

Role of urban forestry in the ecological development of Pune City.

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ABSTRACT

The urbanization enhances the socio- economic and technological growth of the city. The society is benefited in terms of employment opportunities, better lifestyle and healthcare facilities; however, the major drawback of urbanization is overcrowding and environmental degradation of the city. The need and importance of urban forestry is to be analyzed and various measures should be taken to utilize that knowledge in restoring the green cover for achieving the ecological development of a city. The growth pattern seen in the case of Pune city is the expansion of new settlements around the city core, without proper planning and understanding of urban forestry & green spaces. The scope of the research in this paper is limited to the identification of the existing issues in the urban forestry areas of Pune like the Lakes, Parks and gardens, hills, etc. and the solutions to mitigate those problems are mentioned herewith. The paper has anticipated future challenges and the scope for further research is the proposal of the areas identified for the development of urban forestry in Pune city to improve the urban greenery and create a livable space for the city dwellers.

Keywords: Urban Forestry, Urban Greenery, Environmental degradation, Ecosystem, Green infrastructure, Pune City.

RESUMEN

La urbanización potencia el crecimiento socioeconómico y tecnológico de la ciudad. La sociedad se beneficia en términos de oportunidades de empleo, mejor estilo de vida e instalaciones de atención médica; sin embargo, el principal inconveniente de la urbanización es el hacinamiento y la degradación ambiental de la ciudad. Se analizará la necesidad y la importancia de la silvicultura urbana y se tomarán diversas medidas para utilizar ese conocimiento en la restauración de la cubierta verde para lograr el desarrollo ecológico de una ciudad. El patrón de crecimiento que se observa en el caso de la ciudad de Pune es la expansión de nuevos asentamientos alrededor del centro de la ciudad,

sin una planificación y comprensión adecuadas de la silvicultura urbana y los espacios verdes. El alcance de la investigación en este documento se limita a la identificación de los problemas existentes en las áreas forestales urbanas de Pune como los lagos, parques y jardines, colinas, etc. y las soluciones para mitigar esos problemas se mencionan a continuación. El documento anticipó los desafíos futuros y el alcance para futuras investigaciones es la propuesta de las áreas identificadas para el desarrollo de la silvicultura urbana en la ciudad de Pune para mejorar la vegetación urbana y crear un espacio habitable para los habitantes de la ciudad.

Palabras clave: Silvicultura urbana, vegetación urbana, degradación ambiental, ecosistema, infraestructura verde, ciudad de Pune.

INTRODUCTION

The world is rapidly becoming an urban place and almost $\frac{3}{4}$ of the world's population is expected to live in the urban areas by 2025. The population growth has rapidly increased and people started moving to cities for employment, education and new opportunities; ultimately resulting in deterioration of natural resources and environment in urban cities all over the world. Urban forestry is the sustainable planning & planting of trees, protection and maintenance of the green cover in and around the cities for the socio- economic, ecological and environmental benefits for the people. The green cover includes the trees in the yards, streets, parks, green belts, soil & vegetation, lakes & watersheds etc. To develop the Urban forestry of a city the public involvement & support for long term investments in tree plantation and protection of green spaces is necessary.

MATERIALS AND METHODS

This research paper explains the importance and need of Urban Forestry in Pune city, it has identified the existing problems on the basis of the Empirical research methodology. The proposal of mitigation strategies has been discussed on the basis of Social, Economic, Environmental and Ecological aspects of Urban Forestry. The case studies of various Lakes, Parks & gardens, Hills, Streets etc. in Pune, is done by considering the opinions and observation of the people by means of interviews and online reviews of the place.

BENEFITS OF URBAN FORESTRY

The urban green spaces act as an overarching and influential tool which can protect the sustainability of a place through improving the quality of air, increasing property value due to their amenity and aesthetic characteristics and also makes the building energy efficient. It is a cost-effective solution for reducing the pollution, providing shade, tackling the urban heat island effect, prevention of soil erosion and carbon sequestration. According to the Food &

Agriculture organization, trees in urban areas minimize sulfur dioxide and particulate matter, eliminate significant quantities of CO₂ from the environment and emit oxygen.

CASE OF PUNE CITY

Pune is the 8th largest metropolitan city in India and 2nd largest city in Maharashtra state after Mumbai. The city is important due to its economic and industrial growth over the last 3 decades, it has developed as one of the prominent urban agglomerates in India. Between 1991 and 2001, the city grew by 40%, increasing from 1.6 million to 2.5 million and it's estimated that the population may hit 5.6 million by 2031. The city has been adversely affected by the population growth and unplanned urbanization, the destruction of natural green spaces is observed due to the increase in needs of housing and amenities. At present, Pune has approximately 46 lakh trees and the tree cover is around 21 percent. Pune urban area has seven habitats within a distance of 25 km from the center of the city thus; the development strategy has to be more sustainable and meaningful in longer terms.

GOVERNMENT PROPOSALS FOR URBAN FORESTRY IN PUNE

The Forest departments of every State along with other institutional bodies are involved in the management of the Urban Forestry of the city. The Ministry of Environment Forest and Climate Change (MoEFCC) had launched the Nagar Van Scheme on June 5th 2020 and planned to develop 200 urban forests in the coming 5 years. The Warje urban Forest, Pune is considered as a role model for this scheme. PMC has already developed 76 Gardens and 35 Gardens are under development. The plantation program on the hills like Taljai Hill -110 acres and Parvati Hills -50 acres is acquired for development by the PMC. In future, PMC has proposed to develop palm park, Mughal Garden and neighborhood parks in extended villages. PMC has also developed and maintained gardens of other Governmental Departments such as Yashada and Agriculture University Council, etc.

The list of Joint Forest Management Project proposals are Execution by Forest Department- 987.5 Acres, Execution by PMC -812.5 Acres, Plantation on 30 acres along the canals, development of Biodiversity Park- 546.5 Acres in Pashan/Baner, Sutarwadi, Hadapsar, Mohammadwadi and kondhwa bk., Plantation along the Rivers, Lakes & nallahs under JNNURM Program, Plantation by Local Organizations and NGOs with support of PMC- Smruti Van in Kothrud, Hanuman Tekdi, Fergusson College Hill, Chatushrungi Hill and Roadside Plantations in PMC Limits 50000 Plants.

PROBLEM IDENTIFICATION AND SOLUTION STRATEGIES

SR NO	LAKES IN PUNE	ISSUES	SOLUTION
1	<p>Jambhulwadi Lake, Katraj</p>  <p><i>Map 1- showing Jambhulwadi Lake. Source- Google maps</i></p>	<p>Pollution by sewage and industrial effluents Dumping of construction debris Contamination of water is causing the death of fishes</p>	<p>Cleaning of lake Planning of sewage disposal. The slum waste should not be let in the water. To develop the lake boundaries, plantation of trees to create a good ecosystem.</p>
2	<p>Katraj Lake</p>  <p><i>Map 2 showing the location of Katraj Lake. Source- Google maps</i></p>	<p>The lake is under thick cover of water hyacinth indicating its high pollution level which is suffocating its aquatic life. People residing in the surrounding areas have complained about contracting diseases like dengue and malaria.</p>	<p>Cleaning of the lake water. To create tourism opportunities. Removal of Hyacinth and desilting work of water should be done. Beautification work should be done to attract more people like Musical light shows etc.</p>
3	<p>Rajiv Gandhi Zoo Lake, Katraj</p>  <p><i>Map 3 Rajiv Gandhi Zoo Lake. Source- Google maps</i></p>	<p>The decrease of dissolved oxygen (DO) and increase in BOD level has resulted in the death of Fishes. The main cause for the degradation of the lake is the drainage pipeline. The sewage has degraded the water quality of the lake which promotes water hyacinth.</p>	<p>Restoration of the lake is required. Removal of weeds by a natural process and diversion of drainage lines is required. There is a need to place aerators in water to maintain the ecosystem of the lake. Desilting, protection, plantation, walk ways, strengthening of bunds, creation of island and marsh.</p>
4	<p>Manas Lake, Bhugaon</p>  <p><i>Map 4 Manas Lake, Bhugaon. Source- Google maps</i></p>	<p>Harmful compounds like cyanides, thiocyanates, phenolic compounds, fluorides, radioactive substances, etc. are found in the lake. The lake is polluted by dumping of construction debris and solid waste. Many illegal constructions are coming up at the lake site.</p>	<p>Proper monitoring and environmental management plans to control the release of effluents is required. The dumping of waste in the lake should be avoided to ensure that the water is not getting contaminated and proper drainage facilities should be provided.</p>
5	<p>Pashan Lake</p>  <p><i>Map 5 Pashan Lake. Source- Google maps</i></p>	<p>Pollution and contamination of water is observed due to the sewage which is let into the lake by small-scale industries, nearby houses etc. Harmful compounds like cyanides are present in the Lake.</p>	<p>The dumping of waste in the lake should be avoided to ensure that the water is not getting contaminated and proper drainage facilities should be provided. Desilting, protection, plantation, walk ways, strengthening of bunds, creation of island and marsh.</p>
6	<p>Mastani Lake, Dive Ghat, Pune</p>  <p><i>Map 6-Mastani Lake, Pune. Source- Google maps</i></p>	<p>Silt level in the lake is more. The nearby wells have dried up due to less underground water table.</p>	<p>Desilting of the lake, check on underground water table, artificial recharge of aquifers should be done to improve the water level in the lake. Study of the lineaments is necessary for understanding and improving the water storage capacity of the lake.</p>

SR NO	PARKS & GARDENS IN PUNE	ISSUES	SOLUTION
1	<p>Pula Deshpande Udyan/ Okayama Friendship Garden, Sinhgad Road</p>  <p>Map 7-Pula Deshpande Garden. Source- Google maps</p>	<ul style="list-style-type: none"> Parents face an issue to keep their children occupied in some activity. Toilets and sanitation needs to be maintained. The seating isn't sufficient during the peak hours. 	<ul style="list-style-type: none"> Installation of some good play gadgets/ equipment should be done for the kids, to keep the children engaged and enthusiastic, as stepping on the lawn is not allowed. Seating spaces should be increased.
2	<p>Saras baug, Swargate</p>  <p>Map 8-Saras baug, Swargate. Source- Google maps</p>	<ul style="list-style-type: none"> Water in the pond is not well maintained. During monsoon the water bodies sometimes get flooded. Parking space is insufficient. Littering of plastic and paper waste is seen near the food stalls. Some pathway tiles are broken. 	<ul style="list-style-type: none"> Periodic cleaning of the pond water should be done. To create a tourist attraction a laser show can be introduced in the garden, the repairing and decoration of the fountains should be done. Repairing the broken/ old elements in the garden needs to be done.
3	<p>Empress Garden/ Empress botanical garden, Camp</p>  <p>Map 9-Empress Garden. Source- Google maps</p>	<ul style="list-style-type: none"> A lot of mosquitoes are seen in the garden. The chair and benches are not maintained properly. The stagnant water is smelly and needs to be cleaned. Trash and littering is observed in the garden. More trees, plants and shrubs need to be planted. 	<ul style="list-style-type: none"> Periodical cleaning and maintenance of the park is necessary. Use of mosquito repellent spray should be done. New benches and seating arrangements should be added to cater the crowd. Renovation of the park is required with planting more trees, plants, dustbins, installation of some sculptures, art work or any eye-catching element.
4	<p>Katraj Snake Park/ Rajiv Gandhi Zoological park, Pune</p>  <p>Map 10- Katraj Snake Park. Source- Google maps</p>	<ul style="list-style-type: none"> The animals and snakes are less in number. Boating is sometimes open and rest of the time it is closed, to create an eco-tourism spot and to generate revenue the boating and other activities needs to be done without harming the ecosystem of the lake. 	<ul style="list-style-type: none"> Various species of fauna need to be added in the zoo. Scientific information and games can be added for keeping the audience engaged and occupied while in the park. The boating activities should be restarted with proper monitoring for revenue generation.
5	<p>Chittranjan Vatika Garden, Model Colony, Shivajinagar</p>  <p>Map 11- Chittranjan Vatika, Pune. Source- Google maps</p>	<ul style="list-style-type: none"> The toilet facilities are not fulfilling the standards of hygiene. The jogging/ walking track should be maintained. In the evenings, a lot of mosquitoes are observed. The number of crow is observed to be more in the garden and people face dirtiness of the crow shit on the equipment. 	<ul style="list-style-type: none"> The toilet facility needs to be improved. Payable option can be one of the solutions for maintaining the washrooms. The pathway blocks on the jogging track need to be renovated. Use of mosquito repellent spray should be done periodically. The number of crows should be reduced or tackled and often the play equipment should be cleaned
6	<p>Peshwe Energy Park, Sarasbaug road, Swargate</p>  <p>Map 12- Peshwe Energy Park, Swargate Source- Google maps</p>	<ul style="list-style-type: none"> Entry to the park is allowed only if you have a child along with you. The toy train track is very small, some play equipment needs maintenance and the rope climbing activity is not very safe for the children. Provision for filtered water and clean toilets is not there. The stagnant water in the park is not cleaned and many mosquitoes are seen in the area. 	<ul style="list-style-type: none"> The park should be open for all. This will boost tourism and ultimately increase the revenue generation of the park. Maintenance and repairing of the play gadgets and equipment should be done and safety measures should be improved. Provision for filtered drinking water and clean toilets should be done in the park for the public. The lake water needs to be cleaned and mosquito repellent spray should be done periodically.

SR NO	HILLOCKS/ FOREST IN PUNE	ISSUES	SOLUTION
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1	<p style="text-align: center;">Parvati Hill</p>  <p style="text-align: center;"><i>Map 13- Parvati Hill. Source- Google maps</i></p>	<ul style="list-style-type: none">● Littering of plastic bottles and wrappers is seen all over the hill. Good drinking water is not available on the hill top.● Maintenance of the temple and museum is required.● The greenery around the hill has reduced.● The slum pockets and traffic congestion has increased.	<ul style="list-style-type: none">● Cleaning and installation of dustbins should be done.● Provision of filtered drinking water and hygienic washrooms should be done.● The slum should be relocated.● To restore and enrich the greenery of the hill by means of conservation measures and providing protection from illegal encroachment of the hill.
2	<p style="text-align: center;">Taljai Hill</p>  <p style="text-align: center;"><i>Map 14- Taljai Hill. Source- Google maps</i></p>	<ul style="list-style-type: none">● Deforestation is observed and it has affected the ecosystem of the forest.● Garbage is seen while going to the Temple.	<ul style="list-style-type: none">● Afforestation, Installation of signage, dustbins, drives should be done along the road and public places.● Water & soil conservation measures and protection from illegal encroachment of the hill should be done.

FUTURE CHALLENGES

The Urban Forestry can face few arboricultural challenges due to the harsh weather conditions, proper care should be taken while handling the management level challenges by following a proper Urban forest management plan, having a good nursery stocking and taking utmost care post plantation. The program funding must include the maintenance, monitoring and damage costs. While planning the urban forestry of a city, a team of professional and knowledgeable staff is required, few public awareness programs should be initiated to tackle the social issues and sensitize the people towards the environment.

PROPOSAL FOR INCREASING THE URBAN GREEN COVER IN THE CITY

The scope for further research is the proposal for increasing the green cover in the city and to anticipate these future challenges, we have to consider a few factors while selecting and proposing a site for Urban Forestry in Pune city like its accessibility, presence of conservation areas, proximity to residential areas, existence of habitat protection initiatives, horticultural strategies, blue-green infrastructure and policy restrictions/guidelines for the proposed area. On the basis of these factors, Urban Forestry can be proposed along the river banks, nallas, road side plantation, terrace gardens and plantation around the built structure and open spaces.

CONCLUSION

On the basis of earlier discussion, we can conclude that Pune's green cover is not adequate and it is necessary to make the city a livable place for the people by tackling the problems and proposing solutions for future challenges. The lakes of Pune district have a great potential to create ecotourism, if it is developed and managed efficiently by restoring the lake, desilting, protecting, creating walkways, strengthening of bunds, creation of island and marsh. Monitoring the removal of Hyacinth and weed, planning proper drainage lines and controlling the release of effluents in the lake can improve the ecology of the lake. The nallas can be restored by the means of bioremediation, plantation and periodical cleaning of the nallas. The Parks & Gardens in Pune needs to be improved by providing

proper seating facilities, repairing the play equipment, spraying the mosquito repellent in the parks, making provision of clean and filtered drinking water and providing hygienic washroom facilities. Afforestation policies should be implemented throughout the city in full swing to tackle the major threat of air pollution and to increase the urban greenery. The heat island effect needs to be mitigated from the urban areas by providing cool roofs, cool pavements, green roofs and increasing the urban forestry index of the city. A Green belt or Green corridor can be created by planting trees and vegetation along the rivers, streams, canals, highways and other transportation routes. Public opinion and participation should be considered while planning the urban development.

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