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(Eds.)
Urban Forests and Trees

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Urban Forests and Trees

A Reference Book

With 169 Figures and 31 Tables

Springer

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Preface

This publication is the result of more than six years of hard work by a dedicated group of European urban forest and tree experts. The editors are indebted to the national experts of COST Action E12 'Urban Forests and Trees' and to the others who have contributed to the various chapters in this publication. Ultimately, 59 authors from 21 European countries feature in this book. The European Cooperation in the field of Scientific and Technical Research (COST) and in particular its Secretariat deserve our gratitude for their support in establishing an active European community of urban forestry experts.

In our work to prepare this publication, we have been assisted by Karen Sejr, who provided crucial editorial support. We are also grateful to Jette Abel, Birgit Brynjolf, Jette Alsing Larsen, and other colleagues at the Danish Centre for Forest, Landscape and Planning, KVL. Without their contributions, the work could never have been completed. Words of gratitude also go to the publisher, Springer, who have supported the idea to publish a first European reference book on urban forests and urban trees from the very start, and who showed patience during the long production process.

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Sadly our good colleagues Ryszard Siwecki and Friedrich Duhme passed away during the term of COST Action E12. Their contributions to the establishment of a European community of urban forestry experts are duly acknowledged.

The editors
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Introduction

Trees for Better Cities

Today more people live in cities and towns than in rural areas. Urbanization continues in an already heavily urbanized Europe, and as more people come or choose to live in towns and cities, the quality of the urban environment becomes increasingly important. Green spaces are a vital part of any urban conglomeration, providing a range of environmental, social, cultural and economic benefits. Trees in woodlands, parks and gardens, and aligning streets and squares are the most important elements of such green areas, yet their benefits are often overlooked and their proper care neglected.

Urbanization does not only concern the inner-city or peri-urban green spaces, as forests and natural resources at large are also affected by it. The dominance of urban values, norms, preferences and use has led to an emphasis on a wide range of forest and nature goods and services. In the case of forestry, for example, in many European countries social and environmental services are now regarded at the same level as timber production, as acknowledged in new forest and nature policies. Recreational use of forest and nature is higher than ever before, and increasing attention is given to the impacts of green space on human health and well being.

As a result of urbanization, attention for the role of forests, parks, trees and other green space in contributing to sustainable and livable cities and towns has increased at the European and national level. The expanding body of scientific literature on urban green resources, their current and potential functions, their appreciation by urban dwellers, and of course the best way to plan, design, establish, conserve and manage them, testifies of this growing importance.

The Urban Forestry Approach

Among the integrative natural resource management approaches that have been developed recently to meet new, urban demands is that of Urban Forestry. It embodies a multidisciplinary approach to the planning and management of all forest and tree resources – ranging from street trees to peri-urban woodlands – in and near urban areas. Originating in North America during the 1960s and 1970s, urban forestry has attempted to bring various professions and approaches together to take a more integrative perspective on the tree-based part of urban green structures.

In spite of its rich heritage in urban green-space planning and management, it has taken Europe some time to develop an urban forestry research community of its own. Initial reluctance to introduce the concept was only recently overcome. This happened

when the need for such a strategic, integrative and multidisciplinary approach to urban green-space planning and management in highly urban societies was recognised. Recent years have shown the emergence of a number of initiatives to promote and coordinate urban forestry as a research domain in Europe.

COST Action E12 Urban Forests and Trees

One of the key initiatives in this respect was COST Action E12 *Urban Forests and Trees*. *COST* stands for 'European **CO**-operation in the field of **S**cientific and **T**echnical Research'. Its main objective is to ensure that Europe holds a strong position in the field of scientific and technical research for peaceful purposes, by increasing European co-operation and interaction in this field. It is based on so-called 'Actions', which are networks of coordinated national research projects in fields that are of interest to the different member states. The Actions are outlined by a *Memorandum of Understanding* (MOU) signed by the governments of the COST states wishing to participate in the Action.

COST Action E12, in operation from 1997 until 2002, had as its main objective to improve the knowledge base needed for better planning, design, establishment and management of forests and other tree resources in and near urban areas, and, by doing this, to establish urban forestry as a scientific domain in Europe. The Action developed into one of the largest COST Actions ever with close to 100 individual experts representing 79 institutions from 22 countries, demonstrating the large interest in urban green-space issues. Daily coordination of COST E12 was in the hands of the Danish Forest and Landscape Research Institute (now part of the Danish Centre for Forest, Landscape and Planning, KVL).

The establishment of a comprehensive description of the state of the art of urban forest and tree resources was a key element of knowledge generation and networking. During 1998 and 1999, participating national experts prepared state-of-the-art reports on research on urban forests and trees in their respective countries. Reports from twenty countries describing over 400 research projects were compiled into a report published by the European Commission at the end of 1999 (Forrest et al. 1999). Education is important for newly emerging research fields, and therefore the Action also carried out a review of higher education on urban forests and trees in Europe. The final report of this work, with 28 country reports was published in March 2002, also by the European Commission (Randrup et al. 2001).

The First European Reference Book

As COST Action E12 progressed, and the network of researchers, educators, as well as practitioners expanded, the need for improved knowledge generation and dissemination within urban forestry became clear. The Action's reviews of research and education showed that a significant body of knowledge existed within Europe, but also that a comprehensive overview of this was still lacking.

As a result, it was decided to compile a European reference book on urban forests, urban trees, their functions and use, and their planning, design, establishment and

management. The process of compiling and editing, resulting in the book you have in your hands, started during late 2000. Sixty-five of the leading European experts within urban forestry from 21 countries have contributed to the book's contents.

Urban Forests and Trees is the first comprehensive, European reference book on the main aspects of urban forestry. In the first part of the book, information on the form, function and benefits of urban forests and trees is assembled. Chapter 1 sets the stage by providing a conceptual framework for the urban forestry approach, stressing its integrative and multidisciplinary character. The historical roots of the urban forestry approach are described in Chap. 2, which offers insight in the rich history of urban woodland, park and tree planting and management in Europe. The current status of urban forest and tree resources in Europe is the topic of Chap. 3. This chapter shows the richness and diversity in urban forest and tree resources across European cities and towns, and addresses the related difficulties in obtaining a sound overview of the resource base. The final chapter of Part I discusses the many benefits and uses of urban forests and trees, ranging from ameliorating urban microclimates to improving people's health and well being.

Urban forest and tree resources in Europe are extensive and provide urban societies with a large range of important goods and services. How to accommodate the demands of the urban population in urban forestry is the topic of Part II of the book, which addresses the more strategic aspects. Chapter 5 assesses the current status of policy-making and planning related to urban forests and trees, and makes a case for development of strategies and visions to direct urban forestry at various administrative levels. One way of 'translating' these visions into practice is by appropriate design of urban green space. Chapter 6 takes the reader on a European journey of good practice in urban forest design. The many stakeholders involved in urban forestry are the topic of the next two chapters. Examples of partnership approaches, for example involving both the public and private sector, for successful urban forestry projects are provided in Chap. 7. The involvement of people, primarily local residents, in urban forest planning and management is the topic of Chap. 8. A framework for developing participation approaches is given and elaborated through examples of public involvement.

The provision of multifunctional and sustainable urban forest and tree resources starts with the selection of plant material and proper establishment of urban trees. Part III deals with these issues, and describes the very specific growing conditions trees in urban environments face. Chapter 9 discusses the importance of plant quality for establishing trees, and addresses nursery practices. The selection of plant material for urban forestry is the topic of Chap. 10. It intends to be an introduction to the choice of species and a guide to the identification of better plant materials for different urban situations. Main reasons for careful consideration of plant quality and species selection, for example, are provided in the next two chapters. As described in Chap. 11, the abiotic growing conditions for urban trees are complex, different from natural growing conditions, and often harsh. Climatic impacts, hydrology, air and soil pollution, and fire are some of the factors described. Growing conditions are also particular from a biotic perspective, as Chap. 12 shows. Pests, diseases and other biotic threats have been a primary concern for urban foresters in Europe.

Urban forest management, the main topic of Part IV, is the level at which the strategic and operational level need to be aligned. Current practices and innovations within the management of urban woodlands and parks, such as closer-to-nature approaches and the inclusion of social-cultural considerations, are introduced in Chap. 13, while Chap. 15 has the management of individual trees, also known as arboriculture, as its topic. The latter chapter deals with the assessment of trees and the most commonly applied tree care practices: pruning, crown stabilization and wound treatment. In between these contributions, Chap. 14 demonstrates the importance of having accurate information to base management decisions on. Different types of information on the urban forest and tree resource, its use and past management need to be incorporated in comprehensive information systems.

In Part V, the last section of the book, the authors look ahead and attempt to identify developments in urban forestry research, education, and implementation. Chapter 16 briefly assesses the status of research on urban forests and trees in Europe and identifies research topics that need to be prioritized. Chapter 17 argues for the advancement of specific education dealing with the planning and management of urban forests and trees based on the profile of a European urban forester. Finally, examples of innovative urban forestry projects from different parts of Europe, on a local, city-wide and even regional scale, are presented in Chap. 18.

Final Message

This book is the ultimate result of several years of work by a dedicated group of European experts. While not being exhaustive, it represents the most comprehensive European study to date of urban forests and trees, their use, and ways to maintain and develop their multifunctionality and sustainability. A European urban forestry research and education community has emerged partly due to the existence of COST Action E12. This community now has a comprehensive reference for their work; they can place their own activities in a European perspective. The book will hopefully also serve as an important resource for higher education, inspiring both teachers and students. Moreover, policy-makers, managers and other people interested in urban forests and trees can benefit from the information presented.

There are tremendous benefits to be gained from a high quality urban environment. Properly managed forests and trees are essential for underpinning the quality of urban life, enabling European towns and cities to develop as sustainable and enjoyable places for people to live, work, recreate and play. However, European green space is continually under threat due to a wide range of reasons: political and economic dominance in land-use planning, poor growing conditions, pests and diseases, damage during building and road construction, excavation for cables and supply networks and so forth. Problems are worsened by the fragmentation of administrative responsibilities for planning, implementation and management of green space. The legal and policy framework for tree protection is often insufficient. The monitoring, design and management of urban green space lacks the required integration throughout all aspects of city administration.

Thus urban forestry is facing very significant challenges, and the availability and exchange of sound knowledge across cities, regions and countries is crucial, as is the identification of good practice. The editors and authors hope that their efforts have provided an important step forward in this respect.

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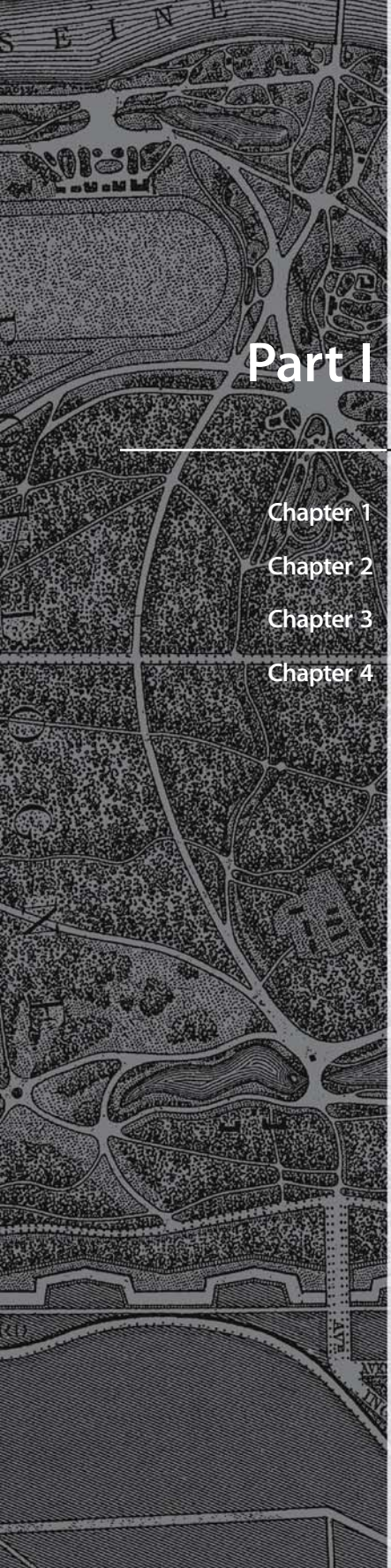

Part I Form, Function and Benefits of Urban Forests and Trees

Chapter 1

The Concept of Urban Forestry in Europe

Thomas B. Randrup · Cecil Konijnendijk · Michèle Kaennel Dobbertin · Renate Prüller

1.1 Introduction

This book provides a comprehensive perspective on the status of urban forestry with a primary focus on Europe. Before addressing various aspects of urban forestry, the applied terminology and definitions should be discussed. This is especially of relevance as the concepts of urban forests and urban forestry are relatively new and subjects of ongoing debate.

The chapter examines the concept of urban forestry from three related aspects. It starts with a general introduction about the use of concepts, definitions and terms in natural resource management and forestry. It then briefly summarizes the development of the urban forestry concept, as well as its definition in a North American context. Next, the implementation and use of the concept in Europe is discussed. As the concept and definition of urban forestry still evoke debate, especially regarding their delimitation from other related terms, the chapter ends with proposing a possible framework for a European definition of urban forestry.

1.2 About Concepts, Definitions and Terms in Natural Resource Management

1.2.1 Concepts, Terms and Definitions

In terminology, which aims at clearly describing and delimiting the meaning of special language in a particular field of knowledge, an important distinction is made between concepts and terms. Concepts are to be considered mental representations of objects within a specialized context or field. They are not bound to particular languages, but they are influenced, as we will see throughout this chapter, by social or cultural backgrounds. Concepts can take the form of terms, appellations, definitions or other linguistic forms (ISO 704:2000(E)).

Difficulties arise when concepts and terms are not related to each other on what would be an ideal one-to-one basis. In practical communication, the usual situation is that there is often more than one term for a given concept, especially if the concept is defined broadly. For example, the concept 'forest' *sensu latu* includes structures such as 'woodland', 'bush', 'rainforest', 'plantation', 'wilderness' or 'urban forest'. It is even more difficult to find precise equivalents of these terms in other languages. The German 'Wald' or 'Forst' (managed forest) is probably not equivalent to the English 'forest.' To

keep things simple, this chapter deals only with the English understanding of the 'urban forestry' concept.

To describe concepts clearly we use definitions, i.e., verbal representation of concepts. Definitions identify the characteristics of a concept and permit its differentiation from other concepts.

1.2.2 Forest – A Multiplicity of Definitions

The complexity of the concept–term relationship partly explains why there is not one generally agreed upon definition of 'forest'. Lund (2002) identifies several reasons why experts are not able to agree on a common definition of forest, for example because they believe that the term is commonly understood, because they do not want to be specific, or because the subject is too complex for people to deal with.

Definitions of forest are commonly based on either land use, land cover, or administrative function. Lund (2002) provides a comprehensive overview of national definitions with large differences among countries and sometimes different definitions within one country. The Food and Agricultural Organization of the United Nations (FAO) started a process, together with several other organizations including the International Union of Forest Research Organizations (IUFRO), to assess the potential for a more integrated use of definitions among international conventions, processes, and national understanding of forest-related terms.

Another reason for the development of diverse definitions of a concept is that they change over time as conditions change (e.g., Schanz 1999). Helms (2002) describes that forests previously regarded primarily as a source of wood, are now valued by society for providing a wide range of ecological benefits and societal services. As has already been mentioned, terminology cannot be separated from the culture, history and condition of a nation.

1.2.3 Standardization and/or Harmonization of Definitions

With a multiplicity of definitions for one concept, the need arises to find a single valuable definition for the concept to which reference can be made. Given the complexity of the problem and the diversity in needs, uses, and ownership situations, it becomes clear that such a standardization is difficult to achieve.

A solution is to foster common understanding and harmonization among definitions of core concepts and terms. Harmonization in this context means improved comparability, compatibility and consistency among definitions, establishment of linkages, and description of relationships among terms. The process of harmonization involves documentation of similarities and differences among definitions for which analytical tools can be used (FAO 2002a). In this sense, harmonization is the most important step towards accurate communication, consistent use, and understanding of a particular concept.

1.3 The Development of the Urban Forestry Concept

1.3.1 Forestry Becoming More Urban

The framework for a concept of urban forestry presented in this chapter has a strong focus on the term 'urban'. As will be shown, urban forestry is primarily defined by the (urban) location of trees and tree stands. As such, the concept deals with both the urban location and the urban function of the forest or tree. Thus, it is clear that urban forestry is at least as much about urbanity as it is about forestry.

New concepts and terms have emerged within the field of forestry in line with the changes in society mentioned before. The social side of forestry has become more recognised, for example, as forests provide a wide range of services to society which in some places are even more important than the traditional focus of forestry, i.e. timber production (Kennedy et al. 1998). Social forestry, for instance, could be defined also as forestry catering for social needs and uses (e.g., Westoby 1989). Community forestry has been defined as any form of social forestry based on the local people's direct participation in the production process, either by growing trees themselves or by processing tree products locally (Raintree 1991). Community forestry has been developed in a rural, mostly developing-country context, but is to an increasing extent being applied to urban areas (e.g., Johnston 1997b).

1.3.2 Managing Trees and Green Areas in the Urban Environment

While urban areas expand spatially and in terms of their economic, social, ecological and political influence, more forests become 'urbanized'. Carrying out forestry in an urban setting, however, is not an entirely new phenomenon. Europe has a rather rich tradition of municipal forest ownership and of 'town forestry'. Several of Europe's cities have owned and managed forests for several centuries (Konijnendijk 1999). This fact as well as other aspects mentioned in this and following paragraphs are reflected in the analysis of various definitions in Table 1.1.

While forestry has shown increasing attention for urban areas and issues, other professions have a long tradition of occupying themselves with green areas inside town boundaries. Parks and other green areas have traditionally been designed and managed by landscape architects and horticulturists. Europe has had a long history of designing and developing urban green areas (e.g., Nilsson et al. 2000). Moreover, the need to take proper care of urban trees led to the emergence of the concept and profession of arboriculture as a 'spin-off' from horticulture. Arboriculture is primarily concerned with the planting and care of trees and more peripherally concerned with shrubs, woody vines and groundcover plants (Harris et al. 1999).

1.3.3 Towards More Integrated Concepts

While different disciplines and professions have occupied themselves with the planning and management of urban green areas, cooperation between them has often been limited. Landscape architects, horticulturists, arboriculturists, foresters and others all had their own specific objectives and interests. Recent years, however, have seen an increasing focus on dealing with urban green structures as a whole. The emergence of concepts and policies related to sustainable development and urban ecology (for example based on the work of Duvigneaud (e.g., 1974)) played an important role in this respect. The United Nations' Habitat-conferences and its Conference on Environment and Development (UNCED, held in 1992) stressed that development of cities could only be achieved by incorporating social, economic and ecological dimensions. This would require integration of the efforts of different sectors and stakeholders at the local level.

Thus urban green structures rather than individual green elements have become the focus. To an increasing extent, practitioners, researchers and politicians deal with the contributions of the entire urban green structure to the quality of urban life and environment. Moreover, they have started to realize that more integrated, green-area planning and management are required to meet current societal demands when operating in high-pressure environments. This led to the emergence of new, integrated concepts and approaches. Urban ecology, as urban proponent of ecology, has been mentioned earlier. Urban agriculture is another example. It could be defined, for instance, as agriculture aimed at growing or raising, processing, and distributing a diversity of food and non-food products located within (intra-urban) or on the urban fringe (peri-urban) of a town, city or a metropolis (Mougeot 2000).

1.3.4 The Emergence of Urban Forestry

The concept of urban forestry originated in North America during the 1960s. Jorgensen introduced the concept at the University of Toronto, Canada, in 1965 (Jorgensen 1970). Urban forestry not only dealt with city trees or with single tree management, but also with tree management in the entire area influenced by and utilized by the urban population. Consequently, the 'urban forest' embraced all trees (in stands and groups as well as single trees) in and around urban areas. Jorgensen also stressed the overall ameliorating effect of trees on their environment as well as their recreational and general amenity value. The new concept also caught on in the United States, where the Society of American Foresters initiated an urban forestry working group in 1972 (Johnston 1996).

During the first decades of its history, many different interpretations of the concept of 'urban forestry' have existed and initially considerable opposition from different sides was encountered. Arboriculturists and other green area professionals were hesitant about introducing the term as a way for foresters to extend their domain to urban areas. Foresters themselves, however, were often not convinced of having a mission in managing small-scale green areas or even single trees in urban areas (e.g., Ball 1997; Miller 2001). Nevertheless, gradually, at least, the concept found more support from

both sides, e.g., through the efforts of the International Society of Arboriculture (ISA). The government of the United States through its Department of Agriculture's Forest Service recognised the value of the new, integrative concept by establishing a national urban forestry program with strategies and research programs (e.g., Johnston 1996).

What does urban forestry encompass according to the approach developed in North America? Costello (1993) defines urban forestry, in short, as the management of trees in urban areas. Management then needs to be regarded as encompassing planning, planting, and care of trees. By mentioning trees, he refers to individual trees as well as small groups, larger stands, and remnant forests. Urban areas are very broadly defined as those areas where people live and work. The most commonly used definition of urban forestry has much in common with this. In the Dictionary of Forestry (Helms 1998) urban forestry is described, according to the definition developed by Miller (1997), 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.

1.4 The Concept of Urban Forestry in Europe

The concept of urban forestry reached Europe during the 1980s, firstly in the United Kingdom where it found following despite initial disagreement regarding its focus (Johnston 1997a). The first city-wide urban forestry project in the United Kingdom was the Forest of London project, inspired by the work of the TreePeople organization of Los Angeles, United States. This organization used tree planting and management as a tool for social, economic and ecological regeneration of cities. At a later stage, a range of 'Forest of …' projects were initiated throughout the United Kingdom and Ireland. Another important development was the establishment of twelve Community Forests near major urban centers in England aimed at forest establishment and management to generate socio-economic and environmental benefits for local communities (Johnston 1997a). Urban forestry also reached The Netherlands at a rather early stage; in 1984 a group of Dutch urban forestry researchers promoted the concept following their visit to the United States (Heybroek et al. 1985). Ireland initially was another country to follow Britain in embracing the concept of urban forestry. The first national Urban Forestry Conference, held in Dublin in 1991, led to government recognition, for example, via a grant scheme for urban woodland. The first major review of urban forestry in Ireland was carried out in 1994 (Johnston 1997b).

Urban forestry research in Europe as well as efforts to define the concept have benefited from recent international networking activities such as COST Action E12 'Urban Forests and Trees'. The objective of this Action was to promote and coordinate urban forestry research in Europe. It attempted to develop common understanding of what the concept of urban forestry encompasses (Nilsson and Randrup 1997). Other examples of European networking have included the annual IUFRO European Forum on Urban Forestry set up in 1998, and the European Urban Forestry Research and Information Centre (EUFORIC), established as Project Centre of the European Forest Institute (EFI) in 2001 (Konijnendijk 2003).

1.5 Towards a European Definition of Urban Forestry

1.5.1 Diversity in Definitions

During the establishment of urban forestry as a known and more widely accepted concept and term in Europe, substantial debate on its definition has taken place. British and Irish definitions very much adhered to the North American coining of urban forestry (e.g., Johnston 1997a,b). This is reflected in the definition given by the British National Urban Forestry Unit (NUFU 1999), describing urban forestry as a 'planned approach to the planting and management of trees and woods in towns'. In line with this, the 'urban forest' is defined broadly. In a Forestry Commission manual for urban forestry, for instance, 'urban forests' were defined as 'trees grown in and close to urban areas for their value in the landscape, for recreation, and including trees in streets, avenues, urban parks, on land reclaimed from previous industrial use, as well as those in urban woodlands and gardens' (Hibberd 1989). NUFU (1999) provides a similar, comprehensive scope: '(the urban forest) collectively describes all trees and woods in an urban area: in parks, private gardens, streets, around factories, offices, hospitals and schools, on wasteland and in existing woodlands'.

Elsewhere in Europe, however, more debate and confusion concerning the concepts of urban forestry and urban forests has occurred. The term 'urban forest', for example, often already exists in different European languages as referring to 'city woodland' (e.g., Tyrväinen 1999; Konijnendijk 2003). An overview of different national definitions of 'urban forestry' and 'urban forests' carried out by COST Action E12 'Urban Forests and Trees' (Forrest et al. 1999) illustrates the diversity in definitions and perspectives.

Table 1.1 presents results of a literature survey and of a questionnaire sent in June 2002 to all authors of papers and posters at the IUFRO/EFI Conference 'Forestry serving urbanized societies', Copenhagen, August 2002. These experts were asked to define urban forestry from the perspective of their respective countries. Seventeen of them returned the questionnaire. In addition, explicit or embedded definitions of urban forest(ry) and related terms were extracted from 39 printed and on-line documents, including the final report of the COST Action E12 (Forrest et al. 1999). All sources were analyzed in terms of presence or absence of semantic elements of definitions, in order to examine objectives, structural elements, location and benefits and values of urban forest(ry).

Although only a limited number of experts participated in the survey (between one and four for most countries), the diversity in terms of definitions is very significant.

In spite of the traditional, narrow meaning of the term 'urban forest' in many languages, agreement seems to exist on urban forestry's broader scope. Virtually all elements of urban green space have been referred to. Experts and definitions differ in terms of what natural resource elements to include in the scope of urban forestry. Some experts consider that only woodland and forests/forest ecosystems should be included in an urban forest. However, the majority believe that single trees, woody vegetation in general, as well as – in most cases – non-woody structures such as lawns