



## THE ECONOMIC VALUE OF NATURE-BASED SOLUTIONS IN EUROPEAN CITIES



### KEY POINTS

- The value of 169 nature-based solutions in European cities is 1.6 billion USD
- Nature-based solutions can deliver excellent return on investment
- The economic value of nature-based solutions by hectare is greater than GDP per capita
- Nature-based solutions are essential to sustainability and climate efforts, in the context of the Green New Deal and the Convention on Biodiversity

### 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.



## Why this study?



Cities and regional governments are making critical contributions to sustainability and climate change, and are key sites of achieving the aims of the Convention on Biodiversity and the Green New Deal. This study demonstrates the economic value of nature-based solutions throughout Europe, in order to raise awareness among decision makers and practitioners about their value, and to demonstrate the potential of urban actions. This briefing note presents the results of value calculations, examples of select nature-based solutions and their economic and social value, methods and data sources, and conclusions.

## What were the results?

The study estimated the economic value of 169 nature-based solutions, and compared these values to their investment costs, resulting in an indication of economic return.

### *Urban nature in European cities delivers high value*

Total value: 1.6 billion USD per year

### *Individual city interventions have significant value*

Average value per intervention: 9.4 million USD per year

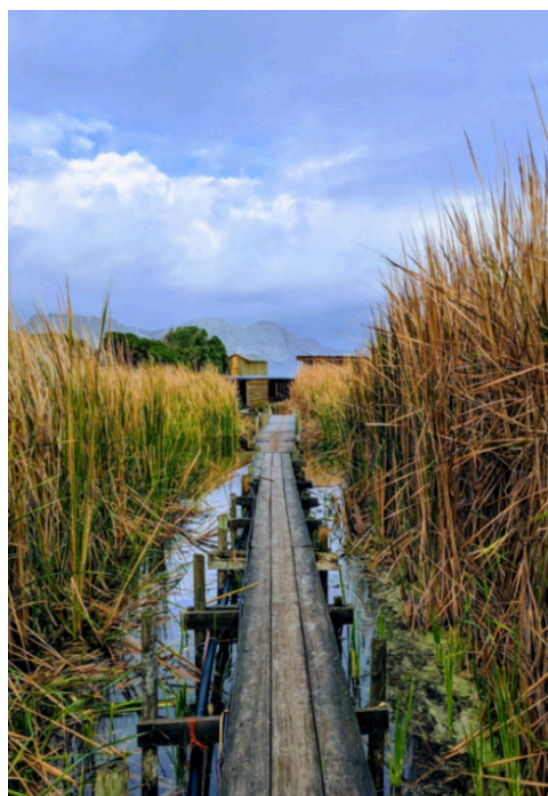
Median value per intervention: 4.2 million USD per year

The value per intervention ranges from 153,000 USD per year, in the Forest Protection Curtain in Iași, Romania, to 113.6 million USD per year in the Protection and development of the Schwanheimer Düne, Frankfurt am Main, Germany.

### *Value by hectare is greater than GDP per capita*

Average value per year by hectare: 81,163 USD

Median value per year by hectare: 27,950 USD



The average value per year by hectare is twice the average GDP per capita in the European Union of 40,937 USD (OECD statistics). These results are well within the range of values reported in studies that survey people on the economic value they attach to goods and services (Bockarjova et al., 2017).

### *Nature-based solutions can deliver excellent return on investment*

- 50 nature-based solutions recouped investment costs within one year, and benefits continued in subsequent years.
- 52 nature-based solutions needed at least several years before benefits caught up to investment costs.

The total cost of these 102 nature-based solutions was 16.1 billion USD. Individual project costs ranged from 16,650 USD to 5.55 billion USD. The average project cost was 157.6 million USD, or 28.9 million USD if the three most expensive projects are excluded. Costs that were not directly related to the realization of the nature-based solutions, and maintenance costs, were not included.



## Examples of nature-based solutions and their economic and social value



### Restoration of urban parks

Improve environmental conditions and accessibility for recreation and biodiversity, and extend urban nature networks in the city.

#### Restoration of Krupp in Essen, Germany

<i>Investment</i>	6.771 million USD
<i>Economic value</i>	9.188 million USD per year
<i>Social return</i>	1.36 USD per year per dollar invested

#### Other cities pursuing urban park restoration

- Royal National City Park, Stockholm, Sweden
- Hofgarten, Augsburg, Germany
- Lille Mosaic community garden, Lille, France
- Park Lužánky, Brno, Czech Republic



### Regeneration of urban rivers and canals

Improve water quality, increase recreational potential, and regulate flooding.

#### Restoration of Lepiku channel in Tallinn, Estonia

<i>Investment</i>	38,850 USD
<i>Economic value</i>	8.5 million USD per year
<i>Social return</i>	218 USD per year for each dollar invested

#### Other cities pursuing regeneration of urban rivers and canals

- Lambro river city regeneration project, Milan, Italy
- Le Lez River, Montpellier, France
- Flood channel, Wuppertal, Germany





### Urban reforestation

Reduce carbon dioxide, regulate the climate, improve urban water and air quality, and increase recreation.

#### Climate adaptation for humid forests in Münster, Germany

<i>Investment</i>	3.66 million USD
<i>Economic value</i>	142 million USD per year
<i>Social return</i>	39 USD per year for each dollar invested

#### Other cities pursuing urban reforestation

- Afforestation in the Aarhus, Denmark
- Reforestation of Malaga's Green Belt, Spain



### Peri-urban forests and wetlands

Urban recreation and flood control.

#### Marsh protection in the Laguna of Venice, Italy

<i>Investment</i>	2.25 million USD
<i>Economic value</i>	1,366 million USD per year
<i>Social return</i>	608 USD per year for each dollar invested

#### Other cities with peri-urban forests and wetlands

- Wigan Flashes wetland restoration, Manchester, UK
- Haukaas Marshlands, Bergen, Norway





## How were these values calculated?



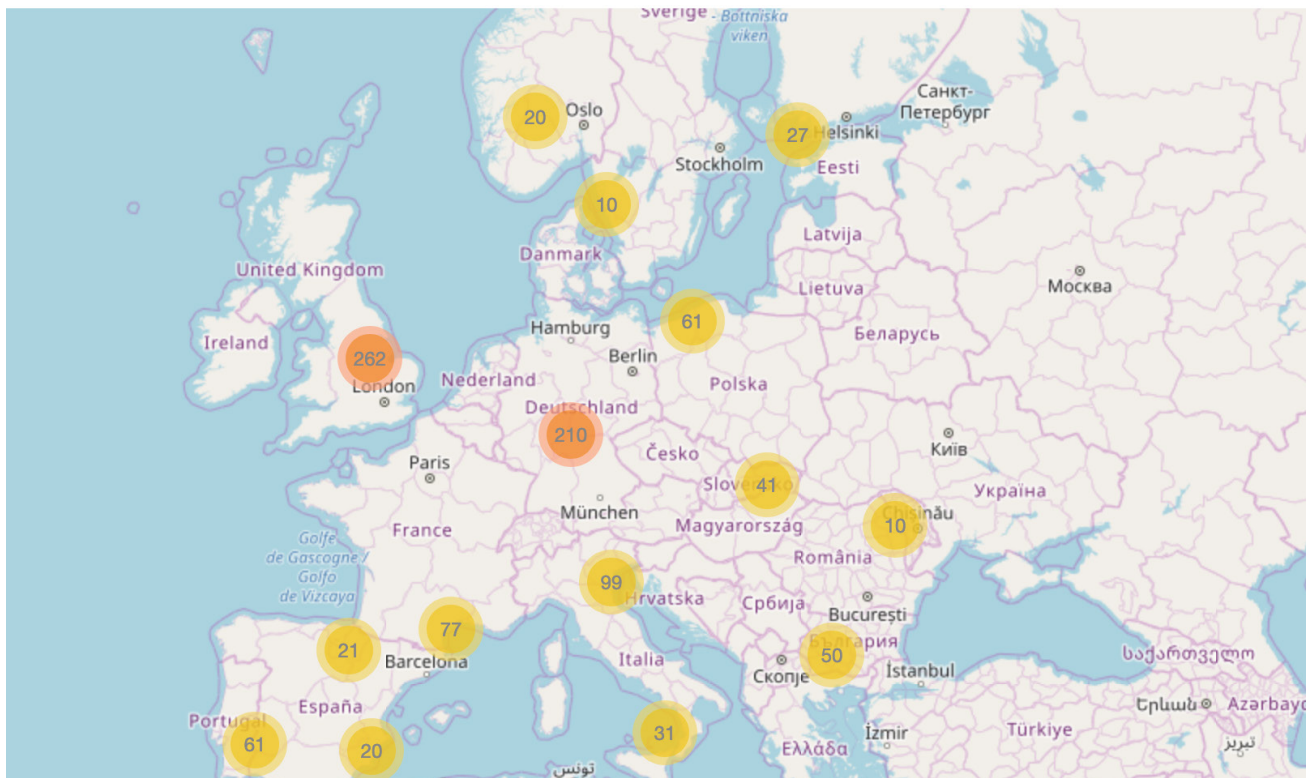
Based in environmental economics methods, the valuation of urban nature is a rapidly expanding research area. When a site cannot be valued directly, an alternative approach is to apply existing estimates from another location, or value transfer. For example, the value of a lake used for recreational fishing in one city can be adjusted and applied to a lake with recreational fishing in another city. The study reviewed numerous valuation techniques that have been used to estimate the value of nature-based solutions. Variations within these techniques, such as methodology, income or price level, or type of nature, were then incorporated into a meta-function (or value transfer function) applied to specific cities. This was based on an existing meta-function that surveyed the extent to which individuals were willing to pay for urban nature (Bockarjova, Botzen and Koetse, 2020). The resulting estimates capture the total economic value of urban nature, based on direct and indirect value to individuals, as well as value that exists even when individuals are unlikely to use the site. This approach helps to adjust existing estimates of the value of urban nature by incorporating the local socio-economic context, including level of income and population density, and the type of nature-based solution and its size.





## Which data sources were used?

The value transfer function described above was applied to a set of nature-based solutions in the Urban Nature Atlas, which includes 1000 examples from across 100 European cities.



[www.naturvation/atlas](http://www.naturvation/atlas)

Additional data employed in the study included the size of interventions, income levels, population density, and the dominant type of nature in urban projects. The methodology necessitated assigning the dominant type of nature even in examples where there were multiple types. In cases where there were multiple nature-based solutions in one landscape, a higher value was assigned.

The study only included examples from the Urban Nature Atlas where the size of interventions was comparable to the existing valuation studies used to calculate the value transfer function described above. This primarily meant that smaller nature interventions that were less than 22 hectares were excluded. The resulting set of useable examples included 169 nature-based solutions with a total area of 817,700 hectares. These examples covered a wide range of interventions, such as planting of street trees, beekeeping, green walls and roofs, community fruit and vegetable gardens, urban parks and forests, green urban squares, rain gardens, green corridors, revitalization of urban river banks, lakes and streams, vertical gardening, and neighborhood regeneration.

## Conclusions



This study estimates the economic value of nature-based solutions recently implemented or underway throughout Europe, by developing and applying a new value transfer function. The results indicate that **nature-based solutions deliver high economic value to residents of European cities**, with a total value of 1.6 billion USD per year and an average value of 81,163 USD per hectare on an annual basis. Each hectare of nature, on average, delivers value that is twice the annual GDP per capita in European Union countries. Moreover, **many nature-based solutions are delivering excellent value for money**, with estimated yearly benefits surpassing total project costs. While an approximation, these estimated values demonstrate high collective appreciation of urban nature by the public, and a substantial monetary equivalent.

The study conveys a strong message to decision makers and practitioners involved in planning, creating, improving, and expanding natural infrastructure in urban areas, including municipalities, NGOs, businesses and entrepreneurs, and financial institutions. The study contributes to evidence that **nature-based solutions are essential to European and international efforts on sustainability and climate change**, particularly in the context of the Convention on Biodiversity and the Green New Deal.

### *Limitations and future research*

This study has three main limitations that can be addressed by future research:

- Due to a lack of valuation estimates, the study was not able to estimate the value of small nature-based solutions under 22 hectares.
- Data limitations did not always allow for tailor-made value estimation of projects. For example, the study assigned the dominant type of nature to examples where there were multiple types, which means the resulting values should be viewed as indicative.
- Data limitation: the information about the extent of the intervention was not always clear, e.g. whether it was an intervention built on the empty ground, or only adding quality and extra functionality to an existing site. We assumed for this exercise that all interventions were fundamental.
- The estimated values of nature-based solutions are based on willingness-to-pay, which is not exhaustive of all benefits of urban nature, measuring benefits that are of perceived value to urban residents

## References

Bockarjova, M., Botzen, W.J.W., Koetse, M.J. (2017) Briefing Note on Financial and Economic Values Database. Deliverable 1.2, H2020 NATURVATION project, May 2017.

Bockarjova, M., Botzen, W.J.W., Koetse, M.J. (2020) Economic Valuation of Green and Blue Nature in Cities: A Meta-Analysis. *Ecological Economics*, 169, 106-408. <https://doi.org/10.1016/j.ecolecon.2019.106480>.



## 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>