

## MAKING NATURE-BASED SOLUTIONS VISIBLE AND PROMOTING SOIL LIFE THROUGH DEEP MULCH GARDENS IN VESZPRÉM, HUNGARY

Chapter 3 is based on Dr Iván Gyulai's lectures and articles (he is an ecologist, a university teacher, president of the Ecological Institute for Sustainable Development Foundation, Hungary, and a member of the National Council for Sustainable Development).

*“How and how often do you water these vegetables?” – asks Iuri Bruni from Siena, which is a frontrunner in Italy promoting community gardens. “No need for watering at all, even in the hot summer period and we do not use chemicals” - says Dr Tímea Szalay, president of the Csalán Association, which manages the three deep mulch gardens in Veszprém. But she must repeat her answer three times since participants of the BiodiverCity study visit simply cannot believe it. Finally, she shows the difference: the soil under the mulch is black and wet, while two meters away, in a traditional plot, where there is no covering, the same soil is visibly much dryer (light brown). “This is a garden where we learn how nature works sustainably...”*

### **Ferenc Albert Szigeti**

*coordinator of the Hungarian Hub for Nature-based Solutions, lead expert of the BiodiverCity network*



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### INTRODUCTION: TRANSFORMING CITIES' RELATIONSHIP WITH NATURE AND THE RISE OF NATURE-BASED SOLUTIONS TO TACKLE THE ECOLOGICAL CRISIS

Bestseller author Richard Louv defined nature-deficit disorder in his book (Vitamin N: The Essential Guide to a Nature, 2016 – where “N” is for “nature”) and launched an international movement to get humans' connection back to nature, especially in urban areas where this connection has been dramatically lost over the last centuries, as it was painfully, but perfectly showcased during the COVID-19 pandemic.

The story of (urban) biodiversity is not only about recreation and halting biodiversity loss is not about protecting cute animals. Biodiversity loss threatens the life support on our planet, and it is a leading threat to humanity's safe. In the shadow of inevitable climate change and rapid urbanism, our connection to nature, deeply rooted in cultural values, attitudes and norms, plays a key role when we intend to increase the size and quality of urban green spaces as well as natural habitats and protected areas in and outside of the cities - in line with the [EU Biodiversity Strategy for 2030](#) and the historic [Nature Restoration Law](#).

Due to our impact on the planet, we face never seen challenges. We have the above, rightfully criticised, but still revolutionary strategies and legislation in Europe, and we have solutions in our hands. Nature provides not only unbelievable benefits for our physical and mental health but also cheap and aesthetic solutions to develop our cities and reshape our landscapes, to make the long-desired paradigm shift in all areas of economic life.

It is always better to talk about solutions, however, the concept of nature-based solutions (NbS) is not new at all. The issue is that according to the International Union for Conservation of Nature (IUCN), one-third of climate mitigation needed to meet the goals of the Paris Agreement can be provided by NbS. At the same time the World Economic Forum states ([BiodiverCities by 2030](#)) that NbS are 50% cheaper in urban infrastructure than grey infrastructure, yet they received just 0.3% of overall spending on urban infrastructure in 2021.

So, we need to raise awareness of all actors to the effectiveness of NbS and lead by example.



There are several definitions regarding NbS. The most useful one comes from the initiator organisation (IUCN): nature-based solutions “*are actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature*”. Conservationists have been restoring habitats for decades, but now, in the shadow of the ecological crisis, there is a massive emphasis on the other side of the coin: the unbelievable ecosystem services natural and modified ecosystems can provide (besides providing habitats for species) and what we have forgotten. What is good for nature, is good for society and the economy.

Therefore we need to reestablish our connection with nature, especially in Europe, since 81% of EU protected habitats and 63% of EU protected species are in “poor” or “bad” conservation status ([2020 ‘State of Nature in the EU’ report](#)). As the EU Biodiversity Strategy 2030 says: Europe’s protected habitats and species continue to decline at an alarming rate because the multiple pressures they face are simply too tremendous to enable their recovery. In line with the global goals, the strategy aims to stop and reverse this trend by promoting the systematic integration of healthy ecosystems, green infrastructure and NbS into all forms of urban planning. The strategy also emphasises that 1€ invested into habitat restoration generates 8–38 € profit in Europe.



Cities have a unique role in this story. On the one hand, they offer unique opportunities for learning and education about a resilient and sustainable future and have a significant potential to boost innovations and governance tools. Still, on the other hand, billions of urban dwellers are also at high or extreme risk of environmental disaster.

Nature-based solutions are efficient, cheap, aesthetic, and good for nature - so, what are we waiting for?

Building on the significant awareness-raising and innovation potential of cities, the BiodiverCity URBACT action planning network will work out community-based approaches to valorise and measure biodiversity and related ecosystem services, enabling communities to plan robust nature-based solutions, and foster pro-environmental behaviours, also contributing to the achievement of the EU Biodiversity Strategy.



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## WHY DOES SOIL BIODIVERSITY MATTER EVEN IN URBAN AREAS?

In the shadow of the ecological crisis, there is a lack of global discussion of soil biodiversity and soil degradation. The grave results show that the paradigm shift in agriculture is inevitable and speeding up the transition is of utmost importance.

Let me quote the excellent documentary Poisoned Soil – “By 1950, half of the world’s land supply had been rendered unfit for cultivation by increasingly intensive agricultural technology. Around half of Hungary’s land is under cultivation, but 2/3 of the cropland is threatened by some form of soil degradation that reduces fertility.” According to the latest report by the Intergovernmental Panel on Climate Change (IPCC), droughts, heat and water scarcity will make production impossible on a third of the world’s cropland by the end of the century. Soil moisture in nearly half of Europe’s agricultural areas has declined substantially in recent decades (while agriculture in general consumes 70% of freshwater resources).

It is therefore clear from the data that there is also a dramatic erosion and deterioration of soil quality, which intensive technology users believe can be offset – for a time – by increasing fertilisation. In the meantime, more and more people need to be fed, the historic 2022 drought with its heat waves has caused hundreds of billions of dollars in (agricultural) damage and serious health risks, and now the supply chains are being disrupted.

By now we know that with regenerative agriculture methods, it is possible to multiply the amount of soil organic matter in a few years, even on a large-scale farm, while reducing the use of chemicals and machines, but not necessarily reducing yields. Many of us ask the same question: if we are currently in the last moment to save the soil, isn’t it a now and here moment for change, to finally produce healthier food while improving the environment and sequestering a lot of carbon dioxide?

So, it is time to talk about soil biodiversity in our cities too and BiodiverCity partner Veszprém has an interesting story to share!



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## HOW DOES THE DEEP MULCH TECHNIQUE WORK?

Deep mulch imitates nature, as plants shed their leaves in autumn, and cover the surface, which protects the soil from degradation, compaction, loss of moisture, and also allows the building of topsoil making soil renewable. In nature, soil is forming, not degrading. It is not only rejuvenating and regenerating, but compared to the previous years it is also increasing in quantity - on one hectare 1 ton of soil is formed every year in natural conditions.



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In arable land, we find that intensive agriculture uncovers and ploughs the soil. Almost half of Hungary's territory is plough-land, which means that half of the country stays unprotected, uncovered for the winter. Therefore, degradation is much faster than revival.

Similarly to what we experience in the forest, in the garden we can also create a thick layer on the surface of the ground in autumn to protect the soil from frosts in winter, and so that the life within the soil stays active. As a result, in spring the soil will be soft and ready for planting without ploughing or digging. On the other hand, as the leaf waste protects the soil in the forest from mechanical compression, the same happens in the garden. But the most important advantage of this thick mulch is that the precipitation falling in the year is preserved in this mulch and is transferred to the soil in a nicely continuous manner. It also protects against temperature changes; the daily temperature fluctuation decreases on the surface of the soil. But what is even more important, the organic waste will form a layer of humus just like in the forest.



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Deep mulch is a 50–60 cm thick cover made of organic waste ready for composting. *“For the first time we use this thick cover, and after, year by year we need less cover as the topsoil is getting thicker. It means that after 10 years soil restoration continues in a closed system with using just the green remains for cover of organic green waste”*. In the autumn (in October and November) we make the deep mulch from organic waste. *“In my case, I used the organic waste from the horse stable: first straw for the surface and cover it with a 10-20 cm thick layer. Then 30-40 cm of stable waste is put on top of this, and then 10 cm straw cover over that”*.

The aim is always to get the optimum nitrogen-carbon proportion for composting. In this case, the straw is low in nitrogen, and when we put the high-nitrogen stable waste on it, and when the rain washes away the ammonium nitrate from the dung, the straw below will absorb it, so the nitrite-nitrate does not get into the soil, but it enriches the straw, and this mixture will be ready for decomposing. Decomposing will not start in winter, because of the cold weather conditions, but in spring – in March and April – the process starts. The thermophilic (heat-producing) phase of composting, which lasts for cc. 2 months will provide the soil with enough warmth for the sprouts to germinate, and this phase is over by the summer. On the contrary, the shallow mulch slows the vegetation period by blocking the sunlight from reaching and warming up the surface of the soil. If we are ready with autumn covering, we will have nothing to do until spring. By the end of May, the soil will be ready for planting.

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*"I started using deep mulch on degraded soil in my one-hectare farmland on a 500 square meter vegetable garden in 2002 in Szuhafő, North-East Hungary, and until now a 25-30 cm deep topsoil has been created from the mulch. I use this humus for planting, and a closed cycle is applied now by using the green waste produced by the system. The results prove that the method mitigates the negative impacts of climate change, because of the high water-retention capacity of the deep mulch and layer of the humus. As soil maintains rainfall for the whole vegetation period, cultivation is possible without irrigation".*



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All kinds of organic waste can be used as mulch locally, no need to transport the organic waste by using energy and creating emissions. The soil cover made of organic waste results in the recreation of soil structure, and soil biodiversity, while the cover protects the soil from degradation and compaction. Plants' health is strengthened by the rehabilitation of topsoil and its biodiversity, because of the natural nutrition instead of using fertilizers.

The weed pressure is decreased to 20% of the area due to permanent agriculture, and the rest of the "weeds" are integrated into the self-supporting system. By using the maximum diversity of the plant community and applying diverse biotopes in place a perfect life-supporting system is created, ready to self-control the system. Due to the rich soil and self-control, production is increased at a minimum of 30%.

There are two basic innovations in the method. The first is the way of mulching. This method is different from the well-known mulching. The problem with traditional mulching is that the soil surface cools down in the winter, and the mulch prevents sun radiation from warming up the soil for the desired temperature of germination. Very often the mulch is composed of organic waste which is not suitable for composting because of the too-low, or too-high carbon proportion to the nitrogen. The third problem is that the mulch is

not deep enough to catch and reserve the rainfall for the whole vegetation period. We overcame these problems by mixing mulch from different types of organic waste at the proper proportion of nitrogen and carbon (1:30-35). The deep mulch prevented the soil from freezing, and the mulch is ready for composting in the springtime which creates heat and warms up the surface a bit earlier. Due to the proper condition of the soil, life is active even in the winter, and the movement in the soil helps us to soften the soil until spring. The deep mulch collects and reserves all the rainwater and gives it to the soil very slowly.



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Another innovation is the self-regulation, avoiding plant protection by humans at all, even if no biological treatments are needed. *"We believe that there is no organic food without self-protection. If we protect the plant instead of self-protection, the plant will not create high nutrition values. There is a kind of social innovation here, too. Instead of organic waste ending in a waste deposit or a central composting plant, local people can cooperate to provide the appropriate composition of the deep mulch by delivering the different types of organic waste locally to each other"*.

## IMPLICATIONS AND LESSONS FOR CITIES

Three small deep mulch gardens have been operating in Veszprém for 8 years now, as a cooperation between the municipality and the local Csalán Association. The land is given by the municipality free-of-charge, the NGO coordinates the work, while the community manages the gardens. The garden visited by BiodiverCity participants is located at the edge of the city, next to a neighbourhood of detached houses, in an area where locals hire small plots from the municipality for cultivating vegetables. The other two gardens are in a housing estate and next to the train station.

These gardens in Veszprém can only work with some differences related to those operating in the countryside. For example, horse manure was given for free by horse keepers from Lake Balaton, but since Veszprém lies on a karst plateau, due to the national Decree on Nitrate Ordinance, covering with horse manure is not possible here (while removal or incorporation into the soil is accepted). They must use more green manure, often given by the municipality or special material like quail manure.

The garden has a huge potential to showcase how nature works, highlight nature-based solutions, and foster pro-environmental behaviour. This is an experiment. Kitchen waste is also used in the garden, this is why many peach trees appear randomly for instance... Branches cut from trees function as a natural fence also providing weed control, and spices are planted in a way to protect vegetables. It is all about learning from nature including a lifestyle which is not about consuming but being adaptable for seasonal products.

## The most important implications for other cities to capitalise on this great idea:

More awareness-raising actions can be organised, fostering more pro-environmental behaviour and helping residents to understand nature-based solutions (now volunteers of the association host interested groups, but its organisation is rather random).



Such a garden might provide an ideal place to launch community composting by the municipality.

This technique has a high potential to be used in already running community gardens.

Food security is high on the European agenda: such gardens could support community-based agriculture, farm-to-fork strategies, and urban farms.



Another factor regarding social innovation: besides the above-mentioned example (using organic waste of residents in the garden), another cooperation can also be foreseen: the park maintenance company can support the garden by providing green waste collected from public areas.