

Bombay is a city of 20 million people and it's steadily growing.

"People migrate to Mumbai from all over India—and even other parts of the world—because of the opportunities here", Dr. Pasnaris told me. "There are resources and potential jobs." It's the business center of the country, people flock here with dreams of economic prosperity.

Dr. Anjali Pasnaris is the Associate Director of The Energy and Resources Institute, a major Indian environmental research institute that investigates resources, climate trends, and population. TERI has started its own university and developed a rating system to accredit green buildings that the Indian government has adopted as the official rating system.

Dr. Pasnaris' personal research interests focus on water. Sanitation and filtration systems, flood mapping, and the monsoon. She invited me to visit her office in Navi Mumbai (New Mumbai).

Mumbai has a good supply of fresh water, she told me. It just comes all at once. It rains 33% of the time here, but it all comes for four months straight. During the monsoon, enough water accumulates here to sustain the city for 8 month long dry season. Migrants from all corners of India flock to the nation's economic center in hopes of finding work on the countless construction projects, sell produce at the enormous bazaars, or other enterprises. Even though the prospect of work isn't guaranteed, at least there will be water and that's a major draw.

I saw this relentless growth when I stayed in the city center during my first 10 days here. Along the street below my apartment, shelters were growing along the street edge every day. Men would haul plastic road barriers from roadside construction sites into position to make three walls, then lay a tarp or corrugated metal sheet above to lay a roof. They would be empty inside, beside a couple of pots and pans and rags.

Eventually, the roadside shelters gain layers. Oil barrels are burned, and flattened to make sturdier walls. Bricks are laid; second stories are added. The end result is a patchwork, a collage of recycled goods and colors. The city's future family's builds their homes out of the used and decrepit material of the city's past. Eventually, the roadside slums tap into electricity cables. Walking by, if you peer into one of these hand crafted domestic residences, past the trash and waste cluttered doorstep, it's not rare to find an immaculately clean interior with refrigerators, kettles steaming, and televisions glaring.

Women chop vegetables and do laundry sitting on the road. Kids clamor on ladders and peer out from second story stoops. The city always carries on functioning around them. Inches from a kid's bare feet, taxis rush by. Goats and chickens mull in the cracks and crevasses, scavenging for scraps and more often than not, mistake plastics for food. Groups gather around the outside of the shelters for three reasons: fights, weddings, or deaths.



I asked my previous host, Soraya, if anyone was upset about these families squatting here. "Where else would they go?" she responded. Nobody, at least in her neighborhood, is pushing to get them to go anywhere quickly. There are no easy solutions.

Driving around the city, I see these roadside slums all over the place. But there are others even less fortunate. At night, after the road's declog from the rush-hour bumper to bumper traffic, the city eerily goes from loud bustling jungle to a quiet and sleepy city. Night reveals where masses take refuge: sleeping on the train station platforms, on the highway lanes, on the oceanfront jetties. Individuals sleep in storefronts, doorsteps, up against trees. It's staggering to see how many of the city call the street home with nothing but a burning pile of trash next to them to keep them warm.

It makes life in the city's largest slum, Dharavi, look pleasant.

In Bombay, no space is left unoccupied, no footprint of the city goes unused. There are farms in between railroad tracks; stores and markets that take over roads. If there is any space free'd up, the next day it will be taken. Since the beginning of the city's history, it has tried to make more space. Bombay began as seven islands, they were connected when land was reclaimed from the ocean. Every square inch is used up. The only ways to go are out, into Navi Mumbai (New Mumbai) or Thane, Mumbai's expansion cities or up, build vertically.

Dr. Parasnis is especially critical of all of the high-rise building projects that multiply the city's surface area, though. By multiplying square-footage, these projects are multiplying

the amount of people that are living here, and consequently multiplying the demand on resources and the amount of waste that needs to deal with.

We need to be critical of calling these projects 'development,' Parasnis said. At the moment they are just building projects. Development suggests progress. Dr. Parasnis prefers a practical approach, she hopes that Mumbai will think about sustainable city-making, rather than blindly stack floors higher and higher in order to make money.

I know very little about the real estate and development market here. But what I have heard is that builders unions hold an disproportionate amount of power in the city. They have a heavy backing from construction workers and have power up top from corrupted government officials. A lot of black money is dispersed into construction projects and often times, buildings are put up without construction permits and ignore safety standards. But money is one of the most important things here in Mumbai, it seems to be what keeps the world spinning.

In Navi Mumbai, projects are built on top of filled in mangrove land. Mangroves are natural buffers from high tides and waves, habitats for biodiversity, and naturally cleanse wastewater. The mangroves provide important ecosystem services, but profit is more important for the short-sighted project managers building here.

This is nothing new, though. Since the start of the urbanization of Bombay, human settlement has changed the character of the landscape, changed the way the water normally flowed. A layer of concrete was laid over the natural landscape, and for that, Parasnis argued, we can't consider damage from monsoons to be a climate change problem, it's a problem that humans have created herself. We've manicured the landscape so that water pools up in certain areas.

I got to get a feel for Navi Mumbai when I was visiting TERI's office. The city is spacious, quiet, peaceful. Compared to Mumbai, it's strikingly clean. Navi Mumbai has an eery feeling to it, though. It's like it's under capacity; ready and waiting to be filled up to the over-the-top and splashing out levels of Bombay.

Navi Mumbai is particularly low-lying. The eastern edge of it lies below sea level and filling in the mangroves exacerbates the vulnerability of the area. The city has a series of holding pools, that they fill up with water during high tides, store, then release during low tide. Think of them as flood-plains. But that's the limit of the city of Mumbai's defense against the sea.

To Parasnis, though, climate change is just a faint issue in the back of her mind.

She told me that in the research she has done, she doesn't see any evidence of sea level rise being a problem here. Her conclusion disagrees with that of the UN, the WorldBank, and climate scientists from major universities, and my own personal opinion. But I kept that to myself.

The point she was trying to make was more subtle, I think. With all the challenges that Mumbai is facing up to, the slow, gradual rise of the sea isn't a pressing issue.

Think about it like this. When a child is hungry, his main concern is finding food to eat. But a child that has food all the time finds other issues to be meddled by. What sports should he play, which girls should he like, etc. Sea level rise, in Dr. Parasnis's eyes is a problem of plenty.

I don't think it's that simple. I don't think it's that easy to cast sea level rise off as a problem for the privileged. It's a problem; albeit a different problem for each different place.

The Netherlands is a rich country. Its entire population is half the size of this city and the nation has the resources, energy, and expertise in the field. But at the same time, they need to be. The Dutch wouldn't have a country if they didn't. Sea level rise isn't an issue only because they are rich. For them it's a matter of defending their nation; defending their identity.

"If a tsunami hits, there is nothing Mumbai could do about a 50 foot wave crashing into it. The city is on a fault-line, there could be an earthquake," Dr. Parasnis said, "if something like that happens, the city is completely unprepared." Sea level rise, and storms, fall under that category of disasters in Parasnis's opinion.

Yes, there is nothing Mumbai could do against an earthquake or 50 ft tsunami. And in this regard, a place like Mumbai is much more vulnerable than Rotterdam. In the Netherlands, those categories of mayhem aren't featured on their risk portfolio.

But sea level rise isn't similar to a completely spontaneous disaster. It's something predictable.

Even though Mumbai has so much to address, it doesn't mean that these issues can be ignored. In the same way that we need to build our future cities based on predictions of population growth, resource, and energy requirements, we also need to build based on predictions about the state of nature. Climate change, too, should be addressed within the framework of sustainable growth.

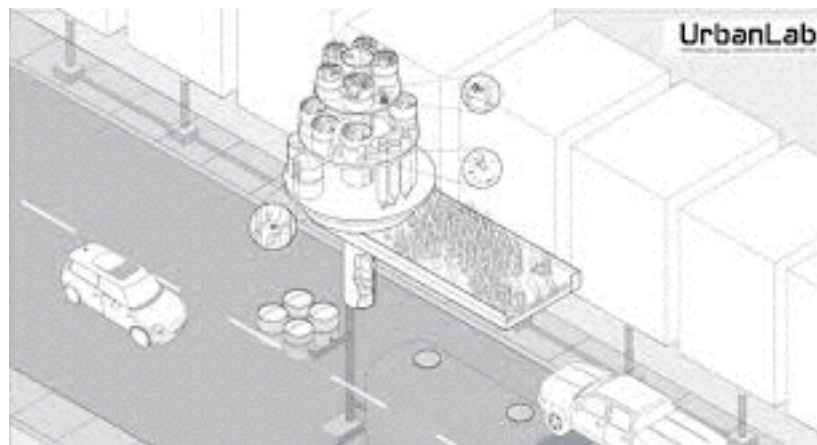
Additionally, for a city that already has a lot going on, it doesn't need to add more to it's already long list by being caught off-guard by the future climate conditions.

I moved on, and asked her about her research on wastewater treatment. I thought she'd be interested in the ideas Chicago's UrbanLab has to treat wastewater using natural ecosystem functions to clean water. The main problem that U.S. markets have with the technology is that its making our waste visible. Americans tend to ignore our waste. Once it's flushed down the toilet or tossed in the trash, it's happily *gone*. But in India, waste is everywhere. There is a cultural tradition of re-use and many of the poorer

neighborhoods living within human waste anyways, so I think a water-purifying living machine could really work here.

Our conservation turned towards the culture of trash. Garbage is littered everywhere. Plastics clog the streets, there are mountains of garbage in random corners, and the train tracks barely surface above a sea of waste. In India, it's the tragedy of the commons, people take immaculate care of their own space, but shared area is thrown to the wayside.

Dr. Parasnis, explained that in the Indian cultural tradition, there is a huge importance of



recycling. Cotton is used and re-purposed until it is grated into dust. Food waste is composted and burned as fuel. With globalization, though, there has been an introduction of new materials: plastics, polyesters, and more and nobody knows how to deal with it, so it's tossed outside onto the sidewalk.

Indian traditions of sustainability extend beyond just household waste. Sustainability is part of cultural identity. Many families are vegetarian for all but 2 or 3 meals. They know that otherwise, there are too many demands and stresses on food supply. Fishing villages don't fish during the monsoon when fish are breeding because they know they need to restock the populations to have food for the rest of the year.

Villages and communities figure out how to manage their habitat and use it's resources that it sustains the generations over time. People from one area get to know their landscape well and become stewards of it. It's necessary for their longterm survival.

This is all changing as people move rapidly into cities in India and all over the world, though. I think there is hope, though. Even in Mumbai, people of similar geographic and religious backgrounds live and group together. If any change is going to happen, it would need to percolate up through the roots. Decentralized. Nothing will happen top down.

Urbanization is a new thing and sustainable urbanism is a problem we should now address.

One final point that Dr. Parasnis mentioned is that Indians in general are happy and they stay happy. Perhaps that is their most important adaptation. That's resiliency. They stay content and happy.

At the end of my time at TERI, a biodiversity researcher in his late 20s took me out to show me the holding pools along Navi Mumbai's east coast. We talked more about the rapidly developing city, the building unions, the pursuit of power, money, and profit. We both agreed that many who are deep in this rat race to make it big have their time perspectives completely askew. Many will throw long-term sustainability completely by the wayside in order to make money on a housing development in the longterm.

"The best part of the pools", Yatish said, "is that they stink. Nobody wants to build their home around here except the mangroves and the birds."



I hoped on the hour train ride home. North through Navi Mumbai, east over the Vashi Creek, and South to Mumbai's northern suburb of Bandra. The train ride is easily the best tour of Mumbai that you can get. It's practically free. The doors are wide open, the warm breeze flows powerfully through the cars. You can hang out of the doors as the city zips by. You see trackside farms, cricket fields, neighborhoods, tents, people walking along the tracks like they are sidewalks. You see the city in the fullest of its complexities, layers, and beautiful disorganization.

I thought about what Parasnis said, about everyone staying happy. Everywhere you look, you can see something amazing. The sun was setting and a thick orange haze was lowering its way over the city. I saw kid leaping from stepping stone to stepping stone over a trash and waste filled creek, bubbling with toxicity. On the bridge above him, two old men, with their arms on each others shoulders sat laughing,





This is the Vashi Creek between Navi and old Mumbai. Completely unstirred. Notice black dot. That's one guy sitting on an inner-tube hand casting a Chinese fishing net.



with huge teeth exposing grins. At their feet a family of goats milled about. The train slowed as we approached a station and I braced myself against the wall of the train to prepare for the surge of crowds shoving on and off, each man eyeing me like the foreign body that I was. On the ride home, I felt especially content, just clattering through this city of 20 million people, just another one of the masses.