



A rooftop edible garden in a Chennai school (left); Greens harvested by students from their school garden (right) in Chennai

Mainstreaming Rooftop Edible Gardens for Urban Heat Resilience in Public Institutions

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Key Messages

- Globally, urban areas are increasingly exposed to extreme heat due to changing climate, aggravated by congestion, dense built environments, and concentrated energy use that trap and intensify temperatures.
- Heat wave impacts are highly unequal. Socio-economic, demographic disparities and limited access to green spaces shape vulnerability, with infants and young children, older adults, people with pre-existing health conditions, pregnant women, low-income households, and outdoor workers at greater risk.
- Nature-based Solutions (NbS) are emerging as holistic and sustainable approaches for addressing extreme heat in urban areas.
- Rooftop edible gardens are NbS that have the potential to strengthen community-led heat adaptation while delivering co-benefits like improved nutrition, education, and overall wellbeing.

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BRIEF

Executive Summary

Densely built and rapidly expanding cities are intensifying urban heat, placing children from low-income communities at risk. UNICEF (2022) estimates that 550 million children already face frequent heat waves, and by 2050 nearly every child worldwide will be exposed¹. Children are physiologically more vulnerable because they generate more heat relative to their body weight and have fewer sweat glands, making it harder for them to regulate body temperature⁽²⁾⁽³⁾. These risks are compounded for low-income children who spend long hours in schools that typically lack adequate cooling mechanisms.

Rooftop edible gardens (REGs) offer a promising, community-driven adaptation strategy that provides both cooling and broader co-benefits like improved nutrition, learning, and wellbeing. However, India's current urban heat policies remain focused primarily on cool-roof solutions, with limited recognition of rooftop greening and no formal inclusion of REGs. Integrating REGs into climate and urban development programs could enhance resilience for vulnerable children and communities.

Purpose

This policy brief makes a case for actively promoting and mainstreaming REGs as a nature-based, low-cost and resilient heat adaptation solution especially in public educational institutions across Indian cities by

- a. Examining the extent to which REGs reduce indoor temperature and consequently improve thermal comfort in two school buildings in Chennai, by using weather sensors.
- b. Presenting co-benefits of REGs reported by beneficiaries and
- c. Critically examining regulatory, structural, and practical or logistical barriers and presenting solutions to overcome these barriers based on stakeholder consultations.



School children involved in garden maintenance and harvesting in a public school in Chennai



(b) Weather Sensors Setup

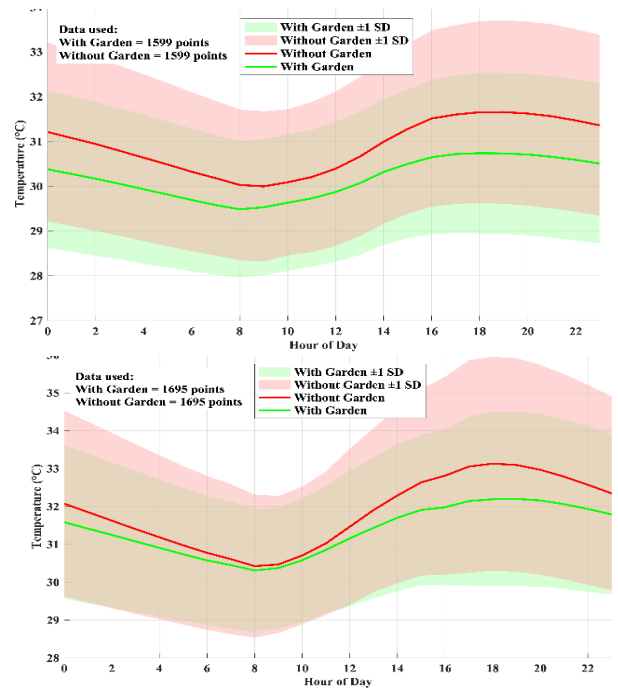
(c) Near-Surface and Radiation Sensors Setup

Sensors setup for monitoring temperature in Chennai Schools

Key Findings

Temperature Reduction Benefits of REGs

REGs from two schools show measurable reductions in indoor heat exposure by moderating the amount of solar energy absorbed and transmitted through rooftops. Rooms located beneath REGs were consistently 1–2°C cooler during peak daytime hours compared to adjacent exposed rooms. REGs also lowered roof surface temperatures by 8–12°C and ceiling temperatures by 2–4°C. These combined effects contribute to improved indoor comfort, particularly during high-heat days when ambient temperatures exceed 30°C.



Temperature difference in school 1 in Adyar, Chennai (top) and school 2 in Adambakkam, Chennai (below)

While the temperature reductions are clear and consistent, the magnitude of cooling varies due to multiple contextual factors such as roof material, extent and density of vegetated cover, surrounding tree shade, garden maintenance, building height, and weather conditions. Thus, while REGs demonstrate strong potential as a passive cooling strategy for vulnerable communities, their performance will differ across locations.

These findings highlight the importance of integrating REGs into broader urban cooling and resilience policies, with attention to site conditions to maximize benefits.

Co-benefits of Edible Gardens

Teachers from schools and government-run day care centres or Anganwadis with REGs reported multiple co-benefits from gardens, ranging from better access to fresh produce to enhanced learning opportunities and community engagement.



Practical Concerns of REGs

REGs offer multiple co-benefits, including improved thermal comfort. However, they also present structural, regulatory, and maintenance-related challenges discussed below. Experts suggest that these challenges can be effectively addressed.

Structural Challenges

1. **Structural Load Capacity:** REGs may add some extra weight to roof slabs, making load capacity a concern. Modular grow-bag systems (about 80–150 kg/m²) are much lighter than soil beds (around 250–400 kg/m² when saturated) and are generally suitable for most buildings⁴. However, as older buildings may have lower strength, a structural audit is recommended to confirm roof stability to guide safe load distribution.
2. **Waterproofing and Roof Protection:** Reinforced Cement Concrete (RCC) roofs are vulnerable to seepage and deterioration if exposed to prolonged moisture. Without adequate waterproofing and drainage, gardens can cause dampness or roof damage⁵. To prevent this, multi-layer waterproofing and well-designed drainage systems help protect the slab and ensure the long-term durability of the roof surface.
3. **Space Constraints and Utility Integration:** Many rooftops contain utilities such as water tanks, solar panels and/or electrical lines, limiting usable

space for gardens. Poorly placed planters may obstruct access or concentrate load where the slab is weakest. Using modular, movable garden units and positioning heavy equipment over structural supports helps integrate REGs without compromising roof function or safety.

4. **Safe Access and Parapet Standards:** Ensuring safe rooftop access—especially in child-centric institutions—is a key structural requirement. Low parapets, narrow staircases, and slippery surfaces can pose hazards. Compliance with standards on parapet height (1.0–1.2 m) and provision of guardrails, non-slip flooring, and secure access pathways are essential to make REGs safe and functional.

Policy and Regulatory Gaps

1. **Limited policy recognition:** India's heat governance framework is still evolving. In 2024, the Government of India has made heat waves eligible for financing under State Disaster Management Funds^{(6) & (7)} and the Government of Tamil Nadu was one of the first states to declare it as a disaster in October of the same year. Most heat action plans/strategies across India, including Tamil Nadu's Heat Mitigation Strategy 2023, identify generic NbS such as greening and afforestation as means of addressing heat. However, alternative NbS such as REGs, which function as community-driven and decentralised heat-adaptation measures remain unrecognised.
2. **Lack of technical standards:** The National Building Code (2016) lacks design, load, and drainage standards for rooftop gardens, leaving architects and engineers without clear technical guidance for safe and replicable implementation.
3. **Untapped institutional entry points:** Several existing programs at the national and/or Tamil Nadu state level could integrate edible rooftop gardens with minimal changes:
 - Poshan Vatikas for Anganwadis⁸ and School Kitchen Garden Guidelines (2019)⁹ already promote edible gardens for increasing access to nutrition and can extend to rooftops.
 - Tamil Nadu Green School Mission (2023)¹⁰ and Samagra Shiksha Abhiyan (SSA)¹¹ can include REGs under their sustainability and infrastructure components.
 - Anganwadi and school building infrastructure codes can embed REGs as a standard green feature.
 - Recognizing REGs as a multi-sectoral NbS within these programs would enable convergence across climate adaptation, nutrition, education and urban resilience goals.

Policy Recommendations

A policy review shows that nutrition gardens find place in policies such as Poshan Vatika and school kitchen garden schemes. Yet, the role of REGs to function as nutrition gardens whilst acting as an affordable cooling strategy for public institutional buildings remains unrecognized. Based on the above discussion we recommend:

- 1. Recognising REGs as a Heat-Adaptation Strategy:** Explicitly include REGs as a community driven, NbS adaptation strategy in relevant policy and program frameworks as they can simultaneously deliver cooling, food, learning, and other co-benefits.
- 2. Developing Technical Guidelines:** Establish standardized design, structural, and maintenance protocols for edible rooftop gardens in public buildings. These should include specifications for waterproofing, load-bearing capacity, safety protection, and drainage systems.
- 3. Integrating REGs into Existing Programmes:** Embed REGs in the SSA and Anganwadi infrastructure codes, recognizing them as an integral green feature in school and Anganwadi buildings.
- 4. Piloting and Demonstrating at Scale:** Launch large-scale demonstration projects under Poshan Vatika and the Tamil Nadu Green School Mission to generate cost benchmarks, maintenance models, and good practices for replication across sites.
- 5. Strengthening Inter-departmental Coordination:** Enable convergence among the Departments of Education, Department of Women and Child Development which administers the Anganwadis, and other state agencies to mainstream REGs within broader urban resilience and health strategies.
- 6. Building Institutional Capacity:** Provide annual maintenance budgets, drip irrigation support, and training through the Horticulture and Education Departments. Establish garden committees to ensure consistent care, safety oversight, and regular monitoring. Strengthen awareness on the co-benefits of REGs by showcasing government champions who have been successfully running REGs—such as Anganwadi teachers of Chennai, TN.
- 7. Empowering Communities for Sustained Impact:** Promote community engagement through parent-teacher associations, local self-help groups, and NGOs to support maintenance, harvest management, and learning activities, ensuring shared ownership and long-term sustainability.

*Note: This Policy Brief is based on a scientific study conducted jointly by IIT Madras and Okapi Research and Advisory, with funding from the Global Disaster Preparedness Center (GDPC). Evidence was collected from Chennai schools where REGs were installed by the **Chennai Resilience Centre** under the **Chennai Urban Farming Initiative (CUFI)** supported by **The Netherlands Enterprise Agency (RVO)**.*

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