GREEN COVER AS A SOCIAL CATALYST FOR A CITY – CASE STUDY: PUNE

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Abstract - A city's social status is defined by how its resources and its conditions, make it comfortable for its inhabitants to thrive. A social condition in a city is mostly governed by its physical features, the availability of resources, climate, etc. Climate being one of the major influential factors for a thriving social life in the city. However, the green cover would define the micro climate and the social pattern in the city. The social well-being would indirectly be influenced by the percentage of green cover in the city moderated by the trees. Trees are a vital part of any city's landscape and green cover. They help in pulling down pollution levels, reduce sound levels, bring down temperatures and invite rain. The green cover in Pune, a suburban city in west India is fast depleting, due to the urban sprawl and fast paced development. Earlier, trees could be found shading the roads in public spaces, sidewalks, by the windows in residential complexes etc. But as one drives along the city - it's a dry landscape; a concrete jungle, glass facades, tall buildings, un-shaded pathways, concrete and tar roads, hoardings, traffic!! . The lack of green cover in the city has caused the ambient temperatures to go up. The city has seen an average minimum temperature rise up to four degrees in the past decade. Additionally, it has been observed that city dwellers prefer to stay in areas with more green cover, walk on shaded footpaths and drive on shaded roads. There seems to be a constant competition between the BUILT and the GREENS in the city for land. Left to it, the BUILT will win its way. In effort to save the GREENS, the National (Indian) Forest Policy was conceived in 2016, to maintain 33% of the country's geographical area under forest and green cover. This paper explores the acts/policies and citizens' participatory ACTIONS in Pune (Maharashtra, India) that focus their efforts towards maintaining the GREEN in the city. Through a case study approach we discuss the hurdles for implementation of these policies as well as highlight some successful initiatives that show a way forward.

Keywords - Climate, Green Cover, Social Well-Being, Trees.

I. INTRODUCTION

As early civilizations developed, they profoundly changed pre-existing natural environments. Indigenous cultures cleared forests, managed landscapes by setting fires, domesticating, and dislocating species, by hunting, thus driving many of the non-human species to extinction. Human contact left few landscapes undisturbed causing a catastrophic effect to them. Writers beginning with Aristotle put forth the term such as "second nature" to refer to elements of the natural world that had been influenced by interaction with humans. [1]
The balance of nature has been disturbed and the result affected climate - extreme natural calamities, unbearable rising temperatures, depletion of the ozone layer and the list is never ending. The mass awakening to conserve nature and to hence forth follow the path of responsiveness to the environment and living in harmony with nature - hence causing it lesser harm was in true sense sustainability, was called upon.

Why does a city need green areas?

The rapid spread of urban sprawl has caused the green cover in the city to be encroached upon. In the most recent decades, urban areas have been increasing in population and thus footprint. People migrate to the cities in search of a vast number of opportunities, which, in rural areas, are not so accessible, turning cities into centers of concentration for infrastructures, recreation and markets, among other elements.

II. NEED FOR MORE GREEN COVER

Vegetation plays a vital role in urban environments. Aside from the aesthetic benefits, trees and other vegetation help mitigate the effects of an urban heat island (UHI) by increasing the latent heat flux through evapotranspiration, preventing the near surface air from heating up during the day and providing evaporative cooling during the night. Shadowing street canyons and buildings, trees prevent them from accumulating more heat, thus reducing the total energy surplus of an urban environment [2,3]. Vegetated roofs and facades can help to reduce the cooling demand in summer and also contribute to insulation in winter, leading to less heat loss into the atmosphere and savings in energy consumption for the immediate environment. [4]
Trees are amongst the most important and significant features in the landscape in the rural and urban areas. They play an important role in enhancing the environment and micro-climate. Trees intercept particulate matter and absorb gaseous pollutants such as ozone, sulphur dioxide and nitrogen dioxide, thus removing them from the atmosphere. Trees also emit various biogenic volatile organic compounds, such as isoprene and monoterpenes that can contribute to

ozone formation in cities.

By transpiring water and shading surface, trees lower local air temperatures. Because trees lower air temperatures, shade buildings in the summer, and block winter winds, they can reduce the consumption of the building energy and consequently reduce the emission of pollutants from power generating facilities.

However, even a minor reduction in the oxygen content of the air will cause a large percentage increase in its carbon dioxide content, which would reinforce the greenhouse effect thus leading to a rise in the global temperatures.

Large number of studies exists analyzing the effects of vegetation on microclimates [4-10]. Having a known impact on urban air temperature, and as such urban heat island mitigation and climate adaptation potential, many authors advise increasing the amount of vegetation in urban environments [3,11,12] and recommend trees to provide ecosystem services to urban areas [13]. Planting trees, therefore, should be extended in general guidelines for sustainable urban planning [14].

III. DEVELOPMENT OF GREEN IN PUNE

Pune alone has seen a steady rise in the highest temperatures recorded for the last 10 years. This year in April, Pune recorded the highest temperature of 43^{o} C in 52 years owing to the reduced GREEN cover and increased BUILT spaces. Various initiatives have been brought into practice by the local governing bodies to help maintain the city's green cover.

Built Green Areas:

1) Road widening and beautification (Roadside tree plantation)- Budgetary provision has been made for road widening and its beautification.. Garden department carries out the road side plantation all along the city. Plantations are done in the area bifurcating roads or the edge of the roads. Depending upon the road widths, every 1 km of running road is planted with more than 200 to 260 no.of trees.

Green Areas around water bodies:



Figure 1: A green belt developed along a Nala

1. **Nala (canal)** development and beautification - Nala development is being proposed by using the treated waste water from sewage treatment plant. Beautification proposals have also been suggested along Mutha river (a major river in the city) from Sangam bridge to Mhatre bridge stretch (distance in Km), with many other viable sites being modified for beautification.

Landscape oriented Green areas - These include landscape conservation areas, nature conservation areas, public open spaces and private playing fields.

1) Garden development - Garden development at various locations in the city has been initiated at a very large scale, 35 more gardens in addition to the existing 62 are being proposed. Each garden is developed with a specific theme like rose garden, Ayurvedic park, Nakshatra Udyan, energy park, railway museum etc.

2) Landscape conservation areas - Areas of open space which have been assessed as containing inherent landscape value and/or provide important green space and natural breaks in the urban environment.

3) Nature conservation areas - Areas of importance for conservation within the city, have been identified through the nature conservation strategy and have been given a grading A, B, C or D to reflect the wildlife value and the conservation efforts in the site.

4) Public open space - land that is freely available for public use of a size and location suitable for recreational activity have been identified and marked.

5) Private playing fields - land used for recreation purposes owned by a private individual or organization and usually reserved for their own use and not publicly available.

IV. ACTS AND POLICIES RELATED TO GREEN COVER

A. The National Forest Policy - In consonance of the public participation, the Maharashtra Forest Department has initiated the 'Maharashtra Harit Sena'/ 'Green Army' which is a body of dedicated volunteers to participate in the plantation, protection, and activities in forest, wildlife, and related sectors around the year.

Preservation of tree Act, 1975 - This act is a manual for every citizen on - how to protect a city's green cover. This act, among other things, categorically defines what constitutes felling. It includes burning or cutting or in any way damaging a tree. The

Maharashtra (Urban Areas) Preservation of Trees Act, 1975 states that, "a tree is any perennial woody plant, whether in the seeding or sapling stage or fully grown stage, and includes shrubs whose branches spring from the ground level". The act defines rules around chopping of trees-Even if the tree is in private premises; it cannot be hacked without prior permission of the Tree Officer.

Even government bodies require permission from the Tree Authority (Pune local authority) for any developmental purpose. There is a time schedule too. On receiving an application, a tree officer has to personally inspect the tree sought to be chopped and submit a report to the Tree Authority within 30 days. The officer has to give adequate public notice in local newspapers as well as by affixing a notice on a conspicuous part of the tree.

The Tree Authority then decides within 60 days whether or not to permit the felling. But even after permission is given, the tree cannot be chopped for 15 days. However, if the authority does not inform its decision within 60 days, the permission applied for shall be deemed to have been granted.

Citizens' rights - As an Indian citizen, we have the right to raise objections. It is not necessary to be residing in the same area where a tree is being hacked. For example, a Mumbai resident can take objection to a tree being felled in Nagpur or even Delhi provided the Union territory has a tree act.

If documents show that the municipal authority had failed to decide, a citizen can demand an explanation from the respective municipal council under the Right to Information Act, 2002. Till an explanation is forthcoming from the authorities, the tree cannot be felled.

Penalty -Every act of chopping at different points of time, whether it is the same tree or different trees, constitutes a separate offence. The penalty includes a minimum fine of Rs.1,000 and maximum of Rs.5,000 with imprisonment from a week to a year.

Other provisions -Bye-law No. 162 of the Maharashtra Cooperative Housing Societies Model Bye- laws says: No member of the society shall destroy, deface or cut down any trees in the society's compound. A violation may render the member concerned liable for action.

There is another act—The Maharashtra Felling of Trees (Regulation) Act, 1964—that deals with protection and preservation of some select trees like Teak, Mango, Mahua, Sandal and Tamarind including mangroves.

Town planning norms for providing green areas in urban centers located in plain areas –

Area extent and Population	Green areas
Small towns (having population less than 50,000 persons)	12% - 14%
Medium towns having population (between 50,000 to 5 persons)	18% -20%
Large cities having population (between 5 lakhs to 10 lakhs persons)	18% -20%
Metro cities (having population more than 10 lakhs population)	20% - 25%

Table 1: Town Planning Norms

Planning principles for providing green areas in urban centers at master plan level -

1) Provision of green belts along national highway/ expressway/ and other major roads/ arteries of the town: Green belts ranging from 100 meters to 30 meters (i.e. 100 mts wide or 60 mts wide or 45 mts wide or 30 mts wide) green belts are proposed along both sides of national highways or expressways or other major arteries of the town.
2) Provision of green areas along river fronts/nala/drain/ canal: the width of such green belts can vary according to the topographical features of the area generally ranging from 30 mts. To 250 mts.
3) Provision of green areas around historical monuments and religious places: about 100mts wide green belts/ areas are provided around historical monuments and religious buildings for the maintenance of their sanctity.

V. GREEN BELT



Figure 2: Green Belt: Green line maintaining an area as Green area.

Green belt policy retains areas that are largely underdeveloped, wild, or agricultural land surrounding urban areas to be developed as green areas. Similar policies include the green ways or green wedges which have a linear extent and may run through an urban area instead of around it.

A green belt is basically an invisible line that goes around a certain area (Figure 1), stopping people from building thereto preserve the integrity of the agricultural land and the wild life.. Green Belts help

protect natural or semi natural environments, improve air quality within urban areas, ensure that urban dwellers have access to the countryside, with consequent educational and recreational opportunities and protect the unique character of rural communities which might otherwise be absorbed by expanding suburbs.

Biodiversity Parks- Biodiversity is the variation of life forms within a given ecosystem or biome-, the main habitat for urban plants and animals. Older, well-established installations attract, for instance, birds and mammals, the natural habitat of which is the forest. Since an increasing part of the population lives in urban areas and receives its daily perception of nature therein, it contributes towards environmental awareness and understanding for humans. While the role of urban forests in terms of carbon sequestration is limited in relation to forests in rural areas, urban trees do play a role in controlling global climate change byindirectly decreasing the use of fossil fuels for infrastructure heating and cooling.

By lowering air temperatures and shading buildings, they can reduce energy consumption by air conditioners in the summer, and through blocking winter winds, they can reduce the consumption for heating.

Following are a few of the guidelines for greening of urban areas and landscaping - (Tree Policy- Pune)

1. To avoid the use of excessive tiling of pavements: porous materials to be used - to increase the ground water table levels and reduce surface runoff
2. Tiling should be done only on pavements with heavy pedestrian traffic - to help recharge as much ground water as possible.
3. Growth of grasses to be encouraged – to help control fertile soil erosion.
4. Excessive pruning to be avoided – this stunts the growth for a few species.
5. Adequate space to be left around trees – to help the roots and the bark or branches breathe.
6. Digging near trees to be avoided- this could cause harm to their roots.
7. Use of organic compost- organic fertilizers and manure has known to have more positive effects compared to chemical ones.
8. Planting of second line of trees to be encouraged – increased number of trees would mean more benefits.
9. Compactness of soil near the trees to be avoided – trees often house habitat at their roots which help them survive longer. Compacting would destroy this micro habitat.
10. Public participation to be ensured – to help make more people aware.

VI. ORGANIZATIONS WORKING TOWARDS CONSERVING THE GREEN COVER

Campaigns (2005-06) for Environmental Justice in India – Critiques and facilitates inputs on various environmental laws and policies, campaign on community control over biodiversity, the open letter campaign, Postcard campaign against the National, Environment Policy, MoEF (Ministry of Environment and Forests) Suno and Chalo!

Focus Areas – Biodiversity, community conservation, environment and development, eco-sensitive alternatives, education.

Kalpavriksh – "Kalpavriksh believes that a country can develop meaningfully only when ecological sustainability and social equity are guaranteed, and a sense of respect for, and oneness with nature and fellow humans is achieved." They operate mostly out of Pune and Delhi. Some of the issues worked on in these areas include dams & environmental impact, conflict between army and villagers in Nagaland, hunting and wildlife depletion, tsunami-related work in the Andamans, urban greening in Pune and Delhi. [15]

Tree Watch – This group is formed under the Kalpavriksh, to bring together people that are concerned about the dwindling tree cover of Pune. This group aims to monitor, act and protect the trees that harbour a variety of fauna and provides its citizens with various ecological benefits. This group would include concerned citizens, and NGO's of Pune. Since their inception in July'05 the group has saved more thousands of trees and has been a support group for concerned Pune citizens.

The group has initiated many activities around urban greening as stated below:[16]

1) **Preventions and Surveillance:** Preventing illegal tree felling, surveying the trees to be cut.
2) **Enforcing Policy:** Working on the policy level like the Maharashtra (Urban Areas) protection and preservation of Trees Act, 1975. Tree plantation programs.
3) **Planning and Implementation:** Collection of seeds and its distribution at time of meetings. Media interaction in case of unwarranted cutting of trees. Identifying possible areas for tree plantations like roads, nalas (streams) and riversides or barren lands.
4) **Awareness:** Creating public awareness about relevant laws and policies among general public through participation in exhibitions, presentations in public programs or just word of mouth. Regular interaction with the concerned authorities.

VII. INITIATIVES WORKED ON

Pune is a city rich in natural resources spread along the banks of two rivers Mula and Mutha and surrounded by hills on all sides forming a green belt. These hills naturally limit the growth of the city. But growing urbanization made this budding metropolis to invade the neighboring suburban and fringe areas resulting in a sprawl. We list the main factors contributing to the diminishing green cover in the city.
Slums/Hutments contributing damage on hilltops and river banks: The sprawl encroached upon the hills surrounding Pune, are recklessly clearing the forest cover. The deforestation and drastic loss of trees also resulted in soil erosion, reducing the hill tops. It is observed that, many hill slopes are encroached by illegal temporary hutments contaminating the soil, demolition of these encroachments is extremely difficult negating the alternative of replanting trees on the hill slopes. Slums are not only seen on the hilltops but also near river banks and nala sides.
Construction sites contributing damage to river banks: The river and nala banks had green cover due to which the direct entry of industrial by-products and garbage was obstructed. But today construction sites are getting too close to the river ultimately causing the tree cover to vanish and allowing the waste entering the river water, making it stagnant and dirty.
Population explosion contributing damage to air: Increasing population has led to the increase in the number of vehicles, creating a congested and polluted city center. This pollution is usually absorbed by the trees, but now due to depleting tree cover, air pollution has become a threat to the city's air quality. Previously the hills which added to the scenic beauty and landscape of the city have started to lose its glory.
In a recent attempt to build supporting infrastructure to satisfy the growing population, a proposal to clear the hilltop was approved. Due to active participation of citizens and NGOs this hill was saved from the massacre. To save the existing tree cover and to increase them, the city government has implemented some measures and to avoid such situations in the future, the concept of Bio-diversity Park reservation came into existence.

Present Day Scenario, Effect of depleting green cover in Pune –
Rivers - The two main rivers Mula and Mutha according to the policy should have a minimum 100m green belt by their sides. The increasing development has led to channeling the river, forcing it to swell in the rains and destroy its surroundings. The disposed garbage and industrial waste further act as an obstruction for the river.
Green belt near the river helps maintain a relation between the manmade and the natural environment. Thus the main intention of green belt is to maintain a balance with the adjoining water body. Open space for planting local species of plants and shrubs should be provided by the sides of rivers and nalas. This helps conserve the biodiversity of the area and its surroundings. These green belts have been observed in a few places, but they are gradually being consumed due to the increasing pace of construction and development.



Figure 3: Earlier and present-day pictures of the river



Figure 4: Earlier and present-day pictures of the river

Canals or nalas- the policy proposes 7.5 m of green belt on both sides of the canal. The concreted canals or nalas further reduce the chances for an ecosystem to strive in or around them. Nala development is one of the few schemes taken up by the local governing body in Pune. The nala near Sarasbaug garden is one such example. The canals are originally are streams which carry the rain water or the water which flows down from the hills and merges into the rivers. These are now flowing carrying unhygienic waste and garbage.

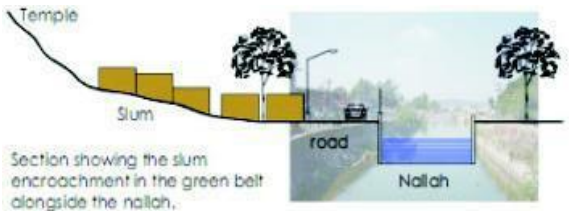


Figure 5: A section through the Parvati hill slum area and the adjoining area

Hills – As Pune sprawled, hills were susceptible to urban sprawl and deforestation. The green cover in the city had to face the brunt.

The hills have been encroached upon by slums and other buildings. The beauty of the hill which provided visual relief earlier is now a disturbing mess with buildings and diminishing greens. It seems to be a heap of concrete which is increasing day by day. The hills need to be conserved, for which the Pune Corporation has been working towards reserving stretches of these as biodiversity hotspots. This is a step forward to save the green cover in Pune.



Figure 6: A future projection of the slum encroachment on the Parvati hill



Figure 7: An older photograph of the Parvati hill (far behind)

Greens on the roads - This is one of the initiatives taken by the Pune local governing body. They have conserved trees which are older than 15 years on the road side, which also overlaps with the tree policy. The Chimaji appa road, Sinhagad Road, Jangli maharaj road, Bajirao road are few of the road stretches where these trees have been conserved. Most of these trees are evergreen trees.



Figure 8: A forest of hoardings and signages with no visual relief – Karve Road Pune



Figure 9: Jangli Maharj Road Pune – Evergreen Rain trees conserved, with a spread of 15-30 mt.

VIII. CONCLUSION

Trees and green zones have become a vital part of urban areas and the cities today. We are in a constant search for visual and mental relief from the pollution, the crowd, the continuous arena of buildings and masses of concrete which have taken us away from our natural habitat. We have created a self-owned and self-made habitat of which environment isn't an integral part. It should have been the other way around. Nevertheless, attempts have been made via the mentioned policies and acts. Initiatives have also been taken by various participatory groups, NGOs and other organizations to conserve and help revitalize the city of its green cover.

The tree policy is another step towards conserving and monitoring the green cover in the city. Since the policy has come into being, few attempts have been made to follow it. But to start somewhere is important and as we say, the rest follows.

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