INTEGRATING FOOD, WATER AND ECOLOGY FOR A SUSTAINABLE BENGALURU

Policy Brief 2025

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atree ASHOKA TRUST FOR RESEARCH IN ECOLOGY & THE ENVIRONMENT

AFD AGENCE FRANÇAISE DE DÉVELOPPEMENT

EXECUTIVE SUMMARY

- Bengaluru faces mounting ecological and social pressures due to rapid urbanization, loss of green cover, water scarcity, and biodiversity decline. With the city's built-up area expanding from 8% in 1973 to over 93% in 2023, urban planning must urgently shift towards sustainability especially with respect to increasingly scarce resources such as water that Bengaluru imports from the Cauvery basin. It also needs to conserve existing green spaces and find innovative ways of fostering biodiversity within the city, as both blue and green spaces will be needed to help mitigate heat stress due to climate change and heat island effect besides contributing to water security. Given that agriculture and food production are the largest consumers of water and the health of citizens depends on the quality of food, there is an urgent need for the integration of food, water and ecology within the city as well as in its surroundings. Nature-based solutions (NbS) offer a pathway to address these intertwined challenges by integrating food systems, water management, and ecological restoration. This policy brief outlines a holistic framework, developed through research by IIHS and ATREE, to embed NbS into urban development.

- Urban food systems, such as edible gardens and pollinator-friendly spaces, present opportunities to reconnect communities with nature, enhance local food security, and support biodiversity. One approach within the city that could be adopted is fostering pollinator support in food gardens, thus establishing a synergy between biodiversity and food. The other is recycling of water for irrigation and food waste into compost to benefit home gardeners and farmers. The third is restoration of tanks or keres in Bengaluru that provides co-benefits in terms of ecological and water security.

- However, implementing NbS requires coordinated governance, data-driven planning, and community engagement. Case studies from Bengaluru illustrate how terrace gardens, institutional campuses, and urban lakes can become micro-hotspots for ecology and food.

- Key policy recommendations include establishing collaborative governance mechanisms, creating financial incentives for NbS, and embedding urban agriculture into zoning regulations. Capacity building, public awareness campaigns, and robust monitoring frameworks are also essential. Leveraging existing institutions and policies like the Bengaluru Climate Action and Resilience Plan can accelerate integration.

- This policy brief calls for a concerted effort to transform Bengaluru into a resilient, equitable, and ecologically vibrant city by reimagining urban infrastructure through the lens of food, water, and nature.

1. INTRODUCTION

Bengaluru's rapid urbanisation has severely impacted its ecological systems. The city's green cover has diminished by 88%, and 75% of its water bodies have been lost (Kulranjan et al., 2023). The built-up area surged from 8% in 1973 to over 93% in 2023, triggering water scarcity, flooding, urban heat islands, and biodiversity loss (Ramachandran et al., 2023). Climate change further amplifies these issues, necessitating urgent integration of ecological resilience into urban planning. Can nature, then, serve as a solution to mitigate these challenges and create more resilient cities?

Nature-based solutions (NbS) are a promising approach to address interconnected issues of ecological degradation, water management, and human well-being. At a larger scale and for agricultural commodity expansion, the possible integration was proposed in a thematic manner by Rege et al., (2024). The authors identified themes (Figure 1) like : (1) Robust land use suitability assessments to determine the viability of agricultural expansion or other competing demands on productive land in given landscapes; (2) the need for plot-level studies of soil biodiversity and ecological functions for commodity crops; (3) Irrigation for commodity crops with blue and green water for evaluating co-dependent drivers and outcomes; (4) an improved understanding of local producer motivations and supply chains and (5) the analysis of co-benefits, trade-offs and synergies in agro-commodity systems.

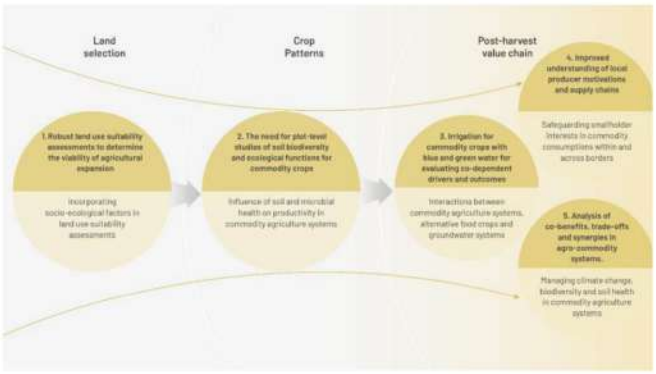


Figure 1: *Integrated process for agricultural commodity expansion.* **Source: Rege et al., 2024**

On a scale corresponding to a cityscape, by embedding NbS into infrastructure and planning, cities like Bengaluru can transform urban landscapes into spaces that support biodiversity and community resilience *(International Resource Panel, 2022)*. Nature-based solutions (NbS) offer a way to address interlinked concerns of ecological security, water availability, biodiversity conservation, and human well-being. Integrating NbS, can address these challenges by promoting sustainable food production, improving water management, and enhancing urban ecology.

As urban populations grow and demand for fresh produce and food security increases, NbS pathways such as edible gardens and pollinator-friendly landscapes become vital. Treating urban food systems as integral components of city planning is essential for sustainability and food security. Additionally, certain studies have indicated that urban spaces are rich in biodiversity, and can offer better refuge for pollinators than neighbouring rural areas due to reduced pesticide use and more resources. Additionally, incorporating water-efficient practices can be beneficial in ensuring resource circularity.

CHALLENGES IN THE CURRENT URBAN LANDSCAPE

One of the key challenges to integrating biodiversity into urban spaces lies in the expansion of built-up environments and the increasing preference for ornamental plant species. This shift has led to the decline of native flora, disrupting habitats and food sources for urban biodiversity. At the same time, urban food systems in India remain largely unexplored, often viewed as separate from rural agricultural production and broader market linkages. The prevailing rural-urban divide obscures the potential of urban food systems to generate a range of ecological and social co-benefits. **From rooftop gardens and community spaces to institutional campuses, housing societies, and urban lakes, integrating food production into cityscapes offers a way to reconnect urban populations with nature while enhancing local food security**. Recognising these connections and embedding them within urban planning is essential for building cities that are not only more sustainable but also more equitable and ecologically integrated.

The implementation of initiatives with an integrative approach is challenging. Apart from biophysical challenges, governance across multiple jurisdictions is also an issue. Lack of institutional coordination and information sharing, along with the heterogeneity of the stakeholders involved can complicate the process for implementing NbS and need to be addressed. **The policy brief offers localised practicable pathways to support the integration of food, water and ecology through urban food systems at different scales.**

In the case of Bengaluru, its urban expansion has resulted in:

- Loss of productive land and biodiversity
- Disrupted water cycles and pollution of blue, grey, and black water systems
- Increased heat island effects and localised flooding
- Declining food and nutritional security for vulnerable communities

Fragmented governance and weak coordination among stakeholders further hinder the implementation of NbS, calling for integrative and localised approaches.

NATURE-BASED SOLUTIONS: A PATH FORWARD

NbS represent an emerging paradigm in urban sustainability, offering multifaceted strategies to address interlinked challenges of ecological degradation, water insecurity, and food system disruptions. Defined by the International Union for Conservation of Nature (IUCN) as actions that protect, sustainably manage, and restore natural or modified ecosystems to address societal challenges, NbS simultaneously provide human well-being and biodiversity benefits *(Cohen-Shacham et al., 2016)*. In the context of Bengaluru, the rapid loss of vegetation, fragmentation of habitats, and strain on water infrastructure call for integrative solutions that reintroduce ecological functions into the urban fabric.

Urban agriculture, edible landscapes, and pollinator-friendly green spaces exemplify how NbS can foster food security, community engagement, and ecological restoration. Urban agriculture, especially food gardens in terraces and public spaces, can localise food production and strengthen food sovereignty. These systems also offer habitat for pollinators, essential for maintaining healthy ecosystems *(Mukherjee et al., 2019)*.

Research shows that urban environments, when managed with ecological intent, can host higher pollinator diversity than surrounding rural areas due to reduced pesticide usage and a greater variety of flowering plants *(Hall et al., 2017; Casiker et al., 2021)*. Bengaluru is rich in biodiversity with over 300 species of birds, 179 species of butterflies and numerous species of wasps, beetles, flies and bees that can be supported by urban pollinator-friendly plants. Most food plants that can be grown in urban settings — such as vegetables and fruits — are dependent on animal pollinators in contrast to wind-pollinated crops such as paddy and millets that are grown in rural areas. Furthermore, there are diverse species of solitary bees in urban areas. Solitary bees are known to be efficient pollinators and can be fostered through bee hotels which serve as nesting sites. The restoration of native vegetation and the inclusion of multifunctional green spaces can enhance resilience to climate-induced stresses such as urban heat islands and flooding *(Kabisch et al., 2017)*. Moreover, when embedded in urban planning, these interventions promote circular resource use, such as composting and wastewater reuse, which freshwater dependence *(Raymond et al., 2017)*.

The success of NbS depends on community participation, inclusive governance, and evidence-based design. Integrating them within formal urban policies and development frameworks is crucial to scale their benefits. As a fast-growing metropolis, Bengaluru presents a unique opportunity to showcase how NbS can be localized and embedded in the daily rhythms of urban life, fostering both ecological and social resilience. Aligning with global sustainable development goals, such strategies offer a pathway to equitable and climate-responsive urban transformation.

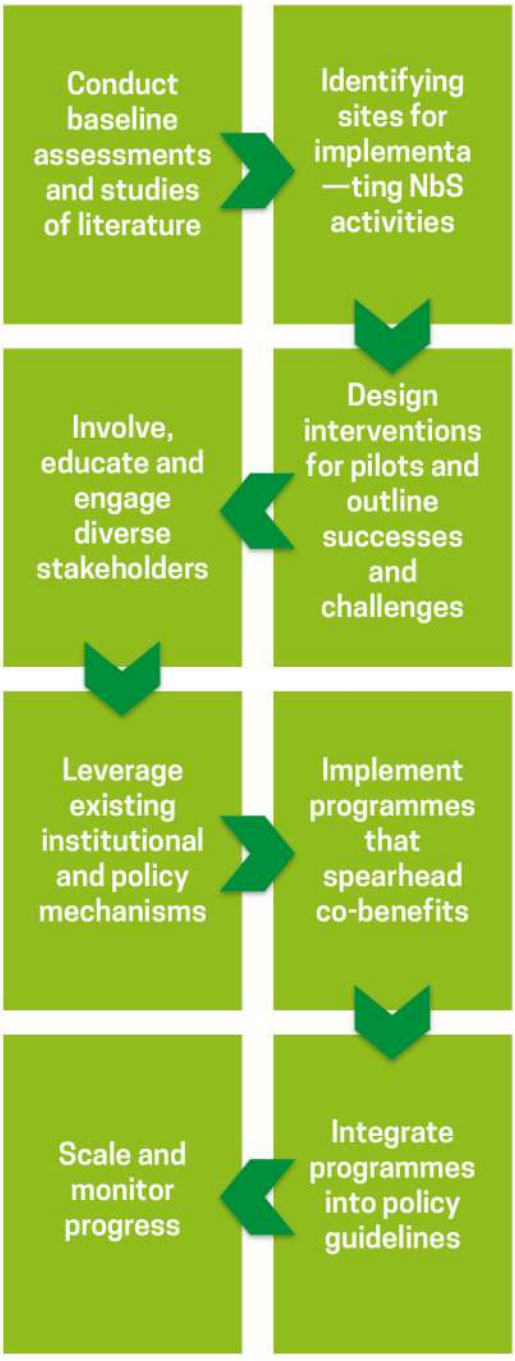
Sustainable urban food systems such as these can have **multiple co-benefits**:

- Urban greening
- Improved biodiversity due to ensuring presence of a variety of pollinators such as bees, birds, and butterflies.
- Improved soil fertility through the use of compost ensures environmentally friendly inputs and better waste management.
- Community participation and well-being with associated benefits of improved physical and mental health.

2. FRAMEWORK FOR INTEGRATING FOOD, WATER AND ECOLOGY THROUGH NBS

While the importance of grappling with challenges associated with urbanisation is well established, practicable pathways to do so need to be designed, tested, improved and mainstreamed.

To successfully integrate food, water, and ecology into a cohesive strategy for sustainable urban development, a clear and systematic framework is required. Researchers at IIHS and ATREE conducted a programme that outlines a stepwise process for integrating food, water and ecology through green urban food systems in Bengaluru, which can be carried out and scaled. This involves the following steps:



1. Conduct baseline assessments and studies of literature

Understanding existing biophysical features, infrastructure as well as existing literature on these phenomena is an essential first step in designing and planning any NbS interventions.

2. Identifying sites for implementing NbS activities

This step involves understanding the potential sites where NbS interventions can be carried out most optimally and effectively.

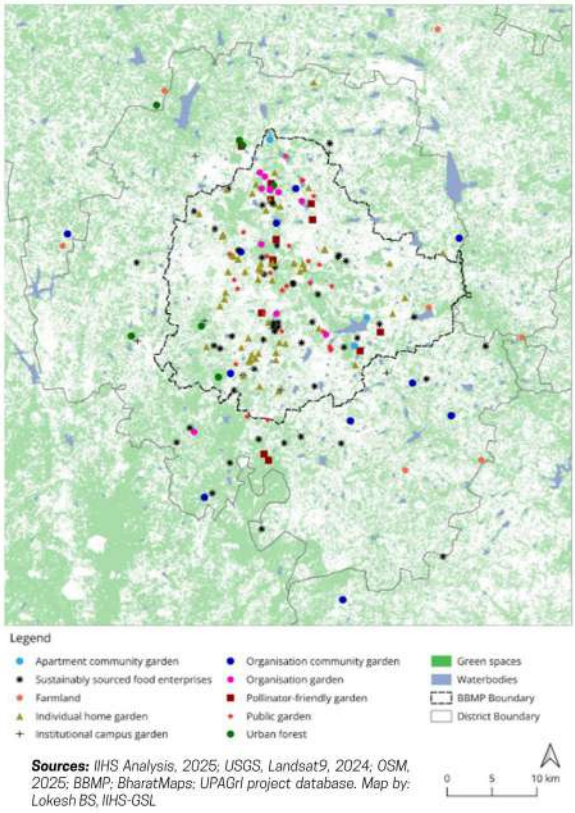


Figure 2: *The map showcases different types of food gardens to foster biodiversity and the potential for scaling up, and the potential for Bengaluru to generate demand for sustainably sourced food from surrounding regions.* ***Source: IIHS***

3. Design interventions for pilot studies and outline successes and challenges

Pilot studies are an important avenue of understanding existing capacity while simultaneously building capacity for the implementation of urban food systems. This can entail pilots at multiple scales, involving relevant stakeholders.

4. Involve, educate and engage diverse stakeholders

Implementing any behavioural or infrastructural change requires stakeholders involved as active participants. Training and educating stakeholders on the relevant knowledge and skill sets required to implement NbS activities.

BRIGHT SPOT

Perception survey for pollinator-friendly gardening

At selected schools and residential complexes in Bengaluru, a perception survey was carried out to capture the understanding, attitudes, and practices related to biodiversity, waste management, food gardens, and environmental awareness among teachers, students, and residents. Key aspects of the survey included familiarity with pollinators, waste disposal practices, and interest in sustainable activities like food gardening. Conducting this survey was vital in gauging current environmental awareness levels and identifying gaps in knowledge and practices, particularly around biodiversity's role in urban settings. By understanding participants' perceptions, intervention programmes can be tailored such that they resonate with the community's needs and challenges. The survey was conducted on a small scale across various schools and apartment complexes, gathering responses and insights into urban and sub-urban environmental engagement levels. This initial data provides a foundation for building awareness programmes and creating sustainable practices in these communities. **An important insight was to increase awareness on kinds of pollinators, particularly ones that do not sting to improve willingness to plant pollinator friendly species.**

5. Leverage existing institutional and policy mechanisms

A number of existing policy mechanisms and institutions can be tapped into to implement urban food systems. These include government programmes and initiatives such as the Bengaluru Climate Action and Resilience Plan. Additionally, working with municipal bodies such as the Bruhat Bengaluru Mahanagara Palike (BBMP) and Bangalore Water Supply and Sewerage Board. The BBMP's Kere Mitra and Hasiru Mitra initiative involves citizens in the maintenance and monitoring of lakes and parks in Bengaluru which can be an efficient way of utilising an existing mechanism for implementing NbS.

6. Implement programmes that spearhead co-benefits

Co-benefits of urban food systems such as improving biodiversity, urban greening, food security, and community well-being emerge through the implementation of such programmes. Recognising the interlinkages between such co-benefits and the interventions planned is significant in order to attract further implementation and financial investment.

7. Integrate programmes into policy guidelines

Institutionalising NbS pathways would require some form of integration into government regulations and policy guidelines. This step would require advocating and influencing relevant politicians and bureaucrats.

8. Scale and monitor progress through established standards

Scaling up of programmes is an essential next step for integrating such activities into mainstream planning. The goal is to ensure the benefits are achieved across the city, in as many pockets or wards as possible. Monitoring is necessary to ensure continued success and course-correction as and when required. However, such monitoring should be through uniform and established standards for scientific monitoring of progress.

CASE STUDY

Creation of Food Gardens in Bengaluru's Terraces, Schools and Lakes

Researchers at IIHS and ATREE conducted pilot studies at various levels of stakeholder engagement revealing opportunities for creating urban food systems. These include stakeholders at four distinct scales or levels:

- *Individual citizens creating and maintaining terrace gardens*
- *Education institutional campuses that offer opportunities for scaling urban gardening activities, biodiversity-rich, pollinator-friendly micro-hotspots in the city. As Bengaluru continues to develop as an educational hub, campuses can foster awareness among young people around urban agriculture, composting, and food security.*
- *Residential complexes as built up spaces that have potential for community engagement and cohesion as well as greening*
- *Urban lakes collaborating with municipal officials to improve surrounding vegetation and thus, urban pollination.*

Ward-level pilots were carried out in order to achieve a holistic understanding of integrating NbS activities through a city-wide approach for Bengaluru. Activities undertaken included:

A. Planting edible gardens through citizen and institutional participation

Food gardens can promote local food production, foster community engagement, enhance urban ecology and greening, contributing to building more sustainable and liveable cities. It also deepens people's knowledge and understanding of nature and natural cycles. Setting up food gardens in apartment complexes can also encourage community engagement, bringing residents together in shared activities, fostering social cohesion, and nurturing a collective sense of responsibility towards green practices. Establishing these food gardens requires a moderately flat area of less than 50 square meters with open soil access and consistent water supply from sustainable sources. Institutions and apartment complexes or residential complexes are increasingly coming up in the expanding city of Bengaluru presenting an opportunity to integrate green-grey infrastructure.

For individual houses and residential complexes the following kits were designed:

- **Open-pollinated seeds sourced from local farmers**
- **A seed box designed using upcycled material for collecting, preserving and sharing seeds**
- **Trellis and pergolas for supporting edible plants designed using an invasive weed (Lantana camara) for a productive purpose.**
- **Compost bins to compost household organic waste**
- **Bird feeder designed using upcycled glass container and wood**
- **Bee hotel to provide nesting material for cavity-nesting bees which are excellent pollinators of food plants**
- **Stingless bee box to house a colony of stingless bees that pollinate, do not sting, and produce medicinal honey**
- **Multipurpose harvest bag to store and carry harvested vegetables, etc**

"While our apartment had some greenery scattered across, it is even more appealing to have plants that can produce food. Seeing your food grow organically in front of your eyes is a special feeling and may inspire many residents to start the same in their own balconies as well. Also, composting and bee hotels also seem to be a good learning opportunity for all of us and an opportunity to better connect with our own surrounding nature."

— Participant of the pilot project by IIHS and ATREE

B. Enhancing bee diversity in the urban environment

Solitary bees are a group of lesser-known bees that do not exhibit stinging behaviour and can be safely supported close to human proximity. Bee hotels, designed as miniature apartment buildings, offer safe havens for solitary bees. These bees buzz pollinate several edible plants such as tomato and brinjal. By providing safe nesting sites, bee hotels help cities sustain and even boost pollinator diversity, enriching urban gardens and community farms with enhanced pollination and food yields.

Stingless bee colony showing stored honey and pollen

Stingless bees (Tetragonula species) are another group of bees that are often overlooked and have the potential for integration in human-dominated spaces. These tiny-bodied bees collect nectar and pollen from very small flowers. The honey produced by them is very low in quantity but highly sought after for its taste, fragrance and medicinal properties. Setting up stingless bee boxes in urban farming systems including terrace and kitchen gardens can be beneficial. ATREE has set out to integrate both these groups of bees in urban agricultural systems. Some of the pollinators observed visiting the bee hotels set up for the pilot study included Megachile disjuncta (Resin bee),

Stingless bees are small-bodied and can forage from very small flowers

Ceratina binghami (Small carpenter bee), Austroscolia soror (Blue flower wasp), Xylocopa latipes (Tropical carpenter bee).

BRIGHT SPOT

Creating Spaces for Bees: A Citizen Science Study of Bee Hotels in the City

The Bee Garden Project, a citizen-science initiative by ATREE, studies cavity-nesting bees in urban spaces and endeavours to motivate the public to take part in bee conservation.

WHAT IS A BEE HOTEL?

A bee hotel provides nesting space for cavity-nesting solitary bees. Solitary bees do not live in large colonies or build hives. They require dead wood, twigs, or exposed soil for nesting. They are important and efficient pollinators of many vegetable and fruit plants. They do not display the typical aggressive behaviour associated with honey bees, and almost never sting unless handled closely.

WHY SET UP BEE HOTELS?

- Bee hotels could help support bee species that face nesting space constraints in the highly built urban environment.
- Maintaining bee diversity is crucial to ensuring a healthy and resilient population of pollinators.
- As vegetable and fruit plants provide excellent bee forage, incorporating bee hotels into edible gardens can increase harvest many-fold.
- Bee hotels serve as a nature-based solution for creating sustainable cities by helping conserve a part of the rich urban biodiversity that can co-exist in human-dominated spaces.

WHAT IS THE STUDY ABOUT?

About 70 bee hotels designed to cater to specific bee nesting requirements have been set up in home gardens and public spaces across Bengaluru city. We monitor and analyse bee activity through a phone-based app that logs observations including date, time and bee activity. The app has a simple guide for identifying common bees that one might expect to see in the city.

WHAT DID WE FIND?

We were excited to see that some of our bee hotels had visitors. Different species of cavity-nesting bees have occupied the bee hotels. These solitary bees are known to be important pollinators for several wild and edible plants.

WHAT CAN WE HOPE TO ACHIEVE?

By setting up and monitoring bee hotels in Bengaluru city, the study seeks to generate valuable data about bee ecology which is critical for designing pollinator-inclusive urban spaces including edible gardens, and institutional and public green spaces. Mobilising citizen action for supporting urban biodiversity, and motivating city-dwellers to take up pollinator-friendly measures at an individual or local level can help support bees and other pollinators in our cities.

BRIGHT SPOT

Supporting various forms of biodiversity at different stages of a cropping cycle

A study by IIHS found that various species of molluscs, vertebrates, mammals, birds and reptiles are supported at distinct stages of any cropping or planting cycle. Being aware of these species dependencies can improve biodiversity and ecology in Bengaluru. These are supported by the soil, moisture, fruits, flowers and warrant actions such as:

- Cover crop cultivation between main cropping cycles for improving soil fertility and to attract diverse pollinators
- Use of biofertilizers and biopesticides for maintaining diversity of below the ground organisms the promote soil fertility
- Mulching using plant biomass to retain soil moisture

CASE STUDY

Use of treated wastewater for agriculture and gardening

Bengaluru's water crisis is well-established, along with the causes for such a crisis. Given that the city of Bengaluru's lake system has been an integral part of its watershed, and has faced degradation, and given that these lakes are replenished by the city's sewage water, treatment of that sewage from the city before it is discharged into the lakes, is an integral feature of restoration of these urban wetlands. The wastewater is treated, reused or discharged through a variety of channels. It has been proposed that reusing wastewater for agriculture as opposed to fresh sources of water can ensure a sustainable circular model. A study by WELL Labs shows that wastewater reuse has a high potential for offsetting freshwater use and building water security.

According to their study, around 76% of the wastewater produced by the city (~1470 million litres per day) is currently treated by centralised and decentralised wastewater treatment plants. The remaining wastewater, about 24%, goes untreated, often finding its way into lakes and groundwater. Reuse of treated wastewater is relevant here because, currently, lakes are full of treated wastewater and do not have the capacity to act as flood buffers.

According to the WELL Labs study, there is scope to expand wastewater reuse within the city. Currently, one third of the city's wastewater is redirected for external reuse, which means it is taken to Kolar, Chikkaballapur and Devanahalli districts where it is used to replenish both groundwater and surface water sources. The remaining water flows into lakes or runs off land to join rivers downstream. This means the huge quantum of wastewater generated in the city is an untapped resource. Once treated to the required quality, wastewater can significantly mitigate freshwater consumption for purposes other than drinking, and this can be crucial in making the city water resilient during low rainfall years. This treated wastewater can be used for purposes such as watering the city's green spaces, and, as mentioned above, to recharge aquifers.

The BWSSB is responsible for building and managing wastewater treatment plants, whereas the Minor Irrigation Department (MID) manages rural and peri-urban lakes and the waterways that connect them, and ensures water supply for agricultural use. Ensuring that the connections and governance run smoothly is important within such multi-governance structures to manage a common resource.

The recycling of wastewater for use in agriculture to potentially reduce demands on distant rivers and local groundwater, is a big step towards resilience in water security. Academic institutions have been monitoring the progress, concern, and opportunities for the social-ecological restoration of the city's water infrastructure, and responding to changing requirements (Purushottaman et al., 2021).

BRIGHT SPOT

Ensuring resource-circularity: Managing organic waste through composting and use in urban agriculture and gardening

Food waste is a major component of urban waste, and when it ends up buried in landfills, it decomposes anaerobically, releasing methane—a potent greenhouse gas (GHG) that contributes to global climate change. Wet waste composting, that is the controlled microbial decomposition of food scraps, is an aerobic process and can act as an effective NbS to address this predominantly urban concern by mimicking natural decomposition processes on a micro scale. By composting food waste locally, Bengaluru can divert it from landfills, lower methane emissions, and

create nutrient-rich compost for urban greenery and gardens. This closed-loop system not only curtails GHG emissions but also supports urban circular economy by recycling valuable nutrients back into the ecosystem, fostering healthier soils and plants in urban spaces.

An example of this is the project by the Chikkaballapura City Municipal Council (CCMC) with technical support from the Indian Institute for Human Settlements and funding from Godrej Properties Limited conducted at Chikkaballapura. It is a Tier-2 city located about 60 km from Bengaluru and has a population of approximately 72,000. The city generates about 28 tonnes per day (TPD) of solid waste. The CCMC collects about 90% of the waste across its 31 wards covering about 17,000 households. Until recently, the collected waste was being disposed of in a designated landfill located 8 km from the city. In an innovative solution, the CCMC initiated the city-farmer partnership for Solid Waste Management. This connected the urban local body with peri-urban farmers. The city supplied segregated wet waste and supported farmers in setting up composting pits on their farms, keeping waste away from landfills, and ensuring quality compost for farms at no additional cost. Usually,the cost for processing the waste is estimated to be around Rs. 900 per tonne waste. The decentralised model adopted by CCMC saved them approximately INR 30 lakh in waste management costs.

Additionally, farmers reported an estimated INR 15,000 in annual savings on agriculture input cost. This model also reduced farmers' reliance on chemical fertilisers by about 20 tonnes, lessening the adverse environmental impact of using chemical fertilisers.

3. POLICY RECOMMEN— DATIONS FOR THE INTEGRATION OF FOOD, WATER AND ECOLOGY

The numerous co-benefits associated with urban food systems should be harnessed by integrating them into city-wide planning. This will require an enabling environment comprising of:

COLLABORATIVE GOVERNANCE AND STAKEHOLDER ENGAGEMENT

Multi-stakeholder engagement is crucial for the successful implementation of integrated NbS. The framework must prioritise collaboration between local governments, community groups, environmental organisations, private sector stakeholders, and urban planners. Establishing a city-wide task force on sustainable urban development can drive this collaboration and ensure alignment with local needs and priorities. This is particularly important amongst existing governance bodies such as the BBMP, BBWSB and state-level and municipal authorities.

STAKEHOLDER-WISE ACTIONS

GOVERNMENT/PUBLIC AGENCIES AND URBAN PLANNERS

- Draft and publish guidelines that support integration of blue-green-grey infrastructure
- Implement such programmes in areas under their jurisdiction (such as in public parks and lakes)
- Create financial incentives and participatory programmes for land-owners and developers

RESEARCHERS AND EXPERTS

- Develop protocol for implementing urban food systems
- Knowledge sharing
- Collaborating with government agencies and citizens in order to test and course correct

CITIZENS/RESIDENTS WELFARE ASSOCIATIONS

- Implement at an individual level, practices to support food, water and ecology
- Spread awareness amongst each other to popularise NbS activities
- Volunteer, monitor and report

DATA-DRIVEN DECISION MAKING

Gathering and utilising data from urban ecosystems, hydrology, and agriculture to guide decision-making. Creating a centralised database that tracks water quality, food production, biodiversity, and ecological health to help assess the effectiveness of integrated solutions and provide real-time insights for adaptive management. For example, water quality of lakes is reported by both private platforms such as Open City Urban Data portal, and government websites such as Karnataka State Pollution Control Board. Such open source information can be harnessed into one platform for improved decision-making abilities.

INTEGRATING, MONITORING AND EVALUATING FRAMEWORKS IN POLICY

In order to obtain consistent data, monitoring and evaluation is important. This will lead to better efficiency in processes, ensuring inclusivity in decision making, equity and fair distribution of benefits. Along with monitoring and evaluation, protocols which ensure course-correction for desirable outcomes should be in place within guidelines.

NATURE-BASED SOLUTIONS IN URBAN PLANNING

Develop urban planning policies that prioritise NbS for water, food, and ecology. This includes zoning laws that support urban farming, incentivising creation of green roofs and green spaces in empty plots or in spaces within apartment complexes; and protecting natural water bodies. The inclusion of NbS should become a core element of city development plans and infrastructure projects. For example, policies that encourage the integration of urban agriculture into city planning should be put in place. In Spain, the municipality of Barcelona has given a central role to urban agriculture in a move towards creating a more sustainable and resilient city (Ayuntamiento de Barcelona 2012; Kauark-Fontes et al., 2023). Additionally, tax incentives for rooftop farming and water harvesting, subsidies for community gardens, and technical assistance for urban farmers could encourage NbS. Urban agriculture could be included as part of the city's food security strategy.

Apis florea visiting a hyacinth bean plant - a seasonal legume

FINANCIAL INCENTIVES FOR NATURE-BASED SOLUTIONS

Provide financial incentives to private developers and businesses to implement NbS in their projects. This can include tax breaks, grants, and access to funding for initiatives such as green roofs, rainwater harvesting systems, and urban tree planting. Additionally, such incentives should detail out guidelines for the use of native, water-efficient species, minimising water-intensive lawns and aesthetic features, providing local biodiversity-friendly habitats encouraging coexistence of biodiversity and people.

COMMUNITY-CENTRIC APPROACHES

Integrating food, water, and ecology requires an emphasis on community-driven initiatives. Encouraging the participation of local residents in urban agriculture, water conservation, and ecological restoration can ensure greater adoption and long-term sustainability of these solutions.

CAPACITY BUILDING AND PUBLIC AWARENESS

Establish training programmes for citizens, urban planners, and local governments on the importance of NbS. This will enhance the capacity of local stakeholders to design, implement, and maintain sustainable solutions. Public awareness campaigns should also be launched to educate the wider population on the benefits of sustainable water, food, and ecological systems.

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GREENING URBAN FOOD SYSTEMS THROUGH NATURE-BASED SOLUTIONS IN BENGALURU

AFD has been working with the Indian Institute for Human Settlements (IIHS) and Ashoka Trust for Research in Ecology and the Environment (ATREE) to analyse the links between urban agriculture, nature-based solutions (NBS) and city-scale resilience in Bangalore. Documenting the role of urban food systems in the production of ecosystem services aims at contributing to the development of sustainable urban development policies. This project is part of the ECOPRONAT research programme, which supports research on how to better take into account biodiversity and mainstream it into key economic sectors.

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