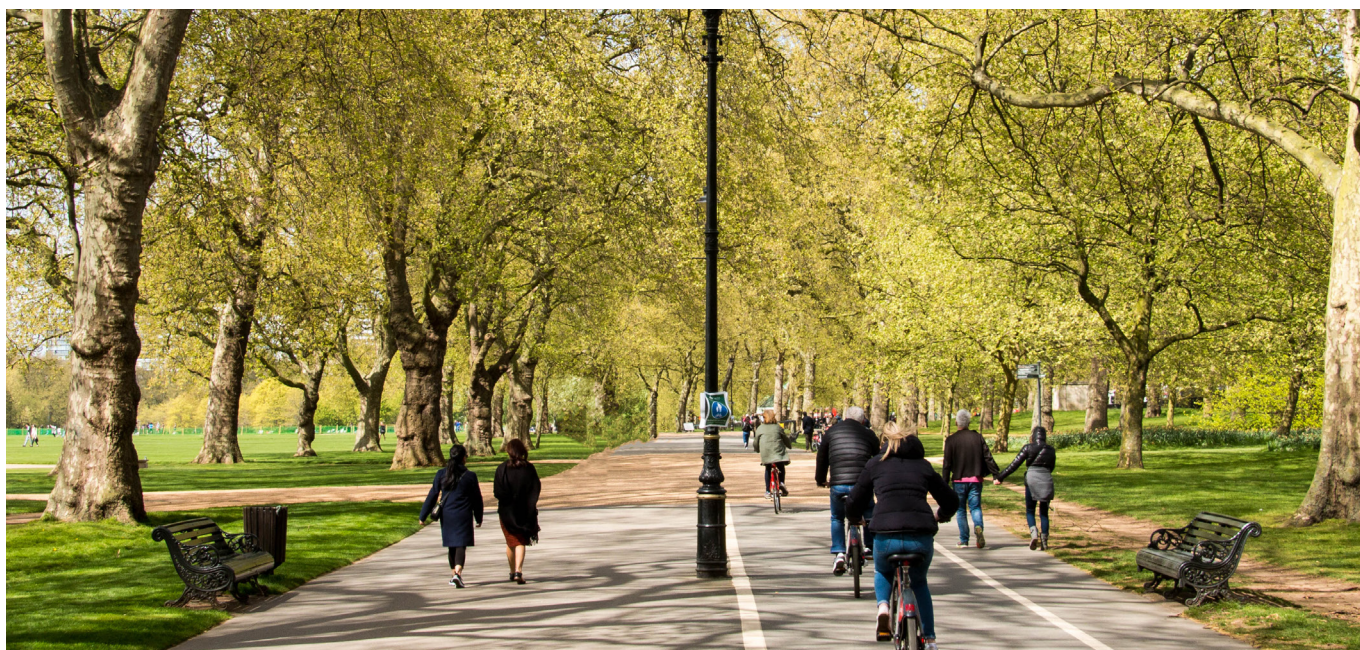




CLIMATE PROBLEM, URBAN NATURE SOLUTION?



KEY POINTS

- Cities tend to be overlooked as sites for nature-based climate solutions, but have tremendous potential for reducing energy demand and building resilience to climate risks.
- Only one-third of nature-based solutions in European cities are explicitly addressing climate change.
- This study identifies clear pathways for positioning nature-based solutions as an urban climate change strategy.

THE NATURVATION PROJECT

NATure-based URban inNOVATION is a 4-year project involving 14 institutions across Europe in the fields of urban development, geography, innovation studies and economics. We are creating a step-change in how we understand and use nature-based solutions for sustainable urbanisation.



Climate change: an urban challenge



Cities are increasingly recognized as both key contributors to the climate change problem, and essential to solving the problem. Cities account for 70 percent of energy-related GHG emissions, the majority from heating and cooling buildings, which means they contribute significantly to the global loss of nature driven by climate change. Yet cities are also at risk from the impacts of climate change. By 2050, the economic cost of rising seas and flooding is expected to reach \$1 trillion USD, and 800 million people in over 570 coastal cities will be at risk from flooding and storm surges (C40 Cities). Climate impacts are also affecting valued forms of urban nature, for instance established trees in Melbourne that cannot survive new elevated temperatures are being replaced with heat resilient species.

Addressing climate challenge requires both mitigation and adaptation strategies, and nature-based solutions are increasingly recognized as a powerful tool for both these strategies. Mitigation attends to the causes of climate change through reduction of greenhouse gas emissions, and adaptation addresses climate impacts with measures to reduce vulnerability and build resilience.

Evidence suggests that nature-based solutions could contribute up to one third of the emissions reductions that are needed to achieve the Paris Agreement. Natural ecosystems such as mangroves, swamps, floodplains and vegetation are also seen to be essential in reducing the impacts of climate change in terms of flooding, droughts, heat extremes and storms.

Yet the role of *urban* nature-based solutions in responding to climate change is often overlooked. This briefing note summarises the role such interventions can play and provides examples of how cities around the world are working with nature to respond to climate change and realise other Sustainable Development Goals. We highlight what works on the ground to support these solutions and how we can build pathways to realise their potential in the future.

'Nature-based solutions are 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)

Figure 1: What are nature-based solutions?

	Parks and urban green areas	Large urban park or forest; Pocket park or neighbourhood green area; Green corridor; Botanical garden
	Grey infrastructure with green features	Alley and street trees, hedges, greens; Riverbank greens; Green playground, school grounds; Institutional green space; Railroad bank and tracks; Green parking lots; House garden
	Blue areas	River, stream, canal, or estuary; Lake or pond; Wetland, bog, fen, or marsh; Sea coast; Delta
	Allotment and community gardens	Community gardens; Allotments; Horticulture
	External building greens	Green roofs, Green walls or facades; Balcony green
	Green areas for water management	Sustainable urban drainage systems; Swales or filter strips; Rain gardens
	Derelict areas	Abandoned and derelict spaces with growth of wilderness or green features
	Green indoor areas	Indoor vertical greens (walls, ceilings); Atriums

Source: Urban Nature Atlas, <https://naturvation.eu/atlas>

How can urban nature-based solutions contribute to addressing the climate challenge?



Our research suggests that urban nature-based solutions can play a key role in addressing the climate challenge. Turning first to **mitigation**, urban nature can *sequester* and *store* carbon. While the total amounts of carbon storage provided by land and water in urban environments are small compared to rural landscapes, urban environments also contain a range of vertical and horizontal artificial surfaces where nature-based solutions can provide additional carbon storage capacity. Maximising the potential for carbon storage under conditions of rapid urbanization may then have the potential to contribute to this global effort on climate change.

More significantly, nature-based solutions can *reduce energy demand* by cooling the built environment. Recent analysis by the International Energy Agency (IEA) suggests that demand for cooling is driving increases in energy demand and emissions. Heat extremes also drive peak demand for electricity which is often carbon-intensive. Nature-based solutions can also provide insulation for buildings in cold climates. Leveraging nature-based solutions to reduce energy demand in the built environment will be critical if cities are to play a strong role in reaching the goals of the Paris Agreement.

Growing energy demand from cooling

Air conditioners and electric fans account for about 10% of all global electricity consumption. This figure is set to triple by 2050, equal to the current electricity capacity of the United States, the EU, and Japan combined. The number of air conditioners in buildings is projected to grow from 1.6 billion today to 5.6 billion in 2050 (IEA 2018).



In terms of **adaptation** our research has found that nature-based solutions can comprehensively address the increasing risks of climate impacts at the urban level. This includes reducing exposure to climate risks directly. The creation of protected areas for nature or parks for recreation in areas which might be particularly exposed to flooding or storm damage prevents housing or businesses being placed in risky locations.

Nature-based solutions can also have a significant effect on reducing the impact of climate risk events on urban places and communities through, for example, increasing tree cover in surrounding areas to reduce the urban heat island effect, or restoring wetlands or coastal ecosystems that dissipate the effects of flooding or storm events.

In addition to reducing exposure to risk, nature-based solutions can build resilience through green roofs that provide insulation and cooling to buildings, or through cool outdoor spaces that act as refuges for vulnerable populations to escape from urban heat. Sustainable urban drainage schemes and making space for water in cities can also increase resilience to flooding, while working with drought tolerant species can support natural systems and the services and benefits that they provide for society.

Evaluating the contribution of urban nature-based solutions to the climate challenge



Despite their potential, there is limited evidence demonstrating how urban nature-based solutions can contribute to the climate challenge. A major challenge is developing appropriate evaluation tools and methods. Existing approaches tend to assess the contribution of nature-based solutions based on single indicators, most frequently urban trees or forests. These assessments have yet to encompass diverse forms of nature-based solutions or consider the trade-offs that exist when cities select solutions that can address sustainability priorities. In essence, these approaches have not yet been adapted to the particular needs of urban settings.

Responding to these gaps, the NATURVATION project has developed a new tool, the **Urban Nature Navigator**, designed to assess the contribution that nature-based solutions can make towards urban sustainability goals, including climate change. Based on a systematic review of the current scientific state of the art, the Navigator allows decision-makers to quickly identify which kinds of urban nature-based solutions are most effective in addressing different sustainability challenges. Figure 2 presents four sustainability and climate challenges along with their most effective solutions. Our analysis shows that while Blue Areas in cities can contribute effectively to multiple climate change goals, other nature-based solutions are more effective in addressing particular mitigation and adaptation challenges.

CARBON STORAGE
<ul style="list-style-type: none">• An indicator for the amount of carbon in water, soil and biomass (kg carbon/m²).• Evidence suggests that parks, urban green areas connected to grey infrastructure, blue areas as well as allotments and community gardens perform most effectively.
AIR COOLING
<ul style="list-style-type: none">• A measure of the effect of nature-based solutions in lowering air temperatures (°C).• Evidence suggests that blue areas are most effective, followed by urban green areas connected to grey infrastructure, parks and external building greens.
PEAK FLOW REDUCTION
<ul style="list-style-type: none">• Peak flow reduction (%) indicates how nature-based solutions reduce the peak flow during storms and/or flooding event.• Knowing how much an intervention reduces the peak flow makes it possible to compare nature-based solution's effectiveness to reduce flooding risks.• Evidence suggests that blue areas and urban green areas connected to grey infrastructure perform most effectively.
RUN-OFF REDUCTION
<ul style="list-style-type: none">• Relative change (%) in the total volume of surface water after the implementation of a nature-based solution indicating efficiency in reducing surface water run-off during storms and/or flooding event.• Evidence suggests that parks, blue areas and external building greens perform most effectively.

Figure 2: Indicators for Evaluating the Contribution of Nature-Based Solutions for Climate Change

Urban Nature Solutions for Climate Change in Action

Many cities are now implementing nature-based solutions for climate action. The Urban Nature Atlas records 1,000 projects that are being implemented across 100 cities in Europe, ranging from managing floodwater in Oslo to community orchards in Seville to green corridors in Budapest.



Inner-City Tree Planting, Bologna, Italy

Support from the EU LIFE programme harnessed the mitigation and adaptation effects of urban forestation. The city established a public-private partnership through the 'green areas inner-city agreement,' where private firms pledged to plant trees in the inner city. This allowed local enterprises to decrease their carbon footprint while also generating environmental and social benefits for the community. To date some 2,300 of the target 3,000 trees have been planted, and a toolkit was created to monitor the contribution to carbon sequestration and air pollution.



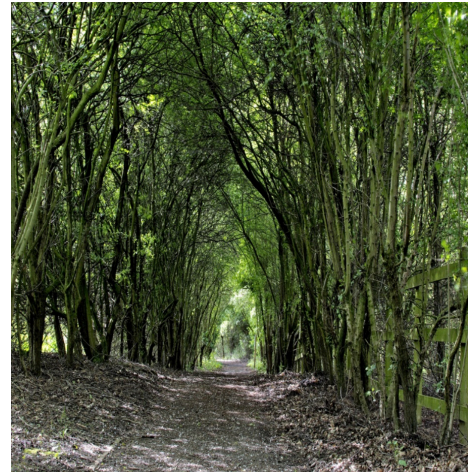
Green Roof, Ministry of Economics & Finance, Athens, Greece

A green roof was established at the Hellenic Treasury (Oikostegi) in 2008, in order to evaluate the contribution that nature-based solutions make towards reducing energy demand. Indigenous aromatic herbs and wild perennial flowers such as hypericum were used, along with poppies, grasses, and chamomile, creating an urban haven for birds and insects. The green roof led to a 50 percent decrease in air conditioning use on the floor directly below the installation, saving €5,630 per year including 9 percent decrease in cooling costs.



Inspiring Water Action in Torne, Doncaster, UK

As part of an Environment Agency-led project benefiting communities and wildlife, 50 hectares of nationally-important habitat is being restored in Doncaster. The work across seven woodland areas will help improve water quality, reduce flood risk, and enhance natural habitats for protected species. By providing additional flood storage the project will help attenuate both peak and flood flows from rainfall events, reducing flood risk and damage, and reducing the financial and carbon cost of pumping water from the Torne catchment. The project is also intended to provide health and well-being benefits to local communities, several of which experience high levels of social and economic deprivation.



BiodiverCity, Malmö, Sweden

The BiodiverCity project responds to increasing heavy rainfall, a malfunctioning storm water management system, and the need for urban integration of greenery and biodiversity. Green roofs, green walls, mobile plant-systems, three-dimensional greenery, and urban biotopes were installed to reduce urban vulnerability, with diverse participation across local authorities, academia, housing companies, and building developers. The continuous involvement of housing companies throughout planning, implementation and commercialization provided continuous learning, while multidisciplinary working groups facilitated horizontal and vertical knowledge development and dissemination.



Overcoming the Opportunity Gap?



Urban nature-based solutions for Climate Change have great potential. As our research has shown, not only can they address multiple climate challenges but they can also contribute to urban sustainability and biodiversity goals. Yet we are not currently making the most of this potential. The use of nature-based solutions is only just gathering momentum and encountering significant challenges in becoming established as ‘business as usual’. More critically, we have found that amongst those nature-based solutions that are being implemented in European cities, approximately only one-third are explicitly seeking to address climate change. Overcoming this **opportunity gap** will be a critical means through which to build urban climate action in Europe and beyond.

Developing **business models** that can bring together the multiple benefits that nature-based solutions generate is critical for realising their potential. Business model types that can specifically support nature-based urban solutions include **risk reduction** where upfront investments into urban nature-based solutions are made to lower future costs from extreme weather events and the **green densification** model which is based on integrating nature-based solutions into urban real estate development, with costs embedded as part of larger ‘sustainable urban living’ business case.

Yet our work suggests that using one business model to support the development of urban nature-based solutions for Climate Change will not be sufficient. Given the multiple forms of benefit that nature-based solutions generate, it is critical to combine approaches which are seeking to generate climate benefits with those that provide other contributions to social and environmental goals, such as improving health and well-being or preserving biodiversity and cultural heritage.

Developing this multi-benefit approach also requires **new forms of urban governance** capable of bringing together the diverse actors that benefit from urban nature-based solutions for Climate Change. Rather than relying on traditional local authority led modes of planning and regulation, our work suggests that nature-based solutions are being supported primarily through new forms of partnership and collaboration between multiple actors. Realising the potential of nature-based solutions for climate, biodiversity and sustainability in cities will require political champions and the development of multiple modes of governing. These approaches are often dependent on the ‘glue’ provided by intermediary organisations that act as a bridge or platform between actors who are not used to working together.

Moving Urban Nature Towards the Mainstream

Advancing this agenda will depend not only on establishing the right ingredients for growing Urban Nature Solutions for Climate Change on the ground but also on establishing the conditions in which they can flourish. We have identified key **pathways** for mainstreaming nature-based solutions for climate action in cities.





Position Nature-Based Solutions as an Urban Climate Change Response Strategy

This pathway focuses on positioning nature-based solutions as urban climate solutions by focusing on their adaptation and mitigation benefits. Since addressing climate change is increasingly recognized as a strategic priority for urban areas, highlighting natural climate solutions for cities can result in access to resources, as well as garner interest from a broader set of stakeholders beyond those already interested in urban greening.

Invest in Nature-based Solutions to Reduce Climate Risk

This pathway focuses on investing in urban nature-based solutions in order to reduce climate risk stemming from the adverse impacts of the climate crisis. As climate change impacts increase in scope and severity, nature-based solutions are being identified by both the public sector and the private financial sector as potential adaptation solutions and risk reduction strategies for cities.

Institutional Changes for Integration and Overcoming Silos

This pathway focuses on integrated practices and planning to overcome silos between sectors and areas of expertise since these barriers make it difficult to draw together diverse stakeholders and achieve solutions with multi-functional benefits. Institutional changes to better match the scope and complexity of sustainability challenges are leading to improved climate action. Stakeholders can take advantage of the interconnections developed to enable urban climate action in order to mainstream nature-based solutions into urban development rather than pursue nature-based solutions as standalone actions.

Learn by Doing

This pathway focuses on learning by doing since mainstreaming nature-based solutions to address climate change in cities requires significant applied and context-specific knowledge. Pilot and demonstration projects develop data and expertise that is critical for mainstreaming nature-based solutions to address climate change. The benefits that can be provided by nature are place specific and therefore nature-based solutions require customization to different urban contexts. Demonstration projects also support collaborative learning to develop new connections between stakeholders and shared knowledge about urban nature's climate benefits.

Unlocking the Potential of Urban Nature Solutions for Climate Change

Nature-based solutions have the potential to contribute to the transformative change required to address climate change. More than ever, we need cities around the world to take action to reduce greenhouse gas emissions and to increase their resilience in the face of climate impacts. Nature-based solutions offer cities a means through which to address climate change whilst realising other important sustainability goals and engaging communities in practical action.

Unlocking this potential will mean experimenting with new business models, governance arrangements and approaches to investment. It will require actors engaging across all levels of government to facilitate the conditions in which these new approaches can flourish. And given that these solutions are often overlooked across the public and private spheres, it will depend on fostering a greater societal recognition of the importance of urban nature.

C40 Cities. Staying Afloat: The Urban Response to Sea Level Rise.

<https://www.c40.org/other/the-future-we-don-t-want-staying-afloat-the-urban-response-to-sea-level-rise>.

European Commission. Nature-Based Solutions. <https://ec.europa.eu/research/environment/index.cfm?pg=nbs>



Massive Open Online Course (MOOC) on Urban Nature-Based Solutions

The NATURVATION project is launching a Massive Open Online Course (MOOC) on nature-based solutions in an urban world. The MOOC will develop an online learning community and contain a collection of inspiring and educational films about the opportunities, challenges and future of nature-based solutions. The MOOC will launch on 13 January 2020. It is a 5 weeks course that runs 7 times a year.

Nature-based solutions have the potential to provide multiple benefits across a range of sustainability challenges facing cities. They can help to limit the impacts of climate change, enhance biodiversity and improve environmental quality while contributing to economic activities and social well-being. Examples include green roofs and city parks that reduce heat, city lagoons that can store water as well as vegetation and rain gardens to intercept storm water.

This course will explore nature-based solutions in cities in Europe and around the world. It will connect together the key themes of nature, cities and innovation. We will discuss how to assess what nature-based solutions can achieve in cities. We will examine how innovation is taking place in cities. And we will analyse the potential of nature-based solutions to help respond to climate change and sustainability challenges.



This course combines both technical knowledge and the social sciences to better understand nature-based solutions in a holistic perspective. New governance arrangements, business models, financing and forms of citizen engagement will be needed to make the promise of nature-based solutions a reality. In this course, we bring together a collection of diverse films and key short readings on nature-based solutions, as well as, interactive forums and practical assignments to create an online learning community.

Watch the video introduction:
<https://youtu.be/JKjRkzxp31M>

Join the course:
<https://naturvation.eu/engage>