



The Urban Lab of Europe !



# Zoom-in I

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## Soil for our future!

The importance of soil and how the US4F project is creating new soil utilising urban organic and construction waste



Author: Daniela Patti





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Recently many people have been following the “10 year challenge”, sharing pictures on social media in which they compare themselves today and ten years ago. If planet Earth were to do it, the comparison would not be positive, as over the past decade much fertile land has been lost.

The City of Maribor is addressing this challenge through a provocative solution: **could new soil be produced from urban waste?**

This Zoom-in article explores the importance of soil and how the project is creating new one through urban organic and construction waste (excavated soil), opening new opportunities for circular economy in the city.

## 1 What is soil?

Soil is essential for production of food, for ensuring quality green spaces and a liveable environments. Yet, the ability of soil to deliver ecosystem services, in terms of food production, as biodiversity pools and as a regulator of gasses, water and nutrients, is under increasing pressure. Current rates of soil sealing, erosion, contamination and decline in organic matter all reduce soil capability for growing plants. Land degradation is largely connected to soil sealing, which affects the infiltration capacity and the soil biodiversity<sup>1</sup>. Furthermore, the land degradation includes soil erosion, loss of organic matter, the decline of the surface and groundwater regime and nutrient enrichment. Land take, soil sealing and degradation thus seriously affect the delivery of ecosystem services, such as water regulation, food production and carbon retention<sup>2</sup>.



Video: “What is soil”; Produced by EEA

Through the UrbanSoil4Food project, the City of Maribor aims at bringing output benefits for soil quality, urban food production and for the environment through circular economy. In respects to soil, the project will produce soil through construction waste and organic matter collected by the city’s public waste management company. An analysis of material flows of waste usable for production of urban soil, will be carried out, taking into account the quality of said waste and quantities available. The new soil could be composed for example by excavated soil from construction sites or compost from biological treatment of municipal wastes and gardens. This way, it will be possible to improve the soil quality of many plots especially at urban gardens in Maribor, as well as to sell the reused soil also to private households.

<sup>1</sup> EEA, 2017, Landscapes in transition, An account of 25 land change in Europe:

<https://www.eea.europa.eu/publications/landscapes-in-transition>

<sup>2</sup> EEA, 2015, Air quality in Europe — 2015 report , EEA Report No 5/2015, European Environment Agency

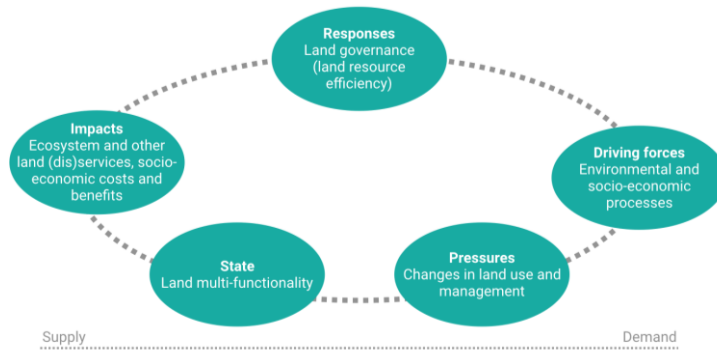


Image 1: The Land System; Source: Eutopian, based on EEA, 2015

## 2 How do you make new soil?

The [Slovenian National Building and Civil Engineering Institute \(ZAG\)](#) is responsible for the testing and analysis of the soil produced through the project, specifically for three different prototypes: pots, vertical green walls and green roofs. After a number of experiments over the past months, the ideal types of soil have been created for the different purposes. Particularly insightful has been the findings of the soil for the outdoor patches of land. In fact, after a number of experiments being carried out under different conditions, to the basic mixture coming from organic and construction waste from the Municipality, coconut fibres and vermiculite, to improve the humidity retaining, were added.

From the point of the construction sector there is a lack of guidelines, protocols or any kind of instructions for the last phase of geotechnical and earthworks works, for example in relation to greening of the soil surface. Meaning that all aspects of construction are clearly defined and followed by belonging standards and guidelines (for example with for concrete mixtures, etc.). Yet, when it comes to the final layer outside the buildings, as for the garden, lawn, mound or dyke, no guidelines exist. Nevertheless, this is the most important layer, as it is being used either for food production, playgrounds or any other application and is under constant influence of wind erosion, water infiltration, etc. and consequently affects all underground layers and underground waters. Therefore, it is a great interest of ZAG to tackle this issue by establishing a laboratory system for testing and evaluating this final layer and bringing more pedagogical knowledge into the traditional construction knowledge.



Image 2: Lettuce growing in different kind of soils produced from urban waste; Source: ZAG

Since ZAG's Laboratory for Stone, Aggregate and Recycled Materials is highly focused on the new paradigm of circular economy and recycling, it is naturally its interest to create new soils from recycled waste. The main challenge of this issue is that currently there is no legislation for testing and development of the so-called recycled soil. There are several documents regarding certification of separate components of recycled soil (such as com-post, biochar, and soil) but when all those components are mixed, a completely new product is developed. Within the project US4F, ZAG specified it as "urban soil", since it is being used in urban areas, where we are either facing lack of soils, or they are degraded or contaminated. To define such urban soils, a technical group was created and composed by project partners from Snaga d.o.o., Deltaplan d.o.o. and ZAG as well as the relevant stakeholders from the soil sciences. Together they have defined proportions of each component, which were later tested in the laboratories as well as with different growth tests. The designed proportions have been as follows:

mixture Z-1	mixture Z-2	mixture Z-3
88% of excavated soils	80% of excavated soils	66% of excavated soils
10% of compost	17% of compost	30% of compost
2% of biochar	3% of biochar	4% of biochar

Furthermore, also pure excavated soil and pure compost were tested both for chemical composition and with growth tests. The excavated soils were used since usually at every construction site a huge amount of high quality soil is being excavated and most likely such soil is being used as a construction material in lower layers of embankments or as landfill, despite the lack of high quality urban soils.

Based on the carried out analyses, ZAG decided to develop three types of urban soils:

- 1) Urban soils for food production (with the highest standards for quality and safety)
- 2) Urban soils for green areas (parks, etc.)
- 3) Urban soils used in construction (or technical urban soils)

The aim is to guarantee the highest level of quality for first category urban soils, which will be used for food growth. Such soils must meet the requirements, which are set in the highest quality guidelines and must be appropriately composed for food growth. Therefore, it will consist of excavated soils, compost made only of green-cut from parks and grass and biochar, the latter with the aim to improve the soil quality.

In the second category, ZAG will mix excavated soils, composts (with included domestic bio-wastes) and biochar. Such soils will be used for urban green areas (parks, etc.), here-by they will also have to meet the requirements of quality guidelines.

The third category of soils will be used in construction sector and will include mainly excavated soils with lower percentage of compost and biochar, depending on its final use in construction. This third category is not related to any plant growth but will nevertheless have to meet adjusted quality guidelines for technical use in construction sector.

Within the project, ZAG is aiming at developing guidelines for all three categories for urban soils adjusted for their final use. Such guidelines will be prepared and proposed to the Slovenian Ministry of Environment and Spatial Planning to include them into future policy discussions and hopefully for future official documents (e.g. Official Gazette or national roadmaps developed under smart specialisation framework).

### 3 With what will soil be made?

The experimented soil will be produced in larger quantities thanks to [Snaga](#), the public waste management company of the City of Maribor. Every year Snaga manages approximately 13.000 tons of organic waste coming from green space maintenance, kitchen waste and wood. Furthermore, the City produces approximately 100.000 tons of un-hazardous waste coming from construction and non-polluted industry. All this could be used for making soil, as the project is experimenting in smaller quantities, with approximately 800-1.000 tons of biological waste.

The produced soil can have a variety of applications. In agriculture, soil is necessary because of its nutrients, vital for plants that will produce food consumption. Similarly, in gardening, plants require nutrients from the soil. For green walls and roofs, soil might not have stringent requirements as plants are often grown for decorative purposes but increasingly also edible plants are being planted, therefore nutrient requirements apply for a light soil, possibly with low clay quantity. Finally, the soil can also be used for construction (e.g. embankments), but in this case it would not need as much nutrients as for gardening, therefore the soil mixture will be adjusted. Ultimately, this produced soil will be branded, in order to create more awareness with citizens about the benefits of their local high quality recycled soil instead of the supermarkets' packed soils with unknown origin and quality. As the project is currently very involved in the setup of the community gardens, a series of promotional actions have been thought of, such as where people could bring their organic waste and exchange it for a bag of soil.



*Video: "Let's talk about soil"; Produced by FAO*

A pilot system for soil production will be one of the main investments of the project. The pilot plant itself will be an experiment, as it will manage smaller quantities than the ones currently available on the market, as the ambition for the future is to replicate a modular model with small plants across the other cities, rather than expanding to a large one. The plant will be composed by three elements: the dry fermentation plant, pyrolysis for production of bio-char (charcoal) and composting; a mixer; and a chemical filter. Particular attention is posed on the issue of smells, in order for the plant to be suitable also in urban populated areas. Finally, the extra energy produced will be used within the plant process as well as for heating in green houses.

## 4 How can we all benefit from this experiment in Maribor?

The [Urban Soil 4 Food](#) experiment carried out by Municipality of Maribor allows to proto-type solutions which can be upscaled in the cities across Europe<sup>3</sup>. But most importantly the learnings will feed into policy development. In fact, there is no specific overall European legislation on the management of soil resources, despite the large range of activities that ultimately depend on soil. Currently reference policies for soil protection, unlike for water and air, are mainly addressed indirectly or within sectoral policies: agriculture and forestry, energy, water, climate change, nature protection, waste and chemicals. The lack of a coherent soil protection policy at European level is also reflected in the scarcity of harmonised soil data, which would enable a framework to coordinate efforts to survey soil status adequately<sup>4</sup>. The need for a Soil Policy is not only recognised as a need from a technical point of view, but also from a broader public. For this very reason back in 2017 a citizens' European petition [People4Soil](#) was initiated to push forward a European Soil Policy, which despite not reaching the one million threshold, managed nevertheless to raise the attention levels on the matter for the wide public. Currently, the City of Maribor is also extremely involved in the EU Urban Agenda Partnership on Circular Economy, where actions in fields of Urban Circular bio-economy are drafted and being implemented by members of partnership together with action on urban resource management.



Image 3: People4Soil campaign; Source: © People4Soil

For a successful implementation at local scale, as well as an effective policy development at European level, the build-up of a broad awareness is necessary. Therefore, it will be important to see the upcoming implementation of the gardens with the normal soil in spring, which will be later compared with gardens where the renewed soil has been used, in order to better perceive the different results!

*Zoom-in report by Daniela Patti, Urban Soil 4 Food expert, Eutropian*

*Interviews with Brina Lazar – City of Maribor, Igor Kos – Wcycle Institute, Kim Mezga, Pet-ra Vrhovnik and Ana Mladenović – ZAG, Marko Kac and Janja Viher – ZIP, Branko Kosi and Petra Hercog – Snaga d.o.o.*

<sup>3</sup> Urban Soil 4 Food Journal: <https://www.uia-initiative.eu/en/news-events/urban-soil-4-food-journal-1-read-about-projects-initial-progress>

<sup>4</sup> Ecologic Institute, 2016, Updated inventory and assessment of soil protection policy instruments in EU Member States, European Commission, DG Environment (ENV. B.1/SER/2015/0022), Berlin



### **Urban Innovative Actions**

Les Arcuriales  
45D Rue de Tournai  
F - 59000 Lille

**+33 (0)3 61 76 59 34**  
[info@uia-initiative.eu](mailto:info@uia-initiative.eu)  
[www.uia-initiative.eu](http://www.uia-initiative.eu)

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Urban Innovative Actions (UIA) is an Initiative of the European Union that provides urban areas throughout Europe with resources to test new and unproven solutions to address urban challenges. Based on article 8 of ERDF, the Initiative has a total ERDF budget of EUR 372 million for 2014-2020.

UIA projects will produce a wealth of knowledge stemming from the implementation of the innovative solutions for sustainable urban development that are of interest for city practitioners and stakeholders across the EU. This Zoom-in, written by a UIA Expert, captures and disseminates the lessons learnt from the project implementation and the good practices identified. It is part of the capitalisation and dissemination activities of the UIA – Urban Innovative Actions Initiative.