

Biodiversity Conservation and Sustainable landscape Management

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Generally the term Biodiversity and its Conservation is considered as part of Forest ecology and a subject dealt by ecologists only. In real term if we see Biodiversity is a very open-wide subject covering almost all the spheres of environment. It not only involves living organisms - plants and animals but as well has relationship with other natural resources. Today the significance of Biodiversity is more in developing cities and urban areas which are reeling under increasing pressure of physical development and growth. The city of Mumbai has a great cultural, religious and sociological background which has helped maintaining a balance between living and non living environment for ages. The status of city's environment is rapidly changing with a lot of morphological changes taking place. This city has a unique geographical features with the presence of almost all the components of nature within its limits. Presence of ocean, sea, creek, freshwater bodies, river systems, mudflats, salt pans, hills and mountains, forests with terrestrial and coastal vegetation makes the place an ideal habitat for almost all kinds of organisms right from insects to mammals. The great biodiversity of Mumbai needs a proper attention and care in future too. Maintaining plant-animal relationship is one of the important aspects of maintaining biodiversity of any place. Landscape planning and proper management practices play a major role in this aspect. In the present paper efforts are being made on how to maintain our old heritage of preserving indigenous species, beautify city with proper vegetation which could also act home for other creatures of this living planet, how to reduce pressure on natural resources through environmentally sound and eco-friendly habits particularly in the area of vegetation.. The paper will also deal with the role of plants and proper landscaping and plant selection techniques in reducing pollution, solid waste management and improving aesthetics. Details of existing vegetation and wildlife sustained by it will be described. An attempt to strengthen Biodiversity status of Mumbai through inclusion of certain useful species in residential and public places will be made.

Despite the fact that the city of Mumbai has been developed on seashore mostly by reclaiming land it still shows a presence of great biodiversity. Most of the vegetation is akin to seashore or wet tropical type. Shore line represents all the ingredients of a coastal habitat with the presence of sand binders and other vegetation in the form of Ipomea creepers, Sphiniplex, vitex regundo, Yucca, Premna, Scaevola, Clerodendron, Thunbergia, Derris, Mangrove species Accacia, Borassus, Avicennia, Rhizophora, Kandelia, Sonneratia, Palms of various types including branched Palm, Hyphnae Indica, Pandanus, Scaevola, Terestiral and Forest species like Callophyllum, Pongamia, Ficus, Hagestromia, Terminalia, Mahuwa, Teak, Sterculia, Khirni, Champa, oroxylum, Terminalia, Barringtonia, Adasonia, Jackfruit, Bauhinia, Bridellia, Bluea, Casia, Bamboo, Jatropa, Holoptolia, Heterophragma, Thuja, Kailaspati, Putranjiva. A number of introduced species are visible within city limits like rain tree, gulmohar,

copperpod tree, eucalyptus, Melingtonia, Spathodia, Jackranda, Perkia etc. A number of garden plants can be representing from both types i.e. indigenous and exotic like rackta palm, table palms, Hibiscus species. Moringa, odalia, Jasmine, Aristolochiaa, Argeriya, Madhavlata, saracaindica, sita ashok, crotons, caesalpania, yucca, cacti and various other succulents.

This coastal city has equally significant animal life sustained by its greenery right from insects to mammals, number of butterflies, moths, beetles, reptiles, amphibians and birds are found throughout the year in different localities. The major species of butterflies include lime butterfly, tiger butterfly, Tonycoaster, Copmmon Sailor, Zezebel, Pangies, swallow tails, mormons, tsermon, etc. Bird life includes different types of shore birds like waders, avocets, curlews, egrets, cormorants, water fowls, teals, herons, terns and gulls, flamingoes, etc. A large number of terrestrial birds like warblers, munia, sunbirds, shrikes, golden oriole, mynas, bulbuls, sparrows, parakeets, bee-eaters, owls, kite, eagle, swallows, kingfisher, cuckoo, dove, woodpeckers, crow pheasants, jungle fowls, Hornbills, pitta, larks, are found around city limits. Sanjay Gandhi National Park which is located within close proximity of city I is a home for a number of reptiles and mammals. The major mammalian species include wild hare, deer, sambhar, wild boar, leopards, etc.

Landscaping plays major role in maintaining any cities environment ecological condition in fact by way of maintaining aesthetic sense and also acting as a better home to flourish its biodiversity. The city of Mumbai is growing at a very rapid pace thereby showing its impact on physical status. A number of old trees are removed or pruned. In many places to allow developmental works. The land development is done by changing the face of land and introducing new vegetation. It needs to be examined thoroughly as plant animal-inter-relationship plays major role in sustaining biodiversity. Right kind of plant species which attract insects and birds for nesting, feeding, breeding also act as ecological controllers for future. For the sake of convenience I suggest that the following kind of planning need to be done for different locations depending on `area available. All the open spaces and roadsides should be lined with evergreen indigenous species like banyan, peepal, umber, mango, neem, jamun, etc. No giant trees should be planted under overhead wire lines and along roadside which need to be opened regularly for road repairs, drainage maintenance, etc. A badly pruned tree chopped from all sides looks not only horrible but reflects on bad planning too. Sometimes trees with lateral branching also create difficulty in smooth movement of traffic within city roads. Public places which are close to slum need not to be populated with thick vegetation for ground level as it might allow anti social elements to misuse the place. Giant trees with a good canopy and shade like rain tree, bakul, putranjiva, hiker species should be planted in such places with clear vision across the area. In case of individual housing projects and private properties efforts should be made to develop plans in such a manner that it not only enhances the aesthetic sense of the place but as well acts as an indicator of the health of biodiversity of city. All indigenous plants

should be retained and new species should also be introduced in accordance with the past history. Number of suggestions are being given below for landscaping such places :

1. Inclusion of indigenous species should be a priority in the proposed landscape work. It appears there are certain myths about indigenous species like they are slow growing in comparison to the exotic ones. It is not true. In fact some of the indigenous species are much more fast growing in Mumbai conditions e.g. is calophyllum, inophyllum, pterospermum, adansonia, etc.
2. Species should be able to provide shelter to different kind of animals by acting as a safe habitat like a bushy thorny plant will allow a small bird to make nest and prohibit predatory species like crows or eagles to take away their chicks eggs. It happens of course in case of nests formed on open, branched trees. Sometimes small birds like warblers or munias prefer delicate herbaceous plants like coleus or ceaselpinnias, acaranthus for making a nest due to easy weaving and delicate nature of host plants on which birds of prey are not able to perch very easily.
3. Insects particularly butterflies, moths, wasps like nectar secreting flowering plants. Efforts should be made that species will serve multiple purposes are planted for this purpose. Species like argeriya, aristolocia, petrea, tylophora, tinspora serve multiple purposes of herbal medicine, aesthetic value and ecological significance. Likewise a number of shrubs and trees like sita ashok, parijat, adulsa, aloe serve multiple purposes besides aesthetic sense. Wind breaking trees act as first line defence mechanism to combat strong sea conditions and reduce intensity of short laden winds e.g. Scaevola, Pandanus, Palms, Barringtonia, Vitex, Premena, Casurina species.
4. Lining of pathways and boundaries through hedge plants also can be done in such a manner that the hedge also serves other purposes. Lining a pathway with a row of tulsi, royelea, elegance or adatoda, can help in providing herbal medicinal material instantly to the residents.
5. Plants which do not need much water and maintenance care need to be selected for saving valuable resources which could be used on other purposes.
6. For a site which is large in dimension efforts should be made to utilize rain water by creating a large pond allowing rainwater to fill it up. The same water can be pumped upto an elevated site by creating a rockery type mound. Afterwards this water could be used partly for irrigation in the adjoining areas on the gravitational pressure principles. The overflowing water from top pond can come down through a cascading waterfall which will help in aeration of the water besides regulating temprate of the adjoining areas.
7. The corners of building and accessory structures could be lined with clumps forming species like areca, or kentia palm or species of bamboos or lilies or jasmine, etc.
8. No foul smelling and trees with allergy causing components within it should be planted within residential areas like sterculia foetida causes foul odour and

ceiba panteta bursts its pods on attaining maturity by releasing large amount of cotton in the air are not accepted by the public residing in nearby areas.

9. For community places like gardens belonging to a co-operative housing society or government organisations efforts should be made to earmark certain portions for planting trees needed often by the residents for traditional purposes and rituals. Plants like durva, tulsi, bel, mango, banana, apta and flower species used for offerings could be considered for such purposes. This practice will not only help to reduce burden on residence but as well help in solving the problem of waste management as everyday large quantity of flowers and sacred plants are brought in city out of which a large unsold quantity is dumped in unplanned manner.
10. Pathways and sit-out areas in a garden should always be laid as higher elevated levels so that no water logging takes place thus not affecting the routine use by garden users.
11. Utilisation of vacant place such as space around pump house, carparkings, balcony and service galleries could be utilized for cultivation of daily need plants and vegetables. This practice is being followed by some of the residents in Mumbai and suburbs whereby a family gets two vegetables in a week from balcony gardens.
12. Species which are useful in cleaning surrounding atmosphere and providing fresh environment and medicinal produce like lemon grass, mint, asparagus, aloe vera, lemon fruits bryophyllum, kadipatta, etc. are easy to grow in captive conditions in a limited space.
13. Species with open branching pattern and without much crowned canopy should be planted in open areas near creek, forests, etc. as many of them like Bombax ceiba, Phoenix, Reetha, Terminalia, Adina, provide an ideal site for nesting of giant birds like kites, vultures, etc.
14. Plants which provide good shelter to scavenger species like crows, mynas should be planted in large numbers within municipal limits wherever there is a problem of controlling municipal garbage specially generated due to dead rats, dogs and discarded fish Waste etc. It is assumed that more than 50% of total volume of dead animal is consumed by these scavenger species in cities.
15. Residents with limited resources but good sense of environmental consciousness can form small groups to impart training on vermicomposting, composting, organic farming in their locality by visiting each other and exchanging their sources and resources.