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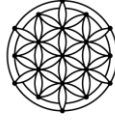
Urban Ecology: Issues and Literature Review

Amrita Bahl¹

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1. Introduction

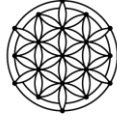
Interconnectedness between humans and their environment is a reality that most of us are aware of. However, over time the emphasis on the lived experience has taken a toll on this awareness of our place in an ecosystem and also the consequent interdependence. As the population continues to grow, our cities are bursting at the seams to accommodate migrants from rural to urban areas who move in the hope of a better quality of life. Instead, most are forced to live in squalid conditions that are unable to provide them access to clean air, water or even the green spaces that they grew up with in the rural areas.

It would be incorrect to say that cities in India are not planned with green spaces. The fact is that, when they are planned, there are usually, earmarked areas for open and green spaces, which get swallowed up when competing priorities clash. Moreover, an inordinately large share of urban space is unplanned and growing rapidly. A combination of institutional and planning failures led to a mish-mash of practices and non-practices where urban planning has become highly flawed, and its implementation even more so. In the process both the quality and amount of green spaces are compromised. The negative impact of this has never been estimated in the aggregate, but a host of studies have pointed out the price that society pays due to poor urban planning and lack of green and public spaces.²

There is a close link between urban planning, access to green and public spaces, and psychological and economic benefits of urban planning that sees the city in the context of the local environment, and more importantly integrates green spaces with the city. An important issue here is that green spaces do not necessarily imply low population density. As cities grapple with issues of pollution, high growth, rising inequality, rapid in-migration etc. it is critical to understand the intimate link between well planned cities that have enough space for nature in its many dimensions.

While a larger study on urban planning and how it can better address green spaces is required, this monograph focuses on a subset of such issues. It examines the definitions, current

² A Brief Guide to the Benefits of Urban Green Spaces, University of Leeds
Urban Green Spaces and Their Need in Cities of Rapidly Urbanizing India: A Review, Manish Ramaiah, Ram Avtar, 2019
The Environmental Benefits of Urban Open Green Spaces, Mehdi Rakhshandehroo, Mohd Johari Mohd Yusof, Universiti Putra Malaysia, 2017
Value of Urban Green Spaces in Promoting Healthy Living and Wellbeing: Prospects for Planning, Lee A, Jordan H, Horsley J, University of Sheffield, 2015
Green Space in Compact Cities: The Benefits and Values of Urban Ecosystem Services in Planning, Märıt Jansson, Swedish University of Agricultural Sciences, 2014
Nature, Role and Value of Green Space in Urban Cities: An Overview, Carys Swanick, Nigel Dunnett, Helen Woolley



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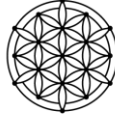
institutional mechanisms including rules and regulations that govern urban greenspaces in India and the road ahead for policies related to urban greens.

The term 'urban ecology' is rarely found in policy documents in the country and has rarely been the topic of much public discussion in recent years, however it is central to sustainable urban planning. It typically refers to the relationship between human and non-human or ecological interactions. There have been a host of definitions proposed by various authors depending upon the context within which they were working. We first discuss these to better appreciate the whole gamut of issues that may be covered under the concept.

Urbanized areas have extraordinarily large ecological 'footprints' with complex, powerful, and often indirect effects on ecosystems even though they cover between approximately one and six per cent of Earth's surface (Rees and Wackernagel (1994)). From a human centric perspective, urban ecology could be defined as that inter-disciplinary field that studies the ecosystems that include humans living in cities and urbanized landscape. However natural sciences tend to define it more from a biological perspective in that this discipline 'analyses the relationships between plant and animal populations and their communities as well as their relationships to environmental factors including human influences' (Endlicher et. al., 2007). The same authors recognize that given the dynamic nature of human settlements there is a need for a more integrated perspective. Such a perspective should cover sociological as well as economic driving forces that influence city developments including their consequences for the perception and well-being of the citizens themselves.

Given our focus on green areas, we also consider the term 'urban forests', a field that is generally accepted to exist under the larger umbrella of urban ecology. Urban forestry has been defined as 'the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits [that] trees provide society' (Konijnendijk & Randrup, 2004). According to the Food and Agricultural Organization (FAO), all tree-dominated green areas including other wooded land, and trees outside forests situated in an urban environment, together comprise an urban forest. Urban forestry also involves studying the form and function of urban forest resources including design and other policies, planning and approaches in selecting and breeding the right trees for an urban environment.

However, despite a reasonable definition of the field of urban forestry, defining green spaces or urban green spaces appears to be more difficult. While typically the term 'forest' has the connotation of a high density of trees, a green space is simply a space where some flora exists. As such it could be a park, a wetland, a marsh, a public space with some flowers, etc. In their meta-analysis of the terms greenspaces and green space, Taylor and Hochuli (2016) found that although many articles implied a definition, only half of the 125 journal articles they studied actually defined what a greenspace was in their study.

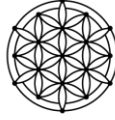


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The same authors suggested two possible interpretations of greenspace for a more functional understanding of the definitions that were provided. In the first instance, greenspace refers to a macro understanding of nature, or natural areas, and includes ‘bodies of water or areas of vegetation in a landscape, such as forests and wilderness areas, street trees and parks, gardens and backyards, geological formations, farmland, coastal areas and food crops.’ The second interpretation leans more towards a representation of urban vegetation, which includes ‘parks, gardens, yards, urban forests and urban farms.’ This second type of understanding refers to a more human-focused land use that necessitates human involvement and planning in order for it to be successful. In line with this, Kumar et. al. (2010) found in their study on land use in Varanasi that tree cover was higher in a planned urban setup as compared to that in the unplanned area.

Definitions are also contextualized, influenced by the language and culture of where the studies were conducted, such that terms like sky garden, street trees, streetscape greenery, etc. have been used in other studies (Taylor & Hochuli, 2016). Despite the subjective nature of defining a greenspace, Lachowycz and Jones (2013) conclude that it ‘broadly encompasses publicly accessible areas with natural vegetation such as trees, plants, and grass.’

For ease of discussion, we use the definition that links a green space as being synonymous with nature, irrespective of accessibility to or use by humans, and therefore **for the purposes of our discussion greenspaces are “bodies of water or areas of vegetation in a landscape, such as forests and wilderness areas, street trees and parks, gardens and backyards, geological formations, farmland, coastal areas and food crops.”**



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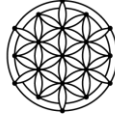
2. Benefits of Greenspaces

Historical documents and mythological stories abound with references to the importance of green spaces for the wellbeing of humans. Since ancient times, ties between people and trees are associated with traditions, symbolism and spirituality, leading to development, be they urban forests (including sacred groves) or stand-alone trees across the world.

Research evidence establishes the significant role of the natural environment in the physical, psychological and emotional wellbeing of human beings in an urban setting. Given that Beijing has high levels of poor air quality most of the year, Ma et.al., (2018) conducted a study to explore the effects of urban greenspaces on the physical, social and mental wellbeing of residents. They found a non-linear impact with those residents living within one to five kilometers experiencing the highest level of wellbeing and those that were at a distance of more than 10 kilometers experienced the lowest level. While individual characteristics such as age, education, marital status, etc. did lead to difference, the authors found that higher wellbeing was recorded for residents with a higher frequency of participation with the space, indicating that 'regularly visiting a city park or public greenspace has a significantly positive impact on welfare, especially in terms of physical and mental well-being.'

While several cross-sectional studies have indicated that urban greenspaces can lead to lower mental distress (de Vries et al., 2013; Fan, Das, & Chen, 2011; Maas, Van Dillen, Verheij, & Groenewegen, 2009; Sugiyama, Leslie, Giles-Corti, & Owen, 2008), the study by White et. al. (2013) demonstrated this link using a positive evaluative index of wellbeing while controlling for time-invariant heterogeneity. Using secondary panel data from over 10,000 individuals, they explored the relation between urban greenspace and wellbeing for the same people over time. Although the effects at the individual level were small, they found that individuals have both 'lower mental distress and higher wellbeing when living in urban areas with more green space'. In the Sugiyama et al. (2008) study, analysis of survey data revealed that after adjusting for socio-demographic variables, the odds of better physical and mental health were 1.37 and 1.60 times higher for residents who perceived their neighborhood as highly green, compared with those who perceived the lowest greenness. Analyzing the association between streetscape greenery and self-reported health, deVries et al., (2013) found that both quantity and quality of streetscape greenery were related to perceived general health, acute health-related complaints, and mental health in adults, with stronger relationships for quality rather than quantity.

Among children, the growing obesity epidemic and lack of physical activity is a growing cause for concern. Ward et.al., (2016) investigated the relationship between time that children spent in greenspaces and with various physical and psychological variables and found that moderate-to-vigorous physical activity was positively associated with greenspace exposure. In fact, greenspace exposure was also more strongly related to greater emotional wellbeing as compared to moderate-to-vigorous physical activity. In fact, Vanaken and Danckaerts' (2018) systematic review of impact of greenspace exposure on children and adolescents found a



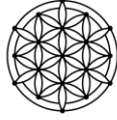
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'beneficial association between greenspace exposure and children's emotional and behavioral difficulties, particularly with hyperactivity and inattention problems.' They even found evidence to suggest an association between mental wellbeing in children and depressive symptoms in adolescents and young adults, although limited in scope. Their review suggested that variables such as demography and socioeconomic status may have independent links with exposure and mental wellbeing. McCracken, Allen and Gow (2016) also found that in their study sample of children in Edinburgh, those with fewer siblings and a higher greenspace use reported better health-related quality of life.

As compared to high-income countries, there are fewer studies on greenspace exposure and better mental health correlated in low- and middle-income countries, despite the growing urbanization. Closer home, in India Mukherjee et. al. (2017) surveyed 1208 adults in Delhi to study the link between park availability and major depression. Park availability, in this study, was indexed as (i) park distance from households, (ii) area of the nearest park; and within one kilometer buffer area around households, (iii) number of parks, and (iv) total area of all parks. The results revealed that residents exposed to the smallest nearest park areas were 3.1 times more likely to have major depression as compared to those residents exposed to the largest nearest park.

Beside the social and psychological benefits evident from the studies mentioned above, urban greenspaces can also provide economic benefits for municipalities such as higher revenues from taxes, as well as citizens who benefit from increase in the values of their properties. Wolfe (2003) reports that physical environment outside shops affects consumer behavior with an increase in willingness-to-pay by around 10% for products in areas where there are trees and where greens are well maintained. Increase in real estate value is also reported in locations with close proximity to urban greenspaces (Tyrväinen, 1997) including water bodies Jim & Chen, 2006; Luttik, 2000. Crompton (2005) found that properties located within close proximity to parks were 20% higher in price, with larger parks leading to higher premiums, and their influence extended over a longer distance (Crompton & Nicholls, 2020).

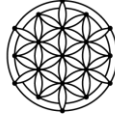
In addition, trees and other vegetation in greenspaces offer several ecological benefits including noise and pollution reduction, local climate regulation, air and water purification, and reduction of global warming serving as carbon sinks, while also helping to reduce energy consumption. In areas with high volumes of traffic, vegetation has been considered as a means to reduce outdoor noise pollution. In Uttar Pradesh, Pathak et al., (2008) conducted a study to monitor noise levels and its reduction with different height and width of vegetation belts. They found significant reductions in traffic noise pollution from vegetation belts of 1.5 – 3 m width and a similar height range, with greater noise reduction as noise frequency increased. Yang et. al (2011) however, suggest that people's perception that a vegetation barrier could reduce noise affect their emotional processing lead them to perceive noise reduction, and especially in the level of noise attenuation that vegetation effects. Trees and other vegetation also provide the public with health benefits of reduced exposure to anthropogenic pollutants through decreased levels of air pollutants and reduce atmospheric carbon dioxide through carbon



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storage and sequestration (Calfapietra et al., 2016, Baró et al., 2014, Vailshery et al., 2013), while also helping mitigate the Urban Heat Island Effect (Shisegar, 2014)

Evidently there is a need for policies that protect and promote urban greenspaces for wellbeing, given the potential cumulative benefits at the community level. Decision makers are increasingly recognizing the importance of improving population mental health and wellbeing. With resurgence in developing sustainable cities, the focus is to develop natural assets that can help mitigate the costs of urbanization including air and noise pollution, perceptions of quality of life among residents, etc. In fact, the World Health Organization suggests designing green area networks such that residents live within a 15-minute walk of an open space. Urban greenspaces including urban and peri-urban forests are increasingly finding favor to combat rising pollution and improving carbon sink numbers, a key commitment made by signatories to the Paris Agreement.



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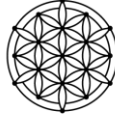
3. Greenspace Typologies

The World Health Organization views urban greenspaces as a component of green infrastructure. As an important part of green services that a city can provide, well-designed, managed and well-connected urban spaces can promote the health and well being of all members of the community.

Given the lack of a standard definition of greenspace, the diverse types of greenspaces can range from city parks to green walls and rooftop gardens, from urban forests to allotment gardens including greens adjacent to lakes or rivers in urban areas. Several typologies have been proposed. Swanwick et al. (2003) proposed 25 greenspace types that were categorized in four main groups namely, functional green space, linear green space, amenity green space, and semi-natural habitats. Bell et al. (2007), in their study differentiated between natural and semi-natural spaces; green corridors; allotments, community gardens and urban farms; outdoor sport facilities; parks and gardens; amenity green spaces; provisions for youth and children; burial grounds, and other public spaces. In their inventory of green spaces in Europe, Cvejic et. al (2015) identified 44 elements of greenspaces that were categorized into parks and recreation, building greens, riverbank greens, allotments and community gardens, agricultural land, natural, semi-natural and feral areas, blue spaces, and private, commercial, industrial, institutional urban greenspaces and those connected to grey infrastructure. Some typologies combined open spaces such as squares, pedestrian and cycling areas with urban greenspaces (DTLR, 2002; Bell et al., 2006).

An Indian study of effect of open greenspaces in Jammu, Malik and Gupta (2019) defined greenspace as 'land that is partly or completely covered in grass, trees, shrubs, or other vegetation...may include parks, community gardens, and cemeteries, schoolyards, public plazas, vacant lots, playgrounds, public seating areas'. Recognizing the dearth of fine grain data on urban greenspaces, Lahoti et. al, (2019), created thematic maps of public urban greenspaces in Nagpur using GIS. In this study, the researchers used the typology based on access and function of greenspaces. Classifying greenspaces under five categories, (Recreational including parks and gardens, playgrounds, greenspaces adjacent to lakes, urban forests; Open greenspaces like rivers; Institutionalized greenspaces including government housing campuses, institutional campuses; Infrastructure and Utility Corridors including roadside greenspaces; and Vacant Land. The results of this study indicated an urgent need to record the status of urban greenspaces and protect them from unauthorized land allocations.

Green spaces are rarely logged and monitored on a regular basis. Scattered studies such as those mentioned above may capture those in some city or a part thereof, but these are ad hoc studies with no systematic follow-up or up-dation. As a consequence, rarely do municipal governments have much idea about how well green spaces are performing, or for that matter even how much area is devoted to greenspaces. Even more importantly the link between low income neighborhoods and lack of green spaces in those areas is a blind spot as far as urban planning is concerned.



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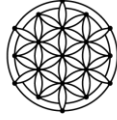
4. Urban Planning

Greenspace planning in the urban context focuses on quantity (percentage of urban area with greenspace), quality (improves urban biodiversity and ecosystem services), connectivity and accessibility. Li et. al, (2005) suggest a three-layered integrated ecological system, which at the city level includes 'green wedges, parks and green corridors', while at the neighborhood level it includes 'green extensions and connections of riverside greenway, road greenway, parks and vertical greening permeate into the built-up areas.'

In their investigation of the contribution of structure, composition and management of vegetation to ecosystem services, Vieira et. al (2018) found that more complex structures of vegetation (trees, shrubs and herbaceous layers) that lacked management (pruning, irrigation, and fertilization) had a higher capacity to provide air purification and climate regulation. Fan et al. (2011), in their study assessing the stress mitigating impact of neighborhood greenness, by encouraging physical activity and/or fostering social support, observed that different components of neighborhood greenspace play distinct roles in influencing stress. They concluded that while overall neighborhood vegetation has a direct stress mitigating impact, parks indirectly mitigate stress by fostering social support.

India has been rapidly urbanizing since 1970 such that the number of million-plus residents cities in the country has grown to 53 in 2011 (Census of India, 2011). The phenomenal growth in different sectors, especially transport, has contributed to rising emissions and environmental degradation. Greenspaces across many cities have decreased significantly, given the competing demands made by urbanization and where space is limited. This is compounded further by the lack of data to measure quality and quantity of greenspaces in India for planning purposes. Gupta et.al, (2012) developed the Urban Neighborhood Green Index to assess the spatial distribution of greenspaces in the vicinity of urban built-up areas (built-up areas defined by proximity to green, built-up density and the height of the structures). They defined urban vegetation using two parameters, i.e., amount of green and the type of green. The Green Index or amount of green was the percentage of green area per unit area and calculated the relative value rather than an absolute value. The authors developed the methodology to help identify action areas for improving the quality of green in critical neighborhoods. They recommended that studies like these could help in the formulation of detailed environmental policies that can be implemented with resident welfare associations at the neighborhood level.

Planning for urban greenspaces in India requires an integrated approach that balances both ecological and social aspects of these spaces with urban development needs. It is imperative that we preserve the existing greenspaces while simultaneously develop more with higher connectivity to ensure sustainability. Livability is increasingly becoming an important criterion for balanced urban development. The United Nations' New Urban Agenda, Habitat III, which identifies improvement of human health and wellbeing as a key priority, was adopted in October 2016. As a signatory, India has committed to the 'creation and maintenance of well-



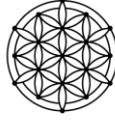
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connected and well-distributed networks of green spaces to improve physical and mental health, urban livability and to enhance resilience to environmental risks.'

In 2014, the Ministry of Urban Development, Government of India released the Urban Greening Guidelines to serve as guide for town planners and facilitate identification of 'key stages in planning and development where urban greenery may be integrated with the built environment'. This was followed by the release of the Livability Standards in Cities in 2017 to generate the Livability Index. Derived from the Smart Cities Proposal, the Standards include 79 indicators, of which only two focus on Public Open Spaces. These are: per capita availability of greenspaces and per capita availability of public and recreational spaces. Reports on the operationalization of these two guiding documents were not accessible at the time of writing.

While the importance of urban greenspace for human wellbeing and biodiversity is uncontroversial, it is a major challenge to provide sufficient and well-functioning greenspace in a country like India where Forests fall under the concurrent list of the Indian Constitution and are legislated by both Central and State Governments. In an urban setting, where forests are hard to develop, the importance of street trees in providing ecosystem services cannot be emphasized enough. Street trees play a vital role in improving the livability of urban areas through the provision of shade, improved air quality, storm water reduction and habitat for fauna. In their review of literature, Mullaney et.al., (2015) report that residents consistently perceived the benefits of trees as outweighing their negative impact. However, trees are the first victims of development plans in urban India. In fact, data reported by the Government of Delhi at the behest of the Delhi High Court and Central Information Commission reveals that on an average one tree has been cut every hour for the past thirteen years. The data shared by the Forest Department reveals that between 2005 and 2010, three government agencies (Public Works Department, Delhi Metro Rail Corporation and Indian Railways) were responsible for the maximum number of trees felled (Hindustan Times, 2018).

While felling is one aspect, another is that of planting and maintaining trees, shrubs or even grass. And yet another is maintaining of 'wild' green spaces such as riverbanks, wetlands, grasslands etc. There is little in policy that explicitly deals with allocating responsibility, accountability or even a method of developing standards. Masterplans therefore tend to be more focused on creating a few human-centric green spaces, rather than integrating planning with the underlying ecology. Planning itself has to evolve, with some standards set for developing human habitations that are well integrated with nature.



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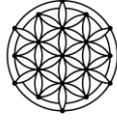
5. Institutional Weaknesses³

As a signatory to the Stockholm Declaration of 1972, India committed to safeguard the natural resources of the earth, including the air, water, land, flora and fauna and specific representative samples of natural ecosystems, for the benefit of present and future generations, through careful planning and management as appropriate. Following this environmental protection and improvement were explicitly incorporated into the Constitution of India through the Forty Second Amendment to the Constitution Act of 1976. In the section on Directive Principles of State Policy, Article 48A was added that declares: ‘The State shall endeavor to protect and improve the environment and to safeguard the forests and wild life of the country.’

Under the Fundamental Duties, Article 51A (g) was added that states that every citizen is responsible ‘to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures.’ In 1986, in the wake of the Bhopal Gas Tragedy, the Government of India enacted the Environment Protection Act under Article 253 of the Constitution of India. This act has also witnessed several judicial discussions and debates. In 2010, under the aegis of the National Green Tribunal Act, 2010, the National Green Tribunal was setup as the leading judicial forum to enforce environment protection laws. The preamble to this legislation states that it is *“An Act to provide for the establishment of a National Green Tribunal for the effective and expeditious disposal of cases relating to environmental protection and conservation of forests and other natural resources including enforcement of any legal right relating to environment and giving relief and compensation for damages to persons and property and for matters connected therewith or incidental thereto.”*

The Forest Conservation Act of 1980 was enacted as a measure to control deforestation and placed a restriction on the de-reservation of forests or the use of forest land for non-forest purposes without the approval of the Central Government. Unlike Forests that are protected by this Act, there is no central legislation for the protection and preservation of trees. Since forests and by that token, trees are a State subject, some states have enacted laws to protect them. These are the Karnataka Preservation of Trees Act (1976), the Goa, Daman and Diu Preservation of Trees Act (1984), and the Delhi Preservation of Trees Act (1994). Dutta (2019) notes that a ‘common feature of almost all the tree preservation laws is the constitution of a tree authority as well as the designation of a tree officer. The tree preservation laws follow the general structure of the criminal law and provide for exemplary powers to the tree officer, including the powers to arrest without a warrant. The most important power given to the tree officer is the power to decide on applications filed by individuals seeking permission for felling of trees. Though most of the state laws provide for a tree authority, the authority has no role in deciding whether trees should be felled or not’.

³ This section has benefitted immensely from Prasad, “Protecting India’s Green Cover: The failure of institutions and laws”, Indicus Foundation 2020

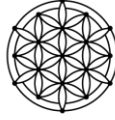


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Closer home, the capital of the world's largest democracy, Delhi has vast areas of vegetation and forests, the most popular being the Ridge. The ridge in Delhi is an area of nearly 7,784 hectares and is divided into Northern Ridge, Central Ridge, South-Central Ridge and Southern Ridge. Discussion about protecting the environment of the city gets myopically confined to these ridge areas, thus overlooking the environment flourishing closer home, i.e. in our neighborhoods. Even though the reserved and notified forests of Delhi are protected under the Indian Forests Act, the question about the welfare of an average lone tree standing on a roadside remains unanswered. The Delhi Preservation of Trees Act, 1994 has been enforced since 1996 with the objective to protect trees in the capital. Its Preamble reads that it is, '*an act to provide for the preservation of Trees in the National Capital Territory of Delhi*', clearly stating the intent of the legislature while enacting this legislation to protect all existing trees with stringent regulations, while also planting new ones. According to this statute any branch or "woody plant" with a diameter of more than 5 centimeters cannot be cut without permission from the Forest Department. Damaging trees in any manner will constitute an offence under this Act. However, the name of pruning, the timber obtained is sold to contractors without any due diligence. The lack of a policy guideline for conducting the exercise of pruning compounds the problem. Prasad, (2016) cites the example of the clearance granted to fell nearly 1500 trees for an elevated road corridor between Vikas Puri and Mukarba Intersection on the outer ring road of Delhi, where the felled trees were auctioned off to the highest bidder, thus reducing trees to a mere commodity. According to him, 'the reason for this is that Delhi has no commercial forestry, thus wood has to be sourced from other states, which would entail duties and overhead charges like transportation, etc. However, when one can get a hardened tree within the city and that too for a trifling price then more and more trees in the name of developmental projects are cut and auctioned off. The forest department in such matters is reduced to a post office, merely receiving applications for felling of trees and approving them, sometimes under pressure'. He points to procedural lapses such as the Appellate Authority for felling orders and the sanctioning authority for permission to fell trees rest with the same entity in Delhi, Secretary, Department of Environment, thus compounding the problem. The problem of 'approving under pressure' that officers of the Forest Department experience was also pointed out by Dutta (2019) in his article. Discussing the functioning of the tree officer, he notes that the 'tendency to act under dictation' was a cause of serious concern as the tree officer is usually a junior officer, who may be unable to question the decisions taken by senior officers such as the principal chief conservator or the secretary.

Prasad (2016) observed that even though certain species of trees are considered under pressure and need to be saved through transplantation, the lack of transplantation guidelines means that workers engaged to carry out the process simply pull them from the ground and plant them without a thought, leading to a majority of trees perishing.

Under the Forest Conservation Act (1980), forest land that is diverted for development activities including construction of roads, railway lines, infrastructure, etc., needs compensatory afforestation to provide for the biodiversity and ecological loss. The law stipulates that compensatory afforestation has to be carried out by the State Government on



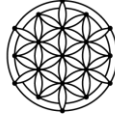
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non-forest land equal to the area of the forest land diverted for development activities. In Delhi, for every tree that has to be felled, the responsible authority is required to plant 10 trees to compensate for the loss. There are several issues with the implementation of this rule on the ground. Land, which is already scarce, needs to be designated for the afforestation. After their Forest Advisory Committee meeting in May 2019, the Ministry of Environment, Forest and Climate Change (MoEFCC) issued an order to States stating, 'no non-forest land, having an area less than five hectares shall be accepted for compensatory afforestation purpose... However, land parcels, if contiguous to RF/PF (recorded forest/protected forest), can be accepted for compensatory afforestation irrespective of their sizes, subject to their suitability.' Compensatory afforestation is further complicated by the lack of guidelines the kind and variety of trees and optimal methods of plantation for them.

Most importantly, it does not take into account the fact that when trees are cut and planted in a location far away from the affected area, the compensatory plantation will have no effect in balancing the environment of the area whose green cover has been denuded. Nevertheless, developers have been quick to commit to this scheme to obtain quick approvals for the projects. Between 2005 and 2010, 65,241 trees were legally permitted to be cut in Delhi and ten times the amount were required to be planted as compensatory plantation. However, less than 50% compensatory plantation was reported and that too, was subject to verification on the ground. In fact, the Directorate of Audit, Government of Delhi observed that the Forest Department was not maintaining proper records for compensatory plantations (Prasad, 2016). In addition, as per the Delhi Preservation of Trees Act, saplings planted under compensatory afforestation have to be monitored for their growth and survival for a period of seven years by a team from the forest department, which due to staff shortages has not been taking place.

Another pitfall of urbanization is the concretization or tiling of sidewalks, sometimes in an attempt to improve the aesthetics of the location. A lack of knowledge on how to perform the task among workers implementing these orders such that sometimes the concrete or tiling is done right up to the trunk of the tree, leaving little or no space for percolation of water or aeration of soil, thereby effectively slowly suffocating the tree to death. This is happening despite the fact that the Ministry of Urban Development, Government of India released 'Guidelines for Greening of Urban Areas and Landscape' in 2000 and the Urban Greening Guidelines in 2014, which 'will act as a model for States and Cities particularly the State Town Planning Departments, Urban Development Authorities and Urban Local Bodies who are responsible for preserving urban greens'. These guidelines prescribe that a minimum area of 1.25-meter x 1.25 should be left un-cemented around trees in the event of paving/concretization. Needless to say, this is not being practiced on the ground. This concretization in cities is only adding to the Urban Heat Island effect, trapping the heat and making areas hotter than their surroundings.

Across the country, Forest Departments have been plagued by staff shortages as well essential equipment. With sanctioned staff strengths not being filled and no recruitment of regular staff, monitoring is limited to office hours during weekdays with no monitoring at night or on

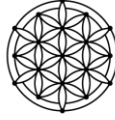


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weekends, resulting in poor management of protected and reserved forests. Prasad (2106) reports that the Asola Bhatti Wildlife Sanctuary, the only wildlife sanctuary located in Delhi 'has an entire colony within its fold, the encroachment is so rampant. Illegal roads have been constructed inside the Rajokri Forests. Illegal felling of trees has become so easy that no one in Delhi fears of any reprimand while doing so'. Filing a series of applications under the Right To Information Act, 2005, with various government authorities in Delhi, Prasad (2016) found that compared to the scale of the task at hand, the protocols, equipment and even manpower were far less than required. The table below is a summary of his findings.

S.No.	Activity/ Equipment	Status
1	Drinking Water	Unavailable at all three field offices of the Forest & Wildlife Department
2	Working Space/ office for Forest staff	Two offices working in hutments. One office, which has 80% of the area under its jurisdiction, is working out of shipping containers.
3	Perambulation of Forests/ Wild life Sanctuary by Forest Guards. Demarcation of Beats and Beat Routes	None whatsoever
4	Maintenance of Beat Books, including Beat Maps/ Beat Diaries – to record observations during patrolling, includes recording of encroachments, and other injury to the forest from fire or other causes.	Not practiced
5	Guards Hammer – this is a metal hammer having a particular number for Marking any intercepted logs/timber or legally felled timber etc. The number signifies a particular guard/ beat route in the protected areas.	None available
6	Preliminary Offence Report – where ever offences are detected the same are to be recorded through a POR and submitted to the Range Officer for immediate action.	Not practiced
7	Working Plan - It is a written document describing the forests including trees outside forest areas, results of the past management practices and proposal for the future forest management interventions for a forest or forest area.	Never prepared till date
8	Uniforms	Never issued
9	Wireless Equipment	All defunct – only carried around to give a semblance of authority.
10	Weapons	None
11	Flying Squads/ Interceptors	None
12	Night vision Equipment (The forest staff literally laughed when inquired about this)	None
13	Patrolling vehicles	None
14	Transport vehicles for seizing and transporting seized timber/ materials.	None (There was one tractor – but it was mysteriously stolen)
15	Vacancies in Sanctioned strength	244 posts lying vacant
16	Additional Strength recommend by the National Forest Commission in 2003.	319 posts (Only 17 posts sanctioned by the Government in 2013 – but not filled till date)

Source: *Protecting the Green Cover in India: Problems in Implementation and Enforcement of Laws (Prasad, 2016)*



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To address this issue of infrastructural shortages, in 2002 the Indian Board for Wildlife recommended that a Forest Commission be set up to look into restructuring, reforming and strengthening of the entire forest setup and affiliated institutions in the country, leading to the establishment of the National Forest Commission in 2003, with Hon'ble Justice B. N. Kirpal, Former Chief Justice of India, as its Chairman. Some important observations that this Commission made were:

[25] In order to ensure that forests meet the emerging and increasing needs of society, their conservation and management on scientific principles to enhance their ecological contribution and to increase their productivity is necessary. A well conserved and managed forest is very efficient in ensuring ecological security. For intensively and sustainably conserving and managing forests and improving their productivity, required resources, both physical and financial, should be made available in accordance with the provisions of the approved Working Plans.

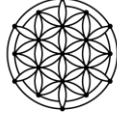
[26] Perhaps the most important contributions that the Central and State Governments can make to achieve the above objective, is to give forest conservation unstinted political support, without which financial and infrastructural support, crucial though they are, will not achieve the objective.

The Commission made a specific recommendation for the National Capital Territory of Delhi:

"Pattern of staffing in most of the States and union territories is similar, but for the National Capital Territory (NCT), Delhi, where IFS officers are posted as Conservator and Deputy Conservators as per cadre allocation of the AGMUT (Andaman, Goa, and Mizoram Union Territory) cadre, there is no well-developed structure of forest rangers and others. It is recommended that cadre strength, and recruitment rules of all categories of frontline staff be framed by government of the NCT, Delhi by making them at par with the other States / union territories; but ensuring that personnel presently working here are not put to any hardship in this process."

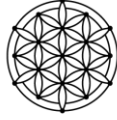
However, these recommendations were not given effect despite observations by the then Prime Minister of India, Dr. Manmohan Singh, in his letter, dated 18.06.2005 to the Chief Minister of Delhi directing the following:

"To aid the efforts of the forest officials, adequate number of home guards and police should be deployed immediately around Wildlife reserves and wildlife sanctuaries. Fill the vacancies in the field staff as soon as possible. To aid the forest officials in dealing with people illegally removing forest produce and illegal hunting, the help of local population, especially tribal living in forest areas should be encouraged and trained and their assistance taken."



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Unfortunately, nearly two hundred and forty-four posts remain vacant in the Forest Department of Delhi and a request for creation of 319 additional posts was summarily reduced to merely seventeen, which were never filled.



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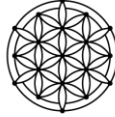
6. The Way Forward

The gaps discussed can broadly be divided into the following buckets:

- Allocating Space
- Allocating Resources
- Allocating Accountability
- Legal Institutions
- Monitoring and Mapping

Easily accessible scientific studies for consumption by policymakers

- Mapping and monitoring of existing greenspaces so that planners have more accurate data to use in their planning process.
- Ensuring independence of regulatory and appellate authorities
- Rigorous scientific studies to evaluate the implementation of compensatory afforestation and the efficacy of this method.
- Development of contextualized guidelines for developing and maintaining high quality greenspaces
- Educational awareness of communities including school children to establish their connection with greenspaces. Partnering with residential welfare associations in planting drives that are based on promoting native trees
- Training a cadre of arborists as part of the Green Jobs Skill Development program to assist the already short-staffed departments.



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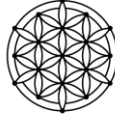
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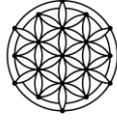
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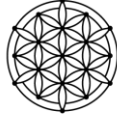
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