
UNIT 2 URBAN FORESTRY

Structure

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2.1 INTRODUCTION

Forests have multiple functions that are interdependent, a forest may be assigned a primary management function, such as production, biodiversity conservation, soil and water protection, cultural and spiritual functions, or a combination of these and others. Forests, irrespective of its location whether located in a remote area or near urban center can perform many functions simultaneously and deliver various combinations of goods and services, depending on national and local conditions that may change over time. Urban forestry is an integrated concept, defined as the art, science, and technology of managing trees and forest resources in and around community ecosystems for the psychological, sociological, aesthetic economic and environmental benefits trees provide society. It emerged as a discipline in North America in response to better ways to deal with the growing importance of tree-dominated urban green space, as well as growing pressures on green areas. Urban forestry has close links to forestry, but tends to be more multidisciplinary, more interactive and participatory in nature, with lot of interest from different stakeholders of the urban region.

Urban forestry plays an important role in addressing environmental issues ranging from environmental engineering related problems which also includes erosion control to noise and air pollution abatement, wastewater management, watershed protection, and glare, reflection, to urban wetlands. Although erosion control and watershed protection are important issues in rural areas but they are also a major concern in urban centers. Urban vegetation comprising of trees and other plants also mitigate the extreme storm water runoff events in urban areas, and which also justifies their role for the development and maintenance of urban forests. Urban trees also intercept rainfall and affect soil infiltration rates of water, which reduces the surface water runoff. Urban forest management thus, is the process of

planning and implementing practices for the stewardship and use of forests to meet specific environmental, economic, social, cultural and aesthetic needs of city dwellers.

The urban forestry is one of the essential dimensions of urban development, and is also very closely associated with the urban environment and ecology. It is also responsible for the good health of its people, culture, social and physical environment of the cities and towns. Customarily urban forestry refers to the trees and forests located in and around the cities, towns and neighborhoods. Urban forestry is essential for a good quality of human life and good environment for the urban dwellers. This unit will give a multidisciplinary and comprehensive understanding of urban forestry and after reading this unit the learner will be able to:

- (i) explain the meaning and importance of urban forestry
- (ii) key characteristics of urban forestry
- (iii) issues and challenges of urban forestry
- (iv) measures to be taken to promote urban forestry

2.2 URBAN FORESTRY: MEANING AND IMPORTANCE

2.2.1 Meaning of Urban Forestry

The word Urban forests are all the trees, forests, associated vegetation growing in or very near the cities, towns, and communities where people live, work, and play. Another definition of urban forestry is urban forestry is an integrated concept, defined as the art, science, and technology of managing trees and forest resources in and around community ecosystems for the psychological, sociological, aesthetic economic and environmental benefits trees provide society. According to the Society of American Foresters, urban forestry is defined as ‘the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits, trees provide to society’. Urban forestry is essential for the sustainable development of the city.

A city without forests and trees would make the city life tough, warm, less scenic and aesthetic, exhaustive and unsustainable. Therefore we need urban forestry i.e. the art, science and technology of managing trees and forest resources in and around urban community ecosystems for the ecological, sociological, economic, and aesthetic benefits trees and forests provide to the society. Some of the benefits of urban forestry are (i) expropriate carbon (ii) provide direct help to climate change mitigation; (iii) help to reduce polluted air; (iv) reduction of urban heat island (UHI) effects; (v) help to control storm water overflow problems; (vi) provision of vital habitat for wildlife; and (vii) provide access to nature.

Urban forests consist of forested stands, like in rural areas, but they also consist of trees found along streets, in residential lots, in parks, and in other land uses. The forests are a mix of planted and naturally regenerated trees. For the purpose of data collection and reporting, the key to defining the urban forests lies in the definition of what precisely constitutes urban land. Using the Census Handbook definition, urban land consists of all territory, population, and housing units located within either urbanized areas or urban clusters. Urbanized areas consist of densely settled territories that contain 50,000 or more people. This definition of urban lands is based solely on census handbook and their population density. Census handbooks in turn, are determined in part by physical features on the land, both constructed, such as roads and rail lines, and natural, such as rivers and ridges.

2.2.2 Importance of Urban Forestry

Urban forests and agriculture exist on a continuum defined by their relationship (and interrelationship) with a given landscape. These two forest types generally serve different purposes, however. Whereas agricultural forests are considered primarily in terms of their contribution to biodiversity conservation or, as in the case of agro forestry, to agricultural production, urban forests are assessed primarily in terms of the range of environmental services and values they provide to urban and suburban residents. The potential list of services is extensive and will vary according to different individuals, organizations, and locations, with many services being difficult to precisely quantify. Trees affect numerous environmental processes, such as water cycling; sound propagation; and pollution formation, dispersion, and removal. Trees also directly affect human populations by altering the social, economic, health, and aesthetic aspects of urban environments. Urban forestry contributes immensely to city and the city life in terms of ecological benefits, social benefits, cultural and economic benefits in a variety of visible and invisible ways. So far we know and have data on visible contribution of urban forestry, the invisible contributions still requires research and methods and techniques to quantify them.

Ecological Importance

Urban forestry plays an important role in addressing a number of known and unknown environmental issues and problems. Some of the well known issues such as noise pollution, air pollution, waste water management, watershed protection have been quantified at different levels by a number of ecologists working on the contributions of urban forestry. It is said that 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 used to mitigate extreme storm water runoff events in urban areas and control the urban flood. Urban trees can affect stream flows. Trees can control urban flood problem. Urban forestry helps to lower air temperatures and can reduce microclimatic effects that affect urban climate. It restricts wind speed and thus helps to reduce the effect of cyclone. In a nutshell ecological benefits of

urban forestry can be classified under the following heads:

- Air Pollution Removal
- Carbon Storage
- Avoided Runoff
- Structural Values: inherent value of a tree's formation
- Other Tree Benefits: Oxygen Production, Wildlife Habitat, and Energy Use
- Urban forestry provide habitat for wild life
- Urban forestry reduces urban heat island effects
- Urban forestry reduces effects of landslides in the cities of hilly areas

Social Importance

Urban trees also known by avenue plantation are well known to enhance the scenic beauty of the city. It provides sheds to the people and all kinds of insects, birds and animals during summer and gives shelter to a number of birds and their nests. It makes the city street beautiful and the urban park with trees is ideal place for children playing, resting, relaxing, practising yoga and walk by the urban dwellers. In other words, green space enhances the outdoor opportunity of urban dwellers and provides opportunities for physical and social activities. Urban trees can help to reduce stress and improved physical health for urban residents. The park with tree can become better venue for local festivals and other cultural programmes. Urban forestry promotes social networking through street walking and during recreation in the park. Urban forestry can reduce crime rate in the cities. Urban forests provide an array of social benefits to people living and working in cities

Economic Importance

Urban forest offers significant economic benefits and generates revenue for the municipality. The housing project in urban areas with greenery and healthy living condition with the greenery fetch higher prices as compared to the housing projects without greenery and tree cover. Besides the landscaping with trees—in yards, in parks and greenways increases 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.

Cultural importance

The modern cities are multicultural in character. With the globalization people from different countries and also from rural areas with much ethnic and cultural character are residing in the cities. The pluralistic character of the cities has expanded the cultural dimensions. The urban forestry and urban forest management depends on a good knowledge of the trees and woodlands,

urban foresters should also be familiar with the social complexities of the communities they serve. Urban foresters those who deal with the governance aspects of urban forestry has to be well versed with the cultural character of the city and also need to respond to the needs of other marginalized groups, such as women, the disabled, the elderly, and the unemployed.

Health Importance

Urban forestry provides mental wellbeing and reduces stress. Several studies have found relationships between human exposure to urban forests and its association with human mental and physical health benefits. Some of the health benefits of urban forestry as identified by a researcher are:

- It helps to enhance birth weights
- reduces deaths from cardiovascular and lower-respiratory-tract illness
- Faster recovery from surgery
- Stress reduction
- Lower prevalence of asthma rates

Check Your Progress Exercise 1

- Note:** a) Use the space given below for your answer
 b) Compare your answers with those given at the end of the unit

1. What is the ecological importance of urban forestry?

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2. How does the urban forestry help in the health issues?

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2.3 CHARECTERISTICS OF URBAN FOREST

The urban forests ecosystems have many special characteristics consisting of natural and artificial plantation, a combination of these distinguish them from other forest types. These characteristics include (i) close proximity to large or dense human populations, (ii) relatively high diversity of species and forest patch structures, (iii) multiple public and private ownership types, and (iv) the management is often geared toward sustaining the tree health and the

ecosystem services. More than 35.4 percent of Indian population lives in urban areas; thus, urban forests greatly influence the day-to-day lives of all these people.

The urban forests and trees provide an array of species and structural diversity that is not typically found in other forests. Since urban forests are planned and designed by human, so they have species richness and more diversity in urban forests than what is found in surrounding native stands. Urban forests are also well known to contain varying proportions of non native tree and bush species, which have been brought purposefully to increase the diversity or to cater to a particular function. Not only are species diverse, but the tree configurations in urban areas are also diverse, crossing many land use types and including single tree specimens, linear rows of street trees or trees along fence rows, and large patches of intact forest stands. The diversity of trees is often dwarfed by the diversity of landowners in urban areas.

The ownership of trees ranges from numerous small parcels of family homes, to private commercial tracts, to varying-sized public properties with varying densities of trees. Urban trees include a mix of planted and naturally regenerated species and often are managed to sustain tree health and benefits and to minimize risk to or conflict with human populations. They typically are not managed as a crop to be harvested; rather, they are a landscape element to be enhanced or sustained.

Although natural regeneration is a powerful force in shaping the urban forest like any other forests, tree planting and various maintenance activities (e.g., watering, raking, pruning, tree removals) are some of the special characteristics of urban forests, which also incur economic costs while helping to provide for safe and healthy urban forests. Enhancing tree cover in environments that are controlled and managed to a greater extent involves additional economic and environmental costs. Planting trees in these environments can produce substantial benefits for the urban population, but such plantings often require water or economic resources that are scarce in developing country like India. In addition to management costs, various risks associated with urban forests related to falling trees and limbs also pose additional costs through personal injury, property damage, and power outages. Proper management and maintenance lead to minimize the risks and costs, but it certainly enhances the numerous benefits for current and future generations.

2.4 TYPES OF URBAN FORESTRY

Urban forestry are of different types and shape those are urban parks, street trees, landscaped boulevards, gardens, river and coastal promenades, greenways, river corridors, wetlands, nature preserves, shelter belts of trees, and working trees at former industrial sites.

Urban Park: Urban Park is a park in an urban area such as Municipal Corporation, municipal council that provide respite, rest, recreation, exercise, and other physical activities to the visitor and urban area people. Various types of trees are found in the urban park which varies from one park to the other. Largely these are open space areas having green space and trees.

Street trees: The street trees are planted near the road side of the city. These trees provide shadows to the urban people during summer and also provide many other benefits to the city dwellers. It has several environmental, social and ecological benefits.

Treed Landscaped boulevards: Treed Landscaped Boulevard means that portion of public road right-of-way which has been landscaped with trees planted at intervals.

Gardens: Open space in the city that has been used for ornamental plants and trees. There are many gardens in Delhi to name a few Lodi Garden and Mogul Garden.

River and coastal promenades: A promenade is a long, open, level area, usually next to a river or large body of water, where people may walk. These are largely found in the coastal area cities. The Puri to Konark marine drive in Odisha with trees both the side make the ride enjoyable. Like it many promenades are found in the cities in the coastal areas.

Greenways: The greenway is an urban corridor of undeveloped land preserved for recreational use or environmental protection. Green way can promote sustainable urban development and raise the quality of life of the urban dwellers.

River Corridor: River corridor is a narrow stretch of land comprising a river and the areas adjacent to it. Many cities situated in the bank of rivers are under the smart city mission are developing river corridors in order to attract tourist and recreation of city dwellers.

Wetlands: A wetland is an area of land that is either covered by water or saturated with water. Wetlands are found in many cities of Kerala which attract a lot of tourist to the state and the municipal government earns a lot of revenue from it by providing boating and recreation facilities in the wetland and in its surrounding areas.

Nature preserves: It is an area of land where the animals and plants are protected, especially when they are rare or endangered. These preserve are endowed with a lot and varieties of trees in order to attract tourist across the season.

Shelter belts of trees: A row of trees planted to protect an area from the wind. It is largely seen in the coastal area cities in order to control the cyclone.

2.5 CONTRIBUTIONS OF URBAN FORESTRY

Carbon sequestration

Urban forests are well known to facilitate the carbon sequestration in varying degrees according to the size and density of the forests. We all know that carbon sequestration occurs when trees accumulate carbon and release oxygen (O₂) essential for human life. The non forest land uses and activities such as roads, homes, office buildings, factories, shopping centers, sports stadiums, and airports releases carbon dioxide into the atmosphere, which contributes to climate change. Urban tree planting efforts, whether through green belts, parks, windbreaks, or shade trees around residential houses, can play an important role in the sequestration of carbon. One well known example from South Africa, where ecologists estimated that nearly 55,000 tons of carbon is sequestered through an urban tree program in Pretoria (Tshwane) South Africa. The development and maintenance of urban forests, coupled with sustainable living concepts such as recycling and wind, solar, and other renewable energy technologies, can be used to address the growing concern of global climate change. Interestingly, it is said that a park-like design of an open space and urban forest seemed to be less effective for carbon sequestration purposes than a natural forest-like plantation.

Noise Abatement

Another possible engineering use of an urban forest is also for noise abatement purposes. In general, taller trees and wider tree groups are most effective in reducing noise pollution. Noise pollution is composed of sounds, and sounds can be absorbed, deflected, reflected, or refracted. Reflected sounds bounce off objects, whereas absorbed sounds are trapped by objects. Refracted sounds are broken up and dissipated into the atmosphere, and deflected sounds bounce off objects and can be directed toward an area of least concern. Noise abatement is often necessary in areas where excessive noise occurs, such as along roadways. Given the high density of people living in urban areas and their associated transportation systems, noise often becomes a significant problem for local residents. Noise can be composed of different wavelengths of energy, and the manner in which it travels through the environment can be affected by a number factors. For instance, the level of outdoor noise is a function of the source, the terrain, the surrounding vegetation, and atmospheric conditions such as wind speed and air temperature (Grey and Deneke 1978). Typically, as noise emanates from a source it decreases in intensity the further away it travels. In other words, noise is loudest the closer one is to it. As noise travels, it spreads in a spherical pattern across the landscape away from its point of origin. Interestingly, urban forests that are closer than about eight average tree heights from a noise can reduce noise pollution more effectively than trees situated further away. Plant arrangement and density can moderate noise levels, and combining plants with different noise attenuation characteristics can more effectively reduce unwanted sounds.

Reduction in air pollution

Urban forests can also contribute to reductions in air pollution and improvements in air quality. Trees found in urban settings play very important roles in cleansing pollutants from the air. Whether trees are located in rows along a street, in parks, or in undeveloped areas, their leaves, branches, twigs, and boles can trap air pollutants. Typically, these trapped pollutants are washed into the ground during rainfall. Grey and Deneke (1978) refer to this process as air washing. In addition, when trees are flowering, their floral scents mask disagreeable odors. Tree and shrub vegetative surfaces, therefore, play an important role in the interception of particulate matter pollution. The level of interception typically depends on particle shape and density, and the tree species employed.

Urban Hydrology

Urban forests and tree intercept, retain and slow the flow of precipitation reaching the ground, they play a very important role in urban hydrologic processes. They reduce the rate and volume of storm water runoff, flooding damage, and can enhance water quality. Estimates of runoff for an intense storm in Dayton, OH, for example, showed that the existing tree canopy reduced potential runoff by 7 percent; a modest increase in the canopy would have reduced runoff by nearly 12 percent. The greatest percent of rainfall interception occurs during the more common small storm events. During large rain events, the percent of rainfall interception can drop to a very small percent as most of the rain reaches the ground. During these large storm events, trees exert a relatively small effect from rainfall interception. Urban forestry also uses the process of incorporating vegetation into an urban area to increase cooling through shading and evapo-transpiration.

Quality of Life

The presence of urban trees makes the urban environment a more aesthetic, pleasant, and emotionally satisfying place where living, working and spending leisure time becomes very smooth and unnoticeable. Studies of urbanites' preferences and behavior have confirmed the strong contribution of trees and forests to the quality of life in urban areas. Urban forests also provide significant outdoor leisure and recreation opportunities for urbanites. Urban forest environments provide aesthetically pleasing surroundings, increased enjoyment of everyday life, and a greater sense of connection between people and the natural environment. Trees are among the most important features that contribute to the aesthetic quality of residential streets and community parks.

2.6 THREATS TO URBAN FORESTS

Urban forests are also vulnerable to a number of potential threats which can significantly alter the configuration and diversity of urban forests and their

associated benefits. Some of the most common threats may include the following:

Insects and Diseases

All types of forests, including the urban forests can be severely affected by numerous insects and diseases, many of them introduced from other geographic regions into urban centers. Some insects and diseases such as the gypsy moth, Asian long horned beetle and emerald ash borer are well known to have caused significant tree mortality in many forests across the globe.

Forest Fire

Incidences of forest fires have increased over the years in all parts of the globe due to a number of factors including manmade. The uncontrolled forest fires can cause significant damage to trees and forests and dramatically alter the urban landscape, especially in urban areas adjacent to the forests. High population growth and urban expansion are considered to be one of the main reasons in ignition of forest fires in forest-urban interface areas. In addition, the intermingling of trees with manufactured structures in these areas significantly complicates and limits the options available for fire suppression activities and vegetation management practices used to reduce fire risk.

Storms

Urban forests can be altered and have been significantly damaged by storms and high velocity winds, ice, and snow storms. As in the case of fire, the proximity of trees to buildings, roads, and power lines complicates forest management in this regard, while elevating the size of the damage.

Invasive plants

There are a number of invasive plants which have invaded different forest types under different climatic zones and have propagated so fast that original native species have been threatened and their density and numbers have dwindled in a short period of time. They have the potential to alter urban forests by removing and replacing native plants and altering ecosystem structure. Some of such well known invasive species include Lantana (*Lantana camara*), kudzu (*Pueraria lobata*), English ivy (*Hederal helix*), European buckthorn (*Rhamnus cathartica*), and Norway maple (*Acer plantanoides*).

Development Activities

Land development significantly alters the urban landscape, affecting plant and wildlife populations and forest biodiversity and health. Development can lead to rapid reductions in tree populations (clearing of forest stands), can alter species composition (e.g., tree planting after development), can increase tree populations (e.g., tree planting in formerly cleared areas), and can alter the urban environment (e.g., increase or decrease in air temperatures).

Development associated with urban expansion into rural areas can also significantly alter the regional landscape, particularly in forested regions where forest area is reduced, fragmented and encroached illegally.

Pollution

Some of the most common agents of pollution in urban areas are solid waste landfills, industrial and vehicular air pollution, and industrial and domestic water pollution. These three agents can affect tree health in urban areas if pollutant concentrations reach damaging levels. Forests have been shown to be affected by air pollution, especially from regional deposition of ozone, nitrogen, sulfur, and hydrogen. Ozone has been documented to reduce tree growth, reduce resistance to bark beetle, and increase susceptibility to drought. Air pollution can also enhance tree growth through increased levels of carbon dioxide or by providing essential plant nutrients such as sulfur and nitrogen.

Climate Change

Climate change is expected to produce warmer air temperatures, altered precipitation patterns, and more extreme temperature and precipitation events. These climate changes can cause changes in urban forest composition, and have the potential to exacerbate other urban forest threats (e.g., invasive species and pests). Climate change has the potential to alter urban forests, not only through species changes, but also through direct effects from storms, floods, etc., that may kill large portions of the forest in relative short time periods. Urban forest managers will need to understand and adapt to potential species shifts and changes to the environment to produce sustainable and healthy urban forests under future climatic conditions.

Check Your Progress Exercise 2

- Note:** a) Use the space given below for your answer
 b) Compare your answers with those given at the end of the unit

1. What are different types of urban forestry?

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2. What are major threats to urban forestry?

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2.7 LET US SUM UP

In this unit we have described the concept of urban forestry while defining the meaning and importance of urban forests in general, we have also discussed the characteristics of urban forestry and different types of urban forestry. The unit has also dealt in details the various types of contribution forests make ranging from economic contributions, to hydrological importance of forests. The various social and environmental contributions, noise pollution to ground water recharge, it further discussed its contribution in controlling the air pollution. Lastly, the unit also enumerated various types of threats which affect the urban forestry.

2.8 ANSWERS TO CHECK YOUR PROGRESS

Check yYour Progress Exercise 1

1. What is the ecological importance of urban forestry?

Answer: Urban forestry plays an important role in addressing environmental issues ranging from environmental engineering related problems which also includes erosion control to noise and air pollution abatement, wastewater management, watershed protection, and glare, reflection, to urban wetlands. Although erosion control and watershed protection are important issues in rural areas but they are also a major concern in urban centers. Urban vegetation comprising of trees and other plants also mitigate the extreme storm water runoff events in urban areas, and which also justifies their role for the development and maintenance of urban forests.

2. How does the urban forestry help in the health issues?

Answer: Urban forestry provides mental wellbeing and reduces stress. Several studies have found relationships between human exposure to urban forests and its association with human mental and physical health benefits. Some of the health benefits of urban forestry as identified by a researcher are following, it helps to enhance birth weights; reduces deaths from cardiovascular and lower-respiratory-tract illness; faster recovery from surgery; stress reduction and lower prevalence of asthma rates

Check Your Progress Exercise 2

1. Explain how trees contribute to better living in urban areas?

Answer: Urban forestry are of different types and shape those are urban parks, street trees, landscaped boulevards, gardens, river and coastal promenades, greenways, river corridors, wetlands, nature preserves, shelter belts of trees, and working trees at former industrial sites.

2. What are major threats to urban forestry?

Answer: Urban forests are also vulnerable to a number of potential threats which can significantly alter the configuration and diversity of urban forests and their associated benefits. Some of the most common threats may include the following: Insects and diseases; Forest fire; Invasive plants; Development activities; storms and pollution.

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2.9 REFERENCES AND FURTHER READINGS

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