

# (Re)envisioning inclusive futures: Applying narrative foresight to deconstruct the problem of urban flooding in the slums of Bengaluru, India

SriPallavi Nadimpalli  | Sahil Mathew  | Tashina Madappa Cheranda 

Center for Study of Science, Technology and Policy (CSTEP), Bengaluru, India

## Correspondence

Dr. SriPallavi Nadimpalli, PhD, Independent researcher, Bengaluru, India.  
Email: [sripallavi.nadimpalli@gmail.com](mailto:sripallavi.nadimpalli@gmail.com)

## Abstract

**Motivation:** Recurring urban flooding in Bengaluru, India, has brought multiple intersecting development challenges to the forefront. While climate change is a catalyst for flooding, rapid urbanisation has aggravated the problem by neglecting its ecological history. Repeated floods have particularly affected migrants living in the slums, further worsening their already vulnerable conditions. Currently, only about 40% of slums are formally recognized by city authorities, leaving most slum dwellers with limited access to public benefits and basic infrastructure. Although the city offers piecemeal solutions, it currently lacks foresight for long-term planning that includes marginalized voices.

**Purpose:** We explore the multiple and intertwined development challenges faced by Bengaluru city, attempting to frame them from the perspective of migrant slum dwellers experiencing flooding. We try to bring to the forefront the everyday risks and vulnerabilities of the marginalized populations in Indian cities, which have received limited attention both in research and policy.

The results of this exercise are intended to create sustainable collaborative processes to inform future decisions, particularly addressing the problem of urban flooding.

**Methods and approach:** Our proposed methodology integrates climate risk assessment—urban flood modelling and exposure mapping of slums across the city—with vulnerability assessments at the household level including analysis of life histories to capture the relative vulnerabilities of slum dwellers and the slums in which they live.

**Findings:** We deconstruct urban flooding, particularly from the perspective of migrant slum dwellers to identify some critical challenges, especially that of recognition, to foresight thinking. By incorporating marginalized voices, our methods aim to be inclusive and contextually relevant, while considering intersectional variations among those marginalized.

A mixed-methods approach allows climate risk assessment to be augmented by life histories of vulnerable slum populations to collaboratively reimagine a more inclusive future.

**Policy implications:** To make policy more inclusive, more participatory processes are needed. The proposed methods will contextualize everyday vulnerabilities and risks of migrant slum dwellers to bring

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these perspectives into conventional climate risk assessment. Thus, a more inclusive future with lower impacts from urban floods can be envisaged.

#### KEYWORDS

climate risk assessment, life history analysis, migrant slum dwellers, narrative foresight, urban flooding

## 1 | INTRODUCTION

Cities face complex risks as existing structural problems intersect with climatic hazards, particularly impacting poor and marginalized populations. In the Indian context especially, often unequal urbanization, neoliberal policies, poor governance structures, among other factors, create fragmented spaces in the cities—where some spaces are fuelled by achieving economic growth, and some others are neglected.

Bengaluru is the capital of the Indian state of Karnataka, with an area of 741 square kilometres and a population of 8.4 million, according to the 2011 Census. The nation's economic liberalization of 1991 significantly contributed to the city's massive transformation, while giving it prominence as one of the largest information technology hubs—both internationally and nationally. The city is also a major hub for multinational corporations, international banking, finance, and hospitality. These developments, propelled by both the land and tax incentives of the state government, and the new privatized infrastructure, brought in transnational corporations and ample job opportunities, attracting an influx of skilled professionals. At the same time, the city also attracted an inflow of low-skilled migrants seeking alternative livelihood opportunities. These migrants are typically from rural areas, where their families are engaged in agriculture (or related sectors), but experience poor productivity because of soil degradation (which is exacerbated by variable climate) and inadequate institutional support for agrarian livelihoods. Regional economic disparities within the state also limit the possibilities of pursuing alternative livelihoods in these rural areas.

In the state of Karnataka, urbanization is highest in the city of Bengaluru, with the urban population in the Bangalore district making up 37% of the total urban population in 2011 (RoyChowdhury, 2021).<sup>1</sup> Despite the overall economic prosperity of Bengaluru and Karnataka, the state ranks poorly on poverty levels and overall well-being. Almost 21% of the total state population lives below the poverty line (RoyChowdhury, 2021). These contrasting indicators reflect unequal development trajectories, visible in the way cities manifest—both spatially and socioeconomically. Bengaluru has been particularly affected by frequent flooding in recent years, in addition to the other challenges of unequal development. While historically the city, with its numerous reservoirs (or tanks), has managed to buffer the above-normal rainfall, rampant encroachments and frequent higher-intensity rainfall brought on by climate change, coupled with planning practices that inadequately consider the ecology of the city, have led to recurring flood events.

The slums and informal settlements in Bengaluru are more prone and more vulnerable to urban flooding. Furthermore, since not all slums are formally recognized (or notified), they are left outside the purview of governing bodies. These slums have evolved somewhat disconnectedly from the economic growth pockets and the development processes that occur in other parts of the city. Therefore, they have limited access to basic services, infrastructure and transportation, with poor housing conditions, reducing their capacities to cope with the problem of urban flooding. The slum dwellers thus face both climatic and non-climatic risks.

Against this backdrop, this article explores the multiple intertwined development challenges faced by Bengaluru city, while attempting to frame them from the perspective of migrant slum dwellers experiencing urban

<sup>1</sup>Districts are administrative divisions of states in India. As of 2022, there are 766 districts in India. There are two districts in Bengaluru: Bengaluru Urban and Bengaluru Rural.

flooding. It also attempts to bring to the forefront the everyday risks and vulnerabilities of marginalized populations in the context of Indian cities, which has received limited attention in both research and policy. Given the nature of the complexity and the recurring (and worsening) urban flooding in the city of Bengaluru (discussed in Section 2), we argue that there is a need for a renewed and holistic reframing of the problem itself, with a more nuanced understanding of the issues. We believe that this reframing is a critical and necessary step in foresight thinking. Section 3 discusses the need for foresight thinking and the role of narrative foresight as a methodological framework in our proposed work. As a first step to examine the problem more broadly, Section 4 deconstructs the multiple intersecting complexities that exist in the city and highlights the problem of recognition (of both slums and slum dwellers) as one of the main barriers to future development processes.

In addition, Section 5 elaborates on the proposed methodology and the methods that can be employed to operationalize such a vision, along with the limitations and challenges that can be potentially experienced. In the final section of the paper (Section 6), we conclude by proposing a way forward for our research. Thus, in mapping the multidimensionality of urban flooding in Bengaluru, and directly connecting it to foresight thinking, this article proposes an approach for envisioning more inclusive alternative futures for slum dwellers who experience urban flooding.

## 2 | CONTEXT OF URBAN FLOODING IN BENGALURU

### 2.1 | Historical snapshot of the city's transforming landscape

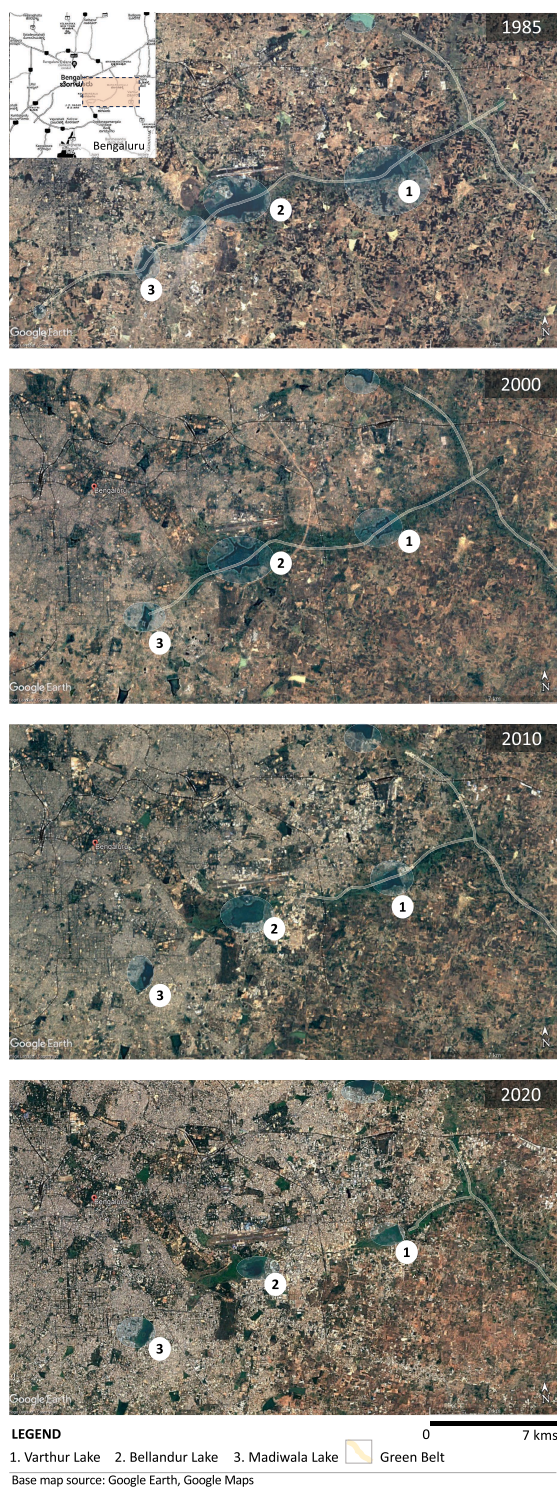
Bangalore is perched at 900 metres above mean sea-level (Sudhira et al., 2007), with no perennial sources of water for the city (Vaidyanathan, 2001). Early settlers created a complex network of tanks by building bunds (or embankments) across small seasonal streams that flowed through the city (Dikshit et al., 1993; Nagendra, 2016b). The network was engineered to allow overflow from one tank to flow through natural weirs into tanks lower in elevation, such that the resulting tank series were interconnected as a cascade (Mosse, 1999). Crucial buffer zones existed around each tank and its interconnected drains, allowing the tanks to expand and contract with each season (Lewis Rice, 1897).

As the city expanded from a population of 251,721 in 1885 to 3,495,566 in 1990 (Kamath, 1990; Lewis Rice, 1897), the ability of the tanks to meet the city's domestic water demand diminished. The introduction of piped water supply from the reservoirs subsequently reduced the use value of the tanks within the city. As a result, most of the tanks were filled up and offered as valuable real estate in rapidly urbanizing Bengaluru. The city has almost a 1,000-year history of interconnected lakes,<sup>2</sup> which was erased over a span of 100 years by a development process that overlooked the immense value of the city's ecological landscape. Figure 1 shows an example of the changing landscape of the Koramangala-Challaghatta Valley (one of the four main watersheds in Bengaluru) over the years. As is evident in the images, urbanization has disconnected the lakes from each other and has also significantly reduced the buffer zones around the lake.

Perhaps not surprisingly, the past 20 years have seen an increasing frequency of urban flooding events in a city that historically did not get flooded (Ramachandra & Aithal, 2017). A combination of high-intensity rainfall events due to climate change (CSTEP, 2022), poor spatial planning and blockage of natural drainage channels (Chu & Michael, 2019), built-up areas (especially in the valleys), erasure of buffer zones around the tanks and its *kalves*<sup>3</sup> has led to higher occurrences of urban flooding. In 2022, the month of September witnessed some of the worst flooding in the city to date, where all the drivers mentioned above combined to cause a single flood event, leaving the most vulnerable homeless in one fell swoop.

<sup>2</sup>Here "city" refers to the geographical area that has now become Bengaluru city.

<sup>3</sup>Drains that connect different tanks in the city.



**FIGURE 1** Changing landscape and rapid urbanisation in the Koramangala-Challaghatta Valley in 1985, 2000, 2010, and 2020. (Source: Author's own; base map source: Google Earth, Google Maps).

## 2.2 | Unsynchronized ongoing efforts

With the increasing recurrence of flooding events in the city, multiple efforts (an example of few initiatives is shown in Figure 2) have been made to recognize and address the problem, although these tend to be disjointed.

The Government of Karnataka's revised draft State Action Plan on Climate Change (EMPRI, 2021) proposes the reduction of urban flooding through maintenance of the drainage system; better solid waste management and effective implementation of a ban on plastics; use of information and communications technologies to develop advance warning systems; and the dissemination of information through SMS, web portals, radio, and other wireless communication networks.

Furthermore, the Karnataka State Natural Disaster Monitoring Centre (KSNDMC) has developed a real-time open-access flood information portal called Varuna-Mitra. The portal provides early warnings and information on flood-hazard zones, highlighting regions that are most likely to be exposed to urban flooding due to extreme rainfall. However, the extent of information dissemination for slum dwellers in Bengaluru (who may not have access to the internet) can be limited.

In addition to government efforts, a Bengaluru-based non-governmental organization (NGO) has developed a climate action plan for the city (Environment Support Group, 2021) to help planners achieve the Paris Agreement targets. The plan encourages urban governments to be aware of and sensitive to social inequities, inspire climate action that responds to public health concerns (including those that arise from urban flooding), while stressing the need for accountability and transparency at all levels. However, the translation of these agendas into action by urban governments has yet to be achieved.

Despite the increased awareness of the problem and the complexity of urban flooding among different stakeholders, there appears to be a lack of a holistic understanding of the issue and its intersection with a number of existing development challenges faced by the city. The initiatives put forward so far appear to be more reactive in nature, aiming to deal with the immediate problem at hand, and therefore focusing on solutions that fix

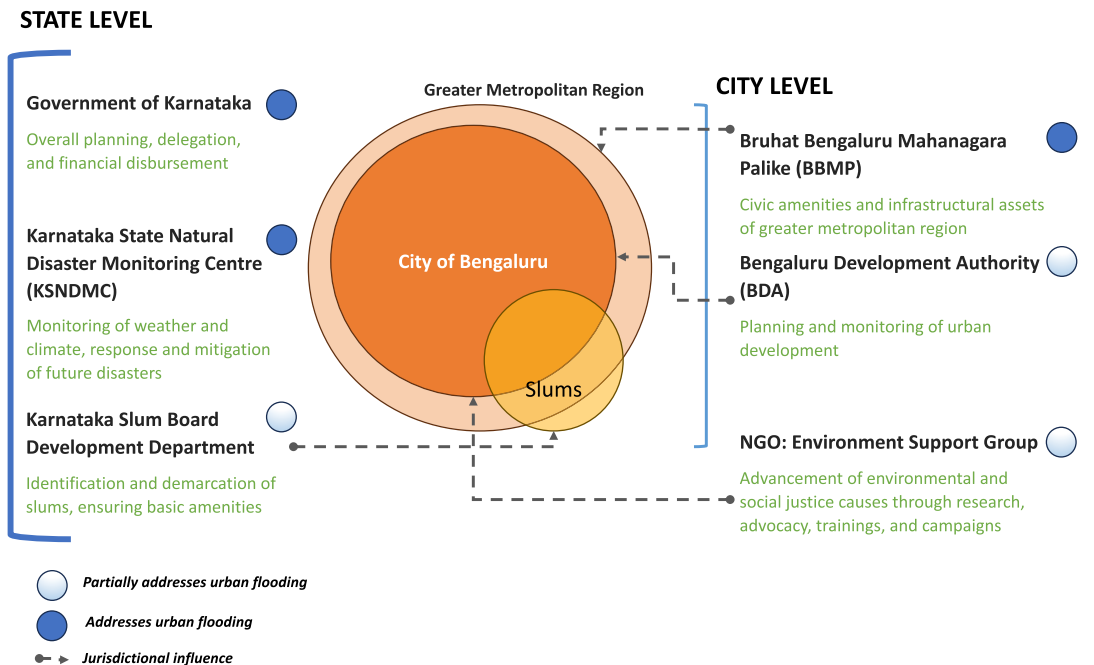


FIGURE 2 Examples of authorities with overlapping jurisdictional responsibilities. (Source: author's own).

storm-water drainage and engineering systems in the city, rather than attempting to visualize the problem within a broader context. There is an absence of a co-ordinated and sensitized effort from local institutions to deliberate and conceive long-term solutions to the problem of flooding. More importantly, the human dimension appears to be missing from the discussion, especially the consideration of the perspectives of the most marginalized, who are differently impacted by the recurring flooding.

### 3 | THE NEED FOR FORESIGHT THINKING

Fernández Güell and Redondo (2012) state that contemporary planning practices seemed to be generally shifting away from long-range urban planning, where one of the reasons has been attributed to the failures in forecasting methods. The authors also add that short-term and contingency planning seem more appropriate (in a rapidly changing sociodemographic and technological context) and comparatively easier to achieve when navigating collaborative partnerships between public and private stakeholders. Foreseeing events for incredibly diverse, dynamic, and complex contemporary cities “in a precise and reliable way” poses a major challenge for contemporary cities (Fernández Güell & López, 2016, p. 455). Furthermore, Ananya Roy (2009, p. 86), adds that in the Indian context, *informality* is the key aspect of the urban planning regime, which “proceeds through systems of deregulation, unmapping, and exceptionalism,” giving rise to a distinct rationality that makes it extremely difficult to effectively plan and proof cities for the future.<sup>4</sup> In Bengaluru, without a new approach that challenges the current scenario, the fragmented approach to planning (as discussed earlier) is likely to persist. Therefore, it becomes critical to start re-strategizing for creating alternate futures for a longer term, beyond a 10-year timeline. In this context, foresight is needed for effective decision-making in the present, for which it becomes necessary to critically engage with futures thinking (Milojević, 2021).

Conway (2015, p. 7) explains that the first step in the process of applying foresight is to “look more broadly” to understand change and how it is occurring, before thinking about what the implications of those changes might be and how they could possibly evolve with time. The last step in applying foresight would be to make decisions in the present to achieve the desired future.

These steps can be unpacked in many ways using different methods and can be integrated with existing development processes. For example, in their work in Spain, Fernández Güell and Redondo (2012, p. 312) explain that foresight can be complementary to planning processes and can offer many opportunities “such as anticipating changes, fostering participation and building networks, in contrast to its perception as a mere story-telling technique that generates oversimplified visions without the backing of rigorous analysis.” They emphasize a territorial foresight approach for translating future urban vision to “practical, measurable strategies” (p. 320) for long-term planning. Their approach combines both qualitative and quantitative tools, with varying participation of experts, end users, and other key stakeholders at different stages of the process. A critical component of their approach was to incorporate a foresight exercise at the very beginning of the urban planning processes.

In Eames and Egmore's (2011, p. 772) community foresight approach in the United Kingdom (UK), the emphasis was also on an “open and reflexive framing of the problem” as an initial step, and adopting a “bottom-up” community-led process as a core focus for incorporating the local knowledge and expertise. In these studies of Spain and the UK, local residents occupied a primary role in the initial stages of visioning and problem articulation. In the latter stages of the foresight process, the responsibility of translating these visions and ideas shifted to the researchers and practitioners or was implemented with the leadership of experts. The emphasis was on participatory processes, in which end users were an integral part.

Adapting Conway's work, in this article, we start with the initial steps to broadly examine the complexities of the urban flooding problem in Bengaluru in a general way, to help initiate future thinking through our proposed

<sup>4</sup>Elsewhere, Ananya Roy (2014, p. 144) explains unmapping as “a regime of regulatory ambiguity,” which is used as “a deliberate tool of spatial management used by various arms of the state in collaboration with market actors.”

methodology. Incorporating an inclusive bottom-up participatory and collaborative processes is critical to the process. For this, narratives are integrated into the methodology to bring in the voices of the marginalized migrant slum dwellers throughout the process. The intent is to understand how these narratives of the migrant slum dwellers are shaped and understood, and to contextualize them.

### 3.1 | The role of narrative foresight

Narrative foresight is focused on the “stories that individuals, organizations, states and civilizations tell themselves about the future” (Milojević & Inayatullah, 2015, p. 151). Recently, there has been an increased recognition of the role of these narratives in futures thinking, particularly the use of metaphors, language, and stories that communicate unconscious biases and discursive narratives (Milojević, 2021).

As with the example of urban dwellings, narratives can help to understand how identities and relationships are shaped and how they are interlinked with the discourses that define cities (Marschütz et al., 2020; Milojević & Inayatullah, 2015). Inevitably, narratives also comprise a temporal component. They help us to understand the transformation of everyday lived experiences through time and are typically organized and communicated in a manner that can be unique to different societies and groups (Milojević & Inayatullah, 2015). At the very core is an active protagonist who gives meaning and value to these narratives. However, not all narratives gain visibility. Some are filtered out by the interplay of power relationships in a context. Narratives also offer insights into the frameworks that shape these power relations, which sometimes sustain and recreate inequalities and disadvantages.

Milojević and Inayatullah (2015), therefore, explain that to initiate change it is necessary to adequately challenge the underlying assumptions of the predominant or powerful narratives to make way for envisioning alternative futures. Drawing on this, we propose the use of narrative foresight to “investigate current modes of knowing the world, challenge detrimental and non-functioning schemas and open up alternatives” (Milojević & Inayatullah, 2015, p. 161) as a critical step.

Using foresight thinking, our proposed methodology intends to analyse change and its implications for the city of Bengaluru to understand and address the issue of urban flooding. It would comprise four main processes. An initial climate risk assessment would enable a better understanding of current and future urban flooding risks to slums. This would be complemented by a life histories (LHs) approach of semi-structured interviews to contextualize the lived experiences of the migrant slum dwellers. Next, household surveys would supplement the first two methods and establish a baseline for the slums under investigation. Through our approach, we aim to highlight the slum dwellers' hidden stories and the local embeddedness of their climate change experiences, as well as the local knowledge, responses, and future aspirations, and include them in collaborative futures-thinking processes. Finally, narratives of change would be initiated to facilitate a strategy to envision alternative futures. All these methods are interlinked, dynamic, and intended to evolve over time.

In the next section, we attempt to deconstruct the multiple intersecting challenges linked with the problem of urban flooding to look more broadly and build a nuanced understanding of the current scenario. The discussion that follows guides our approach for operationalizing future thinking in the proposed methodology.

## 4 | DECONSTRUCTING THE MULTIDIMENSIONAL PROBLEM IN BENGALURU

One of the biggest challenges faced by migrant slum dwellers in Bengaluru relates to the problem of recognition—of their identities as well as of the slums in which they reside—where “recognition itself is contentious, socially constructed, and context dependent” (Chu & Michael, 2019, p. 141).

## 4.1 | Jurisdictional crevices

The main challenge in understanding the slums and their inhabitants in Bengaluru is the lack of a coherent definition, along with estimates on the number of slums, their boundaries, and their population, across different government agencies. At the national level, the National Sample Survey Office defines a slum as a cluster of at least 20 households living in temporary homes with broad characteristics that are similar to those described by the Karnataka Slum Development Board (KSDB),<sup>5</sup> whereas the Census of India 2011 defines slums as a group of a minimum of 60–70 households. These varying definitions lead to disparities over the estimates of the total number of slums in the city (Krishna et al., 2014).

As of 2020, KSDB has identified a total of 421 slums in Bengaluru, of which 398 are notified and 23 non-notified slums (Karnataka State Slum Development Board, 2020). However, a study by Rangelova et al. (2018) claims that there are more than 1,500 slums that are not listed by the regulatory body. Furthermore, Roy et al. (2018) note that 21% of Bengaluru's total urban population resides in slums, as opposed to the figure of 18.5% claimed by KSDB, indicating possible exclusion errors in the surveys conducted by KSDB.

Furthermore, given the informal characteristics and the ever-evolving boundaries of slums, determining a clear demarcation or capturing the variations within the slums for tailored policy interventions is a challenge for the authorities. As a result, the rights and well-being of the slum residents are impacted, especially in the non-notified slums. These areas often do not have access to the services and amenities provided by the city and are also not considered in state-sponsored redevelopment schemes. For example, while one of the government schemes mandates an *anganwadi* (crèche or pre-school education centre) in every slum, it is likely to be overlooked in the non-notified slums, forcing some of the children of migrants to stay behind in their villages with relatives (RoyChowdhury, 2021).

Therefore, the recognition of slums in the city and their management slips through the jurisdictional crevices, and the inhabitants and their varying lived experiences are not adequately recognized.

## 4.2 | Low national priority of internal migrants

In the Indian context, migration typically occurs within a state. The 2011 Census reported that of the total 453 million identified migrants, only 15% were interstate migrants (Bhagat, 2017). Migration decisions are often driven by the interplay of multiple drivers, including climate change, although the Census does not capture these complexities and is limited to a finite set of reasons. The Census of India and the National Sample Survey, which are the only major data sources on migration, inadequately capture the multiple possible patterns of movement, due to the way migration is defined (Bhagat, 2008; Rajan & Bhagat, 2022). Due to data limitations in understanding the “extent, nature, and magnitude of internal migration,” migrants are a low priority in terms of government policies (UNESCO, 2013, p. 4). Additionally, migrants are often discriminated against by locals due to their linguistic and cultural differences, and are labelled problematic outsiders.

## 4.3 | Intersecting challenges of migrants

In the case of Bengaluru, rural-to-urban migration is typically undertaken by small landholders, marginal farmers, or landless labourers whose efforts to cope with the risks (both climatic and non-climatic) they faced in their rural communities were either inadequate or unsuccessful. In addition to the risks that prompted them to migrate, such individuals also experience risks at the destination to which they migrate. The latter often emanates from living

<sup>5</sup>KSDB categorizes slums as areas that are in low-lying, unsanitary, or overcrowded areas, which pose a risk to health and safety; also buildings that are meant for human habitation, in a dilapidated state with low ventilation, narrow streets, and lack of sanitation facilities.



in precarity with poor housing (in slums and informal housing), inadequate access to basic services and public schemes, and an overall marginalized status, owing to their sociocultural positioning. Furthermore, they lack political agency and are disconnected from their established social networks at the origin. These multiple vulnerabilities further “exacerbate migrants’ experiences of climate impacts” (Chu & Michael, 2019, p. 150) in urban areas.

In addition, the experiences of the impacts of climate change vary for different individuals, based on how migrant identities intersect with other structures of social differences (such as gender, class, caste, language, religion, disability, among others), creating variations in everyday lived experiences and their levels of inclusion and exclusion.

#### 4.4 | Varying everyday lived experiences

The seasons of arrival of migrant slum dwellers and the settlements they live in vary (in terms of physical characteristics and access to services and institutional support), significantly impacting their “asset holdings, occupations, aspirations and investments in children’s education, identity cards, and vulnerability to natural disasters” (Krishna et al., 2014, p. 578).

The newer migrants in Bengaluru are typically temporary or circular migrants, often returning home during harvest season. They live in temporary housing (like tents), sometimes on the periphery of the city (Krishna et al., 2014; Roy Chowdhury, 2021). These individuals often lack the necessary government documentation like an *Aadhar* card,<sup>6</sup> to establish their proof of residence, limiting their ability to vote (using voter identification), and thus resulting in poor political representation in the destination cities. The newer migrant settlements are unlikely to be notified and may have more difficulty accessing basic services, education facilities, and employment opportunities. Language barriers, limited social networks and kinship ties at the destination create further barriers to their sociocultural integration into the city.

In the case of job opportunities, even relatively higher levels of literacy and education do not necessarily improve migrants’ access to opportunities (RoyChowdhury, 2021). Furthermore, “given a combination of disadvantages relating to being recent migrants, lacking a foothold in the city and primarily lacking skills, they are pushed to the lowest rungs of unskilled, irregular and part-time work” (RoyChowdhury, 2021, p. 105), thereby impacting their upward socioeconomic mobility.

By contrast, inner-city slums are home to older migrants (sometimes third or fourth generation), who have been in the city for more than 10 years. These slums are often notified and therefore entitled city services. Inner-city slums are more likely to have better connections with civil society associations and political parties (RoyChowdhury, 2021), and are more likely to engage actively with public institutions (Krishna et al., 2014), due to their increased ability to find work and established legitimate status in the cities. However, local politicians often choose to engage only when they see a way to gain votes or promote their party objectives (RoyChowdhury, 2021). Therefore, as RoyChowdhury explains, the interventions from political parties or NGOs, when present, can be sporadic or lead to inadequate piecemeal solutions.

The characteristics of slums, and the vulnerabilities and everyday risks experienced by their residents are thus diverse, and based on multiple factors, including their varying experiences of identity.

#### 4.5 | Barriers to participation in decision-making processes

The heterogeneity and temporality of slums and their residents do not usually offer a conducive environment for forming local groups, producing community leaders, or inspiring collective action, particularly to demand for public

<sup>6</sup>In 2008, the Indian government introduced *Aadhar* card—linking all other identifications to allow easy disbursement of government welfare schemes and programmes.

services such as water, sanitation and electricity (Deshpande et al., 2019). Furthermore, due to the gap in communication between the state administration and slum dwellers, the former is unaware of the needs of each slum area, even though some studies (for example, see Krishna et al., 2014) have shown that slum dwellers are keen to engage with the state. This lack of communication is sometimes reflected in instances where slum dwellers may be unaware of government schemes and projects that might aid them. Furthermore, slum dwellers are sometimes unaware of their status—as residents of either “slum areas” or “slum-eviction areas”—where in the case of the latter, they are always in danger of eviction, as one micro-study in Chennai notes (Sculthorp, 2018).

Therefore, civic participation at the ward level, with robust representation from migrant slum dwellers, is imperative for addressing local drivers of flooding and allocate resources to solve the problem. Ideally ward committees should be the forum where deliberations on local infrastructure are undertaken.<sup>7</sup> However, local institutions are usually populated with high-status professionals; the representation of migrant slum dwellers in governing bodies is typically absent (Krishna et al., 2014).

This section has unpacked some of the factors determining the complex positioning of migrant slum dwellers, both in terms of their physical location and their social location within the local power hierarchies. This positioning affects their access to resources and information, agency in decision-making, levels of participation, ability to inform and influence policies, and ultimately their capacity to cope with multiple risks. The discussion has brought to the forefront the differential experiences of the diverse groups of migrant slum dwellers. Our proposed methodology aims to incorporate some of these critical interrogations—particularly around the issue of recognition—and is elaborated in the next section.

## 5 | PROPOSED METHODOLOGY

We propose a methodology that encompasses the following two broad steps (see [Figure 3](#)) to initiate foresight thinking:

**Step 1:** Understand change (particularly the evolution of the complex problem of urban flooding) and its implications.

**Step 2:** Initiate a strategy for pursuing alternative futures.

The purpose of these steps is to map the problem of urban flooding in Bengaluru's slums with all the nuances and complexities (as discussed in [Section 4](#)), and to initiate a collaborative and inclusive process that incorporates the marginalized voices of urban slum dwellers.

These steps would employ four main processes. The first two processes include (a) a climate risk assessment; and (b) a life histories (LHs) approach (see [Figure 3](#)). These are interconnected and designed to inform each other. Additionally, the timelines of implementation are likely to overlap and extend, as determined by the contextual factors that unfold in the process.

The climate risk assessment is based on the framework of the Intergovernmental Panel on Climate Change (IPCC) (2014), and is intended to not only provide insights into the historical and current risk to slums, but also to generate information on future urban-flood risks to slums, based on assumed scenarios. To add a qualitative dimension to this scientific assessment of flood risk, we integrate LH analysis into the process through semi-structured interviews. These narratives will not only help contextualize the current issue of urban flooding for marginalized migrants in the slums, but will also help develop scenarios for future risk assessments, based on the shared aspirations of the stakeholders involved.

In addition, we propose using (c) household surveys to generate a baseline for the slums identified for the study, as well as to quantify indicators for the vulnerability assessment that would feed into current climate risk

<sup>7</sup>A “ward” is the lowest administrative unit for a city in India. The Bruhat Bengaluru Mahanagara Palike (BBMP) comprises 198 wards in Bengaluru and is responsible for zoning regulations, and maintenance of civic amenities and some public assets (BBMP, n.d.).

“Ward committees” are led by the “local corporator,” along with members of civil society organizations, traffic police, residents' associations, etc.

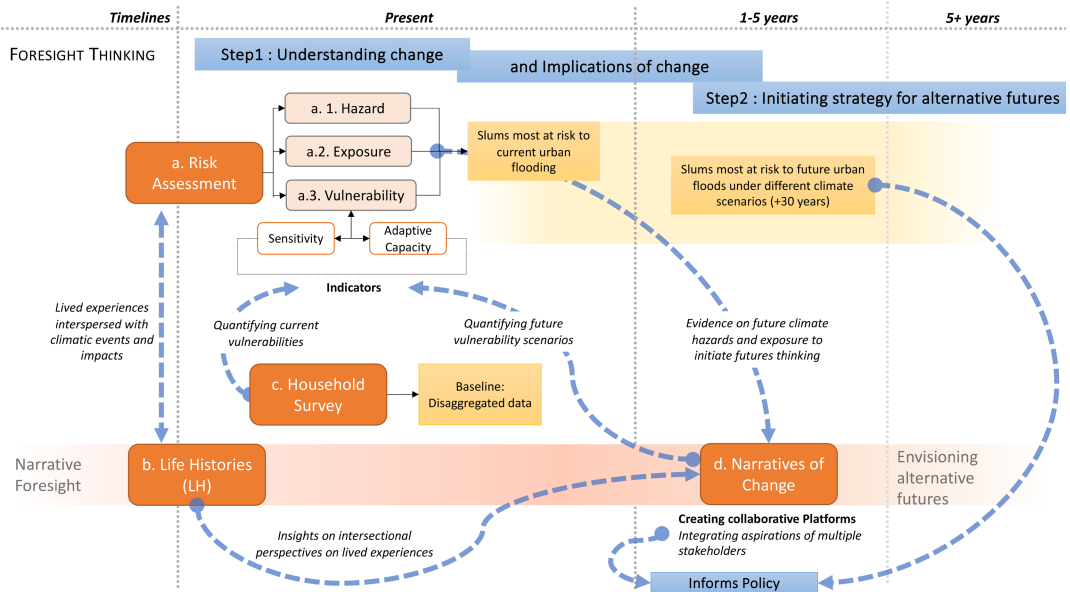


FIGURE 3 Proposed methodological framework (Source: author's own).

assessments. Household surveys aim to collect basic disaggregated demographic information from slum residents, in addition to capturing their migration histories, to address the challenge of data limitation. This information will be supplemented with physical mapping to note the current condition of the available infrastructure and basic amenities in the slums under investigation.

Finally, we propose creating collaborative platforms to initiate (d) narratives of change (elaborated later), where shared future aspirations of multiple stakeholders can be deliberated upon to arrive at preferred futures strategies.

### 5.1 | Climate risk assessment

The IPCC (2014) defines climate change risk as a function of the (a.1) probability of occurrence of hazard(s), (a.2) the exposure of the systems in question, and the (a.3) vulnerability of those systems (see Risk Assessment in Figure 3 [a.1, a.2, a.3]). In this proposed methodology, climate risk assessment aims to (1) examine the probability of occurrence of historical and future urban flooding across Bengaluru city; (2) the historical and projected levels of exposure (of both the slum infrastructure and its inhabitants); and (3) the current and future vulnerability of slum dwellers. These three outputs would be aggregated to arrive at current and future urban flood risks to slums and slum dwellers across Bengaluru.

A climate risk assessment would allow urban planners and policy-makers to **prioritize the slums that are most at risk** of urban flooding and develop appropriate adaptation strategies to lower the risk of floods.

#### 5.1.1 | Current urban flood risk to slums

1. The **probability of occurrence of current urban flooding** can be quantified using historical urban flood frequencies and magnitudes recorded by the KSNDMC for the past 30 years, in combination with gridded (25 km x 25 km) historical daily rainfall data that can be procured from the Indian Meteorological Department. Average

rainfall magnitudes that coincide with the occurrence of urban flood events can be calculated and used as a threshold to calculate the probability of occurrence or the exceedance probability of such rainfall events over the past 30 years. This exercise would generate a map of Bengaluru city (Bengaluru Urban District), highlighting the probability of the occurrence of urban flooding at the *taluk*<sup>8</sup> and/or *hobli*<sup>9</sup> levels.

2. Applying geospatial techniques and extremely-high-resolution urban flood models (UFMs), historical flood inundation maps can be generated. These are essential to quantify **historical exposure**. First, slums across the city will need to be mapped (Ranguelova et al., 2018), along with the infrastructure supporting them (roads, drinking water infrastructure, powerlines, schools, hospitals, etc.). This slum map will then need to be overlaid with the historical flood inundation map to provide **exposure** information that will be computed using geospatial techniques. Exposure could be represented using multiple indicators such as the percentage of slums across the city that are inundated, percentage that have reduced access to food, education, health-care or livelihoods, electricity outages, no drinking water supply—among other services and resources—during flooding. These indicators of exposure can also be aggregated for each slum, which can then be ranked on an exposure scale of *most exposed* to *least exposed* to urban flooding and can be geospatially mapped.
3. The third component of risk, **vulnerability**, is a system property and cannot be observed or quantified directly. According to the IPCC risk framework, vulnerability is a function of the **sensitivity and adaptive capacity** of the system (see Figure 3). Although sensitivity is the degree to which a system is affected (either adversely or beneficially by climate variability or change), adaptive capacity is the ability of a system to adjust to potential damage, to take advantage of opportunities, or to respond to consequences.

An **indicator approach** is proposed for quantifying the vulnerability of a system (Biswas & Nautiyal, 2021; Davino et al., 2021). Quantifiable proxies that represent sensitivity and adaptive capacity characteristics of a system of interest are selected as indicators. To assess the current vulnerability of slum households in Bengaluru, a few examples of indicators are provided in Table 1, considering the issues discussed in the earlier sections of this article. The indicator list is by no means exhaustive and can be expanded to incorporate contextual relevance.

Indicators can be quantified at the household level through **household surveys** (see Figure 3 [c]), using a questionnaire format and conducted in a sample of slums. The survey would help capture disaggregated data on general demographics, such as current income levels, poverty, education, and health, to assess the inherent vulnerability of slum dwellers in the sample and to establish a baseline. Where possible, intersectional variations will be collected within each of these data points. The results of the sample can be generalized to all the slums mapped in the city of Bengaluru, considering the various features captured by the survey. The quantified indicators will be then aggregated to form a vulnerability index that will allow the classification of slums on a vulnerability scale ranging from *most vulnerable* to *least vulnerable*. The vulnerability of slums can also be represented using a map that shows the geospatial distribution of most- to least-vulnerable slums across the city of Bengaluru. The findings of the vulnerability assessment will be further strengthened using insights from the LH assessment.

Current urban-flood risk to slums can be assessed by aggregating the scores of the probability of occurrence of urban-flood hazard, and exposure and vulnerability of each slum to them.

### 5.1.2 | Future urban flood risks to slums

Given the complexities of projecting changes to socioeconomic systems, there are limited studies that have assessed future climate risks. When undertaken, such assessments are usually done at a macro scale (global,

<sup>8</sup>A *taluk* is a local unit of administrative division—a subdistrict within a district.

<sup>9</sup>A *hobli* is a cluster of adjoining villages administered together for tax and land-tenure purposes in the state of Karnataka, India.

TABLE 1 Examples of indicators for assessing vulnerability of slum households.

Function of vulnerability	Indicators
Sensitivity	Sensitive population density (women, very young, very old, and people living with disability/unit slum area) and their intersectional social identities (where possible) Percentage of <i>kutcha</i> <sup>10</sup> homes within a slum
Adaptive Capacity	Percentage of slum dwellers that own their homes Extent of access to social services and institutional benefits Literacy rate Extent of access to basic amenities Extent of access to transportation

comparing different countries), using socioeconomic projections employed in the development of representative concentration pathways (RCPs) and shared socioeconomic pathways (SSPs). Also, there are no studies that have applied future risk assessment on a micro scale, such as to areas within a city.

Although the format of the outputs (of assessments made using our proposed methodology) will be similar to the current flood risk assessment, the number of outputs will depend on the number of climate scenarios considered and the time periods considered. These scenarios will be determined by the data used, either the Coupled Model Intercomparison Project Phase 5 (CMIP 5) (two RCPs) or CMIP 6 (five SSPs):

1. The **future probability of occurrence of urban flooding** will need to be assessed using projected changes in rainfall, obtained by employing downscaled global climate model outputs coupled with high-resolution UFM. This will provide the area inundated and depth of inundation under different climate scenarios for a future period (for example, the 2040s or 2080s) at a city scale. Similar to assessing the probability of occurrence of flood hazard using historical rainfall data, projected rainfall magnitudes from the results of flooding modelled by the UFM will need to be considered as a threshold. This exercise would provide four to 10 hazard maps that highlight the probability of the occurrence of future urban flooding at the *taluk* or *hobli* level for the city of Bengaluru, depending on the data and timescales used.
2. For **future exposure mapping**, the spatial and temporal dynamics of slums will need to be modelled based on historical slum distribution patterns and assumed socioeconomic changes that influence the presence of slums. This slum map would then be overlaid with future flood inundation maps to provide future **exposure** information. Future exposure mapping will follow the same method that has been presented for historical or current exposure mapping. As the exposure mapping exercises will allow us to visualize the spatial and temporal dynamics of slums across Bengaluru, they will address the issues discussed in Section 4.

Finally, given the complexity of assessing future vulnerability, this article proposes the use of **narratives of change** (see Figure 3 [d]) as a fourth process to generate future vulnerability maps for different climate scenarios and timescales.

## 5.2 | Integrating life histories

Our methodology integrates LH with risk assessment, to intersperse the lived experiences of climatic events and impacts with the scientific assessment of climate risks. Life histories draw on rich descriptions of individuals, which

<sup>10</sup>A *kutcha* home is typically built out of poor-quality materials and is the distinguishing character of temporary dwellings.

offer insights into their life experiences as a whole, particularly for understanding “memories, aspirations, and experiences that shape them” (Singh et al., 2019, p. 2669). Furthermore, LH situates life events and key decisions within broader contextual dynamics, which are organized temporally based on specific individual experiences.

In the proposed methodology, LH will focus on individual narratives at the household level to gain insights into:

- How individuals and their life events and experiences (with their agency, aspirations, and decisions to cope with multiple risks) are embedded within broader sociocultural and environmental processes.
- How contextual power relationships (both internal—within households—and external structural constraints) shape their agency in decision-making and adaptive capacities and impact their household's response to risk over time.

The LH approach will be operationalized through semi-structured interviews and will draw on narratives about migration trajectories, decisions to migrate, everyday lived experiences in slums (mainly those related to access to and availability of basic resources, jobs, schools, banks, and other resources), barriers and constraints in everyday life and movements, experiences of urban flooding and other climatic extremities, future aspirations, and desires. Knowledge of the migrant slum dwellers' experiences of everyday (multiple) vulnerabilities, and their adaptation responses and resilience building strategies is critical for understanding, contrasting, and challenging the current framing of the problem of urban flooding, in order to help create the desired future by reframing the existing narrative.

The LH approach will provide a differential lived experience perspective to the historical and current trends of urban flooding analysed through the climatic risk assessments. Once we contextualize and focus on the slum dwellers' hidden stories and the local embeddedness of their climate change experiences, we intend to integrate their local knowledge, responses, and future aspirations into collaborative futures-thinking processes for initiating narratives of change.

### 5.3 | Narratives of change: Initiating collaborative and participatory processes

A critical component in our proposed methodology is to intermesh the LH narratives of the migrant slum dwellers with the narratives of policy-makers, primarily to address the problem of recognition and bridge the communication barriers between them. Understanding the agency of marginalized citizens and ensuring their participation are key ingredients in this process. Foresight tools often run the risk of becoming elite technocratic processes if the participation is restricted to a few “experts” (Eames & Egmore, 2011). Therefore, the differences or similarities in framing the issue from the perspective of both citizens and policy-makers, as well as their varying approaches to addressing the problem, need to be collectively examined to identify potential areas of conflict or disagreement, as well as the possible areas for building collaborative strategies and effect mutual learning. Marschütz et al. (2020) define this process as narratives of change.

Eames and Egmos (2011, p. 769) also explain that “shared visions facilitate the formation and alignment of networks within which innovation takes place.” They add that these shared visions also help articulate priorities and goals based on which the necessary scientific, financial, institutional and political resources can be mobilized.

To operationalize this step, we propose creating a collaborative platform, where the government agencies, slum dwellers, and other stakeholders (including urban planners, academics, practitioners, and experts) can come together to re-assess the issue of flooding. As RoyChowdhury (2021, p. 116) notes in her work “NGOs and the slum committees, caste or community association, and political parties” are some of the channels through which the issues of the urban poor are voiced to the state authorities for policy or action, and would comprise some of the key stakeholders in the process. Similarly, in an action research project implemented in the UK, the local council and a local NGO were the frontrunners of a bottom-up community foresight process aimed at building on the existing local ownership, with a focus on ensuring benefits to the local community (Eames & Egmore, 2011).

In our methodology, we intend to use the narratives of change, which emerge from the deliberations that take place during these collaborative dialogues, to also develop future vulnerability scenarios. Drawing from Eames and Egmos (2011), these collaborative dialogues can be implemented through a range of methods, such as community-led exploratory walks in the slums (to introduce the sites to “outsiders”), and focus group discussions and workshops implemented throughout different stages of the process to reconceptualize the problem, consider future scenarios, and strategize the next steps.

However, an in-depth analysis to understand the functional implications of each of the scenarios is further needed to “reinforce the perception” (Fernández Güell & Redondo, 2012, p. 323). Therefore, in our proposed methodology, the future hazard and exposure maps will be used to inform these deliberations by providing spatial implications of possible future climate change to assist with the quantification of future vulnerability indicators. The interconnection between future risk assessments and the narratives of change would be ongoing (as shown in Figure 3) and would be critical for initiating a strategy for foresight thinking. This step would also help identify possible entry points for policy interventions at the slum level. Furthermore, for transforming existing planning processes, strategies of foresight thinking will inevitably also require a transformation in the governance structures and legal frameworks to occur simultaneously to support the overall process of initiating change (Fernández Güell & Redondo, 2012).

## 5.4 | Rationale for mixed methods

Previous research has identified that one of the major drawbacks of climate change vulnerability and adaptation assessments is that they often overlook its dynamism (Singh et al., 2019). Also, vulnerability assessments sometimes do not effectively capture the complex structural conditions that impact vulnerabilities and adaptation, which are highly contextual and vary temporally. It is also difficult to capture the changing aspirations of different individuals and groups. Adapting from Singh et al. (2019), a life history approach is proposed to address this gap. In addition, narratives of change are used to understand the transforming issue of urban flooding through the past and present, and aspirations for the future, from the perspective of all key stakeholders, to initiate an inclusive and collaborative futures strategy.

In addition, in the Indian context, decisions on policies are mainly data-driven, and the lived experience dimension might be glossed over due to the challenges of quantifying them. And, as Conway (2015, p. 7) explains, while “influencing decision making is the ultimate aim of using foresight,” we acknowledge that “influencing the minds and assumptions of people who make those decisions will be a very real challenge.” Therefore, we believe that by employing a mixed-methods approach, we can include lived experience in scientific risk assessments by including intersectional perspectives of everyday life and vulnerabilities, to develop a holistic and nuanced understanding of urban flooding.

## 5.5 | Potential challenges and limitations

In the proposed methodology, first, gaining an entry and establishing links and networks as an “outsider” to the micro-system of the slums may pose a challenge. Second, for the most vulnerable population, it could be difficult to imagine a future timeline of 20 to 30 years when they have to navigate everyday risks. Third, ensuring continuous engagement and sustaining the interest of state governments (which change every five years) will be another challenge. Therefore, creating collaborative platforms would also entail the difficult task of navigating existing power relations at multiple levels. As Eames and Egmos (2011, p. 778) identify, “Partnership; Trust; Respect; Resources; Inclusivity; Empowerment, Creativity; Reflexion; Hospitality; and, Community Value” will be issues that will require navigation while working with community participants. It will also be necessary for us to acknowledge our own positionality and maintain ethical codes and conduct during the process.

Deliberative processes are also likely to lead to conflicting narratives and aspirations. Therefore, projects that involve collaborative processes must clearly determine the roles and responsibilities of all key stakeholders involved during the initial stages (based on their current and anticipated capacities) to ensure their long-term equitable partnerships (Blanchard et al., 2017; Kunseler et al., 2015; Manikutty, 1998). Additionally, the nature and extent of participation envisioned by different stakeholders might alter as the project unfolds based on contextual determinants. Therefore, drawing from Manikutty (1998), we intend to accommodate for flexibility in the scope and the type of participation planned. Further, this participation must be authentic, with real representation (particularly of the marginalized populations) in the decision-making processes, where multidirectional knowledge transfer between those involved is continuous, to initiate a narrative change. Furthermore, Fenton-O'Creevy and Tuckett (2022, p. 6) note that conviction (both cognitive and affective) is "built through narratives that integrate evidence and expectations with emotional support for a preferred choice." Therefore, these contrasting and sometimes conflicting points of view and aspirations help facilitate the renegotiation of social positions and reclaim agency by challenging predominant voices. Through our proposed methodology, our objective is to arrive at a preferred "conviction narrative," by incorporating knowledge of the past and present and offering evidence to support the envisioning of credible future alternatives, based on thinking differently about the issue of urban flooding. Ensuring transparency will also be necessary in the process.

Within the methods proposed, there are likely to be other implementation barriers as well. First, conducting a climate risk assessment using the IPCC AR6 framework requires adequate technical expertise. These assessments normally require a multidisciplinary team with GIS experts, climatologists, climate modellers, and social science researchers, which can place a heavy burden on logistical and financial resources. As a result, there have been few studies involving a climate risk assessment conducted using the IPCC AR6 framework in the Indian context, and even fewer on a city scale. Therefore, such an assessment, integrating an LH approach, would be a novel undertaking. Second, quantifying, standardizing, and assigning relative weights to vulnerability indicators must be a process that is deliberative and bottom-up, which can be challenging. Vulnerability is highly contextual, and therefore its assessment should be conducted through participatory dialogues among all stakeholders involved (Kumar et al., 2016, p. 524).

## 6 | CONCLUSIONS

In this article, we have deconstructed the issue of urban flooding, particularly from the perspective of migrant slum dwellers, and have identified some of the critical challenges, especially the problem of recognition, for initiating foresight thinking for the city. By incorporating marginalized voices, our methodology is inclusive and contextually relevant, while also considering the intersectional variations among those marginalized.

In addition, the mixed-methods approach allows the traditional climate risk assessment to be augmented by life histories of vulnerable slum populations to support the process of reimagining a more inclusive future collaboratively. The results of these proposed methods will provide scientific quantitative assessments of current and future flooding risks, combining them with everyday lived experiences and future aspirations of multiple stakeholders to help derive reasonable and feasible future alternatives. The broader objective of these juxtaposed methods is to "systematically think about the future to inform the decision making today" (Conway, 2015, p. 2), and to contribute to the growing literature on foresight thinking.

Stimulating long-term thinking while tackling present challenges, negotiating future aspirations and desires of multiple stakeholders, and bringing marginalized voices of migrant slum dwellers to the fore, is the challenge that this methodology addresses, for envisioning a more inclusive future with lower impacts from urban floods.

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## DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article, as no new data were created or analysed in this study.

## ORCID

Sripallavi Nadimpalli  <https://orcid.org/0000-0002-0268-3488>

Sahil Mathew  <https://orcid.org/0000-0001-8696-1408>

Tashina Madappa Cheranda  <https://orcid.org/0000-0001-7581-8956>

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