



THE BENEFITS OF URBAN VEGETATION

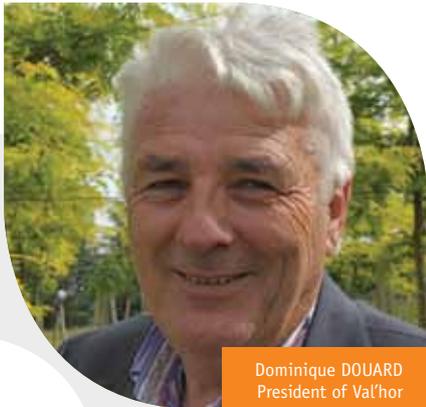
A STUDY OF THE SCIENTIFIC RESEARCH
AND METHOD OF ANALYSIS



Val'hor
Les professionnels du végétal

Plante&Cité
Center for landscape and urban horticulture

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President of Val'hor

Editorial

A study of the benefits of urban vegetation with indicators to aid public decision-making

Plants in cities are our allies in helping promote the health and wellbeing of urban residents, making a vital contribution not just to the quality of the living environment but also to regional attractiveness.

This study, which summarises the scientific research presented in recent international publications, has been produced by Plante & Cité with the support of the Umbrella branch organisation Val'hor, the association for horticulture, floristry and landscape professionals, as part of the Cité Verte ("green cities") initiative, to meet the needs of politicians, professionals, local authorities and businesses responsible for designing, creating and managing green spaces and the natural landscape.

Our aim is to ensure that the benefits of urban vegetation are better reflected in regional planning decisions. To achieve this we have identified five major groups of indicators which can be used to evaluate the full spectrum of plant ecosystem services. We also present a diagnostic tool for analysing these benefits in order to help argue the case for urban vegetation projects, especially during the consultation phases.

This review along with full bibliographic references and the complete study¹ are freely available to all on the Val'hor and Plante & Cité websites.



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¹ in French only

1 URBAN VEGETATION - THE KEY BENEFITS

What does the presence of vegetation contribute to urban environments? This section answers that question point by point, listing the various benefits identified by Plante & Cité in a large-scale review based on international scientific publications. We've streamlined the findings by grouping the 10 key benefits identified under the three pillars of sustainable development: people (the social pillar), natural balance (the environmental pillar) and the economy.

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METHOD

A study undertaken by Plante & Cité in 2010, based on an initial literature review of 104 scientific publications, arrived at a closer understanding of how urban vegetation benefits human health and wellbeing. Since then new international studies have expanded this body of knowledge, documenting the findings in greater detail.

The present study is based on a literature review of more than 300 scientific publications on the benefits of urban vegetation, ecosystem services and the sustainable management of the urban environment (see box). Some of these source studies are French, but the majority are derived from the international scientific literature and have been supplemented by further sources identified as part of the ongoing research watch undertaken by Plante & Cité's documentation service.

CATEGORISING THE BENEFITS

The benefits identified in the literature can be grouped under the three pillars of sustainable development: people (human health and wellbeing, social cohesion, identity), ecological and natural balance (biodiversity, thermal regulation, air quality, water drainage and soil protection) and for the economy (optimising the built environment, utilising plant products, urban agriculture, regional attractiveness).

Each of these benefits is addressed here on a separate page, presenting the current state of knowledge along with examples taken from the international literature and from independent initiatives. ■

HOW STRONG IS THE EVIDENCE?

Studying each of these benefits in turn shows that evaluation can be highly problematic: the determining factors are many and complex. Social contexts vary considerably from one town or city to the next, for example. The studies are not all based on the same methodologies, some results are more robust than others, some facts are better documented. In consequence, identifying the specific contribution made by urban vegetation to a given benefit is often very difficult.

To establish a basis for this presentation, the table below, based on the work of IFPRA, classifies the benefits according to their measurability and the strength of the existing evidence. "Strong evidence" indicates benefits that have been covered by multiple studies and measured accurately in situ in order to assess the impact of the presence of vegetation. "Weak evidence" indicates benefits for which few studies exist and which are studied via modelling or qualitative surveys. ■

CATEGORY	BENEFIT	MEASURABILITY, STRENGTH OF EVIDENCE
For people	Physical health	Strong
	Psychological health	Moderate
	Social cohesion	Weak ¹
For natural balance	Biodiversity	Strong
	Thermal regulation	Moderate to strong
	Air quality	Weak to moderate
	Water drainage	Weak
For the economy	Optimising the built environment	Moderate to strong
	Tourism and attractiveness	Weak ²

¹ Further research required

² Atout France, the French tourism development agency, is currently undertaking a study in this area: 'Nature en ville et tourisme' (nature in cities and tourism).

THE BENEFITS OF URBAN VEGETATION

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The online study at <http://bit.ly/beneveg> includes the full list of bibliographical

KEY

STRONG EVIDENCE
MODERATE TO STRONG EVIDENCE
MODERATE EVIDENCE
WEAK TO MODERATE EVIDENCE
WEAK EVIDENCE

Measurability and strength of the scientific evidence on the contribution of vegetation to various benefits (after Konijnendijk, C.C., et al. 2013).

FOR PEOPLE: HEALTH & WELLBEING

Access to nature and green spaces in urban environments contributes directly to public health by reducing stress, encouraging physical activity, improving the living environment and enhancing city-dwellers' feeling of wellbeing.

Indirect effects are also recorded – higher levels of satisfaction with the living environment, for example, where amenities for leisure activities and sports are available. These benefits are greatly appreciated by urban residents and all users of public urban spaces. A survey from 2012 (see box) also shows that the quality of the living environment with regard to the proximity and quality of green spaces is valued more highly by households than the proximity of shops or the accessibility of public transport.



In the village of Féternes, Victoires du Paysage 2010 / © Val'hor

PHYSICAL ACTIVITY AND REDUCING OBESITY

Strong benefits have been linked with access to a park and with the presence of vegetation in urban environments. Increased physical activity and a reduction in obesity levels are the two benefits most commonly associated with a nearby park or green space. A green space not only provides a location for the activity – it can also create motivation, especially if the quality of the site is perceived as good by users. People are naturally much more likely to use a green space if it is well connected with the rest of the city, if it is well maintained and if they feel good there. ■

OTHER HEALTH BENEFITS

Other benefits are linked to the use of green spaces and to a pleasant living environment. Longevity, reduction in cardiovascular symptoms and respiratory disorders linked to mortality, alleviation of attention deficit disorders, improved ability to concentrate, reduction of stress and improvement in perceived state of health and in mental health are just some of the benefits which have been evidenced but which still require some additional research to be conclusively proven. ■

+ PROMOTING GARDENS WITH THERAPEUTIC BENEFITS

The organisation Jardins et Santé, supported by regional branches across France, works to create and improve gardens designed for therapeutic purposes in healthcare institutions, as well as training specialist gardeners. The institutions targeted are hospitals, nursing homes, care homes and special needs schools. The organisation's work is focused on alleviating mental/neurological conditions – autism and pervasive developmental disorders, Alzheimer's, epilepsy, clinical depression, etc.

To find out more visit: www.jardins-sante.org (French only)

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FOR PEOPLE: SOCIAL COHESION AND IDENTITY



What shall we plant in our garden? Les Dervallières district, Nantes / © Collectif Dérive

MORE OPPORTUNITIES FOR SOCIAL INTERACTION

Several authors speak of the role green spaces play in social cohesion – some drawing on field research in this area. These authors recognise that green spaces potentially offer more opportunities for social interaction than any other type of

space, thanks to their ease of access and their innate characteristics. That said, park users often visit with family or friends, and interactions between strangers generally remain limited. ■

COMMUNITY ATTACHMENT

Community attachment seems to be strengthened by the presence of good-quality green spaces close to dense residential areas. However, green spaces that are heavily or over-used can have the opposite effect, associated with a demand for new amenities. Organising events and educational/participatory initiatives in parks creates opportunities for people to meet and talk, contributing to culture and education. Yet it should also

observed that some public parks can at times provide locations for disorderly conduct, and gatherings of marginal social groups can cause heightened anxiety for users. Support in the form of consultations, appropriate mediation and raising awareness among local residents can often facilitate acceptance and social cohesion in relation to the green space involved. Parks contribute to social cohesion but field research on the subject remains rare. ■

Green spaces strengthen social cohesion in their locality by providing a place where people can meet and activities in which they can participate.

Public green spaces create opportunities for contact between people from diverse social and ethnic backgrounds. These interactions are ways of participating in the life of the community and building a positive community spirit. Community attachment is crucial for getting local people involved in development choices, dialogue and consultation.



La Valette du Var / © Val'hor

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A COMMUNITY GARDEN IN NANTES

For three years the Dérive collective has been supporting the co-creation of a public space at the heart of the Les Dervallières district of Nantes, as part of that city's "Création Partagée" ("creating together") scheme.

The general aim is to make this site a space where the whole community can come together – a space for sharing and experimenting. The facilities provided are decided on collectively with residents, local associations and the site's managers and then completed in working parties which are open to all.

To find out more visit: unjardinpourquoifaire.blogspot.fr (French only)

FOR NATURAL BALANCE: BIODIVERSITY

As green islands, urban parks, linking up to form a multipurpose green network, play an essential role in preserving biodiversity.

In recent years, biodiversity in urban environments – both maintaining it and managing it – has become a major area of concern. Understanding the value of biodiversity through the services it provides plays a key role in promoting the integration of plant life in urban environments. This involves educating children and raising awareness among urban residents of all ages.

URBAN PARKS: SPACES FOR BIODIVERSITY WE NEED TO PRESERVE

Urban parks often have a higher level of species diversity than other types of green spaces. Presence of exotic species is a major contributory factor here. The relative distribution of indigenous and exotic species varies according to the type of organism concerned: we generally see a higher proportion of exotic flora than exotic fauna. Presence of indigenous species in parks is influenced by various factors: urbanisation

(the density of the built environment), the level of isolation, and the park's size and habitat diversity. The spatial attributes of the green spaces and the way they are managed influence the diversity of species and habitats found there. ■

URBANISATION GRADIENT AND URBAN GREENWAYS

As urbanisation levels increase we observe a decrease in species diversity. The level of urbanisation also favours particular species – those that are more generalist or exotic (especially apparent in the fauna of urban parks). The loss of indigenous species can be masked by the presence of less sensitive exotic species. This gradient can be seen as a gradient of habitat loss – with an isolation effect at the extreme end of the spectrum,

when the urban grid does not permit species dissemination.

Recent scientific research undertaken in France as part of the Trame Verte Urbaine (urban greenways) study has shown the key importance of connecting parks together for urban biodiversity, creating multipurpose networks that address both environmental and social challenges. ■



A lane in Niort, voted French Capital of Biodiversity in 2013
/ © Natureparif

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www.nature-en-ville.com

Web portal listing resources for promoting nature in the city

THE "FRENCH CAPITAL OF BIODIVERSITY" COMPETITION

This annual competition honours exemplary strategies for protecting and restoring biodiversity implemented by towns and local authorities. Organised by Natureparif, the

competition is a showcase for innovative initiatives, highlighting best practice and promoting local biodiversity policies. To find out more visit: www.natureparif.fr/

agir/concours-capitale-francaise-de-la-biodiversite (French only) or www.capital-biodiversity.eu/53.html

FOR NATURAL BALANCE: THERMAL REGULATION



A green roof at Lycée de Dardilly near Lyon, where Plante & Cité is staging experiments. / © P. Delhommeau

The presence of urban vegetation reduces the urban heat island effect and helps to improve buildings' energy efficiency.

The urban heat island effect, a temperature imbalance between urban and rural areas, is problematic because the heat has damaging effects on human health, on the lifespan of materials and on the local climate. Several studies have demonstrated the key role played by vegetation in regulating this phenomenon.

HOW PLANTS COOL THE ATMOSPHERE

Plant transpiration releases water into the atmosphere in order to regulate the temperature of the plant's aerial parts. As the water evaporates it uses energy, cooling the atmosphere. This is why parks have been shown to be cooler than the areas around them, a differential that is more pronounced

at night than during the day. The intensity and impact of this phenomenon are related to the size of the park and the composition of its plant life.

The shade provided by trees prevents ground surface overheating and, combined with the cooling effect of evapotranspiration, this

ensures that the air below the tree canopy remains at a more pleasant temperature. A study on the lifespan of urban surface materials shows that tree cover provides effective protection for asphalt, generating savings on maintenance costs. ■

ENERGY EFFICIENCY AND URBAN MICROCLIMATE

The presence of trees around a building increases the overall surface roughness of the environment, reducing the speed and penetrative power of the wind. This effect reduces the inflow of warm air into buildings in summer and of cold air in winter, helping to improve energy efficiency levels. Other planting arrangements also impact the urban

microclimate – notably the incorporation of vegetation on buildings and on all permeable surfaces. Green roofs and walls, for example, help to improve buildings' thermal insulation, thanks to the combined effects of shade, evapotranspiration and the depth of the substrate. ■

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VEGDUD – A PROJECT FOR SUSTAINABLE URBAN DEVELOPMENT

Can increasing vegetation help to control energy consumption and improve the quality of life in dense urban environments? The VegDUD project – part of the sustainable cities programme conducted by the French Research Agency (ANR), overseen by the IRSTV (urban science and technology research institute) and accredited by the Végépolys competitiveness cluster – is working to answer this question. Plante & Cité has been involved in the research programme and will be making the results (in datasheet form with a synopsis) available on its website..

FOR NATURAL BALANCE: AIR QUALITY

Plant photosynthesis, which absorbs carbon dioxide and produces oxygen, is essential to life on earth. Via carbon sequestration and the absorption or emission of pollutants, the presence of vegetation in urban environments is a major factor influencing urban air quality.

Air quality is a major concern in urban environments, in the interests of both public health and the environment. A number of different pollutants are involved here: SO_x, NO_x, CO_x, fine particles. Furthermore, in the context of climate change, the question of carbon sequestration by urban vegetation can be important for local environmental policies.



A tree and dead wood in the eco-district of Bonne, Grenoble / © Cadeau F., Plante & Cité

VARIABLE IMPACTS ON AIR QUALITY

Several studies show that vegetation filters airborne particulates (including PM_{2.5} particles) and absorbs pollutants (proven in particular for NO₂ and SO₂). In Hong Kong, a

study covering 70 parks looked at air quality inside and outside the parks. Park air quality was better than roadside air quality – but not significantly different from the rest of the

urban area, suggesting that urban vegetation impacts overall air quality and not just those areas with dense vegetation. ■

OCCASIONNALLY A SOURCE OF HEALTH HAZARDS

Although ozone is vital in the stratosphere, its tropospheric equivalent is a damaging pollutant for human health, and the main cause of high levels of summer pollution in cities. Vegetation can play a minor role in the formation of this gas by emitting some volatile

organic compounds (VOCs) which are ozone precursors.

Finally, vegetation – specifically the pollen of some plant species – can be a source of allergens causing temporary health hazards. ■

CARBON SINKS

On the urban level, trees and forests function as carbon sinks. Net sequestration can be significant if local anthropogenic emissions permit, and effective where appropriate management methods are employed (e.g. not

burning plant waste from mowing/pruning). Carbon sequestration is almost entirely attributable to trees rather than other kinds of plants. ■

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+ A CHINESE STUDY – RESULTS FROM MODELLING

A scientific study measured quantities of airborne particles, SO₂ and NO₂ in six parks in Shanghai. The results show that vegetation – trees in particular – absorbs these pollutants. The key parameters for absorption are the range covered by the pollution and the tree crown volume. By means of modelling, the researchers were able to estimate the particle capture rate at 9%, and the absorption rates for SO₂ and NO₂ at 5% and 3% respectively.

FOR NATURAL BALANCE: WATER DRAINAGE AND SOIL PROTECTION



Manmade swale in a neighbourhood of Bègles / © Damas O., Plante & Cité

INFILTRATION AND REPLENISHMENT OF WATER RESOURCES

Parks, green roofs, urban forests, etc. all present permeable surfaces, permitting the temporary retention, slower runoff or even infiltration of rainwater.

Green spaces therefore play an important role in rainwater management, and need to be taken into account in decision-making

relating to flood risks. Higher infiltration levels also help to replenish underground aquifers and improve water quality (less leaching, fewer pollutants). ■

SOIL PROTECTION

Urban areas dedicated to green spaces and plants help to protect the soil against encroaching artificial development and the erosion of its physical properties and ecosystem functions/services (hydraulic functions, purification, supporting life).

Plant cover protects the soil from the erosion and subsidence caused by rainfall and rainfall drainage. The root system of the urban plant life creates a protective architectural structure in the soil, adding a further layer of protection against erosion. ■

Because of the role it plays in the water cycle and infiltration, urban vegetation helps to guard against environmental risks, especially floods and soil erosion.

The sealing of land surfaces in urban areas greatly reduces the infiltration of rainwater into the ground: the water runs off the surface directly, joining surface streams and ending in the natural environment. This phenomenon has a number of potentially serious consequences in urban environments.

On the one hand, runoff water picks up suspended matter and pollutants as it travels across urban surfaces. The longer the distances over which stormwater gathers the more polluted it becomes. On the other hand the volume of runoff water can cause flooding – in turn causing accidents and damage.

Finally, stormwater runoff is a resource loss: the urban water cycle is much faster than the natural water cycle and infiltration is often insufficient to replenish groundwater levels. As a result cities sometimes have to source and import their water over great distances – while losing nearly all the rainfall they receive.

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KEY FIGURES

A case study in Beijing (China, 2012) has shown that nearly 2,500 m³ of runoff water can be infiltrated for each hectare of urban vegetation. Additionally, the total volume of rainwater stored by urban green spaces is equivalent to the city's annual requirement for landscape maintenance, i.e. more than 150,000,000 m³.

FOR THE ECONOMY: OPTIMISING THE BUILT ENVIRONMENT

Popular public and private urban green spaces increase the value of nearby properties.

In an urban environment, the study of property prices is one way of looking at the economic value of green spaces (see following section). The theory is that if buyers attach value to a green space, they will be willing to pay more for a property near that space than for a comparable property located elsewhere.



Cours des Arts garden in Nantes, Victoires du Paysage 2012 / © Val'hor

THE PROXIMITY PRINCIPLE ...

Proximity to a green space increases a property's value (Crompton, 2001). This effect has also been observed with urban forests and applies both to houses and apartments. The extent of this phenomenon varies widely from one town to the next and even one park to another. It is therefore difficult to quantify results when context plays such a major role. The park's size determines its influence on the value of a property, with medium-sized parks having the most impact.

Views of an attractive landscape or body of water also add value.

These two influences affect owners as well as tenants (Hoshino, 2010). They are less pronounced in suburban environments, probably because of the greater availability of private gardens and natural areas. But the impact of proximity and view is stronger for parks than for any other type of green space or development. ■

... SOMETIMES NEEDS QUALIFICATION

Occasionally, however, the proximity principle works in reverse: the presence of some parks can lower the price of a property. In such

cases, it is because of the area's crime rate, the noise generated by park users or light pollution from park amenities. ■

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+ ECONOMIC STUDY IN JAPAN

Study of rents paid for studios in a district of Tokyo. Even when studios are comparable in terms of features, rents are higher close to green spaces. Modelling shows that in an area with no park, creating a 5000-m² park within a 450-metre radius increases studio rents by JPY1,430 (USD13.6). However creating a 20,000-m² park, i.e. four times bigger, generates a lesser rent increase of JPY1,230 (USD11.7).

FOR THE ECONOMY: RECYCLING PLANT WASTE

Urban green spaces, like agricultural areas, produce large quantities of biomass. This biomass is being increasingly utilised in urban environments.



Composting plant in Montpellier / © Touénart C., Plante & Cité

ENERGY PRODUCTION

Plant waste can be supplied to local agricultural businesses, or at least converted to energy. The re-use of wood in boilers is well known, but similar processes also exist for grass residues. These materials must be shredded or ground, in the case of wood, and

sometimes turned into pellets in the case of grass clipping. These processes can be technically challenging for local authorities since special facilities are required. However, the amount of biomass recovered generally produces a fast return on investment. In

other cases, using a local firm to pelletise grass waste can contribute to the local economy. ■

RETURN TO THE SOIL

Plant waste can also be used in landscaping, as reflected in the many varieties of mulch and spreads available on the market. Waste from clippings and trimmings is generally insufficient to fulfil an area's total mulching requirement, but the savings produced are nevertheless substantial. Again, it means investing in the proper processing equipment,

or turning to a specialist firm. Plant waste used as mulch has a positive impact on soil, providing structure and organic matter. For instance, high-quality RCW (ramial chipped wood) mulch deteriorates slowly when in contact with soil and therefore has a lifespan of several years. Lastly, all green waste can be recycled at

composting plants. Again, initial investment is required, but the long lifespan of these installations together with their overall contribution to sustainable management usually justifies this option. ■

+ THE VÉGÉTERRE PROCESS

Végéterre is a grinding and composting waste recovery process developed by France's environment and energy management agency, ADEME. After being placed in special storage, the waste is ground and composted for several months before being used to produce a high-quality, organic soil improver compliant with French environmental standard NFU 44-051. This plant-based soil improver can be used as an organic soil amendment, mulch or growing substrate. It is rich in organic matter, magnesium and calcium and poses no risk to crops (per the French National Institute of Agronomic Research, INRA). ADEME has developed special software to size composting plants and calculate their profitability.

More information is available through regional ADEME representatives.

FOR THE ECONOMY: URBAN AGRICULTURE



Allotments in Freising, Germany / © Cholet M., Plante & Cité

Farm and/or food production in or close to towns is booming and has major economic potential.

In recent years, agriculture has been introduced into urban areas, providing considerable benefits in terms of landscaping, values and social cohesion. Allotments or community gardens strengthen an area's social and economic cohesion. These gardens also play an important role in educating the public and raising awareness of economic, health and environmental issues.

AN ECONOMIC ACTIVITY WITH LOCAL ROOTS

Urban agriculture is contributing to a reassessment of food and is prompting more interest in the characteristics and origin of food products. Today urban and peri-urban market gardening meets the needs of consumers wishing to eat locally-grown produce. Small-scale organic farmers or initiatives such as France's "Jardins de Cocagne" organic vegetable cooperatives combine social purpose with farming. However, it should be noted that not

all geo-climatic regions have the same characteristics or offer the same possibilities for plant production. Southern and northern France, for example, have very different urban agricultural environments.

In an urban environment, the quality of soil used for food production is strongly related to how much that soil has been disturbed in the past. Land managers must therefore analyse the soil to ensure it poses no risk to health.

The role of food production in the design of sustainable, resilient cities should not be underestimated. Against a backdrop of recession, urban market gardens, particularly in Latin America, have been demonstrating considerable economic potential for producing food for the urban population. ■

CREATING EDIBLE LANDSCAPES

Urban forests are also discreet production sites and opportunities for harvesting. Seattle, for example, is one of several cities

that have launched an initiative to create "edible landscapes". ■

+ CARROT CITY: CREATING PLACES FOR URBAN AGRICULTURE

From urban allotments and organic vegetable cooperatives to France's "Incroyables Comestibles" (Incredible Edibles) network, urban agriculture is booming and giving rise to new vocations! Researchers at Ryerson University in Canada have published a book on the subject, illustrating how agriculture can be incorporated in cities, especially through design. For more information: www.ryerson.ca/carrotcity

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<http://terresenvilles.org/>
Le site de ressources de l'association Terres en Villes.

FOR THE ECONOMY: REGIONAL ATTRACTIVENESS



Aerial view of the banks of the Rhone in Lyon, Victoires du Paysage 2012 / © Val'hor

The quality of a habitat and more generally the urban environment sends residents and visitors a strong message that can contribute to the region's social and economic development.

Parks and gardens are used not only by local residents but also by visiting tourists and inhabitants of the region who are passing through. Urban ecotourism is expanding and is considered an "ongoing opportunity to conserve social and biological diversity, create new jobs and improve the quality of life" (see box). This form of cultural tourism, described as "sustainable urban tourism", combines the appeal of gardens and natural areas with city exploration.

TOURIST INTEREST

Very little has been published so far on the tourist appeal of green spaces. While there are clear indications that parks and green developments present a definite interest to tourists, there have not been enough studies to draw any general conclusions.

The few studies conducted during the 2000s indicate first and foremost that the vast majority of park and garden users are city dwellers. Meanwhile, tourists consider vegetation in urban environments to be very important, and a small percentage believe parks and gardens to be crucial to a town's appeal, more so than architecture or culture. That

said, all of a town's green developments help boost its image, general atmosphere, beauty and attractiveness. A prestigious park can even be the prime reason for a visit. Studies also reveal that towns offering a themed environment or which are maintained to high standards are especially appealing to tourists.

However, during a recession, budget cuts prompt reductions in staff and the time spent maintaining green spaces. Users notice this unemptiness and use of these spaces suffers accordingly. ■

KEY FIGURES

Study of visits to Thames Barrier Park in London (United Kingdom), created in 2000 primarily as a tourist attraction. In total, only 9% of park visitors were from outside London and 2% were foreign tourists. London residents were therefore by far the largest group of users.

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2 THE VALUE OF URBAN VEGETATION – AN ECONOMIC ANALYSIS

What value does a park or tree-lined street have for local residents and for the economy? This can certainly be measured numerically, although not in monetary figures since we are talking about a non-commercial environmental asset. Beyond these aspects, this section focuses on the role of green spaces in the market economy and the contextual quantification of benefits, or occasionally nuisance, generated by green spaces.

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SOME BENCHMARKS



La Sablière park, green spaces and collective housing, La Garenne-Colombes, Victoires du Paysage 2012 / © Val'hor

For many stakeholders, economic valuation, which is in addition to other biodiversity values, leads to dialogue and exerts a strong influence on decision-making and public policy. To assess the economic value of green spaces, it is important to understand a number of economic concepts.

THE CONCEPT OF A GOOD'S ECONOMIC VALUE

In traditional economic theory, the concept of value is related to that of utility. The utility of a good (i.e. its ability to meet a need) is transcribed into a monetary unit. In a competitive environment, the market price is an equilibrium that reflects consumers' and producers' preferences. However, market price does not always equal the value that consumers place on these goods. To take this into account, we have to turn to the notion of consumer surplus. Consumer surplus is

the difference between the price that the consumer is willing to pay for a good or service and the price actually paid during the transaction. Using these notions and supply and demand curves, we can estimate the value of a good available on the market. Green spaces are not commercial goods: the consumer, in this case the user, spends nothing to enjoy a public green space. Since this service is provided free of charge, the indicators used to analyse commercial goods

do not apply here and it is therefore difficult to determine people's preferences. Economists use a variety of methods to assess the value of green spaces and nature: cost analyses, individual preferences, hedonic pricing, and so on. Each of these methods has its strengths and weaknesses, particularly given the complexity and diversity of the services provided by nature. ■

THE ECONOMIC VALUE OF GREEN SPACES

The total economic value of a good is the sum of all forms of demand. It is made up of several constituent parts.

First, green spaces have a use value related to recreational and landscape enjoyment. Views and accesses to green spaces are usually unique because they are localised. Their value is capitalised in the price of a property, since acquisition of the property gives access to the services provided by these spaces. This is typically the case for homes, hotels or campsites. For example, if a hotel overlooks a park, room charges will generally be higher than for a neighbouring hotel with no such view.

But this capitalisation is only partial, since what is excluded is also partial. Therefore,

price differences observed in the property market, for example, only reflect part of the value that people attribute to green spaces. Green spaces are essentially subject to non-market demands by people who engage in free activities (walking, looking at nature, local heritage, etc.). This is the non-commercial use value of green spaces.

It is also possible that aside from any actual use, individuals put a value on a green space, for example because they want to have the option of being able to benefit from it at a later date. Compared to a conventional private good, this is an insurance. It is the sum that individuals would be willing to pay to ensure that a green space will not be altered. It is the option value for future use.

However, the value of a green space does not lie solely in the individual use we can make of it. Some people would certainly be willing to pay to enable others or future generations to enjoy green spaces. This sum represents the heritage value of green spaces. Lastly, it is possible that some people also attribute an intrinsic value to green spaces even though they do not use them. This value is called existence value.

It is clear that non-use values are less tangible than use values. This does not necessarily mean that they are any less important, but they are more difficult to estimate. ■

A FAVOURABLE PRECEDENT FOR GREEN SPACES

Two economists, Brander and Koetse, recently reviewed some studies made of the economic value of urban green spaces. They also carried out a statistical analysis (a meta-analysis) of these studies to identify sources of variation in the various values. In particular, they looked at 12 studies of hedonic pricing between 1978 and 2008 (see box).

The results obtained by Brander and Koetse suggest that green spaces have a high value. On average, of the 12 studies that used the hedonic pricing method, the price of a home located 200 metres from a

green space was 0.1% higher than that of a home located another 10 metres (0.5%) away. This effect is even more pronounced when a home is located in immediate proximity to a green space, but the price drops quickly as distance increases.

Brander and Koetse also show that an important part of the differences in value observed in the studies is due to regional factors. The context of a study is therefore an important factor in valuing green spaces and it is difficult to deduce a value for a green space in France based, for example, on values observed in the United States. ■



Mediterranean garden,
Victoires du Paysage 2012 /
© Val'hor



HEDONIC PRICING METHOD

The hedonic pricing method (HPM) measures people's willingness to pay for certain environmental attributes by observing their buying behaviour. It analyses how goods are priced by assigning a value to each of the good's characteristics. If we take the example of a house, some people will attach more importance to the view, others to its exposure to sunlight or distance from their workplace. It is therefore possible to place a value on the accessibility of green spaces by linking the price of a property to its proximity to an urban green space.

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INTERNATIONAL ANALYSIS OF THE VALUE OF GREEN SPACES



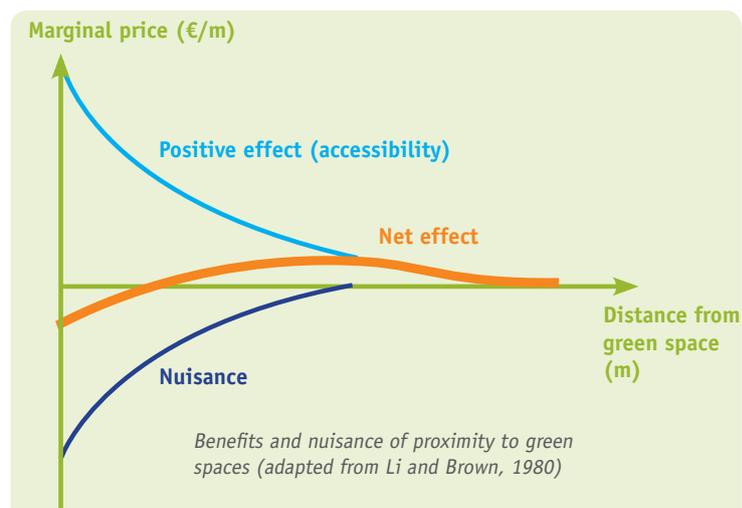
A street in Fribourg where green spaces take on special importance / © Val'hor

Plante & Cité and the Agrocampus Ouest economics laboratory in Angers have been involved in a joint study since 2012. We have reviewed 66 separate studies, conducted between 1965 and 2011, that used the hedonic pricing method (HPM) to measure the value of proximity to urban green spaces. Each study offers a number of potential values, and we have observed 369 different measurements of the effect on property prices of green space proximity. This effect has been converted to constant 2010 euros. Although preliminary, the results reveal a number of phenomena.

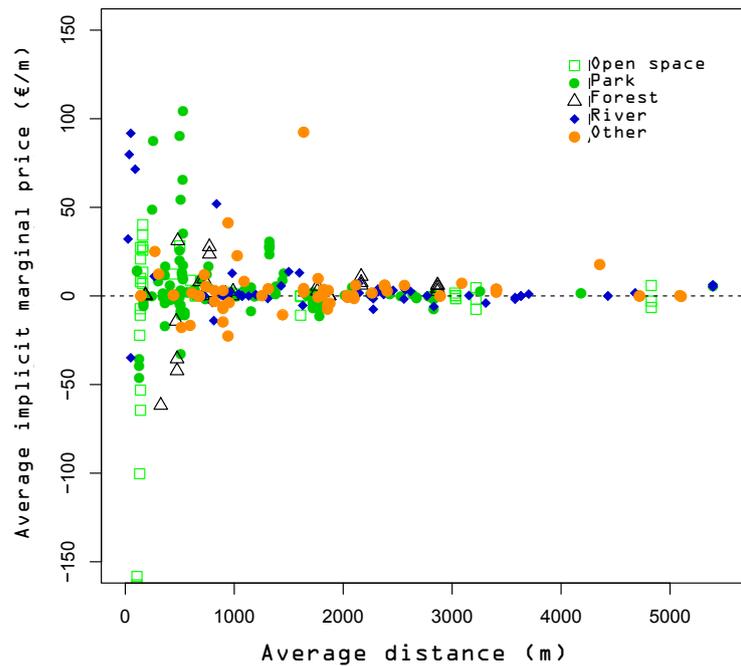
POSITIVE AND NEGATIVE EFFECTS OF GREEN SPACES

Green spaces do not generate solely benefits. Li and Brown (1980) showed that 30 years ago the net effect of proximity to a green space was the resultant of benefits and nuisance generated by that green space. The type of nuisance that some green spaces can generate is mostly related to their public nature. They can be damaged or overused (leading to lack of parking near the park, noise, etc.) or become the scene of various forms of delinquency. As with benefits, such nuisances become less marked as distance increases. When a park generates benefits and nuisances in equal measure, the net effect (measured by the HPM) is close to zero, as shown in the chart opposite. Whether negative or positive, the marginal effect, i.e. the change in price for moving one distance unit closer to a green space, decreases whenever distance increases. In other words, the effect on a property price of “moving 1 metre closer to a green space” is

more pronounced if the property is 50 metres from the green space than 500 metres from it.



This phenomenon was found in the analysis of the 66 studies. The chart opposite(1) shows the estimates of the 369 marginal effects on property prices of proximity to green spaces (in €/m), based on our study of the scientific literature. We see that beyond a distance of 1500 metres, green spaces have virtually no influence on property prices. Within this distance, however, green spaces can generate not only net benefits but also net negative effects. Urban parks and green spaces near rivers tend to generate net benefits of up to €100 per metre if the property is within 500 metres of the green space. This means that people add value of up to €100 to the purchase price of a property located 1 metre closer to a green space. When added up over the total distance between the property and the green space, the value of immediate proximity can amount to several thousand euros. Conversely, some open spaces (farmland or wasteland, for example) or certain forests generate a net nuisance value of up to €50 per metre, as seen in empirical studies.



Implicit marginal price of proximity to green spaces

As shown in the chart below, almost half (46%) of the effects measured in the scientific literature are of little or no significance. This reflects the fact that for many green spaces, the negative and positive effects balance each other out. Almost two thirds of the effects measured are positive. What is particularly striking is the difference between the significance

of the positive and negative effects: 60% of the net negative effects measured are insignificant, whereas it is the opposite for the positive effects. Ultimately, only 13% of

the studies we reviewed found that green spaces, based on those sampled, generated net negative effects. By contrast, 41% of the studies concluded that there were net benefits, with the remainder (46%) unable to conclude whether or not the effects measured were significant. ■

	NET NEGATIVE EFFECTS	NET POSITIVE EFFECTS	TOTAL
Insignificant	20% (72)	26% (97)	46% (169)
Significant	13% (49)	41% (151)	54% (200)
Total	33% (121)	67% (248)	100% (369)

Breakdown of results of the 369 measurements taken from the studies reviewed.

RESULTS IN CONTEXT

To better understand this global overview and put the results in context, two factors must be taken into account.

First, the hedonic pricing method, studied here, only measures private use values. And it certainly does not take into account the full value of the services provided by green spaces. In particular, it does not deal with the individual and collective benefits of urban vegetation on health, social cohesion and the environment. We can reasonably assume that these effects are positive or zero, and that they add to, but do not detract from, the value of green spaces. Taking these effects into account would enable us to observe almost all situations in which green spaces generate net benefits.

On the other hand, much of the variance in the effects measured(2) in the literature is related to the types of green spaces and their location. In particular, we see major disparities between the United

States and Europe. In Europe, green spaces typically generate net benefits. But in the United States, green spaces tend to generate net nuisances, since it is the poorest populations who live in town centres close to these spaces. Net effects also differ between types of green space: for example, parks, gardens and areas near water typically generate benefits, but this is less the case with open spaces and forests. ■

1 The chart does not include extreme observations

2 Results discussed in this paragraph are taken from two statistical models (Logit models) that explain the significance and character of the measured effect based on the study's location, the type of green space in question, and control variables, such as average earnings in the city and climate. Details of these results are available from the authors.

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Micro-Neighborhood Externalities and Hedonic Housing Prices. *Land Economics*, 56 (2), pp. 125-141.

TWO STUDIES LOOKING AT THE FRENCH CONTEXT

Whereas in the past most of the scientific studies that estimated economic values for green spaces using the hedonic pricing method were North American, several studies have now been conducted in Europe and Asia. So far, however, there have been only a few in France. There have been two studies that focused on the towns of Angers and Brest. Both of them illustrate the fact that green spaces in France generate clear benefits.

CASE STUDY: ANGERS

Choumert and Travers (2010) studied the impact of the proximity of green spaces on apartment prices in Angers. They included landscape ecology indicators to assess the natural environment of the apartments. Besides proximity, the study introduces descriptors for the green spaces, including the density of green spaces within a radius of 1000 metres around the apartments, their surface area and their shape. These last two elements do not play a significant role in this study. By contrast, the proximity and density of green spaces are clearly significant. Choumert and Travers calculate that an apartment located 200 metres from a green space is worth 1.4% more than the same apartment situated 300 metres away, i.e. 100 metres further away than the first one. Likewise, a 10% increase in the density of green spaces pushes the price of nearby apartments up by 1.6%. This reflects the high value placed on urban green spaces in France. ■



Green spaces in Angers / Anquetil V., Plante & Cité © Plante & Cité

CASE STUDY: BREST

Similar results can be found in a study conducted in Brest by Ahamada, Flachaire and Lubat (2007). They use “non-parametric” statistical methods which enable them to model subtle effects of distance. They demonstrate that at distances of over 200 metres, green spaces no longer have a visible effect on house prices – a recurrent finding in the scientific literature. According to the results of this study, an apartment in the immediate vicinity of an urban green space is worth 17% more than the same property located 100 metres further away. This result

is not inconsistent with the findings of Choumert and Travers. The difference is due to the diminishing marginal benefit: the same distance increase (100 metres) is more harmful in the immediate vicinity of a green space than it is 200 metres away because it means losing the view of the green space, the tranquillity, and the ability to go there quickly on foot. ■



Green spaces in Brest / Guérin M., Plante & Cité © Plante & Cité

These two French studies confirm the overall effect measured in the preceding analyses: in Europe, and particularly in France, green spaces generate net benefits which impact on housing prices, among other things.

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3 DEVELOPING A DIAGNOSTIC TOOL TO ASSESS THE BENEFITS OF URBAN VEGETATION

Councillors, managers of green spaces, designers and the various stakeholders involved in urban planning are calling for simple tools to evaluate the benefits of urban vegetation that will facilitate analysis of urban planning projects and support the consultation process. In order to meet this need, in this final section we propose an analytical method and assessment indicators that can be adapted to the desired territorial scale and context.

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A SHARED DIAGNOSTIC TOOL

The aim of this tool is to provide all the stakeholders with starting points for reflection and the arguments they need to restore vegetation to its place in urban infrastructure, and to integrate the associated benefits at the planning stage. The proposed self-assessment consists of three stages: knowledge of the territory acquired through data collection; promotion and enrichment of dialogue achieved through the joint analysis; decision-making based on identification of the strengths and policy instruments.

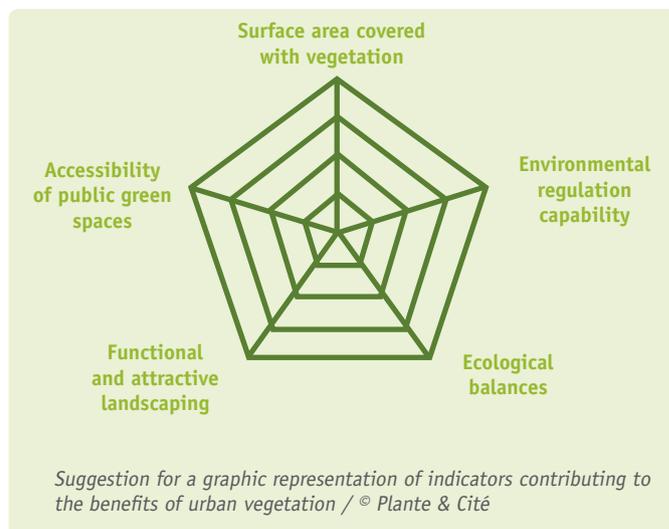
The scientific literature shows that the role of urban vegetation can be evaluated in a number of different ways. We have identified the major factors influencing the benefits of vegetation and have organised them into five inter-related lines of investigation:

- Functional and attractive landscaping
- Accessibility of public green spaces
- Number of spaces covered with vegetation
- Ability to regulate the environment
- Ecological balances

Each of these lines of investigation can be evaluated using indicators that are characteristic of a project's fixed and modifiable elements. The evaluation makes it possible to identify potential for progress and possible trade-offs that can be made to improve the city/countryside compromise.

Each line of investigation can also be applied to different territorial scales (from an individual plot of land to an entire region), and each indicator can be adapted to the evaluation context (management, project evaluation, scenario planning for an urban planning programme, etc.). A tool of this kind can be applied to different scales and to a wide range of objects (public parks, landscaped natural areas, transport routes, etc.).

These five lines of investigation form the basis of the tool. To make it easier to use, we propose an evaluation system for urban characteristics linked to vegetation (see diagram above). This graphic representation is not a result in itself, but should be used as an aid to discussion and



communication for each of the topics covered (see page 30).

Graphic representation makes it possible to identify quickly the knowledge available for each line of investigation and to carry out an analysis of the strengths and weaknesses of an urban planning project with regard to the different types of benefit arising from the presence of vegetation. The tool also makes it possible to discuss different management scenarios and alternative solutions for a project. There is one essential precaution to bear in mind: the indicators listed here as examples must not be used as standards, but as methodological tools to support the three major planning stages of a project (study, consultation with residents, and decision by councillors). ■

A SEPARATE ASSESSMENT FOR EACH SITE

The results of this self-assessment will always be highly context-dependent and must not be considered an end in themselves. The aim of the tool is to provide an aid for consultation, to trigger debate and enable the different stakeholders to position and prioritise their arguments.

By their very nature, the results are not transferable. An assessment conducted for one site will not provide any indication regarding the characteristics of another site, however similar they may appear. Two sites cannot be compared. The results must always be accompanied by a summary report presenting the information on which the assessment is based, the arguments identified and the

conclusions reached. The quality of the report will also make it possible to update the assessment after a few years so as to check the hypotheses and track the site's evolution. This approach is only meaningful in a collective urban-planning process or in a particular planning context. ■

THE FIVE LINES OF INVESTIGATION

Whatever the scale or context of the area under consideration, it is essential to include these five lines of investigation in the urban planning process to take into account the benefits associated with the presence of vegetation. This section describes in greater detail the different aspects of each line of investigation and how closely they are linked to the various benefits of urban vegetation.

Each of these lines of investigation must be evaluated separately on a case-by-case basis. Whereas, in some cases, the evaluation can be based on a measurable criterion, such as the area of green space per resident or the distance between the plot of land in question and a public green space, in most cases, the evaluation will be based on a shared “expert opinion”. Because each line of investigation is based on several different parameters, it will be possible to compare them in qualitative terms. To aid interpretation of the results, we should remember that the links between the lines of investigation and the benefits identified in the study will vary in their intensity. These links are indicated in the table below using a colour key based on the

quantity and tangibility of the findings in the scientific literature and on expert opinion.

Finally, we note that the five lines of investigation correspond to similar methodological tools already implemented by some local authorities. In particular, they can be found in the Open Space Index in the form of proposed benchmarks for the provision of green spaces in New York city. The following descriptions of the lines of investigation and possible questions to be answered during the analysis show how closely the issues are interconnected and demonstrate the need to adapt the questions to the local context. ■

THE BENEFITS (classified by category and according to tangibility, see page 8)		LINES OF INVESTIGATION				
		Functional and attractive landscaping	Accessibility of public green spaces	Surface area covered with vegetation	Ability to regulate the environment	Ecological balances
For people	Health and wellbeing	Strong Link	Strong Link	Medium Link	Medium Link	Weak Link
	Sense of community and identity	Strong Link	Medium Link	Weak Link	Weak Link	Weak Link
For natural balances	Biodiversity	Weak Link	Medium Link	Strong Link	Weak Link	Strong Link
	Thermal regulation	Weak Link	Weak Link	Medium Link	Strong Link	Weak Link
	Air quality	Weak Link	Weak Link	Weak Link	Medium Link	Strong Link
	Drainage and soil protection	Weak Link	Weak Link	Strong Link	Medium Link	Medium Link
For the economy	Enhanced property values	Medium Link	Strong Link	Medium Link	Weak Link	Weak Link
	Attractiveness of area	Medium Link	Weak Link	Medium Link	Weak Link	Weak Link
	Making use of green waste	Weak Link	Weak Link	Strong Link	Weak Link	Medium Link
	Urban agriculture	Medium Link	Weak Link	Medium Link	Weak Link	Medium Link

KEY
STRONG LINK
MEDIUM TO STRONG LINK
MEDIUM LINK
WEAK TO MEDIUM LINK
WEAK LINK

FUNCTIONAL AND ATTRACTIVE LANDSCAPING

The quality of public green spaces, in terms of design harmony, educational and functional features, and maintenance, has a direct influence on how frequently they are used. More generally, at city level, the quality of green spaces contributes to the image and attractiveness of an area.

Sample questions:

- How good are the green spaces, as perceived by local residents, in terms of appearance and landscaping?
- What is the perceived standard of maintenance, the quality of paths?
- Are there freely accessible facilities (for pleasure, sports, etc.)?
- Are there temporary facilities or events, and what are they like (frequency, duration, success, outreach, etc.)?
- Are there educational or public awareness events and what are they like (frequency, duration, success, outreach etc.)?

REFERENCE



New Yorkers for Parks, (page viewed on 05 march 2013). The Open Space Index [2010] [en ligne]. <http://www.ny4p.org/research/osi>

ACCESSIBILITY OF PUBLIC GREEN SPACES

The greater the accessibility of urban green spaces, the greater their effect in terms of improving the physical and mental health of residents, the quality of their living environment, their wellbeing and sense of community, property values and the attractiveness of the area. Included in this aspect is the position of green pockets in relation to one another and their distribution within the urban fabric. This also includes the issue of isolated green pockets and connections and interactions within a green urban corridor.

Sample questions:

- How easily accessible are the parks, allotments, forests, etc. and how well are they integrated into the urban fabric?
- What is the balance between the demand and supply of green spaces?
- What proportion of residents have access to private green spaces?
- What is the average distance people have to travel to reach a green space?
- How are the green spaces distributed within the urban fabric?
- What are the data relating to visitor numbers and time spent in the green spaces?

SURFACE AREA OF PUBLIC AND PRIVATE SPACES COVERED WITH VEGETATION

The quantity of green spaces and soft landscaping areas affects the interaction between people and nature and therefore the individual and collective benefits that users can derive from them. The ratio of green spaces to built-up areas is also a factor affecting regulatory functions (thermal regulation, air quality, drainage). Finally, this type of indicator also plays a role with regard to the management of urban biodiversity.

Sample questions:

- What is the area of green spaces or areas covered with vegetation per inhabitant?
- What is the ratio of green spaces to built-up areas?
- How much vegetation is there along transport routes?
- What are the proportions of the various different types of green space (forests, allotments and communal gardens, agricultural spaces, etc.)?
- How many green spaces have an impact beyond the local community?

ABILITY TO REGULATE THE ENVIRONMENT

Regulatory functions are closely linked to the presence of trees, which play a special role because of their size and longevity. Moreover, avenues of trees and urban forests are key features of the landscape and help create an image of “nature in the city” with all that implies: attractiveness, the human/nature relationship, etc.

Sample questions:

- How many trees are there?
- What is the species diversity of the trees?
- What are the physical qualities of the trees: type of foliage, height and volume, shade, health condition?
- What are the existing forms and how do they relate to air circulation?

ECOLOGICAL BALANCES

Proper, well thought-out management contributes to the maintenance of functional, robust natural spaces, making them better able to provide the ecosystem functions that generate benefits. The intrinsic qualities of green spaces must also be taken into account, particularly when establishing an urban green corridor and/or applying for an ecolabel.

Sample questions:

- Does urban planning take account of the green and blue corridor concept (vegetation and water)?
- What are the management methods used?
- What happens to green waste?
- Are soil assessments carried out?
- How are the different green spaces connected?

SCALABILITY

The five lines of investigation and associated parameters enable us to understand the functions performed by urban vegetation, and the benefits it generates. The parameters can be adapted, depending on the context, enabling the evaluation to be carried out on three different scales: plot level, landscaped area or territory (district, town or conurbation).



View of car park at the Zénith performance venue in Strasbourg, Victoires du Paysage 2010 / © Val'hor

In the full report, available online at www.plante-et-cite.fr, we propose indicators and scalable parameters for each of the five types of function performed by urban vegetation. These proposals are based on the scientific literature and have been discussed with experts. Nevertheless, the parameters must be adapted as required to the different situations and professional requirements. Each urban context and every planning project has its own constraints and objectives; every group using the tool should specify its own frame of reference based on the elements presented here.

PLOT LEVEL

When considering a built plot (homes or offices), the tool can be used to analyse the characteristics of the green environment and the functions it can perform.

The tool can also be used to help characterise and discuss the most appropriate way of improving the living environment of the residents in an apartment block or the occupants of an office building.

For community representatives (councillors,

those responsible for urban planning services or green spaces), the tool can help analyse the accessibility of public green spaces. Finally, the tool can influence proposed regulations for new housing projects (individual or collective) relating to green spaces, particularly their ability to regulate the environment and maintain ecological balances. ■

LANDSCAPED AREA LEVEL

An urban landscaped area (public garden, park, pathways, green corridor, square, etc.) differs from a plot of land in that it is accessible to the public and does not contain homes. At this level, the tool can be used to evaluate the site's contribution to the overall production of benefits. Based on the results, it is possible to identify the strengths and weaknesses of a facility or planning proposal. Here, the tool adds a green space

component to support strategic projects by making it possible to compare the strengths and weaknesses of each landscaped area and by helping draw up specific proposals for improvement, aimed at the gardening teams. The tool can also be used by councillors as a basis for discussion with local residents during the different stages of a project and for communicating the advantages. ■

TERRITORY LEVEL

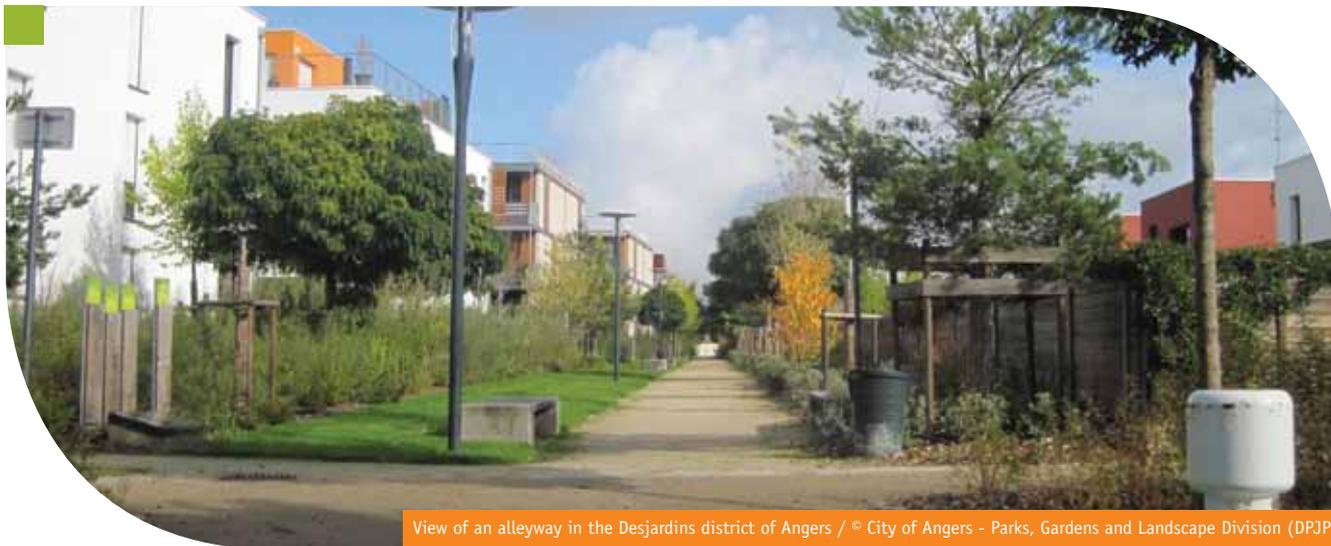
"Territory" here refers to an area consisting of several plots and landscaped areas. Territories can be evaluated on different scales, from a housing development or district to an entire town or city.

At territory level, the tool for analysing the benefits of urban vegetation can be used to help draw up an urban planning policy, including revising the regulations contained in local development plans. The tool can be particularly helpful during phases when housing density is increasing, in particular by providing material for debate based on the characterisation of the different functions performed by urban vegetation.

In this context, an evaluation of the five lines of investigation may highlight the regulatory functions of green spaces in general, and the provision of publicly accessible green spaces that generate individual and collective benefits. ■

PRACTICAL FEEDBACK

The evaluation tool has been tried out in a first full-scale test on a district in the city of Angers. The tool was found to be highly suitable on the ground and appears very promising thanks to its ability to identify the site's strengths and weaknesses.



View of an alleyway in the Desjardins district of Angers / © City of Angers - Parks, Gardens and Landscape Division (DPJP)

TEST AIMS AND CONDITIONS

Under real-life conditions, the exercise is conducted by a head of department assisted by the relevant support staff. In less than two hours, this small group of people can identify the principal evaluation parameters that will then be used by other working groups (managers, councillors, users, etc.) to develop the consultation phases for the space in question.

During this initial phase the objective is to go through the lines of investigation one by one. For each one, the group collects the information and arguments needed to produce a final score. During

each discussion it is important to take note of the questions raised, the facts submitted, and any new ideas: all these elements may prove useful in subsequent sessions and will also make it possible to repeat the analysis after a few years, if necessary. The final score awarded for each line of investigation must always be accompanied by a commentary.

The analysis described here was conducted with the assistance of Fanny Maujean, Director of Parks, Gardens and Landscapes for the City of Angers and the Angers Loire Metropolitan Area. ■

TEST SITE: THE DESJARDINS ESTATE

The Desjardins district close to Angers city centre is a landscaped residential development that is open to the surrounding area. The development has 430 homes with above-ground and underground parking. Tree-lined paths lead to a central grassy area (1.6 hectares), and paths connecting the development to the surrounding district promote non-motorised forms of transport. The development consists of modern homes of different types, including apartments and houses, and 20 percent social housing.

The space is actually a converted barracks, acquired by the city in 2000 (project delivered 2012). The focus of the project was on the quality of the outdoor spaces and on creating a modern environment while pursuing sustainable forms of urbanisation. The choice of materials, building orientation, energy consumption, etc. were therefore carefully

considered. Evaluating the characteristics of the vegetation on this type of site enables us to identify the functions performed by the new facilities. Using the questions raised during the exercise and the facts and information gathered to answer them, we can identify the strengths and weaknesses of the district in terms of the green spaces it provides. In this way we can identify areas for improvement and points to monitor, so as to manage the site as it matures, and consolidate the positive aspects so as to enhance the work already done.

The Desjardins district won an award at Victoires du Paysage, a professional landscaping competition, in 2010.

Project management: PHYTO LAB (landscape architects), ENET-DOLOWY (urban planners), SNC LAVALLIN (technical studies office). ■

SITE ANALYSIS, STEP BY STEP

1 - Functional and attractive landscaping

Score: 3/4 = high quality

Commentary: This score is based on an assessment of the quality of the facilities and the appearance of the site. The site is unusual and of a high quality. The aim in the medium term is to monitor: the materials as they age, the appropriateness of the surroundings, the evolution of types of use and population. There are plans to set up a local monitoring team to conduct surveys of user numbers and user satisfaction every two years to start with. The municipal authority will also carry out a review of the site's evolution every two to three years.

2 - Accessibility

Score: 3/4 = good accessibility

Commentary: This score is based on a qualitative assessment. The location is very good: an open, highly integrated site, with plenty of access routes. However, there is still some work to be done to assess accessibility options for people with reduced mobility and disabled access in general.

3 - Number of spaces covered with vegetation

Score: 3/4

Commentary: This score is based on a quantitative scale. The amount of open ground is particularly good. The area taken up by the various different elements will not change in the medium term. There is potential for progress in the areas of management and making use of a full range of plants.

4 - Ability to regulate the environment

Score: 2/4

Commentary: This score is based on a quantitative evaluation of the ratio of permeable to impermeable surface area, linked to an assessment of the number of trees on the site and their condition. The recent homes have green roofs; all the trees have a natural shape. The challenge in the medium term will be to ensure the healthy development of the young trees.

5 - Ecological balances

Score: 2/4

Commentary: This line of investigation looked at questions concerning the green corridor and site management. Applying for an ecolabel would be an interesting tool to take this further. Ecological continuity aspects need to be addressed in collaboration with the surrounding spaces. This issue concerns policy on a wider scale, which is currently being formalised at city level by means of a plan local d'urbanisme (local urban planning programme).



View of the central green space in the Desjardins district of Angers / © City of Angers - Parks, Gardens and Landscape Division (DPJP)

Fanny Maujean,
 Director of Parks,
 Gardens and
 Landscapes for the
 City of Angers and
 the Angers Loire
 Metropolitan Area



It is an interesting analysis to carry out on a site, with a list of questions that enable us to gain a wider view of its functions. The chosen scale and its appropriateness are of fundamental importance. This tool can be useful beyond the one-off evaluation: if it is repeated regularly (every year or two years) and shared with partners and councillors it can be transformed into a continuous improvement tool.

OPTIONS FOR REPRESENTING THE SITE RESULTS

Desjardins is a high-quality development which is appreciated by the local population. The current condition of the facilities is very satisfactory and the design choices do not pose any management problems at the moment. The few areas requiring attention

are: acquiring a better understanding of the chain of continuity for access to the site, working on the local green corridor and putting in place a monitoring system for the evolution of the district and for the user satisfaction. ■



Results presented in a spider chart and bar chart / © Plante & Cité

THE BENEFITS OF URBAN VEGETATION

SUMMARY

Focusing on the application of ecosystem services in urban settings, this document summarises findings from the scientific literature on the various benefits of urban vegetation: human health and wellbeing, social cohesion and identity, biodiversity, thermal regulation, air quality, drainage and soil protection, increased property values, making use of green waste, urban agriculture and the attractiveness of the area.

Alongside this initial summary, we present a specific analysis of the economic value of urban vegetation based on a meta-analysis of research conducted in this field.

Finally, this document proposes a tool that can be used to analyse a space and to take vegetation factors into account in urban planning projects. Centred around five lines of investigation, the tool can be used on various scales – from an entire territory to an individual plot of land. An example demonstrates how the tool can be adapted to the local context and used to characterise a space and identify areas for improvement to optimise the effect of ecosystem services.

This document aims to bring these elements to the attention of the various stakeholders involved in decision-making and planning with regard to urban vegetation, so as to enrich the consultation phases.



Established in 1995, Val'hor is the French umbrella branch organisation for horticulture and landscaping. It draws together professional organisations from the areas of production, horticultural commerce, nursery gardens, landscaping and gardening. Cité Verte (Green City) is a European grassroots initiative that aims to make the city a better place to live, where vegetation, landscaping and urban nature bring benefits to residents in terms of quality of life, wellbeing, development of a sense of community and environmental protection. In France, Cité Verte is coordinated by the inter-industry association Val'hor. The Benefits of Urban Vegetation project received funding from Val'hor for research into indicators for the Cercle Cité Verte. www.valhor.fr



Plante & Cité is the French national centre for research and experiments in the area of green spaces and urban landscaping. Set up as an association (non-profit organisation), it currently has more than 500 members (local authorities, landscaping firms, design offices, research and training establishments, etc.).

Sponsored by the French Mayors' Association (AMF) and with funding from the inter-industry association Val'hor and the ministries in charge of agriculture and the environment, Plante & Cité develops research and expertise to innovate for sustainable development of parks and green spaces. www.plante-et-cite.fr

Plante & Cité is also part of the Végépolys international competitiveness cluster, with responsibility for “innovation in urban vegetation”.

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