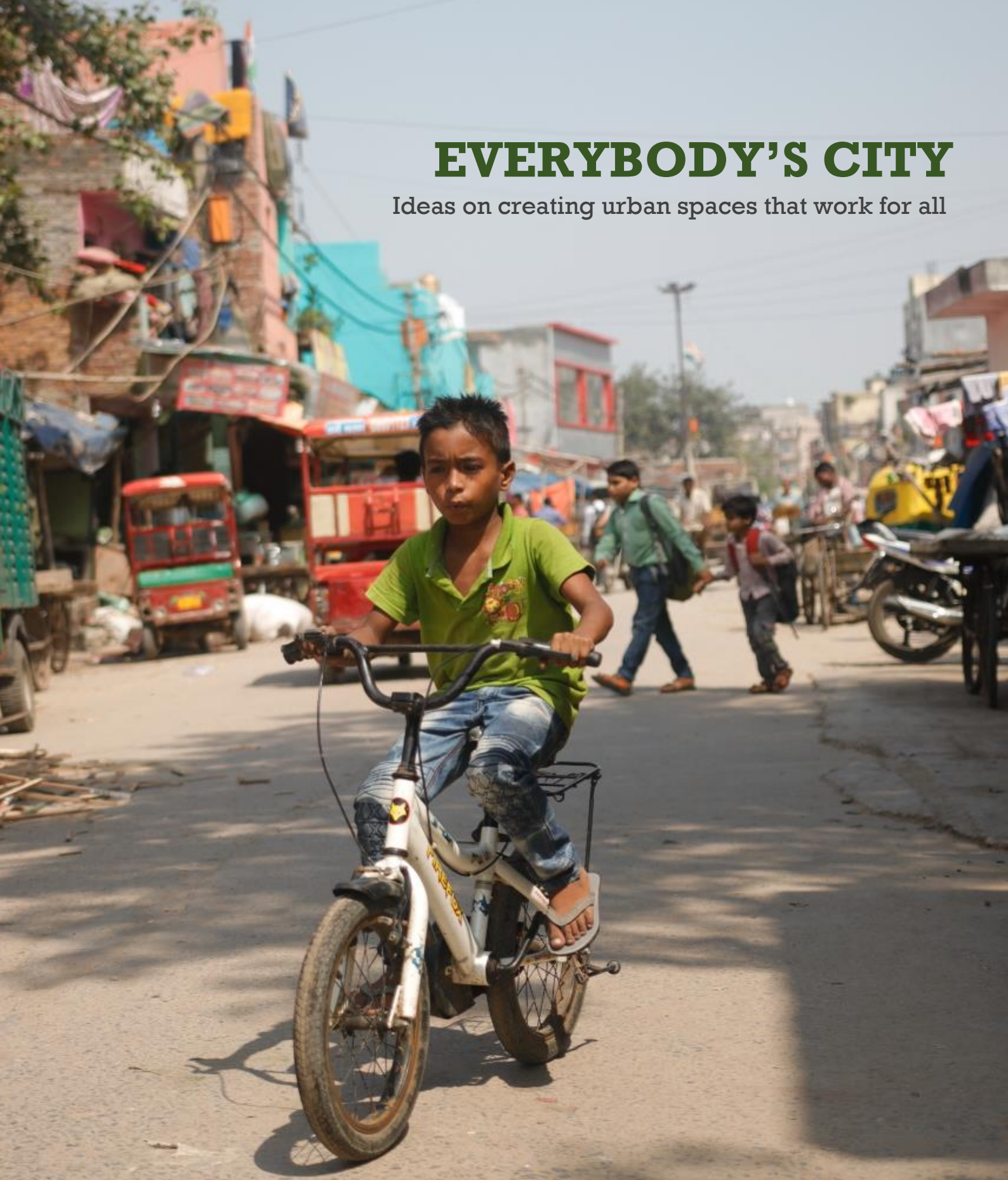


EVERYBODY'S CITY

Ideas on creating urban spaces that work for all



ABOUT NATIONAL FOUNDATION FOR INDIA

The Urban programme within the Local Governance and Accountability (LGA) thematic area of National Foundation for India (NFI) supports work that lends itself to improving the quality of life of ordinary people by building their capacities, creating peoples agencies, improving their interfaces with the Governance systems and strengthening and deepening the role of civil society organizations in building effective, inclusive and participatory democracies. This programme area believes that bringing systems and institutions closer to people will not only make it more responsive but also result in policies and outputs, which will be based on the needs of ordinary citizens especially the poor and the marginalized.

ABOUT SAFERWORLD COMMUNICATIONS (SWC)

Saferworld Communications (www.saferworld.in) is an innovative knowledge-based communications organisation, working to help the humanitarian and development sector spark positive change. It brings together expertise in various facets of disaster risk reduction, development and communication. As a part of the SEEDS network, SWC has been serving the research, advocacy, awareness and evaluation needs of the sector since 2003. Its approach has always been one of combining datasets with innovative storytelling; breaking down complex ideas. Through this lens, it works towards a vision of resilient and sustainable communities.

Editors: Anshu Sharma and Vijayalakshmi Viswanathan

Photographs: © SEEDS | Siddharth Behl and Sarika Gulati

Note from the editors

“They (cities) did not die with a bang; they did not die only when they were abandoned. Perhaps they die like this: when everybody was suffering, when transportation was so hard that working people gave up jobs they needed because they feared suffering of the travel, when no one had clean water and or air, and no one could go walking. Perhaps the cities died when they lost the amenities the cities provided, the visual excitement, the heightened sense of human possibility, and became simply places where there are too many people, and people suffered.” - VS Naipaul

Cities grow throughout their life span, growing faster as they become bigger. The rural – urban fringe constantly gets consumed in this rapid growth. One of the reasons for this is cited as migration. In India, as elsewhere, urban planners deal with these phenomena when problems of urban poverty, inadequate infrastructure and overloaded services manifest themselves in urban areas. Usually, this is too late; the flow of urban migration obliges planners to seek immediate solutions, often ignoring the needs and wishes of the people whose lives are affected.

Most of this planning is centred on statutory laws and procedures that do not always reflect the perspectives of the communities who actually live in these spaces. The process is also seen as being opaque, technical and legal.

Yet, the general publishing on urban issues in India currently falls into one of three categories. It’s either highly technical (in the language of urban planning academia), case study based (on initiatives of specific organisations) or focussed around the latest trend of ‘smart’ cities (in the information technology vein). There is little cross-sectoral, general interest writing that brings to light softer components of these issues.

The research into local innovations and urban issues (upon which this publication is based) showed the necessity of broader awareness. At the heart is an attempt to bring to light challenges and opportunities in a rapidly urbanising India, sparking interest in a new way of looking at this topic.

QUALITY OF URBAN LIFE

The dream of everybody's city – where happiness not stress runs rife
With people-friendly spaces that encourage public life
Self-sufficient neighbourhoods, where to all daily activities you can attend
Where 'smart' is sustainable and useful, more than a fashionable trend

Pedestrians can actually walk, cyclists ride free
Urban agriculture and gardens cut the concrete misery
A city that's vibrant and safe enough to roam about, even at night
Where a decent quality of life is every resident's right!

NEIGHBOURHOODS AS THE KEY TO PLANNING

Prof. Ansari

Imagine a city where a child goes to nursery school within the building where he or she lives. The child then goes to primary, secondary and senior secondary schools within the same neighbourhood. Admission will not be granted elsewhere. However, to ensure this happens fairly, the standard of education at every school is guaranteed to be the same. Such neighbourhoods based on planning principles are actually coming up in the new suburbs of Singapore. Would such an arrangement change the way we look at neighbourhoods in India?

In theory, the neighbourhood is the building block of the city. If a neighbourhood is built to be self-sufficient, then a lot of the basic challenges get addressed. At the centre of this is schooling. The theory is that a child should be able to walk to school without crossing a major road. If that works well, then parents start to get to know each. Children become friends and study and play together.

A similar approach will apply to local shopping centres, dispensaries / clinics / banquet halls for the neighbourhood. If the standard is good enough, why will people bother to go to faraway facilities. Once you've done that, parents have no reason to send their children further away.

Currently, school standards are varying. If a neighbourhood only has a government school, parents will send their children to a private school, even if it 10-15 kms away. You see all the mothers standing at the bus stop with their children and getting them to and from school safely becomes a big task. This is only because we are not maintaining the standard of our neighbourhood schools. That concept itself has died.

Done right, this concept has several advantages. In going to pick up their children from school within the neighbourhood, people meet each other and a community begins to form. Local shopping centres, dispensaries and playgrounds all add to this.

The neighbourhood concept then links with the superblock concept. The idea is that access to houses will be from the main road, no through roads, allowing for a community space in between. This is a central open space with everything facing outwards. This middle square is completely free from vehicles and traffic. Children can play here without parents worrying about accidents. They have even made cycle tracks connecting blocks by making them pass under roads. This came from the Europe and was piloted here in Westend colony. The problem with this is that you have to design the houses appropriately, with living rooms facing the back which became a challenge.

There's another problem. Your facilities are designed for a 15,000 population. But we have no control over this grows. So now we have started designing neighbourhoods for a 15,000 population but looking at civic facilities for a 30,000 population.

With emerging technologies, the future looks even more uncertain. Cities are increasingly dispersing. This is increasing not only with autonomous cars and physical locations but the decreasing need for face-to-face contact. You can teach or work from anywhere. There is no need for face to face contact. So there is no need for cities. They can disperse very widely. As distances increase, people prefer cars than walking these distances, getting into a reinforcing cycle.

What does this mean for our neighbourhoods? As cities unwind, we will have to begin viewing them in an entirely different way!

EDIBLE LANDSCAPES: Household Farming and Urban Agriculture

Sarabjit Singh Sahota- Architect, Urban Designer and Heena M. Hazani- Architect, Environmental Planner

Imagine an urban landscape where people grow their own food, where our balconies are green with our toil and we can enjoy both agriculture and the fruits of urbanity. Evolving a connection with the food we eat is a simple but transformative process. While the primary driver may begin as green benefits for homes, communities and businesses, it can grow into a passion.

For a small sustainable social enterprise, Samyak Green, based outside of Nasik in Maharashtra, this urban farming journey has been a journey of learning and unlearning. Their unique model of urban agriculture, while having gone through many highs and lows, is helping win over families to a greener way of life.

The founder, Mandar, grew up in urban India but spent every holiday with his grandparents in the idyllic environs of his ancestral village. Somewhere along the way, in 1999, he decided to reconnect with the wisdom on vegetables, plants, herbs, health and nutrition that had disappeared amidst his hectic lifestyle. The discovery of Prof. S.A. Dabholkar's epic book - "Plenty for All" inspired him and his journalist wife Dipti to take the plunge in to a new urban agriculture process.

The journey began by investing all his savings and purchasing a barren piece of land in Nashik. Today, 130 fruit trees, grown organically, stand a tribute to the pain and joy of an enduring expedition. Surprisingly they found they were not alone. Many of their urban friends were also experimenting with cultivating vegetables in their balconies and terraces. The classic conflict between aspirations and reality was manifesting everywhere. Most green ventures of these urban friends ended in failures, but a distinctive community of practice had certainly taken root.

But why were these ventures failing? What was it that these experiments were unable to take into account?

The analysis revealed a number of factors that were challenging. The soil used in urban areas is invariably dead and contaminated. At the same time, there was little access to raw organic ingredients such as cow dung and cow urine that can improve soil quality. As the seasons changed, pest attacks would be beyond the competence of the enthusiasts and unexpected guests such as cockroaches, mice and white grub added to these woes. Finally, the lack of quality time and inadequate skills was a major stumbling block

Armed with this first-hand knowledge, the social enterprise called "Samyak Green" was established to help aspiring urban agriculturists take this journey. The readily available resource base-"Sanjeevak Mati" or living soil that was being already produced from the biomass collected on Dipti-Mandar's farm became the core of the idea. Friends were offered containers with readily cultivated vegetable plants in the living- soil.

The idea has gone through a several rounds of iterations. The first container which was delivered weighed 10 kg, too heavy to handle. So thus began a phase of research to make containers light weight and easy to transport and in turn create newer opportunities to address the idea of soil-health. The addition of coco peat to soil, a by-product of the coir industry, helped to improve the water and nutrient- holding capacity of the soil.

Today Samyak Green's readily cultivated containers, also referred as the plant library, do not weigh more than 6 kgs for routine vegetable pots like brinjal, tomato, chilly and other leafy vegetables. The coconut husk now comes from a local temple, which has given rise to a new round of innovations and experiments.

As the routine of distributing these readily cultivated vegetable containers in living soil was established, the next big challenge came in; pest attacks.

Solutions of making homemade bio-pesticides were put forth but time and resources made it difficult to sustain. The workable solutions aimed for a preventive rather than reactive solution. Along with each plant container, a bottle of mixed Neem Ark and cow urine is provided to spread once a week in the soil. A local women's self-help-group produces and packages these, growing a small micro-enterprise alongside it.

Establishing any urban house-hold farm requires attention to many factors. The direction of the balcony, availability of direct sunlight, direction of wind, other gardens in the area, seasonality, temperature variation, reflection/radiation of heat from walls and roofs. That is all routine and standard and can be learnt easily. However, gardening is about our ability to watch each leaf grow and evolve. The belief is that the human connect with plants is the critical success factor is embedded in Samyak Green's mission. They suggest practice of thee 'nis' (नी- in Hindi) neer (नीर), nigah (निगाह) and nireekshan (निरीक्षण), which literally means 'provide just enough water', 'look/glance/care regularly' and do good supervision of garden and its environs. All-in-all there is lot to learn and unlearn on urban agriculture.

As the journey continued, a number of myths began to emerge. Will I get more fruits if I provide more water? Why do the vegetables on my balcony not look like the ones in the mall? The only way to deal with these was to interact and encourage generative dialogue. A series of articles were carried first in the Marathi papers and then published as a manual.

After six years of continuous efforts, Samyak Green has a full setup nursery providing organically cultivated vegetable plants in plastic pots. However, the journey of revitalising an urban sensitivity and passion for agriculture is still on

Rightly so. Samyak Green may be a small local initiative, but it speaks to a larger issue of green benefits in our homes and businesses. This simple act of growing edible plants, vegetables, fruits and herbs holds a huge potential to solve some of the seemingly intractable problems that plague urban life. From the health and nutrition of our children to decreasing ground water levels and urban heat island effects, green practices can help solve this. It can also make an important contribution to household food security, especially in times of crisis or food shortages. Growing fruits and vegetables in urban homes can become a lifestyle statement and part of landscape designing for aesthetics and functional objectives. Bio-degradable waste at the household level is also fast emerging as a cool element of new urban life-style.

In fact, cities and countries around the world have started taking policy actions to promote urban agriculture. The recent push for green roofs in France is just a case-in-point. Beyond households, urban areas have many different parcels of land that can double as urban agriculture spaces with relevant policy action. Think of the use of land along railway corridors, wide roads or Government institutions that can bring multi-dimensional benefits, which require much needed profiling and branding.

A dose of technology can bring the necessary buzz to urban agriculture. Hydroponic Farming involves a type of soil-less farming in which nutrients are drawn from mineral rich water solution. The Aquaponic system of cultivation combines conventional aquaculture and hydroponic farming systems.

Ever since conversations around climate change became part of social consciousness, aspirations amongst people to do ecologically relevant work have been growing by leaps and bounds. This passion from companies to families to even schools is slowly maturing green benefits beyond the experimental stage. Imagine a citywide culture of home farming in every urban centre! The fun has just begun; inspiring and rewarding times lie ahead.

DHALAO IS NOT A DUMP

Shweta Sundar

Have you ever come across a concrete shed while walking on the side walk and, on catching a wisp of this nauseating stench, you've hurried past it without as much as a backward glance? A regular occurrence, scattered disproportionately across our cities.

They camouflage with the backdrop of buildings and boundary walls. Their bareness is designed to elude the eye of a passerby. They make their presence known by a persistent, undesirable odor and a peripheral heap of garbage.

They attract a diversity of domestic fauna, often causing traffic jams. They are the physical manifestation of an invisible yet invaluable system of waste management in our country. Their function is desired, yet their presence is not. They are a constant reminder of a critical threshold of consumption that the society is gearing up to cross.

This is the 'dhalao', the purview of the ragpicker, the municipal worker, and the entire informal waste management system that our cities run on.

This concrete structure is designed to temporarily hold garbage from the surrounding neighborhood before being transported to its final resting place such as a municipal dump or a landfill located at the periphery of the city. Its intended purpose is to provide a space for sorting and temporarily storing recyclables before passing it on to the industries dealing with them.

Dhalaos in Delhi can be traced back to the late 19th century, designed by colonial municipal authorities for monitoring the removal of night soil by the mohalla sweepers under the "vigilant gaze of the overseer" (Prashad2001:7). Then the municipality took over as the sole authority to execute a resolution for the construction of dhalaos in 1884 (Luthra, 2016). By the early 2000s, Delhi counted dhalaos, dustbins and open sites among its garbage collection areas. The location of these garbage collection centers was never pre-decided in the city blueprints when a specific locality was being developed. They were simply created on any available municipal land of any size depending on the availability. The only consideration was a location on the main road to have clear access. There was no consideration of the population density, minimum distance between Dhalaos, quantity it holds etc. In fact, these sheds were designed for the quantity of garbage generated in the early 1800s.

According to the Central Pollution Control Board, the technical wing of the Ministry of Urban Development, 31.6 million tons of Municipal Solid Waste was generated by urban India in 2001. By 2015, this had grown to 47.3 million tons and will reach a projected value of 161 million tons by 2041.

Whether located in the ever-sprawling region of Noida or the sparsely populated area of Tughlaquabad, the view is the same. The pile of shit just keeps mounting up. Since all the landfills in Delhi are either maxed out or are overexceeding their capacity, garbage tends to keep rotting away at these shelters for prolonged periods.

These collection centres have been functioning informally for decades without anyone questioning their validity. Until recently, when residents started voicing their distrust in the governments' ability to handle the city's garbage. With various innovative waste disposal methods in the market like DIY composting, bioremediation, waste-to-energy technologies etc, a shift from these primitive techniques is in demand.

For the dhalaos apparently do not fit in with an aspiring world class city. During the Commonwealth Games in Delhi in 2010, The Municipal Corporation tried to make the city dhalao-free to maintain a certain image on the global platform, but the scheme failed. The South Delhi Municipal Corporation

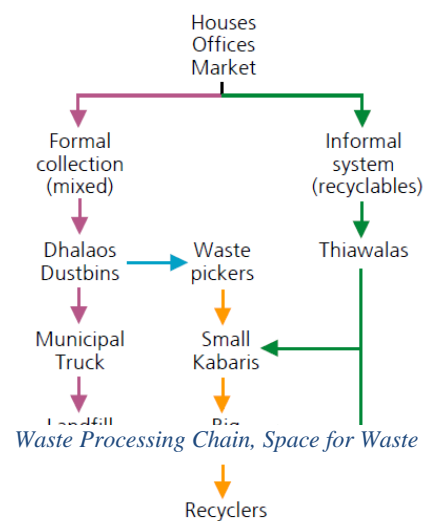
is now launching similar schemes as “dhalao-free zones to keep away ragpickers from the city” (Tribune News Service 2014). This is primarily being achieved through the privatisation of the waste disposal system. By turning over the responsibility to a private party, the government is able to capitalise on Delhi’s garbage.

The private contractors, on receiving a steady daily wage, remove and recycle a bare minimum to meet the contract requirements. Your local *kabadiwala’s* efficiency will beat any recycling system in the world, because his next meal depends on it. To fully grasp the upheaval that such reforms will produce, we need to understand the symbiotic relationship that this concrete shed shares with its users.

A dhalao is a job, a home, a sense of security

The urban waste management system in India is primarily run by the informal sector, untaxed and unmonitored by the government while surviving on daily wages from temporary jobs (World Bank, 2007). There are over 150,000 waste recyclers, and about 40,000 municipal workers. This includes people who pick trash in the landfills, the door-to-door collectors, and two levels of middlemen, who sell plastic, paper and metal to factories to be recycled (WUNRN, 2010). For some, a dhalao is their routine work place, their sole source of income and for some, it is a secure home. Those more fortunate see it as a constant source of complaint.

To give an idea of the significance of a dhalao, the figure on the left represents the sequence of waste disposal in our country. From a socio-economic standpoint, the dhalao serves many other purposes. For those whose daily wage depends on the waste we dispose, it is an indispensable space for sorting and temporarily storing recyclables before selling it to the industries that deal in them.



This chain of waste business serves as a safety net for millions from the economically weaker sections of the society. Waste pickers are seen hovering around these sheds all day, keeping a watchful eye for the next bag of trash to be deposited here. One man’s trash has truly been another man’s treasure.

Privatizing waste collection will soon turn this into illegal encroachment, since “each dhalao would be the *zamindari* of the contractor, who won’t let anyone get in or access waste anymore” (Chaturvedi, 2007). The waste pickers will be forced to sell their trash at cheaper rates, or not be allowed to deposit here at all. “People who pick up the trash are people with very few options. Suddenly from being an informal person, you’ve become an illegal person, and that’s the big shift that happens.” (Chaturvedi, 2007)

People left without a job is a ditch, families left without a home is a quicksand pit. Although both the structure and its contents are officially the property of the state, property rights are rarely enforced, more often they are informally negotiated. The concrete structure is a shelter for the garbage as well as women and children. “I live here to escape being raped and assaulted by men on the streets. The stench keeps them at bay”, a woman rag picker reveals. Even this right to live in a dhalao is not free. From payments to self-proclaimed ‘owners’ to furnishing an almost permanent home, this sends a clear message; they are here to stay.



Shobhraj Kumar and his family of 6 have been living in this 20 sq. foot shed at Masjid Moth for the past several years, shelling out a monthly rent of Rs. 800. Most cannot stand in front of this dump for longer than a few seconds. This is their home. “The poor are blessed with a strong immunity”, Shobhraj says (Akram, 2012). The family collects waste from the nearby residential societies, sharing a symbiotic relationship with some while facing scorn from the others. The neighbors feel that the streets are always littered because of this squatter situation. “While staying in ‘dhalaos’ is seen as an illegal encroachment, many use it as a night shelter,” a senior Municipal Corporation official claimed. Whether by bribes or mutual understandings, the squatters are seldom disturbed by the officials. If evicted, they come back each time. Currently there are a few thousand who live unseen and unaccounted for in these concrete garbage bins across Delhi. Such encroachment is not being encouraged. However, it needs to be kept in mind as we prepare to make cities ‘dhalao free’.

The informal sector, for decades, has been a buoyant force that keeps the city afloat on its sea of garbage. As new policies and innovations are being experimented or implemented in the waste management sector, these *kabaadiwalas* should be considered the primary labor force. The organic nature of cities in India does not allow stringent policies to take effect immediately, as has been exemplified by several government reforms in the past. A participatory approach to formulate a city-scale waste plan, with the help of these *kabaadiwalas*, is our best bet. Only they know the true value of the things we consider *garbage*. Pretending that they do not exist will not do anyone any good.

CYCLING IN A SMART CITY: THE POSIBILITIES

Shefali Bharati

She sits on her yellow and black cycle, helmet firmly buckled under her chin, as she weaves a path through the interminable traffic that clogs the Delhi roads. In the midst of the chaos, she sometimes spots motorists on the footpath, people on the road or cars swerving on the wrong side of the road. It is all messed up and in the midst of this, who would pay attention to a girl of five feet 2 inches? Hopefully, a lot of people do.

The roads in Delhi (and across India) are a common free-for-all where trucks, buses, cars, auto rickshaws, cycles, humans and animals all move together, jostling for space and safety. To add onto the congestion are the blurred lines of lanes, crossings and footpath. In this mix of modes of transport, the bullies are the big buses, trucks and SUV's and the most bullied, cyclists and pedestrians.

Delhi has long been infamous for cramming in more automobiles than the combined rate of other metropolitan cities. The result is directly related to the poor air quality and subsequently poor health.

On the other hand, Delhi also records three million cycle journeys every day — almost as many as car trips. This makes them especially vulnerable to both health impacts and road fatalities. This cycling is primarily of normal people going to and coming back from work. They are largely a section of society who are paid the least and can only afford this mode of transportation. Their bicycles are unadorned, save the basic seat, break and bell. Mixed in among them, you will spot a few cycle enthusiasts, their bikes distinguished by all sorts of gears and paraphernalia.

Developed countries are beginning to measure wealth and progress on their capacity of sustainable development with indexes such as health, environmental and mental quality. India would not rank very highly in these currently. So, what should one do? Await the time everyone takes up cycling? Expect one to cycle in the heat, cold and rain? Or on unsafe and broken roads?

Delhi has a substantial length of cycling track, but this has never been exclusively dedicated to cyclists. First is the very common problem of these lanes being encroached by other vehicles such as cars and buses. One of the solutions to this is a physical barrier, a tall permanent structure that does not let cars in, but this creates a different challenge. These lanes are eventually taken over by motorcyclists or shop vendors. Enforcement comes in here where the traffic police must ensure that these tracks are used for their intended purpose. Bikers may also be deterred from using the cycle lane as their speed would be reduced sharing with cyclists. Once we are able to section out the cars and the buses, we can deal with the bikers and the shop owners and eventually make it exclusive.

The New Delhi Municipal Corporation (NDMC) in its pursuit of making its area a Smart City had released a request of proposal to *Design, Built, Operate & Transfer a Public Bike Sharing System*. The Mysuru City Corporation for Mysore invited a competitive tender for *Procurement, installation and operation of Public Bicycle Sharing System in Mysuru through e-Procurement System* becoming India's first public bicycle sharing service.

Similarly, Bhopal Smart City Development Corporation Limited (BSCDCL) inaugurated a trial phase of smart bikes fitted with GPS and a dedicated track stretching across 6 kms one side (12 kms in total). In their phase two of the plan is a 24-km long corridor with more stations connecting various colonies, markets and prominent public places.

In Jharkhand, the employees of the Khadi Board have voluntarily sought one day to cycle to work in order to save energy. A firm in Pune, *'Enpro Industries Pvt Limited'*, incentivized its 300 employees to cycle to work, saving over 275 liters of petrol every month. The Bhubaneswar Municipal Corporation along with Bhubaneswar Smart City Limited (BSCL) is on its planning stage to bring in almost 1200

bicycles with 120 docking stations across the city and follow in the footsteps of Public Bike Sharing (PBS) systems of London and Montreal.

Therefore, one can see a trend towards integrating the cycling alternative into the urban city. Individuals and state governments are seeking this transportation option and attempting to make it a possible active part of the metropolitan life.

In China and Brazil, the price of the cycle is two times lower to the per capita income compared to India. If the purchase price of the bicycle is reduced by 50%, it will cause a huge spurt in bicycle ownership and would increase the productivity of about 200 million people. For cycling fetches great economic advantages in the larger context. It reduces the geopolitical cost of exhaustible fossil fuel, increases productive work hours and revenue resulting from physical activity, decreases health care costs on lifestyle diseases such as BP, diabetes and cardiovascular illness, and allows for alternative uses of land otherwise occupied by car parking.

However, in order for this to actually catch on, it is just as important to have bicycle appropriate infrastructure as having the vehicle or a road. Many developed countries such as Netherlands, UK and Sweden realize that just having a separate track for cyclists is not enough. It is equally necessary that the tracks be designed in a way that they are obstruction free with wide and smooth turns, proper sign boards and proper bicycle equipment. In Holland, for example, one risks a fine in case they are found cycling on the footpath dedicated to pedestrians. This requires an increase in space to accommodate both, but it would not be occupying any more space than one car lane. Also, once the roads become friendly to cyclists and walkers, car space could decline giving more area to the other.

Admittedly, infrastructure is key. Yet one also needs to incorporate good practices through advocacy, laws and mobilization to help people discover the benefits of cycling. It's not an effort only towards building cycle lanes or parking but making safe, female and children friendly shared spaces. Technology and IT applications can add to its safety and user-friendly dimension.

Attempts such as the Odd-Even drive, pollution check drives and limiting diesel vehicles show an urge amongst people and the government to intervene, but decongesting Delhi and other urban centres requires some serious efforts and an attitude change. The mindset of the people and the infrastructure need to emerge together to reinforce the concept of cycling.

As for a smart city, there is nothing smarter than keeping a healthy body and environment.

A TEEN'S MIRACLE: REVIVAL OF GOPALPUR

Sankalp Shukla

Sparrows reside on an electricity pole at the road corner. Deepak has been staring on them enthusiastically, for the last three days. He suffers with apathy, living inside the two rooms on the first floor of a poorly built dwelling. The little birds soar here and there, in search of twigs and sticks to make their nest and scrutinizing them delights Deepak. He hails from a hamlet in Burdwan, and lives in a small house in Gopalpur, with his uncle, aunt and their three children.

Four mattresses lay on the floor, and beside them small chests are situated, which serve as study tables for the four kids. As soon as Deepak would return from college, he climbs up and stands on the roof. No one knew what he tries to investigate, amidst the long trails of smoking vehicles.

There had been a power cut since the morning. Electricians kept trying to solve the fault. Deepak went up to the roof, with his cup of tea after returning from the college, in the evening. The electricians cleared the nest, and it fell. The eggs lay shattered on the ground, and the sparrows flew away chirping. "Now they will not return", Deepak thought, "Living in my small hamlet was better. The sounds of birds and animals, lush green grass and fruit loaded trees, aroused eternal bliss. But this city, it is submerged under darkness. There is not even a single plant in this stinking concrete jungle; just a few green corners exist in the college." Deepak's family lived in a rented house. For them, keeping a single tulsi pot in the pavement is a great deal, which itself is turning pale because of the deficiency of sunlight.

Deepak's uncle worked under a contractor. Hence, he, and a few other people, lived in two storeyed dwellings. The other houses in this locality are shabbily constructed shacks, some of which just have dark polythene as the roof. It is a society of tailors, household workers, sweepers, rag-pickers, labourers and masons.

There is a serious lack of sanitary facilities, with people defecating in open grounds across the road, where the entire waste of the city gets dumped. Ahead the landfill, is the old lake, which is dying due to the disposal of sewage and industrial effluents.

The Municipal Corporation had no policy around the cleaning of the lake. So, Deepak decided that instead of going to his hamlet in vacations, he would work to solve the problems which prevailed in the locality.

Deepak along with his friends, pondered about building compost toilets in their locality. In his grandpa's home, he had seen that the toilet consists of a very deep pit in which the complete house waste is dumped, and covered with sand, soil and ash. They made up their mind to erect similar toilets. Natural and locally available materials were used for the construction. As an alternative to the bricks, plastic bottles filled with sand and soil were used. Rather than spending a huge fortune on construction materials, waste products from the nearby landfill like rubber tyres, plastic and tin sheets took their place.

Deepak and his friends went from one house to the other, gaining everyone's support in helping them to shape their dream into reality. As the local population mainly consisted of labourers, they themselves began to work. The highest point was chosen as the site. Toilets made of plastic sheets as door, and useless tin sheets as partitions, were built. Pipes, which ran down to the pit, were connected. The best possible utilisation of the slope was done. Excreta was deposited with a minimal amount of water. Tin sheets were used as lids for the pit, and in this way, with the least amount of capital, this deprived locality of Gopalpur achieved proper sanitation.

Everyday large numbers of plastic bottles and tin sheets are abandoned in our blooming metropolises. Their improper disposal gives birth to major problems of soil pollution and environmental degradation. It has become indispensable to reuse them for other purposes.

Currently, the construction industry generates the largest employment. In place of using the traditionally burned and baked bricks, bottles filled with soil can be exploited. This does not compromise the strength, and instead contributes a large share towards protecting the environment.

This was just the beginning. After this splendid triumph, the locality still had unhygienic conditions, due a landfill right across the road. Making the surroundings clean and liveable became their next target. They had a chat with the faculty in their college to discuss ways of resolving this issue. One of the professors suggested that any solution initially begins at the micro level. First of all, they must look for the techniques to minimise waste generation. Then, come the strategies for locality-wise waste disposal and treatment.

With the intention of proper waste management, they gathered the locality, and requested them to refuse polythene and plastics, and recycle whenever possible. As a substitute, people started using paper bags made of recycled paper. With the help of scrapped plastic pipes, drainage lines were created. These went all across Gopalpur and were connected to the pothole. Waste segregation at the community level was the final step. A huge bin was installed to collect the recyclable waste, and the biodegradable waste was discarded in the huge pit. Deepak and his friends, along with their professor, spoke to the college authorities, about the waste transportation, disposition and treatment practices adopted by the city. Emphasis was put on the need for a waste recycling centre. The debate lasted for about three days. It was concluded that, Burdwan does need a recycling centre, and efficient transportation and treatment methodologies.

In his session with the mayor, the director explained the requirement of the recycling centre, and its functioning. The director said, "At the preliminary stage, metals will be separated from plastics. They will be melted at high temperatures and will be used to create other products. Plastics, on the other hand, will also be reused in manufacturing new items. For the collection of recyclable waste, each society will have to be served with a large dumpster. Municipality will have to run dumpers, which will work on weekly basis, and will transport waste to the recycling centre. Moreover, cleaning of the old lake should be done on priority basis, and any sort of garbage disposal in it should be prohibited." Foreseeing the long-term benefits, the mayor agreed to discuss the matter further, with the government.

Everything went in favour, and the feasibility analysis for the recycling centre and the environmental impact assessment was done. Funds were allocated for the establishment of bins, construction of recycling centre and the required weekly transportation services. The industrial plants, which released poisonous effluents into the lake, were asked to install waste treatment facilities.

Within six months, the image of Deepak's locality utterly transformed. The pit, where biodegradable waste was being dumped, served as a source of manure. The community opened up a shop, where it was sold to the farmers. The plastic content had reduced significantly, in the overall waste generated. The landfill across the road disappeared. The old lake, which had become grey, began turning blue. The residents started living in pukka houses, made up of plastic bottles and limestone wash. The Municipal Corporation planned to establish water supply systems, from the lake to Gopalpur and a few other nearby localities. Because of the self-devised drains, waterlogging reduced. The land, which was once buried under mud was then used to plant trees. The water level in the area, started to soar.

As the time passed, the community progressed. Within a year, the former concrete jungle turned as green as an arboretum. All thanks to the water supply system now in operation, people get fresh water for regular consumption. The residents now practice urban farming, which not only helps them to fill their own stomach but earns them a considerable fortune as well. Not only did the local society benefit, because of better earnings, the urban local bodies flourished as well, due to higher tax revenues. While receiving the 'Best City' accolade, the Mayor of Gopalpur expressed gratitude

towards Deepak stating, “The initiative taken by Deepak was appreciable. The young teen truly gave his vigour and zeal, to remould the Gopalpur locality”.

THE ECOLOGICAL FOOTPRINT OF OUR CITIES AND INNOVATIONS FOR GREATER SUSTAINABILITY

Hari Srinivas¹

Every meal we consume, every service we use comes from nature, whether near or far. This complex relationship means enormous challenges in providing a secure living environment. Leaders at the national and local levels in developing countries such as India are faced with the question of meeting the needs of both people and natural systems.

As stated in the Living Planet Report (WWF 2014), the total global consumption of natural resources has risen by 50 percent since 1970, while Earth's natural wealth has decreased by over 30 percent.

Considering this immense pressure our lifestyles are having on the environment, Canadian researchers Bill Rees and Mathis Wackernagel developed the “ecological footprint” concept – *an area of land needed to provide the necessary resources and absorb the wastes generated by an individual or a community* - to highlight the impact of cities on the environment (Wackernagel and Rees 1996). Based on this relationship between humanity and nature, an EF measures the amount of arable land and aquatic resources that must be used to continuously sustain a population, based on its lifestyles and consumption levels at a given point in time.

London, UK serves as a good example: the ecological footprint (EF) of the city is almost equal to the land area of UK as a whole. Similarly, a typical North American city with a population of 650,000 would require 30,000 square kilometres of land – about the size of Kerala state. In comparison, a similar size city in India would require 2,800 square kilometres – less than that of Goa.

India’s cities and urban population are growing at a rate higher than the overall population. This has put the spotlight on cities in attempting to understanding the impact of our lifestyles on the environment. EFs scale the urban and environmental challenges to the level of an individual and help in better understanding and identifying solutions.

Since the United Nations Conference on Environment and Development in 1992, population growth and increases in consumption in many parts of the world have increased humanity's ecological burden on the planet, even though the Earth's total natural resources has remained the same. Global environmental problems are typically considered part of national and international decision-making, it is now becoming increasingly common to also consider the environmental impacts of urban areas, because a rapidly growing proportion of the world's population live in cities.

According to the United Nations Population Division, 2.9 billion people or 47 percent of the earth's population lived in urban areas in 2000. In 2007, global urbanization rate reached 50 percent, and will become 60 percent in 2030. In other words, the world's population could increase by 2.2 billion people in 2030, with 2.1 billion of these people living in cities (United Nations 2015).

As a response to this, municipal decision-makers must be able to measure urban ecological impacts to inform local environmental policy. One way to do this is through ecological footprint (EF) analysis to understand the impacts of lifestyles, and the natural resources needed for that lifestyle.

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All of the resources which people use for their daily needs and activities has to come from somewhere, even if not from their immediate surroundings. Food, electricity, and other basic amenities for survival must be taken from nature.

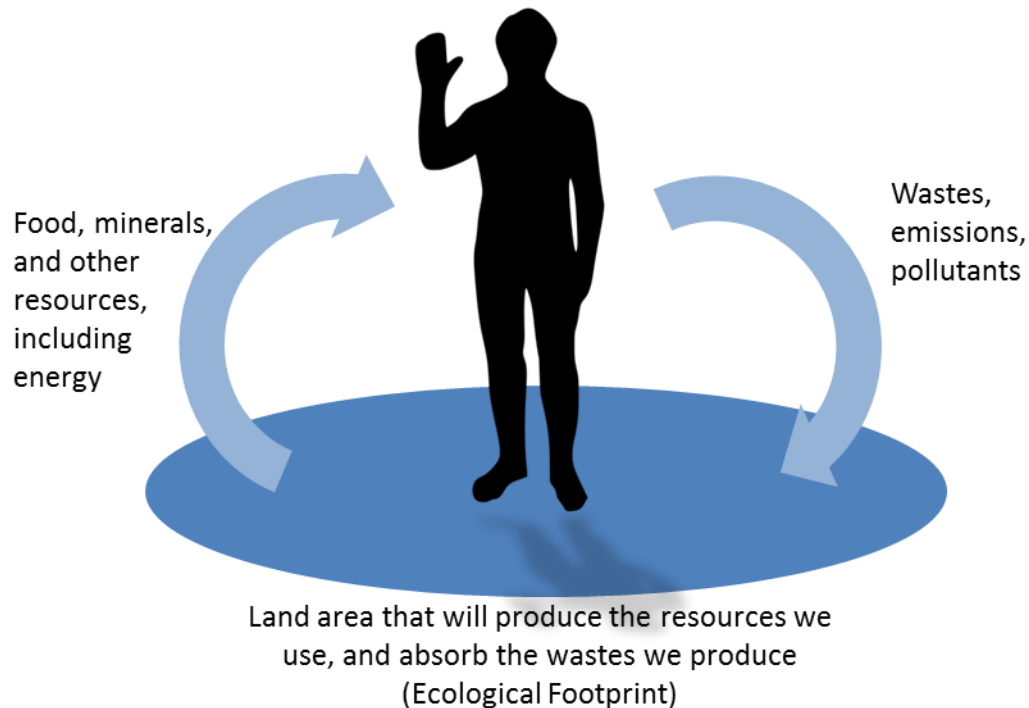


Figure 1: The Concept of Ecological Footprints

It incorporates water and energy use, uses of land for infrastructure and different forms of agriculture, forests, and all other forms of energy and material "inputs" that people require in their day-to-day lives. It also accounts for the land area required for waste assimilation and CO₂ absorption.

EFs can be measured at an individual level, for cities, regions, countries, or the entire planet. EF analysis can also be used for specific activities, or to measure the ecological requirements of producing specific goods or services.

Analysts examine the quantity and different types of natural and manufactured materials and services used, and then use a variety of calculations to convert this into a specific land area. Footprints indicate how much "nature" is available for a defined population to use, compared to how much it needs to maintain its current lifestyles. These materials (and wastes) each demand ecologically productive areas, such as cropland to grow potatoes, or forest to sequester CO₂ emissions. All of these materials and wastes are then individually translated into an equivalent number of global hectares (gha²).

EFs are calculated using a number of metrics, listed in Table 1

Table 1: Examples of footprint data types used in calculating EFs

² Both Ecological Footprints (which represents demand for resources) and Biocapacity (which represents the availability of resources) are expressed in units called global hectares (gha), with one gha representing the productive capacity of one hectare of land at world average productivity.

Footprint type	Details
Carbon	Forest and other land required to absorb CO2 emitted by human activity
Grazing land	Land required to raise the meat and dairy products consumed
Forests	Timber and non-timber forest products generated from forests
Fishing grounds	Fish catch by species and country
Cropland	Area required to produce food for humans, feed for livestock, oil crops etc.
Urban	Land covered by infrastructure, housing, industry and other structures.

To accomplish this, an amount of material consumed by a person (tons per year) is divided by the yield of the specific land or sea area (annual tons per hectare) from which it was harvested, or where its waste material was absorbed (EDN, n.d.). The number of hectares that result from this calculation are then converted to ghas. The sum of ghas needed to support resource consumption and waste generation of a person gives that person's total EF.

Data from 2010 reveals that the per capita EF had exceeded global per capita biocapacity (1.7gha) in 91 of 152 countries. Kuwait, which tops the table, has a per capita EF exceeding 10 gha, while India has a gha of 0.91, much below the global average of 1.7. The US's EF is 8.2 gha.

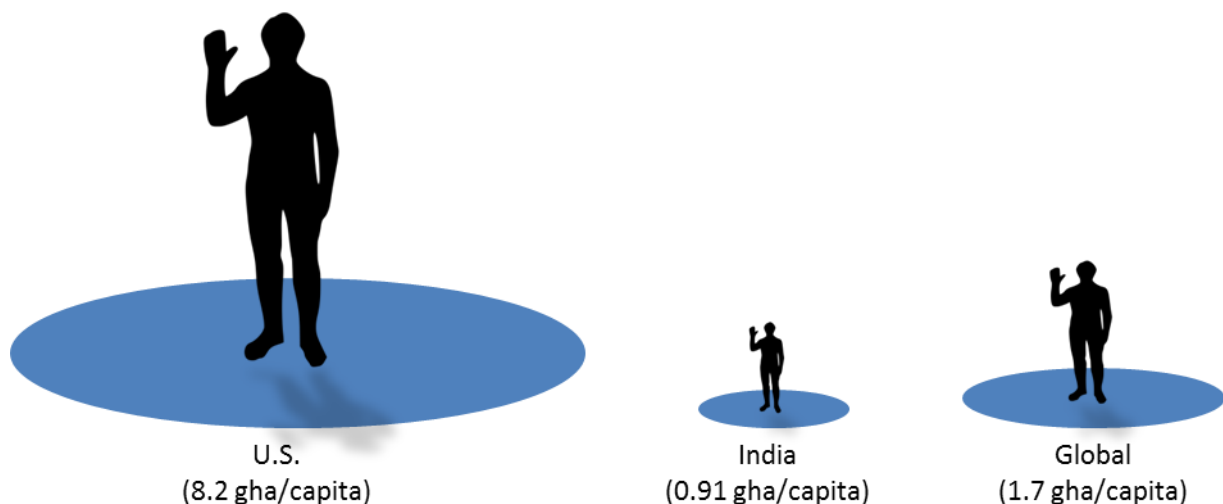


Figure 2: Per Capita Footprints of Global, Indian and American Lifestyles

Calculations done by the author for Tokyo's EF shows that the megacity alone requires a land area more than three times that of Japan as a whole. Such lifestyles have also resulted in more than 60 percent of its food being imported from overseas (MAFF 2016).

India has not been immune to gaps between the amount of natural resources the country uses and how much it actually has. India now demands the "biocapacity"³ of two Indias (UNCBD, 2006) to provide for its consumption and absorb its wastes.

³ "Biocapacity" refers to the capacity of a given biologically productive area to generate an on-going supply of renewable resources and to absorb its spillover wastes. Unsustainability occurs if the area's ecological footprint exceeds its biocapacity.

After China and USA, India has the third largest EF in the world. China's share of global EF is a massive 19 percent, followed by USA's 13.7 percent and India at 7.1 percent (WWF 2014). India's EF has in fact doubled since 1961, exceeded only by the United States and China (GFN and CII, 2008). On average, an Indian has an ecological footprint that is 1/9th of American and 1/3rd that of humanity's global footprint.

While India as a whole demands a significant percent of the world's biocapacity due to its huge population, its per-capita EF, 0.91 gha, is smaller than that in many other countries, and well below the world average of 1.7 gha.

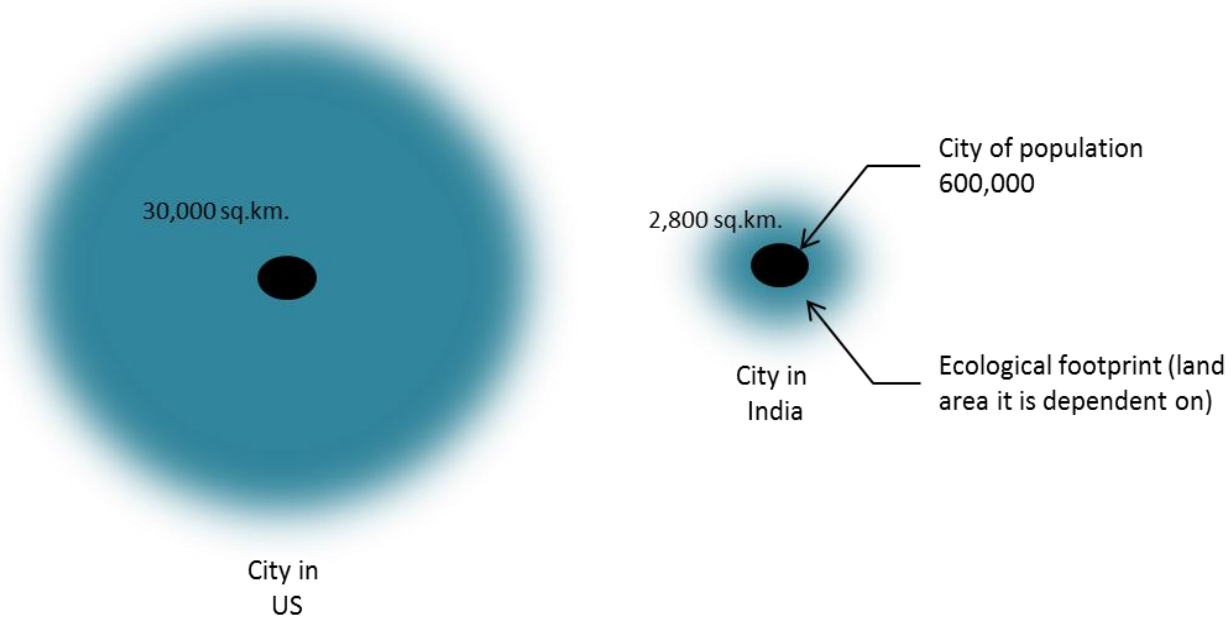


Figure 3: Ecological Footprints of Cities

The United Nations projects that India's population will reach 1.7 billion by 2050. If this is the case, India is likely to face a widening ecological deficit even if current EF per capita levels remain the same.

Since 1961, India's GDP has nearly tripled from \$177 to more than \$1,200 today. Over that same period, however, the EF of the average individual in India has actually declined by 12 percent, in contrast to other industrializing Asian nations where EFs have increased with GDP. This could be due to uneven wealth distribution or increasing size of low-income groups.

Even with a per capita EF of 0.91 gha, there is a high degree of variability within the country. For example, a study of students in the age group of 17-19 years at Chandigarh's Punjab University found their Footprint to be 5.58 gha. (Raj 2012).

Contributions to sustainability

EF is a data tool that helps us play a more important and direct role in understanding and managing our environment. Is the illustrative data of EFs useful? How would EFs contribute to broader sustainability?

- Better understanding of our (over) consumption of natural resources and impacts on the environment

- Clearer idea of environmental problems at the individual/micro levels, and linking global environmental problems to the local level
- Decision-making tool to facilitate action to protect and conserve nature
- Educational tool to encourage lifestyle change and reduce your consumption levels

Shortcomings of EF

Current EF analyses provide a robust, aggregate estimate of human demand on the biosphere as compared to the biosphere's productive capacity. As with any such calculations, EFs are subject to uncertainty and incompleteness in source data, calculation parameters, and methodological variations.

EF analyses are not an exact science, and the values generated are not precise since the quality and quantity of data used play an important role in the resulting EF values.

Other Similar Concepts

EF draws much of its inspiration from the "Carrying Capacity" concept. Carrying capacity refers to the number of individuals who can be supported in a given area within natural resource limits, and without degrading the environment. A similar and narrower concept is an "Ecological Rucksack," defined as the total quantity in kilograms of the natural material that is disturbed in order to generate a product. For example, 21 kgs of earth need to be mined to extract one kilo of steel. Aluminium: 85, Recycled Aluminium: 3.5, Gold: 540,000, Diamond: 53,000,000

Other concepts use the EF idea to study specific issues. Examples include Water Footprint, Energy Footprint, and Carbon Footprint. Food Miles, for example, identifies the distance a food item has to travel from its point of production to its point of consumption.

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PUBLIC SPACES TO COUNTER URBAN FLOODING

Saurabh Popli

Srimala observed the gap between the roof and wall become damp and a trickle of water begin to run down the plastered wall. The peg with her husband's khaki clothes and school uniforms was mere inches away. How long would it remain safe? Outside, the rain clattered noisily on the worn metal sheet, making conversation difficult. Observing the trickle of water reach down from what had been a dry wall up until a few hours ago, she swaddled her infant daughter and huddled her closer. She moved the only trunk away from the wall, out of the way of the trickle that was now beginning to cross the floor. Outside the waters roared, and Srimala was seized with a gnawing fear for her children who should be making their way back home through streets drowned in the deluge. The door opened and in an instant Vinay arrived – disgorging streams of water on all sides - with the children in tow, trailing streams. Srimala surveyed the scene with a mix of relief and alarm. Shaking her head at the pool of water on the constricted floor, she addressed them disapprovingly, but her voice was inaudible over the roar of water crashing on the sheet metal roof. A brief glimpse outside had told Srimala what she already knew; a gushing torrent had consumed the street. It was only the step and the raised door that prevented the stream from entering the house. She prayed inwardly, for the step so far it had kept the one room house dry, but for how long? Intuitively she sensed that unless the storm abated, countless homes would soon be inundated with the rising tide gushing furiously outside.

Over the next two days, several TV news channels devoted extensive coverage over the loss of life and property in the city of Bhopal, not otherwise a common occurrence.

The deluge lasted 24 hours. Over July 8th-9th 2016, Bhopal recorded 175 mm of rain, with 111 mm in just six hours. Several low-lying areas were flooded, and waters rose by up to six feet in several localities. 500 houses were severely damaged and news channels reported 5 deaths. The Upper Lake, a vast body of water of 30sq km surface area, rose by 2.8 m over 24 hours, to the alarm of the city. Traffic and essential services in several parts were severely affected and the risk of disease and economic losses mounted.

A year later, the storm and its consequences had mostly receded from public memory. The issues of risk, vulnerability and economic loss, and that of human life were ascribed to a singular weather phenomenon and forgotten.

Yet, in more than one sense, human impacts of this weather event were already foretold in a scientific study published from Bangalore. Bharath⁴ and co-authors used satellite data and analysed land-use changes over a four-decade- period up to 2014. Reporting on the extensive changes taking place in land-use, the authors explained that Bhopal was increasing urbanisation in its core areas and had a rapidly spreading sprawl at its periphery. Significantly, the city had witnessed major changes to its structure and land cover over the past decades. Whilst the vegetation cover has declined by an astonishing 70% over four decades, urbanization has also led to decreased land under cultivation, and habitat for wildlife. Tree cover is expected to decline to just over a tenth of what it was four decades ago.

Bhopal lies on the Malwa Plateau in Central India and is remarkable for its natural beauty - richly wooded and agricultural lands are set in a mosaic of low hills, lakes and fringed by buildings. The early planners showed wisdom in lands set aside for civic spaces, as well as those for parks, gardens, urban forests, and open lands that form settings for hubbub and civic life and recreational opportunities like sailing, nature walks, excursions and bird-watching, to name but a few.

⁴ Agent Based Modelling Urban Dynamics of Bhopal, India by Aithal H Bharath, S. Vinay, T V Ramachandra

Since the city straddles a high plateau, it depends upon the annual monsoon for sustenance. The city receives almost all of its waters in the two-month monsoon period that then serves to replenish its supply for the year (sometimes longer depending on the rainfall variability). To maximise this usage, one can see how the various water streams were traditionally divided for use. An abundance of historical wells and *Baoli* –water below the surface - was used for human consumption. Its surface waters, in the form of numerous streams, tanks, ponds and lakes, were used for all other purposes. Settlements formed historically around the natural system of channels and rivulets, where orchards and gardens flourished thanks to the rich sediment brought down by these waters.

With the development of modern communication routes, market based agricultural and industrial systems and affordable water extraction technology through borewells, the traditional water systems of the city gradually fell into disuse and was abandoned.

Along with the traditional water systems, access to nature and open spaces have also decreased. The area under municipal limits increased from 71 sq. km in 1975, to 285 sq. km in 2011, an increase of roughly 145% averaged over each intervening decade. This explosion of people, cars and real-estate has brought more and more area of the city under roads, paving and buildings. The hard surfaces convert biologically rich soil into a compact lifeless substrate for single use. Its absorptive, life giving and supporting qualities are erased, replaced by inert surfaces that water quickly moves over.

Numerous studies have shown the beneficial effects of access to nature and open spaces in cities. These benefits include physical and psychological health, through opportunities for play, exercise and recovery from psychological stress. Further, open spaces host a diversity of flora, which often includes mature trees and associated fauna.

With its relatively uneven access to open space, Bhopal is also a typical Indian city. Its relaxed pace of life, affable conversations animate public represents stark cultural differences; in one part, centuries old, tiny shops with merchandise spilling out, sit cheek-by-jowl within bustling markets and scooters weave past jostling crowds. In other, genteel, leafy neighbourhoods, parked cars and high perimeter walls obscure but the canopies of trees tended in private or by the very efficient municipal government, with extensive parks laid out in organized groups along the city's main arteries.

It has been established that vegetation plays an important role in reducing solar heat gain, and reflectance back into the atmosphere, thus reducing overall urban heat island effects over urban areas leading to lower Greenhouse Gas emissions due to lower energy expenditures. Trees and other vegetation absorb and sequester atmospheric pollutants, especially particulate matter, and improve nutrient and moisture availability in the soil.

Open Spaces in Bhopal

The rapid growth of Bhopal intensified in the core urban areas, appearing as an expanding sprawl in the peripheries. Significant changes in the landscape include the reclamation of hitherto natural edges of lakes, rivers and ponds, as well as important features through encroachment, and changes in land-use coinciding with extensive real estate development.

In spite of the rapid pace of development, the city is still home to very large trees, some several hundred years old, are still in evidence in the city, the age, size, girth of the trees is often marked through some significance accorded by sacred thread around its trunk, of a flag at its crown. The Khirni tree in the historic precinct of Sadar Manzil and Iqbal Maidan, and the Ficus trees near the historic Kamlapati park are gentle giants - home to birds and a bustling colony of flying foxes –well-loved and familiar icons anchoring the community's memories to place and witnesses of the city's glorious past. Familiarity and age renders in them a seeming permanence, which, in the bustle and

throb of the city – where shiny new landmarks establish the fluid social backdrop with constant change – important psychological anchors amidst a fragile and tenuous human existence.

Our open spaces comprise both the well-loved and used ones like the promenade along the Boat club, stretching to Vardhman park where beautiful sunsets over expansive waters can be enjoyed, as well as those abandoned and seemingly derelict – which nature has reclaimed, such as along numerous rivulets that criss-cross the urban landscape.

Derelict lands and unused spaces

Abandoned or derelict lands - those that are at seasonal risk of inundation, with unassigned land-uses, contested ownership, left by speculators or government bodies like the railways—include hundreds of hectares within the city limits. They are nebulous spaces, at once gendered and fluid, ecological and anti-human, where nature in her benign aspect has taken over. Tall grass and tangled brushwood give unkempt and untended appearance, with creepers taking over canopies of thorny scrub, present obstacles to entry as well psychological cues of desolation. With the city's canopy cover down to 15% over just a few decades, and the corresponding demands of urban efficiency and performance, the derelict spaces in the city are often the last remaining refuge for wildlife, moderating and controlling the urban heat island effects, flood control, recycling nutrients by decomposing waste. Ecological maintenance functions are performed by riparian edges, and natural lake beds, seasonal drains, ponds, lakes, hedgerows and marginal forests – establish the hydrological regime – essential for health and sustenance of the city, but usually un-acknowledged in urban planning and management.

Undisturbed sites offer the greatest potential for re-colonisation by plant and animal species. It is often here that biodiversity values are the highest. With mature vegetation, these form significant sinks for carbon, and it is estimated that as much as 50% of this biomass is trapped atmospheric carbon. In places where the city has retreated, nature has taken over. Many rivulets pass through or near city streets and localities buzzing with activity. Long forgotten, once dense busy areas of railways and institutional land, are seasonally reclaimed by flood-waters. Lying undisturbed for years, these are significant in terms of biomass above the ground. Similarly, the soil develops under thick layers of humus and organic detritus.

It is here that the city has the greatest opportunities for renewal, in the recognition that the designed open spaces usually long outlive economic cycles of building and replacement of the building stock. They are what form the underlying structure for the city. The landscape structure of open spaces improves economic values and provides a diversity of social, environmental and recreational benefits.

Proper assignment, design and management of these lands can reduce or minimize risks of floods, help in replenishing depleting ground water, mitigating pollution, as well as numerous additional benefits.

TOILET TRIALS AND TRIBULATIONS

Some must still wait anxiously for the cover of darkness to fall
So, they can find a secluded corner to answer nature's call
When danger lurks, to how much health and hygiene can you tend?
Infrastructure built in name, but it's somehow always on the mend

But there's a dream of where sanitation's no longer a constant plight
Nor is scarce groundwater supply polluted due to the waste discharge might
No long line, no claustrophobic jails, smelly and wet
Just the dignity of a safe, airy, functioning and clean toilet!

TAKING THE TOILET FROM SHAME TO CLAIM -TO-FAME

How do you attempt to reposition a toilet in the eyes of a marginalised urban community?

This pilot 'touchless toilet' was part of a larger citizen-led action programme in East Delhi. Strengthening the resilience of societies and service delivery systems is becoming increasingly critical to reducing risks, particularly in the urban context. An informed, aware and resourceful citizenry is the backbone of this strategy. The Delhi Urban Resilience Project supported by UNICEF, looked at activities that promoted participatory risk governance. A vibrant citizens' forum named 'Purvi Dilli Apda Prehari' meaning East Delhi forum for DRR, is now in place. Linked smaller community action groups have come up that work within specific neighbourhoods. This push has bridged socio-economic and political divides to foster a sense that risk is a collective responsibility.

One of these areas is the Sabzi Mandi area in Sonia Vihar. A multi-hazard prone area, it faces challenges such as local flooding, pressure on resources due to high population density, poor solid waste management and lack of safe infrastructure for children to name a few. The residents acknowledge these situations of fragility, which are a result of gaps in service delivery systems and lack of awareness amongst the members of the community.

The earliest settlers were farmers who came from U.P. and since then, it has grown to include a vast mix of residents. From makeshift jhuggis with no amenities to permanent houses with water and electricity connections, the residents have mapped a long journey. Since the beginning they set up a vegetable market every evening on the main street which is an important livelihood resource for the residents.

Most families have added a small toilet room either at the back end of their rooms or on the terrace. The waste from these is directly let out in the empty buffer land on either side. The rag pickers community on the other hand lacks personal toilet facilities. Most of them defecate in the open in the railway buffer land. The present community toilet lies around 300m away from the centre of the community. It is inconvenient for people to get to and use, especially at night

Through our risk, vulnerability and needs analysis, one of the major issues that was identified was this access to toilets. The risk, vulnerability and needs analysis, disaggregated by gender, sex, age it was felt that a pilot demonstration project of a community toilet for women would help in resilience building through a bottom up approach.

Building the toilet was an opportunity to showcase a new way of looking at a community toilet. Considering that women of this community showed stark apprehension in using public toilets due to their poor condition, hygiene was one of the major issues to address. The second was to look at design elements to make it a more positive experience.

SEEDS experimented with the design to create the first foot-operated toilet, designed to minimise the use of hands. Built exclusively for women, it is being used and appreciated by the community. The first of its kind, doors latches, taps, health faucets and flushes all work with a foot-operated system.

This reduced use of hand means less exposure to viruses and infections. For according to the Novus International Journal of Biotechnology & Bioscience, door handles, and water taps are the most contaminated objects in a washroom by far.

Natural light and ventilation have also been key factors in arriving at the design of the toilet. The light provided in the toilets are solar-powered, also encouraging the use of renewable sources of energy. Perforated jalli on all four sides ensures cross ventilation and reduction of foul smell. A translucent fibre roof allows ambient and natural illumination by the sun during the day. Inaugurated in 2018, the toilet is proving a novel addition to the community.

CHANGING OUR APPROACH TO BUILDINGS AND LIVING OFF THE GRID: LEARNING FROM LADAKH

Sonam Wangchuk

How do you create a centre that will be free from the discomforts of environment, but still live off the grid? If it can be done in an area where temperature drop to -20 degrees is normal, it can be done anywhere!

There's a school in Ladakh, in northern most India, where the most dreaded punishment is to be sent home for two weeks. This is a school where students learn by doing things and engage in various innovations to solve real-life problems like climate change. They run the school themselves, with an elected government like a little country and learn management that way. They learn communication by running the campus newspaper and radio. Science and technology are imbibed by building their own school - solar heated mud buildings that stay at +15 even during -15 winters.

In order to do this, there is a holistic system to going off the grid. It is not simply about changing the source of electric power but the entire approach to buildings.

Buildings have a big role to play, generally among people and particularly among students. Research studies in Scandinavia and America have shown that children perform optimally around 22 degrees. In very hot climates, this could go up to 24-25 degrees and in very cold climates down to 18 -20, but beyond that the ability of children to perform drops very fast. So it is not just textbooks and teachers, buildings play a great role too; particularly when the other two are already a challenge!

For a place like Ladakh, we wanted to create a centre that would be free from the discomforts of environment. Ladakh lies in the northern most part of Jammu and Kashmir, bordering Pakistan on one side and Tibet on the other; a trans-Himalayan region at 11,000 feet. Any green patches are human creation, otherwise nature has left the area high and dry. Yet in these harsh conditions, a community didn't just survive. A civilisation thrived and flourished with an identity of its own. People have learned to take care of every patch of land that is irrigable and have created oases in this 'moonscape'.

With modernisation and aspirations, there are challenges. For us, there were very few technologies to heat up cold places. In a country where the majority of the plains suffer from heatwaves, there is very little application of science and technology to such questions. What we wanted was to establish a nursery to innovate and share solutions, a place to show by living. An innovation hub for students, teachers, policymakers. So about 20 years ago, SECMOL – an alternative school - was established. This was done at a golden distance from the city (30 mins), where it cannot influence us, but we can influence it.

What was used were very simple, common-sense, and low- cost approaches. At the heart was orientation to the south. South-facing slopes use the sun and slope to bury the cold of the north. We used materials like earth that is free for everybody. Our belief is that if you have two hands, the sun and earth, you can have a good comfortable shelter. Perhaps more comfortable than cement houses that we spend so much money to build. It is literally 'dirt' cheap! It is also green. Nothing is brought on the site; nothing is left on the site. It is warm in winter and cool in summer.

The walls are made of rammed earth, which has been a tradition in Ladakh. At some point it died, and we are trying to resurrect that. Those are 700-year-old buildings, left to the elements and still standing. So looking at those inspired us. They serve as the heat bank, absorbing the excess solar heat during the day and releasing it in the room at night.

It's not enough to make a warm place which will be like a laboratory product, it has to be appealing and acceptable as well. The architecture need not be outlandish. We took all the elements are from traditional Ladakhi monasteries, while using modern science and solar technology to make them warmer.

So now you have big thick walls that capture the sun, but how do you store the sun for the days/weeks to come? For that, insulation of the building is essential. Natural insulation materials in ceilings, under the floors and the outer walls can keep the building warm.

A lot of this insulation material is generated through carpentry work itself when people are making the doors and windows. Wood shavings and sawdust are equally good insulators as commercial materials. When we ran out, we'd use balled up paper from the garbage; and after that we could even use some of the textbooks that play a role only by keeping the children warm!

These buildings stay at an average of 14°C in the evening. On winter nights when the temperature would go down to -20°, the buildings would stay at +10°C. The minimum temperature within the buildings over many years was +8°C. These temperatures are actually much warmer than a typical Delhi building in winter. It's a place where flowers bloom in the stairwell even in January.

It is sort of centrally solar heated and also naturally lit so that you don't have to use artificial lighting. We use solar lighting anyways, solar panels for electricity, but for this why use the panels? Just use the sun directly.

How does this work? We've used the attached greenhouse concept. The air is heated in the greenhouse and enters through the windows on the upper floor which students open in the morning and close at night. The warm air heats up the fat walls, then cools down and goes back into the greenhouse and that is how the convective current works. This stores the day's heat from the greenhouse into the walls of the house which is then delivered to the rooms as the temperature goes down.

That is day to night storage. It is also possible to do seasonal storage from sunny days to cloudy ones. For that we can use a double envelope system, with both the greenhouse and the rock bank under the floor playing a part. In August and September, when it is not yet very cold, you don't open the windows. The warm air goes through the false ceiling back through the big fat walls and warms it up.

It's not just the comfort but is financially sound over the longer term! Suppose we were building a small room. The cost of the room would be around Rs. 2.5 lakhs if you build with solar and mud; and Rs. 3.5 lakh if we were building with concrete. Not a huge difference. But then if you look at the cost of heating for 10 years in a place like Ladakh or the cost of cooling in a place like Delhi which we often ignore, it comes to Rs 10, 000 or below in the case of a solar building because the use of heating/cooling would be only on extreme days. But the cost of a concrete or stone building comes to about Rs. 5 lakh for a similar level of heating as you get from the sun.

Therefore, the cost of the building over 10 years (keeping in mind that buildings can last for 50 years or more) is 2.6 lakh for solar and 8.5 lakhs for concrete/stone. The cost of the solar building can come from simply the heating cost over 10 years.

In this environment, it is students who have failed in the mainstream schools who study by doing, driving their own innovation and keeping traditions of Ladakh alive.