# Nature-based Solutions for Infrastructure

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Nepal Infrastructure Summit
Kathmandu, 12 September 2024

# What is a Nature-based Solution?

Nature-based solutions are "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing human well-being, ecosystem services and resilience and biodiversity benefits."*

*2022 United Nations Environment Assembly

Translation: Using nature and nature-based processes to benefit both people and biodiversity.

# GREEN INFRASTRUCTURE (GI)

Green Infrastructure Ontario Coalition

**Nature-based Solutions (NbS)/Nature-based Climate Solutions**

**Natural Infrastructure (NI)**

**Low Impact Development (LID)**

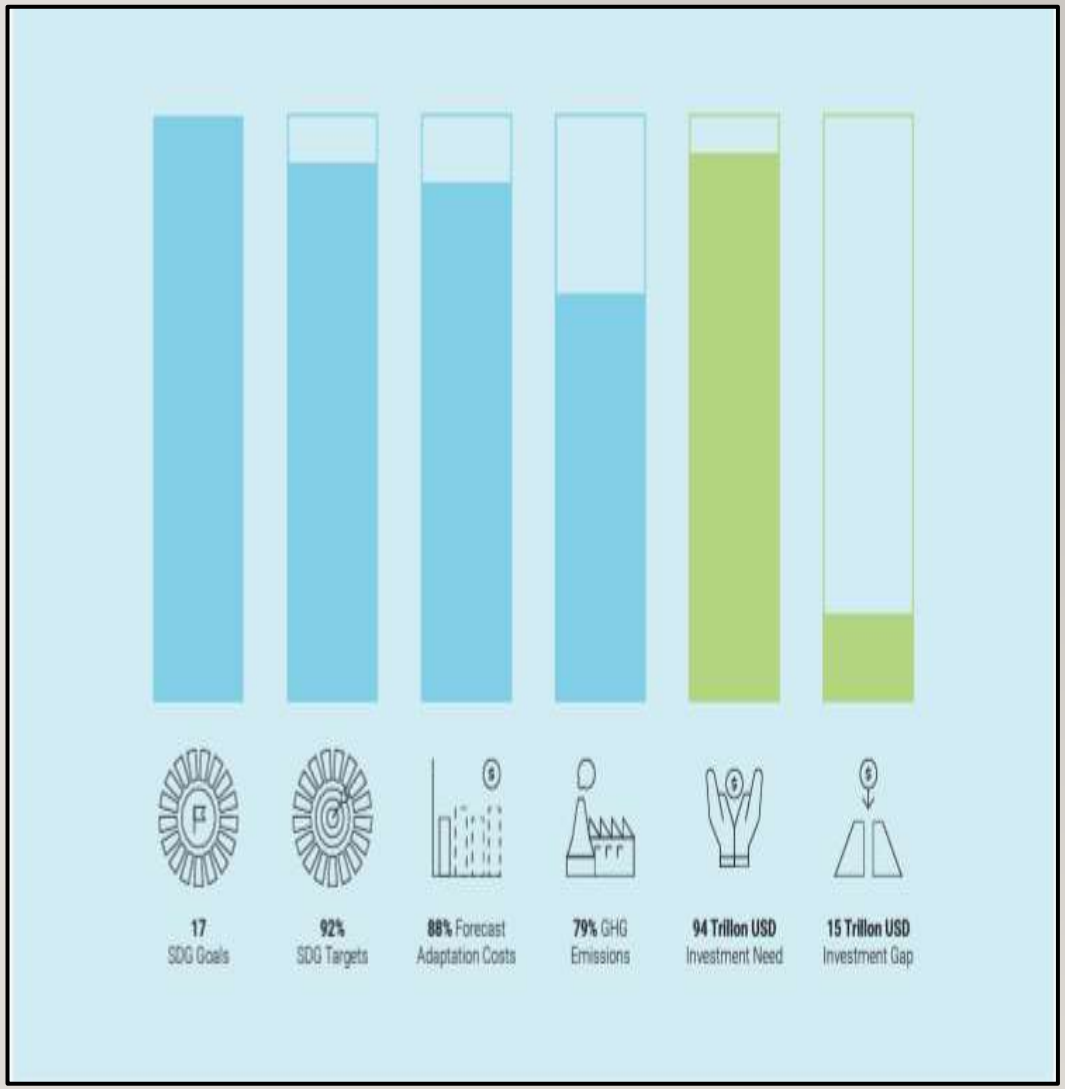
### NATURAL ASSETS:*
- Wetlands
- Forests
- Parks
- Meadows
- Lawns and gardens
- Soil

### ENHANCED ASSETS:*
- Rain gardens
- Green roofs and walls
- Bioswales
- Urban trees
- Naturalized stormwater ponds

### ENGINEERED ASSETS:*
- Permeable pavement
- Rain barrels
- Cisterns
- Perforated pipes
- Infiltration trenches

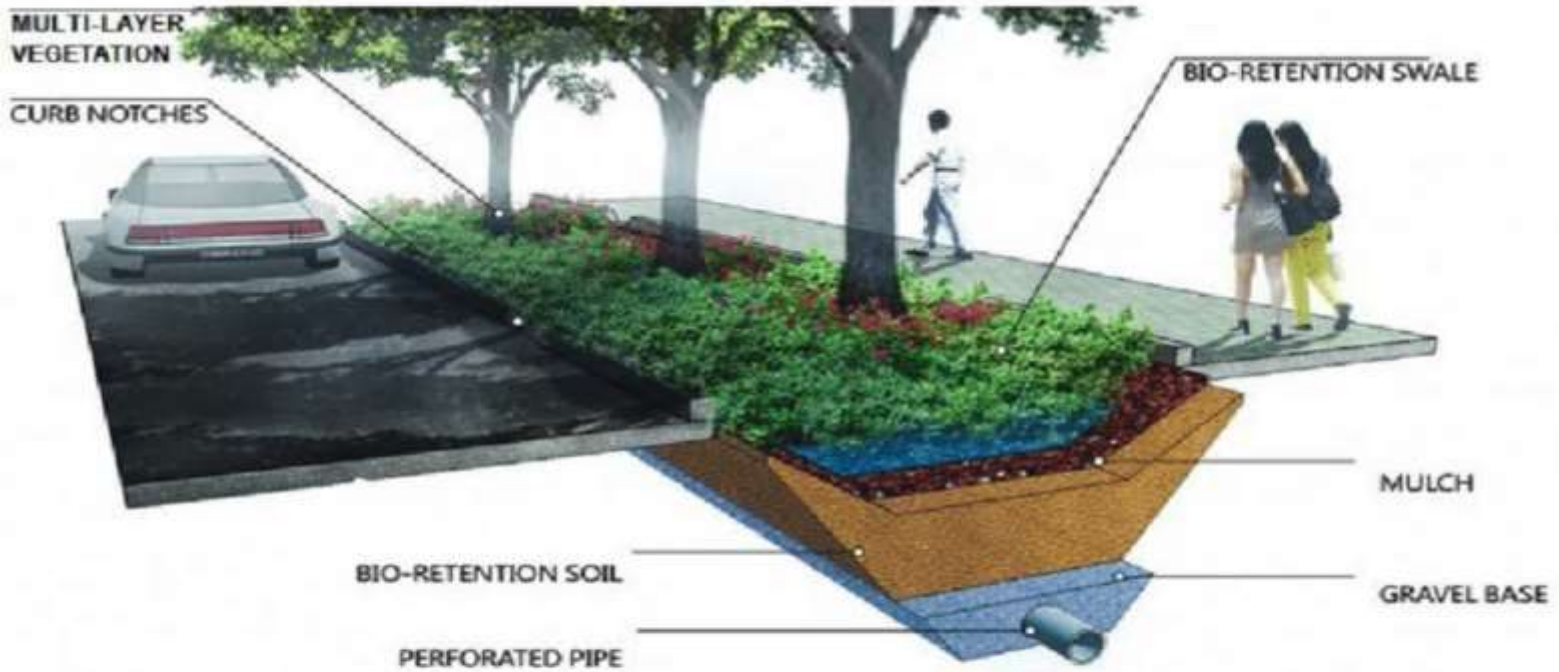
### GREY INFRASTRUCTURE:*
- Bridges
- Roads
- Parking lots
- Culverts
- Pipes


Infrastructure systems are related to:



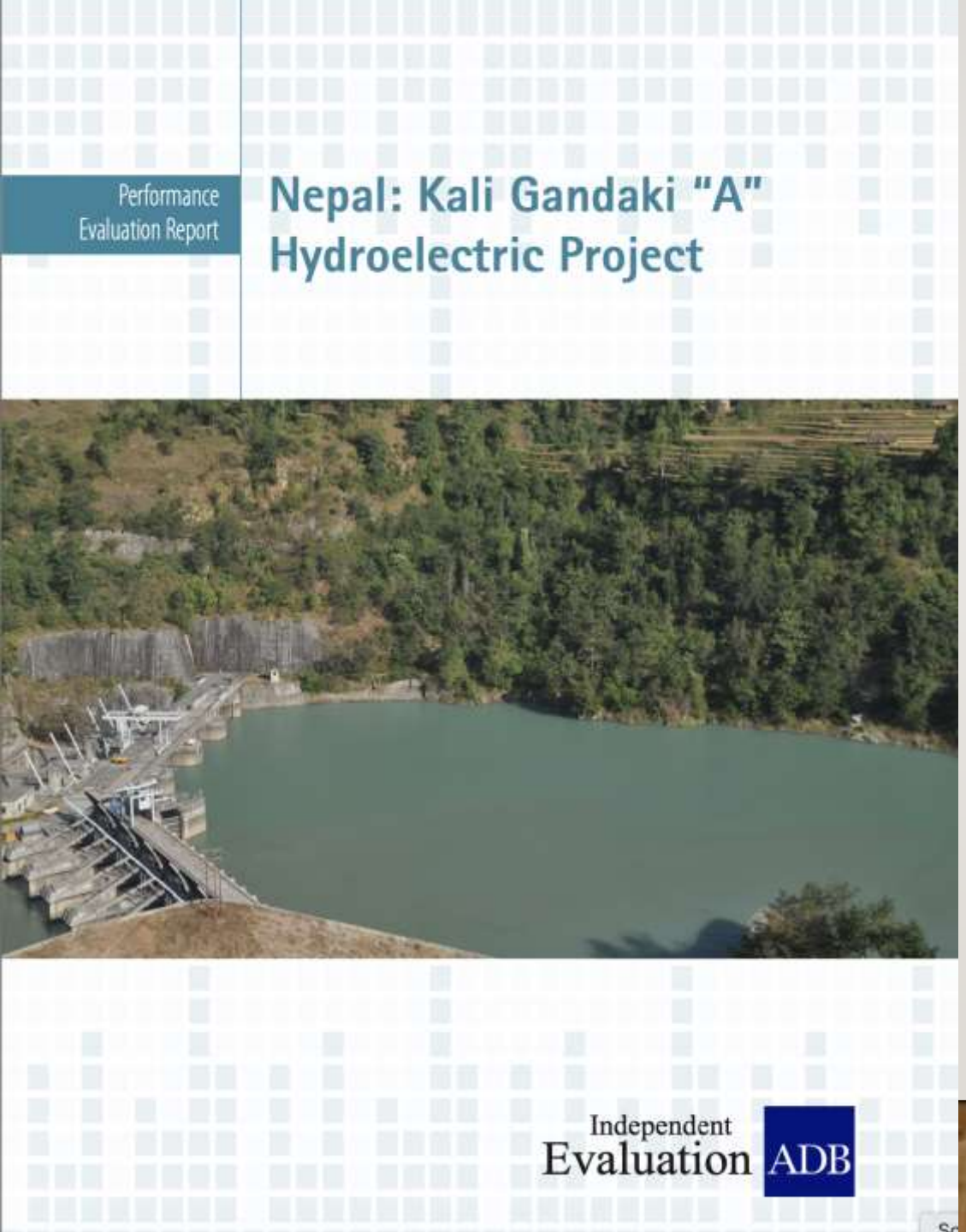
# What are some Examples of Nature-based Solutions?

Urban Parks
Retention Ponds
Wetlands




Bioswale concept diagram: (1) Dirty and polluted water from rooftops, roads and parking lots enters the bioswale; (2) Water is slowed down by various plants and rocks, pollutants settle out, clean water infiltrates the soil; (3) Water enters the perforated pipe and is slowly absorbed into the ground; (4) Excess stormwater exits the bioswale and flows through the pipe into the recipient, cleaner then when it entered and in the amount significantely reduced. Source: http://www.cranejapan.co/grass-bioswale-diagram.html

From Dinic Brankovic, et al, 2019. Bioswales as elements of green infrastructure – foreign practice and possibilities of use in the district of the City of Nis, Serbia




# NbS and Hydropower Projects

Protect/restore forested watersheds as part of a comprehensive management plan

Dam proceeds pay for ecosystem services (clean and dependable water)

# PROJECTS


CITIES ARE BUILDING HEAT RESILIENCE
WRI Partnerships to Explore Urban Heat Resilience
NORTH AMERICA
EUROPE
ASIA
Portland
Boston
Phoenix
Dallas
Atlanta
Charlotte
Columbia
San Antonio
New Orleans
Jacksonville
Hermosillo
Monterrey
Mexico City
Cancun
Barcelona
Istanbul
Marrakech
WRI INDIA
Bihar
Bhopal
Dhaka
Surat
Chennai
WRI MÉXICO
WRI AFRICA
Dire Dawa
Nairobi
WRI BRASIL
Belo Horizonte
Campinas
Rio De Janeiro
Buenos Aires
Cape Town
Durban
Atlantic Ocean
Pacific Ocean
Indian Ocean
OCEAN
Data For Cool Cities - Pilot
Data For Cool Cities - Prospect
Heat Health Impact
Smart Surfaces Coalition
Community-based Heat Measurement
WORLD RESOURCES
Google.org
C40
Adrienne Arsht-Rockefeller Foundation
SMART SURFACES
URBAN

REGIONAL FLYWAY INITIATIVE INVESTMENT CONCEPT 4

# POLLUTION PREVENTION AND WATER MANAGEMENT

Preventing pollution and sound water governance offers massive benefits.

Properly managed wetlands can intercept runoff and transform and store pollutants like sediment, nutrients, coliform and certain heavy metals without being degraded.

RFI investments will aim to realize the full potential of wetlands—particularly in urban environments—for delivering effective pollution and water management using nature-based solutions. This will ensure local wetland communities are less susceptible to flooding and pollution events. RFI investments will provide financing schemes to ensure wetlands are managed sustainably, over the long-term.

## WHY POLLUTION PREVENTION AND WATER MANAGEMENT MATTERS

**$1.4 million/year saved**
by 220 people using constucted wetlands for wastewater treatment (Albania)

**48% reduction**
of biological oxygen demand in wastewater treated in constructed wetlands (Australia)

**85%-90% organic pollutants reduced**
in wastewater treatment in constructed wetlands (Dominican Republic)

## BENEFITS OF WETLANDS TO POLLUTION PREVENTION

**$2.9 billion/year**
avoided cost of constructing artificial wetlands to replace natural wetlands' existing phosphorus filtration

**$4.2 billion**
avoided costs of sediment filtration and phosphorus removal services

**$13 billion**
cost of implementing agricultural best management practices to remove an equivalent phosphorus load annually

Data based on Canada (2021)

CASE EXAMPLE

**ATHURA DISTRICT, UTTAR PRADESH STATE, INDIA**

Constructed Wetlands and Natural Treatment of Wastewater

Area: 1.2 hectares

**90% to 95%**
rate of removal of fecal coliform in waste water through a constructed wetland

**35 square meters**
area required to treat a wastewater load of about 20 cubic meters a day

**Significant biodiversity value**
Significant reduction of contaminants entering big bodies of water, 100% of water recycled, minimal electricity use

References: University of Waterloo (2022); GIZ Albania (2021); Greenway & Simpson (1996) as cited in Almuktar et al. (2018); The Nature Conservancy (2021); Thamke (2021).

# Water Supply and Quality

# What are some Benefits of Nature-based Solutions?

European Commission

# NATURE BASED SOLUTIONS

## Good for biodiversity

Deployment of urban green infrastructure increases habitat for nature.

## Good for disaster risk reduction

Coral reefs dissipate more than 97% of wave energy.

[Nature communications, 2014]

## Good for our health

Health benefits from NBS include

- reduced depression,
- mental health improvement,
- reduced cardiovascular morbidity,
- improved pregnancy outcomes,
- obesity and diabetes reduction.

[EKLIPSE, 2017]

## Important for jobs and business

Over 56,000 jobs created through the Emscher Landscape Park in North Rhine Westphalia region in Germany.

[WWF ILO Report: Nature Hires, 2020]

## Vital for the climate

37% of climate mitigation needed until 2030 to keep global warming below 2°C.

[IPBES GA SPM key message D8, 2019]


**References:**

1. EKLIPSE, *An impact evaluation framework to support planning and evaluation of nature-based solutions projects*, 2017, https://bit.ly/3da5rdC.

2. IPBES Global Assessment on Biodiversity and Ecosystem Services, *Status and Trends - Nature's Contributions to People (NCP)*, 2019, https://bit.ly/3li7Bsx.

3. Nature communications, *The effectiveness of coral reefs for coastal hazard risk reduction and adaptation*, 2014, https://go.nature.com/3OFR2y3.

4. WWF & ILO, *NATURE HIRES. How Nature-based Solutions can power a green jobs recovery*, 2020, https://bit.ly/3k7CFdO.


Environment

# What are some major challenges and solutions?

# CHALLENGE

- Getting started
  - Build awareness; training
  - Demonstration projects
  - Develop a national policy

# CHALLENGES

- Outdated building codes, standards, legislation
  - Assess opportunities to amend sector policies, regulations, guidelines, etc. to introduce NbS

# Finance, tools and references

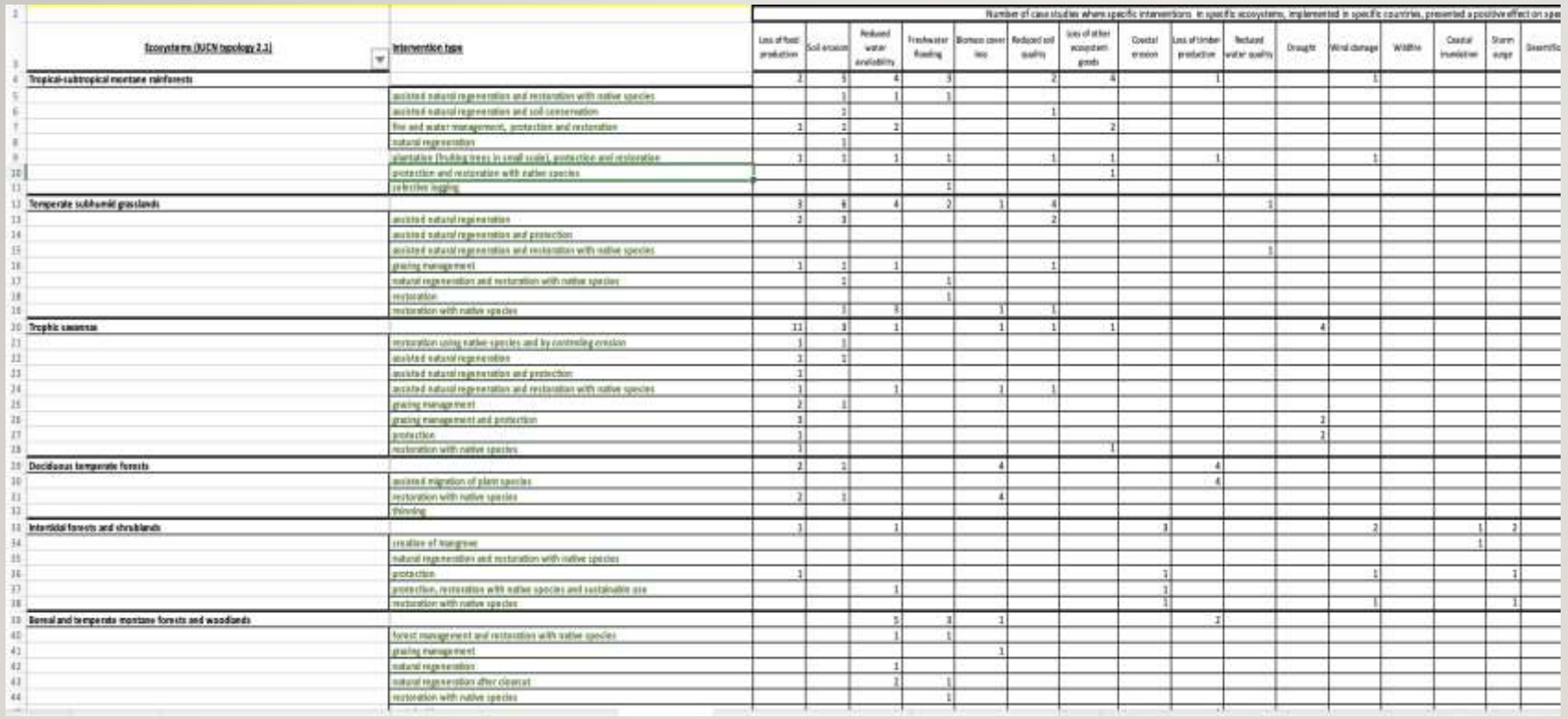
# FINANCE, TOOLS & REFERENCES


**Canada and ADB Launch New Fund to Support Private Sector Climate Action and Nature-Based Solutions**

linkedin.com

The Canadain Climate and Nature Fund for Private Sector in Asia, a $255 million trust fund at ADB.
See:
https://www.adb.org/news/canada-and-adb-launch-new-fund-support-private-sector-climate-action-and-nature-based

# FINANCE, TOOLS & REFERENCES



| Ecosystems (IUCN typology 2.1) | Intervention type | Number of case studies where specific interventions, in specific ecosystems, implemented in specific countries, presented a positive effect on spe | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Loss of food production | Soil erosion | Reduced water availability | Freshwater flooding | Biomass cover loss | Reduced soil quality | Loss of other ecosystem goods | Coastal erosion | Loss of timber production | Reduced water quality | Drought | Wind damage | Wildfire | Coastal inundation | Storm surge | Desertific |
| Tropical-subtropical montane rainforests | | 2 | 5 | 4 | 3 | | 2 | 4 | | 1 | | | 1 | | | | |
| | assisted natural regeneration and restoration with native species | | 1 | 1 | 1 | | | | | | | | | | | | |
| | assisted natural regeneration and soil conservation | | 2 | | | | 1 | | | | | | | | | | |
| | fire and water management, protection and restoration | 2 | 2 | 2 | | | | 2 | | | | | | | | | |
| | natural regeneration | | 1 | | | | | | | | | | | | | | |
| | plantation (fruiting trees in small scale), protection and restoration | 1 | 1 | 1 | 1 | | 1 | 1 | | 1 | | | 1 | | | | |
| | protection and restoration with native species | | | | | | | 1 | | | | | | | | | |
| | selective logging | | | | 1 | | | | | | | | | | | | |
| Temperate subhumid grasslands | | 3 | 6 | 4 | 2 | 1 | 4 | | | | 1 | | | | | | |
| | assisted natural regeneration | 2 | 3 | | | | 2 | | | | | | | | | | |
| | assisted natural regeneration and protection | | | | | | | | | | | | | | | | |
| | assisted natural regeneration and restoration with native species | | | | | | | | | | 1 | | | | | | |
| | grazing management | 1 | 1 | 1 | | | 1 | | | | | | | | | | |
| | natural regeneration and restoration with native species | | 1 | | 1 | | | | | | | | | | | | |
| | restoration | | | | 1 | | | | | | | | | | | | |
| | restoration with native species | | 1 | 3 | | 1 | 1 | | | | | | | | | | |
| Tropic savannas | | 11 | 3 | 1 | | 1 | 1 | 1 | | | | 4 | | | | | |
| | restoration using native species and by controlling erosion | 1 | 1 | | | | | | | | | | | | | | |
| | assisted natural regeneration | 1 | 1 | | | | | | | | | | | | | | |
| | assisted natural regeneration and protection | 1 | | | | | | | | | | | | | | | |
| | assisted natural regeneration and restoration with native species | 1 | | 1 | | 1 | 1 | | | | | | | | | | |
| | grazing management | 2 | 1 | | | | | | | | | | | | | | |
| | grazing management and protection | 1 | | | | | | | | | | 2 | | | | | |
| | protection | 1 | | | | | | | | | | 2 | | | | | |
| | restoration with native species | 1 | | | | | | 1 | | | | | | | | | |
| Deciduous temperate forests | | 2 | 1 | | | 4 | | | | 4 | | | | | | | |
| | assisted migration of plant species | | | | | | | | | 4 | | | | | | | |
| | restoration with native species | 2 | 1 | | | 4 | | | | | | | | | | | |
| | thinning | | | | | | | | | | | | | | | | |
| Intertidal forests and shrublands | | 1 | | 1 | | | | | 1 | | | | 2 | | 1 | 2 | |
| | creation of mangrove | | | | | | | | | | | | | | 1 | | |
| | natural regeneration and restoration with native species | | | | | | | | | | | | | | | | |
| | protection | 1 | | | | | | | 1 | | | | 1 | | | 1 | |
| | protection, restoration with native species and sustainable use | | | 1 | | | | | 1 | | | | | | | | |
| | restoration with native species | | | | | | | | 1 | | | | 1 | | | 1 | |
| Boreal and temperate montane forests and woodlands | | | | 5 | 3 | 1 | | | | 1 | | | | | | | |
| | forest management and restoration with native species | | | 1 | 1 | | | | | | | | | | | | |
| | grazing management | | | | | 1 | | | | | | | | | | | |
| | natural regeneration | | | 1 | | | | | | | | | | | | | |
| | natural regeneration after clearcut | | | 1 | 1 | | | | | | | | | | | | |
| | restoration with native species | | | | 1 | | | | | | | | | | | | |

NbS Evidence Platform

- Actual examples of NbS & relationship to CC
- Compare impacts of different interventions
- Generate maps

https://www.naturebasedsolutionsevidence.info/evidence-tool/

# FINANCE, TOOLS & REFERENCES

IUCN

IUCN Global Standard for Nature-based Solutions

A user-friendly framework for the verification, design and scaling up of NbS

First edition

# CONCLUSION

- NbS for infrastructure is real and viable and beneficial
- Many examples available in Asia to replicate and tools available to employ
- Support pilot initiatives as proof of concept; assess and modify key policies, regulations and standards