

THE GREENS OF MYSORE: An Appraisal of Their Contribution to Environment

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Abstract: Mysore is one of the better maintained million plus cities of India. Its green endowments including water bodies are well known. Formerly a city ruled by kings in British India, Mysore from the point of view of green and water body infrastructure has been well administered. But due to pressures of urbanization and its specificities environmental elements are deteriorating. These need constant monitoring and up-gradation; and have their social, economic and ecological facets.

Vulnerability concomitant to urbanization has been frequently articulated. Demands for land, water and energy have increased. The need for waste management, sanitation, supply of potable water and wholesome regeneration of lakes with rain water inflows has increased and become complex and expensive amidst several intertwined compulsions and priorities. Administration is often seen to be deficient in providing the necessary personnel and monetary and physical resources.

Parks and the famous Chamundi Hills are traditionally parts of the green of Mysore. Parks are planned and maintained by civic authorities like the Mysore City Corporation (MCC) and the Mysore Urban Development Authority (MUDA). Newly developed areas are provided with earmarked amenity spaces yet to be developed and operationalized. Many private households and institutions have their own gardens or parks contributing handsomely to the city's environmental health. Chamundi Hills, all across their slopes have a lot of trees, shrubs and bowers making Mysore salubrious. But all these green entities need to be improved and expert efforts have to be identified and enlisted.

Keywords: Green endowments, urbanization, environmental quality, ecological up-gradation, coordination of green management, planning stock, water bodies.

I. INTRODUCTION

A green area has to create value, civic pride and improved quality of life for urban residents. The value of green spaces for human beings is not restricted to merely recreational functions. They also contribute substantially towards improving the general standards and patterns of life in a city. This contribution ranges from tangibly clean and healthful endowments to sound insulation and environmental purification (Gowda, K & Sridhara M. V. 2000). Trees and shrubs, particularly when they are densely spread over significantly large areas, can contribute to prevent erosion of soil to fertility increase and to abatement of summer heat.

The management of green spaces and benefits of caring for trees, and the emphasis on nature education, training and publicity are very much needed and are all a part of urban up-gradation. Plant species that bear edible berries, fruits and nectar will have to be raised for attracting and providing the birds with suitable habitat. In the Indian context of economic development maintenance of green areas contributes substantially towards enhancing employment and supporting livelihood.

Here in this paper, the authors seek to provide an appraisal of many aspects of green administration in

the City. Obviously, the strengths and weaknesses are proposed to be recorded and suggestions made. This is indeed an empirical study.

II. THE STUDY AREA – MYSORE CITY

Mysore is known for its magnificent palaces and other majestic buildings, well laid out gardens and tree lined boulevards, shimmering silks and sandalwood; the 'City Royale' always figures in the tourist's itinerary. The City has to continue to grow in an orderly and environment-friendly way and should be growing in aesthetic content – parks, public squares, pretty sidewalks, waterfront promenades and green concourses. Mysore is currently undergoing extensive and varied urban expansion. There is a need for a strategic vision involving adaptive and realistic tools and new urban planning practices/methods.

Mysore is located at an altitude of 770 meters above MSL and situated in the larger south central part of the Indian Deccan Plateau at 12° 18' North latitude and 76° 12' East longitude. The gradient within the city ranges from 1 to 100 m to 1 to 50 m. Its situation amidst beautiful sylvan surroundings with the majestic Chamundi Hills (1085 m) as a backdrop is indeed unique. The northern part of the city drains into the river Cauvery and the southern part into the river *Kabini*, a tributary of the *Cauvery*.

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The climate of Mysore can be described as ‘tropical monsoon type’. Mysore manifests a very hospitable climate all through the year, where temperatures vary between 20⁰ C and 30⁰ C. Neither too hot nor too cold, it’s always pleasant although some climatic changes have become visible as the surrounding forest areas have become greatly depleted. The city lies in the rain shadow region of the Western Ghats and, therefore, receives no more than 850 mm rainfall per annum mainly between the months of April and November. Even in the rainy season, relative humidity does not exceed 60 percent. April and May are the hottest months. Being located on an undulating plateau, the city and its surroundings have large tracts of land suitable for forests and pastures. Its forests are describable as deciduous (see **Plate 1&2**).



Plate 1. Deciduous forest; nature in Mysore leaves shed during January and February



Plate 2. Deciduous forest with lush green Manasagotri Campus

Mysore city is having more than a million population at present. Increase in population and unbridled urbanization of Mysore city have nibbled away green spaces as the city continues to expand horizontally. The Comprehensive Development Plan (CDP) for Mysore City has the Local Planning Area (LPA) of 233.13 km² and conurbation area of 92.21km² (see **Fig. 1**) While planning for new residential layouts, existing green spaces may get cleared up and give way to public and semi-public buildings or houses. Here, the need to add on new areas to the green belt gains importance. Even as the city grows, green belt also has to expand.

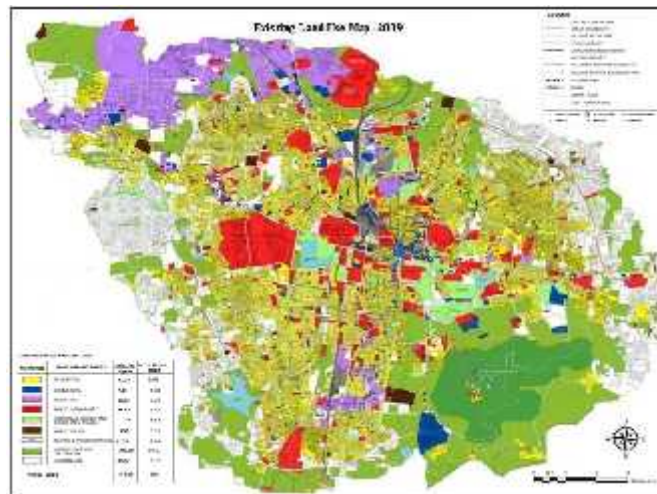


Fig. 1 Existing Land Use Map of Mysore City – 2009. Source: Mysore Urban Development Authority (MUDA)

Satellite imagery of the city shows the wide natural valleys with greenery running through the various parts of the city (see **Fig. 2**). On the southeast Chamundi Hill and its associated ecosystem embody a very huge green area. These valleys facilitate effective drainage and prevention of urban floods and are generally quite green. These are the areas that need to be declared green areas and protected from adverse urban impact as they open up several eco-endangering

economic prospects. It is important to adopt an integrated approach to conservation of green areas so that contiguous stretches can be formed and their ecological benefits are enhanced; fragmentation of green areas has to be minimized as far as possible. It is possible to derive synergic benefits from conserving and managing the natural valleys as green areas and make Mysore a sustainable city rather than an urban concrete jungle.



Fig. 2 Satellite image of Mysore city

The City is divided into a number of use Zones, considered as residential, commercial, industrial, public, semi-public, etc. Each zone has its own regulations and features as the same set of regulations cannot be applied obviously to all of them. The objectives of land use planning may in brief be summarized as: improving physical environment, strengthening urban economy, ecological up-gradation and fostering of social values. An analysis of the land use pattern of Mysore shows a preference towards residential development which covers a greater portion of the city, and this is expected to increase in the next few years.

A city rich in culture and heritage, is also known for its sandal wood art and fragrance, silk, flora, fauna, handicrafts, classical music, architectural wonders and of course Mysore is renowned for its educational and research centers. It is a shoppers' delight offering right from incense sticks to exquisite silk sarees.

III. THE GREENS OF MYSORE

The sylvan manifestations of nature in the urban environment can foster a sense of wellbeing; belonging and self-esteem; enrich the quality of environment; feeling of physical stress reduction, quality of self-awareness and self-esteem influence tourism and promote employment activities; can contribute to income generation from lopping of trees and compost manure production; an opportunity for understanding and appreciation of nature and the need to conserve it; and also conservation of wild life and natural open space can safeguard environmental assets for future generation. A city's green cover is priceless. It embodies the various trees and other greenery as they add to the aesthetics of the cityscape, and contribute immensely to a relaxed and healthy ambience. Design of a city's green elements is an important part of urban planning.

Since early 20th century, visionaries such as Sir K. Sheshadri Iyer, Jamsetji Nusserwanji Tata, Sir M.

Vishveshwaraya, and Sir Mirza Ismail emphasized the importance of trees, parks and green recreational spaces beyond their visual contribution in a cityscape. But in our hurry to "modernize" through rapid economic growth and the expediency of ever increasing types and intensity of land use, urban aesthetics and environmental upkeep and enhancement are being sidelined (Janardhan Roye, 2009). Mysore is known for many institutional and public/civic buildings amidst huge open spaces (see **Plates 3&4**).



Plates 3&4. General view of residential green with an abundance of coconut trees

The categories of green areas in Mysore are **institutional greens, regional and neighborhood parks, avenue plantations, boulevards and road median greenery, city forests, historical landscapes, sports complexes, lakes and its surrounding areas, green belts**, etc (see Fig. 3). These green elements provide nests for lots of bird species and sometimes rabbits also are seen in these. These quasi-forests keep the campuses cool and provide a welcome sense of retreat for the visitors and workmen, students and staff etc., thereby minimizing the psychological stress amidst routine. Aesthetics are generally given priority while planting the saplings. Ornamental trees are planted at the periphery of the green area and trees for yield are planted inside. This program is undertaken by the authorities to develop

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and maintain bio-diversity and check soil erosion and hold moisture balance in the campus premises.



Fig.3 Mysore City: Location of Parks, Open Spaces, Green Areas and Lakes/Tanks. Source: MUDA

The gardens are generally neatly planned; lawns, flowering plants and hedge cuts and topiary are ornamentally laid out. It is a delightful experience for the passersby. During summer these exhibit their green foliage and exude fragrance and could well be of economical value; their seeds if conserved yield oil.

A. Institutional Greenery

Mysore is known for many institutional and public/civic buildings (see Plate 5, 6, 7 &8). The major open space and recreational centers are University of Mysore, Sri Jayachamarajendra College of Engineering, Regional Institute of Education, All India Institute of Speech and Hearing, Telecommunication Offices, Central Food Technological Research Institute, zoological gardens, many Schools and Colleges, race course and golf club, hotels and resorts, various administrative offices, quite a number of small institutional areas, cultural and religious centers and so on which provide large scale lung space with preserved and often manicured greenery in the city.



Plate 6. Public open spaces – Clock Tower and Town Hall in Mysore CBD



Plate 7. Open spaces of public institutions – District Commissioner's Office



Plate 5. Amba Vilas Palace, in the CBD of Mysore



Plate 8. Institutional Green – Part of the Infosys Campus

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Another important green space is Chamundi Hill which is a unique landmark of Mysore City and is considered as one of the rich heritage sites having religious, tourism and ecological importance (see **Plate 9&10**). It acts as catchments for the more than ten surrounding lakes. It has a rich biodiversity with 450 plant species of which about 50 are medicinal plants, 145 species of birds and 60 species of butterflies. There are remarkable improvements in the raising of various plant species in the western parts of the hill, thanks to the efforts of the Department of Forests.



Plate. 9 A view of Chamundi Hills - protection and conservation of flora and fauna



Plate 10. Ecological endowments of Mysore City

The gardens around the palace temples contain sacred trees and plants, providing the flowers needed daily for worship in the temple. They include Aswatha, neem, mango, Bilwa, Shami, Champak trees and Tulsi plants.

The new extensions have a row of Honge and other trees, spreading beautiful aroma during its flowering season. A series of Gul Mohars or May Flower Trees have been planted on either sides of several roads. During May-June, the trees spread a carpet of fiery red and golden color flowers on the roads.

i) Green Belt- It is defined as the management of forest and other plant communities in and near cities for the primary purpose of providing open space, recreational opportunities and other amenities including prevention of environmental degradation. The green belt is for the purpose of protecting and preserving the flora, fauna and scenic beauties and as a visual buffer against the often-ungainly industrial or utility areas and sprawls; and as a means to replenish oxygen – mitigation of carbon dioxide and carbon monoxide poisoning.

The Mysore Urban Development Authority has reserved 356 sq. kms as Green Belt between the

conurbation and the LPA boundary with a view to ensure better weather conditions all through the year. Arrangements have to be augmented to monitor and increase green activities in the green belt area (see **Fig.3**).

ii) Urban Forestry - It is a specialized type of forestry that has the objective of choosing, cultivation and management of trees for their actual and potential contribution to the physical, social and economic well being of the urban community. It embraces a multi-dimensional system that includes maintenance of water sheds, water bodies, biological control of weeds and pests, human and animal habitats, outdoor recreation facilities, landscape design, recycling of municipal wastes, tree care in general and future production of wood and fiber as raw material. The Forest Department has taken up massive tree plantation in the open areas within Mysore city.

B. Residential Greens

Avenue trees are found along the sides of many major roads in the city. Apart from avenue trees, coconut trees are prominent within residential plots in Saraswathipuram, V. V. Mohalla, Jayalakshampuram, Vidyaranyapuram, and also the promising areas for trees are: Lalithadri Nagar, Shanthaveri Gopal Gowda Nagar, Vidya Nagar and Rabindranath Tagore Nagar, Vijayanagar IV Stage, Metagalli and Yelwal, Hootagalli and Dattagalli, Sathagalli, JSS Layout, Police Layout, KC Layout, Roopa Nagar, JP Nagar, University Layout, Srirampura, BEML Layout, Rajarajeshwari Nagar, Vasanth Nagar and Ambedkar Nagar among many others.

The city working group on environmental protection and pollution control has identified **13 residential areas** inside Mysore City Corporation limits. The areas include Jayalakshampuram, Yadavgi, Saraswathipuram, Bannimantap, Vidyaranyapuram, Gokulam 1st Stage and 2nd Stage, Gayathripuram, Siddarthanagar, Kuvempunagar, Jayanagar, Mahadevapura Extension, Metagalli and Industrial suburb areas (see **Plates 11, 12, &13**). There are 10 areas coming under the Mysore Urban Development Authority including Ramakrishna Nagar 1st Stage and 2nd Stage, Datagalli, Srirampura, Alanahally Extension, Kesare, Hebbal 1st Stage, 2nd Stage and 3rd Stage, Vijayanagar 1st Stage, 2nd Stage, 3rd Stage and 4th Stage and Bogadi 1st Stage and 2nd Stage for planting trees.



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Plates. 11&12 Examples of residential green in Kuvempu Nagar



Plate 13. Author Krishne Gowda's residence with Bougainville flowers

C. Regional Parks, Neighborhood Parks and Gardens

The mental health and emotional well being of a people is positively influenced by green spaces and interaction with other elements of nature. In this way, parks enhance the quality of life in our cities. Parks provide a converging space for communities, a place for relaxation or recreation and the opportunity to experience nature in an otherwise denatured urban environment. Having a well maintained and managed park near one's residence can increase its value considerably.

Mysore city has a total of 650 big and small parks. The Mysore City Corporation (MCC) has about 100 members of staff to maintain 218 parks in its control and is getting 442 parks developed in new layouts developed by the Mysore Urban Development Authority (MUDA). The city has many parks that are just as old as heritage buildings (see plates 14&15).

The Cheluvamba Park in Yadavagiri is among the largest of the well-maintained parks. There are several parks in the city in the range of 4 to 5 hectares of area. Not many out of the 650 parks in the city measure less than half a hectare.



Plate 14. Entrance of the well maintained residential park in Kuvempu Nagar (next to Kamakshi Hospital)



Plate 15. Children's play area within the Park



Plate 16. Bonsai Garden within the Sri Ganapathi Sachidananda Ashram

The Mysore city has a science Park, one of the rarest of its kind and is situated in the premises of Regional Institute of Education. The city has a park exclusively for the visually impaired which is located opposite to the Curzon Park. The theme of this park is 'touch, feel and understand'. With its background music the blind can visualize nature. A unique herbal park has been developed in this city.

In Mysore, a **Bonsai Garden** called *Kishkindha Vana* is located within the Sri Ganapathi Sachidananda Ashram on Nanjangud road just 3 kms from the city centre (see Plate 16). In a highly urbanized setting, it may sometimes be very difficult to show a tree which grows in deep jungles. Although one has access to dedicated magazines and television channels, nothing can replace direct experience. In such circumstances, the Bonsai concept can be of great help. Bonsai technique allows us to have a miniature forest. Just as well-maintained zoos can be great assets to a city, bonsai gardens too can be of immense value.

The **Zoological Garden** (founded in 1892) is named after its founder, the erstwhile Maharaja Chamarajendra Wodeyar, this 40.5 hectares park houses the Mysore zoo and is located just one kilometer away from the city center (see Fig. 4). It is home to some 2,000 animals belonging to 200 different species, fascinating among them being the royal Bengal Tiger, Giraffe, Indian and African Elephant, White Tiger, Lion, Rhino, Nilgiri langur, Himalayan Brown Bear, Hippopotamus and the Tapir, among many others.

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Fig. 4 Satellite image of Chamarajendra Zoological Gardens located in the Eastern part of CBD

With its profuse cover of vegetation and meticulous landscaping, it provides near-natural environment to the zoo animals. It has to its credit the breeding of rare animals and largest mammals in captivity and hence ranked among the best zoos. 35 species of ornamental plants and 85 species of trees from India and abroad beautify the landscape of the zoo.

The zoo offers plenty of amenities to the visitors like cobbled walkways, direction signs, layout maps, guides, library, information brochures, snack kiosks, clean drinking water, public conveniences, ample places to sit down and play areas for children. About 2 million visitors visit this Zoo every year which indicates its popularity.

d. Avenue plantations, boulevards and road median greenery

The Mysore Maharajas, right from Krishnaraja Wodeyar III up to Jayachamaraja Wodeyar, the last ruler of the *Yadu* dynasty, took great care in promoting the aesthetic value of their city's famous roads and streets adorned with the choicest trees. Even today, the city has a series of lush green trees with enchanting flowers, in one season or the other. It is a pleasure to walk on these streets (see **Plate 17, 18, 19**).



Plate 17. Well grown avenue trees next to Central Food Technological Research Institute Campus located in the western part of CBD of Mysore.



Plate 18 Lush avenue trees opposite to Kalamandira Road.



Plate 19 Lush green trees with enchanting flowers in the Jhanshi Lakshmi bai Road

They planned the selection of trees so well, it hindered neither the beauty of the palatial buildings the Maharajas built for various purposes, nor the traffic, which of course was not as dense as it is today. The main thoroughfare, Sayyaji Rao Road, had flowering trees growing straight and tall, obstructing none. The long white flowers (to find one such tree behind the Chamundi Guest House on Dewan's Road) spread a beautiful fragrance all around.

Another famous road known for its beautiful avenue trees has been the 100 feet road or the Chamaraja Road, now a double road. On either side are thick and lush grown rain trees, with wide-spread green canopies, not allowing any sunshine on the road even during the hottest of summer days! The road from the Race Course almost up to the Lalitha Mahal Palace has a series of huge rain trees, giving shelter to men and horses which often pass on this road. It is a pleasure to take an evening walk on this road after resting a while on the stone benches of the Karanji Tank. Another royal road from the hind entrance of the Palace to the Jagan Mohan Palace, called the Jagan Mohan Palace Road, has rows of beautiful Jacaranda trees with full of bell-shaped blue flowers. The adjacent Seetha Vilas Road has an excellent row of well-grown neem trees, now a treasured variety for its herbal value.

There is a widespread danger or prospect of destruction to the old scenic trees and strings of flowering bushes, grassy patches and roadside greenery. At the same time a series of callous acts on green cover is unfolding on a regular and routine basis. Trees wither and crash due to lack of aeration

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and watering to the roots, as a result of unimaginative concrete pavements (see Plate 20). For widening of roads and drains or laying of underground cables, the anchorage area of long existing trees get destroyed. Streets are frequently littered with branches and leaves following the mayhem heaped on them by chopper-wielding state electricity gang-men clearing the way for overhead lines (see Plate 21).



Plate 20. Lack of aeration and watering to the roots – 1st main in Saraswathipuram.



Plate 21. Avenue trees are chopped by electricity gangmen clearing the way for overhead lines – Manasgangotri Campus

The continuous danger of destruction to the green cover has already resulted in an unhealthy rise in surface temperatures and related changes in climate like heightened toxic content in the air, and noise pollution. It is no surprise that incidents of vulnerability to stress, road rage, nervous tension and other psychic and medical problems among adults and children are mounting. Sparrows and other birds have long become rare and we are witnessing the natural endowments or wholesomeness giving way to a plethora of pharmacies, clinics, and hospitals in the landscape.

Civic authorities (MCC & MUDA), Electricity (CHESCORP), Telephone (BSNL) and Police departments keep endangering trees mercilessly in the name of pruning / trimming / development. The authorities have now started widening some of the major roads in recent years for easy movements of vehicles. Axing of trees along roadsides seems to be inevitable in view of ever increasing vehicular traffic and the hugeness of vehicles.

Well-developed trees exist along major roadsides and the authorities are endeavoring hard to maintain these trees and have been planted one in every 10 meters. Of these newly planted tree saplings of different varieties, substantially many are surviving and the authorities are attending to the problem of preserving planted saplings – the avenue trees as well as the ones in open space.

The total road network of the city was 335 kms in 1971. It increased to 432 kms in 1981, which accounts for 29 percent increase over a decade. There are 48 main roads in the city covering a total length of around 58 kms. As many layouts have developed between 1981-1991, the total road length exceeds 600 kms. The road capacity in older parts of the city has remained the same while the quantum of traffic has increased significantly. Now the total municipal roads have increased to more than 1093 kms (see Fig. 5). The road network of the city includes three ring roads, viz. outer ring road, intermediate ring road and inner ring road and also arterial roads, sub-arterial roads, collector roads, and others. The three ring roads not only collect traffic from other roads but also act as bypass roads at their respective locations in order to minimize congestion especially at the core of the city.

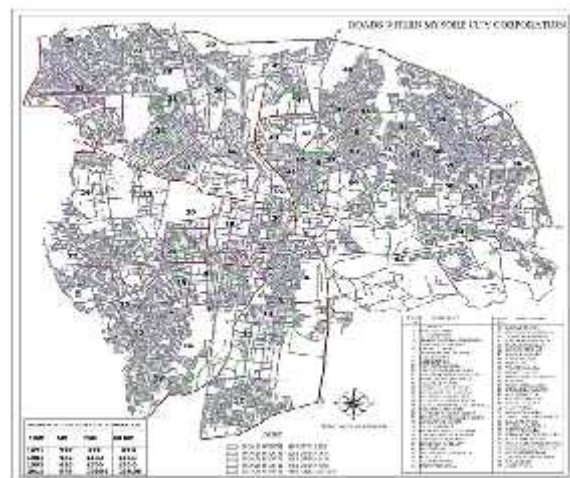


Fig. 5 The network of roads and streets in Mysore city

Cutting Avenue Trees for widening the Roads - Nearly two dozen giant trees were felled on the Krishnaraja Sagar Road to make space for broadening the railway bridge and widening the underpass near the railway station (see Plates 22& 23).

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Plate 22. Cutting avenue trees for road widening in Krishnaraja Sagar Road - close to the Railway Station



Plate 23. Cutting avenue trees for road widening in Lalitha Mahal Road

These included widening of the railway bridge to lay three pairs of tracks to facilitate. Trains coming from Chamarajanagar and Nanjangud to switch tracks, before entering the platform at the Mysore railway station. Officials also stated that the bridge had to be lowered by 1.2 m to 1.4 m as the existing gradient of the track on the Mysore-Chamarajanagar line was steep; as per the new safety norms of the Indian Railways, the gradient had to be reduced from 1:190 m to 1:260 m. Because of this, the road underneath had to be re-laid at a lower level. The existing gap between the road and the bridge was reckoned to be around 4.5 m and if the bridge was lowered by 1.4 meters, the gap would be reduced further and safety would be compromised.

But officials pointed out that there were water pipelines criss-crossing the road at lower depths and hence if the pipes were to be suitably re-laid, the trees on the surface had to be felled. The existing road under the bridge would also be widened to accommodate four lanes to cope with the increase in traffic. It was inevitable that the trees had to be removed, the officials added.

The authorities concerned in the water works department say that these incidents are common when it comes to providing amenities in urban areas and have to be accepted by the people so that civic amenities are improved.

Roots of big trees have a tendency of growing deeper and farther in search of moisture. The small leaks in the pipelines attract the feeder-roots that are capable

of penetrating into the smallest holes in the pipeline and then grow in size within the pipe, causing blockages and ruptures which eventually hinder water supply,' the water authorities pointed out the necessity of chopping down such roots that posed a threat to the pipelines.

IV. PLANT NURSERIES IN MYSORE: AVAILABILITY OF PLANTING STOCK

Planting material may be produced in nurseries run by public bodies (Departments such as Urban Forestry, Horticulture or others) (see plates 24&25), in private nurseries (more than 20) (see plate 26), or by major individual institutions (see plate 27) for their own use. Trees planted on public access lands are often obtained from nurseries run by the Department of Urban Forestry in Mysore Division. The only problem is that limited species are available in public nurseries. Private nurseries exist in many places in Mysore city; they work on a smaller scale and concentrate on selling of saplings which are in high demand. As they are often engaged in the production of ornamental and fruit tree species, they may add significantly to the availability of species. Avoidance of mono culture in tree plantation is an item of ecological value worthy of pursuit.



Plate 24. Urban Forestry plant nurseries – next to Kukkarahalli Lake.



Plate 25. Government plant nurseries



Plate 26. Private flower, fruits and tree nursery

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Plate 27. Mysore University Campus - plant clinic and nursery

Experts have identified a few species that are considered favorable to Mysore's climatic conditions and soil. According to them, species such as champaka, pongamia pinnata, cassia spectabills, casia javanica and jacaranda may be planted. As Mysore is fast growing and many new areas are coming up, there is scope for tree plantation to forestall and minimize environmental pollution and soil erosion and to promote ground aquaeaction. That way, tree plantation can almost always be clubbed with rain water conservation and harvesting and maintenance of storm water drains. Wherever possible, large shady trees are preferable to raising and maintenance of lawns; trees are more efficient in photosynthesis and conversion of carbon dioxide into oxygen.

V. LAKES AND ITS SURROUNDING REGIONS:

Mysore city has three relatively healthy and surviving water bodies - Kukkarahalli, Karanji and Lingambudhi moderately supporting bio-diversity. At present, there are about 5 major and 20 smaller water bodies greatly contributing to the city's ecological health and add to its beauty and calmness. These lakes are popular picnic spots and are frequented by nature lovers as they attract a number of migratory birds. The area around these lakes is lush green and therefore a good place to relax after a day's work.

Many water bodies of Mysore and its surroundings are in different stages of decay including eutrophy (inadequacy of aquatic oxygen to sustain fish and other creatures). They are generally not getting recharged with rain water duly. Haphazard human interventions over the years have caused this deterioration. Inadequately and unperspectively planned urbanization including topographical interventions and land use have disturbed rain water flow-channels into tanks endangering aquatic life. Quality water availability to various types of users has become jeopardized.

In Mysore, some Lakes have disappeared and in their place stand towering symbols of urbanization, irresponsibility and lack of love for nature or its beauty. To cite an example, the famous Doddakere Lake is now the venue of *Dasara* Exhibition and football grounds. The Jeevanna Rayanakatte near City

Railway Station and Subbarayanakere on the Chamaraja Double Road have both dried up and have become playgrounds and parks. There are many lakes small and big which have met their end due to lack of will on the part of authorities and the citizens. Greed for urban land is the major cause behind the destruction of lakes.

These lakes/tanks contribute to ground water recharging, support livelihood by way of fishing and grazing, and quench the thirst of the bovine population and other types of fauna and supply the water needs of wild birds and animals.

Topography and Hydrology - The topographic setting of the city has radial slopes towards east and south with a smooth ridge running west to east and south; rainfall over the ridge area gets distributed and flows east or south along the low gradient slopes. These naturally undulating terrains and valleys, lend themselves perfectly to the development of lakes that can capture and store rainwater. A series of shallow tanks varying in size are developed. The gentle topography has also good potential for ground water development.

Each lake stores rain water from its catchments with excess flows spilling downstream into the next lake. The storm water runs through drains only. These drains often carry sewage in it, which results in the lakes getting polluted.

The undulating topography of Mysore has enabled the building of lake chains in the vicinity. The practice of encroaching lakes for various construction activities has led to the problems of flooding, since this has disturbed the chain like integrity of lakes. These lakes are facing other problems too such as pollution from sewage and heavy metal contamination, the negligent attitudes of short-sighted politicians and a subservient or indifferent bureaucracy. Faulty governance and overcrowding of the city beyond its infrastructural limits are to blame for the languishing of city's lakes.



Plate 28. Lakes are getting polluted - drains often carry sewage

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The authors have found that most of the lakes are infested with weeds and the area near the lakes has heaps of garbage thereby making the water bodies completely unfit for recreation and other wholesome uses. "Lakes are getting degraded beyond retrieval. Encroachment, siltation, weed infestation, discharge of effluents both industrial and domestic are hastening the death of lakes, where besides being polluted due to sewage leakages, major portion of the lake is occupied by weeds. The field study revealed that many areas do not have planned sewerage systems and thus, discharge the sewage into the open drains. The

main problems facing these lakes in Mysore is from the loss of the catchment area, sewage inflow, to disturbance from fishing and poor redesign plans and efforts. The tradition of bore well is a significant reason for the deliberate neglect of tank systems in urban areas.

i) A Case Study of Karanji Lake

The Karanji Lake, situated at the foot of Chamundi Hills, east of the Mysore Zoo, is known for its largeness and serenity. It is famous not only for its natural beauty, but also for the variety of winged visitors from far off lands (see **Plates 32 & 33**).



Plate 32. Karanji Lake - adjacent to the Mysore Zoo



Plate 33. Karanji Lake – Boating facilities to the visitors

The 90 hectares lake area, managed by the Mysore Zoo, has a butterfly park, and a walk-through aviary. While water-spread area is about 55 hectares, the foreshore area measures about 35 hectares. This aviary is considered to be the biggest walk-through aviary in the country. Apart from this, there is also the Regional Museum of Natural History on the banks of the lake.

Fearing the death of the lake, the Zoo authorities restored the lake by spending nearly Rs. 18 million. Following the restoration work including removal of weeds and pollutants from the water body, the lake started attracting birds again from other places. Apart from these birds and butterflies, there is a lot of life in the area, like mongoose, foxes and wild cats. It is hoped that the lives of these animals,

part of the symbiotic eco-system, are not disturbed as a result of development. A giant fountain which can spew water up to 40 feet was added as an attraction. In this eco-complex, a nursery of medicinal plants has also been developed.

ii) Kukkarahalli: Lake and it's Environ

Kukkarahalli Lake called Kukkarahalli Kere (Lake is 'Kere' in local Kannada language), is located in the heart of Mysore City, adjoins Manasagangotri within the University of Mysore campus, the Kalamandira and the Central Food Technological Research Institute campus. It was constructed during 1884 by Mummadi Krishnaraja Wodeyar to provide water for irrigation to about 4000 hectares of land outside the city (http://en.wikipedia.org/wiki/Kukkarahalli_lake).

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The Lake also used to be a source of water supply to the city of Mysore but over the years, sewage and excessive land encroachments (mostly illegal) and blockage and unplanned diversion of water flow sources almost led to eutrophication of the lake. The University of Mysore and the citizen forums of Mysore continue to make efforts to preserve the lake by implementing several remedial measures. The maximum depth of lake is reported to be 5 m (16feet). The east-west bund holds water on one side. Sandy loam to clay loam forms the dominant geological ambience of the Lake. On the northern side another temporary bund hold back the direct flow of waste water into the lake.

Now the Lake is spread over 58 hectares within the part of the prestigious Mysore University campus. Surroundings of tank, gardens, lawns and avenues of campus accommodate 432 species of plants classified into 85 families (Rao &Razi, 1974). In addition, campuses of Central Food Technological Research Institute, Regional Institute of Education, All India Institute of Speech and Hearing, Chandravana, and Mysore University makes vast stretches of green patch supporting varied life forms (see **Plate 34&35**).



Plate 34. Kukkarahalli Lake – surrounded by thick vegetation within the Mysore University Campus



Plate 35 Panoramic view of Kukkarahalli Lake

The lake was once a big attraction to bird watchers. According to Naturalists, about 176 species of birds (a large number of them migratory birds, including birds from Siberia) numbering 10,000 to 15,000 visit the lake during winter to roost. Organized bird watching expeditions around the lake used to be actively pursued by the **Mysore Amateur Naturalists** (MAN) Association. The birds now found in the lake precincts (some of the birds are *pictured in the gallery*) are spot-billed Pelican, Little Cormorant, Painted Storks, Openbill Storks, Eurasian Spoonbills, Black crowned Night Herons, and Oriental Darters, Birdlife International has included Kukkarahalli Lake in the list of 38

important Bird Areas in the State or Karnataka (see **Plate 36**).

During the year 2003-2004, with grants of about US \$ 0.2 million (Rs 91 lakhs) provided by the Asian Development Bank, Karnataka Urban Infrastructure Development Corporation (KUIDFC) in association with the University of Mysore under whose jurisdiction the Lake falls and citizens groups, carried out the restoration works of the lake. In order to effectively minimize the arrival of pollutants and wastes into the lake ecosystem, the measures implemented have covered the following with funds provided by the Asian Development Bank.



Plate 36 Island for birds - Kukkarahalli Lake

- Widening of the bund on the southern side,
- Forming a new walkway on the western side for the benefit of large numbers of morning walkers who visit the lake,
- Shaded (Bougainvillea creepers) stone benches for visitors to sit, relax and enjoy the scenic serenity of the lake,
- Improving the eastern and the northern pathway,
- Fencing of the lake perimeter,
- The iron watch tower (within the lake) about 100 feet (30 m) from the shores has been restored,
- Lighting arrangement along the southern bund,
- Adopting rainwater harvesting methods to improve the quality and quantity of water inflows,
- Adopting aeration of water techniques: boating is one of the methods widely adopted - a boating center has been established,
- Removal of algae manually,
- Engineering methods to clean the boundary regions of the lake such as by desilting and opening of the intake channel,
- Ban on immersion of idols during festivals,
- Ban on dumping of medical waste in the lake,
- Increased security system to restrict human interference,
- Increased aquaculture,
- Stakeholders participation for collective ownership and responsibility to restoration activities.

iii) Lingambudhi Lake

Lingambudhi stands first in terms of richness entirely due to its location bordering a growing city. One and half decades ago Lingambudhi Lake was in the outskirts of Mysore City, but now it is engulfed on all the sides by the growing city. It has a catchment area of 45 km². Lake Fringe that was without tree coverage in the beginning of the observation has grown into a thicket by 1997–98 courtesy State Forest Departments’ social forestry scheme and began thinning by 2002–03 due to firewood collection and natural death of fast growing trees that were planted. Forest department officially declared the lake spread over 217 acres, as Lingambudhi Bird Sanctuary in 2001.



Plate 37. Lingambudhi Lake – Year by year water storage reduced due to urbanization.



Plate 38. Completely dry due to draught conditions in the year 2012.

A total of around 210 birds have been spotted here including the local and the migrants. Breeding activity of Pelicans, Spoon bills, Ibises, Grey Herons and Cormorants were recorded here for two consecutive years, 2000 and 2001. Lake got completely filled once in last one decade. Twice, there were reports of fish and birds death. On a single day 54 species of Butterflies were recorded in 2001. Vegetation, mainly supporting butterfly

population like *Cadabaspp*, *Criticaliaspp*, *Cassis spp*, and variety of grasses was abundant at that time. Thicket that provides incessant shade throughout the day provides shelter to these migratory butterflies roosting.

The other important lakes are Mariayappana (Bogadi) Lake, Dalvoy Lake, and Hebbal Lake with the city.



Plate 38. Mariayappana (Bogadi) Lake



Plate 39. Dalvoy Lake



Plate 40. Hebbal Lake

VI. MOVING TOWARDS A GREENER MYSORE

To promote a green environment in a residential or industrial area, the first step is to regulate development or building construction activities. Appropriately, it is known as “The Scenic Zone” in city planning law and it is playing an important role in the preservation of urban green through its proper maintenance. The other is to preserve green areas in their existing condition and wherever possible to enrich and diversify them.

The Vision 2020 Document for Mysore prepared by the Mysore Agenda Task Force (MATF) emphasizes green belt development. The project report notes that rapid urbanization has led to accumulation of silt in many water bodies and they have become marshy land and thus green patches in residential areas are fast diminishing. Wetlands (Management and Conservation) Rules, 2010 was issued by Ministry of Environment and Forests (MOEF), for conservation and management of wetlands. The Lake Development Authority is an autonomous regulatory, planning and policy body for Protection, Conservation, Reclamation, Restoration, Regeneration and Integrated Development of Lakes, whether natural or man-made in the state of Karnataka

(<http://www.karunadu.gov.in/lda/activities.html>). The Authority has been formed to take remedial measures and to restore and revitalize the dying lakes and to co-ordinate efforts of various organizations working for these objectives. The Authority would also arrange for financial support from various funding agencies. The Authority would prepare a database about lakes with the help of satellite imageries and Survey of India top-sheets and ground inspection. The Authority would also concentrate on monitoring of lakes. Policy formulation regarding public participation in lake development is also being worked out. Apart from these the Authority would take up actual implementation of various state and centrally sponsored schemes for lake development.

It has been suggested that the state of ecological and environmental repair of Mysore urban and industrial areas should be ensured by increasing the green cover. It calls for tree plantation on either side of roads in residential areas, suitably in vacant grounds at schools, hospitals and graveyards. These blocks of plantation will serve as a huge lung space for the city in future. While the MUDA in conjunction with the Department of Forests has taken up tree plantation along the outer ring road, very little has been done in residential areas.

Every year, a competition is organized for the public and also for the organizations. Exhibits of flowering and ornamental plants at gardens are judged and there will be prizes for the best ones. In addition to the display of carefully nurtured flowering plants of the Horticulture Department, individuals, educational institutions, government offices, industrial houses, hotels, police stations and Central Government offices are also participating in the show. The “Green Mysore” campaign aims to plant saplings in the city through an afforestation program involving educational institutions, government offices and NGOs. A variety of species including *nelli*, *honge* and *neem* have been identified by the Forest Department apart from medicinal plants such as *tulsi* and *doddapatre*. A unique feature of the “Green Mysore” campaign is the importance being accorded to medicinal and herbal plants. The authorities had set a target of providing 33 percent green cover along avenues by 2012, under urban forestry aegis.

Although afforestation and planting of saplings by the Forest Department is a regular feature, it was taken up on a massive scale in the year 2008 in a bid to reverse the trend of rampant tree felling. The authorities have also taken up ground water recharging by digging water percolation pits.

Also on the anvil is a program to create awareness about the imperatives of protecting environment and rainwater harvesting and the Forest Department proposes to play a major role in it. The department would tap in-house expertise and coordinate with the departments of horticulture, public works and MCC for watershed development, rainwater harvesting and afforestation. The other departments involved in the project include the MUDA, the Department of Agriculture, MCC, Public Works Department. The rest would be done by different organizations and NGOs.

The task of developing parks was too burdensome for the MCC and hence, Private Public Participation (PPP) was proposed. In Mysore, the only park maintained by a private organization is Vishwamanava Park, under the care of Raman Board and in addition, there are also several other parks unofficially maintained by the local residents. Regarding the Chamundi hills, the efforts have been designed by the members of the Mysore Amateur Naturalists (MAN), and supported by other NGOs such as the Association of Concerned and Informed Citizens of Mysore, *Mysore Grahakara Parishat* and other like-minded organizations to upgrade the forest cover, and to encourage conservation of flora and fauna, promotion of eco-tourism and research, providing information to increase awareness and educating villagers surrounding Chamundi hills on the need for its conservation. Eminent citizens of Mysore,

NGOs and environmentalists have been demanding creation of a buffer zone around the hills. They suggested that all development activities that adversely affected the existing land use pattern be shelved. Chamundi Hills not only provides green cover and lung space for Mysore, but is also a major watershed and helps in ground water recharge and upgrading the micro climatic conditions.

The water front design should be functional, maintainable, cost effective, visually pleasing and environmentally sound and also enable the people to relax there. Including a wooded buffer strip and aquascaping in the shoreline design is one way. A buffer strip improves and maintains the water quality by providing a filter area to trap sediments and excess nutrients, reduce maintenance time and cost, preserves natural beauty of a setting, screen undesirable views and frames good views and provides erosion control and shoreline stabilization. The tree line in aquascaping provides the much needed nesting place for birds, both resident and migratory. The aquascaping plan – visitors parking area can be thought of, short native woody plants, moisture preserving forest perennials can be planted, ornamental native aquatic plants can be planted to create a natural shoreline and improve water quality by reducing erosion and filtering runoff water etc.

VII. CONCLUSIONS

The people in urban areas need a break from their busy, tiring and often unhealthy and unpleasant modes of work and routine. As everyone cannot go to distant National Parks or forests, it should be possible for the government to bring a part of nature closer to city dwellers. This can best be achieved by developing pieces of land in or near cities as parks, gardens, open spaces and mini-forests including maintenance of water bodies in and around the urban area. These green patches and open spaces should be evenly distributed in the city of Mysore to function as city lungs. A larger area can be planted with suitable trees, shrubs and creepers to provide a forest atmosphere; and operational cost may be contained. In the green belt area, flowering trees, shrubs and creepers have to be additionally encouraged and planted. The existence of water sheets or water bodies is an important asset to the environment and has a beneficial effect on the microclimate of the city. The tank beds could also serve as outdoor recreational areas which are very much needed for the city dwellers. These tank beds must be freed from the covetousness of land grabbers and their supporters among administrators and politicians.

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