QUESTION OF CITIES

Forum for nature, people, and sustainability ®

‘This may be the coolest summer. Be ready for 51 degrees C’

Photo: Imtiyaz Shaikh

The abysmal and unsustainable state of ecology in our cities, the severed relationship between people and nature, the indifference of most governments to the environment, policies which damage or destroy various natural habitats in pursuit of development, and the clear and present danger of Climate Change are all issues of deep concern to us.

Question of Cities is India's only online journal dedicated to urbanisation, ecology and social equity. We strive to document stories and develop dialogues on these themes to imagine, create and re-create sustainable, inclusive and equitable cities.

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Illustration: Shivani

After COP28: The implications for India's cities and vulnerable communities

Aravind Unni

December 29, 2023

For the millions in India's cities, the recently-concluded annual climate summit, or COP28, appears inconsequential and detached from their lived realities of heat waves, bitter cold, and unprecedented rainfall. The urban poor and marginalised communities find themselves on the periphery of such global and national discussions on climate change. However, India stands at a pivotal moment to adopt a proactive role in climate leadership in cities, especially in the Global South. The government can further decentralise climate action to cities, document and quantify the climate impact on the urban poor, and acknowledge that informality in work and housing are key aspects of cities rather than see them as violations and encroachments.

The annual climate summit of the United Nations, called Conference of Parties, in its 28th edition this year in Dubai was the grandest but the most contentious summit since it began nearly three decades ago. It had significant outcomes. The important one signalled the beginning of the end of the fossil fuel era with a swift, just, and equitable transition. Called the UAE Consensus, it was ratified by nearly 200 countries. One of the summit's key outcomes, the first Global Stocktake, called on nations to present ambitious emission reduction targets in their 2025 climate action plans and underscored the imperative to limit warming to 1.5 degrees Celsius. A landmark achievement was the agreement on the Loss and Damage Fund for nations disproportionately impacted by climate change, resulting in nearly USD 800 million in commitments.

The summit featured 10 declarations and 170 announcements, including a first-ever and welcome declaration on food systems, health, and multi-level actions on urbanisation. It also resulted in the mobilisation of more than $85 billion in funding, including historic replenishments for the Green Climate Fund and Adaptation Fund, marking a positive phase in climate action. With these under its belt, the Dubai COP sounds like an impressive success despite its many conflicts of interest.

However, the summit revealed fault lines and limitations. There was a substantial funding shortfall for clean energy transitions and climate adaptation in the developing countries which meant that critical discussions on climate finance were kicked down to next year. There was also a record presence of 2,456 fossil fuel lobbyists who out-numbered delegates from climate-vulnerable nations, and drew attention to the dominance of the industry in COP discussions. And, as is well known by now, the summit faced criticism for shying away from a definitive denouncement of fossil fuels; the incremental approach got some praise but others deemed it a death warrant.

Unfortunately, for vulnerable communities – especially the millions of poor in cities – the COP28 'gains' appear distant, inconsequential, and detached from their lived realities which have seen an increasing incidence of heat waves, bitter cold, and unprecedented heavy rainfall. Millions, who count as urban poor and marginalised communities in our cities, find themselves on the periphery of global discussions on climate change – both at COP and nationally – to alter that. The way ahead is for the central government to decentralise climate action more to cities, document and quantify the climate impact on the urban poor, and acknowledge that informality in work and housing are key aspects of cities rather than violations and encroachments.

Cities in COP28, finally

The COP28 marked a significant shift in climate discourse by giving cities a prominent role. With cities projected to accommodate 80 percent of humanity by 2050 and responsible for 70 percent of the carbon-dioxide emissions now, focusing on urban areas was long overdue to meet the commitments of the Paris Agreement of 2015. The summit's inaugural Local Climate Action Summit on December 1 united over 500 mayors and subnational leaders, and secured $467 million for urban climate action, emphasising the involvement of cities in the Nationally Determined Contributions (NDCs) and financing. The event coincided with the first-ever COP declaration on climate and health.

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On December 6, the summit hosted the second Ministerial Meeting on Urbanisation and Climate Change with 71 countries joining the Coalition for High Ambition Multi-Level Partnerships (CHAMP). Commitments under this involve robust urban climate actions, and improved cooperation between local and national governments; the COP28 agreement reflected this shift with nomenclature such as "multilevel" action and emphasising vulnerable "local communities" to develop sustainable and climate-resilient cities. This is the strongest recognition of cities as crucial battlegrounds for climate action.

India in COP28

India's interventions at COP28 were received positively. The country positioned itself as a proactive player on the international stage, its delegation laid claim to host COP33, emphasised the urgency of accessible climate finance for the developing nations, voiced concerns for the Global South, and pushed for equity reminding delegates of Common but Differentiated Responsibility (CBDR).

It also highlighted initiatives like the Green Credits Programme and addressed the vulnerability of the Himalayan region. Its 'achievements' included a 33 percent reduction in emission intensity and reaching 40 percent non-fossil fuel-based electricity capacity, 11 and nine years respectively ahead of schedule.

Despite the strides, India's absence from key COP declarations on health, food systems, and energy raised concerns. The lack of an urban ministerial delegation underscored gaps in representation at the city-urban level.

India's cities and the vulnerable

India faces significant challenges with over 75 percent of its territory experiencing various climate impacts. Recent events such as the heavy rain and flooding in Delhi and cyclone Michaung hitting Chennai highlighted the increasing frequency of climate-related disasters in cities. The once-in-a-century Mumbai floods of 2005 now occur regularly. Several cities scorch under soaring temperatures every summer, causing heat-related illnesses and impairing livelihoods of outdoor workers and people in informal settlements.

India's cities also grapple with persistently high pollution levels, inadequate services, and substantial development deficits. Millions of people in informal settlements and informal livelihoods bear a disproportionate burden, with 50-70 percent of the urban population defenceless against the intersecting vulnerabilities in housing, livelihood, and socio-economic factors. State responses increasingly lack empathy for the urban poor, as seen during the G20 summit when slums were covered or demolished.

Top-down, unscientific urban planning exacerbates the situation, contributing to maladaptation rather than mitigation of climate impacts. High-value infrastructure such as the Mumbai Coastal Road Project, waste incinerators, and smog towers in Delhi, worsen urban vulnerabilities. The centralisation of actions and interventions in Indian cities is worrying. While some Urban Local Bodies like those in Mumbai, Chennai, and Bengaluru are making efforts for climate action, these initiatives remain insufficient and lack coordination.

The climate action plans do not have a national framework and statutory mandate, leaving communities and their participation mostly out of climate action in cities. Also, increasingly all plans – heat action plans, flood mitigation plans, disaster management plans, master plans and climate action plans – overlap with contesting documents and contradictions, creating a muddle of city planning actions. There is another aspect – plans, futile or not, do not extend beyond the metros leaving the 10,000-odd Tier 2 and 3 cities to their own devices. The need to empower all ULBs and decentralise climate action was never greater.

Centre-stage the urban vulnerable

As COP28 increasingly recognises cities as pivotal players, the need to acknowledge urbanisation as a driver of climate action gains prominence. It is the "local communities" that must be supported with climate finance and capacities, focussing specifically on the most marginalised in cities, and ensuring their inclusion in climate action. The following strategies can facilitate this:

Eliminating the urban blind spot: Urban areas have historically been excluded from climate planning, creating a policy blind spot in India's climate policies and even the Nationally Determined Contributions (NDCs). The CHAMP declaration of COP28 is an opportunity to address this lacuna, recognise urban or city governments as key stakeholders in climate action and recipients of climate finance. The NDCs are to be recalibrated to include local communities, addressing their specific needs and concerns, to build resilience against climate events.

Recognising urban local communities as stakeholders: Adhering to the principle of 'Nothing for us, without us', it is imperative to acknowledge that the most vulnerable people or communities in cities are among the worst impacted by climate events. These include people living in informal settlements, the urban homeless, informal workers, and other numerous categories. While the UNFCCC framework recognises nine constituencies like farmers, indigenous people, youth, and gender, the need now is for specific articulation and representation of urban local communities that shoulder many climate actions at the lowest level. This, in India's cities, translates into millions of people. The effort has to be to ensure that they speak for themselves, raise their concerns at the COPs and at the national level.

Assessing and mapping emerging urban vulnerabilities: The emphasis of the Global Stocktake on "local communities" underscores the need to articulate and document the vulnerabilities in cities; these may differ from city to city too. It also further emphasises the need for "up-to-date assessments of climate hazards, climate change impacts and exposure to risks and vulnerabilities". This documentation is crucial at two levels – for Indian cities to move forward on climate mitigation actions, and to firm up an international framework to diversify community representation.

Decentralising climate actions through re-imagining 74th CAA: Aligned with the CHAMP declaration, establishing shared governance at national, state, and local levels would now be necessary. Climate actions and interventions are heavily centralised and work in a top-down mechanism with not much room for engagement with cities and communities as key actors. The currently under-used 74th Constitutional Amendment

Act (CAA) should be revitalised to empower Urban Local Bodies to address climate change as a potential 19th function. This will be challenging in the present climate of re-centralised governance in the country but it is the best bet to deal with the highly decentralised climate threat in our cities. This will also mean that India's representation of climate concerns at COP are attested by cities, including climate action in the smaller and fast-growing cities too.

Documenting loss and damage: The urban poor and marginal communities are forced to suffer daily loss and damage, particularly within the informal sector, during extreme climate events such as high heat and rain. Documenting, categorising, and quantifying these impacts is vital for integrating the losses into global debates so that these go beyond anecdotes and stories in the media or informal reports by the civil society. This will help establish the macro-narrative of how much the marginalised in cities suffer. Also, it will temper India's international (COP) posturing as an 'achiever'.

Recognising Common but Differentiated Responsibilities (CBDR) nationally: Translating the CBDR at city level is an important step ahead. Acknowledging differentiated impact on cities – even within a city on different classes of people and communities – is crucial to address funding disparities. Doing this will help strengthen India's advocacy of CBDR at the international level. This would also ensure that the vulnerable people in cities receive proportional financial support for climate action, preventing funds from being diverted to large-scale infrastructure and interventions not required by such communities.

Recognising informality and people-based solutions: For urban poor communities, informality is the mainstay of their existence. With over 80 percent of the workforce employed in the informal sector and 40-70 percent living in informal people-built settlements in cities, informality needs to be recognised as an intrinsic part of the urban – and as part of the solution. Only then can people-based solutions to climate challenges be leveraged. Local innovations that are affordable, frugal, people-built, and low-carbon need to be incentivised. This is in sharp contrast to the framework of existing climate action and environmental protectionism that views informality as violations and encroachments.

Reimagining urban planning for inclusion, sustainability, and disruptions: Over-hauling archaic and pre-climate change urban planning policies is essential. Urban planning has to move away from planning for grey infrastructure – or dominance-over-nature approach – to planning for green, blue, and public good infrastructures. This shift includes recognising and allocating space for informal settlements and livelihoods, urban commons, and public-green-blue networks within master plans. Also, urban planning needs to better predict disruptions, displacements, and migrations due to various climate impacts like sea level rise, flooding, and other projected disasters. Impending reforms in urban planning are an opportune space.

Developing knowledge sharing and capacity building platforms: Urging a departure from solutions that are not economically viable and socially feasible, allowing socially feasible solutions to emerge from communities and cities of the Global South are crucial. Such capacity building, supported by financial allocation and trained

community human resources, can ensure that cities and local communities prove to be the bulwark of climate action in a decentralised way.

Breaking silos for coordinated climate action in cities: Future climate policies should transcend silos and foster collaboration among key national actors like urban development, climate change, labour, disaster management authorities, home affairs and so on. Adopting a convergence model and establishing climate cells at various administrative levels ensure integrated and effective climate governance, with a specific focus on communities as drivers of change. This approach is vital for effective climate governance.

India, thus, stands at a pivotal moment to adopt a proactive role in climate leadership on cities beyond COP28. Rather than passively waiting for future COPs, India can advocate the acknowledgement of urban vulnerable local communities in the international climate initiatives and steer the narrative for climate action in cities of the Global South. The work, though, begins at home.

Photo: Creative Commons

‘Move people back into trains and buses, it’s affordable and it’s climate action’

Hussain Indorewala speaks to Team QoC

February 9, 2024

As cities in India see a rise in private transport, the modal share of public transport has declined. This varies from city to city but nowhere is it more stark than in Mumbai which was once famed for its accessible and affordable options such as the suburban railways and the bus system, which together ferried nearly 12 million commuters a day. However, “we now have a metro-airport-highway orientation which is not the old railway-bus-pedestrian one. The money goes where the priorities are…This idea that users must pay for essential services but everybody must pay for luxury services is how the system has been re-organised,” says activist and teacher **Hussain Indorewala** in this in-depth interview. As road congestion and traffic emissions become endemic, and climate mitigation actions demand a review of the transport sector, the public transport might save the city.

Public transport, especially a robust even if chaotic bus system, has been at the centre of mobility in most Indian cities. A few have had old railway networks while many sport the metro. The benefits of public transport are countless – it prevents traffic congestion, reduces greenhouse gas emissions and air pollution, and provides economic opportunities. For decades, private transport was marginal even in large cities like New Delhi and Mumbai where more than 80 percent of commuters used various modes of public transport and intermediate transport such as rickshaws and taxis.

However, in the past few years, as governments invested heavily in physical infrastructure such as roads, bridges, freeways, sea links and highways that primarily support two-wheelers, cars and SUVs, the focus shifted from public transport. People's preferences moved in this direction too.

The shift has been remarkable in Mumbai, a commuter city. Of all motorised transport, the railways and BEST bus networks carried 74 percent of the city's commuters in 1998; by 2018, this share was down to 56 percent while the share of private transport such as two-wheelers and cars had galloped from 13 to 27 percent.

The city now has nearly 2.2 million private cars and 2.5 million two-wheelers. The resulting road congestion and traffic jams have become legendary. As the central and state governments brag about infrastructure projects like the Mumbai Trans Harbour Link, inaugurated last month, and the Coastal Road, the significance of public transport cannot be emphasised more. Importantly, public transport holds the key to Mumbai's climate action.

Photo: Jashvitha Dhagey

Hussain Indorewala is an activist and teacher.

How can public transport systems be integrated into planning cities?
Actually, it is already integrated. It is an integral part of urban planning in many cities. Take the example of the newly-inaugurated Mumbai Trans Harbour Link. It was supposed to be a 'rail-cum-road link'. With a railway line, it would have facilitated people to live in Navi Mumbai and travel to work in Mumbai at low cost. The housing there would have been for people who could afford it too.

From a planning perspective, a railway link would make sense because it would have opened up the mainland for people with modest incomes to access. Now, because it is a freeway, the people who will benefit are those buying luxury real estate in Navi Mumbai. This is the purpose of the project. The advertisements were there on the day of the inauguration itself. The beneficiaries of this infrastructure are not the common citizens of Mumbai. So, there is a connection between land use and infrastructure development but it can be both ways. It can promote affordable housing or expensive housing. We are doing the latter.

The approach to public transport focuses more on physical infrastructure than people's mobility. Do we not need better mobility planning rather than mere infrastructure planning?
The question is what is meant by mobility. We should be precise about how we define our problems. Historically, the older city evolved in the pre-automobile period. It had trams, animal-based transport, largely pedestrian mobility, and the railway line. Much of the urban form is not really suitable for four-wheelers. When you shift to private mobility to a large extent as we have, you not only have to do infrastructure projects but also transform the urban fabric radically to make it suitable.

The approach to large infrastructure projects have also changed. For instance, in the 1990s, the study by WS Atkins recommended strengthening rail-based transport, and connecting the railheads Churchgate and Chhatrapati Shivaji Maharaj Terminus, building road space only in the east-west direction and not in the north-south direction, bringing in congestion pricing for cars, and so on. The understanding was clear: discourage private and encourage public transport. In 2005, the World Bank's Comprehensive Transport Study dramatically changed the way mobility was envisioned – more large infrastructure projects such as sea links, freeways, metros, airports.

We now have what can be called the metro-airport-highway orientation to mobility which is undoing the old railway-bus-pedestrian one. Mumbai is seeing this shift. Compare the investment in these modes; there is very little or negative investment in bus and rail, but a lot in freeways, metros and airports which are not for average citizens. The money goes where the priorities are. One has to think about mobility but specifically non-motorised and public transport mobility, and discourage private mobility as much as possible.

Mumbai's metro network is touted as the panacea for all woes but its connectivity and affordability are not comparable to the railway or bus. Where do you place it in the city's transport matrix?
This is a good question because the metro is one of the reasons that the BEST bus undertaking is being gradually shrunk. There is a conscious effort by BEST to convert itself into a feeder service for the metro. Perhaps the thinking in the BEST, Brihanmumbai Municipal Corporation and the government is that if changes are made in the way buses are organised – for instance, suspending long routes – commuters will use the metro. But the metro is unaffordable for bus users. The only way this shift can happen is by reducing the metro rates but there is no effort towards that; the metro is exclusionary priced.

Secondly, the metro line 3 is underground but metro lines have been built on top of arterial roads, in some places the columns have taken away road space where bus lanes could be introduced. The metro is poorly planned. Again, it has to do with increasing land values as we have seen on the Link Road in Malad, benefitting owners on that route. There is a case for building a metro system if it is underground and densely networked, not this way. Even now, bus corridors can be introduced on arterial roads, it is simple and cost-effective but there is not much interest.

How would you reflect on the citizen's campaign to keep the BEST afloat? What more needs to be done?
I was, and am, part of the group called *Aamchi Mumbai, Aamchi BEST* (Our Mumbai, our BEST). It is not the only group demanding public transport; others like the Mumbai Mobility Forum, Mumbai Environment and Social Network (MESN) and individuals have been making a passionate case for public transport for years. Our group started in 2017 when Ajoy Mehta, as Mumbai's municipal commissioner, came out with so-called reforms including an increase in fares, removing concessions for senior citizens, cancelling non-profitable routes, and bringing in private contractors. We called it the 'Mehta model'.

Mehta and others made a big fuss about BEST's losses but people forget that it was always a revenue-deficit system working on the cross-utility subsidy model; the surplus from electricity distribution subsidised the transport. BEST stands for Brihanmumbai Electric Supply & Transport. As the Bombay Tramway Company Limited, it was a private transport service and was taken over by the BMC in 1947 because the working population needed affordable public transport. BEST was the core bus transport system complementary to the railways and also a feeder to the railways with bus depots right outside railway stations.

The privatisation of electricity – to facilitate private service providers like Reliance and, later, Adani to enter the power distribution sector – and subsequent court orders broke up the cross-subsidy model, which resulted in the transport division piling up deficits. These so-called "losses" and "inefficiencies" became the pretext for bringing in private operators; today, nearly two-thirds of the buses operated by BEST are run by contractors.

What was the campaign able to do?
Aamchi Mumbai, Aamchi BEST has social scientists, transport planners, labour union representatives and social activists who argued that the main problem was not revenue deficits but the policy promoting contractualisation, shrinking the service to promote the metro and to eventually sell BEST land to builders. The BMC justified contractualisation – also called wet leasing – as cost-cutting. The contractors are reducing costs by cutting down on maintenance and slashing wages. The combination of poorly paid and overworked workers, and poorly maintained buses has meant more accidents and multiple incidents of buses catching fire.

The number of buses owned by BEST is declining; it has barely 1,061 buses, down from about 4,000 nearly 15 years ago. Since it is not buying buses, its workforce has been rendered excess. This was a way to downsize; otherwise, the unions would have protested. Aamchi Mumbai, Aamchi BEST aimed to create the understanding that the interests of commuters and workers are not necessarily in conflict. In fact, many BEST union representatives passionately argue for expanding and improving public transport. So, we are a citizens' platform to promote reliable, affordable and sustainable public transport.

The Mumbai Climate Action Plan suggests that the electrification of buses, rickshaws and cabs, and the shift to public transport heralded by the metro, will help climate action. How realistic is this?
The Mumbai Climate Action Plan (MCAP) is not a statutory plan. It is essentially a wish list but even so, it does not do enough. It is conservative. For instance, it talks about dedicated bus lanes but they will be built "wherever feasible" by 2040. Why wait till 2040? These can be made tomorrow if the BMC wants to. One lane each on the Western Express Highway and Eastern Express Highway can be reserved for buses.
The truth is that Mumbai's transport system is being consciously planned as a divided and stratified system, where the level of income and status determines the degree of flexibility and comfort in movement: individual automobile-based transport for those at the top of the pyramid, overhead and underground rail for middle-income professional and managerial class, and overburdened surface rail, buses and non-motorised modes for the working poor.

The MCAP is working very much within this status-quo framework rather than fundamentally rethinking transport infrastructure. If it was serious, it would have called for stop-work of the Coastal Road because it is the most atrocious infrastructure from the climate perspective. The already reclaimed area can be converted into a park and bicycle space. It could have insisted that the Trans Harbour Link include a rail or a Metro line, but did not. It could have called for a stop to all the projects which will increase north-south car traffic all the way to Virar, but did not. The MCAP has nothing to say about them.

Which other cities have efficient bus systems and what lessons can be drawn?
Many cities have good bus-based public transport services. London is a great example; many European cities too. South American cities such as Bogota are usually cited as an example for the Bus Rapid Transit System. The then mayor of Bogota made an

important point when he said that “driving a car is not a right, parking your car is not a right, but affordable public transport is a right.” Those car users who oppose higher costs on driving or parking should simply be told that it is not your right to drive a car; it is your privilege. If they want privilege, they pay for it. There are multiple examples and good practices that our cities can follow.

It is a mistake to think that public transport can be planned in isolation. Good public transport is that which can exist alongside private transport but now the emphasis is more on the former. In Singapore, buying a car is very expensive because you pay multiple times its market value for licences and permits which are auctioned. The revenue generated is used to upgrade public transport. If Mumbai had a good revenue-generating parking policy or congestion pricing, it could be used to run BEST services.

This is not difficult to do, not like building mega-projects such as the Trans Harbour Link. One of the suggestions *Aamchi Mumbai, Aamchi BEST* made, which also came from the unions, was to merge the BEST and BMC budgets instead of the separate C-budget for the bus system. If the BMC introduces parking and other costs on private automobiles, it can use that to run BEST but they refuse to. There is a lot to learn from other cities about how to organise buses and other public transport.

The importance of public transport is officially acknowledged but only on paper. In what ways do you think cities can, or should, prioritise public transport in the context of climate change?
Interestingly, public transport is climate action. Improving the modal share of public transport is the single-most important climate action any city can take. About 20 years ago, 80 percent of Mumbai’s share of transport was public transport, leaving out walking and cycling. Today, it is down to 55-60 percent, and declining. There is a notion amongst planners that people buy cars because it is aspirational, but it is in fact the direct result of policy. When the government creates highways, people are induced to switch to private transport. If we spend money on good quality public transport, people will switch to that.

If the modal share increases again to 80 percent, the cost of travel will be more affordable and, also, sustainable. There’s a simple calculation to measure emissions per capita; the fuel cost of travel is how much fuel is burned. For the suburban railway this is about 25 paise per person, bus is about 58 paise, the metro is Rs 2.05. It tells you simply, without complicated statistics, that if you take the bus or train, you burn less fuel. Move people back into trains and buses, and you have climate action.

How can we build urban public transport that is climate adaptive?
The first thing is to change the modal share – bring people back into public transport. I don’t mean metros, I mean railways and buses. Buses would be the easiest, railways can be augmented. Mumbai’s bus system has to be revived with bus priority lanes, buying more buses, even diesel buses because if people use buses less fuel is burnt anyway.

Secondly, electrification is a distraction; the electrification of BEST is a “green” cover for privatisation. If we must, then electrify the cars. That’s the elephant in the room, not the buses. Mumbai has 3,500 buses in all but close to 2.2 million cars. But what does the MCAP say about the electrification of cars? It says “it will happen over time with the right incentives.”

Then, encourage people to walk and bicycle more which means that people live close to the places of their work. This means you cannot move people from Dharavi to Mulund or salt-pans, they should live in or around Dharavi. A proper climate action plan will address these aspects too. Also, find ways in which existing buildings can be repaired-retrofitted rather than replaced with skyscrapers. So, we build fewer roads and not chop down the Aarey for infrastructure projects; the metro car shed could have been in Bandra Kurla Complex. Redesign highways and sea links to run buses and bicycles and make driving of cars more expensive. Climate action also means more bus lanes are built instead of metro lines.

It is about changing priorities. Within the existing paradigm, the talk is about a few open spaces and encouraging people to switch to electric vehicles; this is alright but not serious climate action, it is just distraction. Incidentally, the MCAP should have been a regional plan.

It is not enough that public transport is accessible to all, it should also be equitable. We need to qualify transport. Public would mean a price structure affordable to most people in the city. The Metro is not a public transport system; it is more precisely defined as a ‘publicly operated mass-transit system for the middle class.’ It is better than private cars but not affordable for many. The buses and the railways **are** public transport in Mumbai. If you have a large share of people using public transport, at least in terms of access, you have equitable transport. Of course, an AC or first-class ticket will cost more but the service is accessible to people with limited means.

There are other dimensions – do the elderly access public transport, is it designed in a way that they can board it or switch modes, how do women and the disabled access public transport? Once you have the basic public transport, then you can think about access and equity of specific groups. Right now, the problem is that the public transport is shrinking – this affects everybody.

Photo: Lalbagh Botanical Garden in Bengaluru by Manojk/Creative Commons

‘Cities are valued as places of commerce and not well-being, so trees are seen as dispensable’

Harini Nagendra talks to Team QoC

October 20, 2023

In an age when cities are building more malls, parking lots, offices, schools and colleges, there seems to be hardly any room for trees. We have stopped valuing the natural resources and the ecosystem they support; as cities turn grey and concrete, people need the green lungs all the more. “Trees are important for the resilience of a city and resilience of people who live in the city,” says Dr **Harini Nagendra**, professor of ecology at Azim Premji University. Talking to **Question of Cities**, Nagendra recalls her relationship with trees in her growing up years; how the relationship deepened as she changed cities; and why it’s important to have environmental psychologists and health experts in planning.

In concrete-dominated cityscapes, trees offer a pause. Their presence often goes unnoticed but their absence is striking, their uses are many. Cities may have tree authorities but what is really needed is a tree policy for a city prepared with experts and citizens in neighbourhoods, says Dr **Harini Nagendra**, professor of ecology at Azim Premji University, and distinguished writer on nature and sustainability who co-authored *Cities and Canopies: Trees in Indian Cities*. The acclaimed book featured on the 2021 Green Literature Festival's honour list.

"Research has shown that trees reduce pollutants, buffer micro temperature fluctuations and reduce the Urban Heat Island effect by lowering surface asphalt temperatures," she says in this interview to **Question of Cities** about the need for trees amidst the concrete in cities, the nostalgia of older city-dwellers about trees, and the need for the younger generation to develop connections with them.

Dr Harini Nagendra is a distinguished writer on nature and sustainability.

Can you share some of your fondest memories of trees and how this is reflected in your books?
I grew up in Delhi and Bengaluru where I used to go to parks for walks with my parents. We just walked and walked while looking at trees, stopping to see deer or pigeons in Lalbagh. My mother had her B.Sc in Botany in the 1960s, unusual for her generation, and she had that love for plants. It meant a different kind of walk, barely 50 metres in 10 minutes, stopping to tell plants apart. These are my subliminal childhood memories. My dad was a bureaucrat, we lived in government quarters in different cities which meant gardens and trees, looking at a fig tree, monkeys or birds on it for hours. I think all of these childhood memories came together later when I did my PhD in Microbiology, Chemistry and Zoology.

A book like *Cities and Canopies: Trees in Indian Cities* really grew from my first book Nature in the City which was on Bengaluru's ecology. I didn't write it as an academic book, but many who read the book said that though they were interested in nature, they

found it a little heavy. Seema (Mundoli, co-author) and I discussed a lot. My research on Bengaluru's urban ecology, which I began in 2006, was 'to preach outside the choir', so to speak. I had in mind a man who, during a Rotary Club's seed ball initiative held in a 5-star hotel, said sarcastically in Kannada: "Who doesn't like trees? All the great people here have been talking for the past hour that trees are important. I agree but I have a job in Vidhan Soudha where I have to clock in at 9am. My bus gets stuck in traffic, your trees are obstructing my right to reach work."

It's true. Most people like trees but think like this man – can we get rid of the trees in the city to keep traffic moving smoothly, and visit forests on weekends to get our fix of trees? Seema and I have collaborated since 2013, and have a common interest in communicating our research to circles beyond academia.

What would you say is the relationship, or different facets of it, between trees and cities?
I think trees remind us that, at the fundamental level, we share space with other kinds of beings. How we share space in cities where everything is a struggle for the majority of residents who are always running, trying to find their bit of space in a very cramped city, is the issue. Places of nature give us the breathing space to reconnect to the natural world around us, to realise that it's not only human beings who live on the planet. Nature helps to de-stress, connect to our spiritual side, respect the web of life. All this is not possible if you only have malls, parking lots, offices, schools and colleges, the grey and the concrete.

What did you intend as the takeaways from *Cities and Canopies*?
People carry nostalgia, the memory of their connection to nature. This is especially so for older people who have forgotten about their early relationship with trees. One of the most gratifying things for Seema and me has been, after our talk, to hear someone say "Oh, I had this favourite tree in my grandmother's house" or "I had a name for this tree" and similar memories. The book rekindled their memories, then they went out tree-spotting in their neighbourhoods.

Secondly, a large number of young people and school-going children have read it. They are young enough to still have their connection to trees. A girl in Class 8 said to me "in my lifetime, I have seen this road change, as trees disappeared from the road". I cannot forget her. We should not have a world where a 13-year-old is saying this, it's heartbreaking.

Thirdly, people found the science fascinating. We wanted to bring in things like exotic and indigenous varieties, what defines each, how we take cultural prejudices of immigrants and non-immigrants into scientific research on trees, and what is still unknown. Many people have seen trees but not paid enough attention. They told us: Yes, we have seen grazers, fishers, people say they are an eyesore and need to be removed, but now we want to challenge these notions. So, there are these little mindshifts which we really appreciate.

Finally, there is the mental health aspect. It is interspersed but not a big element in the book. The Covid-19 pandemic was right after the book and we realised that, after this, many people appreciate the importance of trees for mental health.

Why and how are trees important, or crucial, to urban ecology and cities?
Trees are important for the daily well-being of cities but cities are built on economic-cost analysis. With global environmental change, there is an increase in pollution, physical and mental health issues, societal fragmentation, crime and climate change. Trees are important for the resilience of a city and resilience of people who live in the city – I am separating the two though they are connected.

If we didn't have trees, we would have a lot more air pollution. Our research and so much other research shows that trees reduce sulphur dioxide, nitrous oxides and carbon monoxide, and buffer micro-temperature fluctuations. The Urban Heat Island effect reduces, surface asphalt temperatures decrease, and road temperatures become bearable. Similarly with flooding – if there are no wetlands, and all parks and green spaces are concretised, there would be more flash floods because there is no place for the water to percolate into the earth. This is what I mean by the resilience of the city as a whole.

Who in the city is getting affected? It is the poorest of the poor. Heatwaves and floods impact all people, but the wealthy can live in a hotel during a flood. What can you do if you are poor and your shack gets flooded? Even in the heart of our megacities, people – or largely women – forage for bits of firewood, food, medicines, and other things. In Bengaluru, there is the pongamia seed used for lighting lamps, which many women forage and sell for a little extra income. So, trees are central to our lives in cities.

Indeed, but trees are seen as unnecessary or impediments in urban planning. What needs to be done to set this right?
We focus a lot on money in cities. Of course, given it is a political economy, it's always more profitable for officers to approve new road projects than to protect status quo and preserve trees. There is money in rejuvenating a lake or river front, but there is no money in saving trees. They work in a project-oriented mode. "I protected something" is not necessarily useful to officers keen to establish a career and initiate ambitious projects. Secondly, the value of a city is as a place of commerce, not as a place of well-being. The part that gets the most traction, in the media or residents' associations or the government, is the impact of trees on pollution because it's related to public health. That's why I have been saying that it's important to have environmental psychologists and health experts in planning. We need to mainstream this way of thinking into mass architectural design and teaching.

Birds and trees are deeply interconnected, as you have shown. You spoke of hornbills returning to their habitats in Bengaluru's "protected sacred groves and restored lakes". How can this be adapted in other cities?
We have to be creative with city spaces, finding ways to insert trees in. There's a lot of scope in smaller cities and peri-urban areas, but it's more difficult in older cities. What we saw is that if a lake is restored, species like pelicans and painted storks come back, which are species not seen in Bengaluru in years. Our research using eBird data has shown that migratory bird species continue to be impacted but resident bird species recover quickly once you restore a lake. Similarly, ground-nesting birds are more impacted, but tree-nesting birds recover, perhaps protected by sacred groves or trees.

My economist colleagues at Azim Premji University have proposed a national urban employment guarantee scheme largely focused on urban commons and urban nature. It could have a positive economic effect on cities like the rural employment guarantee scheme had in villages, providing work opportunities while restoring lakes and sacred trees. I always think of Kathalekan in Uttara Kannada district, Karnataka – kathale means dark and kan means forest – which is so dense that you can't see the light but a new species of frog was discovered. Who knows what other species are waiting to be discovered amidst the trees.

The relationship that you draw between decorative palms, urbanisation and IT parks from California to Bengaluru is interesting. It's seen in other 'IT cities' too. How can this be countered?
I think positive examples help. Some companies are open to this, others are not. Many gated communities in Bengaluru that planted royal palms because of the California-IT influence realised that once the palms grow for 20-plus years they become unstable, are not meant for our environments, and chopped them down.

Secondly, the more progressive IT parks realise they can do something different and it becomes an example. WIPRO, for instance, started with the idea of planting trees to offset carbon emissions but, along the way, they were open to working towards water sustainability and biodiversity too. After restoring part of their campus, it attracts so many butterflies, and biodiversity that comes to a little artificial wetland. This has become a showcase where corporate groups from across India are brought. This is what we need.

Would you say that in our cities, it is primarily people who have been saving or protecting trees while governments treat trees as dispensable in the pursuit of development?
Yes, people have been at the forefront of this, often communities start social movements and inspire each other. People know like-minded people across cities, share data, exchange legal documents. But such people are a fraction of a city's population. I wish many more people would get involved because governments really respond to that. The moment you have masses out on the street, governments change tune, they do respond. The administration sees trees as dispensable because it still functions in the older world where it believes it has urgent things to fix, such as traffic for which wide roads are needed. But it's an outdated concept. The world is changing around us, environmental issues are more crucial. They are not seeing that but they will if more people demonstrate that they care about the environment as much as they do about, say, traffic.

There is a class factor; many people might be interested but cannot spare time to save trees because they are busy making a living.

I agree, there's a niche of people in such movements and they are influential. But let me put it this way — there are movements of all kinds, the ones that gain traction or media attention are the ones in which influential people are involved. It's not that the poor are not engaging in these social movements, nobody is listening to them.

What is your assessment of how the judiciary has been with respect to protecting trees and ecology in cities?

It's mixed and varied. There could have been policy changes for protecting nature, but I would say that if there are programmes and policies for trees, it is because of an activist judiciary. For example, in Bengaluru, when road widening was taken up on Jaymahal and Bellary Road near the Bangalore Palace, we did an assessment of the environmental damage of tree-felling and wrote in Bangalore Mirror. The court took suo moto cognisance of it and directed action. The trees were saved for a few years though they were eventually cut down. An influential PIL by the Environmental Support Group helped to save many lakes.

Tree planting in cities cannot be a one-size-fits-all approach. What would you recommend for the authorities and people?

At the local level, there are versions of tree authorities but what our cities need are tree policies. Tree authorities lack the mandate, financial power, power over other departments; they can only recommend. Even if tree authorities were functional, we don't have tree policies in cities, which describe for instance, a suggested list of trees that people can plant.

This is easily possible but each city needs its own list. Bring together tree experts, architects, non-governmental organisations, and citizens together in neighbourhood meetings to find out why a neighbourhood needs trees. Is it for food, climate, health, protection against sea level rise or flooding, mental health relief, mere beauty? Among the common questions we get is "I live in XYZ area, I want to know what to plant". So, Seema and I have worked on a tree planting guide for Bengaluru, which will be officially released soon, but for legitimacy and scale, city municipalities should take on initiatives of this kind.

Photo: Creative Commons

How is India mainstreaming gender in Climate Change adaptation?

Chandni Singh

September 8, 2023

Women are often portrayed as victims of Climate Change, or as 'most vulnerable' while failing to recognise other realities. Women's contribution to household-adaptive capacities and intra-household decision-making, often cooperative than combative, is lost. This oversight erases the substantive evidence on how women determine food, nutritional security and family well-being while adapting to climate events. The deep vulnerability of men belonging to poor, marginalised backgrounds is also erased in these homogenising narratives. India's State Action Plans on Climate Change equate gender with women, mostly discussing them as a homogenous category and ignoring non-binary genders. Climate Change research needs to draw on decades of gender studies to move from being gender-blind to increasingly calling for gender-transformative climate action.

The experience of Climate Change is deeply gendered and intersectional. What exactly does this mean and what implications does it hold for creating climate-resilient, inclusive, and liveable cities? In this essay, I follow three advances in conversations around gender and Climate Change adaptation. First, how the notion of only women as vulnerable is misleading; second, the variable outcomes of mainstreaming gender into climate action plans; and third, what gender-transformative climate action could mean.
Mainstream discourses on Climate Change and its impacts on people have tended to focus on extreme events – devastating floods, scorching heat waves, ever-strengthening cyclones – quantifying destruction and damages in dollar values and offering an alarming spectacle of precarious lives and livelihoods. Within this, many have demonstrated that women tend to bear the brunt of these impacts, left as they are to deal with eroded livelihoods, increased care duties, poorer financial capacities to recover and adapt.

It is only lately that this research and practice has caught onto what gender studies experts have known for a while – that vulnerabilities to climatic risks but also non-climatic shocks and stressors are strongly mediated by an interplay of class, caste, gender, livelihood types, and location. For example, upper-caste women's material conditions such as concrete housing, better housing locations, and social capital can reduce their vulnerability to flooding compared to men and women from lower castes. Within poor households, as Climate Change makes precarious livelihoods even more uncertain, men can face social stigma and mental distress due to unpaid loans, but women experience higher domestic work burdens, worse health, and intimate partner violence.

Such articulations of climate impacts affecting women disproportionately do two things. First, they frame women as victims of Climate Change, as vulnerable subjects to be 'targeted' through vulnerability alleviation interventions or as 'virtuous' grassroots environmentalists to be 'rewarded'. Almost two decades ago, Seema Arora-Jonnson cautioned about the implications of this lopsided and somewhat harmful binary of women as victims or inherently virtuous, arguing that "generalisations about women's vulnerability and virtuousness can lead to an increase in women's responsibility without corresponding rewards."

Second, a focus on women as vulnerable to Climate Change excludes acknowledgement of male vulnerability, erasing how young male migrants are entering climate-sensitive, poorly paid livelihoods as they move into cities, or how older men are left to make sense of a farming identity as farming itself becomes unviable. Thus, the binary of men or women as vulnerable overlooks the intersectional drivers of climate vulnerability, simultaneously disavowing the structural conditions under which women's vulnerability is constructed and perpetuated, as well as leaving out vulnerable men who are often disadvantaged by caste status, social norms of masculinity, and poor incomes and assets.

'Mainstreaming' gender: two steps forward, one step back?

Given this context of differential and intersectional vulnerability, where does India stand? Drawing on global calls towards 'mainstreaming' gender into climate policy,

India's national and subnational policy has taken various positive steps towards mainstreaming gender in its National Action Plan on Climate Change (NAPCC) and in State Action Plans on Climate Change (SAPCC).

The NAPCC, formulated in 2008, says,

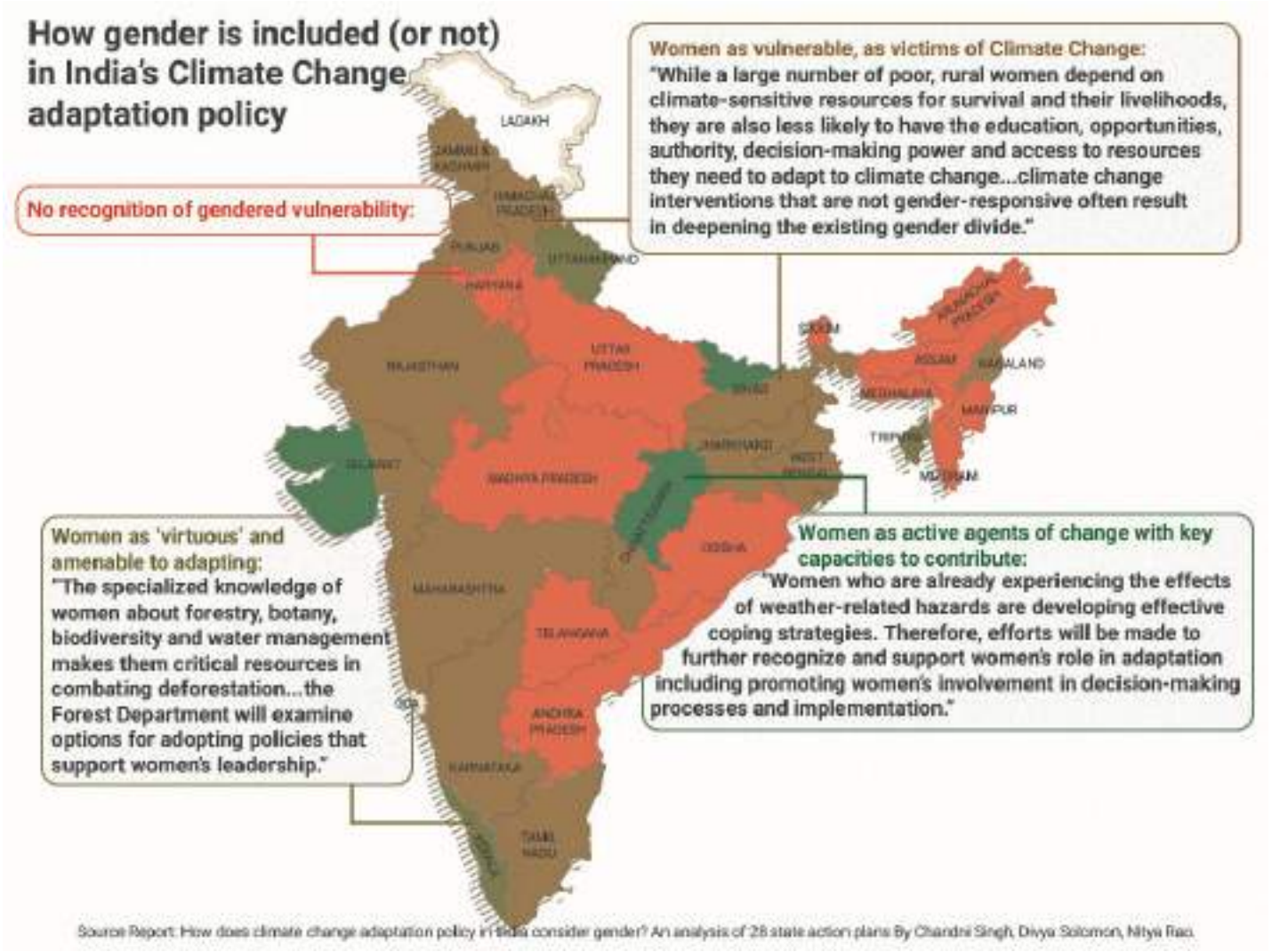
...the impacts of climate change could prove particularly severe for women. With climate change, there would be increasing scarcity of water, reduction in yields of forest biomass, and increased risks to human health with children, women and the elderly in a household becoming the most vulnerable. With the possibility of decline in availability of food grains, the threat of malnutrition may also increase. All these would add to deprivations that women already encounter and so in each of the adaptation programmes, special attention should be paid to the aspects of gender. (NAPCC 2008, page 14)

While homogenising all women as vulnerable and not acknowledging intersectional vulnerability, the NAPCC provided states with a national articulation around the gendered impacts of Climate Change. We reviewed 28 SAPCCs to examine how states had gone about formulating this and moving ahead. The study found that most SAPCCs explicitly mention gender as a mediator of vulnerability and adaptive capacity but operationalise it inadequately and unevenly (an important caveat is that all states are revising their SAPCCs currently and the revised ones are beginning to nuance their consideration of gender).

Alarmingly, 12 of the 28 SAPCCs did not mention or acknowledge gender, highlighting how sub-national policies on Climate Change have a long way to go. The 16 SAPCCs that do mention gender, do so in a variety of ways and often use multiple framings. Fifteen states still view women as victims of Climate Change, mainly focusing on increased work burdens (time to collect firewood or water) as indicators of this. Three states (Tripura, Kerala and Uttarakhand) swing in the opposite extreme, acknowledging women's knowledge and societal roles as key for Climate Change adaptation.

Only four states (Bihar, Chhattisgarh, Gujarat, Uttarakhand) speak of women as change agents, as holding power and potential to shape and drive adaptation on the ground. Given that most policies tend to frame women as victims of Climate Change or 'most vulnerable', they fail to recognise how women contribute to household adaptive capacities and the reality of intra-household adaptation decision-making which is often cooperative than combative. This oversight erases the substantive evidence on how women determine food and nutritional security, and family wellbeing in households, through direct and indirect labour and care duties.

All the SAPCCs view gender through binaries of male/female-headed households which masks intra-household heterogeneity, relational gender dynamics and changing masculinities. Fourteen SAPCCs allude to intersectionality by discussing how gender intersects with livelihood opportunities especially in agriculture and forest-based livelihoods; labour divisions; natural resource access and use; and existing deficits such as caste-based marginalisation.



However, worryingly, in all the SAPCCs, gender is equated with women, and women are mostly discussed as a homogenous category. This overlooks the differential experiences of women and men, views gender as fixed, and does not acknowledge underlying societal drivers of vulnerability. Only Nagaland, Chhattisgarh, and Uttarakhand SAPCCs acknowledge that certain men are also vulnerable to climatic risks.

Climate action in practice

While the climate policy space presents a mixed picture on how it is mainstreaming gender, it is instructive to examine the action on the ground. A range of actors and interventions, at different locations and scales, are in play. In India, Climate Change adaptation is happening in various sectors – from heat advisories in informal settlements to improved irrigation efficiency in farmlands, from planned relocation away from coastlines at risk of cyclones to providing risk insurance.

Taken together, these interventions have their own ways of operationalising vulnerability and gender mainstreaming, and **there is negligible understanding on whether climate actions in India are helping or hindering gender equality.** I piece together some lines of evidence to try and answer this question.

Globally, we know that adaptation interventions, or actions to reduce risk to Climate Change, can actually increase gendered vulnerability and deepen inequalities when it is top-down and blind to existing social conditions. Examining about 320 peer-reviewed papers, Professor Joyashree Roy and authors found that "current adaptations aiming to reduce exposure, risks, and vulnerabilities to climate change do not automatically enhance gender equality"; in fact, "without an explicit focus on gender equality and transformative change at project formulation, design, implementation, and monitoring stages, adaptation projects run the risk of reproducing existing gender disparities".

Replicating this study for cities, we found that several commonly used adaptations such as early warning systems and building risk awareness through public messaging showed mixed effects on the targets of SDG 5 on Gender Equality, often excluding women where digital literacy is low, or unable to reach informal settlements and those who are poor. Certain strategies such as urban agriculture interventions do increase women's agency but may increase their unpaid work.

While there are no studies systematically assessing how current Climate Change adaptation is affecting gendered vulnerability or whether they are helping meet equality goals, scattered evidence paints a mixed picture. In rural areas, adaptation interventions assume households as male-headed and unchanging, with techno-infrastructural measures prioritised. The increasing focus on 'climate-smart agriculture' and digital media to achieve this potentially exclude certain men and women – for example the landless, the illiterate. Some notable exceptions are more gender-sensitive climate advisories by MSSRF in Tamil Nadu or SPS's Women-Led Climate Resilient Farming model which focus on federating women farmers by focussing on micro-irrigation.

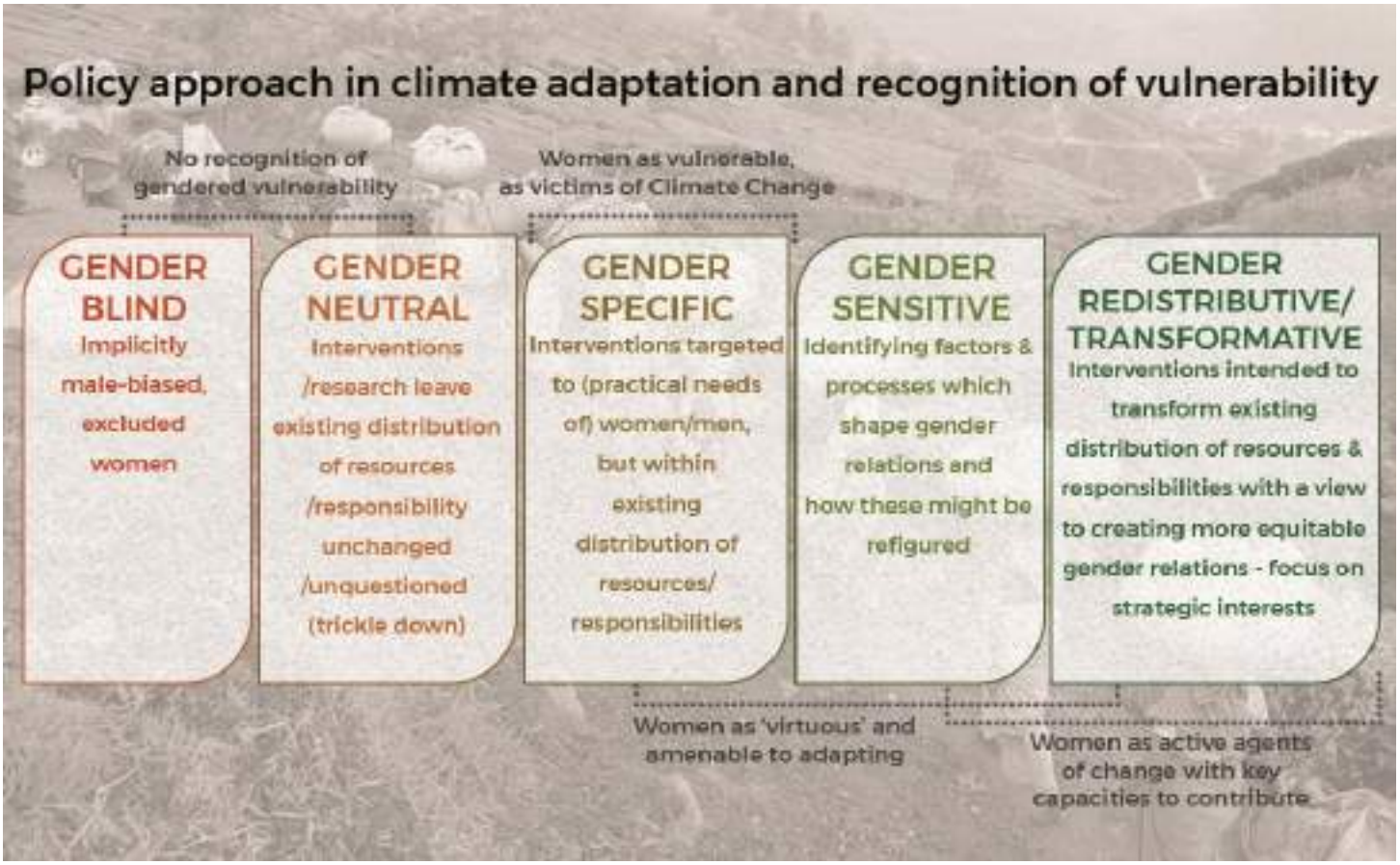
In cities, gendered outcomes of adaptation are mixed. While migration, a strategy used to diversify risk, can improve household incomes and investments in health and education, they often lead to lower quality of life for women, reported in terms of decreased leisure, higher unpaid work, and loss of place and home. Women in cities also face non-climatic barriers to equality and integration, which then get exacerbated when floods and droughts hit. Some experiments are however showing promise – from MHT's women-led heat management in informal settlements in Ahmedabad to women-led urban farming enterprises that are providing income and helping recycle wet waste in Bengaluru and Pune.

Tentative steps towards gender-transformative action

The Intergovernmental Panel on Climate Change (IPCC) report in 2022 stated with high confidence that "there are very few examples of successful integration of gender and other social inequities in climate policies to address climate change vulnerabilities and questions of social justice". This should serve as a reminder that the climate actions we are putting in place are not addressing gendered vulnerabilities, and in some cases are exacerbating it by paying lip service to gender equity concerns.

The research on gender and Climate Change has matured to move away from being gender-blind to targeting women (gender-specific) and increasingly calling for gender-transformative climate action. Such a transformative approach moves away from

"merely emphasising the inclusion of women in patriarchal systems, (to) transforming systems that perpetuate inequality can help to address broader structural inequalities not only in relation to gender, but also other dimensions such as race and ethnicity" (IPCC 2022).



Mainstreaming gender has served a purpose in making us acknowledge gender in Climate Change but to assume it will lead to gender-transformative change is placing too high a burden on such a weak mechanism. **As Indian states revise their SAPCCs, and greater attention and investment flow into climate adaptation, we must complement the mainstreaming approach with one that focuses on systemic change.**
One that makes gender-disaggregated data, gender budgeting, and gender expertise in developing the policy, minimum requirements in all SAPCCs. One that uses meaningful ways to include and prioritise voices of grassroots organisations, men and women in adaptation planning and decision-making. One that learns from other successful movements and vehicles of transformation such as women's rights and LGBTQIA+ collectives. And, finally, one that moves current adaptation actions from a women-targeting approach to a mix of gender-specific and gender-transformative approaches.

There is work to be done.

Photo: Vijay Sonar/ Flickr

‘Mumbai’s development not being done as per its extreme climate risks’

Adam Sobel speaks to Team QoC

June 30, 2023

India’s financial capital, Mumbai, witnessed its worst flood in July 2005. Since then, it has found a place in the list of world’s coastal cities projected to be at risk from floods, cyclones, storm surges and sea level rise due to Climate Change. Researchers in Princeton University, ten years ago, predicted a 46 per cent rise in cyclones in the Arabian Sea which would affect the city. The Intergovernmental Panel for Climate Change (IPCC) sent out similar warnings in its report four years ago as the oceanic temperature changes in the Arabian Sea and sea level rises. “The challenge in Mumbai is to take actions proactively, despite their cost, rather than wait for the worst to happen as we did in New York City,” says Professor **Adam H. Sobel**, who researched Mumbai’s cyclone preparedness.

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Most Indian cities are being developed rapidly without paying heed to their natural ecology, Climate Change and its impact. Far from being nature-led, the planning of cities is poor which is evident, among other instances, when a city floods even with a little rain. Mumbai ranks among the world's ten cities where rising sea level can cause erosion of its ecosystems worsening the effect of storm surges and flooding. Its preparedness for present challenges is far from adequate while the need is to prepare for more frequent once-in-25-years floods.

What should Mumbai's planners bear in mind as they plan for the future, what can the city expect as Climate Change and sea level rise add to the floods, what risks are on the horizon are some of the questions we posed to the well-known atmospheric scientist Adam H. Sobel, professor at Columbia University's Lamont-Doherty Earth Observatory and Engineering School, who studied Mumbai.

Sobel works on, among other things, the dynamics of climate and weather phenomena, with a focus on understanding the risks to human society from extreme weather and Climate Change. He is the author of *Storm Surge*, a book about Superstorm Sandy, and has hosted *Deep Convection*, a podcast featuring real conversations between climate scientists. Sobel speaks about, among other aspects, how Mumbai's infrastructure projects – current favourite of governments – increase its risk of flooding.

Adam H. Sobel is a Professor of Earth and Environmental Science and Applied Mathematics, Columbia University.

Have you tracked or seen major shifts in the way Indian cities, especially Mumbai, addressed Climate Change impact in the last few years? What has been different?
I cannot claim to be an expert in the policies of Indian city or state governments. I do try to follow what is happening in Mumbai, mostly from a distance and then from visits over a few years, the most recent in late 2019. It is good to see governments in Maharashtra and Mumbai that seem to take the city's climate risk more seriously, as it deserves. The new flood early warning system by the Ministry of Earth Sciences looks state-of-the-art, from what I understand, but I would like to know more about how the warnings are used. There does seem to be increased awareness of Mumbai's great vulnerability, as a very low-lying island city with both enormous population and enormous wealth in the harm's way via sea level rise, flood risk and cyclones. I do not know if this awareness has had any impact on the city's rapid development, including along the highest-risk parts of the coastline.

It is now established, by studies and scientific models, that the cyclone risks to India's coastal cities have aggravated. What steps would you expect India's government to take to minimise possible damage to people and property?
Cyclone activity has increased in recent decades in the Arabian Sea in particular. Attribution studies by Hiroyuki Murakami and others at Princeton University have used high-resolution climate model simulations to argue that an Arabian Sea increase is an expected consequence of human-induced global warming. The winds and rains produced by cyclones are increasing, on average, globally. And sea level rise amplifies coastal flood risk, especially in low-lying cities like Mumbai.

India's government, as governments in other high-risk countries including the United States, where I live, would be well advised to think proactively about the most effective and equitable ways to manage this increasing risk. Pressures to develop the coastline are hard for governments to resist, especially in economically hyper-active megacities like Mumbai. Hence the infrastructure projects being planned and built now, many of which are on the most low-lying and vulnerable lands, including along the Arabian Sea and Thane Creek, increase Mumbai's risk even further over what it already was. **The state, local, and federal governments would be wise to find alternatives to these high-risk projects.**

Your study at Columbia University showed that major cyclone and storm surges used to be historical once-in-a-hundred-year events in Indian cities but that was changing. Would you elaborate on this and the possible reasons for it?
Our study of Mumbai's cyclone risk did not actually explicitly look at Climate Change, but only at Mumbai's historical risk. We hope to update it to look at the Climate Change signal. The Princeton study by Murakami et al. did look at the Climate Change signal, and found that the increased Arabian Sea cyclone activity in recent decades is a consequence of warming.

The big climate-related disasters are, in your words, "sufficiently rare" in cities which, therefore, do not factor them into planning or building cities. Are we at a point where cities must consider such events as common occurrences as they plan for the next two-three decades?
Cities tend to be reasonably well adapted to events that occur frequently. Rare events

those that occur, on average, less frequently than something like once every hundred years — tend not to be planned for or built for very well, unless one has happened recently. With Climate Change, some kinds of events are happening more frequently, and planning should definitely account for them. The recent floods in Mumbai (2005, 2017, 2019) may be among them, and cyclones may be as well, considering the model projections as well as the recent near-misses of Cyclones Ockhi and Nisarga. **What this means is that no one should still be planning based solely on historical data; that is not an adequate guide to the future. Predictive science is needed, including climate models.**

Advanced climate models by researchers in Princeton University some years ago predicted a 46 percent rise in cyclones in the Arabian Sea and a 31 percent decline in the Bay of Bengal. How would you explain this?
Climate models project that the Arabian Sea warms disproportionately more than other regions, including the Bay of Bengal, from greenhouse gas emissions, as a consequence of monsoon changes. This relative warming favours cyclones in the Arabian Sea. So, they are likely to be more here.

Sea-level rise, another manifestation of Climate Change, is now threatening many of India's coastal cities though the extent of its impact is still being debated. What would you say to those who argue that it's an overblown risk?
Sea level rise is a certainty, and it is one of the aspects of global warming that takes the longest to fully materialise. So sea level will increase, far into the future, even if emissions stop soon (and they show no sign of doing that, so it will increase yet more). And sea level becomes a problem to coastal areas long before they are permanently inundated, because **a higher sea level increases the risk of coastal flooding due to storm surge, or eventually just high tides.** Given how many people and how much economic value resides close to the coast around the world, it is difficult to overstate this risk.

Please elaborate on how sea-level rise combined with extreme rain or storm surge impacts a city like Mumbai.
Storm surge is the elevation of the water above where it would otherwise be, due to wind. The total water level in a coastal flood event is the storm surge plus the tide plus the mean sea level. If mean sea level is higher, the same storm produces greater flooding. When there is heavy rain at the same time, the higher sea level obstructs the drainage of rivers into the sea, thus also increasing freshwater flooding and creating what we call a "compound" flood event.

You have repeatedly spoken of the need to rely more on science in assessing risks and impacts of Climate Change. In your testimony to the US House of Representatives in 2019, you spoke of using observation, models and theory in predicting extreme weather events. What is your assessment of how governments and policy makers approach this, is science informing policy?
The science of defining climate risk in the most practical way for cities is still developing, but governments should engage with scientists in academia and the private sector as well as their own agencies to try to get the most relevant forward-looking views. In the United States and Europe, there is a rapidly growing private sector

in this space because of demands for climate risk disclosure. Some of the same science can be used for urban planning, but it would be best if it were done in an open-source manner rather than using proprietary models as the private sector tends to do. Governments should be accountable to their citizens, and that starts from being open about the scientific information that is going into decisions.

India should also do what it can to make its own energy infrastructure as low-carbon as possible. Of course, the country needs energy for its development and deserves relatively little blame for the current state of the climate because its own emissions have been historically quite low. But there is no need to repeat the bad decisions made by other nations (my own especially among them) by investing in yet more fossil fuel infrastructure — the future will be decarbonized, and it's better to be ahead of the curve than behind it.

What do you see happening in India in the above context, are governments and policy makers paying attention to scientific and observation-model-theory approaches? Is Mumbai on track here?
I am not in a position to make an authoritative or comprehensive statement about how policy makers in India are using science (or are not). I can say that **the development of key coastal cities, including Mumbai and Chennai, to name just two I have visited, is not being done in a way that is sensitive to the cities' extreme climate risks** — if it were, there would be less building of roads, buildings, ports, coal plants, etc., along fragile and vulnerable coasts, wetlands, and riverine floodplains. These cities are being set up for even worse future disasters than would otherwise be necessary.

In the area of emergency management, on the other hand, there has been impressive progress. Recent severe cyclones on the eastern coast have caused much less loss of life than they would have in the past, due to effective forecasts, warnings, and evacuations. I hope the new flood warning system in Mumbai will be similarly effective. Evacuations would be much more difficult in Mumbai, but one can at least plan ahead of time so that the best possible decisions can be made in the moment.

In the same testimony, you averred that "…with respect to extreme weather…changes in the future will be greater than in the past or present". Would you elaborate on this?
I just meant there that as the climate continues to warm, we will see more "unprecedented" extreme weather events of various kinds — especially heat waves, droughts, floods, and cyclones – because the climate as a whole will be warmer than it has been at any time since before the human species evolved.

Uncertain science should not be a reason to delay action on Climate Change, you stated in the past. What sort of delayed actions are you seeing on this issue and what level would it be at – international organisations, governments, big business?
The biggest problem is that governments of most countries, but especially the highest-emitting ones, have been far too slow to acknowledge the severity of the problem and stop burning fossil fuels. My own country, the United States, is foremost among these. While the proximate problem is lack of action by our federal government, the ultimate cause is that we are a petrostate in which the fossil fuel industry has great influence. .

This explains the climate denial movement's strength here, and our government's failure to lead, or even participate particularly constructively, in international climate negotiations, over most of their history (the Paris Agreement under Obama being the main exception).

There are often parallels drawn between Mumbai and New York. What lessons can Mumbai – or any Indian coastal city – take from New York's response to Hurricane Sandy? What did New York not get right and what have been its steps since?
The response of the New York City government to Sandy in the moment was actually quite good in most respects. This kept the death toll relatively low, considering the event's severity. Evacuations, closure of the subway system, and other emergency management actions were taken in a timely way, due to plans that had been developed ahead of time over the preceding decades. The exception is nursing homes, adult care facilities and hospitals in flood zones that were not evacuated, but should have been. New York's failure, on the other hand, was that little or nothing had been done to make its critical infrastructure more flood-resistant, despite warnings from scientists going back at least 20 years before the event, that it should do so. These kinds of actions take sustained investment; they are not emergency management actions that can be done in a few days. This was why we saw the severe flooding of our transit system, sustained power outages over much of the city, and so on. Since the event, there has been much more investment in making sure we are better protected next time. The projects being done in the name of "resilience" are not optimal, due to limitations of politics, funds, and so on, and they surely wouldn't completely protect us if another Sandy were to come, they would at least reduce the impacts somewhat.

The challenge in Mumbai, and many other places that are at high risk but haven't seen an event so severe as to transform their citizens' and governments' perceptions of that risk, is to take such actions proactively, despite their cost, rather than wait for the worst to happen first, as we did in New York City, and as is the typical pattern in most places.


Photo: Jitesh Malik

Chalo Chalein: Learning from the urban ecology of Chandigarh

Jitesh Malik

January 13, 2023

Monsoon has displayed its fury this year once again, spreading havoc and flooding cities such as Guwahati, Nashik, Ahmedabad, Delhi, and Hyderabad. The grim situation has put the focus on systemic and structural causes, and on how we build our cities. In Mumbai — which sees torrential rains every year — large swathes of land have been released for high-intensity development under Development Plan 2034, making it more vulnerable to climate events. The already dense city has lost sandy beaches, mangroves, marshy lands, forests, and its coastline is being changed, all in the name of development or climate mitigation measures. Authorities harp on techno-fixes as climate action but the situation calls for undertaking a systemic change, not simply an assortment of projects that deflect attention from business as usual.

In 1948, a committee headed by engineer P.L Verma chose the site for a new town to be built as the capital for the partitioned Punjab. After considering several existing cities and taking multiple factors such as distance from the border, cost of land, availability of water and soil conditions, the committee decided to locate Chandigarh (30.74°N, 76.79°E) at the foothills of the Shivalik on a gently sloping site flanked by two seasonal streams namely Sukhna Choe and Patiala Ki Rao. A third seasonal stream, the N-Choe flows through the centre of the city surrounded by a green corridor, the Leisure Valley. The natural drainage of the city is from the North East to South West with these choes, or streams, forming its major channels.

The master plan for Chandigarh largely draws from the theories of 1940-50s, the most notable being the garden city movement. With ample green space developed as parks in each of its residential sectors, Leisure Valley running through the city, a lake and surrounding forest in the north, and greenbelt around the city, the master plan brought together a diversity of green spaces within its orthogonal grid. Aptly termed the City Beautiful, Chandigarh does offer clean(er) air, high tree cover and a well-drained city terrain to its residents.

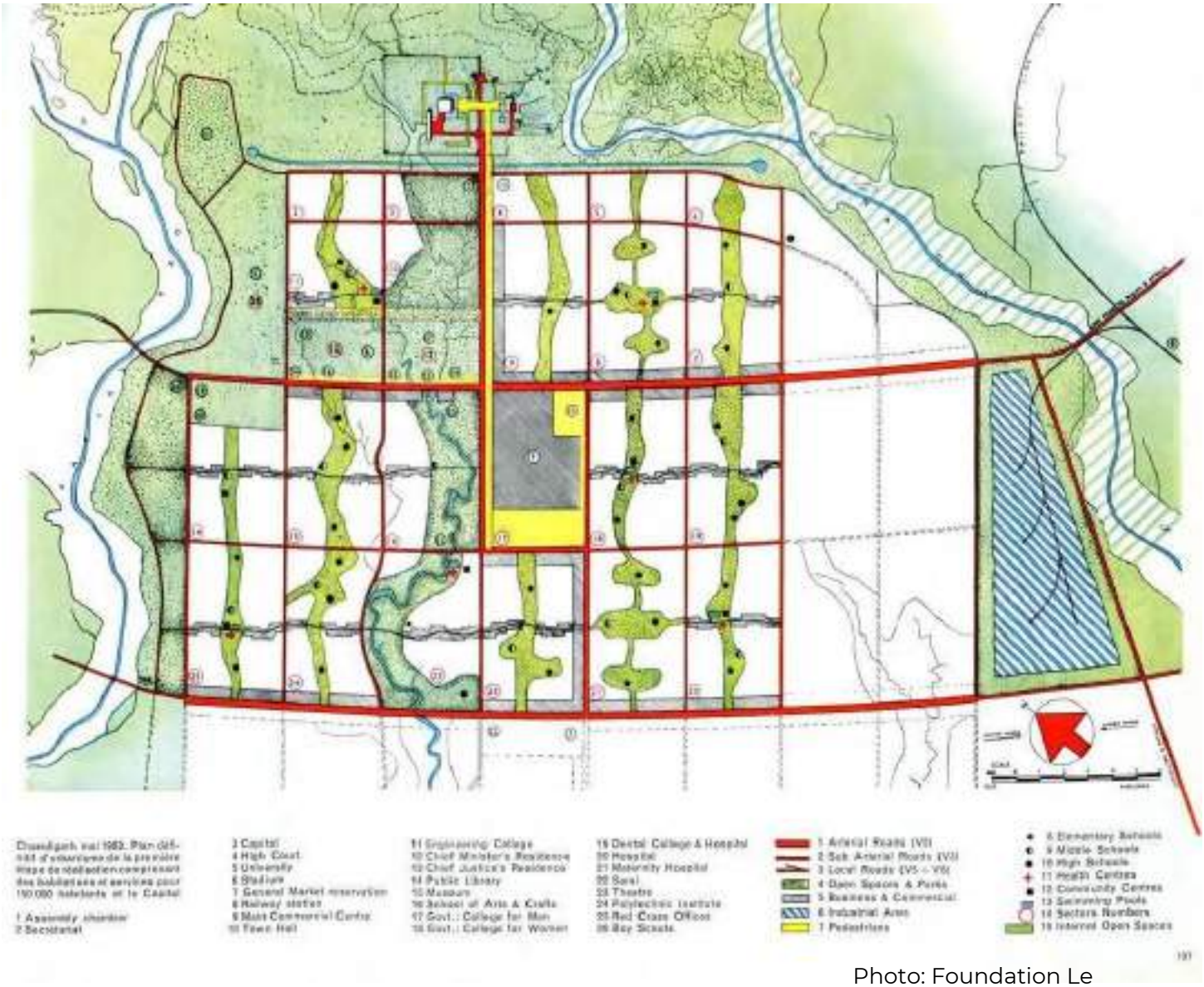

Photo: Foundation Le Corbusier

Master plan of Chandigarh by Le Corbusier.

However, a closer look reveals that the lakes, groves and gardens are mostly topological features, not living ecological places. Even though there is a romantic understanding of green open spaces, the hydrological cycles and complex ecology of a riparian forest are distant from the planners' imagination.

Chandigarh landscape: A 'hierarchy of open spaces'
In the hierarchy are its greenbelt, the lake, the Leisure Valley, parks, and its famous tree-lined avenues.

The greenbelt: In 1952, a five-kilometre radius surrounding the city was protected by the Punjab New Capital (Periphery) Control Act; this was enlarged to 10 kilometres in 1962. The Act mandated that no construction be permitted here, except with prior permission of the District Collector, in order to retain its agricultural and forest features. After the re-organisation of Punjab and the constitution of Chandigarh in 1966, this periphery came to be controlled by the governments of Punjab, Haryana, and Chandigarh. The romantic idea of the greenbelt has been dismantled mostly by the government projects but also by private real estate interests as well as the need to house people not accommodated in the Chandigarh plan.

The Lake: In 1958, Sukhna Choe was dammed to create the three-square kilometres Sukhna lake at the northern end. The site was a low-lying basin whose edges were raised to form the lake. The Choe came down directly into the lake causing serious siltation. To remedy this, it was diverted and three siltation pots were created from where the lake is fed. Additionally, land was acquired in the catchment area for a sanctuary which eventually became a protected wetland under the Government of India.

A bronze plaque embedded in a concrete cube at the lake declares Le Corbusier's intentions: "The founders of Chandigarh have offered this lake and dam to the citizens of the new city so that they may escape the humdrum of the city life and enjoy the beauty of nature in peace and silence." The city side of the lake now has a patchy amusement park, a club, tarred walking paths, harsh lighting, a restaurant and food court, and speakers playing near-continuous music. The wetland side is a thick forest area with diverse flora and fauna which migratory birds make their seasonal abode. Another lake was made in Sector 42 in 2008.

The Leisure Valley: This eight-kilometre valley stretches along the eroded seasonal rivulet N-Choe running north-south of the city. The N-Choe becomes visible in Sector 1 in the north and enters Mohali after Sector 51 before flowing into Ghaggar River. Ten public gardens flanking the N-Choe constitute the Leisure Valley. Referred to as the "lungs of the city" the linear gardens range from 55 metres to 300 metres wide. The Leisure Valley contributes significantly to the quality of life providing residents with aesthetic, ecological, social and infrastructural functions.

Sector parks: Sectors in Chandigarh are designed as "the container of family life." There are only two vehicular entry points into each sector; a sector is divided into four blocks. Each of these (mostly) residential blocks has a small park. Chandigarh has about 1,900 large and small parks. With 38 square kilometres per capita, the city boasts of one of the highest green cover per capita among major cities in India.

Tree lined avenues: While the first phase of the landscape planning was done by Le Corbusier and team, MS Randhawa, the first administrator of Chandigarh, detailed the planting of the Rose Garden and chose various avenue trees during 1966-68. Thought was given to the structure, texture, and flowering season so that one or another avenue is in full bloom but this was ecologically questionable because the team chose single species plantation of ornamental trees for each avenue.

Walking for a ground view

Chandigarh is a network of roads, the seven Vs as they are called, supporting its status as one of India's cities with highest per capita income and car ownership. The automobile-centered view enables a fast-paced but fleeting impression of the green city. To experience it closely, one must walk. A group of us architects, artists, students, and professionals came together a year ago to do this. There is something to be said about walking in Chandigarh; the act of walking makes one aware of the diversity of life that thrives – or not – in the interstices of its planned grid beyond its ornamental trees.

The format was simple and inclusive; anyone could propose and lead a walk after a discussion with the group. A small group usually does a recce, chooses a path, and announces it as a public walk on our Instagram handle; anyone can join. We walk, observe, and discuss the human and natural processes of our city. Some of the significant walks were along the choes and heritage zones of Chandigarh.

Our first exploratory walk was along a popular part of the Leisure valley. About five of us started from the Rose Garden in Sector 16, a popular sightseeing spot with its pretty manicured garden hosting nearly 1,600 species of roses neatly inside flower beds. The tall central fountain is a city landmark. There are topographical undulations along the Choe which offers an immersive experience of the mountain landscape. A network of underground piped water with sprinkler systems helps maintain the smooth grass, according to the gardeners there. Much of the water used is city water – not grey water – supplied by the Chandigarh Municipal Corporation; there are serious debates about using this for parks.

Descending into the Choe gave us a closer view of drainage infrastructure and its bioswale function. In early March, the N-Choe passing through the Leisure Valley tends to be quite dry. Fallen dried leaves made crisp sounds as we treaded on them, birds hummed on trees and crickets competed to make a concert. We descended downstream. An edge of the Choe is lined with stone rubble, protecting it from erosion from the gushing seasonal flows; there were marks and debris from the last monsoon of weathered remnants of plants about seven to eight feet above the stream bed.

Mapping the bat colony

About 20 minutes of walking in the Choe brought us to a bend and a vehicular bridge – a bend not noticed from the road or gardens across the bridge. There are several such bridges and culverts along the N-Choe which ensure an uninterrupted flow of the stream below and the traffic above. In many ways, Chandigarh's use of the natural choes to augment the stormwater drainage of the city holds lessons for newer cities. These bioswales came long before the push towards blue-green infrastructure in urban landscape design.

We had entered Shanti Kunj through this subterranean route. A bamboo grove with names etched on its smooth bark caught our attention. There are multiple ways in which people engage with a landscape; this seemed to be a lovers' spot. Curious about what lay ahead, we walked through a grove of Harad trees to unfamiliar sounds – it was a whole colony of bats. This was the thick and narrow part of the Choe. As we jumped and crawled, the screeches turned louder and we wondered if we were going to be attacked. Something dripped on us too.

A few weeks later, we undertook a cycling trip around the N-Choe. It was spring and the city was blooming with many flowers. To our amazement, the bat colony had left that spot. The roosts are usually thousands of bats living together for about ten years. Was this the end of the roost period or had a disturbance caused the migration, were we responsible for it? Later, we came upon bat habitats south of the N-Choe in Sector 36 part of the Leisure Valley and at other places in Sectors 19 and 14.

Sensing the city

They were all Indian Flying Fox species. These bats, largest of its type, are typically urban creatures and use their deft flying skills to forage fruit from urban groves and help with pollination and propagation. Some studies show the connection between the roost location and riparian urban forests with tall trees along waterbodies. The location of the roost in Shanti Kunj seems like an ideal place; here, the Choe becomes narrow and inaccessible with limited human activity and minimum pollution of light. We will record these observations over time, connect the dots to deepen our understanding of the bat habitat, and the ecological impact. That this is a people's effort makes it special.

Then, we followed the stream as it left the municipal limits of Chandigarh to enter Punjab. At several points, real estate projects and government institutional areas have diverted the stream out of their campuses. Outside the boundaries of Chandigarh, the N-Choe lies abandoned, dumped with industry effluents and untreated sewage, as it flows south.

This method of sensing – not merely mapping – the city by walking allowed us an embodied experience. It was a reflexive process where sounds, touch, sights and smells evoked awe, surprise, fear, discomfort, and joy in us. The walking experience is but one of the multiple ways in which we can engage with the city's ecology. The diverse composition of the group allowed us to discuss artistic, ecological, social, architectural, and technological readings of our city. For example, after a walk, a cyanotype printing workshop was organised and, at another time, the group documented diverse grasses along Patiala Ki Rao.

Zooming out: From the stream to the river

Chandigarh is constructed over an area of 114 square kilometres and around 50 per cent of it is green cover.[1] The streams that flow through the city originate in the Shivalik hills in the north. The N-Choe meets the Faida Pind Nallah on the immediate outskirts of Chandigarh and continues to the Ghaggar River near Patiala. The Patiala Ki Rao flows through Chandigarh and then goes through Mohali, Nayagaon, Kharar and Landran to eventually merge into the Sutlej at Bali Kalan, near Ludhiana. The Sukhna Choe joins the Ghaggar River near Mirpur village in Panchkula district.

Photo adapted by Jitesh

What is evident from this reading of the choes is that there is complex ecology in them and surrounding them. Streams, birds, mosquitoes, and wind transcend state and municipal borders. Yet, cities are planned and built, all our policies and laws are framed, within these human-made demarcations. All discussion about the choes stops at the Chandigarh border.

While the Chandigarh administration acts as a steward for the choes within its territory, it officially ignores them when they cross its boundary. In fact, the choes may appear as seasonal streams in the northern sectors of Chandigarh but the same choes become nallahs down south. The nallahs have become dumping grounds for sewage, garbage, and construction waste – urban ecology uncared for.

The masterplan for Chandigarh paid attention to creating parks and green spaces which lend the city its tag of the beautiful city, but it may not have fully grasped the nuances of the hydrological cycles and the complex ecology of a riparian area turned into a city. The reserved forest near Patiala Ki Rao, for example, nestles between two bustling high-traffic roads but displays facets of urban ecology such as self-sustaining forest, low-lying grass patches, and streams struggling to support life due to high human impact.

Today's plans for cities should do better to integrate urban ecology.

Photo: Shiv Prasad/

Make space for rivers in cities, draft policies to protect them

Himanshu Thakkar

November 4, 2022

Natural rivers and their ecosystems in cities are being ruined in the name of development with projects stripping away them of their ecology, changing their geographical features, and leave a lasting damage on the marine life as well on people whose livelihoods depend on rivers. We are already witnessing the consequences of the worsening state of urban rivers in multiple ways including increasingly destructive floods, water scarcity even in cities with multiple rivers and waterbodies, worsening quality of life especially for the vulnerable, and increasing economic, social, and cultural impact. The age-old river-centric planning is crucial to save our waterbodies, lakes, and rivers.

Do we have space for rivers in our cities? This seems a question of an old- fashioned or romantic mind but it is a legitimate question as India's massive and rapid urbanisation comes at the cost of its urban ecology, including rivers and waterbodies. Going by our lived experience, the rate at which the natural areas in cities – especially rivers and waterbodies – are exploited or ignored, the way in which planners and governments treat rivers and their various essential components in cities big or small, the answer has to be a clear 'no'.

Rivers in India's cities, or urban rivers if they can be so called, are not only in a poor state but their condition is worsening with every passing day. Pollution, encroachments, solid waste dumping, damming, water diversions, over-exploitation of groundwater, degradation of catchment areas, destruction of water bodies, denudation of wetlands and forests, indiscriminate mining, the impact of massive construction such as bridges, flyovers and metros are the known physical threats to urban rivers.

A complete lack of legal or institutional protection of the rivers in cities accompanied by a mindset that sees rivers as non-essential and expendable entities are among the major causes for the sorry situation of the rivers. Urban planning or city plans do not adequately protect them; in fact, planning is limited to land use or land allocation and barely takes into account natural resources in a city. Urban rivers, more often than not, are reduced to sewage pipelines.

This is true of rivers Yamuna in Delhi, Agra, and Mathura, Ganga in Prayagraj, Varanasi, and Patna, Gomati in Lucknow, Mithi and other rivers in Mumbai, Mula-Mutha in Pune, Sabarmati in Ahmedabad, Dravyawati in Jaipur, Khan in Indore, Kshipra in Ujjain, Jhelum in Srinagar, Mahi and Vishvamitri in Vadodara, Tapi in Surat, Arkavathi and Virishabhavati in Bengaluru, Ennore in Chennai to name a few.

They are polluted and often unusable, turned into dumping grounds for the cities' sewage and industrial effluents, and their riverine ecology is damaged by the year. The consequences of the worsening state of urban rivers are already being experienced in multiple ways including increasingly destructive floods, water scarcity even in cities with multiple rivers and waterbodies, worsening quality of life especially for the vulnerable, and increasing economic, social, and cultural impact. The rapidly rising urbanisation and rapidly increasing per capita footprint of urban India means that these consequences are set to worsen, at a time when Climate Change and extreme weather events, including floods, pose a major challenge for urban governance.

How Kolkata wetlands treats sewage

It is not that we do not know how to treat and take care of urban rivers. Nature provides us lessons – the East Kolkata Wetlands (EKW) has been a blessing for the Hooghly River. The threats that rivers in other cities face are also prevalent in Hooghly, and they are increasingly hostile for the wetlands too, but the latter provides a remarkable example of how the sewage of Kolkata gets treated at the wetlands before being discharged into the river. This is a natural function, treated without the use of land and capital-intensive Sewage Treatment Plants (STPs) which rarely function in a sustained way or are bypassed.

As Amitangshu Acharya noted about the East Kolkata Wetlands, "In 1930, a local landlord and fish farm owner, Bhabanath Sen, began to let Calcutta's wastewater into his fishponds. The success he witnessed with fish growth and productivity laid the foundation for a globally celebrated example of urban sustainability – the East Kolkata Wetlands. Today, a vast waterscape of 264 fishponds recycles 750 million litres of sewage and wastewater, and where 50,000 fisherfolk and vegetable farmers turn excrement into 10,000 tonnes of fish and 50,000 tonnes of vegetables." This does not mean that all is well with the East Kolkata Wetlands; a struggle is going on in Kolkata to save the wetlands from urban onslaught as the city expands.

As sewage and effluents are directed to the rivers in a city, STPs have become the mainstay of cities to treat its filth, but their functioning has been inconsistent. Not all the STPs function at optimum capacity, a few do and help to showcase that the sewage is "treated" before letting it out into the waters. Non-functioning STPs end up releasing untreated or semi-treated sewage into the rivers and water bodies of cities. Local governments have no clue about how to ensure that STPs – touted as the only solution – deliver the promised results; yet, more and bigger STPs are built. There is no attempt to make their functioning more transparent, accountable, or participatory. Decentralised STPs can help reduce cost, it is simpler to ensure that they remain functional, and they can recycle the treated sewage locally. However, governments do not appear to have any interest in them.

Riverfront "development"

The most celebrated example of how to treat – or not to treat – a city's river lies in Ahmedabad's Sabarmati riverfront project. It was made famous by Prime Minister Narendra Modi himself. He inaugurated it and later promised, on billboards put up by the Bharatiya Janata Party in Varanasi during the 2014 Lok Sabha election, that if elected he would convert the Ganga in Varanasi to a Sabarmati-like riverfront.
Fortunately, that has not come to pass yet though some components of the riverfront "development" plan were implemented. The Varanasi project has reportedly been scrapped after it was completely destroyed by monsoon floods in August 2021. The Dravyavati Riverfront Project in Jaipur remains stalled for years due to dispute between the government and the contractor.

At the heart of this idea lies the presumption that natural river and its ecosystems can be toyed with to create physical infrastructure – a riverfront – for economic or leisure pursuits. This goes under the garb of development when, in reality, such projects strip away the river of its natural ecology, change its geographical features, and leave a lasting damage on the marine life as well on people whose livelihoods depend on it.

At a meeting on urban rivers in Pune in April 2018, co-organised by South Asia Network on Dams, Rivers & People and INTACH, when I asked Bimal Patel, architect-planner of the Sabarmati Riverfront Development Project, what a river is in the context of the riverfront "development," he had accused me of nursing "old-fashioned, romantic ideas" about rivers. However, people seem to treasure such ideas, and are opposing the so-called innovative riverfront "development" projects around the

country including in Delhi, Pune, Vadodara, Lucknow, Bhagalpur, and Kota to name a few. In Hyderabad, the Musi River Front Development Project remains scrapped even after spending crores.

How river science defines a river

Indeed, defining a river is key to answering the question about whether there is space for rivers in our cities. Briefly, a river is a hydrological drainage entity that is defined by the state of its climate, catchment, tributaries, upstream-downstream, lateral, vertical and temporal connectivities, and its floodplain. The aquatic and terrestrial biodiversity along the river, and the components of what flows in the river are other important components of a river.

It is not just water that flows in a river, but also silt, boulders, nutrients, and biodiversity. The biodiversity flow in a river is in fact not just upstream to downstream, but also downstream to upstream. Being a landscape level entity, the river also necessarily has ecological, social, cultural, and religious significance, it also provides a large number of economic services. The tributaries, the flood plains, the lakes and wetlands, the forests and ridge are very integral to a functional river.

There is nothing romantic about this definition of a river, it follows from the basic science of rivers which seems to escape or is wilfully ignored while planning and building cities. Planners and city governments have little interest in the science of rivers, architect-planners who helm riverfront “development” projects show little to no understanding of rivers, a city’s water governance system does not recognise the significance of rivers for their own sake.

The latter basically view the river, or the space occupied by it, in two ways – first as potential estate development, and second as a dumping ground for the city’s waste. Only when the city floods during heavy rain that they realise that the riverine land is fundamentally a natural drainage system. Yet, the link between devouring the river, narrowing it down or constructing on its banks for riverfront projects, and increasing floods in a city is rarely made by either officials and planners or people at large.

Taking or making land from the river, euphemistically called reclamation, is at the heart of the logic and economics of riverfront projects, even if such projects are sold to the people as environment improvement or river regeneration/rejuvenation efforts. This reclamation often happens without basic environmental or social impact assessments or genuine public consultation process. We saw all this happen in the Sabarmati riverfront project. What irritated Bimal Patel in that Pune meeting was the repeated, reasoned argument by many participants that Sabarmati is no longer a river but only a canal storing stagnant, non-flowing water that was brought from the Narmada River over which Ahmedabad had no right.

Such “development” does only one thing to the river: It kills the river. When such projects are politically backed and expanded across the country, the answer coming from the highest authorities tasked with protecting environment to the question of whether there is space in a city for rivers is: Sorry, there is none.

A policy vacuum

Just how significant rivers are to urban plans, even massive or grand ones, is evident in the union government's Smart Cities Mission – there is no component in it related to rivers or the broader water sector. How can a city be "smart" without being river-smart or water-smart? But this question does not seem to have entered the minds of those in the government who put that Mission in place.

In fact, there is a total policy vacuum as far as the urban water sector or urban rivers are concerned. There is no policy to guide governments in water or river governance, there is no definition of what is a water-smart city, there are no stated objectives about urban rivers. The Pune meeting as well as the India Rivers Week meeting earlier ended with resolutions that India urgently needed a comprehensive urban water policy which would also define a river-smart city.

In November 2020, the National Mission for Clean Ganga (NMCG) introduced, in consultation with National Institute of Urban Affairs, a "Urban River Management Plan: Components and Guidance Note." However, the note is neither a policy of the Government of India on urban rivers nor is it backed by any force of law. As it states: "The overall objective of this document is to assist cities along the Ganga River to improve the state of the river in their stretch. While the central focus is on the Ganga, the document also applies to other rivers flowing through these cities."

The pathetic quality of this document is apparent when it states on page 17 that "The Ganga River Basin with an area of 1,080,000 sq km is one of the largest river basins in the world. It flows through the Indo-Gangetic plains of the country before merging in the Arabian Sea." The Ganga does not merge into the Arabian Sea which is on the west coast of India; it flows eventually into the Bay of Bengal on the east coast. This is just one of many examples reflecting on the poor quality of this document which anyway is about the Ganga, not a comprehensive one for all urban rivers.

The NMCG brought out two more documents – "Strategic Guidelines for making river sensitive Master Plan" in June 2021 and "Guidance Note for Environmentally Sensitive, Climate Adaptive and Socially Inclusive Urban Riverfront Planning and Development" which was undated. They are a mouthful, more importantly they are guidelines only. India cannot not have a comprehensive urban river, or urban water, policy.

Several petitions have been filed with the National Green Tribunal (NGT) and in various high courts and the Supreme Court to protect urban rivers or challenge projects that threaten them. There have been some welcome orders, but cumulatively there has not been much positive change as many court orders – even if they protect urban rivers – remain unimplemented. In a few cases, the judiciary has not been able to fathom the significance of rivers or the urgency of the situation.

Urban rivers and Climate Change

The increasing frequency, intensity, and spread of the floods in cities is one of the many impacts of Climate Change on urban rivers. The need to protect and rejuvenate urban rivers in all their manifestations becomes even more important in the context of

Climate Change and with the intensification of the water cycle. While our cities are fast losing rainwater holding, storing and recharging capacity, the global movement in a number of cities is in the opposite direction, with spreading concepts of room for the rivers and sponge cities.

In a largely gloomy situation, there are hopeful signs too but done by people – A Million Wells Initiative and Paani Earth in Bengaluru, Sarang Yadvadkar and Jivit Nadi group' efforts on Pune's rivers, the Yamuna Jiye Abhiyaan in Delhi, citizens' groups cleaning rivers such as Netravathi in coastal Karnataka, Tawi in Jammu, and Cooum river in Tiruvallur in Tamil Nadu, people documenting the state of urban rivers such as Adyar River in Chennai and Hooghly's heritage in Kolkata.

Suggestions to improve urban rivers

The Union and state governments must come out with a national and state urban water policy which will also provide for urban rivers. No activities should be permitted, by law, in the 1-in-25 year floodplains and restricted activities with no construction permitted in the 1-in-100 year floodplains. The policy should also provide measures to protect the groundwater recharge zones and improve the capacity of the cities to hold, store, recharge the rainwater. All existing water bodies and wetlands should be protected and improved through desilting and other measures. Similarly, the city's drainage system must be clearly defined and provided legal protection from any changes.

The policy should define norms for transparent, accountable, and participatory management of all river- related activities and infrastructure. These should be legally mandatory. No additional external water should be provided to a city till it exhausts its rainwater and local water bodies, recycles treated water, and implements demand-side measures. As far as feasible, decentralised STPs should be made the norm.

Additionally, there should be ward-level management committees in a city to ensure participatory management of all components of the city's river system with involvement of independent civil society and academia. Annual state and national competitions for various tiers of cities should be conducted for the most river-friendly cities.

Interestingly, in December 2019, Prime Minister Modi said at the first meeting of National Ganga Council: "There is need for new thinking for 'River Cities'...a new river-centric thinking in planning for cities on the banks of rivers. The river health needs to be mainstreamed into urban planning process by developing Urban River Management Plans." Unfortunately, there are no signs of this new thinking in the governance of our urban rivers.

There needs to be an urgent realisation all around, from governments to planners and people, that sooner rather than later, a river always retaliates and the water always wins – even in swanky "smart" cities.

Photo: Shweta Wagh

Techno-fixes for flood risk mitigation in Mumbai: An ecological critique

Shweta Wagh

July 15, 2022

Monsoon has displayed its fury this year once again, spreading havoc and flooding cities such as Guwahati, Nashik, Ahmedabad, Delhi, and Hyderabad. The grim situation has put the focus on systemic and structural causes, and on how we build our cities. In Mumbai — which sees torrential rains every year — large swathes of land have been released for high-intensity development under Development Plan 2034, making it more vulnerable to climate events. The already dense city has lost sandy beaches, mangroves, marshy lands, forests, and its coastline is being changed, all in the name of development or climate mitigation measures. Authorities harp on techno-fixes as climate action but the situation calls for undertaking a systemic change, not simply an assortment of projects that deflect attention from business as usual.

In an interview aired on national television last year, the then Environment Minister of Maharashtra, Aaditya Thackeray, referred to Mumbai's controversial Coastal Road project as a sustainable infrastructure project. The car-only eight-lane freeway, he said, will be a carbon neutral road, and by creating 96 hectares of green open space that will consist of holding ponds, percolation tanks and even an urban forest, it will become a carbon sink for the city.

The idea of creating a "forest" on concretised land by reclaiming the intertidal rocky shore is laughable since unlike a natural ecosystem, it will lack the function of enabling groundwater percolation and reducing surface run-off. After spending crores of rupees to concretise the coast, and build a destructive and futile freeway, the city now plans to spend crores in greening interventions to re-brand this newly reclaimed expanse as a project of coastal resilience.

The increasing vulnerability of the city to climate events has exposed the failure of our urban-infrastructure and planning system. Yet, every time cities flood, authorities are quick to term them as natural calamities rather than considering their socio-ecological dimensions at the global or local scale. The Intergovernmental Panel on Climate Change (IPCC) has highlighted the vulnerability of coastal cities and communities to sea level rise and extreme events owing to "non-climatic anthropogenic drivers".

But despite these warnings, there has been little or no focus on the shift in the planning system since the 1980s, that is oriented increasingly towards real estate speculation. Environmental and planning regulations that directly or indirectly protected ecosystem services in coastal cities have been watered down almost to non-existence. Since liberalisation, as public controls on private capital are relaxed to promote finance and real estate, planning has been recast as piecemeal mitigation measures and "green infrastructure" fixes – proffered as substitutes for degraded and depleted ecosystems.

The response of the authorities to address the threat of flooding has been of two kinds. The first relies on hard engineering interventions, attempts to push back the sea, and divert or flush out the storm water. To achieve this, a number of infrastructure projects have been proposed in Mumbai – sea walls, underground tanks, river channelisation. However, more recently, politicians, officials and engineers in the city have begun to adopt the language of international think tanks and academics, acknowledging the failures of conventional approaches. And so, while the Brihanmumbai Municipal Corporation (BMC) is continuing to build "grey infrastructure," it also seems keen to invest in "soft technologies" and "nature-based solutions" for flood risk mitigation and coastal resilience. This approach is one of the highlights of the recently released Climate Action Plan for Mumbai.

Nevertheless, the sincerity of this green talk is open to question, judging by the current approaches to flood mitigation in the city. These are of three kinds: green-washing or re-branding 'maladaptive' mega projects as green infrastructure; green-signalling or interventions that seem to compensate for greater ecological destruction elsewhere; and green-swapping or substituting (rather than conserving) existing ecosystems with infrastructure as solutions to environmental problems.

Seawalls and bulwarks: Disregarding natural defences to coastal risk
In Mumbai, seawalls are being built along beaches to counter coastal erosion and protect coastal areas from storm surges. Seawalls are an attractive option to officials and politicians, despite the scientific wisdom that militates against them. Coastal landscapes are dynamic and evolving ecosystems, an outcome of geo-morphic processes of erosion and deposition; building impediments like seawalls disrupts these processes.

Mumbai's coast comprises rocky headlands and sandy bays, interspersed with estuaries where freshwater drainage courses come under tidal influence. The CRZ Notification of 1991 was introduced to protect this zone (CRZ-I) along with the sub-tidal areas (CRZ-IV), or the permanently inundated continental shelf below the high-tide line, and the nearshore land areas (CRZ II and III). But ever since it was introduced, the regulation has been subjected to an onslaught of amendments, as and when it was seen to pose a hindrance to developers and mega project proponents.

The significance of these coastal ecosystems came to light during the disastrous flood of July 2005. The biggest contributor to this was Mumbai's centrepiece real estate megaproject, the Bandra Kurla Complex (BKC), which was carved out of the Mithi river. This was only recently admitted officially, when a Supreme Court-appointed panel accurately described the Mumbai Metropolitan Region Development Authority (MMRDA) – the planning authority of the BKC – the "biggest encroacher" of the Mithi river. Nevertheless, despite the common knowledge that estuarine ecosystems that absorb both storm and tidal water can play a crucial role in mitigating urban floods, land reclamation and the construction of embankments or sea walls in intertidal areas of the city continue.

Like the BKC, the Coastal Road is the city's latest big-ticket project. The project was made legally possible in 2015, as just months before it was cleared, the CRZ was amended to permit reclamation of the seabed for constructing roads –frustrating the very intent of the law it was introduced under. In fact, reclamation has even been justified as a climate adaptation strategy. At a conference on climate crisis organised by a corporate think tank a few years ago, one of the speakers argued that the creation of more land for the city will make climate adaptation financially viable.

Nevertheless, the site of the coastal road construction is the least vulnerable to coastal erosion risk. The intertidal rocky shore – which the project has buried under debris and concrete – is an outcome of the processes of wave and tidal action. This geomorphic feature allows the absorption of waves and tidal water and helps mitigate urban floods while also providing a natural defence against sea erosion. Scientists anticipate that massive land reclamation along the western coast of the island city will significantly affect tidal activity and cause an increase in wave and tidal attack on structures along the shore – exacerbating the risk of urban floods.

Another cause for concern is that infrastructures such as seawalls displace the threat of erosion elsewhere. Seawalls are now being proposed and constructed along sandy beaches in Mumbai's western suburbs, and promenades are replacing fragile coastal habitats. The question is: do all sandy beaches need shore protection?

The Maharashtra Coastal Zone Management Authority (MCZMA) does not hesitate to grant CRZ clearance to such projects, even on beaches that are not eroding. Recently, it approved the construction of a seawall along the sandy shore at Aksa beach in the northern suburbs. A sandy beach is an outcome of deposition of loose particles of sand carried by waves. Aksa beach has a large extent of sand dunes with dune vegetation – a sign that this stretch of coast is not eroding. While on the one hand the BMC is promoting "nature-based solutions", on the other, ecosystems that help maintain the stability of beaches are being destroyed in the name of coastal risk mitigation.

Channelisation and concretisation: Undermining the ecosystem

The undermining of natural ecosystems can be attributed to lack of systematic surveys of the city's diverse and complex ecological systems in urban development plans. In Mumbai, many of these ecosystems have survived because of the No Development Zone (NDZ) chalked out in earlier development plans. The NDZ, however, has been gutted in the Development Plan 2034. Large swathes of the city's areas marked as such have now been released for high intensity development. Even the recently published Mumbai Climate Action Plan for the city provides a highly impoverished view of the city's ecology, that only recognises legally "protected" areas such as forests and mangroves as areas worthy of protection.

Mumbai's four major rivers – Dahisar, Mithi, Poisar and Oshiwara – originate in the densely forested hilly core, a large part of which has been designated as Sanjay Gandhi National Park. Contiguous with this area is the Aarey Milk Colony which supports a range of ecosystems including hillocks with natural vegetation, forest and scrub, valley floors with seasonal freshwater marshes, grassland and fields. The vegetative cover of these river catchment areas play a key role in reducing run-off by allowing groundwater percolation. Until recently, the NDZ status of Aarey set restraints on real-estate capital, thus enabling the preservation of its green cover and critical ecosystems.
However, the natural streams and rivulets in Aarey are being channelised with concrete embankments, destroying their riparian areas. Last year, the concretisation and diversion of one such stream caused unprecedented flooding and the submergence of staff houses, buffalo sheds and fields.

A natural stream is a complex ecosystem; the interface of the stream and its adjacent areas constitute a surface and subsurface hydrological exchange zone. From the perspective of river engineers, channelisation helps flush water out at a rapid pace, while freeing up surrounding land for construction. River channelisation clears the way for subsequent land-use changes that exacerbate the risk of downstream flooding.

Channelisation and concretisation formed an integral part of the Brihanmumbai Storm Water Disposal (BRIMSTOWAD) project – through the creation of a network of storm water drains, increased drainage capacity, deepening and widening nullahs by constructing concrete embankments, repairing dilapidated drains and the construction of pumping stations at various locations along the coast to flush out tidal water. The devastating floods of 2005 were partly blamed on the failure to implement the BRIMSTOWAD project. However, in a dense city like Mumbai where hard infrastructure for storm water drainage may be necessary, it is counterproductive if these are built at the cost of the existing natural ecosystems.

The BMC now plans another megaproject for harvesting rainwater in the form of Japanese-inspired underground concrete cisterns to hold excess storm water. This might work, it is believed, as a strategy to prevent water-logging in chronic flooding hotspots if located below existing roads or buildings. Ironically, two large open spaces in Central Mumbai were identified for building such holding ponds. Local residents and politicians opposed them, fearing loss of their neighbourhood parks. However, the former environment minister reassured them that the surface of the massive concrete tank would be resurfaced to "normal" after the construction. One wonders what is the rationale for undermining the percolative capacity of an existing open space to create impervious underground tanks?

Nature-based solutions for floods: A palliative for disrupted ecosystems
In recent years, concepts such as "blue-green infrastructure" in place of "grey infrastructure" and "nature-based solutions" have been gaining popularity. Ideas such as "slow, spread and soak" are contrasted with technologies for draining or flushing out water. An official recently argued that Mumbai needs a 'paradigm shift' for which "the whole city must become a drain". This, however, is not a call for conservation, but for massive re-engineering projects, in the form of "soft infrastructure" such as permeable pavements, bioswales, Miyawaki forests, rain gardens, absorbent landscapes, and man-made wetlands.

All of this sounds promising on paper but many of these projects seem to work at cross-purposes with one another – de-concretising some parts of the city while others continue to be concretised. As techno-fixes to the existing paradigm of real estate-oriented planning, these interventions have a limited scope – as tactical palliatives for strategic blunders. While nature-based solutions may find resonance in public relations campaigns, the indiscriminate destruction of the city's ecological defences and flood protection barriers continue. By failing to challenge the status quo, they appear as piecemeal solutions to detract attention from systemic irrationality.

Urban resilience has now become the buzzword around which many interventions to tackle urban floods and extreme weather events are being framed. But as Ashley Dawson argues, resilience has become a "key discursive trope" in most parts because many varied meanings can be attached to the term, allowing people and institutions with very different agendas to "embrace superficially similar ends".
Resilience-related adaptive measures provide a way out for policy makers, and a way in for investors and green technology firms, all eager to convert crisis into opportunity. But most of all, when this is all that is done in the name of resilience, they build a false sense of security while confronting an extremely precarious future.

So, we need to ask: how effectively do the proposals for climate action alter the city's current planning and development paradigm? If Mumbai's planners are really serious about alleviating the extreme threats that the city faces, they must first take the precautionary principle seriously.

This would involve undertaking a systematic and comprehensive review of the existing plans and projects in the city with an open mind to assess which ones are and which

are not in the interest of the city's long-term health and security. A comprehensive and careful assessment of the existing land cover and ecological processes at the scale of the Mumbai region is, therefore, critical. It would also involve undertaking a systemic change as climate action, not simply an assortment of projects that deflect attention from business as usual.

What Mumbai needs, in other words, is progressive environmental action, rather than innovative ways of profiting from a crisis.

Photo: Shobha Surin

‘This may be the coolest summer. Be ready for 51 degrees C’

Dr Minal Pathak speaks to Ananya Desai

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As most cities in India reeled under heat waves this summer and Climate Change impact made itself evident, questions emerged about the future: Was India was doing enough to mitigate it, would Heat Action Plans help combat the heat waves, what would be needed beyond these plans. **Dr Minal Pathak**, professor at Ahmedabad University’s Global Centre for Environment and Energy, the first Indian woman in the technical support unit of the Intergovernmental Panel on Climate Change (IPCC), and one of the lead authors of the IPCC report released on the subject offers a deeper insight into the climate crisis in this exclusive interview to **Question of Cities**.

Dr Minal Pathak lives and works in Ahmedabad, the city that experienced a deadly heat wave in 2010 and has since put in place Heat Action Plans to combat the effect of rising temperatures on people. Dr Pathak brings her impressive professional skills – a PhD in Environmental Science, visiting scholar at the Massachusetts Institute of Technology (MIT), senior scientist with the Intergovernmental Panel on Climate Change (IPCC), member of the organising committee of the IPCC Cities Conference, and key member of the Global Centre for Environment and Energy in Ahmedabad University – to bear on the issue. “Urban heat phenomenon will be pretty bad because we are building our cities with a lot of concrete,” says Dr Pathak as she holds forth on heat waves, Climate Change and city making.

Photo: Ananya

How are the IPCC reports, which outline the rise in heat waves and warn about the future, being received in India?

They are much better received than earlier. Maybe it’s the combination of events happening and greater awareness, but the IPCC reports are getting more attention by governments, people, and the mainstream media. I remember that before the ‘1.5 Report’ (IPCC’s Sixth Assessment Report that indicates the repercussions of a 1.5 degrees Celsius increase in global temperatures), it was just another report that got covered and forgotten. The reception now is improving but it’s still not where we would like it to be. People don’t understand how this affects them, so that gap still needs to be filled.

How bad is the urban heat island phenomenon likely to get in our cities? Which cities are most at risk?
It's going to get bad, pretty bad, because we're building our cities with a lot of concrete. The more our cities are growing, the more their built-up area is increasing and the area under vegetation (green) is declining. This is going to make our cities much hotter. Cities that are naturally warmer will face a much higher impact, cities with moderate climates will be hotter too. Cities like Ahmedabad and Delhi which are already crossing 40 degrees Celsius will record 45 to 46 degrees Celsius. However, if we are able to find ways to sustain our green spaces, it would reduce the urban heat island effect.

Can you draw out the relationship between urban development and rising heat waves? What needs to be changed while planning cities so that they are more sustainable?
Open spaces with trees and such can work wonders in reducing heat, but it has to be a genuine effort to establish a green cover as well as plan for efficient rainwater harvesting. The green cover is declining due to construction and materials with which buildings are constructed. Most commercial buildings have glass facades which is terrible for the climate. The fancy new apartments barely have any green cover. Can we not have a minimum requirement for green cover? I don't mean exotic potted plants or lawns which are bad because they require a lot of manure and water to maintain. Also, the Heat Action Plan is independent of the city plan in Ahmedabad, the two are not integrated. For example, in planning East Ahmedabad, there should be a collaboration between the city plan and HAP which will lay down how to construct new buildings with materials that are more sustainable and reflecting heat. They need to actively regulate building construction.

There has been a significant urban sprawl, increasing density in Ahmedabad over the past few decades. Is there a direct or immediate correlation to the rise in heat waves?
Urban sprawl has happened at the expense of the hinterland which would originally have been forests, or agricultural land or just wilderness, even rural habitats. When we build settlements and urbanise, we lose quite a bit of these. We have lost hundreds of trees, a lot of forest cover, and all that has a direct impact on urban heat. More sprawl and less density (of green) has adversely affected Ahmedabad with rising temperatures. The simple solution to this: we need more green cover, we need to rapidly plant trees and let them grow wild.

Ahmedabad was the first city in India and South Asia to chalk out a Heat Action Plan in 2013. Has it helped?
I think it has because it set the template for other cities and states to follow. It almost kickstarted a chain reaction. The Heat Action Plan has reduced the number of people dying in the cities every summer. So, it does have a positive impact.
Do you believe a National Heat Action Plan is possible or desirable?
A general guideline is certainly possible but not one plan because India has a diverse climate. It doesn't matter at what level the plan is drawn up; what matters is how robust and ambitious it is. It needs to take into account the future. This might just be the coolest summer you will ever experience; next year can be worse. So, it's not if Ahmedabad is ready for 45 degrees Celsius but whether it's ready for 51 degrees Celsius. Sorry, if this sounds horrible but it is the truth.

Are Heat Action Plans enough to counter heat waves?
They are not enough; they provide only small symptomatic relief. My daughter and my husband suffered a heatstroke, you had one too. There are so many cases of heat-related morbidity too. If the plan was working, this wouldn't happen. But I wouldn't say it's useless. The HAPs need to be monitored to see if they are fully implemented, especially for the people listed as vulnerable, and so on. It's a great initial step but we need to find a way to upscale it.

You often emphasise the future.
Our emissions will increase and we must plan for it. India is creating climate or heat mitigation plans with the solar power initiatives, electric vehicles, switching from coal to renewable energy and so on. But there isn't a direct correlation between what we do individually and heat, it's not like you emit a molecule here and the warming happens right away here; it's a function of concentration. So, if someone emits in the US, you are still likely to face a heat wave. This has been India's argument on the global stage: We have contributed a lot less to climate change than the developed countries and it is their duty to reduce emissions rather than ours. But our emissions will increase too.

A study by Climate Impact Lab says heat would kill more than diseases and that India will be the worst-hit as temperatures rise. What measures must we take?
We need to have a concrete plan at the state level and also enforce it at the sub-national level. This should not just be for heat, but an integrated plan for Climate Change, nutrition, health and development. Human health is an important factor that will help people adapt and grow resilient against Climate Change. This especially applies to women because if they are not given adequate nutrition, they cannot withstand some of the extremes. So, there needs to be a multi-integrated agenda for Climate Change, urban development and health.

As a scientist, what kind of policy response would you like to see to combat heat waves?
I can outline three points: Firstly, we need to pay attention because heat waves are not a one-off phenomenon, they are likely to continue. So, I would like to say to whoever is reading: Wake up. Secondly, there need to be strong immediate measures at the policy level to identify the people who are at risk and ensure that policies respond to the most vulnerable. Thirdly, we need more long-term thinking that this is how it is going to be in the next 20-30 years, and accordingly plan what to do.

To those out there who still deny climate change or heat waves, what would you say?
They are living in fantasy. There is very strong evidence to show that human actions are causing climate change. The science is out there, it's up to them to figure out how long they want to deny it.

What can we realistically do at an individual level to combat Climate Change?
An individual can reduce between 40 and 70 per cent of their carbon footprint, but it needs to be supported by infrastructure. The choices you make in your day-to-day life – in the coolness of your air conditioner, appliances you buy, your commute, what you consume and where you buy it from, what you eat and where you get that from –

are all contributing factors. From a more scientific perspective, the authors of the report studied 60 actions and the top three that emerged were: switching to electric vehicles, shifting to a plant-based diet and shifting from private motorised transport to walking, cycling and public transport.

Do you think it's possible to walk in Indian cities?
You must have noticed that people in Ahmedabad walk and cycle a lot in the mornings. But, they wouldn't want to walk to work. There are three months in a year when the weather is good enough to cycle or walk. If the majority of us cycled, the roads would be better. I agree that Indian cities are not fit for cycling, but we need to make it happen by putting in infrastructure.

Is "going green" a way for corporations to shift the responsibility of combating Climate Change on consumers?
If the corporations are not doing anything, then yes. But the choices consumers make decide what's produced and how. If I say no to plastic, then the producer is forced to find alternatives. The consumer has power and corporations have the ability to influence the market. So, it works both ways.

How can educational centres and universities further the efforts against Climate Change?
Universities have a major role to play. It troubles me that the younger generation is not engaged in these conversations. There's the 'Fridays for Future' movement, extinction rebellion, and Greta Thunberg, but such conversations are missing on Indian campuses, especially in Ahmedabad. In the elite schools that I go to, I'm finding it hard to engage students. Somewhere we are missing the mark. At Ahmedabad University, we have Climate Change as a core elective that every student has to study. We offer undergraduate, graduate and doctoral level courses in it too.

Girls and women suffer the most in extreme climate events, something that even the IPCC report flagged. How can we ensure that our policies are gender-sensitive?
When it comes to disaster plans, we need to see if women are on the committees and if they have the voice to make decisions. Most positions of power and decision-making are held by men and they don't fully capture the gender dimension. You have to make the committee gender-sensitive which will in turn make the policies gender-sensitive. Climate policies shouldn't just address gender balance but they should do more to correct the gender inequality in society.