Barriers to Mainstreaming Nature-Based Solutions in Urban India

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Indian cities face many challenges.

Climate change, ecological degradation, and unplanned growth are creating unprecedented risks for an increasingly urbanising India.

Floods

Water scarcity

Heat waves

Photos by Dibakar Roy (left), WELL Labs (centre), and Raw Pixels (right)

What are nature-based solutions (NbS)?

NbS is the use natural and modified ecosystems and ecological processes to to provide environmental and socioeconomic benefits.

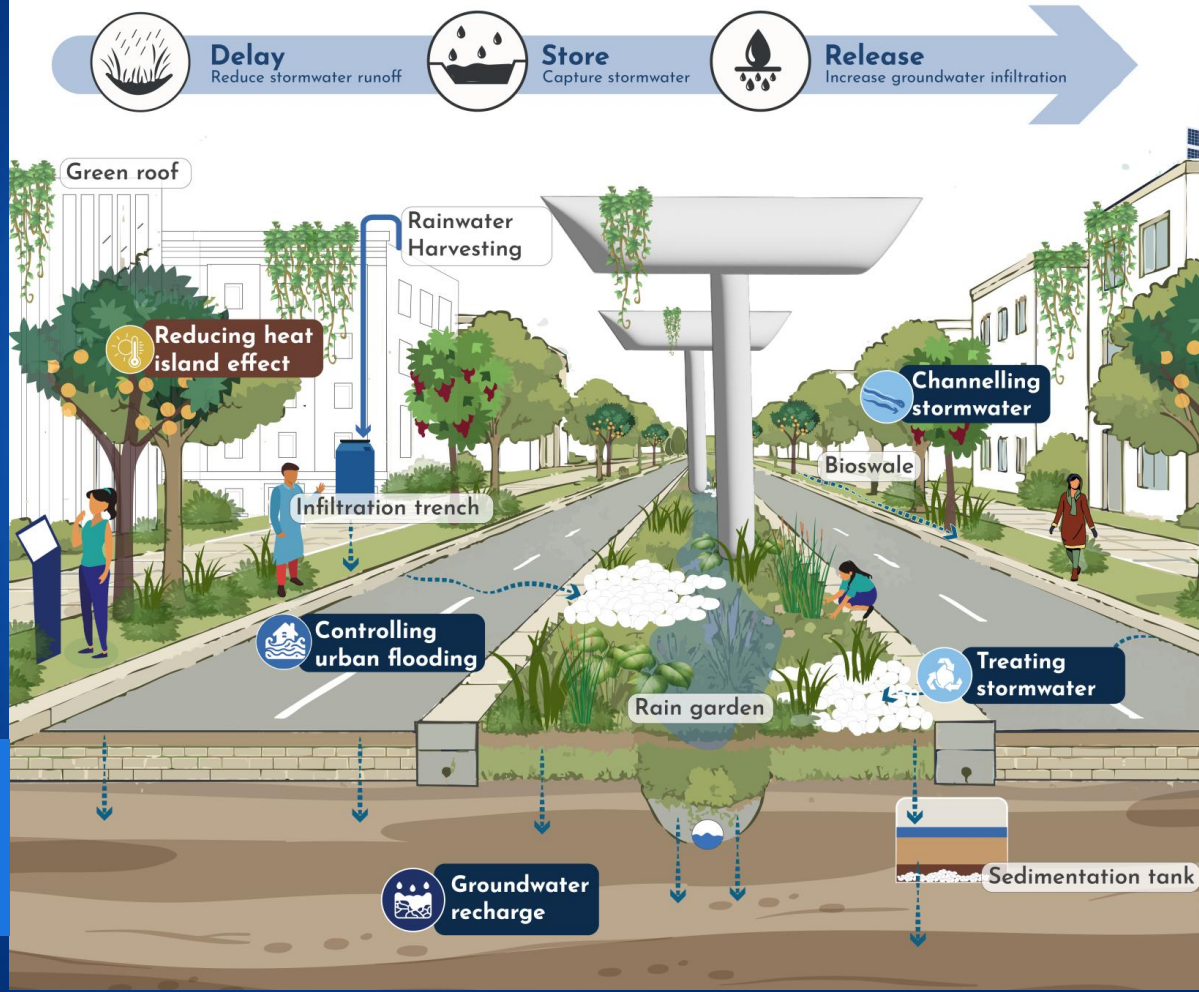
There are various kinds of NbS, such as permeable pavements, green roofs, bioswales, rain gardens, infiltration trenches, wetlands, and parks.

Benefits

NbS

1. Regulate temperatures
2. Sequester carbon
3. Create recreational spaces
4. Recharge groundwater
5. Reduce energy and cooling costs
6. Improve air and soil quality
7. Protect habitats
8. Increase biodiversity
9. Improve public health
10. Protect against extreme weather events

Estimates suggest that NbS can provide 37% of the climate change mitigation needed by 2030 to meet Paris Agreement targets.



While NbS have significant potential to address environmental challenges in urban India, barriers across financial, technical, institutional, and social dimensions hinder their large-scale adoption.

Our study delves into these barriers, synthesises insights from other geographies, and explores solutions to overcome these challenges.

Research Methodology

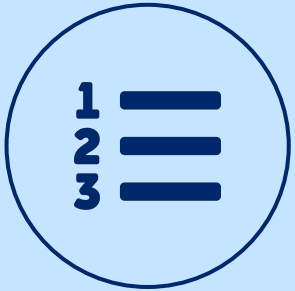
- Literature review
- Policy analysis
- Multi-stakeholder workshop
- Key informant interviews

Multi-stakeholder workshop on mainstreaming NbS in urban India, Bengaluru, May 2025

Barriers to Mainstreaming NbS in Urban India

Lack of scientific evidence

There is not enough data from the Indian context on the extent to which NbS can address a particular threat and provide benefits.



Lack of tendering protocols, design standards, and technical capacity

There are guidelines. standards, and trained professionals for conventional engineering solutions, but not for NbS.

Inadequate funding and financial incentives

The dearth of revenue generation models, investment incentives, and funding, especially for operations and maintenance, deters widespread NbS adoption.

Administrative and institutional barriers

Policy and governance gaps, complex approval processes, weak enforcement mechanisms, and limited stakeholder coordination hamper NbS projects.

Lack of Scientific Evidence

1. **Lack of localised data**
   It is difficult to select appropriate NbS due to a lack of evidence from Indian cities.

2. **Insufficiently quantified benefits**
   There is no standardised framework or sufficient data to consistently quantify and document the full range of NbS benefits.

3. **Integration with grey infrastructure**
   Stakeholders lack clarity on how to effectively integrate NbS with existing grey infrastructure for optimal results.

4. **Data gaps at different scales**
   Data is siloed and scarce for small-scale, decentralised urban NbS (green roofs, permeable pavements, etc.). More data is available globally for large-scale, traditional NbS (forests, lakes, etc.).

Intervention	Reduction in Runoff	Groundwater Recharge	Reduction in Temperature
 Permeable pavements/ parking lots	**5 – 30.8%**	**5 – 23.1%** annual rainfall infiltration	range of **3 – 5°C** reduction in air temperature
 Rain garden	**23 – 31% per sq. m**	**0.42 – 0.70 mm/day** infiltration rate	range of **3 – 5°C** cooling impact
 Wetlands	**31 – 41%**	**21 – 250 mm/yr** groundwater recharge	up to **11.1°C** reduction in surface temperature

Different studies show different quanta of NbS benefits as projects are extremely localised and vary based on hydrogeology, humidity, etc.

Lack of Tendering Protocols, Design Standards, and Technical Capacity

1. **Lack of standardised designs and materials**
   The absence of standardised designs for NbS means that consultants have to recreate them for every project.

2. **Gaps in tendering protocols**
   Government procurement frameworks are geared towards grey infrastructure and have no provisions for NbS. Schedules of Rates often do not include sustainable materials, such as native plant species.

3. **Low technical capacity**
   Engineers, government officials, and architects are not trained in NbS design, implementation, and monitoring—courses on these topics are rarely part of curricula. Institutions are also not equipped to appraise project proposals and make informed decisions.

The lack of standardised designs for NbS means that consultants have to recreate them for every project.

Administrative and Institutional Barriers

1. **Lack of coordination among government departments**
   Various government departments and agencies operate in silos despite similar goals, leading to duplicated efforts.

2. **Project delays due to bureaucratic bottlenecks**
   The necessity of securing approvals from multiple government departments for land, fund disbursement, etc. and ambiguity regarding who can authorise clearance processes results in significant delays, hindering NbS adoption.

3. **Regulatory overlaps**
   Ambiguous legal mandates and jurisdictional confusion, particularly between national and state laws, leads to a lack of accountability and hampers project implementation.

4. **Data deficit**
   The absence of localised ecological and climate data, such as heat maps or biodiversity inventories, affects the decision-making capabilities of institutions and policymakers.

The absence of localised ecological and climate data impedes decision-making.

Administrative and Institutional Barriers

5. **Lack of community engagement**
   Decision-making processes tend to be top-down, with limited opportunities for meaningful inputs from affected communities. This limits the social acceptance and long-term sustainability of projects.

6. **Preference for quick results**
   Short-term political interests frequently drive the selection of projects that promise quick results. The result is the sidelining of long-term, transformative NbS solutions.

7. **Insufficient collaboration among stakeholders**
   Governments, researchers, and practitioners do not work closely together. As a result, the uptake of research and innovation is slow.

8. **Patchy enforcement of environmental regulations**
   Many environmental programmes lack stringent penalties or accountability mechanisms for non-compliance. This undermines their credibility and effectiveness, allowing violations to go unchecked and reducing incentives for stakeholders to adopt sustainable practices.

Stakeholders must work closely together to increase the uptake of research and innovation.

Lack of Financial Instruments and Incentives

1. **Fragmented public funding**
   Most NbS projects rely on a complex, fragmented financing model that requires implementers to navigate multiple funding streams across national and state governments.

2. **Lack of budgetary allocations**
   Dedicated budgets exist mainly for traditional projects such as tree planting and lake rejuvenation, but not for small-scale urban NbS like green roofs or bioswales, which can often provide more value for money.

3. **Underutilised public financing mechanisms**
   Targeted climate funds and grants, such as those proposed by the 15th Finance Commission, remain underutilised.

4. **Lack of long-term financial planning**
   Public funding focuses on initial capital costs, without provisions for long-term operations and maintenance. This leads to the premature failure of pilots and threatens the sustainability of NbS projects.

There are budgetary allocations for traditional projects, such as lake rejuvenation, but not for small-scale urban NbS.

Lack of Financial Instruments and Incentives

5. **Insufficient integration into environmental credit systems**
While carbon credits are well-established in the NbS space, they apply only to certain types of projects, such as afforestation. Additionally, credit systems that go beyond carbon sequestration to quantify other benefits of NbS, such as water conservation, could help direct additional funding towards them.

6. **Limited incentives for the private sector**
The lack of policy measures such as green bonds or incentives like tax breaks, coupled with weak public-private partnership frameworks, limit private NbS projects.

7. **Insufficient information regarding benefits**
Businesses are reluctant to invest in NbS as the returns on investment is unclear due to the absence of quantifiable data on the financial gains, risk profiles, and social/environmental impacts

Insufficient data regarding the returns on NbS projects deters businesses and philanthropies from investing in them.

The Way Forward

Evidence & Data

1. Establish robust protocols for localised data collection and monitoring across India's diverse hydrogeological landscapes.
2. Develop standardised metrics and methodologies for measuring outcomes such as carbon sequestration, flood mitigation, biodiversity enhancement, etc.
3. Strengthen open data platforms.

Capacity & Standards

1. Integrate NbS into curricula.
2. Formulate clear, context-specific technical design guidelines tailored to India's varied climates and ecosystems.
3. Include NbS in procurement and tendering frameworks.
4. Conduct training programmes and certification courses for government officials, engineers, architects, and communities.

The Way Forward

Finance & Incentives

1. Develop tools and frameworks to assess the risks of and returns on NbS investments.
2. Implement pilot projects with rigorous monitoring and evaluation
3. Foster blended finance models.
4. Provide financial incentives like grants, concessional finance, tax breaks, or performance-based payments.

Governance & Policy

1. Mandate cross-departmental collaboration through joint task forces or working groups.
2. Update infrastructure policies to integrate NbS with grey infrastructure.
3. Incorporate NbS in regulatory and planning frameworks, such as master plans, zoning regulations, and environmental impact assessments.
4. Policies should mandate long-term maintenance and stewardship of NbS, with clear funding and accountability mechanisms.

NbS projects require long-term maintenance and stewardship to be effective.

The Way Forward

Public Engagement

1. Institutionalise participatory planning processes to ensure community engagement.
2. Hold nationwide awareness campaigns.
3. Showcase successful projects through the media, conferences, and awards.
4. Involve citizens in monitoring and maintaining NbS through citizen-science initiatives.

Thank You

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