

→ Why Ecosystem-based Adaptation matters for cities

If you are concerned about the impacts climate change will have on your city and looking for ways to make it more attractive for residents and businesses, this paper makes the case for why you should integrate Ecosystem-based Adaptation (EbA) to climate change into your work.

This brief is part of a **series of papers** on the evidence of the effectiveness of EbA as a type of Nature-based Solutions. Find out why EbA matters for **cities**, in the **water** and the **agricultural sectors**.



CITIES ARE BOTH DRIVERS AND VICTIMS OF CLIMATE CHANGE

Did you know that **75%** of global greenhouse gas emissions are produced in and by cities, especially through buildings and transport? At the same time, cities are especially vulnerable to climate change impacts. Around **70%** of all cities are already facing negative effects of climate change, and nearly all are at risk – some even face existential threats. Those who suffer most are residents living in poor housing in unsafe locations. Heatwaves, the deadliest climate risk in cities, cause mortality rates of nearly **15%** above normal death rates, reduce workforce productivity, and damage infrastructure. Over **1.6 billion** people in nearly 1,000 cities will be affected by climate change in 2050, and its consequences will cost cities more than **10%** of their GDP by 2100. Sea level rise and coastal flooding will threaten over 800 million people and the infrastructure they depend on in nearly **600** cities by 2050. The costs of sea-level rise could shoot up to **trillions** of dollars per year by 2100. The current **unsustainable growth** of cities, especially coastal cities in Africa and Asia, threatens natural ecosystems and the resources (e.g. biodiversity and water) that urban centres depend on. This is jeopardizing human well-being, and social and economic prosperity.

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ECOSYSTEM-BASED ADAPTATION IS PART OF THE SOLUTION

The important role of cities in contributing to climate change, combined with their immense susceptibility to its effects, highlight the need for sustainable urban planning, engineering, and construction. To tackle current and future challenges, working with nature rather than against it is often more resource-efficient, sustainable, and beneficial. Every dollar invested in adaptation can generate up to **10 dollars** in benefits. NbS for adaptation have the **potential** to restore natural resources, foster economic growth, create jobs, and improve human health and well-being.

What are the benefits of EbA for cities?

Nature in cities provides recreational spaces and thus improves health, wellbeing and quality of life.

Green spaces counter the heat island effect and can cool cities by up to 15°C.

Green areas are important habitats to protect and increase biodiversity.

Urban green spaces improve air quality and reduce associated health costs.

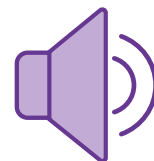
Ecosystems are essential for regulating water run-off in cities.



EbA protects cities from disastrous climate change impacts in a cost-effective manner. Ecosystems can regulate risks and buffer impacts in many ways, including through regulation of coastal and surface flooding, temperature regulation, and erosion control. Very often, it is cheaper and more efficient to use green infrastructure – or a combination of green and grey – than to rely on grey infrastructure alone. Ensuring that urban infrastructure is adapted to the effects of climate change can increase upfront costs by about 3%, and also generates benefits that outweigh costs by 4 times, on average. An analysis of 102 NbS implemented within the European Union showed that 50 of those solutions had recuperated investment costs within the first year.

Green spaces cool cities and counter their 'heat island' effect.

Increased temperatures and more frequent and intense heat waves are especially harmful for cities, which are on average 3–8°C warmer than surrounding rural areas. This so-called urban heat island effect is mainly caused by the heat emitted by buildings, industry, and transport, as well as by a lack of the shading and cooling effect of vegetation. The solution is, therefore, green. Tree canopy cover and well-irrigated grassed areas can lower surface temperature by around 15°C, green walls and roofs cool adjacent rooms by about 2°C, and green areas lower the urban heat island effect by 1°C, on average. This phenomenon is known as the 'park cool island effect'. Barcelona's efforts to increase tree coverage from 5% to 30% reduced temperatures so successfully that it saved USD 10 million in annual utility bills from air conditioning in buildings, and also improved air quality.



reduce noise
up to
10 dB



lower surface
temperature by
around
15°C

Plants prevent premature deaths caused by air pollution and smog. Air pollution is a big problem in cities, where 80% of the urban population is exposed to unsafe air conditions. This causes seven million premature deaths yearly worldwide. This risk is even higher for residents of cities with more than 100,000 inhabitants in the Global South, where 97% of cities have air pollution problems. Air purification, an important ecosystem service, can help reduce this problem. The clean air provided by urban trees in the Chinese city of Guangzhou, for example, is estimated to create benefits worth an USD 9.2 million annually.

EbA pays off for cities. Green natural spaces and the positive reputation of a place that is adapted to climate change threats make a city interesting for investors and can boost the economy. Holding or purchasing spaces for renaturation and parks can be expensive, but the investment is beneficial for the city as a whole. A comparison between central business districts with and without high-quality tree canopies indicates that people spend about 10% more for goods and services in green surroundings. The same holds true for business: Singapore's strong reputation as an economic centre is partly attributed to its urban greenery, which is strategically developed to strengthen the city's beauty, lure investments, and foster further economic growth. This is a paying idea, given that adaptation measures can even have a positive impact on a city's credit rating by protecting or creating a safer environment for investments.

Ecosystems are essential for regulating water run-off in cities.

Urban areas are characterized by a high degree of concrete that impedes water infiltration into the earth. This disturbance of the natural water cycle leads to heavier run-offs, which can cause flooding during heavy rain events. Ecosystem-based measures, such as Chicago's green roofs, can prevent cities from dangerous water flows by slowing stormwater run-off by 36%. Another relevant ecosystem service many cities depend on is water filtration. This service was analysed for Mumbai, where the decrease in forest cover proportionally increased the required water treatment costs. Even a deforestation rate of well below 1% leads to a rise in water treatment costs of about USD 50,000 per year.

Urban EbA measures can function as carbon sinks that remove CO₂ from the atmosphere.

The planting of trees, restoration of wetlands around rivers, greening of roofs and facades, and other similar measures can capture and store greenhouse gases like CO₂ and Methane. For the Colombian city of Medellín, estimates predict a rate of CO₂ absorption of more than 160 tons per year for only one of its 30 green corridors (covering 65 hectares), which together help to reduce average city temperatures by 2°C. Overall, the potential of ecosystems, including urban ecosystems, to capture greenhouse gases is huge: They can achieve more than 1/3 of global climate change mitigation needs.

Nature in cities makes people healthier and happier. In addition to their cooling and air purifying effects, nature in cities provides a place for fitness and recreation; hospitalized patients are believed to heal faster if they have a view of nature, saving USD 93 million per year in healthcare costs. A similarly positive effect is observed regarding the noise reduction capacity of green facades and roofs. They can reduce noise up to 10 dB and are especially effective for air traffic noise. Psychologically, natural elements in cities are shown to decrease stress, encourage psychological rehabilitation, and contribute to higher life satisfaction. Greenery in cities, such as parks and urban gardens, increase people's sense of belonging and can encourage social cohesion.

Habitat creation leads to resilient urban biodiversity. Urban EbA measures provide habitat for plants and animals, thereby protecting and enriching biodiversity, ecosystem health, and the ability to provide cherished ecosystem services like water regulation or air purification. An example is the canal naturalization of Singapore's Bishan-Ang Mo Kio Park; changes in its bank-side vegetation increased the number of insects associated with clean water and encourage more complexity in both terrestrial and aquatic biodiversity. This is important, as a high level of biodiversity is more resilient to disturbances such as climate change, allowing ecosystems to survive and continue functioning.



URBAN EBA IN PRACTICE: CLIMATE-PROOFING SOCIAL HOUSING LANDSCAPES IN LONDON

London, like so many other cities, is facing potentially harmful climate change impacts like extreme heat waves and floods. Increasingly heavy rainfalls are dangerous, as the capacity of the city's drainage systems is nearly exhausted. The worst climate change impacts are felt by poor people living in precarious housing conditions.

In three social housing areas in West London characterized by a high exposure to climate change risks and poverty, the charitable organization Groundwork London and the Hammersmith and Fulham Council started work to help residents adapt to the effects of climate change using nature.

Affordable, highly effective, and socially accepted measures formed a broad package that included:

- Rain garden combined with tree pit
- Residential and low-level green roofs
- Tree and shrub planting
- Resident planting/gardening areas
- Permeable paving
- Grassy basins.



Urban green areas provide recreational spaces and increase quality of life. © Jamie Street / unsplash.com

The project realized impressive gains

- An average of 90% of the rainfall that lands on the green roofs is absorbed. Combined with the other measures, this diverts 1,286,815 litres of rainfall away from a challenged drainage system each year.
- The project was worth its investment: every £1 invested generated £4.39 of benefits.
- The vast majority of residents (80%) acknowledges a significant improvement in the quality of their surrounding green spaces.

Social activities included awareness-raising around climate change adaptation, community engagement, and training for local apprentices on how to implement and maintain the above measures.

Encouraged by their great success, the organizations have launched knowledge-sharing activities through resources on the project's website and international visits that foster exchange and discussion.



Green spaces allow natural infiltration of rainfall and take pressure of built drainage system. © Cherie Xiao / flickr



Where to find more information

Publications

- Practical Guide to implementing green-grey infrastructure, [Green-Gray Community of Practice](#) (2020) – provides information on combining nature-based and conventional (grey) infrastructure solutions.
- Strengthening blue-green infrastructure in our cities, [Dreiseitel and Wanschura \(2016\)](#) – offers information on the combination of green and blue infrastructure.
- The value of nature in urban life, [ICLEI](#) – a poster on the diverse life-supporting and life-enhancing contributions of nature to people in cities and surrounding areas.
- Nature-based Solutions to Climate Change Adaptation in Urban Areas: Linkages between Science, Policy and Practice, [Kabisch et al. \(2017\)](#) – brings together a wealth of knowledge on the effectiveness of NbS in addressing climate change adaptation from diverse but inter-related fields of study.
- Voluntary guidelines for the design and effective implementation of ecosystem-based approaches to climate change adaptation and disaster risk reduction and supplementary information, [SCBD](#) (2019) – provide detailed information on considerations for EbA and Eco-DRR, their respective principles and safeguards, and implementation issues (including mainstreaming, awareness raising and capacity building). It also includes a section dedicated to [Outreach into Sectors](#), including infrastructure.

Initiatives and networks

- The [Global Green-Gray Community of Practice](#), created in 2020, is an international group working to: innovate and pilot new green-grey approaches; expand science, engineering, and policy activity; increase awareness; and build a community that helps increase broad acceptance and enable access to finance.
- [C40](#) is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge, and drive meaningful, measurable, and sustainable action on climate change.
- [Climate-ADAPT](#) aims to support Europe in adapting to climate change, helping users to access and share data and information.
- [Building with Nature](#) is a design philosophy in which natural processes deliver a number of benefits such as protection against flooding and coastal erosion, and opportunities for nature and recreation.
- [ICLEI](#) – Local Governments for Sustainability is a global network of more than 2,500 local and regional governments committed to sustainable urban development.
- [Nature-based solutions: Transforming cities, enhancing well-being | European Commission](#) showcases nine EU-funded projects that address climate change challenges through NbS.



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