

# Urban forestry

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**Urban forestry** is the careful care and management of tree populations in urban settings for the purpose of improving the urban environment. Urban forestry advocates the role of trees as a critical part of the urban infrastructure. Urban foresters plant and maintain trees, support appropriate tree and forest preservation, conduct research and promote the many benefits trees provide. Urban forestry is practiced by municipal and commercial arborists, municipal and utility foresters, environmental policymakers, city planners, consultants, educators, researchers and community activists.

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Tree pruning in Durham, North Carolina



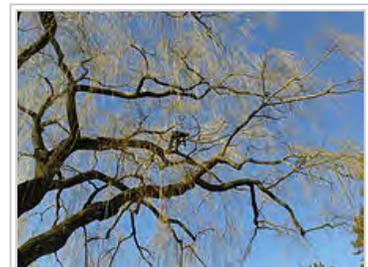
James Kinder, an ISA Certified Municipal Arborist examining a Japanese Hemlock at Hoyt Arboretum

## Functions and values

Function, the dynamic operation of the forest, includes biochemical cycles, gas exchange, primary productivity, competition, succession, and regeneration. In urban environments, forest functions are frequently related to the human environment. Trees are usually selected, planted, trimmed, and nurtured by people, often with specific intentions, as when a tree is planted in a front yard to shade the driveway and frame the residence. The functional benefits provided by this tree depend on structural attributes, such as species and location, as well as management activities that influence its growth, crown dimensions, and health.

Urban forest functions are thus often oriented toward human outcomes, such as shade, beauty, and privacy. As prominent "things," arranged in distinctive formations, trees command a symbolic and material presence that informs how places and landscapes are imagined. This link that humans have to trees has been theorized by Kellert and Wilson (1993) to be a genetically based emotional need to be close to trees and other greenery. According to their "Biophilia Hypothesis," millions of years of human survival and evolution depended on our ability to cope with the natural world; learning what was safe and dangerous involved the imprinting of strong positive and negative emotional reactions to various natural stimuli. Although 21st century American society is no longer as dependent on nature for day-to-day survival, Kellert and Wilson suggest that closeness to the natural world is still critical for psychological well-being. The complex symbolic and emotional ties that humans have with trees have important implications for the importance of sound urban forest management practices that impact not only quality of life on an ecological level, but on the human and cultural level. People develop emotional attachments to trees that give them special status and value. Removing hazardous trees can be difficult when it means severing the connection between residents and the trees they love. For many, feelings of attachment to trees in cities influences feelings for preservation of trees in forests (McPherson 1998).

The value that people place on trees is especially evident with respect to big trees. There has always been a public fascination with large trees, especially the largest specimens of trees that reach a mature height of greater than 40 or 50 feet (i.e., Champion Trees) (Barro et al. 1997, Dwyer et al. 1991). Moreover, the ability of big street trees to create a ceiling of branches and leaves over all or part of a street impacts the scale of changing shadows cast by the trees, sunlight filtration, and other human-scale considerations that



Professional Tree Climber (arborist: Zack Weiler) climbing a willow tree in Port Elgin, ON, Canada

provide a changing visual environment (Zube 1973, Jones and Cloke 2002). In their qualitative study of Denmark residents' perceptions of the importance of the urban forest, Hansen-Moller and Oustrup (2004) found that the scale of urban trees was one of the main conditions of an "ideal" urban forest, through its volume, height, and ability to envelop a person, thus creating a barrier from the outside world.

Urban forests bring many environmental and economic benefits to cities. Among these are energy benefits in the form of reduced air conditioning by shading buildings, homes and roads, absorbing sunlight, reducing ultraviolet light, cooling the air, and reducing wind speed - in short improvement of the microclimate and air quality (McPherson 1994; McPherson & Rowntree 1993; Simpson & McPherson 1996; Coder 1996; Wolfe 1999; Hastie 2003; Lohr *et al.* 2004). There are also economic benefits associated with urban trees such as increased land, property, and rental value (Morales *et al.* 1983; Anderson & Cordell 1988; Wolf 1998; Dwyer *et al.* 1992; Mansfield *et al.* 2005; Orland *et al.* 1992; Hastie 2003; USDA Forest Service 2003, 2004). Well-maintained trees and landscaped business districts have been shown to encourage consumer purchases and attract increased residential, commercial and public investments (Wolf 2004, 2007). Trees located in business areas may also increase worker productivity, recruitment, retention and satisfaction (Kaplan & Kaplan 1989; Kaplan 1992; Wolf 1998). Urban forests also improve air quality, absorb rainwater, improve biodiversity and potentially allow recycling to 20% of waste which is wood-based<sup>[1]</sup> Many cities today are dealing with stormwater management system issues where their existing systems can no longer hold the volume of water that falls in storms.<sup>[2]</sup> One sustainable solution to this is planting street trees with grates underneath them to hold water. Trees and their soils work to filter runoff pollution and soil contaminants by absorbing them and processing them into less harmful substances.<sup>[2]</sup> They also collect water in their limbs and release it back into the atmosphere over time.<sup>[2]</sup> This makes trees a solution to stormwater runoff issues and urban heating issues.

The social and even medical benefits of nature are also dramatic. Urban poverty is common to areas lacking green spaces.<sup>[1]</sup> Visiting green areas in cities can counteract the stress of city life, renew vital energy and restore attention, and improve medical outcomes.<sup>[3]</sup> Simply being able to see a natural view out of the window improves self-discipline in inner city girls.<sup>[4]</sup>

Having regular access to woodland is desirable for schools,<sup>[5]</sup> and indeed Forest kindergartens take children to visit substantial forests every day, whatever the weather. When such children go to primary school, teachers observe a significant improvement in reading, writing, mathematics, social skills and many other areas.<sup>[6]</sup>

Various methods are available to capture the value of urban trees, each designed to analyse a specific type of green space (individual trees, parks, trees on golf courses etc.). The following are examples of studies that have used these different approaches, along with their respective constraints.

Method	Study	Location	Results	Limitations
Contingent valuation	Tyrvaainen (2001)	Joensuu and Salo, Finland	More than two-thirds of the respondents were willing to pay for the use of recreation areas, with mean WTP ranging from 42 to 53 FIM/ month, depending on their location. <sup>[7]</sup>	Estimated value of environmental amenities is based on a hypothetical market scenario
Choice modeling and survey	Salazar and Menendez (2007)	Valencia, Spain	Residents closer to a proposed park had a higher WTP for the park than those further from it. <sup>[8]</sup>	Bias, protest answers, strategic answers
Direct estimates	Pandit and Laband (2010)	Auburn, Alabama, USA	17.5 percent tree cover on property = 14.4 percent reduction in electricity (\$31/month) 50 percent dense shade = 19.3 percent reduction in electricity (\$42/month). <sup>[9]</sup>	Mitigation effects of climate excluded, Aesthetic values excluded
Numerical modeling	McPherson <i>et al.</i> (2005)	USA	Every dollar invested in urban tree management returned annual benefits ranging from \$1.37 to \$3.09. <sup>[10]</sup>	Aesthetic values excluded

## Practice

Urban forestry is a practical discipline, which includes tree planting, care, and protection, and the overall management of trees as a collective resource. The urban environment can present many arboricultural challenges such as limited root and canopy space, poor soil quality, deficiency or excess of water and light, heat, pollution, mechanical and chemical damage to trees, and mitigation of

tree-related hazards. Although quite striking in an urban environment, large trees in particular present a continuing dilemma for the field of urban forestry due to the stresses that urban trees undergo from automobile exhaust, constraining hardscape and building foundations, and physical damage (Pickett et al. 2008). Urban forestry also challenges the arborists that tend the trees. The lack of space requires greater use of rigging skills and traffic and pedestrian control. The many constraints that the typical urban environment places on trees limits the average lifespan of a city tree to only 32 years – 13 years if planted in a downtown area – which is far short of the 150-year average life span of trees in rural settings (Herwitz 2001).

Management challenges for urban forestry include maintaining a tree and planting site inventory, quantifying and maximizing the benefits of trees, minimizing costs, obtaining and maintaining public support and funding, and establishing laws and policies for trees on public and on private land. Urban forestry presents many social issues that require addressing to allow urban forestry to be seen by the many as an advantage rather than a curse on their environment. Social issues include under funding which leads to inadequate maintenance of urban trees. In the UK the National Urban Forestry Unit produced a series of case studies around best practice in urban forestry which is archived here (<http://www.bbcwildlife.org.uk/node/3576>).

## By country

### United States

#### History

Tree warden laws in the New England states are important examples of some of the earliest and most far-sighted state urban forestry and forest conservation legislation. In 1896, the Massachusetts legislature passed the first tree warden law, and the other five New England states soon followed suit: Connecticut, Rhode Island, and New Hampshire in 1901, Vermont in 1904, and Maine in 1919. (Kinney 1972, Favretti 1982, Campanella 2003).

As villages and towns grew in population and wealth, ornamentation of public, or common, spaces with shade trees also increased. However, the ornamentation of public areas did not evolve into a social movement until the late 18th century, when private individuals seriously promoted and sponsored public beautification with shade and ornamental trees (Favretti 1982, Lawrence 1995). Almost a century later, around 1850, institutions and organization were founded to promote ornamentation through private means (Egleston 1878, Favretti 1982). In the 1890s, New England's "Nail" laws enabled towns to take definitive steps to distinguish which shade trees were public. Chapter 196 of the 1890 Massachusetts Acts and Resolves stated that a public shade tree was to be designated by driving a nail or spike, with the letter M plainly impressed on its head, into the relevant trunk. Connecticut passed a similar law in 1893, except its certified nails and spikes bore the letter C. (Northrup 1887).

The rapid urbanization of American cities in the late 19th century was a concern to many as encouraging intellectual separation of humanity and nature (Rees 1997). By the end of the 19th century, social reformers were just beginning to understand the relationship between developing parks in urban areas and "[engendering] a better society" (Young 1995:536). At this time, parks and trees were not necessarily seen as a way to allow urban dwellers to experience nature, but more of a means of providing mechanisms of acculturation and control for newly arrived immigrants and their children (e.g., areas to encourage "structured play" and thus serve as a deterrent for youth crime) (Pincetl and Gearin 2005). Other prominent public intellectuals were interested in exploring the synergy between ecological and social systems, including American landscape architect Fredrick Law Olmsted, designer of 17 major U.S. urban parks and a visionary in seeing the value of including green space and trees as a fundamental part of metropolitan infrastructure (Young 2009). To Olmsted, unity between nature and urban dwellers was not only physical, but also spiritual: "Gradually and silently the charm comes over us; the beauty has entered our souls; we know not exactly when or how, but going away we remember it with a tender, subdued, filial-like joy" (Beveridge and Schuyler 1983 cited in Young 2009:320). The conscious inclusion of trees in urban designs for American cities such as Chicago, San Francisco, and Minneapolis was also inspired by Paris's urban forest and its broad, tree-lined boulevards as well as by the English romantic landscape movement (Zube 1973). The belief in green cover by early park proponents as a promoter of social cohesion has been corroborated by more recent research that links trees to the presence of stronger ties among neighbors, more adult supervision of children in outdoor areas, more use of the neighborhood common areas, and fewer property and violent crime (Kuo et al. 1998, Kuo and Sullivan 2001, Kuo 2003).

Many municipalities throughout the United States employ community-level tree ordinances to empower planning officials to regulate the planting, maintenance, and preservation of trees. The development of tree ordinances emerged largely as a response to the Dutch Elm Disease that plagued cities from the 1930s to 1960s, and grew in response to urban development, loss of urban tree canopy, and rising public concern for the environment (Wolf 2003). The 1980s saw the beginning of the second generation of ordinances with higher standards and specific foci, as communities sought to create more environmentally pleasing harmony between new development and existing infrastructure. These new ordinances, legislated by local governments, may include specific provisions such as the diameter of tree and percentage of trees to be protected during construction activities (Xiao 1995). The implementation of these tree ordinances is greatly aided by a significant effort by community tree advocates to conduct public

outreach and education aimed at increasing environmental concern for urban trees, such as through National Arbor Day celebrations and the USDA Urban and Community Forestry Program (Dwyer et al. 2000, Hunter and Rinner 2004, Norton and Hannon 1997, Wall et al. 2006). Much of the work on the ground is performed by non-profits funded by private donations and government grants.

Policy on urban forestry is less contentious and partisan than many other forestry issues, such as resource extraction in national forests. However, the uneven distribution of healthy urban forests across the landscape has become a growing concern in the past 20 years. This is because the urban forest has become an increasingly important component of bioregional ecological health with the expanding ecological footprint of urban areas. Based on American Forests' Urban Ecosystem Analyses conducted over the past six years in ten cities, an estimated 634,407,719 trees have been lost from metropolitan areas across the U.S. as the result of urban and suburban development (American Forests 2011). This is often due to the failure of municipalities to integrate trees and other elements of the green infrastructure into their day-to-day planning and decision-making processes (American Forests 2002). The inconsistent quality of urban forestry programs on the local level ultimately impacts the regional context in which contiguous urban forests reside, and is greatly exacerbated by suburban sprawl as well as other social and ecological effects (Webb et al. 2008). The recognition of this hierarchical linkage among healthy urban forests and the effectiveness of broader ecosystem protection goals (e.g., maintaining biodiversity and wildlife corridors), highlights the need for scientists and policymakers to gain a better understanding of the socio-spatial dynamics that are associated with tree canopy health at different scales (Wu 2008).

## United Kingdom

In the UK urban forestry was pioneered around the turn of the 19th century by the Midland reforestation association, whose focus was in the Black Country. In the mid 1990s the National Urban Forestry Unit (NUFU) grew out of a Black Country Urban Forestry Unit and promoted urban forestry across the UK, notably including the establishment of the Black Country Urban Forest.<sup>[11]</sup> As urban forestry become more mainstream in the 21st century, NUFU was wound up, and its advocacy role now carried on by organisations such as The Wildlife Trusts and the Woodland Trust.

## Canada

### Toronto

Toronto is a diverse city with a mosaic urban forest – a patchwork of unique situations made up of trees growing in the many residential yards, lining the public streets, and beautifying public parks. Unlike the trees that grow in a wild setting, urban trees are faced with harsh conditions that can be detrimental to their health and growing potential. Soil compaction, air pollution, habitat fragmentation and competition from invasive species are some of the hardships city trees endure. Some neighbourhoods have a geriatric tree population; many mature trees that will reach the end of their lifespan very soon, with few young trees to replace them.

Some neighbourhoods suffer a serious lack of species diversity, with mainly ornamental, non-native or invasive tree species such as Bradford pear, Japanese tree lilac and Norway maple. Still other neighbourhoods, most often newly constructed subdivisions, lack tree cover completely.

Simply planting more trees cannot solve the problems faced by the urban forest. Through creative and innovative approaches the public, partnered with private enterprises can maximize the potential benefits of trees planted, and minimize the stresses they will have to overcome.

Although most people express a concern for urban trees and consider them very important, many lack the basic knowledge and skills needed to address and prevent the issues listed above. Collective action, or inaction, will make or break the future of the urban forest. Through fostering a sense of ownership amongst Toronto residents for this commonly owned resource, residents will enjoy better air quality and reduce their demand for energy.

## Constraints

Resolving limitations will require coordinated efforts among cities, regions, and countries (Meza, 1992; Nilsson, 2000; Valencia, 2000).

- Loss of green space is continuous as cities expand; available growing space is limited in city centres. This problem is compounded by pressure to convert green space, parks, etc. into building sites (Glickman, 1999).
- Inadequate space is allowed for the root system.
- Poor soil is used when planting specimens.
- Incorrect and neglected staking leads to bark damage.

- Larger, more mature trees are often used to provide scale and a sense of establishment to a scheme. These trees grow more slowly and do not thrive in alien soils whilst smaller specimens can adapt more readily to existing conditions.
- Lack of information on the tolerances of urban tree cultivars to environmental constraints.
- Poor tree selection which leads to problems in the future
- Poor nursery stock and failure of post-care
- Limited genetic diversity
- Too few communities have working tree inventories and very few have urban forest management plans.
- Lack of public awareness about the benefits of healthy urban forests.
- Poor tree care practices by citizens and untrained arborists.

## Organizations

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|---|--|--|
| ▪ Alliance for Community Trees<br>( <a href="http://www.actrees.org">http://www.actrees.org</a> ) | ▪ Our City Forest<br>( <a href="http://www.ourcityforest.org">http://www.ourcityforest.org</a> )                     | ▪ TREE Fund<br>( <a href="http://www.treefund.org">http://www.treefund.org</a> )                                     |
| ▪ American Forests  | ▪ Society of Municipal Arborists<br>( <a href="http://www.urban-forestry.com">http://www.urban-forestry.com</a> )    | ▪ TreeLink ( <a href="http://www.treelink.org">http://www.treelink.org</a> )   |
| ▪ Casey Trees   | ▪ Society of American Foresters  | ▪ Trees Are Good<br>( <a href="http://www.treesaregood.com">http://www.treesaregood.com</a> )                        |
| ▪ Friends of the Urban Forest   | ▪ LEAF ( <a href="http://www.yourleaf.org">http://www.yourleaf.org</a> )   | ▪ Canopy.org<br>( <a href="http://www.canopy.org">http://www.canopy.org</a> )  |
| ▪ Greening of Detroit   | ▪ Tennessee Urban Forestry Council<br>( <a href="http://www.tufc.com">http://www.tufc.com</a> )                      | ▪ Trees Atlanta  |
| ▪ Hantz Woodlands   | ▪ The Tree Council, UK<br>( <a href="http://www.treecouncil.org.uk/">http://www.treecouncil.org.uk/</a> )            | ▪ Arborist Video Blog<br>( <a href="http://greybrucetree.ca/category/blo">http://greybrucetree.ca/category/blo</a> ) |
| ▪ International Society of Arboriculture  | ▪ Tree City USA Program<br>( <a href="http://www.arborday.org/programs/ti">http://www.arborday.org/programs/ti</a> ) | ▪ TreesCharlotte<br>( <a href="http://treescharlotte.org/">http://treescharlotte.org/</a> )                          |
| ▪ National Urban Forestry Unit  |  |  |
| ▪ OpenTreeMap<br>( <a href="http://www.opentreemap.org">http://www.opentreemap.org</a> )          |  |  |

## See also

- |                                   |                           |                               |
|-----------------------------------|---------------------------|-------------------------------|
| ▪ Arboriculture                   | ▪ Horticulture            | ▪ Natural resource management |
| ▪ European Arboricultural Council | ▪ i-Tree                  | ▪ Planting strategy           |
| ▪ Forestry                        | ▪ Landscape architecture  | ▪ Silviculture                |
| ▪ Garden city movement            | ▪ Million Tree Initiative | ▪ Urban reforestation         |

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### Notes

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