

Second, a perspective from twentieth century Kabbalistic Judaism:

Putting themselves in relation with all things, humans will then remember that in the deepest being of all that exists is hidden the Divinity to which they themselves feel 'connected' and by which they are conscious of being inhabited. They will feel that the *Shekhinah*, the Divine Presence, desires to dwell in them... Humanity and nature. Ecological necessity: Humans, humble in front of their Creator and recognizing Its goodness, regard nature with respect and come close to it without expecting gifts... Always, while contemplating these wonders, humans sense their Creator who reminds them: 'See how beautiful is My work!... Be careful not to corrupt it... because if you corrupt it no one after you will be able to repair it!'

(Author's translation from Safran A (1998) Florence, Italy: Giuntina, *La Saggezza della Kabbalah* transl. P. Maiteny).

Finally, there is a striking similarity of meaning between the above quotations and the following, written by contemporary native North Americans:

For all the people of the earth, the Creator has planted a *Sacred Tree*... The life of the tree is the life of the people. If the people wander far away, if they forget to seek the nourishment of its fruit, or if they should turn against the Tree and attempt to destroy it, great sorrow will fall upon the people. Many will become sick at heart. The people will lose their power. They will begin to quarrel among themselves over worthless trifles. They will become unable to tell the truth and to deal with each other honestly. They will forget how to survive in their own land. Their lives will become filled with anger and gloom. Little by little they will poison themselves and all they touch. As long as the tree lives, the people will live. It was also foretold that the day would come when the people would awaken. They would begin to search again for the *Sacred Tree*.

(From Bopp J, Bopp M, Brown L, and Lane P Jr (1985) *The Sacred Tree: Reflections on Native American Spirituality*, 2nd edn. Alberta, Canada. Four Worlds International Institute for Human and Community Development.)

See also: **Landscape and Planning:** Perceptions of Forest Landscapes. **Social and Collaborative Forestry:** Common Property Forest Management; Joint and Collaborative Forest Management; Social and Community Forestry; Social Values of Forests.

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Urban Forestry

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Introduction

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. During recent decades an international urban forestry research community has developed, as has an increasing body of knowledge as well as new approaches and techniques. Urban forestry has close links to forestry, but tends to be more multidisciplinary.

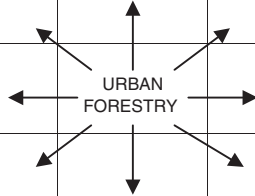
Concept of Urban Forestry

According to the Society of American Foresters' *Dictionary of Forestry* (1998 edition), 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 society.'

The concept and scope of urban forestry is summarized in **Table 1**. Urban forestry has the urban forest as its domain. An urban forest is defined as

Table 1 The urban forestry matrix, representing the scope of urban forestry

	The urban forest		
	Individual trees		Urban woods and woodlands
	Street and roadside trees, and associated vegetation	Trees in parks, private yards, cemeteries, fruit trees, etc., and associated vegetation	
Form, function, design, policies and planning			
Technical aspects (e.g., selection of plant material, establishment methods)			
Management aspects			



comprising all tree-dominated green areas in and around urban areas. Thus it includes, according to Food and Agriculture Organization (FAO) definitions, forests, other wooded land, and trees outside forests, as long as these are situated in urban environments. The terms ‘woodlands’ and ‘woods’ are often used in an urban forestry context to distinguish between the wider urban forest resource and its components that have traditionally been defined as ‘forest.’ At a strategic level, urban forestry includes attention to the form and function of urban forest resources, as well as policies, planning, and design policies related to these. Urban forestry involves a range of techniques and approaches in terms of the selection and breeding of the right trees for urban environments and growing conditions, as well as tree establishment. Strategic and more operational aspects are brought together at the level of urban forest management.

The strengths of the urban forestry concept include the following characteristics:

- integrative, incorporating different elements of urban green structures into a whole (the ‘urban forest’)
- strategic, aimed at developing longer-term policies and plans for urban tree resources, connecting to different sectors, agendas, and programs
- multidisciplinary and aiming to become interdisciplinary, involving experts from natural as well as social sciences
- participatory, targeted at developing partnerships between all stakeholders, and aimed at multiple benefits, stressing the economic, environmental, and sociocultural benefits and services urban forests can provide.

Brief 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, fuelwood, construction wood, and fodder, as well as a reserve in times of war. Green areas inside the city walls often had a similar utilitarian role, being used as areas for agriculture, for example. Interest in the more aesthetic and recreational benefits of urban green space developed during the mercantilist and Renaissance periods. A new class of wealthy citizens emerged and showed an interest in estates, parks, and other green areas for leisure as well as for economic and prestige purposes. City authorities, often with the support of industrialists, took a greater interest in their green areas during the time of the Industrial Revolution. Large groups of workers had moved to the cities and needed to be provided with socially acceptable ways of spending their leisure time. Formerly closed-off royal and private parks and domains were opened to the public, and new green areas very much focused on active uses were created. Green space planning and management became more established parts of municipal activity during modern times (Figures 1–3).

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. Individual trees along streets and roadsides had been given attention, for example through shade tree regulations in North America, and later became the domain of arboriculture. 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



Figure 1 Street trees are an important element of the urban forest. Courtesy of Thomas Randrup.



Figure 2 Urban forests are among the most popular environments for outdoor recreation. Courtesy of Kjell Nilsson.



Figure 3 Trees alongside waterways are an important component of the urban forest. Courtesy of Thomas Randrup.

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.

Urban Forest Resources

Comprehensive assessments of urban forest resources have been scarce. Most assessments have been at the local level rather than national or international. Moreover, they have focused on only one or several components rather than the entire urban forest resource. While woodland data are often not very difficult to obtain due to existing inventories accord-

ing to set definitions for ‘forests’ it remains difficult to assess the urban share of overall resources.

An exception has been the comprehensive assessment of national urban forest resources carried out by the US Department of Agriculture Forest Service. The study focused on tree canopy cover as the main indicator and combined methods using satellite imagery, existing statistics, and more detailed assessments at the local level. The assessment showed that about one-third of metropolitan areas defined in terms of administrative jurisdiction, in the adjacent USA is covered by tree canopy, i.e., approximately 8% of the entire country and about one-fourth of all US trees. When looking more narrowly at urban areas (cities, towns, and other built-up areas), urban trees still cover about 1% of the entire US land area. Less comprehensive assessments in Europe, often looking at land use categories rather than tree canopy cover, found green space cover of major cities to range from 5% to more than 60% of city area. Other comparative studies indicated a share of woodland within the municipal boundaries of larger cities to range between less than 1% to more than 40%. Although woodlands in and adjacent to urban areas mostly comprise a small percentage of the entire woodland base of a country, this still means several millions of hectares for Europe alone.

Urban Forest Functions

Social Benefits

The recreational values of forests, parks, gardens, and other urban green areas are especially well documented in the Western world. Urban woodlands in Europe, for example, attract as many as several thousands of visits per hectare per year, thus by far surpassing the average visitor number for woodlands. As people tend to prefer outdoor recreational areas close to their homes, urban green areas are the most popular outdoor recreational areas. Urban dwellers often form strong attachments to trees and green areas close to their homes, which often leads to controversy in cases of tree removal. Recently the health impacts of urban green space have also been studied. Urban green space can have a positive impact on physical and mental health, for example by providing settings for physical exercise, reducing ultraviolet radiation and air pollution, and reducing stress. By being actively involved in tree planting and management, local communities can be strengthened. In many developing countries, trees often have cultural and spiritual values that could assist new urban dwellers in finding their place in cities and towns. Urban forests also have high educational values by representing nature and natural processes in cities and towns, and they have often been used as testing and education areas for forestry and other disciplines.

Economic Benefits

Timber and other wood products from urban forests are in many Western countries often not very highly prioritized. But in other parts of the world they are crucial. Large parts of the urban population of Africa, for example, are still heavily dependent upon fuelwood. Systematic planting of street trees for timber production is widely practiced in countries of Southeast Asia; urban green areas, in which trees play an important part, provide non-wood forest products such as mushrooms, berries, medicinal herbs, rattan, and so forth. In addition, trees play an important role in urban agriculture, which provides an important source of livelihoods in developing countries. The focus in the Western world has been on additional economic values such as green areas contributing to more attractive cities for people to work, live and relax in. Studies in Denmark and Finland, for example, have shown the positive impact of nearby forests and green on house prices. Cities across the world have turned to planting trees and other greening efforts to attract investment and taxpayers.

Environmental Benefits

Trees and other vegetation intercept particles and gaseous pollutants. Moreover, they act as carbon sinks in the equations relevant within the context of global warming. Important in both the developed and developing world is the role urban vegetation plays regarding water. Trees reduce stormwater runoff and can assist with processing wastewater and minimizing air pollution and diseases from sewage water through its use for tree planting. Many cities have established and conserved forests for protecting their drinking water resources. Urban forests protect soils and moderate harsh urban climates, for instance by cooling the air, reducing wind speeds, and by giving shade. The shade effects of trees have proven to be significant in, e.g., the USA. Here shade provided by trees may result in building energy saving and lowering air conditioning cost. In arid regions, forest shelterbelts around cities help combat desertification. The level of biodiversity of urban green areas is often surprisingly high, representing nature close to where people live. Cities such as Rio de Janeiro and Singapore still have tracts of tropical rainforest within their boundaries. In Europe, national parks are found at the gates of large cities such as Warsaw, Moscow, and Vienna.

Pressures on Urban Forests

Urban forestry has to deal with growing trees in often very harsh urban environments. A first challenge is to protect green areas and trees against encroachment and annexation by other types of urban land use. The competition for land in and near cities is fierce. If urban forests can be conserved, they have to be protected against a wide range of biotic, abiotic, and anthropogenic stresses. Limited urban resources are very intensively used, and wear, tear, and ecosystem degradation by for example trampling, disturbance, and vandalism occur. Moreover, not all uses are easily accommodated and conflicts of interests are very common. Anthropogenic stresses are also caused by the presence of traffic installations and all kinds of infrastructure. Growing spaces for trees, and especially for those growing along streets, are limited. Levels of soil, water, and atmospheric pollution are often high, and climatic conditions can be harsh due to the artificial environment created by human structures. The use of deicing agents often has a detrimental effect on street and roadside trees. Consequently a large share of the trees planted in urban environments dies within the first years after planting. While pressures on urban forests in urbanizing societies are multiple, urban forest

planners and managers are facing budget cuts and municipal reorganizations.

Urban Forestry Practice

Inventory and Evaluation

The starting point for urban forestry programs, policies, and planning is to assess the potential of the urban forest resource in terms of form and functions, as well as urban society's preferences regarding the benefits and services the urban forests should provide. Comprehensive urban forest resource and function inventories and monitoring are thus required to support decision-making. During recent years various (computerized) information systems to support policy-making and planning have been developed. A rapidly expanding body of research aims to assess the different social, environmental, and economic values urban forests can provide. In North America, for example, the environmental values especially of urban trees have been quantified in monetary terms, for example through assessing the cost avoided for air pollution reduction and cooling by using trees. Cost-benefit studies have shown that benefits of urban trees generally extend far beyond the cost of planting and management. This information is also very important for effective and efficient urban forestry. More efforts have also been made to determine what society's preferences are with regards to urban forests. Tools and procedures for public consultation and participation are increasingly used, in order to generate optimal benefits from a rather limited resource. Public participation is not only important at the strategic level, but also in establishment and management, for example to create a feeling of shared ownership.

Policies, Planning, and Design

One of the characteristics of the urban forestry concept is its strategic nature. Strategic programs and policies for urban forestry, however, are still not very common across the world. Exceptions are the Community Forests in the United Kingdom, embodying a long-term program aimed at generating socio-economic and environment regeneration of 12 urban agglomerations through forest and tree establishment and management. Another problem is the lack of integration of urban forestry with more general urban and regional policies and planning.

With only limited resources and a large societal demand, proper design of urban forests is crucial. Aesthetic aspects are of course important, as is the tradition in garden and landscape architecture, but

design should also recognize the different roles urban forests play. Trees are living organisms, which requires a thorough knowledge of their development and possibilities as basis for design. Design has to build on strong links with future management, in order to develop a sustainable and multifunctional urban forest resource. The woodland part of urban forestry also requires extensive design, e.g., in terms of zoning different functions and providing attractive and safe environments for various forms of recreation.

Species Selection and Establishment

Urban conditions are very different than the conditions in rural or natural areas. Complex and often rather hostile urban growing conditions require a careful selection of the right tree species. There is a need for integrated focus on the identification and selection of cultivars and species for urban forestry, based on sound knowledge of site conditions and tree characteristics.

Urban trees have to endure a wide range of threats, as described before. As urban tree populations are often dominated by only a few tree species or families, the risks related to pests and diseases are larger. The dramatic impact of Dutch elm disease in North America and Europe is an example of this. In order to develop a more resistant urban forest resource, it is advisable to provide for sufficient variation regarding tree species, genus, and family.

The use of exotic versus native species has also been a topic of concern. Urban forests often include a high share of exotic tree species. There are several reasons for this, including the fact that some of these species might be better adapted to artificial environments, for aesthetic reasons, or interest in exotics as a result of the colonial era. The trend is towards increasing the use of native species, because of the demand for more nature-oriented management of green area's and interest in maintaining genetic resources.

The establishment of trees in urban environments often requires a major effort, especially when paved areas are concerned. Consideration should be given to the growing conditions below the surface, as sufficient space should be provided for root development. Special soil substrates have been developed for application in urban conditions. Sound establishment techniques are also needed in terms of planting holes, adequate water supply, protection against threats such as deicing salt, and proper staking if needed. Trees are often planted as part of construction and development schemes, so that the process of planting requires special care during the construction activities. In the case of woodlands, establishment of

trees often is easier, although more difficult than in many rural forests due to higher trampling and compaction. Natural regeneration can supplement planting and sowing of seeds.

Management

The management of urban forests operates on different levels. At a more integrated and strategic level, management approaches should regard the urban forest as a whole, with linkages between its different components and its form and functions. Specific techniques are then also needed for the different components.

The management of single trees (arboriculture) builds on long tradition and experience. An important tree care activity is pruning, aimed at for example the training of young plants, maintenance of health and appearance (i.e., for aesthetic reasons), reduction of hazard, control of plant size, influence on flowering, fruiting, and vigor, and compensation for root loss. Different pruning approaches and techniques have been developed, but 'modern arboriculture' as developed in the USA during the 1970s is now widespread throughout the world. Modern arboriculture is based on a detailed understanding of tree biology, and the tree's natural reactions to wounds, cuts, and so forth. Related to this is the discussion whether or not to treat wounds. The need to detect hazardous trees and assess tree vitality, however, is now becoming widely accepted as an important urban tree management feature.

Arboriculture also plays an important role in parks and gardens, but here management of other types of vegetation also comes in. More integrated approaches to the management of different park and garden elements are under development. Traditional forest management techniques are often not directly applicable to urban areas. Public scrutiny and different functions of urban woodlands require that management techniques have to be adapted. Education and awareness raising can enhance public understanding of management measures, thus reducing concern and the potential for conflict. Selection cutting methods are often seen as more appropriate for especially smaller-scale urban woodlands. Thinning regimes can be used to provide a greater diversity in urban woodland stands to meet, for example, urban demands for a wide range of recreational opportunities and experiences.

Management activities, just like policies and planning, should be based on detailed resource inventories and monitoring. These should not only provide basic information about the trees (species, age, height, and so forth), but also about vitality, special characteristics and their place in a wider

urban forest context, not least related to human demands.

Urban Forestry Research and Education

By its very nature, urban forestry is an approach involving multiple disciplines and their specific body of knowledge and expertise. Urban forestry has also become recognized as a field of scientific relevance in Europe, and gradually an international research community has been formed. A survey of 20 European countries identified more than 400 recent or ongoing research projects on trees and/or forests in the urban environment. Many of these projects focused on only one element of urban forests, with about equal attention for street trees, trees in parks, and woodlands. The discipline of forestry had been involved in about half of all projects listed by national experts participating in the survey. Especially during recent years, however, more integrative research has been developed, focusing on the urban forest resource as a whole, as well as following a more multidisciplinary approach. Natural science gradually has become supplemented by social and planning sciences, although the natural science disciplines are still very dominant in urban forestry research in Europe, as well as in North America.

With growing scientific as well as practical interest, the need to develop urban forestry education also became clear. The USA hosts many degree programs in urban forestry. In Europe, higher education in urban forestry has been less developed so far. Recent years, however, have shown an increase in degree programs and student enrolment. Urban forestry education programs are also under development in other parts of the world, and most notably Southeast Asia.

See also: **Afforestation:** Species Choice. **Landscape and Planning:** Forest Amenity Planning Approaches; Perceptions of Forest Landscapes; The Role of Visualization in Forest Planning. **Recreation:** Inventory, Monitoring and Management; User Needs and Preferences.

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illustrate the way amenity planning has developed in different world regions, with a particular emphasis on innovative and integrated approaches to forest amenity in the context of broader landscape-planning initiatives. The conclusion points to areas of emphasis and challenge for the future.

Definitions of Amenity Planning

Amenity is generally deemed to refer to something pleasant as well as useful, often (but not always) associated with leisure. Forest amenity planning is therefore concerned with visual pleasure or attractiveness, often termed visual amenity (see **Landscape and Planning: Visual Analysis of Forest Landscapes**), but also with other aspects of the forest that make it a pleasant place to visit or to have as a nearby resource. Amenity planning thus places people rather than timber at its heart, and pleasure rather than economic return as its end; this sets it apart from planning for productivity, where the focus is on silviculture and the economic value of the forest products. Environmental impact assessment (EIA) requirements in the planning legislation of many parts of the world, including Europe and North America, tend to focus on the impacts of plans on soils, water, air, fauna, and flora, in other words, ecological and natural heritage, rather than cultural heritage, although this is beginning to change in some regions and countries. Amenity planning implies, at its ideal, an integrated approach to planning where aesthetic issues are combined with recreational and other social needs as part of a holistic planning process. In an increasingly globalized society, amenity planning is also an important tool in preserving the diversity and distinctiveness of different locations and landscapes.

Forest Amenity Planning Approaches

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Introduction

This article begins by defining forest amenity planning and its relationship with other planning approaches. The benefits of forest amenity are explored in the context of a brief history of forest planning and design. Modern amenity planning is set against the international agenda for sustainability and recent legislation on forest and landscape planning. Examples of different approaches from North America, Europe, and Australasia are used to

Forest Amenity Benefits

There is a considerable range of potential amenity benefits that forests can provide for people who live or work near them, or who visit them for leisure activities. The amenity benefits that have been identified include functional aspects such as landscape enhancement (especially in areas of dereliction or abandoned agriculture); screening (for example, of mineral workings); noise reduction; dust filtering; summer shade; shelter; wildlife conservation and enhancement; providing the setting for buildings or groups of buildings in the landscape; and providing a location for many different kinds of recreation, from bird-watching and berry-picking to children's play and mountain biking. The perceptual and psychological benefits that are also important in amenities