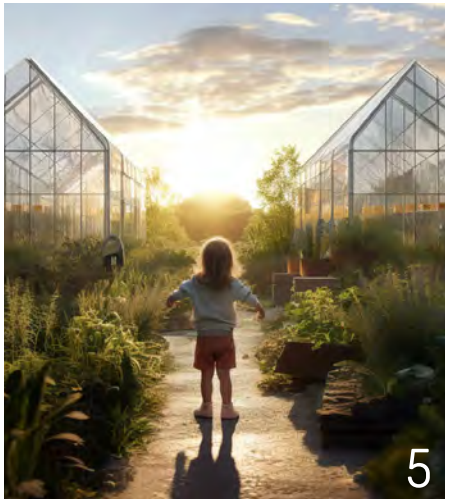
Urban Insight
By Sweco

Regenerative neighbourhoods - where people and nature flourish

SWECO

How do we design future neighbourhoods by regenerative design together?



Regenerative design is important in the context of the new Nature Restoration Law because it emphasizes creating systems that restore and enhance natural ecosystems, rather than just minimizing harm.

Cities have great opportunities to increase green-blue spaces within the built environment as support to ecosystems and social well-being.

'Greening cities' by integrating green-blue infrastructures is a promising approach. However, green infrastructure alone is insufficient for creating regenerative urban environments.

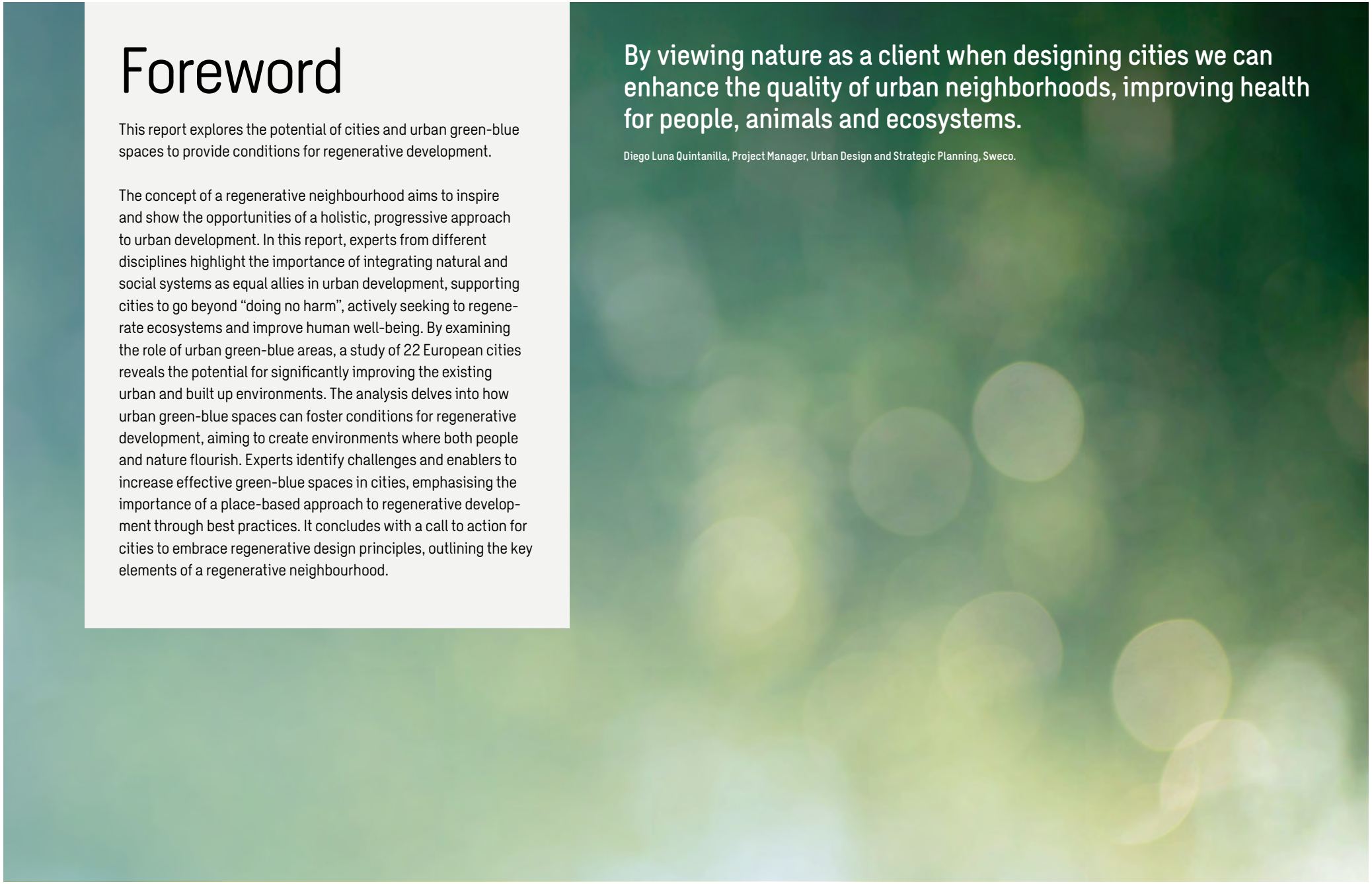
Regenerative neighbourhoods - where people and nature flourish

Content

Foreword

This report explores the potential of cities and urban green-blue spaces to provide conditions for regenerative development.

The concept of a regenerative neighbourhood aims to inspire and show the opportunities of a holistic, progressive approach to urban development. In this report, experts from different disciplines highlight the importance of integrating natural and social systems as equal allies in urban development, supporting cities to go beyond “doing no harm”, actively seeking to regenerate ecosystems and improve human well-being. By examining the role of urban green-blue areas, a study of 22 European cities reveals the potential for significantly improving the existing urban and built up environments. The analysis delves into how urban green-blue spaces can foster conditions for regenerative development, aiming to create environments where both people and nature flourish. Experts identify challenges and enablers to increase effective green-blue spaces in cities, emphasising the importance of a place-based approach to regenerative development through best practices. It concludes with a call to action for cities to embrace regenerative design principles, outlining the key elements of a regenerative neighbourhood.



By viewing nature as a client when designing cities we can enhance the quality of urban neighborhoods, improving health for people, animals and ecosystems.

Diego Luna Quintanilla, Project Manager, Urban Design and Strategic Planning, Sweco.

Introduction to regenerative design

Cities face environmental challenges due to exploitation of natural environments, high resource consumption and pollution. A regenerative design approach views cities not in isolation but as part of a larger ecological whole. In a regenerative neighbourhood, natural and social systems are integrated as equal partners. This concept encourages cities to move beyond merely neutral impact towards actively regenerating natural systems and enhancing human well-being. By designing cities that give back more than they take, we can create harmonious communities where both people and nature thrive. How do we design those neighbourhoods together?

Image: Biotopia. Vision project by Sweco Architects.

Cities face environmental challenges due to their exploitation of natural environments, high consumption of resources like water, energy, and materials, and their significant contribution to environmental pollution, intensifying the societal challenges linked to equity, access to opportunities, affordability and social justice. Yet there are tremendous opportunities to transform cities into more resilient and regenerative urban environments.

The concept of a regenerative city envisions urban areas as integral parts of a greater ecological whole, rather than isolated entities. Cities and municipalities should aim not only for neutral impact but also for actively regenerating both ecological and social systems. Adopting regenerative development principles will support cities to go beyond environmental challenges: regenerative development is about humans' place in nature and the place that we give nature in our life. A regenerative neighbourhood actively helps to enhance both the natural and social systems it interacts with. Existing neighbourhood´s have great opportunities to expand and enhance their green-blue spaces, supporting both ecosystems and social well-being. Beyond their ecological value, urban green-blue spaces play a fundamental role in reinforcing neighbourhoods and communities, with positively impacting social inclusion, equity, health and climate justice among other social values.

With this report, Sweco explores the untapped potential of cities to create conditions for incorporating regenerative principles, with a particular focus on the potential of green-blue spaces within the existing urban fabric. We also advocate for a shift away from simply pursuing "doing no harm" towards actively restoring and regenerating ecosystems. This approach will not only benefit natural systems but also contribute to more resilient, healthy and socially inclusive living environments for future generations.

What is regenerative development?

Regenerative development goes beyond simply addressing environmental challenges and biodiversity loss. It focuses on our role as humans within nature and the importance of preserving the natural world.

Currently cities tend to get the majority of their essential resources (energy, food, water and materials) from outside their urban boundaries. Regenerative urban development promotes a restorative

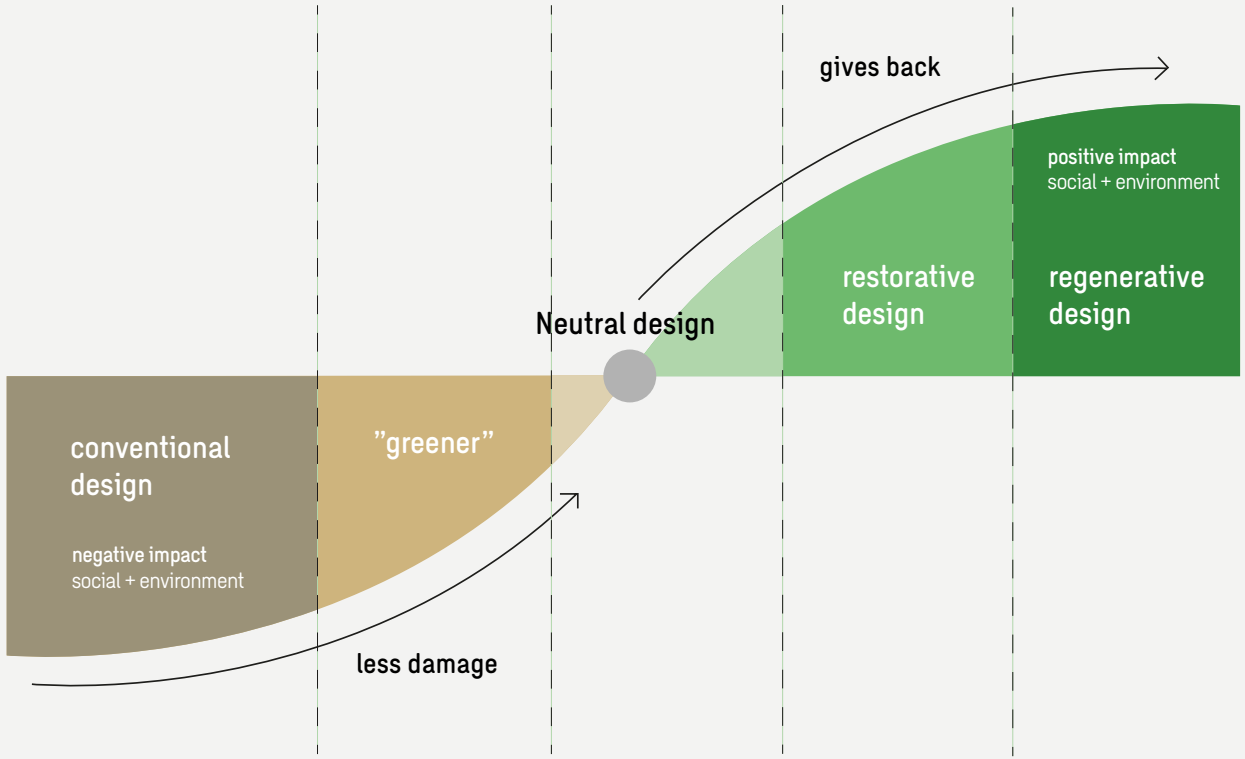
relationship with the natural systems that cities get their resources from[1]. It supports a symbiotic relationship between a city and its surroundings, and minimises environmental impact by regenerating the productive capacity of the ecosystems that inhabitants depend on.[2] Regenerative design not only reduces harm to the environment but actively improves it. It goes beyond neutral impact by restoring and repairing ecosystems, improving human well-being, and enabling resilient thriving communities.

According to regenerative principles, humans are not seen as separate from nature. Instead, they are recognised as integral components of a larger interactive ecosystem of living things and their non-living habitat, working in harmony with it.[3] This integrated systemic approach is also consistent with the One Health principle recommended by the World Health Organisation and the United Nations. One Health aims to sustainably balance and optimise the health of people, animals and ecosystems. It recognises that the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent.[4]

The planetary boundaries framework is a scientific concept that outlines the environmental limits within which humanity can safely operate. Unfortunately, we have already exceeded six of the nine critical planetary boundaries.[5] Exceeding these boundaries increases the risk of irreversible environmental changes that could jeopardise human well-being and the planet's health. Achieving a neutral impact on our support systems – environmental, social, and economic – is no longer sufficient.

Going beyond neutral impact

According to Pamela Mang and Bill Reed from the Regenesis Institute for Regenerative Practice and Herbert Girardet from HafenCity University Hamburg, regenerative development is a societal shift from doing less damage to actively giving back to the environment, encompassing several levels of ecological design.



Source: Sphera Sostenible.

Conventional design generally limits itself to meeting the minimum legal requirements, without giving much thought to the environmental impact that a design may have.[6] This trend has gradually evolved, giving rise to "greener" designs that seek to reduce the harmful effects on both the environment and society. However, despite the rise in environmental and social ambitions, these efforts have not significantly transformed our production and consumption models,[7] and their impact remains relatively modest.

Neutral design takes green design one step further, aiming for a neutral impact on the environment and maximum resource efficiency. It seeks to minimise or eliminate its impact altogether.

Restorative design aims to give back more to the environment than a project uses, progressively restoring the capacity of ecological systems and biogeological cycles. It seeks to ultimately reverse the negative impacts of human intervention. "Restorative approaches seek to improve current systemic performance, returning living systems to a state of health".[8]

Regenerative design "embeds the capacity to continue to improve performance through time and through varying environmental conditions".[9] It considers human development as inherent parts of social-ecological systems. Therefore, the social systems and behavioural changes are at the heart of regenerative design, understanding the diversity and uniqueness of each place (socially, culturally and environmentally) as crucial to the design process.[10] This integration promotes holistic and resilient solutions that are more likely to succeed and be embraced by the communities they serve.

Since regenerative development is an overarching holistic concept, it can mean different things in different fields. While implementing positive energy districts, community-driven urban agriculture, or collective rainwater management systems are certainly integral to building regenerative cities, they are part of a broader vision of this concept. Taking into account the human-nature balance in regenerative development, Sweco experts have helped identify the following social and cultural aspects as fundamental drivers:

1. Holistic approach: Regenerative design aims to create sustainable systems that integrate environmental health, economic vitality, and social equity. Addressing social and cultural concerns ensures that the design is not just ecologically sound but also socially inclusive and equitable.
2. Community engagement: Involving local communities in the design process ensures that the solutions are tailored to their specific needs and values. This leads to higher acceptance, more effective implementation, and the project's long-term sustainability.
3. Behavioural change: Sustainable practices often require changes in behaviour. Understanding and integrating social and cultural norms can facilitate these changes, making sustainable practices more natural and easier for people to adopt.
4. Cultural values: Respecting and incorporating cultural heritage helps in preserving local identities and traditions. This can enhance the sense of place and community, fostering a deeper connection between people and their environment.
5. Social equity: Regenerative design seeks to address social inequities by ensuring that the benefits of sustainable development are distributed fairly. This includes providing access to resources, healthy living conditions, and opportunities for all community members.
6. Resilience: Social and cultural diversity contributes to the resilience of communities. By valuing and integrating diverse perspectives and knowledge systems, regenerative design can create more robust and adaptable solutions to environmental and social challenges.

By considering these aspects, regenerative design not only aims to restore and regenerate natural ecosystems but also to create thriving, resilient, and equitable human communities.

Visualisation by Sweco.

Why regenerative design is necessary for nature and health

The decline of biodiversity is progressing at an alarming rate and scale, triggering a chain reaction. The latest updates from the European Environment Agency[11] show that in Europe, 81% of protected habitats are in poor condition, with 36% deteriorating and only 9% improving.

Over the next decade, the interplay between biodiversity loss, pollution, depletion of natural resources, climate change, and socioeconomic forces will lead to a dangerous convergence of environmental and societal issues.[12] According to the WEF Global Risks Report for 2023 and 2024, biodiversity loss and ecosystem collapse are among the most severe consequences of broader systemic failures and are emerging as one of the fastest deteriorating global risks of the coming decade.

The World Health Organization (WHO) and the United Nations recognize the global "triple crisis' – biodiversity loss, environmental pollution, and the health crisis – as interconnected, threatening the well-being of both humans and our planet.[13] The collapse of ecosystems will have far-reaching economic and societal consequences, affecting everything from rising food prices to public health and social inequality.

In fact, human health and the health of the planet are intrinsically interconnected. The WHO estimates that 24% of the global disease burden is attributable to environmental factors.[14]

By 2030, 44% of the global gross domestic product (GDP) in cities will be at risk due to biodiversity loss.[15] This includes impacts on industries that directly depend on healthy ecosystems and biodiversity, such as agriculture, fisheries, recreation and tourism. The degradation of ecosystem services like pollination, water purification, and climate regulation will severely disrupt the global economy.

The implementation of the EU´s Nature Restoration Law, which was formally adopted on 17 June 2024, makes this topic even more relevant. Under the new law, EU member states must submit national restoration plans to the Commission showing how they will deliver on the targets. They will also be required to monitor and report on their progress. At least €20 billion a year should be allocated from the 2021-2027 EU budget for spending on biodiversity.[16] Additionally, the EU is set to spend at least 30% of its budget on climate-relevant objectives.

The regulation combines an overarching restoration objective for the long-term recovery of nature in the EU's land and sea areas, and sets binding restoration targets for specific habitats and species. These measures should cover at least 20% of the EU's land and sea areas by 2030, and ultimately all ecosystems in need of restoration by 2050.

Regenerative design is important in the context of this new law because it emphasises creating systems that restore and enhance natural ecosystems, rather than just minimising harm.

The EU Nature Restoration Law

To ensure the continued provisions of ecosystem services to European citizens, the EU´s Nature Restoration Law requires member states to take these actions:

- Halt the loss of urban green and increase urban green space and urban tree canopy cover
- Restore the natural connectivity of rivers and the natural functions of related floodplains
- Halt and reverse pollinator decline
- Restore and rewet peatlands under agricultural use
- Put in place measures aiming to increase farmland bird populations and to achieve a positive trend in certain other key biodiversity indicators in agricultural ecosystems
- Achieve a positive trend in a range of biodiversity indicators in forest ecosystems
- Contribute to the EU-level commitment of planting at least three billion additional trees by 2030

Restoring balance: How can cities lead the way towards resilience?

A city is a place where diverse interests must coexist, often in a small area. Today, many cities also have densification as a goal for urban development. This, in turn, creates new challenges, such as reduced access to various types of green infrastructure for both people and nature, and a noisier urban environment with its consequences for the environment and health.

As cities grow and densify, they tend to lose green-blue spaces and biodiversity. Paving over natural surfaces, removing trees, canalising waterways, and planting uniform vegetation can potentially turn spaces into ecological 'dead zones' with diminished ecosystems, leaving them even more exposed to flooding, heatwaves, and other effects of climate change. This harms the ecosystem services that all people rely on. However, instead of exerting more pressure on already limited natural resources, it is crucial to shift our focus towards upgrading our environment to become resource positive.

The challenge today goes beyond creating urban areas with neutral impact. As the next step in the journey of resilience, cities should not just become resource-efficient and low-carbon, but should positively enhance rather than undermine the ecosystem services they receive from beyond their boundaries.

With regenerative design, each development project has the potential to include nature as an equal partner in the design and planning process. By repairing damaged ecosystems or creating new natural systems, cities can enhance ecological connectivity and give back to nature. Enhancing biodiversity and ensuring that nature continues to provide essential services (such as clean water and air and pollinating crops).

Today, three quarters of all EU citizens live in cities, suburbs, and towns.[17] Since this number is projected to increase, it is imperative for the EU to prioritise urban action as a key element in its nature restoration efforts. Healthy and resilient urban ecosystems and biodiversity are key to ensuring the resilience of European cities. Although research is still going on to understand the exact connections and causative pathways, they seem to provide benefits in several areas of climate change mitigation and adaptation, reducing the negative effects of noise and air pollution, food security, and human health and well-being.[18]

Visualisation by Sweco.

Urban green-blue spaces support ecosystems and well-being

Urban growth presents both opportunities and challenges for achieving the EU Nature Restoration Targets, particularly in enhancing urban ecosystems. Although the overall population in Europe is projected to fall slightly up to 2050,[19] the number of inhabitants living in capital city metropolitan regions is projected to increase 6.8% overall from 2021 to 2050. Projections also suggest that the number of inhabitants living in metropolitan regions, other than the capitals, will increase slightly up to 2050. In some countries, like Sweden and Ireland, the number of inhabitants in metropolitan regions is projected to increase by more than 20.0%.[20] In a more urbanised Europe, how can cities help meet the EU Nature Restoration Targets related to urban ecosystems? Furthermore, can cities provide the conditions for regenerative practices?

Taking into account the importance of urban green-blue spaces as a fundamental support for ecosystems, the EU Nature Restoration Law sets a series of objectives that seek to secure no net loss of green urban space and tree cover by 2030, and a steady increase in their total area from 2030 onwards.

Moreover, according to a European Environment Agency (EEA) review, the degree of greening within cities varies across neighbourhoods, with less and lower quality green space typically found in communities of lower socio-economic status. The EEA highlights that more action is needed to reduce inequalities in access to high-quality green space to maximise the health and well-being benefits of nature in cities.[21] The United Nations concluded that through the creation of green-blue spaces, nature-based solutions can be used to address certain social challenges in urban areas as they pertain to climate change. This improves the cities' resilience to climate change, enhances residents' quality of life, and increases biodiversity in the city.[22]

From grey to green:

Analysing 22 European cities' potential for expanding urban green-blue areas

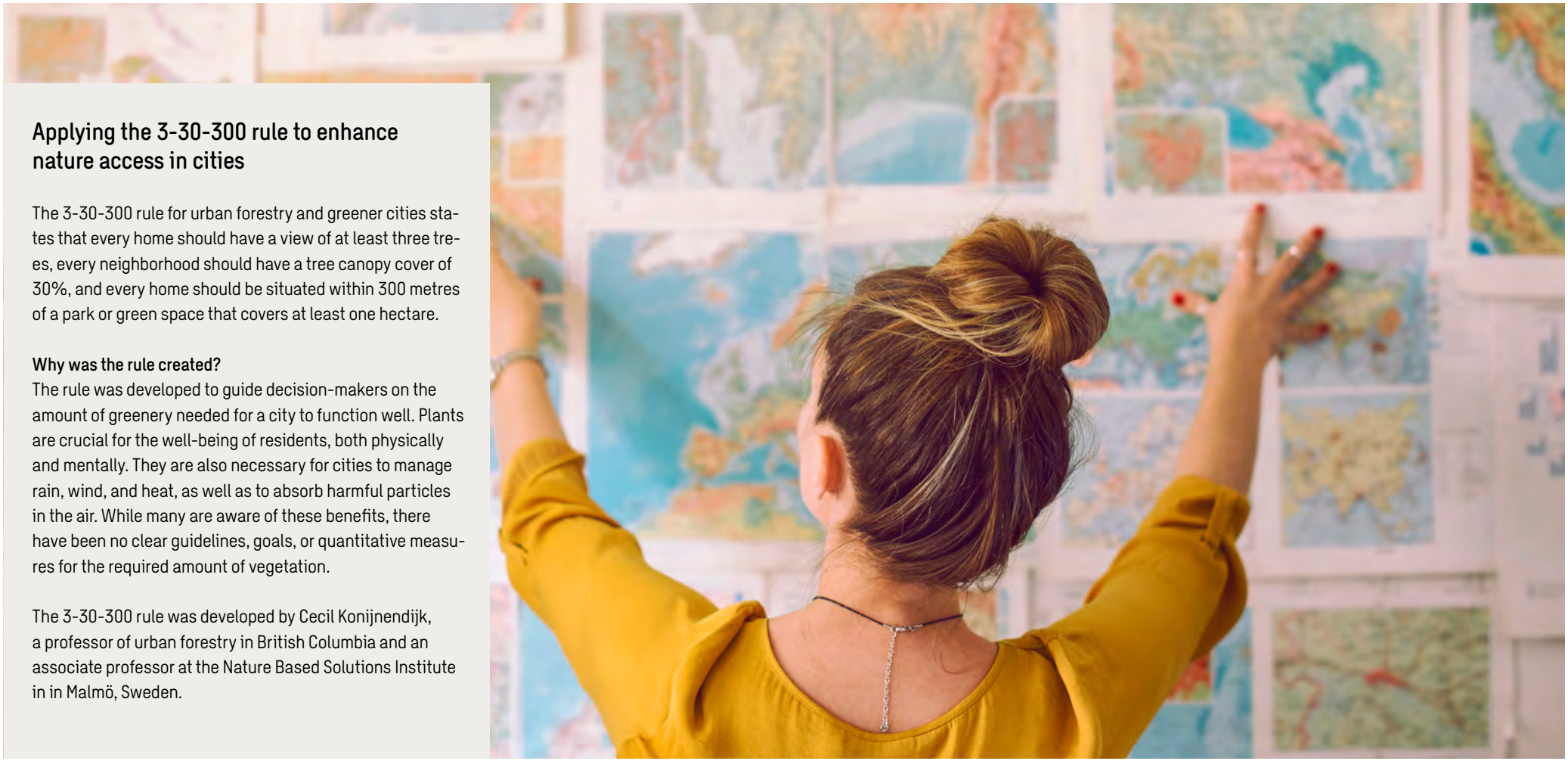
Recognising the pivotal role of green-blue spaces, Sweco's study of 22 northern European cities explores both the current state and potential increase of green-blue cover within existing built-up urban areas. This research highlights the significant opportunity for creating conditions for regenerative development through greener and more liveable cities.

Almanakken, Vision project by Sweco Architects highlighting a regenerative neighbourhood. The name of the project, the Almanac, refers to the changing seasons and cyclic regularity of nature.

One of the great challenges for the improvement and increase of urban ecosystems is that cities are already built. Gaining extra space within urban contexts entails a number of barriers linked to land use, real estate market dynamics, and land ownership as well as associated financial, planning and governance models. This is particularly relevant when creating additional large green areas, which are only possible in the context of ambitious urban renewal operations (public and private). However, the potential of smaller green-blue spaces, which are more organically integrated into the built fabric, should not be underestimated: urban blocks, infrastructure and industrial parks have the potential to largely increase their green-blue cover.

To analyse the current amount of surface area occupied by green-blue spaces within built-up urban areas, Sweco conducted a study of 22 European cities. Based on these findings, we also evaluated the potential for these cities to increase their net surface cover of green-blue elements within the existing urban footprint, as a first condition to reinforce and increase urban ecosystems.

Opportunities for ecosystem restoration of natural and agricultural zones and green urban areas were not assessed, but should be equally treated in relation to regenerative design of neighbourhoods. These zones do not only provide services to city dwellers, but they are core areas for species to forage, reproduce and migrate, while the urban habitats provide a fine connective mesh that offers food and nesting for urban species.



Applying the 3-30-300 rule to enhance nature access in cities

The 3-30-300 rule for urban forestry and greener cities states that every home should have a view of at least three trees, every neighborhood should have a tree canopy cover of 30%, and every home should be situated within 300 metres of a park or green space that covers at least one hectare.

Why was the rule created?
The rule was developed to guide decision-makers on the amount of greenery needed for a city to function well. Plants are crucial for the well-being of residents, both physically and mentally. They are also necessary for cities to manage rain, wind, and heat, as well as to absorb harmful particles in the air. While many are aware of these benefits, there have been no clear guidelines, goals, or quantitative measures for the required amount of vegetation.

The 3-30-300 rule was developed by Cecil Konijnendijk, a professor of urban forestry in British Columbia and an associate professor at the Nature Based Solutions Institute in in Malmö, Sweden.

The analysis was performed using the Copernicus database from the European Earth observation programme, specifically the Urban Atlas (land use data) and landcover data of green-blue cover (trees, small woody features, grass and water). The data selection was made based on the definition of green features as stated in the Nature Restoration Law and the available, homogeneous datasets at European level. This analysis focussed specifically on land-use classes that can be considered urbanised surfaces within the administrative perimeters: roads, urban fabric, industrial, public and commercial zones, sports facilities, railways, airports, and ports. Other land use classes considered permeable open spaces, such as parks, agricultural zones, water bodies, and natural areas within the administrative perimeters were not included in the analysis.

Based on Eurostat's population projections for the capital city metropolitan regions and the non-capital metropolitan regions, a group of 22 cities in Europe was chosen: Amsterdam, Antwerp, Bergen, Berlin, Brno, Brussels, Copenhagen, Dublin, Gothenburg, Helsinki, Krakow, London, Munich, Oslo, Prague, Rotterdam, Stockholm, Stuttgart, Tallinn, Tampere, Vilnius and Warsaw.

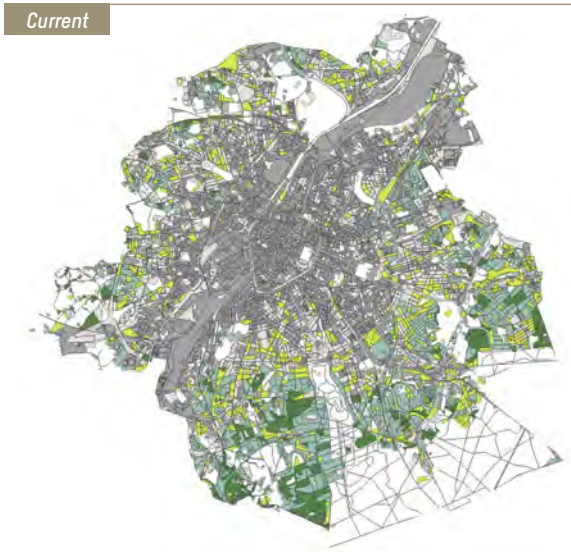
- The first part of the analysis evaluated the existing proportions of green-blue cover per land use class.
- The second part of the analysis evaluated the potential to increase the green-blue cover per land use class in the built environment (roads, urban fabric, industrial, public and commercial zones, sports facilities, railways, airports, and ports).
- The third part of the analysis evaluated the impact on human, environmental and animal health of the potential increase of green-blue cover when applying regenerative principles.

Increasing urban green-blue cover in cities

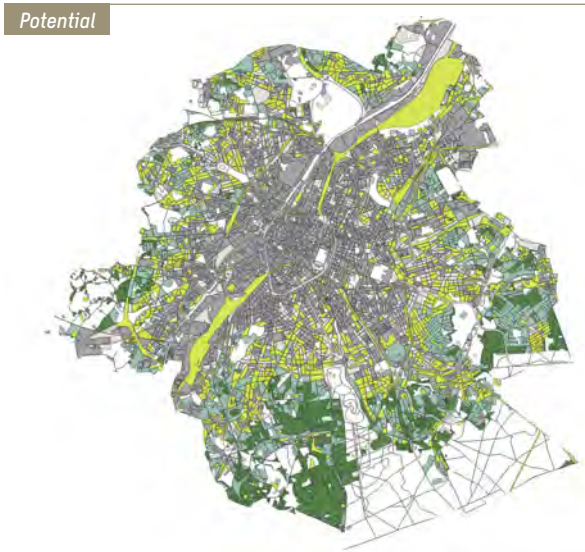
Green-blue cover %

0 –15 15 – 30 30 – 40 40 – 60 60 – 80

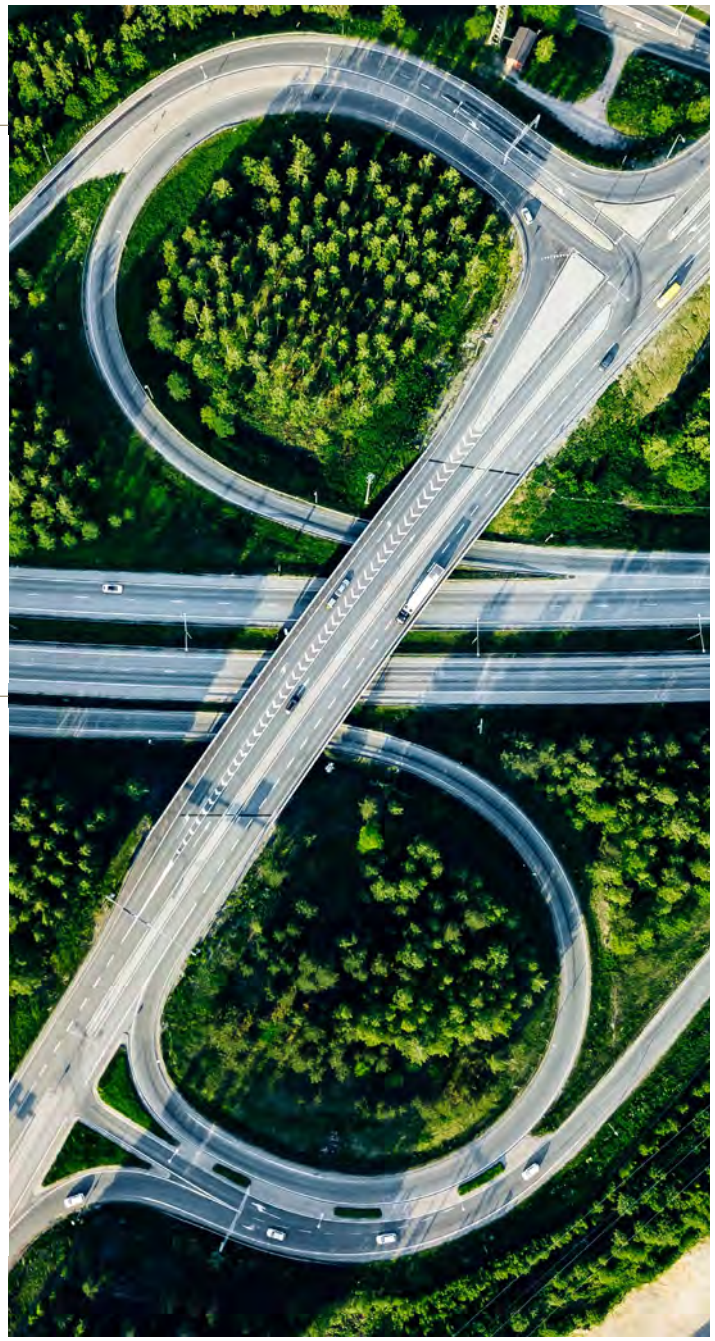
Current



Potential

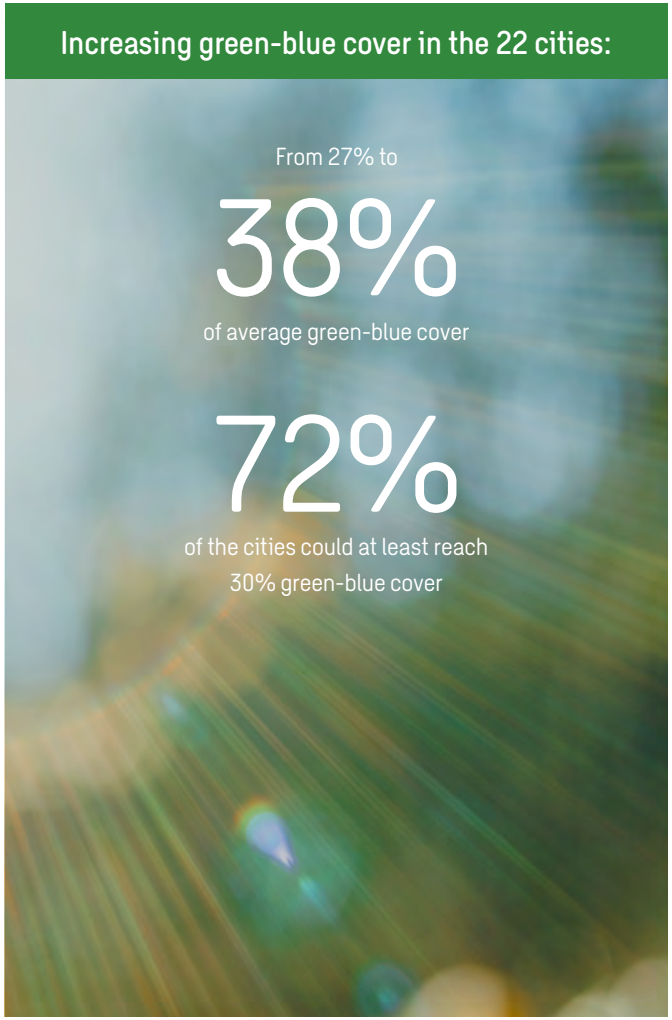


Maps of Brussels. The current green-blue cover in the built environment is 24% but it could increase up to 32%.This publication has been prepared using European Union's Copernicus Land Monitoring Service information. These products have been produced with funding by the European Union.[38]

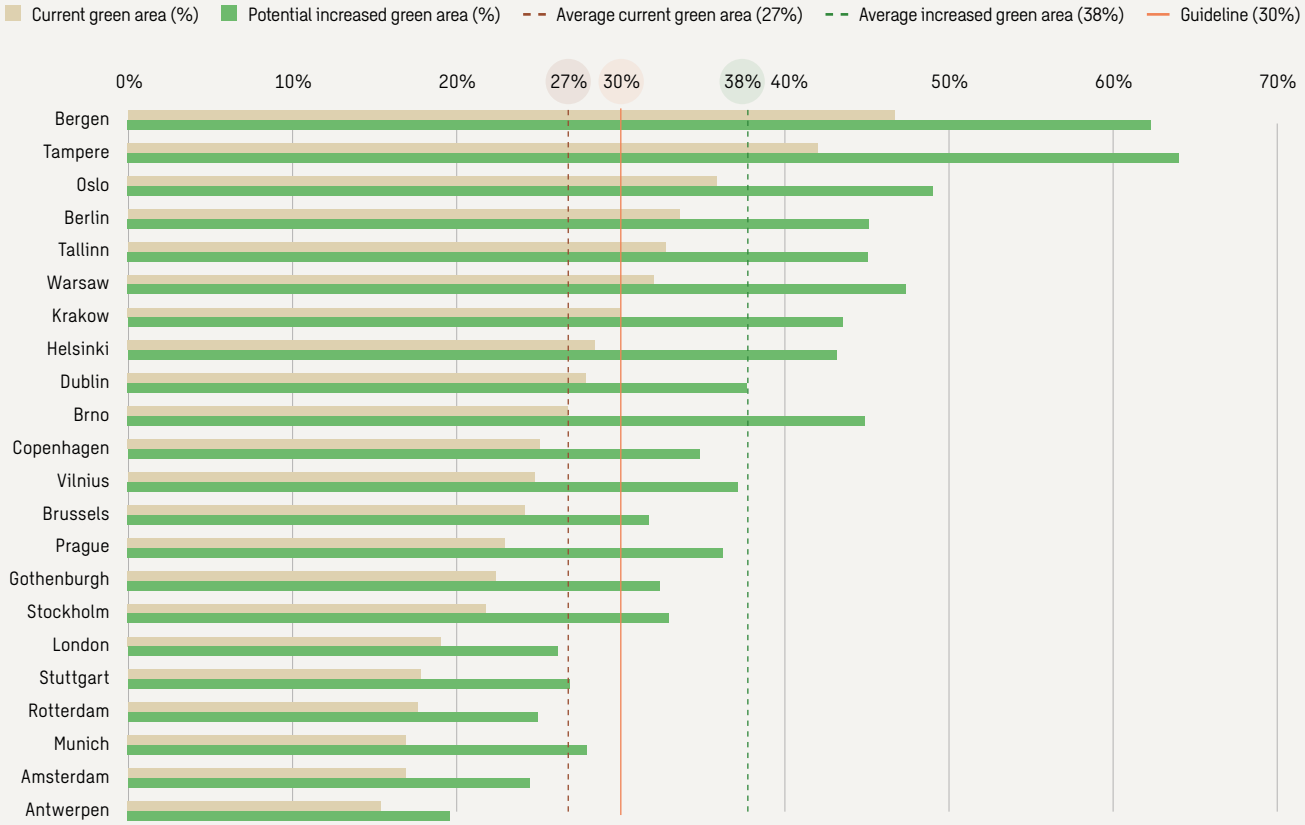


Potential to increase urban green-blue areas

The green-blue areas for each land use class were calculated by summing the high-resolution layers of four land cover types: trees, small woody features, grass, and water. Focusing on the level of green-blue areas within the built environment of the cities, Bergen is the greenest with 47%, and Antwerp, Amsterdam and Munich are the least green with about 17% each. In absolute terms, however, London has the highest amount of green in built areas with 22.286 ha. Overall, the 22 cities have an average of 27% green-blue areas within their built environments, totaling 133,262 hectares across all cities. This is comparable to the size of the Faroe Islands or half of Luxemburg. To estimate the potential of new green-blue infrastructure, a statistical approach was used to determine a realistic percentage of green-blue and its composition (trees, shrubs, grass and water) that could be achieved in each land use class.[23] This potential is based on the current percentage of green-blue cover of



Cover of green-blue in the built environment



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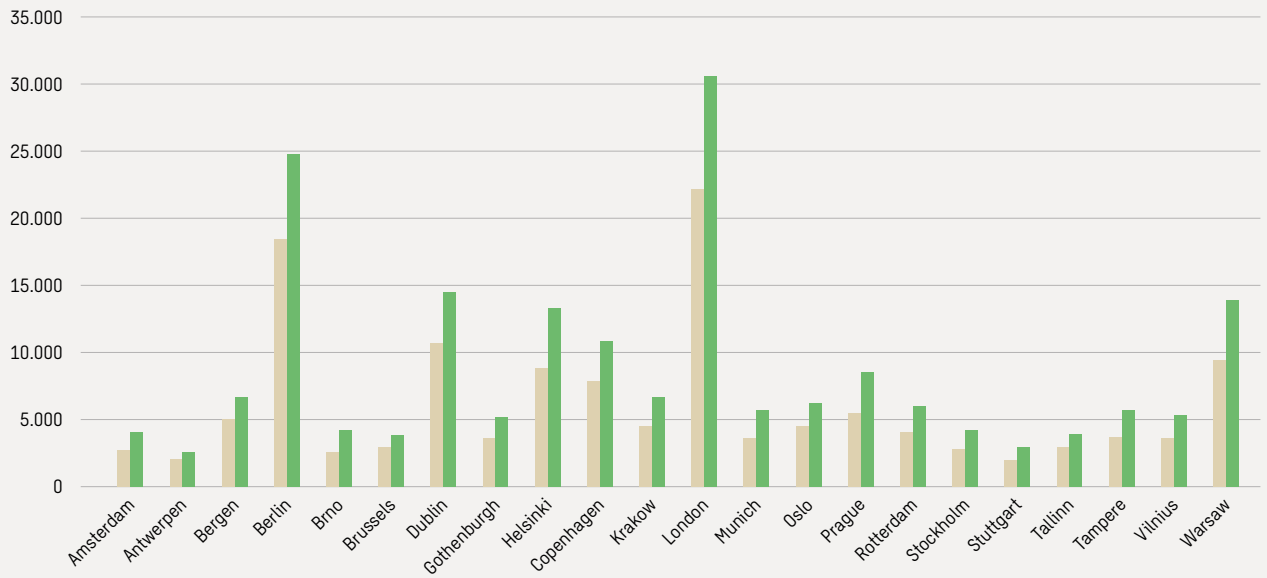
the areas with the highest share (75th percentile) of green-blue in each land use. Since this percentage is already achieved in specific areas of some cities, we infer that it could also be a potential in other areas of those same cities with the same land use. Local opportunities and limitations must always be considered at the project level through regenerative design principles, and the percentage should be used as an inspirational guideline. This method can also inspire designers by providing references for methods or greenforms that work within this specific land use and city.

Evaluating the potential of the 22 cities to increase their green-blue urban areas, we found that London has the potential to increase its green-blue cover by 8.436 ha, improving from 19% to 26% of its built environment. Based on the data analysis, this can mainly be attributed to relative high greenness in some zones of dense and medium density urban fabric and that both land uses together comprise 41% of the total area of the city. The city that has the least potential for increasing its green-blue area is Antwerp with 538 ha, which is less than a 1% change. This is due to relatively homogeneous levels of green over the city, combined with small absolute areas of built-up areas.

Proportionally, Tampere has the largest potential to increase its green-blue cover, from 42% to 64%. Based on the data analysis, this can mainly be attributed to high green-blue levels in some parts of the city, where roads, industrial/commercial/public zones, and low density urban fabric contribute the most to the overall increased green percentage in the built environment. The cities with the lowest proportion of green-blue cover, Amsterdam and Munich, have the potential to increasing their share to 25% (+8%) and 28% (+11%), respectively.

If we look at the aggregated numbers, all 22 cities have the collective potential to include 56,290 ha more green-blue in the built environment, an increase from 27% to 38%. To put this into perspective, this area is equivalent to 400 times the size of Hyde Park in London (140 ha), 500 times the city center of Tallinn (113 ha), or seven times the Port of Rotterdam (8,114 ha). This comparison highlights the potential impact of measures and policies that seek to increase urban green-blue areas.

Green-blue cover in the built environment



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Increasing green-blue cover in the 22 cities:

From 133,000 to

189,552

hectares green-blue area

+56,290

extra hectares of green-blue in the built environment

42%

increase in green-blue surface area

The potential of additional green-blue cover in the 22 cities is equivalent to:

Hyde park in London (140 ha)

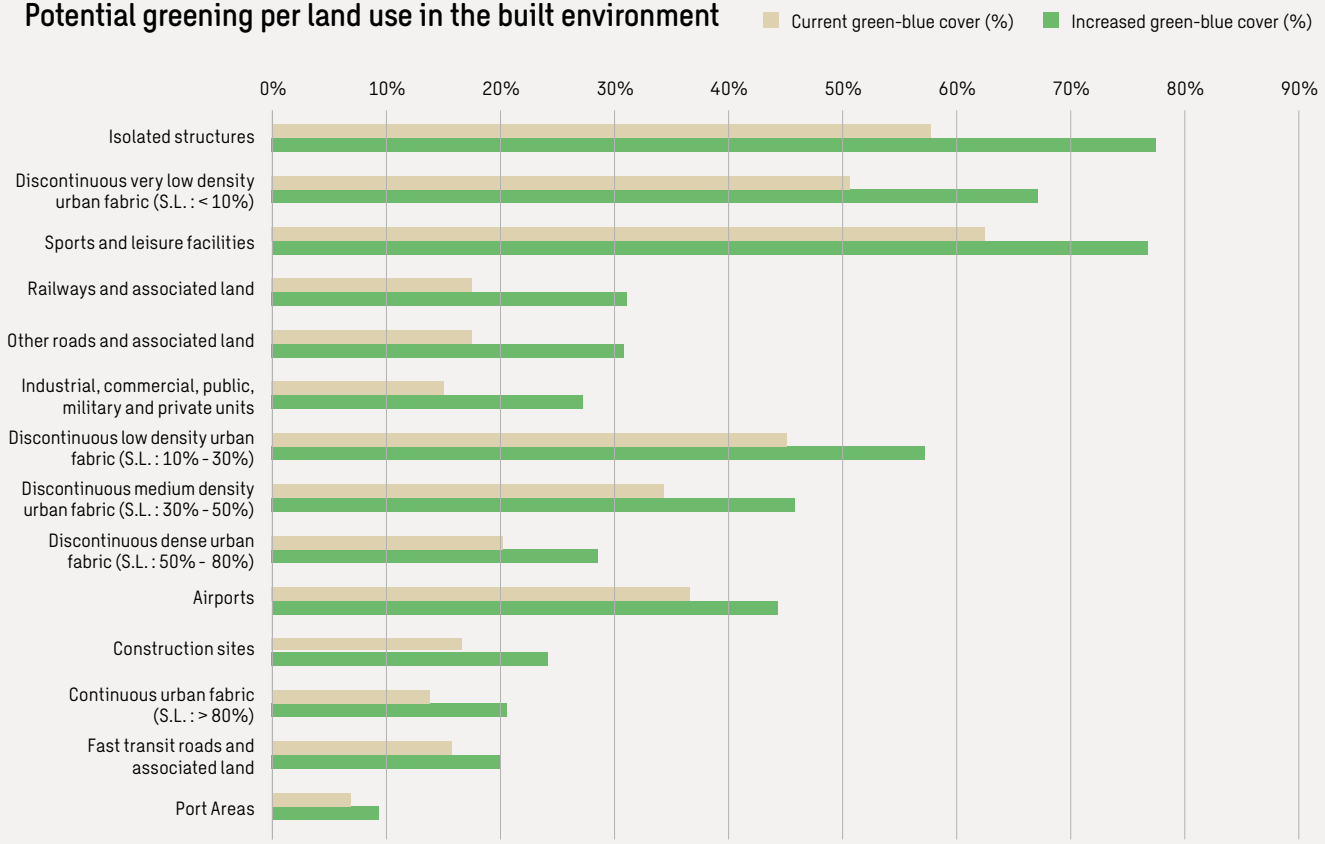
Port of Rotterdam (8.114 ha)

Centre of Tallinn (113 ha)

Looking at the land use classes separately, we see large differences in absolute greening potential when aggregating the over all 22 cities. The land use classes 'industrial, commercial, public, military and private units' and 'discontinuous dense urban fabric (sealing 50%-80%)' have by far the largest potential of 12,555 ha and 10,776 ha additional green-blue cover, respectively. Roads and sport and leisure infrastructure also have a significant greening potential. The land uses below differ greatly in terms of use as well as property structure (public vs private owners). The speed and ease of greening these cities vary, necessitating tailored strategies such as large-scale public projects or targeted subsidies to ensure effective implementation.

When prioritising urban development, it's best to combine local knowledge about interest in greening with a data-driven approach. Considering both the modeled additional green hectares (which impact the environment and biodiversity) and the potential increase in green-blue cover (linked to mental health and the goal of 30%) can help with decision-making. For example, prioritise land uses with

Potential greening per land use in the built environment



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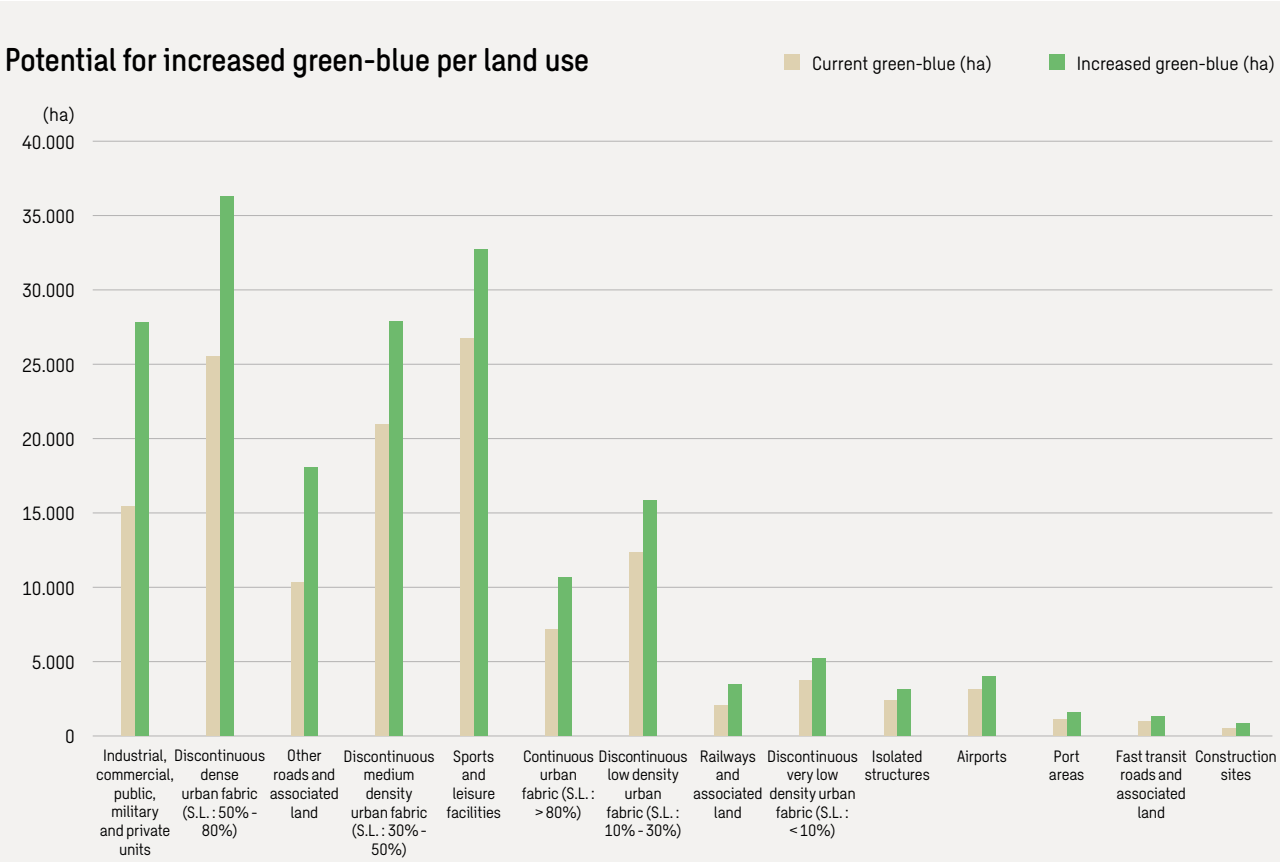
limited existing green space but significant growth potential (over 30%) over those with abundant green space but limited opportunities for expansion.

Additionally, converting abandoned land uses like dumpsites, mines, or old industrial sites into new natural or green urban areas can make a significant contribution to urban development (5,393 ha).
In the short term, land without current use (4,868 ha) can be temporarily developed into species-rich areas with pollinator-friendly grasslands, tiny forests, and ponds.

In urban development, combining local insights with a data-driven approach is crucial to implement greening measures. Local policy makers could, for instance, prioritise subsidies, communication and education efforts for certain land uses based on data regarding area and percentage potential in order to optimise outcomes.

Tobias Nauwelaers, Senior Project Leader, Nature Restoration and Urban Ecology, Sweco.



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Impact from increased green-blue areas in cities

It is important to emphasise that the green-blue surface is not an end in itself. Within the principles of regenerative development, it serves as a foundation for qualitative landscape and ecosystem interventions that create the necessary conditions for nature and society to thrive as an integrated system. This approach aligns with the One Health principle, endorsed by the World Health Organization and the United Nations, which advocates for the interconnected health of humans, animals, and ecosystems.[24]

The 3+30+300 guideline, which is being implemented in cities and towns across the world, is based on some of the latest research on the contributions of trees and green space, especially to climate action and public health promotion. Using the values obtained from the previous analysis, an impact analysis of the potential ecosystem services was performed, using the One Health approach and 3-30-300 guideline[25] as a base.

Applying certain quality standards to the potential increase of 56,290 ha of green-blue areas can have positive effects on people's health, the health of ecosystems, and animal health, as shown in the following pages.

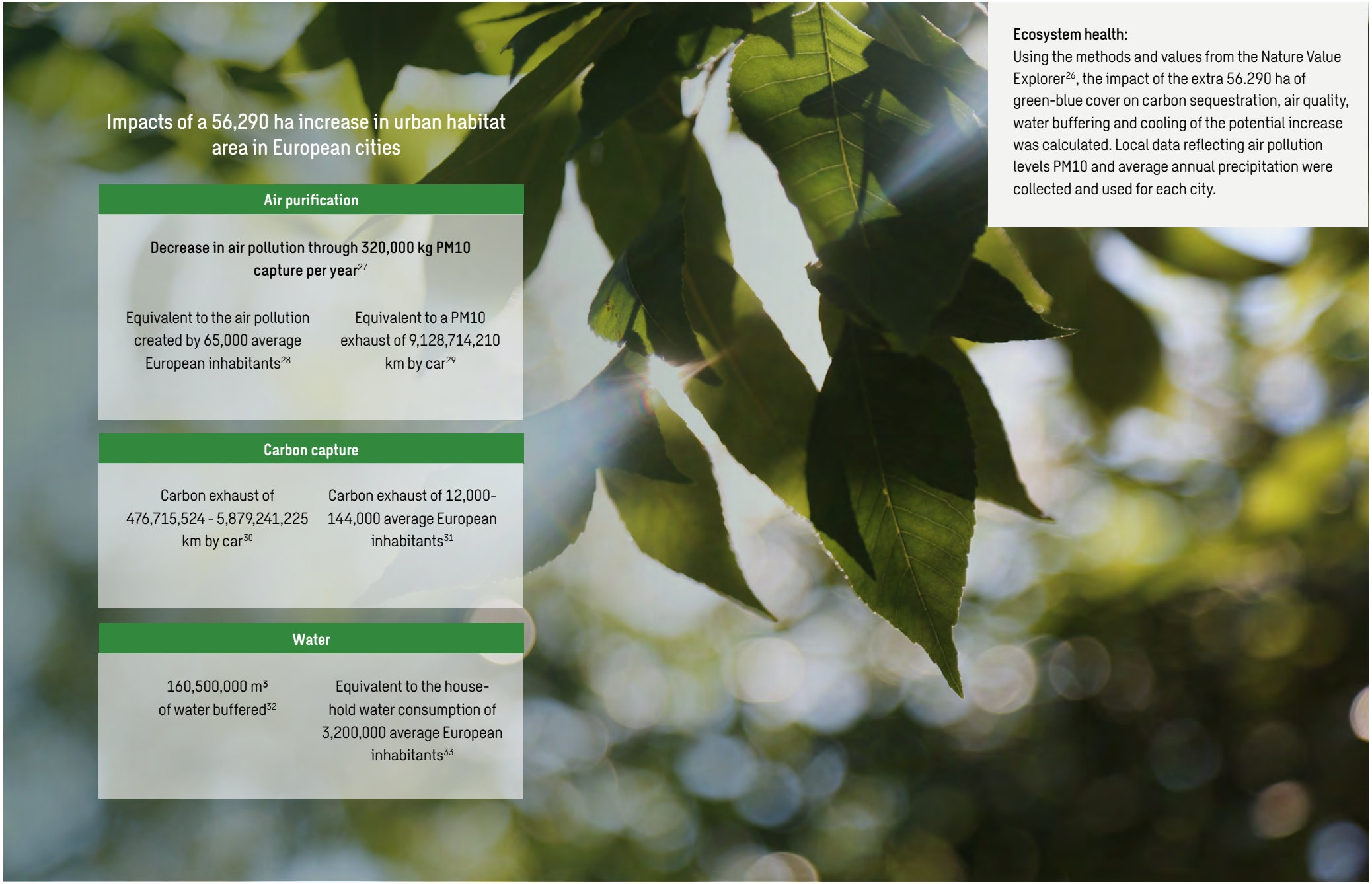
Cecil Konijnendijk. Photographer: Yosr Hmam Spit.

Implementing the 3+30+300 greening guideline can lead to significant cost savings, such as reduced cooling and air conditioning demands and lower public healthcare expenses due to healthier lifestyles. This guideline is versatile and can be applied across various scales, from urban regions to individual neighborhoods, as well as specific sites like hospitals and schools.

Cecil Konijnendijk, founder, Nature Based Solutions Institute

Human health:
To assess the potential impact of increased green-blue areas on human health, the effect on tree canopy cover per neighborhood was calculated, following the 30% guideline.

Secondly, access to green urban areas (300 m guideline) was calculated based on the assumption that new developments allow for semi-public green infrastructure, and that building blocks and streets form interconnected urban green areas.



Impacts of a 56,290 ha increase in urban habitat area in European cities

Air purification

Decrease in air pollution through 320,000 kg PM10 capture per year[27]

Equivalent to the air pollution created by 65,000 average European inhabitants[28]

Equivalent to a PM10 exhaust of 9,128,714,210 km by car[29]

Carbon capture

Carbon exhaust of 476,715,524 - 5,879,241,225 km by car[30]

Carbon exhaust of 12,000-144,000 average European inhabitants[31]

Water

160,500,000 m³ of water buffered[32]

Equivalent to the household water consumption of 3,200,000 average European inhabitants[33]

Ecosystem health:
Using the methods and values from the Nature Value Explorer[26], the impact of the extra 56.290 ha of green-blue cover on carbon sequestration, air quality, water buffering and cooling of the potential increase was calculated. Local data reflecting air pollution levels PM10 and average annual precipitation were collected and used for each city.

Animal health:
For animal health, the analysis focused on the quantity, quality, and connectivity of urban habitats. The quantity of urban habitat was estimated based on the area of new potential green-blue spaces. The quality improvement was calculated using the BAF+ score, as defined and used in Brussels.[34]

56,290

ha increase in urban habitat area[35]

200%

improvement of urban habitat quality[36] according to the Enhanced Biotope Area Factor

Going further - the city that gives back

On average, across all 22 cities and land use classes analysed, the current green-blue cover in the greener areas consists of 34% trees, 19% small woody features, 21% grass, and 12% water and wet areas. This means that increasing the proportion of trees and water features would amplify the impact on key indicators, such as strengthening biodiversity, reducing pollution, and increasing health.

More importantly, the delivered ecosystem services can be maximised by mimicking natural systems, such as forests with layered vegetation, closed nutrient cycles, and a microclimate and wetlands with high carbon stores and cooling open water. Using ground-based vegetation is always the most sustainable and least expensive form of greenery and provides the most services. However, the below-ground volume for rooting is usually limited in dense built environments. Regenerating and protecting unpaved and healthy soils is key to supporting healthy ecosystems.

To enhance the amount of green-blue infrastructure in the built environment, it is also important to incorporate green engineered solutions, such as semi-permeable and green pavements, vertical green walls, and green roofs. as semi-permeable and green pavements, vertical green walls and implementing greenroofs.

Furthermore, following the principles of regenerative development, the social composition and distribution within the overall urban structure of cities plays an important role. Prioritising the enhancement of nature in less green, socioeconomically disadvantaged neighbourhoods, particularly those with more children and elderly, can have a greater impact on improving human health compared to other parts of the city.

Visualisation by Sweco

We need to rethink how we structure, build, and utilise our urban spaces. The future envisions a city that gives more than it demands. Enabling people, animals and nature to live together in harmony. How do we design that city together?

Dr. Ragnar Van Acker, project leader, climate adaptation and coordinator healthy & safe environment at Sweco

From planning to actions - 4 examples from European cities

This part of the report showcases a selection of innovative projects from European cities that exemplify innovative and progressive solutions in urban planning. While regenerative design extends far beyond merely enhancing green-blue urban areas, it emphasises the critical role of a place-based approach in fostering holistic development. By examining specific projects and actions, we highlight how understanding the unique social, economic, cultural, ecological, and material contexts of a place is essential for its prosperity. As the building industry evolves, urban planners should consider how to become regenerative partners in city development, asking: What does each place need to flourish? Through these examples, we illustrate the potential for transformative change in urban environments.

1 Increase quality of existing green spaces, biodiversity and climate resilience

Biodiversity gain of city centre greening: the Netherlands

The municipality of Eindhoven prioritises making its city centre greener. But what is the biodiversity value of this added green space? Sweco helped determine, research and monitor the biodiversity values of nine locations in the city centre of Eindhoven for two years. Based on a range of assessments, experts developed new design guidelines and an ecological planting concept, complete with plant catalogs, aimed at enhancing biodiversity. The local ecosystem, including native vegetation, flora, and fauna, served as the foundation. From an ecological perspective, nature was seamlessly incorporated into the urban fabric.

Location: Eindhoven, the Netherlands, 2021-2024
Team: Sweco: Ecology, city planning partner: Dutch Butterfly Conservation
Client: Eindhoven Municipality
Sweco as a partner: Research and survey together with Butterfly Conservation.

Photographer: Gijs Meijer, Sweco.

2 Integrating nature and ecosystems in buildings

A multi-use building with greenery and community activities: Lithuania

The goal of this project is to establish a high-quality urban environment that maximises the functionality of both indoor and outdoor spaces within the block, while providing a variety of services and activities. The commercial premises on the first floor will serve the residents, employees, and visitors of the area. A catering building has been designed at the centre of all the buildings, and the rooftop will feature an extensive plantation of trees and a public roof terrace. There is enough soil to support the growth of trees up to 6-8 metres. This roof will be visible and accessible via bridges from all surrounding buildings and will become an attractive public space.

Location: Lvivo str. 59, Vilnius, Lithuania
Team: Sweco Lietuva Design Unit and Architects: Aketuri architektai and Arches
Client: Releven Prime Properties
Sweco as a partner: Site investigations and design services (project proposal stage for public hearing procedures and technical design stage for construction permit and design of structural parts.

Made by Aketuri architektai.

3 Demineralisation of urban infrastructure and increasing greenery

Rebalancing historical design for healthier living: Belgium

Historical maps from the 18th century show that Mechelen, Belgium, was once protected by a belt of fortresses known as 'De Vesten'. These fortresses served as both gateways and social spaces. Yet up until 2022, the areas were dominated by car infrastructure.

Mechelen aims to restore liveability by prioritising walking, cycling, and public transport. By increasing the amount of unpaved green areas from 2.9 to 6.5 hectares, the city enhances climate resilience and public health. Stakeholder consultations included civil society organisations, action committees, and schools, with discussions in neighbourhoods targeting hard-to-reach groups. We analysed the health and economic impacts of the projected modal shifts, and mapped green spaces to ensure that there was at least one hectare of accessible green space within 300 metres, as recommended by WHO. The potential for social interaction and leisure activities was evaluated by conducting qualitative assessments of the street and park designs.

Location: Mechelen, Belgium (72,000 inhabitants)
Client: Agentschap Wegen & Verkeer and City of Mechelen
Sweco as a partner: Landscape design, road design, infrastructure, process management, environmental impact assessment

Visualisation by Sweco.

4 Change in land use to reduce carbon, increase natural areas, and support community activities

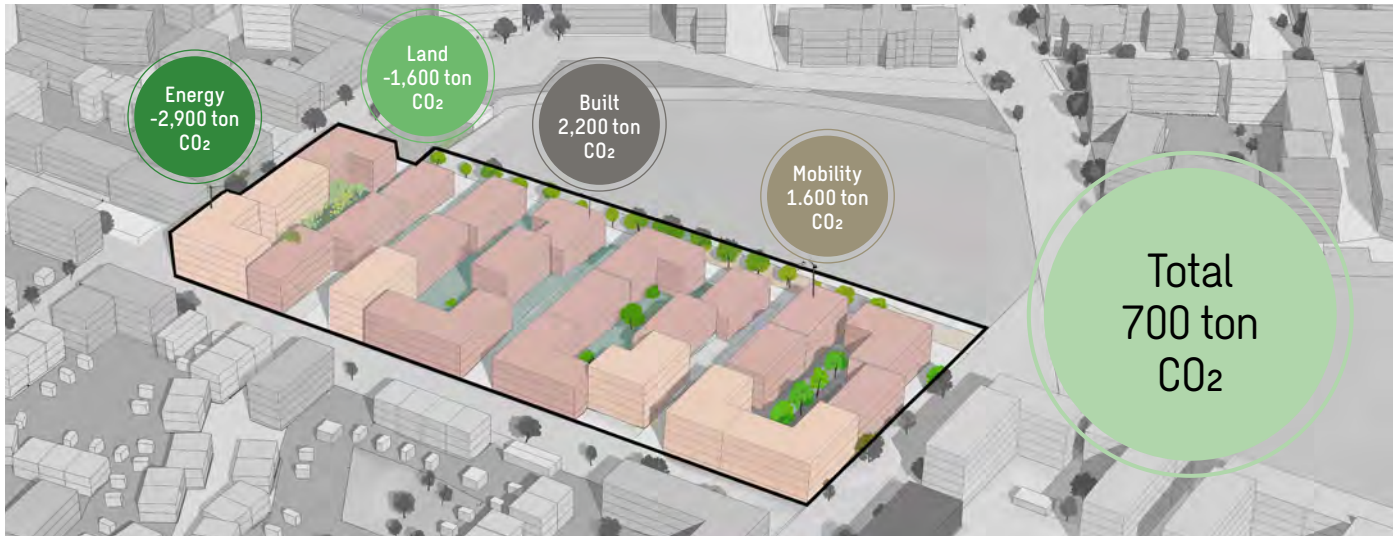
Change in land use for climate-positive urban renewal: Sweden

Is it possible to create climate-positive neighbourhoods? Sweco's climate calculation for Sjöstaden in Trelleborg demonstrates that this is indeed achievable. The assessment considers buildings, energy, land use, and mobility, with a focus on urban carbon sinks, cycling, shared transport, and more sustainable construction methods.

"This is the first model of an entire district," says Gunilla Wembe, lead architect at Sweco. With cities responsible for 70% of global emissions, climate-positive urban areas are crucial for the green transition. Sjöstaden aligns with the 2030 Agenda, EU Taxonomy, and Paris Agreement.

Using Sweco's C3City method, the project includes a holistic climate assessment for emissions from buildings, energy, land use, mobility, and urban greenery. A 3D model visualises outcomes, helping identify urban planning elements that significantly impact carbon emissions.

Location: Sjöstaden, Trelleborg, Sweden
Team: Collaboration between Sweco, Trelleborg Municipality, Skanska, and OBOS
Client: Trelleborg Municipality
Sweco as a partner: Holistic climate assessment



Vision C3 City Sjöstaden, Trelleborg. Image: Sweco Architects

Urban regenerative development – Challenges and enablers

Regenerative development requires a deep understanding of the various elements at play as well as the ability to adapt to changes and evaluate risks.

To successfully achieve regenerative development, a shift in mindset is needed that recognises humans as an integral part of nature. This requires embracing a holistic perspective that views ecosystems as interconnected living systems.

Traditional linear approaches must give way to planet-centric, place-based solutions that prioritise ecosystem health. Climate change only adds to these challenges by introducing extreme weather conditions, which makes maintaining green spaces more complicated. Adaptive strategies, such as resilient infrastructure and effective water management, are essential for navigating these complexities.

Economic pressures and short-term interests pose significant obstacles, as many developers prioritise immediate gains over long-term sustainability and often overlook regenerative measures. Urban space constraints further limit opportunities for biodiversity and for equitable access to urban public green spaces, particularly in densely populated areas where the need for housing or commercial buildings may conflict with repurposing land for other uses. Restoring ecosystems also requires a substantial coherent mix of interventions (infrastructure, supportive regulations , and education) and substantial funding , which is frequently lacking.

Transition to a regenerative city is a societal change. Integrating living systems thinking is essential for gaining a more profound comprehension of the interdependence between environmental and social needs. By viewing developments as living ecologies, we can address these needs systemically. Interdisciplinary collaboration is needed to ensure the ecological soundness and effectiveness of projects, involving the participation of a wide range of experts, technical and social, across all stages.

Securing adequate funding is another key enabler. Cities must provide incentives for developers to invest in green infrastructure. Programmes like Germany's "Federal Program for Biological Diversity" and EU initiatives such as the Green Deal offer valuable models for inspiring such investment. Furthermore, low-barrier funding is critical for supporting grassroots efforts, which are vital for encouraging widespread community involvement.

Empowering communities also plays a pivotal role. Clear communication and education are fundamental to shifting public perceptions. Compelling storytelling and public awareness campaigns should help to change mindsets by emphasising the local benefits of regenerative development. Ensuring that all community members are involved in decision-making processes can be difficult. Socio-economically disadvantaged groups are especially hard to reach and involve, even though their needs are very important. Diverse perspectives need to be considered to create spaces that genuinely meet the needs of all residents. Additionally, cross-border collaboration and knowledge sharing, particularly in pilot projects, are essential for spreading best practices and driving innovation.

Addressing disparities in health outcomes among different socioeconomic groups is crucial. Regenerative development must ensure that all community members benefit from improvements in health, access to green spaces, and overall quality of life (health equity).

Strong leadership and innovation in urban governance is critical to advancing regenerative practices. Entrepreneurial forms of governance can promote stricter regulations and facilitate multidisciplinary cooperation.[37] Integrating clear biodiversity requirements into planning systems and carbon accounting frameworks can provide powerful incentives for businesses to adopt resilient practices.

Lastly, the real estate sector must take greater responsibility in the implementation of regenerative values in development projects. Transparent communication about the long-term benefits of regenerative development can help build demand for these practices, ensuring ongoing commitment to ecological health and supporting new business models.

In general, development is relatively fast paced in cities, as opposed to the slow succession that takes place in the development of robust ecosystems. Soil development, maturing of trees, migration of plants and animals and other ecological processes take place over much longer time periods. Protecting what is already present is therefore essential in managing the urban ecosystem.

Biotopia. Vision project by Sweco architects

Recommendations

9 key elements for a regenerative neighbourhood

To address issues related to pollution, nature and biodiversity, resource management, and climate change, 'greening cities' by integrating green-blue infrastructures is a promising approach. These infrastructures can support ecosystems and enhance urban resilience. However, green infrastructure alone is insufficient for creating regenerative urban environments. Under a regenerative approach to urban development, urban green spaces are the spatial frameworks that support larger ecological and socio-economic living systems.

This report and the accompanying study highlight the great potential of European cities to expand their green-blue cover. More importantly, they emphasise the need for a place-based, systemic approach that integrates green infrastructure with environmental policies, community engagement, sustainable mobility, energy and water management, circular economy, food production, and public health. Looking at regenerative development as a progressive path to urban development, Sweco experts from different disciplines have identified nine key interdependent elements that characterise a regenerative neighbourhood. Here's what to consider.

1 Green infrastructure

Urban planning should consider co-evolving with the given natural elements of the place rather than containing, or taming them. Emphasise the integration of ecologically managed green and blue spaces, trees, wetlands, and green roofs to support biodiversity, improve climate resilience, and provide recreational spaces that promote physical activity and mental well-being.

Focus: Tree canopy cover and distribution of green spaces (3-30-300 guideline), biodiversity richness, heat stress reduction, equitable access for all vulnerable groups.

2 Biodiversity, native species, & ecological restoration

Prioritise the use of native plant species in parks and green spaces to enhance local ecosystems and support higher levels of biodiversity. When integrating and managing green spaces, do not restrict nature, give it a chance to grow to its full potential. Efforts to repair degraded lands or waterways can enhance the city's ecological health.

Focus: Native species coverage, control of invasive species, restoration and reparation of degraded lands.

3 Ecosystem connectivity & habitat networks

Create green corridors that connect parks, forests, and water bodies to preserve natural ecosystems and allow species to move across urban areas, ensuring their survival and minimising the barrier effect.

Focus: Length of green corridors, connectivity among habitats, species movement, migration success, leave green fields undeveloped, create undisturbed natural areas.

4 Water management, or the sponge city principle

Cities need to sustainably manage rain water by retention, infiltration and harvesting systems through nature-based solutions. This helps to prevent flooding, maintain water quality, create habitats for wildlife and contributes to have healthier communities.

Focus: Percentage of stormwater managed on-site, quality of urban water bodies, flood risk reduction, permeable surfaces.

5 Community engagement, social inclusivity & leadership

Engage residents in the planning process and allow them to contribute to the vision and actively participate in regenerative practices, from local governance to community gardening. This encourages people to learn and collaborate with each other to communities can grow and co-evolve. The aim is to ensure inclusivity, equity, and a shared sense of responsibility.

Focus: Level of community empowerment, including participation rates in community events, number of co-created projects, levels of health equity, including social equity and inclusivity. Innovation in local governance models.

6 Circular economy & closed loops

Energy, materials, and water must flow in closed-loop systems, minimising waste and reusing and recycling raw materials. Energy can be generated from renewable sources like solar, wind, or geothermal power. Waste is treated as a resource, such as using organic waste for composting or converting it into energy.

Focus: Amount of waste diverted from landfills, percentage of energy sourced from renewables, material reuse rates, demountable structures, shared services and infrastructures, use of circular flows in construction and production.

7 Urban food production

Encourage local food production through urban agriculture, permaculture, rooftop gardens, and community gardens with native and climate-resistant species. Involve residents in their establishment so that these projects are supported by the community. Integrating these type of food systems into the city through local supply chains helps reduce transportation emissions and supports local economies.

Focus: Amount of food produced locally by the community, accessibility of gardening plots.

8 Resilient & adaptive infrastructure

Integrate a development plan for the city or municipality where minimum requirements are set for socio-economics and ecology in project development. Build or retrofit infrastructure that is net-positive, resilient to climate change (extreme heat, rainfall, drought). Buildings should not burden the environment, but rather enhance people's health, utilising nature incorporation (e.g. breeding and nesting spaces), renewable materials and energy efficiency technologies.

Focus: Percentage of net-positive and healthy buildings available to all, including the most vulnerable in society, energy efficiency ratings, regenerative finance systems based on social and environmental justice for development, climate resilience metrics, heat stress reduction, bringing brownfields back to life.

9 Regenerative transportation & mobility

Make key services and facilities accessible within 15 minutes walking or cycling distance. Promote sustainable transportation options, such as cycling, walking, and public transit. Cities should reduce car dependency by creating walkable neighbourhoods with interconnected bike paths, e-transport, and car-free zones.

Focus: Walkability and bike-ability scores, modal shift (share of walking/ biking/public transport vs. car use), air quality improvements, the amount of green infrastructure integrated in transport infrastructure (reinforcing rather than weakening green corridors), 15-minute city.

By embracing these key elements of regenerative design principles, cities can regenerate both human and natural systems. They can then function like living ecosystems that sustain and renew themselves over time.


CIVIC CENTRE
LOCAL FOOD PRODUCTION
RECYCLING CENTER
5
7
5
1


COMMUNITY & SOCIAL SERVICE
RECYCLING
9
8
6
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4
3

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Urban Insight

By Sweco

Urban Insight is Sweco's international knowledge platform, where experts come together to develop and share insights, facts and solutions for how to plan and design sustainable cities and the societies of the future. Global and local initiatives will be organised throughout the year to inspire and open up discussions about sustainable urban planning.

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