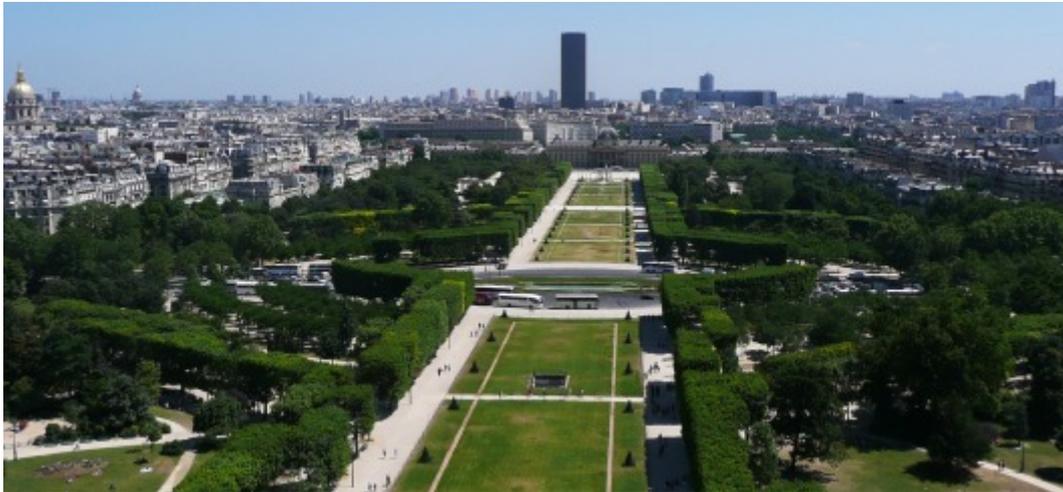


## Urban and Peri-Urban Forestry

### Basic knowledge



**The aim of this module is to assist forest managers, forest policymakers and decision-makers, urban planners, urban foresters, arborists, private landowners and other stakeholders in assessing, planning and sustainably managing trees and forests in and around cities. The module presents common issues and challenges associated with urban and peri-urban forestry and provides strategies and tools for addressing these challenges, as well as for sustainably managing urban and peri-urban forest and tree resources. It includes case studies from a range of cities, countries and regions.**

#### **What is urban and peri-urban forestry?**

Urban and peri-urban forestry is an integrated, interdisciplinary, participatory and strategic approach to planning and managing forest and tree resources in and around cities. It involves the assessment, planning, planting, maintenance, preservation and monitoring of urban and peri-urban forest and tree resources and can operate at scales ranging from single trees to landscapes and ecosystems. The scope of urban and peri-urban forestry encompasses the entire development spectrum – from sprawling, spontaneously growing metropolises to highly planned urban development projects.

#### **Why is urban and peri-urban forestry important?**

In 2008, for the first time in history, more than half of the world's population lived in cities and towns. Today, 54 percent of the global population is urban, and this proportion is expected to increase to 66 percent by 2050. Poorly planned urban growth is likely to result in an increased "heat island" effect (see [In more depth](#)), air pollution, soil degradation and public health issues. Maintaining sufficient healthy and safe food, clean water, clean air, energy, housing and green spaces in urban areas is a major challenge. In the absence of integrated land-use planning and sustainable urban development strategies, rapid urbanization can damage forest and tree resources, thus reducing their contribution to the development of sustainable cities. On the other hand, healthy and sustainably managed urban and peri-urban forests can increase the health and resilience of cities in the face of changing and increasingly challenging economic, social and physical environments.

#### ***The benefits of urban and peri-urban forestry***

Urban and peri-urban forestry has many potential benefits, which vary in nature and importance depending on the location and economic, social and environmental circumstances of a given urban/peri-urban complex. For example, the sustainable production of woodfuel may be of considerable importance in a rapidly expanding urban area in a developing country, whereas the provision of recreational opportunities may be afforded higher priority in cities with developed economies. The benefits derived from urban and peri-urban forestry are also likely to

vary in different areas of the same urban/peri-urban complex and among socioeconomic groups.

#### **Urban issues**

- Food security
- Urban poverty
- Soil and landscape degradation
- Reduced biodiversity
- Air and noise pollution
- Greenhouse-gas emissions
- Extreme weather events
- Energy shortage
- Heat island effect
- Limited accessible green space
- Public health
- Stormwater runoff
- Limited recreation opportunities
- Exposure
- Limited water resources

#### **Potential benefits of urban and peri-urban forestry**

- Provide food, clean water and woodfuel
- Create jobs and increase income
- Improve soil conditions and prevent erosion
- Preserve and increase biodiversity
- Remove air pollutants and buffer noise
- Sequester carbon and mitigate climate change
- Build resilience
- Save energy and grow woodfuel
- Provide shade
- Provide more accessible green space
- Improve physical and mental health of residents
- Mitigate stormwater runoff and reduce flooding
- Provide opportunities for recreation and environmental education
- Provide shelter
- Reuse wastewater

#### ***Management of urban and peri-urban forests***

An integrated urban and peri-urban forest management plan analyses the current situation, identifies potential challenges, and develops strategies to meet current and future needs. It seeks to reduce risks and costs and to manage urban and peri-urban trees and forests to maintain and increase the provision of goods and environmental services. One size does not fit all: each urban and peri-urban area has its own unique and constantly evolving economic, social and environmental conditions. The priorities and foci of urban and peri-urban forestry are likely to vary in different situations, and they should be derived through consultation and teamwork among multiple stakeholders – such as urban foresters, arborists, forest policymakers and decision-makers, urban planners, health and safety professionals, landowners and local communities. Communication and collaboration play key roles in raising awareness about urban and peri-urban forestry and supporting the development and implementation of an urban and peri-urban forest management plan.

#### **Urban and peri-urban forestry contributes to SDGs:**



**13** CLIMATE  
ACTION



**15** LIFE  
ON LAND



## In more depth

Trees and forests in and around cities provide a wide range of goods and environmental services and make important contributions to the livelihoods and quality of life of urban dwellers.

Many cities have protected, restored or established forests on their peripheries (“peri-urban” forests) with the aim of, for example: protecting drinking water supplies; combating desertification; protecting settlements from avalanches, floods and sandstorms; safeguarding biodiversity; and providing recreational opportunities. National or provincial forest services are usually responsible for the management of peri-urban forests.

Trees play a number of important roles in urban areas. For example, they reduce hourly ozone, sulphur dioxide and particulate matter in cities, remove large quantities of carbon dioxide from the atmosphere, and release oxygen. They can ameliorate the “heat island” effect of cities – that is, the higher surface and atmospheric temperatures that commonly occur in cities due, in part, to the absorption of sunlight by paved surfaces and roofs – through evaporative cooling and by providing shade. Forests and trees also help beautify urban landscapes (often increasing land values), produce consumable goods such as fruits, woodfuel and construction material, and provide recreational and educational opportunities as well as habitat for urban wildlife.

Specialized municipal departments (e.g. “parks and recreation”) usually have responsibility for managing public urban forests and other public green spaces. In many cities, however, a large part of the urban forest estate is privately owned, for example in private gardens, hotel grounds, private medical facilities and office developments. The management of urban and peri-urban forests and other green infrastructure, therefore, requires careful coordination among national, regional and local governmental agencies and with private landowners. Decision-making processes that involve diverse stakeholders (e.g. policymakers, researchers, practitioners, government agencies, landowners, forest users and local communities) are likely to be most effective in identifying common needs, setting priorities, and preparing and implementing management plans.

### ***Characteristics and challenges of urban and peri-urban forestry***

Given the close proximity of large populations, the diverse functions of and demands on urban forests and trees, and the unique physical environments presented by urban landscapes, urban foresters, arborists and urban forest planners require different skill sets to those commonly found among forest managers in rural settings. Urban and peri-urban forests differ from forests in rural areas in various ways:

- **Diversity and complexity.** Urban and peri-urban forests are often highly diverse in terms of land use, land ownership and management objectives. Multiple land uses create complex landscapes with a wide range of tree species, ground covers, soil types, microclimates and wildlife and diverse people, buildings and other infrastructure.
- **Fragmentation and connectedness.** Urbanization inevitably leads to landscape fragmentation. Compared with forests in rural areas, urban and peri-urban forests are usually sparsely distributed and poorly interconnected, although they are often highly connected with other elements of the urban environment, such as roads and buildings, and they have a close relationship with people living in and around them.
- **Dynamics and human dimension.** Urban and peri-urban forests are subject to powerful human forces that drive often rapid changes in urban land use and management. Human activities and attitudes strongly influence the planning, establishment, maintenance and conservation of urban and peri-urban forests.

Urban and peri-urban forest management faces many challenges, such as:

- competition and conflict with other land uses (e.g. infrastructure and farmland);
- the perception of urban and peri-urban forests as obstacles to urban development;
- the perception that urban and peri-urban forests pose hazards to urban dwellers (e.g. wildfire and tree falls) and, linked to that, a lack of understanding of the benefits of urban and peri-urban forests;
- the diversity and complexity of urban and peri-urban forests, including in their ownership;
- a harsh growing environment;
- the lack of a legal framework and policy support;
- inadequate funding;
- the lack of professional staff;
- limited educational and training resources; and
- insufficient communication among stakeholders.

### ***Sustainable management of urban and peri-urban forests***

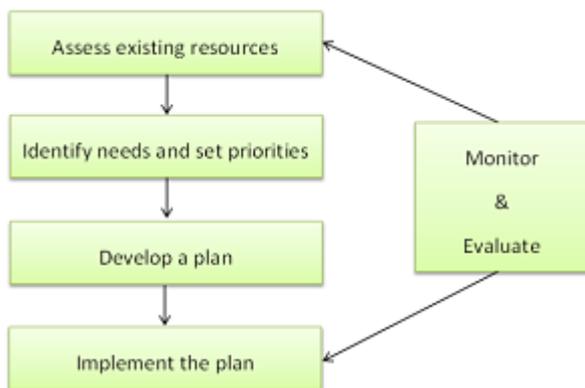
## Planners and managers of urban and peri-urban forests and trees have three basic goals:

1. ensuring that urban and peri-urban forests produce sufficient goods and environmental services to meet the needs of growing urban and peri-urban populations;
2. achieving an appropriate balance between urban development and environmental conservation; and
3. ensuring the sustainability of urban and peri-urban forest resources and their capacity to meet the needs of present and future generations.

**Urban and peri-urban forests are dynamic, and their structure, components and distribution can change dramatically. Urban forest management plans should be comprehensive and long-term, they should be adaptable to change, and they should aim to sustain benefits and functions over time at the lowest possible cost.**

**The figure shows that the sustainable management of an urban forest complex (comprising both urban and peri-urban forests and trees) involves five basic steps:**

1. assess existing resources;
2. identify needs and set priorities;
3. develop a management plan;
4. implement the plan; and
5. monitor the implementation of the plan over time and adapt as required.



### **1. Assess existing resources**

The first step in the preparation of an urban and peri-urban forest management plan is an inventory of the resource, including its history, status and existing issues. The type and scope of data will vary depending on management objectives (e.g. production, protection or recreation), which may differ within an urban landscape and between cities (and countries). The scope of the inventory will also depend on the availability of funds and technologies such as remote sensing.

There are several ways to conduct inventories. They may be simple “windshield surveys” in which tree data are collected from a slow-moving car, or statistical samples of an entire urban and peri-urban forest estate.

In addition to the information typically collected in [forest inventories](#), urban and peri-urban forest inventories should include assessments of risks to human health and safety, maintenance needs, and existing conflicts over management and use. Tree health is an important parameter in urban and peri-urban forests because decayed and fallen trees can pose risks to people in densely populated cities as well as to urban infrastructure. Some tree pests, such as the processionary moth, may also be of concern to human health and safety.

Information should be gathered on land availability and tenure, water resources, and tree nurseries – including the availability of seedlings of different species.

## **2. Identifying needs and setting priorities**

The management objectives of urban and peri-urban forestry should be identified and prioritized. They may include the provision of goods such as wood, woodfuel, food and fibre and environmental and recreational services.

Data from the forest inventory and other sources (e.g. urban plans and social-impact surveys) can help identify potential issues and future management needs, planting sites, tree-related risks, and the potential for the production of goods and environmental services. Such data provide the basis for multistakeholder priority-setting processes that aim to achieve an appropriate balance among legitimate competing interests.

The success of urban and peri-urban forest management depends on public support and participation. The involvement of the community in priority-setting and other decision-making processes, therefore, is essential from an early stage.

## **3. Developing a management plan**

Management plans for urban and peri-urban forests may vary in scale (e.g. local, city, national or regional), duration (short-term to long-term) and type (e.g. master or strategic). Their development requires adequate baseline data, professional guidance, time, funding and the collaboration of multiple stakeholders. Ideally they will encompass an entire urban and peri-urban forest estate, even though different segments of the estate are managed by different entities.

A standard management plan for urban and peri-urban forests should include sections on the following

- Background
- Current status and issues
- Analysis of potential for urban and peri-urban forest development
- Administrative and legal framework
- SMART (specific, measurable, achievable, realistic and timely) goals and objectives
- Cost–benefit analysis
- Budget
- Tree establishment, maintenance, protection, removal and use
- Outreach and public education activities, including safety
- Community involvement process
- Gaining political endorsement
- Workplan with timeline.

## **4. Implementing the management plan**

Those responsible for implementation (e.g. government agencies, other stakeholders, or combinations of entities) should take the actions specified in the management plan in a timely, effective and efficient manner. Detailed workplans should be developed with clearly delineated responsibilities and specified actions.

The approach taken to implementing the management plan will vary depending on the nature of the administrative system and laws, the stage of development of the urban environment, and the level of public involvement. Typically, however, the implementation of an urban and peri-urban forest management plan includes the following steps:

- clarifying and reaching agreement on the respective responsibilities of the entities managing the urban and peri-urban forest and tree resources;
- passing tree ordinances, regulations or policies;
- making available the necessary financial resources;
- hiring tree-care professionals and/or planning community management programmes;
- developing public education programmes; and
- conducting activities according to the detailed workplan.

## **5. Monitoring and evaluation**

Ensuring the sustainability of urban and peri-urban forests requires a long-term monitoring programme so that the effects of management interventions can be evaluated and the achievement (or otherwise) of management objectives can be assessed. An effective monitoring programme also generates information that can be used to adapt the forest management plan in light of experience and to inform the development of future management plans.

### ***Planting trees in urban areas***

The following points should be considered when planting trees in urban and peri-urban environments:

- A **site evaluation** includes an analysis of the site factors likely to affect tree growth or be affected by it, both above-ground (e.g. light, slope, wind, salt, surrounding vegetation, overhead wires, street/security lights, buildings, signs and vandalism) and below-ground (e.g. rooting space restrictions, soil pH, soil compaction, soil drainage, soil depth, and the location of underground utilities).
- **Site modification** – such as by relocating lights and wires, changing soil pH, improving drainage and incorporating compost – may be required to ensure adequate tree establishment and reduce seedling mortality.
- Key elements to be considered in **tree species selection** include their suitability to site conditions, the potential for achieving management objectives (e.g. the production of goods and environmental services), longevity, pest resistance and maintenance needs. Native species may be best adapted to the local environment and most able to provide suitable habitat for local biodiversity.
- **Tree-planting** should be guided or performed by professionals. Plantings should be tended to ensure survival, optimal growth and the achievement of management objectives: interventions may involve, at various stages, mulching, weed control, irrigation, fertilization, pruning and thinning.

Additional tips:

- Consider species diversity and human needs.
- Select high-quality planting material and prepare it adequately.
- Use species suited to the climate and the site.
- Use species and cultivars with inherently resilient structures capable of adapting to harsh urban conditions.
- Plant trees in locations with adequate space for development.
- Avoid tree–sidewalk conflicts by using trees that are tolerant to root damage and planting trees at the right depth.
- Avoid species that produce pulpy fruit, allergenic pollen or unpleasant-smelling flowers, and those likely to drop “honeydew” (a sticky, sugar-rich fluid secreted by aphids and some scale insects feeding on plant sap), especially close to roads and parking areas.
- When planting under power lines or other overhead cables, choose species whose maximum height at maturity will be significantly less than the height of the cables.
- Involve local people as much as possible.

### ***Protection of trees in urban and peri-urban areas***

Urban and peri-urban environments exert many pressures that may result in the loss, damage or decline of forest resources. The protection of those resources requires an adequate legal framework and the use of best management practices.

#### **Legal framework: tree ordinances, regulations and public policies**

Legislation is a powerful tool for protecting existing forests and trees and for enabling local communities to develop and use urban and peri-urban forests sustainably. Urban and peri-urban forest estates are often dispersed in diverse locations and involve complex management arrangements on both public and private land. Policies, laws and regulations can provide authority, offer guidance to residents, specify rights, responsibilities and minimum standards, and regulate human activities affecting the resource. They may include the following:

- **Policies** establish principles or guidelines for future decisions, actions, laws and regulations and provide an overview of the general approach to be taken to urban and peri-urban forest establishment, management and use.
- **Tree ordinances and by-laws** may provide authority, establish required conditions or actions, offer guidance, set standards, identify agents responsible for management activities, and provide incentives for maintaining a healthy, vigorous and well-managed urban or peri-urban forest. Common types of tree ordinances and by-laws include street tree ordinances, tree protection ordinances (including compensatory measures for damage), tree preservation ordinances and by-laws, and view ordinances (i.e. protecting scenic views from trees on neighbouring properties that might block them).
- **Permits** are usually defined in tree ordinances and may encompass both publicly and privately owned trees. Permits commonly address issues related to tree removal, tree work, and the encroachment of construction in defined tree protection zones.
- **Standards and specifications** are guidelines for work performance, including tree-planting, tree maintenance and tree protection. Standards and specifications should be site-specific in order to best suit local circumstances.

#### **Best management practices**

Best management practices [\[see cases\]](#) can be used to protect trees before, during and after the development of a new urban area, such as a housing, industrial or commercial centre.

**Pre-development.** A well-designed urban forest management plan is essential for ensuring that an urban development retains and protects an appropriate number of pre-existing trees and is able to establish and manage an urban forest that meets the needs of the new community. Making use of existing trees can reduce the need for tree-planting, which is expensive, and reduces the time required before the urban community benefits from the presence of mature trees and forests.

Key elements in a successful tree retention and protection plan are:

- the definition of development zones;
- the identification of forests and trees to be retained; and
- planned protection measures.

**During development.** Care is needed to avoid damaging pre-existing forests and trees during the development of new urban centres. Some municipalities develop codes of conduct to regulate interventions affecting trees and forests while construction is in progress. Such codes may include the following:

- Design spaces to avoid conflicts.
- Install protective structures.
- Avoid root damage.
- Reduce soil compaction.
- Prepare forests and trees for construction disturbance, such as by ensuring that they are as healthy as possible before work begins (e.g. by watering and fertilizing).
- Protect and preserve (e.g. by stockpiling) soil for future tree-planting.
  
- Provide public education about the value of forests and trees in urban environments.
- Coordinate with other departments.
- Monitor the construction process.

**Post development.** A long-term plan should be put in place to protect trees from vandalism, disease and other threats. The plan may include periodic interventions, such as:

- mulching;
- pruning;
- thinning and tending;
- “training” young trees and caring for old trees;
- stability and risk assessment;
- pest and disease monitoring and related phytosanitary treatments; and
- tree removal.

#### ***Links to other planning and management activities***

Most of the planning and management activities described in this module refer to urban and peri-urban forests under the jurisdiction of municipal governments. Cities can have major impacts well beyond municipal boundaries. Management plans for peri-urban forests under the jurisdiction of national or provincial forest departments should aim to alleviate the pressures and demands on such forests arising from urbanization. The management plans of the various jurisdictions should be compatible, interlinked and, as much as possible, aligned with the needs of growing urban populations.

## Further learning

- Clark, J.R., Matheny, N.P., Cross, G., & Wake, V. 1997. [A model of urban forest sustainability](#). *Journal of Arboriculture*, 23, 17–30.
- Cranz, G. & Boland, M. 2004. [Defining the sustainable park: a fifth model for urban parks](#). *Landscape Journal*, 23(2): 102–120.
- Day, S.D. & Dickinson, S.B., eds. 2008. [Managing stormwater for urban sustainability using trees and structural soils](#). Blacksburg, USA, Virginia Polytechnic Institute and State University.
- Dwyer, J.F., Nowak, D.J. & Noble, M.H. 2003. [Sustaining urban forests](#). *Journal of Arboriculture*, 29(1), 49–55.
- FAO. 2008. [WISDOM for cities: analysis of wood energy and urbanization using WISDOM methodology](#). Rome.
- Knuth, L. 2005. [Legal and institutional aspects of urban and peri-urban forestry and greening](#). Rome, FAO.
- Maco, S.E. & McPherson, E.G. 2003. [A practical approach to assessing structure, function, and value of street tree populations in small communities](#). *Journal of Arboriculture*, 29(2): 84–97.
- Matheny, N.P. & Clark, J.R. 2008. *Municipal specialist certification study guide*. Champaign, USA, International Society of Arboriculture.
- McLain, R., Poe, M., Hurley, P.T., Lecompte-Mastenbrook, J. & Emery, M.R. 2012. [Producing edible landscapes in Seattle's urban forest](#). *Urban Forestry & Urban Greening*, 11(2): 187–194.
- McPherson, E.G. & Simpson, J.R. 2003. [Potential energy savings in buildings by an urban tree planting programme in California](#). *Urban Forestry & Urban Greening*, 2(2): 73–86.
- New Jersey Community Forestry Program. 2013. [New Jersey Shade Tree and Community Forestry Assistance Act](#).
- Ordóñez, C. & Duinker, P.N. 2010. [Interpreting sustainability for urban forests](#). *Sustainability*, 2(6): 1510–1522.
- Pennsylvania State University. 2008. [Planting and after care of community trees](#). University Park, USA, Pennsylvania State University.
- Pokorny, J., O'Brien, J., Hauer, R., Johnson, G., Albers, J., Bedker, P. & Mielke, M. 2003. [Urban tree risk management: a community guide to program design and implementation](#). St Paul, USA, USDA Forest Service Northeastern Area State and Private Forestry.
- Prefeitura da Cidade do Rio de Janeiro. 2015. [Plano director de arborização urbana da cidade do Rio de Janeiro](#).
- Prefeitura de São Paulo - Verde e Meio Ambiente. 2015. [Manúal técnico de arborização urbana](#).
- Prefeitura Municipal de Belém & Universidade Federal Rural da Amazônia. 2013. [Manúal de orientação técnica de arborização urbana de Belém. Guia para planejamento, implantação e manutenção da arborização em logradouros públicos](#).
- Thompson, R., Pillsbury, N.H. & Hanna, R.J. 1994. [The elements of sustainability in urban forestry](#). Riverside, USA, California Department of Forestry and Fire Protection.
- USDA Forest Service. [A guide: developing a street and park tree management plan](#).
- USDA Forest Service. 2003. [Urban and community forestry outreach services strategies for all communities](#).
- Vermont Department of Forests, Parks & Recreation. 2013. [Guidelines for developing urban & community forestry plans](#).
- Ward, C.D., Parker, C.M. & Shackleton, C.M. 2010. [The use and appreciation of botanical gardens as urban green spaces in South Africa](#). *Urban Forestry & Urban Greening*, 9(1): 49–55.

## Credits

This module was developed with the kind collaboration of the following people and/or institutions:

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