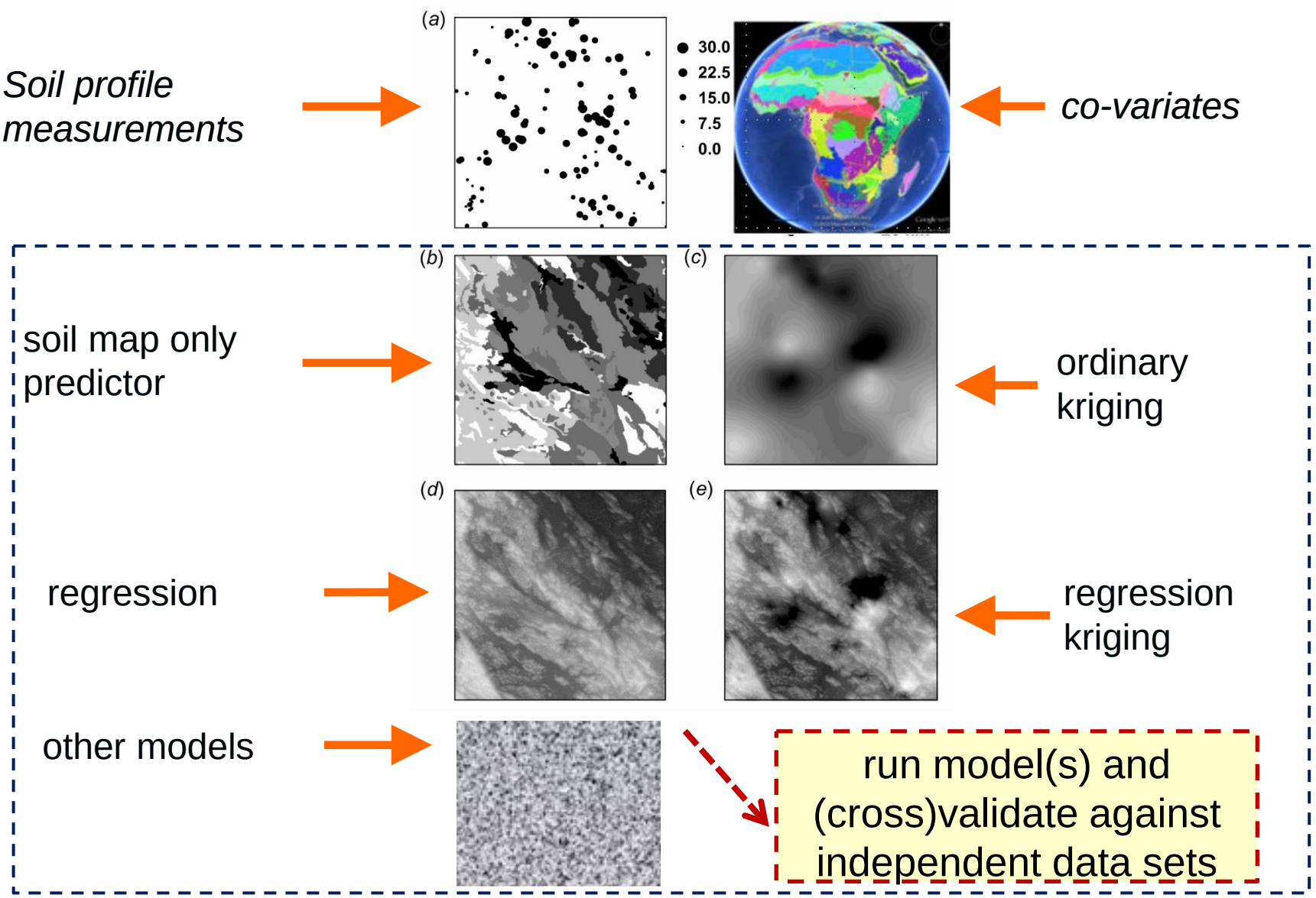
- Represent soil forming factors (Jenny, 1941):
  - Climate
  - Organisms (biology)
  - Relief (hydrology)
  - Parent material (rock etc.)
  - Time





- Managed in portal:
  - *WorldGrids.org*
  - Standardized format: 1 km resolution
  - So far ~ 80 layers

Model specifications: Fit model(s)



Soil properties

Six Depths

- 0 - 5 cm
- 5 – 15 cm
- 15 – 30 cm
- 30 – 60 cm
- 60-100 cm
- 100-200 cm
- Depth to bedrock

and

Effective depth

Data specifications: www.globalsoilmap.net

GlobalSoilMap.net

SoilGrids1km (*so far*)

Organic Carbon (ORCDRC) 19

Soil organic carbon (fine earth fraction) in permilles (g/kg)

ORCDRC 0–5cm (mean)

Depths available

0–5cm | 5–15cm | 15–30cm | 30–60cm | 60–100cm | 100–200cm

pH in H2O (PHIHOX) 19

Sand % (SNDPPT) 19

Silt % (SLTPPT) 19

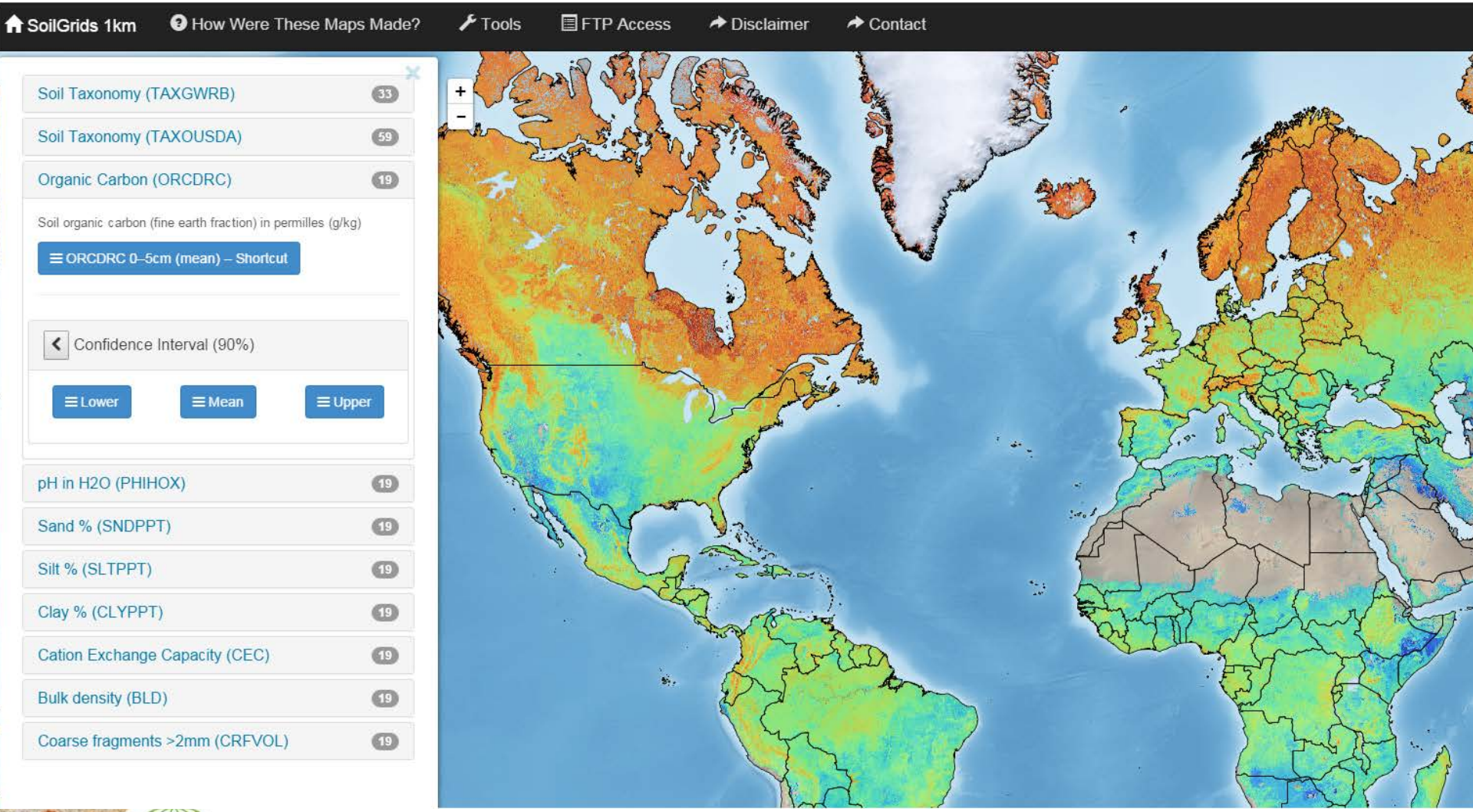
Clay % (CLYPPT) 19

Cation Exchange Capacity (CEC) 19

Bulk density (BLD) 19

This list will grow in future SoilGrids releases...

SoilGrids1km (30x30 arcsec)



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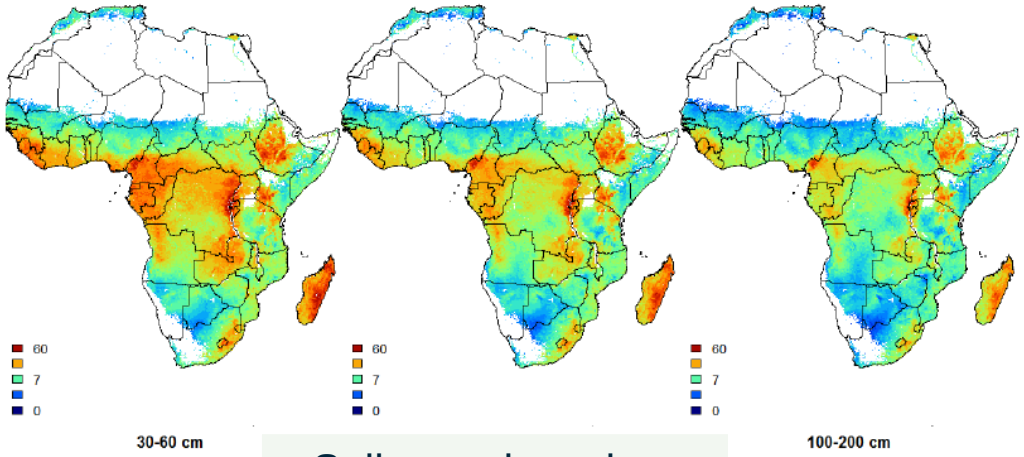
http://soilgrids1km.isric.org/

Hengl T. et al. (2014) SoilGrids1km — Global Soil Information Based on Automated Mapping. PLoS ONE 9(8): e105992

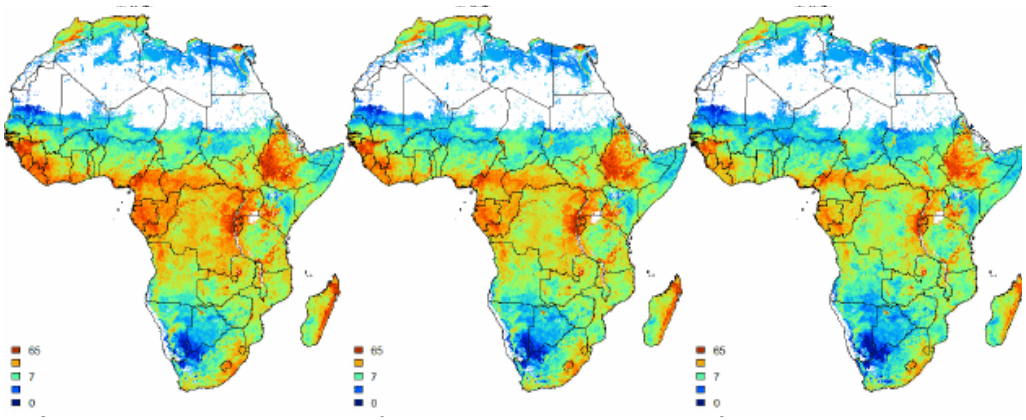
Updating SoilGrids: From 1km to 250m

9 soil properties



Soil organic carbon

20 soil properties



AfSoilGrids1km

- ~10,000 profiles
- linear regression

(ISRIC, 2013)

AfSoilGrids250m

- ~ 25,000 profiles
- Random forests and regression-kriging

(Hengl et al., 2105)

PLoS ONE 2015,10(6): e0125814. doi:10.1371/journal.pone.0125814

ISRIC GlobalSoilMap.net Africa Soil Information Service AfricaSoils.net WDC World Data Centre for Soils Wageningen ICSU WORLD DATA SYSTEM

Use of soil information

Work in progress

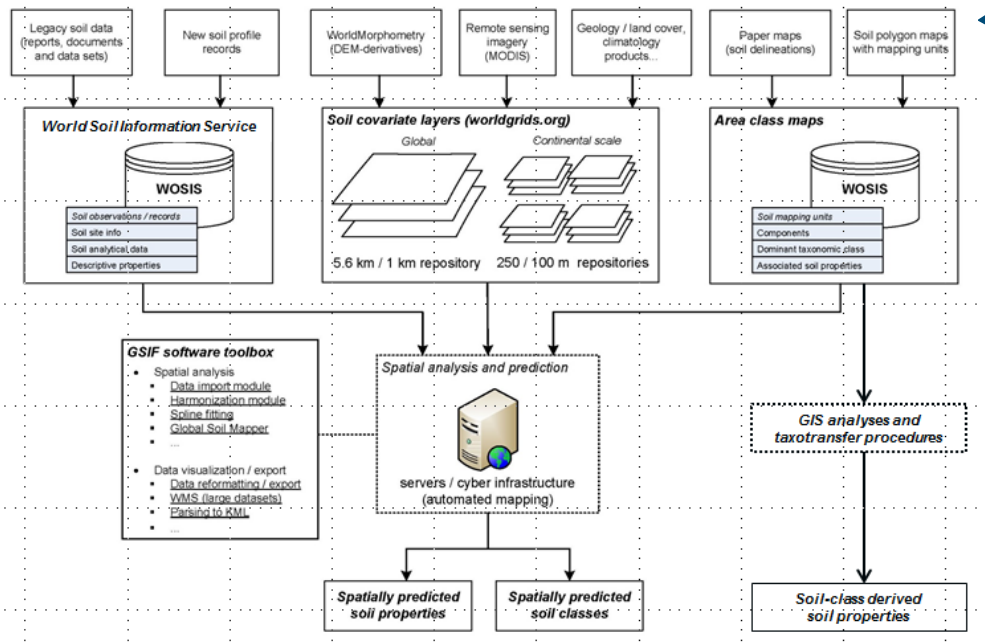
Data sources

WoSIS & WorldGrids

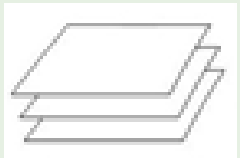
Modelling

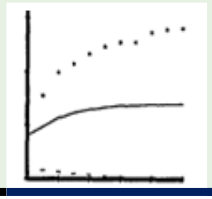
Soil information (maps)

Use of soil information



Earth system modelling, food security, ...





POLICY / DECISION MAKING

NEW DATA (crowd sourcing; Soilinfo App)

ISRIC

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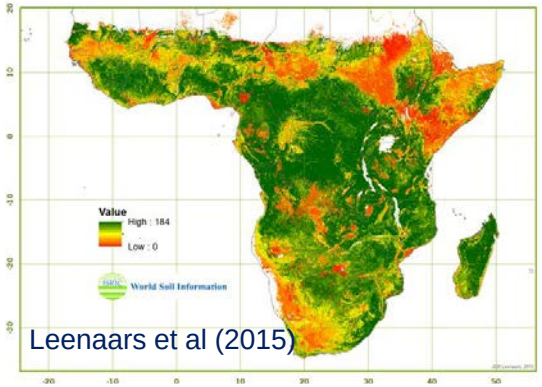
ICSU WORLD DATA SYSTEM

GlobalSoilMap.net

Global Yield Gap Atlas

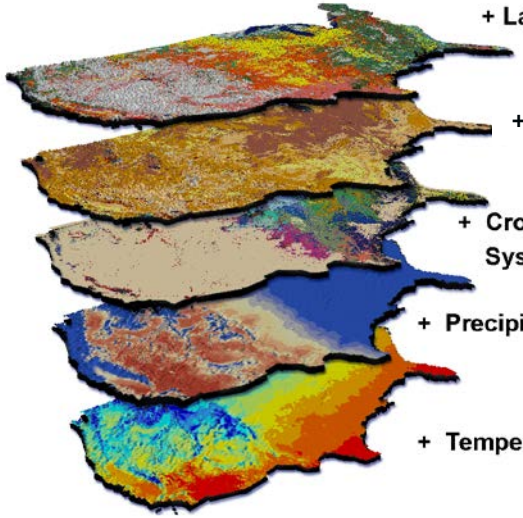
Africa Soil Information Service AfricaSoils.net

Use of soil information (national scale): Crop production potential (SoilGrids)



Leenaars et al (2015)

Land utilisation types



+ Soils

+ Landuse

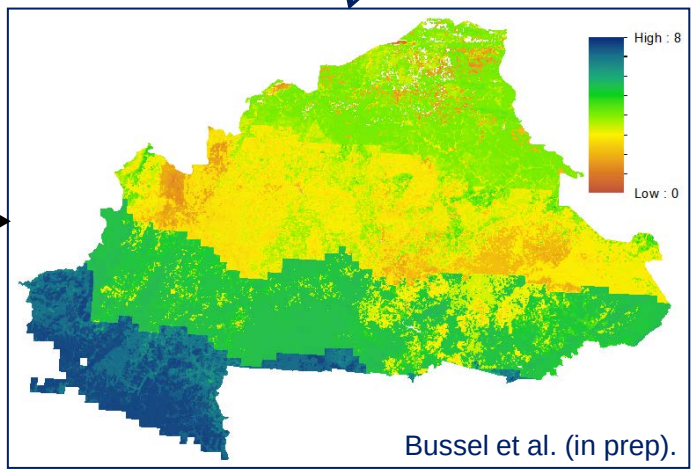
+ Slope

+ Cropping Systems

+ Precipitation

+ Temperature

crop simulation models



Bussel et al. (in prep).

Yield-gap analyses

Work in progress ...

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ICSU WORLD DATA SYSTEM

GlobalSoilMap.net

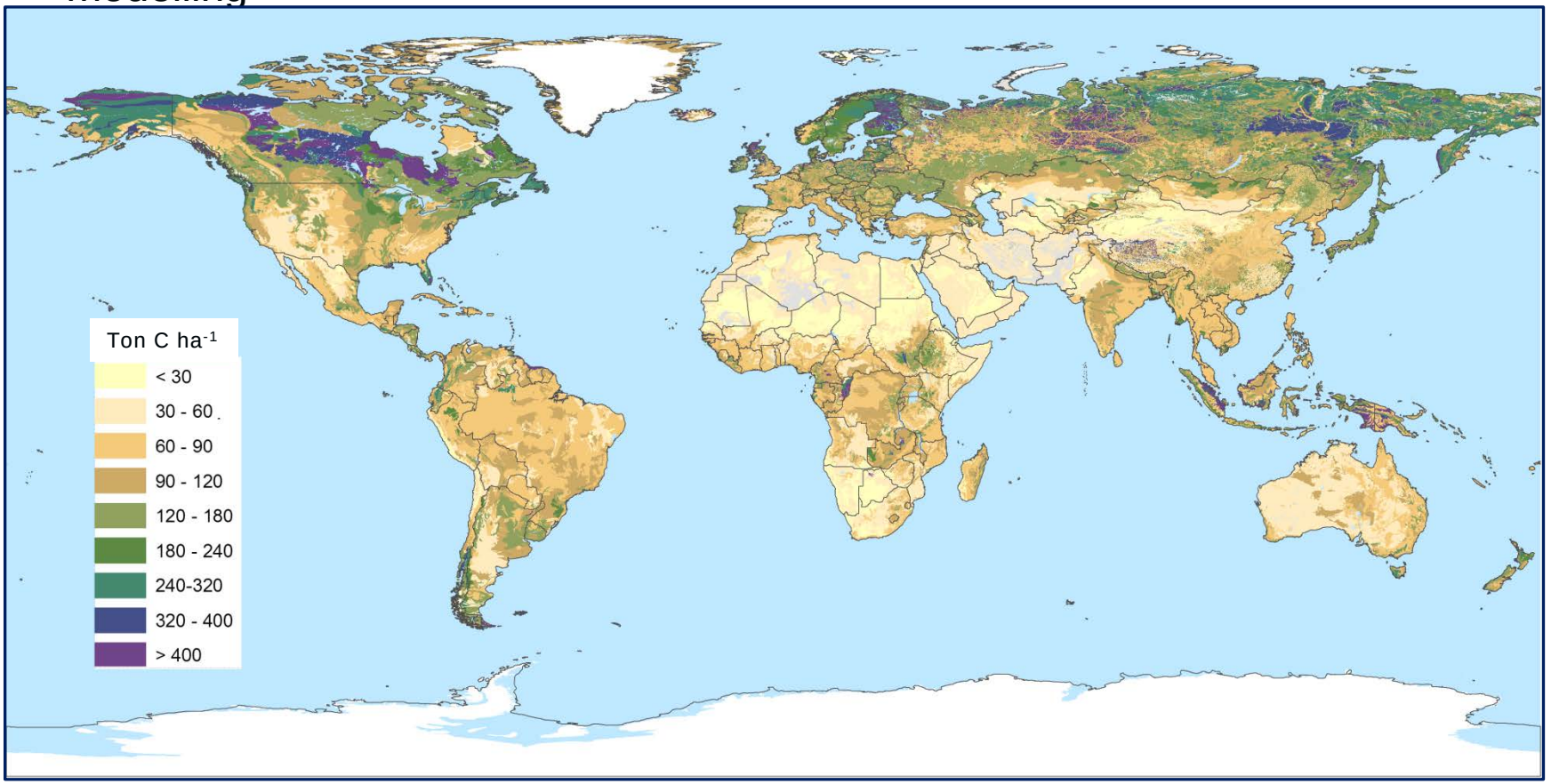
Global Yield Gap Atlas

Africa Soil Information Service AfricaSoils.net

Use of soil information (global scale):

Global organic carbon stocks (WISE30sec)

- Some 30% of the global SOC stock to 2 m (2060 ± 215 Pg C) is held in the Northern Circumpolar Region
- Potentially, large GHG emissions upon global warming → Earth system modelling



* SOC stocks to 1 m depth

Batjes (2015, submitted)

Concluding remarks

- The soil science community should ensure that soil information can be utilized to take effective measures at the desired scales
- In partnership, ISRIC has developed GSIF as a framework for collating, harmonising and analysing world soil data
- The system allows for regular updates of world soil information at user-defined resolutions (from 250m to 50km)
- The international community can help to improve the methodologies and products by submitting validation reports, sharing additional geo-referenced soil profile and covariate data, and by expanding the present range of models, thus sharing ownership

Further information: www.isric.org

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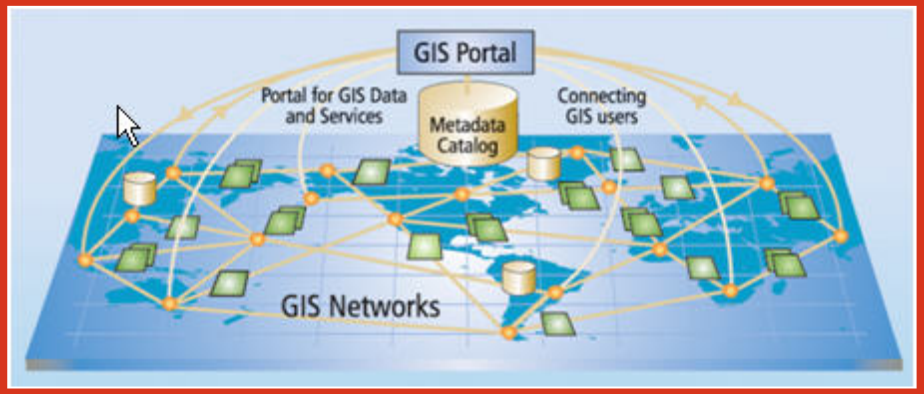

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