Transformative Urban Mobility Initiative

Nature Based Solutions (NBS) in the Transport Sector

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Nature Based Solutions (NBS) in urban transport offer the potential to build resilience and adapt to the effects of climate change and address the transport infrastructure gap.

Many countries around the world are facing an "infrastructure gap," with a need for enhanced transport infrastructure—which the impacts of climate change will only heighten. Fulfilling these service needs will lead to economic growth, jobs, and poverty reduction. Yet addressing this 'infrastructure gap' with traditional or grey infrastructure, often built with concrete and steel, will only magnify greenhouse gas emissions (GHG), climate change, environmental degradation, and biodiversity loss, ultimately deepening inequality and undermining future economic growth.

Nature, however, has proven to be a powerful ally in our adaptation efforts. Nature Based Solutions (NBS) use natural systems and habitats such as forests, floodplains and soils to reduce the force of storms, floods, and erosion. NBS are critical to building urban resilience as well as sequestering carbon and enhancing biodiversity, and offer a host of other benefits to people, such as improved health and wellbeing.

Key benefits of NBS in the transport sector
Source: Author

Often referred to as green-grey infrastructure, the integration of NBS into traditional transport infrastructure can boost resilience, lower costs, and better protect communities. NBS can safeguard infrastructure from climate impacts, avoiding costly damage. As the UNFCC wrote, NBS, when compared to traditional infrastructure, "delivers more jobs per dollar, higher economic returns, and are faster to implement and more sustainable in the long run," (UNFCC, 2020). A study In Colombia found that creating forested buffer zones near roadways at risk of landslides was about 16 times more cost-effective than repairing damage (Grima et al. 2020). The World Economic Forum estimates that $44 trillion in economic value generation depends on nature and its ecosystem services (World Economic Forum 2020). Despite this, less than 10% of all public climate finance is directed at NBS for climate adaptation; even less consideration is given to NBS in the transport sector.

The COP27 conference held in Egypt in 2022 featured unprecedented acknowledgement of the role that NBS can play in avoiding the climate crises. The UN Environment Assembly (UNEA) has formally agreed on a definition of NBS, recognizing its importance in the global response to climate change (UNEP, 2022). This shows the increasing global momentum for the recognition and adoption of NBS to address climate change and paves the way for greater political mobilization and more funding for NBS.

Cross-sectoral cooperation between the responsible departments in the fields of transport, urban planning, urban greenspace, energy, health and disaster/risk management is crucial in the implementation of any NBS. The interdependencies of modern infrastructure systems means that disruptions in one can cause major ripple effects across a city. Only cross-sectoral cooperation can achieve long-term climate resilience.

The success and long-term viability of NBS is likewise highly dependent on the inclusion of a variety of stakeholders such as women, local communities, and indigenous people.

Examples of NBS in the field of mobility — starting from the global/big picture to more concrete city-level approaches — can be found in the following pages. Policy tools, concepts, and case studies for further review can be found in our sourcebook GIZ's Adapting Urban Transport to Climate Change.

Smart Urban Design

15-minute cities reallocate road space to prioritize walking and cycling, and giving the city green lungs through green infrastructure. That leads to reduced GHG emissions, improved air quality and public health, enhanced biodiversity and climate-proof transport infrastructure and services to prepare for future climate events.

Green Corridors

NBS can drastically reduce ambient temperatures in cities. Trees, vegetation, water bodies, and green surfaces act as natural ACs, purify the air, improve comfort for walking, cycling, and public transport, mitigate against the urban heat island effect and reduce the need for mechanical cooling.

Revitalizing a city by revitalizing a river: Seoul, Cheonggyecheon

Seoul, South Korea restored the Cheonggyecheon River, which for decades had been covered by a 10-lane roadway and four-lane elevated highway that carried over 170,000 vehicles through the megacity daily. Transforming it into a green-blue corridor, Seoul radically expanded its bus rapid transit network (BRT) to respond to the reduced road capacity, better integrating it into other public transport networks. The overall response: cars disappeared, buses ran faster and were better utilized, subway use increased, and walking and cycling shot up.

The urban park has improved air quality. By acting as a natural air-conditioner, the river corridor sees temperatures 3-4 degrees lower than areas 400 meters away. The open watercourses increase resilience against flooding and bird, fish and insect numbers and species have increased.

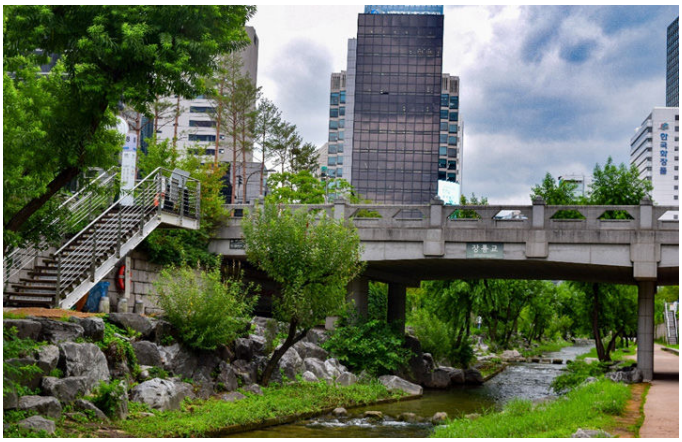

Photo by Jeanne Rouillard on Unsplash

Mitigating against heat by developing natural air-conditioning systems: Medellin's Corredores Verdes (Green Corridors)

Medellin, Colombia has developed 30 interconnected green corridors across the city, confronting the soaring temperatures created by heavy use of concrete. In doing so, the city has reduced temperatures by more than 2°C (with an expected further decrease of 4-5°C within 20 years). The initiative demonstrates how widespread urban tree planting can have far-reaching impacts, from sequestering carbon and cleaning the air to improving urban biodiversity and reducing the city's urban heat island effect.

The corridors have likewise accelerated the modal shift to walking and cycling in the city by providing congruent walking and cycling paths and improving the comfort, safety, and experience of journeys. The green corridors are fully integrated with the BRT system, underground metro, cable car system and bike sharing schemes.

Photo by C40 Cities

Trees reduce heat in the built environment by providing shade, deflecting radiation from the sun, and releasing moisture into the atmosphere. Shaded surfaces may be 11–25°C (20–45°F) cooler than peak temperatures in unshaded areas.

Coastal Flooding & Erosion

Coastal flooding and erosion threaten road and rail infrastructure. Coastal ecosystems such as mangroves, sand dunes, and coral reefs act as natural flood gates, shoreline armoring, and sponges. They can work against sea level rise as well as natural hazards that bring intense wind, rainfall, or storm surge. Yet these ecosystems are at risk globally due to unimpeded coastal development, watershed, and marine pollution. By 2050, an estimated 1.3 billion people will live in flood-prone areas, with the poorest and most vulnerable suffering from floods disproportionately.

NBS provides benefits at a lower cost than single-purpose grey infrastructure and has lower replacement costs following extreme events. Unlike traditional engineering approaches that require retrofitting or replacing, NBS naturally adapts when conditions are suitable.

Source: It All Starts With a Road: The Key to Mobility in Haiti

Marshes reduce damage. *The annualized benefit of coastal wetlands for storm protection services in the United States alone is $23.2 billion (Costanza et al. 2008). During Hurricane Sandy, coastal wetlands averted $625 million in direct flood damages and nearby communities experienced 20 percent less property damage than those without coastal wetlands (Narayan et al. 2017; Sutton Grier et al. 2015).*

Revegetating hillsides to protect against landslides and sea-level rise: Haiti

Heavy rainfall, floods, landslides, and wave impacts during storms have destroyed roads and highway systems in parts of Haiti, making them inaccessible and resulting in costly repairs and maintenance. By revegetating hills, marshes, and dunes, these natural elements designed to stabilize and protect coastlines act as natural buffer zones to help protect the road, which in turn safeguards the large investments in road infrastructure (World Bank, 2021).

Cheaper and quicker to implement than traditional flood management techniques, NBS do not have to be used in isolation. Installing them in conjunction with conventional concrete flood barriers, for example, can deliver higher levels of flood protection for highway infrastructure.

In Haiti, NBS reduced the reliance on carbon-intensive materials such as concrete and steel; as the vegetation matured, it removed carbon from the atmosphere through sequestration. NBS also created new wildlife habitats, increasing biodiversity in the area.

Fighting floods through road-side nature based solutions: London, UK

Storm water run-off from roads and highways has created a battle for those living in London. By flooding onto streets, polluting, and eroding water quality and other natural ecosystems, this run-off imposes financial and environmental costs on Londoners. As the impacts of climate change heighten, such flooding will become worse. In response, London has implemented rain gardens, bioswales, and permeable pavements across the capital.

Permeable pavements are alternatives to traditional pavements, made of materials such as porous concrete that allow water to filter through and into the soil instead of turning into runoff. They can be up to 50% less expensive to install than traditional pavement and are generally cheaper to maintain.

Bioswales — channels designed to concentrate and convey stormwater runoff while removing debris and pollution — can also be beneficial in recharging groundwater.

Source: Zach Kleine, Twitter

Planted in shallow basins in yards and along streets or sidewalks to absorb street, sidewalk, and rooftop runoff, rain gardens are typically 30 percent more absorbent than a traditional lawn. Not only good for use in areas at risk of flooding, rain gardens can be introduced upstream of flood risk areas; this will reduce the risk of flooding so long as they share the same catchment area.


Source: Urban Design London

Storm water run-off. *As city surfaces are impermeable, storms generate high volumes of run-off, which can lead to flooding and pollution. In many cities, combined sewer and stormwater pipes erupt, resulting in raw sewage discharging onto city streets and waterways. These hazards disrupt transport and business activites and threaten human health and safety.*

Sources:

Nature-Based Solutions for Coastal Highway Resilience: An Implementation Guide – Flood Resilience Portal

GI_transport.pdf (europa.eu)

Fact Sheet | Nature as Resilient Infrastructure – An Overview of Nature-Based Solutions | White Papers | EESI

Nature-based Solutions in Latin America and the Caribbean: Regional Status and Priorities for Growth | Publications (iadb.org)

SUTP_Sourcebook5f-2_AdaptingTransport-to-ClimateChange.pdf (transformative-mobility.org)

UN Environment Assembly concludes with 14 resolutions to curb pollution, protect and restore nature worldwide (unep.org)

Integrating Green and Gray : Creating Next Generation Infrastructure (worldbank.org)

A Catalogue of Nature-Based Solutions for Urban Resilience (worldbank.org)

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