**Briefing Paper 2:**

**The societal benefits of (peri)-urban forestry in Europe**

Amy Stewart,
Social and Economic Group, Forest Research, Northern Research Station, Edinburgh, EH13 9HH
Amy.Stewart@forestry.gsi.gov.uk

Simon Bell
Professor and Head of the Department of Landscape Architecture, Institute of Agricultural and Environmental Sciences, Estonian University of Life Sciences, Kreutztwaldi 5, Tartu 51014, Estonia
Associate Director of OPENspace, the Research Centre for Inclusive Access to Outdoor Environments, Edinburgh College of Art, Lauriston Place, Edinburgh, EH3 9DF, Scotland
s.bell@eca.ac.uk

Giovanni Sanesi
Associate Professor of Urban Forestry and Forest Ecology and Planning, Dipartimento di Scienze delle Produzioni Vegetali, Università degli Studi di Bari, Via Amendola, 165/A, 70126 Bari, Italy
Sanesi@agr.uniba.it

Rik De Vreese
Co-ordinator Human Ecology Programme, Vrije Universiteit Brussel, Vakgroep Menselijke Ecologie, gebouw K, Laarbeeklaan 103, B-1090, Brussel, Belgium
Rik.De.Vreese@vub.ac.be

Arne Arnberger
Institute of Landscape Development, Recreation and Conservation Planning Department, Department of Spatial-, Landscape-, and Infrastructure-Sciences, BOKU – University of Natural Resources and Applied Life Sciences, Vienna, Austria
Arne.Arnberger@boku.ac.at

1. **Introduction**

Worldwide, the concept of sustainable development has been embraced and it is now widely accepted that to fulfil a sustainability agenda, forestry should be used to deliver economic, environmental and social benefits. Around 73% of the European population now resides in cities (UNDESA, Population Division, 2010) and increasing levels of urbanisation are likely to continue over the coming years: the United Nations Department of Economic and Social Affairs, (UNDESA, Population Division 2010) predicts that by 2050 the proportion of the European population living in urban areas will reach 84%. The convergence of these two themes – sustainable forestry resources and management and urbanisation – means that if trees and forests are to be utilised to provide the maximum benefits to society as a whole, it follows that greater consideration should be paid to their role in an urban and peri-urban context, where the majority of people live.

Urban forestry has been defined in a variety of ways. In the 1960s, the term ‘urban forest’ was introduced into Europe from the United States and referred to woodland in and near urban areas (Konijnendijk, 2003; Konijnendijk et al., 2006). As established in the first briefing paper on the (peri-)urban forest resource in Europe, today, one of the most commonly used and most widely supported definitions of ‘urban forestry’
originates from the Society of American Foresters, which states that it 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 to society’ (cited in Hunter, 2001: 277). Urban forestry and by extension, peri-urban forestry, is therefore clearly concerned with both individual trees as well as woodlands and is focused on the benefits trees can deliver to people, rather on simply the trees themselves (Hunter, 2001: 277). It follows that in any discussion of urban and peri-urban forestry (UPF) it is imperative that sufficient emphasis and consideration is given to the benefits that it can actually and potentially provide for society and how these benefits can be achieved.

This paper describes the major benefits that UPF can provide to humans, under headings relating to the three pillars of sustainable development, the environment, society and the economy. Benefits include improvements to the physical quality of the places where people live, and enhancements to their quality of life. In some circles, and with increasing policy influence, these benefits are referred to as ecosystem services, a concept which includes ‘provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide [for example] recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling’ (Millennium Ecosystem Assessment, 2005).

While there are numerous potential benefits for which as yet the evidence is tentative at best, we prefer to focus on those benefits for which there is currently the most evidence available and those which are most commonly applicable in an urban/peri-urban context. At the end of each of the three sections on benefits, the paper discusses key factors and issues for consideration when attempting to maximise the realisation of these benefits. Finally, alongside concluding remarks, gaps in the current state of our knowledge are highlighted and future research opportunities identified.

2. Benefits

While there is a growing literature on the specific benefits of UPF to society, this is in its infancy when compared with the literature available on the benefits of green space and green infrastructure/structure more broadly. This briefing paper therefore, while concentrating its discussion on evidence directly related to trees and woods also draws on the wider literature relating to green space and infrastructure/structure, since trees and woods are important elements within these concepts and these evidence sources have much to inform the UPF agenda.

2.1 Environmental

The environmental benefits that UPF can provide to society are significant. This is especially true in the context of increasing urbanisation because trees can help to mitigate the environmental impacts of increasing urban development through:

1. Improving air quality
2. Moderating urban climates
3. Reducing rainfall runoff intensity and flooding and improving water quality
4. Reducing noise levels

They can also benefit society in terms of their role in:

5. Supporting biodiversity

2.1.1 Improving air quality

Air pollution is a major concern in most cities and the European Environment Agency (2009) estimated that exposure to dangerous particulate matter in the air, for example, caused 370,000 premature deaths in Europe in 2005. Trees help to improve air quality (and therefore also human health) by a process of interception of particulates and gases such as ozone (O$_3$), nitrogen dioxide (NO$_2$), carbon dioxide (CO$_2$), and sulphur dioxide (SO$_2$) through surface effects and also absorption into the leaves (Nowak and Dwyer, 2000: 13). A study undertaken in London (Tiwary et al. 2009) concluded that of all vegetation types (grass, shrubs, trees etc) trees are the most important element of green space for air quality improvements.

2.1.2 Moderating urban climates

As discussed in the first briefing paper on UPF resources, built up areas have different thermal characteristics to natural environments, tending to reflect heat into the local environment during the day and release absorbed heat into the air at night. This urban heat island effect increases energy use for cooling and can make towns uncomfortable places to work and live. Although as briefing paper 1 observed, the urban heat island effect can damage UPF resources through thermal stress and drought, trees can also help to alleviate its impacts on humans and the environment.

There is evidence to suggest that vegetation in general and trees in particular can help to regulate and modify urban climates (Chen and Jim, 2008; Pauleit and Duhme, 2000). Trees can help to lower air temperatures through absorbing solar radiation which leads to the evaporation and transpiration of water through the leaves and which thus cools the leaves and the air. In a recent systematic review of the empirical evidence relating to the use of urban greening to cool towns and cities, Bowler et al. (2010: 152) revealed that an urban non-green site would be, on average, around 1°C hotter than an urban park and that larger parks tended to be cooler. By providing shade and cooling buildings, trees can help to reduce air conditioning system and energy use. A study undertaken in Athens, Greece, concluded that in the examined streets, the cooling effect of trees could reduce summer time consumption of air conditioning during the day by 2.6-8.6% and during peak hours by 2.9-9.7% (Tsiros, 2010).

Cities can also suffer from localised wind problems as a result of turbulence around large buildings and wind forcing through gaps in buildings – the so-called Venturi effect – which can make windy cities very uncomfortable. Semi-perforated objects such as trees significantly reduce the turbulence of winds and increase the shelter effect in streets and public spaces (Li et al., 2007). A study undertaken in Pennsylvania, USA found that in a residential area with 67% tree cover, at 2m above ground level wind speeds were reduced by 67% in summer and 60% in winter compared with similar residential areas that had no trees (Heilsler, 1990 cited in Nowak and Dwyer, 2000: 12). The wind reduction potential of urban trees has also
been linked with reduced heating needs in North America (Nowak and Dwyer, 2000: 16).

2.1.3 Reducing rainfall runoff intensity and flooding and improving water quality

Urban areas are dominated by impermeable surfaces and structures such as buildings and roads and this can significantly impact upon the hydrological cycle (Driver and Troutman, 1989 and White, 2002 cited in Chen and Jim, 2008: 60). With limited vegetation and soil coverage to allow water to percolate into soil and subsoil, urban areas can suffer problems with high levels of storm-water runoff and flooding. Trees can help reduce these in two ways, firstly by intercepting and re-evaporating water from their canopies and secondly allowing water to percolate into the soil beneath their canopies (Chen and Jim, 2008: 60; Nowak and Dwyer, 2000: 16-7). Findings from one American study (Sanders, 1986 cited in Chen and Jim, 2008: 61) in Dayton, Ohio suggested that the existing 22% tree canopy reduced potential runoff by 7% during a heavy storm and that were this increased to 29% canopy, runoff would be reduced to almost 12%.

Water quality can also be improved by trees through their ability to capture atmospheric pollution and affect the chemical composition of the water that runs off them or into the ground (ERM and Willis, 2004: 15). The hydrological function of trees and woodlands in urban areas is of particular importance in terms of protecting drinking water supplies and in some places forests are used to protect aquifers (Tyrväinen et al., 2005: 97).

2.1.4 Reducing noise levels

Unwanted noise can cause physical and emotional stress to humans and in urban areas problems can be more acute because of the high concentration of people and machinery (Chen and Jim, 2008: 59). Some studies have shown that properly placed bands of trees can act as barriers and help reduce noise levels (Aylor, 1972; Bucur, 2006; Fang and Ling, 2005; Miller, 1997). Furthermore, by visually blocking noise sources, it has been argued that trees can help to reduce perceptions of the amount of noise generated and heard and they can also generate more pleasant noises such as the trees rustling in the wind and bird song from the canopy (Anderson et al., 1984 cited in Nowak and Dwyer, 2000: 17; Chen and Jim, 2008: 60).

2.1.5 Supporting biodiversity

The delivery of benefits and ecosystem services from UPF is dependent on the maintenance and conservation of biodiversity, even if the mechanisms underlying the trade-off between biodiversity and other benefits are poorly understood (EASAC, 2009; Millennium Ecosystem Assessment, 2005). Furthermore, habitat surveys, as well as studies focusing on flora and fauna, have all demonstrated the importance of tree cover for biodiversity in urban areas (Tyrväinen et al., 2005: 99) and enhanced biodiversity can often also enhance an area’s recreational and aesthetic qualities (Chen and Jim, 2008: 62).

The importance of reversing habitat fragmentation through ensuring habitat connectivity and strengthening biodiversity resilience in the face of climate change has been recognized as vital to ensure, not only a halt in the loss of biodiversity, but
also the maintenance of a range of ecosystem services such as productive soils, clean water and attractive recreational areas (EEAC Biodiversity Working Group, 2009). UPF can play a significant part in achieving this through their ability to enhance ecological connectivity, providing vital networks and corridors for various species between habitats.

Some authors have described urban biodiversity at species level by analyzing particular keystone species (Rudd et al., 2002) such as insects and birds (Gregory et al. 2003; Ishitani et al., 2003). These studies offer some clues on the quality of biodiversity in some urban areas as well as on the capacity of urban forestry to produce ecological functions and benefits (Hilty and Merenlender, 2000).

UPF can play a significant role in supporting biodiversity, especially with respect to avian species. For example, a study by Padoa-Schioppa et al. (2009) investigated the relationship between bird communities and structural attributes such as vegetation types in urban parks within Milan, Italy. They found that the more tree cover within a park the greater the avian ecological diversity; large parks supported greater diversity than smaller ones and the structural heterogeneity of forest trees within green spaces was a fundamental aspect supporting high level of species abundance of birds.

2.1.6 Key considerations for environmental benefit realisation

For optimum pollutant interception, it has been found that trees should be located near to the pollutant sources (Impens and Delcarte, 1979 and Spitsyna and Skripal’shchikova, 1991 cited in Chen and Jim, 2008: 57). Trees with the most foliage are also said to be the best choice (Royal Commission on Environmental Pollution, 2007). One study found that conifers were generally more efficient at improving air quality than broadleaves and that rough leaf broadleaved trees were more effective than smooth leaf varieties (Beckett et al., 2000). However, conifers have also been found to be more susceptible to damage caused by air pollution (Tyrväinen et al., 2005: 93). Donovan et al. (2005) explored the role of different tree species in removing air pollutants such as low-level ozone (O₃), nitrogen oxides (NOₓ) and carbon monoxide (CO) in Birmingham, UK and found that Pine (Pinus), Larch (Larix) and Silver Birch (Betula pendula) had the greatest potential to improve urban air.

However, Donovan et al. (2005) also found that while all trees are beneficial to air quality in terms of their deposition of pollutants, some tree species, such as oaks, willows and poplars, can actually worsen downwind air quality if planted in large numbers through their emission of volatile organic compounds (VOCs) which contribute to the formation of ozone (Loreto et al., 1995; Loreto, 2002; Rapparini et al., 2004). However, while there is a link between VOC emissions and ozone formation, VOC emissions from trees typically account for less than 10% of the emissions from anthropogenic sources and at the same time, trees can also help to reduce ozone formation and concentration (Taha, 1996; Nowak et al., 2006).

A systematic review (Bowler et al., 2010) of empirical evidence relating to the use of greening to cool urban areas found that tree species have varying capabilities with respect to lowering temperatures and their value to society will also depend on their location (Bowler et al., 2010: 153). Chen and Jim (2008: 58) suggested that trees located to the west side of buildings were most valuable, followed by trees planted on
the east side and then the south in the Northern Hemisphere and the north in the Southern Hemisphere. However, in some instances trees can also increase heating needs in winter (Akbari et al., 1997; Simpson and McPherson, 1996; Tyrväinen et al., 2005: 98). Therefore, Chen and Jim observed (citing Pitt et al., 1979 and Akbari, 2002) that deciduous trees are more valuable than conifers because they do not block solar radiation during winter, while in summer they do.

However, in certain instances trees can actually increase temperatures. Tree canopies can prevent cooler air from reaching the ground because of a reduction in atmospheric mixing (Nowak and Dwyer, 2000: 12-3). Reduction in atmospheric mixing in tree street canyons can also have a local negative impact on air quality (De Ridder, 2003; Jonkers, 2008). Moreover, tree canopies can also retain heat at night time (Bowler et al., 2010: 153). In addition, the costs of sustaining certain tree species in terms of their water requirements may be more than the energy savings gained from the shade they provide (Nowak and Dwyer, 2000: 17).

In terms of wind speed reduction, individual, isolated trees have little effect on wind speed and direction, but several trees grouped together can have more of an impact (Nowak and Dwyer, 2000: 12). Furthermore, Chen and Jim (2008: 58) report that the ‘effectiveness of windbreaks depends on tree height, width, length, and permeability’. It also depends on their placement in relation to spaces and buildings (Li et al., 2007).

As far as noise reduction is concerned, Nowak and Dwyer (2000: 17) argue that for ‘optimum noise reduction, trees and shrubs should be planted close to the noise source rather than the receptor area’, with 30m-wide belts of tall, dense trees combined with soft ground surfaces (which absorb sound) reducing apparent loudness by around 50% (or 6-10 decibels). However, others have found that the visual screening of noise sources provided by trees can actually enhance sensitivity to noise in some cases so the specific context must be taken into account (Watts et al., 1999).

In relation to biodiversity: larger wooded areas tend to offer more habitat types and habitat for species requiring larger areas in which to live; older woodlands (in particular primary woodlands) and single or groups of old trees usually attract a greater richness of species than younger ones; monoculture plantations, managed for timber production are usually less biodiverse than more naturalistic plantations; and intense recreational use may have a negative impact on biodiversity (Tyräinen, 2005: 99-100).

Therefore, some of the benefits gained from UPF may sometimes be at the expense of other benefits. Furthermore, as Nowak and Dwyer (2000: 12) point out, it is clear that as well as positive impacts, there can also be negative impacts from the planting of (peri-)urban trees and that:

- improper landscape design, tree selection, and tree maintenance can increase environmental costs such as pollen production and emissions from trees and maintenance activities that contribute to air pollution as well as increase building energy use, waste disposal, infrastructure repair, and water consumption.

As a result, all of the above factors must be seriously considered in any UPF initiative and the potential benefits should be weighed up against the potential costs.
2.2 Social

There are a variety of social benefits which can be derived from UPF and these can be broadly categorised into four areas:

1. Recreation, physical health and mental well-being
2. Social interaction, inclusion and cohesion
3. Education and learning
4. Aesthetics and quality of place

2.2.1 Recreation, physical health and mental well-being

Urban and peri-urban woodlands and parks offer numerous recreational opportunities, ranging from physically active use such as hiking, mountain biking to less strenuous forms of use, such as meeting with friends for a picnic or mushroom and berry picking. The recreational opportunities provided can help contribute to people’s quality of life, their health and well-being. Such spaces are social meeting places but can also provide opportunities for solitude (Arnberger et al., 2010a). They are places for daily routine activities such as jogging and dog walking (Arnberger and Eder, 2007), but also places which attract tourists. Trees in gardens offer more private and less public but still important benefits, while trees in streets are also important (see below).

Sedentary lifestyles can contribute to health conditions such as type 2 diabetes, respiratory disorders, coronary heart disease and obesity. UPF undoubtedly provides resources which facilitate outdoor recreation and physical activity, which is extremely beneficial to society (de Vries et al., 2011). However, the findings of studies investigating whether access to green spaces can encourage greater levels of physical activity have been inconsistent (Giles-Corti and Donavan, 2002; Giles-Corti et al., 2005; Kaczynski et al., 2009; Lackey and Kaczynski, 2009; Neuvonen et al., 2007; O’Brien, Williams and Stewart, 2010: 49; Sugiyama et al., 2009).

There is more substantial evidence to support the restorative, stress and metal fatigue alleviating potential of UPF and the positive impact green spaces can have on mental well-being (Croucher et al., 2007: 27; de Vries et al., 2003; Guite et al., 2006; O’Brien, Williams and Stewart, 2010: 49-50; Townsend, 2006). Both use of and views of green space have been found to be psychologically and physiologically restorative, helping to reduce blood pressure, improve attention functioning, enhance mood, increase the ability of people to cope with stress and even encourage faster rates of healing in patients recovering from surgery (Grahn and Stigsdotter, 2003; Hartig et al., 2003; Kuo, 2001; O’Brien, Townsend and Ebdon 2010; Ulrich, 1984; Ulrich et al., 1991). These benefits can be obtained without visiting wooded areas – even the view of trees from a building can provide health benefits.

2.2.2 Social interaction, inclusion and cohesion

Although there is currently limited evidence to show that trees specifically can help enable social interaction, inclusion and cohesion (which have been shown to be beneficial to health and well-being), there is more evidence that green spaces in general can encourage people from different backgrounds to interact and can be used
as a platform to bring communities together (Bell et al., 2008). Evidence implies that
green spaces, especially those including trees, are better used than non-green ones,
ectivate more social activity and contact and those people who use such spaces
more frequently have stronger perceptions of social and community ties (Coley et al.,
1997; Kweon et al., 1998; Sullivan et al., 2004). There is also some evidence that
public urban forests and parks can play an important role in aiding the integration and
social inclusion of people from different cultures, at least in respect of children and
young people (Ravenscroft and Markwell, 2000; Seeland et al., 2009: 10).

Practically engaging people in UPF initiatives through participation in planning,
decision-making, education and volunteer programmes, as well as activities such as
tree planting, can also have significant social impacts, promoting ‘social structure and
organization even in the most deteriorated neighbourhoods by building interaction and
capacity’ (Elmendorf, 2008: 154). Furthermore these participatory activities can result
in a landscape that better meets local needs, and can promote a sense of ownership
over, identification with and sense of pride in the area. More on participation can be
found in the briefing paper on governance.

2.2.3 Education and learning

UPF initiatives and resources are valuable assets in terms of education and learning.
As we have noted, through environmental volunteering activities such as tree
planting, participants can gain useful skills and competencies to enhance their
individual and community capacity and quality of life (Lovell et al., 2010).

Modern day living means that many people have limited contact with nature and the
environment. As Konijnendijk (2008: 153) argues, urban woodlands and trees can
help to ‘re-connect’ people with nature and educate them about its importance and
continued relevance to their daily lives. This can be achieved through formal
education programmes, projects to engage local schools and kindergartens as well as
through the provision of education facilities such as visitor centres, nature trails and
information and interpretation boards.

The availability of (peri-)urban trees and woodlands is particularly important for
children and young people because it means that (peri-)urban schools are not
disadvantaged through lack of access to the natural environment. They also provide a
venue for outdoor play which has been shown to be an important part of children’s
development (O’Brien and Murray, 2007).

2.2.4 Aesthetics and quality of place

Vegetation, including trees, plays an important role in improving the aesthetics of
urban and peri-urban areas, as Chen and Jim (2008; 61) argue: ‘Vegetation is key to
making cities pleasant and liveable’ and creating places that people want to live in,
work and visit. Indeed, Mabey (1999, cited in Royal Commission on Environmental
Pollution, 2007) argues that ‘it is trees above all else that are needed to break up the
hard edged texture of urban living’ and create a more aesthetically pleasing landscape.
Different types of vegetation create landscape variation with varying colours, textures,
forms and densities, both breaking up and defining spaces (Tyrväinen et al., 2005:
90).
Trees (especially those with a large canopy) and other vegetation can mediate the negative effects of retail land on local neighbourhoods and enhance public perceptions of the visual quality of urban settings (Ellis et al., 2006; Wolf, 2004 and 2005). Trees and other types of vegetation can also be used to provide a screen to less pleasing views and elements of the landscape and, with good design, can be used to frame more desirable views and draw people’s attention towards them (Chen and Jim, 2008: 61).

Furthermore, trees in urban spaces can also play a role in creating a sense of identity for a place and can act as significant markers of time and space for people, contributing to their feelings of attachment to a place, as well as feelings of pride over the local area (Bonaiuto et al., 1999; Garner, 2004; Trieb, 2002). Place attachment can encourage the social and political involvement of local residents in the preservation of the physical and social features of their urban neighbourhood such as woodlands.

2.2.5 Key considerations for social benefit realisation

There are a great many factors which have been shown to impact upon the potential of UPF to provide its full potential in terms of social benefits.

It has been strongly evidenced that the proximity of (peri-)urban forests and parks to where people live has a huge impact on levels of usage and therefore the benefits that can be gained from use (Cohen et al., 2007; Coles and Bussey, 2000; Giles-Corti et al., 2005; Neuvonen et al., 2007; Royal Commission on Environmental Pollution, 2007; Ward Thompson et al., 2002). However, physical access is by no means the only issue: the accessibility and quality of (peri-)urban green spaces also have huge implications for usage. As well as being close to where people live, such spaces also need to be easy to get to such as by having entry points away from busy roads and affordable, good public transport links where appropriate (Van Herzele et al., 2005).

Another important consideration is the issue of social/environmental justice. Those members of society who are economically disadvantaged often live further away from green space and even where green resources do exist in less affluent areas, they are frequently of poor quality, badly maintained and have few use-promoting facilities (Crawford et al., 2008c cited in Forest Research, 2010; Fairburn et al., 2005: 93; Royal Commission on Environmental Pollution, 2007). There is also substantial evidence that the use of green space varies hugely between different social groups with underrepresented user groups including the elderly, young people, women, ethnic minorities, disabled people and the economically disadvantaged (Fairburn et al., 2005; Sanesi and Chiarello, 2006). This must be addressed if urban and peri-urban green spaces are to fulfil their full potential and provide benefits for all members of society.

People’s perceptions of UPF have a big impact on their use of these resources. For example, many studies have identified the fact that often people perceive urban woodlands to be dangerous or unsafe places, with high levels of anti-social behaviour and user conflicts (Arnberger et al., 2010b; Jones et al., 2008; Jorgensen and Anthopoulou, 2007; Jorgensen et al., 2007; Ward Thompson et al., 2002). Some things that can be done to help lessen these fears include ensuring sites have good visibility, clear sightlines, visible signs of maintenance and management, an absence of litter and vandalism and management of understorey to make them more visually appealing.
This perception of fear is reflected in the six major barriers affecting usage of urban green space identified by the UK Urban Green Spaces Task Force (2002: 18):

1. Lack, or poor condition of facilities, especially seats, toilets and play opportunities for children.

2. The incidence of anti-social behaviour. The potential for conflict between children and adults is often cited, but there are increasing concerns over the presence of drug and alcohol users, undesirable characters and ‘stranger danger’.

3. Concerns about dogs and dog mess.

4. Safety and other ‘psychological’ issues including feelings of fear and vulnerability based on real experiences and perceived concerns. This applies not only to people’s own personal fears, but also especially to fears for their children.

5. Environmental quality issues such as litter, graffiti and vandalism

6. Loss of variety and too much old-fashioned design, especially for young people for whom 19th century parks do not always represent an exciting or attractive environment (although there are plenty of more contemporary designed examples across Europe).

It is important to take steps to address these obstacles since they are common to many areas. However, it is also of fundamental importance to understand the local context and the specificities of barriers, preferences and needs within the local population. Significant efforts must be made to find out what people want from urban green spaces, both in order to minimise conflicts between different types of user and to ensure the use of urban green spaces is maximised (Arnberger et al., 2010b; Hunter, 2001; Reichhart and Arnberger, 2010; Sanesi and Chiarello, 2006; Tyrväinen et al., 2005).

Probably the key component of any strategy to address improved access and barriers to the use of urban forests and other green spaces is engagement with the local community (Weldon et al., 2007). This can help identify and meet the needs of different groups in society and provide them with information and knowledge to enhance their understanding of the resource. This is especially pertinent for hard to reach groups such as those already identified as underrepresented users of urban green space. Furthermore, community engagement, facilitated access initiatives and organised activities and events can be useful instruments in overcoming barriers to use such as concerns about safety since they allow people to become more familiar with woodlands and green spaces in their area and feel a greater sense of ownership over them.

It is particularly important to engage with children since evidence suggests that the more time children spend in woodlands and green spaces, the more time they are
likely to spend in them as adults and the more confident and comfortable they will be about doing so (Ward Thompson et al., 2002).

2.3 Economic

Although it is apparent that UPF confers numerous environmental and social benefits on society and that these are extremely valuable, often these benefits are difficult to evaluate in monetary terms. However, some attempts have been made to give them economic values and there are other indications that UPF can have a significantly positive economic impact, although the evidence base that links different UPF activities to different levels of economic benefit is still to be developed (Forest Research 2010). The evidence of economic benefits will be discussed under the following three headings:

1. Valuation of benefits
2. Property values
3. Willingness to pay

2.3.1 Valuation of benefits

A recent study examined the economic value of the benefits of an initiative which aims to plant one million trees in Los Angeles, USA. It estimated that the benefits from this scheme over the next 35 years will be $1.33 billion and $1.95 billion for high- and low-mortality scenarios respectively, with an average annual benefit of $38 and $56 per tree planted (McPherson et al., 2010). These estimates are made up of the following benefits: 81% aesthetic/other, 8% storm-water runoff reduction, 6% energy savings, 4% air quality improvement and less than 1% from carbon reduction in the atmosphere. Few European valuations of the above benefits exist but there are a number of examples from the USA. For example, Heisler (1996, cited in Nowak and Dwyer, 2000: 16) estimated that annual energy use in a house with trees could be 20-25% lower than for the same house in an open area. In another study (Nowak et al., 2006) it was estimated that US trees are responsible for the removal of 711,000 metric tons of air pollutants per year with a value of around $3.8 billion1.

There also exists case study-specific evidence that investments in urban forestry can have a positive impact on job creation, new business start ups, and private investment leverage which should all contribute to increased gross value added (GVA) (Sarajevs, in press). One of the best examples of this to date is a study focusing on the Mersey Forest where around £7 million pounds of EU funding was used for new tree planting, land reclamation, bringing woodland into management, creating access to green space and recreational facilities, managing and improving habitats, as well as engaging local communities and business support activities for forestry-related businesses (Regeneris, 2009). This study concluded that every £1 invested in the initiative would generate £2.30 in increased GVA, £3.00 in GVA and social cost savings such as air pollution absorption and £10.20 in GVA, social cost savings and other non-market health and well-being benefits over the lifetime of the investment (Regeneris, 2009).

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1 The monetary value of pollution removal by trees was estimated using the median externality values for the United States for each individual pollutant – O₃, PM₁₀, NO₂, SO₂ and CO.
2.3.2 Property values

Studies also exist which use hedonic pricing methods to examine the impact of urban and peri-urban green spaces and forestry on property prices. Although, ‘a property price increase is not in itself unambiguously a benefit, especially as it may disadvantage prospective buyers’ (Forest Research, 2010: 19), higher property prices may benefit local economies in indirect ways such as through generating more taxes for governments (Bell et al., 2008: 43). Many of the studies in this area are from the USA, although some European studies do exist from Finland, the UK, Spain and the Netherlands, as discussed below. Most of the studies focus on green space as opposed to specifically considering the role of trees and forests.

There is significant evidence which indicates that both the proximity of houses to and views of well-managed, aesthetically pleasing green spaces, woodlands and parks increases property values (Greater London Authority 2003, cited in Fairburn et al., 2005: 20; Morancho, 2003 cited in Bell et al., 2008: 42; Tyrväinen, 1997a). One Finnish study (Tyrväinen and Miettinen, 2000) concluded that for every 1km further away a property was located from the nearest forested area, it experienced an average 5.9% decrease in market value. Furthermore, properties with views of forests were on average priced 4.9% higher than similar properties without such a view.

However, in a study in the Netherlands, Luttik (2000, cited in Bell et al., 2008: 42) found that the impact of green areas on house prices was ambiguous and that while it was difficult to establish a relationship between recreational areas or parks bordering residential areas and house prices, there was more evidence to suggest that green spaces integrated within residential areas were more likely to attract a premium. Therefore, it may be that localised, or national preferences for certain types of green space have an impact on whether or not proximity to them effects property prices.

2.3.3 Willingness to pay

While there are numerous studies examining the willingness of people to pay for services conferred by urban green spaces, trees and forests these generally focus on exploring how much people are theoretically willing to pay for non-market benefits such as recreation or for preserving such spaces (del Saz Salazar and García Menéndez, 2007; del Saz Salazar and Rausell-Köster, 2008; Tyrväinen, 1997b; Tyrväinen and Väänänen, 1998). Therefore, they cannot be properly construed as studies looking at the economic benefits of urban green space and forests but should be seen more as studies exploring the relative value people place on these types of areas and the services they provide. However, there is some evidence from the USA (Wolf, 2006) that the presence of more roadside vegetation, trees and green spaces not only increases amenity value but is also positively associated with a greater willingness to pay for goods and services from retail outlets. Some work has also been completed which explores the GVA of spend from tourists to woodland sites, which in some ways can be considered as real world evidence of willingness to pay. For example, the 2005 England Leisure Visits Survey estimated that the average spend per tourist visit to woods/forests generally was £28 (cited in Regeneris, 2009: 22). However, there appears to be little work exploring the spend of tourists visiting urban or peri-urban woodland specifically.
2.3.4 Key considerations for economic benefit realisation

Although the economic value of the environmental and social benefits of UPF has been touched upon in this section, the factors which should be considered relating to the realisation of these benefits has been covered in previous sections. In terms of direct economic benefits (GVA), very little guidance is available which specifically deals with how best to achieve these benefits in relation to UPF. However, there is some evidence which suggests that the types of trees in view of, or close by to properties impacts upon the potential positive effect they can have on property prices. For example, in a UK study, Willis and Garrod (1992) found that broadleaved woodland enhanced property prices, whereas conifers (excluding larch, Scots pine and Corsican pine) reduced property prices. However, these findings are likely to be location and country specific and point to the fact the local preferences must be taken into account. Furthermore, quality of green space and UPF is intimately linked to property value and it is therefore ‘also important to consider improvements in aesthetic quality’ as investments in this will likely yield great benefits to quality of place (Forest Research, 2010: 22).

3. Conclusions

3.1 Moving ahead with the societal benefits of UPF

This briefing paper has summarised the chief benefits that UPF can afford to society, reviewing environmental, social and economic benefits in turn and discussing the practical considerations which need to be taken into account in ensuring that these resources fulfil their potential. It is clear that urban and peri-urban forests and trees provide a vital resource to urban populations in a multitude of ways but that in the planning and execution of UPF interventions, many factors must be taken into account. In particular, it must be remembered that not all benefits can be realised in every location and management plans and strategies for urban and peri-urban trees and forests ‘should focus on optimizing the mix of benefits that are most important in a particular area’ (Nowak and Dwyer, 2000: 11). Although there is much to learn from examples of initiatives elsewhere, the benefits of UPF will always be context and location specific to some degree and a focus on local needs and local participation in related actions are vital to secure the maximum societal benefits possible.

3.2 Evidence needs

There are numerous gaps in the current evidence base relating to the benefits that UPF can provide to society. Below are listed some of those which it is most essential are met within the European context to enable benefit realisation to be maximised:

3.2.1 General

1. Across all benefit areas there is a preponderance of studies originating from North America. There is an overwhelming need to replicate some of these studies and further explore the issues they address within a European context. Moreover, there is a particular lack of research and evidence relating to UPF in southern and eastern Europe
2. Another cross-cutting gap in evidence is the lack of studies and guidance focusing on how exactly UPF should be designed and maintained (including decisions about species choice, density, distribution and quality) to ensure maximisation of the potential benefits to society (Bowler et al., 2010: 153-4). For example, in the area of health benefits, Tyrväinen et al. (2005: 86) suggest that while a ‘high aesthetic quality may not be required for a stress reducing effect’ it may very well be required ‘to attract people to the green area’. As the first briefing paper on UPF resources highlighted, the lack of guidance in this area is probably compounded by the fact that there is a significant lack of basic knowledge about the extent, composition, quality etc. of current UPF resources.

3. There is a lack of knowledge regarding the different benefits generated by different types and elements of UPF.

4. There is also a lack of evidence relating to the forestry techniques required to provide different kind of benefits.

5. More also needs to be understood about how the attainment of certain benefits impacts upon the realisation of other benefits and how best to achieve a satisfactory balance between them.

### 3.2.2 Environmental

1. Evidence for the climate moderating effects of trees and other vegetation is largely based on observational studies of a small number of green spaces and the impact of specific greening interventions on wider urban areas has not yet been demonstrated (Bowler et al., 2010).

2. More research into the role of urban and peri-urban trees in intercepting rainfall and the effects on soil infiltration and sustainable urban drainage would prove valuable. In particular, modelling work to predict levels of rainwater run-off in different scenarios would be of benefit (Forest Research, 2010)

3. More research on the sheltering effects and the reduction of turbulence and discomfort by urban trees in windy cities is also needed.

4. As for many other benefits, there currently exists a lack of guiding models for biodiversity planning at the city and neighbourhood levels (Tyrväinen et al., 2005).

### 3.2.3 Social

1. Very little research into the social benefits of urban and peri-urban green space examines the specific role and contribution of trees and forests.

2. Although there is evidence pointing to the restorative effects of UPF, longitudinal studies focusing on the impact such spaces have on recovery from stress and attention fatigue over the long-term would be useful (Forest Research, 2010).
3. There is a knowledge gap about how much recreation use urban and peri-urban woodland can sustain without the degradation of the quality of the recreation experience. Further research into the social and ecological carrying capacities of urban and peri-urban woodland is needed (Arnberger & Haider, 2007).

4. There is a need for a much greater level of research into the preferences and use of urban and peri-urban forests and other green spaces by different groups (ethnic, gender, age, disability, economically disadvantaged etc.) in society and its impact upon social inclusion and cohesion (Forest Research, 2010).

5. Furthermore, much more could be done to investigate how to address barriers to usage and how to target efforts at specific groups in society (Stewart and O’Brien, 2010).

3.2.4 Economic

1. A gap exists in terms of economic evidence available on, and the quantification of the majority of the benefits discussed, especially in the European context.

2. A methodology to deliver rigorous economic evaluation of environmental projects requires further development. Moreover, a method is needed to assess the cumulative effects of site-based activities because ‘when sites are connected their value intensifies’ (Forest Research, 2010: 195).

3. There is a need for more quality primary studies into specific UPF interventions and investments and their outcomes. These should utilise best practice guidance in additionality and impact assessment and the results should be usable within a value transfer approach (Forest Research, 2010).

4. There is a lack of data available on visitor numbers to urban and peri-urban woodland which renders attempts to evaluate their importance and economic value for recreation redundant. Consequently, there is a need for regularly assessed recreational use data across forests which would also aid efforts to identify trends in user composition and to assess the success of management interventions (Arnberger, 2006).

5. European studies exploring the impact on consumers of urban and peri-urban trees in business and retail environments would be welcomed, such as studies exploring willingness to pay for retail goods and services (Stewart and O’Brien, 2010).

6. There is also a gap in terms of what is known about business perceptions of urban trees and forests and how green environments impact upon business location decisions.
References


Sarajevs, V. (In draft) Critical assessment of evidence of net economic value of initiatives to create or improve greenspace. Forest Research, Edinburgh


