



Rapporto finale Final report

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### LIFE Project Number LIFE15 ENV/IT/000225

### Final Report Covering the project activities from 01/07/2016<sup>1</sup> to 30/09/2020

Reporting Date<sup>2</sup> 31/12/2020

# LIFE PROJECT NAME or Acronym **SOS4LIFE**

	Data Project				
Project location:	location: Italy - Emilia-Romagna (Region)				
	Municipality of Forlì (FC), Municipality of Carpi (MO) Municipality of San Lazzaro di Savena (BO)				
Project start date:	01/07/2016				
Project end date:	31/10/2019 Extension date: 30/09/2020				
Total budget:	€ 1.788.749,00				
<b>EU contribution:</b> € 1.060.551,00					
(%) of eligible costs:	59,29%				
	Data Beneficiary				
Name Beneficiary:         Municipality of Forlì (FC)					
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<sup>&</sup>lt;sup>1</sup> Project start date

<sup>&</sup>lt;sup>2</sup> Include the reporting date as foreseen in part C2 of Annex II of the Grant Agreement

SOS4LIFE - LIFE15 ENV/IT/000225 Final Report





# This table comprises an essential part of the report and should be filled in before submission

Please note that the evaluation of your report may only commence if the package complies with all the elements in this receivability check. The evaluation will be stopped if any obligatory elements are missing.

Package completeness and correctness check	
Obligatory elements	√ or N/A
Technical report	
The correct latest template for the type of project (e.g. traditional) has been followed and all sections have been filled in, in English In electronic version only	~
Index of deliverables with short description annexed, in English In electronic version only	~
<u>Mid-term report</u> : Deliverables due in the reporting period (from project start) annexed <u>Final report</u> : Deliverables not already submitted with the MTR annexed including the Layman's report and after-LIFE plan Deliverables in language(s) other than English include a summary in English	✓
In electronic version only	
Financial report	1
I he reporting period in the financial report (consolidated financial statement <b>and</b> financial statement of each Individual Beneficiary) is the same as in the technical report with the exception of any terminated beneficiary for which the end period should be the date of the termination.	*
Consolidated Financial Statement with all 5 forms duly filled in and signed and dated On paper (signed and dated originals*) and in electronic version (pdfs of signed sheets + full Excel file)	1
Financial Statement(s) of the Coordinating Beneficiary, of each Associated Beneficiary and of each affiliate (if involved), with all forms duly filled in (signed and dated). The Financial Statement(s) of Beneficiaries with affiliate(s) include the total cost of each affiliate in 1 line per cost category. <i>In electronic version (pdfs of signed sheets + full Excel files) + in the case of the Final report</i> <i>the overall summary forms of each beneficiary on paper (signed and dated originals*)</i>	~
Amounts, names and other data (e.g. bank account) are correct and consistent with the Grant Agreement / across the different forms (e.g. figures from the individual statements are the same as those reported in the consolidated statement)	1
Mid-term report (for all projects except IPs): the threshold for the second pre- financing payment has been reached	N/A
Beneficiary's certificate for Durable Goods included (if required, i.e. beneficiaries claiming 100% cost for durable goods) On paper (signed and dated originals*) and in electronic version (pdfs of signed sheets)	N/A
Certificate on financial statements (if required, i.e. for beneficiaries with EU contribution ≥750,000 € in the budget) On paper (signed original) and in electronic version (pdf)	N/A
Other checks	
Additional information / clarifications and supporting documents requested in previous EASME letters (unless already submitted or not yet due) <i>In electronic version only</i>	~
This table, page 2 of the Mid-term / Final report, is completed - each tick box is filled in In electronic version only	✓

\*original signature by a legal or statutory representative of the beneficiary / affiliate concerned

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### 2. List of key-words and abbreviations

land take soil sealing de-sealing urban regeneration urban resilience ecosystem services SOS4LIFE | Save Our Soil For Life EASME I Executive Agency for Small and Medium-sized Enterprises ISPRA | Italian National Institute for Environmental Protection and Research **GIS** | Geographic Information System ISTAT | Italian National Institute for Statistics US-DSS | Urban and Soil Decision Support System DBTR | Regional Topographic Database **PSC I Municipal Structural Plan** POC | Municipal Operational Plan RUE | Urban building regulation PRG | General regulatory plan PUA I Urban Development Plan PUG | General urban plan ES - Ecosystem services D.Lgs - Legislative Decree Del. | Deliverable Mil. | Milestone DPR – Decree of the President of the Republic VIA - Environmental Impact Assessment VAS - Strategic Environmental Assessment VALSAT - Environmental and territorial sustainability assessment ARPAE – Emilia-Romagna Regional Agency for Prevention, Environment and Energy TRS – Excavated soil and rocks S.C. - Steering Committee MON.C. - Monitoring Committee

SC.C. – Scientific Committee



## 3. Executive Summary

SOS4LIFE is a demonstration project that aims to contribute to the implementation on a municipal scale of European guidelines on soil protection and urban regeneration. More specifically, the project intends to apply on a municipal scale, the no net land take by 2050 objective, established by the roadmap towards a resource efficient Europe [COM (2011) 571] and reaffirmed by the 7th Environmental Action Program [1386/2013 / EU].

Through the implementation of demonstration actions, the project aims to produce a package of standards, operational and monitoring tools that will be adopted by the three partner municipalities and can be disseminated and replicated in other municipalities and also transferred to other European contexts.

The specific objectives of the project are:

- 1. evaluate the ecosystem services provided by urban soils and quantify the costs and impacts caused by land take and soil sealing;
- 2. define a framework of urban planning rules and operational tools to apply, at the municipal level, the goal of "no net land take" and promote urban regeneration;
- 3. carry out demonstrative de-sealing interventions as examples of compensation for new urbanizations and improving urban resilience to climate change;
- 4. develop a municipal-scale Information System for monitoring land use, which can be replicated at the Italian and European level, which can also be a tool to support decisions on urban planning;
- 5. transfer tools, regulations, guidelines and methods to other municipalities and local authorities in Italy and Europe;
- 6. promote, through a bottom-up approach, the adoption at regional level of laws and regulations aimed at enforcing "no net land take" and increasing the recycling of urban areas and regeneration processes;
- 7. increase the awareness of decision makers, technicians and citizens, regarding the need to protect the soil and its ecosystem functions.

To achieve these objectives, the project was divided into the following actions:

- A1 Preparatory activity for the definition of tools to limit land take
- B1 Measurement at municipal scale of the impacts of land take and evaluation of ecosystem services
- B2 Demonstrative interventions of de-sealing with soil restoration
- B3 Urban planning rules and tools to limit, mitigate and compensate for land take and promote urban regeneration
- B4 Urban and Soil Decision Support System (US-DSS) Information system for land take monitoring and urban regeneration
- C1 Monitoring the impact of the project's actions
- D1 Awareness-raising, dissemination and Networking interventions
- E1 Project management and After Life Plan.

The main results of the project are the following:



- Mapping of land take and soil sealing for the territories of the 3 partner municipalities Del. 14.1, 14.2, 14.3, 14.6, 14.7, 14.8, 14.11, 14.12, 14.13
- Mapping of ecosystem services by territories of the 3 partner Municipalities (later extended to the whole regional territory) Del. 20 and 33
- Soil quality map (later extended to the whole regional territory) included in the US-DSS Information system Del. 30 and 33
- Report containing an estimate of the economic and environmental impacts resulting from the land take and soil sealing in the 3 partner municipalities Del. 19
- Evaluation of ecosystem services of urban soils (Carpi case study) and relative map Del. 24
- Guidelines for the evaluation of ecosystem services in urban areas Del. 23
- Guidelines for the removal, management and reapplication of topsoil Del. 27
- Guidelines for improving the resilience of urban regeneration interventions to climate change Del. 29A
- Guidelines for the management / revision of urban plan residues Del. 29B
- Guidelines relating to the surface credit exchange mechanism Del. 12
- 3 General Urban Planning Plans that contain rules for the limitation of land take and for urban regeneration (being drafted)
- 3 desealing demonstration interventions (2 started in Forlì and San Lazzaro di Savena and under construction and 1 planned and soon to be started in Carpi);
- Urban Soil and Decision support system Del. 30 and 33
- 12 stages of the traveling photographic exhibition Del. 13
- Educationa Kit Del. 13.1
- 16 scientific and informative articles Del. 42
- 14 Networking meetings Del. 41
- 34 between Exhibitions, Workshops, Seminars, Webinars, Conferences
- Socio-economic impact assessment report Del. 45
- Urban Planning Award 2018 at the UrbanPromo exhibition for the "Giardino dei Musei" desealing project in Forlì
- Inclusion of the SOS4LIFE Project among the Best Practices in the Guidelines for Green City by the Green City Network (2018)
- Urban Planning Award 2019 at the UrbanPromo exhibition for the SOS4LIFE Project
- Inclusion of the SOS4LIFE Project among the Best Practices in the 2019 Report of ISPRA (Higher Institute for Environmental Protection and Research)
- Inclusion of the SOS4LIFE Project among the Best practices of ICESP (Italian Circular Economy Stakeholder Platform) 2020.

The Emilia-Romagna Region, partner of the project, approved the new regional urban planning law no. 24/2017, which implemented the European target of "no net land take" by 2050 and which introduces limits on land take and promotes urban regeneration.

All 328 Municipalities of Emilia-Romagna to comply with the regulatory provisions of the Regional Law 24/2017 are proceeding with the drafting and subsequent approval of the new General Urban Plan which will contain rules to limit land take and promote urban regeneration.

Almost all of the project was implemented in compliance with what was initially foreseen.

The main difficulty was to carry out the desealing demonstration interventions. The problems were of various kinds:

- find the financial resources to implement the interventions (the European contribution does not finance the execution of the desealing works but collateral activities such as the preparation of demonstration plots and the consequent monitoring or environmental characterization activities)
- need to carry out environmental characterization activities and, often, to carry out the reclamation of the areas;
- need to obtain authorizations from the competent Superintendency, since these are areas in the historic center or near areas of environmental value;
- greater design complexity for the application of the procedures set out in the Guidelines.

For the reasons set out above, it was not possible to respect the implementation times of the desealing interventions. In order to report, if not the completion, at least the start of the interventions, an extension of the project completion deadline was requested from 31/10/2019 to 30/09/2020. This extension, requested in March 2019, was authorized by EASME in August 2019 with Letter Amendment no. 2 to the Grant Agreement.

It was not possible to produce Deliverable 25 - Register of building practices with updating of land register. Unlike what was initially hypothesized, despite having the Municipal Property Register (containing land data, and house numbering of each building), it was not possible to associate the data relating to building practices as this would also have required the digitization of all building archive (long and expensive operation) and the implementation of a specific database starting from the scanned documents. Furthermore, it was not possible to have the data relating to the users of the various services (eg. Electricity service) as these services are provided by a plurality of subjects and there is no single database.

It should also be considered that each municipality uses a different software for the management of building practices and this too has caused a further problem.

However, additional activities have been carried out such as, for example, the preparation of Soil Quality Maps starting from the Ecosystem Services Maps and these maps have been produced for a large part of the regional territory. Furthermore, all these data, mainly useful for supporting urban planning decisions, have been made available and can be consulted in the US-DSS Information System.

Deliverable 35 and Milestone 36 provided for Forlì and Carpi to reach by the end of the project the municipal resolutions for the adoption of the new general urban planning instruments (P.U.G.) containing provisions regarding the limitation of land take. The terms for adopting the new urban planning instruments pursuant to the L.R. 24/2017 have, however, been extended by the Emilia-Romagna Region to 01/01/2022. Most of the municipalities in the region (including Forlì, Carpi and San Lazzaro di Savena) are drafting the new urban plans that will only be adopted in 2022.

For more details, see the following chapters.

### 4. Introduction

### Environmental problem/issue addressed



The SOS4LIFE project aims to countering and monitoring land take, soil sealing and the loss of eco-system services due to urban sprawl. As highlighted by the *Thematic Strategy for Soil [COM(2006) 231]* and several reports of the European Environment Agency *[Urban Sprawl in Europe, The ignored challenge, 2006; The European environment - State and Outlook, 2010 and 2015]*, urban sprawl and soil sealing is one of the main causes of soil degradation and one of the most serious environmental challenges on a European scale.

Soil is a non-renewable resource that provides essential ecosystem services to the community such as food, fiber and timber production, microclimate regulation, soil carbon stock, water storage and water regulation.

Soil is an habitat for biodiversity and an important element of the agricultural and natural landscape: it's estimated that only 25% of the earth surface is endowed with arable land and only a part of this land falls into the best classes of capacity of use *[Millennium Ecosystem Assessment, 2005]*. The removal of land from agricultural use (land take) by urbanization processes and the development of transport infrastructure, as well as altering the landscape, leads to a reduction in production capacity that affects European food security and environmental sustainability of increasingly intensive agricultural practices (e.g. livestock farms that need land also for the agronomic reuse of effluents - DIR 91/676/EEC). Considering the growing global food demand and the limit of the natural soil resource, agricultural land take at local scale indirectly contributes to produce Indirect Land Use Change (ILUC) at global scale, such as deforestation, with a major impact on natural ecosystems and biodiversity [MEA, 2005].

Soil sealing, related to buildings, parking and roads construction, directly affects the soil-based ecosystem services: these impacts increase local hydraulic risk and adversely affect climate change adaptation European policies [SOER 2015].

Urban sprawl leads car mobility, with increased energy consumption, vehicle traffic and air pollution with an impact on energy efficiency and health impacts. The land take and soil sealing affects the whole European Union, with different rates between member countries and regions, often unrelated to demographic and social dynamics.

### Outline the hypothesis to be demonstrated / verified by the project

The EU strategy established by the Roadmap for Resource Efficiency in Europe [COM(2011)571] sets a common European target of "No net land take by 2050", but there is a deficiency of European Life Projects about de-sealing interventions, as reported by "LIFE and soil protection" (EC, 2014): the SOS4LIFE aims to fill this gap and demonstrate the applicability of the "No net land take by 2050" at a municipal scale aiming to a wider dissemination, reporting demonstration interventions of removal of sealed surfaces (de-sealing) and guidelines aimed to increase awareness of the extent of land take and the related problems in terms of quality and safety of our cities.

#### Description of the technical / methodological solution

Starting from the European best practices [action A1] on limitation, mitigation and compensation of land take, the activity of measuring the level of land take and soil sealing at local level was developed and related to the quantification of unimplemented building forecasts and the mapping of urban areas that can be subject to regeneration and reuse interventions to avoid consuming new soil. Starting from these data, the impact that land take has determined at a local level in terms of loss of soil-based ecosystem services has been evaluated. It was also quantified the contribution, in terms of eco-systemic services, of permeable surfaces in the urban context [Action B1].

A technical and regulatory activity study has been defined, aimed to the elaboration of guidelines to be included in urban planning tools and urban regulations of the partner municipalities of the project [Action B3]. In particular, the aim is testing and demonstrating the effectiveness, technical feasibility and economic sustainability for the real estate operator and for the municipal budget, of a compensation system for land take and soil sealing which allows construction on "not build areas" only after "green restoration" to agricultural or semi-natural use of unused sealed areas of at least equivalent surface, located both in urban and rural areas. At the same time, measures will be prepared and adopted to encourage and incentivize urban regeneration that may include regulatory and operational simplifications, volumetric incentives, tax exemptions. Guidelines will also be prepared to apply technical solutions aimed at improving resilience to climate change [Action B3].

An important part of the SOS4LIFE project is certainly the implementation of three demonstration actions of de sealing with green restoration: one for each of the partner municipalities [Action B.2]. The three sealed areas, for a total surface of 10.750 square meters, will be public green areas (topsoil comes from construction sites specifically identified and will be use for the green restoration). The purpouse of these project actions is to demonstrate the technical and economic feasibility of de-sealing actions as a measure of compensation for land take and to evaluate through ex-ante and expost monitoring activities the environmental effects of the restoration of green areas of intervention and the possibility of improving urban resilience to climate change.

The definition of a local knowledge allows to proceed to the implementation of an Urban and Soil Decision Support System (US-DSS) for the continuous monitoring, at municipal level, of data related to land take and soil sealing, urban regeneration processes, regeneration of brownfield sites, loss of soil ecosystem services [Action B4]. Soil Decision Support System is related to an open data Web Gis tool, which allows to visualize all maps and it's available at the following link: <u>https://sos4life.regione.emilia-romagna.it/sos4life/</u>. The main outcome of this tool is developing System to monitor land take and soil sealing.



#### Expected results and environmental benefits

Thanks to the Guidelines and to the intensive dissemination activities, most of the expected results have been achieved. Knowledge of soil and related ecosystem services has been increased. Awareness of policy makers, public and private technicians as well as citizens about the impacts of land take and soil sealing has increased. At the same time, a number of useful tools for urban planning and for the design of interventions of urban transformation and regeneration have been prepared and provided to technicians. Increasing the resilience of our cities to climate change through increased attention to land use and the maintenance and restoration of soil ecosystem services is an important result: Increasing permeability and green infrastructures in urban areas improves microclimate conditions and carbon stock (reducing pollution), while limiting land use in peri-urban areas allows to preserve the important functions of the soils.

### Expected longer term results (as anticipated at the start of the project)

The effects and results of the SOS4LIFE Project do not end with its conclusion: the most important results of the project are expected in the medium- and long-term period. Several guidelines have been prepared as a summary of the main actions and with the aim of providing a useful tool to deepen the themes and replicate the experience: the dissemination activity of the contents of the guidelines has led to their assumption also by other municipalities (for example, Guidelines to improve resilience to climate change in urban regeneration projects generated widespread interest by other municipalities). The application of this Guidelines will improve the realization of urban transformation and regeneration interventions (public and private works), attends to the preservation or restoration of soil and related ecosystem services. These guidelines (deliverable 29A), the Guidelines for the removal, management and reapplication of topsoil (deliverable 27) and the Guidelines on the mechanism of exchange of surface credits and measures to promote urban regeneration interventions (deliverable 12), will help municipalities planning and implementing more sustainable urban regeneration interventions, according to the preservation and/or restoration of soil permeability and to the principles of circular economy.

The Guidelines for the assessment of ecosystem services in urban areas (Deliverable 23) and the US-DSS (Deliverables 30 and 33) will be use (mainly by Public Administrations) for urban planning. The application of these guidelines will increase the awareness of administrators and technicians on the different quality of soils that are affected by urban transformation or regeneration projects, guiding them to more responsible choices.

Emilia-Romagna Regional Law 24/2017 implemented the European goal of "No net land take by 2050": the medium-term result is the obligation, for all the 328 municipalities of Emilia-Romagna Region (for a total of 22,452.78 km<sup>2</sup>) to define a General Urban Plan that implements the regional law and introduces limits to land take. The effect expected during the following years, till 01/01/2024, will be the containment of land take on a regional scale and an incentive for urban regeneration interventions.

Demonstrative interventions of de-sealing of sealed areas and green restoration (including the reuse of topsoil from another urban construction site) were also designed and partly implemented. These activities have tested the technical and economic feasibility of this type of compensatory intervention, which will be increasingly necessary to achieve the objective of "No net land take".



### 5. Administrative part

The Municipality of Forlì is Responsible of the coordination and management of the project and has designated (on 27/07/2016) as Project Manager (PM) the Architect Stefano Bazzocchi – Unità Riqualificazione Urbana – Servizio Urbanistica e Edilizia.

The PM ensures the constant monitoring of the overall progress of the project and of each action and sub-action in which the project is articulated, including the activities that will be outsourced, coordination with each partner, draws up the reports required by the project, manages relations with stakeholders and the European Commission.

The PM manages the relationships with the partners by email or telephone and provides support to them for problem solving. On several occasions, the PM has personally visited the offices of some partners for specific meetings, linked to technical tables related to some actions.

The City of Forli in January 2018 entered into the required Partnership Agreements with each of the associated beneficiaries: each partner has nominated an internal manager as a reference for the PM.

In order to manage the activity related to each action or sub-action, specific working groups (Technical Table) have been constituted and each partner has nominated its representative (one for each group). The coordination of the individual actions or sub-actions and the related working group has been already established in the project.

The governance of the project has been entrusted to the following collegial bodies that have periodically met in presence at the partners' offices or by videoconference:

- Steering Committee (S.C.) chaired by the PM and attended by a representative from each partner. For the aspects related to the economic and financial reporting of the project, the coordinating beneficiary has used the support of an external company;
- Scientific Committee (SC.C.) is chaired by a Coordinator appointed by the CNR partner, with functions of analysis, supervision, accompaniment to the development of methodological, normative, scientific, technical contents of the project actions;
- Monitoring Committee (MON.C.) has supervised the activities planned in Action C1 with the function of monitoring the processes in order to ensure an optimal and sustainable socio-economic impact of the results. In addition to the representatives of the partners, the external consultants in charge also participated in the meetings.

Monitoring Committee and Scientific Committee have often met jointly.

The Committees direct and promote the activities of the operational staff:

- Technical Staff (TEC. S.) is coordinated, for each partner, by internal Managers specifically nominated and responsible for the implementation of activities, including through Technical Tables under Actions A, B and C;
- Administrative Staff (ADM. S.) is coordinated, for each partner, by administrative managers specifically nominated.

The Project Manager set up mailing lists specifically dedicated to the various

Committees and the Technical and Administrative Staff in order to send them the relevant communications and meetings.

The exchange of information and documents between partners and between PMs and members of Staff or Committees, as well as with the company in charge of the economic-financial reporting of the project, took place both by email and using the online platform "Groupware" made available by the Emilia-Romagna Region. Subsequently, the Region replaced Groupware with Microsoft Teams.

An initial work plan has been provided with a detailed timetable of the project (regularly reviewed and updated) indicating the deadlines for each deliverable and each milestone and the duration of individual sub-actions and the scheduling of meetings of the collegial bodies (Steering Committee, Scientific Committee, Monitoring Committee). The initial work plan was also accompanied by a Gantt that represents, in a more synthetic way, the deviations in the timing of implementation of the various actions and sub-actions.

In order to monitor and represent the state of implementation of the project, a specific table with Progress Indicators (%) has been prepared.

Summary lists of project deliverables and milestones have also been prepared along with the relevant deadlines. At the end of the project there were no substantial deviations, in terms of content, from the approved project: the main timetable deviations are detailed in the technical description of the individual actions.

There were 4 visits by the appointed Monitor Dr. Riccardo M. Giandrini (07/02/2017 in Forlì, 24/05/2018 in Bologna, 26/06/2019 in Bologna, 25/06/2020 by videoconference): during each visit the status of implementation of actions and the progress of spending was verified. It was also possible visiting the areas of intervention and viewing the demonstration plots. Throughout the course of the project, the Monitor has been periodically contacted to clarify doubts or to solve problems that emerged in the development of actions, related to budget issues or reports preparation. The contacts with the Monitor have been managed by the Project Manager both by phone and email. Regarding budget and reporting issues, the Monitor has also been contacted by the company in charge of financial reporting of the project. Responses have always been timely and comprehensive.

Contacts with EASME occurred mainly for the following reasons:

- receipt of the Grant Agreement to be signed and re transmission of the same;
- via e-mail for communication by EASME of the payment of the first pre-financing and the second financing;
- by e-mail for communication by EASME of the outcome of the various monitoring visits and evaluation of the Midterm report and Progress Report;
- by e-mail for communication relating to the events for the 25th anniversary of the LIFE program in which the SOS4LIFE project participated with an event and for which, following an email request, it received some gadgets to be distributed;
- by e-mail for the communication by the Municipality of Forlì, as coordinating beneficiary, of the delay in the transmission of the Midterm Report;
- submission by EASME of the Letter amendment n ° 1 to the Grant Agreement



- request for extension by the Municipality of Forlì and response by EASME (Letter amendment n° 2 to the Grant Agreement)
- reminders, via email, for sending the Final Report

Two amendments to the Grant Agreement were approved:

- Letter Amendment n°1 to the Grant Agreement Modification of the definition of conditions for natural persons, submission of VAT certificate and threshold for submission of the certificate on the financial statements;
- Letter Amendment n°2 to the Grant Agreement Modification of the following:
  - (1) Forms A1, C2 and C3 as set out in Annex II of the Grant agreement are modified as set out in the new Forms A1, C2 and C3 attached to the letter.
  - (2) The duration of the project in Art. 1.2.2 of the grant agreement is extended and shall run for 51 months from 01/07/2016 to 30/09/2020.

### 6. Technical part

### 6.1. Technical progress, per Action

# ACTION A1 "PREPARATORY PHASE TO IDENTIFY TOOLS TO LIMIT LAND TAKE"

divided into 3 sub-actions, has been completed and reported at Mid-term Report.

Objective: gathering information and best practices on limiting, mitigating and compensating land take by looking at statistics, maps, demographic data and mapping of national/European experiences, and by holding a meeting at national level and two study visits to Dresden and Stuttgart.

Action A1 was divided into the following sub-actions:

# Sub-action A.1.1 – Gathering data available at local level and definition of measure and monitoring methods

Foreseen start date: 01/07/2016 Foreseen end date: 30/01/2017 Coordination: Municipality of Forlì Actual start date: 01/07/2016 Actual end date: 31/01/2017

Sub-action A.1.2 – identification of guidelines at regional/national/European level for the removal, storage and reinstatement of soils in construction sites, and assessment of the ecosystem services provided by urban soil.

Foreseen start date: 01/07/2016Actual start date: 01/07/2016Foreseen end date: 30/01/2017Actual end date: 30/01/2017Coordination: Emilia-Romagna Region

Sub-action A.1.3 – Identification of best practices for no net land take and improvement of urban resilience, and study visits at European level.

Foreseen start date: 01/07/2016Actual start date: 01/07/2016Foreseen end date: 30/01/2017Actual end date: 30/01/2017Coordination: Emilia-Romagna Region

The main outputs of action A1 were the following:

- Sub-action A1.1: Report containing a list of local data on land take and a review of measuring, monitoring and representation tools (Del. 10);
- Sub-action A1.2: Report containing a review of rules, guidelines, best practices to remove ad reinstate soils and assess ecosystem services (Del. 11);
- Sub-action A1.3: Report (translated into English) containing a summary of rules, guidelines, best practices, European case studies on limiting land take (Del. 9).

The following milestones provided for by the project were realised:

- Meeting in Bologna to present the best practices, with the participation of experts from other Italian provinces and regions (Mil. 9);
- Study visits to Dresden and Stuttgart (Mil. 10);
- Creation of the Technical Working Group (Sub-action A1.1) charged with data collection and review (Mil. 1).



# ACTION B1 "MEASUREMENT OF THE IMPACT OF LAND USE AT MUNICIPAL LEVEL AND ASSESSMENT OF ECOSYSTEM SERVICES"

divided into 3 sub-actions, has been completed.

Objective: To reconstruct the historical evolution of land use and define an overview of the current consumption and soil sealing in each Municipality involved; to estimate the economic and environmental impact of land take and soil sealing in terms of loss of eco-systemic services; to assess eco-systemic services of urban soils.

Foreseen start date: 01/07/2016	Actual start date: 01/07/2016
Foreseen end date: 28/02/2018	Actual end date: 31/12/2018

Action B1 is divided into the following sub-actions:

Sub action B.1.1 – Elaboration of the local knowledge framework: land take and soil sealing dynamics Coordination: CNR lbe has been reported at Mid-term Report.

**Sub action B.1.2 - Costs and local impact of land use dynamics** Coordination: CNR lbe

Sub action B.1.3 – Evaluation of ecosystem services of the urban soils and guidelines for protection and improvement Coordination: CNR lbe

### Sub action B.1.2 - Costs and local impact of land use dynamics

Coordination: CNR Ibe

Action B1.2 provided the estimation at municipal level of the economic and environmental impacts resulting from land take in recent decades in terms of loss of the following Ecosystem Services (ES): i) agricultural production, ii) surface water regulation, iii) microclimate regulation, iv) support for biodiversity, v) organic carbon storage, vi) buffer and filter of contaminants. The activity was carried out by the Geologic Seismic and Soil Service of Emilia Romagna and CNR IBE with the collaboration of the 3 municipalities with the support of the Technical Table convened in conjunction with the meetings with the partners of action B1.1 and/or through data exchange (mainly by mail) with the partners of action B1.2.

Action B1.2 delivered three maps of soil-based ecosystem services for the municipality of Forlì, Carpi and San Lazzaro di Savena (Del. 20) and 1 report containing an estimate of economic and environmental impacts due to lad take and soil sealing in the 3 municipalities (Del. 19).

# Quantification of the loss of ecosystem services: biophysical and economic estimates

In order to estimate ecosystem services loss, we adopted the unit reference values used by ISPRA in the 2018 report "*Land take, territorial dynamics and ecosystem services*", for almost all the ecosystem services considered.

Data for seven ecosystem services were processed: agricultural productivity, PRO, water storage capacity, WAS, and surface water regulation capacity (infiltration), WAR, soil carbon stock, CST, microclimate regulation, CLI, the buffer and filter capacity against pollutants, BUF, and the habitat for soil biodiversity, BIO (Table 1).

Ecosystem service	Acronym	Biophysical unit of measurement	Economic unit of measurement
Carbon storage and sequestration	CST	t/ha	€/t
Habitat quality	BIO	-	€/ha
Agricultural production	PRO	t/ha -	€/t €/ha (VAM – Average agricultural value)
Microclimate regulation	CLI	cu.m.	€/KWh
Availability of water	WAS	cu.m.	€/cu.m.
Regulation of the hydrological regime	WAR	cu.m.	€/cu.m./year
Water purification	BUF	-	€/ha/year

Table 1. Biophysical and economic units of measurement of the ecosystems services considered

As for WAS, WAR, CLI, BUF and CST, the impact of land take is considered to be equal to the degree of soil sealing, taking into account that disturbed soils continue to store carbon and store and transmit water. As for agricultural production and provision of habitats for biodiversity, on the other hand, the supply of this services is considered fully lost, regardless of the level of sealing.

For the purposes of the economic evaluation of the loss of soil-based ecosystem services, 1985 and 2016 in Forlì and San Lazzaro di Savena were considered as reference years, and 1980 and 2016 in Carpi.



### Materials and Method

### Agricultural productivity (PRO)

To assess the value of agricultural productivity, and the impact of land take on it, two distinct approaches were used, both weighed on the classification of land use capacity (Guermandi, 2000). In the first case, the potential production of common wheat (*Triticum aestivum* L.) was considered, which averages 83 q/ha in the Emilia-Romagna plain (Emilia Romagna Region, 2014). Considering that the productions reach 90 q/ha in the best soils, land use capacity class 1, the potential production of common wheat was calculated as:

q/ha = 90 \* land use capacity class (PRO)

The economic evaluation of the impact of land take on PRO is therefore based on the estimate of the loss of yield in t/ha of common wheat, assuming a value of  $\in$  205.95/t (ISMEA November 2018).

In the second case, the Average Agricultural Values (VAM, in euros) provided by the Revenue Agency for each Italian municipality and for the different land uses were used, as done by ISPRA at national level (ISPRA, 2018). The average agricultural value defined by the Revenue Agency was therefore attributed to each land use class. In currently sealed areas, an estimated value, VAM<sub>est</sub>, has been assumed, estimated by linear regression between VAM and the PRO index:

 $VAM_{est} = a + b * PRO$ 

The coefficients a and b of the equation above have been calculated for the three partner municipalities.

### Soil water reserve (WAS)

The amount of water potentially stored in soil, and therefore available for plant growth (AWC), was evaluated as the volumetric water content at field capacity (WC\_FC, mm m<sup>-1</sup>) minus the volumetric water content in water at wilting point (WC\_WP). The WC\_FC and WC\_WP were estimated using locally calibrated pedotransfer functions (PTF) (Ungaro et al., 2005), whose inputs are soil structure, particle size fractions (sand, silt and clay %), organic carbon content (%) and bulk density (Mg m<sup>-3</sup>). The PTFs were applied to all the benchmark soil profiles of the three municipalities, obtaining for each soil the volume of water potentially contained down to a depth of 100 cm. Knowing the quantitative distribution of the different soils in the different soil delineations, it is therefore possible to estimate the cu.m. of water potentially stored per hectare:

cu.m. water/ha = (AWC mm  $m^{-1}$  /1000) \* 10000

For each of the delineations of the soil map, the cu.m. of water in relation to their areas were calculated. The average values of AWC in mm m<sup>-1</sup> are equal to 135.7, 140 and 123.3 for Forlì, Carpi and San Lazzaro di Savena respectively,

Following the 2018 ISPRA report, the economic evaluation was based on estimated costs (Reddy, 2015) equal to US \$ 0.04/cu.m. and US \$ 0.93/cu.m. in 2012, which converted into euros and updated to 2015 correspond to  $\in$  0.03-0.71/cu.m.. In the three municipalities under study, for the purposes of the economic evaluation, a unit cost of  $\in$  0.33/cu.m. was considered, equal to the estimated profitability of the water distributed by the Emiliano Romagnolo Canal (CER) in 2015 (Solimando, 2016).

### Soil water regulation (WAR)

The amount of water that potentially infiltrates into the soil (cu.m./year), not affecting the drainage system for the removal of surface water and therefore available for recharging the groundwater, has been estimated for each municipality considering the average annual rainfall and the average saturated water conductivity of the soils present on the area of each municipality. Average annual rainfall is equal to 687, 778 and 764 mm respectively for Forlì, Carpi and San Lazzaro di Savena; the average saturated water conductivity values are equal to 11.08, 15.39 and 38.00 mm/day respectively for Forlì, Carpi and San Lazzaro di Savena.

In terms of economic evaluation, a recent meta-analysis (Jónsson and Davíðsdóttir, 2016, in ISPRA, 2018) reports various economic values that can be associated with the soil-water regulation service. These range from 62 to 126 \$/ha/year as the market price for the water cycle regulation service, from 30 to 1175 \$/ha/year for the hydrological control of the territory through various cost items. The values of the cost per unit of volume or mass vary from zero to 49 \$/t/year and between 3.2 and 20 \$/cu.m./year, with an average value of 11.34 \$/cu.m./ year corresponding to 8.74 €/cu.m./year.

### Carbon stock (CST)

Soil carbon stock was assessed for each benchmark soil profile for the reference depth of 100 cm, applying the following equation:

CST Mg/ha = SOC % \* BD (Mg m<sup>-3</sup>) \*100 \* (1-sk)

Where SOC is the average soil organic carbon % over 100 cm depth, BD is the average soil bulk density over the same reference depth, (Mg m<sup>-3</sup>), sk is the coarse fragments content (diameter >2 mm, vol/vol). The stock estimated for each soil map delineation is then the weighted mean of the stocks of the different soil typological units (UTS) within any given delineation, weighted in terms of its areal extention.

As for the economic evaluation of the soil carbon storage and sequestration service, there are different approaches, but two are the most used (ISPRA, 2018). The first is based on the social cost (SCC), the other on the market value of the emission permits. The social cost considers, on a global level, the damages avoided thanks to the sequestration of  $CO_2$ . This type of cost is highly variable due to the uncertainty of the estimate.



The ISPRA 2018 report refers to the updated values, used by US EPA (Interagency Working Group on Social Cost of Greenhouse Gases, United States Government, 2016), which for 2015 indicate a value of 36 \$/t (2007 dollars per ton of  $CO_2$ ), corresponding to a value of 33.18  $\in$ /t  $CO_2$  (2015), which in terms of C corresponds to 101.85  $\in$ /t C. An analysis of values from literature on the social cost of carbon sequestration (Tol, 2005) indicates an average value based on selected studies, using a weighting system proposed by the author, equal to 122 \$/t C. For 2018 using the reference of the meta-analysis by Tol, the suggested value is 122 \$/t C (2005), equal to 121.45  $\in$  /t referred to 2015.

In terms of the market price for the emission permits, the ISPRA 2018 report refers to a market price for the valuation of C stock over the period 2012-2017, which referred to 2015 is equal to  $\in$  6.3/t CO<sub>2</sub>eq, or  $\in$  23/t C.

### Microclimate regulation (CLI)

The direct contribution of soil to the regulation of the microclimate is based on its capacity to store water available for evapotranspiration processes, the consequence of which is to significantly lower the temperature, thus mitigating the heat island effect. For the purpose of quantifying the service and its economic evaluation, the cubic meters of available water were calculated for the soils of each municipality (as the difference between the water content at field capacity and that at the wilting point), considering it as a potentially evapo-transpirable and therefore calculating the energy cost necessary for its evaporation ( $\in$ /Kwh). The calculation assumed an energy expenditure of 2.4346 GJ/cu.m. equivalent to 674.4 KWh. For contractual powers up to 6 kW, the cost of electricity varies from  $\in$  0.19/kWh to  $\in$  0.48/kWh, all inclusive (network services, excise duties, VAT). According to Eurostat, the final average price per kWh of electricity (cost inclusive, therefore, of expenses and taxes) is equal to  $\in$  0.2080/kWh.

### Filtering and buffering of pollutants (BUF)

The water purification service provided by the soil through physico-chemical processes is a regulation service and like many of these, its evaluation is based on the calculation of a replacement cost, usually referring to the removal of phosphorus and/or nitrogen. The range of unit values reported in the literature is however very wide, depending on the pollutants loads, the technology applied and the pedo-environmental conditions. Jónsson and Davíðsdóttir (2016, in ISPRA, 2018) in a recent meta-analysis reported values between 544-6402 \$/ ha/year (2012) for filtering and decontamination, which correspond to 415-4887 €/ha/year (2015).

### Habitat provision for biodiversity (BIO)

This service is to be considered as an index of the overall biodiversity, and as such according to some classifications, it falls into the category of so-called support services, or in the regulation and maintenance services according to others.

As for the economic value to be associated with this service, the reference is given by Costanza et al. (1997, 2014), which provides the global economic value of 17 ecosystem services, including habitats, divided into 16 biomes. The most updated estimate revised by Costanza et al. in 2014, refers to the work of de Groot et al. (2012). Considering the prevalent land use in the three municipalities under study, the

reference values considered for the economic evaluation of the service was that of intensive agricultural areas, equal to  $\in$  260.2/ha. In the case of the municipality of San Lazzaro, considering the presence of hilly areas with extensive agricultural land use, for which a higher economic value per unit of surface area is proposed, equal to 520.4  $\notin$ /ha, a weighted average was calculated as a function of the sealed soil surfaces in the two environments.

#### Results

#### San Lazzaro di Savena

Table 2 reports the economic evaluation for the seven services considered in relation to the changes that occurred in terms of land take between 1985 and 2015 in the municipality of San Lazzaro di Savena; the estimated loss ranges between 97.5 and 137.3 million  $\in$ .

ES	Description/Unit	1985	Value	2016	Value	Difference
	C stock (Mg)					
CST	Market price	450211.9	€ 10,354,873.58	436538.2	€ 10,040,378.90	-€ 314,494.68
	C stock (Mg)					
сѕт	Social cost	450211.9	€ 54,678,234.64	436538.2	€ 53,017,566.00	-€ 1,660,668.64
PRO	VAM, euro	92869487.8	€ 92,869,487.81	83668779.0	€ 83,668,778.97	-€ 9,200,708.84
	Wheat, q	194099.2	€ 39,974,726.65	173414.5	€ 35,714,723.45	-€ 4,260,003.20
CLI	AWC, cu.m.	5293933.2	€ 742,590,141.95	4707558.0	€ 660,338,162.22	-€ 82,251,979.73
WAR	cu.m. infiltrated	2676.5	€ 21,947.11	2456.8	€ 20,145.37	-€ 55,853.89
WAS	AWC, cu.m.	5293933.2	€ 1,746,997.96	4707558.0	€ 1,553,494.12	<i>-</i> € 193,503.84
BUF	Min, ha free soil	3503.2	€ 1,453,845.39	3215.6	€ 1,334,492.60	-€ 3,699,936.66
	Max, ha free soil	3503.2	€ 17,109,833.48	3215.6	€ 15,705,209.26	-€ 43,543,351.01
BIO	ha free soil	3503.2	€ 1,101,448.45	3215.6	€ 1,011,025.53	-€ 90,422.92
						Difference
					Min	-€ -97,467,569.19
					Max	-€ 137,310,983.54

 Table 2. Municipality of San Lazzaro di Savena: economic evaluation of the loss in ecosystem services between 1985 and 2016.

#### Forlì

Table 3 shows the results for the municipality of Forlì: taking into account land take occurred between 1985 and 2016; the estimated loss at municipality level ranges between 97.9 and 246.2 millions €.

ES	Description/Unit	1985	Value	2016	Value	Difference
CST	C stock (Mg)	2185198.7	€ 50,259,570.57	2123500.8	€ 48,840,519.24	-€ 1,419,051.34



Market price					
C stock (Mg)					
Social cost	2185198.7	€ 265,392,384.61	2123500.8	€ 257,899,176.58	-€ 7,493,208.03
VAM, euro	627399457.7	€ 627,399,457.74	594028017	€ 594,028,017.49	-€ 33,371,440.25
Wheat, q	1347073.6	€ 277,429,807.72	1274415.3	€ 262,465,825.69	-€ 14,963,982.03
AWC, cu.m.	29741098.7	€ 4,171,840,821.62	29446626.0	€ 4,130,534,574.35	-€ 41,306,247.27
cu.m. infiltrated	12616.6	€ 103,456.28	11881.1	€ 97,425.22	-€ 186,962.93
AWC, cu.m.	29741098.7	€ 9,814,562.56	29446626.0	€ 9,717,386.57	<i>-</i> € 97,175.99
Min, ha free soil	18364.8	€ 7,621,393.12	17294.2	€ 7,177,098.23	-€ 13,773,141.68
Max, ha free soil	18364.8	€ 89,693,696.38	17294.2	€ 84,464,934.31	-€ 162,091,623.99
ha free soil	18364.8	€ 4,778,521.66	17294.2	€ 4,499,954.12	-€ 278,567.54
					Difference
				Min	-€ 97,925,795.03
				Max	-€ 246,244,277.34
	Market price C stock (Mg) Social cost VAM, euro Wheat, q AWC, cu.m. cu.m. infiltrated AWC, cu.m. Min, ha free soil Max, ha free soil ha free soil	Market price         C stock (Mg)         Social cost       2185198.7         VAM, euro       627399457.7         Wheat, q       1347073.6         AWC, cu.m.       29741098.7         cu.m. infiltrated       12616.6         AWC, cu.m.       29741098.7         Min, ha free soil       18364.8         Max, ha free soil       18364.8         ha free soil       18364.8	Market priceC stock (Mg)Social cost $2185198.7$ $\in 265,392,384.61$ VAM, euro $627399457.7$ $\in 627,399,457.74$ Wheat, q $1347073.6$ $\in 277,429,807.72$ AWC, cu.m. $29741098.7$ $\in 4,171,840,821.62$ cu.m. infiltrated $12616.6$ $\in 103,456.28$ AWC, cu.m. $29741098.7$ $\in 9,814,562.56$ Min, ha free soil $18364.8$ $\in 7,621,393.12$ Max, ha free soil $18364.8$ $\in 4,778,521.66$	Market priceC stock (Mg)Social cost2185198.7 $\in$ 265,392,384.612123500.8VAM, euro $627399457.7$ $\in$ 627,399,457.74594028017Wheat, q1347073.6 $\in$ 277,429,807.721274415.3AWC, cu.m.29741098.7 $\in$ 4,171,840,821.6229446626.0cu.m. infiltrated12616.6 $\in$ 103,456.2811881.1AWC, cu.m.29741098.7 $\notin$ 9,814,562.5629446626.0Min, ha free soil18364.8 $\notin$ 7,621,393.1217294.2Max, ha free soil18364.8 $\notin$ 4,778,521.6617294.2	Market price         C stock (Mg)         Social cost       2185198.7       € 265,392,384.61       2123500.8       € 257,899,176.58         VAM, euro       627399457.7       € 627,399,457.74       594028017       € 594,028,017.49         Wheat, q       1347073.6       € 277,429,807.72       1274415.3       € 262,465,825.69         AWC, cu.m.       29741098.7       € 4,171,840,821.62       29446626.0       € 4,130,534,574.35         cu.m. infiltrated       12616.6       € 103,456.28       11881.1       € 97,425.22         AWC, cu.m.       29741098.7       € 9,814,562.56       29446626.0       € 9,717,386.57         Min, ha free soil       18364.8       € 7,621,393.12       17294.2       € 7,177,098.23         Max, ha free soil       18364.8       € 4,778,521.66       17294.2       € 4,499,954.12         Min         Min         Min         Min         Min

Table 3. Municipality of Forli: Economic evaluation of the loss in ecosystem services between 1985 and 2016.

### Carpi

Table 4 shows the economic evaluation for the seven services considered in relation to the changes that occurred in terms of land take between 1980 and 2016 in the municipality of Carpi; the estimated loss at the municipal level varies between 228.3 and 448.6 million  $\in$ . In evaluating these figures, well above those of the other two municipalities, it must be considered that in the case of Carpi, the loss of services due to land take between 1980 and 2016 was partly overestimated, as most of the built-up surfaces (mostly houses and roads) in rural and peri-urban territory as early as 1980 were calculated only in the coverage relating to 2016.

ES	Description/Unit	1980	Value	2016	Value	Difference
	C stock (Mg)					
CST	Market price	1941992.6	€ 44,665,828.72	1818398.0	€ 41,823,154.24	-€ 2,842,674.48
	C stock (Mg)					
СЅТ	Social cost	1941992.6	€ 235,854,995.56	1818398.0	€ 220,844,438.37	-€ 15,010,557.19
PRO	VAM, euro	373026164.8	€ 373,026,164.81	325078576.3	€ 325,078,576.28	<i>-</i> € 47,947,588.53
	Wheat q	809036.9	€ 166,621,154.12	704677.5	€ 145,128,338.73	-€ 21,492,815.39
CLI	AWC, cu.m.	17676398.9	€ 2,479,502,297.14	16464215.3	€ 2,309,466,991.46	-€ 170,035,305.68
WAR	cu.m. infiltrated	12616.6	€ 103,456.28	11881.1	€ 97,425.22	-€ 186,962.93
WAS	AWC, cu.m.	17676398.9	€ 5,833,211.63	16464215.3	€ 5,433,191.06	-€ 400,020.57
BUF	Min, ha free soil	11982.8	€ 4,972,845.83	10584.0	€ 4,392,343.87	-€ 17,995,560.77
	Max, ha free soil	11982.8	€ 58,523,804.87	10584.0	€ 51,692,066.14	-€ 211,783,900.77
BIO	ha free soil	11982.8	€ 3,117,914.42	10584.0	€ 2,753,946.68	-€ 363,967.74

	Difference
Min	<i>-</i> € 228,327,864.75
Мах	-€ 448,570,977.89

Table 4. Municipality of Carpi: Economic evaluation of the loss in ecosystem services between 1980 and 2016.

From the estimates made for the seven ecosystem services considered, it follows that the total average value per unit area of the services for unsealed soils is equal to 265.54, 309.58 and 290.88 €/ha respectively for San Lazzaro (3.216 ha), Forlì (17.924 ha) and Carpi (10,584 ha).

Sub-action B.1.2 was carried out, in addition to CNR IBE, by Emilia-Romagna Region (Geological, Seismic and Soil Service), with the contribution of the Municipalities of San Lazzaro di Savena, Forlì and Carpi and the participation of the other partners of the technical table.

### Extension of the assessment of soil ecosystem services to all the soils of Emilia Romagna plain at a 500 m resolution and definition of a synthetic index of soil quality

Project Action B4 aimed to create a geographic information system (Urban and Soil Decision and Support System - US-DSS) with a web-GIS interface, in which to collect data and monitor land take and soil sealing integrated with the regional topographic database and other thematic maps. The Geographic Information System was also conceived as a decision support tool in the context of spatial planning.

During the implementation of the Project, it was considered essential, in order to guarantee support to land planning decisions, the integration of the maps of ecosystem services into the geographic information system. Extending the activities of action B1.2, it was decided to provide an additional information layer to the geographic information system created by action B4, creating (and then integrating into the US-DSS) the map of soil-based ecosystem services of the entire plain of Emiliano-Romagna (which was initially set up only for the three partner municipalities).

The activity was not limited to the preparation of maps of soil ecosystem services for the remaining part of the regional territory (the one for which the regional databases had data available), but it produced also (as requested by the urban planning technicians of the partner municipalities) a summary map of the overall soil quality. This takes into account the quantity and quality of the ecosystem services provided by the soils in the different parts of the area.

Resorting to a geostatistical approach, the maps relating to basic soil properties required as inputs for estimating the different ecosystem services (Table 5) were created: soil textural fractions (sand, silt and clay %), organic carbon content (%), pH. Starting from these, the other properties of the soils used as input (Figure 1) were estimated by means of locally calibrated pedotransfer functions (PTF): physical and hydrological characteristics (bulk density, BD; available water capacity, AWC; infiltration capacity (saturated water conductivity, Ksat, and air entry potential, PSI<sub>E</sub>); 26



water content at field capacity, WC FC) and physico-chemical propertis (cation exchange capacity, CSC). The maps are in raster format, with pixel size of 500 m.

Code	Input data	Calculation										
BIO	QBS <sub>at</sub> as a function of dominant Land use (High= 1; Medium= 0.5; Low= 0.25) Bulk density, BD (mg ha <sup>-1</sup> ) Organic C, OC (%)	$BIO_{0-1} = (LogOC_{0-1} - BD_{0-1}) + QBS_{at}_{0-1}$										
BUF	CSC (cmolc/kg) as a function of Organic C (%) and clay content (%) CEC = 6.332 +0.404 Clay + 1.690 OC (R <sup>2</sup> = 0.75) pH Average shallow groundwater depth, WT (cm)	BUF <sub>0-1</sub> = Log CSC (pH; sk) <sub>0-1</sub> with pH<6.5 reduction by 0.25 or 0.5 depending on CSC and skel>30% by 0.25 for water table deeper than 100 cm, and BUF <sub>0-1</sub> = Log CSC (pH; sk) <sub>0-1</sub> *WT/100 in case of occurrence of a shallow water table within the first 100 cm of soil depth, being WT the average water table depth (cm).										
CLI	Available water capacity, AWC (vol/vol) AWC= WCFc-WCWP Average shallow groundwater depth, WT (cm)	$CLI_{0-1} = IogAWC_{0-1} + WT_{0-1}$										
CST	Organic C, OC (%) Bulk Density, BD (Mg m <sup>-3</sup> )				C	ST <sub>0-1</sub>	= log (	OC * BD	) <sub>0-1</sub>			
PRO	LC classes and intergrades	LCC Score LCC	I 1 III/IV 0.5	I/II 0.95 III/VI 0.3	II 0.8 IV 0.4	II/I 0.9 IV/II 0.5	II/III 0.7 IV/III 0.5	II/III/IV 0.65 IV/VI 0.27	II/IV 0.55 V 0.3	III 0.6 V/II 0.4	III/II 0.65 VI/IV 0.25	0.57 0.57 <b>VIII</b>
WAR	Hydraulic saturated conductivity, Ksat (mmh <sup>-1</sup> ) Air entry point , <u>PSIe</u> (cm)	$WAR_{0-1} = \log Ksat_{0-1} - PSIe_{0-1}$										
WAS	Field Capacity (-33 kPa), WC <sub>FC</sub> (vol/vol) Average shallow groundwater depth, WT (cm) <u>Sk</u> , coarse fragments (Ø >2 mm, vol/vol)	WA WAS₀	$WAS_{0-1} = (WC_{FC} * 1-sk)_{0-1}$ for water table deeper than 100 cm, and $WAS_{0-1} = (WC_{FC} * 1-sk)*WT/100$ for water table within the first 100 cm					cm, and 100 cm				





Figure 1. Basic soil properties and PTF estimates to assess soil-based ecosystem services in the Emilia-Romagna plain.

Figure 2 shows the maps of six soil-based ecosystem services in the plain area of Emilia Romagna. The same information are available in the Emilia-Romagna Region

MOKA web-portal. MOKA is a CSM (Content Management System) GIS, which allows non-expert users to handle and organize the contents of GIS applications.

The values calculated on a regional basis for the various indicators of soil ecosystem services were used to define a synthetic index of soil quality in order to identify the soils in the regional territory to be protected by virtue of the high level of ecosystem services provided.

Given its multifunctionality, defining the quality of the soil is complex. Four of the six indicators were used to better highlight the concept of soil multifunctionality: PRO, biomass production, BUF, buffer capacity, CST, current carbon stock, and WAR, water infiltration.

Biomass production, including food, is one of the main services provided by soils. The soils of the Emilia-Romagna plain are among the most productive in Italy, both in quantitative and qualitative terms. The ability of the soil to purify the water that infiltrates from its surface ensures the protection of the first aquifers. The organic carbon stored in the soil, in addition to being the basis of its chemical and physical fertility, represents a carbon deposit of extreme importance for the mitigation of climate change due to the excess of climate-altering gases in the atmosphere, including CO<sub>2</sub>. The good infiltration capacity of the soils, in addition to ensuring the recharge of the aquifers, reduces the risk of flooding and mitigates its effects.





Figure 2. Maps of soil ecosystem services indicators in the Emiliano-Romagnola plain.

The soil quality index is given by the sum of the four different standardized indicators:

IQ= PRO 0-1 + BUF0-1 + CST 0-1 + WAR 0-1

Based on the distribution of IQ observed values, five classes of soil quality are defined (Table 6) using the quantiles of the distribution: Class 1, >80°p, Class 2 <80°p and > 60°p, Class 3 <60° p and > 40°p, Class 4 <40°p and > 20°p, Class 5 <20°p (Figure 4).

Soil quality class	Range of values	Percentiles of the distribution
1	2.42 - 3.29	>80°
2	2.29 – 2.42	80-60
3	2.17 – 2.29	60-40
4	2.02 – 2.17	40-20
5	0.00 2.02	<20°

Table 6. Definition of soil quality classes based on the sum of four indicators of ecosystem services.



Figure 4. Soil quality index map for the soils of the Emilia-Romagna plain.

The map of the soil quality index and the maps of the single soil ecosystem services are available to users as thematic layers in the Urban and Soil Decision Support System - US-DSS (<u>https://sos4life.regione.emilia-romagna.it</u>) and on the Emilia-Romagna Region MOKA web-portal

(https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/SOS4LIFE/).

# Sub action B.1.3 – Evaluation of ecosystem services of the urban soils and guidelines for protection and improvement

Coordination: CNR IBE, in collaboration with the Geological, Seismic and Soil Service of Emilia-Romagna Region,

Action B1.3 defined a methodology to survey, characterize and map the urban soils within the built-up area of one municipality (Carpi), provided an approach to assess and quantitatively evaluate the ecosystem services provided by urban soils, coherent <sup>30</sup>



with the approach implemented at municipality scale (Action B1.2), and delivered the guidelines to manage and improve urban soils.

Outcomes of the action include the map of urban soils for the built-up area of the municipality of Carpi, a report describing the methodology to map and evaluate the ecosystem services provided by urban soils and a synthesis of the results obtained (Del. 24). Furthermore, the action delivered the guidelines for assessing soil ecosystem services in urban environment and their management (Del. 23, in Italian and English).

Activities started at the end of 2017 and ended in December 2018; hereafter follows a summary of activities and results.

### Materials and methods

A preliminary soil map identified 16 preliminary urban landscape units, defined based on the following sources: i) the 1: 50,000 scale soil map of the Emilia-Romagna Region, ii) the detailed land use map (2008 edition), iii) the maps relating to the plan documents of the Technical Office of the Municipality of Carpi, and iv) multitemporal aerial photos. These preliminary urban soil units were then surveyed with free sampling by carrying out 185 observations with an auger. Routine soil analyzes were performed at 117 sites and heavy metals were analyzed at 40 sites.

On the basis of preliminary cartography, field observations and results of the laboratory analyzes, 19 sites were selected to carry out physical hydrological measurements and measurements of biological fertility and soil biodiversity, aimed at evaluating the ecosystem services provided by urban soils. In 5 sites, soil profiles were opened with an excavator supplied by the Municipality of Carpi, which were described according to the standard procedures of the Geological, Seismic and Soil Service of the Emilia Romagna Region. Soils were classified according to the World Reference Base, WRB (2014).

The excavation of the soil profiles has made it possible to better understand the dynamics of urban soils, consisting mostly of exogenous soil material above the natural soils in place. The following typology of urban land have been defined:

ACRONYM	NAME	WRB 2014	CHARACTERISTICS	HORIZONS SEQUENCE					
urban	100% WATERPROOF: streets, houses, parking lots, concrete courtyards, sidewalks								
CRP	CARPI franco ghiaiosi	TECHNOSOLS	Bricks> 20% in the control section (roundabouts, tubs, flower beds, small gardens)	^Cu – (Ab) - Bwb					
LUC1	LUCREZIO over CTL1	Calcaric Regosols (Prototechnic, Transportic) over CTL1	Reports with artifacts <20% recent on original soils. Generally the fillings have FL-	^Au-^C (AB)u – (Ab) - Bwb					
LUC2	LUCREZIO over CTL3	Calcaric Regosols (Prototechnic, Transportic) over CTL3	thicknesses and total limestone values> 10%. The organic matter values are linked to the	^Au-^C (AB)u – (Ab) - Bwb					
LUC3	LUCREZIO over MDC3	Calcaric Regosols (Prototechnic, Transportic) over MDC3	age of the carryover and use. The original soil is usually quite deep (rarely seen in drilling)	^Au-^C (AB)u – (Ab) - Bwb					

ACRONYM	NAME	WRB 2014	WRB 2014 CHARACTERISTICS	
MRX1	MARX argilloso limosi		Clayey carryovers	^(Au)-^Cu
PET1	PERTINI over CTL1	Hypereutric Cambisols (Transportic) over CTL1	Reports with artifacts <20% with the appearance of structure	^Au- ^Bu- – (Ab) - Bwb
PET2	PERTINI over CTL3	Hypereutric Cambisols (Transportic) over CTL3	originating from the starting soil).	^Au- ^Bu- – (Ab) - Bwb
BCP1	BOSCO CAPPUCCINA franco limosi	Hypereutric Cambisols-Calcisol (simil CLT1)	Soils apparently in place, with no or few artifacts only on the surface, but which probably	A-Bw-Bk
BCP2	BOSCO CAPPUCCINA franco argilloso limosi	Hypereutric Cambisols-Calcisol (simil CLT3)	have had some sort of disturbance; sometimes surface coverings (20-30 cm above the original soil)	A-Bw-Bk
BUD1	BUDRIONE over SMB1	Calcaric Regosols (Prototechnic, Transportic) over SMB1	Very little widespread in the map area; more present if the map were extended to the entire municipality.	^Au-^C (AB)u – (Ab) - Bwb

The auger holes samples were then reviewed and, where possible, attributed to these soil typological units.

Some auger holes samples were classified as Technosols (defined as "soils that contain many artifacts, i.e. 20% or more in the soil profile up to 100cm or are sealed by a continuous hardened layer or contain a geomembrane; they are the result of many human activities and are mainly present in urban, industrial areas, roads, landfills and mining sites, based on the quantity of artifacts found and their location"). The overwhelming majority of samples, on the other hand, were classified as Regosols, Cambisols and Calcisols.

The final map of urban soils was then compiled, using the preliminary mapping units, the map of the degree impermeabilization prepared by the municipality of Carpi, the ISPRA 2017 map of soil sealing, the LIDAR digital model, the aerial photos from different years (1943, 1954, 1969, 1976, 1994, 1996, 2000, 2003, 2006, 2008, 2011, 2014, 2018) and the sampling points.





Cartographic Units

Urban area				Urban area			
Cartographic Units	% waterproof	Area ha	%	UC	% waterproof	Area ha	%
urbano	97.01%	118.90	3.78	BCP2-urbano	47.84%	28.06	0.89
urbano-CRP-PET0	94.90%	139.34	4.43	LUC1-BCP1-urbano	41.62%	24.11	0.77
urbano-LUC0	91.38%	134.42	4.28	LUC2/BP2	33.27%	10.13	0.32
urbano-LUC2	90.50%	121.45	2.98	MRX1	22.41%	5.52	0.18
urbano-CRP	90.47%	67.19	2.14	BCP1	13.96%	2.55	0.08
urbano-BCP1	87.37%	139.76	4.45	PET2/BCP1	13.41%	12.01	0.38
urbano-LUC1	86.70%	168.25	6.24			1155.37	37.52
urbano-LUC3	71.00%	45.62	1.45				
urbano-LUC0-BCP1	76.66%	37.38	1.19	Peri-urban area			
urbano- BUD1	70.93%	0.83	0.03	UC	% waterproof	Area ha	%
urbano/PET2/LUC2	61.87%	33.08	1.06	CTL1	22.72%	566.98	18.04
LUC2-urbano	63.18%	32.36	1.03	CTL3	15.43%	477.09	15.18
LUC1-urbano	59.44%	29.02	0.92	MDC3	11.20%	866.82	27.58
BCP1-urbano	58.95%	21.27	0.68	SMB1/SMB2	17.71%	52.75	1.68
CRP-LUC2	49.87%	7.94	0.25			1963.64	62.48

Most of mapping units are soil associations defined in terms of % of sealed surface, which can be easy measured. It is more difficult to define partially sealed areas where different soil typologies, such as CRP, LUC, Pet and BCP, occur in different amount. For some mapping units it was decided to indicate the presence of such soils, even if less than 25% in extent, in order to differentiate such units from units which are sealed over more than 90% of their area. These soils, regardless their limited areal extent, can in fact still support the supply of ecosystem services, and this is to be taken into account.

The following pictures show some of the most common soil mapping units within the urban fabric.



urbano-BCP1

urbano-CRP-PET0

Urbano-LUC0





LUC2/urbano

LUC1-urbano

BCP2-urbano

#### Ecosystem services of urban and peri-urban soils

Urban soils supply important ecosystem services: among the main ones, microclimate regulation, water regulation, pollution mitigation, biodiversity support, carbon storage.

In the context of action B1.3, some ESs subject to direct measurements both in the field and in the laboratory were preliminarily considered: carbon storage (CST), water regulation (WAR), and biodiversity support (BIO).

#### Carbon storage (CST)

Soil carbon stock contained (Mg ha<sup>-1</sup>) is calculated on the basis of the organic carbon (OC) content in volume% multiplied by the relative bulk density (BD - Bulk Density; Mg m-3) of the first 30 cm of soil, which represent the depth most susceptible to anthropic disturbance.

CST= CO x 0.30 x BD x 100

The values of OC stock (Mg ha<sup>-1</sup>) were analyzed in terms of land use category (Vp, urban parks and public gardens; Se, arable land; Rv, roadside green, in this case flower beds; and Br, forest), and urban soil typology.

Statistically significant differences (p<0.05) in CO % are detected among the different typologies of urban green, with the mean values for forests (3.04%) and flower beds (2.37%) significantly higher than those observed for arable lands (1.42%) and urban parks (1.81%). The following figure shows mean values, standard errors, and confidence intervals for CO stock (Mg ha<sup>-1</sup>) in the four land use types.



### Water infiltration (WAR)

In the 19 sampling sites where bulk density and soil organic carbon were measured, the topsoil saturated hydraulic conductivity was determined using a Guelph permeameter.



The box and whicker plot in the following figure shows the mean values, the standard errors and the confidence intervals for the means for Ksat (mm/h) in the different typologies of urban greens. Mean values do not differ significantly among themselves,


but the trend is in agreement with expectations based on land use and degree of soil compaction.



### Biodiversity (BIO) and biological fertility index (IBF)

The biological fertility of urban soils was evaluated through the use of a synthetic index (IBF, biological fertility index) which considers a series of biological parameters: the organic matter content, basal respiration, cumulative respiration, microbial carbon contant, the metabolic quotient and the mineralization quotient. Each of these parameters is linked to the chemical-biological processes that occur in the soil and which determine its functionality.

Fresh samples were taken for each of the sampling sites, stored at -20  $^{\circ}$  C, and then analyzed in the laboratory.

For each of the parameters, 5 ranges of values have been set, each of which has been assigned the score of the range to which it belongs; the algebraic sum of the scores for each parameter returns the biological fertility scale reported in the following Table (Benedetti et al., 2008).

Parametri			Punteggio			
utilizzati	1	2	3	4	5	
Sostanza organica	a <10	$\geq$ 1,0	> 1,5	> 2,0	> 3.0	
TOC*1.724	< 1,0	$\leq$ 1,5	$\leq$ 2,0	$\le$ 3,0	- 5,0	
Respirazione	< 5	$\geq$ 5	> 10	>15	> 20	
basale Cbas	- 5	$\leq 10$	$\leq 15$	$\leq 20$	> 20	
Respirazione	< 100	$\geq 100$	> 250	> 400	> 600	
cumulativa Ccum	100	$\leq$ 250	$\leq 400$	$\leq 600$	> 000	
Carbonio	< 100	$\geq 100$	> 200	> 300	> 100	
microbico Cmic	< 100	$\leq 200$	$\leq 300$	$\leq 400$	- 400	
Quoziente	> 0.4	< 0,4	< 0,3	< 0,2	< 0.1	
metabolico qCO <sub>2</sub>	<u> </u>	$\geq$ 0,3	$\geq$ 0,2	$\geq 0,1$	< 0,1	
Quoziente di		> 1	> 2	> 3		
mineralizzazione	< 1,0	< 2	< 3	< 4	>4	
qM	i			— · ·	ġ	
parameters used and score						
Classe di	I	п	ш	IV	V	
Fertilità	stanchezza allarme	stress preallarme	media	buona	alta	
Punteggio IBF	6	7-12	13-18	19-24	25-30	

The analysis of the biochemical parameters and the calculation of the soil fertility class did not show any differences within the different types of urban green. All 19 analyzed soils fall within the average fertility class (class III), although within this class the range is very wide and there are differences in values between the groups analyzed.

#### QBS index (Biological quality index)

A useful index for evaluating the biological quality of the soil is the Soil Biological Quality Index (QBS-ar) based on the presence of multiple groups of micro-arthropods adapted to the particular edaphic conditions of the soil (Parisi, 2001). Each group (taxa) of individuals is assigned a score (EMI, morphological echo index) based on adaptation to soil conditions, the sum of which defines the QBS-ar. The following figure shows the average QBS-ar values measured in the different types of urban green areas.





average QBS-ar values measured in flowerbed, forest, park, arable land

With the exception of urban forest, the other types do not show significantly different values. Interestingly, agricultural lands show higher QBS-ar values than urban parks and flower beds. The index is indeed very sensitive to anthropogenic disturbance, typical of green areas in urban areas.

#### Maps of ecosystem services provided by the urban soils of Carpi

In addition to the direct measurements for CST, WAR, and BIO at 19 sites, the ecosystem services of the soils were assessed both at all the 117 sampling sites and over the entire area under assessment, following the methodological approach illustrated in the report of action B1.2 "municipal scale measurement of the impacts of soil sealing and evaluation of ecosystem services". The ecosystem services considered are soil buffer capacity (BUF), microclimate regulation (CLI), current carbon stock (CST), water storage (WAS). Agricultural productivity (PRO) is added to these only in the case of the areal assessment.

The following figures show the maps of the indicators of the 5 ecosystem services calculated at the sampling sites (5 classes defined on the quantiles of the observed distributions: 0 lower value, 1 higher value). Also shown is the map of an overall indicator, the Soil Quality Index, defined as the sum of the value of the five indicators calculated for each sampling point.

In the maps, it is possible to observe clear trends that characterize, in the different units of the soil map, the different ability to provide ecosystem services, also highlighting that the soils of urban green areas provide high quality services in most cases.

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In order to provide a tool for assessing the ecosystem services of the soils that continuously covers the entire surveyed area, the analytical data available were used to estimate with a geostatistical approach the input variables required for the calculation of the indicators of the ecosystem services selected on a 100 m regular



grid. In addition to the 5 indicators estimated for urban green areas, the potential agricultural productivity (PRO) was also calculated.



Once the value of the indicators in each cell of the grid was defined, and corrected for the percentage of sealing (ISPRA, 2018), two synthetic indices of soil quality were calculated based on their ability to provide ecosystem services: the number of services

with a value greater than the 75th percentile of the observed distribution for each indicator, and the quality index calculated by adding the individual indicators.



## Public green areas and their typologies within the area surveyed in the municipality of Carpi

For the public green areas of the city of Carpi (see figure below), the carbon stock (0-30 cm, Mg ha<sup>-1</sup>) and the available water capacity (AWC, cu.m.) were calculated in quantitative terms, as shown in the following tables.





### Map of green areas of the urban area of Carpi

Green areas	Cstock	Area	Cstock	C stock/ab	CO2eq	CO2 eq /ab
C stock 0-30 cm	Mg	На	Mg/ha	Mg	Mg	Mg
Sporting green	4041	51.2	78.9	0.06	14819	0.21
Area of environmental rebalancing	1407	16.9	83.2	0.02	5158	0.07
Public green	5212	64.7	80.6	0.07	19112	0.27
School Park	1832	22.6	81.2	0.03	6719	0.09
Road green	2195	31.5	69.6	0.03	8049	0.11
Villas and surrounding parkland	379	6.4	59.4	0.01	1388	0.02
Total	15067	193.2	78.0	0.21	55246	0.78

Available water storage capacity	Area	AWC	AWC	AWC	AWC	mm/m²
	На	cu.m.	cu.m./ha	cu.m./ab	cu.m./albero	
Sporting green	51.2	15488	302.4	0.218	0.456	30.2
Area of environmental rebalancing	16.9	5324	315.0	0.075	0.157	31.5
Public green	64.7	20024	309.6	0.282	0.589	31.0
School Park	22.6	7124	315.8	0.100	0.210	31.6
Road green	31.5	8790	278.9	0.124	0.259	27.9
Villas and surrounding parkland	6.4	1934	303.3	0.027	0.057	30.3
Total	193.2	58682.0	303.7	0.826	1.726	30.4

### Guidelines

Guidelines have been drawn up (Del. 23) that allow the technical services of any municipality to evaluate ecosystem services in urban areas. The guidelines describe the procedure followed for the characterization of non-sealed soils in an urban environment, providing the references (technical and bibliographic) of the different steps. Although experienced pedologists must carry out the survey of urban soils, these guidelines allow the technical offices to plan, contract and coordinate the entire procedure.

The guidelines also describe the information and cartographic resources available for the Emilia-Romagna region and the procedure for consulting and downloading data.

#### Action B1 – Deliverables and Milestones

The main outputs of action B1 (sub-actions B1.1-B1.2-B1.3) are as follows:

- sub-action B1.1: Map of the historical evolution of land use (one for each Municipality Del. 14.1, 14.6 and 14.11);
- sub–action B1.1: Map of land take (one for each Municipality Del. 14.2, 14.7 and 14.12);
- sub–action B1.1: Map of soil sealing (one for each Municipality Del. 14.3, 14.8 and 14.13);
- sub–action B1.1: Map of not built or only partially built building areas (one for each Municipality Del. 14.4, 14.9 and 14.14);
- sub–action B1.1: Map of urban regeneration areas (one for each Municipality Del. 14.5, 14.10 and 14.15);
- sub–action B1.1: Report about land take, soil sealing, implementation state of building areas and urban regeneration areas (Del. 15, 15.1, 15.2, 15.3);
- sub–action B1.2: Maps of soil ecosystem services for the whole municipal territory on scale of 1:25,000 (one for each Municipality Del. 20.1, 20.2, 20.3)
- sub-action B1.2: Report containing the estimate of economic and environmental impacts generated by land take and soil sealing (Del. 19)
- sub-action B1.3: Guidelines (also in English) for the assessment of ecosystem services in urban areas and practical actions for their management (Del. 23),
- sub-action B1.3: Report and Map related to the case study of Carpi containing evaluation of ecosystem services (Del. 24),

The following project milestones have been reached:

- sub-action B1.1 Start of the local area study concerning land use and soil sealing dynamics – (Mil. 13);
- sub-action B1.3 Start of the soil investigation, sampling and analysis campaign for non-sealed soils related to Carpi case-study (Mil. 14)
- sub-action B1.2 Conclusion of activities to estimate the economic and environmental impacts resulting from land take and soil sealing (Mil. 21)
- sub-action B1.3 Conclusion of activity related to Carpi case-study (Mil. 22)



# ACTION B2 "DEMONSTRATION ACTIONS OF DE-SEALING THROUGH SOIL REINSTATEMENT"

Objective: To demonstrate the economic viability and technical feasibility of de-sealing actions as a measure to compensate land take, and to assess through ex ante and ex post monitoring the environmental impact of replacing the area with a green space and the possibility to improve urban resilience to climate change.

Foreseen start date: 01/07/2016 Actual start date: 01/08/2016 Foreseen end date: 31/08/2019 Actual end date: 30/09/2020 (except for the desealing interventions which are still in progress)

Action B2 is divided into the following sub-actions:

- B.2.1 De-sealing of an area in the municipality of Forlì
- B.2.2 De-sealing of an area in the municipality of Carpi
- B.2.3 De-sealing of an area in the municipality of San Lazzaro di Savena
- B.2.4 Guidelines (also in English) for the removal, management and reapplication of the top-soil (Del. 27)

The project included three de-sealing actions in the municipalities of Forlì, Carpi and San Lazzaro di Savena, with removal of sealed soil and replacement with a green area through soil and topsoil reinstatement. The areas to be de-sealed in Carpi and Forlì were public car parks located in the city centre, whereas the one in San Lazzaro di Savena was a small suburban industrial area where there were municipal warehouses, buildings and paved service areas used for the separate collection of waste.

The costs of the de-sealing actions are not funded under SOS4LIFE project, but are paid by the Municipalities or by private entities.

The action was completed with regard to the initial soil and microclimatic characterization, the creation of demonstration plots and subsequent monitoring, and the drafting of the guidelines. After being designed, the demonstrative desealing interventions have begun in Forlì and San Lazzaro di Savena (environmental characterization, reclamation and demolition have been carried out), but not yet in Carpi and will be completed in the After Life period.

# Sub action B.2.1 – B.2.2 – B.2.3 - Demonstrative plots – Pedological and microclimatic activities

In each of the 3 intervention areas, the Emilia-Romagna region and CNR has carried out pedological and microclimatic monitoring activities in collaboration with the Municipalities, in order to assess both ex ante and ex post environmental conditions in the areas.

For the monitoring activities, a raised plot (bed) has been realized to place soil samples taken from the intervention areas and samples of topsoil taken from the area where the soil to be reinstated will be harvested. The costs for the preparation of the plots were foreseen under the project.

An information totem has been positioned next to each demonstration plot to illustrate SOS4LIFE project objectives, and describe de-sealing and monitoring actions.

Initially, to coordinate the activities to be carried out in the 3 areas, the Working group met and defined the technical specifications of the 3 demonstration plots – one for each intervention area – to be used also for monitoring purposes.

During the meeting, information about the systems to be provided in the plots were shared – irrigation and electric systems. The group also discussed about the features of the information totem and the position of the plots in the intervention areas.

Afterwards, each Municipality reported to the CNR and the Region to realise and start the demonstration plots for the purpose of monitoring.

First of all, samples of topsoil to be used for the restoration of green spaces were taken and analysed, as well as samples of technosoil harvested in the intervention area. They are the same samples to be placed in the raised demo plots.

The activity of soil sampling and analysis is described in a dedicated technical report (Del. 7 – Midterm Report). Please refer to it for further details.



2017 - Demonstrative plots in San Lazzaro di Savena, Carpi and Forlì

Every plot contains two flowerbeds of 1sq.m each with topsoil and technosoil. The plants planted in the plots are Elaeagnus x ebbingei (oleaster) and Viburnum tinus L. (laurustinus). They were selected because they are easy to manage for experimental monitoring and available in plant nurseries.



Viburnum tinus L (left) e Eleagnus ebbingei L. (right)

Each plot was equipped with an irrigation system.

In general, irrigation was deactivated from October to March-April and reactivated in spring (10 minutes a day for two days a week) and reset for the summer to 5 minutes a day.

A HOBO Onset Station mod. H20-USB with Decagon 10HS (cu.m. / cu.m.) soil moisture and soil temperature sensors Onset TMC6-HD (° C) was placed near the  $_{\rm 46}$ 



plots, with one sensor of each type positioned in the central area of the plot, free from plants, about 15 cm deep. The sensors have been programmed for data logging at 30-minute intervals and with manual data download at the time of monitoring visits.

The soils of the two plots at each site were monitored regularly during the project (Humidity, Temperature, Biological Quality of the Soil: Qbs-ar Index).

In addition to soil monitoring, plant growth was also monitored. The growth of the plants was monitored regularly from spring to late autumn, from the beginning of the plant. The following measurements were made:

- a. Morphometric analysis: average height (on three main branches) and diameter at the collar (under any bifurcations or of the largest jet).
- b. Measurement of leaf gas exchanges (photosynthesis, transpiration, stomatal conductance) with the CIRAS-2 gas analyzer (Portable Photosynthesis System) during the growing season.

Have been installed a total of five Davis weather stations mod. Vantage PRO PLUS equipped with solar panel and buffer battery: one in the project area and one in the neighboring green area (except in San Lazzaro di Savena). A Modem with hourly transmission of meteorological data was also installed in each weather station. The standard meteorological data acquisition interval is 30 minutes and they recorded data relating to:

- Air temperature (° C)
- Air humidity (%)
- Precipitation (mm)
- Wind speed (m / s)
- Wind direction (degrees)
- Global solar radiation (W / m ^ 2)
- UVB solar radiation (UV-Index)



Meteorological stations installed in Carpi

Forlì – Piazza G. da Montefeltro

Forlì - Piazza Dante



Meteorological stations installed in Forlì

San Lazzaro di Savena - Via Speranza



Meteorological station installed in San Lazzaro di Savena

A microclimatic model was created for each of the three sites subject to desealing, using the modeling software ENVI-met (http://www.envi-met.com/). The model was initialized by entering the orography of the current state (Ex-ante) and the meteorological data for the day that recorded the maximum temperature for the year 2015.





#### Envi-met model for Forlì

Since the installation of the plots and meteorological stations, plot monitoring missions have been carried out quite regularly (Table 4), with detection of the ecophysiological parameters generally from spring (April-May) to September / October, monthly control of the batteries buffer and data download of the meteorological station and soil moisture sensors.

Forlì	Carpi	San Lazzaro
17/05/2017 20/06/2017 25/07/2017 22/08/2017 20/09/2017 20/12/2017 14/02/2018 15/03/2018 17/04/2018 07/06/2018 26/07/2018 26/07/2018 24/09/2018 31/10/2018	15/06/2017 13/07/2017 10/08/2017 14/09/2017 18/12/2017 13/02/2018 14/03/2018 10/04/2018 08/05/2018 05/06/2018 24/07/2018 04/09/2018	19/07/2017 22/08/2017 26/09/2017 18/12/2017 13/02/2018 14/03/2018 10/04/2018 09/05/2018 06/06/2018 25/07/2018 05/09/2018 31/10/2018
04/12/2018 18/12/2018	29/11/2018 18/12/2018	29/11/2018 04/12/2018 18/12/2018
10/04/2019 21/05/2019 13/06/2019 17/07/2019 4/09/2019 30/10/2019 20/11/2019	11/04/2019 16/05/2019 17/06/2019 18/07/2019 3/09/2019 30/10/2019 20/11/2019	10/04/2019 21/05/2019 14/06/2019 19/07/2019 4/09/2019 30/10/2019 20/11/2019
15/01/2020 [Covid-19] 15/06/2020	15/01/2020 [Covid-19] 15/06/2020	15/01/2020 [Covid-19] 15/06/2020

List of missions carried out in the demonstration sites

A first report of the soil and climate monitoring activities is contained in the Del. 26. The final report on pedological and climatic monitoring activities (Del. 36) describes in detail the evolution of soil characteristics and plant growth in the plots during the project. The data acquired by the meteorological control units are also analyzed and the "ex post" climatic simulations (always carried out with ENVI-met software) are presented. These climatic simulations take into account the layout of the areas at the end of the planned intervention.



ENVI-met climate simulation - San Lazzaro di Savena (before and after)

## Sub action B.2.1 – Desealing intervention in Forlì (Report Del. 37)

The desealing intervention in Forlì is located in Piazza Guido da Montefeltro: the area of intervention has a surface of about 6.500 square meters and it is located in the south-west quadrant of the historical center of the city, not far from Piazza Saffi (the main square). Piazza G. da Montefeltro, whose surface is almost completely sealed, is 50% used as public parking and 50% occupied by a raised square with additional car parking spaces under its surface. The whole parking area is in front of the San Domenico Museums, headquarter of the Civic Art Gallery and of important temporary exhibitions which attract many visitors to Forlì every year.



Forlì – Intervention area (Piazza Guido da Montefeltro – As built plan, Google maps)

The green recovery of Piazza G. da Montefeltro also aims to enhance the museum complex with an arrangement of outdoor spaces, due to the historical context.



The desealing intervention is part of a wider strategy aimed to increase the endowment of green areas to serve the historic center and to improve the resilience to climate change of this part of the city.

The first part of the intervention (which is a demonstrative action in the project SOS4LIFE) involves the demolition and removal of the paving and of the structures of the current parking area and the restoration of green areas through the filling of soil and topsoil and the creation of lawn areas with shrubs and trees. The area will be equipped with urban furnishings and public lighting. A temporary bus parking for will also be created on the front of Via Andrelini for the exhibition visitors.



Forlì – Intervention area (Piazza Guido da Montefeltro – As built plan, Google maps)





As Built plan/Project Plan

The removal of sealed surfaces ("de-sealing") related to the first part, will increase the permeable surface from the current 6% to over 70%. The green areas will increase 4,500 square meters.

The technical-economic framework of the intervention foresees a total cost of € 1,000,000.00 (about 154 €/sqm including decontamination costs).

The intervention is co-financed with state and municipal resources and with the contribution of the "Fondazione Cassa dei Risparmi" of Forlì" (Banking foundation).

The project of the "Garden of Museums", presented at the 2017 edition of "Urban Promo" in Milan (an important national urban planning review), received the 2018 Urban Planning Award assigned by the Magazine



Urban Planning Award 2018



Project Rendering



Preliminary environmental analyses were carried out in April 2018, which identified potential contamination by hydrocarbons. The results of the analysis were transmitted to ARPAE (Regional Agency for Environmental Protection of Emilia-Romagna) and the required procedure for the removal started.

The final project of the intervention was approved by the Municipality of Forlì on 29th of May, 2018.

The Environmental Characterization Plan was approved by ARPAE on 27th of September 2018, which provided for further investigations and samplings, performed in February 2019 (a buried tank found in the area was removed at the same time).



Preliminary environmental surveys - Soil sampling and analysis - April 2018



Environmental characterization - Surveys and soil sampling - February 2019

As a result of the Environmental characterization, a decontamination project was prepared and approved by ARPAE on the 1<sup>st</sup> of October 2019.

The executive project of the "Garden of Museums" was approved by corporate decision no.  $1179 - 15^{\text{th}}$  of May 2020, and the procurement process has been started on  $28^{\text{th}}$  of May 2020. The work has been contracted on the  $13^{\text{th}}$  of August, 2020 (corporate decision n. 1953) and the contract for the de – sealing intervention has been subscribed on the  $1^{\text{st}}$  of December 2020: a preliminary activity of Explosive Remnants of War (ERW) reconnaissance has been managed in November 2020.



Demolition work (4 december 2020)



Demolition work (4 january 2021)



Demolition work (21 january 2021)

Demolitions have been starting from the 2<sup>nd</sup> of December 2020: all paved surfaces have been removed with the exception of the central runway which allows access to vehicles not only for the demolitions but also for the following activity of filling and topsoil placement. The central runway will be progressively demolished, according to the filling activity which has been starting since April 2021.





Soil carry-over activities, work in in progress (15 April 2021)

The topsoil will be placed in the final phase of filling (it comes from a suburban area located in Via Mangella, Forlì, a site designated as a new road). The intervention will be tested for the application of the Guidelines for the removal, management and reapplication of topsoil (Del. 27). The intervention is going to be completed on June/July 2021.



Circular economy of the soil

The delay of work completion is mainly due to the following reasons:

- the state contribution co-financing the intervention has been available only in 2019;
- the execution of the required procedure of the Environmental Characterization and the preliminary activity of Explosive Remnants of War (ERW) reconnaissance.

### Sub action B.2.2 – Desealing intervention in Carpi Report Del. 37

The de-sealing intervention of the Municipality of Carpi has been originally planned in Piazzale San Rocco, an area located in the historical center of the city (Bocciofila Area): this is a paved parking area useful for the residents of the historic center and the visitors of the nearby Auditorium San Rocco.

The de-sealing intervention planned a green recovery of 2.000 square meters area, with an increasing of permeable surface up to 66 % (the initial value was 1%).



Piazzale San Rocco - ex Bocciofila area (Google maps)

On March 24th 2014, the City Council with Resolution No. 44 approved the Preliminary Project of "Construction and management of a one-level underground parking in Piazzale della Meridiana and green recovery of a portion of the block between Via San Rocco, Giordano Bruno and Cesare Battisti, including the management of the other paid parking areas of the municipality of Carpi and the Parking in Piazzale Maestri del Lavoro". The Resolution envisaged the implementation of the intervention by outsourcing the construction and management (so, the project for the construction of the new underground parking lot also included the de-sealing intervention of Piazzale San Rocco)

The City Council, on 15<sup>th</sup> of Decembre 2015, made some non-substantial changes to the project (Resolution n. 212).



The call for tenders was published on January 18<sup>th</sup> 2016 and the deadline, including subsequent extensions, was fixed on October 28th, 2016: no offers were received. The failure of the possibility of realizing the underground parking (a replacement for the parking area of the de-sealing intervention) has not allowed to continue the desealing intervention initially planned.

Moreover, failing the realization of the intervention by a private implementer, the City had to provide for the direct financing of the work and finding the necessary sums in the municipal budget.

The Municipality of Carpi had to identify another area for the de-sealing demonstration intervention: so, it was a main road, located in Historical centre, 800 meters long and almost paved.

The goal of this intervention is implementing the existing green infrastructure (tree row) to contrast the effects of climate change (improving the microclimate by reducing the paved surfaces and favoring the infiltration of water thanks to rain gardens and draining pavements). Once implemented, this intervention will allow to mitigate the effect of Urban Heat Island and more intense weather events.

A green recovery intervention (topsoil filling and shrubs planting) will affect the whole strip underneath the trees (1.670 sqm.), while the cycle path will be repaved with draining materials: the permeable surface of the intervention area will be increased from 4% to 46%. The project has received the authorization of the "Soprintendenza Archeologica Belle Arti e Paesaggio" on January 4th, 2021.

The Municipality of Carpi expects to approve the executive project and to carry out the tender procedures by summer 2021: the total cost of the intervention has been estabilished at  $\in$  510,000.00. (The expected date for the work starting is October 2021 and the work ending is set for Summer 2022).



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#### Viale Carducci (Google maps)



Viale Carducci Current situation and Project setting



On the left: Layout of the Current Situation – On the right: Layout of the Project setting





Since the intervention in the Ex Bocciofila area has not been implemented and the relocation in another area (Viale Carducci) has been temporarily postponed, the Municipality of Carpi has not been able to use the sum allocated in the budget for the external entrusting of the environmental characterization.

#### Sub action B.2.3 – Desealing intervention in San Lazzaro di Savena Report Del. 37

The de-sealing intervention of the Municipality of San Lazzaro di Savena is located in a disused handicraft area located in the north-west part of the municipal territory and bordering the area of the Savena River Park (Via Speranza, on the border with the Municipality of Bologna).



San Lazzaro di Savena - Location of the area of intervention, near to the Savena River

The City Urban Plan has identified the craft area of Via Caselle - Speranza, near to the Savena river, as a regeneration site. The area included city-owned properties used as warehouses and the Waste Separation Area: the Municipality aimed to reduce the sealed surfaces compared to the existing ones and to expand the area of the Fluvial Park along Savena, so the notice for saling of its properties has been published on October 2015 and Alce Nero S.p.a has been resulted as the contractor.

The Urban Plan Project has been presented by Alce Nero on the 30<sup>th</sup> of November, 2016: it was adopted by City Council resolution no. 20 of the 17<sup>th</sup> of May 2018 and finally approved by City Council resolution no. 54 of 20<sup>th</sup> of December 2018. The related Urban Convention, which rules the implementation of the intervention, has been signed on 21<sup>st</sup> of May, 2019. The environmental characterization and remediation works were performed.



San Lazzaro di Savena - Preliminary characterization activities (2018)



The urban plans required a mandatory "permission to landscape" related to the position of the area and the River: it has been issued on the 13th of September 2018. The project foresees the green recovery of the most part of the sealed surfaces: the Alce Nero headquarters will be surrounded with an important green area in continuity with the River Park (the reconstruction of some buildings with tertiary functions is also foreseen).



Riverfront cycle and pedestrian path rendering

Permeability	Surface	Exsisting	Permeabil	Permeable	Permeability	Desealing
and	sqm.	permeable surface sqm	ity index (exsisting)	surface of project sqm.	index (project) %	Sqm.
desealing			%			
"Alce Nero" intervention area	12.000	2.316	19,3	7.834	65,3	
Total territorial area (Urban Development Plan)	35.925	19.223	53,5	24.070	67,0	4.847

Synthesis of surfaces, with highlighting of % permeability and sqm. by desealing

As a result of demolition and desealing interventions there will be a significant increase of permeable surfaces from 24% to 65% (+ 6.770 sqm).

A parking lot will be realize with draining paving and bicycle paths that will connect with the routes along the river Park.

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Area of intervention before demolition and desealing works (left) and project (right)



Layout of intervention before demolition and desealing works





Project Layout

The implementation of the intervention has been starting from 11<sup>th</sup> of July 2019 to 9<sup>th</sup> of June 2020: all pre-existing buildings were demolished and all paved surfaces was removed. The activity more properly defined as de-sealing is, therefore, concluded. It remains to carry out the green restoration of part of the sealed surfaces.



Demolition works



Area of intervention after demolition works

Characterization and remediation activities had been carried out prior to the demolition phase. However, during the demolition phase, it was necessary to remove an underground cistern founded during digging operations.

At the end of the demolition phase and the removal of the sealed surfaces, the ground level was levelled.

The area has been prepared for the continuation of the intervention that included new buildings and urbanization works and green recovery.

A second "permission to landscape" has been presented on 20<sup>th</sup> of July, 2020: it has been issued on the 20<sup>th</sup> of October 2020.

On 18<sup>th</sup> of November 2020 the request for a Building Permit for urbanization works has been submitted and in the same date the request for the construction of the building complex of the company "Alce Nero" has been presented.

The preliminary phase of both requests has not been completed yet. Integrations have been requested by the municipal offices and must be provided.

The works related to the urbanization works in charge of the private implementer (green recovery included) will start after the issuing of the relevant building permit. It is estimated that the works can be carried out in the period 2022-2023.



The implementation of the interventions (new building and urbanization works) is governed by the urban planning agreement: compared with the time schedule established by the agreement, there have been delays in the deadlines due to the COVID emergency, for which the extensions of the law have intervened as per Law no. 27/2020 converting Legislative Decree no. 18/2020 "Cura Italia", art. 103 and Law no. 120/2020 converting Legislative Decree no. 76/20 "Simplification Decree", art. 10.

During the preliminary phase of the urban planning project presented by the private developer, some problems emerged and some needs changed. This has led to various reworkings of the project before reaching the definition of the urban structure that has, finally, allowed to approve the PUA, to sign the related urban convention and to transfer the municipal area to the developer.

The critical elements that led to the time deviation are:

- a contrary opinion of the *"Soprintendenza Archeologica, Belle Arti e Paesaggio"* (due to landscape protection of the river);
- the Risk analysis Approval procedure and the following environmental remediation;
- the choice of the renewed top management of the company to entrust the Project to a new group of architects.

#### Sub-actions B.2.1-B.2.2-B.2.3 – Final considerations

The main issues related to the de-sealing demonstration interventions are:

- the necessary preliminary environmental investigation and subsequent environmental characterization;
- the costs variation (based on the extent of the intervention, the buildings and pavements demolition, the decontamination);
- the necessary public environmental authorities notes related to the land scape preservation and to the environmental investigation;
- the application of the Guidelines for the removal, management and reapplication of topsoil (Del. 27) requires the provision in the specifications of the correct methods for taking, storing and laying the soil.

The 3 partner municipalities, as indicated in the After Life Plan, are committed to completing the implementation of the interventions.

Three videos (one for each partner municipalities) related to the whole desealing process will be available.

At the end of the whole process, it will be possible to quantify the real cost, and the impact of the new green surfaces.

# Sub action B.2.4 – Guidelines for the removal, management and re-application of topsoil

### Responsible: Emilia – Romagna Region

#### **Project Framework and Timeline**

The sub-action has identified the critical regulatory issues in the field of desealing activities and suggested solutions for management, conservation and reuse of soil with the aim to realize "Guidelines for the removal, management and reapplication of topsoil".

The activity has been implementing for ten months (from January till October 2018): it's also available an English version and a new graphic model has been redefined.

The part related to the arrangement of the topsoil in the site of application and the cost evaluation has been implemented during early 2019, thanks to the contribution of the Emilia – Romagna Region Office *"Environmental Assessments and Promotion of Sustainable Development"*.

#### Descriptions

The guidelines are intended for Authorities with land use management tasks and for sector technicians: desealing, an urban planning operation that the new Emilia-Romagna regional law on the regulation of land use (LR 24/2017) promotes as a measure of compensation to land take, is subject to the application of environmental regulations on the management of earth and excavated rocks (Presidential Decree 120/2017) and Legislative Decree 152/06.

The purpose of the guidelines is to provide useful operational indications so that the soils excavated in the implementation of urban transformation interventions are not wasted, but can be reused on the basis of their intrinsic qualities both in situ and in areas intended for urban regeneration interventions, or recovery of agricultural areas to restore part of the ecosystem services (and in particular the topsoil).

The Guidelines are composed of six chapters plus two annexes: after a brief introduction on the purpose of the publication and its normative value, the first chapter is about soils of the Emilia - Romagna Region and its meaning (related to its environmental compartment).

Chapter 2 deals with the regulations related to desealing actions (especially the evaluation of the soil in the various types of construction site and its intrinsic quality essential for proper reuse).

Chapter 3 concerns web platforms for the management of topsoil and Chapter 4 is about site methods for the best management of soils in order to maintain intact their physical properties. Chapters 5 and 6 aim to support technicians using maps as a reference for defining the intrinsic quality of soils.



The annexes are a site vademecum for the "Soil Management Plan" and a standard format for a soil report in case the project scope includes the possibility of an "in situ" characterization of the topsoil.

The guidelines are accompanied by a wide range of images and tables.

#### Working methods

An outline index of specific insights and the partner responsible for each topic has been defined at the first meeting, according to their skills, experiences and inclinations. During the following meetings all the contents have been collectively discussed (even the participation to events and the content of the abstracts): so, a professional beneficiation has been led to the whole working group (the Guidelines have been presented to the Executives of the Emilia - Romagna Region Urban Planning and Geological Seismic and Soil Services).

The Guidelines have been published on the SOS4LIFE website and on the Emilia – Romagna Region web site at the following page

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2018	Date of Meetings		
February	5, 21		
March	13, 27		
April	-		
Мау	8, 22		
June	11, 26		
July	18		
August	14		
September	13, 27		
October	15, 25		
November	13*		
December			

Working group meetings B.2.4.

#### Municipal approval of the Guidelines (Mil. 29)

The Guidelines have been approved and implemented by the 3 partner municipalities with the following municipal resolutions:

- Municipality of Forlì Municipal Council Resolution n.196 (13<sup>th</sup> of May,2019);
- Municipality of Carpi Municipal Council Resolution n. 88 (14<sup>th</sup> of May 2019);
- Municipality of San Lazzaro di Savena Municipal Council Resolution n.99 (16<sup>th</sup> of May, 2019).

The Guidelines for the reuse of topsoil were created as a tool to be combined with desealing operations in an urban area. But they have the prerogative of being able to be used as a manual in any type of excavation operation and for this reason they have been adopted in contexts other than urban planning. They are used in the Environmental Impact Assessments where they are now systematically inserted as a reference tool to manage the soil "in situ" and "ex situ", as they have been included in the technical notes for the implementation of the EAPs (Extractive Activities Plan) for quarry restoration actions, so far in particular as regards the Municipalities of Rimini and Piacenza.

- Valsat (Environmental and territorial sustainability assessment) and Technical Notes for the implementation of Extractive Activities Plan of the Municipality of Rimini – Council Deliberation n. 96 (24<sup>th</sup> of January, 2020);
- Extractive Activities Plan Technical Notes of the Municipality of Piacenza Council Deliberation n. 1489 (16<sup>th</sup> of October, 2020).

### **Dissemination activities**

The guidelines were presented at the following public events:

- 1. "Land take: dynamics, impacts and strategies to counter it", Forlì, 5<sup>th</sup> of October 2018;
- 2. "Decontamination under the Circular Economy", Rimini, 8<sup>th</sup> of November 2018;
- 3. World Forum on Urban Forests, Mantova, 29<sup>th</sup> of November 2018;
- 4. "Green strategies for the cities of the future", Bologna, 10<sup>th</sup> May 2019;
- 5. "The management of excavated soil and rocks: recent regulatory provisions", Ferrara, 18<sup>th</sup> September 2019;
- 6. "Counteract land take: experiences, norms and guidelines", Bologna, 22th November 2019;
- 7. Networking Meeting with Progireg (Interreg project), video meeting, 18<sup>th</sup> September 2020;
- 8. SOS4LIFE Final Event, Webinar, 23<sup>th</sup> September 2020;
- 9. Networking Meeting with Soil4Life project, video meeting, 24<sup>th</sup> September 2020;
- 10. Higher Training School on Remediation of Contaminated Sites "Regeneration" section, Webinar, 14<sup>th</sup> October 2020.

The Guidelines have also been included among the best practices in the ISPRA 2019 Report on land take.

In August 2021 the guidelines will be presented at Eurosoil 2021 (which replaces the 2020 edition postponed due to COVID).





### Action B2 – Deliverables and Milestones

The main outputs of action B2 (sub-actions B2.1-B2.2-B2.3-B2.4) are as follows:

- sub-action B2.1, B2.2, B2.3: Report with the chemical-physical characterization of the substrates used for the experimentation - techno soil and topsoil (Del. 7)
- sub–action B2.1, B2.2, B2.3: Certifications of commencement of works, one for each de-sealing site (Del. 22) - <u>The certification refers only to San Lazzaro di</u> <u>Savena and Forlì. Carpi's intervention has not yet begun.</u>
- sub–action B2.1, B2.2, B2.3: Evaluation report of the soil and eco-physiological conditions in the 3 Municipalities: at the end of the 1st year and at the end of the 2nd year of Monitoring (Del. 26)
- sub–action B2.4: Guidelines (also in English) for the removal, management and re-application of the top-soil (Del. 27)
- sub–action B2.1, B2.2, B2.3: Evaluation report of physiological well-being index and eco-systemic services of the soils of the intervention areas ex ante / ex post in the 3 Municipalities (Del. 36)
- sub–action B2.1, B2.2, B2.3: Final reports on the execution of the intervention, one for each de-sealing site (Del. 37).

The following project milestones have been reached:

- sub-action B2.1, B2.2, B2.3 Ex ante microclimatic characterization in the 3 Municipalities (Mil. 17);
- sub-action B2.3 San Lazzaro di Savena Approval of the urban implementation plan relating to the area subject to the desealing intervention and release of the authorization;
- sub-action B2.1 Forlì-Completion of the demolition phase and removal of sealed surfaces (Mil. 25) - This phase was completed after the end of the project (in April 2021).
- sub-action B2.4: Forlì, Carpi and San Lazzaro di Savena municipal resolution approving the guidelines (Mil. 29);

The following project milestones have not been reached:

- sub-action B2.2 Carpi, award of the contract for the desealing works (Mil. 15); as previously described, the desealing works in Carpi have not yet begun
- sub-action B2.1 Forlì Completion of desealing works (Mil. 31) desealing activities have been completed but the restoration to green has yet to be carried out.
- sub-action B2.2 Carpi Completion of desealing works (Mil. 32)
- sub-action B2.3 San Lazzaro di Savena Completion of desealing works (Mil. 34) - <u>desealing activities have been completed but the restoration to green has</u> yet to be carried out.

### ACTION B3 "RULES AND TOOLS TO LIMIT, MITIGATE AND COMPENSATE LAND TAKE AND PROMOTE URBAN REGENERATION"

Objective: to adopt urban planning/regulatory tools to implement no net land take and promote urban regeneration.

Coordination: Municipality of Forlì Foreseen start date: 01/11/2016 Actual start date: 01/03/2017 Foreseen end date: 31/08/2019 Actual end date: 30/09/2020

Action B3 is divided into the following sub-actions:

#### Sub-action B.3.1 – management of "plan residual developable land"

Coordination: Municipality of San Lazzaro Working group meeting: 28/09/2017

Outcome of the activity has been the realization of Guidelines for the revision of residual plans (urban planning forecasts that have not been implemented yet). The territory of the Municipality of San Lazzaro di Savena was used as a reference in order to examine the unimplemented urban forecasts and to verify the possibility of reducing or transferring them within the main "urban core" to reduce land take and sprawl and promote a more compact city.

The Responsible of the Action, Municipality of San Lazzaro di Savena, externally entrusted two professional assignments: a technical support assignment, which was entrusted to arch. Carla Ferrari (expert in urban planning) and an assignment for the evaluation of the legal aspects related to the revision of the not implemented building forecasts, which was entrusted to the lawyer Lorenzo Minganti. The activity has been managed with a focus working group with the participation of the project partners.

Four meetings happened:

- San Lazzaro di Savena, 20<sup>th</sup> of April 2018;
- San Lazzaro di Savena, 18<sup>th</sup> of December 2018;
- Forlì, 24<sup>th</sup> of January 2019;
- San Lazzaro di Savena, 2<sup>nd</sup> of December, 2019.



#### Methods

The activity has been developed with aim of defining and fully describing the results of the analysis of the residual building forecasts contained in the urban planning instruments and the related revisioning procedure.

In the evaluation of the existing building forecasts, reference was the urban regional legislation of Emilia-Romagna, considering that the cases examined concern urban planning instruments drawn up on the basis of that legislation. This does not invalidate the method, which can be applied to other territories, declining according to the provisions of the various urban planning instruments and regional regulations of reference.

The working group defined the meaning of "plan residue" and the following categories (among the potentially urbanized areas):

- Potentially areas manage by direct intervention;
- Vacant lots inside the urbanized territory, with buildability estabilished by urban tools;
- Vacant lots with buildability established by implementation urban planning instruments, inside and outside Urbanized territory.
- areas whose implementation is subject to the submission of "implementation urban plans" (presented and not approved yet, or not agreed yet);
- planned areas that have not been implemented.

#### Analysis of the types of planned areas

**1a)** From the intersection of the aerial photos with the planning and with the cadastral map, a reconnaissance of the undeveloped areas in the Urbanized Territory was made. About 100 areas have been identified that include various types of free areas. Among these undeveloped areas 12 vacant lots with building potential have been identified and selected. These lots are configured as plan residues and occupy a total land area of about 34,000 square meters.



Analysis of undeveloped lots




Lots with building potential

However, it cannot be assumed that the entire surface of the 12 lots can be preserved from being used for building purposes.

It will have to be verified, on a case-by-case basis, if there are any "acquired rights" that prevent the elimination of the building provisions.

It is also possible that the negotiation to be started to prevent the lots from being built, will result in the transfer of the building potential to other free areas, obtaining a good result in terms of increasing the green equipment of the urbanized area or improving the conditions of permeability, but with modest results in terms of reduction of land take.

It is therefore a surface that can only theoretically be preserved from construction.

**1b)** Free building lots within the perimeter of urban development plans approved and agreed (within and outside the urbanized territory), not implemented or in the process of being implemented, were considered as possible residues of the plan.

Lots still free from construction but still buildingable, in urban development plans, not implemented or in the process of being implemented, can be considered as residuals of the plan when the expiry terms of the urban planning agreement are reached and the Municipality can therefore, justifiably, allocate non-built areas for use other than that provided for in the urban plan.

It is believed that, during the validity of the urban planning agreement, it is very difficult for these lots to be preserved from being used for building purposes considering that:

• for the planned areas under implementation, these are areas within which the urbanization works and public parks have been carried out, the costs of which are recharged on the value of the individual lots,

• for planned areas not fully implemented, since they are in any case approved and affiliated urban development areas, there may still be costs for private operators, more contained, possibly to be compensated.

It cannot be ruled out starting negotiations with private operators, but the outcome may consist in the transfer of the building potential to other areas outside the urbanized area, without reducing land take.

2) It was carried out a survey of the

- PUA (in implementation of PRG or POC) submitted but not approved,
- PUA (in implementation of PRG or POC) approved but not agreed.

subordinated, in order to be implemented, to the completion of the "implementation" planning process.

These areas would constitute plan residues only if the PUAs were approved and contracted.

3) The planned areas, which have not been implemented, are divided into:

3a) Areas of possible urbanization of the PSC (Municipal Structural Plan) that have not been implemented with a POC (Municipal Operational Plan);

3b) Areas of POC (in force) for which the PUA (Urban Development Plans) has not been presented (case not present in San Lazzaro),

3c) Areas of POC (expired) for which the PUA has not been presented.

The above areas would constitute potential residues of the plan if they were confirmed by urban planning and if they completed the process up to the agreement of the PUA.

#### What can be done for the various types of built-up areas?

With reference to building areas subject to direct intervention (case 1) and to planned areas with subordinate implementation (case 2), the following possible urban planning actions can be identified:

- confirm the building potential;
- reduce the building potential;
- reset the building potential;
- transfer the building potential to other areas.

Each Municipality will have to evaluate, case by case, what action to take, also in order to verify the possible consequences from a juridical-legal point of view.

With reference to the planned areas that have not been implemented (case 3), each Municipality will have to assess, case by case, the possible consequences under the juridical-legal profile, if and how these areas can be called into question, as part of a new urban planning tool:

- eliminating them and restoring the original agricultural use of the land,
- reducing the size of the area,
- transferring the building potential to other areas.
- In summary, the survey of free building lots with direct intervention identified:
- very few free building lots in the Urbanized Territory,
- a few vacant lots in the planned areas (with Urban Development Plan) currently being implemented, whose buildability is however confirmed by urban planning,



even when dealing with dated Urban Development Plans in which the urbanization works have already been completed;

 almost all of the lots included in planned areas being implemented by the POC (Municipal Operational Plan), slowed down by the economic crisis, which can be built up are confirmed, since these are Urban Development Plans in the process of being implemented, legitimately within the terms of the relative agreements.

#### **Revision of the perimeter of the urbanized territory**

In consideration of the modest outcome deriving from the recognition of the undeveloped lots (a few lots that can be classified as "plan residues"), it was deemed necessary to verify what other actions can be implemented, to contain the land take, using, as a tool, urban planning.

One of the possible actions is represented by the revision of the perimeter of the urbanized territory.



Perimeter of the urbanized territory (San Lazzaro di Savena)

The revision of the Urbanized Territory can make it possible to contain land take as governed by Regional Law 24/2017.

Regional Law 24/2017, which acknowledges the goal of "no net land take" by 2050, establishes a limit on land take by 2050 equal to 3% of the surface of the urbanized territory at the date of entry into force of the same law (or to 01/01/2018). The perimeter of the urbanized area, made in compliance with the law, but applying some criteria, can allow to limit its extension and therefore to limit the amount of land take.

Assuming the objective indicated in Action B3.1, to reduce urban fragmentation and sprawl and promote the "compact city", it is believed that, for the identification of

the Urbanized Territory, the only connotation of "building with continuity" does not is sufficient and that the territorial areas that do not have the conditions to be considered urban places in which a relationship life takes place, should not be considered as an Urbanized Territory.

The 25 territorial areas, classified by the Municipal Structural Plan of San Lazzaro di Savena as Urbanized Territory, were analyzed, including the chief town, verifying:

- if they are, at least, classifiable as inhabited centers according to the Traffic Laws (that is, if they respect the condition of a compact built environment with more than 25 buildings);
- if they have the minimum requirements to be considered "urban" places in which a relationship life takes place, finding, or not, the presence of territorial equipment and in particular of school equipment, religious equipment, sports equipment, public and school transport, utility facilities (police forces, pharmacies, post offices, banks, etc.), food businesses, bars and restaurants.



Analysis of the 25 areas classified as urbanized territory

The in-depth analysis carried out showed that few areas defined as Urbanized Territory have the requirements listed above.

On the basis of the verifications carried out, with respect to the 25 areas classified as Urbanized Territory, was proposed the confirmation of 9 territorial areas and the re-classification of 16 territorial areas as areas built in rural territory, excluding them from the perimeter of the Urbanized Territory.





With a dashed line are the areas for which the exclusion from the urbanized territory is proposed

The outcome of the revision of the urbanized territory can be very significant in terms of containment of the land take (also because the areas considered part of the urbanized territory may favor expectations of further expansions).

In the case study of San Lazzaro di Savena, comparing the surface of the urbanized territory provided for by the current Municipal Structural Plan equal to approximately 7,500,000 square meters, with the surface of the urbanized territory as a result of the processing carried out, equal to approximately 6,000,000 square meters, a reduction of the calculation base of 3% of approximately 1,500,000 square meters is obtained with a saving of approximately 45,000 square meters of land that is preserved by the building.

In this case it is an effective saving since 3% is not calculated on the territorial surface not considered as part of the urbanized territory.

#### Strategies for the widespread recovery of the existing building stock

Another of the possible actions that can be put in place, to contain land take, using urban planning as a tool, is represented by the possibility of adopting strategies for the widespread recovery of the existing building stock.

The goal of promoting strategies for the widespread recovery of the existing building stock stems from the need to decline the theme of urban regeneration, now assumed as a paradigm of urban planning, at the scale of small urban settlements. In these settlements the opportunities to promote significant urban regeneration interventions are limited, while there is a widespread inadequacy of the existing buildings.

Deepening the knowledge of the existing building heritage can allow to define strategies for its widespread recovery (which make interventions more convenient) which translate into the definition of strategies for urban planning, aimed at making

the existing building safer against risk seismic, more energy efficient, safer against hydraulic risk, resilient to meteoric events, to face and contrast climate change.

The urban settlement of Idice, a fraction of the Municipality of San Lazzaro di Savena, was selected to carry out the aforementioned study.

A field analysis was carried out which allowed to characterize the existing building stock, collecting and representing useful / indispensable information for developing the seismic, hydraulic and energy aspects in the new general urban planning tool.

#### Seismic risk of urban areas

A map of the seismic risk of urban areas was built, with homogeneous areas for seismic risk, to recognize the most critical situations that require measures to improve seismic safety.

The analysis showed that almost all the buildings in the urban settlement of Idice are not adequate to the current seismic legislation (as they were mainly built before its entry into force), in the face of a territory that is susceptible to local amplification of the seismic motion.

Among the actions to be pursued are:

- inform and raise awareness among the resident population regarding the issue of seismic risk of buildings and the existence of tax concessions for seismic improvements and adjustments;
- promote the creation of a municipal cadastre of data on the structural characteristics of buildings;
- introduce the obligation of the "Attestation of the seismic risk class" in case of interventions on the existing building stock.

#### Hydraulic risk of the built settlement

The hydraulic risk map of urban areas is the result of the overlap of the elements of territorial risk with the vulnerability of the buildings with respect to flood events that could involve the main water system (Torrente Idice for the territory in question) and the secondary and minute network.

Based on the results of the analysis, a detailed hydrological study is strongly recommended regarding the functioning of the sewage system and the functionality of the drainage system to solve the existing criticalities, verifying the interventions under construction, to guide future urban planning choices.

#### **Resilience of buildings with respect to extreme weather events**

With the aim of recognizing the ability of the built-up area to respond and adapt to extreme events such as heavy rains or floods, it is necessary to verify the adequacy of the existing drainage system, identifying any critical issues and identifying the actions and interventions necessary for the resolution of critical issues or which, at least, do not jeopardize the state of affairs.

The evidence of the criticalities allows the implementation of concrete strategies, programs and projects to improve safety and increase the resilience of the urban settlement.



#### Strategy to reduce energy consumption and climate-altering emissions

With the aim of defining a strategy to reduce energy consumption and climatealtering emissions, an analysis of the urban settlement of Idice was carried out, aimed at reconstructing the energy demand and highlighting the critical issues. Through the analysis carried out it was possible:

- reconstruct the energy profile, by analyzing electricity and methane gas consumption, and comparing it with the primary energy needs and with the thermal transmittance conditions of existing buildings;
- define actions to reduce emissions and improve energy performance and, consequently, to reduce energy consumption as well as climate-altering emissions.

The improvement of the building envelope and the use of renewable sources such as solar/photovoltaic on the roof (on those buildings that do not already have a solar thermal or photovoltaic system), have been identified as interventions to improve the efficiency of the existing building stock. The effectiveness was assessed in terms of improving energy performance and, consequently, reducing energy consumption as well as climate-altering emissions.

The hypothesized efficiency measures concern 96 buildings in Idice which, if completed, will reduce annual consumption by 2,497.3 MWh/year and climatealtering emissions by 504.4 ton CO<sup>2</sup> equivalent.

This corresponds to 26.6% of the consumption and climate-altering emissions of the users served by methane gas attributed to the study area.

Compared to the current consumption of 11,500 MWh (which corresponds to an emission of greenhouse gases equal to 2,400 tons of  $CO^2$  equivalent), the implementation of the proposed efficiency measures would reduce primary energy consumption by almost 4,000 MWh or 800 tCO<sup>2</sup> equivalent.

Overall, the implementation of the planned actions would lead to a reduction in consumption and climate-altering emissions by 33-34%, in line with the final objectives of the existing sectoral planning tools (SEAP – Sustainable Energy Action Plan, PER – Regional Energy Plan and PNIEC - Integrated National Plan for Energy and Climate) by 2030.

Following this specific activity of analysis of the characteristics of Idice, as part of the participatory path "Forty Choices", wanted by the Municipal Administration and financed by the Emilia-Romagna Region to define actions and objectives to implement the new Sustainable Energy and Climate Action Plan (SECAP), on March 17, 2019, a "Resilient Walk" was held in Idice in search of the signs of climate change in the area. The walk, which was open to all, was attended by citizens and municipal consultants and technicians engaged in action B.3.1 of the SOS4LIFE project.

#### Implementation of the Guidelines (Mil. 37)

The Guidelines (Del. 29B) have been implemented:

- by the Municipality of San Lazzaro di Savena with Municipal Council Resolution no. 229 of 23/12/2020.
- by the Municipality of Forlì with Municipal Council Resolution no. 3 of 13/01/2021.

## Sub-action B.3.2 – Tools and rules for "no net land take" and urban regeneration

Coordination: Municipality of Forlì

The activity of sub-action B3.2 was mainly aimed at integrating in the new general urban plans of the Municipalities of Forlì and Carpi rules to limit, mitigate and compensate the land consumption, leading to the adoption of these urban plans (Del. 18, Del. 35 and Mil. 36).

In addition, sub-action B3.2 also provided for the drafting of Guidelines for a land take compensation system (de-sealing and surface credits exchange) and measures to promote urban regeneration interventions: a useful tool to support a compensation system for land take from the point of view of "no net land take" hoped for by Europe.

To carry out sub-action B3.2, a specific Working group was set up in which representatives of all partners participated.

The Working group of sub-action B3.2 met in the initial phase on the following dates: 28/03/2017 - 07/07/2017 - 03/08/2017.

Subsequently, considering that the drafting of the new general urban planning tools had to be carried out autonomously by the Municipalities of Forlì and Carpi as required by the Project, the Working group continued at a distance the preparation of the Guidelines which was coordinated by the Municipality of Forlì.

## General urban plans that integrate rules to limit, mitigate and compensate for land take

Sub-action B3.2, and in particular, this activity, is the one that has been most influenced by regulatory developments at the regional level.

When the SOS4LIFE Project was presented (September 2015) and also when it was approved and started (summer 2016), the reference regional legislation did not yet provide for specific provisions on the limitation or compensation of land take.

There was not and still is not a national framework law that establishes limitations on land take (it has been under discussion in Parliament for some time).

Following the launch of the SOS4LIFE Project, a new regional urban planning law was defined, the L.R. 24/2017, which was approved at the end of December 2017. The new regional law:

- implemented the European target of "no net land take" by 2050 (introducing a limit on land take by 2050 equal to 3% of the urbanized territory at the date of entry into force of the Law - 01/01/2018);
- favors urban regeneration and the requalification of the existing building stock;
- provides for the compensation, by means of desealing interventions, of the land taked by urban transformations outside the perimeter of the urbanized territory;
- introduced a different type of general urban planning instrument (the PUG -General Urban Planning Plan) which replaced the 3 urban planning instruments envisaged by the previous law (Municipal Structural Plan, Municipal Operational Plan and Urban Building Regulations);
- has provided for the obligation for all Municipalities of the Region to adapt to the new rules and to draft the new PUG by the deadline of 01/01/2021; this deadline,



due to the pandemic, was extended to 01/01/2022; the deadline for definitively approving the PUG was established by law on 01/01/2024.

We do not claim to attribute the result of the approval of this law to the SOS4LIFE Project, but, of course, the fact that the Region was a partner in this Project was a stimulus and provided useful elements for its definition.

From a certain point of view, this legislative novelty is to be considered positive, because the Region has made the European objectives its own by imposing new rules that will make it possible to limit land take throughout the region (328 municipalities). This goes in the direction desired by the SOS4LIFE Project.

On the other hand, it is undeniable that this change has impacted on the performance of this action which provided for the drafting of a new urban planning tool by the Municipalities of Forlì and Carpi.

The different type of general urban plan and also the different approach to soil protection (and related ecosystem services) and urban regeneration, introduced by the law, made it necessary to review the timing of implementation of this sub-action. The Municipalities of Forlì and Carpi (but also the Municipality of San Lazzaro di Savena although not formally committed to this effect in the approved Project) to adapt to the new law, found themselves having to abandon the assumed approach. This led to a delay in the drafting of the General Urban Planning Plans (PUG) of the two Municipalities which will be adopted in the After Life period at the beginning of 2022 as established by law.

The activity of the Municipality of Forlì relating to the drafting of the new general Urban Plan was developed with the following steps:

- 2016 Drafting of the geological report
- 2016 Drafting of socio-economic analyzes
- 2018-2019 Drafting of the kwowledge framework and preparation of a preliminary document
- 9/12/2020 Determination of assignment Service for drafting the updating of the socio-economic analyzes of the PUG
- 9/12/2020 Determination of assignment Drafting service Environmental and territorial sustainability assessment (activity in progress)
- 15/04/2020 Submission of Socio-economic Analysis Report of the PUG
- 20/04/2021 Determination of the establishment of the PUG Office
- 2020-2021 Drafting of the PUG and the related strategy for urban and ecological environmental quality.

The Municipality of Forlì immediately entrusted the drafting of the new General Urban Plan to its own Urban Planning Service technicians, even if the establishment of the PUG Plan Office (which must take care not only of its drafting but of its subsequent management) was formalized only in spring 2021.

But for some activities the Municipality of Forlì made use of external assistance.

The budget of the approved project envisaged, for Forlì, the assignment of three external assistance related to the drafting of the new General Urban Plan:

- drafting of the geological report and related geotechnical investigations;
- preparation of socio-economic analyzes
- drafting of the strategic environmental assessment.

The task of drafting the geological report was entrusted externally before the approval of the project and the consideration was carried out and paid in 2016 before the start of the project, therefore the cost is not accountable.

Similarly, the preparation of a first version of the socio-economic analyzes was externally entrusted and the related cost, also in this case paid in 2016 before the start of the project, is not accountable.

During the development of the project the knowledge framework of the PUG was built.

This activity has led to the drafting of numerous thematic maps which have provided the knowledge bases for the definition (currently in progress) of the "Strategy for urban and ecological environmental quality" which is one of the main documents of the new General Urban Plan.

In consideration of the entry into force of the new L.R. 24/2017 and of the need to draw up the PUG, the Municipality of Forlì has externally entrusted a new task of drafting the socio-economic analyzes to have updated data at the end of 2020.

For the cartographic processing activity (with the use of GIS software) the Municipality of Forlì has entrusted an external assignment (through public tender procedures) to an expert cartographer who has supported the municipal technicians.



Forlì - Knowledge framework Map of public areas (green areas, sports facilities, schools, car parks, health facilities ...)

This external assignment took place during the development of the Project and led to the preparation of the analyzes and maps of the Knowledge Framework that are attached to the Final Report.

Some analyzes refer to the entire municipal area, others have been prepared on the scale of the neighborhood (territorial units into which the municipal area is divided).

The Knowledge Framework of the Municipality of Forlì is divided into:

- A Socio-economic system
- B Environmental system
- C1 Urban structure analysis vol.1



- C2 Urban structure analysis vol. 2
- C3 Urban structure analysis vol. 3
- C Territorial system
- D Planning system.



Forlì - Knowledge framework - Map of the urbanized territory

Starting from the Knowledge Framework, a Preliminary Document (Del. 18) has also been prepared which briefly outlines the contents of the new PUG and anticipates the main themes of the "Strategy for urban and ecological environmental quality" (including the limitation of land take and urban regeneration).



Forlì - Knowledge framework – Ecological network map

The Municipality of Carpi has provided (possibility allowed by Regional Law 24/2017) to draw up the General Urban Planning Plan at the level of the Union of Municipalities of the Terre D'Argine to which it belongs. The inter-municipal plan includes the territories of the municipalities of Carpi, Campogalliano, Novi di Modena and Soliera.

The activity of the Municipality of Carpi was developed with the following steps:

- 14/11/2019 Determination of the award of the tender for the assignment of the drafting service of the inter-municipal PUG
- 4/12/2020 Signing of the contract for the drafting of the inter-municipal PUG
- 9/12/2020 Resolution of appointment as Head of the intercommunal PUG Office
- 24/02/2021 Determination of the establishment of the PUG Office (intermunicipal technical staff).
- The drafting of the Carpi PUG is currently underway and the plan will be prepared by the end of 2021 to be adopted at the beginning of 2022.

The Municipality of Carpi had foreseen in the approved project budget, among the costs of external assistance, an assignment for the definition of regulatory and territorial planning guidelines aimed at limiting land consumption. This assignment includes the drafting service of the new inter-municipal PUG and part of the relative cost is borne by the Municipality of Carpi.

But these external assistance costs, incurred after the conclusion of the Project, are obviously not accountable.

# Guidelines for a land take compensation system (de-sealing and surface credits exchange) and measures to promote urban regeneration interventions (Del. 12)

These guidelines (also in English) are a guiding tool to help achieve the European target of "no net land take by 2050" and, in particular, to introduce in urban planning tools and building regulations, rules and implementing provisions functional to this objective.

The guidelines are aimed primarily at public administration, policy makers, public officials and technical managers and professionals dealing with urban planning and urban regeneration.

The guidelines are structured in 2 parts:

- 1. the first part is dedicated to analyzing the issue of land take and identifying which strategies, rules and operating methods can be implemented to limit, mitigate and compensate for land take and soil sealing;
- 2. the second part is dedicated to the theme of urban regeneration, as a strategy to be favored to combat land take.

The guidelines have been prepared taking into account and systematizing the knowledge acquired, the experiences made and the results achieved with the other sub-actions of the SOS4LIFE project:



- Sub-action A1.3 "European-wide survey of best practices for no net land take and improvement of urban resilience and visit to case studies". The survey on European best practices has provided an overview of the different approaches to limiting land take. Further knowledge and evaluation elements were acquired with study visits to the cities of Dresden and Stuttgart which have already consolidated experiences;
- Sub-action B1.1 "Elaboration of the local knowledge framework of the dynamics of land take and soil sealing". The construction of local maps of land take and the level of soil sealing, as well as the reconstruction of the historical evolution of these phenomena, has increased awareness of these issues and allowed for the sharing of definitions and indicators;
- Sub-action B1.2 "Costs and local impacts of the dynamics of land take". The
  estimation of the economic and environmental impacts of land take, starting
  from the drafting of maps of ecosystem services, has increased knowledge on
  the functions of the soil and its diversity, stimulating the drafting of a summary
  map of the quality of soils that is functional both to support decisions in area of
  territorial planning and to manage a compensation system for land take;
- Sub-action B1.3 "Evaluation of ecosystem services of urban soils and guidelines for protection and improvement". The Carpi case study provided a methodology for evaluating the ecosystem services of urban areas that are fundamental to counteract the effects of climate change and improve the resilience of our cities;
- Sub-actions B2.1, B2.2, B2.3 "Demonstrative interventions of de-sealing with soil restoration". Even if these interventions have not yet been completed, their planning and partial implementation has provided useful elements for evaluating their technical-economic feasibility and has highlighted some problems to be taken into account in compensatory interventions;
- Sub-action B2.4 "Definition of guidelines for the removal, management and reapplication of top-soil". It made it possible to develop operational guidelines to favor the reuse of the soil (and in particular the topsoil) deriving from excavations and urban transformations. This is functional both to the restoration of ecosystem services and to the circular economy;
- Sub-action B3.3 "Criteria and guidelines for improving urban resilience to climate change". The "Freeing the soil" guidelines are another guiding tool (which also contains useful operational indications) for planning urban regeneration interventions which, by making use of natural-based solutions, can improve urban resilience to climate change.

In the premise of the first part of the Guidelines, are recalled the definitions of "land take" and "soil sealing" that were assumed during action B1.1 and the documents of the European Commission which were the reference for the SOS4LIFE project. In the following chapters, the approach to soil protection is analyzed in depth in three levels in order of priority: limit, mitigate and compensate land take.

The first level foresees the protection of the soil avoiding its transformation and the consequent loss of ecosystem services. This is possible by introducing limitations on land take (firstly at the regulatory level, secondly also at the local level through urban planning regulations and tools).

The strategy to limit land take can be summarized in the following points:

• promote urban regeneration and introduce restrictions on land take mainly through a national framework standard and any regional regulations;

- know the local dimension of the phenomenon by preparing an updated map of land take and soil sealing;
- understand the causes and dynamics of land take and any relationships with demographic growth;
- know the characteristics of the soil at the local level by preparing maps of ecosystem services;
- periodically monitor land take and soil sealing using a territorial information system.

In cases where a transformation of the soil occurs, it is necessary to adopt mitigation measures to maintain some of the functions of the soil and reduce the negative effects of soil sealing on the environment and human health.

What has been described in the guidelines regarding land take mitigation is summarized in the following points:

- manage and plan soil transformations with greater awareness of the value of the soil through the use of a soil quality synthesis index map;
- evaluate the ecosystem services of urban soils to more correctly plan the climate adaptation of the urbanized territory;
- adopt a minimum ecological quality index (such as the Biotope Area Factor) to limit sealed surfaces in urban transformation or regeneration interventions and increase green infrastructures, with consequent maintenance or restoration of part of the ecosystem services essential to ensure climate adaptation;
- apply nature-based solutions to improve the urban resilience of urban regeneration interventions.

The last level, in the face of the transformation of the soil for urban use, provides for the activation of compensation measures aimed at restoring at least part of the ecosystem functions lost with soil sealing.

Soil is a precious resource, not renewable if we consider the timing of pedogenesis in relation to the duration of human life.

While supporting the need to safeguard the soil and also putting in place legal provisions to limit it, we cannot exclude that there is still land take.

The European goal of "no net land take by 2050" seeks to reconcile the need for growth and evolution of the city with the need to bring this growth back into a more sustainable development model.

Limited land take is permitted, but compensation must be provided for.

A balance must be guaranteed between land take and de-sealing of surfaces currently waterproofed with subsequent renaturalization, restoration to greenery or for agricultural use (depending on the context in which the de-sealing intervention is carried out).

Land take involves the total or partial loss of the ecosystem services that the soil itself provides us (e.g. agricultural production, water infiltration and storage, carbon storage, microclimate regulation, etc.).

Therefore, compensatory de-sealing, even where possible, does not guarantee the total restoration of ecosystem services.

In summary, the balance between land taken and recovered soil, necessary to implement the principle of "no net land take", can be realized in the possibility of consuming new soil only in the face of:



- the execution of a compensatory intervention of de-sealing and renaturalization, restoration to greenery or agricultural use;
- the acquisition / availability of "surface credits" deriving from previous compensatory interventions of de-sealing and renaturalization or restoration to greenery or agricultural use; in order to be able to manage / transfer these "surface credits" it is necessary to keep track of them (register them) from their generation to their use for compensatory purposes (this aspect will be discussed in detail below).

In drafting the guidelines, and in particular to verify the feasibility of the compensation system and the surface credit mechanism, the Municipality of Forlì made use of notary advice. An external assistance was entrusted to the Notary Alessandro Torroni of Forlì. The study he produced was partially cited in the Guidelines and is fully submitted together with the deliverables.

The main elements to be taken into consideration in a land take compensation system are:

- it is necessary to have a stock of potentially de-sealable areas;
- the areas of potential de-sealing must be mapped and filed; the database must be continuously updated;
- the compensation should not only be quantitative but should also take into account the quality of the soils consumed (for this purpose the Soil quality synthesis index map and the knowledge of quantity and quality of the ecosystem services provided by the various parts of the territory are useful);
- it is important to define operating procedures for compensatory interventions, specifying the roles of the parties involved and regulating them with an agreement;
- to support and facilitate the compensation system it is useful to provide for an exchange mechanism of "surface credits" accrued with compensatory interventions; for this purpose, it is necessary to have a municipal register in which to note the accrued "surface credits" and to record their origin, transfers and uses;
- in compensatory interventions it is appropriate to adopt correct methods of recovery and reuse of the topsoil and the soil from urbanization construction sites (it is possible, even in the local area, to combine the demand and supply of soil).

The second part of the Guidelines deals with the theme of urban regeneration.

Urban regeneration is the main strategy that must be implemented to counteract land take.

Urban regeneration is also an important opportunity to rethink and redesign our cities, to make them more usable, more accessible, safer, more resilient to climate change (and therefore also greener). The goal that we must and can pursue through urban regeneration is to improve the quality of life, well-being and health of the inhabitants.

In addition to acting on the legislative side by introducing provisions at national and regional level to limit land take, the same laws must also impose urban regeneration as a priority and introduce rules to promote it.

Taking as a reference the Regional Law 24/2017 of the Emilia-Romagna Region, which introduced limits on land take and which favors urban regeneration, were highlighted those incentives and tools that may be determined by law:

- procedural simplifications (in particular with respect to other interventions involving land take);
- reduction of contributions that the private operator must pay to the Municipality (eg extraordinary contribution due in case of urban changes and reduction of the construction contribution);
- granting of additional building rights and other bonuses;
- exceptions to some building parameters (density, heights, distances)
- granting of public funding / grants as part of urban regeneration plans and programs.
- register of properties available for reuse and urban regeneration
- temporary uses.

The Guidelines also refer to the complex issue of reclamation which, almost always, accompany urban regeneration interventions and which can affect their feasibility due to costs and times.

To promote urban regeneration, it is also important to know the existing buildings stock and the abandoned areas that can be recovered. Similarly, to the theme of the areas to be de-sealed, the areas to be allocated to urban regeneration interventions must also be filed and mapped in order to plan their recovery and to make known the potential for reuse to private operators.

In addition to what can be established by law, other incentives can be put in place at the local level to promote urban regeneration:

- increase in the reduction of the construction contribution to be paid to the Municipality for certain types of interventions for the recovery of existing buildings and for urban regeneration;
- reduction / exemption from payment of the public land occupation fee for all construction sites in the historic center and / or relating to the recovery of existing buildings or urban regeneration;
- reduction of other local taxes (eg municipal property tax, waste tax, etc.) for interventions on existing building stock;
- non-repayable municipal contribution (or interest rate contribution for mortgages) for the restoration of the facades and common parts of the buildings.

Finally, the Guidelines take into consideration the importance of citizen involvement in urban regeneration processes and examine some approaches that have often proved effective in triggering urban regeneration interventions, such as temporary reuse and tactical urbanism.

## Sub-action B.3.3 – Criteria and guidelines to improve urban resilience to climate change

Coordination: Emilia-Romagna Region

The activity carried out in action B3.3 concerned the development of guidelines to improve resilience in urban regeneration interventions. It is a guiding tool to support the planning of urban regeneration interventions that pay particular attention to the issues of resilience to climate change.



To carry out this activity, the Emilia-Romagna Region made use of external assistance which was entrusted through a public tender procedure. The technicians of the Region were therefore supported by the Temporary Grouping of Professionals who won the tender and which included engineers, architects and agronomists.

The working group of action B3.3 was made up of technicians from the Region and the external technicians in charge. This working group was then extended on various occasions, involving the representatives of the various partners.

### Guidelines "Freeing the soil" - for improving resilience to climate change in urban regeneration processes (Del. 29A)

The guidelines consist of 2 volumes.

Vol. 1 - Guidelines was produced, as required by the approved project, in Italian and English versions. 100 pages were estimated. The final document was much longer (278 pages), it is accompanied by many images and ad hoc graphics. This affected the cost and also the timing of implementation.

Volume 1 addresses the issues of resilience at the urban scale, at that of the project and from a regulatory point of view, with a particular focus on nature-based solutions that can be implemented in the built environment, to free the soil and implement adaptation measures through green and blue infrastructures and the use of vegetation in hostile environments.

Volume 1 is organized in 5 chapters:

Introduction to the guidelines

- 1 Urban areas to regenerate and climate
- 2 Criteria for urban, ecological and environmental quality
- 3 Nature-based projects and interventions
- 4 Green in urban environments and hostile habitats
- 5 Glossary and bibliography

The project sheets contained illustrate different solutions with a rich array of images, technical drawings and texts, with an indication of the criteria and costs of intervention and maintenance. The volume ends with a reference glossary on the themes of climate, heat, vegetation and water.

Volume 2 collects, analyzes and describes in its various components a selection of 20 case studies (which originally had to be 16) relating to projects and adaptation processes, carried out nationally and internationally in redevelopment and regeneration contexts, at different scales.



1 / GUIDELINES 2 / CASE STUDIES

It should be noted that the second volume, initially envisaged as an internal working document preparatory to the preparation of the guidelines, was subsequently conceived as a real publication with a graphic layout coordinated with the volume of the actual Guidelines of which it now forms part integral. This clearly involved further work on the contents, texts, iconographic apparatus (photos, diagrams, drawings and projects) and on the graphics that accompany the representation of the salient data of the filing and the evaluation and representation of the ecosystem services provided.

The 190 pages initially estimated became 238.

The editing and the English version of this second volume also led to a higher cost and a lengthening of the times for the final return of the product.

The 20 case studies were classified and grouped into 6 different categories:

- A Large brownfields of transformation and Eco-Districts
- B Large brownfields of transformation and urban parks
- C Urban squares, public spaces, public gardens, car parks
- D Temporary gardens
- E Bottom-up initiatives
- F Urban planning tools and detailed plans

The project sheets contained in it illustrate the case studies through a general text - with a focus on green and blue infrastructures and the reference standards - and an apparatus of images and schemes aimed at showing the elements of innovation and replicability.

#### Methodological approach and activities carried out

For the drafting of the guidelines, it was decided to start from the analysis of good practices, concrete cases, national and international that identify spaces, areas and degraded neighborhoods with strong waterproofing, transformed and returned to the community through processes and projects with a strong environmental matrix. The case studies identified, classified by different types, were the result of three progressive activities:

• analysis and filing of urban, landscape, hydraulic and agronomic data of the redevelopment and / or regeneration of public space and soils;



- analysis of the replicability of the proposals from the point of view of the Italian regulations and standards relating to the sustainable management of water in urban areas, the management of public parks, the management of waste associated with the de-sealing of urban soils;
- integration / revision of the contents for comparison with the SOS4Life project partners.

From these activities it was possible to derive the key themes and the recurring or more frequently practiced solutions in the different application contexts for regulatory, economic, planning and process reasons, from which the contents of the Guidelines were defined.

44 case studies carried out, in progress or planned at national and international level were identified. These are projects of urban redevelopment and / or regeneration of public space in which interventions were carried out with de-sealing works of waterproof surfaces and restoration of permeable soils using Nature-based Solutions (NbS) and Sustainable Urban Drainage Systems (SUDS).

Through an initial survey, a classification of the case studies was achieved in the 6 major categories mentioned above.

The comparative analysis of the different case studies resulted in the final selection of 20 cases (19 in Europe and 1 in the United States).



Volume 2 – 20 Case studies

The following criteria were used in the comparison:

- innovation of the urban planning process and / or transformation of the place;
- integration of issues, including soil, green infrastructure, blue infrastructure and grey infrastructure;
- innovation of reclamation and waste management practices, also in a logic of circular economy;

- ability to intervene over time and in progressive stages of implementation;
- exemplarity on particular thematic aspects also for the purposes of replicability in the regional context (phytoremediation, bio-remedy, construction aspects, cost containment, ...);
- positive effects on the local context, in a strategic, environmental, economic and social key;
- objectives and salient aspects to be explored in order to extrapolate aspects of good practice and replicability.

Each case study is presented through a brief initial general description, which highlights its peculiarity in relation to the scale of intervention. The process that governs the intervention under study, when significant, is briefly described below, and there are insights into the nature-based solutions used.



che funzione svolge

il processo di trasformazione urbana e di desealing

le fasi fondamentali del processo

e di coinvolgimento degli attori

il processo di trasformazione

urbana e di desealing

di trasformazione

e delle comunità

what function does it perform? - the process of urban transformation and desealing



The fundamental phases of the transformation process





Ecosystem services provided - phases - dimensions of desealing



Target audience of the guidelines: Public administration, planners, technical designers, citizens

#### Target audience of the guidelines

The guidelines are addressed to the public administration - to officials in the urban planning and urban regeneration, public works and green sectors - and to professionals working in the fields of urban design, architecture, landscape and engineering in design studios and businesses.

The guidelines are a guiding tool and, as such, not directly binding.

Municipal administrations and public officials are invited to use the "Freeing the soil" guidelines and experiment with them with gradual interventions, to learn - with the design and business world - a new way of designing the public city.

#### The transdisciplinary approach

The planning of urban regeneration interventions (which aim at increasing resilience to climate change) is complex and requires a plurality of actors and skills and a great ability to find effective, feasible and sustainable solutions.

These guidelines are the result of a transdisciplinary collaboration afferent to the fields of urban planning, landscape, agricultural and hydraulic engineering and architecture.

Throughout the research phase and in-depth study of the case studies, various moments of structured discussion were organized between the technical working group and the representatives of the partners to share the system and the structure of the work and deepen their aspects and needs.

#### Workshops with SOS4LIFE project partners and other bodies involved

To establish the content of the guidelines, various workshops were organized between December 2018 and June 2019, addressing four aspects:

- the most significant obstacles in projects designed to combat land take and promote urban regeneration;
- aspects of the replicability of best practices with particular reference to planning and regulatory issues;
- the ease of use and application of the guidelines;
- the strategic aspects aimed at the application of the Regional Law 24/2017 on urban planning, with particular reference to the definition of content in support of the Strategy for Urban and Ecological Environmental Quality of the PUG (General Urban Planning Plan) at the scale of the urban and building project.

All the meetings were managed and facilitated with thematic working groups, through different methods of comparison: the focus group, to focus on common problems and obstacles; the value proposition canvas, to develop solutions to the obstacles posed; the charrette and technical inspections to develop design solutions.

The meetings were attended by the group of experts appointed by the Emilia-Romagna Region, the representatives of the SOS4LIFE project partners, the technicians and consultants of the Municipalities of Forlì, San Lazzaro di Savena, Carpi, ANCE Emilia-Romagna, Legambiente Emilia-Romagna and ARPAE. The officials of the Municipalities of Rimini, Cervia (RA), Medicina (BO), Montechiarugolo (PR) and the Renana Reclamation, which have ongoing trials on urban resilience, collaborated.

The meetings of the working group took place at the following moments:

07-11-2018	First meeting of the group of experts in charge with technical representatives of the E-R Region. Bologna headquarters of the E-R Region
06-12-2018	1 <sup>st</sup> Working group meeting: E-R Region , Group of experts, Partner representatives partecipated. Bologna headquarters of the E-R Region
01-02-2019	Meeting of the group of experts in charge with technical representatives of the E-R Region. Bologna headquarters of the E-R Region
05-04-2019	2 <sup>nd</sup> Working group meeting: Focus Group to focus on common problems and obstacles. E-R Region , Group of experts, Partner



	representatives partecipated. Bologna headquarters of the E-R
	Region
17 – 04 - 2019	<b>3</b> <sup>rd</sup> <b>Working group meeting:</b> <i>Value proposition canvas</i> to develop solutions to the common problems identified. : E-R Region , Group of experts, Partner representatives, partecipated. Technical officials from various sectors of the partner municipalities and external subjects [from other municipalities and technicians of the Renana Reclamation] also participated. Bologna headquarters of the E-R Region.
21 – 05 - 2019	<b>4</b> <sup>th</sup> <b>Working group meeting:</b> <i>La charrette</i> to develop design solutions of urban planning, architectural and landscape nature. E-R Region, Group of experts, Partner representatives, Technical officials from various sectors of the partner municipalities and external subjects [from other municipalities] participated. Bologna E-R Region, Esprit Nouveau Pavillion.
11 – 06 - 2019	<b>5<sup>th</sup> Working group meeting:</b> <i>Study visits</i> in Milano Marittima (Cervia) and Rimini; E-R Region , Group of experts, Partner representatives, Technical officials from various sectors of the partner municipalities and external subjects [from other municipalities] participated.

In addition to these meetings, there was intense work by the Group of external consultants appointed by the Region together with the regional technicians who coordinated and developed the activity.



3<sup>rd</sup> Working group meeting in Bologna



Study visits in Milano Marittima, Cervia and Rimini

#### The project sheets of the Guidelines (Vol. 1)

The Guidelines contain numerous project sheets, each of which describes a different nature-based solution.

The design solutions are aimed at:

- manage the urban heat island and heat waves with green infrastructure
- manage urban rainwater and heavy rainfall with blue infrastructure
- favor the infiltration of rainwater into the soil
- manage excavated soil and rocks
- raise the environmental and performance requirements of public works.

Each sheet briefly describes the function of the proposed nature-based solution and which ecosystem services it can provide in the urban context. The sheet contains examples and references to the work carried out, design schemes and also provides an estimate on the construction and maintenance costs.





Volume 1 – Guidelines

function performed, services provided to the urban environment, design and construction aspects, references



ecosystem services provided (regulation, production, cultural) - fruition, botanical, hydraulic functioning schemes (in dry weather, in rainy conditions)



function performed, recommended species, usability and attractiveness



ecosystem services provided (regulation, production, cultural) – maintenance costs - low maintenance species in relation to public use

#### Presentation and dissemination of guidelines

The contents and results of the study, laboratory and synthesis activities were presented in intermediate and final events in different ways and in different locations:

17-01-2019	in Parma presentation of the work in progress during the SOS4Life event "De- sealing: concrete experiences of urban regeneration and positive soil balance"
28-06-2019	in San Lazzaro di Savena event linked to the SOS4Life project organized by the Municipality of San Lazzaro "Let's save our soil: the European SOS4Life project for the new urban planning season in San Lazzaro di Savena"



22-11-2019	in Bologna presentation of the draft of the Guidelines during the SOS4Life event "Countering land consumption: experiences, standards and guidelines
28-05-2020	Webinar dedicated to the presentation of the Guidelines "Freeing the soil" - for improving resilience to climate change in urban regeneration processes
12-06-2020	Webinar / Training programme and networking meeting with european project ADRIADAPT (Interreg), Nature-based climate adaptation, through the guidelines of the SOS4Life project - part one
26-06-2020	Webinar / Training programme and networking meeting with european project ADRIADAPT (Interreg), Nature-based climate adaptation, through the guidelines of the SOS4Life project - part second
13-07-2020	Webinar - Presentation of the guidelines at the Conference "Water and trees in the city to manage change" Event organized by AIAPP TUM together with the Order of Architects of Ascoli Piceno OAAP. The video of the presentation is available at the link: https://bit.ly/Acquaealberiincittàpergestireilcambiamento.
18-09-2020	Webinar - Networking meeting with European project PROGIREG (Horizon2020)
23-09-2020	Webinar - Final event of the SOS4Life project "Saving the soil - Guidelines and work tools for technicians and administrators"
6-10-2020	The resilient city and climate change, lecture at SPAM - Rome Architecture Festival, session Climate-proof cities
12-10-2020	2nd Webinar Urban and environmental quality, climate, public space and new forms of mobility, in the Seminar "The construction site of urban regeneration", organized by AUDIS, Assolombarda, Metropolitan City of Milan and others. The video of the presentation is available at the Link: video https://www.facebook.com/101505213246232/posts/3453955724667814/?vh=e
20-10-2020	Webinar, Freeing the soil: landscape management and nature-based measures for climate adaptation in cities, organized by Contratti di Fiume, ERSAF Lombardia. The video of the presentation is available at the link: https://youtu.be/shLxN2-SmNY

#### Implementation of the Guidelines (Del. 32)

The Guidelines (Del. 29A) have been implemented:

- by the Municipality of San Lazzaro di Savena with Municipal Council Resolution no. 228 of 23/12/2020;
- by the Municipality of Forlì with Municipal Council Resolution n. 27 of 02/03/2021;
- by the Municipality of Carpi with Municipal Council Resolution n. 91 of 18/05/2021.

#### Action B3 – Deliverables and Milestones

The main outputs of action B3 (sub-actions B3.1-B3.2-B3.3) are as follows:

- sub-action B3.2: Guidelines (also in English) relating to the surface credit exchange mechanism and measures to promote urban regeneration interventions (Del. 12);
- sub-action B3.2 Preliminary document to the Municipal Urban Plan with objectives of limitation, mitigation and compensation of land take (Del. 18);

- sub-action B3.3: Guidelines (also in English) to improve resilience to climate change in urban regeneration interventions (Del. 29A);
- sub-action B3.1: Guidelines for the management / review of urban plan residues (building lots not built) (Del. 29B);
- sub-action B3.3: Municipal resolutions (Forlì, Carpi, San Lazzaro di Savena) for the adoption of Guidelines to improve resilience to climate change in urban regeneration interventions (Del. 32)

The following project deliverables were not produced:

 sub-action B3.2 - Municipal resolutions (Forlì, Carpi) for the adoption of the General Urban Plan which integrates rules on the limitation of land take (Del. 35).

The following project milestones have been reached:

- sub-action B3.3: Presentation to stakeholders of the Guidelines to improve urban resilience to climate change (Mil. 30); The presentation of the Guidelines to stakeholders (other Italian Regions, other Italian Municipalities, Regional Agencies for Environmental Protection) took place on 28/05/2020 with a specific Webinar which was attended by over 600 people from all over Italy;
- sub-action B3.1: Municipal resolutions (San Lazzaro di Savena, Forlì) for the adoption of Guidelines for the management / review of urban plan residues (Del. 37) 23/12/2020 and 13/01/2021.

The following project milestones have not been reached:

- sub-action B3.2 Municipal resolutions (Forlì, Carpi) for the adoption of Preliminary document to the Municipal Urban Plan with objectives of limitation, mitigation and compensation of land take (Mil. 28);
- sub-action B3.2 Adoption (for Forlì and Carpi) of the General Urban Plan which integrates rules on the limitation of land take (Mil. 36).

The Municipality of Forlì has prepared the preliminary document (Del. 18) for the general urban plan (P.U.G.) even if this document has not been formally approved by the municipal council (Mil. 28). The Municipality of Carpi has externally entrusted the task of drafting the General Urban Plan (activity which is in progress) but has not deemed it necessary to produce a preliminary document. Both Municipalities (and also the Municipality of San Lazzaro di Savena) will adopt the proposal of the new General Urban Plan at the beginning of 2022 in compliance with the deadline established by the regional law.

Deliverable 35 and Milestone 36 provided for Forlì and Carpi to reach by the end of the project the municipal resolutions for the adoption of the new general urban planning instruments (P.U.G.) containing provisions regarding the limitation of land take. The terms for adopting the new urban planning instruments pursuant to the L.R. 24/2017 have, however, been extended by the Emilia-Romagna Region to 01/01/2022. Most of the municipalities in the region (including Forlì, Carpi and San Lazzaro di Savena) are drafting the new urban plans that will only be adopted in 2022.



# ACTION B4 "URBAN AND SOIL DECISION SUPPORT SYSTEM (US-DSS) – INFORMATION SYSTEM FOR MONITORING LAND TAKE AND URBAN REGENERATION".

Objective: to create a regional Information System which allows - in a dynamic way by GIS and We-GIS tools - to monitor, manage and process data about territorial transformation, land take and soil sealing, their impact in terms of loss of ecosystem services, and to support decision-making processes by increasing policy makers awareness on these topics.

## Sub-action B.4.1 "Creation and implementation of the US-DSS Information System"

Coordination: Emilia-Romagna RegionForeseen start date: 01/12/2016Actual start date: 01/03/2017Foreseen end date: 30/09/2019Actual end date: 30/09/2020

Similarly to what happened for most of the other actions, a Working Group was also set up for action B.4 in which participated the representatives of the partners and also the various consultants.

Working group meetings: 16/03/2017 - 06/04/2017 - 11/04/2017 - 05/05/2017 - 14/12/2017 - 19/12/2017 - 20/12/2017 - 23/02/2018 - 14/03/2018 - 27/12/2018 - 27/02/2019 - 17/10/2019 - 18/02/2020

First B4.1 action meetings were often held in parallel with those of action B1.1 and B1.2 in the context of which maps relating to land take and soil sealing and maps of ecosystem services were prepared.

The development of action B4.1 was divided into the following phases:

- construction of the local database for each partner municipality;
- definition of a shared data model and updating procedures;
- loading data into the data model;
- construction of a specific web-gis application for consulting / querying the database;
- · testing and implementation of the web-gis functions;
- checking and uploading to regional servers.

To carry out action B4.1 each of the 3 partner municipalities and the Region made use of external assistance.

#### The construction of the local database (Del. 16)

The initial sharing of definitions and indicators (in action B1.1), the production of the maps and the construction of the databases of the 3 partner Municipalities was essential for the subsequent work of creating the US-DSS Information System.

In the first phase of sub-action B4.1, the data produced in sub-action B1.1 were collected and structured. These data are contained in the vector database (Del. 16).

To deepen and replicate the method followed by the 3 partner Municipalities to analyze their urban planning tools in order to obtain the data necessary for the construction of a detailed monitoring system for land take and soil sealing, it is possible to refer to the Report of action B. 1.1 (Del. 15) which fully illustrates it.

#### Shared data model and US-DSS Information system (Del. 30-38)

Once the data delivered by the partner Municipalities of the Project were collected and organized, a shared data model was defined that allows for the description and monitoring of land take and soli sealing in a homogeneous manner.

The data model was populated in two alternative ways:

- starting from the analysis of the maps of general urban planning tools for the 3 partner municipalities and for any other municipalities that wish to follow suit;
- starting from the "Land Use" database of the Emilia-Romagna Region, integrated with the classes relating to the construction of the Regional Topographical Database (DBTR) for other Municipalities that don't have the possibility to build the database by analyzing their own urban planning tool.



MAPPA DEL CONSUMO DI SUOLO (trasformato da agricolo o naturale in superficie urbanizzata) 0 -10 % Forlì - Land take and Soil sealing Maps – Action B1.1

This double modality allows more structured Municipalities and with greater human and financial resources to be able to replicate, if desired, the path of construction of the municipal database to be loaded into the system, as well as other smaller Municipalities to be able equally to have an analysis and monitoring tool that makes use of regional databases (although obviously the first solution guarantees greater detail).

At the level of validation of the results, particular attention was paid to the comparison between the two ways of populating the database and to the analysis of which classes of the DBTR should be integrated into the Land Use to obtain a degree of detail similar to that obtained from the analysis of the maps of the municipal general urban planning tool.

Four plugins have been prepared in both Windows and Linux versions (one for each partner Municipality, plus one for Land Use) for the QGIS open source GIS software. These plugins are used to automate the translation of municipal data into the data model in order to make them homogeneous.

The structure of the data model is centered on the origin of land take divided into two hierarchical levels.

The intended use of the cartographic objects is described by the functional category attribute, borrowed from the Regional Law 15/2013.

The data was loaded into the model to form the structure of the US-DSS Information System.

The data model was designed to be consulted through an ad hoc Web-GIS application.





Shared data Model - on the left from municipal urban planning tools analysis on the right from the regional topographic database (DBTR) and regional database of land use



Regional topographic database (DBTR) - land use map

In September 2020, the reference time horizon of the data on land take and soil sealing in the database was:

- 2016 for the three project partner municipalities (upload of data delivered at the end of 2016, with updates for the years 2017, 2018 and 2019 for the Municipality of Forli)
- 2014 for the remaining municipalities of the region (reference date of the version of the Land Use database available).

Even if with data referring to different time horizons, the whole regional territory is therefore represented without solution of continuity.

The goal is to keep the information system updated with the periodic uploading of updated data by the municipalities and with new versions of the regional land use map and the DBTR.

Specifically, the Region is updating the Land Use Map for 2018. An update to 2018 will therefore be available in the coming months for the entire regional territory.

The information system is not limited to providing information on the quantity and location of the land take on the level of soil sealing of the various parts of the territory.

It was, in fact, enriched by the provision of maps of the individual ecosystem services, developed during the project by the CNR, always starting with the rich supply of regional maps.

The mapping of ecosystem services covers the regional plain and the foothills area (areas for which data were available).

In addition to the maps of the individual ecosystem services, a summary map of the quality of soils has also been included, which takes into account the quantity and quality of the services present in the various parts of the territory.

The maps of ecosystem services and the soil quality map are an important support for urban planning and whenever it is necessary to take a decision relating to the transformation of a part of the territory because they provide us with information on the characteristics and overall quality of the soil in the area subject to intervention. This information allows policy makers and technicians to make more informed choices and also to evaluate location alternatives for transformation interventions. Above all, they make it possible to direct any residual transformations on soils of lesser value while preserving those of better quality.

### Web-Gis (Del. 33)

The information system can be consulted in two ways:

 a more technical WebGIS developed with opensource software specifically for the SOS4LIFE project which, in addition to the consultation of the various maps, allows a series of queries, even on a specific or areal basis (more suitable for technicians);



SOS4LIFE US-DSS Webgis



• the WebGIS on the Moka platform which is an easier to use tool used by the Emilia-Romagna Region to organize and display cartographic data; this mode does not allow to carry out specific queries (more suitable for informative use for a general public).



SOS4LIFE Webgis on Moka platform

The WebGIS specifically created for SOS4LIFE allows you to view different information layers:

- land take
- soil sealing
- different information levels of the DBTR (Regional Topographical Database)
- orthophoto
- ecosystem services maps
- soil quality map
- other information layers by loading specific WMS services (Web Map Service) made available by the Geoportal of the Emilia-Romagna Region.

In the WebGIS interface, a portion is dedicated to viewing the map.

There are also a series of menus that allow you to set different types of queries:

- the query can refer to different territorial levels (regional, provincial, municipal or aggregation)
- or for a specific area (shape file or drawn directly using the appropriate command in the web-gis interface)



SOS4LIFE Webgis - example of query by type of land take

It is possible to query the soil consumed with details on:

- origin of land take (eg consolidated territory, implementation urban plans, infrastructures and endowments, rural and other)
- land take by function (residential, production, tertiary etc.)

Similarly, it is possible to set queries relating to soil sealing.

By uploading a specific perimeter (shapefile) or by drawing an area on the screen, it is also possible to query the soil quality map.

This is important to simulate the impact of a transformation intervention in terms of loss of ecosystem services (and in particular of possible loss of better quality soils).



SOS4LIFE Webgis - example of query starting from a specific perimeter



It is also possible:

- query the maps of each single ecosystem service at a specific point to know the level of that specific service.
- extract a report in pdf format of any query that has been carried out.

If the Information System is kept periodically updated, it is also possible to make a comparison between the data referring to different years.

A user manual of the Web-GIS interface (Del. 39) has been prepared, which explains the various possible queries and the various functions available.

The verification and testing of the Web-Gis interface was carried out by the partner Municipalities together with the Region. This activity led to an improvement in the functionality of the Web-Gis interface and the correction of some bugs.

The Web-Gis interface has been implemented and perfected to be mainly functional to the activities of municipalities and other public bodies (provinces and regions) but can also be used by technicians and private operators.

Once the interface refinement phase was completed, the Region proceeded through its IT Service to carry out all the necessary tests and to make the necessary corrections to the application to make the Information System publishable on regional servers and accessible to the public.

The Web-Gis application of the US-DSS Information System is accessible to the public at the following link:

https://sos4life.regione.emilia-romagna.it

The version on the MOKA platform is accessible at the following link. <u>https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/SOS4LIFE/</u>

## Sub-action B.4.2 "Replicability on a national and European scale of the US-DSS Information System"

Coordination: Emilia-Romagna RegionForeseen start date: 01/12/2017Actual start date: not started yetForeseen end date: 30/09/2019Actual end 30/09/2020

Action B4.2 included activities for the dissemination, transfer and replicability of the US-DSS.

In order to illustrate the US-DSS Information System that has been prepared as part of the SOS4LIFE project, to show the functionalities of the WebGIS that has been implemented to allow consultation and query, to describe the types of data available and explain how can be built and updated by other interested public bodies, an activity program (Del. 40) has been established.

The event to present the US-DSS information system and illustrate the functions of the WebGIS took place regularly in Bologna, at the headquarters of the Emilia-Romagna Region on 22/11/2019.

It was mainly dedicated to the Municipalities of Emilia-Romagna, the Stakeholder Region (Piedmont, Tuscany and Lombardy), the Regional Agency for

Environmental Protection (ARPAE) and other interested public bodies and entities. 91 people participated (with representatives of 34 Municipalities, ARPAE, the Province of Ravenna, the Emilia-Romagna, Piedmont, Tuscany and Lombardy Regions)

The other planned activities were scheduled in the final part of the project. The pandemic has impacted on the implementation of these activities. Some have not been implemented, others have been postponed and for others the method of implementation has been changed.

In March 2020 a study visit was scheduled to Malaga (Spain) to present the results of the SOS4LIFE project and to illustrate the contents and functions of the US-DSS Information System and the related WebGIS. The Municipality of Malaga contacted by email at the beginning of February 2020 did not reply and then the COVID-19 lockdown phase took place in both countries and the site visit was no longer considered as feasible. In the following months it was possible to disseminate the results of the project at European level.

On 31/03/2020 a representative of the SOS4LIFE project was invited to participate in the Webinar organized by the PROGRESS (INTERREG) project "Interregional Thematic Seminar" Promoting the measurement of the costs and benefits of ecosystem services derived from land use ". It was an opportunity to present a summary of the results of the project (including the US-DSS Information System). This webinar was attended by representatives of other European research projects or institutions from Dublin (Ireland), Barcelona (Spain), Craiova (Romania), Riga (Latvia).

The exchange of experiences at European level continued on 10/06/2020 during the 1st International Training Workshop (ITW) - "Measurement of the costs and benefits of ecosystem services derived from land use", organized, again in videoconference mode, by the PROGRESS project.

Another moment of sharing at the European level was the Zoom Meeting of the XI Workshop Silva Mediterranea-CNR (international) which was attended by representatives of the European projects INTERREG PROGIREG, LIFE17 CCA / IT / 000079 URBANGREEN, PRIN-EUFORICC, INTERREG URBFORDAN.

An important opportunity for the dissemination of the project results at European level was the participation in the Eurosoil review scheduled for the second half of August 2020 in Geneva. Eurosoil 2020 had been identified as a European exhibition in place of the participation in the Global Soil Week (which took place in 2019 in Nairobi-Kenya but was not scheduled for 2020). As part of the various thematic sessions of Eurosoil 2020 there was the possibility to present the results of the project and also to illustrate the US-DSS Information System and the functions of the WebGIS with a particular focus on data relating to ecosystem services. Due to the COVID-19 pandemic, the organizers of Eurosoil 2020 had to postpone the exhibition to 2021. The SOS4LIFE Project participated with representatives of the CNR and Region partners in thematic round tables within which the themes of the sessions were defined. Three abstracts were presented


for participation in 3 different thematic sessions and all 3 abstracts were accepted by the Scientific Committee. Therefore, in the 2021 edition of Eurosoil, which again due to the protracted pandemic will take place in Virtual Congress mode, 3 separate presentations of the project results are scheduled in 3 distinct conference sessions.

At the national level, the dissemination of the results and the presentation of the Information System, despite the persistence of pandemic limitations, mainly took place, on the occasion of the final event of the project, the streaming Webinar "Freeing the soil" which was attended by over 270 people from all over Italy (from almost all the Italian regions).

Furthermore, the results of the project (including the characteristics and functionalities of the Web-Gis of the Information System) were presented during the networking meetings in videoconference with the PROGIREG project and the City of Turin (18/09/2020) and with the Soil4Life project. (24/09/2020).

### Action B4 – Deliverables and Milestones

The main outputs of action B3 (sub-actions B3.1-B3.2-B3.3) are as follows:

- sub-action B4.1: Municipal vector data-base with updates for the 3 partner Municipalities, on land take and soil sealing and degree of urban planning implementation with shared data model (Del. 16);
- sub-action B4.1: Urban and Soil Decision Support System (US-DSS) for the three Municipalities, shared and acting as a regional prototype, with shared data model (Del. 30);
- sub-action B4.1: Regional web-gis based on local databases, available for consultation by the public (Del. 33);
- sub-action B4.1: list of model-existing regional data and identification of the new model-municipal, urban and building data to be processed with the project (Del. 38);
- sub-action B4.1: Manual of procedures, methodologies and internal processes of the Municipal Administrations (Del. 39);
- sub-action B4.2: planning and development plan of the activities for the replicability of the US-DSS on a regional, national and European scale (Del. 40).

The following project deliverables were not produced:

 sub-action B4.1 - Register of building practices, with the updating of the land register, which intersects the data relating to utilities with the shared data model (Del. 25).

It was not possible to produce Deliverable 25 - Register of building practices with updating of land data register. Unlike what was initially hypothesized, despite having the Municipal Property Register (containing land data, and house numbering of each building), it was not possible to associate the data relating to building practices as this would also have required the digitization of all building archive (long and expensive operation) and the implementation of a specific database starting from the scanned documents. Furthermore, it was not possible to have the data relating to the users of the various services (eg. Electricity service) as these services are provided by a plurality of subjects and there is no single database.

It should also be considered that each municipality uses a different software for the management of building practices and this too has caused a further problem.

However, additional activities have been carried out such as, for example, the preparation of Soil Quality Maps starting from the Ecosystem Services Maps and these maps have been produced for a large part of the regional territory. Furthermore, all these data, mainly useful for supporting urban planning decisions, have been made available and can be consulted in the US-DSS Information System.

The following project milestones have been reached:

- sub-action B4.1: Start of implementation of the data model and the Regional Information System (US-DSS) (Mil. 16) – 16/03/2017
- sub-action B4.1: First meeting with stakeholder regions, strategic regional municipalities and ARPA to share the structure of the information-data model (Mil. 18) – 22/11/2019;
- sub-action B4.1: Start of experimentation of the information system for the three municipalities, shared and acting as a regional prototype, with a shared data model (Mil. 26) – 31/12/2018;
- sub-action B4.1: Implementation of the Urban and Soil Decision Support System (US-DSS) and activation of the related regional web-gis (Mil. 35) – 30/09/2020.



# ACTION C1 "MONITORING THE IMPACT OF THE PROJECT ACTIONS"

This action is implemented in parallel with the development of the project itself, with the objective to monitor the correct start/development of each planned action/activity, the objectives reached and expected results, the impact of the results at the end of the project and in the following 5 years.

Coordination: Municipality of Forlì Foreseen start date: 01/07/2016 Actual start date: 01/07/2016 Foreseen end date: 31/10/2019 Actual end date: 30/09/2020

The monitoring activity has been implemented during the project development, aim to verify the correct start/execution of each planned action/activity, the achievement of the expected objectives and results, the impact of the results at the end of the project and estimate the impact in the following 5 years.

The monitoring activity, coordinated by the Municipality of Forlì and carried out thanks to the collaboration of all partners, aimed to verify the performance indicators of LIFE2015 projects provided by the Call 2015 Guidelines and reported on the relevant Excel table (Deliverable n. 44).

The Monitoring Committee (one representative for each partner) met seven times:

- 06th of October 2016 Bologna, CNR Headquarter
- 28th of March 2017 Bologna, Emilia Romagna Region Headquarter;
- 28th of September 207 Carpi at the same time as the Annual Project Meeting
- 17th of April 2018 Bologna, CNR Headquarter
- 07th of May 2019 Bologna, Emilia Romagna Region Headquarter;
- 04th of December 2019 Bologna, Emilia Romagna Region Headquarter;
- 07th of September 2020 Video meeting.

The chairman of the Monitoring Committee, Fabrizio Ungaro – CNR, has been appointed during the first meeting: the Committee is chaired by the CNR, which has also taken over the chairmanship of the Scientific Committee, since the two Committees were reunited jointly.

The Monitoring Committee organised data collection for each indicator, divided the data collection activities among the partners, analysed the data collected and checked the development of the project against the objectives and expected results.

The indicator and monitoring tables have been updated by the Project Manager using data provided by the various partners.

Groupware platform has been used for the exchanging information and monitoring data in the initial phase: on September 2018 Groupware has been replaced by the "Microsoft Teams".

The monitoring process has been divided into three fields of investigation:

- project field;
- environmental field;
- socio-economic field.

The measurement Project field covered the correct development of the project, the progress of the planned actions and the related outputs.

With regard to the measurement of the project field, a number of specific excel tables have been prepared to monitor the progress of the project.

The tables are:

- Gantt Chart which shows the progress of individual actions and sub-actions of the project and any deviations from the planned timetable;
- Progress Indicators which shows the progress in percentage terms of each individual action and sub-action; the estimate of the percentage of progress takes into account not only the temporal progress of the action, but also the completion of planned activities, the preparation of deliverables and the achievement of milestones.

A Deliverables List and a Milestones List has been prepared: Deliverables and Milestones have been progressively listed according to the deadlines indicated in the approved project. The lists highlight any deviations from the initially established deadlines.

The initial work plan has been accompanied by a more detailed timetable than the initial one. The deadlines and the scheduled periods for convening the various Steering, Monitoring and Scientific Committees have been highlighted.

The foreseen actions have all been completed. The desealing actions have been partially implemented during the course of the project and will be completed in the After Life phase. The foreseen Deliverables have been produced (except. Del. 25 and Del. 35 as reported), some milestones were not achieved or were achieved later than expected: anyway, the Project has been implemented.

Due to Environmental issues (Resource efficiency - Soil), the measurement covered direct and indirect impacts on soil, efficient use of resources and other environmental aspects related to actions B1, B2, B3 of the project:

- carbon storage [Mg/ha];
- hydraulic regulation, water storage capacity in cu.m./ha;
- hydraulic regulation, surface runoff in cu.m./ha;
- biodiversity (QBS), Ecomorphological indicator (EMI);
- effect on the microclimate in terms of evapotranspiration capacity (kwh/ha).
- balance of eco-systemic soil services on a municipal scale with respect to the indicators referred to in action B2;

The impact of the implementation of standards and guidelines for "No net land take" and urban regeneration has been measured through the following indicators:

- Land take [ha/yy]:
- Increasing urbanised territory [%/yy];
- Numbers of desealing interventions
- desealing areas [mq]
- planned urban regeneration areas [mq]
- implemented regeneration areas [mq].



The monitoring of the Socio-Economic Field mainly concerned actions B1, B2, B3, B4, D1.2 and included the following indicators:

- increasing decision making ability of public administrators;
- number of Municipalities adopting the target "no net land take by 2050";
- number of Municipalities adopting the Urban and Soil Decision Support System (US-DSS);
- increasing Citizen' awareness of the value and soil eco-systemic functions of soil;
- increasing the environmental value of soil by Companies and private entities;
- incidence of tax relief for urban regeneration and land take limits on municipal budget revenues;
- reduction of costs for energy consumption for heating and cooling in the domestic sector.

The monitoring took place throughout the life of the project and included:

- 2 ongoing surveys, presented with Midterm Report and Progress Report
- 1 survey at the end of the project presented with the Final Report.

The Monitoring Committee noted that, given the nature of the project, it was not possible to measure (but only estimate) some environmental and socio-economic indicators. The difficulty lies in the fact that the project is mainly focused on the definition and approval of regulations, guidelines and urban planning tools that introduce limitations on land use with the aim of "no net land take".

The repercussions in the environmental and socio-economic fields of the new urban planning policies and related urban planning instruments will be detectable in the medium-long term when the relative forecasts have been implemented.

In the socio-economic field, an Evaluation Report (Deliverable n.45) of the socioeconomic impacts of the results was produced, attached to the Final Report. The drafting of the Socio-economic Impact Assessment Report was entrusted externally by the Region. The persons in charge participated in various meetings of the Monitoring Committee during which they presented the structure of the Report and discussed the data to be collected with the representatives of the partners.

An interim report (and a first version of Deliverable n.45) was presented during the monitoring visit in June 2019.

At least 5 surveys of the impact of the results carried out in the 5 years following the end of the project are also planned (action E1.2 After Life Plan).

The Report starts from the analysis of data relating to urban sprawl in the partner municipalities. The analysis aims to highlight how much this phenomenon is more or less accentuated and what costs each hectare of land consumed outside the urban area entails (considered as the urban perimeter of the "chief town" defined by lstat in the Population Census).

The consequences of settlement dispersion and related land take were measured in demographic terms (residents, families) and in terms of the economic costs that are generated by "greenfield" building interventions typical of sprawl (costs of new urbanization works and their maintenance, private transport, local public transport, suburban school transport and loss of ecosystem services).

To reduce settlement dispersion, which continues to consume land and generate diseconomies, it is increasingly necessary to implement urban regeneration interventions, redeveloping the existing building stock and recovering abandoned areas. The new urban planning law (LR 24/2017) approved by the Emilia-Romagna Region goes in this direction. This regional law, in addition to encouraging urban regeneration, incorporates the European goal of "no net land take" by 2050.

In the second part of the Report, the possible effects (in terms of demographics and entrepreneurial activities) caused by a greater use of urban regeneration interventions were examined.

To this end, some urban regeneration interventions implemented in the Region between 2001 and 2011 have been taken as a reference (therefore measurable in detail through the census data).

The de-sealing and green restoration interventions envisaged in the SOS4LIFE project are themselves examples of urban regeneration / redevelopment, which over time can potentially generate impacts on the value of the buildings in the area, on the population, on economic activities. (in particular in the field of the green economy), on ecosystem services (in particular in terms of infiltration of rainwater, climate regulation, increase in biodiversity) and on employment in terms of potential generation of new ULAs (units of work).

The final part of the Report dealt with the issue of increasing the sensitivity and involvement of politicians, technicians and citizens on the issues of the project. The measurement of this impact was made starting from the results of the 2 questionnaires that were proposed to the local public administrations and to the participants in the events. It also takes into account the data relating to the participation of politicians, public and private technicians, students, teachers and citizens in the numerous events organized / participated by SOS4LIFE.

The administrative data (mainly related to the population and businesses) and the resulting projections, photograph a situation largely dating back to the end of 2019, without considering the effects caused by the pandemic (COVID-19) that broke out in course of 2020 and continues in 2021; effects that are affecting and will affect not only people's lifestyles, but also the economy and probably the relationship of man with the environment.

# Action C1 – Deliverables and Milestones

The outputs produced as part of the action E are as follows:

- Monitoring plan shared by the Monitoring Committee including template and digital chart (Del. 3 – Midterm Report);
- Intranet for sharing the Monitoring process (Del. 6 Midterm Report);
- 1<sup>st</sup> Report in correspondence with the Midterm Report with the update of the "LIFE Project Specific Indicators" excel worksheet (Del. 17 – Midterm Report);
- 1<sup>st</sup> Monitoring reports showing progress and result indicators (Del. 21 Midterm Report)



- 2<sup>nd</sup> Monitoring reports showing progress and result indicators (Del. 21 Progress Report)
- 2<sup>nd</sup> Report in correspondence with the Progress Report with the update of the "LIFE Project Specific Indicators" excel worksheet (Del. 28);
- 3<sup>rd</sup> Report in correspondence with the Final Report with the update of the "LIFE Project Specific Indicators" excel worksheet (Del. 44);
- Report evaluating the long-term socio-economic impacts on the system and on the population of the territories considered Final Report (Deliverable n. 45);
- 3<sup>rd</sup> Monitoring reports showing progress and result indicators (Del. 46 Progress Report)

All the milestones foreseen by the project have been achieved:

- Appointment of the person in charge of the Monitoring Committee and of the members for each partner (Mil. 4);
- Establishment (first meeting) of the Monitoring Committee (Mil. 8);
- Validation of a set of indicators for every Field and Monitoring Action (Mil. 12).

# ACTION D1 "COMMUNICATION, DISSEMINATION AND NETWORKING INITIATIVES"

Action D1 was developed in parallel to the entire project with the aim of promoting, in all the subjects involved, respect for soil as a resource and the intrinsic value it has from an environmental and social point of view. The initiatives, meetings, events and involvement of various groups of individuals (politicians, experts, associations, students and citizens) regarding aspects and projects linked not only to themes relating to "sustainability" and respect of the environment, but also similar from a technical point of view, were great opportunities to disseminate the principles that guide the SOS4LIFE operation and the effects and results its development will bring.

Coordination: Legambiente Foreseen start date: 01/07/2016 Actual start date: 01/07/2016 Foreseen end date: 31/10/2019 Actual end date: 30/09/2020

Generally coordinated by Legambiente, action D1 is developed with the contribution and collaboration of all partners; as for the other actions, a working group has also been set up for this one.

Working group meetings: 6/10/2016, 23/10/2017.

In addition to the specific meetings of the working groups, the progress and activities of action D1 were always regularly illustrated and discussed during the periodic meetings of the Steering Committee and the annual project meetings.

The activity, in addition to some face-to-face meetings, was mainly developed through exchanges of emails or video meetings (especially in the pandemic period).

Action D1 is divided into the following sub-actions:

## Sub-action D1.1 - Networking

Networking has been structured in a Networking Plan (Del. 5.1 – Midterm Report) shared with the partners, thanks to which some of the European projects that deal with or have dealt with themes similar to those of the SOS4LIFE project have been identified, organisational methods have been defined and a programme of meetings and events throughout the duration of the project has been planned. Shortly after the start of the project, initial contact was made with other European projects – primarily projects with the common theme of land take or the theme of ecosystem services provided by soil.

During the development of the SOS4LIFE project, the European projects with which it was possible to establish contact and exchange information and experiences are, in part, different from what was initially foreseen.

On the website of the SOS4LIFE project, a specific page has been dedicated to the Networking activity, which contains a brief description and a link for each of the projects with which contacts and exchanges have been activated. Similarly, a link to SOS4LIFE has been placed on the websites of some of these projects.

DATE	VENUE	EVENT – ACTIVITY
20/09/2016	Antwerp (Belgium)	LIFE - Ecosistem services Conference 2016 EU "Helping nature to help us" with 14 other LIFE project LIFE11 ENV/FI/000911 LIFE12 BIO/LV/001130 LIFE12 ENV/FI/000150 LIFE12 ENV/UK/000473 LIFE12 NAT/GR/000275 LIFE13 BIO/CY/001114 LIFE13 ENV/BE/000212 LIFE13 ENV/LV/000839 LIFE14 CCM/ES/000957 LIFE14 IPE/FI/00023 LIFE13 ENV/IT/001218 LIFE13 ENV/LT/000189 LIFE14 NAT/UK/000070 LIFE13 NAT/NL/000079
2-4/11/2016	Stuttgart (Germany)	SOS4LIFE – Study visit to Stuttgart, leader city of the URBAN-SMS European project
30/11/2016	Bologna (BO) – Italy Emilia-Romagna Region	SOS4LIFE - Meeting "Verso il saldo zero di consumo di suolo: quali strumenti?" – representatives of the following projects also participated: LIFE12 ENV/IT/000578 Helpsoil LIFE13 ENV/IT/1218 Life SAM4CP

The Networking activities in which the SOS4LIFE project was involved as a participant or organizer were the following:



10-12/05/17	Tallin (Estonia)	LIFE Platform Meeting on Ecosystem Services -
		decision making
		LIFE13 ENV/LT/189 VivaGrass
		LIFE11 NAT/NL/776 Amsterdam Dune Project LIFE13 ENV/BE/212 Green4Grey
		LIFE13 NAT/UK/443 Cumbrian Bogs LIFE13 NAT/IT/1075 Pan Life
		LIFE13 INF/GR/188 Life Natura2000ValueCrete
		LIFE12 ENV/FI/150 LifePeatLandUse
		LIFE15 ENV/IT/225 Sos4Life
		LIFE14 NAT/BE/000364 Life in Quarries LIFE11 ENV/IT/000168 Making Good Natura
16/11/17	Torino (TO) - Italy	LIFE13 BIO/UK/428 EcoCoLife LIFE SAM4CP - Seminario internazionale "Suolo, servizi
		eco sistemici, infrastrutture verdi e blu, resilienza e pianificazione"
		representatives of the following projects participated: HORIZON2020 Connecting Nature: bringing Cities to life,
		bringing life into Cities INTERREG ALPINE SPACE - AlpES
		INTERREG ALPINE SPACE – LOS_DAMA! INTERREG CENTRAL EUROPE-Magic Landscapes
00/14/17		
28/11/17	Bologna (BO) - Italy Emilia-Romagna	"Consumo di suolo e servizi ecosistemici" –
	Region	LIFE15 ENV/IT/225 Sos4Life
		LIFE13 ENV/IT/1218 Life SAM4CP LIFE15 ENV/IT/396 Life Biorest
		LIFE15 ENV/IT/000641 Life Soil4Wine
13/07/2018	Torino (TO) - Italy Botanical Garden	LIFE BIOREST - Seminario "Verso una strategia europea per la protezione del suolo" – SOS4LIFE
	University of Turin	attended the Seminar with a presentation
11/05/2019	Bologna (BO) – Italy - Golinelli Foundation	LIFE BIOREST Convegno "Strategie Green per la città del futuro" – SOS4LIFE attended the Seminar with a
12/07/2010	Bologna (BO) Italy	presentation
12/01/2019	Emilia-Romagna	ENV/IT/000641 Life Soil4Wine
12/12/2019	Roma – Italy	LIFE17 GIE/IT/000477 SOIL4LIFE - Forum per la
	ISPKA Headquarters	in the Forum
31/03/2020	Webinar	PROGRESS (INTERREG) Interregional Thematic
		benefits of ecosystem services derived from land use"

16/04/2020	Webinar	Zoom Meeting-XI Workshop Silva Mediterranea-CNR (international) INTERREG PROGIREG LIFE17 CCA/IT/000079 URBANGREEN PRIN-EUFORICC INTERREG URBFORDAN
10/06/2020	Webinar	PROGRESS (INTERREG) international Workshop
26/06/2020	Webinar	PROGETTO INTERREG ADRIADAPT – Training Programme – L'adattamento climatico Nature-Based – SOS4LIFE ha contribuito con un proprio rappresentante all'attività formativa
18/09/2020	Video-Meeting	SOS4LIFE - Networking meeting with project INTERREG PROGIREG e Città di Torino
24/09/2020	Video-Meeting	SOS4LIFE - Networking meeting with project LIFE17 GIE/IT/000477 SOIL4LIFE

Exchanges of information and experiences also involved the LIFE17 GIC / IT / 000091 Life Beware project and the Institut Paris Region and the related european project REGREEN (Horizon2020).

The Networking activity is described in detail in the specific Networking Report (Del. 41)



20/09/2016 Antwerp – Belgium - 11/05/2017 Tallin - Estonia



28/11/2017 Bologna

13/07/2018 Torino







18/09/2020 VideoMeeting Interreg PROGIREG

24/09/2020 Videomeeting LIFE Soil4LIfe

# Sub-action D1.2 - Communication Plan and "Dissemination Pack" development

The dissemination activity throughout the duration of the project was very intense and made use of all the tools that had been foreseen.

The first dissemination activities were reported in the Midterm Report when was provided photographic documentation of Project logo, Communication kit, Educational kit, Brochure, Roll-Up, Notice Board and Information Totems.

This Final Report describes the various dissemination activities (Workshops, Seminars, Conferences, participation in Exhibitions, dissemination activities for Students) and provides an update on the use of the various dissemination tools (Website, Social networks, Videos, Scientific articles and information, Newsletters, Layman's Report, Press Releases, Educational Kit)

# Dissemination Events-Activities (Workshops, Seminars, Webinars, Conferences, participation in Exhibitions)

During the project, various public events were organized to disseminate the objectives and results. There was also the opportunity to present the results of the project in numerous events organized by other public or private entities. The dissemination activity was strongly interconnected with the networking activity.

The events organized and promoted directly by the SOS4LIFE project were advertised through news on the website, posts on social media and specific press releases: in some cases also through paper posters. For many of these events it was also possible to have a response with articles in newspapers and magazines in print or online that were collected in the press review.

Below is the list of dissemination activities

Altogether there are 34 events (which include Workshops, Seminars, Webinars, Conferences, participation in Exhibitions).

When	nr	Wher	What	Photo
16/09/2016	1	San Lazzaro di Savena (BO)	Festival della Terra	
30/11/2016	2	Bologna	SOS4LIFE - Meeting "Verso il saldo zero di consumo di suolo: quali strumenti?"	



15/06/2017	3	Forlì	Seminar "Rigenerare la città con la natura"	
21/09/2017	4	Venezia	URBANPROMO GREEN 2017	
21/11/2017	5	Milano	URBANPROMO 2017 (Exhibition)	
5-7/12/17	6	Firenze (FI)	42° Congress Nazionale Società Scienze del Suolo	
07/05/2018	7	Bologna (BO) CNR Istituto di Biometeorologia	Seminar "Modellistica per progettazione urbana in chiave climatica"	
16-17/ 5/2018	8	Roma (RM) Ergife Palace Hotel	Conference Esri Italia 2018	

17/05/2018	9	Helsinki & Vantaa	European Forum on Urban Forestry (EFUF) 2018	
28/05/2018	10	Firenze (FI)	Progetto nazionale di educazione sui temi dello Sviluppo Sostenibile "Isola della Sostenibilità	
07/06/2018	11	Ferrara (FE) Urban Center	Festival dello sviluppo sostenibile 2018	
29/08/2018	12	Gattatico (RE)	Introductory Seminar to the Summer School	
10- 13/9/2018	13	Palermo (PA)	Conference - Primo Convegno congiunto SISS- SIPE "II ruolo della scienza del suolo per gli obiettivi dello sviluppo sostenibile	
20- 21/9/2018	14	Ferrara(FE)	Remtech 2018 (Exhibition)	



21/09/2018	15	Venezia	UrbanPromo green 2018	
05/10/2018	16	Forlì (FC)	Conference - SOS4LIFE - "Consumo di suolo: dinamiche, impatti e strategie per contrastarlo. Città compatta e rigenerazione urbana"	
6- 9/11/2018	17	Rimini (RN)	Ecomondo (Exhibition)	
20- 23/11/2018	18	Milano (MI)	URBAN PROMO 2018 (Exhibition) XV edizione di Urban Promo (2018) "Progetti per il Paese"	
27/11/2018	19	Milano (MI) Politecnico di Milano	Conference - CRCS "Consumo di suolo, servizi ecosistemici e green infrastructures: caratteri territoriali, approcci disciplinari e progetti innovativi"	
27/11- 1/12/2018	20	Mantova (MN)	Seminar "Toward the "No Net Land Take" - Urban planning based on soil ecosystem services" - World	

			Forum on Urban	
			Forestry	
17/01/2019	21	Parma (PR)	Seminar "De- sealing: esperienze concrete di rigenerazione urbana e saldo positivo di suolo"	
16/02/2019	22	San Lazzaro di Savena (BO)	Participation Workshop "Scelte Forty"	
3/6/04/2019	23	Riva del Garda	Seminar - Rassegna Urbanistica Nazionale dal 3 al 6 aprile 2019	
13/04/2019	24	Forlì	Seminar - Forli- Smart City Live	
10/05/2019	25	Bologna	Conference - Strategie green (LIFE BIOREST)	
19/06/2019	26	Gattatico (RE)	Istituto Cervi "La cura del territorio"	
28/06/2019	27	San Lazzaro di Savena (BO)	Workshop - Salviamo il nostro Suolo	
18- 20/09/2019	28	Ferrara	REMTECH 2019 (Exhibition)	



24/09/2019	29	Torino	Workshop Combined Green Strategies for green cities	
30/10/2019	30	Parma - University	Seminar - "Emergenza climatica - soluzioni per l'adattamento urbano"	
14- 15/11/2019	31	Torino	Urban Promo (Exhibition)	
22/11/2019	32	Bologna	Seminar SOS4LIFE - Contrastare il consumo di suolo: esperienze, norme e linee guida	
28/05/2020	33	Bologna	Webinar Guidelines "Freeing the soil!" sub-action B3.3	
23/09/2020	34	Bologna	SOS4LIFE Final Event - Webinar - SALVARE IL SUOLO - Linee guida e strumenti di lavoro per tecnici e amministratori	

During the dissemination events 110 Municipalities, 8 Regions, 11 Provinces, 5 Regional Agencies for Environmental Protection were involved.

Among the dissemination activities, 7 were dedicated specifically to High Schools and Universities.

17/05/2017	1	Forlì (FC)	Liceo Scientifico Fulcieri (High School)	
8-9/06/17	2	Sesto Fiorentino	Scienzestate 2017 (High School and University Students)	
02/10/2017	3	Cesena FC	Facoltà di Architettura (University)	
01/02/2018	4	Modena	Liceo scientifico Tassoni (High School)	SOS-UF
13/04/2018	5	Modena	IIS "Fermo Corni" – Polo Vinci (MO) (High School)	SISUIF SISUIF



27/04/2018	6	Milano	Scuola di Architettura Urbanistica Ingegneria delle Costruzioni AUIC del Politecnico di Milano (MI) - University	
24/09/2019	7	Torino	Workshop Combined Green Strategies for green cities - University	Approcio   Mutidisciplinare pri   Scosostenibili:   Curparia

The participation / organization of dissemination events also continues in the After Life phase.

# Scientific articles (Del. 42)

During the development of the Project, were published n. 16 articles in technical/scientific journals or in national reports on land take. All the articles are listed in the Del. 42.

Further articles were published in the first part of the After Life period and others are in preparation.

### Press releases and press review (Del. 42)

The Del. 42 also contains a copy of the 15 Press Releases that have been issued by the various partners to inform about the activities or initiatives of the Project. An extensive Press Review has also been prepared documenting the dissemination of communications relating to the project.

### Traveling photographic exhibition on the value of the soil (Del. 13)

Among the tools for disseminating the risks associated with soil sealing and the need for virtuous land management practices, the project also wanted to create a photographic exhibition, with the aim of offering the public an opportunity for information on the activities carried out from the project.

In its final realization, the exhibition consists of:

- 17 photo-textual panels, of which
  - 10 panels describe the ecosystemic functions of the soil for the quality of life of man and the environment, declined on 10 verbs that recall its fundamental role: Feed (food), Conserve (Carbon), Host (biodiversity),

Purify (water), Refresh (heat island), Witness (historical memory), Inform (science), Protect (hydrogeological risk), Treat (active ingredients), Regenerate (psychological well-being);

- 4 photo-textual panels describing the project, the exhibition, the data on land take in Europe/Italy/Emilia-Romagna, and the de-sealing technique;
- 3 photo-textual panels that summarize the historical evolution of land take and the de-sealing experimentation of each of the 3 partner municipalities.
- 22 highly evocative 40x60 cm photographic shots, dedicated to examples of disused or unfinished buildings, and therefore abandoned.

Textual photo panels and photographic shots define three narrative sections:

- the ecosystem functions of the soil;
- the measurement of land take and the de-sealing experimentation carried out by the 3 partner Municipalities;
- a visual itinerary through potentially regenerable abandoned landscapes

From 28 August 2018 to 4 November 2019 the exhibition stopped in 12 different locations (instead of 9 as foreseen in the approved project):

- in the 3 partner municipalities: Carpi (MO), Forlì (FC), San Lazzaro di Savena (BO)
- in 7 other cities/localities of the Emilia-Romagna Region: Gattatico (Reggio Emilia), Parma (PR), Modena (MO), Nonantola (MO), Castelvetro (MO), San Giorgio in Piano (BO), Levizzano Rangone-Castelvetro (MO)
- in 2 cities of the Lombardy Region: Mantova (MN), Casalmaggiore (Cremona).



Traveling photographic exhibition



In 2020 were scheduled 2 other stages of the exhibition which have been postponed due to the pandemic by Covid-19. Further stages of the exhibition will be organized in the After Life period.

# Educational kit (Del. 13.1)

An Educational Kit was produced that incorporates themes and topics from the traveling exhibition on the soil. 500 copies of the Kit were printed and it was made available in pdf format on the Project website. 289 paper copies were distributed to 27 training institutions (Environmental Sustainability Education Centers and schools), and to 9 municipal offices. 58 requests to send material were received through the website.



Educational Kit

# Video (Del. 31)

A project video entitled "A question of soil" was produced. The video has a duration of 13 minutes. It focuses on the dialogue between an informed citizen and a grazing cow. The video, made primarily for educational / informative use, was conceived to raise awareness among citizens (and especially students) regarding issues related to the loss of soil and related ecosystem services.

While waiting to be able to complete the production of 3 short videos dedicated to desealing interventions in the partner Municipalities destined to be produced and conveyed in the After-life plan phase, the production of the videos was integrated with the creation of thematic video pills.

### Newsletter

8 newsletters were sent to the 1434 email contacts collected during the project period. Through the newsletter 8657 people were reached. 3522 unique recipients opened the received emails and 1224 clicks were detected on the emails.

### Layman's Report (Del. 34)

A document has been produced that summarizes the themes and contents of the Project and tells its vision and main outputs with references to the "Guidelines on good practices to limit, mitigate and compensate for soil sealing" of the European Commission, to data and the description of the problems connected to soil protection at the Italian and regional level. Each chapter is accompanied by the testimonies of the partners. The Layman's Report was printed in 2000 copies, which will be distributed mainly during the After Life phase.



#### Layman's Report

Until 30 September 2020, 14 Pages (1st and 2nd level) and 49 Articles / News have been published. Most of the deliverables have been published on the website and all the events organized have been reported. During the development of the project, a continuous work has been done to optimize the contents of the various pages in which the website is divided. The structure as a whole, of immediate and easy navigation, and the regular publication of contents ensured that the public could be regularly updated on the progress of the Project and that they could participate in its activities.

Below are some summary data on the visibility of the website which in the period of activity of the project totaled 36,214 visits (excluding the accesses of the site administrators) and 12,396 visitors.

Website



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#### Website - Visits per month

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2016								5	232	623	1.650	1.058	3.568
2017	704	449	528	646	644	346	427	317	354	656	667	275	6.013
2018	394	277	424	425	649	333	234	378	757	602	570	637	5.680
2019	1.101	862	614	802	646	537	872	532	608	909	1.456	819	9.758
2020	595	469	580	444	2.791	2.553	1.032	694	2.037				11.195

# Website - Visits per month (daily average)

							<u> </u>						
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	General
2016								1	8	20	55	34	28
2017	23	16	17	22	21	12	14	10	12	21	22	9	16
2018	13	10	14	14	21	11	8	12	25	19	19	21	16
2019	36	31	20	27	21	18	28	17	20	29	49	26	27
2020	19	16	19	15	90	85	33	22	68				40

Trend of visits in the period Sep 2016-Dec 2020

#### SOS4LIFE - LIFE15 ENV/IT/000225 Final Report

Visualizzazioni totali

					Mesi e anni	Media	giornaliera					
	GEN	FEB	MAR	APR	MAGGIO	GIU	LUG	AGO	SET	ΟΤΤ	NOV	DIC
2016								1	232	623	1.6K	1.1K
2017	704	449	528	646	644	346	427	317	354	656	667	275
2018	394	277	424	425	649	333	234	378	757	602	570	637
2019	1.1K	862	614	802	646	537	872	532	608	909	1.5K	819
2020	595	469	580	444	2.8K	2.6K	1.0K	694	2.0K	1.0K	887	515
2021	518											

MENO VISUALIZZAZIONI



At the top of the most viewed pages are the Home Page, the Project page, and the Documents page with the possibility of downloading the deliverables. The most read news and pages of the website in the period from September 2016 to December 2020 are the following:

Home page/Archives	
	16.938
Project	2.670
Pubblicate le Linee guida sulla rigenerazione urbana	1.951
Documents	1.917
Azioni	1.668
Partner	1.454



Avanzamento attività	833
Networking	728
Presentazioni	671
Contacts	661
28 maggio - Presentazione delle Linee guida sulla rigenerazione urbana	644
Un indice per misurare la qualità del suolo: l'esperienza di Stoccarda	563
Convegno «Contrastare il consumo di suolo: esperienze, norme e linee guida»	547
Verso il saldo zero del consumo di suolo: quali strumenti?	460
La valutazione dei servizi ecosistemici del suolo e la pianificazione del territorio	451
Dresda: pianificazione urbanistica e compensazione biologica	425
"Un tesoro di suolo diventa kit didattico"	422
Project	409
23 settembre - Evento finale di progetto	406
A Parma la 5° tappa della Mostra e un Convegno	399
I giardini della pioggia	395
30 novembre 2016 - Save the date!	261
Documents	252
Media	249
Al via il progetto Sos4Life	226
Evento finale: on line tutti i materiali	211
Linee guida per la rimozione, gestione e riapplicazione del topsoil	165
Valutazione dei Servizi Ecosistemici a livello comunale	148
Nascosta	147
Continua il viaggio della Mostra	134
Partners	126
II Rapporto CRCS 2018	117
Newsletter	115
Luca Mercalli all'evento finale di SOS4Life	101

# **Social Networks**

To amplify the dissemination of the activities related to the project, and create reference groups with a strong interest in the topics covered and a consequent spontaneous willingness to disseminate them, the project regularly published news, information and insights on the social profiles activated (Facebook and Twitter ).

The third social network activated at the start of the project, Google+, not only proved to be inadequate to support the communication of the project, but was closed by Google itself in April 2019.

PAGE	URL	ACCOUNT
Facebook	https://www.facebook.com/saveoursoilforlife/	@sos4life
Twitter	https://twitter.com/Sos4L	@Sos4L
		#SOS4life
Google+	https://plus.google.com/100791107952073338850	discontinued

The communication activity on social media proved to be effective, also for having found opportunities and useful content for publication regardless of the release schedule of the deliverables and project events.

Facebook turned out to be more successful and easier to use than Twitter, which turned out to have a less impactful relational network for the project. Consequently, less attention was paid to Twitter also for the communicative characteristics of this social media and the reduced possibility of giving voice to complex and articulated contents.

FB – Likes on the profile page		598
FB - Followers		657
FB - N. post		166
FB – Page coverage (n. times)	Daily Total Impressions	45.555
FB – Page coverage (unique visitors)	Daily Total Reach	31.207
FB – Page views (unique visitors)	Daily Total Consumers	2.147
FB - Click on the page (unique visitors)	Daily Page Engaged Users	3.538
FB – Post coverage (n. times)	Lifetime Post Total Impressions	40.522
FB – Post coverage (unique visitors)	Lifetime Post Total Reach	30.922
FB - Clicks on posts (unique visitors)	Lifetime Engaged Users	3.146
FB – Reactions and Comments		1.731

### FACEBOOK



	SOS 4LIFE	
SOS4Life @saveoursoilforlife	UFE15 ENV/IT/000225	
Home		
Informazioni	ı∲ Mi piace 🔌 Condividi 💉 Suggerisci modifiche \cdots	Scopri di più 🔗 Invia un messaggio
Post		
Foto	Post	Community Mostra tutti
Twitter	SOS4Life	🐞 Piace a 624 persone
Video	12 aprile - 😡	Sollower: 689
YouTube	Come trasformare una città con la #natura 🌱 🌳 🌺 ?	-
Community	Ne parlerà il progetto #proGlreg al convegno e al tour virtuale di Torino	Informazioni Mostra tutto
Fventi	dell'appuntamento di metà progetto.	Contatta SOS4Life su Messenger
Evena	Tre visite virtuali con gli stakeholder, interviste, presentazioni e dibattiti,	www.sos4life.it
	per approtondire J il lavoro realizzato nell'ambito dei Turin Living Lab.	Organizzazione
Crea una Pagina	Altro	
Crea una Pagina	Altro	Trasparenza della Pagina Altro
Crea una Pagina	Altro	Trasparenza della Pagina Altro Ti stiano mostrando queste informazioni per alutarti a comprendere meglio lo scopo di una Pagina. Vedi le azioni eseguite dalle persone che gestacono e pubblicano contenuti.

#### **TWITTER**

Tweet	Tweet views	Followers
129	55.981	97



A good support for the dissemination activity was also provided by the SOS4LIFE channel on YouTube (https://www.youtube.com/channel/UCYpbp1UkTwXVD1w-WDsQL9g/videos) on which was published the popular video "A question of soil", video pills on the themes of the project and video recordings of events. The data relating to the views of the 47 videos are as follows:

YOU TUBE	2016	2017	2018	2019	2020	Total
Views	23	230	182	465	898	1.798
Time / hours		10,4	7,5	12,3	137,7	168
New subscribers	1	2	1	11	27	42

The number of views at the time of closing this Report has risen to 2,418



The dissemination activity, in addition to having increased the awareness of technicians, politicians, citizens and students on the value of the soil and on the importance of countering its consumption, has also made it possible to obtain the following awards:

- Urban Planning Award in the 2018 edition of UrbanPromo (in Milan) for the desealing project "Giardino dei Musei" in Forlì
- Inclusion in 2018 of the SOS4LIFE Project among the Best Practices in the Guidelines for Green City by the Green City Network
- Urban Planning Award in the 2019 edition of UrbanPromo (in Turin) for the SOS4LIFE Project
- Inclusion of the SOS4LIFE Project among the Best Practices in the 2019 Report of ISPRA (Higher Institute for Environmental Protection and Research)
- Inclusion in 2020 of the SOS4LIFE Project among the Best practices of ICESP (Italian Circular Economy Stakeholder Platform).





Urban Planning Award 2018 and 2019 REPORT | SNPA 08/2019

PROGETTO EUROPEO SOS4LIFE (SAVE OUR SOIL FOR LIFE) LIFE15 ENV/IT/000225, FORLÌ, ITALIA Autor della schole Sonere di Fari Soneretari

Il progetto sucped SOGUEEE, che ha preso i via nel luglio 2016 e si concluderis nell'otatore 2019, intende contribuire all'attuacione degli indrizzi europei in materia di tutele del suolo con l'obiettito di diroctarre l'applicabilità a sola comunale della strategia comunitaria del "no net land taise" (saldo zero di consumo di suolo) ttabilito dalla Rodimap per un uso efficiente della rinore in Europa (2011). La partenetti di di ropotto comprende i comuni di Forli (phe ha l'usolo di continamento), Carpi (MO) e Sen Lazzro o di Sevena (BO), la flegione Emilia-Romagna, CNR libreri, Legandiarette Emilia-Romagna, ANCE Emilia-Romagna e Fold Mobilit Integrata. 1 a donni cinvolti nel progetto hanno proceduto alla misuazione a luetto locale dei consumo e dell'impermesbilizzazione dei tudo per ricotturio esi i quadro statuiso sa la damombie evolutive stonte dei ferroreno: Queste misutzanoi sono funzionale alla costruzione di un sistema di montoreggio che posta essere registato sa sola regionale.



DAL PANO STRATEGICO AL PANO TERRITORIALE METROPOLITANO

dai contenuti territorial del Piano Strategico Metropolitano, propone li nuvoo strumento di painificazione territoriale quale momento di trasiformazione non impositiva ma orientativa nel controni tdei comuni. Le strategie progettuali del PTM prevedono «aree obbiettivo» che vengono considerate come ambiti propulsori della riquafificazione elo rigenerazione urbana sostenibile quali "grogotto di vita da territorio", tati da generare effetti di migitoramento delle condizioni di vita urbana e metropolitana. Aree che devono ospatte progetti di tutelarialarizzazione elo progetti strategici condivisi di brevelmediolungo periodo per portera ad una rigenerazione complessiva del sistema territoriale metropolitano. L'Indrivitazione ofielle "aree obbiettivo" finalizzate a creare opportunità di sviluppo avrà come fondamento didea al territorio contenuta nel Piano Strategico definita dalfancioazione in bioregioni urbane policentriche e trsente Di Pogetti Stategio, Città Metodettana II ervere Megnotomicneti hug-piencontegiano, dimensiona II and



In cli bateva da levea Iprogeto 503-414F, avvisto nel 2016, intende dimostraer Tappicabilità a scala locale defibiettivo europeo del'consumo nelto da sulo zero al 2050. I partenanto, continato dal Comune di Forit, è composto da Regione Emilia-Romagna, Comune di Carpi, Comune di San Lazzaro di Savena, CNR IBE, ANCE Emilia-Romagna, Legambente Emilia-Romagna e Forti Mobilità Integrata. In ciascun Comune sono stati misurati e mapati consumo e impermedizizzazione dei sulo fri costruerdone le dinamiche envilative. Nei te comuni sono stati valitate magnati sette servizi ecositemici dei suoli e stimato l'impatto del consumo di suolo su tali serviz. Sono state i valitate rodate carte della quattà dei suoli basate sui servizi ecosistemici. A partire da queste valutazioni, un sistemi informativo, in face di utilinazione, potrà formie un supporto alle decisioni in materia di piamilicazione territoria. Autere: Sterno Bazzochi (Comune el Foni) Auterodimienti wasolite.ti 

Green City Network Guidelines 2018 – ISPRA Report 2019





ICESP – Italian Circular Economy Stakeholder Platform

# Action D1 – Deliverables and Milestones

The outputs produced as part of the action D are as follows:

- sub-action D1.2 Communication Kit Project logo, concept, graphic design and coordinated image (Del. 2 – Midterm Report);
- sub-action D1.2 Dissemination/information material information brochure, noticeboard, roll-ups (Del. 4, 4.1, 4.2 and 4.3 Midterm Report);
- sub-action D1.1 Networking plan and communication tools (Del. 5.1-5.2 Midterm Report);
- sub-action D1.2 Information Totems to install in the de-sealing areas of the three municipalities involved (Del. 8.1, 8.2 and 8.3 – Midterm Report);
- sub-action D1.2 Traveling photographic exhibition on the soil theme (Report Del. 13)
- sub-action D1.2 Educational Kit (Del. 13.1)
- sub-action D1.2 n. 1 Professional video of the project (Del. 31)
- sub-action D1.2 Layman's Report (Del. 34)
- sub-action D1.1 Networking Report (Del. 41)
- sub-action D1.2 Scientific/dissemination articles, press releases, press reviews (Del. 42).

It wasn't considered useful to produce the folders with the project logo (Del. 4.3).

The following milestones have been achieved:

- sub-action D1.2 1-day project kick-off meeting in Forlì 19/07/2016 (Mil. 2 Midterm Report);
- sub-action D1.2 3 Conferences to launch the de-sealing interventions (Mil. 7 – Midterm Report) – instead of at each Municipality, a single press conference



was held at the Region (17/11/2016) that illustrated the entire SOS4LIFE project and the 3 de-sealing interventions;

- sub-action D1.2 Website and social networks 6/09/2016 (Mil. 11 Midterm Report);
- sub-action D1.2 Start of the Traveling photographic exhibition 28/08/2018 (Mil. 27)
- sub-action D1.1 Realization of 3 videoconference meetings (Mil. 33) 1<sup>st</sup> 10/06/2020 Web Meeting with the Progress project (Interreg), 2<sup>nd</sup> 18/09/2020 Web Meeting with the Progreg project (Horizon2020) and the city of Turin, 3<sup>rd</sup> 25/09/2020 Web Meeting with the Soil4Life project
- sub-action D1.2 Participation in the Remtech Exhibition in Ferrara– 21/09/2018 (Mil. 38)
- sub-action D1.2 Participation in the S.A.I.E. Exhibition in Bologna (Mil. 39) Instead of the S.A.I.E. Exhibition, the SOS4LIFE project was presented at the Urban Promo 2018 Exhibition in Milan 23/11/2018 with the display of 2 illustrative panels and with insertion for 1 year in the online gallery of the event
- sub-action D1.2 Final event of the project in Bologna (Mil. 40) Due to the pandemic, the final event was organized on 23/09/2020 in webinar mode and was broadcast in live streaming from the Legambiente headquarters in Bologna (over 270 participants)
- sub-action D1.2 Participation in the Global Soil week (M il. 41) Instead of the Global Soil week (which in recent editions took place outside Europe) it was decided to participate in Eurosoil2020. Three different abstracts related to the results of the SOS4LIFE project were presented. All 3 abstracts were admitted (2 presentations and 1 poster session). However, the 2020 edition of Eurosoil has been postponed to 2021 due to the pandemic. The partners CNR-Ibe and the Emilia-Romagna Region will participate in Eurosoil2021 Virtual Congress 23-27 August 2021 representing the SOS4LIFE project. Considering that the 3 abstracts had been admitted for the 2020 edition postponed to 2021, the Milestone is considered to have achieved even if materially the presentations will be made in August 2021.

The following milestones have not been achieved:

- sub-action D1.2 Start of educational workshops to present the educational kit to teachers (Mil. 19) - It was problematic to be able to organize meetings with several teachers. Therefore, it was preferred to deliver the educational kits directly to the Environmental Sustainability Education Centers and to some teachers of various schools. In addition, online promotion was carried out.
- sub-action D1.1 Transnational study visit in a European selected city (Mil. 20)
   Due to the pandemic it wasn't possible to carry out this visit which was scheduled for the final phase of the project in spring 2020 (the destination would have been the city of Malaga in Spain). There were other international networking meetings, in webinar mode, during which it was possible to present the results of the project to other European cities.
- sub-action D1.2 Launch of citizenship awareness events (workshops, barcamps, flashmob) Mil. 24 These events, scheduled for 2020 in the final phase of the project, have not been realized due to the pandemic. Before the pandemic, the 9 stages of the traveling exhibition became 12 (with a further 3 stages). There were also several public events for the dissemination of the

project results in which the citizens took part, but flashmobs and barcamps were not feasible.

# ACTION E1 "PROJECT MANAGEMENT AND AFTER LIFE PLAN"

Action E1 was developed in parallel with the project, with the objective of ensuring its correct organisational and financial management for its entire duration and guaranteeing dissemination of the relevant results in the 5-year period following its conclusion.

Coordination: Municipality of Forlì Foreseen start date: 01/07/2016 Actual start date: 01/07/2016 Foreseen end date: 31/10/2019 Actual end date: 30/09/2020

Action E1 is divided into the following sub-actions:

### Sub-Action E1.1 Project Management by the Municipality of Forlì

The Municipality of Forlì, in its position as coordinating beneficiary, was responsible for Project Management.

Management of the project was entrusted to a Project Manager (PM) appointed by the Municipality of Forlì.

Contrary to what was initially envisaged by the approved project, the Municipality did not recruit additional staff for a fixed-term period to entrust with the role of Project Manager, preferring instead to use one of its own employees. Following the Director General's deliberation n° 1464 of 27/07/2016, Architect Stefano Bazzocchi, Urban Regeneration Manager of the Urban Planning Department of the Municipality and one of the authors of the SOS4LIFE project, was formally appointed to the role of Project Manager.

Aside from the appointment as Project Manager, architect Stefano Bazzocchi was and still is responsible for European project SOS4LIFE procedures.

The same aforementioned executive decision entrusted coordination of the project to the Manager of the Urban Planning Department, Architect Massimo Visani. The Project Manager dealt with:

- guarantee constant control of all actions, including activities that will be outsourced, and coordination with partners;
- draft the planned reports in collaboration with partners;
- manage reports with EASME, the European Commission and the appointed Monitor;
- manage relations with stakeholders;
- organise and take part in meetings, project meetings, study visits and networking and dissemination activities.

Having appointed an inhouse PM, the Municipality of Forlì availed itself of the possibility of recruiting, for a fixed term period, a technical collaborator to support the PM for the entire duration of execution of the various activities.

This did not determine an increase in the number of days envisaged in the project and therefore, the overall cost of Project Management.

The expert supporting the Project Manager was recruited as additional staff.



This PM support role was held by 3 different technical officers throughout the project:

- engineer Marika Medri from 17/10/2016 to 10/09/2017
- engineer Marco Barlotti from 15/10/2017 to 31/03/2018
- architect Serena Orlandi from to 1/02/2019 to 30/09/2019.

To manage and implement the project, every partner arranged to appoint its own technical contact person and administrative contact person (for economic-financial aspects).

In his activity, the Project Manager mainly has been deal with these contact people. All partners has been report to the Project Manager, by periodically informing him of the technical advancements and of any type of observation, problem, improvement to maximize the performance of the results.

By its very nature, action E1 was linked to and interacted with all the actions planned.

The project governance was entrusted to the following committees which has been meet personally at the partners' headquarters or via video conference:

- Steering Committee (SC) it had the role of periodically assessing the state of progress of the project, both in terms of technical and financial aspects, it was responsible for solving any problems that may arise and that could affect execution of the project and it assessed and approved any budget variations. The committee met, on average, twice a year, one of which in conjunction with the Annual project meeting.
- Scientific Committee (ScC) it was chaired by a scientific Coordinator appointed by partner CNR and was entrusted with the following tasks: analysis, supervision, support to the development of methodologies, regulatory, scientific and technical aspects, as well project actions. The committee met, on average, twice a year.
- Monitoring Committee (MC) it managed the activities planned under Action C1 by monitoring the processes, in order to ensure the best sustainable socioeconomic impact of the results. The Monitoring Committee was made up of representatives of the partners. At the time of its establishment, the chair of the committee was entrusted to CNR. It met, along with the Scientific Committee, on average twice a year.
- All the committees availed themselves of the support of operational staff:
- Technical Staff (TS) coordinated, for each partner, by internal specially appointed Representatives; they was in charge of the activities under the project actions, also by working through Working groups;
- Administrative Staff (AS) coordinated, for each partner, by specially appointed administrative representatives.

With regard to economic-financial accounting for the project and solving relevant problems, the Project Manager and the Steering Committee availed themselves of the support of an external company chosen by the Municipality of Forlì by means of a public tender (Techne).

The exchange of information and documents between the partners and between PMs and members of the Staff or Committees, as well as with the company in charge of the economic-financial reporting of the project, took place both by e-mail and by using the "Groupware" online platform made available by the Emilia-

Romagna Region. The Region subsequently replaced Groupware with Microsoft's Teams.

Coordination of project activities also held annual meetings attended by all those who dealt with the development of technical actions and administrative aspects for each partner.

The kick-off meeting that launched the project was held in Forlì on 19/07/2016. The annual project meeting were held:

- in Carpi on 28/09/2017;
- in Forlì on 5/10/2018;
- in San Lazzaro di Savena on 26/09/2019.



Kick-off Meeting Forlì – 19/07/2016

Kick-off Meeting Bruxelles 14/10/2016



Meeting - Carpi 28/09/2017



Meeting - Forlì 05/10/2018





Meeting San Lazzaro di Savena 26/09/2019

Due to the pandemic, it wasn't possible to organize the 2020 meeting.

Annual meetings were opportunities to update all participants on the state of the project, to share the results achieved and to plan subsequent activities and deadlines.

The Project Manager also took part in the kick-off meeting organised by EASME in Brussels on 14/10/2016 (dedicated to the soil-related projects eligible for funding, including those for the 2015 call).

The Committees met on the following dates:

- Steering Committee: 07/09/2016 28/03/2017 01/06/2017 28/09/2017 27/03/2018 8/11/2018 7/05/2019 4/12/2019 11/08/2020;
- Scientific Committee/Monitoring Committee: 6/10/2016 28/03/2017 28/09/2017 17/04/2018 7/05/2019 4/12/2019 7/09/2020.

The monitoring visits by the appointed Monitor, Mr Riccardo Giandrini, were held:

- in Forlì on 07/02/2017
- in Bologna and San Lazzaro di Savena on 24/05/2018
- in Bologna on 26/06/2019
- by videoconference on 25/06/2020.

All partners participated in these visits.



Monitoring Visits -San Lazzaro di S. 24/05/2018 and Bologna 26/06/2019

Contacts with EASME occurred mainly for the following reasons:

receipt of the Grant Agreement to be signed and retransmission of the same;

- via e-mail for communication by EASME of the payment of the first pre-financing and the second financing;
- via email for communication by EASME of the outcome of the various monitoring visits and evaluation of the Midterm report and Progress Report;
- via email for communication relating to the events for the 25th anniversary of the LIFE program in which the SOS4LIFE project participated with an event and for which, following an email request, it received some gadgets to be distributed;
- by e-mail for the communication by the Municipality of Forlì, as coordinating beneficiary, of the delay in the transmission of the Midterm Report;
- submission by EASME of the Letter amendment n ° 1 to the Grant Agreement
- request for extension by the Municipality of Forlì and response by EASME (Letter amendment n° 2 to the Grant Agreement)
- reminders, via email, for sending the Final Report.

Two amendments to the Grant Agreement were approved:

- Letter Amendment n ° 1 to the Grant Agreement Modification of the definition of conditions for natural persons, submission of VAT certificate and threshold for submission of the certificate on the financial statements;
- Letter Amendment n ° 2 to the Grant Agreement Modification of the following:
  - 1) Forms A1, C2 and C3 as set out in Annex II of the grant agreement are modified as set out in the new Forms A1, C2 and C3 attached to the letter.
  - 2) The duration of the project in Art. 1.2.2 of the grant agreement is extended and shall run for 51 months from 01/07/2016 to 30/09/2020.

**Sub-action E1.2 After Life Plan** to guarantee the maximum and most effective dissemination during the 5-year period after conclusion of the project. This sub-action was implemented in the final phase of the project.

The required After Life Plan has been prepared (Del. 43).

The After Life Plan contains a brief description of the main objectives, the main activities and results of the project. The communication tools used are listed. There is also a brief summary of the dissemination and networking activities carried out. A chapter (reported below) describes the After Life strategy and at the end there is a table listing the activities planned for the After Life period with the related budget.

# After Life Strategy

The de-sealing intervention in the Municipality of Forlì, related to the application of the Guidelines for the removal, management and reapplication of topsoil, will continue. If conditions permit, the topsoil resulting from another urban transformation located in the Municipality of Forlì will be reused for the green recovery intervention.

The two weather stations located in Forlì will remain active to continue to periodically collect meteo-climatic data, carrying on even after the completion of the de-sealing and green recovery in order to verify the effects of this action on the microclimate of the area.

The completion of the 3 short videos, one for each of the de-sealing actions, serves to prove the realization of the projects (demonstration activity) and also to have useful material for the dissemination activity.


The 3 partner municipalities have to periodically update the local data on land take and soil sealing, and it is responsibility of the Emilia - Romagna Region to update the data for all regional municipalities from new maps of land use: these updated values will improve the database of the Urban Soil and Decision Support System (US-DSS) realized by the Life Project and available on a server of the Emilia-Romagna Region.

The other important commitment for all partners is the continuation of dissemination of project results and networking activities.

The target for the dissemination activities remains unchanged and is very wide: it is an audience ranging from public and private technicians to local administrators, students and their teachers and all other citizens.

The target is to continue raising awareness among all citizens on the importance of soil and ecosystem services using proven tools like the travelling photographic exhibition or public meetings to disseminate/inform. It is expected that dissemination activities dedicated to students and teachers using the educational kit will continue, through meetings at schools and universities: the video of the desealing action on the three different sites will also be made available.

It is also important to continue the dissemination of project results such as guidelines and de-sealing actions as an example of best practices in urban planning and the Monitoring and Decision Support System: this will be done in traditional ways, widely used during the project such as the organization of specific training/information events (seminars, workshops) or the participation as a representative of the project in events organized by other public or private entities or other European projects (including Italian or European trade fairs or exhibitions, such as Eurosoil 2021). We will continue using distance learning/dissemination tools such as webinars, as they undoubtedly allow a wider participation and greater dissemination of results.



After Life Plan

The After Life strategy will also continue to support the dissemination of the project results in the more traditional forms and in presence, always with the support of communication tools such as the website and social media: the commitment is to keep the website and the social profiles (Facebook and Twitter) up and updated throughout the After Life period.

The Youtube SOS4LIFE Channel will continue to host the videos recorded during these years (events, seminars, webinars and the informative/divulgative "video-pills" on the main themes of the project). This channel will host the 3 short videos dedicated to the de-sealing actions and all the others new "productions".

The pursuing of networking activities (face-to-face or remote meetings) with other European projects aimed at exchanging experiences and disseminating the project results is an important part of the After Life Strategy.



After Life Plan

#### **Action E1 – Deliverables and Milestones**

The outputs produced as part of the action E are as follows:

- initial work plan, including a strategic-executive programme for project actions, Gantt chart and allocated roles (Del. 1 – Midterm Report)
- After Life plan (Del. 43).

All the milestones foreseen by the project have been achieved:

- first meeting of the Steering Committee 7/09/2016 (Mil. 3 Midterm Report);
- assignment to an external company to support the management and reporting of the project - 10/01/2017 (Mil. 5 – Midterm Report);
- appointment of the Project Manager 27/07/2016 (Mil. 6 Midterm Report)
- presentation of the After Life Plan attached to the Final Report (Mil. 42).



# 6.2. Main deviations, problems and corrective actions implemented

The Project, in the implementation phase, was not subject to substantial changes in terms of content, objectives and organization of the activities.

In the implementation of the project, situations occurred that led to a delay with respect to the estimated timing and there were some changes in the deliverables and milestones initially established.

The details of the changes relating to Deliverables or Milestones are already contained in the description of the individual actions and sub-actions (chapter 6.1 Technical Progress per Action).

The main deviation from the approved project concerned the overall schedule and was caused by the delay in carrying out the desealing demonstration interventions (Action B2): one for each partner Municipality.

In March 2019 a formal request for Amendment to the Grant Agreement was sent to EASME containing the proposed extension of the project duration by 11 months, moving the deadline indicated in form A1 from 31/10/2019 to 30/09/2020.

Although the extension was granted, the implementation of the interventions (for Forlì and Carpi only partly due to the pandemic) was further delayed.

The desealing interventions in Forlì and San Lazzaro di Savena are at an advanced stage of construction and will be completed in the AfterLife period. The Carpi desealing intervention has been planned and has yet to be started but there is a commitment by the Municipality to always carry it out in the first part of the AfterLife period.

The other time difference concerns (for Forlì and Carpi) the adoption of the new general urban planning instrument which includes rules for the containment of land take. The new municipal urban plans of Forlì and Carpi (but also of San Lazzaro di Savena) are being drafted and, as required by Regional Law 24/2017, will be aimed at containing land take and will favor urban regeneration. The legal deadline for the adoption of these plans has been extended (due to the Covid-19 pandemic) from 01/01/2021 to 01/01/2022. Therefore, one more year was granted to the various Municipalities of the Region, all involved in the drafting of these plans, to make up for some delays caused in 2020. The difference is, however, only temporal. Because the foreseen urban plans are being drawn up and will be adopted by contributing to the objectives of the SOS4LIFE Project, as foreseen.

## 6.3. Evaluation of Project Implementation

Structure, objectives and actions of the Project have not undergone substantial changes.

The activity, as part of the individual actions and sub-actions in which the project is articulated, was largely coordinated using the Workging Group in which representatives of the various partners participated. For some activities partly carried out in the field (e.g. for actions B2 and B1.3), we worked in smaller groups which, normally, saw the involvement of CNR-Ibe, the Region and the Municipalities on the territory of which acted.

The meetings of the Workging Group served both for an initial discussion on how to implement the action, and for periodically discussing the problems encountered and sharing the documents produced. In some activities (eg drafting of Guidelines for the reuse of topsoil – Del. 27) the method of carrying out through meetings of the Working Group was particularly effective and prevalent. For other activities, the meetings were more sporadic and the work was carried out remotely by contacting via email, telephone and videoconference.

The reserved area on the Groupware platform that was made available by the Region was useful for sharing documents between partners.

Subsequently, this sharing tool was replaced by the Microsoft Teams platform, also made available by the Region.

Videoconferences (with Google Meet or other similar platforms) have been used more frequently since the start of the pandemic.

The periodic meetings of the various Committees (Steering Committee, Monitoring and Scientific Committee) were important moments of comparison and updating of the partners on the progress of the project as a whole, of the individual actions and to solve any problems.

The organizational methods were largely functional to the implementation of the Project. Certainly, once the project is completed, an underestimation of the impact of some variables that have affected the timing of implementation can be noted.

The problems that emerged during the development of the Project were not related to the structure or purposes but to the temporal overlap of some actions. It was considered to be able to develop some actions in parallel but this was only partially possible, as certain actions needed data deriving from others.

There were situations that were not foreseeable and that led to delays in the preparation of the scheduled deliverables. Among these was the approval of the new regional urban planning law (Regional Law 24/2017), which was not known at the time of the preparation and approval of the project. There was also the amendment to the Public Procurement Code which affected the procedures for awarding professional assignments and technical services. In addition, new labor regulations and regulations relating to the budgets of public bodies have come into force.

Unlike other projects, some of the actions, in order to be implemented, required input or a precise political will (which may vary in the event of a change of municipal administrations during the project).

The drafting of a new urban planning tool and the related urban planning choices are strictly dependent on the will of the political decision makers.

Furthermore, as we have seen, the contents of urban plans may be subject to changes in the laws (in this case regional). Although, fortunately, the new regional law assumes and adopts the European objective (no net land take by 2050) that is the basis of the project. We do not want to attribute to the SOS4LIFE project the new regional urban planning law and its orientation towards a more sustainable territorial planning. But the fact that the Region has been a partner of the Project since its presentation in the 2015 call, has contributed (by providing the first studies, data and evaluation elements) to support the path that led to the approval of the



Regional Law 24/2017 in December 2017 (innovative throughout the national panorama).

Another variable, which affected the timing of implementation (in particular of the desealing interventions) was the financing of the works. The European contribution does not finance the execution of the works but only informative collateral activities (the Totems in each area of intervention) and the creation and monitoring of demonstration plots with soil and technosol. The procurement of financial resources by the 3 Municipalities (own resources or private resources) was more complicated and took longer than expected.

Regarding the costs for the implementation of the various actions, no significant deviations were detected at the end of the Project. Certainly there were some activities that were more demanding (for example the creation of the US-DSS Information System) leading to an increase in the cost of external assistance.

The objectives set by the Project have largely been achieved. This has already been confirmed in chapter 6.1 for each action. The next chapter 6.4 analyzes the results and their effects.

Some results of the Project are immediately visible. Among these, certainly the increase in awareness of the importance of the soil and to combat its consumption and waterproofing. The constant and intense dissemination activities (which made use of all possible methods and channels) made it possible to increase the knowledge and awareness of politicians, public and private technicians, economic operators, students and ordinary citizens on these issues.

A confirmation of this is given by the growing interest in the Project and by the numerous participation in the various initiatives. The Reports, but above all the various guidelines published (and presented on various public occasions) have been downloaded and are already used by various municipal administrations as well as by private technicians.

The Municipality of Forlì, for example, has already approved 2 urban regeneration projects in which the Guidelines for increasing resilience to climate change have been applied (Del. 29A).

Other results of the Project, such as the US-DSS Information System - Del. 30 and 33 (useful not only as a monitoring tool but above all as a support for decisions relating to soil transformation) or the new municipal urban plans (which contain rules for limiting land take), will be visible and will produce concrete effects in the AfterLife phase and beyond.

Obviously, political choices have great importance in defining the contents of the new municipal urban planning plans and the related regulatory provisions to contain land take and promote urban regeneration.

We will see the effects of these choices when the plans are finally approved and begin to be implemented.

## 6.4. Analysis of benefits

The expected results described in paragraph 4. "Introduction" led to the following benefits divided by topic.

#### Climate change and energy

The application of the "no net land take" principle makes it possible to preserve the carbon storage potential in the soils of the three partner Municipalities but, in perspective, also in the entire Regional territory as the new Regional Law 24/2017 implemented the European target of the "no net land take" to 2050 and requires all municipalities to draw up new urban plans (activities in progress) that will favor urban regeneration and introduce limits on land take. Reducing land take will avoid further emissions associated with urban sprawl. The adoption and application of the Guidelines for the assessment of ecosystem services in urban areas (Del. 23) contributes to the management of urban soils. These soils (which can be of various types) are very important because, in often very urbanized contexts, they contribute to carbon storage (CST), water regulation (WAR), and support for biodiversity (BIO).

The Guidelines (Del.23 - Action B1.3) are also a useful tool, in particular for Municipalities, to evaluate the characteristics of these soils and establish their quality in order to identify their correct use and limit their transformation.

The "Freeing the Soil" Guidelines (Del. 29A - Action B3.3) provide the operational tools to design interventions that make it possible to improve urban resilience to climate change (counteract the urban heat island and the effects of extreme meteorological events).

In general, the urban planning tools, the desealing demonstration actions and the various guidelines produced by the project contribute synergistically to implement the objectives of the EU's Climate-Energy package and the new strategy for adaptation to climate change (Forging a climate-resilient Europe - the new EU Strategy on Adaptation to Climate Change [COM (2021) 82]), as well as the development of the Green Infrastructure [COM (2013) 249] and the improvement of the urban environment [COM (2005), 718]. They also provide a contribution to the reduction of emissions and energy consumption of the Action Plans for Sustainable Energy (SEAP) adopted by the three partner municipalities, as part of the Covenant of Mayors.

#### Water and hydraulic risk

The application of the principle of "no net land take", de-sealing interventions and measures to increase the permeability of urban areas, contributes to pursuing the objectives of the Water Directive and the Floods Directive [DIR 2000/60 / EC, DIR 2007/60 / CE] through the reduction of runoff, the increase of infiltration and recharge of the aquifers and a better management of rainwater. These actions make it possible to reduce the risks of flooding related to the increase in intensity and frequency of extreme precipitation phenomena.



#### Peri-urban agriculture and rural territory

The reduction of agricultural land take and the fragmentation of rural territory, allows to preserve the land continuity of farms and to improve the effectiveness of the actions of the Rural Development Program aimed at the development of multifunctionality and the short supply chain, at the promotion of greening agriculture and the improvement of the rural landscape. In areas with a greater livestock vocation, such as Carpi, the maintenance of agricultural surfaces guarantees greater sustainability of the manure spreading practices pursuant to Directive 1991/676 / EEC. The preservation of the local agricultural production base will reduce indirect land use changes outside the EU (ILUC) linked to the growing demand for agricultural land on a global scale, one of the main factors of erosion of natural ecosystems and loss of biodiversity [UN (2005 ) MEA]. This contributes to pursuing the EU's sustainability objectives and the goal for a "Land Degradation Neutral World" established by the UN with the Rio + 20 Conference.

#### Air quality

In an indirect and long-term form, the project, by initiating a process of recompacting the urban structure through greater use of urban regeneration interventions and fewer and fewer new urbanizations, can contribute to the objectives of the air quality directive [DIR 2008/50 / EC amended by DIR 2014/1480 / EC] through the reduction of private vehicle traffic generated by urban dispersion and the increase in the efficiency of local public transport.

The new urban planning instruments pursuant to the L.R. 24/2017 being drafted in the Emilia-Romagna Region, and, therefore, also in the 3 partner Municipalities (activity started during the development of the SOS4LIFE Project) are more focused on urban regeneration and on the containment of land take and can provide support in achieving these quality objectives.

#### **Biodiversity**

The project also provides (especially with the various guidelines Del. 12, Del. 23, Del.27, Del.29A) a contribution to the EU strategy for the protection and increase of biodiversity by 2030. As highlighted in the European Atlas of Soil Biodiversity, the soil is home to one third of the planet's biological diversity. All actions to limit waterproofing, increase resilience with green infrastructures and restore or preserve the ecosystem services of the soils lead to a qualitative and quantitative improvement of biodiversity, particularly in the urban environment. Overall, the SOS4LIFE project contributes to the sustainable development of the EU and the implementation of the 7th Environmental Action Program (also of the forthcoming 8th Program) by reducing the pressures on the soil resource and contributing to the EU objectives in terms of climate change, energy, water, air, urban environment, green infrastructure, sustainable agriculture and biodiversity. The project, in line with the Thematic Strategy for Soil [COM (2006) 231], promotes awareness of the value of soil as a finite and non-renewable resource, and guarantees the acquisition of skills among administrators, technicians and professionals, to promote, also in the construction sector, a circular economy based on the reuse of the soil and the recycling of urbanized areas.

#### Expected longer term results and benefits

The socio-economic effects of the project will occur on different temporal and spatial scales. Demonstrative de-sealing interventions (action B2) have effects that are closer in time, but also more localized and diversified according to the urban context in which they are inserted.

The Forlì intervention concerns a parking area within the historic center. The transformation into public green areas (mainly permeable) has the following positive effects in the intervention area and in the adjacent areas:

- creation of new spaces for social and recreational use in densely populated areas with a scarce endowment of green areas;
- improvement of urban quality and increase in tourist attractiveness with enhancement of the cultural and commercial functions present;
- increase in property values;
- reduction of the heat island effect and microclimatic improvement with savings on summer air conditioning;
- increase in rainwater infiltration capacity and carbon storage capacity.

Carpi's intervention concerns the redevelopment of an avenue located on the edge of the historic center. In this case, the green restoration of a paved strip in correspondence with the existing row of trees and the replacement of part of the flooring with draining materials has the following positive effects in the intervention area and in the adjacent areas:

- increase in rainwater infiltration capacity and carbon storage capacity.
- reduction of the heat island effect and microclimatic improvement with savings on summer air conditioning;
- improvement of urban quality;
- enhancement of the tertiary and commercial functions present;
- increase in property values.

The San Lazzaro di Savena desealing intervention is carried out in a disused peripheral production area, part of a larger urban redevelopment project. In addition to the effects mentioned above for the other desealing interventions, this intervention makes it possible to expand the Park area along the Savena river, facilitate cycle and pedestrian accessibility to the riverside area and enhance, with the inclusion of new tertiary functions (limited to a small part of the area), also the context.

The application of the Guidelines for the reuse of topsoil (Del. 27 - Action B2.4) combined with rules that impose compensatory desealing interventions (with subsequent restoration to green) will also contribute to developing a virtuous circular economy that will allow, in the context local, not to waste soil by matching the supply of land deriving from new urbanizations with the request for land for restoration interventions.

The environmental and socio-economic effects of the application of rules and guidelines to limit, mitigate and compensate for land consumption and promote urban regeneration and the effects of using the Information System, as a monitoring tool but also to support decisions (Actions B1, B3, B4), can be evaluated and



verified over the medium and long term on a larger spatial scale (municipal and regional).

Some of these expected effects are listed:

- development of building activities related to urban regeneration and improvement of housing quality. It is expected that the application of the rules and guidelines developed by the project will lead to an increase in the recovery interventions of abandoned urban areas, and to redevelopment of the existing real estate assets aimed at improving housing quality, energy saving and, not last, to seismic adaptation (Carpi was hit by the 2012 earthquake; San Lazzaro and Forlì are also part of a high seismic risk area);
- relaunch in terms of employment and revenue of the local construction sector, today in severe crisis, with particular reference to SMEs specialized in renovations, energy and seismic upgrading of buildings, recycling of aggregates, construction of green infrastructures;
- activation of local supply chains for the production of materials for urban regeneration and energy requalification of buildings;
- increase in the real estate values of the areas and buildings subject to interventions;
- urban regeneration, desealing and green restoration;
- increase in urban resilience to climate change (reduction of heat island effects with benefits on, reduction of energy consumption in the housing sector with benefits on household budgets, reduction of the risk of flooding connected to intense meteorological events with benefits on the safety side);
- improvement of the quality and supply of public green spaces with positive repercussions on the quality of life and well-being of residents;
- preservation and increase of agricultural production capacity and improvement of the peri-urban landscape;
- in the long term, the application of urban planning regulations on "no net land take", in particular relating to the demolition and relocation within the urban perimeter of abandoned or incongruous rural buildings with respect to the agricultural territory, will lead to a progressive improvement of rural landscape and its attractiveness, with economic benefits for agricultural production activities, tourist hospitality (agritourism, B&B) and the reduction of management and maintenance costs of public services connected to sprawl. The application of "non net land take" principle, combined with settlement policies of the urban structure fabric will reduce the per capita cost of public services such as local public transport;
- indirect benefits will also be obtained from the reduction of private vehicle traffic: urban expansion and dispersion in fact generate an increase in traffic which in turn entails economic, environmental and health costs for the community, connected with the increase in consumption of fossil fuels, polluting emissions and road congestion [EEA, 2006];
- reduction of hydraulic risk and costs associated with damage from flooding in Emilia-Romagna. This phenomenon, combined with the extensive waterproofing of the soil, increasingly leads to widespread flooding with consequent material damage. The application of "no net land take" principle and the promotion of de-sealing and regeneration interventions, aimed at

increasing the permeability and water retention capacity of the urban territory, will contribute to reducing the hydraulic risk due to flooding and the extent public and private costs for the restoration of damage;

 increasing the awareness of political decision makers, technicians and citizens on the value of the soil and the need to preserve it. The actions related to the construction of the knowledge framework (B1), the demonstrative ones (B2), those of definition of urban planning and regulatory tools to contain land take (B3 and dissemination activities (D1) together with those of construction of the US-DSS information system (B4) contribute to raising awareness, among decision-makers, technicians, operators in the construction sector and in general public opinion, of the value and functions of the soil and of the economic and environmental costs associated with its consumption; the perception of soil as a common good to be preserved and protected in the interest of the community, will be strengthened.

The activity that has been carried out in the context of this project (which has already provided ideas for the new regional urban planning law 24/2017) can help stimulate the definition and approval of a European Directive on the subject of soil still missing so that can move from the phase of direction and orientation to a binding legislative provision for all the Member States of the Union in which the soil is considered a common good that must be protected.

The socio-economic impacts of the Project are dealt with in more detail in the specific Report (Derl. 45).



# 7. Key Project-level Indicators

The online KPI Database, introduced after the start of the SOS4LIFE Project, has been updated with the final data.

Below is a summary table of the data uploaded to the online KPI database (https://webgate.ec.europa.eu/eproposalWeb/kpi).

In the last column on the right of the table there is a comment on the data.

Below, after the Table of KPIs, there is a description of the data reported in the final update of the "Life Specific Indicators" (Del.28) which had been compiled at the start of the Project and then monitored during the Midterm Report and Progress Report.

#### SOS4LIFE - LIFE15 ENV/IT/000225 Final Report

Key Pr	oject level Ind		START VALUE		REVOND END VALUE	LINIT	Comment
INDICATO	K CODE	Area of environmental/climate	START VALUE	END VALUE	BETOND END VALUE	ONT	Comment
		implementation actions (e.g. development, testing, demonstration, application of best					The de-sealing interventions foreseen in the proposal started in the urban territories of three municipalities (Forfi. S. Lazzaro di Savena and Caroi) but are expected to be concluded only in the
1.5	Project area/length	practices/innovations).	0	1	21390	m2	after-LIFE period. Legally binding acts of Emilia-Romagna Region= Adoption of urban planning rules to limit, mitigate
15	Project area/length	Conservation or improvement of the status of an area or serment	0	40452	2245200	ha	or compensate soil sealing and stimulate urban regeneration. The project provided various guidelines and tools to implement the regulation in the territories of the municipalities. The value at the end of the project is the territorial extension of the 3 Municipalities involved in the nonizer. The value hownod 5 varies is the total area of the Emilia-Romanna Revion.
1.5	Humans (to be)	Persons whose lives were directly		40432	2243200	Number of residents	project: In the way of the second sec
1.6	influenced by the project	positively impacted by MAIN envir. actions of project - see Guide	0	221761	4457318	within or near the project area	The adds is the end of the product of the number of the adds is the whole population of the Emilia- Romagna Region.
	Resource efficiency -						Indicator values are the sum of land uptake in the 3 Municipalities (Forl), Carpi and San Lazzaro di Savana) involved in the project. The soil sealing ha at the beginning of the project was determined with reference to the same period (from 1997-2000 to 2016) for all the Municipalities on the basis of the data collected for the preparation of the B1.1 Action Report. The soil sealing ha at the end of the project refers to the actual cadastral data provided by the 3 Municipalities involved in the project. The soil sealing ha estimated after 5 years is the objective set by the municipalities in their urban plans: it includes also de-sealing interventions, not only the prevention of soil uptake. Part of the de-sealing interventions in three municipalities involved in the project started during the LFE
4.3	soil Nature and Biodiversity -	Soil sealing	110	19	10	ha	project, but they will be concluded only in the after-LIFE period (about 2 ha overall). This is an evaluation that takes into account the situation in the territories of the 3 partner Municipalities.
7.2	Ecosystem services assessment Nature and Biodiversity -	Ecosystem Service Condition	Moderate	Moderate	Moderate		We assessed the Ecosystem Services provided by soils and the impact of land uptake according to a regionally calibrated methodology defined by the project and in the following publication: "Catzolari C., Ungaro F., Filippi N., Guermand M., Malucelli F., Marchi N., Staffiani F., Tarocco P., 2016. A methodological framework to assess the multiple activity for the two services particular distribution of the distribution of the two services and the activity of the two services actions distributed variable activity for activity of the 100 method of the security services activity of the services activity of the 100 method of the security of the security of the 100 method of th
7.2	assessment	Ecosystem Service Trend	deterioration	deterioration	Some improvement		203.
10.2	Governance - Involvement of non- governmental organisations (NGOs) and other stakeholders in project activities	Public body/bodies	0	134	200	number of stakeholders involved due to the	During the project 34 events (Workshops, Seminars, Webinars, Fairs, Conferences) and 14 Networking activities were organized or participated by SOS4LIFE during which It was possible to contact and involve stakeholders. Two online surveys were also prepared in 2017 e 2020 which were answered by numerous public administrators and technicians as well as professionals. 110 Municipaillies, Regions, 11 Provinces, 5 Regional Agencies for Environmental Protection have been involved. The data was obtained from the presence sheets of the events directly organized by SOG4LIFE and from the receptones to the surveys.
10.2	Information and awareness raising to	Public body/bodies	0	134	200		No. of unique visits = The data refers to the total for the period from September 2016 to September 
11.1	Website Information and	No. of unique visits	0	12396	15000	visits	The average per year at the end of the project is 3,099 unique visits.
	awareness raising to the general public - Other tools for reaching/raising awareness of the general public.	Print media (e.o. newspaper and				Number of outcomes	The value is the total number of articles nublished in newspapers and magazines, also
11.2	Information and	magazine articles)	0	16	20	events, etc)	specialized, scientific articles.
11.2	awareness raising to the general public - Other tools for reaching/raising awareness of the general public	Other media (idao/broadcast/loaffats)		47	55	Number of outcomes (e.g. nr of reports,	The value refers to the total number of videos published on the Youtube channel of the SOS4LIFE project and also disseminated through social networks.
11.2	Information and	Other media (wdeorbroadcastriealiets)	0	47		events, etc)	The 47 voteos published reached, at the end of the project, a total of 2,416 wews.
11.0	awareness raising to the general public - Other tools for reaching/raising awareness of the general public	Displayed information (poster,		20	20	Number of outcomes (e.g. nr of reports,	Displayed information includes estimated views of 16 roll-ups, 10 notice boards, 3 totems - one totem for each Municipality. The information totems have been positioned in the areas of the desealing interventions (with the exception of that of San Lazzaro di Savena installed in a park). The people who may have viewed the information were estimated taking into account the positioning of the Totem (in a public area) and of the Notice Board (at the partner offices).
11.2	Information and awareness raising to the general public -	mormation boards)	0	23	29	events, etc)	
11.2	Other tools for reaching/raising awareness of the general public	Events/exhibitions	0	46	51	Number of outcomes (e.g. nr of reports, events, etc)	Event/exibitions includes 30 Seminars, Webinars, Conferences, Workshops, 4 Fairs, 12 traveling photographic exhibition
	Capacity building -						During the project, SOS4LIFE participated (sometimes as organizer) in n. 14 Networking events (Platform Meetings, Seminars, Conferences, Workshops, Webinars and other meetings) both at
12.1	Networking	Members of interest groups	0	808	1000	No. of individuals	national and European level. The value refers to the total number of participants. SOS4LIFE project has organized 7 specific seminars dedicated to high school and university students and their tackness.
12.2	Capacity building - Professional training or education	Students (in higher education)	0	890	1200	No. of individuals	234 students that participated in these events. The value also takes into account also the 356 didactic kits distributed to teachers. Other students and teachers (this number is not quantifiable) participated in the other 34 dissemination events. 30 events are considered here (including workshops, seminars, webinars, conferences) which were mainly attended by public and private technicians. The number of individuals takes into
12.2	Capacity building - Professional training or education	Professionals	0	3307	4000	No. of individuals	account the participants in the various events. The number of participants for each event was recorded directly or taken from the attendance sheet. In some cases data were provided by the organizers.
							The value was calculated starting from the number of person-days indicated in the approved
							project. This number of 7386 person-days was divided by 220 (average number of days worked per year). The resulting number (33.57) was divided by 4.25 (number of years of duration of the project). The FTEs "beyond S years" will be used by the beneficiaries for monitoring the planning activities through the Decision Support System developed by the project, the continuation of the dissemination activities and the coordination of the foreseen de-sealing interventions (all these
13	Jobs	Jobs	0	8	2	No. of FTE	activites are included in the After-LIFE Plan). Running - operating costs during the project include the approved budget of euro 1,788,749.00 plus
14.1	Contribution to Economic growth - Running cost/operating costs	Running cost/operating costs during the project and expected in case of continuation/replication/transfer after the project period	0	3938749	4678749	e	a non-eligible cost estimated at euro 2,000.000.00 for the 3 descaling interventions and an additional estimated amount of euro 50,000.00 feating to administrative, management and planning non-eligible costs inalated to both the descaling actions and the implementation of the various project actions. The costs for the realization of the After Life activities are estimated in Euro 740,000.00 to be mainly incurred by the public partners.
14.3	Economic growth - Future funding	Beneficiaries' own contribution			739500	€	Overall for the implementation of various After-Life activities, is estimated a contribution by the public partners (3 Municipalities, Emilia-Romagna Region and CNR-Ibe) of Euro 739,500.00.
	Contribution to Economic growth - Continuation/replicati on/transfer after the project period - Entry into new						The continuation of the project action will involve an in-depth study on the evaluation of ecosystem services in the urban environment (in particular the ecosystem services provided by the soil and wegatation); the use of Nature Base Solutions to counteract climate change (urban forestry interventions); the soil recycling and the use of compost deriving from organic waste treatment as a soil improver. These activities will be financed by European projects, such as FECTH whose proposal was presented in 2021 for the Green deal Call of the Horizor202 program. The
14.4.1	entities/projects Contribution to Economic growth -	Continuation					infurnit painty of Forni and UNIK-libe are part of the partnership that presented the proposal.
1456	Continuation/replicati on/transfer after the project period - Entry into new geographic areas	ITALIA					The representatives of a Italian Regions (Tocscana, Piemonte and Lombardia Regions and the Autonomous Province of Bolzano) were involved in the networking activities within the project and have participated in some events during which the results of the project were presented. Seeing the high interest showed by these stakeholders, the project activities are expected to be replicated in other parts of flat), not only in the Emilia-Romagna Region.

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#### LIFE SPECIFIC INDICATORS

#### Action B2

A first group of indicators, among those identified in the drafting phase of the project, refers to the ex ante and ex post (action B2) soil and microclimatic monitoring activity carried out in the three areas where de-sealing interventions are planned. They are indicators relating to the quality of soils and ecosystem services. The updating of these indicators has been entrusted, by competence, to the CNR partner.

All indicators have been updated. At the end of the project, the values found are positive and corresponding to or higher than the values expected at the beginning of the project.

For indicator 3.3.1, relating to the carbon stock, the calculation method used is as follows: OC% (Organic carbon) \* BD (bulk density) \* 30 cm (topsoil). The values were calculated on the basis of the averages observed in the demonstration sites on 30 cm of topsoil (Italian average data taken from the EU reference on EIONET SOIL).

Indicator 3.3.1 shows, in the limited sample considered, at the end of the project a value of 47 Mg/ha (up from the previous data of 30.20 Mg/ha in the Midterm Report), exceeding the expected result of 45 Mg/ha. The data at the start of the project was 0.45 Mg / ha.

Indicator 3.3.2 refers to the surface hydraulic regulation, total infiltration.

Represents the AWC (available water capacity) per 100 cm of soil. The values were calculated on the basis of the observed averages of the agricultural soils of homologous areas of the Emilia-Romagna plain. The European reference data wasn't available. The data at the beginning of the project was 0 cu.m./ha.

At the end of the project a value of 1670 cu.m./ha was calculated, higher than the expected value of 1500 cu.m./ha.

The 3.3.3 indicator refers to the surface hydraulic regulation, total runoff.

An average annual precipitation of 1000 mm was considered, with an average daily intensity from about 0.5 mm/h to 4 mm/h and an infiltration capacity of about 4 mm/h. The values are calculated on the basis of the observed averages of agricultural soils of lowland areas. The figure at the start of the project was 10,000 cu.m./ha.

At the end of the project a value of 0 cu.m./ha was estimated (i.e. the water infiltrates all and there is no runoff) higher than the expected value of 2000 cu.m./ha.

Also the verification of the 3.3.4 biodiversity indicator (QBS), which has grown from 86 (Midterm Report data) to 100 EMI (final data), showed an increasing value exceeding the EMI 10 index expected by the end of the project. This is an average value observed on the topsoil at the 3 demonstration sites. The European reference data was not available The data at the start of the project was 0 EMI.

Indicator 3.3.5 refers to the effect on the microclimate (soil contribution to ET - Evapotranspiration).

Calculation method: amount of energy necessary for the evaporation of the available water content of the soil. This energy is subtracted from the "sensible heat", constituting an index of the effect of the soil on the microclimate. The values were calculated on the basis of the average values of the agricultural soils of homologous areas of the Emilia-Romagna plain. The European reference data was not available. The data at the beginning of the project was 0 kwh/ha.

At the end of the project a value of 1,126,221.61 kwh/ha was calculated, higher than the expected value of 1,011,576.3 kwh/ha.

Indicator 3.3.6 refers to the balance of eco-systemic soil services at the municipal scale with respect to the indicators referred to in action B2.

For the estimation and calculation of the indicators and their variations over time, was applied the original methodology published in the work "Calzolari C., Ungaro F., Filippi N., Guermandi M., Malucelli F., Marchi N., Staffilani F., Tarocco P., (2016) A methodological framework to assess the multiple contributions of soils to ecosystem services delivery at regional scale" Geoderma, 261, 190-203. The data at the beginning of the project was 0.

At the end of the project, the sum of standardized indicators for carbon stock, total infiltration, total runoff, biodiversity, effect on the microclimate reaches a value of 0.72 higher than the 0.7 initially expected.

#### Action B4

Another group of indicators refers to the continuous monitoring of the impact of the application of rules and guidelines (produced with action B3) through the US-DSS information system provided for by action B4.

As has been specified several times, the impact of the rules and guidelines will only be truly measurable in the years following the conclusion of the project, or when, after their adoption/approval, they will begin to produce their effects. At the end of the project, it is possible to provide real data that depend more on the current economic situation (and the related construction crisis) than on the effects of the rules/guidelines that have not yet entered into force. Certainly the new Regional Law n. 24/2017 which introduced the goal of "no net land take" by 2050 (and a limitation of land take from 2018 to 2050 by 3% of the current urbanized area). This goal will have to be incorporated by all the new planning instruments that the Municipalities of the Emilia-Romagna Region are called upon to draw up.

The monitoring system was created and is freely accessible to the public on the servers of the Emilia-Romagna Region at the following address: https://sos4life.regione.emilia-romagna.it

The data relating to land take (indicator 3.3.7) and the increase in urbanized territory (indicator 3.3.8) were obtained by adding together the data provided by the 3 partner Municipalities by updating the maps produced as part of action B1 .1 already completed.

For the indicator 3.3.7 (land take) at the end of the project was recorded an average consumption in the period 31/12/2016 - 31/12/2019 equal to 19 ha/year, numerically lower than the expected result of 80 ha/year, therefore much better. The data at the start of the project was 161 ha/year.

To indicator 3.3.8. the urbanized area shows an average increase in the period 31/12/2016 - 31/12/2019 of 0.20%/year, also in this case better than the expected 1.20%. The data at the start of the project was 2.40%.

At the start of the project, the number of desealing interventions carried out (indicator 3.3.9) was 0. The expected figure was 3 desealing interventions carried out at the end of the project (1 for each partner municipality). At the end of the project, the desealing in San Lazzaro di Savena was completed (pending restoration to green areas) and partially started (in terms of environmental remediation) in Forlì, which is nearing completion. Therefore it is possible to consider 2 as final data.

Indicator 3.3.10 relates to the waterproofed areas subject to desealing. The initial figure is 0 sqm.. The expected final figure was 10,500 sqm. At the end of the project the



surfaces subject to desealing are equal to 9,347 sqm. The surface subject to de-sealing and green restoration works includes 4,500 sqm. in Forlì and 4,847 sqm. in San Lazzaro di Savena (these are interventions already started and nearing completion). The over 1,670 sqm. of the intervention that will be carried out in Carpi have not been accounted for.

One of the objectives of the project to combat land take is to increase the areas of urban regeneration.

The mapping of the areas already destined in the current municipal planning instruments to be recovered and of the further urbanized areas that can expand this stock was prepared in sub-action B1.1.

With regard to the indicator 3.3.11 relating to areas subject to urban regeneration already planned at the time of the Midterm Report, a value of 3,463,400 sqm. was found, much higher than the initial data (1,800,000 sqm.) and the final data expected (1.845.000 sqm.). The final data of 3,505,592 sqm. confirms a slight increase in the wide availability of areas to be used for urban regeneration.

It is important, however, to specify that the data includes both the urbanized areas to be regenerated already included in the existing urban planning instruments and the additional areas that the 3 Municipalities have identified and which are included in the new general urban planning instruments.

Indicator 3.3.12 represents the surface of the urban regeneration areas already implemented or in the process of being implemented (therefore it provides us with a data on how much of the forecasts referred to in indicator 3.3.11 are actually materializing). This indicator also shows growth. The figure of 435,000 sqm. the initial phase of the project had risen to 739,310 sqm. registered at the time of the Midterm. At the end of the project, based on the data provided by the 3 partner Municipalities, this indicator grows further to 1,141,947 sqm. demonstrating how progressively (despite the crisis) urban regeneration forecasts are being implemented.

#### Sub-Action D1.2

A third, large group of indicators intends to measure, in terms of the audience reached, the impact of the activities of dissemination and dissemination of the contents and results of the project.

The monitoring of these indicators was coordinated by Legambiente which was assigned the leading role of action D1.2 in collaboration with the Municipality of Forlì and the other partners.

The dissemination activity was very intense throughout the duration of the project and made it possible to achieve excellent results (34 events were organized and attended by representatives of SOS4LIFE).

For the indicators of group 12.1 (12.1.1, 12.1.2, 12.1.3, 12.1.4, 12.1.5, 12.1.6, 12.1.8, 12.1.9) the numbers of participants were considered in the case of events (dissemination, information aimed at students or exhibitions). The data was acquired directly for the events of the project or requested from the organizers for events not by the SOS4LIFE project. For the project website, the pages activated on social networks and related posts were considered the unique views, "likes", shares and comments (all activities that show interest in the news published). The quantification of the audience reached by other tools such as press conferences and related feedback in print media or on websites or published scientific articles, take into account the copies sold or disseminated (of newspapers, paper magazines and scientific reports), the dissemination of digital copies via mailing list or online views or downloads. The data

were acquired directly where available or requested from those who manage the websites and those who publish newspapers and paper magazines.

The data show a positive increase (in several cases also very significant) in the values of all indicators compared to those reported at the Midterm. For almost all indicators, the data at the end of the project exceeds the expected result.

It should be noted that indicator 12.1.1, in addition to the Website (12,396 unique visitors), reports the audience data reached by the Notice Boards (138,121 people reached), installed in March 2017 and not counted (if not partially) to the MidTerm and the data of the Layman's Report (2,000). The data relating to the Notice Boards consider as a whole all the panels installed in the offices of the various partners and includes employees and visitors.

Seven different didactic initiatives were organized (12.1.3) and 356 didactic kits were distributed. Unfortunately in 2020, due to the pandemic, it was not possible to continue with this activity and the final data is one of the few below expectations. The activity will continue in the AfterLife phase like the other dissemination activities.

The number of interlocutors reached during exhibitions and external events (12.1.4), equal to 12,154, grew significantly, in particular thanks to the participation in 2017 in Urban Promo, in 2018 at the Remtech Exhibition in Ferrara and Urban Promo Milan (which replaced the initially planned SAIE Exhibition) and also to the two Webinars organized in 2020.

The final data of the 12.1.6 index (which refers to audiences reached by Press Conferences, Media Meetings, Press Releases, Scientific and popular articles) was widely above expectations and growing compared to the Midterm, whose value increased from 116,675 to 546,683 individuals.

The final result was also good for the indicator 12.1.7 representative of the dissemination activity via video. It includes not only the visualization data of the informative video specifically produced for the project (and mainly aimed at schools) but also the data of the visualizations of the numerous videos that have been published on Youtube and on the social profiles of the project (shooting of various events and videos - pills on the themes of the project). The final data of 2,418 views is satisfactory and exceeds the initially expected result.

As part of the indicator 12.1.8 which accounts for the people reached with public events, mainly aimed at citizens, an important contribution to reach the total of 4,035 people (which doubles the expected result) was given by the 2,354 visitors of the 12 Stages of the Traveling photographic exhibition (initially only 9 were planned).

#### Sub-Action D1.1

The data relating to indicators 13.1, referring to the networking activity, takes into account the participants in the networking initiatives organized directly or to which the SOS4LIFE project was invited and participated with at least one of its representatives. In the final balance, Networking activities (despite being held back by the pandemic) were 14. In the last period, precisely because of the limitations, there were Webinars or Videoconferencing meetings.

The number of people reached at the end of the project, equal to 808, showed a marked increase compared to the Midterm and well above expectations (300).

For details on the various Networking activities, please refer to the specific final Report (Del. 41).



#### Action A1

Indicator 13.2 refers to the preparatory activity carried out for action A1. It includes both the study visits to Dresden and Stuttgart, and the Meeting open to the public which took place in Bologna at the end of November 2016. This indicator also takes into account the participants.

#### Action D1

The indicators of series 15.5 relate to continuation, replicability and transferability.

With regard to indicator 15.5.1 (entry into new Bodies / Projects) it should be noted that the Municipality of Forlì and the CNR participated as potential partners in the Proposal of the FETCH project presented as part of the Green Deal call of the Horizon2020 program on 26/01/2021.

For indicator 15.5.2, at the end of the project there is no entry into new sectors.

Indicator 15.5.3 Entry into new geographical areas - Regions to which the transfer of the project results is intended - reports a final data of 20 (the expected data was 5). In fact, the results of the project were initially transferred to the stakeholders regions (Piedmont, Tuscany and Lombardy). The communication of the results was then extended to all of Italy on the occasion of the two webinars in 2020 (May and September) in which technicians, administrators, teachers and students from all Italian regions participated.

Indicator 15.5.4 Entry into new geographical areas - European countries to which dissemination is expected - reports a final data of 6 (the expected data was 3). During the project, the results were transferred to various networking meetings attended by representatives of other European cities, or following requests for documents and documents. The European countries to which the project results were transferred are France, Spain, Latvia, Ireland, Bulgaria, Germany. Furthermore, the English version of the various Guidelines has facilitated their dissemination in Europe.

#### Action C1

Indicators 16 (from 16.1 to 16.7) relating to other socio-economic effects were also updated at the end of the project and show an increase compared to the data in the Midterm Report.

The main effects of the project (those on the containment of land take) will be seen in the medium-long term when the rules and guidelines on the limitation of land take will begin to be applied, and when the new municipal planning instruments that contain will be progressively implemented.

Indicator 16.1, relating to the increase in the decision-making capacity of administrators and public technicians with expertise on land take, takes into account the participants in the 2 questionnaires that were prepared in 2017 and 2020. The Midterm Report data of 170 is grew to 269 as a result of the second questionnaire. The final data is lower than the initial estimate of 300. However, if we take into account the wide participation of technicians and public administrators in the numerous events for disseminating the results of the project, the number is decidedly higher.

Indicator 16.2 (spread of municipalities that adopt the goal of "no net land take") takes into account the fact that all municipalities in Emilia-Romagna (328) are required to comply with Regional Law 24/2017 which provides for the target of "no net land take" by 2050 and are drafting the new General Urban Plan. Three of these municipalities have already approved it, another 25 have started the process, the remaining are being

drafted and, presumably, they will start the process between the end of 2021 and the beginning of 2022.

Indicator 16.3 refers to the dissemination of the US-DSS information system. The US-DSS was made available by the Emilia-Romagna Region for all 328 Municipalities. It is freely accessible on the regional website to anyone. It was also presented to the 3 stakeholders Regions (Piemonte, Toscana and Lombardia) in November 2019.

Indicator 16.4 (increased awareness of citizenship on the value and eco-systemic functions of the soil) reports a final data of 584,582 citizens involved and participants in the results of the project, much higher than the 100,000 initially expected. The data takes into account the no. of individuals reached through events and initiatives mainly aimed at citizenship.

For this indicator were considered participants in the events dedicated to citizenship, in the final event, citizens who viewed the Totems, press and web news following press conferences or press releases, who visited the stages of the traveling exhibition, who visualized the informative videos, who interacted on social networks.

Indicator 16.5 (increase in social responsibility of companies and individuals with respect to the environmental value of the soil) mainly reports the number of companies and professionals in the construction / urban planning sector involved and participating in the results of the project, i.e. those who have been reached within the specific dissemination initiatives (Conferences, Seminars etc.). The final number (19,560), very high compared to expectations (50), also takes into account the companies in the construction sector reached through the institutional communication of ANCE E.R. which sent news, information and results of the project to members and other interested parties.

It was also possible to update indicator 16.6, relating to the financial amount of tax reliefs related to urban regeneration interventions. The final value, equal to  $\in$  910,136.16, takes into account the reduction of the payment for the occupation of public land and the single municipal tax (IMU) for properties subject to redevelopment in the historic center; contributions for the execution of the seismic risk classification of private buildings; other contributions for actions aimed at the regeneration of the historic center, such as for the rental of vacant buildings or for the restoration of the facades of buildings. All the resources allocated at the municipal level were considered (details are given in the Report on socio-economic impacts).

Differently from what was considered in the drafting phase of the project proposal, it was not possible to have the data necessary to calculate or estimate for indicator 16.7 (reduction of energy consumption costs for heating and cooling in the domestic sector) the effects of the project in terms of % reduction in private expenses for energy consumption.

The excel "Life Project Specific Indicators" table containing the updated data at the end of the project is attached to the related Report (Del. 28).



# 8. Comments on the financial report

#### **GENERAL NOTES**

## VAT

With the "Letter Amendment N° 1 to Grant Agreement", dated the 21/09/2018, about VAT, it is written that "Non-deductible VAT is eligible as expenditure, save for those activities matching the concept of sovereign powers exercised by Member States". Therefore, with regard to the "Mid-term Report Evaluation", no further documentation appears to be necessary to demonstrate that, for Comune di Forlì (COFO), Unione Regionale Costruttori Edili Emilia-Romagna (ANCE), Consiglio Nazionale delle Ricerche (C.N.R. IBIMET), Comune di San Lazzaro di Savena (COSLS), Comune di Carpi (COCARPI), Comune di San Lazzaro di Savena (COSLS), Legambiente Emilia Romagna APS (LegambienteER) and Regione Emilia-Romagna (RER), VAT is a cost.

#### PERSONNEL

Personnel costs have been calculated on the basis of the actual gross salary plus compulsory social security charges.

Apart from the personnel of Forlì Mobilità Integrata involved in Action B.2 only, the staff employed by the partnership have had different roles according to every single action they took part to, thus respecting their technical competences as specified in the section "Role in the Project"; in the file named "SOS4LIFE life\_financial\_reporting", is indicated, person by person, year by year, the role for which the person has worked the most hours.

With reference to the notes in the document D-2119920 EASME, referred to the Midterm Report of the Project SOS4LIFE and regarding the hourly rate of the personnel involved in the Project, the Municipalities of Forlì, Carpi, San Lazzaro di Savena and the Emilia-Romagna Region have reported "non additional personnel" working hours with an hourly rate that was estimated too much higher than the hourly rate foreseen in the budget, please consider that:

- during the design phase, the National Collective Labour Agreement for Local Functions Department ("Contratto Collettivo Nazionale di Lavoro per Comparto Funzioni Locali") was taken into account. It provides for a work-time distribution of 6 hours per day over 6 working days per week;
- on the contrary, during the project's operational phase, work-time distribution per single employee was taken into account; it results to be the typical condition of all personnel of the public entities involved to be 7.20 hours per day (expressed in cents) for 5 days per week.

The use of this different work-time distribution, during the project's operational phase, generated an increase of the daily personnel cost for each employee of approximately 20% of the total amount.

The increase in personnel costs was also due to other parameters:

- part of the personnel has been granted level promotions or has taken on roles of greater responsibility with consequent salary increases;
- in May 2008, the National Collective Labour Agreement for Local Functions department ("Contratto Collettivo Nazionale di Lavoro per Comparto Funzioni

Locali"), three-year period 2016-2018, was signed. It has planned an increase in pay scales and payment of arrears.

## TRAVEL

Covid 19 pandemic has reduced some planned trips for year 2020 preventing partners from participating in two international meetings: "Eurosoil 2020" (replacing "Global Soil week"), postponed to 2021 (SOS4LIFE representatives will participate in this edition) and the transnational networking meeting planned for spring 2020, which, due to lockdowns and travel restrictions, could not take place (there was, however, participation in international webinars featuring other European projects).

#### **ORGANISATION-SPECIFIC NOTES**

#### Comune di Forlì (COFO):

PERSONNEL. Unlike from it was foreseen in the Grant Agreement, the Municipality of Forlì charged as Project Manager an internal employee (Stefano Bazzocchi), whose role is Technical Officer responsible of the Urban Requalification Unit (Urban Planning Department). Although Mr Bazzocchi is mainly dedicated to the Project Management activity, he is also involved in the execution of other actions of the Project; for this reason, the Municipality of Forlì charged another person that could support and help him even in the relationships with the other partners. This person ("additional staff") was hired with a fixed-term contract in order to collaborate with the Project Manager and was given other technical roles in the frame of some specific actions and considering his specific competences. Hiring a fixed-time person did not produce any difference as for the number of days and the budget foreseen for the Project management.

The sum of working days of the two persons (Project Manager and Collaborator) does not exceed the number of working days foreseen in the Project, Action E.

At the beginning, the Collaborator for the Project Manager was Mrs. Marika Medri. She was then engaged by another Public Body with a long-term contract and the Municipality of Forlì replaced her by hiring Mr Marco Barlotti with a fixed-term contract.

Marco Barlotti was hired on a permanent basis, through a public tender of the Municipality of Forlì. He changed his role, although he still worked on SOS4LIFE Project. Serena Orlandi was hired on a temporary basis as a collaborator of the Project Manager.

As for Actions B1 and B3, for the reasons already mentioned in the description of every single action, the Municipality of Forlì, unlike foreseen by the project, did not hire fixed-term personnel ("additional staff"), but charged a natural person, shifting from "Direct Personnel Costs" to "External assistance costs" within the limits admitted by Grant Agreement.

#### EXTERNAL ASSISTANCE.

Compared to the approved Project, the Municipality of Forlì reports the following variations.



The drafting of the geological report for the new urban planning instrument (Action B3), planned in the project, was outsourced in February 2016 prior to the starting of SOS4LIFE project on July 2016, therefore the related cost is not accountable and has not been included in the Financial Report.

Likewise, the socio-economic analyses for the new general urban planning instrument (Action B3) were outsourced in February 2016 and carried out before July 2016, therefore the related cost was not accounted. Since a new regional planning law was approved in December 2017, the Municipality of Forlì had to outsource to another contractor, in order to get updated socio-economic analyses and fulfil the new requirements. The related cost incurred by the Municipality is again not accountable.

Due to the postponement to 01/01/2022 of the deadline set by Emilia-Romagna Regional Law n. 24/2017 for the preparation of the General Urban Plan, it was not possible to use the resources provided for the Strategic Environmental Assessment (Action B3) by 30/09/2020. This environmental assessment should be drawn up in parallel with the preparation of the General Urban Plan. The task of drafting the Environmental Assessment has been outsourced in December 2020, after the end of Project. The related costs will be paid in 2021 by the Municipality, that is why it has not been reported in the financial report.

The above-mentioned expenses are in line with the approved Project, but they are not accountable because they were incurred before the beginning or after the end of the Project.

During the development of the Project, the Municipality of Forlì required support to elaborate the cartographic documents needed for the drafting of the General Urban Plan (Action B3) and for the implementation of the Information System (Action B4). For this reason, a professional assignment has been outsourced to a technician specialised in drawing up cartographic plans using GIS software.

IT consultancy service for database updating and GIS upgrading for the Information System (Action B4) was regularly contracted during the Project and it is reported in the Financial Report. The cost of this service was higher than originally budgeted because the updating of the cartographic database and the related implementation activities of other data necessary for the implementation of the US-DSS (Urban and Soil Decision Support System) took more time. The follow-up and local implementation activities of the US-DSS were demanding and required a contract extension.

The Municipality of Forlì has externally outsourced, replacing the partner F.M.I. Forlì Mobilità Integrata s.r.l, a soil sampling and analysis activity in the desealing site in Piazza Guido da Montefeltro (Project "Giardino dei Musei"). This activity was necessary to integrate the environmental analysis already executed according to the request of the competent Regional Agency for Environmental Protection, in order to determine more precisely the extent of the polluted area to be cleaned up. The soil sampling and analysis activity was commissioned to the company SOGEO S.R.L (conservative transformation action - soil analysis and related services) for a final cost of  $\in$  15.682,12.

As anticipated in the previous paragraph dedicated to PERSONNEL, the expenses related to "additional staff", Expert in land take, foreseen by the approved Project for actions B1 and B3 has reported under the item EXTERNAL ASSISTANCE, because

instead of a fixed term employment, it has considered as a direct assignment of an external consultancy.

#### Unione Regionale Costruttori Edili Emilia-Romagna (ANCE):

OTHER COSTS – PERSONNEL. Project expenses included the cost of participation (exhibition area) to the international event "Global Soil Week", later replaced by "Eurosoil 2020", which was postponed to 2021 due to the Covid-19 pandemic. Although they did not attend the above-mentioned international events, ANCE Emilia Romagna had already taken care of part of the organization.

The staff was also engaged in the publication of an illustrative article of SOS4life Project on the international magazine "L'industria delle costruzioni". There were many preparatory activities and the personnel involved had to travel to the Journal's headquarters in Rome several times during 2019 (costs not been reported in the financial report).

#### Consiglio Nazionale delle Ricerche (C.N.R. IBIMET):

PERSONNEL. Anita Maienza and Silvia Baronti are to be considered "additional", as they are "research grant", i.e. personnel employed on a temporary basis with a research grant, funded by SOS4LIFE.

In particular, the total number of hours worked by Anita Maienza is higher than the total number of hours worked for SOS4LIFE, because in the same period she was also involved in the Institute's biochar project and in the AGFORWARD Project.

EXTERNAL ASSISTANCE COSTS – TRAVEL. Part of the amounts allocated to the external assistance cost item for Actions B.1 and B.2, foreseen for soil biodiversity advice and analysis, were used to refund travel expenses, using resources and expertise already available to internal staff.

#### Comune di Carpi (COCARPI):

EXTERNAL ASSISTANCE.

Compared to the approved Project, the Municipality of Carpi reports the following variations.

The Municipality of Carpi had foreseen in the approved project budget, among the costs of external assistance related to action B3, the assignment of a consultancy for the definition of regulatory and territorial planning guidelines aimed at limiting land take. These costs were connected with the drafting of the new municipal urban plan.

The Municipality of Carpi has provided (possibility allowed by Regional Law 24/2017) to draw up the General Urban Planning Plan (PUG) at the level of the Union of Municipalities of the Terre D'Argine to which it belongs. The inter-municipal plan includes the territories of the municipalities of Carpi, Campogalliano, Novi di Modena and Soliera.



The drafting of the Carpi PUG is currently underway and the plan will be prepared by the end of 2021 to be adopted at the beginning of 2022.

The external assistance costs foreseen in the budget for action B3 are not accountable in the Project as the contract was signed at the end of 2020 and the expense will be paid after the transmission of this Report.

Among the budgeted costs (for action B2) there was also the assignment of external assistance for the environmental characterization of the soil in the de-sealing area.

Since the de-sealing intervention, as motivated in Chapter 6 Technical Part, was not implemented in the area identified initially, the Municipality of Carpi has not entrusted the characterization task.

Therefore, even if the intervention was relocated to another area towards the end of the project, it was not possible to sustain and report this expense.

#### Comune di San Lazzaro di Savena (COSLS):

PERSONNEL. Filomena Oronzo was absent due to illness for a long period in 2017, so his hourly cost is higher considering the ratio of hours worked vs wage.

#### F.M.I. Forli Mobilita' Integrata (FMI):

PERSONNEL. The establishment of FMI company was approved by Resolution of the Municipal Council of Forlì no. 155 of 19/12/2011. The personnel employed by FMI in the SOS4LIFE Project, consisting of Maltoni Claudio, Spazzoli Stefano and Pozzi Gianpaolo, were employed by the Municipality of Forlì until 31/12/2011. Since 01/01/2012 they have been employed by the new FMI company, that is why the Project personnel is hired on the same date, 01/01/2012.

EXTERNAL ASSISTANCE. See note above regarding the execution by the Municipality of Forlì instead of FMI of a complementary activity for the environmental characterisation foreseen in Action B.2.

#### Legambiente Emilia Romagna APS (LegambienteER):

PERSONNEL. The Partner Legambiente Emilia-Romagna affected lower costs for permanent staff as an employee was hired with a new contract introduced by the Jobs Act (various Italian legislative measures in 2016), enforced later than the Project's approval. This contract benefits of fiscal incentives for the employment of young people.

#### Regione Emilia-Romagna (RER):

PERSONNEL. Francesco Malucelli, employed by the Emilia-Romagna Region and member of the Project Staff, in November 2016 was seconded, by the means of a special agreement, to ARPAE (Regional Agency for the Environment); nevertheless, he has kept on working for the SOS4LIFE Project and his cost is being affected to Emilia Romagna Region.

Nerieri Marco and Garberi Maria Luisa are to be considered as non-additional personnel, because they were already employees of the Emilia Romagna Region, from the moment they joined the working group ("Atto del Dirigente – Determinazione - No. 6141 of 02/05/2018 - Modifica della composizione del gruppo di lavoro").

PERSONNEL – EXTERNAL ASSISTANCE. As already highlighted, Emilia Romagna Region could not charge additional staff; for this reason, the activities were carried out:

- part by permanent staff by using a lower number of working days compared to scheduled programs;
- part moving amount foreseen for additional staff to external assistance, according to the following scheme (Action A has already ended when the SOS4LIFE regional budget chapters were opened and therefore there was no time to complete the related award procedures):

Action foreseen	Amount foreseen (additional staff)	Name of sub- contractor	Description of sub-contracted item/service	Amount (external assistance)	Action
A 1	€ 2.000	RTI: STUDIO			
B 3	€ 7.040	ASSOCIATO	ELABORATION OF		
B 3	€ 7.040	LOMBARDI-	INTERDISCIPLINARY		
B 3	€ 7.040	SPAZZOLI-	GUIDELINES TO BE ADOPTED		B3
B 3	€ 7.040	PAGLIONICO,	FOR THE URBAN,	€ 38 170 80	(included
B 3	€ 7.040	STUDIO	ARCHITECTURAL AND	0001110,00	part of D1)
A 1	€ 1.000	GEODESIGN	LANDSCAPE DESIGN OF		part of D T
D 1	€ 3.200	ASSOCIATI, ELENA FARNÈ	URBAN REGENERATION INTERVENTIONS		
A 1	€ 3.100		CONSTRUCTION OF AN		
B 4	€ 9.600	ANDREA	INFORMATION SYSTEM FOR	€ 35.637.22	B4
B 4	€ 30.400	LUGLI	MONITORING LAND TAKE		
C 1	€ 22.400	SER.IN.AR.	DATA COLLECTION, PROCESSING AND ANALYSIS OF SOCIO-ECONOMIC IMPACT OF LAND TAKE	€ 18.300,00	C1

## 8.1. Summary of Costs Incurred

	PROJECT COSTS INCURRED					
	Cost category	Budget according to the grant agreement in €*	Costs incurred within the reporting period in €	%**		
1.	Personnel	1.071.707,00	1.279.652,57	119,40%		
2.	Travel and subsistence	43.838,00	28.098,03	64,10%		
3.	External assistance	482.870,00	451.757,27	93,56%		
4.	Durables goods: total non-depreciated cost					



	- Infrastructure sub- tot.			
	- Equipment sub-tot.			
	- Prototype sub-tot.			
5.	Consumables	34.600,00	19.820,02	57,28%
6.	Other costs	38.716,00	39.152,77	101,13%
7.	Overheads	117.018,00	127.290,74	108,78%
	TOTAL	1.788.749,00	1.945.771,40	108,78%

\*) If the EASME has officially approved a budget modification through an amendment, indicate the breakdown of the revised budget. Otherwise this should be the budget in the original grant agreement. \*\*) Calculate the percentages by budget lines: e.g. the % of the budgeted personnel costs that were actually incurred

Allocation of costs per action:

Short name of action	1. Personnel	2. Travel and subsiste nce	3. External assistanc e	4. Dur abl e	5. Purc has e or	6. Consuma bles	7. Other costs	TOTAL
				goo ds	leas e of			
Δ1	105 104 70	0 700 50			land		7 5 10 57	101 400 70
AI	105.104,70	0.790,52					7.519,57	121.422,79
B1	209.878,99	7.729,74	75.363,47			1.624,93	375,00	294.972,13
B2	220.335,50	2.413,15	52.596,51			18.195,09		293.540,25
B3	158.365,18	478,60	120.599,3 1				12.977,14	292.420,23
B4	117.853,96	223,90	97.701,98					215.779,84
C1	85.105,92	87,15	18.300,00					103.493,07
D1	189.808,02	5.549,02	27.196,01				14.487,76	237.040,81
E1	193.200,30	2.817,95	59.999,99				3.793,30	259.811,54
OVER HEAD S								127.290,74
TOTAL	1.279.652,5 7	28.098,0 3	451.757,2 7	0,00	0,00	19.820,02	39.152,77	1.945.771,4 0

## 8.2. Accounting system

For Public Bodies like Municipalities and Region the accounting system is regulated by the national law and foresees the obligation of creating specific budget items for revenues and expenditures.

As far as the Municipality of Forlì is concerned, the sums financed by the EU go into a specific revenue item for EU grants where a sub-item was created and dedicated to the SOS4LIFE Project.

Each public body also created specific expenditure items dedicated to the SOS4LIFE Project that allow monitoring every single cost. Expenditure items usually include other sub-items related to each type of expenditure: e.g. for the

Municipality of Forlì, "Prestazioni di Servizio" include external assistance costs e travel costs; "Personale" includes additional staff costs.

These sub-items do not necessarily correspond to the cost categories indicated in the project.

All budget revenues and expenditure items are destined to the project and cannot be used for other types of expenditures. Cost incurred for the project are paid by using the sums available in these items.

The Municipality of Forlì also created a special expenditure item for transferring the funds to the associated beneficiary partners.

No specific sub-item was created for "Permanent staff costs" because they are from the Municipality's own resources. Already existing annual items are being used for this kind of expenditure.

The partners CNR e FMI identified specific cost items in their analytical accounting system for the Project SOS4LIFE, where all grants and related costs are recorded.

Legambiente and ANCE use specific codes for the Project SOS4LIFE costs in the frame of the general double-entry accounting records.

Permanent staff costs are affected to the Project SOS4LIFE by the means of the timesheet, where working hours are registered.

Public bodies also have a CUP (Codice Unico di Progetto, Unique Project ID) specially created for a public investment project. This ID is essential to monitor public investments and is one the most important tools to ensure transparency and traceability for financial flows.

A list of the ID codes for cost/expenditure items of each partner (apart from the public Bodies) is given below:

#### **MUNICIPALITY OF FORLI'**

UNIQUE PROJECT ID (CUP): C69D16000940001

Cost center 321 (Urban Planning Dpt.)

REVENUE ITEM - SOS4LIFE: Capitolo 011000 CONTRIBUTI COMUNITARI, Articolo 011000/0426 UE Trasferim.SOS 4 LIFE

EXPENDITURE ITEM - SOS4LIFE:Mid-term Report - LIFE15 ENV/IT/000225 SOS4LIFE

Capitolo 048120 PROGETTO UE SOS4LIFE - PERSONALE,

Capitolo 048121 PROGETTO UE SOS4LIFE - IRAP,

Capitolo 048550 PROGETTO UE SOS4LIFE - PRESTAZIONE DI SERVIZI,

Capitolo 010210 PROGETTO UE SOS4LIFE - TRASFERIMENTI.



#### ANCE Emilia-Romagna

ITEM DESCRIPTION

**REVENUE SOS4LIFE** 

Contributo Progetto SOS4LIFE

EXPENDITURE SOS4LIFE

Spese di viaggio Progetto SOS4LIFE

Costo del personale Progetto SOS4LIFE

Spese Consulenze/Prestazioni di Servizio Progetto SOS4LIFE

Spese diverse Progetto SOS4LIFE

## CNR - IBE

Cost Center P0000689 (industrial accountability) where all revenues and expenditures for the SOS4LIFE EU PROJECT are recorded .

## **MUNICIPALITY OF CARPI**

UNIQUE PROJECT ID (CUP) - C9F16004610001

**REVENUE ITEM - SOS4LIFE** 

320.00.02 "Trasferimenti correnti dall'Unione Europea per progetti UE - SOS4LIFE" – codice meccanografico: 2010501

**EXPENDITURE ITEM - SOS4LIFE** 

390.00.32 "Prestazioni di servizi - Spese correnti per servizi finanziati con trasferimenti UE - SOS4FILE" - codice meccanografico: 0901103

## MUNICIPALITY OF SAN LAZZARO DI SAVENA

UNIQUE PROJECT ID (CUP) - E69D16003340001.

**REVENUE ITEM - SOS4LIFE** 

201000010260 - 1 Contributo comunitario progetto SOS4Life EXPENDITURE ITEM - SOS4LIFE

1010000430102 - 10 Personale - spese viaggio - progetto SOS4Life

1030000430211 - 15 Prestazioni professionali progetto SOS4Life

1030000430299 - 2 Prestazioni servizio per il progetto SOS4Life

1100000439999 - 10 Spese generali progetto SOS4Life

#### FMI

Cost Center SOS4 LIFE 14/001 where expenditures for the SOS4LIFE EU PROJECT are recorded .

#### Legambiente Emilia-Romagna

Revenue account code SOS4LIFE 4103

Expenditure account code SOS4LIFE 3103

#### **EMILIA-ROMAGNA REGION**

UNIQUE PROJECT ID (CUP): - E64H16000520008

SOS4LIFE ENTRY ITEM: 5800

COST ITEMS:

U38232 SPESE PER L'ATTUAZIONE DEL PROGETTO;

U38234 SPESE PER CONSULENZE PER L'ATTUAZIONE DEL PROGETTO;

U38238 SPESE PER PRESTAZIONI PROFESSIONALI E SPECIALISTICHE;

U38242 SPESE PER ORGANIZZAZZIONE EVENTI, PUBBLICITA' E SERVIZI.

Every single partner has followed his own internal rules to approve costs; public bodies have followed current laws.

Every person involved in the project has recorded his working hours in the timesheet included in the "expenditure standard declaration"; at the beginning of the next month to which it is related the timesheet has been signed by the Project Responsible, too.

The Municipality of Forlì, the Municipality of San Lazzaro, the Municipality of Carpi, Emilia Romagna Region, CNR and Forlì Mobilità Integrata have an electronic time registration system (every employee has his own badge); ANCE and Legambiente Emilia-Romagna manually register working presences in the so called LUL, Libro Unico del Lavoro, Working Unique Register.

During the eligible period each partner has asked all suppliers to use the code LIFE15 ENV IT 000225 – SOS4LIFE to identify the project costs in all invoices related to project costs.

#### 8.3. Partnership arrangements (if relevant)

The Municipality of Forlì has wired the sums of the first pre-funding operation on 12/10/2016 to the following partners: CNR, Municipality of San Lazzaro, Municipality of Carpi, FMI, Ance, Legambiente Emilia-Romagna. The bank transfer to Emilia-Romagna Region was made on 31/01/2017 under specific request of the Emilia-Romagna Region as they needed to prior register specific budget items in order to check the revenues. This operation was made at the beginning of 2017. The second pre-funding sum was distributed on 12/05/2018.

#### 8.4. Certificate on the financial statement

No certificate is due as no partner receives a total contribution in the form of reimbursement of actual costs from the EU higher than  $\in$  300.000.



# 8.5. Estimation of person-days used per action

Action type	Budgeted person- days	Estimated % of person-days spent
All projects when applicable Action A: Preparatory actions	592	92,84%
ENV projects Action B: Implementation actions	4248	87,08%
ENV and GIE projects Action C: Monitoring of the impact of the project action	600	84,75%
ENV and GIE projects Action D: Public awareness/communication and dissemination of results	1028	114,91%
ENV and GIE projects Action E: Project management	918	99,48%
TOTAL	7386	92,77%



This project has received funding from the European Union's programme "LIFE Environment and Resource Efficiency" Questo progetto ha ricevuto il finanziamento del programma dell'Unione Europea "LIFE -Ambiente ed Efficienza delle Risorse"



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