

MAKING EUROPE'S BUILT ENVIRONMENT GREENER, HEALTHIER AND MORE RESILIENT

July 2024



RECONCILING URBANIZATION, RESILIENCE AND WELLBEING: THE ROLE OF NATURE

The implementation of urban green infrastructures, including vegetated roofs and walls across Europe's buildings, stands as a pivotal strategy in fostering the resilience of urban environments, thereby enhancing the well-being of inhabitants.

The escalating frequency of heatwaves, prolonged droughts, intense storms, and widespread flooding serves as a stark indication of the rapidly evolving climate. This underscores the critical need to prioritize preemptive measures and readiness, particularly within densely populated urban centers.

Urbanization is another catalyst for accelerating the implementation of green infrastructures within cities. From 1950 to 2020, the proportion of Europeans residing in urban areas surged from 51.7% to 74.9%, a trend projected to persist, with an estimated 83.7% of the population expected to reside in urban areas by 2050¹. Residing in urban centers offers numerous advantages to inhabitants, including access to economic prospects, cultural amenities, and closer social ties. Nonetheless, this urban milieu can lead to various mental health challenges stemming from rapid urbanization, such as feelings of loneliness, homelessness, or insecurity². One often overlooked aspect, not yet comprehensively understood by contemporary science, is the intricate interplay between residents and their immediate surroundings.

Research indicates that adults dwelling in urban settings face elevated risks to mental well-being, partially attributable to a dearth of natural elements.

Vienna has 44% of its area covered with Green Infrastructure

To resolve this, a recent study³ underscores the significance of ample provision of public green spaces within local neighborhoods and within walking distance to foster positive mental health outcomes.

Thus, the well-being of urban inhabitants is inherently intertwined with their access to green spaces and a sense of integration with the natural environment. However, the pace of urbanization frequently neglects the integration of nature as a fundamental component of urban development, resulting in the emergence of “grey cities” that prioritize built infrastructure at the expense of accessible natural surroundings.

The benefits of integrating urban green infrastructures extend to people, nature, and climate, with a multitude of positive impacts including:

- *Climate Adaptation: Urban Resilience Against Extreme Weather Events.* Green roofs' cooling effect can decrease urban temperatures by 2.5 to 6°C,⁴ mitigating the impact of heatwaves, a crucial aspect of cities' adaptation to climate change. They also reduce the risk of flooding by retaining and detaining rainwater on roofs, thereby alleviating pressure on urban infrastructure⁵ during extreme weather events.
- *Climate Mitigation: Creating new carbon sinks and reducing energy needs.* Greening impervious urban surfaces can significantly lower buildings' energy demand and convert them into carbon sinks. Analyses by the European Commission's Joint Research Centre⁶ indicate that greening 35% of the European Union's impervious urban surfaces (more than 26,000 km²) could reduce summer cooling energy demand by up to 92 TWh per year, equivalent to about 15,000 medium-sized windmills. Additionally, vegetated surfaces could avoid up to 55.8 Mtons per year of CO₂ equivalent, approximately the carbon footprint of Finland.⁷
- *Enhanced Solar Panel Efficiency.* Combining solar panels with vegetation on roof surfaces (bio-solar roofs) optimizes panel performance due to the cooling effect of plants and evapotranspiration. Studies⁸ indicate that bio-solar roofs can increase the electricity output of photovoltaic panels by more than 8%.
- *Improved Stormwater Management.* Green roofs retain and detain stormwater in growing media and vegetation, reducing urban runoff and stormwater surges. This contributes to more energy and cost-efficient stormwater management in urban areas⁹ while restoring the natural water cycle through water infiltration and evapotranspiration.
- *Urban Nature Restoration.* Vegetated surfaces on buildings serve as habitats for various species of insects and birds, including endangered pollinators. Their presence is instrumental in reintroducing nature into cities and restoring biodiversity across Europe.¹⁰
- *Enhanced Inhabitants' Well-being.* Vegetated surfaces positively impact health and well-being by reducing noise pollution, providing daily contact with nature, and alleviating residents' mental fatigue and depression. Green roofs and walls foster a sense of community and add cultural and aesthetic value to urban neighbourhoods, particularly in densely populated areas.

The integration of urban green infrastructures stands as a multifaceted solution to address climate & energy challenges while simultaneously improving the quality of life for urban residents and supporting biodiversity conservation efforts.

An aerial photograph of a city, likely Berlin, showing a dense urban environment with numerous multi-story apartment buildings. The buildings are interspersed with green spaces, including trees and parks. The overall scene is presented in a muted, greenish-grey color palette. The text is overlaid on this image in a large, white, sans-serif font.

THE EVOLUTION OF EU LEGISLATION OVERTHE PERIOD 2019-2024 TO PROMOTE URBAN GREEN INFRASTRUCTURE

Berlin has 51% of its area covered with Green Infrastructure

At the close of 2019, the European Union unveiled the European Green Deal, starting an ambitious legislative agenda aimed at addressing climate change, restoring nature, promoting circularity in Europe, and ultimately propelling Europe toward becoming the first climate-neutral continent by 2050. Spearheaded by President of the European Commission, Ursula von der Leyen, the past five years have witnessed a robust body of legislative actions initiated under this landmark initiative.

Since its inception, legislation spanning various domains such as energy, climate, water, biodiversity, and waste has undergone revision. At the time of drafting of this paper, most of these legislative files have been adopted, with some already in force, while others are still going through an approval process.

Regarding urban green infrastructures, prior to the European Green Deal, there was no European legislation that integrated provisions supporting their deployment and these solutions were mostly absent from the public debate. Facilitated by targeted advocacy and awareness-raising endeavors, the output on urban green infrastructure, both in terms of legislation and initiative, has been unprecedented. The overview included at the end of this paper delineates pertinent legislative and non-legislative files that have incorporated green infrastructures within an urban context.

These concern different aspects and benefits of green infrastructure solutions. The Energy Performance of Buildings Directive¹¹ integrates legal obligations recognizing the added value of the combination of solar energy with green roofs (biosolar roofs), the Nature Restoration Law¹² integrates objectives for the return of biodiversity in urban areas, and the Urban Wastewater Management¹³ Directive includes binding provisions to draft concrete plans to restore the natural water cycle and the reduction of stormwater overflow in cities. The policies, legislative acts, and guidance documents outlined above necessitate implementation at the national level. Directives, for instance, mandate transposition into the national regulatory framework. Consequently, a structured and concerted effort from various stakeholders is imperative, along with a more systematic integration of green considerations into urban planning, development, and regeneration initiatives.

This concerted effort underscores the EU's commitment to fostering sustainable urban development and emphasizes the integral role of green infrastructures in achieving environmental, social, and economic objectives across European cities.

WHAT'S NEXT? PREPARING THE FUTURE OF EUROPE'S CITIES

Despite the positive momentum described above, multiple drafts of the adopted legislation (either at the stage of the European Commission's proposal or the European Parliament's position) contained more ambitious or more binding requirements for the deployment of green infrastructures than what was included in the final legal text. For instance, the Commission's proposal on the Nature Restoration Law held ambitious and quantified urban greening targets for cities (rather than the qualitative targets of the final approved text) with a mandate to reach an easily quantifiable gain of green spaces on new or existing buildings.

As a result, despite notable progress, there remains a pressing need for additional and more ambitious legislative initiatives to propel the widespread adoption of urban green infrastructures.

To advance this agenda, the EU institutional term spanning 2024-2029 must have a decisive acceleration in the structural transformation of our cities. In pursuit of this objective, we would like to highlight the following recommendations for consideration:

1 Integrate systematically the urban dimension in European policies.

Embed an urban dimension in all European policies and advocate for the integration of Green Infrastructures in urban areas beyond a sector-based approach. Emphasize the multifaceted interlinkages of Green Infrastructures with biodiversity, water, energy, agriculture, health, cohesion, and regional policies.

2 Prioritize Health and Well-being in EU policy goals.

Elevate the health and well-being of urban residents and their connection with nature as core policy goals of the new EU institutions. This aspect cannot be neglected given the Europe's urbanization growth and the lack of access to green areas within them.

3 Improve current legislation on Green Infrastructures.

The increase in visibility and understanding of green infrastructures' benefits led to their integration in multiple pieces of European legislation. However, the underlying provisions are often limited in scope or entail diminished obligations. Truly enabling the return of nature in Europe's cities will require the adoption of new measures under the next mandate to foster their adoption. In addition, rather than a sector-based approach, we strongly advocate for overarching provisions on green infrastructures that recognize their multiple and cross-cutting benefits for cities, in particular the "greyest" ones.

4 Effective Implementation and Monitoring.

Ensure full and prompt implementation and continuous monitoring of the current policy and regulatory framework adopted under the European Green Deal supporting the deployment of green infrastructures, taking actions in case of lack of progress.

5 Provide the necessary financial support to actors willing to install green infrastructure.

The EU has the capacity to provide substantial financial support to green roof projects in order to mitigate their installation costs for inhabitants. This could take the form of a ringfencing of a relevant financing programme in the upcoming revision of the EU Multiannual Financial Framework. Additional public resources should also be used to leverage private investments, namely through the aggregation of small-size projects or the design of innovative financing schemes and incentives.

6 Provide the necessary skills and capacity building to deploy these solutions at large scale.

Invest in the development of skills, capacity-building, and technical assistance to ensure the quality of green infrastructure projects. Coherently, capacity and knowledge of the availability and benefits of these solutions, in particular at the local level, must be fostered.

CONCLUSION

The policy and regulatory focus on green infrastructures in urban areas is significant progress. Our contribution to this advancement stems from innovative collaboration among industry stakeholders within the [EU Chapter of the EU Green Infrastructure Network](#), which adopts a cooperative competition approach that transcends traditional competition, leveraging industry experiences, competencies, and resources to advance a shared vision for urban greening. To amplify our collective efforts and innovative capacities for greater impact, more business leaders must commit to this cause, ideally with representation across the entire value chain.

The upcoming years hold immense significance; green infrastructures must be a priority of the new European Institutions' urban policies. We are committed to serving as an active partner for policymakers and stakeholders dedicated to transforming our cities into healthier, more beautiful, and resilient environments for both people and businesses. Through collaborative efforts and innovative solutions, we can foster sustainable urban development and enhance the quality of life for urban dwellers across Europe.



ABOUT US

WGIN is a collaborative global network promoting the integration of green infrastructure in urban planning that unites 21 National Associations. In 2019, WGIN set up a European Chapter, supported by four corporate members, to raise awareness among EU policymakers about the multiple benefits of green infrastructure. The WGIN EU Chapter organises every year the European Green Infrastructure Day, which is an annual policy conference, gathering EU policymakers, green roof industry leaders, experts and NGOs, dedicated to exploring the state of affairs of urban green infrastructure in the European Union and how to foster their uptake.

For more information:

Luigi Petito
Head of EU Chapter Secretariat
luigi.petito@wgin.org

We are social, follow us on LinkedIn and X:



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4. [Water, energy and climate benefits of urban greening throughout Europe under different climatic scenarios](#), Emmanuele Quaranta, Chiara Dorati, Alberto Pistocchi, 2021
5. [Rainwater management through urban green infrastructures](#), Green Infrastructure Alliance, April 2022.
6. [Water, energy and climate benefits of urban greening throughout Europe under different climatic scenarios](#), Emmanuele Quaranta, Chiara Dorati, Alberto Pistocchi, 2021
7. The role of green roofs in enhancing carbon uptake and storage in the urban environment is also highlighted in the latest report of the Intergovernmental Panel on Climate Change (IPCC) Working Group III.
8. For example, an integrated bio-solar system can generate 8.3% more electricity on average than a standalone system. See: "Integration of green roof and solar photovoltaic systems," S. C. M. Hui and S. C. Chan, in Proceedings of Joint Symposium 2011: Integrated Building Design in the New Era of Sustainability, 2011.
9. Urban greening is a successful prevention strategy to avoid water overflows, exhibiting a much higher benefits to costs ratio compared to the corresponding "grey" strategies. See: [Costs and benefits of combined sewer overflow management strategies at the European scale](#), Emanuele Quaranta, Stephan Fuchs, Hendrik Jan Liefting, Alma Schellart, Alberto Pistocchi in Journal of Environmental Management, 2022.
10. [Bringing back biodiversity in our cities: the role of green roofs](#), Green Infrastructure Alliance, June 2022.
11. [Directive \(EU\) 2024/1275 of the European Parliament and of the Council of 24 April 2024 on the energy performance of buildings \(recast\)](#)
12. [Regulation of the European Parliament and of the Council on Nature Restoration and Amending Regulation \(EU\) 2022/869](#)
13. [European Parliament legislative resolution of 10 April 2024 on the proposal for a directive of the European Parliament and of the Council concerning urban wastewater treatment \(recast\)](#)

An aerial photograph of a city, likely Oslo, showing a dense urban layout with buildings, streets, and green spaces. The image is overlaid with a semi-transparent green filter. The text is centered and reads:

OVERVIEW OF LEGISLATIVE AND NON- LEGISLATIVE FILES INCORPORATING GREEN INFRASTRUCTURES

Oslo has 77% of its area covered with Green Infrastructure

ENERGY PERFORMANCE OF BUILDINGS DIRECTIVE (EPBD)

Legal nature	Drective, Binding
Status	Approved, entered into force
Reference(s) to Green Infrastructure	Article 9a, paragraph 4 "Member States shall also take into account structural integrity, green roofs, and attic and roof insulation, where appropriate."
Assessment	This provision requires EU Member States to consider green roofs when fulfilling their new obligation to progressively install solar panels on the EU public and private building stock. Despite not necessarily requiring the installation of a biosolar roof, this obligation will improve understanding of its co-benefits.

NATURE RESTORATION LAW

Legal nature	Regulation, Binding
Status	Approved, not yet entered into force
Reference(s) to Green Infrastructure	Article 6, paragraph 1 and 2 "Member States shall ensure that there is no net loss in the total national area of urban green space... by 31 December 2030" and "Member States shall achieve thereafter an increasing trend in the total national area of urban green space, including through integration of urban green space into buildings and infrastructure, in urban ecosystem areas...after 31 December 2031".
Assessment	Despite not mentioning specifically green infrastructure solutions, this text can support their integration to fulfill the targets of a) no net loss of green spaces by 2030 and b) increasing urban green spaces thereafter. In addition, under the Nature Restoration Law, Member states are required to submit national restoration plans to the European Commission, outlining their strategies to achieve targets and monitor and report progress. These plans will initially cover the period until June 2032, and subsequently be reviewed every ten years until 2050. Additionally, the legal text tasks the Commission with presenting a report summarizing available financial resources at the EU level, assessing funding requirements, identifying any funding gaps, and proposing adequate funding solutions.

URBAN WASTEWATER TREATMENT DIRECTIVE (UWWTD)

Legal nature	Directive, Binding
Status	Approved, not yet entered into force
Reference(s) to Green Infrastructure	<p>Article 5, paragraph 5 and Annex V</p> <p>“Integrated urban wastewater management plans shall include at least the elements set out in Annex V and prioritise green and blue infrastructure solutions wherever possible.”</p> <p>“Member States shall ensure that their competent authorities consider at least the following: firstly, preventive measures aiming at avoiding the entry of unpolluted rain waters into collecting systems, including measures increasing green and blue spaces in urban areas in order to reduce storm water overflows or limiting impermeable surfaces in the agglomerations”.</p>
Assessment	<p>The Urban Wastewater Treatment Directive requires cities with over 100,000 inhabitants to develop integrated urban wastewater management plans by December 2033. Positively, the final text of the Directive mandates Member States to set as a priority the development of green and blue infrastructures as an effective way to reduce stormwater overflow. This is a crucial recognition of the benefits of these solutions, including green roofs and walls, that will support their deployment in the next years in the preparatory phase of these plans.</p>

TAXONOMY REGULATION

Legal nature	Directive, Binding
Status	Entered into force
Reference(s) to Green Infrastructure	<p>Annex II amending Delegated Regulation (EU) 2021/2139</p> <p>“The adaptation solutions implemented: favour nature-based solutions or rely on blue or green infrastructure to the extent possible”.</p>
Assessment	<p>The Commission’s delegated act on sustainable activities for climate change adaptation and mitigation objectives of 2021, complementing the Taxonomy Regulation, added nature-based solutions as a sustainable financing activity under the Taxonomy technical screening criteria.</p> <p>In 2023, another delegated act on, among others, the sustainable use of water resources and the protection and restoration of biodiversity, also included green roofs as a sustainable investment to tackle the above challenges.</p>

GUIDELINES ON THE ENERGY EFFICIENCY FIRST PRINCIPLE

Legal nature	Guidance document, non-binding
Status	Published
Reference(s) to Green Infrastructure	<p>COM (EU) 2021/1749</p> <p>“Implementation green infrastructure practices, such as green roofs, which can retain large amount of rainwater and consequently reduce the storm water volume rate of run off entering the drainage system.”</p> <p>“Consideration of green and blue infrastructure in local spatial planning that provides synergies between energy efficiency improvements in individual buildings through the application of natural ventilation, green roofs and walls, and district-level reduction of the heat island effect.”</p>
Assessment	<p>The Commission published guidelines to Member States to help them apply the Energy Efficiency First principle in different sectors. For buildings and water, green infrastructures are mentioned as type of measures that can be introduced to put the principle into practice, both reducing storm-water overflow and the heat island effect.</p>

NEW EU STRATEGY ON ADAPTATION TO CLIMATE CHANGE

Legal nature	Communication, non-binding
Status	Published
Reference(s) to Green Infrastructure	<p>COM (2021) 82 final</p> <p>“Implementing nature-based solutions on a larger scale would increase climate resilience and contribute to multiple Green Deal objectives. Blue-green (as opposed to grey) infrastructures are multipurpose, “no regret” solutions and simultaneously provide environmental, social and economic benefits and help build climate resilience. For example...developing urban green spaces and installing green roofs and walls”.</p>
Assessment	<p>The Commission’s strategy on adaptation to climate change from 2021 clearly sets nature-based solutions, with green roofs and walls, as a no-regret solution when it comes to the adaptation to climate change but also given their numerous benefits. This strategy was key to creating an understanding of the benefits of these solutions going forward.</p>

BIODIVERSITY STRATEGY FOR 2030: BRINGING NATURE BACK INTO OUR LIVES

Legal nature

Communication, non-binding

Status

Published

Reference(s)
to Green
Infrastructure

COM(2020) 380 final

“Green urban spaces, from parks and gardens to green roofs and urban farms, provide a wide range of benefits for people. They also provide opportunities for businesses and a refuge for nature. They reduce air, water and noise pollution, provide protection from flooding, droughts and heat waves, and maintain a connection between humans and nature.”

“The promotion of healthy ecosystems, green infrastructure and nature-based solutions should be systematically integrated into urban planning, including in public spaces, infrastructure, and the design of buildings and their surroundings.”

“Planting trees and deploying green infrastructure will help us to cool urban areas and mitigate the impact of natural disasters.”

Assessment

The Commission’s communication for an EU Biodiversity Strategy for 2030 was the basis for the proposal on the Nature Restoration Law. In the document, the European Commission is clear that urban planning needs a system shift in how it envisages the integration of vegetated surfaces.

To bring nature back to cities and reward community action, the Commission calls on European cities of at least 20,000 inhabitants to develop ambitious Urban Greening Plans by the end of 2021. These should include measures to create biodiverse and accessible urban forests, parks and gardens; urban farms; green roofs and walls; tree lined streets; urban meadows; and urban hedges. They should also help improve connections between green spaces, eliminate the use of pesticides, limit excessive mowing of urban green spaces and other biodiversity harmful practices. Such plans could mobilise policy, regulatory and financial tools.

EUROPEAN PARLIAMENT RESOLUTION ON THE EU BIODIVERSITY STRATEGY FOR 2030: BRINGING NATURE BACK INTO OUR LIVES

Legal nature	Resolution, non-binding
Status	Published
Reference(s) to Green Infrastructure	P9_TA(2021)0277, point 50 “Highlights that green urban areas and green infrastructure can provide ecosystem services to support biodiversity and contribute to the physical and mental well-being of the population;”
Assessment	As a response to the Commission’s EU biodiversity strategy, the Parliament adopted a resolution further stressing the benefits of green infrastructure solutions.

EUROPEAN PARLIAMENT RESOLUTION ON THE REVISED POLLINATORS INITIATIVE

Legal nature	Resolution, non-binding
Status	Published
Reference(s) to Green Infrastructure	P9_TA(2023)0441, point 29 “Emphasizes the benefits of green roofs, vertical gardens and sustainable urban agriculture practices in providing habitats for pollinators and contributing to urban resilience and improved quality of life for city residents;”
Assessment	Following a quite timid Commission’s communication on the revised pollinators initiative regarding green infrastructure, the Parliament adopted an ambitious position on the initiative, highlighting again the benefits of green roofs and calling to incorporate the conservation of ecosystem services into urban planning (See point 27).

EUROPEAN PARLIAMENT RESOLUTION ON THE CONSEQUENCES OF DROUGHT, FIRE AND OTHER EXTREME WEATHER PHENOMENA: INCREASING THE EU'S STRENGTH TO FIGHT CLIMATE CHANGE

Legal nature	Resolution, non-binding
Status	Published
Reference(s) to Green Infrastructure	<p>P9_TA(2022)0330, point 6</p> <p>“Supports the Commission’s intention to contribute to an overall cooling effect by setting up an EU platform for urban greening; calls on the Commission to set ambitious and specific binding targets on urban biodiversity, nature-based solutions, ecosystem-based approaches and green infrastructure, which would benefit both humans and wildlife and contribute to the overall biodiversity targets; stresses the need to include measures such as a minimum share of green roofs on new buildings, supporting urban farming, including the use of productive trees, where appropriate, ensuring that no chemical pesticides are used and reducing fertilizer use in EU urban green areas, and increasing the number of green spaces in line with the number of inhabitants;”</p>
Assessment	<p>This document is another strong position from the European Parliament in support of Green Infrastructures for their short and long term contribution to mitigate and adapt to extreme weather events. In particular, the Parliament clearly calls for specific binding targets on urban biodiversity.</p>

EU LEVEL TECHNICAL GUIDANCE ON ADAPTING BUILDINGS TO CLIMATE CHANGE

Legal nature	Guidance, non-binding
Status	Published
Reference(s) to Green Infrastructure	<p>Green roofs are mentioned multiple times and presented on several occasions as a climate adaptation solution for a variety of climate risks namely for heat waves, for heavy storms and rainfalls, and severe droughts. It is also underlined as a way to improve the performance of photovoltaic panels.</p>
Assessment	<p>The Commission shared two documents, a technical guidance and best practices for implementation. The technical guidance provides a policy overview and support for actors to conduct climate vulnerability and risk assessments for buildings while the best practices guidance provides examples of climate adaptation measures for new and existing buildings. In the latter, green roofs are present several times and recognized as a beneficial climate adaptation solution.</p>