Research Brief

natural capital PROJECT

Stanford WOODS INSTITUTE for the ENVIRONMENT

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Valuing Urban Nature – Implications for Flood Resilience

ISSUE OVERVIEW

Sea-level rise and extreme weather events such as torrential rain storms are having devastating consequences in the United States and globally. Researchers, practitioners, and policymakers are increasingly calling for the use of natural and nature-based approaches to protect urban areas from flooding which has increased in frequency and intensity as a result. Natural features can help stabilize shorelines and protect communities from river flooding while, providing other co-benefits for people and ecosystems.

In a new study, scientists at the Natural Capital Project developed a framework for valuating urban nature and examined different factors cities must consider when making infrastructure and other investment choices. This brief is part of a series based on that research which looks at nature's ability to provide resilience to flooding and the various co-benefits associated with nature-based solutions.

Photo Credit: Glenn Fawcett

RECOMMENDATIONS AND POINTS FOR DECISION-MAKERS – COASTAL PROTECTION

As coastal communities face rising sea levels due to climate change, cities will need to make hard choices between investing in physical barriers like seawalls or restoration of habitats such as coral and oyster reefs, dunes, seagrass, and other types of 'living shorelines'. To improve coastal protection, practitioners should:

- Restore and conserve the vegetation and reef types that are appropriate for the setting and in sufficient abundance to be effective. In particular, use vegetation in protected bays as alternatives to hard infrastructure for shoreline stabilization.
- Use models and examples from other cities to develop, and typologies for different types of coastlines to design a place-based approach to reduce risk in a particular setting. For example, the New York City Urban Waterfront Analysis 2013 Report includes informative examples of different typologies of coastlines in New York City that could be applied elsewhere.
- Identify areas where built infrastructure is necessary due to insufficient space for nature-based solutions to be effective and use existing models to understand potential costs to a suite of co-benefits from implementing traditional engineering approaches. Where possible consider living shorelines for shoreline stabilization, which often combine natural features with built approaches.
- Consider multiple lines of defense, where each natural and built approach serves a different coastal protection role, especially in places without sufficient space along the shoreline to achieve nature-based reductions in coastal hazards with a single approach.

- Understand negative effects of hard infrastructure on ecosystems and the services they provide, such as increased erosion adjacent to built substitutes, loss of natural features upon which early life stages of fish rely, and loss of beaches for tourism, recreation and aesthetic value.

RECOMMENDATIONS AND POINTS FOR DECISION-MAKERS – RIVER FLOOD IMPACT REDUCTION

Nature-based solutions can be effective source reduction strategies, including permeable areas such as parks or open spaces and engineered devices like retention ponds to help retain stormwater. Restoring rivers helps protect urban areas from flooding and can provide opportunities for recreation and habitat restoration. These options are often less costly than built infrastructure, such as levees or elevating homes. To maximize urban protection to river flooding, practitioners should:

- Consider complementing nature-based solutions with built infrastructure to address large floods.
- Address small to medium-scale flood events (lower than 20% mean annual flood) by installing nature-based solutions to increase infiltration on low slopes and high-permeability soils.
- Restore floodplains to create space for floodwaters and reduce exposure by moving people out of the hazard zone. Floodplain restoration also provides access to the river that has multiple benefits (e.g. recreation, access to water for domestic use, etc.).
- Reduce streambank erosion (a major result of high peak flow) using riparian vegetation, which is at least as effective as engineered solutions. Vegetation must be maintained, however, and should be chosen to maximize co-benefits.

Photo Credit: US Coast Guard

BACKGROUND

Two out of every three people will live in urban areas by 2050, so the continued development of cities will increasingly shape human well-being. An estimated $50–64 trillion will be invested globally in new urban infrastructure by the year 2030, with an additional $2.4 trillion per year needed to implement the United Nations Sustainable Development Goals. In the United States, population, property, and important infrastructure such as military bases, ports and airports in and around our major cities are all at risk.

According to NOAA, with continued ocean and atmospheric warming, sea levels are expected to rise faster than ever before, putting almost 40% of the U.S. population at risk for coastal flooding, storm surges, and other hazards. Rising sea levels also threaten infrastructure—from roads to bridges to power plants—especially in specific locations that can expect sea levels to rise faster than the global average.

Risks from riverine flooding are increasing as well. The U.S. Environmental Protection Agency reports that from 1965 to 2015, large floods have become more frequent across the Northeast, Pacific Northwest, and northern Great Plains, with river flood events generally coinciding with increases in the frequency of heavy rainfall effects. Climate change may exacerbate river floods by increasing the frequency and severity of heavy precipitation events.

ABOUT THE STANFORD NATURAL CAPITAL PROJECT AUTHORS

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