Let's reconnect with nature!

The ReNatUrE Project

This brochure aims to provide a summary of the results of our activities during the project ReNatUrE to inform the wide public. Our goal is to show how restoring nature in cities can make them more biodiverse, sustainable, and enjoyable places to live.

1 ReNatUrE – Restoration of urban ecosystems for biodiverse, liveable, and sustainable cities in Europe

The mission of the 'ReNatUrE' project was to study the state of implementation, the methods, the challenges and the opportunities of ecological restoration in European cities. For the project, ecological restoration refers to all activities taken to increase the ecological value of urban greenspaces. The main project aim was to facilitate biodiversity and ecosystem services in urban areas by promoting urban ecosystem restoration across Europe.

Therefore, we undertook several steps: We collected and evaluated restoration efforts in urban grasslands globally, resulting in a synthesis published as a review paper (Fekete et al., 2024). We contacted stakeholders across almost 600 European cities to evaluate the enablers and barriers for urban restoration in a questionnaire survey. We also shared strategies on how to improve urban nature with local stakeholders in various platforms. The vision of the project was to contribute to making our cities not only more biodiversity-friendly and sustainable, but also more liveable for the human populations.

We hope that our work inspires stakeholders responsible for urban greenspace management and planning to make their cities more biodiverse, vibrant, and liveable. We also aim to provide guidance to everyone who wants to live in a greener and healthier environment and re-connect with nature in cities, as everybody can contribute and support biodiversity in their gardens!

Natural beauty – planting and sowing native wildflowers can be incorporated into urban greenspace planning and in private gardens to support urban biodiversity
(Photo credit: Tamás Miglécz)

2 Urban greenspaces – biodiversity and ecosystem services

Did you know that cities can be surprisingly rich in biodiversity?

For instance, in several western European cities, such as Berlin, Brussels, and Maastricht we can find 50% of the whole flora of the respective country within the city boundaries! Moreover, there are many examples of threatened plant and animal species restricted to urban areas, meaning that these plants and animals do not occur elsewhere but within cities.

Urban greenspaces do much more than looking pretty. An important issue is taking into consideration all the benefits, which are provided by urban greenspaces. These are, for instance, air filtration, micro-climate regulation, noise reduction, rainwater drainage, sewage treatment, and a large variety of recreational and cultural values. These benefits – known as **ecosystem services** – are often closely tied to biodiversity. That's why protecting and restoring nature in cities is essential for people's wellbeing, especially as more and more people live in urban areas. By this means, green steps can be taken towards a healthier urban population and sustainable, more resilient settlements.

Based on the results of our **Pan-European stakeholder survey,** about half of the participating cities rated the current condition of their urban nature as good or very good. However, there were also 10% rating the cities' urban nature as poor or very poor. Luckily, most cities found urban nature to have improved over the last ten years. Still, some areas are losing biodiversity or remain ecologically degraded, and many greenspaces persistently lack variety. However, the recently adopted **EU Nature Restoration Law** gives us a unique opportunity to reverse this trend in cities.

The targets of **urban ecosystem restoration**, namely ecological intactness (i.e., healthy and well-functioning ecosystems as well as high biodiversity) need to be ambitious but still acknowledge the level of urbanisation. Restoration targets should be chosen to achieve increased urban green area at high ecological quality. Based on the results of studies on urban grassland restoration across the globe, it is recommended to create a network of heterogeneous urban greenspaces and to establish functional connections between them by designing habitat corridors. By this, the local positive effects of habitat restoration can be scaled up to larger spatial scales.

Planting trees and other plants in urban areas can reduce the heat load by regulating the micro-climate
(Photo credit: Pixabay)

3 Just naturally – extensive management promotes biodiversity

Sometimes, less is more – this is also the situation with the **management intensity** (i.e., fertilization, mowing, irrigation) of short lawns. By reducing the frequency of maintenance, lawns can be converted into meadows – a habitat type, which attract much more plant and animal species. But it's not always that simple. Note that in nutrient-rich conditions solely reducing the mowing intensity will not bring back a colourful meadow but result in a tall-growing grassy lawn. Thus, consider reseeding and potentially a soil treatment to bring back flowers. The elimination of **fertilizer and chemical applications**, or at least the reduced use of pesticides and herbicides in urban grasslands is critical to increase biodiversity.

An urban meadow consisting of tall herbs, dotted with trees and shrubs – an ideal habitat for a whole range of different plant and animal species
(Photo credit: Valentin H. Klaus)

In addition to avoiding the use of chemicals, shifting to less intensive, biodiversity-friendly management in urban greenspaces can also be conducted by reducing the frequency of **mowing**. Based on the results of our review, in several cases the most suitable restorative management involved the reduction of mowing frequency to an intermediate level, especially compared to very frequently cut amenity lawns. The application of **rotational management of meadows**, which means establishing areas being mown at different times and with different frequencies is also highly recommendable to support urban biodiversity. Generally, the maintenance of a diverse range of habitats and mowing regimes are beneficial for several different taxa.

By leaving even a narrow strip of uncut flowers during the mowing of meadows, we can aid pollinators and other insect communities
(Photo credit: Valentin H. Klaus)

Another aspect:

the number of mowing events could be chosen according to the **soil nutrient content**. In places of elevated nutrient availability two to three cuts are required to maintain a species-rich grassland in a temperate climate. However, under nutrient limited conditions preferably mowing once a year would be the most suitable. It is also recommended to leave the cut vegetation for a few days and harvest it as hay, while leaving uncut grass refuges by delaying mowing of some areas from spring to summer (rotational mowing).

Besides the opportunity to reduce maintenance costs via the reduction of mowing frequency, another important option should be mentioned: the maintenance of urban vegetation with considerably **less irrigation** or no irrigation at all. Species selection for urban restoration actions should therefore consider future extreme environmental conditions by using native drought-tolerant species that can also have a great ornamental value, but which are better suited for native pollinators. This could be an important step towards climate adaptation without irrigation, saving a lot of money, and decreasing the ecological footprint of the maintenance of greenspaces as well.

Dry grasslands are beautiful as well!

This beautiful patch of wildflowers made up of dry grassland plant species can also be the ornament of the garden
(Photo credit: Laura Godó)

4 The beauty of native biodiversity

Planting native species – especially local varieties – is one of the most effective ways to restore urban biodiversity. One of the most frequently implemented restoration measures in urban areas is planting of **native woody plants**, such as (fruit) trees and shrubs, or using native herbaceous species for grassland restoration. Based on the results of the reviewed grassland restoration studies, **native seed mixtures** are especially effective in reducing the abundance of undesired woody and invasive plant species. For increasing plant and invertebrate species richness in a certain habitat, sowing of high-diversity mixtures in high density is suggested. However, when there is no urgent pressure for the rapid creation of dense species-rich meadows, lower sowing rates on less productive sites can be recommended and save money.

This lawn has not been mown for five years, transformed into a bee pasture, as part of the Wildflowery Budapest project; Budapest – Tabán (Photo credit: Soma Horváth)

Native species provide suitable habitat and ideal nectar source for pollinators (Photo credit: Pixabay)

Why native plants?

The use of native seed mixtures has several **advantages**. For instance, in terms of higher numbers of germinated seeds and established species, native seed mixes are more effective in restoring urban habitats than mixtures also including non-native species. Seeding native species provides more resources for native arthropods, when compared to commercial non-native species. Last but not least, native species proved to be climatically better suited and to perform better regarding floral productivity, visibility, and variety than non-natives – a highly important aspect for urban gardeners.

What's more, using not just native, but also **regional seed material** – the seeds of native species grown in the region (i.e., wildflower seeds from local or regional provenances) – could support the resilience of urban habitats by introducing native species adapted to the local climatic and soil conditions. When dealing with the issue of sowing, the local **availability of seeds** is an outstandingly important aspect. One challenge is sourcing enough local seeds for everyone. That's why building regional seed networks is essential to support future urban restoration projects.

5 Let's make cities biodiversity-friendly!

There are several other ways for supporting biodiversity in urban greenspaces. Leaving or introducing deadwood to certain places, creating piles of stones, wood, or roots which could serve as habitats for different species, installing nesting and resting structures for wild bees, birds, or bats or even designing artificial wetlands and ponds could increase the biodiversity of the concerned settlements. These actions not only help wildlife but also bring nature closer to people. Doing so in public greenspaces can have an important educational value as well, serving as demonstration sites of best practices that can be adapted in everyone's private garden.

A thirsty little guest at the garden bird bath
(Photo credit: Pixabay)

Green roofed structures in city parks that provide homes for various insects have an outstanding impact on shaping public attitudes
(Photo credit: Pixabay)

Piles of stones and deadwood can serve as a place for sunbathing, wintering and hiding for various animals in private as well as public spaces
(Photo credit: Valentin H. Klaus)

Another connection point between man and nature...

Biodiversity-friendly public greenspace management can inspire the way we manage our gardens. Based on the results of our questionnaire survey on private **gardens in Hungary**, people are generally open to adopting biodiversity-friendly practices in their urban gardens. Without the need for completeness, such biodiversity-positive **practices** can be: avoiding the use of fertilizers and herbicides, omitting the planting of adventive plants, application of near-natural soil covering – mulching, composting or leaf litter piles – to serve as wintering and hiding places, planting flower strips for pollinators, installing nesting structures for insects, installation of bird nest boxes and bird bath, outplacement of bat nest boxes or even designing a garden pond. By applying only some of the above-mentioned practices, the observation frequency of animals in gardens will definitely increase, which is the 'reward' of the application of ecological practices and a re-connection point between **people and nature in cities**.

6 It matters, what is under your feet – the importance of soil conditions for restoration measures

Before restoring a greenspace, it is important to understand the soil. The right soil conditions are key to helping native plants thrive. When getting to the question of the right **soil**: improving soil quality and plant health with compost proved to be successful in supporting the establishment of native forbs in places of highly degraded soils. At the same time, although soil amendment with compost has a positive impact on the restoration of planted native forbs, it increases weed cover as well. Thus, it is suggested to use compost in soils with very low nutrient and organic matter content, potentially combined with manual weed management.

On the contrary, in many sites that have been fertilised in the past, **lowering nutrient contents** – especially phosphorus – may be necessary in urban soils for supporting grassland restoration. One rather costly method for this is the removal or replacement of the existing topsoil. In the case of acidic soils, liming could be a more feasible and cost-effective alternative to reduce phosphorus availability when needed.

Compost is not only useful in kaleyards – it also successfully supports the establishment of native plants in areas with severely degraded soil
(Photo credit: Pixabay)

Based on the results of our Pan-European survey, one of the least frequently implemented restoration measures in urban areas is the creation of new urban meadows by using specific **nutrient-poor soil** substrate and seeding. However, this method is proven to lead to very desirable outcomes, also in the long term, and can easily be applied to newly developed greenspaces. Using nutrient-rich topsoil for creating urban habitats is therefore not recommendable from an ecological viewpoint.

Don't ignore vacant lots and abandoned areas either!

The spontaneously recovering vegetation in vacant lots can provide potential habitats or feeding sites for invertebrate species
(Photo credit: Valentin H. Klaus)

The spontaneously recovering vegetation in urban wild areas such as wastelands, **vacant lots**, post-industrial sites, and other "forgotten" areas are a hidden gem, and an important component of urban biodiversity. Such spontaneously developing vegetation can contribute to increasing the overall area of urban greenspaces and additionally provide habitats or feeding sites for various invertebrate species. Since vacant lots are often underappreciated and not managed properly, there is a need for developing guidelines for the management of greenspaces in vacant lots considering both social and ecological needs and benefits.

7 The connection between our vision and our activities – let's look at greenspaces through different lenses!

Based on the results of our questionnaire survey, the most important goal of most city's greenspace planning and management is to ensure **visually attractive greenspaces**. Aesthetics – how green spaces look – still drives many decisions in city planning and management. Often, an ornamental and well-kept appearance of urban greenspaces stands in contrast with the level of biological diversity of a given area. Although in most of the cases traditional lawns are characterised by lower biological diversity compared to urban meadows, they are often considered to be neat, pleasing, and aesthetically valuable. Acceptance of less tidy and more biodiverse greenspaces can therefore be supported by targeted communication campaigns and by highlighting the beauty and importance of wild and colourful biodiversity.

Native meadow and forest species together with non-invasive ornamental plants can make a nice, flower-rich and structurally diverse grassland component of the castle park in Gödöllő, Hungary
(Photo credit: Orsolya Valkó)

Some endangered arable weeds are simply stunning in their beauty. By using these species, such as the cowcockle and the cornflower, we can create visually pleasing green spaces and important flower resources for pollinators at the same time
(Photo credit: Pixabay)

Another important goal is to promote **recreation, health and well-being** of citizens. For a city's inhabitants, it is important that an urban greenspace is flower-rich, dotted with trees, shady during heat, harmonious, and that it supports well-being and offers a soothing sight. At the same time, it should be functional, with an opportunity to sit or lie down, suitable for walking, child- and dog-friendly and support recreation, sports, and leisure activities.

Promoting the **attractiveness of the city** and creating **places for social meetings** are also among the most important goals of a city's greenspace planning and management.

Luckily, biodiversity and beauty can go hand in hand.

Increasing the attractiveness of degraded urban greenspaces and subsequently urban tourism can create a synergy with the application of biodiversity-friendly and close-to-nature solutions: when designing flower beds, native species such as endangered arable weeds could be used together with ornamental, non-invasive exotic species, while the joint presence of annuals and perennials can make plant communities appear more attractive throughout the whole year and reduce management costs compared to annually re-sown flower beds.

While many of the afore-mentioned goals of urban restoration focus on benefiting people, some cites also reported the aim to generally **promote biodiversity** by urban greenspace planning and management. However, due to the lack of expert information or even due to misinformation, there are several obstacles to be tackled. For this reason, providing sufficient and understandable ecological information as an adequate knowledge base and a useful collection of best practices are essential future steps to promote urban habitat restoration. By this means, citizens can understand the value of biodiversity friendly urban greenspaces and could view tall urban grasslands as **biodiversity-friendly alternatives** to lawns.

Finally, also as an important goal of urban restoration, there is the great need to promote **contact between people and nature**. By creating diverse patches with native wildflower species or urban meadows that also support flower-visiting insects, the potential for citizens to observe different faunal species can be highly increased. In this way, by the application of relatively simple measures, human-nature relationships can be strengthened. Such experiences may last for a lifetime!

Wildflowers on the roadside – such mixtures of annual wildflowers are particularly valuable if they include native and maybe even endangered plant species that have become very rare in modern arable lands
(Photo credit: Pixabay)

When there is a solution despite competing land uses...

Small changes count!

Mini-meadows created using native wildflower species support flower-visiting insects, enhance the aesthetic appearance of sealed spaces, and are yet mobile as well
(Photo credit: Valentin H. Klaus)

People are more likely to support wild-looking spaces if they understand their purpose and if their needs are considered in the **planning process from the very beginning**. This should be done before any restoration or re-creation takes place – otherwise it can be too late to get people onboard. Intensive information campaigns and the demonstration of biodiversity-friendly practices at the city scale could inspire ecological measures in private gardens as well.

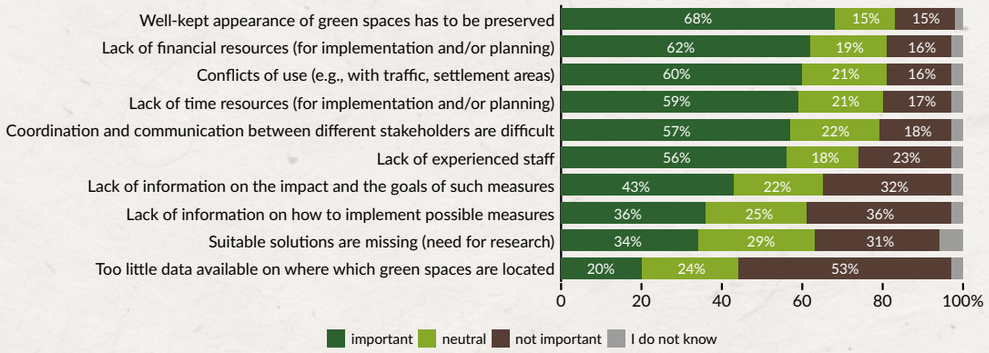
Grazing is highly beneficial for grassland biodiversity but can be difficult to implement in an urban context. Yet, it is possible as shown in Lausanne, Switzerland
(Photo credit: Valentin H. Klaus)

What a difference - tall urban grasslands as biodiversity-friendly alternatives to short cut lawns. Their aesthetic value, species richness and the support given to native pollinators are indisputable
(Photo credit: Valentin H. Klaus)

Road verges can also be covered with diverse perennial herbs, bringing a bit of colourful nature into everyday urban life
(Photo credit: Valentin H. Klaus)

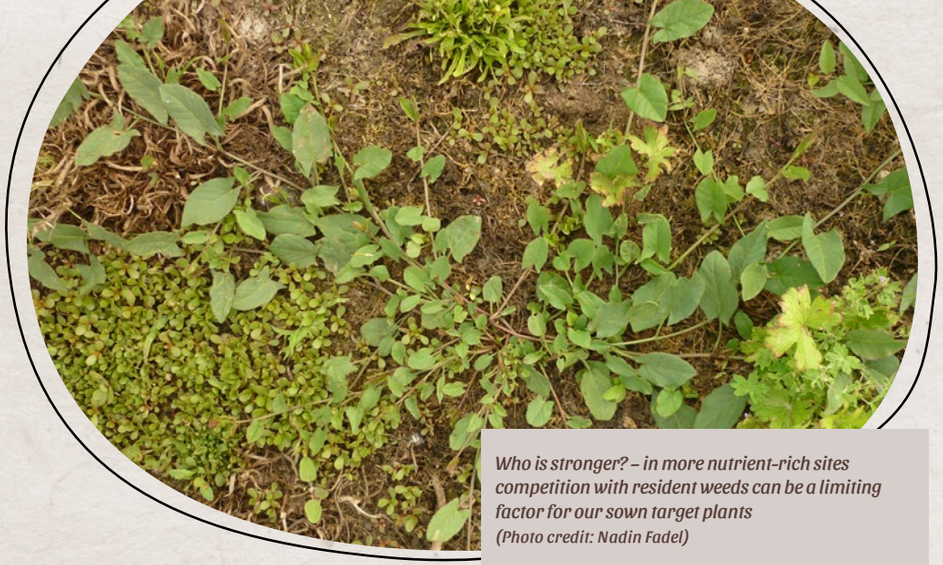
8 Let's make the idea work! – practical aspects in the light of implementation

Based on the results of our survey, the **lack of financial resources** for the implementation and/or planning of public restoration activities is an important obstacle concerning urban restoration. Similarly, the lack of time resources and the lack of experienced staff were also mentioned as hindering factors of urban restoration. For this reason, there is a need of ensuring low costs and tackling financial and work-time constraints by the creation of urban greenspaces that are easy to care for. Streamlining the administrative processes (e.g., improved communication within the city administration) and having ready-made ecological solutions could considerably improve restoration efficiency.



Results of our pan-European questionnaire survey – the graph shows the obstacles to implementing biodiversity-supporting measures in urban grasslands as reported by the cities in descending order of importance

There were other **obstacles** as well, mentioned by some responding cities. Sometimes, there is too little data available on where are the greenspaces located (e.g., lack of a suitable geoinformation system) or there is a lack of information on how to implement possible measures. In conclusion, while the implementation of restoration measures appears well possible, their practical realization can still be challenging.



Who is stronger? – in more nutrient-rich sites competition with resident weeds can be a limiting factor for our sown target plants
(Photo credit: Nadin Fadel)

There are also some **practical obstacles** of grassland restoration, which are typical for urban areas: tilling urban soils is often difficult, and the predominantly nutrient-poor and acidic soil conditions hamper the establishment of several species. In more nutrient-rich sites competition by sown grasses or resident weeds can be another limiting factor for target plants, especially on bare soil or after soil treatment. So, keep an eye on your restored site to take suitable measures if needed to warrant its success.

As a take-home message, we can state: we need even more action!

Many restoration measures are frequently implemented by cities, however there is still a large potential for more action, particularly in small cities. Accordingly, supporting especially smaller cities in overcoming the beforementioned obstacles might facilitate the implementation of urban restoration measures further.

Our research project revealed that there are still several **knowledge gaps** that challenge making general guidelines for broadly applicable urban restoration actions. For instance, there are very few studies on large-scale (e.g., city-scale or regional-scale) effects of urban restoration, and comparative studies using the same restoration design in various different cities are also urgently needed. More multi-taxa studies are required to comprehensively assess the effects of urban restoration on faunal biodiversity and on the interspecific interactions between certain species. Finally, insight in restoration and maintenance measures that simultaneously enhance biodiversity and several other ecosystem services is currently not widely available.

9 The role of gardens in preserving biodiversity – where the change is up to you

Given that residents manage their gardens independently, the environmental conditions in private gardens are shaped by individual decisions and habits, based on individual values and perceptions. These urban greenspaces could serve as a major arena for human-nature relations benefiting both people and biodiversity. Thus, these are the places where people can most effectively contribute to biodiversity conservation by themselves. On a global scale, gardens constitute up to one third of urban areas, which means that gardens have a huge potential for supporting urban biodiversity. For realizing this potential, it is crucial to motivate and support garden owners in adopting biodiversity-friendly practices by providing appropriate information and guidance. First of all, it is important what types of plants we use for the decoration of our garden. Species planted in gardens are not chosen at random, rather certain traits are favoured. We often prefer plants that grow fast, are good competitors, have attractive flowers and can reproduce successfully. However, these traits also make plant species potentially successful **invasive species that do ecological and economical harm**. As gardens are a major propagule pressure and host many species with a high probability of establishment outside urban areas, it is extremely important to pay attention for what we plant in our gardens and how we treat our garden waste.

Why does this matter?

Himalayan balsam – a former ornamental plant. Via human introduction it is now present across much of the Northern Hemisphere and is considered an invasive species that harms native biodiversity
(Photo credit: Pixabay)

The costs of eradicating invasive plants are fairly huge – e.g., more than 34 billion USD per year in the United States only. Another aspect why to pay attention to what we do in our gardens: in the United Kingdom, the ornamental plant trade is responsible for 90% of human introductions of plant pests. Unlike native species, ornamental plants are highly susceptible to new plant pathogens while pollinators are not attracted to most of them. The **solution** could be using native plants, ideally those that are adapted to the regional soil and climatic conditions, instead of planting non-natives, thereby the risks of future invasions can decrease significantly.

By planting native species, we support our native pollinators – butterflies, bees, bumblebees and many other important taxa. This is not only favourable for the pollination of the fruits and vegetables we grow, but also for the health of our garden, and – on a global scale – for the overall biodiversity.

Make a choice, that will be appropriate in the future as well!

Although eye-catching for a short time, this flood of flowers also contains non-native species that can threaten native communities
(Photo credit: Pixabay)

Tips for creating a biodiversity-friendly, cozy and close to natural garden:

- Find out what plants will flower in your garden if you don't mow the lawn for a month;
- Put out bird feeders and bird baths - check it out who visits them;
- Leave hiding places in your garden - explore if more insects remain in the untreated area;
- Use compost for vegetables and flowerbeds - let's check if it makes your plants grow better;
- Install an insect hotel in your garden - observe the beauty of its useful visitors;
- Plant native shrubs that provide winter food for birds;
- Try to find out if there are any invasive plants in your garden - do weeding to prevent their future spread.

10 Summary

Wildflowers in the city can bring back nature to our homes.

The ReNatUrE project showed that restoring nature in cities is not just possible – it's already happening in many places. Still, there's much more we can and need to do, especially in smaller cities and private gardens. Even small steps – like mowing less, planting native flowers, and creating resources for insects – can bring nature back into our daily lives. Together, these actions help to build greener, healthier, and more resilient cities. **Let's bring nature home!** One meadow, garden, or flower patch at a time.

Impressum and acknowledgements

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Further reading

Review paper on urban grassland restoration: Fekete, R., Valkó, O., Fischer, L., Deák, B., Klaus, V.H. (2024): Ecological restoration and biodiversity-friendly management of urban grasslands – a global review on the current state of knowledge. *Journal of Environmental Management* 368: 122220. https://doi.org/10.1016/j.jenvman.2024.122220

An article on the importance of the Nature Restoration Law (EU regulation) for restoring urban habitats: Klaus, V. H., Řehounková, K., Valkó, O., Degtjarenko, P., & Schelfhout, S. (2025). Countries need ambitious urban biodiversity targets under the EU Nature Restoration Law. *npj Urban Sustainability*, 5(1), 1-4. https://doi.org/10.1038/s42949-025-00218-8

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