

Urban Agriculture in Informal Settlements in India: Insights From Pune and Bangalore

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Keywords	Urban agriculture; informal settlements; mental health; material well-being
Bangalore Population	13.6 million
Pune Population	6.28 million
Bangalore Area	741 km ²
Pune Area	331 km ²
Bangalore GDP	110 billion USD
Pune GDP	69 billion USD
Climate Zone (Bangalore and Pune)	Aw (tropical savanna)
ARC3.3 Linkage	Equity, Development, and Informality Element

while its vegetation cover has shrunk by 76% in the same period (Ramachandra and Kumar, 2010). In Pune, 18 km² green spaces have been lost from 1992 to 2001 (Butsch et al. 2017). Coupled with green cover loss, both cities are seeing large population growth (in 2018 Pune was home to 6.28 million people, expected to rise to 8.44 million in 2030; Bangalore had 11.44 million inhabitants, expected to touch 16.23 million in 2030) (UNDESA 2018). In this context of rapid change, various sustainability initiatives are being piloted and implemented in the cities. We examine how UA can add to these initiatives, possibly targeting participation and empowerment of marginalised communities living in informal settlements.

Urban agriculture in Pune and Bangalore. As part of a three-year project titled “Urban and Peri-urban Agriculture as Green Infrastructure: Implication on wellbeing and sustainability in the Global South,” we mapped the landscape of UA in Pune and Bangalore. Data was collected through key informant interviews (n=51) with practitioners, policymakers, civil society actors and urban farming groups; scoping visits to informal settlements in Bangalore and Pune; and a household survey (n=61) using a semi-structured questionnaire to capture UA types, drivers, and outcomes.

Characteristics of UA in Informal Settlements. Urban agriculture in informal settlements in India is widespread and also diversely practiced. While growing in individual houses has always existed, there has been a rise in UA support in the last decade and a large rise during the COVID-19 pandemic. Despite various challenges posed by lack of space and resources, and insecure land tenure, urban farmers in informal settlements have developed some innovative and adaptive strategies to cultivate a range of plants. The majority of the urban gardens in both cities (>60%) began post-2010. Motivations in both these cities remain largely as a pastime or hobby. About 30% of participants in Bangalore started for fresh food and health reasons. A majority of respondents reported that they themselves along with their children and spouses look after the gardens (very few report parents/elderly).

Introduction: The Promise of Urban Agriculture. Cities in the Global South are urbanising rapidly, and often face complex challenges of inadequate infrastructure, congestion, hunger, malnutrition, pollution, poverty, and growing inequality. Climate risks are especially exacerbated in informal settlements where everyday hazards interact with low adaptive capacities and poor performance on development indicators. Nature-based solutions such as urban agriculture (UA) are being increasingly considered as a feasible and potentially effective adaptation solution (Bezner-Kerr et al., 2022; Shaw et al., 2022) that can also reduce food miles, incentivise low-carbon diets, ensure food and nutritional security, and provide additional incomes (Rao et al. 2022; Artmann et al., 2018; Ayambire et al., 2019; Puigdueta et al., 2021; Du et al., 2022). Being a highly localised, inherently bottom-up strategy, UA also holds promises of reconfiguring agency, even in highly marginalised and poor communities (Certomà & Martellozzo, 2019).

How do these promises of UA play out in the growing cities of the Global South? From a systematic review of around 450 peer-reviewed papers, Rao et al. (2022) show that the literature on UA has clear regional a bias with current research focusing on the Global North. They also highlight that “while the Global North reported positive environmental outcomes... Issues of land, labour and livelihoods are largely discussed in the Global South.” To address this gap we examined UA in two large, and expanding cities in India—Bangalore and Pune. Both cities have seen rapid change in land use: Bangalore’s built-up area has grown from 7.9% in 1973 to 58.4% in 2009,

Among our UA respondents from informal settlements in Bangalore (n=25) and Pune (n=36), 87% were women with a majority (>60%) in the age group of 31-50 years. Communal farming practices (undertaken by higher-income groups in peri-urban collective farms) were totally missing in informal settlements. We found that the average size of urban farms and gardens were 35 square feet (as opposed to >900 square feet in other settlement types). Spaces to farm in informal settlements, predominantly, were terraces, balconies, backyards, and

empty plots. Most UA practitioners reused discarded containers, tires, bags/sacks, and boxes as planters. A few respondents had chosen climber plants that covered their walls and spread over the roofs, which they referred to as a ‘cooling strategy’. In these settlements, UA takes multiple forms: it may be practiced on rooftops, balconies, backyards, empty plots, etc.

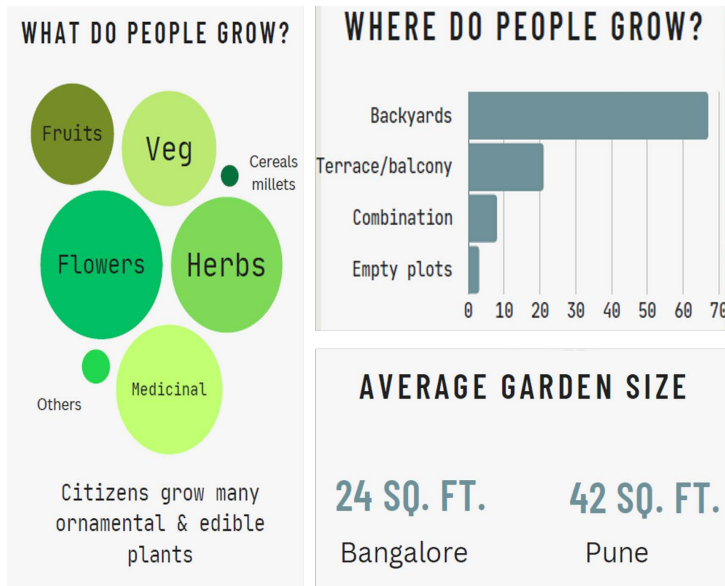


Figure 1. Overview of urban farms in informal settlements in Pune and Bangalore
Source: Singh et al., 2023

In terms of types of plants, a combination of plants is grown, ranging from vegetables, tubers, fruits, medicinal plants, herbs, flowering and other ornamental plants. Although it was never the case when they grew just one type of plant, a large proportion of participants (79%) grew herbs and medicinal plants, which might indicate their knowledge and use of plant medicines and herbs for any kind of minor illnesses. Flowering plants were mainly to fulfil their requirement for daily offerings during worship. Cash expenditure on inputs were as minimal as INR 45 (with a range of INR 0-1,000) per month.

Almost all informants used municipal water and made their own seeds by sourcing them from native farms or from their neighbors. People spent less than an hour per day on farming, mainly because of time constraints. Their social network of family, friends, and neighbors serve as sources of information, whereas in other settlements the internet, social media and books are used to learn about UA. In informal settlements, 74% of respondents were composting their wet waste, but other allied activities like wastewater reuse, rainwater harvesting, and beekeeping were difficult to adopt given space and financial constraints.

The most significant enabler of UA in informal settlements was their community network. Collective belief in making their space green which has multiple co-benefits makes UA vibrant in these settlements. In the absence of support and guidance from any formal source, people deeply value connectedness, community cohesion, and mutual support.



Figure 2. Urban gardening in informal settlements in Pune uses space in front of houses.
Photos: Chandni Singh, Swarnika Sharma

Outcomes of UA on Sustainability and Well-Being. Ongoing initiatives in informal settlements in Bangalore and Pune find that UA is least intensive in terms of input use, typically growing native vegetables and fruits, low/no use of synthetic inputs, reusing grey water, and composting kitchen waste. Reported outcomes of UA included perceived reduction in local temperatures and improved thermal comfort of up to 4C (Singh et al., 2023), enhanced food security, and providing refugia for urban biodiversity (Sagar et al., 2022). Lack of access to space and constraints of time remain key challenges for growing food in low-income settlements, highlighting inequalities in terms of land availability, tenurial security, and livelihood precarity. UA holds potential to provide place-based and meaningful interventions around food sovereignty, localised thermal comfort, wet waste reuse; accruing towards urban climate and sustainability goals (Table 1). In economic terms, there was not much that the informal inhabitants perceived to be significantly contributing to their households. Even savings from spending less on purchasing all the food required was not perceived as any considerable amount.

Sustainability outcomes	Well-being outcomes
<i>Thermal comfort</i> – Majority (80%) agree UA regulates temperature even with smaller spaces available for farming	<i>Food and nutritional outcomes</i> – Referring to their gardens as “immunity boosters,” informal settlements take pride in food diversity and nutrition in their daily consumption from their own garden.
<i>Wet waste recycling</i> – Simple composting practice by dumping vegetable waste and leftover food in the soil beneath plants, results in a positive outcome of waste recycling. This was perceived by 65% of people in informal settlements.	<i>Aesthetics and placemaking</i> – Relate greenery around with making their small house spaces aesthetically appealing. Using that small green space to retreat oneself was repeatedly mentioned.
<i>Biodiversity</i> – Not only diverse food and medicinal plants, but birds, butterflies, bees, and other smaller insects contributed to improving biodiversity. More than 80% of people reported this.	<i>Subjective well-being</i> – Space to cope with mental stress and recharge happiness. Being and working in gardens was a “satisfying and therapeutic experience,” “a life-changing activity,” and “deeply rewarding.” Relational well-being in community-building through sharing seeds, inputs, produce, and knowledge was deeply valued.

Table 1. Outcomes of UA towards sustainability and well-being

Supporting UA in informal settlements. The sustainability and well-being benefits of UA hold promise, even if space-constrained informal settlements. Based on stakeholder engagement in the two cities (IIHS 2023), pathways to mainstream and scale UA are synthesized as follows:

- Using urban agriculture as an **avenue for generating green jobs**, with UA being recognised and listed as a source of green jobs by the Skill Council for Green Jobs, thematic training and certification courses on kitchen/terrace gardening, composting, soil management, and technology-driven practices like hydroponics and vermicomposting.
- **Closing the loop** between wet waste segregation, composting, and food-growing to reduce waste landfills around the cities.
- Strengthening **School Kitchen Gardens** to improve child nutrition by including urban agriculture in the school curriculum of primary and secondary schools for environmental sensitisation.
- **Deliberate urban plans and building design** that make space for and incentivise sustainable practices such as waste recycling and food-growing, reimagine place-making initiatives in Smart City Projects as food growing and nutritional gardens.

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Additional Data

- **Population Density:** Banaglore -- 18,300 people/km²; Pune -- 13,000 people/km²
 - **Gross National Income (GNI):** 2,540 USD (Lower-Middle Income)
 - **Gini Coefficient:** 32.2
 - **Human Development Index (HDI):** 0.644 (Medium)
 - **Type of Climate Intervention:** Adaptation
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