URBAN CLIMATE CHANGE RESILIENCE TRUST FUND
Asian Development Bank

ADB

Nature and Climate Nexus: Promoting Nature-based Solutions (NbS) for Sustainable Infrastructures in Asia and the Pacific

Challenges and Approaches in Quantifying NbS Benefit Streams

24 October 2022 (Monday) • 2–3 pm (Philippines/GMT+8) • Zoom

Challenges in Measuring NbS Benefits

- **Breadth of potential benefits:** Benefits of NbS are wide ranging, and there is potential for a large range of metrics to be applied – drawn from different thematic areas
- **Challenges in data collection:** Quantification of potential benefits across all metrics may not be immediately available, and requires planning for data collection input from early stages of project development
- **Timescales for benefit delivery:** Many co-benefits are slow to accrue. Longer time-scales make it difficult to model returns for investments and compare future benefits against current costs. Discount rates can be important
- **Lack of familiarity among policy makers:** Often, the process of identifying co-benefits is unfamiliar to partners and clients and they require some support in understanding business case
- **Boundary issues:** Impacts of NbS can go beyond administrative boundaries. Capturing and accounting for these benefits may be beyond the jurisdiction of implementing agencies (e.g., downstream effects)

- **Indicators and methodologies do exist however, and are well established (if under used)…just need more coherent frameworks…**

Types of Benefit Streams

ECOLOGICAL RESILIENCE

1 Increased contribution to climate mitigation
- Tonnes of carbon removed or stored per unit area

2 Energy and carbon savings from infrastructure
- Energy saved per year (kWh/y) and tonnes of carbon saved per year (tC/y)

3 Improved microclimate regulation
- Temperature reduction in urban areas

4 Increased habitat and biodiversity
- Composition of indigenous vegetation or species

5 Increased water quality
- Composition of nutrient load and heavy metals (%)

6 Increased ground water availability
- Depth of groundwater

7 Increased soil quality
- Soil quality indicator

8 Improved air quality
- Air Quality Index (AQI) at monitoring stations

9 Improved flood mitigation
- Flood peak reduction (increase in time to peak)

10 Increased coverage of natural areas
- Area of open space/ vegetation

PHYSICAL RESILIENCE

1 Reduction in risk from hazard on critical urban infrastructure
- Reduction in recovery time post event for infrastructure to be brough back to pre-event level of functionality

FINANCIAL AND ECONOMIC RESILIENCE

1 Increased revenue from economic activity
- Expenditure for economic activity e.g. recreation and tourism

2 Avoided costs of infrastructure investment
- Capex and Opex Costs

3 Avoided costs of consumption
- Energy consumption costs or water consumption costs

4 Avoided health costs due to ecosystem services
- Health care costs associated with air quality, heat exposure

5 Avoided health costs due to physical activity
- Healthcare costs associated with low levels of activity

6 Avoided health costs linked to disasters and flooding
- Health care costs associated with water contamination

7 Increased property values
- Change in mean or median land and property prices

8 Avoided costs of flooding impacts
- Costs associated with flood damage

9 Avoided costs of loss of livelihoods from disruption
- Loss of working days and income due to disruption event e.g. flooding or sickness from poor solid waste management

10 Avoided costs of insurance from lower frequency and intensity of incidents
- Costs of home insurance

SOCIAL AND INSTITUTIONAL RESILIENCE

1 Increased accessibility to open space
- Average journey time for residents to green space

2 Reduced health impacts from air pollution
- Incidence of respiratory illness

3 Reduced health impacts related to physical activity
- Years of life lost due to low levels of activity

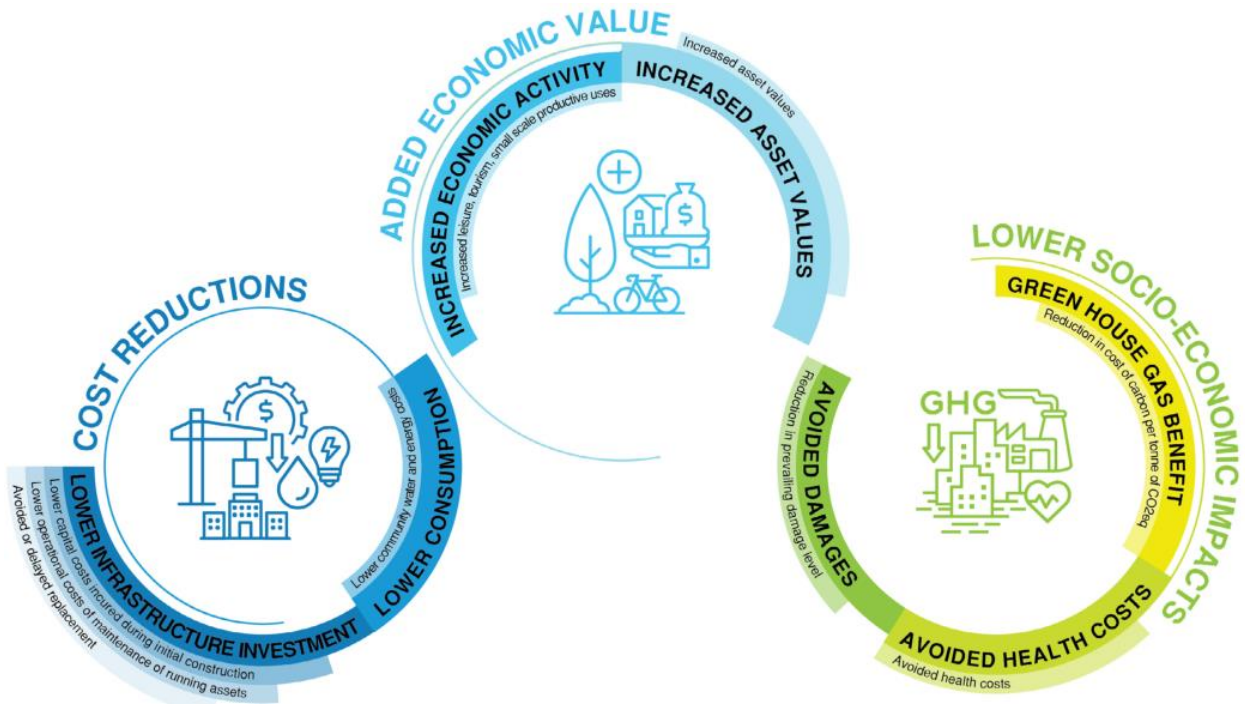
4 Improved sense of place
- Community feedback

5 Increased knowledge on urban ecosystems
- Community feedback on urban ecosystems and their functions

6 Community value of nature and ecosystems
- Number of participants in community events celebrating local nature

7 Increased participation of community
- Participation rates in local environmental management

Key Economic Benefits



How can NbS be framed in economic terms?

Subsets of benefit streams can build financial/economic case

Cost reductions
- Lower capital costs during construction
- Lower infrastructure operational and maintenance costs
- Avoided or delayed infrastructure replacement costs
- Lower community water or energy costs
- Adjusted insurance costs

Lower Socio-economic impacts
- Avoided $ damages of natural events (e.g., flood)
- Avoided health costs (e.g., reduced DALYs)
- GHG benefits (e.g., stored carbon)

Added economic value
- Increased asset values (e.g., property, amenity)
- Tourism, small scale productive uses, commercial amenity

Methodologies exist to capture and calculate benefits

Case Study 1: New Clark City (Philippines)

Avoided costs of infrastructure investment and operation costs

Reduced costs of embankment and works to direct river and control flow	Reduced costs of construction by leaving river in existing channel	⊕ 2.4 million
Reduced costs of bridge construction (infrastructure crossing)	Reduction in cost of 6 bridges ($5 million/ bridge): Shift bridge to shorten span	⊕ 30 million
		⊕ 2 million
Avoided pond cost (transfer to flood plain)	*Data not available*	
Low natural and landscape boundary costs, minimal grading	Reduced grading due to shift in retention pond	⊕ 15 million
	Expansion of river zone	⊖ 5 million

Master planning exercise for New Clark City (Philippines)

- 9450 ha, 1.2m inhabitants
- Increasing the river zone of Cut-Cut River by following natural topography
- Reducing works to direct river, avoiding grey infrastructure and embankments
- Providing floodplains with open green spaces and retention ponds
- Enhancing linkages with ecological structures

Benefit streams

Cost reductions

- Quantified benefits primarily in cost reductions
- NbS delivered $50m reduction on $350m investment. – 15%
- Reduced need for grey infrastructure (bridges, river embankment works)
- Fewer earth works by adopting the natural flow of the river for retention ponds

Lower socio-economic impacts

- Avoided downstream flooding
- Avoided health costs (recreation, non-modal transit, heat island effects)
- Reductions in GHG emissions

Added economic value

- Green branding (e.g., hosting of Southeast Asian Games)
- Recreational revenues (fishing, sports, small-scale agriculture)
- Property values along river corridor
- Note some offset against development benefits of grey infrastructure

Case Study 2: Revitalization of Informal Settlements and their Environments (RISE) - Indonesia

	ECONOMIC BENEFITS	ECONOMIC VALUE ESTIMATES	$
COST REDUCTIONS	*Avoided costs of infrastructure investment and operation costs*		
	Avoided grey infrastructure costs	Avoided costs of water drainage and storage infrastructure	*Data not available*
	Reduction in annual road maintenance cost	Estimated at Net Present Value (NPV) $90,000 for 21 km	⊕ 90,000
	Avoided energy and water consumption costs		
	Savings in water costs	Water savings per household ($112/year)	⊕ 1.83 million
ADDED ECONOMIC VALUE	*Increased NbS related economic activity*		
	Improved micro-economies and urban farming	Production value	*Data not available*
	Lower loss of earnings in flood	Reduced loss of earnings per household ($143/year)	⊕ 650,000
	Time savings on waste disposal	Time savings per housholde ($39/year)	⊕ 180,000
	Increased property or other asset values		
	Rising land values	Increase in value of assets	*Data not available*
LOWER SOCIO ECONOMIC IMPACTS	*Avoided infrastructure damages*		
	Reduced infrastructure damage	Reduced infrastructure damage per household ($29/year)	⊕ 130,000
	Avoided health impact costs		
	Reduced loss of earnings	Reduction in DALYs (valued at per capita GDP income at $57/household/year)	⊕ 260,000
	Savings in medical costs	Reduction in DALYs (valued at per capita GDP income at $94/household/year)	⊕ 1.54 million
	Avoided GHG emissions		
	Avoided captured GHG	Avoided, captured GHG value ($/TCO2eq.)	*Data not available*

NbS in Informal Settlements - RISE (Makassar, Indonesia)

- Community scale NbS interventions
- Improved water supply through rainwater harvesting and recycling, improved sanitation through newly-installed septic tanks, biofilter gardens wastewater treatment, improved drainage, and flood and tidal inundation management (e.g., wetlands), resilient access roads and utility corridors along with community capacity development for long-term operations, maintenance and system replication.
- EIRR of 17.5% indicating strong economic returns

Cost savings

- Savings in water costs
- Reduction in road maintenance costs
- Avoided grey infrastructure costs

Lower socio-economic impacts

- Avoided flood infrastructure damages
- Avoided livelihoods losses
- Avoided health costs (e.g., faecal contamination, vector habitats)

Added economic value

- Green branding
- Productivity and NbS economic activity (micro-farming)
- Increasing property and land values

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THANK YOU!

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