Co-creating Biodiversity in Urban Areas
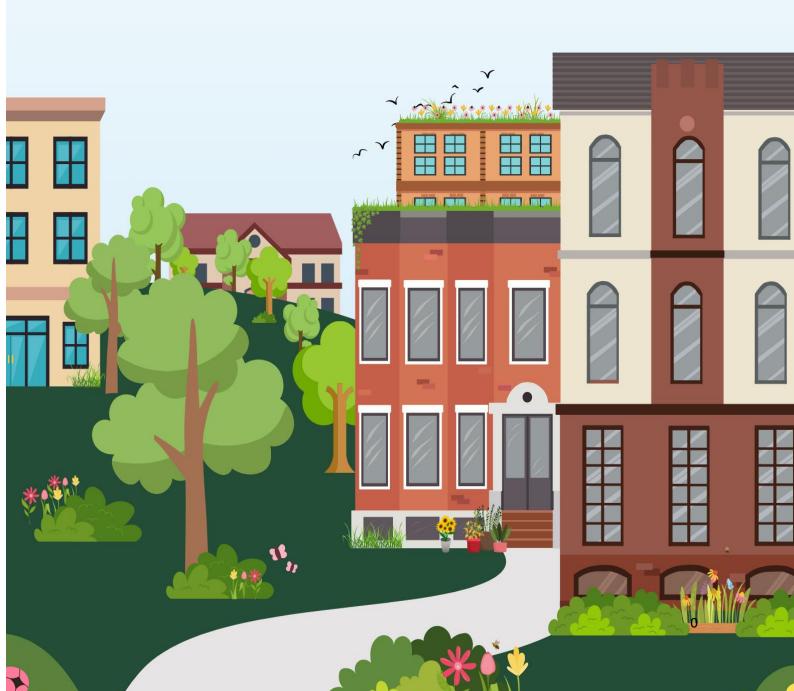
Practical guide on how to co-create a project to support urban biodiversity

Contents

1.   Introduction

The Co-Bio project

As global populations grow and economies develop, increasing demands on land-use systems have led to significant biodiversity declines, with 80% of European habitats in poor condition, necessitating a collective effort across all sectors of society to reverse the damage, restore ecosystems, and adopt climate- and biodiversity-friendly practices. The Co-Bio project aims to support the EU Biodiversity Strategy 2030, with a concrete focus on urban biodiversity. The project aims to enhance the capacity of professional and volunteer adults within the public, private, and civil society sectors to co-create shared solutions for urban biodiversity.

The Partners

Green Forum is organised under the Technical and Environment Department of Vejle Municipality as a network for citizens and civil society organisations with an interest in climate, ecology, nature and the environment.

Greenformation Ltd. is a small enterprise based in Budapest aiming to trigger green and social transition and transformation through catalysing biodiversity conservation, the enhancement of society, sustainable and just energy use, biodiversity conservation as well as behaviour change.

The Center for Citizen Dialogue is a consultancy and knowledge center with expertise and competences in citizen involvement in municipal work. We are based in Copenhagen, Denmark, and advise Danish and Scandinavian municipalities on how to involve citizens and stakeholders and how to lead and facilitate co – creation processes.

Gartenpolylog promotes the development of community gardens and care of communities for green spaces since 2007. It supports the network of community gardens in Austria, offers workshops for grown-ups and children in environmental education as well as group organisation.

The Rightchallenge Association is a NGO which aims to promote education and training as a means of social inclusion and sustainable development. Education must focus on the holistic development of all people in order to prepare them to intervene and participate in all dimensions of society.

CESIE is a European Centre for Studies and Initiatives based in Palermo, Sicily. It is a non-profit, apolitical, and non-governmental organisation, implementing projects in more than 80 countries. Established in 2001 and inspired by the work and theories of the Italian sociologist Danilo Dolci (1924-1997).

The Athens Lifelong Learning Institute is a research and education institute based in Athens, Greece. Its mission is to foster and enhance innovation processes mainly in the areas of education and lifelong learning, human capital development, knowledge society and social inclusion.

About the guide

Biodiversity is essential for maintaining healthy ecosystems. Without diverse habitats, nature can not provide its benefits, on which human life also depends. Thus, preserving biodiversity is crucial for our future as well. Biodiversity faces numerous challenges, particularly in urbanised environments. Despite these challenges, urban environments also present opportunities. Well-designed cities can support large populations within limited spaces, improving living standards and optimising resource use while protecting extensive natural areas. (Secretariat of the Convention on Biological Diversity, 2012 (CBD, 2012)). Preserving and enhancing urban biodiversity is achievable with concerted efforts at various levels.

Governments and municipalities play a pivotal role in maintaining and enhancing biodiversity in cities, and significant contributions can also be made at the individual level. Cross-sectoral cooperation and stakeholder involvement are vital for initiatives aimed at preserving urban biodiversity. Engaging NGOs, citizens, and experts can elevate the quality of these initiatives, making them more effective and sustainable. Co-creation involves multiple stakeholders in a project or initiative, from the planning stage through implementation to maintenance and monitoring. Establishing a connection and sense of ownership over a green space or project can lead to more effective and sustainable outcomes.

This guidebook aims to highlight the importance of urban biodiversity and co-creation, offering a comprehensive manual on how to co-create projects focused on preserving urban biodiversity. Involving multiple stakeholders in a project can be challenging, but the rewards are significant. This guidebook provides a step-by-step approach for interested stakeholders to co-creatively enhance urban biodiversity, covering the entire project lifecycle from the initial phase to maintenance and evaluation. Various parties, including municipalities, professionals, NGOs, and citizens, can participate in urban biodiversity projects. This guide supports all of them by offering crucial information, hints, and tips on effective collaboration and co-creation for urban biodiversity.

WHY is co-creating urban biodiversity important?

2.   Importance of urban biodiversity

Biodiversity has been rapidly declining in recent years, primarily due to human activities such as land use changes, pollution, and climate change (European Parliament, 2020). The rate of urbanisation is increasing constantly; by 2050, the urban settlement area will be triple, and the urban population will be double (CBD, 2012), causing a significant challenge to urban biodiversity. Biodiversity plays a crucial role in maintaining healthy ecosystems and the benefits they provide.

Urban biodiversity has been defined as "the variety of species richness and abundance of living organisms (including genetic variations) and habitats found in and on the edge of human settlements" (Müller et al., 2013)

2.1   Understanding urban biodiversity

Urban biodiversity faces unique challenges, including limited space, isolated habitats, human disturbances, invasive species, and the accelerated effects of climate change. Despite these obstacles, many cities host significant numbers of native or even endemic species since plenty of bigger towns are located in or near global biodiversity hotspots, and on average, 50% of regional or national species can be found in urban areas (CBD, 2012).

The value of urban wildlife is often underestimated. Urban nature exists not only in natural settings (e.g., urban forests) or agricultural areas like meadows and arable lands, and urban-industrial landscapes, like parks, gardens and lawns but also in urban wetlands, abandoned lands and industrial sites, roadside verges, vacant lots, ruins, allotment gardens, cemeteries, residential gardens, villas, botanic gardens, and individual balconies, all of which are potential sources of urban biodiversity (Panwar, 2021).

Urban biodiversity is closely linked to a city's social and ecological systems. Urbanisation usually generates a decrease in the settlement's biodiversity, but the extent of the loss and the variety of species in urban areas vary by region, geographical landscape, biome, and the history of the city. The loss of biodiversity could decrease the city's resilience to extreme events (like heat waves, heavy precipitations, floods, etc.), which can be mitigated or even reversed by careful urban design and planning (Elmqvist et al., 2013). Reconnecting humans with nature, incorporating existing knowledge into urban planning and considering nature in urban design can support sustainable urban life for both people and wildlife. Well-managed urban habitats can effectively support biodiversity and thus enhance the resilience of cities.

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2.2 Biodiversity's contribution to human well-being, benefits of urban biodiversity for society

Ecosystems, including natural and urban green-blue areas, provide numerous benefits and essential services for human life, such as food, clean water, and fresh air, mitigating climate change effects, maintaining important nutrient and water cycles, and contributing to human health by providing recreation and aesthetic services. In urban environments,

"Ecosystem services are the benefits human populations derive, directly or indirectly, from ecosystem functions'' (Costanza et al. (1997)).

different types of ecosystem services can be more important for the inhabitants than in rural areas. In heavily built-up cities mitigating the climate change effect -like reducing the heat island effect- may hold more importance than in rural areas. Not all urban green-blue spaces deliver the same services, and their quality can differ widely. For instance, a city forest or park with diverse, low-maintenance vegetation may support rich urban biodiversity and several high-quality ecosystem services. Conversely, a park with mowed lawns and monoculture plantings, although still a green space, offers significantly less biodiversity and, consequently, fewer or poorer ecosystem services (Guerry et al., 2021). The following ecosystem services are the most important ones in urban areas:

Provisioning services

- Food
- Fresh water

Regulating services

- Urban Temperature regulation
- Noise reduction
- Air, water, soil purification
- Mitigation of climate change
- Runoff mitigation
- Waste treatment
- Pollination, pest regulation and seed dispersal
- Global climate regulation

Cultural services

- Recreation
- Aesthetic benefits
- Cognitive development
- Place values and social cohesion
- Education and research

Supporting services

- Habitat for biodiversity

Table 1. The most important ecosystem services in urban areas

Preserving and increasing urban biodiversity could greatly contribute to the good condition of ecosystem services and, through this, to human well-being. Pollinators are essential for **food and natural medicine production**. Eighty per cent of crop and wild flowering plant species are dependent on animal pollination (European Commission, 2024). Urban green spaces can be essential habitats for pollinators like bees and butterflies. Urban green and blue spaces can enhance **air quality** and **reduce air pollution** by capturing and filtering harmful pollutants. Additionally, they regulate local climates by providing shade, mitigating the urban heat island effect, and cooling the surrounding areas. (Gionfra et al., 2023). Although the number of species present in soils may not always seem to impact ecosystem services directly, **soil** biodiversity is crucial for delivering adequate services (Wall and Nielsen, 2012). Diverse urban habitats offer unique **educational opportunities**, foster **environmental awareness**, and help connect people to nature. Urban green areas provide space for **recreation,** relaxation, and different physical activities. They can also improve the immune system by exposing it to microorganisms, which are essential for developing a **healthy immune system** (Rook, 2013). Therefore, accessing urban green spaces and connecting to nature can improve citizens' physical and mental health and overall **well-being** (Gionfra et al., 2023). Diverse urban ecosystems have more ecological resilience, meaning they are better equipped to withstand environmental changes, such as extreme weather events or climate change impacts, and they also enhance the ability to provide ecosystem services (Gionfra et al., 2023).

Urban ecosystems provide not only benefits for people but also have negative effects (called ecosystem **disservices) as well**. Ecosystem disservices are "functions of ecosystems that are perceived as negative for human well-being" (Lyytimäki and Sipilä, 2009). Examples include damages to infrastructure from microbial activity and bird excrement, root systems breaking up pavements, and animals digging nesting holes. Urban ecosystems can also cause health problems from allergies, fear of dark green areas perceived as unsafe, diseases transmitted by animals, and obstruction of views by trees. Some animals, such as rats, wasps, and mosquitoes, and plants like stinging nettles, are often considered disservices (Elmqvist et al., 2013). Considering these disservices and how to minimise them during urban planning could enhance citizens' acceptance of such habitats or green-blue areas.

Research indicates that higher biodiversity can enhance the benefits ecosystems provide, mitigate negative impacts, and improve ecosystem resilience to changing conditions. In contrast, biodiversity loss can disrupt ecosystem functioning, compromise ecological integrity, and diminish the essential services that underpin human health, well-being, and livelihoods (Lo and Rawluk, 2023). Therefore, improving the condition of biodiversity in our cities is essential for nature conservation, human well-being, and survival.

2.3 Threatening factors of urban biodiversity

Urban biodiversity is influenced by various factors, both natural and anthropogenic. The planning, design, and management of urban environments, influenced by economic, social, and cultural elements, play a crucial role in shaping urban biodiversity. Urbanisation introduces numerous challenges and threats to biodiversity; therefore, it is essential to know, address, and mitigate the threatening factors that affect urban biodiversity.

One of the major challenges urban biodiversity faces is **land cover change.** Changing natural areas into agricultural and built-up areas results in **habitat loss and fragmentation**. This

fragmentation destroys natural habitats and isolates populations, reducing biodiversity and disrupting ecological processes.

Climate change further exacerbates these issues, with cities experiencing higher temperatures due to the urban heat island effect and facing altered precipitation patterns and extreme weather events that affect urban species' distribution and behaviour (Elmqvist et al., 2013).

Pollution (air, water, noise and light) significantly threatens urban biodiversity. Emissions from traffic and industries contribute to poor air quality, negatively impacting plant and animal health. Urban runoff, containing pollutants from sewage, vehicle effluent, and fertilisers, contaminates waterways, leading to eutrophication and pollution of both surface and groundwater. Additionally, high noise levels and artificial lighting disrupt wildlife's natural behaviours and breeding patterns (Panwar, 2021; Elmqvist et al., 2013).

Urban areas are also prone to the introduction of **invasive species**, which outcompete or prey upon native species, altering ecosystem dynamics (Elmqvist et al., 2013).

Urbanisation modifies **natural water flow patterns**, affecting aquatic ecosystems and the species that rely on them (CBD, 2012).

Poorly planned urban development without green spaces or adequate zoning regulations exacerbates biodiversity loss.

Human activities, such as recreation and development, disrupt wildlife, causing stress and habitat displacement. Urbanisation facilitates the spread of diseases among wildlife, domestic animals, and humans, with cascading effects on biodiversity. Overexploitation of plants and animals for ornamental or medicinal purposes leads to declines in targeted species.

2.4 How can urban biodiversity be improved?

Improving urban biodiversity involves a combination of conservation strategies, ecological planning, sustainable practices, and community engagement. The EU has created a variety of **policies and initiatives** to enhance urban biodiversity (see section 4).

Mitigating threatening factors such as pollution can reduce negative impacts on ecosystems. Implementing stricter pollution controls and enhancing waste management practices are essential steps. Encouraging sustainable urban development practices, like using native plants and water-efficient landscaping, can further mitigate biodiversity loss.

Ecological planning plays a crucial role in urban design, guiding smart urbanisation that limits sprawl and minimises impacts on biodiversity while meeting development goals (Guerry et al., 2021). **Nature-based solutions** (NBS) that aim to protect and restore nature to achieve societal goals and enhance socio-ecological resilience are increasingly recognised by policymakers and practitioners as a cost-effective approach to climate change adaptation that also provides multiple benefits for both nature and society. Integrating **green infrastructure**, such as parks and green roofs, supports biodiversity and helps restore degraded habitats within urban areas. Sustainable water management practices protect aquatic ecosystems, including preserving natural watercourses and creating wetlands. Enhancing connectivity by creating wildlife corridors reduces habitat fragmentation and maintains biodiversity.

Education and community engagement are vital for improving urban biodiversity. Engaging citizens in monitoring and collecting data on urban biodiversity through citizen science initiatives provides valuable information for conservation efforts. Raising awareness through educational programs, workshops, and community events fosters a supportive community for conservation. Collaboration among government agencies, non-profit organisations, businesses, and communities is essential to implement and sustain biodiversity-friendly initiatives.

2.5 State of play at the EU level and in project countries

Europe's ecosystems, including croplands, forests, pastures, and urban areas, support a rich species diversity. However, human activities have severely threatened this biodiversity, resulting in many species and habitats being in unfavourable conservation status. Habitat fragmentation, intensive agriculture, pollution, overexploitation, and climate change are the primary drivers of biodiversity loss. Despite efforts such as the EU Biodiversity Strategy for 2020, which aims to halt biodiversity loss and restore ecosystems, many ecosystems remain degraded, impacting their ability to provide essential services. The EU must accelerate its efforts towards enhancing its natural capital's value in decision-making processes and intensify conservation and restoration efforts to protect and sustain biodiversity (CBD, European Union - Country Profile, 2024).

Within the framework of the Co-Bio project, we analysed the condition of biodiversity in each partner country. In the following section, we provide a brief overview of the main challenges biodiversity faces in these countries.

Austria

Loss of wetlands and other water bodies due to hydrological alterations have a harmful impact on biodiversity. Both agricultural intensification and abandonment threaten biodiversity through pesticide use and habitat degradation. Despite a high percentage of organic farming (27.7%), industrial farming practices remain a significant threat. Forestry practices, including the removal of dead wood, negatively impact biodiversity. High rates of land consumption and soil sealing reduce habitat availability and accelerate the urban heat island effect.

Denmark

Denmark is the most intensely cultivated country in Europe, with its farmland covering approximately 60% of the whole national territory. The use of fertilisers and chemicals in an estimated 56% of the country's area degrades natural habitats and pollutes ecosystems. Furthermore, there is insufficient space for natural habitats due to intensive farming practices and urban expansion, leading to habitat fragmentation. Nitrogen and phosphorus pollution from farming activities threaten aquatic environments, causing oxygen depletion and harming aquatic species. The absence of large grazing animals, which historically maintained open areas and diverse flora, has led to overgrowth and reduced biodiversity. Non-native species such as giant hogweed, Ragusa rose, mink, and raccoon dogs dominate and thus displace native species as well as disrupt ecosystems.

Greece

Urbanisation and agricultural expansion lead to habitat loss and fragmentation. Coastal forests and low-altitude forests are particularly affected. Climate change is expected to intensify ecosystem loss and degradation, particularly wetlands. Intensive farming and abandonment of traditional agriculture degrade ecosystems. Soil, water, and air pollution from various sources

harm biodiversity. Invasive species disrupt native ecosystems. Frequent fires degrade forests and reduce biodiversity.

Hungary

Grasslands and forests, particularly the Pannonian steppes, are among Hungary's most significant ecosystems but are increasingly threatened by agricultural expansion and urban development. Forest fragmentation is a major concern as it disrupts wildlife corridors and diminishes habitat quality. Wetlands, especially the Hortobágy and Kiskunság National Parks, are under threat from drainage, land conversion, and water management practices.

River habitats, such as the Danube and Tisza, are affected by hydrological alterations, dam construction, and pollution, leading to habitat degradation and species decline. Intensive agriculture results in the runoff of pesticides, fertilisers, and other chemicals into water bodies, causing eutrophication and harming aquatic life. Industrial activities contribute to air and water pollution, impacting both terrestrial and aquatic ecosystems. Shifts in temperature and precipitation patterns affect species distribution, phenology, and ecosystem dynamics. Invasive species such as the common ragweed (Ambrosia artemisiifolia) cause significant economic and health problems, outcompete native species and disrupt ecosystems. Aquatic invasive species like the zebra mussel (Dreissena polymorpha) alter freshwater ecosystems and outcompete native molluscs.

Italy

Urbanisation, agricultural expansion, and infrastructure development reduce natural habitats, disrupting ecosystems. Invasive alien species outcompete native species for resources, disturbing ecological balances. Shifts in temperature and precipitation patterns alter habitats, threatening species that are unable to adapt. Industrial activities, agriculture, and urban areas pollute habitats and waterways, harming wildlife. Unsustainable harvesting, overfishing, and illegal logging deplete populations and disrupt ecosystems. Conversion of natural habitats to agriculture or urban areas reduces biodiversity. Public engagement and education on biodiversity conservation need improvement.

Portugal

Urbanisation and sprawl lead to habitat fragmentation and biodiversity loss. A lack of connectivity between green spaces restricts gene flow and reduces biodiversity. Urban development seals land, affecting water circulation and soil balance. Limited data on species and ecosystems hinders effective conservation planning. Economic growth is often prioritised over environmental considerations.

Summary from the project countries

The main challenges biodiversity faces in the project countries are habitat loss, pollution, climate change, and the impact of invasive species. Nowadays, addressing these challenges requires coordinated efforts, improved policies, and increased public awareness.

> **Want to know more?**
>
> **Further literature on biodiversity, ecosystem services and the benefits they provide:**
>
> Elmqvist T. et al. (eds.) (2013). Urbanization, Biodiversity and Ecosystem Services: Challenges and Opportunities: A Global Assessment, DOI 10.1007/978-94-007-7088-1_3
>
> IUCN (2023). Embracing biodiversity: Paving the way for nature-inclusive cities. Retrieved from
> https://iucn.org/story/202305/embracing-biodiversity-paving-way-nature-inclusive-cities
>
> IPBES (2019). Global assessment report of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services, Brondízio, E. S., Settele, J., Díaz, S., Ngo, H. T. (eds). IPBES secretariat, Bonn, Germany. 1144 pages. ISBN: 978-3-947851-20-1
>
> European Commission (2024). Nature needs you Retrieved from
> https://ec.europa.eu/environment/stories/nature-needs-you/
>
> European Commission (2024). Knowledge Centre for Biodiversity. Retrieved from
> https://knowledge4policy.ec.europa.eu/biodiversity_en

3. Importance of co-creation

Preserving and supporting urban biodiversity needs to happen at all levels. It requires strong support from the government through regulations, strategies, and plans, while individuals can also do a lot to support urban biodiversity. However, the biggest support could come from cross-sectoral initiatives involving several stakeholders. Municipalities and NGOs often lead such initiatives, but implementing an action alone could mean less support and could even lead to resistance. Informing citizens and even involving them in the planning phase is more and more common in urban planning processes; however, involvement throughout the whole process could yield even better results. The concept of co-creation is not common everywhere; therefore, in this section, we briefly introduce the concept and its benefits in urban biodiversity preservation.

3.1 What is co-creation?

Co-creation is a collaborative approach that involves stakeholders in designing and building inclusive and sustainable solutions. Effective co-creation requires identifying and engaging relevant stakeholders, including policy-makers, local organisations, communities, and residents. Traditionally, guidance has focused on professional decision-makers, but it's crucial to involve the broader community in enhancing urban biodiversity (Morello et al., 2018).

Known also as co-production, social innovation, and network governance, co-creation encourages collaboration among various societal sectors to address complex problems like climate change. It involves public organisations, citizens, civil society, and private companies working together to boost innovation beneficial for both people and the planet as well as achieve better outcomes (Center for Citizen Dialogue, 2022).

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The concept has evolved from business practices into urban planning, emphasising the importance of mutual understanding and creative problem-solving among all stakeholders to tackle sustainability and green transition challenges (Morello et al., 2018; Center for Citizen Dialogue, 2022).

3.2 Why are co-creation and co-stewardship important in enhancing urban biodiversity?

The institutional framework, policies, and strategies at both the EU and national levels are essential for establishing a framework and defining the current state and goals for supporting biodiversity. These strategies provide guidance, set objectives, and regulate urban development. Local strategies and plans at the regional or municipal level can further support biodiversity conservation by identifying and addressing local challenges. However, to reach results, involving stakeholders and communities is crucial in urban planning and can occur at various levels. Urban planning is mainly initiated and coordinated by public bodies like municipalities and sometimes includes the involvement of citizens, NGOs, and professionals, but stakeholder participation is usually considered only during the planning phase. Grass-root initiatives and different small-scale projects initiated by NGOs and communities are becoming more and more current. Co-creation processes involving different stakeholders with different expertise, backgrounds, and initiatives can strengthen the connection between different stakeholders and enhance the success of the project. While coordinating multiple stakeholders requires more resources, the advantages of stakeholder involvement are numerous:

1. **More acceptance:** Citizens are more likely to accept the changes if they can be part of the process.
2. **Ownership**: Feeling ownership strengthens the connection with a project and keeps motivation and engagement long-term.
3. **Awareness raising**: Raising awareness is one crucial element of biodiversity preservation. However, only informing citizens does not always yield the desired results. Small-scale projects involving citizens could effectively change attitudes since inhabitants can have hands-on experience.
4. **Better cooperation with other stakeholders**: Municipalities, citizens, communities, and NGOs sometimes have different goals or the means to achieve the goals. The co-creation process helps understand other's perspectives.
5. **Creative solutions**: Thinking together in a group usually increases creativity and could lead to innovative solutions.
6. **Maintenance is easier**: Involving several stakeholders (e.g., citizens and community groups) in all project phases could help maintain the implemented solutions and require fewer human resources from the municipality. On the contrary, in some cases, successful initiatives by the community can be taken over by the municipality, which has more financial resources to continue or even replicate the project. It all depends on the initiative or project, but co-creative solutions can potentially enhance the long-term viability of initiatives by sharing the tasks and responsibilities as well.

4. Review of policies and initiatives

The European Union adopted several policies, strategies, laws, and guidelines to support biodiversity and promote sustainable urban planning. Additionally, local strategies have been developed to preserve urban biodiversity further. Below is a selection of the key regulations, though this list is not exhaustive.

Convention on Biological Diversity

At the 1992 Earth Summit in Rio de Janeiro, world leaders adopted the Convention on Biological Diversity, a global pact aimed at sustainable development by preserving biological diversity, using its components sustainably, and sharing the benefits of genetic resources fairly. Signatory governments, known as Parties, commit to these goals and collaborate on national and international strategies to ensure biodiversity conservation and sustainable use.

EU Biodiversity Strategy for 2030

The EU's Biodiversity Strategy for 2030 is an ambitious, long-term plan to protect nature and reverse ecosystem degradation. It aims to set Europe's biodiversity on a path to recovery by 2030. One of the aims of the policy is to green urban and peri-urban areas and promote nature-based solutions integration into urban planning,

Nature Restoration Law

The Nature Restoration Law is a comprehensive EU legislation that aims to restore degraded ecosystems, particularly those critical for carbon capture and disaster mitigation. It addresses the alarming decline of over 80% of Europe's habitats, aiming to enhance biodiversity, improve natural services like water and air purification, support climate goals, and bolster resilience against natural disasters and food security risks. One of the specific targets of the law is to achieve "no net loss of green urban space and tree cover by 2030, and a steady increase in their total area from 2030".

The European Green Deal

Climate change and environmental degradation pose an existential threat to Europe and the world. To address these challenges, the European Green Deal aims to transform the EU into a modern, resource-efficient, and competitive economy by ensuring no net emissions of greenhouse gasses by 2050, decoupling economic growth from resource use, and leaving no person or place behind.

Other policies directly or indirectly support biodiversity conservation

The *Regulation on Deforestation-free products* ensures that products consumed by EU citizens do not contribute to global deforestation or forest degradation. The new *Soil Monitoring Law* protects, restores, and ensures the sustainable use of soils. The *Marine Strategy Framework Directive* is the EU's primary tool for protecting marine health, aiming to achieve good environmental status for marine waters and ensure sustainable protection of marine resources. SDG11 of the *United Nations Sustainable Development Goals* aims to "make cities and human settlements inclusive, safe, resilient, and sustainable". EU strategy on adaptation to climate change (*EU Adaptation Strategy)* outlines how the EU can adapt to climate change impacts and achieve climate resilience by 2050, with four main objectives: smarter, swifter, and more systemic adaptation, as well as increased international action.

Initiatives supporting urban nature and biodiversity

BiodiverCity: Community-based approaches to foster urban biodiversity

Nature-Positive Cities: Creating cities that live in harmony with nature.

BiodiverCities: BiodiverCities aimed to enhance civil society participation in local and urban decision-making, leading to building a joint vision of the green city of tomorrow shared among citizens, scientists and policy-makers.

Urban Nature Platform: Supporting towns and cities in restoring nature and biodiversity

Initiatives tackling the drivers behind (urban) biodiversity loss

GDP, material consumption, and energy consumption are very much intertwined; thus until we insist on economic growth to deliver well-being, material and energy consumption will rise, while wildlife and well-being supporting natural services will keep on diminishing. Therefore, if we want to preserve biodiversity, we need to tackle its root causes, namely, to change our consumption-driven economic paradigm to an economy that enhances well-being and supports all life on Earth. There are plenty of initiatives out there supporting this aim:

Beyond Growth Conference, 2023: The conference allowed society, and especially EU decision-makers, to find ways of turning today's geopolitical and geophysical crisis into an opportunity to disengage from the socially and ecologically damaging race for growth and embark on a new path.

Post-growth Theories: A post-growth society calls for a democratically planned and equitable downscaling of production and consumption to avoid trespassing planetary boundaries while providing basic services for all.

Degrowth stresses that wealthy countries can create prosperity while using less materials and energy if they abandon economic growth as an objective.

Caring or gift economies put care at the heart of our societies to achieve social justice and prevent ecological breakdown.

Lean Economy, based on community and its culture, provides the sequel to today's capitalism and thus does not imply either growth or degrowth of the market economy, but wide-ranging expansion of the 'informal', non-monetary economy, 'core economy'. It is the economy of care, music, play, family, volunteering, activism, friendship, and home.

Doughnut Economics is based on the Doughnut visualisation of ecological boundaries and social foundations.

Degrowth Donut is a visualisation tool for assessing the current environmental and social capacity of a concerned region for ecologically and socially sustainable transformation. The donut includes cultural, socio-economic, and biophysical indicators, giving an overall picture of the strengths and weaknesses of the concerned region (country or city or in between) while providing opportunities to adapt the model for local circumstances.

WHAT can be done locally?

5. Challenges and opportunities at the local level

As mentioned, urban biodiversity faces unique challenges due to the urban environment embedded in its social and economic systems. These challenges can vary based on a city's geographical, social, and economic conditions, and even within a city, different habitats face distinct issues due to local conditions. Creating and restoring large city parks or nature reserves requires a different approach and serves a different purpose than establishing a community garden or a green roof. Opportunities to preserve and support biodiversity in our cities or neighbourhoods can vary widely; therefore, we have compiled practical ideas that can generally enhance urban biodiversity. Our focus is on actions that can involve multiple stakeholders. The challenges also vary depending on the project's scale, the stakeholders involved, financial resources, and support from institutions and citizens. We provide solutions for addressing the most common challenges.

5.1 What are the local challenges/obstacles, and what can we do to overcome them?

Addressing urban biodiversity challenges involves several critical aspects. Effective water management and the rehabilitation of wetland habitats are essential for supporting wetland ecosystems, requiring a shift away from drainage practices. Combating the impact of invasive species and promoting native species are crucial for maintaining healthy urban ecosystems. Ensuring fair distribution of green spaces and addressing green gentrification are necessary for achieving social equality in urban biodiversity initiatives. Urban designs often prioritise human needs and short-term financial gains over biodiversity, contributing to habitat loss from urban sprawl. Additionally, inefficient recycling, pollution, chaotic urban planning, and flooding are major issues compounded by bureaucratic inefficiency, competition for space, lack of knowledge, and the need for long-term stakeholder involvement.

5.2 What can a professional, citizen, municipality, or volunteer do to increase urban biodiversity? Opportunities for co-creating urban biodiversity

Supporting urban biodiversity can be achieved on various scales. We can participate in tree-planting or invasive plant removal actions to help restore a nature reserve, but we can also plant wildflowers in our garden or on our balcony. Different solutions suit different conditions; what works in one place may not be applicable in another. Reducing threats such as pesticides and pollutants also contributes to preserving biodiversity. Actions to support urban biodiversity range from simple and inexpensive to complex and costly. We have compiled some ideas that could aid in urban biodiversity preservation, focusing on solutions that can be implemented on a wider scale through a co-creation process, though some can be undertaken individually at a smaller scale. While these ideas generally can aid urban biodiversity, the success of such initiatives greatly depends on several factors, such as the quality of the implemented idea, the proximity of natural areas and other environmental factors. Before implementing any initiatives, we advise to

have background research on the conditions and factors that can affect the project (see Chapter 6.1.).

Type of actions	Impact on biodiversity	Cost	Maintenance effort	Benefits
Providing shelter and food for animals				
Nest boxes	Low	Low	Low	Provide habitat, easy to install.
Bird feeders, water for birds and insects	Medium	Low	Medium	Provide food and water, it can attract more species.
Bug hotels	Medium	Low	Medium	Provide nesting areas for solitary bees, hibernation spots for various insects, and food sources for decomposer insects like woodlice, which feed on decaying vegetation.
Hedgehog houses	Low	Medium	Medium	Hedgehogs help gardeners by eating slugs, so providing hedgehog houses in urban spaces is crucial for their protection and survival, especially for females raising their young in the spring.
Bat boxes	Medium	Medium	Medium	Bat boxes offer bats a spot to rest, sleep during the day, and raise their young.
Log piles, dead branches	High	Low	Low	Provide home and food for amphibians, insects, mosses, lichens and fungi.
Restoring/transforming existing green areas				
Tree planting	Medium-High	High	Medium-High	Cooling effect, providing shade, carbon sequestration, and reducing the heat island effect.
Eradicating invasive species	Medium-High	Medium-High	Medium-High	Providing space for native and endemic species.
Creating ponds	High	High	Low	Cooling effect, visual effect.
Planting wildflower meadow	Medium-High	Low	Low	Provide habitat for insects, and shelter for small animals such as hedgehogs.

Type of actions	Impact on biodiversity	Cost	Maintenance effort	Benefits
Leaving unmanaged "No-mow" sites in a green area	Medium-High	Low	Low	Provide shelter for insects.
Creating green areas				
Community gardens	Medium-High	Low-High	High	Provide food security, build community
Creating ponds	High	High	Low	Cooling effect, visual effect.
Rain gardens	Medium-High	Medium	Low	Reducing the heat island effect, water purification.
Pocket parks	Low	Medium	High	Cooling effect, visual effect.
Bioswale	Low	High	Low	Reducing surface runoff.
Pollinator nest sites	High	Low	Medium-High	Providing food and habitat for pollinator species, mitigating local heat island effects, enhancing air quality.
Street trees	Low	High	Medium-High	Improve air quality, reduce heat island effect,
Transforming buildings				
Living walls	Medium-High	Medium-High	Medium	Reducing energy consumptions, improving building insulation and air quality
Green roofs	Medium-High	Medium	Low	Rainwater retention, reduce energy consumption, reduce noise and air pollution, reduce heat island effect.
Vertical and roof gardens	Low	Medium	Medium	Reducing urban heat-island effect, storm water Runoff mitigation, pest control, and energy savings.

Table 2. Examples of nature-based solutions

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Tools and literature to explore further nature-based solutions

GREEN SURGE Project (2024): A typology of urban green spaces, ecosystem provisioning services and demands
https://www.e-pages.dk/ku/1334/html5/

Catalogue of Nature-Based Solutions Measures (2024):
https://clevercitiesguidance.wordpress.com/wp-content/uploads/2018/11/nbs-catalogue.pdf

NBS Benefits Explorer (2024):
https://nbsbenefitsexplorer.net/tool

Nature-based Solutions Evidence Platform (2024):
https://www.naturebasedsolutionsevidence.info/evidence-tool/

5.3 Already existing well-working cases in the project countries and their lessons learned, and how they can be upscaled and applicable to other localities

HOW to enhance urban biodiversity through co-creation?

6. How to co-create a project? Crucial steps of co-creating urban biodiversity

Before starting a co-creation process, it is recommended to familiarise yourself with the local environment, biodiversity challenges, impacted species, and urgent needs. For instance, if habitat fragmentation is a significant issue, creating connections between green spaces to facilitate animal movement may be advisable. Alternatively, if drought and climate change effects are prevalent, implementing blue infrastructure like ponds or rain gardens could offer effective mitigation. Local strategies, plans, and input from experts and the community can pinpoint problematic areas and primary challenges, guiding the co-creation process toward solutions satisfying all parties involved while enhancing biodiversity.

Co-creation can occur on various scales, from city-wide initiatives like developing city parks involving multiple stakeholders to smaller scales with only a handful of stakeholders, such as creating pocket parks within neighbourhoods. Projects can span several years or be short-term initiatives. While the steps outlined in this section are applicable across all scales, their importance may vary depending on the project. Though not all steps are essential for success, the non-crucial steps can also enhance the process and better tailor it to local conditions. In this section, a "project" refers to any initiative supporting urban biodiversity through a co-creation process.

The following colour code can help identify the essential, recommended and optional steps:

⇒**Essential step during the project**

⇒**Recommended step to enable deeper understanding and more tailored solutions to local conditions**

⇒**Optional step to further increase the sustainability and success of the project**

In this section, we will cover the whole project cycle, from the very beginning steps of defining the goals, objectives, and stakeholders through the planning and implementation phase to the monitoring, maintenance, and evaluation phase. We provide tools guiding questions, and suggestions in each step. The following steps are covered in this section:

Step 1 Understand local conditions and identify problems

Step 2 Explore potential solutions

Step 3 Select the most suitable solution

Step 4 Identify stakeholders

Step 5 Motivate, activate and engage stakeholders

Step 6 Explore similar cases

Step 7 Risk assessment

Step 8 Prepare an action plan

       Step 8.1 Plan the implementation

       Step 8.2 Plan the maintenance

       Step 8.3 Plan the evaluation

       Step 8.4 Plan the monitoring

       Step 8.5 Plan the awareness-raising actions/communication

Step 9 Baseline assessment

Step 10 Implement the actions defined in the action plan

Step 11 Maintenance and monitoring

Step 12 Evaluation

In Annex 3, you can find a summary of the steps.

6.1 How to start a project? Defining goals, objectives, and scale

Sometimes, you already have an idea or goal to enhance urban biodiversity or increase green areas in your district or neighbourhood. While the first few steps (steps 1 and 2) are not always necessary (or you have already completed them), we recommend performing those steps to have a deeper knowledge and understanding of the local conditions that would make sure that the initial idea is suitable and feasible to local conditions. Defining your goals and objectives would

help with the planning and especially the evaluation phases of the project. However, please note that the goal does not need to be set in stone; several circumstances can affect the final project outcome (e.g., feedback from stakeholders or any unforeseen changes in local conditions); therefore, flexibility is desired to adapt to those changes easily.

Step 1 Understand local conditions and identify problems

Identifying local conditions, challenges, and problems is crucial to finding suitable solutions. Understanding the local system and context can help ensure the project's success and long-term viability. This step can also involve co-creation through group discussions, albeit typically with a limited number of stakeholders present during the initial stages of the project development. The following actions can help familiarise yourself with the local conditions.

- Consultation with local NGOs, experts (e.g., ecologists, landscape architects), the municipality and communities can help analyse the local geographical, environmental, social and economic conditions and challenges.
- Local strategies, plans, and historical data can help pinpoint local challenges and areas that require urgent interventions. While increasing green and blue infrastructure generally supports biodiversity, tailored solutions to specific problems are more sustainable and impactful.
- Involving local communities in expressing their opinions on local challenges could enhance their acceptance and support, and applying their knowledge could help tailor the solution to their specific needs.

Helping questions and guiding suggestions	Tools
- What are the main threatening factors to urban biodiversity on the local level? - What are the hot spots where urban biodiversity is the most endangered? - What are the main local environmental conditions? Consider soil type, temperature, precipitation, etc. - What are the socio-economic conditions of the area? How might they influence or be influenced by biodiversity projects? - What does nature need? - What are the main needs of citizens?	- Local environmental or biodiversity strategies, plans - Ecosystem services assessment - Maps: green areas, biodiversity index, heat, noise, pollution maps, flood risk areas - Local species and habitat inventory - Community surveys or group discussions to gather their input and observations - Consultation with municipality, NGOs, experts

Step 2 Explore potential solutions

After identifying the problem you want to address, you can find suitable solutions and explore their suitability in your area. Consider the following actions during the process.

- Review already existing similar cases. Select two or three possible solutions, explore their benefits and risks, and the time, cost and resources (both human and technical) needed for implementation and maintenance.
- Explore different kinds of NBS that would serve as solutions to the identified problems and could benefit biodiversity.
- Explore the possible sites that could be suitable for each solution. Problems related to land ownership sometimes hinder the process; therefore, consultation with land owners and providing the information in such cases is essential.
- Consider conserving and restoring already existing places before creating any new infrastructure.
- Explore not just the environmental but also the social impacts (both benefits and risks) of the possible solutions. For this, the involvement of a smaller group of stakeholders is strongly desired to find the most suitable solution that could also address social challenges.

Helping questions and guiding suggestions	Tools
- Which type of NBS can be a solution? - Where can the possible solutions be implemented? Identify specific sites or areas within the city/district that are suitable for the proposed solutions. Identify land ownership and whether the land can be secured for your project. - Are the solutions applicable in our city/district/area? Consider local conditions. - What kind of benefits do the solutions have? Consider ecological, social, and economic benefits. - Do they have risks? Consider ecosystem disservices and trade-offs and whether they can be mitigated. - How will the solutions impact stakeholders? - What resources are needed for the implementation and the maintenance?	- NBS list - Green Surge NBS catalogue - Clever Cities NBS catalogue - Urban GreenUP NBS catalogue - NBS case study finder - Network Nature case study finder - Urban Nature Atlas - NBS Benefit explorer - Cost-benefit analysis (CBA) A preliminary cost-benefit analysis could support the decision-making process. - Multi-Criteria Analysis (MCA) Identifying and comparing different options could support the decision-making process. - SWOT analysis

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Example for exploring different solutions				
Problem	The **Urban Heat Island** (UHI) effect is a phenomenon where urban areas experience higher temperatures than their rural surroundings due to human activities, concrete buildings, asphalt, and lack of vegetation. This leads to increased energy consumption through higher level of air conditioning use, elevated emissions of air pollutants and greenhouse gases due to the lack of absorption capacities, and adverse health effects.			
Possible solution 1	**Green Roofs** Planting vegetation on rooftops of buildings reduces heat, absorbs greenhouse gases and air pollutants, and enhances urban biodiversity.			
Impact on biodiversity	**Impact on society**	**Further benefits**	**Risks**	**Cost and other resources**
Provides habitats for insects, birds, and small animals, increasing urban biodiversity.	Lowers building cooling costs, reduces noise pollution, and improves air quality.	Absorbs rainwater, mitigating runoff and reducing the risk of flooding, enhances the aesthetic appeal of buildings, and sequesters carbon dioxide, aiding in climate change mitigation.	Structural challenges and added weight on buildings, higher upfront costs, and maintenance requirements.	Low cost and requires low maintenance.
Possible solution 2	**Urban Tree Planting** Planting trees along streets, in parks, and other public spaces to provide shade and reduce urban temperatures and air pollution.			
Impact on biodiversity	**Impact on society**	**Further benefits**	**Risks**	**Cost and other resources**
Enhances habitats for birds, insects, and other wildlife, promoting greater biodiversity in urban areas.	Provides shade, reduces energy costs, improves air quality, and enhances mental well-being.	Increases property values, supports local communities, and sequesters carbon dioxide, aiding in climate change mitigation.	Potential for root damage to infrastructure, ongoing maintenance and watering needs, and risk of introducing non-native species.	Medium cost and requires regular maintenance.
Possible solution 3	**Urban Ponds** Creating small ponds in urban areas to help cool the environment and provide a habitat for various species.			

Impact on biodiversity	Impact on society	Further benefits	Risks	Cost and other resources
Supports aquatic plants and animals, increasing urban biodiversity and creating micro-habitats.	Offers recreational and educational opportunities, improves mental well-being, and enhances the beauty of urban spaces.	Helps manage stormwater runoff, reduces flooding risks, and improves water quality through natural filtration processes.	Space competition in densely populated areas, potential for attracting unwanted pests like mosquitoes or invasive species, and ongoing maintenance requirements.	Medium to high cost, requires low or medium maintenance.

Table 3: Example for exploring potential solutions to the defined problem

Step 3 Select the most suitable solution

In some cases, this may serve as the initial step. If you are already familiar with the local conditions and the possible solutions, selecting the most suitable solution is the first step in your project. It could be set in motion by one stakeholder or a committee (e.g., municipality, NGO) focused on relevant topics. It can also result from the first two steps completed through a co-creation process involving a smaller stakeholder group. While this step could also engage a group of stakeholders, additional stakeholder involvement is probably necessary after defining the exact intervention and location. In some cases, nature must be isolated and left alone to regenerate. Consider what is needed for nature and biodiversity preservation and involve experts and local knowledge gainers in decision-making.

Helping questions and guiding suggestions	Tools
● Exclude solutions for which you do not have the necessary financial, human, or technical resources. ● Consider choosing a combination of solutions.	● Democratic discussion ● Results of CBA MCA and SWOT (see step 2)

Financing a project, especially in the long term, could be challenging. Sometimes, you have a dedicated budget for such projects, but in some cases, you need to secure funding in order to initiate the implementation. There are several options, including exploring grants and subsidies from governmental bodies, such as local municipalities, national environmental agencies, or international programs focused on urban sustainability. Additionally, private-sector partnerships can be pursued, particularly with companies interested in corporate social responsibility (CSR) initiatives. Community fundraising and crowdfunding campaigns can also effectively engage local residents and stakeholders in the project's financial support. Lastly, consider long-term financing strategies like establishing an endowment fund or securing recurring donations from local businesses and philanthropists.

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Literature on financing options to enhance urban biodiversity

Funding for cities
https://commission.europa.eu/eu-regional-and-urban-development/topics/cities-and-urban-development/funding-cities_en

Biodiversity and finance
https://knowledge4policy.ec.europa.eu/biodiversity/topic/biodiversity-finance_en

Approaches to financing nature-based solutions in cities
https://growgreenproject.eu/wp-content/uploads/2019/03/Working-Document_Financing-NBS-in-cities.pdf

Investing in nature-based solutions
https://op.europa.eu/en/publication-detail/-/publication/e7eefad4-08dc-11ee-b12e-01aa75ed71a1

6.2 How to involve stakeholders? Activate, engage, and motivate stakeholders

This step is pivotal and integral to the co-creation process, serving as a continuous and vital process throughout the entire project. We highly recommend appointing a facilitator at the project's outset to guide and oversee the co-creation process. Intense collaborative planning among various public and private actors, stakeholders, and citizens is crucial from the initial stages for efficiently addressing complex problems and creating innovative designs. Studies highlight the importance of such partnerships for successfully implementing such projects, as they help manage potential conflicts, issues, and constraints. We also recommend involving stakeholders early on in the project, ensuring that the planning is already based on collaboration.

As mentioned before, identifying and involving citizens can start at the very beginning of the project, so completing the first steps could also involve co-creation. Therefore, Steps 4 and 5 can be concluded before Step 1 if you do not have a specific idea of enhancing urban biodiversity and would like to involve stakeholders from the start. However, after the solution and the locality have been identified, broader stakeholder involvement may be necessary; therefore, we discuss this part of the process here as the fourth and fifth steps.

Given the significance of this role and the importance of engaging, motivating, and uniting individuals from diverse sectors and backgrounds, a separate document (*Tools for facilitating co-creation: Methods and guiding principles* link) has been developed within the framework of the Co-Bio project, to support the facilitation in co-creation process. In this section, we outline the necessary steps for stakeholder involvement in a project. The accompanying tools provide more comprehensive insights into the facilitation process.

Step 4 Identify stakeholders

Stakeholders for urban biodiversity projects include individuals, communities, organisations, and government entities working together to design, build, and manage projects. This collaboration leverages shared skills, resources, and knowledge to develop inclusive and sustainable solutions. Stakeholder involvement generally leads to better, more appropriate

solutions and helps overcome implementation challenges. The following actions can help identify the stakeholders.

- Define the group of stakeholders by identifying 1) the stakeholders most impacted by the project's outcome, 2) the stakeholders who have the most impact on the project, and 3) what kind of experts are needed for the implementation, etc.
- Pay special attention to involving vulnerable groups—such as children, the elderly, people with physical disabilities, mental health issues, the socially disadvantaged, and asylum seekers—enhancing the project's impact and aligns with the European Green Deal's objective of a 'just transition' and 'leaving no one behind.'
- Besides the skills and knowledge the stakeholders have, explore their interest. Involving them in activities lie in their areas of interest might help keep the interest in the long-term.
- Consider also responsibilities and roles among the stakeholders. You may want to involve a broader stakeholder group in the implementation phase and a smaller core stakeholder group in the decision-making activities.

Helping questions and guiding suggestions	Tools
- Who are the most impacted stakeholders by the project's outcome? - Which stakeholders have the most impact on the project? - What kind of experts are needed for implementation? - Explore the skills that are needed for your project. - Explore the stakeholders' main interests. - Consider involving officers from public bodies, business owners from the private sector, citizens, communities, NGOs, decision-makers, experts and professionals.	- Stakeholder Mapping - Visualisation of stakeholders' level of influence, interest, expertise *Tools for facilitating co-creation: Methods and guiding principles* (link)

The *Tools for facilitating co-creation: Methods and guiding principles* (link) document provides further information and tools about the process.

Step 5 Motivate, activate and engage stakeholders

Motivating and engaging stakeholders is crucial throughout the project, not just in the beginning. Actively engaging a diverse group of stakeholders ensures transparency, fairness, and effectiveness, promoting trust and mutually beneficial outcomes. One of the main challenges we identified in the co-creation process is motivating the stakeholders and keeping them engaged in the long term. Feeling ownership of an initiative or a green-blue space could greatly contribute to the project and keep the motivation on a high level. We recommend planning regular meetings and discussions with the stakeholders and having a platform where interactions can happen between the stakeholders.

Helping questions and guiding suggestions	Tools
● How can we foster a sense of ownership among stakeholders? ● How can we keep stakeholders engaged long-term? ● What motivates each stakeholder group, and how can we leverage those motivations?	● Regular meetings and workshops ● Online platform ● *Tools for facilitating co-creation: Methods and guiding principles* (link)

6.3 How to plan the project? Defining timeline, risk assessment, implementation, maintenance, monitoring, evaluation and communication plan

Step 6 Explore similar cases

This step is optional in the process; however, it is recommended to explore the already existing cases similar to your chosen solution to identify the success factors and the possible lessons learned. Reviewing similar cases can provide valuable insights and help avoid common mistakes.

Helping questions and guiding suggestions	Tools

● Why was the case study a success?
 	
● Are there any lessons learnt during the process?
 	
● What impact did it have on biodiversity and society?
 	
● What were the local conditions of the case study, and can the solution be applicable in your case?
 	
● How were the stakeholders involved in the case study?
 	
● How was the project monitored and evaluated over time?
	● NBS case study finder
	
	    Network Nature case study finder
	
	    Urban Nature Atlas
	
	    Oppla urban biodiversity case studies

Step 7 Risk assessment

In this step, we aim to identify potential risks associated with the project and develop strategies to mitigate or address them. If you completed Step 2, this phase can offer a deeper understanding and a more detailed analysis of the possible risks. It's important to recognize the possible trade-offs of the proposed solution, such as ecosystem disservices that a green area

may provide, and to devise strategies to tackle them. Social, economic, and environmental aspects should be considered also when assessing risks.

Helping questions and guiding suggestions	Tools
● What kind of ecosystem disservices can be associated with the project? ● Did other case studies identify associated risks or have negative impacts? ● What are the social, economic, and environmental risks associated with the project? ● How can we minimise or mitigate identified risks?	● Literature about ecosystem disservices ● Group discussion ● Lessons learned from case studies ● SWOT analysis used in Step 2

Step 8 Prepare an action plan

Define the necessary actions, the involved stakeholders, the timeline, and the related costs and resources. The following are the actions to be delivered under this step:

- Define the actions needed for the process, considering all phases of the project, including implementation, maintenance, monitoring, and evaluation. Remember to include communication and awareness-raising actions in each phase of the project.
- Define the involved stakeholders in each action. In some cases, not all stakeholders participate in all actions. For example, experts may only help with the planning and/or implementation phase, or one dedicated member may be responsible for the communication actions but may not be involved in all actions.
- Set up a timeline for each action, considering factors such as the vegetation period, migration period of animals, and winter (resting) period.
- If you completed Step 2, you have preliminary knowledge about what resources are needed and their related costs. In this step, the costs and resources could be further detailed. Consider human resources, such as how many people are needed during the implementation, maintenance, and monitoring phases. Also, consider the non-human resources needed, like machines, devices, and materials.
- Prepare a financial plan and estimate the financial resources required, including labour costs, material costs, equipment rentals, and any other expenses (e.g. land purchase).

Co-creation should prioritise equity and justice, respecting the diverse knowledge, skills, time availability, and resource constraints of participants when scheduling meetings and designing activities. This approach ensures that the results reflect participants' interest, values and foster a sense of shared ownership, encouraging continued involvement and advocacy for the concepts created, even after the planning process ends.

Step 8.1 Plan the implementation

Define the specific activities required to execute the project.

- Identify the stakeholders who will participate in the implementation phase. This may include contractors, engineers, landscape architects, volunteers, community members, and other relevant parties.
- Develop a detailed timeline outlining when each activity will occur. Consider the sequence of tasks, dependencies, and milestones to ensure smooth progress throughout the implementation phase.
- Estimate the financial resources required for the implementation phase. Ensure that the budget aligns with the project's overall financial plan.
- Determine the logistical requirements for the implementation phase, such as procurement of materials, equipment, and supplies. Develop a procurement plan to ensure timely acquisition and delivery of necessary resources.

Step 8.2 Plan the maintenance

Co-creating biodiversity does not end with the implementation and execution of the actions. It usually requires ongoing maintenance and aftercare, particularly for long-term success, thus:

- Define the resources needed for the maintenance and the frequency of the needed actions.
- Consider ad-hoc and unforeseen circumstances and prepare for them as well.

Helping questions and guiding suggestions	Tools
- What specific actions are required to implement and maintain the project effectively? - Who are the key stakeholders involved in the concerned Steps, and what are their roles and responsibilities? - Think about regular discussions with the stakeholders - What is the timeline for each activity, and how do they align with the overall project schedule? - What are the estimated costs and resources needed for these Steps, and how will they be allocated? - How will logistics and procurement be managed to ensure timely access to materials and equipment?	- Project management app or tools - Online platform for internal (stakeholder) and external communication - Cost estimation and budgeting tools - Action plan Template (see Annex 1)

Step 8.3 Plan the evaluation

Evaluating the impacts of the implemented actions on biodiversity is necessary to measure the success and define whether you achieved your goals. With monitoring actions, we can collect data for future evaluation and also assess whether the implemented project needs some

adjustment. While evaluation usually happens at the end of the project, based on the monitoring results, planning what we want to evaluate and find the necessary indicators can help define the monitoring actions as well. Therefore, we recommend planning the evaluation before planning the monitoring action; however, during the project, we will do the evaluation after and based on the monitoring results. While assessing biodiversity and ecosystem services can be challenging in small-scale and short-term projects, some tools help evaluate small projects' impact on biodiversity. We would also recommend evaluating the social impacts of the project by sending out surveys or questionnaires or conducting focus group sessions with citizens.

Changes in biodiversity can be evaluated in several ways, e.g., by measuring species richness and abundance, as well as assessing soil and habitat quality but also by taking photos or organising bioblitz actions. Resources of your project and the skills of the involved stakeholders can be assessed, and based on that, **the most suitable indicators** and actions can be defined, based on the monitoring actions can also be outlined. You can find some examples with different scales and resources in Section 6.6 that could help with the evaluation of the project.

Helping questions and guiding suggestions	Tools
● What indicators are most appropriate for monitoring changes in biodiversity and evaluating impact? ● What kind of skills and resources do we have to evaluate biodiversity changes? ● Consult with the suggested measurement methods (see Chapter 6.6) or other resources and define what kind of tools can be used. ● Considering vegetation change, what is the expected time within biodiversity changes can be measurable?	● Project management app ● Action plan Template (see Annex 1) ● Indicators and actions measuring biodiversity changes (See 6.6 How to measure the success? Evaluating the changes)

Step 8.4 Plan the monitoring

Monitoring is important to reflect on the implemented actions and to change maintenance actions if needed. It is also an essential requirement of the evaluation phase. Based on the defined indicators and needed actions to evaluate biodiversity changes, the following monitoring actions can be set up.

- Implement regular monitoring schedules (e.g., monthly, quarterly) to track changes in biodiversity.
- Consider the defined actions and timeline for the maintenance activities and harmonise the monitoring actions with them. Ensure consistency in the methods used for each monitoring action.

Helping questions and guiding suggestions	Tools
● How frequently should monitoring activities be conducted? ● Considering vegetation change, what is the expected time within biodiversity changes can be measurable?	● Project management app or tools ● Action plan Template (see Annex 1) ● Indicators and actions measuring biodiversity changes (See 6.6 How to measure the success? Evaluating the changes)

Step 8.5 Plan the awareness-raising actions/communication

We recommend regularly communicating the actions taken during the project and inviting others to participate in any actions they find themselves interested in. A platform (e.g., social media or the website of a participating NGO or municipality) should be found where you can regularly create short posts and inform the citizens about the project, and share information about urban biodiversity. We recommend summarising the actions and findings in a short report after the implementation and after each monitoring action. These reports can be disseminated to professionals and municipalities and can be shared on events. We also recommend installing an information board onsite, where the initiative is implemented (e.g., with a QR code) where citizens can be informed about the project and its activities.

We recommend collecting feedback from stakeholders about each action for potential alignment and for future cases. Reflecting on the positive impacts and what could have been done better could help improve the current project and similar future projects as well.

Helping questions and guiding suggestions	Tools
● Who are the target groups for awareness raising/communication? ● Consider planning a communication action (e.g., an event) in each phase of the project and regularly post short posts ● Post short additional and background information about the importance of urban biodiversity for knowledge improvement	● Use online channels and platform ● Organise events ● Collect stakeholder feedback

6.4 How to implement a project?

Step 9 Baseline assessment

This step is optional, however, we strongly recommend compiling a baseline assessment of the area's biodiversity and socio-economic status to understand the pre-project state. Using the same tools you choose to evaluate the changes, -either counting the species or taking photos- it is useful to have baseline data that can be compared with the data collected during the monitoring phase.

Helping questions and guiding suggestions	Tools
● What is the current state of biodiversity in the project area? ● What species are present in the area? ● What are the key characteristics of the habitats? ● Use the chosen method for biodiversity evaluation	● Methods chosen in planning the evaluation substep

Step 10 Implement the actions defined in the action plan

Implementation is a crucial phase where planned actions are executed to achieve the project's objectives. Involving experts in this process is essential for a fruitful and sustainable project. Furthermore, proper coordination and facilitation of the planned actions are also crucial for successful implementation. Please see the *Tools for facilitating co-creation: Methods and guiding principles* (link).

Helping questions and guiding suggestions	Tools
● Ask experts' support during the implementation. ● Consider the stakeholders' interests and involve them in the actions in which they have an interest. ● Check whether you have the needed resources. ● Use native and endemic plant species when restoring/creating green areas.	● Project management app or tools ● *Tools for facilitating co-creation: Methods and guiding principles*

6.5 How to maintain and monitor a project?

Step 11 Maintenance and monitoring

Co-creating biodiversity often does not end with the implementation and execution of the actions. Supporting a co-creation project usually requires ongoing maintenance and aftercare,

particularly for long-term success. Monitoring actions can be combined with maintenance actions together.

Maintenance activities are essential to sustain the improvements made during the implementation phase. Regular upkeep, such as invasive species control, cleaning the project site and proper water management, ensures that the project area remains conducive to biodiversity enhancement. Vegetation management, like regular pruning, weeding, and planting, is essential to maintain the desired vegetation structure and composition. Maintaining and caring for the implemented intervention could strengthen the connection between people and nature.

Monitoring actions are crucial for assessing the effectiveness of the implemented actions and making informed decisions for ongoing management. As defined earlier in the evaluation planning phase, the chosen indicators should be monitored using the chosen methods. The Urban Biodiversity Data Collection template can be used to track changes.

Helping questions and guiding suggestions	Tools
● Consider if anything needs to be improved during the maintenance and monitoring. Lessons learned during aftercare. ● Can the chosen indicators be monitored, or do the chosen method and indicators need adjustment? ● Did the motivation of the involved stakeholders change over time? If yes, why? ● Communicate the results, share them with the community/other municipalities/experts, etc.	● Template for monitoring ● The chosen method for monitoring the indicators. ● Reflecting together with stakeholders on what went well and what needs to be improved.

6.6 How to measure the success? Evaluating the changes

Step 12 Evaluation

Evaluating the success and changes in biodiversity within urban areas involves a range of indicators and measurement methods. These can vary in complexity from scientific assessments requiring specialised knowledge and tools to simpler observational and participatory methods that community members can conduct. In the table below, there are some suggestions to evaluate the changes in biodiversity from complex methods through medium tools with complexity to alternative, easy-to-apply methods. Consider how much time is needed for proper evaluation. Changes in biodiversity take time; often, a few years are needed for visible or sensible results. In Annex 2, you can find a template for the project evaluation, including the impact on biodiversity, stakeholders, society, environment, and others.

Indicator	Complex method	Medium complexity	Easy
Number of Species (Species richness)	**Systematic sampling** Conduct comprehensive biodiversity surveys using methods like quadrat sampling for plants and transect walks for animals. **Resources needed**: Trained personnel, sampling equipment, and statistical analysis tools.	**Bioblitz events** Organise bio blitz events where community members and experts collaborate to record as many species as possible in a specific area and timeframe. **Resources needed**: Volunteer coordination, identification guides, and data recording tools.	**Photographic documentation** Encourage community members to take and share photos of different species they encounter. **Resources needed**: Cameras or smartphones, an online platform for photo sharing and identification.
Species Abundance	**Population surveys** Conduct systematic population surveys using methods like mark-recapture for animals and plant density estimates. **Resources needed**: Expertise in population sampling, statistical software, and field equipment.	**Regular counts and observations** Conduct regular counts of key species, such as bird counts or pollinator observations along set transects. **Resources needed**: Volunteer training, observation tools (binoculars, data sheets).	**Citizen science apps** Use citizen science apps where community members can record sightings of species. **Resources needed**: Smartphones, access to apps like iNaturalist or eBird.
Habitat quality	**Detailed vegetation and soil surveys** Monitor changes in plant cover, composition, and health, and measure soil quality indicators like organic matter content and nutrient availability. **Resources needed**: Soil testing kits, plant identification guides, and expertise in ecological surveys/analysis.	**Visual habitat assessments** Conduct visual assessments of vegetation cover and habitat features like water sources and nesting sites. **Resources needed**: Volunteer training, standardised assessment forms.	**Simple observational logs** Encourage community members to keep logs of changes they observe in plant growth, habitat features, and the presence of invasive species. **Resources needed**: Notebooks or digital logs, basic identification guides.

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Indicator	Complex method	Medium complexity	Easy
Wildlife activity and behaviour	**Automated monitoring systems** Use camera traps and acoustic monitors to document wildlife presence and behaviour over time. **Resources needed**: Camera traps, acoustic monitoring equipment, and data analysis tools.	**Scheduled wildlife surveys** Conduct scheduled surveys for birds and bats using visual and acoustic methods. **Resources needed**: Binoculars, bat detectors, volunteer training.	**Community observation and reporting** Involve community members in reporting wildlife sightings and behaviours through observation logs or apps. **Resources needed**: Smartphones, community training sessions.
Pollinator activity	**Detailed transect walks and timed observations** Perform transect walks to count pollinators and conduct timed observations of flower visits. **Resources needed**: Transect setup, stopwatches, identification guides, expertise.	**Pollinator gardens and regular counts** Establish pollinator gardens and have regular community-driven counts and observations. **Resources needed**: Garden space, planting materials, volunteer coordination.	**Snapshot surveys** Encourage residents to take snapshot surveys of pollinators visiting flowers in their gardens or local parks. **Resources needed**: Cameras or smartphones, online survey platform.

Table 4: Examples of evaluating the changes in biodiversity

Helping questions and guiding suggestions	Tools
● Consider the time needed for visible results. ● Have you achieved your goals or adjustments needed during maintenance? ● Have you noticed some trade-offs because of the implementation? If yes, can they be mitigated?	● Template for evaluation ● Reflecting together with stakeholders on what went well and what needs to be improved.

Where should I start? Helping questions to find which Steps should be performed

Do you want to enhance urban biodiversity?
↓

Yes
↓

Are you familiar with the local challenges and conditions?
↓   ↓

Yes   No→ Start with Step 1 to understand the local system.
↓

Do you have a specific idea or a solution to a local problem?
↓   ↓

Yes   No→ Start with Step 2 to explore possible solutions.
↓

Have you identified the stakeholders?
↓   ↓

Yes   No→ Start with Step 4 and 5 to identify the stakeholders.
↓

Do you know the potential impacts and risks of your idea?
↓   ↓

Yes   No→ Start with Steps 6 and 7 to explore similar cases and to identify potential risks.

↓

Have you identified the indicators and the methodology for evaluation?
↓   ↓

Yes   No→ Define clear goals and find the most suitable indicators (check 6.6)
↓   ↓

Do you have an action plan for the implementation, maintenance, monitoring, evaluation and communication?

↓   ↓

Yes   No→ Start with Step 8 to prepare an action plan.

↓

Congratulations! You can start implementing the project! To make the evaluation easier, we recommend performing a baseline assessment.

Table 5: Guidance on steps to be performed

6.7 How can an initiative be sustainable/applicable/upscalable? How can it be a long-term solution?

To ensure an urban biodiversity initiative is sustainable, it is essential to have civil support and continuity. Shared interest and ownership among stakeholders, along with institutional support, are crucial for long-term success. Involving the community, especially young people, and raising awareness are vital, with activities like school gardens and reusing green spaces playing a significant role. It is important to establish systems that require minimal care, have secured funding, and foster cooperation and networking. Education and communication are key to success. Utilising citizen science projects, social campaigns, and democratic structures to engage people and reduce fear of nature ultimately create a sense of personal connection to the initiative. Feeling ownership over a place or a project can help keep the engagement on a high level and in the long term. A coordinating body could also enhance the sustainability of such projects.

Glossary

Ecosystem services: Ecosystem services are the benefits human populations derive, directly or indirectly, from ecosystem functions (Costanza et al., 1997).

Ecosystem disservices: Ecosystem disservices are functions of ecosystems that are perceived as negative for human well-being (Lyytimäki and Sipilä,2009).

Nature-based solutions (NBS): Solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more, and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions (European Commission).

Co-creation: Co-creation is a collaborative approach that involves stakeholders in designing and building inclusive and sustainable solutions.

Annexes

Annex 1:

Template for Action Plan

Project Title: Project Duration: Project Objective(s): Project Location: Project Coordinator:						
Actions	**Start**	**End**	**Involved stakeholders**	**Resources needed**	**Costs**	**Feedback and reflection on the actions**
Implementation						
Action 1						
Action 2						
Communication						
Maintenance						
Action 1						
Action 2						
Communication						
Monitoring						
Action 1						
Action 2						
Communication						
Evaluation						
Action 1						
Action 2						
Communication						

Annex 2:

Template for evaluation

Project Title: Project Duration: Project Objective(s): Project Location: Project Coordinator:					
Evaluating Biodiversity					
Applied methodologies:					
Indicators	**Baseline conditions**	**1st Monitoring**	**2nd Monitoring**	**3rd Monitoring**	**One year reflection**
Indicator 1					
Indicator 2					
Indicator 3					
Overall impact on biodiversity					
Evaluating the social impacts of the project					
Stakeholder group 1					
Stakeholder group 2					
Stakeholder group 3					
Evaluating other impacts of the project					
Environmental impacts					
Economic impacts					
Other impacts					
Evaluating communication actions					
Number of involved people in the project					

Number of events	
Number of posts	
Number of people reached	

Annex 3:

Summary of the steps

Step	Aim	Helping questions	Tools
Step 1 Understand local conditions and identify problems	Identifying local challenges and problems and understanding the local system can help find suitable solutions and ensure the project's success and sustainability.	● What are the main threatening factors to urban biodiversity on the local level? ● What are the hot spots where urban biodiversity is the most endangered? ● What are the main local environmental conditions? Consider soil type, temperature, precipitation, etc. Check local strategies and plans for the data. ● What are the socio-economic conditions of the area? How might they influence or be influenced by biodiversity projects? ● What does nature need? ● What are the main needs of citizens?	● Local environmental or biodiversity strategies, plans ● Ecosystem services assessment ● Maps: green areas, biodiversity index, heat, pollution maps ● Community surveys or group discussions to gather their input and observations ● Consultation with municipality, NGOs, experts

CO-BIO

Step	Aim	Helping questions	Tools
Step 2 Explore the solutions	Exploring potential solutions and assessing their suitability in the local conditions ensures that the most suitable solution is found for the project.	● Which type of NBS can be a solution? ● Where can the possible solutions be implemented? Identify specific sites or areas within the city/district that are suitable for the proposed solutions. Identify land ownership and whether the land can be secured for your project. ● Are the solutions applicable in our city/district/area? Consider local conditions. ● What kind of benefits do the solutions have? Consider ecological, social, and economic benefits. ● Do they have risks? Consider ecosystem disservices and trade-offs and whether they can be mitigated. ● How will the solutions impact stakeholders? ● What resources are needed for the implementation and the maintenance?	● NBS list Green Surge NBS catalogue Clever Cities NBS catalogue Urban GreenUP NBS catalogue ● NBS case study finder Network Nature case study finder Urban Nature Atlas ● NBS Benefit explorer ● Cost-Benefit Analysis (CBA) A preliminary cost-benefit analysis could support the decision-making process ● Multi-Criteria Analysis (MCA) Identifying and comparing different options could support the decision-making process. ● SWOT analysis

Step	Aim	Helping questions	Tools
Step 3 Select the most suitable solution	Finding the most suitable solution can help address the specific local challenges.	● Exclude solutions for which you do not have the necessary financial, human, or technical resources. ● Consider choosing a combination of solutions.	● Democratic discussion ● Results of CBA and MCA and SWOT
Step 4 Identify stakeholders	Serving to find the involved stakeholders vital in the co-creation process.	● Who are the most impacted stakeholders by the project's outcome? ● Which stakeholders have the most impact on the project? ● What kind of experts are needed for implementation? ● Explore the skills that are needed for your project. ● Consider involving officers from public bodies, business owners from the private sector, citizens, communities, NGOs, decision-makers, experts and professionals.	● Stakeholder Mapping ● Tools for facilitating co-creation: Methods and guiding principles
Step 5 Motivate, activate and engage stakeholders	Engaging stakeholders ensures sustainability, transparency, fairness, and effectiveness, promoting trust and mutually beneficial outcomes.	● How can we foster a sense of ownership among stakeholders? ● How can we keep stakeholders engaged long-term?	● Regular Meetings and Workshops ● Online Platform ● Tools for facilitating co-creation: Methods and guiding principles

		● What motivates each stakeholder group, and how can we leverage those motivations?	
Step	**Aim**	**Helping questions**	**Tools**
Step 6 Explore similar cases	Finding similar case studies and learning from them.	● Why was the case study a success? ● Are there any lessons learnt during the process? ● What impact did it have on biodiversity and society? ● What were the local conditions of the case study and can the solution be applicable in your case? ● How were the stakeholders involved in the case study? ● How was the project monitored and evaluated over time?	● NBS case study finder Network Nature case study finder Urban Nature Atlas Oppla urban biodiversity case studies
Step 7 Risk assessment	Defining the risks and outlining how to minimise them or how to address them	● What kind of ecosystem disservices can be associated with the project? ● Did other case studies identify associated risks or have negative impacts? ● What are the social, economic, and environmental risks associated	● Literature about ecosystem disservices ● Group discussion ● Lessons learned from case studies ● SWOT analysis used in Step 2

Step	Aim	Helping questions	Tools
		with the project? ● How can we minimise or mitigate identified risks?	
Step 8 Prepare an action plan	Defining the necessary actions, the involved stakeholders, the timeline and the related costs and resources.		
Step 8.1 and 8.2 Plan the implementation and maintenance	Defining the specific activities required to execute the project.	● What specific actions are required to implement and maintain the project effectively? ● Who are the key stakeholders involved in these steps, and what are their roles and responsibilities? ● Think about regular discussions with the stakeholders ● What is the timeline for each activity, and how do they align with the overall project schedule? ● What are the estimated costs and resources needed for these steps, and how will they be allocated? ● How will logistics and procurement be managed to ensure timely access to materials and	● Project management app ● Online platform for internal (stakeholder) and external communication ● Cost estimation and budgeting tools ● Action plan Template (see Annex 1)

		equipment?	
Step	**Aim**	**Helping questions**	**Tools**
Step 8.3 Plan the evaluation	Defining whether you achieved your goals and the impact of the project.	● What indicators are most appropriate for monitoring changes in biodiversity? ● What kind of skills and resources do we have to evaluate biodiversity changes? ● Consult with the suggested measurement methods (see 6.6) or other resources and define what kind of tools can be used. ● Considering vegetation change, what is the expected time within biodiversity changes can be measurable?	● Project management app ● Action plan Template (see Annex 1) ● Indicators and actions measuring biodiversity changes (See 6.6 How to measure the success? Evaluating the changes)
Step 8.4 Plan the monitoring	Reflecting on the implemented actions and change maintenance actions if needed. It is also an essential requirement of the evaluation phase.	● How frequently should monitoring activities be conducted? ● Considering vegetation change, what is the expected time within biodiversity changes can be measurable?	● Project management app ● Action plan Template (see Annex 1) ● Indicators and actions measuring biodiversity changes (See 6.6 How to measure the success? Evaluating the changes)

Step	Aim	Helping questions	Tools
Step 8.5 Plan the awareness-raising actions/communication	Raising awareness about the importance of biodiversity and to engage citizens	● Who are the target groups for awareness raising/communication? ● Consider planning a communication action (e.g., an event) in each phase of the project and more regularly post short posts ● Post short additional and background information about the importance of urban biodiversity for knowledge improvement	● Use online channels and platform ● Organise events ● Stakeholder feedback
Step 9 Baseline assessment	Understanding the pre-project state of biodiversity.	● What is the current state of biodiversity in the project area? ● What species are present in the area? ● What are the key characteristics of the habitats? ● Use the chosen method for biodiversity evaluation	● Methods chosen in planning the evaluation substep
Step 10 Implement the actions defined in the action plan	Execution of the planned actions to achieve the project's objectives.	● Ask experts' support during the implementation. ● Use native and endemic plant species when restoring/creating	● Project management app

Step	Aim	Helping questions	Tools
		green areas.	
Step 11 Maintenance and monitoring	Maintenance and monitoring are crucial in sustaining the implemented interventions and evaluating their success.	• Consider if anything needs to be improved during the maintenance and monitoring. Lessons learned during aftercare. • Can the chosen indicators be monitored, or do the chosen method and indicators need adjustment? • Did the motivation of the involved stakeholders change over time? If yes, why? • Communicate the results, share them with the community/other municipalities/experts, etc.	• Template for monitoring • The chosen method for monitoring the indicators. • Reflecting together with stakeholders on what went well and what needs to be improved.
Step 12 Evaluation	Evaluating the results can help define the effectiveness of the implemented actions.	• Consider the time needed for visible results. • Have you achieved your goals or adjustments needed during maintenance? • Have you noticed some trade-offs because of the implementation? If yes, can they be mitigated?	• Template for evaluation • Reflecting together with stakeholders on what went well and what needs to be improved.

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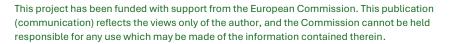
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