



ISRIC
World Soil Information



Advancing interoperable soil data exchange for global soil data information systems

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Wageningen, 2018



- **Founded in 1966, upon recommendation of UNESCO, FAO and IUSS**
- **Independent foundation** based in Wageningen
- **Cooperation** agreement with Wageningen University.
- 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**)
- **Global Soil Partnership**, hosting the **Soil Data Facility** (pillar 4, 5)



Guiding principles



- We are **strongly science based** for the development of our methods and products.
- All our **IP is open** (E.g. CC-BY-SA); we strictly respect IP rights of our data providers.
- Our data is **FAIR** (Findable, Accessible, Interoperable, Re-usable)
- We build active **user communities** among scientists, policy makers and private sector
- We actively monitor **new developments** and develop new technologies for producing and serving soil information to modern technologies (apps, webtools, (sensor) data sources, etc.)
- We collect and produce also other **types of soil information**, such as micro-nutrients, soil biodiversity and soil pollutants.
- We focus on **spatial and temporal** variations

**CLIMATE
CHANGE**

**WATER
MANAGEMENT**

USER COMMUNITY

**Soil
Information
Brokering**

**Soil Museum
& Capacity
building**

**Setting
Standards &
References**

**Co-creation
&
Boosting
impact**



ISRIC
World Soil Information

World Reference Collection

Scientific Excellence

Soil Data

**SUSTAINABLE LAND
MANAGEMENT**

FOOD SECURITY

Vision



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

Challenges on:

- Sustainable Land Management
- Food Security
- Land Degradation (Neutrality)
- Soil Organic Carbon (SOC)

International Initiatives:

- Global Soil Partnership
- Sustainable Development Goals
- Paris Agreement
- 4p1000

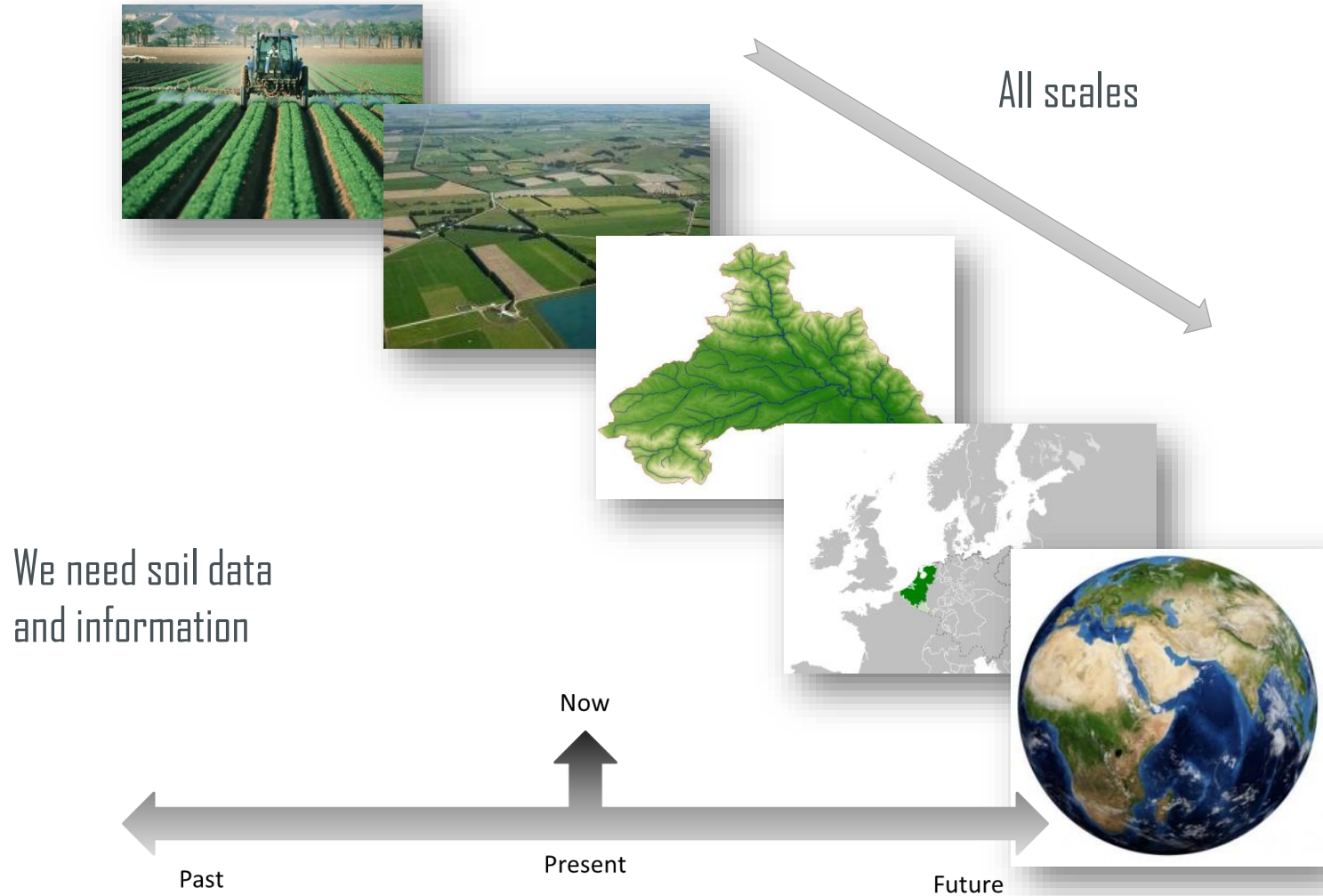


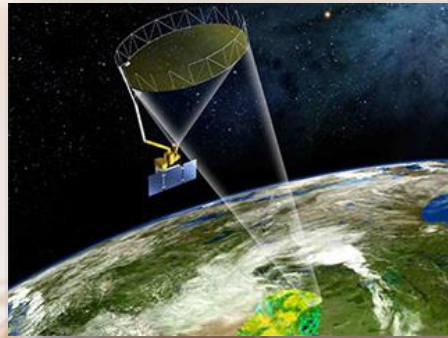
United Nations
Framework Convention on
Climate Change



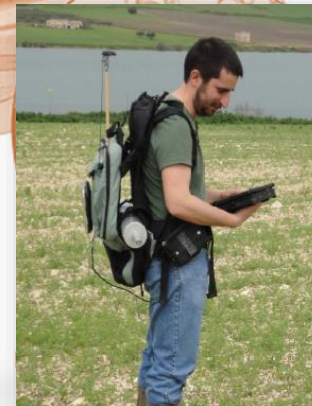
United Nations
Convention to Combat
Desertification

Global Soil Services





- 9 Atmospheric profile
- 10 Eddy covariance system
- 11 Groundwater observation well
- 12 Stream gauge
- 13 Automatic sample collector
- 14 Optical sensors
- 15 Position sensor
- 16 TDR probes
- 17 Tensiometer
- 18 LAI sensor
- 19 Gas exchange measuring device

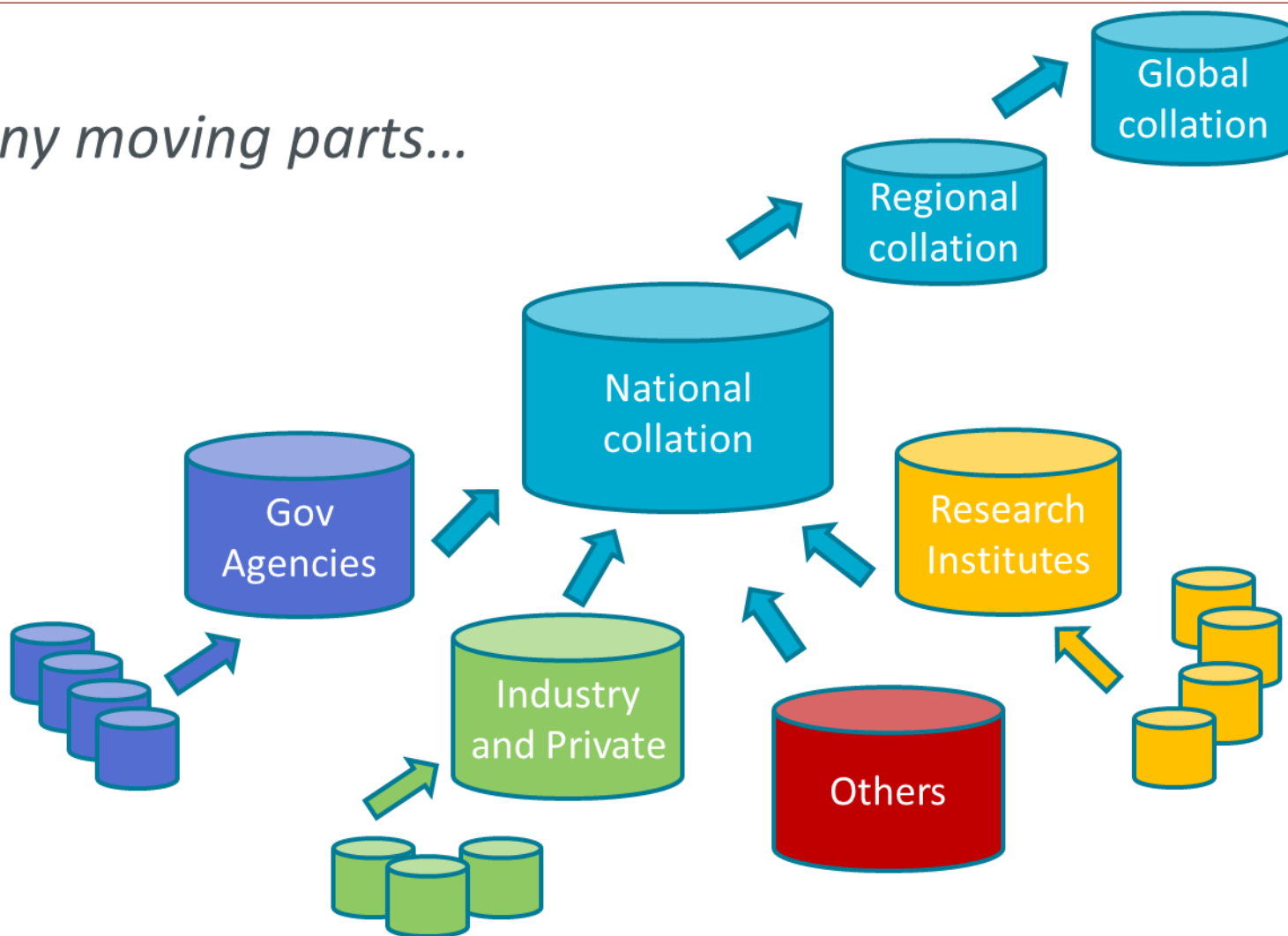


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Sources and flows of soil data



many moving parts...



Problem space



Standardisation and harmonisation in collection, storage and exchange is needed



Great challenges in soils

- Many 'dormant' data repositories (**silos**)
- Soil data is often **specialized**, user unfriendly
- Much field data lack **quality assurance** and **validation**
- Lack of **technical capacity** (data processing, Web-GIS)
- Lack of commonly agreed and broadly applied soil data exchange **standard**

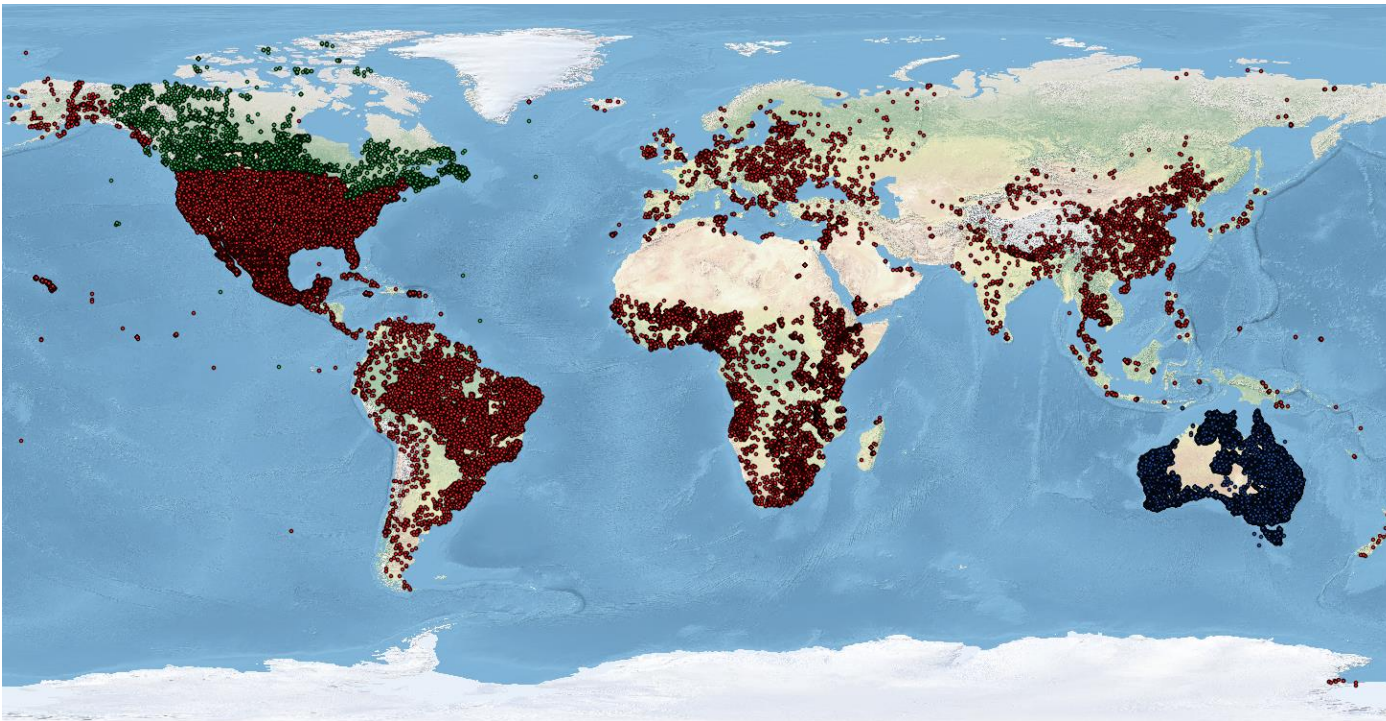


Therefore are we working on:



- ISRIC has a **centralized** soil information system and infrastructure
- Global Soil Partnership is building a **federated SIS**
- Work on soil data **interoperability** is done in several communities.
- **Local institutes** are collating their own SIS (such as WENR for NL)
- This allows for:
 - *Standardised and harmonised* soil data and information
 - to increase the *impact* of (global) soil information
- This is a challenge at **national** scales as well as on a **global scale**
- *But* one organisation can never do this alone

World Soil Information System (WoSIS)



- Soil Profile database
- >150.000 profiles
- Ongoing process
- Properties:
 - Bulk density
 - Calcium carbonate
 - Carbon (Total / Organic)
 - Coarse fragments
 - pH
 - Water retention
 - Texture (Sand, Silt, Clay)
 - Cation exchange capacity
 - Electrical conductivity
 - Phosphorus
 - Total nitrogen
 - Classification: FAO, WRB, S. Taxonomy

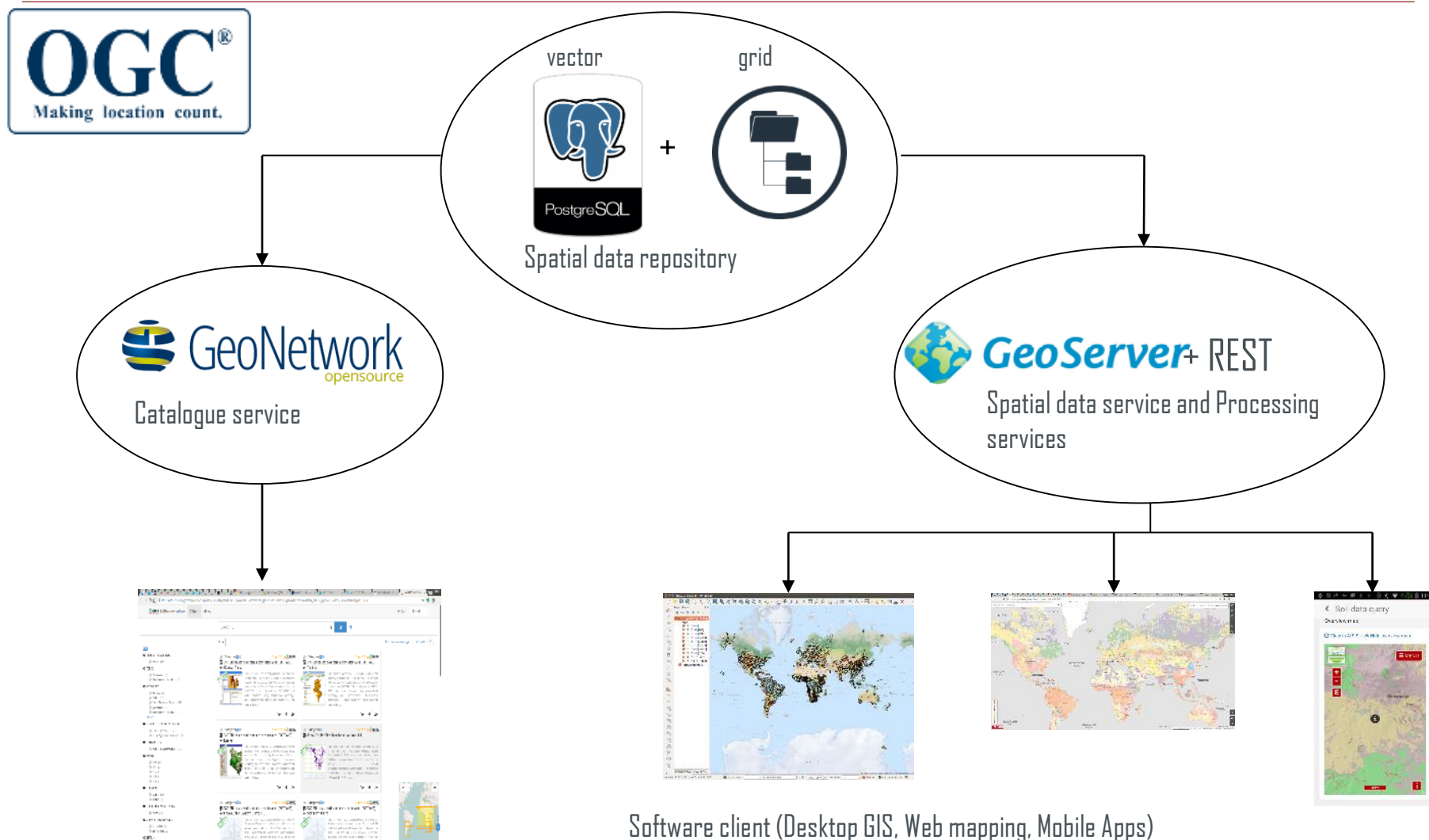
WoSIS (status October 2018):

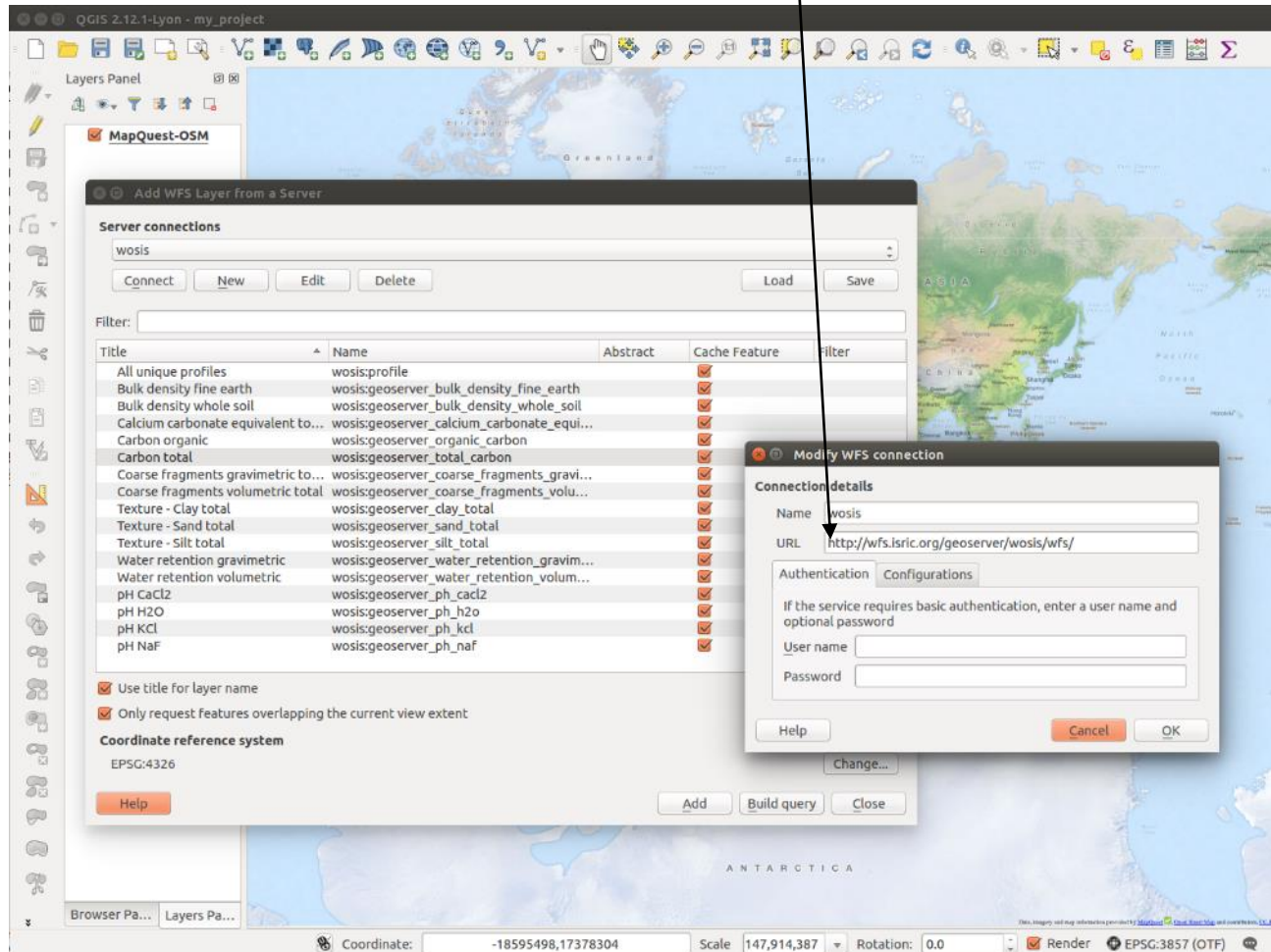
Red dots, served by WFS (98,776 profiles)

green dots, in standardization process ('CA-CanSIS', 'CA-CUFCO', 'CA-FECD', 'CA-SPD'; 12,170 profiles)

blue dots, import process (AU-CSIRO; 274,495 profiles).

ISRIC Spatial data infrastructure



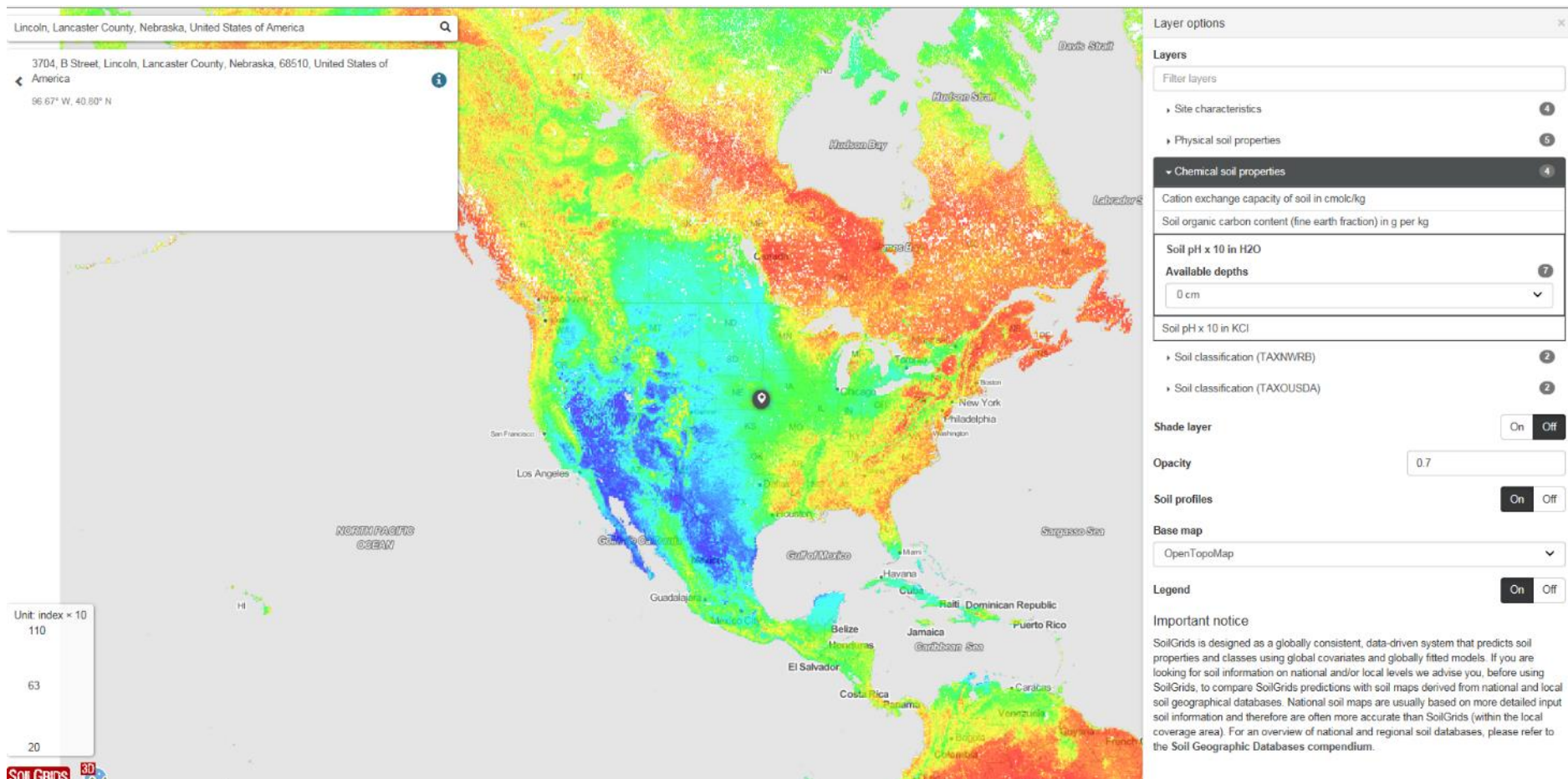


- One central place for data gathering by GIS applications
- Free to use and download
- Start your research immediately with standardized and validated soil data
- More info
- <http://isric.org/explore/wosis>

- soil **property** and **class** maps at **7 depths** up to 2 m
- **Automated** soil information system
- Using **profile** data and **spatial** information (covariates)
- **Machine learning** algorithms
- 250m * 250m **resolution**
- Accessible through **web service** (Available by WMS/WCS/FTP and SoilInfo app) www.soilgrids.org
- Updatable
- Open data
- Rapid growth of number of downloads and citations, increasingly used as input in **global studies**
- User support provided, active **mailing list**



SoilGrids: pH-H₂O at soil surface





Towards a Global Soil Information System

Global Soil Partnership - Country level (INSII) - institutional:

- Pillar 4 - soil information
- Pillar 5 - harmonisation
- National support: country driven
- Global network and agenda setting
- Global Soil Information System **GLOSI** (to be build)
- **GSP Soil Data Facility** hosted by ISRIC needs and will build tools for distributed systems
- Wants to use formats/structures that are internationally accepted



<http://www.fao.org/global-soil-partnership/pillars-action/>

The Global Soil Partnership



GloSIS:

- **Soil profile** databases (Tier 1, Tier 2)
- Global **polygon** coverage, as replacement of FAO/UNESCO SMotW, 1:5M
- Global **Grids**:
 - Harmonized World Soil Database, version 2
 - Fine-resolution grid of soil properties, version 0 (collation of grids, 1km)
 - Fine resolution grid of soil properties, version 1 (harmonized, <1km)

Guidelines and **capacity development** for implementation.

SoilSTAT:

- Foreseen system for **monitoring**, forecasting and status **reporting** of the soil resource.
- Addition to the FAOSTAT family of reporting systems.

GloSIS Guiding Principles



- Infrastructure bringing together soil information collected by (national) institutions in a **de-centralized** way.
- GloSIS is to be a **federation** of soil information systems.
- Source institutions **retain** their data and **control access**.
- Data sharing according to **data policy** of data providers.
- Implementation that is **lightweight**, cheap to deploy, "simple".
- Based on **open source** software.
- Should **empower** countries (and other data providers) to develop their national soil information system as a centre for national soil information.

GloSIS Implementation



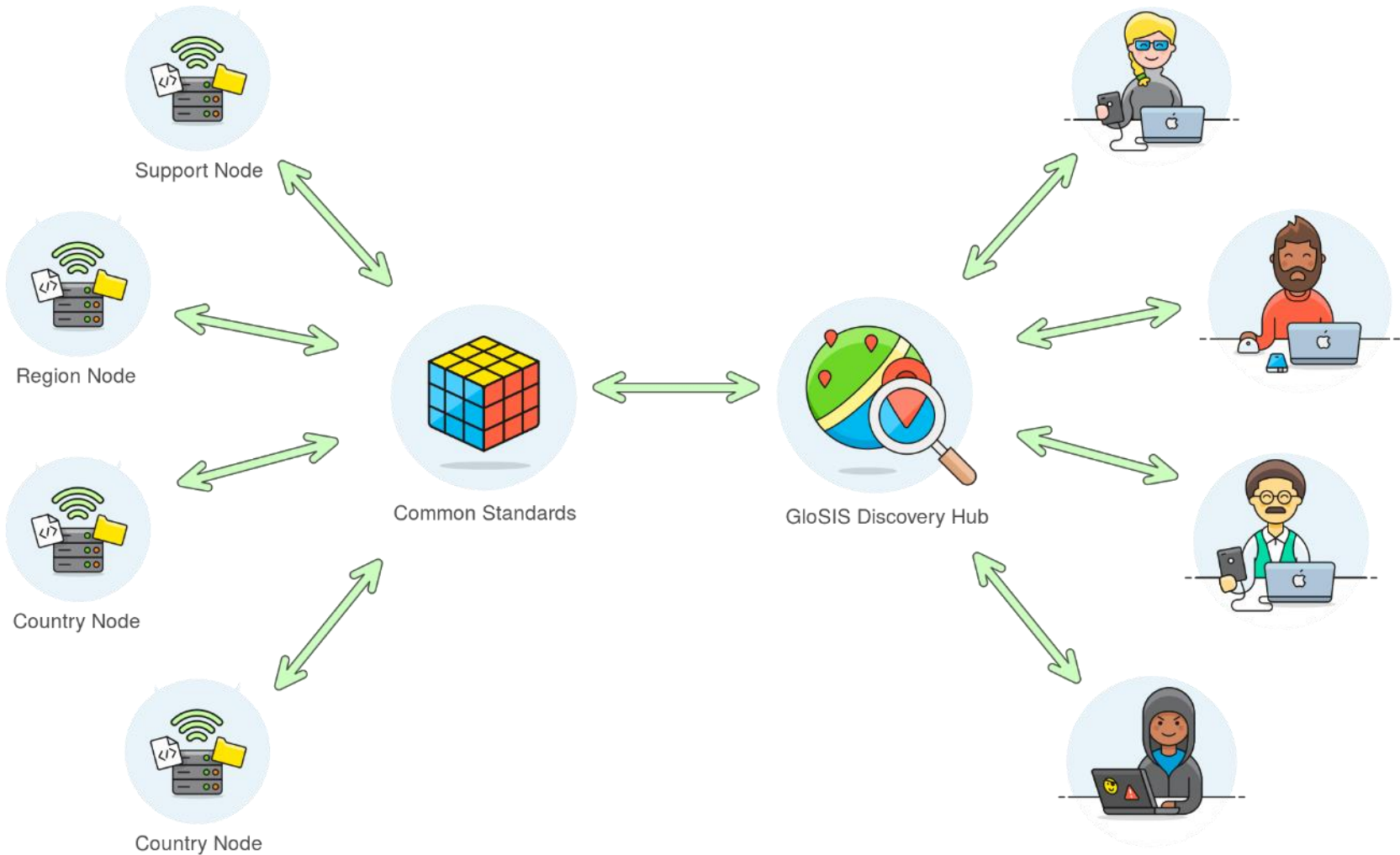
Implementation period: 2017 – 2020.

Coordinated by **GSP Secretariat (FAO)** and **GSP Soil Data Facility (ISRIC – World Soil Information)**, with contributions from Pillar 4 Working Group, Pillar 5, soil information experts.

General timeline GloSIS:

- 2017: SDF appointed, general work plan presented during INSII 3 for implementing GloSIS.
- 2018: development technical specifications of GloSIS and its data products
- 2019: implementation and testing
- 2020: population and capacity building

GSP Soil Data Facility



GSP Soil Data Facility



Initiatives on soil data standards



Pillar 5 WG



Ag domain WG



Soil data WG



ISO 28258



Soil



IUSS WG - SIS

GSP Pillar 5: Harmonisation



- Develop exchange standard for soil data (SoilML or other)
- Develop vocabularies or add to existing ones
- Harmonise soil analysis methods (GLOSOLAN)
- Harmonise soil profile, classification, maps, sampling, analysis
- Capacity building

<http://www.fao.org/global-soil-partnership/pillars-action/5-harmonization/en/>

IUSS WG on Soil Information Standards



To develop, promote and maintain internationally recognized and adopted standards for the exchange and collation of consistent harmonized soils data and information worldwide.

- Vocabularies for SoilML
- Use cases
- Capacity building
- <https://www.iuss.org/>



GODAN Working Group on Soil Data



GODAN Soil data working group:

- Since April 2017
- 65 subscribers
- 45 organisations
- 9 international presentations
- Advocacy for SoilML
- Use cases
- Capacity building
- <http://www.godan.info/working-groups/soil-data>



Manaaki Whenua
Landcare Research



ROTHAMSTED
RESEARCH



BONARES



Food and Agriculture Organization
of the United Nations



ISRIC
World Soil Information

gODAN
Global Open Data
for Agriculture & Nutrition



ISRIC
World Soil Information

Use case: OGC IE



- Three organizations providing data using the same standard (Soil-IE-ML) in an interoperable manner
- Global studies need data from multiple data sources in 1 format, currently that's hardly available:
- SoilML enables that by proposing a new core model (including GML/XML schema);

The IE experiment
proves that it works:
Next step is v2.0





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The aim is to be able to provide FAIR Linked Open Soil Data for regional and global studies without spending half of the budget on data preparation and harmonisation within each project.

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