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1 AUTHOR:

Cecil Konijnendijk van den Bosch
Swedish University of Agricultural Scie…

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A decade of urban forestry in Europe

Cecil C. Konijnendijk*

Skov & Landskab, Danish Forest and Landscape Research Institute, Hoersholm Kongevej 11, DK-2970 Hoersholm, Denmark

Abstract

Major changes in society have led to a call for structural changes in forestry, also in Europe. Urbanisation as one of the major driving forces has had a clear impact on European forestry. One of the new approaches emerging in response is the concept of urban forestry. It was developed in North America during the 1960s as innovative approach to managing natural resources in urban environments. Aimed at the integrated planning and management of all tree-based resources in cities and towns, the concept found broad support in North America after initial resistance from both foresters and urban green professionals. Similar resistance was met in Europe, and here it took until the early 1990s before the concept of urban forestry found broader acceptance and support. Since then, a European urban forestry research community has emerged, as have policies, programmes and higher education incorporating elements of urban forestry. Urban forest resources in Europe might be small in relative terms compared to other natural resources. They do, however, cover millions of hectares of land and provide multiple, highly demanded goods and services. Forestry can benefit from urban forestry experiences and innovations, for example in terms of better meeting the expectations and demands of urban society. Urban forestry, on the other hand, is firmly rooted in some of the basic concepts of traditional forestry, such as sustained yield. Review of a decade of urban forestry in Europe shows that strong links should be maintained for the benefit of both.

Keywords: Urban forestry; Urbanisation; Forest science; Forest policy; Europe

1. The new face of forestry

With the major socio-economic transition of the Western world into an urban, post-industrial and global economy and society, traditional forestry and natural resource management have been facing considerably public scepticism and re-evaluation (Kennedy et al., 1998). The legitimacy of foresters has been challenged and many long-standing public forest and natural resource policies and practices have been questioned (Kennedy et al., 1998; Otto, 1998). An adaptation of professional values and management concepts constituting a major paradigm shift has been called for (Kennedy et al., 1998).

The need for change has led to various developments and adaptations. In North America, for example, 'new forestry' in the shape of sustainable ecosystem-based management or stewardship was developed as a new guiding concept for forestry. Similar developments have taken place in Europe, where multiple-use management and sustainable forest ecosystem management now are accepted and leading concepts (e.g. Kennedy et al., 1998). These new approaches recognise the importance of the socio-cultural and environmental values of

*Tel.: +45-4576-3200; fax: +45-4576-3233.
E-mail address: cck@fsl.dk (C.C. Konijnendijk).

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forests, apart from the economic values (i.e. timber production) that have traditionally been prioritised. Rather than managing tree stands, complex forest ecosystems are the subject of management. The human dimension of these ecosystems in terms of multiple users and stakeholders is an integral part of this. Not only foresters but also public land managers, in general, are increasingly turning into social value brokers and conflict management facilitators (Kennedy and Ward Thomas, 1995; Kennedy et al., 1998). The significant changes in forestry are can also be derived from the changes in definitions of terms as 'forest', 'forestry' and 'forester' over time (Helms, 2002).

Kennedy et al. (1998) conceptualised the ongoing paradigm shift in forestry through the transition from a machine model to an organic model. In the new, organic model, the complexity of forest ecosystems with their interdependent subsystems and many relationships is recognised and appreciated rather than distrusted, and focus is on forest function or process. Rather than the rigid, hierarchical and monodisciplinary forestry institutions of the past, new forest management institutions are needed. These should be flexible, accepting and open organisations, involving a wide range of disciplines and interests being actively involved in a collaborative dialogue. Broader and more inclusive visions and goals are formulated, but science and scientists provide one set of values and skills. As community-level participation and conflict management are increasingly important, diverse social science and people skills are recognised and developed.

The role of urbanisation in the change of forestry should not be overlooked. Large parts of the world have become highly urbanised and the majority of the world's population now lives in cities and towns (WRI, 2001). Although some forests have been under the direct influence of cities and towns for ages, and especially in Europe (Hosmer, 1922; Konijnendijk, 1999), the dramatic 'urbanisation' of the forest is a more recent phenomenon. Paris (1972) spoke of the 'citification' of the forest: conflict situations between 'industrial' and 'societal' use of forests have been occurring to an increasing extent, and urban societies have been imposing their ideas, values, perceptions and life styles on the countryside and its forest areas. Although a growing part of the forest resource has come under urban influence, both directly (i.e. becoming incorporated into the interface or located at the interface with urban areas) and indirectly (as urban uses and values have also come to dominate more remote forest areas), forestry has been rather hesitant to recognise its urban mandate. It has considered itself as a primarily rural activity, most forest resources are situated in rural (or natural) areas and the production process had much in common with agricultural production. Töpfer (2001) mentions how the traditional urban–rural controversy (one was either pro- or anti-urban) has obstructed with more effective and sustainable land use planning, for example at the urban fringe. Institutions such as the Food and Agriculture Organisation of the United Nations, and state forestry agencies even in the most urbanised countries have only recently recognised their urban mandate (e.g. Konijnendijk, 1999; FAO, 2002). Policy-makers, planners and managers, however, have expressed the lack of forestry concepts, approaches and methods adapted to the urban environment (Krott, 1998; Konijnendijk, 1999).

This article aims to explore the status and prospects of the incorporation of the urban dimension into forestry, as important element of the overall paradigm shift occurring within the field. It reviews the emergence and status of the concept of urban forestry in Europe, as an attempt to accommodate forestry and the need for an urban scope. Finally, urban forestry's possible value for the development of forestry at large is analysed.

2. Development and definition of the urban forestry concept

The most broadly accepted definition of urban forestry, based on Miller (1997) is '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' (Helms, 1998, p. 193). This definition already makes it clear that urban forestry is more than just 'forestry' in (or near) urban areas. Apart from forest resources, for example, other tree-dominated

vegetation is included in the scope of urban forestry.

2.1. Brief history of urban forestry in North America

The term 'urban forestry' was first used in 1965 as title for a graduate study on the success and failures of municipal tree planting in part of Metropolitan Toronto (Johnston, 1996). Before that, graduates of forestry schools in North America were more frequently hired to manage municipal tree management programmes because of their biological, quantitative and managerial skills (Miller, 2001). Problems caused by for example introduced pests and diseases had called for more integrative tree management approaches (Johnston, 1996). In spite of recognition of the concept by the Society of American Foresters, and the hosting of National Urban Forestry Conferences, it took some time for urban forestry to become accepted by a broader group of experts. For example, many foresters were reluctant to see a role for forestry in urban areas. Many arborists and other urban green space professionals were hesitant to embrace urban forestry, as they felt that foresters used it as a way into their domain (Johnston, 1996; Miller, 2001). The benefits of using the integrative and interdisciplinary concept, however, were increasingly recognised. Helped by the lobbying efforts of interest groups such as American Forests, political support for the approach was gained. A rather extensive funding scheme was developed to support urban forestry research, policy and practice. The American urban forestry research scene today is very well developed, with high-level research being undertaken at universities together with federal and state research agencies (Johnston, 1996; Miller, 2001). Higher education in urban forestry exists through, for example, 30 Baccalaureate programmes, mostly offered by forestry faculties or departments (Miller, personal communication).

2.2. Brief history of urban forestry in Europe

It took longer for the concept to gain hold in Europe, although Europe can pride itself on a long tradition of urban green space planning, design and management. Developments such as the growing demands for urban green functions and increasing pressures on green areas led to an interest in more strategic and integrated approaches, such as urban ecology and urban green structure planning, during the 1970s and 1980s. Researchers interested in the tree dimension of urban green got to know the concept of urban forestry as applied in North America, e.g. through study visits and conferences. Some of the North American urban forestry pioneers were involved in organising the symposium 'Trees and forests for human settlements' in Norway (1976), jointly with the United Nations' Habitant Forum and the International Union of Forest Research Organizations (IUFRO) (Johnston, 1997a,b).

Initial resistance against the concept also existed in Europe. Even though the scientific Arboricultural Journal was given the subtitle 'International Journal of Urban Forestry' in 1981, its publisher the British Arboricultural Association saw the term as an unnecessary 'Americanism' (Johnston, 1997b). Support for the concept came from interested landscape architects and especially foresters. Researchers at the Dutch state forest research institute undertook several study tours to North America in order to get familiar with the approach during the early 1980s (Heybroek et al., 1985).

Britain, however, became the first European stronghold of urban forestry. Representatives of NGOs and other interest groups involved with urban tree planting and management schemes helped promote the concept based on close collaboration with American counterparts, e.g. by setting up several large-scale urban forestry projects in various cities (e.g. Johnston, 1997b). Governmental interest followed, e.g. through the nationwide Community Forests developed during the late 1980s. Forest and tree planting and management were to be used as tools for environmental, social and economic development of 12 urban agglomerations and their surrounding areas. The Community Forests programme draws heavily upon elements of the urban forestry concept, such as focus on social values and a broader concept of 'forest' (Davies and Vaughan, 1998). The National Urban Forestry Unit (NUFU) was set up in 1995 as an independent organisation championing the

need for integration of tree planting, conservation and management with different agendas, such as health, land reclamation, built development, heritage and education (NUFU, 2002). Initially, Ireland was the only country to follow Britain in embracing the concept of urban forestry. The first Urban Forestry Conference, held in Dublin in 1991, led to government recognition for example via a grant scheme for urban woodlands. The first major review of urban forestry in Ireland was carried out in 1994 and the first urban tree resource in Ireland (for Dublin) started in 1993 (Johnston, 1997b).

Networking and international contacts proved crucial in the British, Dutch, Irish as well as other cases. The International Society of Arboriculture, set up in the United States in 1924 as the National Shade Tree Conference, gradually increased its international member base and activities to meet part of the networking demand (Johnston, 1996). Several new networks of urban forestry researchers emerged in response during the 1990s. The Nordic Forest Research Cooperation Committee (SNS) supported a first Nordic workshop on urban forestry held in Reykjavik in 1996 (Nilsson and Randrup, 1996). SNS continued to support urban forestry networking through funding joint Nordic–Baltic seminars in Tallinn (Sander and Randrup, 1998) and Kaunas (Randrup et al., 2001). The European Forest Institute (EFI), an independent non-governmental organisation conducting forest research, also became involved in urban forestry research during the mid-1990s. It undertook a comparative European study of urban woodland policies, conservation and management (Konijnendijk, 1999).

The Danish Forest and Landscape Research Institute then initiated what proved to be an important step for the advancement of urban forestry in Europe. A network for the promotion and coordination of urban forestry in Europe was set up in 1997, under the European Union-funded COST programme (European Cooperation in the field of Scientific and Technical Research). COST Action E12 Urban Forests and Trees ran until 2002 and involved more than 100 experts from 22 European countries. The Action organised a series of seminars as well as two conferences on urban forestry topics, often with the participation of experts from outside Europe. It reviewed the status of research and higher education on urban forestry in Europe, issued a long list of publications and started compiling a first European reference book on urban forestry. A strong European network resulted from the Action and led to several new initiatives (Nilsson and Konijnendijk, in press). One of the direct spin-offs of COST E12 as well as EFI's activities concerning urban forestry was the establishment of the European Urban Forestry Research and Information Centre (EUFORIC) in 2001. EUFORIC operates as one of six so-called Regional Project Centres of EFI. These are centres without walls focusing on a topic of specific interest within European forestry. EUFORIC aims to act as a clearinghouse and coordinator within European urban forestry. Activities so far also included organising conferences such as 'Forestry serving urbanised societies' in Copenhagen (2002), and the launch of a new scientific journal (Urban Forestry and Urban Greening) to serve the urban forestry research community.

A number of additional new, international initiatives emerged within European urban forestry during the late 1990s and early 2000s. Various international projects, for example under the European Union's Fifth Framework Programme for research have used the term, although still seldom in their title, were started. Conferences on urban forestry topics such as indigenous vegetation and plant health in urban horticulture were held. From a non-scientific perspective, IUFRO's European Forum on Urban Forestry, organised annually since 1998, can be mentioned. The Forum brings together urban forestry practitioners to exchange experiences and ideas (Krott, 1998).

2.3. Defining urban forestry in Europe

The emergence of an urban forestry research community at the European level might suggest that broad acceptance of the concept has been achieved. The definition of urban forestry within the European context is still under debate.

One of the problems faced related to the difference between 'concept' and 'term'. While concepts are the cognitive representation or perceptions of

objects or facts, terms are their linguistic expression or linguistic label (ISO, 2000). While broad agreement seems to exist about the relevance of the urban forestry concept, the term has evoked confusion in Europe. 'Urban forest' can be translated into different European languages into terms such as Stadtwald (German), stadsbos (Dutch), by nær skov or byskov and taajamametsä (Finnish). These often have had a longer tradition as referring to only the woodland element of urban green structures (Konijnendijk, 1999). Urban woodlands in the form of communal, city or town woodlands are a very European phenomenon, with a long history of woodland conservation and management (Hosmer, 1922; Konijnendijk, 1999).

The wide variation in definitions of 'urban forestry' and 'urban forests' still used in Europe is illustrated in Table 1. The more traditional meaning of terms similar to 'urban forest' can be noted. English-speaking countries have been the first to incorporate urban forestry as a more integrative and broad concept. Through its activities and discussions, COST Action E12 'Urban Forests and Trees' has helped to make at least the concept of urban forestry more accepted amongst European researchers (Nilsson and Konijnendijk, in press). The concept applied is very similar to the definition of urban forestry as mentioned at the outset of this article (Helms, 1998).

'Forest' within 'urban forest' thus has been given a different meaning than the traditional forest concept encompasses. By including small woods, parks and gardens with area size and/or canopy cover below thresholds for 'forest', as well as individual trees the traditional forest concept has been broadened considerably.

3. Status and significance of urban forestry in Europe

3.1. Urban forest resources

Urban forests refer to all forest and tree resources in (and close to) urban areas. This concept is difficult to operationalise for the purpose of reliable resource inventories. Questions to be answered include how to define 'urban', 'forest', as well as 'close to'. Different countries use very different definitions of 'urban' (Forrest et al., 1999) and 'forest' (Helms, 2002). As we have seen, moreover, the 'forest' in urban forest related to more than forest in its more traditional definition. 'Other wooded land' and 'trees outside forests', categories used by FAO for its forest resource assessments (FRAs) (FAO, 2002), in the shape of for example parks, gardens and street trees are to be included when they are located in (or near) urban areas. Problems with operationalising the urban forest concept hamper sound resource inventories and monitoring. Moreover, FAO's FRAs have not paid any particular attention to urban forest resources so far, although 'trees outside forests' were mentioned in the FRA 2000 as an important area for future assessments (FAO, 2002).

A first national, comprehensive assessment of urban forest resources was carried out by the United States Forest Service (Dwyer et al., 2000). It applied a combination of methods, including satellite imagery, national statistical data and assessments for particular cities or metropolitan areas. Tree canopy cover was used as a more reliable indicator than land use types. The assessment showed that 74.4 billion trees cover 33.4% of the metropolitan areas (urban countries) in the 48 adjacent states, i.e. approximately 8% of land area and 1/4 of all trees in the 48 states. In urban areas in a more narrow sense (i.e. cities, towns, villages, etc.), 3.8 billion trees cover 27.1% of the land, i.e. approximately 1% of the entire adjacent United States.

No comprehensive, comparative assessments of urban forest resources in Europe (international or national level) seem to be available at the time. Table 2 includes information about some (partial or less reliable) assessments of urban green space cover. The European Environment Agency has provided statistics on urban green area cover in selected European cities, but mentioned that statistics are unreliable and not easy to compare (EEA, 1995). It is uncertain, for example, what types of green areas (category? ownership?) have been included. Moreover, total green structure, with its non-tree-dominated elements, will be larger than the urban forest resource. The survey by Ottitsch (2002) faced similar problems, while the study by Pauleit et al. (2002), attempting to use tree canopy

Table 1
Examples of definitions of urban forestry and urban forests provided by the national experts of COST Action E12 'Urban Forests and Trees' (based on Forrest et al., 1999)

Country	Definition of urban forest and/or urban forestry
Finland	Urban forests have been defined as forests located in or near an urban area where the main function is recreation. They consist mainly of natural forest vegetation and therefore, the definition excludes for example, man-made parks with lawns.
Germany	No adequate term is existing to cover urban forests and urban forestry. A tradition exists with using the term 'Stadwald', referring to the forest element. Urban forest mostly would refer to man-made forest on formerly agricultural or even derelict land specifically designed and managed for the recreation of the urban population.
Greece	Urban forests refer to urban green spaces and include: (a) the trees along the streets of towns and cities; (b) the parks and gardens within city boundaries; and (c) the forests around towns and cities.
Iceland	Urban forestry is the planting of trees and tree stands within the legal boundaries of urban areas with the purpose of providing amenities for the population, namely shelter, recreation, landscaping, beauty and even production of timber or other products, where it does not detract from other amenity values.
Ireland	An extensive definition, similar to North American concept, is applied for urban forestry. Recognised are e.g. the adoption of forestry principles, the inclusion of the entire tree and woodland resource in and around an urban area, the fact that trees are managed as part of an overall resource, urban forestry being a social discipline, the need for coordinated involvement, etc.
Italy	The term urban forest has hardly been used. The concept of 'urban forests and trees' is related to the wider, inclusive of the term 'urban greenery', defined as any designed open space in urban areas, concerned with—as a whole or in part—vegetation elements and regularly managed.
Lithuania	Urban forestry includes forests, street trees and other green areas. The focus of urban forestry in Lithuania has mostly been municipal.
Slovenia	Urban forests represent forests, parks, i.e. woodland resources in urban areas, which have environmental and social rather than production functions and benefits for the citizens. The urban area is regarded as the area of a (town) municipality. The owner of the urban forest should in principle be the municipality.
The Netherlands	Approximately 10% of all Dutch forests considered urban woodlands. The term 'urban forest' would translate as 'stadsbos' (Borgesius, 1992), i.e. referring to urban woodland. For urban forest at large, the term 'urban green' is most commonly used.

Table 1 *(Continued)*

Country	Definition of urban forest and/or urban forestry
	Public urban green areas include nature areas, urban woodlands, parks, green areas, public gardens and street and roadside trees.
United Kingdom	Urban forestry is a multi-disciplinary activity that encompasses the design, planning, establishment and management of trees, woodlands and associated flora and open space, which is usually physically linked to form a mosaic of vegetation in or near built-up areas. It serves a range of multi-purpose functions, but it is primarily for amenity and the promotion of human well-being.

cover, seems more informative, although the authors also expressed their concern about data quality and comparability.

Johnston and Rushton (1999) also noted the lack of records and inventories of urban tree resources, as did the British Green Spaces Taskforce. The latter called for a green space typology and more reliable and comprehensive inventory of green spaces (DTLR, 2002). In the Netherlands, the national statistical data for municipal land use include green areas as consisting of a wide range of elements, such as parks and gardens, woodlands and cemeteries (CBS, 1998).

From a forestry perspective, the woodland element of urban forests has special interest. In this case, it is not much easier, however, to obtain comparative data, although the definition of these woodlands as 'forests' under the national law should facilitate inventory. The major difficulty is to determine what woodlands are to be classified as 'urban'. Table 3 provides the results of some assessments made. In many cases, urban woodland

Table 2
Data on urban green space cover in Europe (examples)

Region/country	Information on urban green space resource	Reference
Europe	Green space cover of selected cities varied between 5% (Madrid) and 60% (Bratislava).	EEA (1995)
	Tree (canopy) cover in cities in 8 European countries: ranging from 1.5 to 62%.	Pauleit et al. (2002)
	Green area cover for 14 European cities surveyed varied between 5% (Thessaloniki) and 56% (Ljubljana); average of approximately 30% for all cities. Green space per inhabitant from 6 to approximately 7000 m^2.	Ottitsch (2002)
Belgium	Flanders region: 9% of municipalities covered by green areas (1991 survey). Brussels region: 14% (2300 ha) of land area covered by green space.	Basiaux et al. (1999)
Great Britain	Green areas cover approximately 14% of urban areas. Parks and green spaces estimated to account for 120 000–150 000 ha.	DTLR (2002)
The Netherlands	Average municipal green space cover of 19% for 22 of the largest Dutch cities (i.e. average of 228 m^2/inhabitant).	CBS (1998)

Table 3
Data on urban woodland area and cover in Europe (examples)

Region/Country	Information on size of urban woodland resource	Reference
Europe	Average woodland cover of 18.5% within municipal boundaries of 26 larger European cities (104 m^2/inhabitant)	Konijnendijk (2001)
Belgium	Flanders region: approximately 4.5% of municipalities included in 1991 survey covered by woodlands. Walloon region: 25 000 ha of forests located in suburban areas and managed for community uses. No data on municipal forests available. Brussels region: 1950 ha (12%) of land area covered by woodlands.	Basiaux et al. (1999)
Czech Republic	Fifteen percent of all forests owned by municipalities and cooperations. 100 larger cities own between 500 and 8000 ha of forests.	Záruba (1998)
Finland	Municipalities in Finland own 430 000 ha of forests.	Löfström (1999) cited by Tyrväinen (1999)
France	270 000 ha of forests in the Greater Paris region; 80 m^2 of forest per inhabitant (compared to 800 m^2 for France as a whole).	Moigneu (2001)
Latvia	0.8% of all Latvian forests considered urban forests (owned by cities and towns). Twenty percent of urban areas covered by forests.	Donis (2001)
The Netherlands	Average municipal woodland cover of approximately 7% for 22 of the largest Dutch cities. Larger cities usually have municipal forest cover of between 0 and 5% (1993 data).	CBS (1998)
Slovakia	Ten percent (186 000 ha) of Slovakian forests owned by municipalities.	Graus (1998)
Sweden	300 000 ha considered 'urban fringe forests', i.e. more than 1% of the overall Swedish forest cover.	Carlborg (1991) cited by Rydberg (1998)
United Kingdom	Community forests programme aimed at achieving a 30% woodland cover ($\approx$119 000 ha) around 12 large agglomerations over next decades. Actual cover in 1999 was 6.5%.	Ball et al. (1999)

area and/or cover are assessed by only including the areas defined as 'forest' within the municipal boundaries. The study by Konijnendijk (1999, 2001) is an example of this. Scientists have attempted to assess the wider urban woodland resource at country level by including peri-urban or urban fringe forests, as well as by including all municipally-owned forests, as shown in the table.

Similar tables could be drawn up for other components of the urban green structure or urban forest resource, for example public parks and gardens, street tree population, and so forth. Again, comparative data are difficult to obtain (Johnston and Rushton, 1999; Pauleit et al., 2002).

The limited data presented here at least provide some insight in the significance of urban forest resource in Europe. Table 3 suggests that Nordic and Central European countries assess their urban woodland resource to one or several percents of their overall forest resource. This share is considerably higher in the more urbanised parts of Western Europe, and increasing through afforesta-

tion near large agglomerations (Mather, 1990; Konijnendijk, 1999). In some local cases, urban woodland resources are very significant: Berlin owns approximately 27 000 of nearby forests, and the city of St. Petersburg is responsible for a 142 000 ha forest greenbelt (Konijnendijk, 1999). In absolute terms, urban woodland resources are significant, covering millions of hectares in Europe. As the work by Dwyer et al. (2000) indicated, the actual urban forest resource is significantly larger when other tree-dominated lands are included.

3.2. Provision of goods and services

Urban forest resources might be small compared to e.g. total forest land in many European countries, their are of high importance in terms of providing goods and services to society, even although timber production is often of minor importance (Konijnendijk, 1999). Urban woodlands and other parts of the urban forest are the most popular outdoor recreation environments in Europe. Between 1/4 and 1/2 of all annual forest visits in France take place in the 80 000 ha of forests in the Greater Paris region (Moigneu, 2001). In Sweden, an estimated 55% of all forest visits are to urban woodlands (Rydberg, 1998). Urban woodlands in Europe often attract several thousands of visits per hectare per year (Konijnendijk, 1999), as the large majority of all recreational visits to forests are paid to sites not more than 1–2 km from the home (e.g. Hörnsten, 2000). The impact of urban forests on physical and mental human health, e.g. through offering environments for exercise and reducing stress, also has been given research focus lately (Grahn and Stigsdotter, 2003). The presence of trees and woodlands close to where many people live can also cause problems, as in the cases of fires occurring at the urban fringe, as well as of health threats such as diseases carried by animals, and allergies.

Urban trees and other vegetation intercept particles and gaseous pollutants (Harris, 1992; McPherson et al., 1997) and act as carbon sinks in the equations relevant within the context of global warming (McPherson and Simpson, 1999). They reduce stormwater runoff and many European cities have established and conserved forests for protecting their drinking water resources (Konijnendijk, 1999). Urban green protects soils and moderates harsh urban climates, e.g. by cooling the air, reducing wind speeds and shading (McPherson et al., 1997). The level of biodiversity of urban green areas is often surprisingly high (Milligan Raedeke and Raedeke, 1995). National parks are found at the gates of large cities such as Warsaw, Moscow and Vienna (Konijnendijk, 1999).

Cities have often turned to green areas for providing attractive environments for businesses to settle and people to live (Konijnendijk, 1999, 2001). The generally positive impact of nearby forests and green areas on house prices has become documented, e.g. by Tyrväinen (1999). Price (2002) provides a review of ways to assess the aesthetical values of urban forests.

3.3. Policies

Attention for urban forestry at the European level has been limited so far, although sufficient access to public green space is seen as an important indicator for sustainable cities (EEA, 1995). At the national level, however, new policies have incorporated the importance of urban forests and/or urban forest elements. Countries such as Belgium (Flanders), Denmark, Ireland, The Netherlands and Great Britain issued afforestation policies in which urban agglomerations have the highest priority. Woodland grant schemes thus favour urban settings. Social and environmental services such as providing opportunities for outdoor recreation and protection of drinking water for primarily urban populations have become prioritised in national forest policies (Konijnendijk, 1999). Urban and community forests are described as a priority and powerful tool in the England Forestry Strategy issued in 1998 (Forestry Commission, 1998). Some European cities with a long history of woodland ownership developed strategies and policies for their woodlands, while most other cities have contented themselves with forest management plans only (Konijnendijk, 1999). Comprehensive local urban forestry strategies are even less common, especially outside of Britain

and Ireland. Krott (personal communication) mentions that is has been problematic to develop true urban forestry policies at city level due to for example funding problems, political struggles and different priorities.

3.4. Research and education

The described networking initiatives helped urban forestry research establish itself in Europe. Reviews of the status of urban forestry research and higher education in Europe carried out within the framework of COST Action E12 acknowledged the increasing level of activity (Konijnendijk et al., 2000; Andersen et al., 2002). A survey of 20 European countries identified more than 400 recent or ongoing research projects on trees and/or forests in the urban environment. A wide range of topics had occupied researchers, while attention for three main components of urban forests—woodlands, parks and individual trees—had been about equal (Konijnendijk et al., 2000). Higher education (i.e. at Bachelor level or higher) on urban forestry has been less developed so far. One hundred and eighty educational institutions in 28 countries offered 31 full degree programmes and 191 courses and modules. Only very few, however, were regarded 'urban forestry' in the true sense of the concept by the researchers, as mostly only some elements were touched upon, primarily from a monodisciplinary perspective. An increase in the number of programmes and courses offered, however, was noted (Andersen et al., 2002).

4. Discussion: urban forestry's relation to forestry

Urban forestry has gradually established itself in Europe as integrative and innovative approach towards the tree-dominated part of urban green structures. The urban forest resource is relatively small compared to overall forest resources, but expanding and already covering a significant area of land. They provide multiple essential benefits to urban societies. A research community has emerged during the past decade, higher education is under development and policy attention is increasing. But, what has made urban forestry innovative and in what way can it be a valuable contributor to the ongoing development of modern forestry. Moreover, how does urban forestry build upon and benefit from traditional forestry concepts and approaches?

As outlined in the first section, structural changes in forestry are called for. The very concept of forest, for example, has been under continued scrutiny (Helms, 2002). It has broadened over time to take an ecosystem perspective, but a further crossing of boundaries has been called for, as different land uses need to be regarded in a more integrated way (Kennedy et al., 1998). The traditional urban–rural divide, for example, has unproductive and gives wrong sense of alternative development options. More regional and landscape concepts are needed to strengthen the links and complementarities between cities and rural areas (Töpfer, 2001). New concepts and approaches such as landscape ecology and management, sustainable land use, urban ecology, and urban agriculture all take a more integrative perspective on different land uses, land covers and ecosystems. Urban forestry does the same by crossing the boundaries between woodlands and other elements of urban (and peri-urban) green structures. Initiatives such as the English Community Forests go even further. Building on the concepts of urban and community forestry, new types of 'forest landscapes' are created, where woodlands are only one—be it important-element of land use mosaics (Davies and Vaughan, 1998).

This also provides a suitable platform for multiple disciplines to work together. Urban forestry is multidisciplinary, and ideally even interdisciplinary. The earlier mentioned review of research on urban tree resources in Europe identified 38 disciplines being involved, including basic as well as applied sciences, natural and social sciences, the humanities as well as planning sciences (Konijnendijk et al., 2000).

Multifunctionality in forestry is also called for. By focusing on other goods and services than the traditional output of forestry, i.e. timber production, urban forestry provides an interesting perspective. Urban forestry, by its very nature, can only be successful if meeting the multiple demands of ever-present urban societies. In this way, urban

forests have been described as 'hotspots' for forestry at large (Krott, 1998). They act as testing grounds for forestry at large attempting to meet changing societal demands. It has shown that the soft values of forests and trees are in fact very important, socially, environmentally as well as economically. The possible negative effects of having trees and forests close to people, as in the case of wildfires, should not be neglected in this respect.

Modern forestry should manifest itself more as social value broker and conflict manager. Again, urban forestry provides a valuable example. Social services are in focus, as providing healthy recreational, living and working environments is prioritised. High demands for urban forest goods and services have to be met by a small resource base, and conflicts have been a logical consequence. Thus urban foresters have had to develop their people skills as well as conflict management capacities. They are learning how to involve other stakeholders in their decisions and activities. In high-pressure urban environments, partnerships are a necessity. Teamwork with fellow professionals is required, as well as close collaboration with non-experts. Urban forestry can become a powerful tool for community building. The integration of fringe groups, for example, can be promoted through urban forests and forestry (Dwyer et al., 2000; Krott, personal communication). As areas of collaboration and demonstration, urban forests can improve transparency and forestry's image in society (Rydberg, 1998; von Gadow, 2002).

This brings us to developing new, flexible institutions for managing forests and other natural resources. Urban forestry has faced the same need and new types of institutions have been created. The independently-operating project teams that coordinate the 12 English Community Forests, for instance, operate in close collaboration with a range of public and private actors, combining skills such as forestry, ecology, planning, marketing and community relations and involvement.

Funding has been a growing problem for public and private forestry in Europe. Urban green space management has traditionally been dependent on municipal budgets, which have been reduced over time. As a consequence, innovative ways of raising income and reducing costs have been explored. Infiltration of alternative funding programmes, from the local level to the European Union, has been one strategy. Marketing of goods and services other than timber or of locally produced certified timber has been attempted, with variable success. Urban foresters have demonstrated that they produce services in a very efficient way. Management of the municipal forests of Wuppertal, Germany costs less than €1 per forest visit, which compares favourably to the cost of other recreational activities (Vosteen, 2002). In some cases, urban forestry elements have been built into large-scale projects such as new housing schemes, landscape development, and industrial developments (e.g. Konijnendijk, 2001). Krott (personal communication) believes that this 'greening' of major development projects is very important for the success of urban forestry.

Programmes such as the English Community Forests, the England Forestry Strategy and various national and local policies and programmes promoting urban forests also relate to another demand placed on forestry at large: the need for bolder and long-term strategies connecting to agendas other than those of traditional forestry.

The relationship between forestry and urban forestry is based on mutual benefits and not on 'one way traffic'. Forestry has been the driving force behind the development of the concept of urban forestry, for a start. Foresters were brought into cities because of their more holistic and strategic insight (Miller, 2001). Today, forestry is still the leading discipline in European urban forestry research and education (Konijnendijk et al., 2000; Andersen et al., 2002). This it not strange, as explained by Collins (1997) who outlines the links of urban forestry with traditional forestry. Urban forestry has adopted the principle of sustained yield, which underpins forestry; it sets out to achieve and maintain a balanced age structure within each urban locality, ensure continuous tree cover, and hence sustained provision of goods and services for current and future generations. Trees are managed as part of the overall resource, and by means of long-term planning based on secure resource allocation and detailed surveys.

Urban forestry and forestry at large thus are closely connected and should remain so in order to benefit from each other's efforts in better meeting the demands of changing societies.

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