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From the Editor's desk

The Ministry of Environment, Forest and Climate Change (MoEFCC) had released a brochure on the best practices on Urban Forests, to address the theme of World Environment Day 2020 - '**Celebrating Biodiversity**'. The **Nagar Van (Urban Forests)** proposes to develop **200 Urban Forests across the country** upto 2025, "**Warje**" Urban Forest in Pune (Maharashtra) has been considered as a role model for the Scheme.

With growing urban areas and increase in concrete surfaces, establishing greenery in urban areas is the need of the time to control heat island effect and promote climate conscious development. the proposed scheme promotes **people's participation and collaboration** between the Forest Department, Municipal bodies, NGOs, Corporates and local citizens. These urban forests will primarily be on the **existing forest land in the City or any other vacant land** offered by local urban local bodies. The finances for the scheme will be paid for by the CAMPA (Compensatory Afforestation Fund (CAF) Act, 2016) funds. Compensatory afforestation means that every time forest land is diverted for non-forest purposes such as mining or industry, the user agency pays for planting forests over an equal area of non-forest land, or when such land is not available, twice the area of degraded forest land. Urban Forestry needs to be encouraged for sustainable Urban Development

Meenakshi Dhote



SPA



ENVIS



MoEFCC

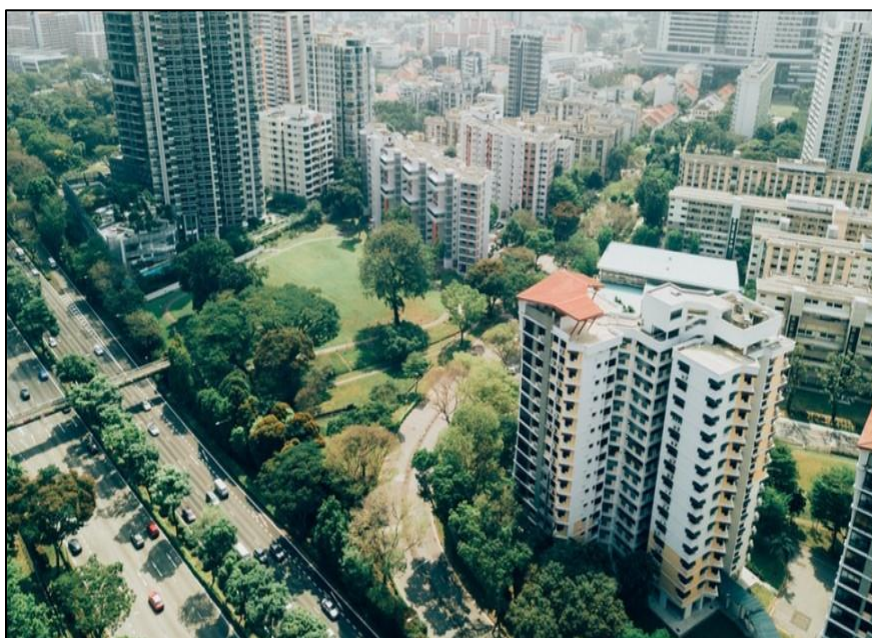
ENVIS Newsletter

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ENVIS RESOURCE PARTNER ON HUMAN SETTLEMENTS AND THEIR IMPACT ON ENVIRONMENT

Centre For Environmental Studies School Of Planning And Architecture, New Delhi

Urban Forestry



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Definition of Urban Forestry:

Urban forestry is the art, science and technology of managing trees and forest resources in and around urban community ecosystems for sociological, economic and aesthetic benefits trees provide for society. With increasing urbanization in the 20th century, the incorporation of trees into urban settlements has also increased - to the point that the management of all trees within the urban area is considered a distinct discipline of forestry.

The world is fast becoming an urban place and almost two third of the world's population is expected to exist in urban areas by 2025. Cities occupy less than 3 per cent of the global terrestrial surface, but account for 78 per cent of carbon emissions, 60 per cent of residential water use and 76 per cent of wood used for industrial purposes. Dealing with multiple risks of climate change such as temperature and precipitation variability, drought, flooding and extreme rainfall, cyclone and storm surge, sea level rise and related environmental health menace is a stern public policy and adaptation management challenge for India.



Fig 1: Low Carbon Cities
Source: <https://terriscreek.weebly.com/>

Urban forestry is the scrupulous care and management of urban forests, i.e. tree populations in urban settings for the purpose of improving the urban environment. The urban forests involve entire cities and their environs and are an environment of trees and related organisms, structures and people. Urban forestry can be defined as the raising and management of trees in and around urban areas. Urban forests are one of those green infrastructures comprising trees which are more known for their intangible benefits than tangible benefits in urban environment.

Benefits of urban forestry:

There are multiple functions and benefits of urban Vegetation. Urban parks, gardens and natural landscapes provide several non-market or intangible benefits for urban population. Urban green spaces play an important part in offering town-dwellers a more stress free environment, irrespective of sex, age or socio-economic background. It can be divided in several part such as:

1. Ecological Benefits:

Urban forestry plays an important role in addressing environmental engineering problems, including those related to erosion control, noise and air pollution abatement, wastewater management, watershed protection, and glare, reflection, and traffic control . A fully-grown tree can annually absorb up to 150kg of carbon dioxide — one of the main greenhouse gases contributing to global warming. Urban vegetation (trees and other plants) can be used to mitigate extreme storm water runoff events in urban areas and control the urban flood. Urban trees can affect stream flows as well, by their ability to intercept rainfall and affect soil infiltration rates of water. By lowering air temperatures, they reduce microclimatic effects and improve the urban climate. Trees influence thermal comfort, energy use, and air quality by providing shade, transpiring moisture, and reducing wind speeds.

2. Social Benefits:

Urban trees enhance the beauty and environmental quotient of city and are among the most important features contributing to the aesthetic quality of residential streets and community parks. Urban trees can reduce stress and improved physical health for urban residents and can be of real benefit to health and enhance cultural activities by providing venues for local festivals, civic celebrations, political gatherings and theatrical performances where people of all ages can interact.

3. Economic Benefits:

Urban forest offers significant benefits in reducing building air-conditioning demand and reducing energy consumption and also Landscaping with trees—in yards, in parks and greenways increase property values and commercial benefits .It act as places for recreational activity, thus making forest tourism a source of wealth generation. Furthermore, they impart various economic benefits through tangible economic items like firewood, timber, fruits, medicinal products, etc.

Characteristics of Urban Forests :

Urban forest ecosystems have many special characteristics that, in combination, distinguish them from other forest types. These characteristics include

- (1) close proximity to large or dense human populations,
- (2) relatively high diversity of species and forest patch structures,
- (3) multiple public and private ownership types, and
- (4) management often geared toward sustaining tree health and ecosystem services.

Urban issue	Potential benefits of urban forests
Food security	Provide food, clean water and wood fuel
Urban poverty	Create jobs and increase income
Soil and landscape degradation	Improve soil conditions and prevent erosion
Reduced biodiversity	Preserve and increase biodiversity
Air and noise pollution	Remove air pollutants and buffer noise
Greenhouse gas emissions	Sequester carbon and mitigate climate change, improve local climate and build resilience
Extreme weather events	Mitigate local climate and build resilience
Energy shortage	Save energy through shading/cooling, and grow wood fuel
Heat island effect	Cool the built environment through shade and evapotranspiration
Limited accessible green space	Provide more accessible natural and green space
Public health	Improve the physical and mental health of residents
Flooding	Mitigate storm water runoff and reduce flooding
Limited recreational opportunities	Provide opportunities for recreation and environmental education
Exposure	Provide shelter
Limited water resources	Enable infiltration and the reuse of wastewater
Lack of community and social cohesion	Provide distinctive places for formal and informal outdoor interaction

Fig 2 : Potential benefits of urban forests

Source: Guidelines on urban and peri-urban forestry

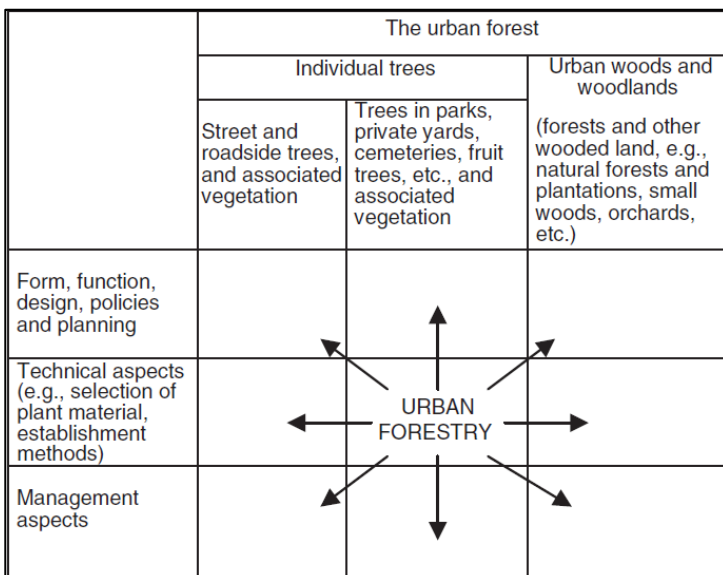


Fig 3 : The urban forestry matrix, representing the scope of urban forestry

Source: Urban Forestry

History of Urban Forestry:

The earliest interest in trees and green areas at large as contributors to more attractive cities dates back to for example the ancient Greek and Roman civilizations. During the Middle Ages, many European cities took an interest in protecting the surrounding woodland resources, for example for providing food, fuel wood, construction wood, and fodder, as well as a reserve in times of war.

With increasing urbanization and a growing demand for and pressures on urban green areas, the call for more comprehensive and integrated natural resource management emerged during the twentieth century. Various elements of urban green structures had traditionally been the domain of different professions. Horticulturists, landscape architects, and park managers had primarily been concerned with inner city public green space such as parks. Foresters, finally, had been hesitant to be active inside cities and remained at the urban fringe, where larger woodlands and other green areas are situated. A range of other professionals, including ecologists, biologists, and planners had also been involved.

The concept of urban forestry emerged in North America in response to increasing pressures on urban green spaces, and in recognition of the primary role trees play within urban green structures. Graduates of forestry schools were more frequently hired to manage municipal tree management programs because of their biological, quantitative, and managerial skills. The term '**urban forestry**' was introduced in 1965 as part of a study on the success and failures of a municipal tree planting program. In spite of initial resistance to the term and concept from both foresters as traditional urban green space professions, urban forestry gradually found wider scientific, political, and professional backing in North America. Other parts of the world, including Europe, took notice of the concept during the 1980s, but only during the past decade has a more established global research community within urban forestry emerged. Forestry has played an important role in the advancing of urban forestry, as have many other disciplines, including landscape architecture, landscape ecology, horticulture, arboriculture, soil sciences, as well as planning and social sciences.

In India from ancient times, flowers and plants have been admired and cultivated. There are many references to the Gardens in old Buddhist literature and the Sanskrit plays. But it was from the North, Central Asia and Persia that the splendid garden traditions were introduced in India, taking roots under various Muslim conquerors. A few surviving Mughal gardens, at present, are found in Srinagar, Pinjore, Delhi, Agra and Allahabad cities.

Urban Green Status In India:

According to Census of India (2011), 31.16% of the country's population resided in urban areas. Unplanned, unauthorized, haphazard urban expansions lead to a large amount of agricultural land being converted to urban use, mostly in the peri-urban areas. Cities like Varanasi, Chandigarh, Jaipur, Bhopal, Allahabad and Noida have more than the WHO prescribed norm of 9 sqm whereas cities like Bengaluru, Ludhiana and Amritsar have less than the norm ranging from 1% to 5%.

Special care has been taken to include urban forestry in the city's master plans in respect of newly developed cities after Indian independence, e.g., Gandhinagar and Chandigarh. Gandhinagar, the capital city of Gujarat state, leads in per capita urban greenery among Indian cities with Chandigarh taking second and Bangalore last position (based on 2001 population census).

Total area of the Gandhinagar capital project of Gujarat state is around 57 km². By the year 2005, tree cover of the city was 57.13% of the total geographical area amounting to 32.56 km².

City	Per Capita Green Spac (sqm/inhabitant)
Greater Noida	278.00
Gandhinagar	162.80
Chandigarh	54.45
Delhi	21.52
Bangalore	17.32
Jaipur	2.30
Kolkata	2.00

Fig8 : Some Important Indian Cities with Per Capita Green Space

Source: Urban Green Guidelines, 2014 (TCPO,GoI,MoUD).

<http://www.censusindia.gov.in/> and The Asian Green City Index, 2011.

Chandigarh city was built as a replacement of Lahore city, the capital of undivided Punjab which went to Pakistan during 1947. The city has more than 35% of its geographical area under forest and tree cover, making it one of the greenest cities of India.

Bangalore city is known as the Garden City of India due to the large number of parks and private gardens, roadside & avenue trees and the magnificent Lalbagh & Cubbon Park. The city has around 705 parks spread across the city in the form of small and medium sized parks as well as large parks. Estimated crown cover of the city is about 19.9 % of the geographical area. This amounts to per capita green space availability to around 17 m².

Kolkata, the „City of Palaces“ is known for huge British palaces and buildings and adjacent parks and private gardens, roadside & avenue trees and the magnificent Maidan in front of Victoria Memorial Hall. At present, Kolkata has urban green spaces ranging between 1 to 2 per cent. Kolkata has only 2 m² green per capita according to the “The Asian Green City Index”, 2011.

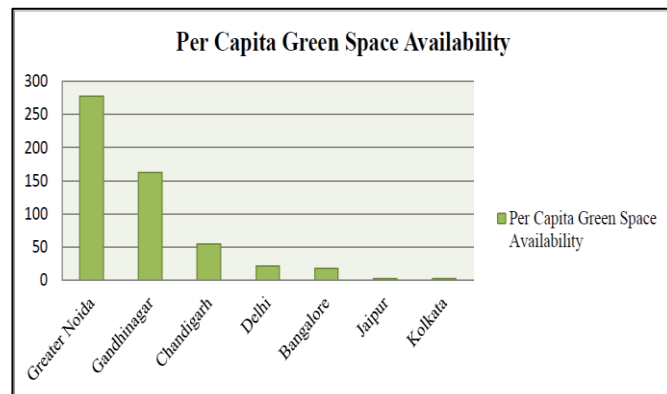


Fig 9: Per Capita Green Space Availability

Source: Source: Urban Green Guidelines, 2014 (TCPO,GoI,MoUD).

Fig4 and 5 : Green Space in Bangalore and Chandigarh

Source: Urban Green Guidelines, 2014 (TCPO,GoI,MoUD).

Greater Noida is a city located in the Gautam Budh Nagar district of the northern state of Uttar Pradesh and come under the purview of National Capital Region (NCR) of India. Greater Noida Master Plan has provided ample space for urban greens with most of the residential sectors earmarking large chunks of land under green provides 278sqm per capita green space for its residents.



Fig 6 and 7 : Green Space in Gandhinagar and Greater Noida

Source: : Importance, Strategy, and Planning in Indian Context

New Delhi, the capital city of India, has grown to be one of the greenest capitals in the world. Department of Environment and Forests of NCT, Delhi has been mainly responsible for increasing the green cover of the city from 30 km² to 300 km² during last 10 years, despite of acute biotic pressure. The city has some well-maintained parks and gardens like Lodhi Garden, Mughal Garden, Deer Park, Budha Jayanti Samarak Park, Indraprastha Park and The Garden of Five Senses .

The situation is so concerning as compared to the other cities. International minimum standard suggested by World Health Organization (WHO) and adopted by the publications of United Nations Food and Agriculture Organization (FAO) is a minimum availability of 9 m² green open space per city dweller. So the city's urban green cover is inadequate and now reducing drastically.

Constraints in Urban Forestry:

Most of the Indian cities have been facing much threat to its green space. In fact the open spaces are the first casualty in the reckless drive for intensive building operations and most of the Indian cities grew up without a plan.

- The shortages of green space as most of the spaces are utilized for residential or business purposes due to huge population pressure. Such unplanned development leads to the shortage of open green space. So, it is very difficult to expand urban green cover.
- Unequal spatial distribution of green space. Several areas of the city have absolutely no parks while majority of the total green space are concentrated in some select ward areas.
- Increase of built up area and increasing population density leading to congested living.
- Urban forests can be greatly affected by natural catastrophic events such as norwester, cyclone etc., which can result in broken branches or uprooted trees among other impacts (Greenberg and McNab 1998, Irland 2000, Proulx and Greene 2001, Valinger and Fridman 1997). Such events can cause damage to people and property.
- The factors responsible for loss of urban forestry are lack of funding, weak linkages with other resource management programs, and improper planning that fails to consider the surrounding ecosystem, the community, and the regional context.

Managing Urban Forests For Sustainability:

Urban forest planning and management that encourages sustainability advocates the broadening of strategies from simply maintaining forest structure in a particular area to a communitywide effort. These efforts include exchange of information, prioritizing benefits, designing management objectives, coordinating management activities, reviewing outcomes, and evaluating progress. Given the diversity and connectedness of the urban forest resource, the following items are considered key elements of sustainable urban forest management.

Recognize and Embrace Diversity and Complexity:

The diversity and complexity of urban forest resources require management programs that draw from multiple disciplines. Among the fields that may be involved in urban forest management are forest and wildlife management; hydrology and soils; meteorology and atmospheric science; landscape architecture and recreation management; psychology and sociology; and economics and political science. Taking full advantage of how each of these disciplines can contribute to the management of urban forests is critical to the development of policies that are tailored to fit the wide range of urban environments.

One-Size Management Does Not Fit All:

Given the unique character of urban forests found in particular settings, effective management requires differing forest management strategies within an urban environment (e.g., by land use, intensity of development) and among urban areas (e.g., different Eco regions and populations). With the complexity of land uses, a "one size fits all" urban forest management scheme is not appropriate for these diverse ecosystems. Managers should develop locally specific strategies to meet the needs of local populations within this regional context.

Focus on the Human Dimensions:

What most distinguishes urban from exurban forests is the dynamic influence of people. Human activities not only change urban forest structure to meet functional needs, but they also try to minimize detrimental changes due to natural forces (e.g., insects and diseases). Given the inherently slow development of trees amid rapidly changing urban environments, human forces for change pose significant challenges for natural resources management in urban areas.

Encourage Coordination Across Land, Users, and Ownerships:

A key element in managing urban forests in a regional context is the coordination of activities among different owners and managers across jurisdictions. The participation of multiple stakeholders in urban forest management is contingent on the creation of a forum to help link forest structures and their management throughout the urban system. Such collaborative stewardship involves not only owners, users, and managers but also includes those involved in the management of other urban components (e.g., city planners and residents). Partnerships among a wide range of decision makers who affect urban forest resources provide opportunities for those involved to identify common interests and resolve potential problems.

Capitalize on Connections with Other Activities:

A combination of diverse human actions and natural forces will continue to shape urban forests in the years ahead. These forces highlight the need to coordinate urban forest resource management with many other urban activities. Some of these activities include land use planning, environmental protection, residential development, infrastructure development and maintenance, community empowerment, and environmental education. These activities are highly likely to have a greater impact on the condition of the urban forest resource than all of the management activities that focus exclusively on maintaining urban vegetation.

Implement Comprehensive Planning and Management:

The diversity of urban forest resources demand comprehensive approaches to their management. The complex relationships of urban forest components to air and water quality, wildlife habitat, and aesthetic character suggest that focusing management activities on only one component of the urban forest is likely to yield an unbalanced flow of important benefits (Neville 2000). Thus, it is important that a comprehensive ecosystem-based approach to management is adopted.

Implement Adaptive Management:

Because urban forests are dynamic systems, their management must also be able to respond to rapid changes in the health and use of resources over time. Implicit in adaptive management of urban forests is the ability to monitor progress and evaluate the effectiveness of management decisions. To evaluate the effectiveness of management activities, management plans should include a means by which managers can review the outcomes of their efforts by

- (1) monitoring the effects of program activities,
- (2) identifying areas for improvement, and
- (3) modifying management plans to address problems.

Adaptive management provides the flexibility necessary to sustain and enhance important forest resources in changing urban environments.

A Model To Guide Urban Forest Planning And Management For Sustainability:

The framework for urban forest planning and management is based on five interrelated which are describe below:

I. Social context-

The concerns, attitudes, and values of community residents, organizations, and government agencies.

2. Management goals and objectives-

Urban forest benefits and functions that the community wishes to sustain.

3. Means-

Specific vegetation structure and management programs that have been identified as necessary to sustain desired urban forest benefits.

4. Management outcomes-

Urban forest structure, condition, and use resulting from management programs.

5. Information-

Inventory data, statistics, survey results, and research providing information about the characteristics of the resource, the relationship between vegetation structure and benefits, management techniques, urban forest health, and monitoring technologies.

These five factors are connected through a process of urban forest planning and management. First, operating within the social context that encompasses and permeates all of urban forestry, interested individuals and groups interact with policy makers and managers to prioritize the urban forest benefits they want to sustain and to develop budgeting alternatives to obtain these benefits.

Working within the planning and management system, managers translate desired benefits into management goals that they can use to plan management actions. Next they implement the vegetation structure or urban forest management programs needed to sustain desired functions. In this process is a great deal of learning and adjusting as new management outcomes are sought and ongoing programs are evaluated. A large number of individuals and groups may be involved in this dynamic management/evaluation monitoring process.

The input of information about urban forest functions, benefits, health, and management techniques is constant throughout this process of setting goals and implementing and evaluating management activities.

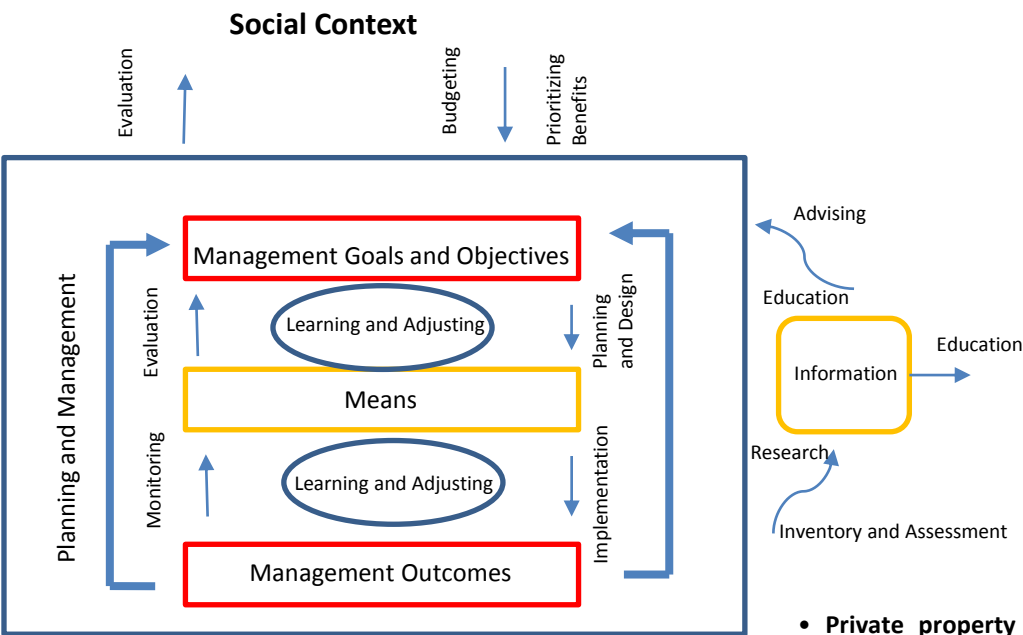


Fig 10: A model of sustainable urban forest planning and management
Source: Sustaining Urban Forests

Plans, Practices, Programs, Policies:

There are various plan, practice, program and policies are needed for proper Urban Forestry which are briefly describe below:

- **Urban Forest Management Plans (UFMP)** – A comprehensive plan should address goals and actions for the entire urban forest within the defined boundaries, on both public and private property. Topics covered may include maintenance standards, tree inventories and assessments, planting plans, tree selection standards, personnel training and development, community engagement, and many other items.
- **Maintenance plans for street trees and other public trees** – These plans address operational processes involving individually managed trees on public property such as streets, recreation centers, and other public places.
- **Natural areas management plans** – Surveys and stewardship plans for publicly owned natural areas include both broad and specific management goals for trees that are managed as a group or population, as opposed to individually like street trees.
- **Regional and state-wide plans** – These could include existing plans or planning processes directly or indirectly related to aspects of the broader urban forest, such as open space, recreation trails, economic development, etc.

Emergency and disaster plans – It's essential to prepare in advance for withstanding – and recovering from – emergencies and natural disasters that can impact the urban forest. Key elements of preparedness include planning, communications, advance inventory, training, handling vegetative debris, and assessing vulnerability.

- **Relevant previous or historic plans** – For purposes of comparison as well as to preserve “institutional memory” and avoid reinventing the wheel, it can be important to collect all previous planning efforts related to the urban forest.

- **Community tree programs** – These can include planting, stewardship, and training programs often managed by independent non profit organizations.

- **Private property tree programs** – Including tree giveaways and other municipally or independently managed incentive programs to promote tree planting and stewardship on private property.

- **Educational materials, promotion, and outreach** – In addition to the general public, key targets include large landholders, such as hospitals, schools, and other institutions or individuals.

Municipal urban forestry policies – These can include a wide range of tools – guidelines, ordinances, laws, regulations – concerning such things as public agency cooperation, green industry collaboration, cooperative arrangements with utilities, protection and preservation of large and/or private trees, use of native species, etc.

Municipal tree boards/shade tree commissions – Depending on their structure, these volunteer-based bodies may have advisory or even regulatory functions.

- **Municipal urban forest budget** – Without line items in the city budget, urban forestry activities are apt to be haphazard at best.

- **Municipal urban forest staffing** – With a budget in place and protected, adequate staffing is essential for making progress toward a sustainable urban forest. Of course, municipal capacity can get a tremendous boost from independent non profits, community groups, and individual volunteers. And increasingly, formal arrangements with commercial contractors can be an economical way to supplement or even substitute for municipal staff.

- **Funding sources** – Even with a standing budget line always need supplemental funding.
- **Maps** – Print and electronic maps at all scales – neighbourhood, municipal, regional – are essential tools for planning and management purposes.
- **Citywide urban forest GIS** – To the fullest extent possible, seek to integrate urban forestry information within the structure of overall municipal GIS (Geographic Information System).
- **Comprehensive list of stakeholders** – There is a need of assemble a contact list of all key players, partners, and stakeholders (e.g., government representatives and agencies, nonprofit organizations, community groups, large or institutional landholders, utilities, etc.) – as well as what they each bring to the table (e.g., resources, issues, regulations, programs, etc.).
- **Others** – Additional items to consider compiling include sources on **green jobs** training programs, **agroforestry** (fruit and nuts), state **urban and community forestry** contacts and resources, and various **specifications and standards**.

Designing The Urban Forest:

An urban forest plan with a purpose is all about maximizing the ecosystem services derived from them. This purpose-driven framework encompasses all of the parameters which comprise a well-rounded urban forest.

Step 1: Knowing what to plant:

The first step is to identify an appropriate list of species. Tree census is a wonderful way to understand the kind of trees that can grow in a particular environment. After the Ministry for Environment, Forests and Climate Change (MoEF&CC)

announced a national tree census in 2015, tree census has been undertaken in various cities, for example in Bengaluru. Similar initiatives have been undertaken by independent conservation organizations like the “Delhi Landmark Tree Map” by Vertiver and IORA Ecological Solutions for New Delhi. The “iTree” initiative is an example where citizens conduct the inventory of urban trees. Local participation by enlisting residents, schools and colleges in this step is strong way to gain the support of the final benefactors of the urban forest.

Step 2: Understanding the local ecology:

Most cities have some urban forests historically embedded in them due to religious, aesthetic or economic purposes. These are areas of thriving biodiversity, and can be a lens to view the natural ecosystems of an urban space.

Step 3: “Enabling” indicators to drive design:

Enabling indicators influence design decisions as well as monitor results, as against performance indicators which simply monitor results. Identifying enabling indicators depending on the purpose(s) is a new approach to planning urban forests. For example, “tree canopy cover” is a commonly used enabling indicator addressing quantitative aspects of an urban forest, as against “per capita area of green space” which is a performance indicator.

Urban tree diversity” and “physical access to nature” are considered two of the most common indicators for urban forests that can influence the number species chosen, ages of trees and, spread of the urban forest in the city. Other popular enabling indicators for urban forests are canopy cover, storm water control and air quality improvement.

Enabling indicators for planning urban forests can be developed to capture the spatial extent (quantity, accessibility, connectivity), diversity (quality), and ecosystem services (purpose), covering all 5 parameters of a well-rounded urban forest.

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