OUTCOMES AND KEY FINDINGS

Theme 1. Assessment, mapping, and monitoring of salt-affected soils

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There were 14 talks and 29 posters in our Theme 1.

There were two keynote talks (*Triantafilis* and *Lavado*) related to our topic and the main feature of this meeting, **GLOBAL MAP OF SALT-AFFECTED SOILS** is also our topic**.**

Now, based on a subjective interpretation, first we shall have a look at various aspects of the presentations, such as novelty, topic, scale, geographical and national representation based on the first author. Classifications might overlap.

Traditional or modern approach?

- Traditional 24
- Modern 14

Assessment, mapping or monitoring

- Assessment 18
- Mapping 17
- Monitoring 3

Representation of study/mapping scales

- Regional 15
- Field 13
- National 8
- Continental 1

Representation of continents

• Asia	11
• Europe	9
• South America	7
• Africa	6
• North America	5
• Australia (Keynote talk)	1

Countries with more than one presentation

• IN	4
• US	4
• CO	3
• RU	3
• BR	2
• IT	1.5 (EU)
• CH	?
• EG	?
• PK	?
• ?	?

Most frequently mentioned modern methods

We know that *salt-affected soils* are the soils which are **BEST SUITED for** *DIGITAL SOIL MAPPING* and these soils **NEED IT MOST** due their **high depth, lateral** and **temporal variability.** Our first session yesterday was a session on DSM, covering every aspect, such as

- Various remote sensing techniques
- Proximal sensing, such as Electromagnetic Induction inversion method
- Laboratory techniques, such as Diffuse reflectance spectroscopy
- Prediction algorithms, such as Machine learning algorithms
- Spatial interpolation techniques, such as Regression kriging

Schematic representation of the relationship of some factors that facilitate the mapping of salt-affected soils

PRECONDITIONING FACTOR	MAIN VARIABLES	CONSEQUENTIAL VARIABLES
Relief	**Salinity⇔Sodicity⇔Alkalinity (pH)**	*Surface discoloration*
Hydrology	↓	*Mechanical properties*
Other soil forming factors	**Electrical conductivity**	Hydrophysical properties
		Extent of plant cover/biomass
		Species composition/abundance

Bold character = **main variable** to map. Underlined character = observable by remote/proximal sensing. *Italic character* = *covariable*

Main outcome of the Symposium in our theme

Mapping and assessment of salt-affected soils MUST BE CARRIED OUT with Digital Soil Mapping techniques.

Conditions for that were enhanced by the preparation of Global Map of Salt-affected Soils through the publication of the guidelines and the trainings.

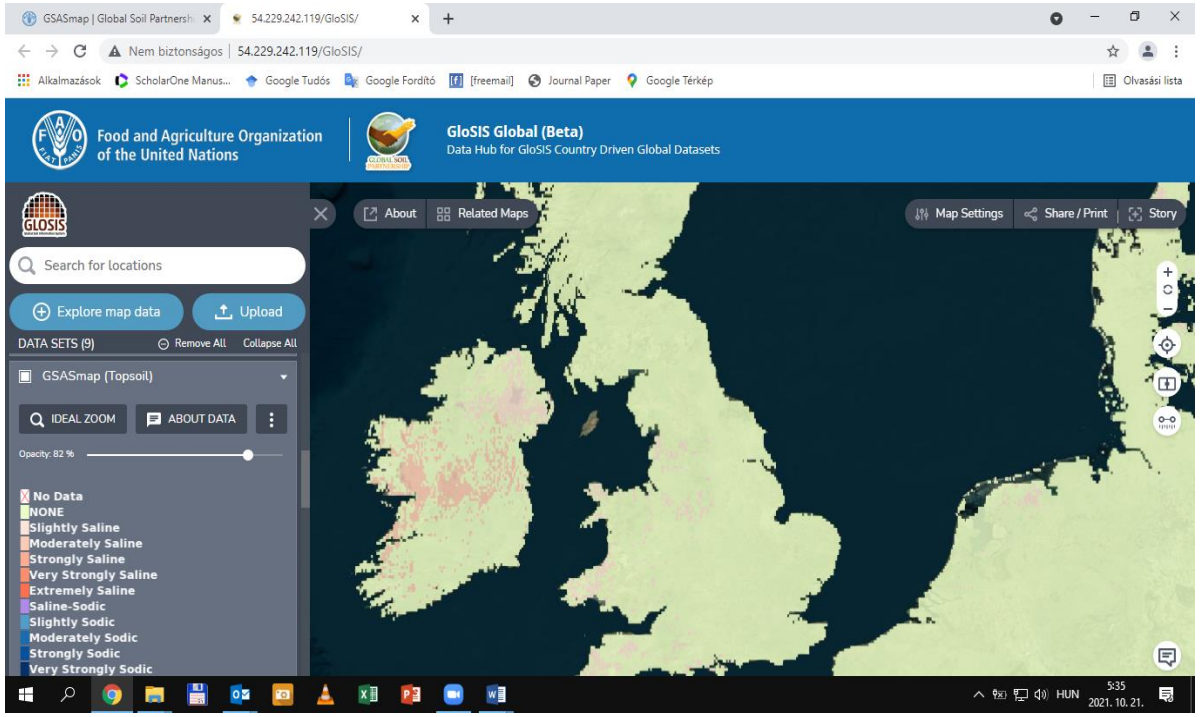
Key messages? There are recurrent issues.

- in northern Amazonia sodic soils were formed in depressions, which might be used as paddy if clayey, or pasture if not
- it is fine to use 1:5 extract data
- "salinization occurs due mainly to drainage, irrigation, fertilization, amendments and deforestation"
- "Based on the Random Forest method, the accuracy of the soil salinity indication is 79%„
- Random forest is suitable for predicting soil salinity
- Machine learning provided very different estimates compared to previous ones, 1 km resolution is not enough to capture local variability
- increasing pH and EC reduces VNIR reflectance values in the lab
- "results show the utility of easy acquisition data such as pH and EC together with information from free-use satellite images "
- carbonate and palygorskyte minerals cause Vertisol degradation (Ks)
- At low salinity values the prediction uncertainty is great
- Remote sensing data were combined with field data
- Large variability of texture and low salinity are difficult conditions for precise estimation
- linear regression equation was formulated to predict soil salinity
- "Extended landscape mapping based upon both space images interpretation and landscape transformation model demonstrates better prediction powers then common methods of multi-spectral images classification."
- excessive irrigation practice must be corrected
- modified Soil Salinity Risk Index was used
- very low plant available water content was found in salt-affected spots
- there is salt accumulation in low-lying locations
- "external parameter orthogonalization (EPO) method implementation leads to moderate improvement in the accuracy of OC prediction"
- Order of precision of maps is Combined > Machine learning > Spatial interpolation
- EM results could be linked to zones of different mineralogy
- "Soil profile and by elements of nano-, micro- and mesorelief can serve as a method for diagnosing the geochemical stability of landscapes"
- first salinity map of Paraguay created based on 80 EC and 204 pH&ESP sampling points
- limited irrigation decreases the intensity of salinization
- dropping level of Caspian sea results in dropping watertable which induces desalination of soils
- occurrence of natural SAS is limited in SA, most dominant processes are water-related
- 95% has nil, 4% has slight salinity in Burkina Faso
- 4 site-specific soil management zones were delineated inside 2.94 ha in Sri Lanka
- salt-affected soils in Surcin area must be reclaimed
- USDA NRCS carries out conventional lab analysis + predictive Middle Infrared Spectrometry, as well as Proximal sensing with Electromagnetic Induction
- there are improved alfalfa varieties with better salt tolerance
- traditional pokkali (rice/prawn rotation) is superior to either monoculture for soil properties, mainly Bd and SOC in northern Kerala
- land use change alters soil properties in natural coastal wetlands in Kerala

Machine learning techniques are useful
Combination of field and remote sensing data is needed
Prediction at low salinity level is difficult
Distribution of salts has universal laws
Not only salt accumulation but also desalination occurs when conditions change.

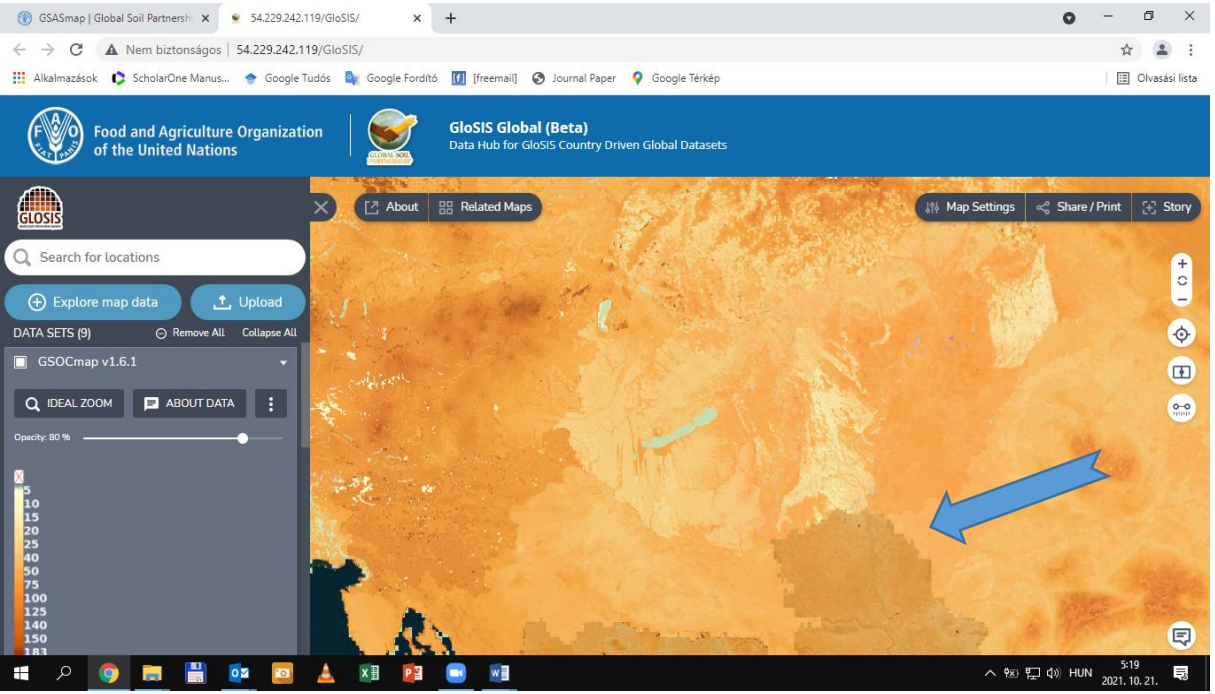
Our community looks forward to further developments with the Global Map series

Global soil maps were created with **new** *methodology*, **new** *threshold values*, therefore show **new** *distribution* of properties and need interpretation. Who will do that?

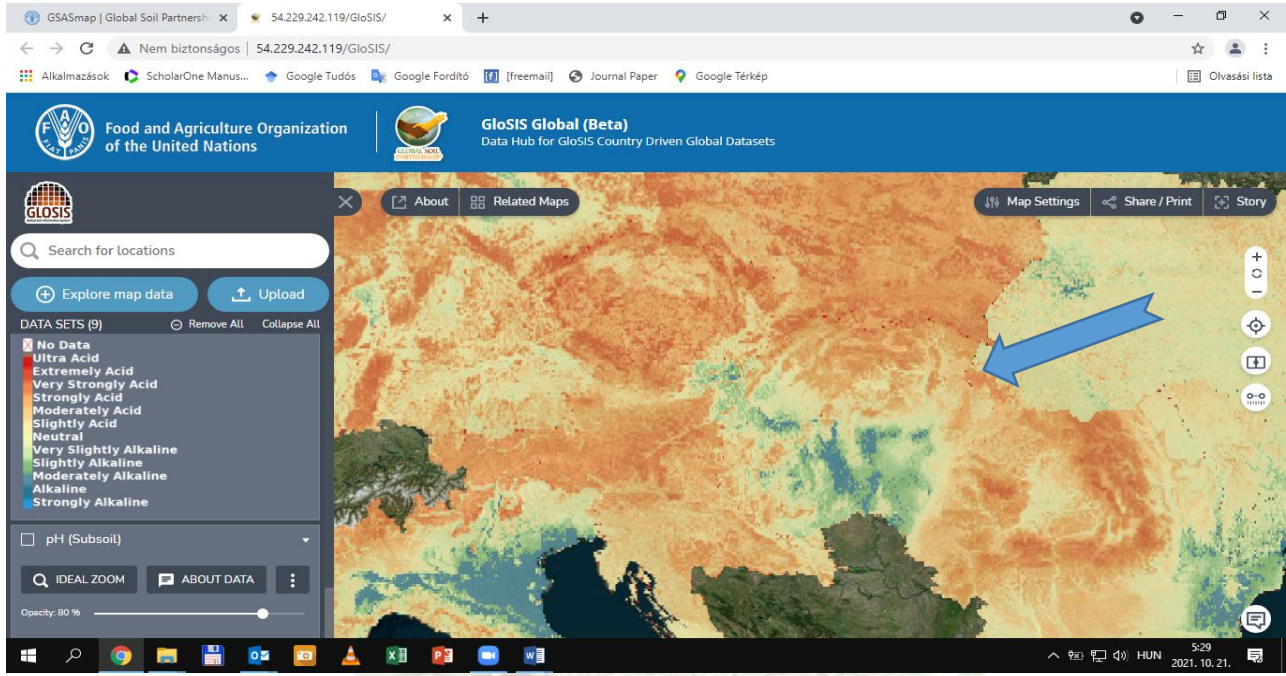


? Salt-affected soils in Ireland, Wales and England from GSAS, 2021 ?

Global soil maps need harmonization across national boundaries (eastern part of Central Europe)



Organic carbon map from GSOC 2017



pH map from GSAS 2021

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Thank you for the attention!

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