



TOWARD THE “NO NET LAND TAKE” URBAN PLANNING BASED ON SOIL ECOSYSTEM SERVICES



29.11.2018 - Mantova, Politecnico – WORLD FORUM ON URBAN FORESTS

«Urban tools (regulations and procedures) to limit, mitigate and compensate the land take and promote urban regeneration»

Stefano Bazzocchi (Municipality of Forlì), C. Calzolari - F. Ungaro (CNR) et al.

“LAND TAKE” and “SOIL SEALING”

LAND TAKE

SWITCHING FROM AGRICULTURAL AND NATURAL COVERAGE TO URBAN COVERAGE

First Report (2009) of the National Observatory on Land consumption, Politecnico Milano referring to the definition of the EEA (European Environment Agency) 2006 and the JRC (Joint Research Center of the IES-Institute for Environment and Sustainability)

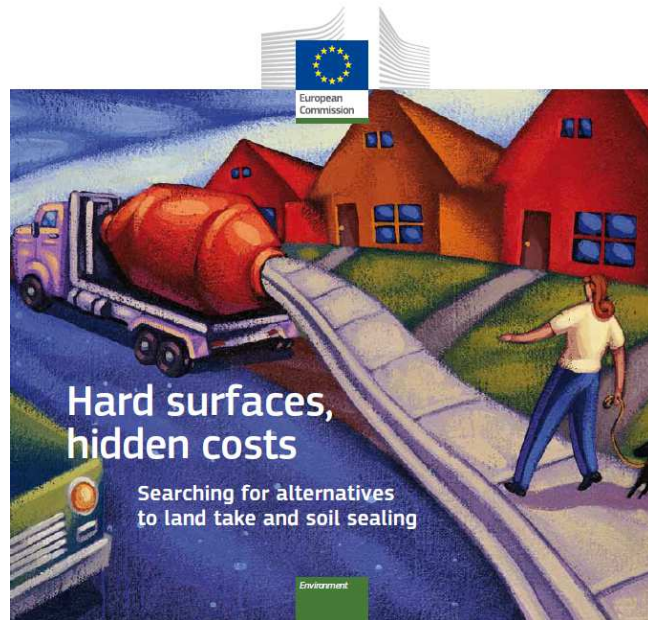
CHANGE FROM A NON-ARTIFICIAL COVERAGE (UNUSED LAND) TO AN ARTIFICIAL COVERAGE OF THE GROUND (SOIL CONSUMED) ISPRA (Italian Institute for Environmental Protection and Research) Report 2014

SOIL SEALING (impervious coverage)

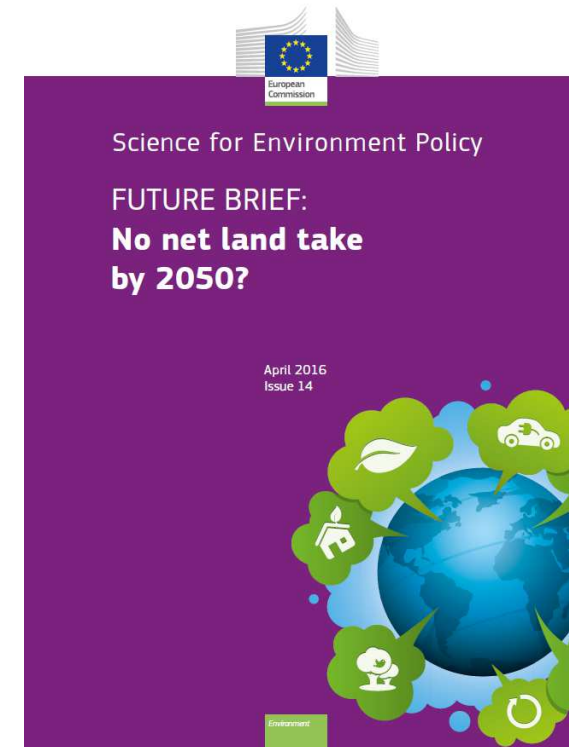
PERMANENT LAND COVER WITH ARTIFICIAL MATERIALS FOR CONSTRUCTION – ISPRA 2014

Magritte “La poitrine” - Musée Magritte (Bruxelles)

WHAT DOES EUROPE DO ?



Guidelines on best practice to limit,
mitigate or compensate
soil sealing



2006 Soil Thematic Strategy (COM(2006) 231)

**2011 Roadmap to a Resource-efficient Europe (“no net land take” by 2050)
(COM(2011) 571)**

2012 Guidelines on best practice to limit, mitigate or compensate soil sealing

2014 Seventh Environment Action Programme

SOS4LIFE
SAVE OUR SOIL FOR LIFE



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ITALY

Government Bill "Containment of land take and reuse of the built up land" approved by the Chamber on May 12, 2016 and currently stopped in the Senate introduces among the fundamental principles

Re-use - Urban regeneration

Limitation of land take and soil sealing

NOT APPROVED

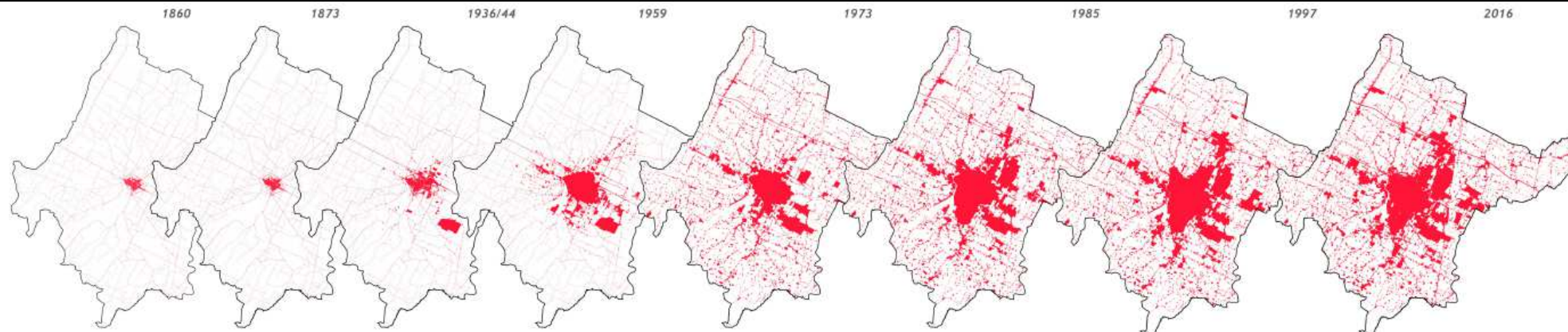
EMILIA-ROMAGNA - L.R. 21.12.2017 n. 24



promotes the URBAN REGENERATION and the redevelopment of the existing building heritage

- introduces the principle of NO NET LAND TAKE
- limits LAND TAKE to 3% of Urbanized Territory for each Municipality until 2050 (for new settlements outside the Urbanized Territory)

FORLI' – LAND TAKE EVOLUTION 1860-2016



*% di territorio consumato sul totale della
Superficie territoriale comunale*

1860
2,14%
448 ha

1860	1873	1944	1959	1973	1985	1997	2016
488 Ha	491 Ha	890 Ha	1975 Ha	3372 Ha	4482 Ha	4982 Ha	5536 Ha
2.14 %	2.15 %	3.90 %	8.65 %	14.77 %	19.63 %	21.82 %	24.24 %

LAND TAKE

2016
24,24%
5.536 ha
over
22.835 ha

*andamento demografico della popolazione
residente e consumo di suolo procapite*

1861
37.477 inh.

1861	1871	1936	1961	1973	1985	1997	2016
37.477 ab. 130 mq/ab	38.639 ab. 127 mq/ab	65.683 ab. 135 mq/ab	91.945 ab. 215 mq/ab	107.739 ab. 313mq/ab	110.730 ab. 405 mq/ab	107.461 ab. 464 mq/ab	118.295 ab. 468 mq/ab

POPULATION

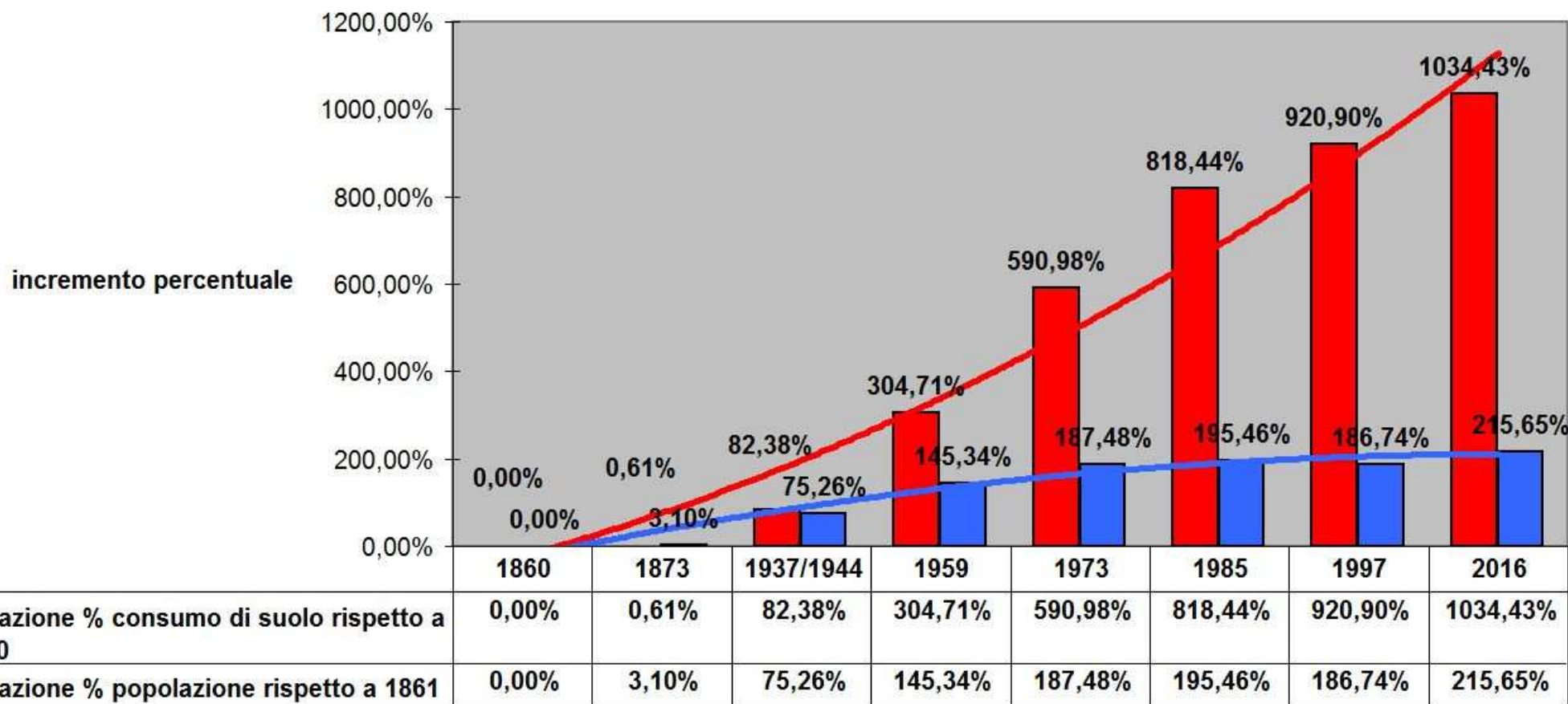
2016
118.295 inh.

FORLI' – LAND TAKE vs POPULATION

LAND TAKE

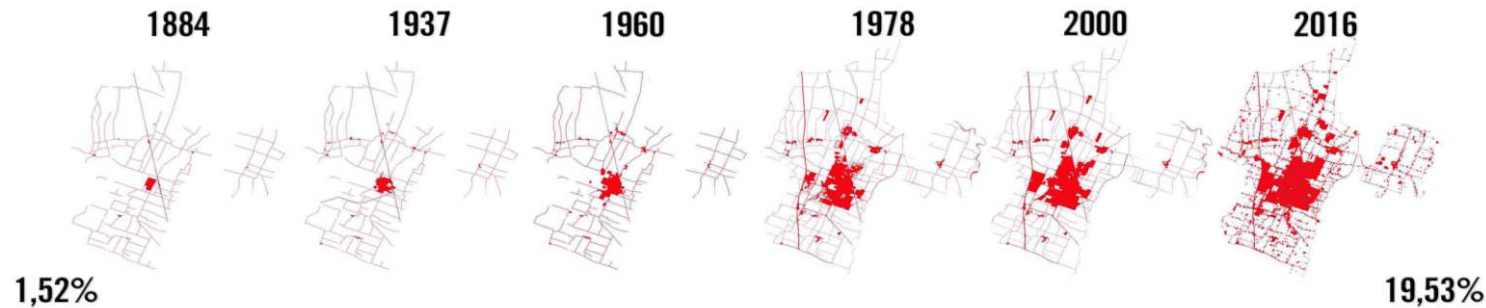
POPULATION

FORLI' - Confronto variazione % consumo di suolo-popolazione 1860-2016

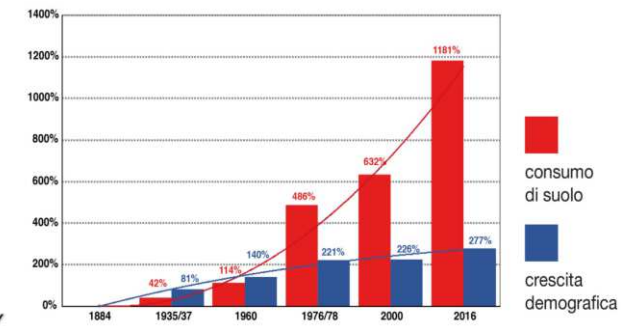


CARPI – S.LAZZARO DI SAVENA–Historical land take evolution

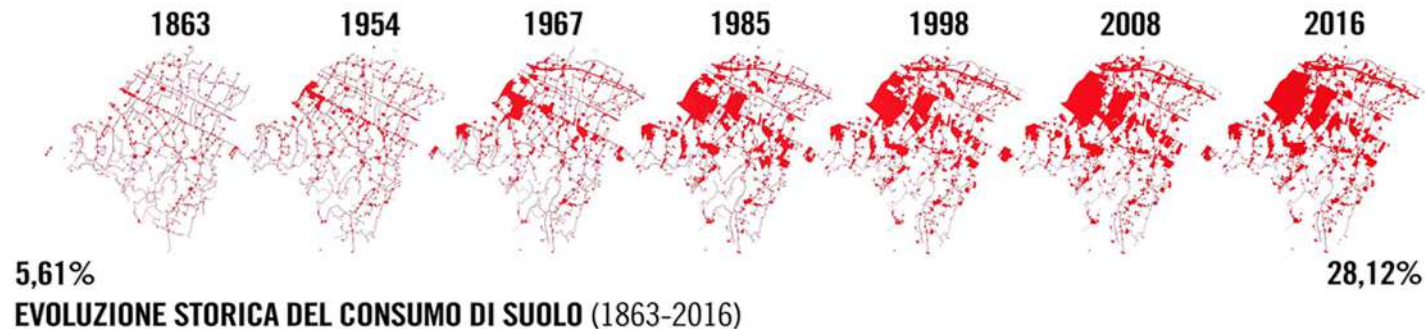
CARPI



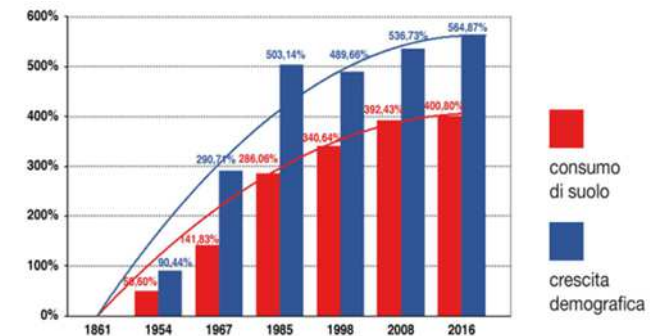
EVOLUZIONE STORICA DEL CONSUMO DI SUOLO (1884-2016)



SAN LAZZARO DI SAVENA



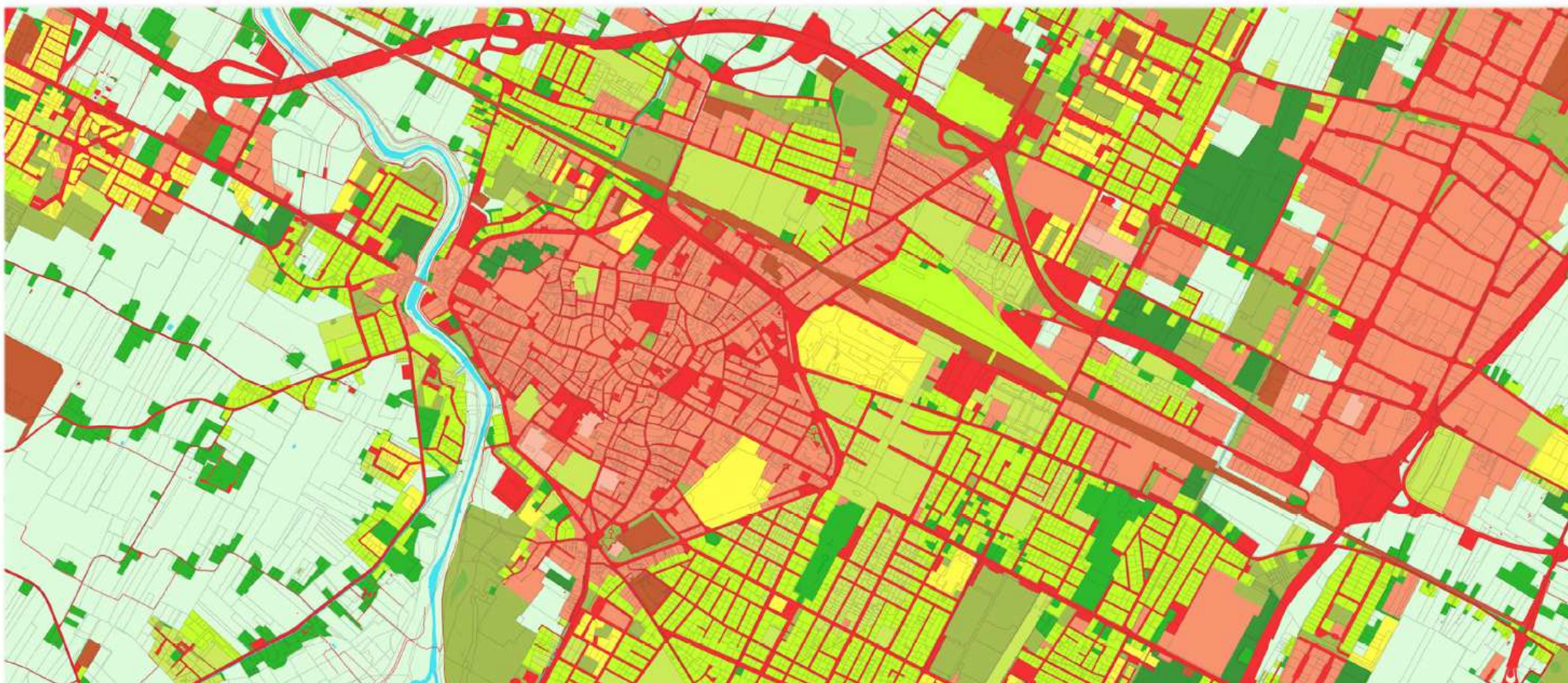
EVOLUZIONE STORICA DEL CONSUMO DI SUOLO (1863-2016)





LAND TAKE MAP
(from agricultural and natural areas to urbanized areas)

FORLI' – SOIL SEALING LEVEL - 2016

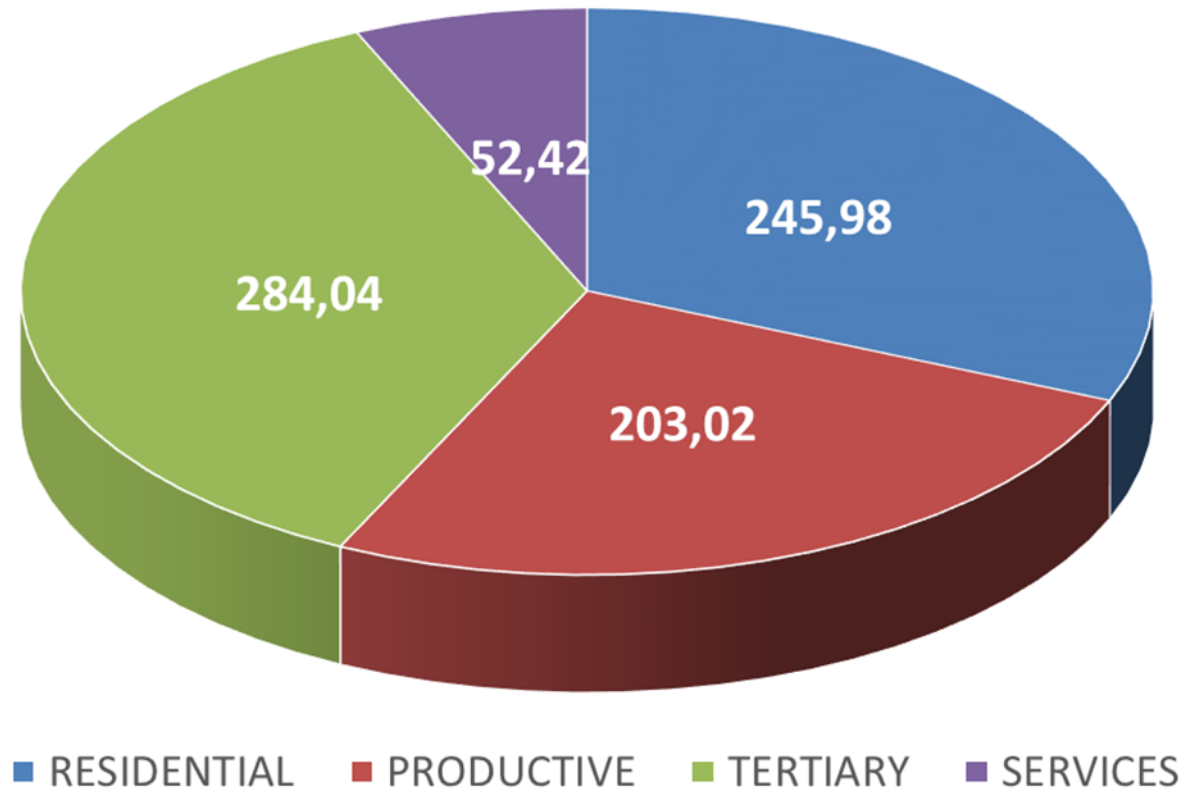


SOIL SEALING MAP

0 -10 %  90 -100 %

FORLI' – RESIDUAL PLANNED BUILDING AREAS AT 31.12.2016

RESIDUAL PLANNED BUILDING AREAS (ha)



**Residual building
potential
1.564.067 mq.**

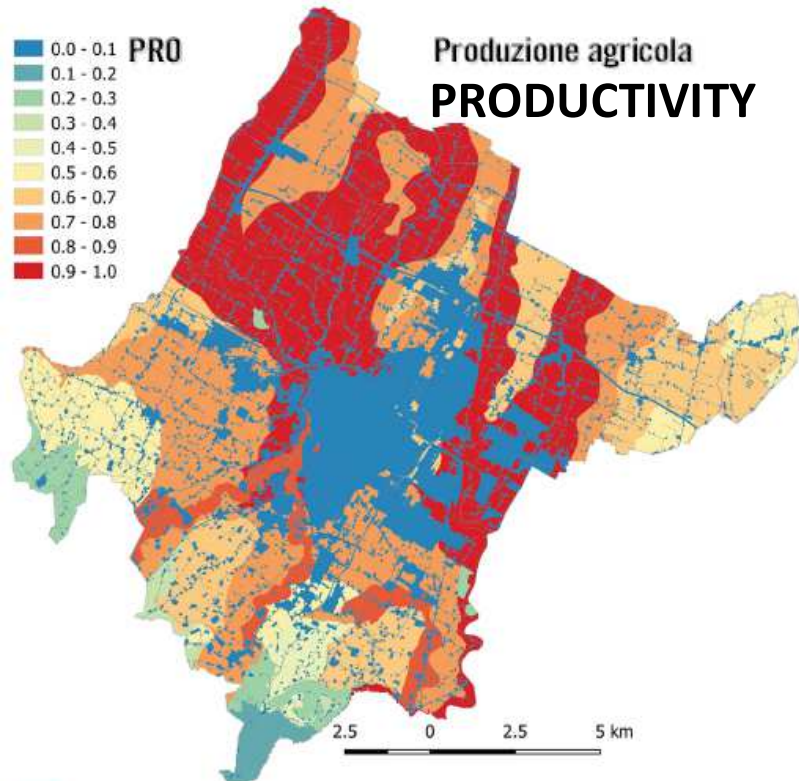


**on a territorial
surface of
785,46 hectares**

**INCLUDES BUILDING EXPANSION AREAS (LAND TAKE)
AND URBAN REGENERATION AREAS**

FORLI' – ECOSYSTEMS SERVICES MAP (CNR Ibimet)

MAPPA DEI SERVIZI ECOSISTEMICI

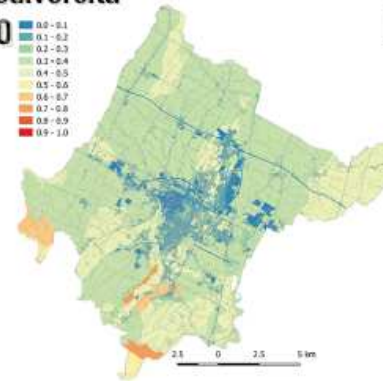


0.9 - 1.0 Livello più alto del Servizio
HIGHER LEVEL

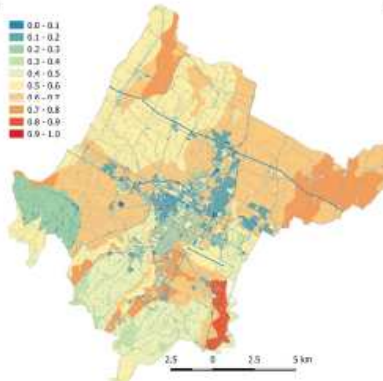
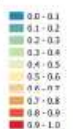
BIODIVERSITY

Biodiversità

BIO



CST



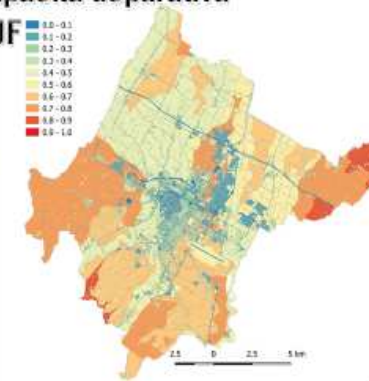
Stoccaggio di carbonio

SOIL CARBON STOCK

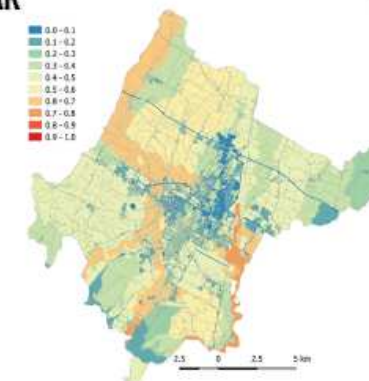
BUFFERING

Capacità depurativa

BUF



WAR



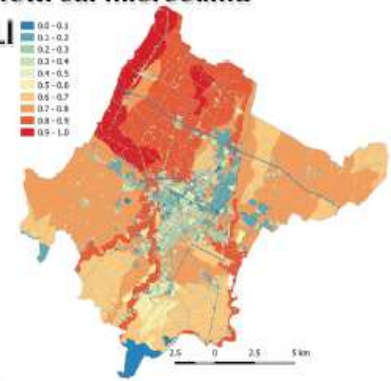
Infiltrazione acqua

WATER REGULATION

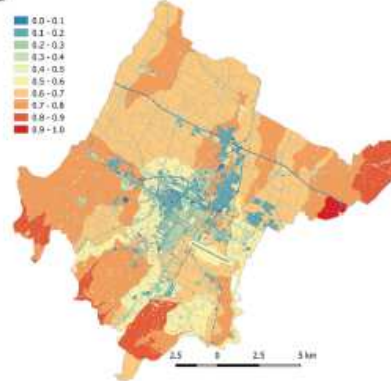
MICROCLIMATE

Effetti sul microclima

CLI



WAS



Riserva di acqua

WATER STORAGE

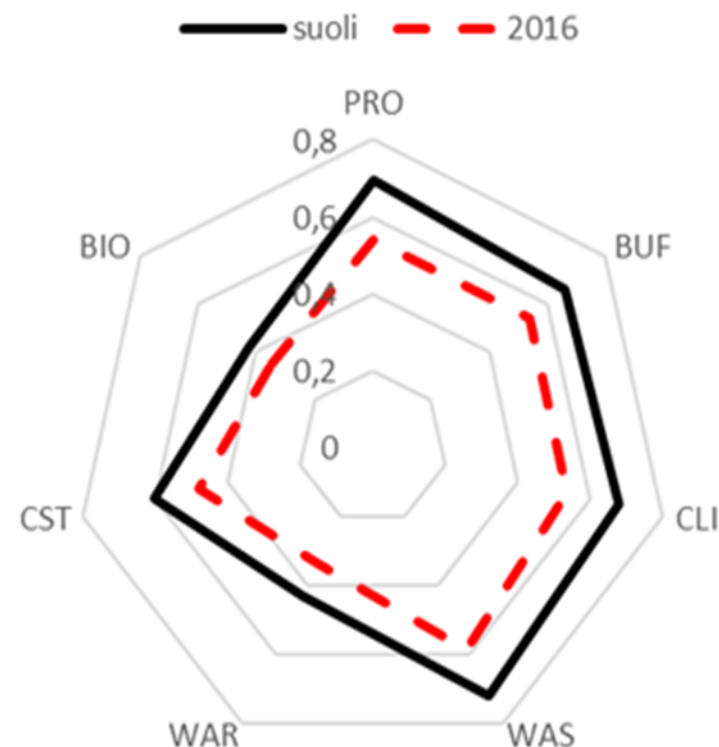
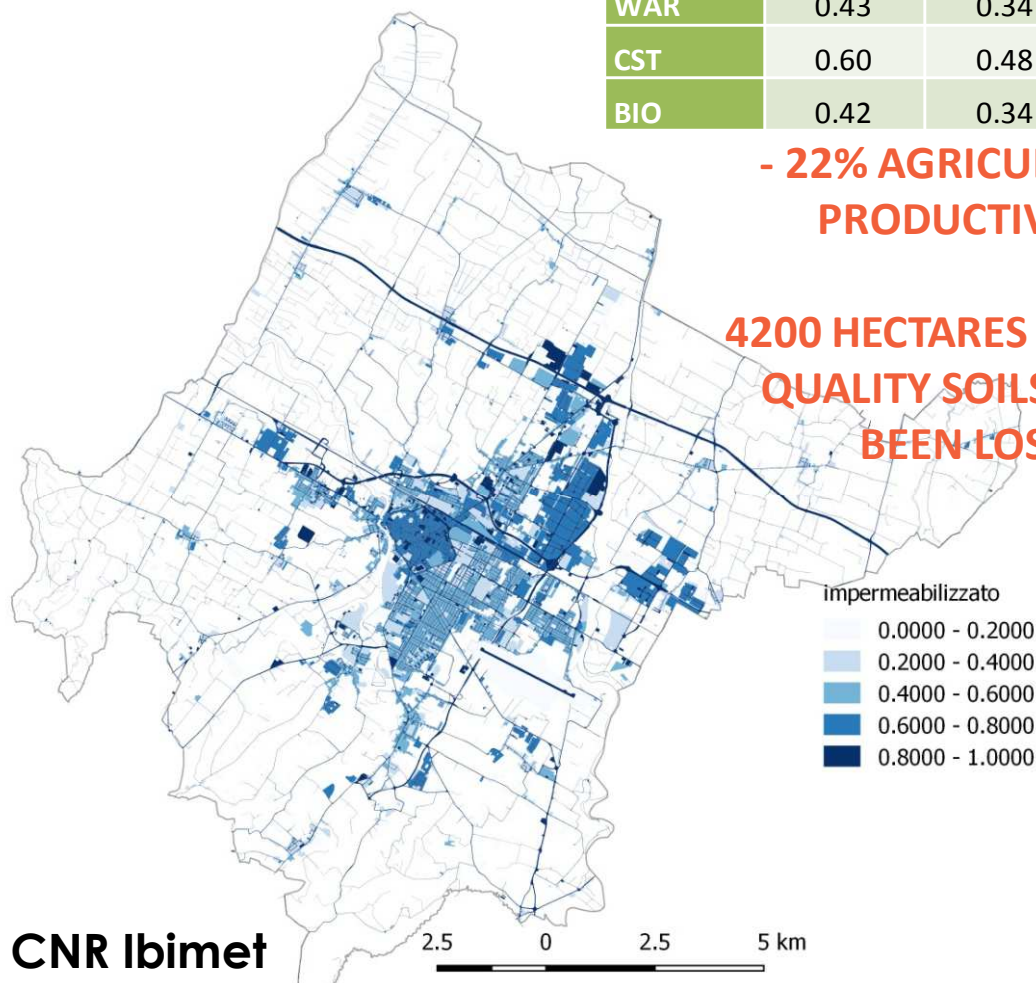
FORLI' – LAND TAKE IMPACT (CNR Ibimet)

IMPACT % ON ECOSYSTEM SERVICES OF SOIL SEALED

ES	SOIL	SEALED	
PRO	0.70	0.54	-22%
BUF	0.66	0.54	-19%
CLI	0.68	0.54	-21%
WAS	0.72	0.58	-19%
WAR	0.43	0.34	-22%
CST	0.60	0.48	-20%
BIO	0.42	0.34	-18%

**- 22% AGRICULTURAL
PRODUCTIVITY**

**4200 HECTARES OF HIGH
QUALITY SOILS HAVE
BEEN LOST**



SE	Suoli	Imperm.		ISPRA	
PRO	0.70	0.54	-22%	0.64	-8%
BUF	0.66	0.60	-9%	0.61	-7%
CLI	0.68	0.61	-10%	0.61	-9%
WAS	0.72	0.66	-9%	0.66	-8%
WAR	0.43	0.38	-10%	0.39	-10%
CST	0.60	0.54	-10%	0.55	-8%
BIO	0.42	0.39	-9%	0.39	-7%

CNR Ibimet



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TOWARDS “NO NET LAND TAKE”: TO LIMIT LAND TAKE

- **REACH THE “NO NET LAND TAKE” GOAL IS NOT EASY**
- WHEN AN AGRICULTURAL OR NATURAL SOIL IS URBANIZED LOSES SOME OR ALL (IF SEALED) ECOSYSTEM SERVICES
- ANY COMPENSATION WILL BE ONLY PARTIAL
- SOME ECOSYSTEMS SERVICES WILL NOT BE RESTORED
- SOME WILL BE RESTORED WITH A WORST QUALITY
- **THE BEST SOLUTION IS ALWAYS NOT CONSUMING SOIL**
- THE BEST STRATEGY TO COUNTERACT LAND TAKE IS PROMOTING URBAN REGENERATION

YOU MUST:

- MAP AREAS TO REGENERATE (BROWNFIELDS BUT NOT ONLY)
- PRIORITY ADDRESS NEW INTERVENTIONS IN THESE AREAS
- INCENTIVE THE URBAN REGENERATION
- LIMIT URBANIZATIONS OF NEW SOILS

TO MITIGATE LAND TAKE

- IT IS IMPORTANT TO MITIGATE THE EFFECTS OF THE URBANIZATION
- WE NEED TO PLAN **STANDARDS** THAT ALLOW US TO MAINTAIN THE HIGHEST POSSIBLE LEVEL OF **PERMEABLE SURFACES** (ALSO IN URBAN REGENERATION INTERVENTIONS)
- THE **DEGREE OF PERMEABILITY** SHOULD BE VERIFIED BOTH IN THE PROJECT AND IMPLEMENTATION PHASE



TO MITIGATE: MORE GREEN

- THE REALIZATION OF GREEN SURFACES OF VARIOUS TYPES (public and private green areas, green walls, green roofs etc.) ALLOWS TO MAINTAIN / ENSURE SOME ECOSYSTEM SERVICES (eg. water infiltration, effects on the microclimate, carbon storage) VERY IMPORTANT IN THE URBAN ENVIRONMENT **TO INCREASE URBAN RESILIENCE TO CLIMATE CHANGE** (to counteract the effects of intense meteoric events, of urban heat island, pollution)



TO MITIGATE: TO REDUCE THE IMPACT OF LAND TAKE

CONTAINING AND ASSESSING THE PERCENTAGE OF SEALED SURFACES BOTH IN NEW URBANIZATIONS AND IN URBAN REGENERATION INTERVENTIONS BY USING AN INDEX LIKE B.A.F. - Biotope Area Factor (Berlin 1994) THAT INSPIRED the Green Space Factor (Malmo 2001), the Seattle Green Factor (2006) or the RIE, Building Impact Reduction (Bolzano 2007)

Abbeygate Vizion – Milton Keynes (UK)



Reichenbergertrasse Berlin – Sarah Riviere arch. – photo Jan Bitter



BIOTOPE AREA FACTOR - BERLIN

Surface type		Weighting factor
Sealed surface Impermeable to air and water and has no plant growth (concrete, asphalt, slabs with a solid subbase)		0.0
Partially sealed surfaces Permeable to water and air, but no plant growth (mosaic paving, slabs with a sand/ gravel subbase)		0.3
Semi-open surfaces Permeable to water and air, some plant growth (gravel with grass coverage, wood-block paving, honeycomb brick with grass)		0.5
Surfaces with vegetation unconnected to soil below On cellar covers or underground garages with less than 80 cm of soil covering		0.5
Surfaces with vegetation unconnected to soil below No connection to soil below but with more than 80 cm of soil covering		0.7
Surfaces with vegetation connected to soil below Vegetation connected to soil below, available for development of flora and fauna		1.0
Rainwater infiltration per m² of roof area Rainwater infiltration for replenishment of groundwater; infiltration over surfaces with existing vegetation		0.2
Vertical greenery up to 10m in height Greenery covering walls and outer walls with no windows; the actual height, up to 10 m, is taken into account		0.5
Green roofs Extensive and intensive coverage of rooftop with greenery		0.7

https://www.berlin.de/senuvk/umwelt/landschaftsplanung/bff/index_en.shtml

TO COMPENSATE LAND TAKE

- THE MAIN GOAL IS TO **REDUCE LAND TAKE**
- “NO NET LAND TAKE” DOES NOT EXCLUDE TO CONSUME NEW SOIL IN A RESIDUAL WAY, BUT **YOU HAVE TO FORWARD A COMPENSATION**
- MITIGATION WITH MORE GREEN SURFACES REDUCES COMPENSATION
- THE COMPENSATION CONSISTS PRINCIPALLY IN **INTERVENTIONS OF DESEALING** (DESIGILLATION) WITH RESTORATION TO GREEN OR AGRICULTURAL USE OF AN AREA THAT NOW IS SEALED (NOT PERMEABLE)
- BALANCING BETWEEN NEW "TRANSFORMED" SOILS AND SOIL "RESTORED TO GREEN" **NEEDS AREAS AVAILABLE FOR DE-SEALING INTERVENTIONS**



HOW MUCH LOSS OF SOIL MUST BE COMPENSATED ?



4,5 ha - agricultural

4,5 ha – land take

2,13 ha – sealed soil

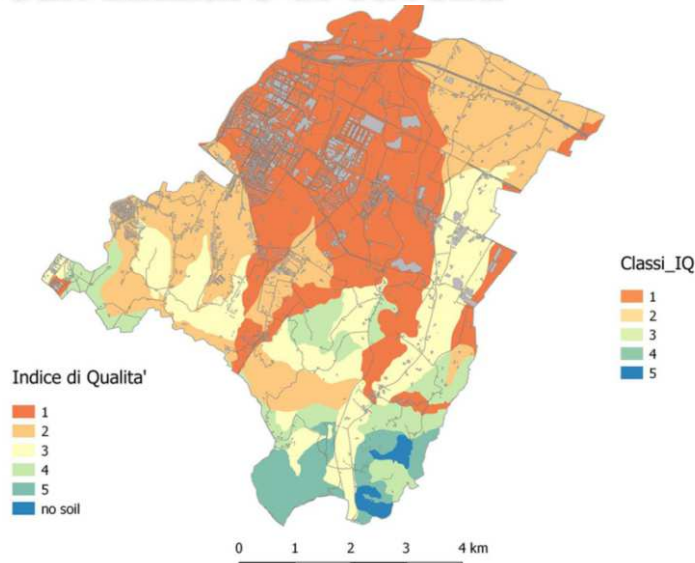
- ANY INTERVENTION THAT PROVIDES LAND TAKE MUST BE COMPENSATED WITH A DE-SEALING INTERVENTION IN ANOTHER AREA.
- IT WILL NOT BE EASY TO FIND SUFFICIENT AREAS FOR A COMPENSATION, EVEN ONLY, QUANTITATIVE.

NOT ONLY QUANTITY

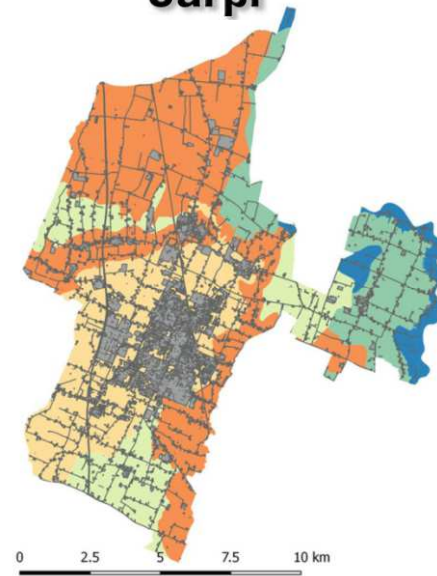
- THE URBANIZATION OF NEW SOILS (RESIDUAL) SHOULD BE COMPENSATED.
- TO DO THIS, IT IS IMPORTANT TO PREPARE ALSO A **MAP OF THE QUALITY OF SOILS**
- THE MAP CLASSIFIES THE SOILS IN ACCORDANCE WITH THE QUALITY / QUANTITY OF ECOSYSTEM SERVICES THAT ARE PROVIDED
- AT THE SAME TIME THE MAP PROVIDES INDICATION OF THE **BEST SOILS TO BE PRESERVED BY THE TRANSFORMATION**
- THE SOIL QUALITY MAP ALLOWS TO **ADDRESS THE CHOICES OF TRANSFORMATION TO LESS VALUABLE AND MORE COMPROMISE SOILS**
- THE SOIL QUALITY MAP IS NECESSARY **TO ENSURE A COMPENSATION LEVEL MORE CORRECT** OF THE IMPACT RESULTING FROM THE TRANSFORMATION OF A SOIL.

ECOSYSTEM SERVICES – QUALITATIVE COMPONENT

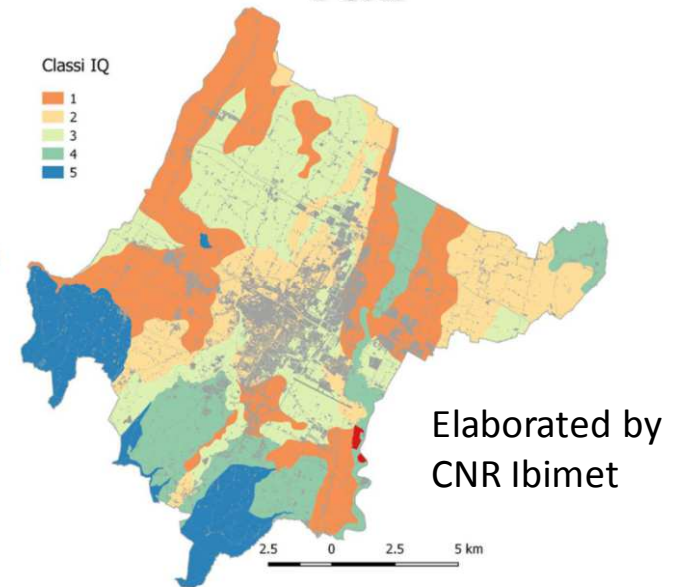
San Lazzaro di Savena



Carpi

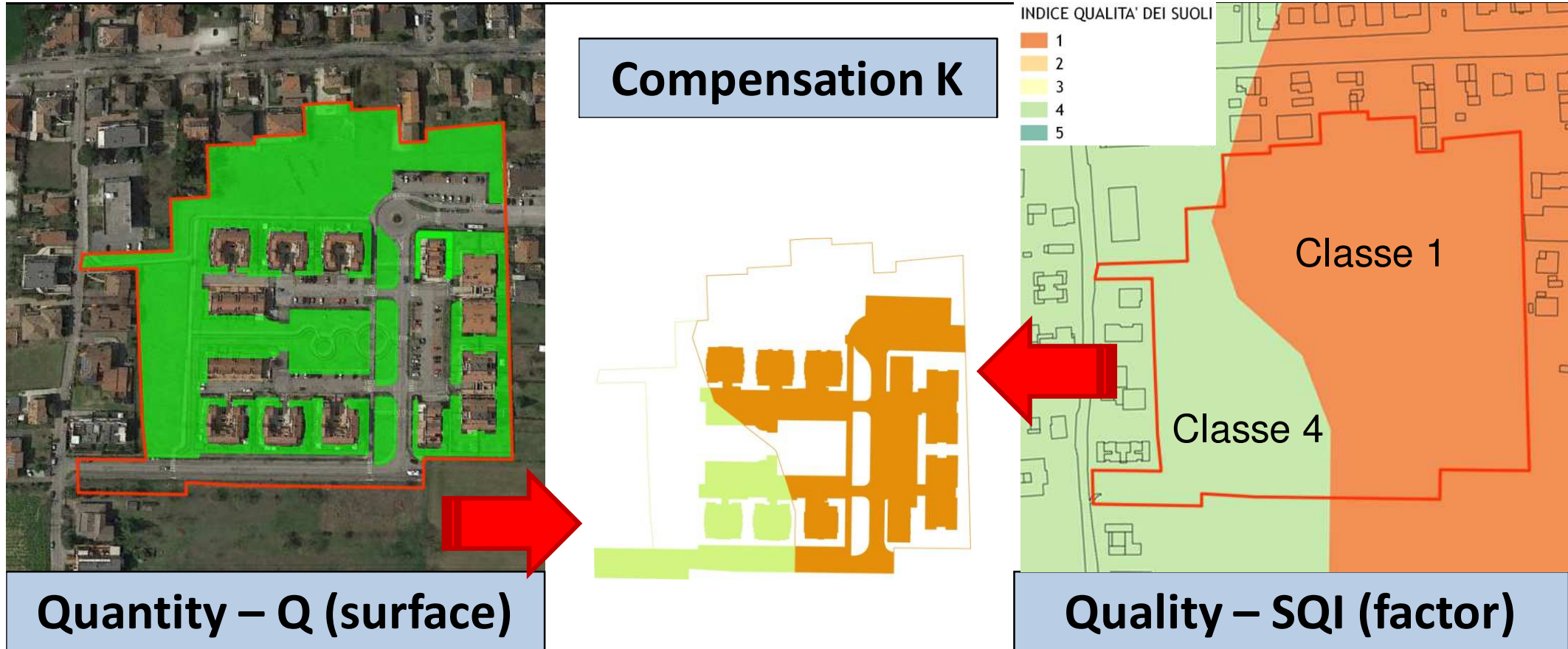


Forlì



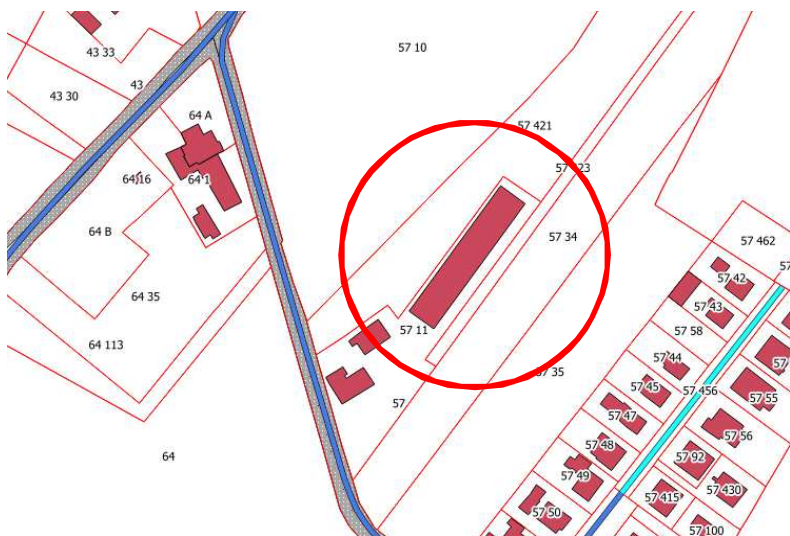
- IT IS NECESSARY, THEREFORE, THAT THE COMPENSATION TAKES ACCOUNT OF A QUALITATIVE COMPONENT
- THE SOIL THAT IS TRANSFORMED IS NOT ALWAYS THE SAME
- THE QUALITY OF SOIL IN EACH PART OF THE MUNICIPAL TERRITORY IS INDICATED BY THE SOIL QUALITY MAP

COMPENSATION = QUANTITY x QUALITY



THE QUANTIFICATION OF THE COMPENSATION WILL BE DETERMINED BY:
 $(Qa \times SQI1) + (Qb \times SQI2) = K$ (surface to be compensated by desealing)
SQI FACTOR INCREASES AS THE CLASS OF SOIL GROWS
(1 is the best class)

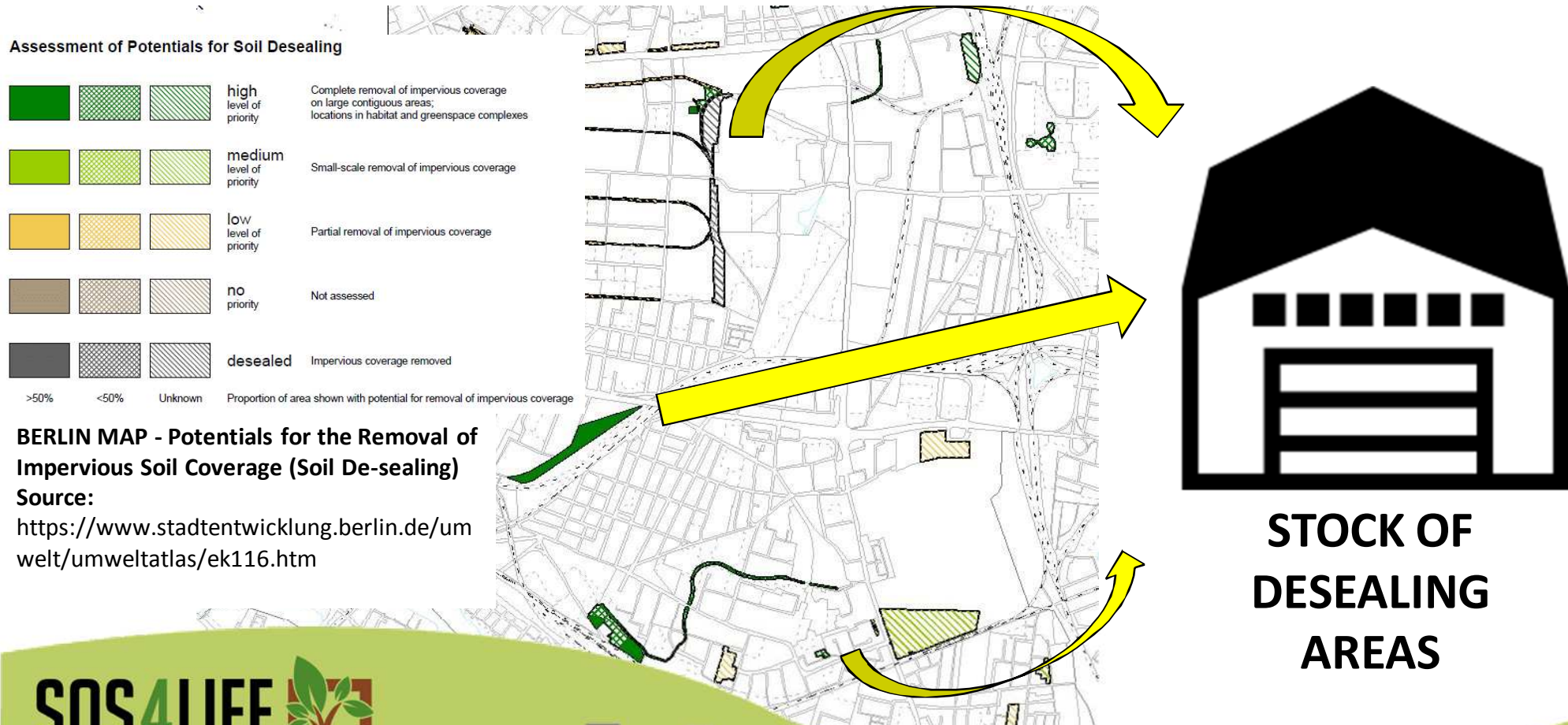
WICH AREAS TO DE-SEAL ?



POTENTIAL DESEALING AREAS MAP

LOCATING AND MAPPING AREAS OF POTENTIAL DESEALING

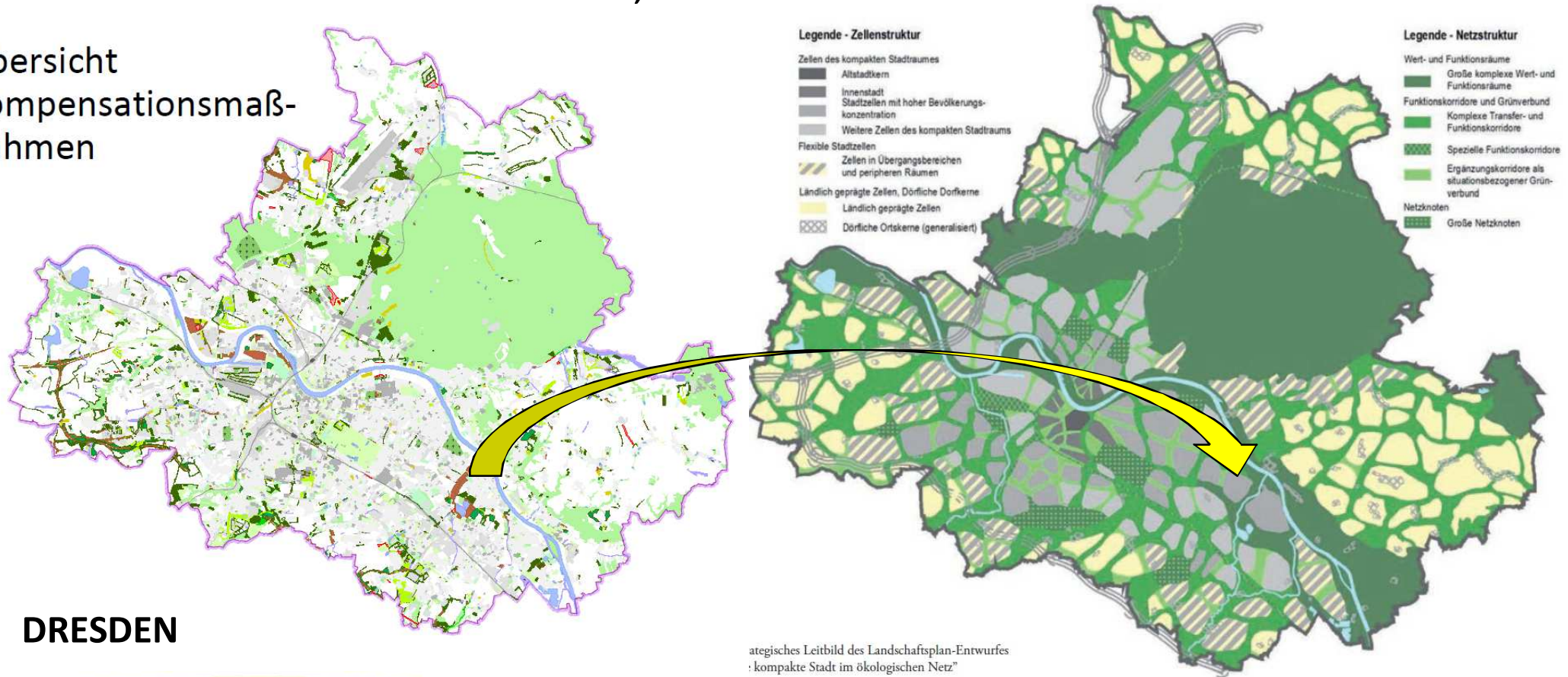
It is necessary to establish and maintain a stock of areas to be desealed and restored to green or agricultural use to compensate for the consumption of new soil



A MUNICIPAL STRATEGY

- THE MUNICIPAL ADMINISTRATION ADDRESSES THE COMPENSATORY INTERVENTIONS TO GIVE IMPLEMENTATION TO ITS ECOLOGICAL-ENVIRONMENTAL STRATEGY, DEFINING THE PRIORITIES

Übersicht
Kompensationsmaß-
nahmen



DESEALING – costs and operating methods

Edificio
Area di sedime = 62,5 m x 12,2 m = 762,5 mq
Superficie coperta = 62,5 m x (6,2 x 2) m = 775 mq
Area scavo di base = 790 mq
Altezza H media (stimata) = 2,5 m
Volume (stimato) = 762,5 mq x 2,5 m = 1.906 mc
Area
Superficie scoperta impermeabilizzata (esclusa superficie coperta edificio) =
Totale superficie impermeabilizzata (Superficie coperta edificio + impermeabilizzata) = totale area da ripristinare = 775 mq + 25 mq = 800 mq
Stima costi di demolizione edificio/i (valutare anche eventuali costi di amianto)
Costo rimozione di copertura di amianto-cemento = 775 mq x 19,55 €/mq = 15.151 €
Costo demoliz./smaltim. = 1.906 mc x 10 €/mc = 19.060 € [parte fuori terra e
Costo demolizione cordoli c.a. = 0,3 x 0,4 x 150 m x 200 €/mq = 3.600 €
Costo smaltimento cordoli c.a. = 0,3 x 0,4 x 150 m x 45 €/mq = 810 €
Costo totale demolizione edificio = 15.151 € + 19.060 € + 3.600 € + 810 € = 38.621 €
Stima costi di de-sealing superfici impermeabilizzate
Scavo/asportaz. vespaio-stabilizzato (smaltimento compreso) = 790 mq x 0,2 r
Stima costi di ripristino ad uso agricolo
Costo di ripristino = 800 mq x 0,35 m x 10 €/mc = 2.800 €
Costo medio al mq. per ripristino area
Stima costi demolizione + Stima costi de-sealing + Stima costi di ripristino
Totale superficie impermeabilizzata (edificio + area scoperta) = (38.621 € + mq = 42.559 € / 800 mq = 53,20 €/mq)
Note:
*** ripristino terreno agricolo ***

SCHEDA n. 2

Comune: FORLÌ

Località **Cà Petrucci, via Castelfalco**

Tipo di zona urbanistica: Zona agricola

Tipo di edificio/area: Edificio agricolo dismesso

Foto aerea



Fonte: Google Maps

Foto 1



- <https://www.berlin.de/senuvk/umwelt/bodenschutz/de/vorsorge/download/arbeitshilfe1-kostenansaetze.pdf>

Nutzung/Bestand	Planung/Entwicklungsziele	Umfang der Kostenabschätzung
Brachfläche, ehem. Fahrbereitschaft MFS	vollständiger Rückbau, Erweiterung Landwirtschaft /	Rückbau Fahrbahnen, Schuppen, Garagen und Aufenthaltsgebäude

Berlin.de Senatsverwaltung für Stadtentwicklung und Umwelt
Altlastensanierung



gen Verkehrsflächen der ehem. ehem. Polizeistandortes. Einschließl i. Garagen und Aufenthalts-/



BERLIN

Legende Flächen (digitalisiert)

Typ 9 - mehrgeschossige Gebäude - 325 m²

Typ 10 - Sonderbauten - 0 m² (nicht vorh.)

Art der Flächen	Typ 1 - 2	Typ 3 - 4	Typ 5 - 6	Typ 7 - 8
typische Anlagen in %	100% - 100%	100% - 100%	100% - 100%	100% - 100%

- TO ESTIMATE COSTS FOR VARIOUS TYPES OF DESEALING
- DEFINING OPERATING METHODS FOR DESEALING INTERVENTIONS

HOW TO COMPENSATE ?

EVERY ACTUATOR OF A TRANSFORMATION INTERVENTION THAT CAUSE LAND TAKE MUST COMPENSATE

**HOW
?**

1) STOCK OF AREAS AVAILABLE

a) DESEALING DONE
DIRECTLY BY ACTUATOR
following operative
indications of the
Municipality

a) MONETIZATION AND
IMPLEMENTATION BY
THE MUNICIPALITY

2) STOCK OF AREAS SOLD OUT OR INSUFFICIENT

- a) COMPENSATION (total or partial) BY
USING SURFACE CREDITS registered
for other desealing and green
recovery interventions
- b) MONETIZATION and
implementation by the Municipality
when the desealing area is available
(the amount is linked to the
realization of the compensatory
intervention)

FORLÌ–De-sealing intervention in G. da Montefeltro Square

FORLÌ Stato Attuale (Google Earth)

BEFORE



Progetto - Rendering

AFTER



AFTER



LIFE15 ENV/IT/000225

CARPI e S. LAZZARO DI SAVENA – De-sealing interventions

CARPI Stato Attuale (Google Earth)

BEFORE



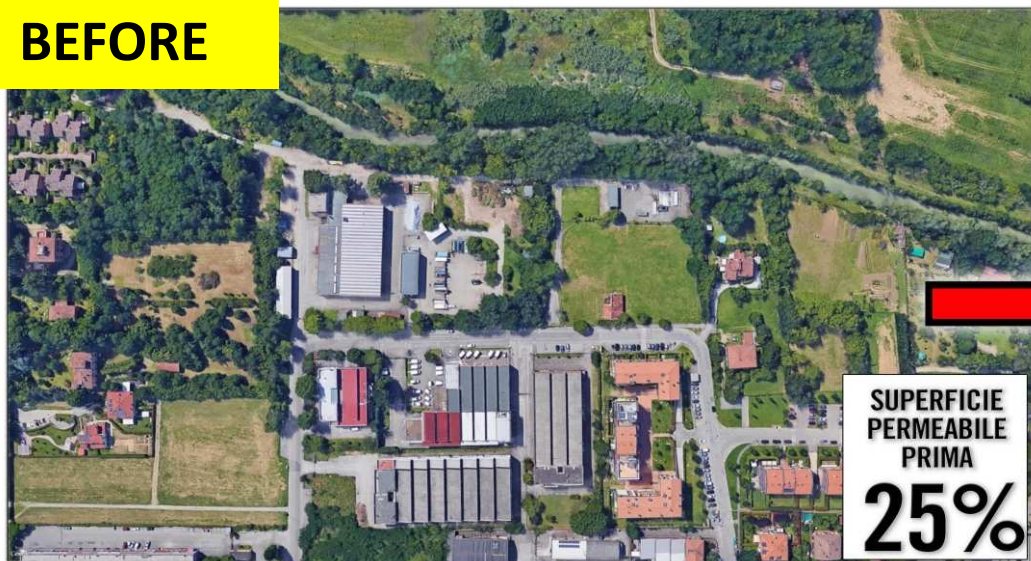
Progetto - Fotoinserimento

AFTER



SAN LAZZARO DI SAVENA Stato Attuale (Google Earth)

BEFORE



Progetto - Fotoinserimento

AFTER



DEMONSTRATIVE PLOTS IN THE INTERVENTION AREAS



Bioclimatic and pedological monitoring to evaluate the effects of green restoration



TOP SOIL REUSE

Soil is precious and must be safeguarded as a substantially not renewable resource.

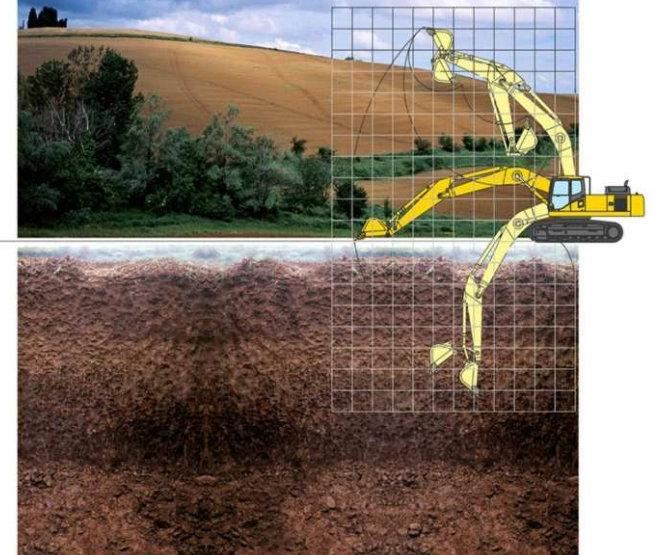
The topsoil, corresponding to the most superficial horizon of the soil, rich in organic substance and microorganisms, can be reused favoring the formation of a new soil and it **MUST NOT BE WASTED**.

As part of the project, guidelines were drawn up to support desealing interventions with subsequent green restoration.

The aim of the Guidelines, with a view to circular economy, is to encourage the reuse of topsoil.



Linee guida per la rimozione,
gestione e riapplicazione del top soil
AZIONE B.2.4



This project has received funding from the European Union's programme "LIFE Environment and Resource Efficiency" under Grant Agreement n. LIFE15 ENV/IT/000225



LIFE15 ENV/IT/000225



Thank you for your attention