

Urban Forestry for Multifunctional Urban Land Use¹

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Introduction

World-wide urbanisation brings with it a wide range of challenges. The demand for land increases, and the energy, resource, water and waste disposal needs of urban populations need to be met. Especially in the developing world, where most mega-cities are located and urbanisation is particularly rapid and not necessarily controlled, providing good living conditions to urban populations is one of the main challenges of our time (UN Habitat 2004). Policymakers are facing tremendous pressures to develop city management strategies that strive for sustainable cities where all inhabitants can enjoy at least a fair quality of life and a reasonably healthy environment.

In the quest for healthy, liveable and sustainable cities, urban green spaces with trees as a major component play an important role. They can help improve livelihoods, temper harsh urban climates, conserve biodiversity, and contribute to better human health. During recent years, integrative and strategic concepts and fields of activity have been developed and implemented across the globe to promote and develop tree-based resources catering to multiple urban demands. Urban forestry is one such promising concept, which in recent years has gained the capacity to cater to a wide range of urban needs and realities.

Trees and forests for sustainable cities

Challenges related to urbanisation are very significant. Basic concerns such as the provision of food, housing, sanitation and employment have highest priority and are still to be addressed, especially in the developing countries. Urban green space therefore will only be given political priority if it can be used to meet these major urban challenges. Past experience has shown that urban green spaces form more than just a “supplementary” urban

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infrastructure and can even help provide livelihoods. The goods and services provided by forests and trees in or close to urban centres can be grouped into three main value-based categories.

Economic and livelihood values of urban green

Poverty alleviation and food security are high on the agenda of many international institutions and development aid programmes. With half of the world's population living in cities and towns, urban agriculture plays an important role in this respect. Many countries have a long tradition of urban dwellers supplementing their diet and/or economy with local agricultural produce (Urban Agriculture Magazine no 13. 2004). Establishing woodlots in villages and close to urban centres relieves the pressure on natural forests for fuelwood, poles and fodder. Urban forests can enhance urban agricultural production, primarily in agroforestry systems (FAO 2003, Akinbamijo 2004). Growing trees in combination with other crops or with keeping animals adds value through enhancement of microclimate and other growing conditions and diversification of produce, for example. Timber and other wood products can be very important in urban areas; large parts of the urban population of Africa, for instance, are still heavily dependent upon fuelwood. In times of war and conflict city dwellers have often turned to nearby woodland for illegal cutting of fuelwood, as in the case of Sarajevo in Bosnia and Herzegovina during the 1990s war that split up Yugoslavia (FAO 2005a). Forests and trees also provide non-wood forest products such as mushrooms, berries, (medicinal) herbs, rattan, seeds, leaves etc. In the industrialised countries, cities have often turned to green areas for providing attractive environments for businesses to settle in and people to live in (Konijnendijk 2003). The generally positive impact of nearby well-managed forests, green areas and trees on real estate prices and business development has been documented during recent years, for instance through hedonic pricing studies (Wolf, 2004; Tyrväinen *et al* 2005).

Environmental and ecological values of urban green

Many of the environmental services provided by urban green space are characterised as climatic or engineering benefits, offering a “green infrastructure” to cities and towns. Of particular importance in both the developed and developing world is the role of forest resources in water management. Many of the world's largest cities rely on fully or partially protected forests in nearby or more remote catchment areas for much of their drinking water. Additional protective measures are often needed to ensure high quality drinking water from these watersheds (Dudley & Stolton 2004). Quito in Ecuador is one of several Latin American cities that has taken active steps, financially supported by the creation of a water consumption fee, to protect their watershed forests (Echavarría 2001). In arid regions, forest shelterbelts around cities help combat desertification (FAO 1999). Trees reduce storm water runoff and can assist with processing wastewater. Urban green also protects soils and moderates harsh urban climates, for example, by cooling the air, reducing wind speeds and giving shade (Tyrväinen *et al* 2005). Trees and other vegetation intercept particles and gaseous pollutants and thus help reduce air pollution, as a study of Beijing, China, has shown (Yang *et al* 2005). Moreover, forests and trees in cities act as carbon sinks in the equations relevant within the context of global warming (Johnson & Gerhold 2003). The level of biodiversity of urban green areas is often surprisingly high, representing nature and the “wild” close to where people live (Kowarik & Körner 2004, Stewart *et al* 2004).

Social and cultural values of urban green

The recreational values of forests, parks, gardens and other urban green areas are especially well documented in the Western world. Urban woodland in Europe attracts thousands of recreational visits per hectare per year (Konijnendijk 2003). The large majority of all

recreational use of forests takes place in areas not more than 1-2 km from people's homes (Hörnsten 2000). The aesthetic values of trees and green have been known for centuries; urban green space makes for better, more attractive cities. Urban green can have a positive impact on people's physical and mental health by providing settings for physical exercise, reducing ultraviolet radiation and air pollution, and lowering stress levels (e.g. Grahn & Stigsdotter 2003). By being actively involved in tree planting and management, local communities can be strengthened and crime rates can be reduced (Kuo 2003). In many developing countries, trees often have cultural and spiritual values that could assist new urban dwellers in finding their place in cities and towns. Today's green spaces and the way they are used and managed can thus have strong historical roots (Forrest and Konijnendijk 2005).

The concept of urban forestry

Natural resource planning and management in highly dynamic urban societies are complex activities. Therefore, concepts and strategies that extend beyond conventional boundaries and involve a wide range of disciplines as well as stakeholders are needed. In the case of forests, tree-based systems and other green resources in and near urban areas, these concepts should recognise the multiple values provided, as well as the role green spaces can play in sustainable development. For the last three decades, the social aspects of forestry have been widely recognised (e.g., through social and community forestry), encouraging fair and equitable sharing of forest benefits by the local population, access and use rights, and the participation of civil society in decision-making processes related to the sustainable use of tree and forest resources (Wiersum 1999). The experience and expertise gained by community-based forest resource conflict management is most relevant for land use and land use change issues in urban environments (FAO 2002a).

In line with the dynamics described above, the concept of urban forestry has been developed and implemented as a framework for integrated planning and management of urban (and peri-urban, i.e. adjacent to urban centres) tree resources. The most widely used definition of urban forestry was developed by Miller (1997) who calls it "an integrated, city-wide approach to the planting, care and management of trees in the city to secure multiple environmental and social benefits for urban dwellers". Urban forestry, initially developed in North America, has gradually gained a larger following among scientists and practitioners across the world, although the precise scope and content of the concept remain topics of expert debate (Randrup *et al* 2005).

Urban forestry is generally considered to encompass all aspects of establishing, conserving and managing tree systems in or near urban areas. This implies that it also incorporates growing trees as part of agroforestry systems and taking care of individual trees through arboriculture². The areas of intervention of urban forestry in relation to the green structure and

² Urban forestry and urban agriculture are not the only relevant new concepts that have emerged. "Urban greening", for example, has been defined as the planning and management of all vegetation to create or add value to the local community in an urban area (Kuchelmeister 1998). Although the main difference between urban greening and urban forestry may seem the former's explicit inclusion of all non-tree dominated vegetation in urban areas, differences between the two concepts are more fundamental. From this point of view, urban "greening" would also comprise urban "agriculture". Urban forestry has developed into a science-based field of activity, and, in different countries, a recognised field of expertise in which professionals from various disciplines (e.g. landscape architects, foresters, geographers) can specialise. This is not (yet) so in the case of urban greening, which is a concept, mainly based on activity or philosophy (Randrup *et al* 2005). It is being developed primarily in a developing country context, as was the case with community forestry before.

distribution include three areas: form design, functions and policies; technical aspects; and management of both individual trees and urban woodlands. Traditionally, the forestry sector neglected the urban environment, paying more attention to the rural areas. Nowadays, the sector tends to include more comprehensively the concept of “trees outside forests” (FAO 2001, FAO & CIRAD 2002), with an improved approach to landscape management, agroforestry and urban forestry. From the perspective of the Food and Agricultural Organization of the United Nations (FAO), urban and peri-urban forestry considers tree-based systems at large in or adjacent to urban areas (Kotka III 1996; FAO & CIRAD 2002).

Table 1 The urban-rural tree-forest matrix

The grey-shaded area represents the domain of urban forestry (based on Randrup *et al.* 2005).

	Urban and peri-urban			Rural	
	Individual trees		Urban woodlands (forests and other wooded land, e.g. natural forests and plantations, orchards)	Individual trees Shelterbelts, trees in between lots, ‘parkland trees’ etc.	Natural and plantation forests
	Street and roadside trees	Trees in parks, private yards, cemeteries, fruit trees etc.			
Form, design, functions and policies					
Technical aspects (e.g. selection of plant material, establishment methods)					
Management aspects					

Box 1 Main principles of the concept urban forestry

The concept of urban forestry has several main principles, which include:

Urban forestry is integrative and comprehensive

The concept incorporates different green-space elements into a whole (the “Urban Forest”) and thus promotes a holistic view (Mock 2004; Pauleit *et al* 2005). It aims for more integrated land-use systems, for example by combining forest, agricultural, nature conservation and recreational areas. It builds on the notion that sustainability of tree-based systems is not exclusive to forest resources, but also applies to other systems such as agroforestry systems

and lined tree plantings. Integration also occurs in land ownership, closely related to legal or customary rights of access to and use of the land, the trees and their products (tenure aspects).

Urban forestry is strategic

Urban forestry envisions development of long-term policies and plans responding to the needs for tree resources and urbanisation prospects, connecting to different sectors, agendas and programmes, and taking into account the continuous tendencies of expansion and densification of cities (Mock 2004, Ottitsch & Krott, 2005). This is particularly true when poverty, conflicts and natural disasters force the rural population to migrate into cities (UN Habitat 2004b).

Urban forestry is multisectoral, multidisciplinary and aims to become interdisciplinary

Urban forestry is built on the involvement of experts and practitioners from a wide range of disciplines and professional backgrounds. These do not only include natural resource professionals, but also planners, social scientists, economists, and others. Urban forestry thus operates beyond traditional sectoral and disciplinary boundaries (Miller 1997, Nilsson *et al* 2005).

Urban forestry emphasises social inclusiveness

Developing partnerships between different stakeholders is a key element of urban forestry. While respecting local cultures and traditions, the concept emphasises the involvement of different segments of local communities in managing and using tree resources (Mock 2004, Van Herzele *et al* 2005). It promotes decentralisation, public participation, transparency and accountability, and fair and equitable sharing of benefits and access to resources. The development of true partnerships often require the establishment of new institutions, for example public-private, or new public institutions that involve multiple layers of government (Jones *et al* 2005).

Urban forests are multifunctional

Urban forestry caters to the needs of urban society by providing multiple benefits. These include the various economic and livelihood, environmental and ecological, and socio-cultural goods and services urban forests can offer (Mock 2004, Tyrväinen *et al* 2005).

The world's urban forest resources

One of the challenges facing urban forestry is the difficulty to operationalise the concept. This may partly explain why there is very limited information available on the extent of urban forest resources. International, national and even local resource inventories and monitoring of developments are scarce. One important variable is the geographical limit of urban (and peri-urban), which varies from one site to another and in time. Another variable is the type of resources in terms of tree-based and greening systems being considered. For its Forest Resource Assessments (FRAs), FAO defines three main categories, namely “forest and forest land”, “other wooded lands” and “trees outside forests” (Kotka III 1996, Kotka IV 2002). These are all found in urban and peri-urban areas and include for example parks, gardens and street trees and agroforestry systems. The FRA's activities and mandate have increased substantially over the two last decades and FAO has been requested to pay more attention to aspects such as non-wood forest products and trees outside forests. Consequently, trees outside forests comprise an important area for future assessments as mentioned in the FRA 2000 report (FAO 2001).

A study by the United States Forest Service (Dwyer *et al* 2000) was the first comprehensive national level assessment of urban forest resources. A combination of methods was applied, including satellite imagery, national statistical data and assessments of particular cities or metropolitan areas. Tree canopy cover was used as a more reliable indicator than land use types. The assessment showed, amongst others, that 3.8 billion trees in urban areas cover 27.1% of the land, i.e. about 1% of the country.

Europe has not seen countrywide or international comparative assessments of urban forest resources so far, in spite of some efforts, especially by the European Environment Agency (Pauleit *et al* 2005). An explorative study by Pauleit *et al* (2002) used tree canopy cover as an objective indicator and found municipal canopy cover of selected European cities to range from 1.5 to 62%. In some European cases resource data has been compiled on specific elements of the urban forest, such as woodlands within municipal boundaries. From the information available, be it sketchy and hardly comparable, the significance of urban forest resources in Europe does emerge. Urban and peri-urban woodland alone covers several millions of hectares (Konijnendijk 2003).

Urban forest resource information from other parts of the world is even more difficult to obtain. Some of the sparse insights in Asian urban forest resources have been provided by Kuchelmeister (1998), Webb (1999) and Palijon (2004), while more recently an increasing amount of data is also emerging from China (e.g. Jim & Liu 2001, Yang *et al* 2005). Information on urban forest resources in selected cities of northern and western Africa, Latin America and Central Asian cities have also been documented through case studies (FAO 1999, CIFOR & IDRC 2003).

Although information on the natural resource base is scattered or incomplete, varies in quality and is not adequately disseminated, it can be concluded that the potential of urban forest resources is under-developed. The status, size and structure of these resources are often significant but vary greatly. Findings also suggest that urban green space is under pressure from other forms of land use in most parts of the world, although recent afforestation in Europe, for example, has led to an increase in urban (forest) resources at local level.

Urban forestry policies and legislation

Urban forestry policies

Lack of awareness about the potential of urban forestry, of information exchange, and of strategic, coordinated action so far means that the full potential of the urban forestry concept remains to be realised. This is particularly the case in the developing world (Konijnendijk *et al* 2004). FAO has been among the first organisations taking up the challenge of promoting the concept - under the name urban and peri-urban forestry - as a framework for action, with emphasis on the developing countries and countries with economies in transition, and urban forestry's contributions to food security and poverty alleviation. FAO's activities have included a review of existing activities within urban forestry, as well as an identification of needs for further development. It has encouraged partnership and information sharing between localities and countries. With a state of the art assessment and institutional and policy strengthening as a basis, the role of urban forestry thinking in sustainable development could be enhanced and developed. One of FAO's recent initiatives is an outlook study of

urban and peri-urban forestry in countries of West and Central Asia as part of the Forestry Outlook Study for this region (FOWECA).

In terms of policy integration, much remains to be done at the global level, in spite of recent developments in, for example, the field of urban agriculture. In the Harare Declaration in Urban and Peri-urban Agriculture in Eastern and Southern Africa (2003), heads of cities and governments have engaged themselves to promote a shared vision of urban and peri-urban agriculture accompanied by concrete policies and instruments. It should be noted, however, that the integration of land issues is not consistently addressed, and that trees and general greening are not even mentioned at times.

At the European Union level of policymaking, attention to urban forests or even urban green space at large has been limited so far, although access to green space is now seen as an important indicator for sustainable cities (Pauleit *et al* 2005). At the national level, however, new policies have incorporated the importance of urban forests and/or urban forest elements. Many north-western European countries have issued policies aimed at establishing new forests primarily for providing social and environmental services, and in which urban agglomerations have the highest priority. Accompanying grant schemes thus favour urban settings. Except for Britain and Ireland, comprehensive local urban forestry strategies are even less common. Ottitsch and Krott (2005) mention that it has been problematic to develop true urban forestry policies at city level due to issues such as funding problems, political struggles, and different priorities. Many city administrations face increased pressure by ongoing administrative reform and budget cuts, which often also lead to diminishing resources for green-space management.

In North America, urban forests have become recognised as important elements of national forest and natural resource policies. The development of the Canadian National Forestry Strategy (2003–08) has been a major step for urban forestry in Canada, as a specific section is allocated to the urban forest and public engagement in sustainability (National Forest Strategy Coalition, 2003). Urban forestry policies are institutionalised in the United States, where they exist at federal, state and local level, and are accompanied by funding and research programmes (Dwyer *et al* 2000).

Although urban forestry capacities and policies are often insufficiently developed, especially outside North America and (parts of) Europe, some successes have been achieved elsewhere. Singapore, for example, has strongly institutionalised urban green-space planning and management. It has developed a proposal for an island-wide park connector network (Yuen 1997, cf. Palijon 2004). The Chinese government has recently incorporated the urban forestry concept into its national policies, as seen in afforestation, the establishment of shelterbelts around urban areas, and the awarding of urban greening awards to cities with successful green space development and management practices (e.g. Liu *et al* 2004). The example of Zimbabwe is rather typical for many (developing) countries. Although urban forestry is hardly recognised in national policies and legislation, municipal by-laws have often been used to safeguard cities' ornamental tree resources (Makonese & Mushamba 2004). Much can be learnt from the few cities, such as Curitiba in Brazil, that have succeeded in developing advanced greening policies.

Urban forestry legislation

Legislation is an important but challenging issue as long-term security of access and use of the resources is a primary condition for promoting tree planting and conservation in a

sustainable manner. A recent FAO study of urban forestry and urban greening legislation indicates that at national and sub-national levels, a clear need still exists to further develop or improve existing legal frameworks (FAO 2005b). In the rare cases that urban forests are mentioned in national legislation, it is mostly through certain explicit provisions as part of forestry acts. Some links to urban forests are found in environmental legislation and in land use planning acts. Land use legislation and protection of urban forest resources is especially problematic in developing countries, where uncontrolled migration towards cities, poverty and lack of control lead to drastic and illegal changes in land use and overexploitation of green resources.

Most relevant legislation exists at municipal level, and deals with tree protection and restriction of tree removal. For example, the large majority of 34 European cities surveyed by Schmied and Pillmann (2003) have laws in place for protecting trees in public and private areas. If trees are protected, for example through tree preservation orders, felling is subject to official authorisation. Still, there are many exemptions to these laws, mainly due to ownership status and the location of trees. Legislation at municipal level also covers so-called hazard(ous) trees that pose a threat to public safety. Mortimer and Kane (2003) examine the topic of tree owner liability from hazardous trees in the US, pointing out that changes in legislation give private owners greater responsibility for avoiding (or preventing) tree hazards.

Research & development and education in urban forestry

Research & development

Recent years have seen the emergence of a global community of researchers working from an urban forestry perspective. Organisations such as the International Union of Forest Research Organisations (IUFRO), which has a working group on urban forestry, and the International Society of Arboriculture (ISA) have been key players here. Researchers from developing countries are taking an increasingly active part in international research networks, aided by modern information technology and donor funding. This trend has been supported by workshops and conferences³ on policy and development issues.

European urban forestry research has benefited from nearly a decade of networking initiatives, supported for example by the European Commission. A survey of 20 European countries identified more than 400 recent or ongoing research projects on trees and forests in the urban environment (Konijnendijk *et al* 2000). A wide range of topics was being investigated by researchers, while attention to three main components of urban forests - woodlands, parks and individual trees - is about equal. Among the recent innovative research projects are those studying the impacts of urban forests on human health (Grahn & Stigsdotter 2003), economic valuation of urban forest benefits (Tyrväinen *et al* 2005), and the development of participatory tools for the planning and management of urban woodlands (Van Herzele *et al* 2005). Another expanding research area is that of developing and

³ These include, amongst others, events organised by FAO and the Forest Environmental Cooperation of the Asia-Europe Meeting (ASEM). The latter hosted a well-attended Asian-European workshop on urban forestry in Suzhou and Beijing, China, at the end of 2004. Participants at both events called for enhanced international cooperation and networking, for example at the regional level, as well as establishment of national and regional centres of excellence for urban forestry, and demonstration urban forests (ASEM 2004). FAO events have included the World Forestry Congresses, the Expert consultation on trees outside forests in November 2001 (FAO 2002b), and a workshop on urban forestry in Tehran, Iran, July 2003.

implementing information systems, such as GIS, in order to support policymaking and management of urban forests (Schipperijn *et al* 2005).

Urban forestry research and development has become most firmly established in the United States. The country's Forest Service has generated extensive new knowledge on the urban forestry concept and its benefits through its special, regional urban forestry research centres (Dwyer *et al* 2000). Innovative research in the US has included the quantification of various environmental benefits of urban forests, such as air pollution reduction and climate melioration (see Dwyer *et al* 2000 for examples), studies of the social and community impacts of urban forests (Kuo 2003 for an overview), and studies of the economic impacts of trees (see Wolf, 2004; also Box 14.1). Perhaps more than elsewhere, results of state-of-the-art research have been used to develop decision-support tools, such as the CITY-Green programme of American Forests (Schipperijn *et al* 2005), thus strengthening the, often weak, science-policy interface.

Quantification of urban forest resources, benefits and monetary values, as well as biotic, abiotic and human threats to urban forest sustainability have been topics of the growing body of Asian literature (e.g., Jim & Lui 2001, Kwak *et al* 2003, Palijon 2004, Yang *et al* 2005). Australia and New Zealand have been at the forefront of studies on maintaining indigenous vegetation in urban areas and controlling invasive species (e.g., Stewart *et al.*, 2004). Recent urban forestry research in Latin America has included a study on the role of Santiago de Chile's urban forest in air pollution reduction (Escobedo *et al* 2005), while experiences with municipal forest management have also been compiled for the first time (CIFOR & IDRC 2003). Research in the region may have benefited from recent networking initiatives; urban forestry was on the agenda during a worldwide IUFRO conference held in Chile, for example (Barros 2002).

Research needs to help assess urban forest resources, society's demands and preferences, and assist with identifying good practices in urban forestry to support planning and management. City and country case studies of urban and peri-urban forestry (FAO 1999) showed that urban development has included important social forestry initiatives and provided important lessons for cities which are in the early stages of developing their urban forestry programmes.

Education and training

Education and training are crucial for developing the capacities needed for sound and successful urban forestry. It is important to train specialists who are able to look at urban tree resources as a whole and as a multifunctional resource, and who are aware of the contributions that different disciplines and professions can make. Education and training can take many different forms and occur at many different levels. Unfortunately, higher education (i.e. at Bachelor level or higher) on urban forestry is not yet very well developed. According to a survey, 180 educational institutions in 28 European countries offered 31 full degree programmes and 191 courses and modules that dealt with (elements of) urban forestry (Andersen *et al* 2002). This seems significant, but researchers found only very few of these courses truly adhering to the urban forestry concept by taking an integrative and multi- or interdisciplinary perspective. An increase in the number of programmes and courses offered, however, was noted. Several urban forestry Master's degree programmes have recently been set up or are under development, including an international Master's programme in urban forestry and urban greening in Denmark and Sweden.

Higher urban forestry education is also uncommon and fragmented outside Europe, with the US as an exception. In the US, urban forestry has become established as a field of higher education and the number of programmes has grown over time (Miller 2001). However, accreditation of urban forestry education, important for professional recognition, status and quality, remains an important topic of debate in the United States. The non-governmental Society of American Foresters (SAF), for example, certifies forestry schools, but no special accreditation scheme exists as of yet for urban forestry programmes. Urban forestry courses thus become accredited only through their affiliation to a general forestry school (Miller 2001). Developments in higher urban forestry-related education are evident in other parts of the world. Plans exist, for example, in Malaysia and other Asian countries to set up urban forestry curricula, possibly in twinning with programmes in Western countries.

In terms of training and continued professional development, some efforts have been made to establish an international standard for professional education in urban forestry. These efforts primarily concern the arboricultural (i.e. tree care) component of urban forestry and aim to establish and maintain a certain level of knowledge, professionalism and skill. Continued professional education of its worldwide membership of experts is a main objective of the International Society of Arboriculture (ISA). Professionals can be granted, for example, the status of ISA Certified Arborist, a professional vocational qualification obtained by passing a theoretical examination on tree care and management. Several countries have adopted this scheme or developed their own, with differing success (Johnston 2001). The first group of Singaporean professionals was certified some years ago, while the first Malaysian experts were to be ISA-certified during summer 2005 with the assistance of Danish colleagues.

Urban and peri-urban forestry institutions and partnerships

The lack of recognition to urban forests at national or sub-national level, for example as a separate land use category, has limited the required long-term and cross-sectoral planning. In most countries, implementation of the urban forestry concept is restricted to the municipal level from an institutional perspective. But even at city level, green-space responsibilities are poorly defined, and many different municipal departments occupy themselves – often without real cooperation – with specific aspects of urban forestry. In Europe, for example, the planning and management of city parks, street trees and peri-urban woodland - has traditionally been the domain of different professionals and sometimes even different departments (Randrup *et al* 2005).

Multi stakeholder approaches call for non-traditional tools and methods. Huge demands for urban forest goods and services have to be met by a small resource base, and social conflicts have been a logical consequence. Thus all urban professionals and staff dealing with tree-based green-space resources (e.g. foresters, landscape architects, planners, geographers) have had to develop their “people” skills as well as conflict management capacities and learn how to involve other stakeholders in their decisions and activities. In high-pressure urban environments, partnerships are a necessity. Team work with fellow professionals, as well as close collaboration with residents and other lay people, is a must. As discussed earlier in this book for Urban Agriculture, Urban Forestry is a potentially powerful tool for community building and conflict management (FAO 2002a) as, for example, the integration of fringe groups into the community (Ottitsch & Krott 2005), or the improvement of transparency and forestry’s image in society.

The development and institutionalisation of urban forestry in the United States gained force only as a result of major lobbying efforts by NGOs such as American Forests. These NGOs saw the benefits of a strategic approach to urban tree planting and management for generating multiple benefits. Awareness raised by these NGOs led to strong links between research, policy and implementation of the urban forestry concept, resulting in national, state and local urban forestry institutions being developed. Great Britain's National Urban Forestry Unit (NUFU), an independent organisation, has provided assistance to a large number of local and regional urban forestry initiatives (Konijnendijk 2003). The role of high-level politicians in raising awareness is important. Large-scale tree planting campaigns can be a tool to gain political commitment as well as public awareness. Eighty thousand residents of Puerto Princessa City in the Philippines, for example, were made aware of the benefits of urban forestry through their involvement in a massive local reforestation project (Palijon 2004).

New institutions that have sufficient flexibility for managing forests and other natural resources are also needed. The independent project teams that coordinate the English community forests set up near large agglomerations, for instance, operate in close collaboration with a range of public and private actors. These teams combine skills such as forestry, ecology, planning, marketing, and community relations and involvement (e.g. Jones *et al* 2005). The call for municipal coordination and a higher level of service in green-space management was also responded to in Johannesburg, South Africa, where a City Park Office was created along the principles of new public management.

For developing urban forestry institutions and capacities, networking between researchers, policymakers, practitioners as well as other stakeholders is crucial. COST Action E12 Urban Forests and Trees, a scientific and technical network financed by the European Commission, helped put urban forestry on the map in Europe. The role of FAO, IUFRO and ASEM in building North-South cooperation was already mentioned. Information brokers such as the Resource Centre for Urban Agriculture and Forestry (RUAF, www.ruaf.org), US-based TreeLink (www.treelink.org), and the European Urban Forestry Research and Information Centre (EUFORIC, www.sl.kvl.dk/euforic) assist with the development of research, policy, education and implementation of partnerships. City twinning and networking, implemented in many different contexts, is another tool for networking and capacity building. United Cities and Local Governments (UCLG, www.cities-localgovernments.org/uclg), for example, acts as "united voice and world advocate" of democracy-based self government and works together with the United Nations in meeting the Millennium Development Goals⁴ at local level. Within FAO, the Priority Area for Interdisciplinary Action (PAIA) "Food For The Cities" provides a means to improve intersectoral actions in urban and peri-urban areas for poverty alleviation (e.g., considering aspects of nutrition, health, agriculture, forestry, and fisheries). Bringing in its focus on trees as a major, multifunctional component of green structures and its base of expertise and knowledge developed over 40 years or more, urban forestry can be joined with other concepts and fields in the quest for sustainable urban development.

Needs and perspectives

⁴ The United Nations set out the following Millennium Development Goals to be achieved by the year 2015: 1) Eradicate extreme poverty and hunger; 2) achieve universal primary education; 3) promote gender equality and empower women; 4) reduce child mortality; 5) improve maternal health; 6) combat HIV/AIDS, malaria and other diseases; 7) ensure environmental sustainability; and 8) develop a global partnership for development (source: <http://www.un.org/millenniumgoals/>)

Policy needs and perspectives

Urban forestry requires a strategic perspective and the development of targeted, specific policies and of sufficient capacities in order to be successful. Much remains to be done, as the planning and management of “green” is often still a rather single-sector activity, carried out by foresters and other natural resource professionals but with limited involvement of, for example, social scientists and local communities. On the other hand, the planning related to “land” (including real estate aspects) is being carried out by other professionals and services, such as urban planners and landscape architects. Further development of urban forestry and enhancing its contribution to sustainable development at large require a bold and strategic approach. Task-oriented, comprehensive urban forestry is a term coined by Ottitsch and Krott (2005), and presupposes that urban forestry will only be successful if it establishes direct links to urban demands and tasks at hand, like infrastructural works, the integration of marginal groups, and improving city competitiveness and image, for example.

Although the positive aspects are dominant, the potential negative aspects of forests and trees close to residential areas such as wildfires, diseases, and increased allergies should be kept in mind. A bad Selection of tree species, the roots of which eventually cause damage to infrastructure, can lead to the rejection of tree planting altogether. Some argue that urban parks are often places of crime and illegal activity. In certain cases, planting of trees has been used for claiming rights of ownership to land, thus becoming a major cause of conflict.

The benefits of urban forests should be directed towards local communities, and legal, economic and institutional arrangements should be in place to ensure this. Currently, land tenure practices in many – especially developing – countries has obstructed real community “ownership” of urban forestry and related activities. Moreover, planning and management of urban forest resources is becoming increasingly complex (e.g., Dwyer et al., 2001), their outcomes are becoming more significant to people, and the number of individuals and groups involved in planning and management processes is growing. This calls for a close collaboration with research, so that decisions can be based on a sound, comprehensive knowledge base.

Research needs and perspectives

Several recent assessments have captured the gaps in knowledge and the research needs within urban forestry. Liu *et al* (2004), for example, mention that more information about the size and structure of urban forest resources is needed in China. Other priority topics for research mentioned are species selection, managing pests, diseases and abiotic stress caused for instance by air pollution, and the development of information systems to support planning and management. Nilsson *et al* (2005) also list more studies on the characteristics of urban sites and improving tree adaptability to sites as research priorities for Europe. Urban sites are associated with a range of biotic, abiotic and human pressures, for example related to pests and diseases of vegetation, traffic emissions, de-icing salts, and vandalism. Other research needs relate to the development of environmentally-sound management methods, studies of public preferences and changing demands for urban forest benefits, assessment of these benefits and their incorporation in strategies for sustainable development, and the development of better information and public participation tools. Several of the research needs identified for the USA are similar (Dwyer *et al* 2001). They include more research to: improve the comprehensive health of urban vegetation; improve resource inventory and monitoring; promote dialogue between urban forest owners, users and managers; foster collaboration among agencies and groups; improve understanding of how forest configuration influences forest use and benefits; create better understanding of urban forest health; and

enhance dissemination about urban forest benefits and management. Overall research needs are supposed to enhance collaboration between disciplines and fields of attention, as well as between scientists, planners and managers.

The need for technology transfer and information sharing exists not only within countries, but also between countries and the world's regions. Calls for research networking, identification of centres of research excellence, and the establishment of demonstration urban forests have been mentioned earlier in this paper. In order to meet these calls and make sure that developing countries are not excluded, sustainable donor and other funding options need to be explored.

Educational needs and perspectives

Education that incorporates an urban forestry perspective is still in its early stages of development, especially in the developing world, but important steps have been taken recently. Programmes and courses should make an effort to focus on the strengths of the urban forestry concept, incorporating multiple perspectives and disciplines, and taking a comprehensive view of the urban forest resource. Initiatives taken in the direction of international cooperation in education should be encouraged. Tertiary education is one area of focus, while training and continued professional development is another. The work of ISA and other organisations to enhance the professionalism of green-space practitioners, for example by international certification and accreditation, should be supported and further developed.

Urban forestry for development

The experiences described above show the significant potential of urban forestry, also for developing countries. However, in promoting urban forestry, its basic strengths should be kept in mind. The concept promotes inclusiveness in terms of involving experts, policy-makers and stakeholders from all walks of life. The need to join forces with other initiatives aimed at sustainable urban development is therefore crucial. Urban forestry needs to be considered within the context of other comprehensive concepts for natural resource management and land use in urban areas, at the urban fringe, and at the urban-rural interface, such as urban greening, green structure planning and landscape planning, several of which have been discussed in this book. In terms of providing urban livelihoods and helping cities to “farm for the future”, it is obvious that urban forestry should be closely linked with urban agriculture. Trees can provide significant benefits when used in urban agroforestry systems, such as by improving site conditions for growing crops, providing fodder, and offering wood and non-wood forest products that can help diversify production.

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