

Mapping soil multifunctionality for urban planning: how to deal with limited knowledge on soils?

EGU2020-11491



Context

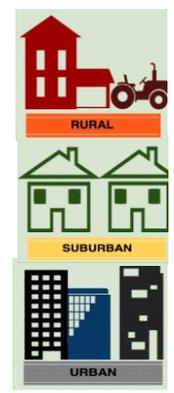


Soil = resource + many functions

- Ecological:** regulation of water, carbon & nutrients cycles, biodiversity
- Human based:** food/biomass, epuration, support of activities, supply of raw materials



New territorial scale including inter-urban spaces



- Rural soils:** maps, data available
- Urban soils:** no maps, few data

No net land take by 2050
(7th EU Env. Action Program)
"ZAN" in France

- ⇒ **Soil preservation & restauration**
- ⇒ **Which decision aid tools?**

- Existing**
- multi-criteria indexes (soil scientists)
 - GIS-indexes (geographers)

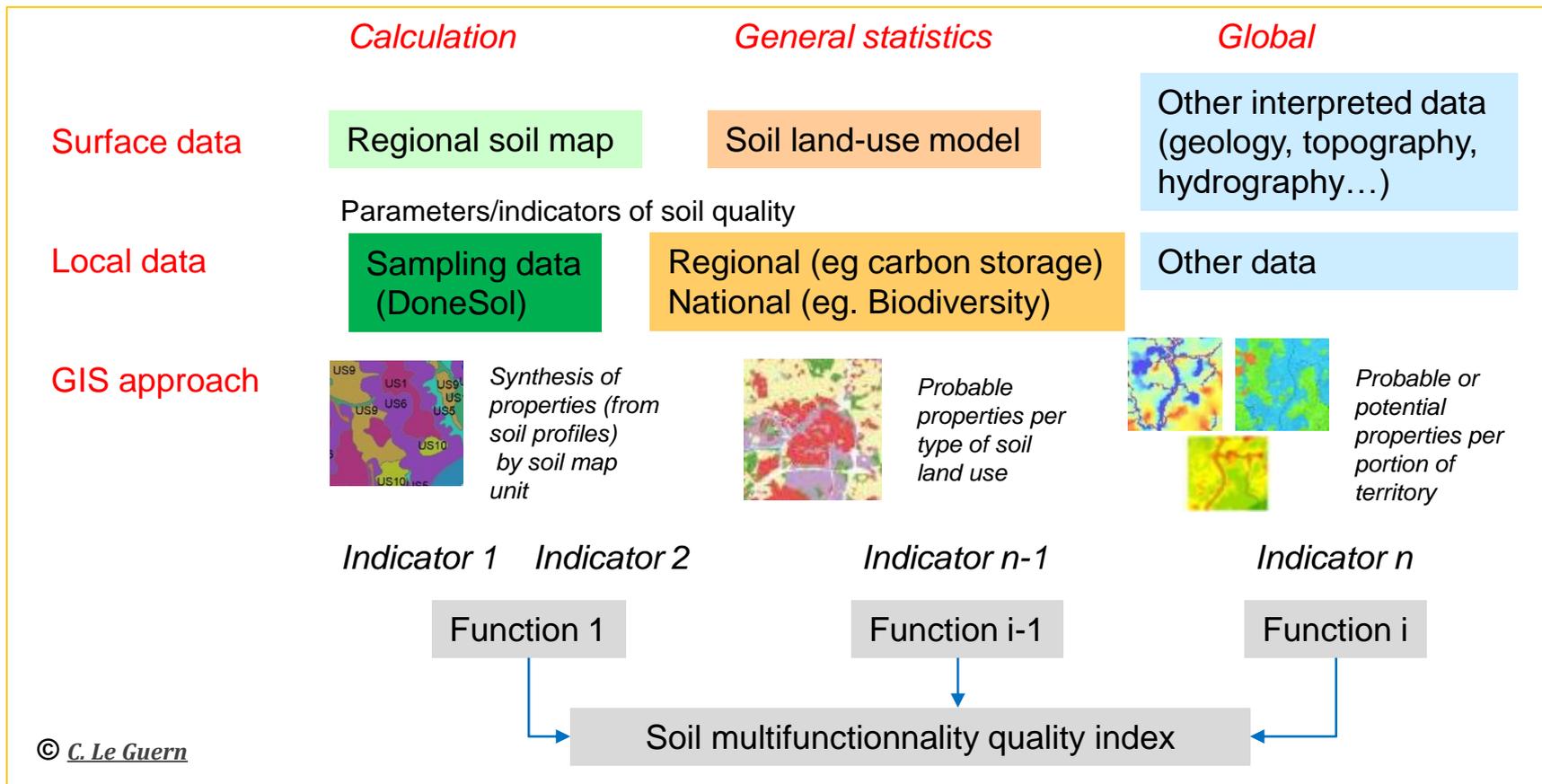
Choice: integrative GIS indexes at metropolis scale



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Methodology to map each function according to territorial (un)available data



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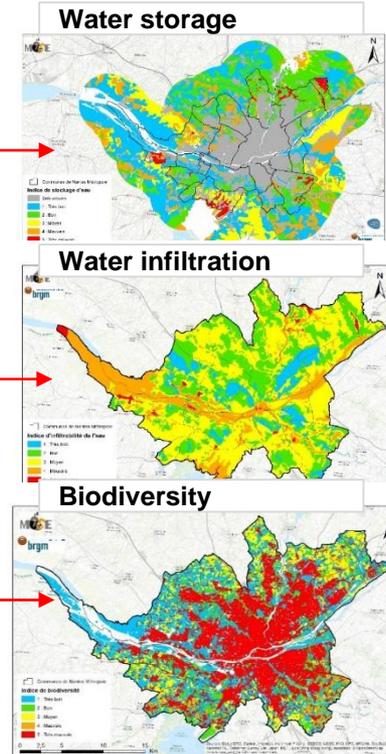
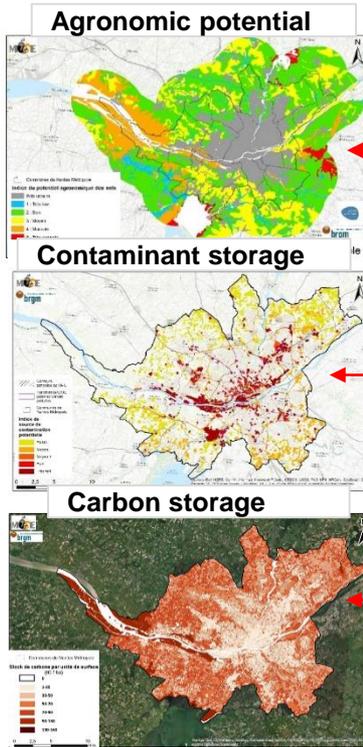
**Soil function maps:
Nantes (France)**

Calculation:
soil map (1/250 000),
sampling data,
No data on urban soils

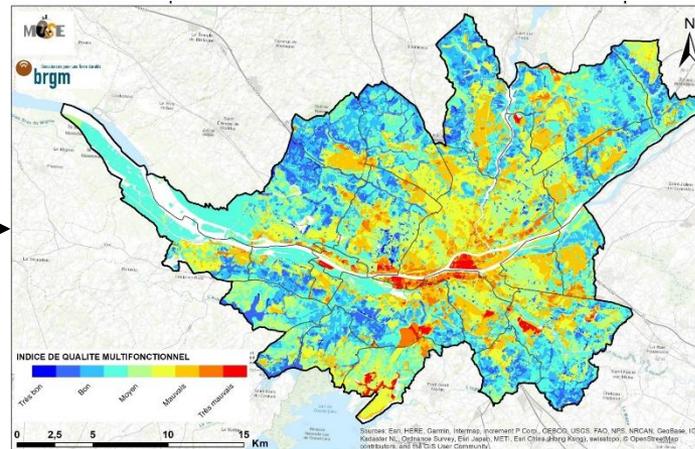
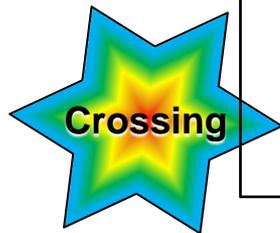
Global:
eg.
geology (1/50 000), (potential)
contaminated sites (1/25 000),
« cadastre » (1/5 000)

Statistical:
Regional/national data
per land use,
soil land-use model
(1/10 000)

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Water regulation



**Multifunctionality
quality index maps**

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➤ Appraisal of developed methodology:

Various functions mapped 
 Multifunctionality quality index maps
 Maps easy to understand (urban planner feedback)

Crossing maps with very different scales
 Some functions not mapped for urban soils 
 Limited information with a global index:
 individual function maps needed

Next steps

- Verify accuracy of statistical mapping: comparing with existing and new data
- Refine mapping methodologies (ex. water retention...)
- Continue interactions with urban planners and decision-makers

➤ Further challenges on urban soils

- Increase knowledge on urban soils
 - Typology => one/several according to objectives?
 - Mapping => How? any feedback? 3D?
 - Data :
 - minimum data sets vs objectives
 - common practices for data acquisition
 - databases on soil quality (eg. French BDSolU – Donesol)
 - From data to referential maps => Methods? Geostatistics?

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Abstract

Urban planning historically considers soils as a support for infrastructures. Hopefully, awareness is increasing on the fact that soils offer many more services than just this one, thanks to their various functions. It is therefore necessary to develop methodologies and tools that allow the urban planners to take into account the opportunities and constraints associated to soils. Considering the existing quality indexes already developed by the researchers, we faced within the MUSE project various difficulties and in particular the lack of knowledge on urban soils in France. We therefore developed a methodology to deal with limited knowledge on urban soils and tested it first on the Nantes metropolis territory (France). Our aim was to map each soil function as well as a soil multifunctionality in such a way that urban planning documents may refer to them.

The aim of the multifunction map is to help protecting soils that show various functions, including patrimonial functions. We therefore considered the following functions: carbon storage, water storage and infiltration, storage and filtration of contaminants, agronomic potential, biodiversity reservoir. We did not consider the support and natural resources provision functions. According to the level of knowledge on soils (local/regional/national scales, direct/indirect), we considered three mapping approaches (statistical, global, and calculation) to build function maps, and interpreted them in terms of soil function index (SFI) map. To build the soil multifunctionality quality index (SMQI) map, we crossed the various function index maps using a ponderation according to the territorial issues. These issues derive from discussions with the urban planners of the local authority and the number of functions assessed on each part of the territory (some functions not mapped in the city center). We carried out discussions with the urban planners all along the methodological development process to ensure applicability of the index map produced.

The results obtained are very satisfying considering the level of knowledge on soils. The urban planners of the local authority clearly imagine how to use both the soil function maps as well as the soil multifunctionality quality index map. We are nevertheless aware of the limits due to the use of data with different scales of validity (eg. 1 / 250 000 for pedological map; 1/10 000 for soil land-use model; statistical data on C and biodiversity at pedoclimatic scale vs national scale). The comparison with local punctual data helps verifying the degree of confidence of the maps. The methodological development is currently being adjusted and tested on other cities (in particular Marseilles and Châteauroux, France) and further discussed with urban planners at national scale. Efforts are necessary to build a wider and more precise knowledge on urban soils by gathering and sharing existing data. This implies building reference knowledge and by defining the most useful properties to acquire in a systematic way to characterize soils so as to optimise urban planning and development.

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