

Defining and Mapping soil based ecosystem services at different scales: a flexible methodological approach at multiple governance levels

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PARTNERS

- **POLICY - DECISION MAKERS**
- **Municipality of Forlì (Coordinator)**
- Municipality of Carpi
- Municipality of San Lazzaro di Savena
- Emilia Romagna Region
- **SERVICES PROVIDERS**
- Forlì Mobilità Integrata s.r.l.
- UNIONE REGIONALE COSTRUTTORI EDILI EMILIA-ROMAGNA
- **SCIENTIFIC PARTNER**
- Institute of Biometeorology – National Council of Research
- **PUBLIC ENGAGEMENT (ENVIRONMENTAL NGO)**
- Legambiente Emilia Romagna

Start date: 01/07/2016

Duration: 3 years

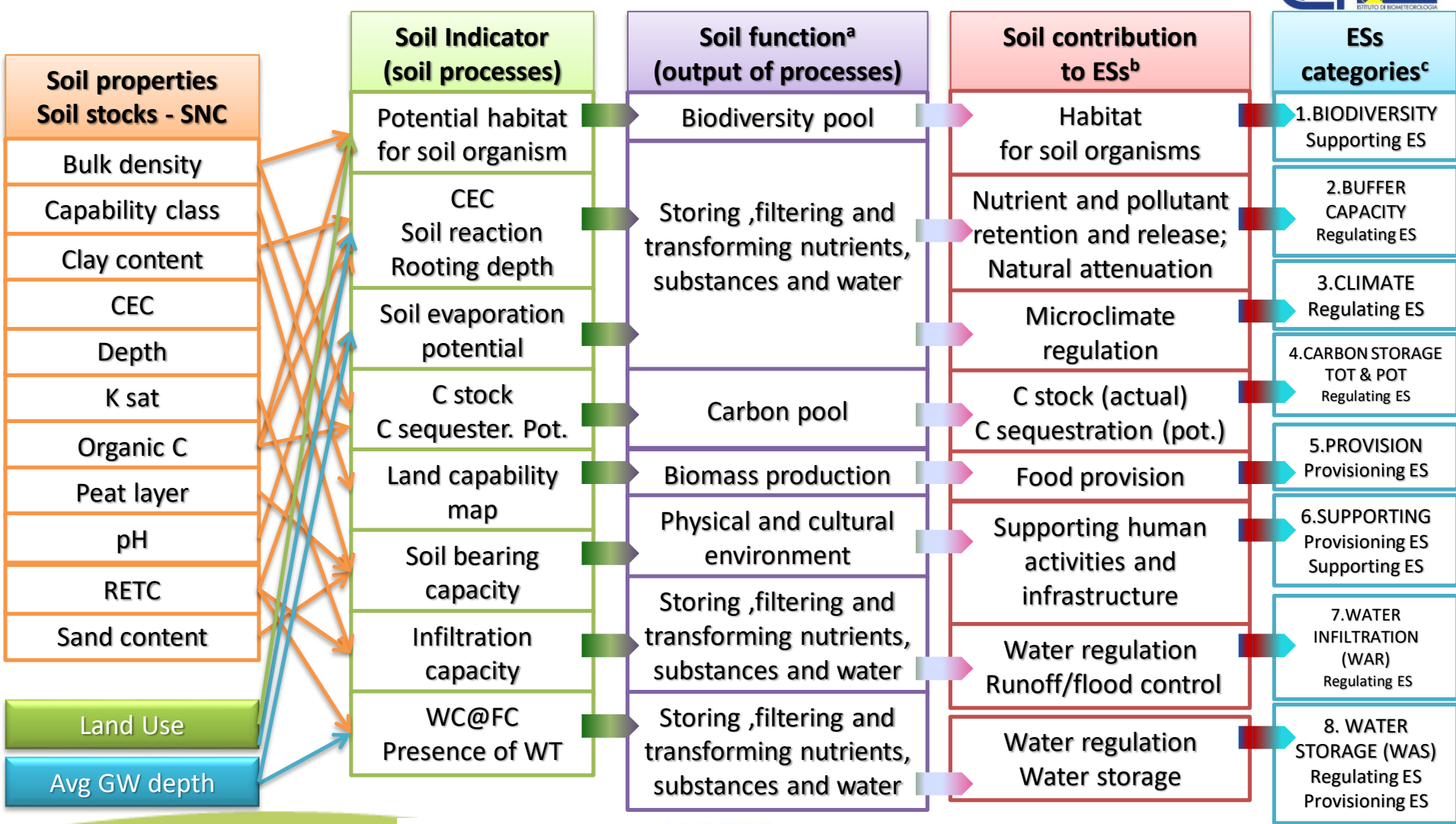
Save our Soil for Life – SOS4LIFE

- Evaluate **ecosystems services** provided by **urban and peri-urban soils in Emilia Romagna region (Italy)** and quantify costs and impacts caused by land take and soil sealing
- Define a feasible regulation framework and operational tools to achieve, at the municipal level, the target of **no net land take** and promote **urban regeneration**
- Promote and practice **de-sealing interventions in three towns** as a way to compensate newly urbanized areas and improve the urban resilience
- Develop a **Urban and Soil Decision Support System** for policy makers (municipalities and regions) for monitoring land use change, soil-sealed areas, urban regeneration processes, soil ecosystem services
- Raising **awareness** on the need **to save our soils** among decision makers, technicians, citizens.

Introduction

- Soil is still an **ignored component** in policy level decisions (Hewit et al., 2015) despite the centrality of its role in ESs supply
- There is a need for soil ESs assessment and for promoting **soil-ecosystem linkage** in the development of policy and management of land resources (Bouma et al., 2015; Mc Bratney et al, 2014; Lal, 2013; Robinson et al., 2012)
- Ecosystem services (ESs) research is currently focusing more and more on soils but few studies have focused on the **linkages between soil properties and ES provision** and the use of **soil data** is often minimal (Adhikari & Hartemink, 2016)
- In the spatial context, pedometrics research can efficiently support **ESs assessment and mapping** in order to elucidate the **spatial dimension of ESs supply, and the interrelationships among ESs**

ESs: underpinning soil functions, indicators and data



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A methodological framework to assess the multiple contributions of soils to ecosystem services delivery at regional scale

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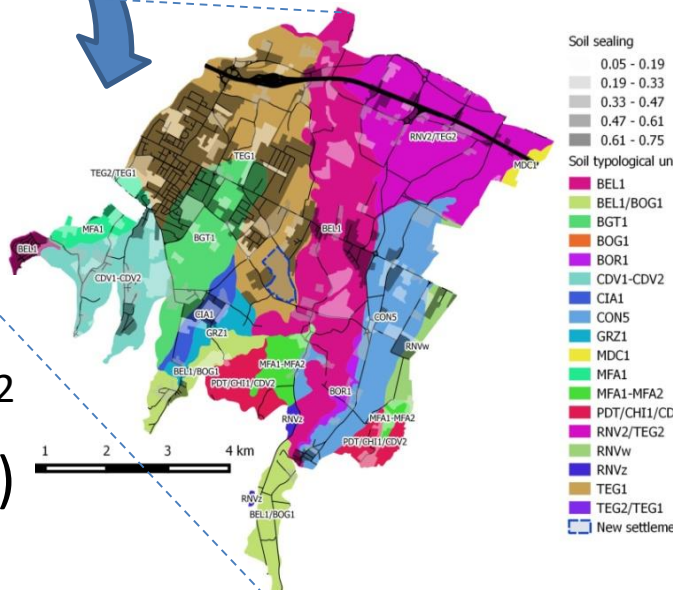
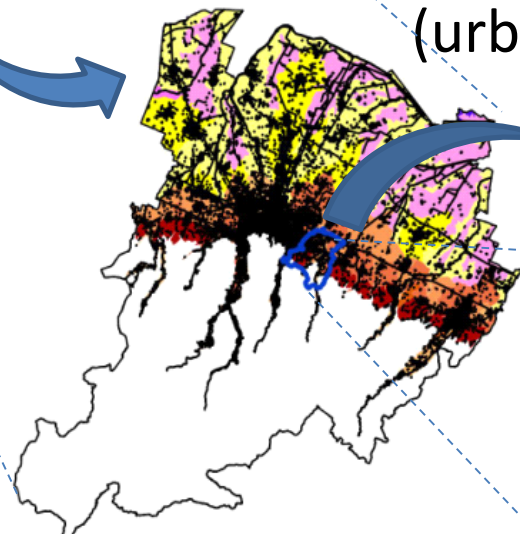
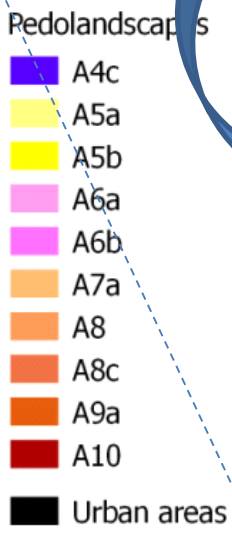
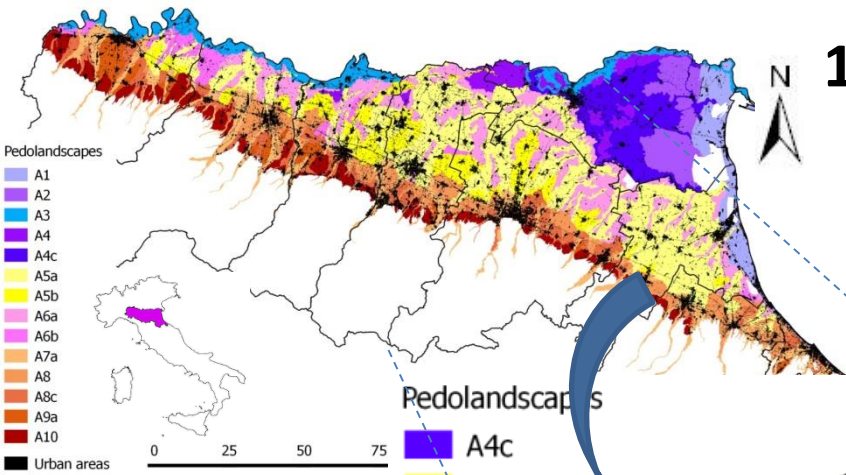


Study areas: 3 nested levels

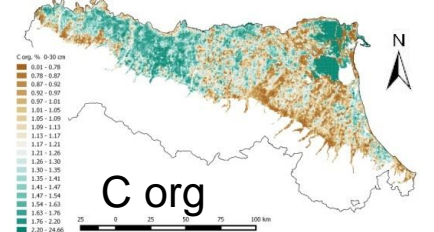
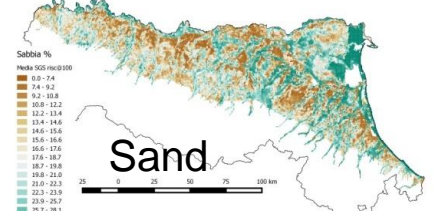
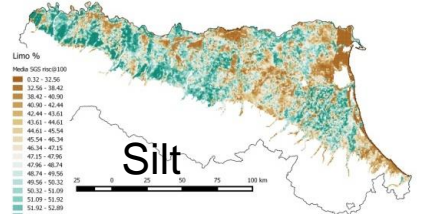
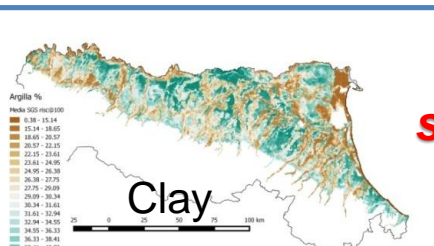
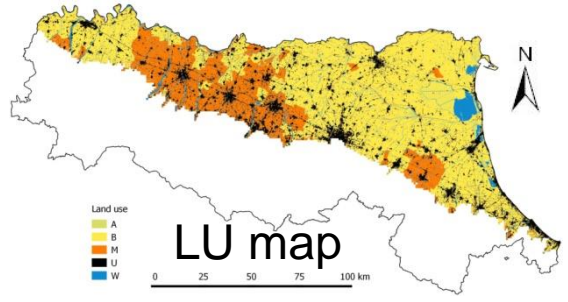
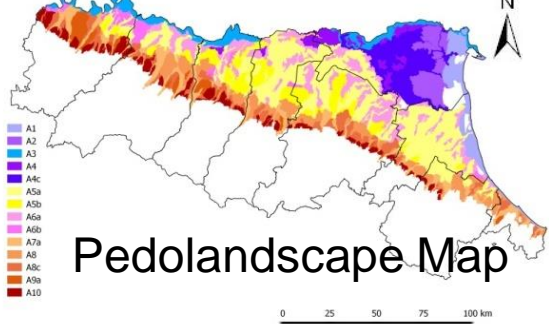
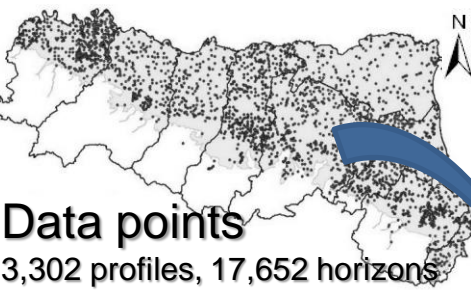
1. Region: Emilia Romagna plain 12.002 km² (urban area 1.764 km², 14.7%)

2. Province: Bologna 1.966 km² (urban area 397 km², 20%)

3. Municipality: San Lazzaro di Savena 34 km² (urban area 8.2 km², 24.3%)

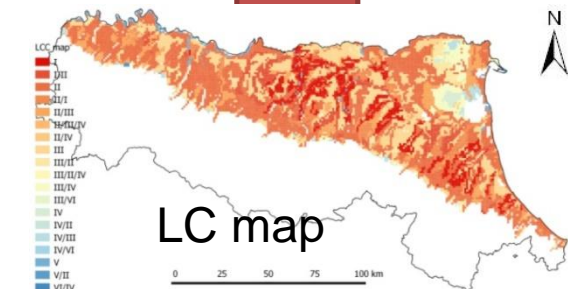
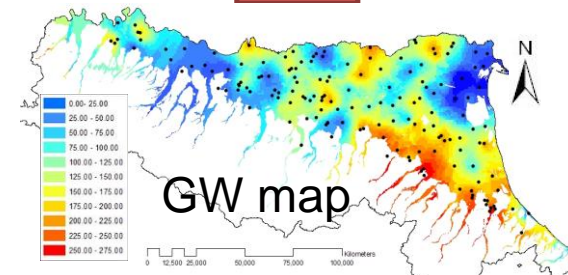
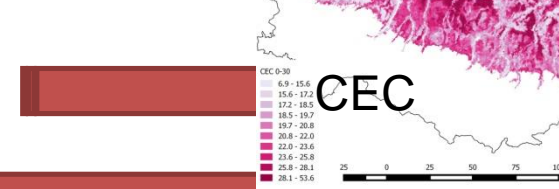
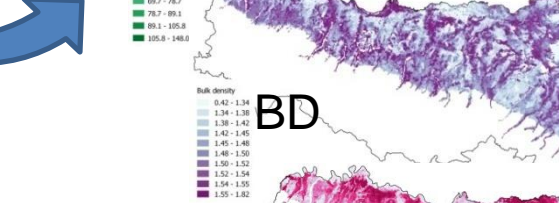
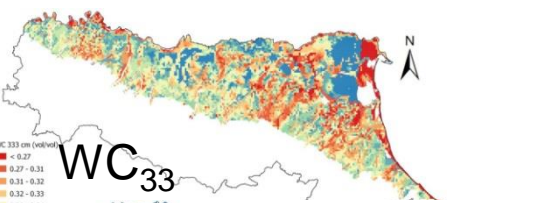


DIGITAL SOIL MAPPING approach



1. SGS scorpan K

2. local PTFs



3. Normalized indexes [0,1] for each soil function /ES

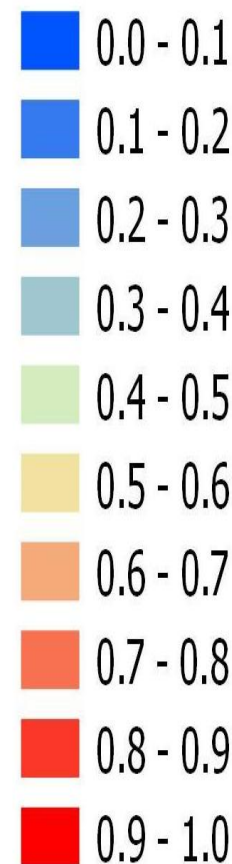
NORMALIZED INDEXES FOR EACH SOIL FUNCTION

Existing data and maps → definition of indicators →
 Calculation → normalization (0-1) of each indicator's
 value → mapping of indicators which are at the basis of
 the following functions

Soil Functions

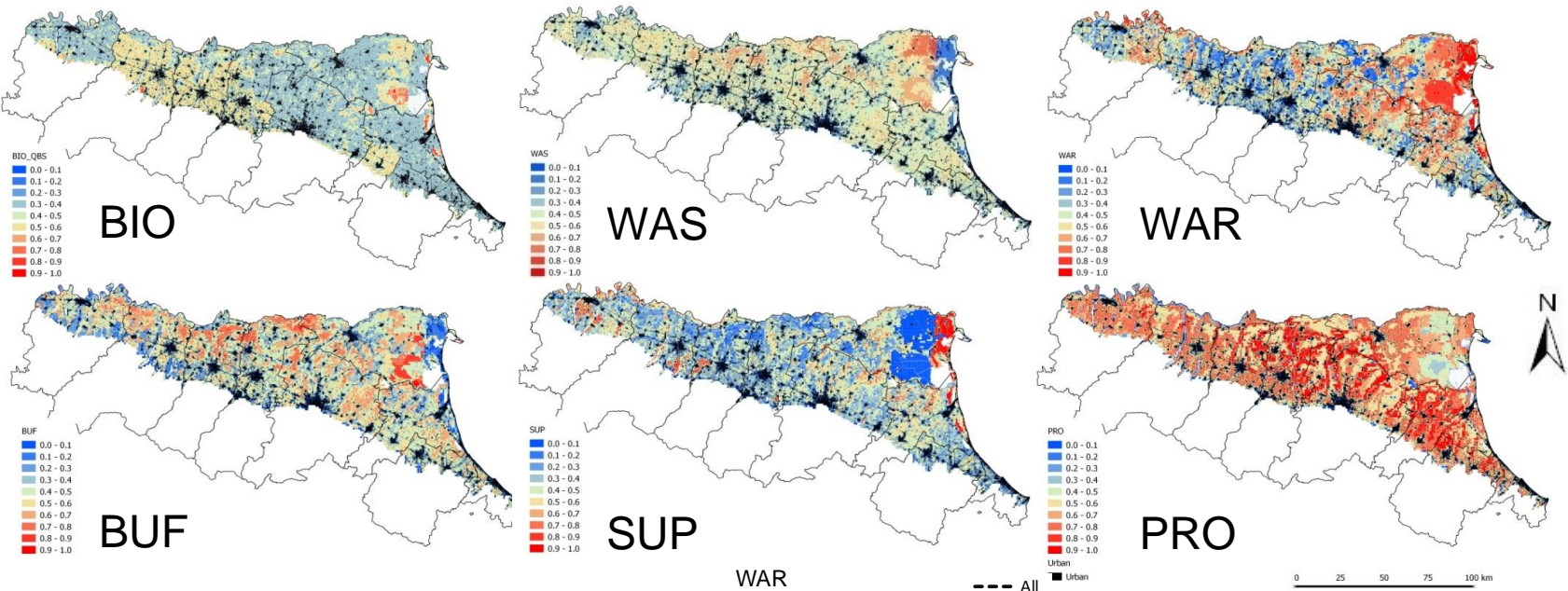
- Provision
 - Biomass production (PRO)*
- Regulation
 - Soil buffer capacity (BUF),*
 - Microclimate regulation (CLI)*
 - Water storage (WAS),*
 - Water infiltration (WAR),*
 - Carbon sink actual and potential (CST, CSP)*
- Support
 - Support to infrastructures (SUP)*
 - Support to biodiversity (BIO)*

For each indicator

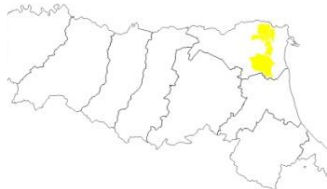


value 0 indicates
 the relative
 minimum.

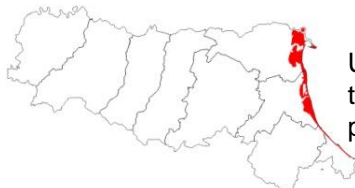
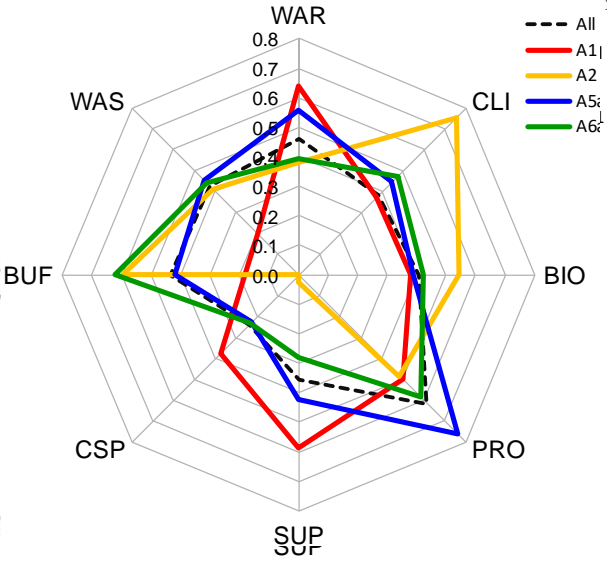
Mapping the indicators , at the base of the soil functions to ES at regional scale



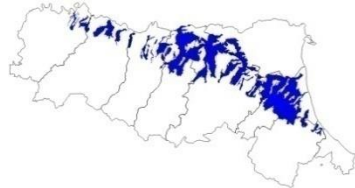
Unit A2 - Fine textured soils, with organic layers and peat of recently reclaimed area of Po river delta plain



Unit A6a - Fine textured soils of the depressions of the Apennines recent alluvial plain

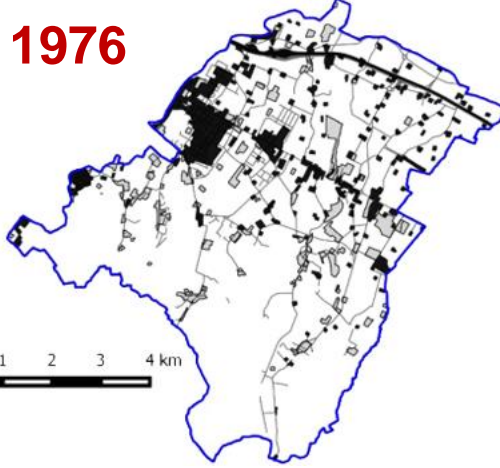


Unit A1 - Coarse textured soils of coastal plain

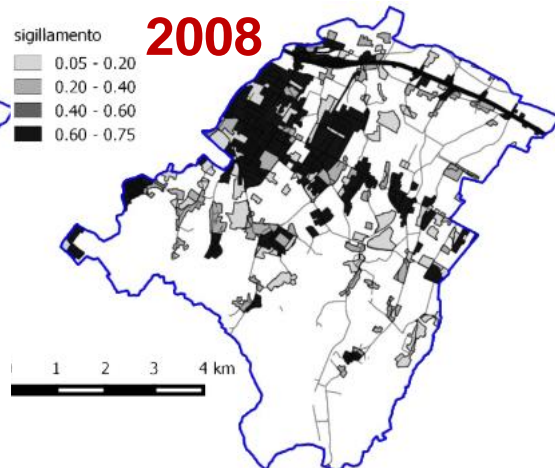


Unit A5a - Loamy textured soils of the levee areas of the Apennines recent alluvial plain

1976

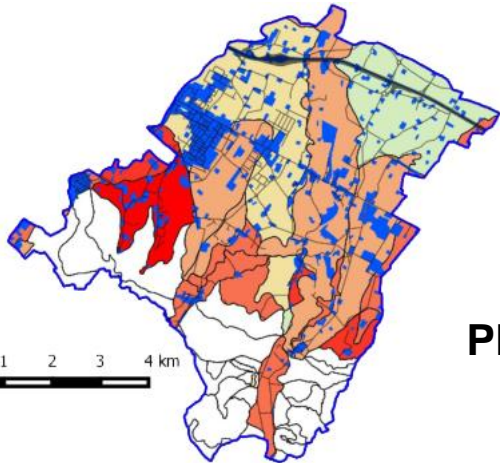


2008



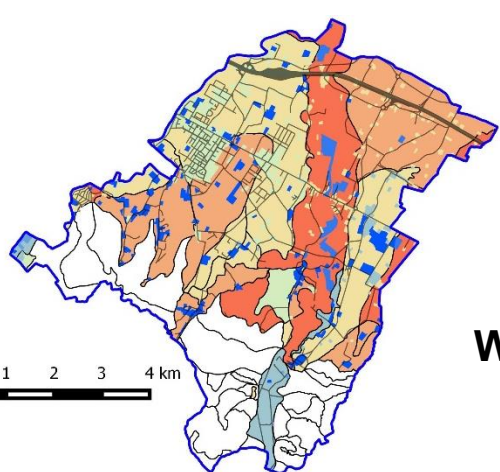
sigillamento
 0.05 - 0.20
 0.20 - 0.40
 0.40 - 0.60
 0.60 - 0.75

Municipality of S. Lazzaro di Savena (plain area): 1976-2008



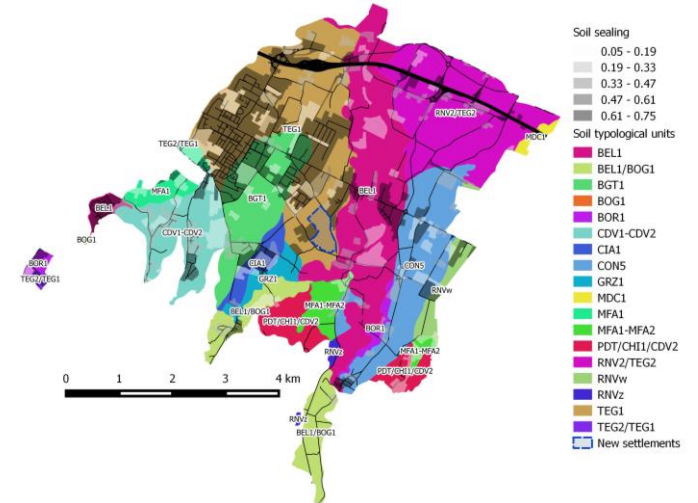
PRO

PRO
 0.0 - 0.1
 0.1 - 0.2
 0.2 - 0.3
 0.3 - 0.4
 0.4 - 0.5
 0.5 - 0.6
 0.6 - 0.7
 0.7 - 0.8
 0.8 - 0.9
 0.9 - 1.0



WAR

WAR
 0.0 - 0.1
 0.1 - 0.2
 0.2 - 0.3
 0.3 - 0.4
 0.4 - 0.5
 0.5 - 0.6
 0.6 - 0.7
 0.7 - 0.8
 0.8 - 0.9
 0.9 - 1.0



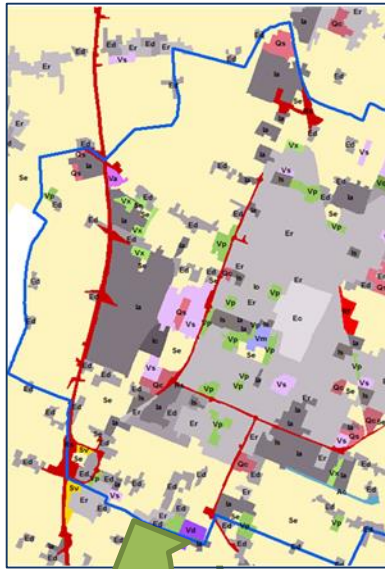
Soil sealing
 0.05 - 0.19
 0.19 - 0.33
 0.33 - 0.47
 0.47 - 0.61
 0.61 - 0.75

Soil typological units
 BEL1
 BEL1/BOG1
 BGT1
 BOG1
 BOR1
 CDV1-CDV2
 CIA1
 CONS
 GRZ1
 MDC1
 MFA1
 MFA1-MFA2
 PDT/CHI1/CDV2
 RNV2/TEG2
 RNVw
 RNVz
 TEG1
 TEG2/TEG1
 New settlements

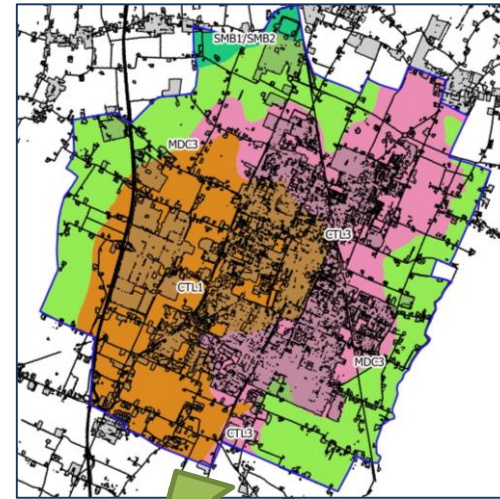
	1976	2008	
seal	5.2%	10.9%	110.8%
PRO	0.62	0.58	-6.9%
WAR	0.60	0.56	-6.1%

Identifying urban soil units to assess soil ESs at municipal level

2. Land use

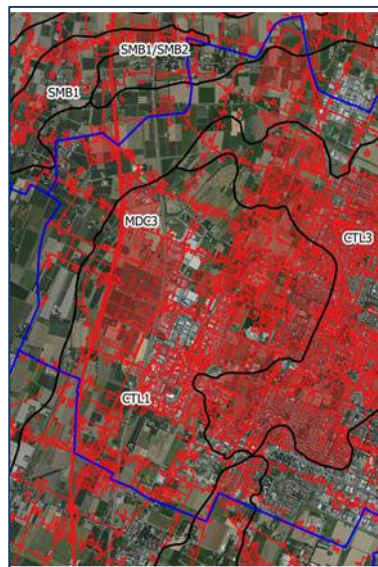


4. Soil mapping units



6. Urban soils survey

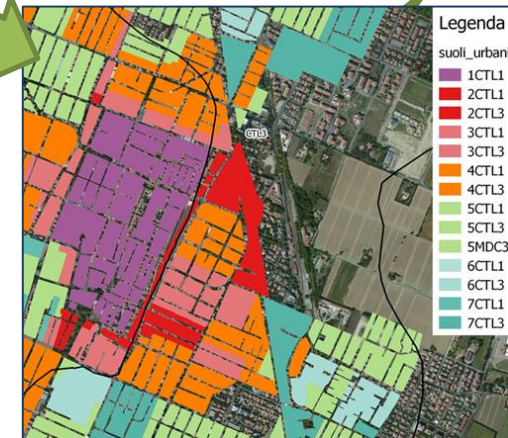
1. Urban areas



3. Urban tipology



5. Urban soil units



DEFINING/MAPPING ECOSYSTEM SERVICE

- i. Which system did you use to define the ecosystem services you are working on?
 - i. We referred to the MEA framework
- ii. What category of ecosystem services does your project deal with?
 - ii. Provisioning, Regulating, Supporting
- iii. How have you assessed the ecosystem services-methods and tools ?
 - iii. We developed a indicator based method to estimate soil functions underpinning Ess; indicators are based on available soil data and ad hoc soil survey
- iv. Tell us your success stories – are they replicable and transferable?
 - iv. The method has been applied at different scales, from regional to municipal scale, in different areas of Emilia Romagna plain, approach is transferable if data are available
- v. Tell us about the main problems encountered
 - v. Major challenge: validation, we assessed potential supply not actual demand, Including soil diversity and services in planning instruments



Thanks for your attention!