ISRIC World Soil Information

Standardization and harmonisation for global soil data provision

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- About ISRIC – World Soil Information
- Our experience in soil information systems
- Standardisation at ISRIC
- About GSP Soil Data Facility

ISRIC – World Soil Information

Some features

- Founded in 1966, upon recommendation of UNESCO, FAO and the IUSS
- Independent foundation based in Wageningen
- Cooperation agreement with Wageningen University.
- 20 staff, plus guest employees, plus students
- Accredited as the World Data Centre for Soils (WDC – Soils) by the International Council for Science
- Participating Organisation of the Intergovernmental Group on Earth Observations (GEO)

Vision

A world where **reliable** and **relevant** soil information is **freely-available** and **properly used** to address **global** environmental and social **challenges**.

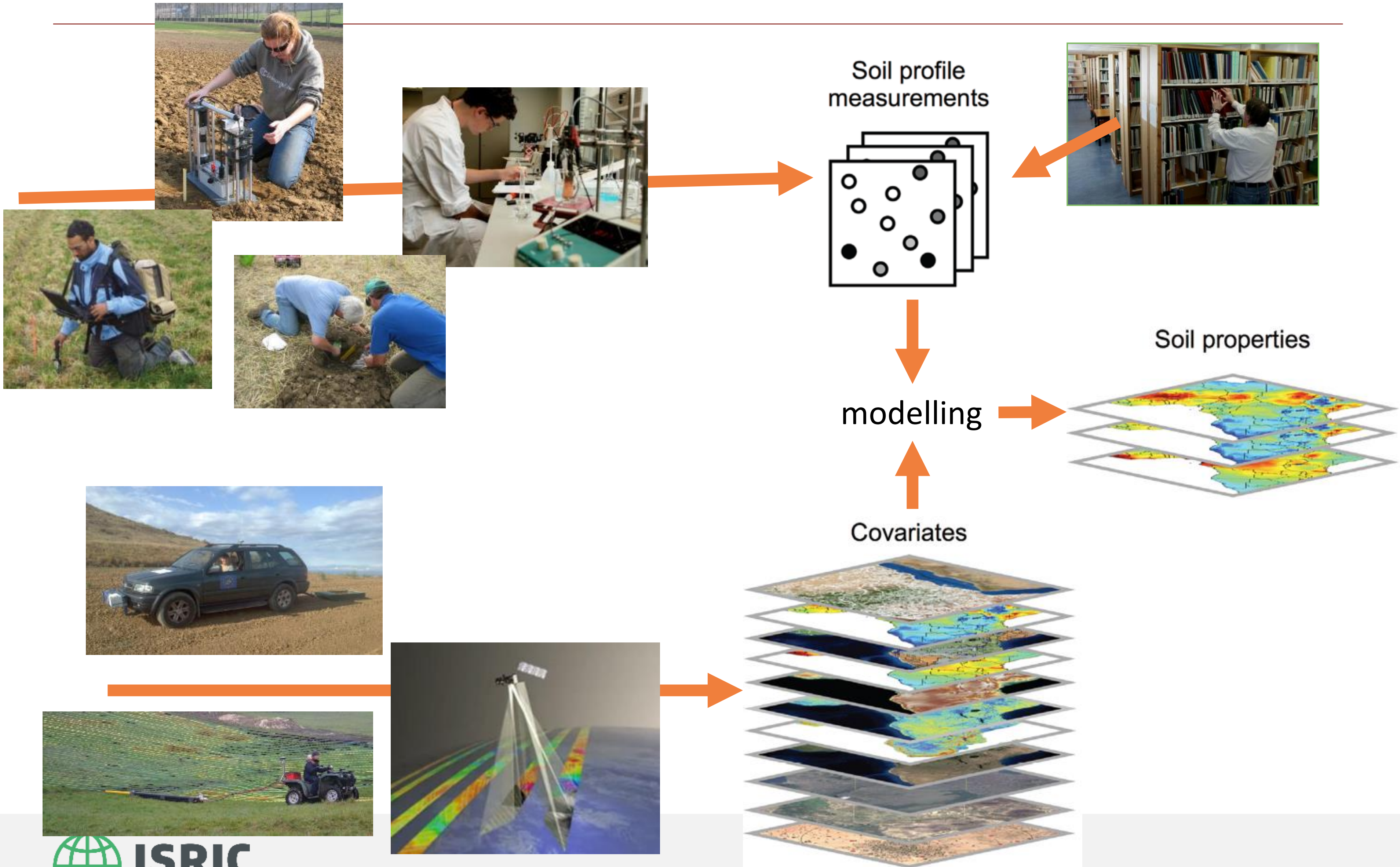
Mission

- We produce and serve **quality-assured soil information** together with our partners at global, national and regional levels.
- We stimulate the use of this information to address global challenges through **capacity building**, **awareness raising** and direct **cooperation** with users and clients.

Vision on our role

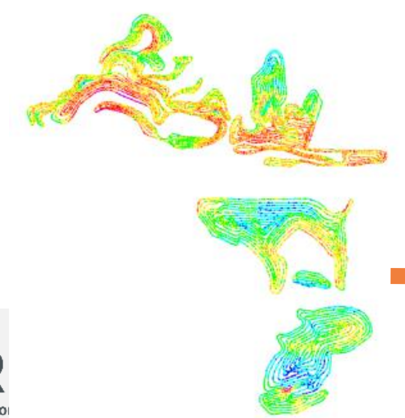
- We are a **service provider** to the international science communities, policy communities and the private sector
- ISRIC plays a significant role in **standard setting** for soil data gathering storage and serving ('Foundation')
- ISRIC is the **trusted broker** of global soil information for different client groups connecting global producers and users of soil information (Raison d'etre')
- ISRIC **develops capacity** for building and using soil information systems in developing countries ('connecting with the market')
- ISRIC develops **derived knowledge products** for sustainable soil and land management, together with clients and partners ('increasing impact')

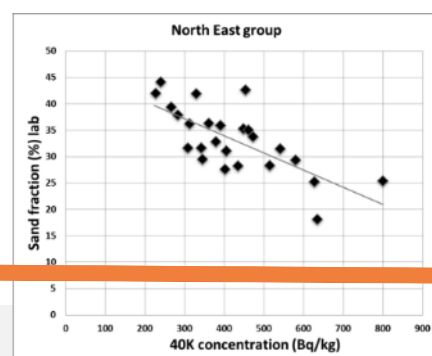
From measurements to information

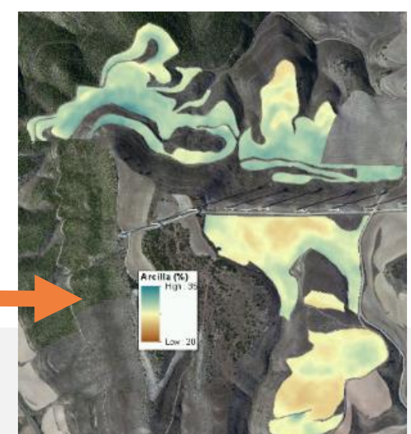


Data acquisition process

- New point data (eg. AfSIS, LUCAS, project data etc.), lab or sensor based.
- New spatial information:
  - Estimation of properties through sensing
  - Covariates (eg. DEM, Land use satellite data etc.)
- Existing data and data collected for other projects



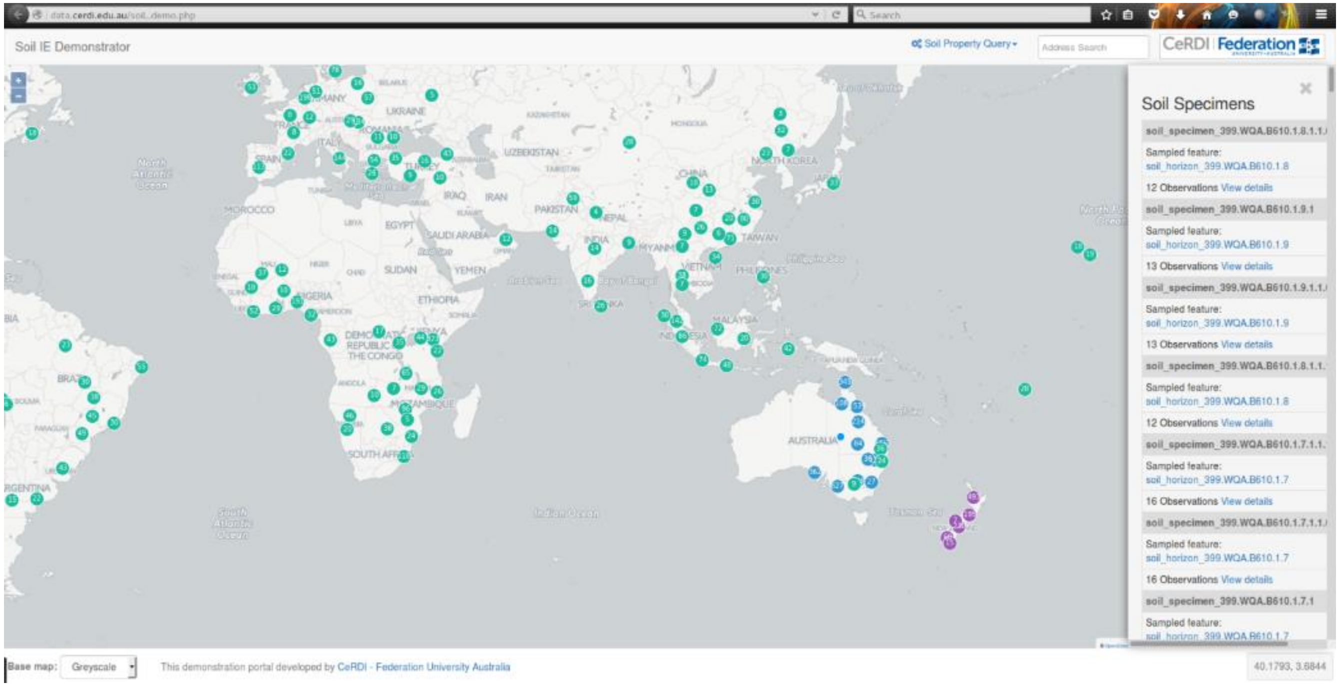




Work stream 1:
Reference and Standard Setting
(‘The Foundation’)

World Reference Base (WRB)

Soil Data Interoperability Experiment



Manaaki Whenua Landcare Research

CSIRO

Federation UNIVERSITY·AUSTRALIA

OGC® Making location count.

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GODAN Working Group on Soil Data

Initiatives:

IUSS WG - SIS

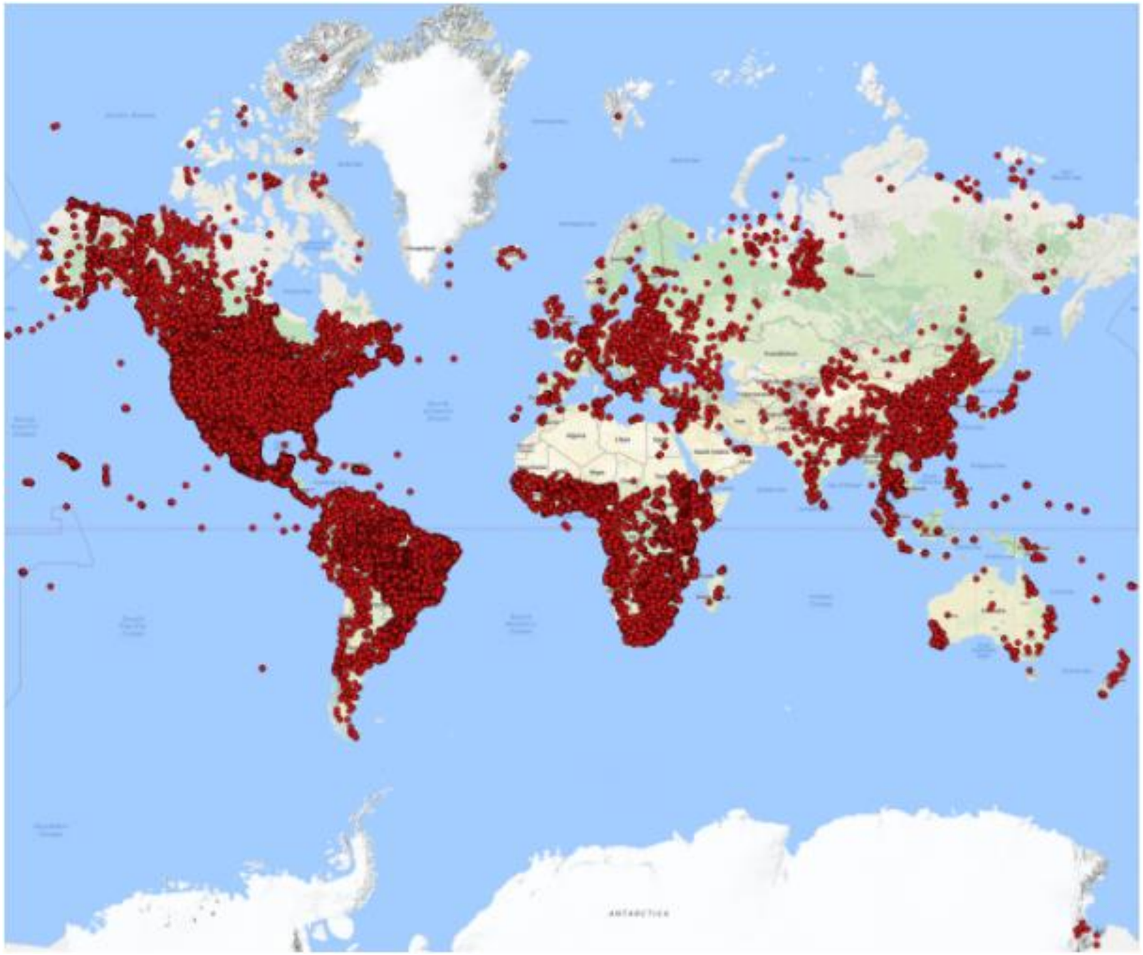
Partners:

50 subscribers
38 organisations
7 international presentations in 2017

Your organisation?

Work stream 2:
Soil Information Brokering
(‘Raison d’être’)

Data holdings in WoSIS (June 2017)



- ~ **126 thousand** unique profiles
- ~ **111 thousand** profiles with geometry
- ~ **30 million** soil properties measurements of which
  - ~ **4 million** have been standardized so far
- Bulk density
- Calcium carbonate
- Carbon (Total & Organic)
- Coarse fragments
- pH
- Water retention
- Texture (Sand, Silt, Clay)
- Cation exchange capacity
- Electrical conductivity

- Classification: FAO, WRB, US Soil Taxonomy

WoSIS: World Soil Information Service

- PostgreSQL database developed to:
  - Store soil data with their lineage (e.g. licence)
  - Standardize and harmonize the disparate source data
  - Ultimately serve quality-assessed soil data for a range of applications
- Provides the basis for a distributed system

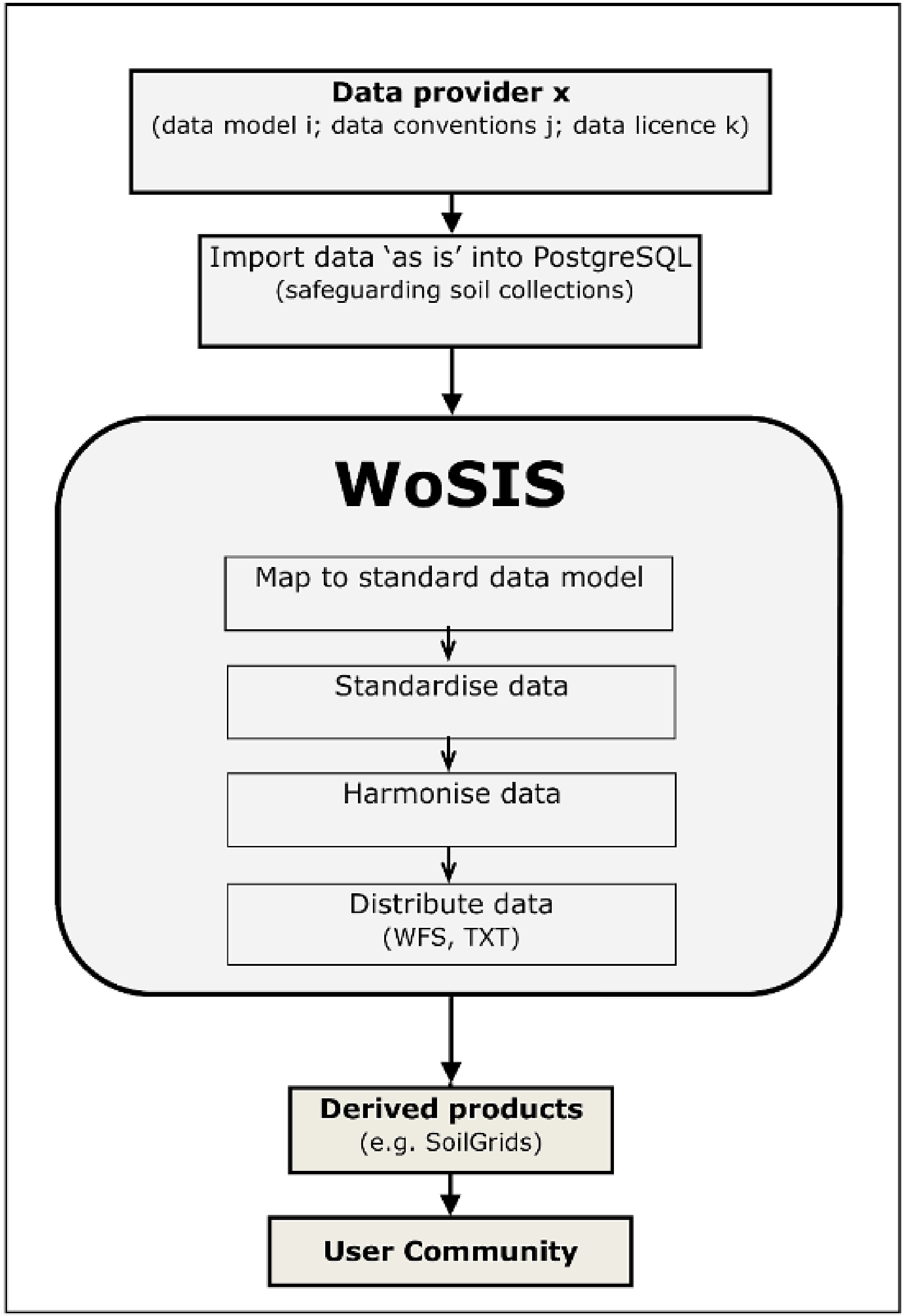
"Decision makers and managers must have access to the information they need, when they need it, and in a format they can use"
(GEO, 2010)

See: ISRIC Data and Software Policy

Main steps in data processing

And:

- Consistency checks & quality control scheme
- Managing intellectual property rights: respecting the IP of data owners/contributors



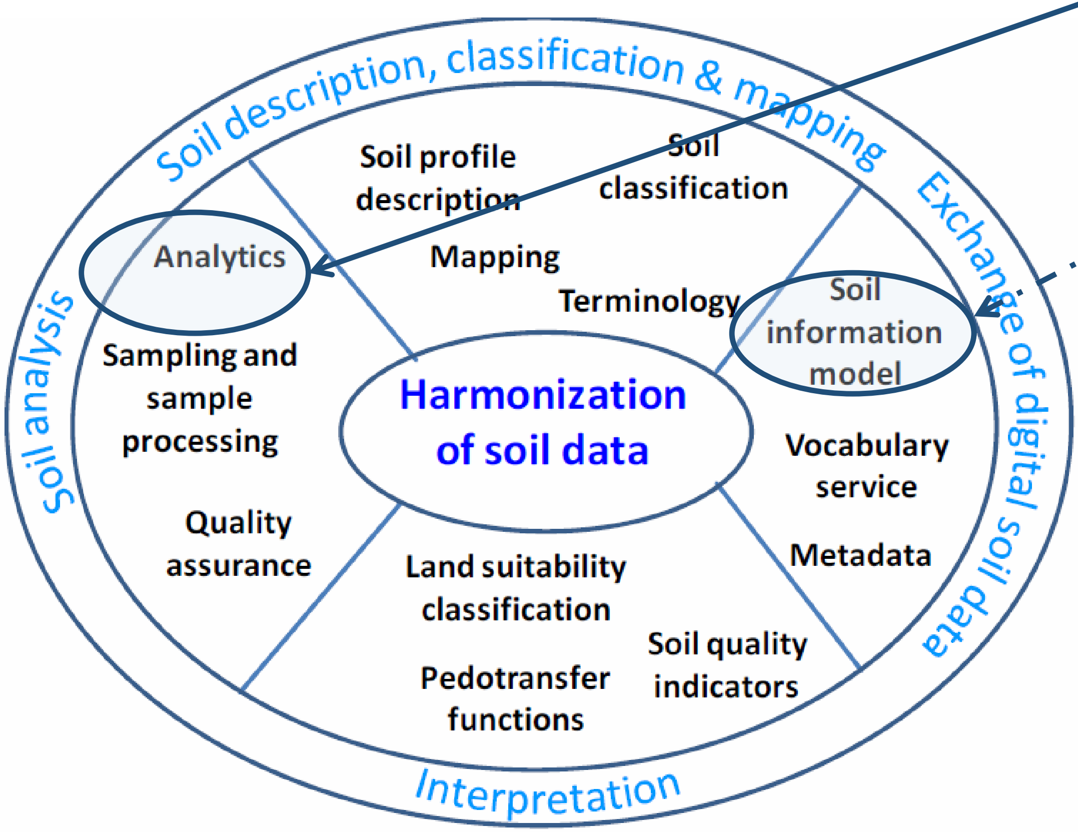
Standardisation steps

- Identify repeated profiles
- Attribute names
- Units (incl. conversion factors)
- Formats of measured values
- Analytical methods

➢ Current focus: soil properties considered in GlobalSoilMap specs

pH
Organic carbon
CEC
Bulk Density
Water Holding Capacity [b]
Calcium carbonate equivalent
Sand, silt, clay fractions
Coarse fragments (>2mm; as volume percent of whole soil)
Electrical conductivity

Areas of harmonization



Present focus in WoSIS
(soil data derived from routine soil surveys)

"Providing mechanisms for the collation, analysis and exchange of consistent and comparable global soil data and information"
(GSP Pillar V)

Harmonize to reference method ‘Y’ (*not yet undertaken in WoSIS*)

- Make the data comparable, as if assessed by a single given (reference) method Y
- There is generally no universal equation for converting from one method to another in all situations
- GSP community will need to develop ‘region’ specific conversions building on comparative analyses of (archived or new) soil samples (GSP WG5, Baritz et al. (2014); GLOSOLAN)

Source: GlobalSoilMap (2013)

Harmonize to reference method 'Y'

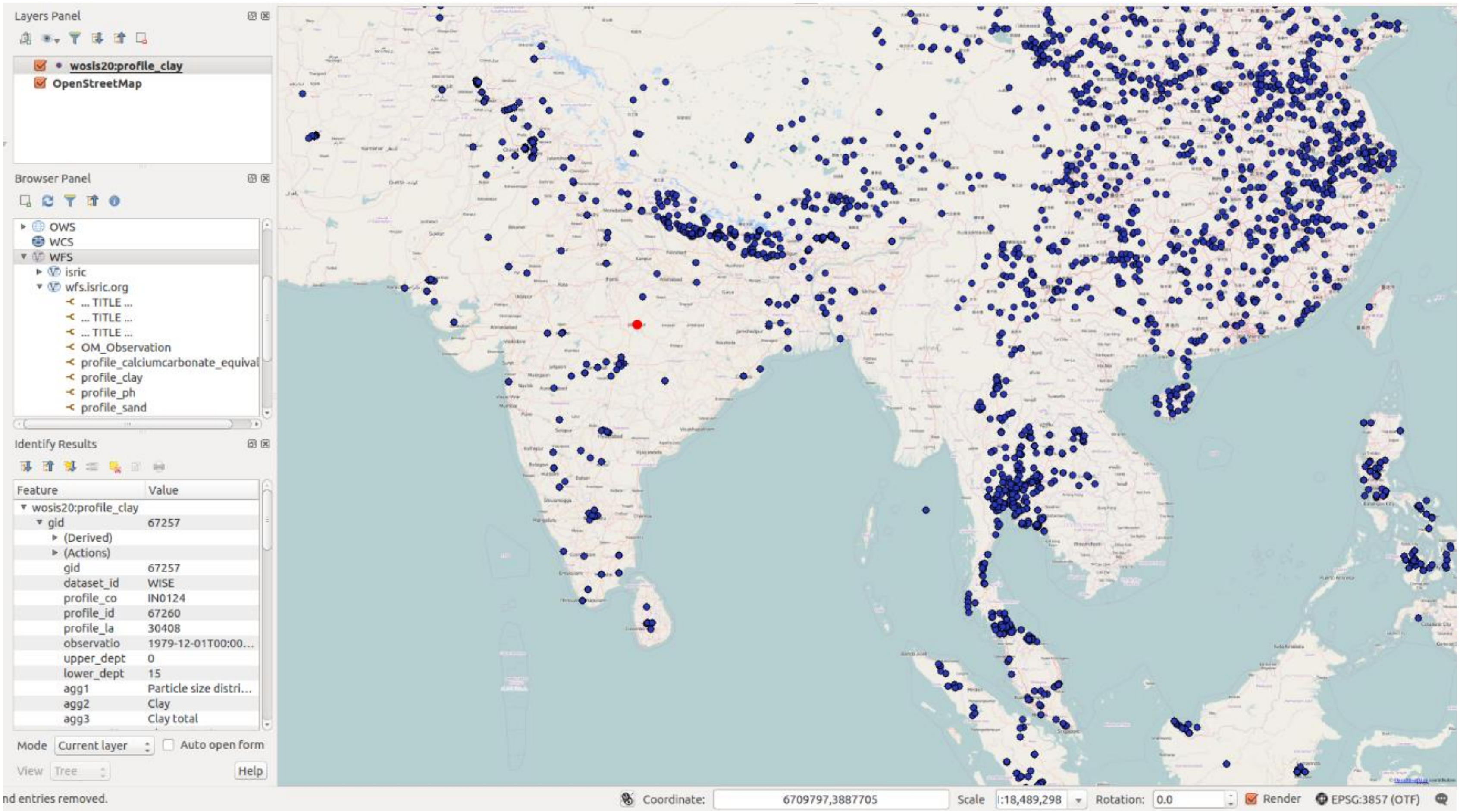
(*not yet undertaken in WoSIS*)

Table 11 Example regression equations for converting values of pH between different methods

No.	Target Method (Y)	Source Method (X)	Equation	R2	Reference
1	pH (1:1 0.01 m CaCl2)	pH (1:1 water)	$y = 1.08(x) - 0.973$	0.98	Miller and Kissel (2010)
2	pH (1:1 0.01 m CaCl2)	pH (saturated paste)	$y = 1.10 (x) - 0.923$	0.98	Miller and Kissel (2010)
3	pH (1:1 0.01 m CaCl2)	pH (1:2 water)	$y = 1.05 (x) - 0.950$	0.97	Miller and Kissel (2010)
4	pH (1:1 water)	pH (1:1 0.01 m CaCl2)	$y = x + 0.267 (EC\ 1{:}1\ water)^{-0.445}$	0.99	Miller and Kissel (2010)
5	pH (1:2 water)	pH (1:1 0.01 m CaCl2)	$y = x + 0.239 (EC\ 1{:}1\ water)^{-0.505}$	0.98	Miller and Kissel (2010)
6	pH (1:5 0.01 m CaCl2)	pH (1:5 water)	$y = 1.012 (x) - 0.76$	0.99	Conyers and Davey (1988)
7	pH (1:5 0.01 m CaCl2)	pH (1:5 water)	$y = 0.979 (x) - 0.71$	0.68	Bruce et al., (1989)
8	pH (1:5 0.01 m CaCl2)	pH (1:5 water)	$y = 0.887 (x) - 0.199$	0.88	Aitken and Moody (1991)
9	pH (1:5 0.01 m CaCl2)	pH (1:5 water)	$y = 0.197 (x)^2 - 1.21 (x) + 5.78$	0.92	Aitken and Moody (1991)
10	pH (1:5 0.002 m CaCl2)	pH (1:5 water)	$y = 0.948 (x) - 0.308$	0.90	Aitken and Moody (1991)
11	pH (1:5 0.002 m CaCl2)	pH (1:5 water)	$y = 0.178 (x)^2 - 1.043 (x) + 5.10$	0.94	Aitken and Moody (1991)
12	pH (1:5 1 m KCl)	pH (1:5 water)	$y = 0.803 (x) + 0.077$	0.81	Aitken and Moody (1991)
13	pH (1:5 1 m KCl)	pH (1:5 water)	$y = 0.233 (x)^2 - 1.797 (x) + 7.143$	0.98	Aitken and Moody (1991)
14	pH (soil solution)	pH (1:5 water)	$y = 1.28 (x) - 0.613$	0.78	Aitken and Moody (1991)
15	pH (soil solution)	pH (1:5 0.01 m CaCl2)	$y = 1.105 (x) - 0.140$	0.79	Aitken and Moody (1991)
16	pH (soil solution)	pH (1:5 0.002 m CaCl2)	$y = 1.050 (x) - 0.112$	[illegible]	[illegible]
18	pH (soil solution)	pH (1:5 1 m KCl)	$y = 1.175 (x) - 0.262$	[illegible]	Aitken and Moody (1991)

Source: GlobalSoilMap (2013)

WoSIS web service for easy access



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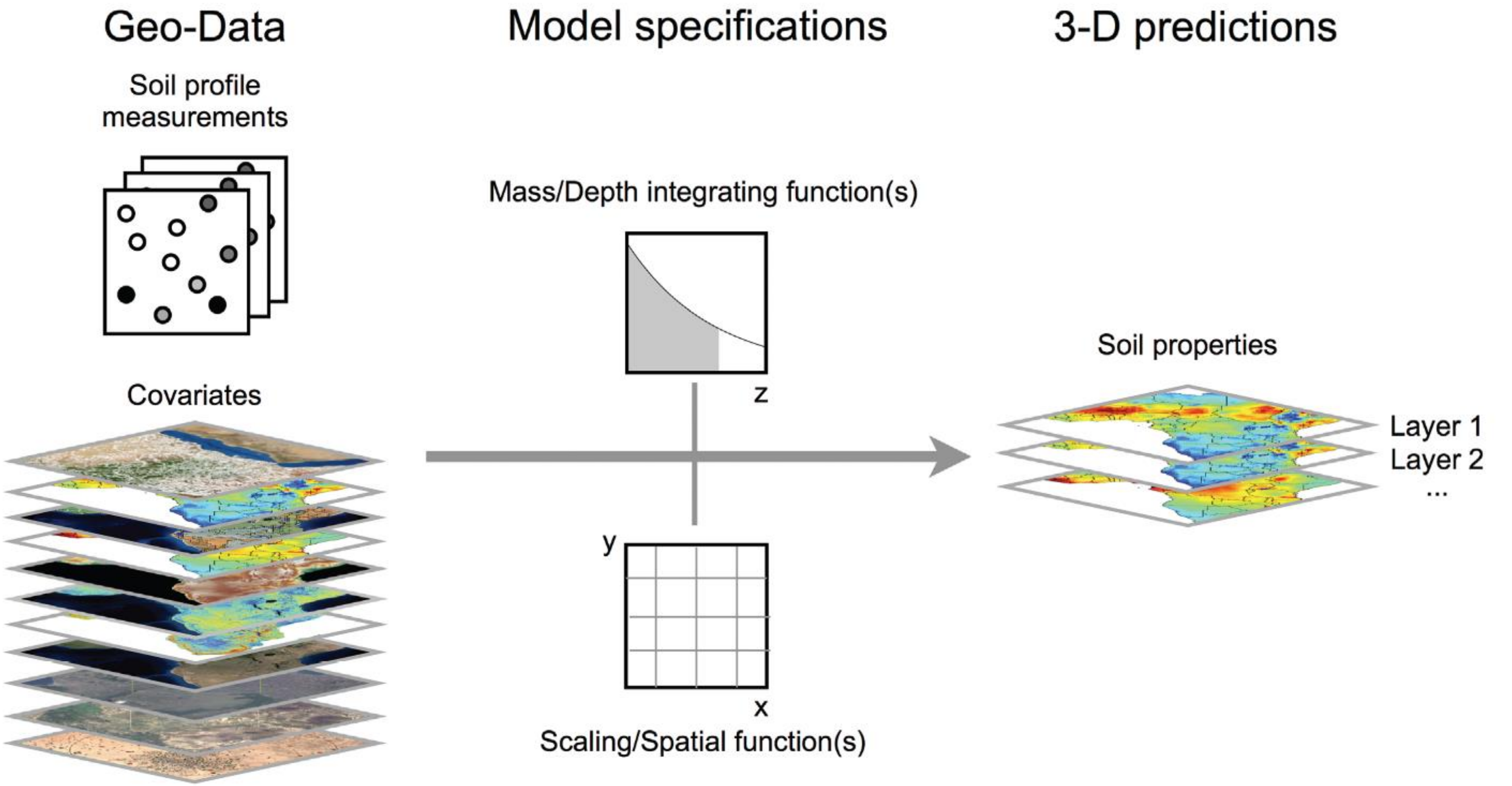
From points to grids



SoilGrids

- **Automated** soil information system
- Using **profile** data and **spatial** information (covariates)
- **Machine learning** algorithms
- 250m * 250m **resolution**
- Accessible through **web service** and mobile phone **app**

- Updatable
- Open data
- Moving towards crowdsourcing

SOILGRIDS
A system for automated global soil mapping
www.soilgrids.org

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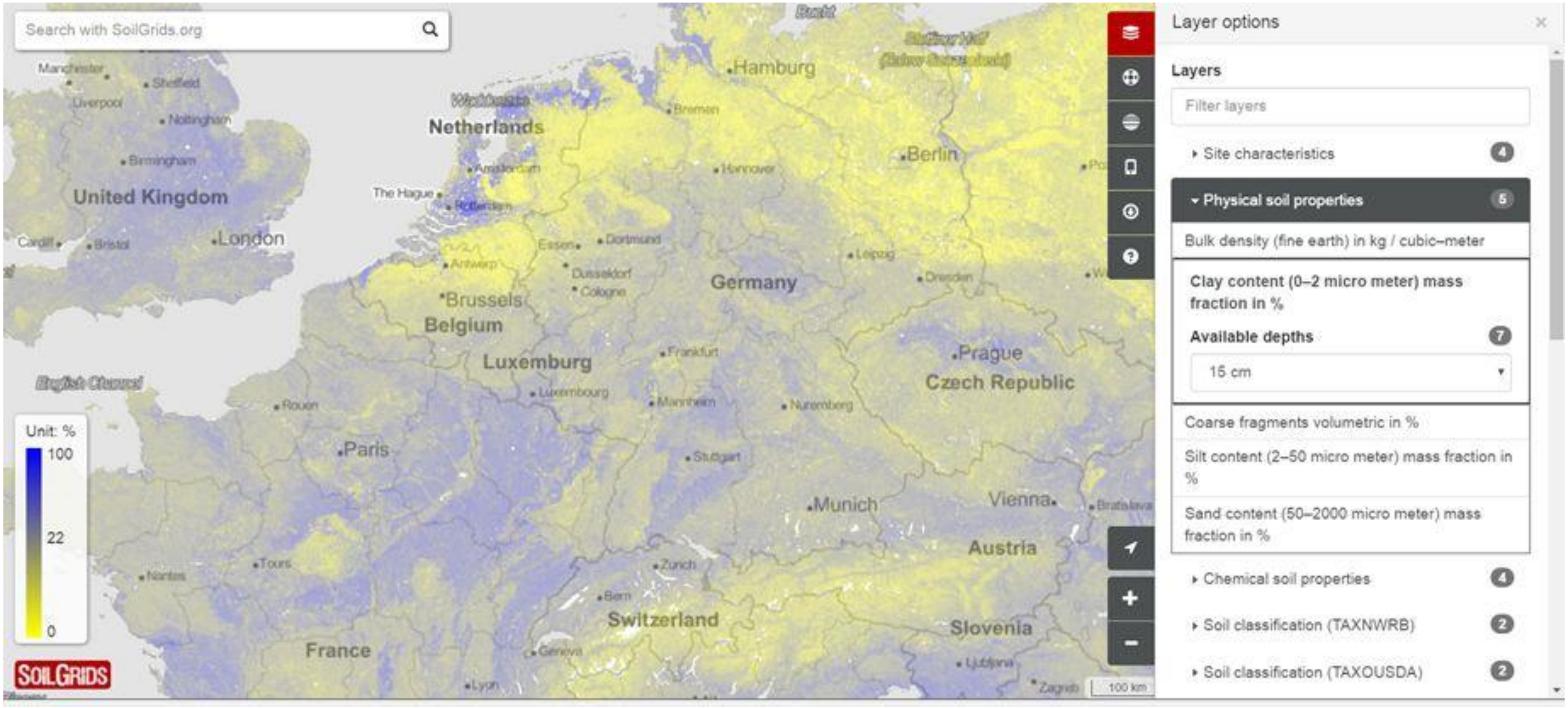
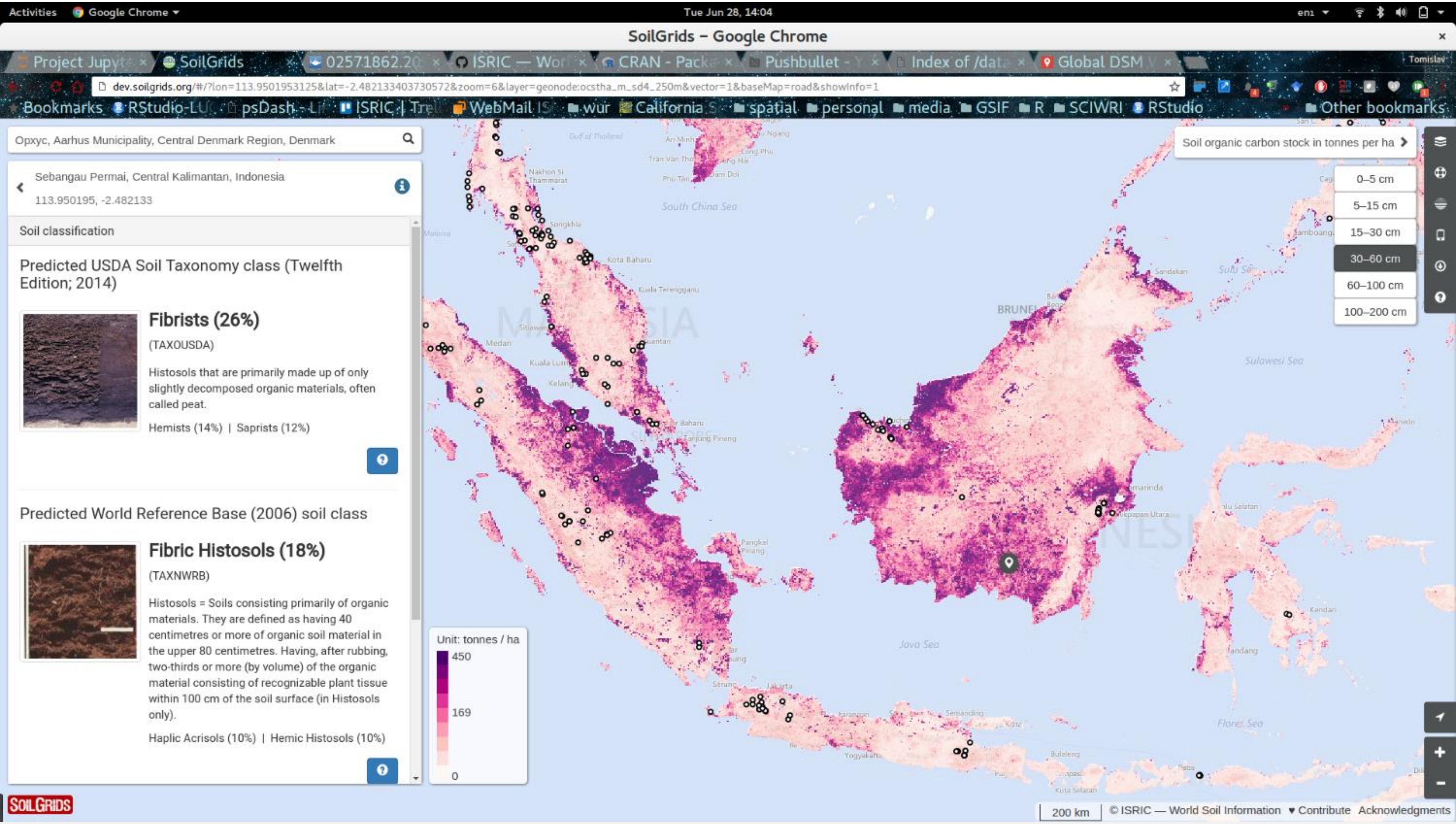
SoilGrids: clay content at -15 cm (%)



SoilGrids: SOC stock 30-50 cm (ton/ha)



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Relevant Developments

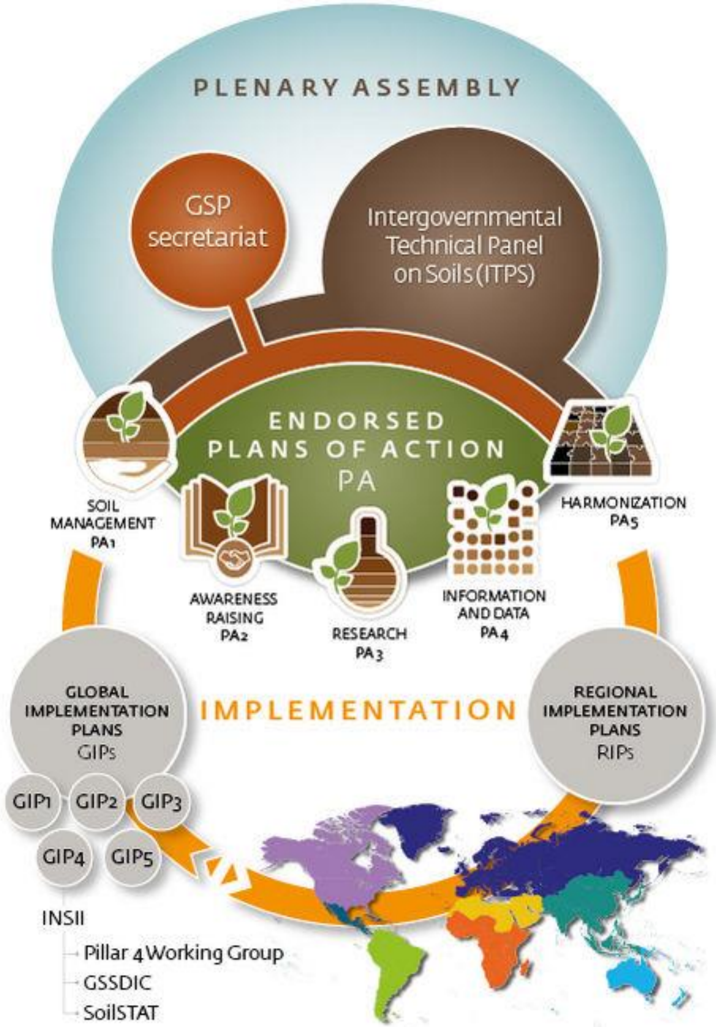
Preferred supplier to UNCCD

Land Degradation Neutrality

- **SDG 15.3**
- **Three sub-indicators**
  - Land use change
  - Net Primary Production
  - Soil Organic Carbon (SOC)
- ISRIC provides baseline SOC data to all countries
- Challenge: monitoring

United Nations
Convention to Combat Desertification

The Global Soil Partnership



- Soil Data Facility

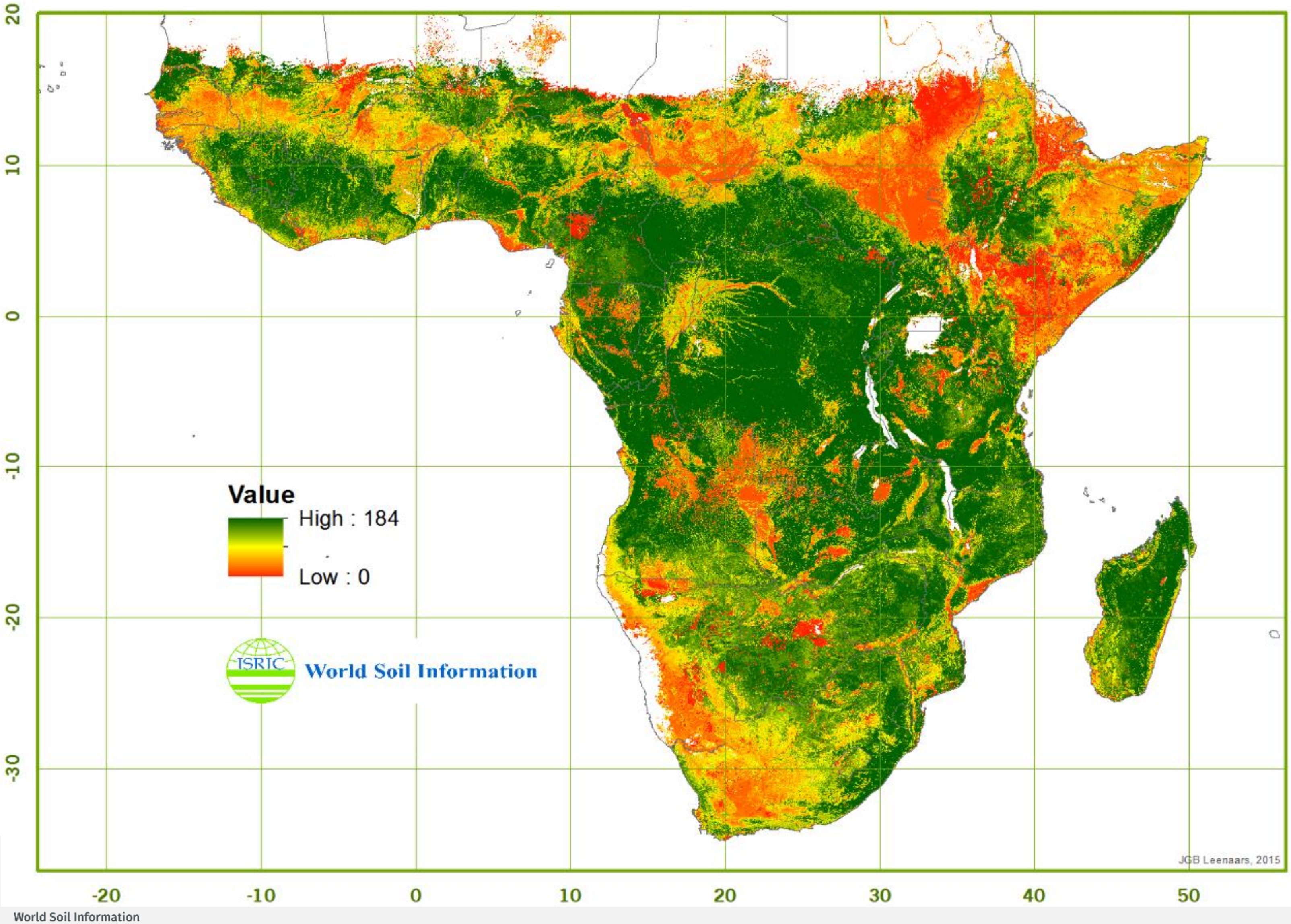
- Partners: governments, knowledge institutions, NGOs
- Goal: enhance sustainable soil management
- Pillars 1-5 (thematic)
- Regional partnerships
- ITPS (technical back-up)

Pillars of Action

- **Pillar 1: Soil Management**
  - Promote sustainable management of soil resources
- **Pillar 2: Awareness Raising**
  - Encourage investment, technical cooperation, policy, education, awareness and extension in soil
- **Pillar 3: Research**
  - Promote targeted soil research and development focusing on identified gaps, priorities and synergies
- **Pillar 4: Information and data**
  - Enhance the quantity and quality of soil data and information
- **Pillar 5: Harmonisation**
  - Harmonisation of methods, measurements and indicator for the sustainable management of soil

Work stream 4:
Developing derived Products
(‘Boosting Impact’)

Plant-available water holding capacity (mm, maize)



World Soil Information

Information platform for production of site specific fertilisers

Concluding remarks

- Soil information and its derived products are **crucial for addressing global challenges**
- Standardisation and harmonisation of field and lab methods are of crucial importance for the **quality of global soil information products and the derived products**
- With partners we are working towards **global soil data inter-operability**
- The quality-assessed data will be served using an increasing range of **web-services through ISRIC's evolving SDI**
- **ISRIC supports SOPHIE** and its results can easily be accommodated in the WoSIS database structure.

More information:

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