INVESTOR BRIEF

Scaling up investment in Nature-based Solutions for Climate Resilient Infrastructure **Bangladesh**

GLOBAL CENTER ON ADAPTATION

UNIVERSITY OF OXFORD

Oxford Programme for Sustainable Infrastructure Systems

UK International Development

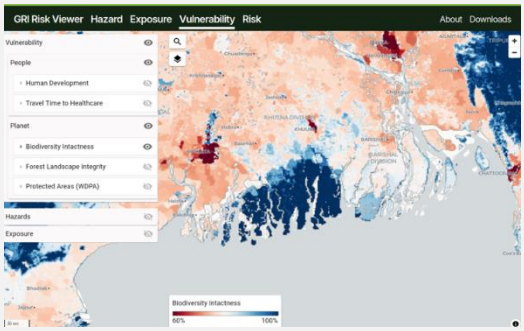
Partnership | Progress | Prosperity

KEY MESSAGES

- The transport sector contributes around 11% to Bangladesh's GDP, with roads accounting for the majority of passenger and freight transport.
- By 2050, coastal flooding event is likely to cause €7.4 billion of direct economic damage to the road network.
- By 2050, riverine flooding is likely to cause €5.4 billion of direct economic damage to the road network.
- Without climate adaptation, an impact equivalent to 2% of the GDP by 2050 and 9% by 2100.
- 8 High-priority NbS investments are identified according to investor preferences.

THE GLOBAL TOOLS FOR NBS

The Global Tool on NbS aims to address critical data gaps by 1) assessing and pricing climate risk for infrastructure systems, 2) quantifying the value of nature-based assets in protecting infrastructure, and 3) using this data to identify and evaluate NbS investment opportunities. They provide policymakers, financial institutions, and private investors with actionable data and analytics, helping integrate nature-based solutions into national and sub-national infrastructure planning.



BANGLADESH'S ROAD INFRASTRUCTURE UNDER A CHANGING CLIMATE

Critical Infrastructure systems of Bangladesh

Bangladesh's transport infrastructure is critical to its economy, encompassing a 173,809 km road network, 3,159 km of railway with 519 stations, 13 airports, 32 ports, 6056 km of waterways and 80 terminals.[1]

The transport sector contributes around 11% to Bangladesh's GDP, with roads accounting for the majority of passenger and freight transport.[2] Over 80% of passenger traffic and freight traffic in Bangladesh rely on road networks.[3] Paved roads include 3,570 km of national roads, 4,323 km of regional highways, and 9,719 km of zila roads (Figure 4[4]

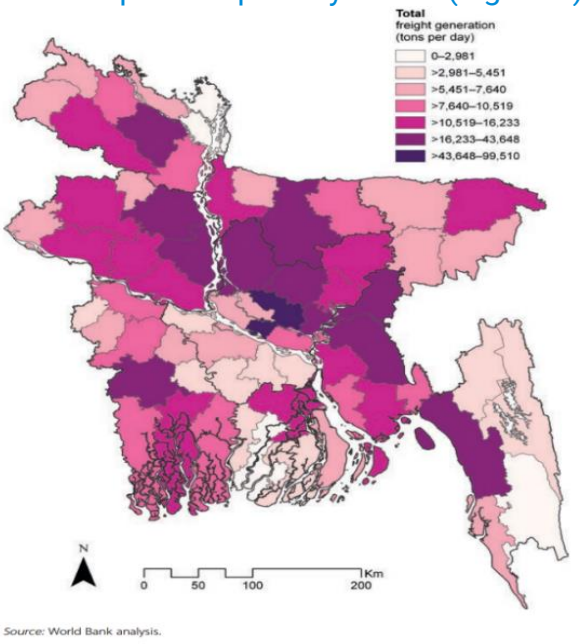
The most critical transport routes are the national highways which connect the capital (Dhaka) to the ports and key industries.[4] Dhaka alone generates > 43,000 tons of freight per day (Figure 1). Key trade corridors include the **N1** which connects the capital to the country's largest port; **N2** which connects the capital to the North-East tea, gas, and stone industries; **N5 and N6** which connects the capital to the agriculture industries in Northern Bangladesh; **N7** which connects the capital to the Mongla Seaport and **N8** which connects the capital to the fishing and agriculture industries in the South-West (Figure 4).

Bangladesh prepares to develop an economic corridor connecting the northeast and southwest regions, by upgrading the road network. As the country prepares to achieve upper middle-income status by 2031 and high-income status by 2041 (Perspective Plan 2041), it is exploring a comprehensive development strategy.[5] This strategy focuses on structural transformation and nationwide welfare enhancement through the establishment of an economic corridor connecting the northeast and southwest regions, by upgrading the road network. This road connectivity will enable Bangladesh to upscale key industries to increase domestic productivity, distribute employment and convert key value chains along the corridor to net exporters within the global value chain. Therefore resilience of the current and future transport infrastructure is critical under a changing climate.[5]

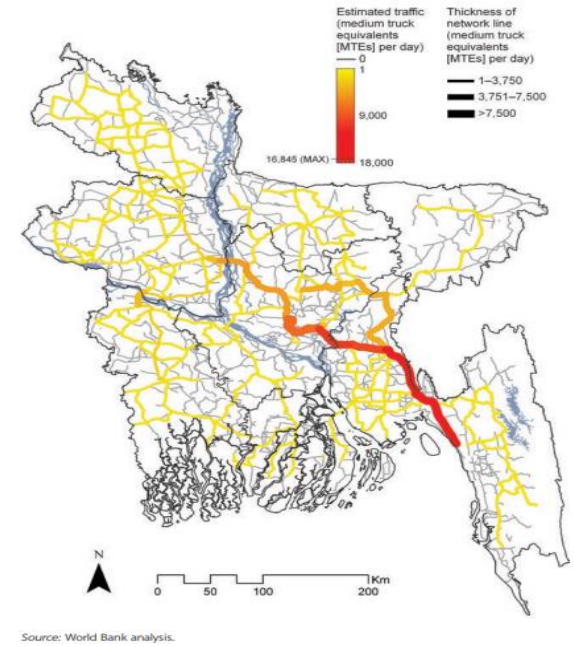
Projected Climate Change in Bangladesh

In 2022, Bangladesh ranked 163rd out of 192 in climate change readiness and 29th most vulnerable (Figure 3**).**[6] Its tropical location in the Bay of Bengal exposes Bangladesh to both acute and chronic climate hazards. Severe monsoonal flooding, powerful cyclonic winds, and high storm surges frequently disrupt essential services and hinder sustainable socio-economic development.[7] Meanwhile, rising sea levels and saline intrusion pose long-term threats to the country's low-lying coastal regions, where two-thirds of the land is less than three meters above sea level.[1]

- By 2050, projections indicate that 17% of Bangladesh's landmass could be submerged, displacing 20 million people.[8]
- The economic toll of climate change is also significant, with potential annual losses reaching 2% of GDP by 2050 and 9.4% by 2100, driven by both direct infrastructure damages and broader economic disruptions. consequences, such as the loss of livelihoods and food production.
- 56% of the population live in high climate exposure areas.[9]
- Coastal flooding, riverine flooding and landslides are the most relevant climate hazards, exacerbated by frequent tropical cyclones (Figure 5).[1]



(a)



(b)

Figure 1. Interdistrict freight generation by (a) freight tons per day and (b) traffic count.[10]

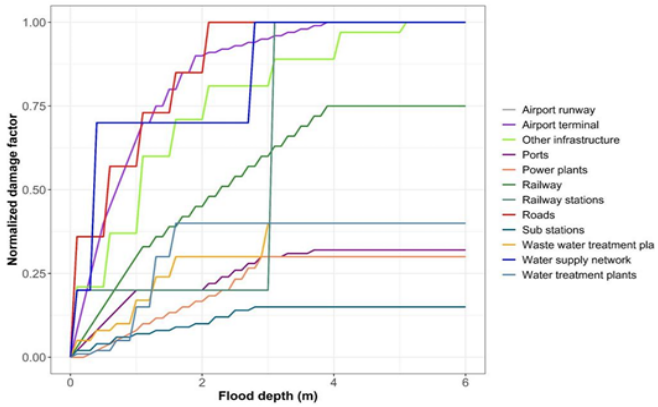


Figure: Flood damage curves (Sources: Huizinga, et al., 2017; Miyamoto Interna 2019; FEMA, 2011; Kok et al., 2005; Snuverink et al., 1998)

Figure 2. Flood damage curves of critical infrastructure in Bangladesh[1]

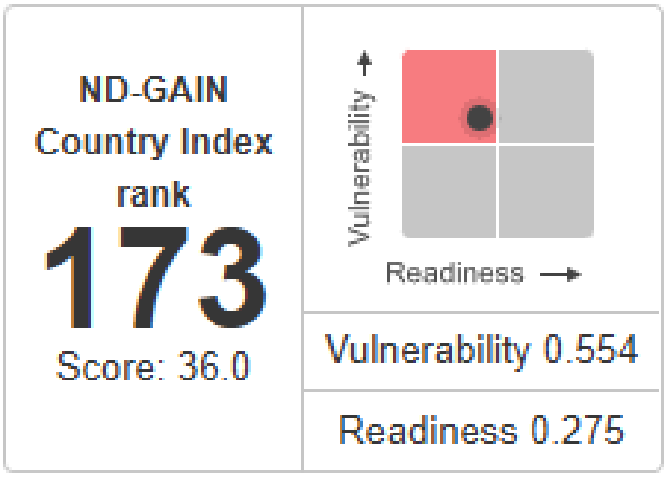


Figure 3. Bangladesh ND-GAIN country index rank[6]

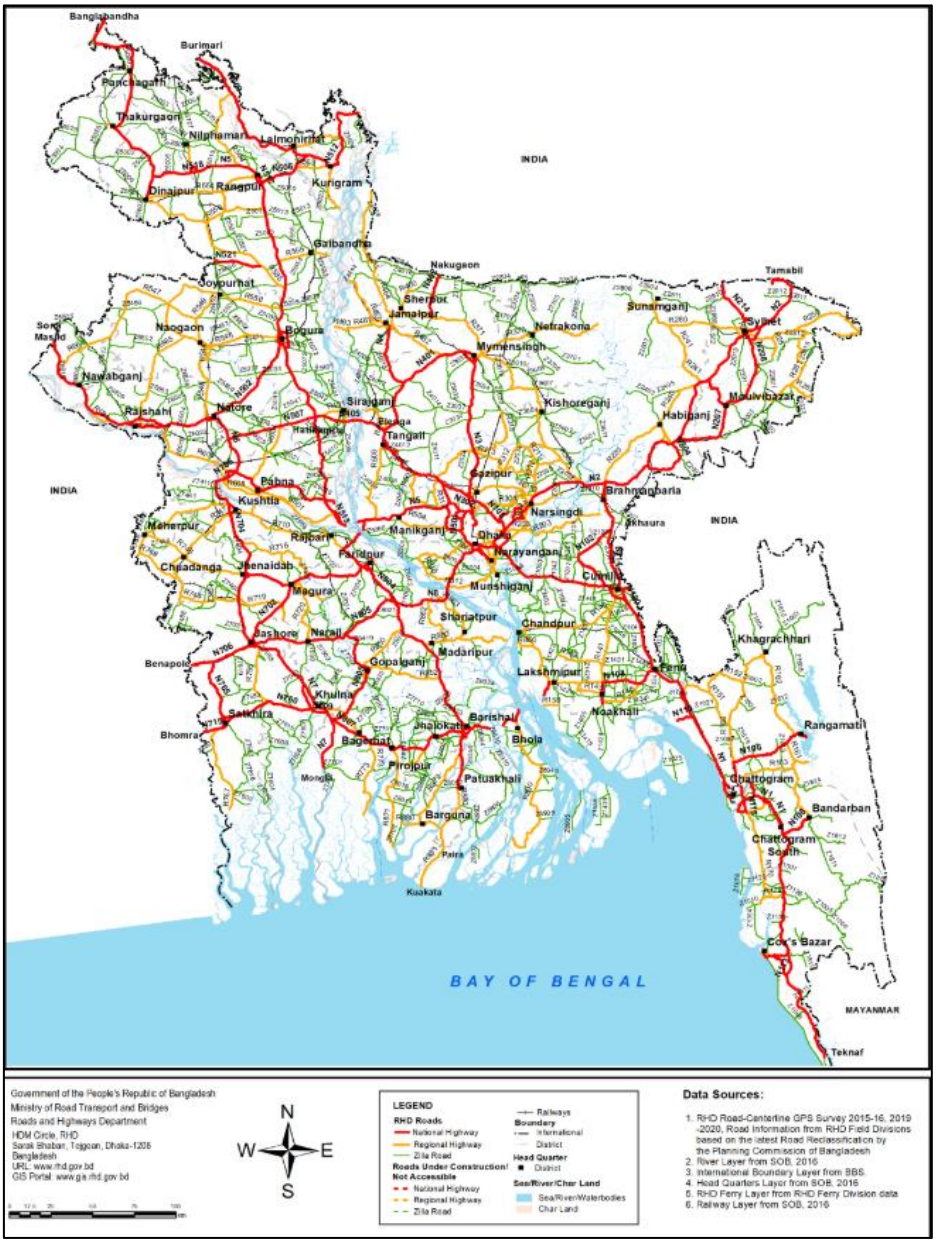


Figure 4. Bangladesh's road network[11]

CLIMATE RISKS ON BANGLADESH'S ROAD INFRASTRUCTURE

Climate-related impacts on Transport Infrastructure

By 2050, a 1-in-50yr **coastal flooding** event (RCP 4.5) is likely to cause **€7.4 billion** of direct economic damage to the road network. **The key hotspots of economic damage are along the south-west and south-central coastline** (Figure 5**,** Figure 6**).**[1]

By 2050, a 1-in-50yr **riverine flooding** event (RCP 4.5) is likely to cause **€5.4 billion** of direct economic damage, to the road network. **The key hotspot areas of economic damage are in the Sylhet division in the north-east, as well as in and around Dhaka, Chittagong and Khulna** (Figure 5,Figure 6.**)**[1]

Road infrastructure is the most vulnerable to flooding events of critical infrastructure in Bangladesh (Figure 2).[1]

By 2050 coastal and riverine flooding is expected to affect 128 Upazilas across 19 coastal districts Three upazilas are particularly vulnerable to coastal and riverine flood events:[1]

1. In **Shyamnagar Upazila**, historical 50-year riverine and coastal flood events caused damages of €389.2 million, projected to increase to **€389.9 million** by 2050 for similar events.[1]
2. In **Patuakhali Sadar Upazila**, historical 50-year riverine and coastal flood events resulted in damages of €355.5 million, expected to rise to **€383 million** by 2050 for similar events.[1]
3. In **Hatiya Upazila**, historical 50-year riverine and coastal flood events caused damages of €257.6 million, likely to increase to **€294.7 million** by 2050 for similar events [1]

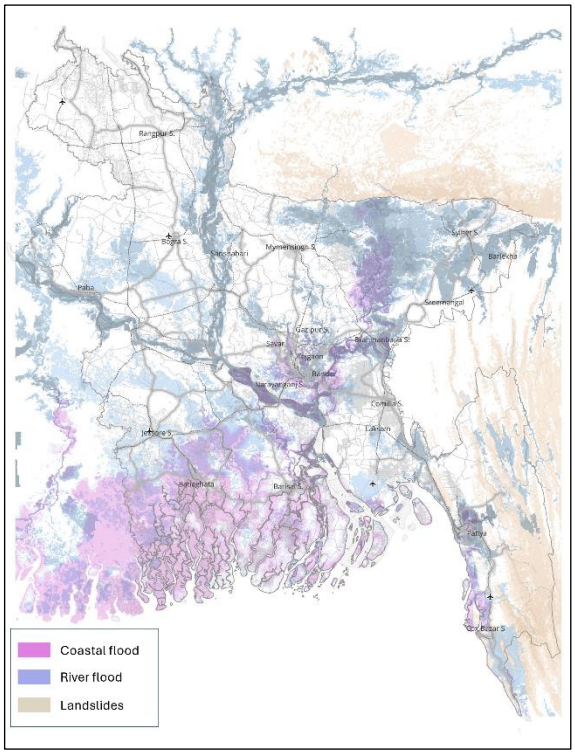


Figure 5. Key climate hazards in Bangladesh[12]

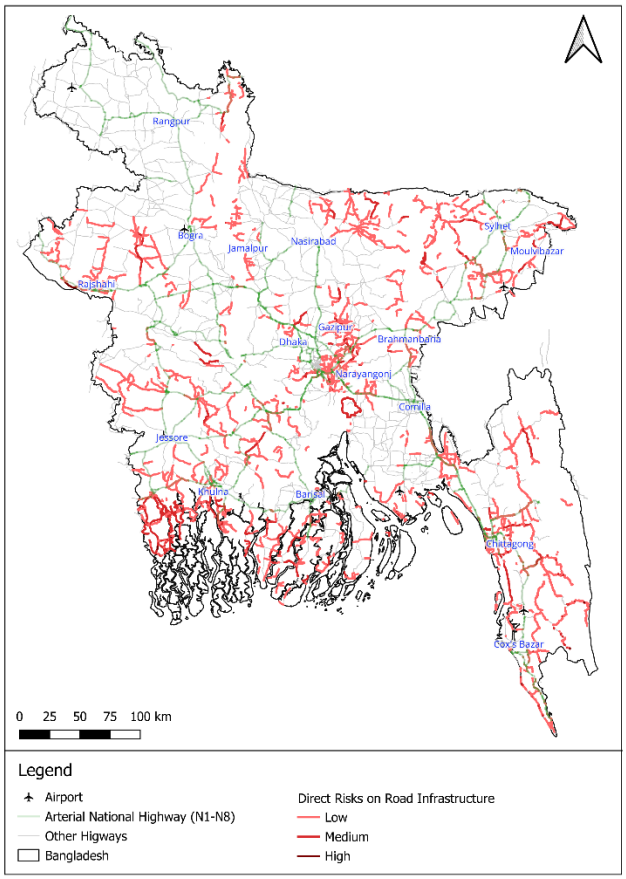


Figure 6. Climate risks to the Bangladesh road network.[12]

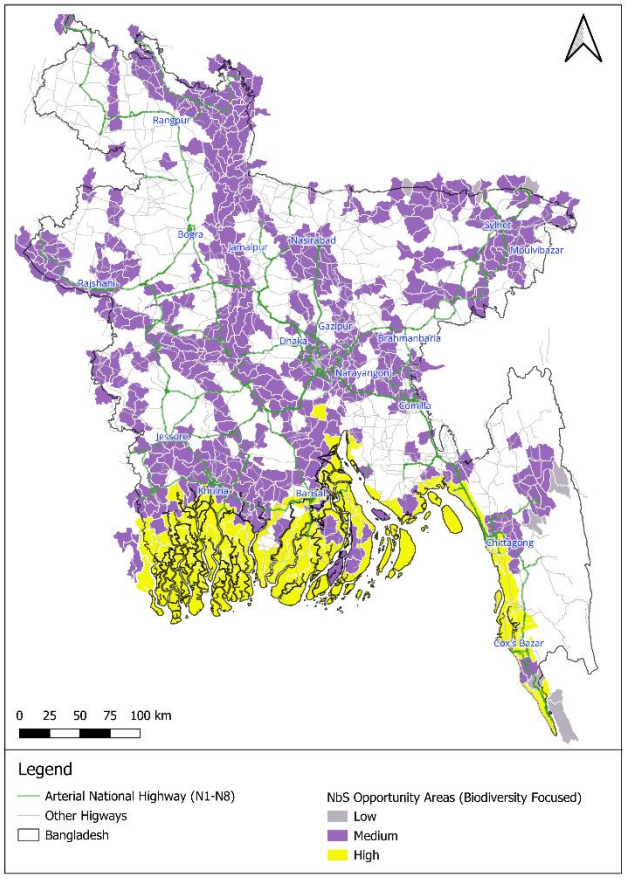


Figure 7. Potential NbS locations in Bangladesh[12]

USING GLOBAL TOOLS FOR NBS TO SCREEN INVESTMENT OPPORTUNITIES

Assessing NbS opportunities for Bangladesh's road network

Bangladesh's NbS opportunities were identified by linking three key climate hazards—coastal flooding, river flooding, and landslides—to targeted NbS interventions: mangrove planting, floodplain restoration, and slope reforestation (Table 1).

Suitability for each NbS option was established by evaluating the existing ecological conditions needed for these ecosystems to thrive and by assessing the direct risks posed to nearby infrastructure.

This integrated approach has revealed enormous potential, with opportunities covering approximately **0.5 M hectares for mangrove restoration, 0.3 M hectares for floodplain restoration and 700 hectares for slope reforestation.**

Defining a Pipeline of NbS investments

A pipeline of potential NbS investments was defined by assessing both the inherent opportunity for nature-based solutions and the criticality of existing infrastructure.

Top 3 NbS opportunities were prioritized based on investor preferences, which could focus on return on investment (ROI), carbon (C), biodiversity (BI), or a balanced approach (BA) across all parameters (Figure 9). If community impact is the primary consideration, preferences could be adjusted to reflect impact per capita (Figure 10). An example of ROI prioritization is shown in Figure 8.

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Table 1. NbS strategies suitable for infrastructure resilience

NbS	Description	Risk-reduction	Co-benefits	Costs
Floodplain Restoration	Plant native trees, shrubs, and grasses along river banks to stabilize soils and reduce erosion.	Cuts bank erosion by ~20–40%; Can lower flood peak heights by approximately 30–50%. Benefit–cost ratios (BCRs) are reported in some cases to range from about 1.5 to 3	Enhances riparian habitat, modest carbon sequestration, improves water quality, boosts aesthetics and recreation.	~$100–$300/ha initial investment; maintenance at 0.5–1.5% of capital cost; benefit–cost ratios (BCRs) ~1.5–3.
Mangrove Restoration	Re-establishes coastal mangrove forests through replanting, protection, and hydrological rehabilitation to recreate natural coastal buffers.	Attenuates wave energy by up to ~50%, reducing coastal erosion. BCRs are variable (~1.5 in favorable settings).	High blue carbon storage (3–4× that of terrestrial forests), nursery habitat for fisheries, improved coastal water quality, recreational benefits.	Low-to-moderate costs (often tens of dollars/ha/year);
Slope Reforestation	Plant native, deep-rooted trees and ground cover on unstable slopes to bind soils and prevent erosion/landslides.	Can lower erosion and landslide risk by approximately 60–80% in appropriate sites. BCRs range from 2 to 4	Enhances soil stability and fertility, increases water retention, sequesters carbon, and supports biodiversity.	Typically ~$100–$500/ha;

Figure 8. Top 3 NbS opportunities ranked by return on investment (ROI) in Bangladesh

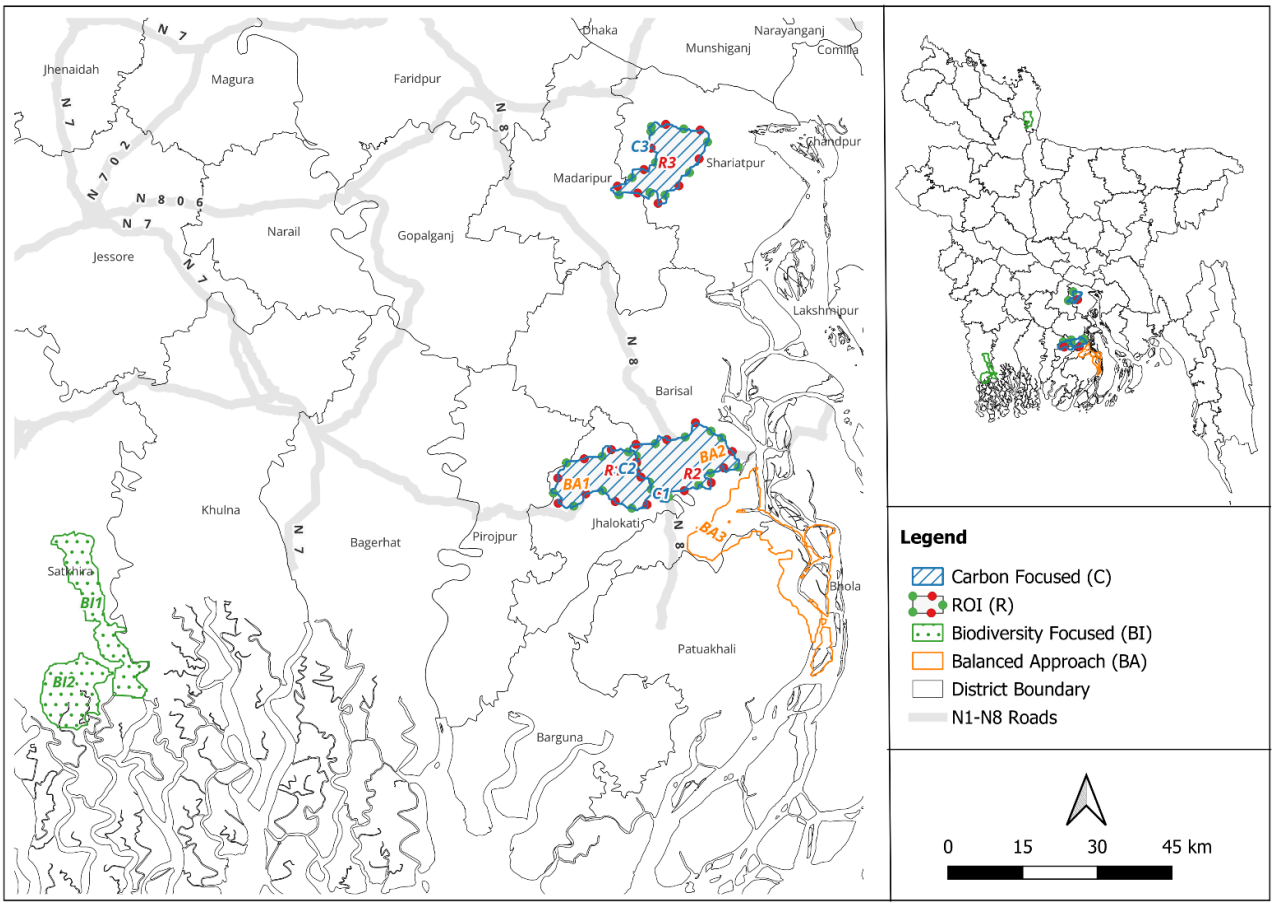

Figure 9. NbS prioritisation by investor type.

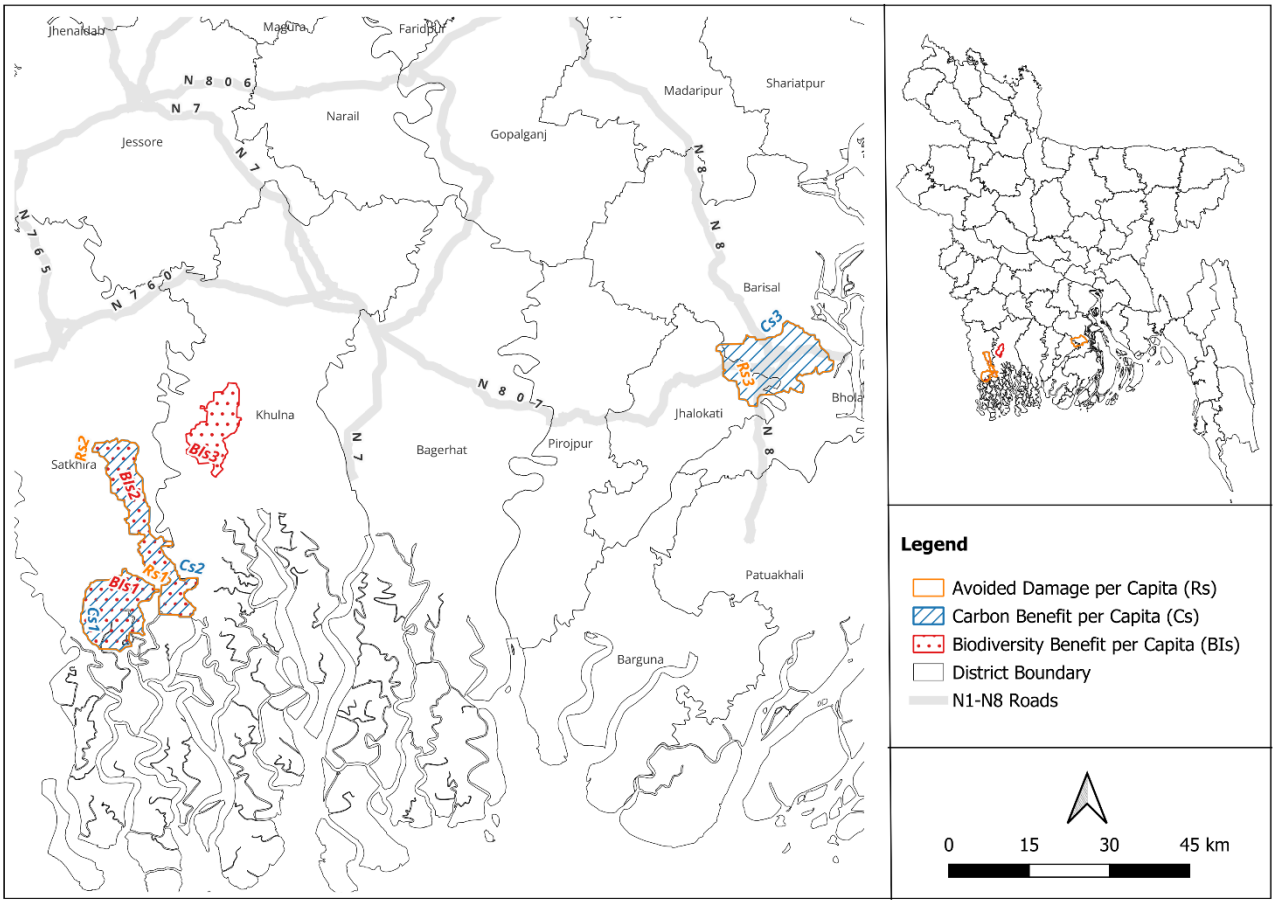

Figure 10. NbS prioritisation by social impact

PIPELINE OF NBS PROJECTS FOR CLIMATE RESILIENT INFRASTRUCTURE

Table 2. Summary of top 3 NbS projects by investor type.[12]

#	Investor type	Project	NbS	Hazard	EAD	ROI	CBR	Biodiversity index	Net Carbon return	Benefiting population
1	R1, BI1, BA1	Jhalokati Sadar Upazila, R870	Floodplain Reforestation	Fluvial Flooding	4.7k	6.52	9.24	0.65	25.2k	239k
2	R2, Rs3, BI2, Cs3, BA2	Barishal Sadar Upazila, N8, R870	Floodplain Reforestation	Fluvial Flooding	3.8k	5.29	6.47	0.66	0.2M	541.3k
3	R3, BI3	Shariatpur Sadar Upazila, R860, R861	Floodplain Reforestation	Fluvial Flooding	22.8k	5.07	6.87	0.64	0.2M	259.4k
4	BA3	Bakerganj and Bauphal Upazila, N809, N8	Floodplain Reforestation	Fluvial Flooding	66.5k	4.59	7.9	0.66	0.2M	161.7k
5	C3	Chilmari Upazila, N5, R555	Floodplain Reforestation	Fluvial Flooding	3.4k	1.87	2.87	0.57	15.9M	95.2k
6	BIs3	Paikgacha Upazila, R760, R780	Mangrove Planting	Coastal Flooding	11.8M	1.82	213.9	0.53	0.4M	58k
7	Rs1, Cs1, C2, BIs1	Shyamnagar Upazila West	Mangrove Planting	Coastal Flooding	22.5M	1.41	147.9	0.51	0.8M	61k
8	Rs2, Cs2, C1, BIs2	Shyamnagar Upazila East	Mangrove Planting	Coastal Flooding	24.2M	0.9	38.34	0.51	2M	136.9k

Note: shaded rows indicate that the project protects a key trade route. **R:** Return on investment focused; **C:** Carbon focused; **BI**: Biodiversity focused; **BA:** Balanced approach; **Rs:** Avoided damage per capita; **Cs**: Carbon benefit per capita; **Bis:** Biodiversity benefit per capita

The global tool for NbS provides insight to investors which goes beyond prioritising by infrastructure damage. Table 2 demonstrates a list of suitable NbS projects based on ROI, cost benefit ratio, biodiversity index, net carbon return and the population benefiting. It represents the top 3 opportunities of multiple investor focuses (financial, carbon, environmental, balanced, social), which combined have been ranked by ROI as an example. The highest ROI project (#1) ranks first for financial, biodiversity, and balanced investors, focusing on restoring floodplains to enhance resilience against fluvial flooding along the R870 and Zila roads in Jhalokati Sadar Upazila. The second project appeals to financial, biodiversity,, balanced, and social impact investors by benefiting the largest population (541.3k) through floodplain reforestation in Barishal Sadar Upazila. This project also strengthens resilience along the N8, a national road and key trade route. Additional national road and trade route resilience projects include floodplain restoration efforts along the N8 in Patuakhali Zila (#4) and the N5 in Gaibandha Zila (#5), targeting balanced and carbon focused investors, respectively. Projects #6–8 focus on vulnerable coastal Upazilas through mangrove reforestation, addressing the region's highest estimated annual damage due to significant coastal flooding risks.

UNLOCKING INVESTMENT IN NATURE-BASED SOLUTIONS

Mobilizing NbS Investment for Adaptation

Scaling financing for nature-based solutions to drive adaptation demands integrated strategies that leverage diverse financial instruments, tailored project management, and supportive policy frameworks—both globally and in regions such as Bangladesh—especially given that NbS are pivotal for climate mitigation, resilience, and sustainable livelihoods, and UNEP estimates nearly $11 trillion is needed by 2050 (about $400 billion annually) compared to current levels of around $154 billion per year.

Firstly, not all NbS are equal from a finance perspective; most investments are in established sectors—such as agriculture, forestry, aquaculture, and tourism—with clear revenue streams (e.g., commodity sales, hospitality) that also boost community resilience. In contrast, innovative green infrastructure projects (like green buildings, water management, and mangrove restoration) struggle to monetize their broad adaptation benefits, while traditional conservation focuses solely on protecting nature. Each category requires tailored financial solutions—from blended finance to market-based approaches—to effectively manage its unique risks and opportunities.

Secondly, the inability to monetize adaptation benefits biases investments toward projects with traditional commercial or carbon returns. Although non-commercial gains (social and biodiversity) are attracting some premium, more than half of the nature funds studied focus on agriculture and forestry due to their favorable risk-adjusted returns. Standardized metrics, robust valuation tools, and greater investor disclosure on financial performance and impacts are key to unlocking broader market-based innovations for NbS.

Thirdly, NbS investments are complex, tailored, and require active management, often hindering scalability despite potential gains from standardization. Nature Funds deploy a mix of instruments—including equity, loans, mezzanine loans, and bonds—with advanced ESG features (e.g., covenants, impact-linked interest adjustments, carbon dividends). Typically executed in private markets, these illiquid investments span over five years, usually ranging from $5–50 million, and demand hands-on post-investment oversight. More standardized structures and metrics could help scale financing while still benefiting from specialized, blended finance solutions.

Fourth, DFIs, public finance, and blended finance are crucial in de-risking and catalyzing NbS investments. Nature Funds employ risk mitigation at both the fund level—using financial guarantees, first-loss or subordinate capital, and preferred returns—and the investment level—via technical assistance, stakeholder collaboration, and offtake agreements, alongside mechanisms like seniority, collateral, and additional guarantees. Many funds also provide dedicated technical assistance grants. With deep local knowledge and the ability to aggregate projects, DFIs bridge global and local markets by offering public concessional finance and mobilizing private capital for NbS adaptation, especially where resilience benefits remain unmonetized.

Fifth, private sector investment managers and specialized nature finance funds complement DFIs by deploying targeted, high-impact capital in niche areas, leveraging their expertise to overcome the complex barriers of NbS adaptation investments. While DFIs provide broad mandates and local insights, partnerships with these specialists enable landmark, replicable transactions and the development of pipelines linking viable projects to global capital. Despite their slower scale and relatively limited commercial capital, emerging market signals and growing investor demand highlight the need for supportive policies, regulations, and targeted blended finance arrangements that integrate nature into core business practices and catalyze nature-positive investments at scale.

Governance on NbS implementation in Bangladesh

In Bangladesh, the governance of natural asset projects, particularly those related to floodplain restoration and mangrove planting, is overseen by several key government institutions. The Ministry of Environment, Forest and Climate Change (MoEFCC) plays a central role in setting policies and regulations for environmental conservation, ensuring sustainable management of ecosystems. Under MoEFCC, the Forest Department is directly responsible for the conservation and restoration of mangrove forests, including the Sundarbans, through afforestation and biodiversity conservation programs. The Ministry of Water Resources (MoWR) formulates policies and strategies for water resource management, while its implementing agency, the Bangladesh Water Development Board (BWDB), executes large-scale floodplain restoration and river management projects. Additionally, the Department of Environment (DoE), under MoEFCC, enforces environmental regulations and conducts impact assessments to ensure sustainability in development projects. The Local Government Engineering Department (LGED), under the Ministry of Local Government, Rural Development and Cooperatives, also integrates nature-based solutions at the community level, implementing wetland and floodplain management initiatives.

GLOBAL TOOLS FOR NATURE-BASED SOLUTIONS[12]

Overview

Scaling investment in nature-based solutions (NbS) is crucial for tackling climate change impacts on Infrastructure systems while promoting sustainable development. The Global Center on Adaptation (GCA), in collaboration with Oxford's Program for Sustainable Infrastructure at the University of Oxford, has developed the Global Tools for NbS, an initiative funded and led by GCA and grounded in Oxford's research on infrastructure systems resilience. This initiative aims to accelerate NbS investment and enhance climate-resilient infrastructure.

The Global Tool addresses data gaps by 1) assessing and pricing climate risks to infrastructure, 2) quantifying the protective value of nature-based assets, and 3) identifying NbS investment opportunities. By providing actionable data to policymakers, financial institutions, and investors, the tool supports integrating NbS into infrastructure planning, mobilizing adaptation investments, and embedding resilience globally.

Key Features of the Global Tools for NbS

The Global Tools for NbS have 3 major modules that give a comprehensive view on NbS opportunities for Climate Resilient Infrastructure, and multi-criteria prioritization of adaptation options. The tool is structured around three core components:

1. Global Climate Risk Screening of Infrastructure Assets Assesses the vulnerability of road, rail, and energy transmission networks to climate-related hazards, by integrating global datasets (e.g., coastal/river flooding, landslide risk) with Oxford's National Infrastructure Systems Model (NISMOD) to evaluate risks under different climate scenarios (RCP4.5 and 8.5) across timeframes (2030, 2050, 2080) and various return periods.

Key Outputs: Maps identifying climate risk hotspots for current and future scenarios; Global and asset-specific estimates of Annual Damages

2. Global NbS Opportunity Scanning for CRI Identifies potential areas where NbS can reduce climate risks to infrastructure, by utilizing advanced landcover and coastal datasets alongside algorithms to pinpoint opportunities for:

- Mangrove Restoration (reducing coastal flooding),
- Floodplain Revegetation (mitigating river flooding),
- Slope Reforestation (reducing landslide risk).

Key Outputs: Maps of suitable areas for each NbS option based on geographical and ecological conditions; Spatial indicators quantifying the potential maximum risk reduction

3. Global Multicriteria Prioritization of NbS for CRI Supports investment decisions by comparing NbS implementation costs with their benefits and co-benefits, by combining quantitative data (e.g., Infrastructure Value at Risk, carbon credits, biodiversity enhancements) with qualitative criteria in a cost-benefit framework.

Key Outputs: A color-coded Global NbS Prioritization Map (red, amber, green) highlighting areas with the highest return on investment; A multi-criteria prioritization table to guide stakeholders in selecting bankable NbS opportunities.

Path Forward: Scaling Investment in NbS

By providing robust analyses of climate risks, NbS suitability, and cost-benefit scenarios, this tool empowers governments, financial institutions, and private investors to make informed, targeted investments. The goal is to drive a global transition toward more sustainable and climate-resilient infrastructure systems, with the technical release event serving as a pivotal platform for stakeholder engagement and adoption of NbS strategies.

	How are Infrastructure Assets impacted by climate change?	*Where do NbS solutions have potential for risk reduction on Infrastructure Assets?*	*How do I prioritize a bankable pipeline of NbS investments for Climate Resilient Infrastructure?*
	1.Global Climate Risk Screening of Infrastructure Assets	**2.Global NbS Suitability Mapping for CRI**	**3.Global Multicriteria prioritization of NbS for CRI**
Capabilities →	Climate Risk Screening of Global Road, Railway and Energy Transmission Infrastructure for: • Coastal flooding • River flooding • Landslides	Assessment of suitability and risk reduction potential of 3 NbS solutions for Global Infrastructure Assets: • Mangrove restoration • Floodplain revegetation • Slope reforestation	Global multi-criteria screening and prioritization of effective NbS solutions for CRI, including: • Global costs of NbS Implementation • Indicator of Risk Reduction Potential • Estimated Carbon-market revenues • Co-benefits (biodiversity, etc)
Outputs →	**Global Hotspot Mapping of Climate Impacts on Infrastructure**, including Expected Annual Damages per asset, for different climate scenarios (RCP4.5/8.5) and return periods (2-100 years)	**Global NbS Suitability Scanning Maps** for Climate Resilient Infrastructure	**Global NbS Prioritization Maps and Multi-Criteria Table of NbS for CRI**, and Screening of a potential pipeline of Bankable NbS projects at the watershed and country level

Figure 11: Overview Global Tools for NbS

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