

Barcelona green infrastructure and biodiversity plan 2020



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FOREWORD

Barcelona is committed to preserving and enhancing the natural heritage present in the city to enable each and every one of us to benefit from and enjoy it. To achieve this in a systematic manner, we have drawn up this **Barcelona Green Infrastructure and Biodiversity Plan** setting out the goals we aim to reach and the various lines of action to engage in with a view to reaching said goals. It is vital to strive towards a city where nature and urbanity converge and enhance one another, where green infrastructure attains connectivity and where green heritage achieves continuity with the natural area surrounding it. Our aim is not for nature in the city to form a map of isolated spots; rather, we seek to forge a genuine network of green spaces. This greenery must be conceived as green infrastructure forming part and parcel of the city, serving an environmental and a social function.

From a forward-thinking approach, it is encouraging to consider that natural ecosystems, their flora and their fauna do not only belong to the city, they also constitute a collective asset of human-

kind as a whole. It is essential to realise that when enhancing urban green infrastructure the bearing we have extends far beyond the boundaries of the city. Consequently, this plan falls in line with the EU Biodiversity Strategy to 2020 and the strategies laid out along these lines by the UN by means of the Aichi targets for 2011-2020.

We should recall that for many years Barcelona has been actively committed to sustainability through its Agenda 21. Accordingly, this plan is another component of the overall endeavours the city is making in all areas, ranging from air quality to the protection of specific zones such as the Parc de Collserola, whilst likewise covering aspects directly linked to quality of life such as noise control and pet ownership. Barcelona City Council and the Metropolitan Area implement specific policies to enable nature to fit into the city and to enhance biological diversity based on the philosophy that a city with greater green infrastructure is a city where people can benefit from higher levels of health and wellbeing.

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1. INTRODUCTION

1.1 Why a Green Infrastructure and Biodiversity Plan?

In major cities, biodiversity – especially that which is present in green spaces – is typically the only chance citizens have of coming into contact with nature and it fulfils vital environmental and social functions which help to improve quality of life and wellbeing. Barcelona Green infrastructure and Biodiversity Plan of Barcelona is envisioned as a **strategic instrument** which sets out the challenges, goals and commitments of the local government when it comes to **preserving green infrastructure and biological diversity** and defining how **people** can discover their natural heritage and benefit from it whilst taking great care of it.

We deem **biodiversity** to be the variety of life found on Earth which forms part of our global natural heritage. Biodiversity existing in the city constitutes a living green structure serving as a habitat for fauna and forming a **green network** which acts as an element of the urban system comprising buildings and all developed areas.

A concept similar to the green network is that of **green infrastructure**: a network of spaces with public or private agricultural or landscaped natural vegetation, a multi-purpose resource providing ecological, environmental, social and economic services. These services are enhanced further when **connectivity** of green infrastructure is achieved. Ecological connectivity refers to the quality of the natural environment and partly-transformed areas which enable the ecological processes and flows that characterise them (water, material, genes, etc.) to continue, in addition to allowing the movement and dispersion of organisms.

Urban greenery comprises all the green areas within the urban fabric which have come to form part of said fabric on account of a projected transformation of the space, and in turn this greenery (largely consisting of parks and gardens), along with the natural and agricultural areas, forms the green infrastructure described above which houses a wealth of native and exotic **species** and which operates in a single, complex ecological system. Urban greenery is both plant biodiversity and a living habitat for animal biodiversity.

The presence of flora and fauna in the city provides many benefits to its inhabitants. Nonetheless, such heritage is subject to a host of factors and **impacts** making its survival by no means easy. The physical and environmental quality conditions of a city are not always the most suitable, especially when it comes to the availability of water and space, or air and ground quality, for instance. Similarly, urban pressures affect natural heritage: the city's development, demand for leisure and traffic are all activities which have an effect on biodiversity.

The **natural heritage of a city** – comprising areas with vegetation in a specific physical environment which form a habitat for many varieties of urban fauna – must be **preserved**. In this respect, preservation shall refer to human use of the biosphere in order to reap maximum sustainable benefit whilst maintaining the potential needed for future generations. This includes concepts such as conservation, maintenance, sustainable use, restoration and improvement of the setting.

Indeed, **Barcelona Green Infrastructure and Biodiversity Plan** sets out a long-term plan of actions in order to achieve **green infrastructure** that can offer the following advantages:

- Creating benefits for people.
- Providing environmental and social services.
- Creating havens of life within the urban environment.
- Introducing nature into the city.
- Connecting and reuniting the city with the territory.
- Making the city more fertile and resilient to tackle future challenges.

Accordingly, Barcelona Green Infrastructure and Biodiversity Plan is a **strategic instrument** setting out the commitment of local government in **preserving green infrastructure and biodiversity**, and in encouraging **people** to become familiar with natural heritage and to benefit from it whilst taking care of it. The aim, therefore, is to achieve green infrastructure to act as a resource providing a wealth of services in a **city where nature and the urbanity converge and enhance one another**.



Tres Turons

Poster 1.
The geography of Barcelona plain

The city stretches across Barcelona plain, as it is called, and the surrounding area. It is host to a huge variety of natural spaces within a zone that does not even cover 100 km². The particularly favourable geographical location allows for a variety of natural phenomena to converge: two river mouths with a river delta each; the coastline, with sandy beaches and Montjuïc hill; the reliefs of the plain; and Collserola, a mountain range with an

ancient landscape of highly modified forests. This landscape is currently formed by a mosaic of natural environments: crops, dry lands, scrubs, maquis shrubland, pine forests, holm-oak woods, oak woods, shore vegetation, and of course the plain with its ancient creeks and marshes, the natural rural element of which is now very rare because it is the most heavily occupied area within the city.



Barcelona 1808. Source: Arxiu Nacional de Catalunya

Poster 2.
Green infrastructure within the urban fabric

Green infrastructure is present within the entire urban fabric although it often forms isolated spots and bears no continuity. This plan seeks to enhance its

ecological, environmental, social and economic services by connecting the various areas with vegetation to produce firm, effective ecological infrastructure.

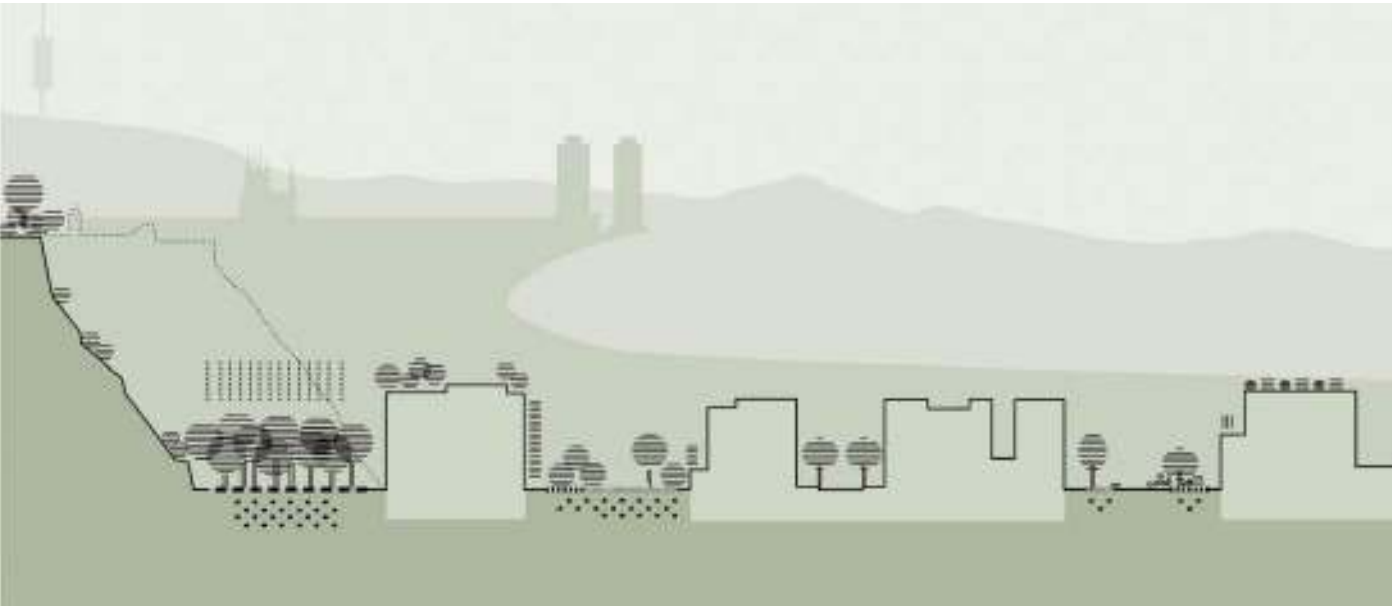


Source: Google Maps

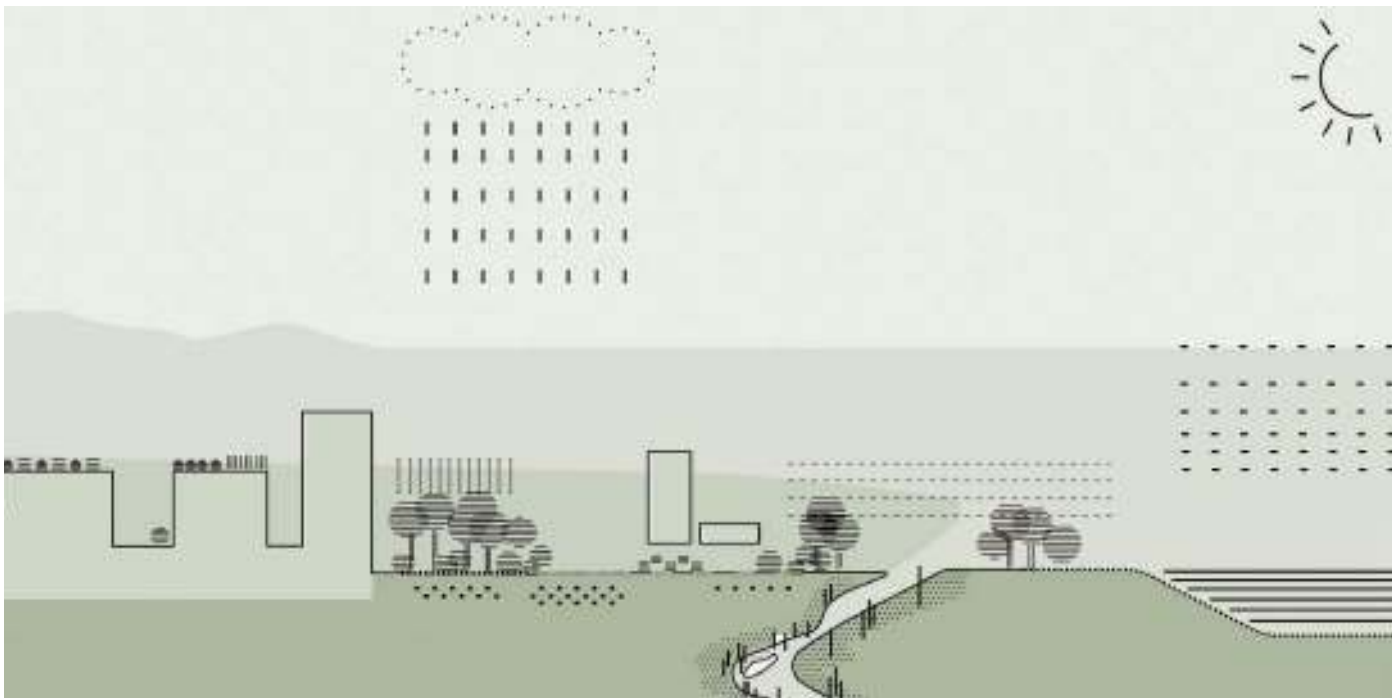
Poster 3.
Types of spaces that make up the city's
green network

A range of natural and landscaped, large and small, public and private, simple and complex spaces come together to form the city's green network: natural open

spaces, river areas, forests, parks, gardens, squares, vegetable gardens, tree-lined streets, street greenery, ponds, roofs and walls.



open natural spaces forest green roofs green walls gardens trees-lined streets squares landscaped streets



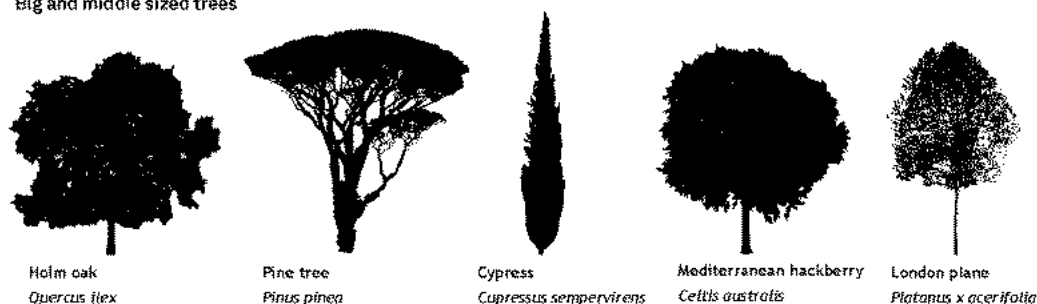
vegetable gardens parks river areas coast

Poster 4. Common or noteworthy plant and animal species in Barcelona city

Barcelona city benefits from remarkable biodiversity: the native and exotic flora and fauna are well represented and cer-

tain species are protected or of special interest.

Big and middle sized trees

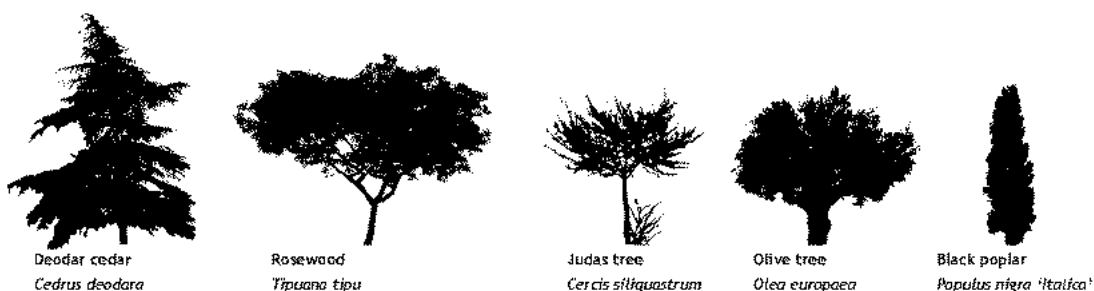


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Hàbitat Urbà

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2020

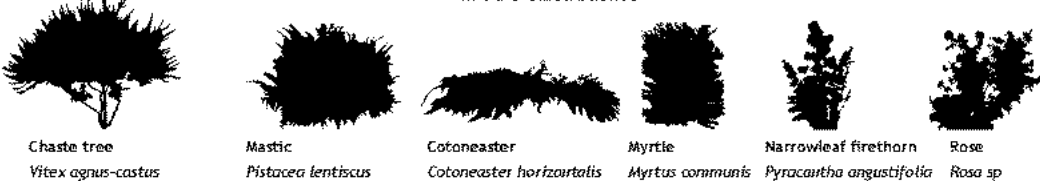


Small-sized trees

Big-sized bushes

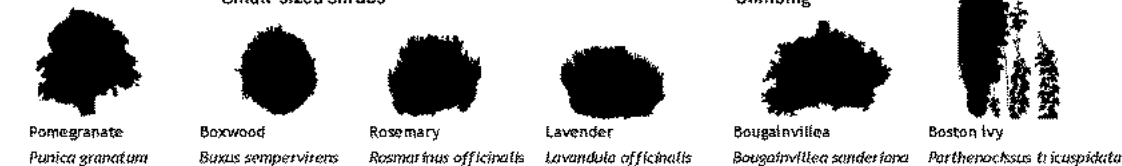


Middle-sized bushes



Small-sized shrubs

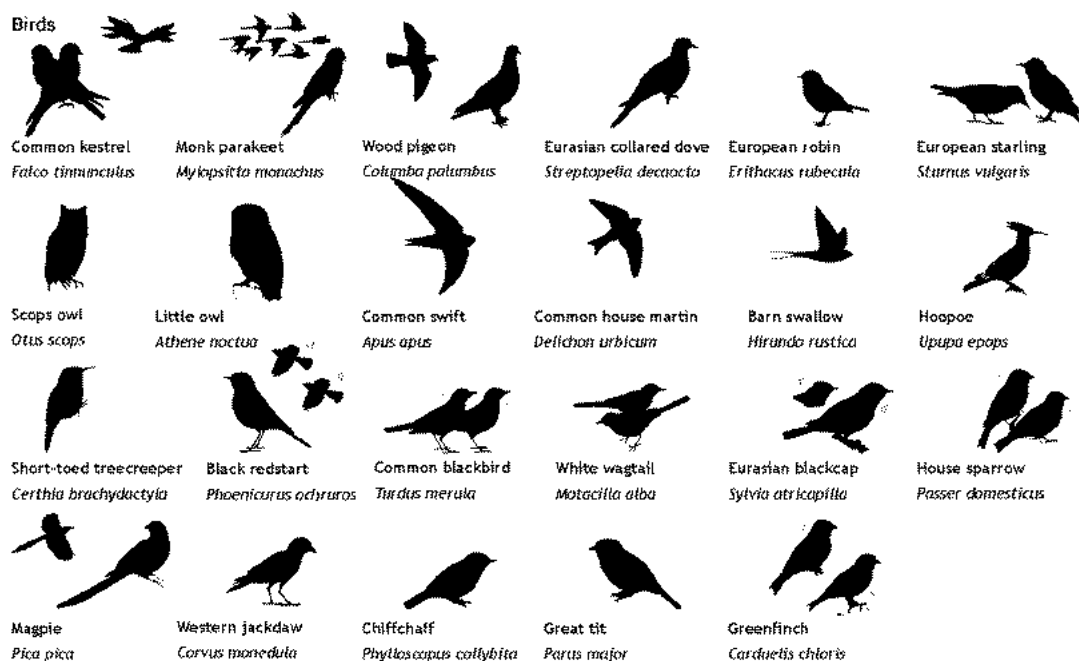
Climbing



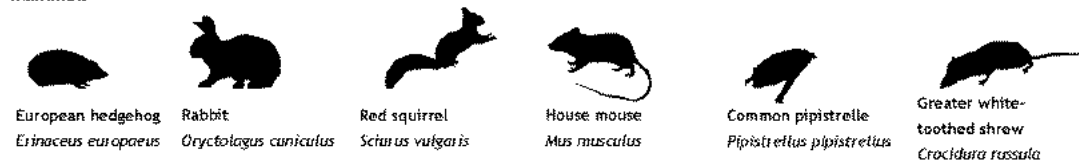
Perennial and carpeting plants



Birds



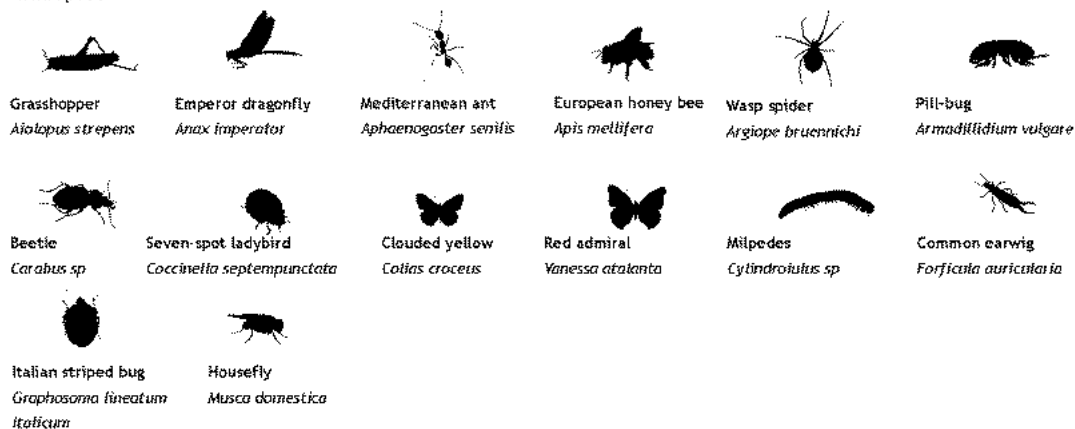
Mammals



Amphibian and reptiles



Arthropods



1.2

What do green infrastructure and biodiversity provide?

Ecological infrastructure constitutes a life support system and it has a major role to play: enabling a city to function in conjunction with other infrastructure. It is formed by public and private multi-purpose, natural and landscaped areas that provide benefits in ecological, environmental, social and economic terms. **Connectivity**, i.e., continuity of green areas, enhances this contribution, as it encourages the mobility of the organisms found in these settings in order to ensure that the ecological processes and flows, characteristic of these spaces with regard to water, material, fauna, etc., are not disrupted. Poster no. 5 “Metabolism of the urban fabric in terms of infrastructure and biodiversity” shows the aspects of the city’s metabolism that are most closely associated with green infrastructure and biodiversity: the water cycle, flows of food, waste and energy, and air.

Urban green areas provide ecological benefits that are vital to a city, such as nature, biodiversity, complexity and connectivity, as well as sociocultural advantages such as health, wellbeing, beauty, landscape, culture and encouragement of socialisation.

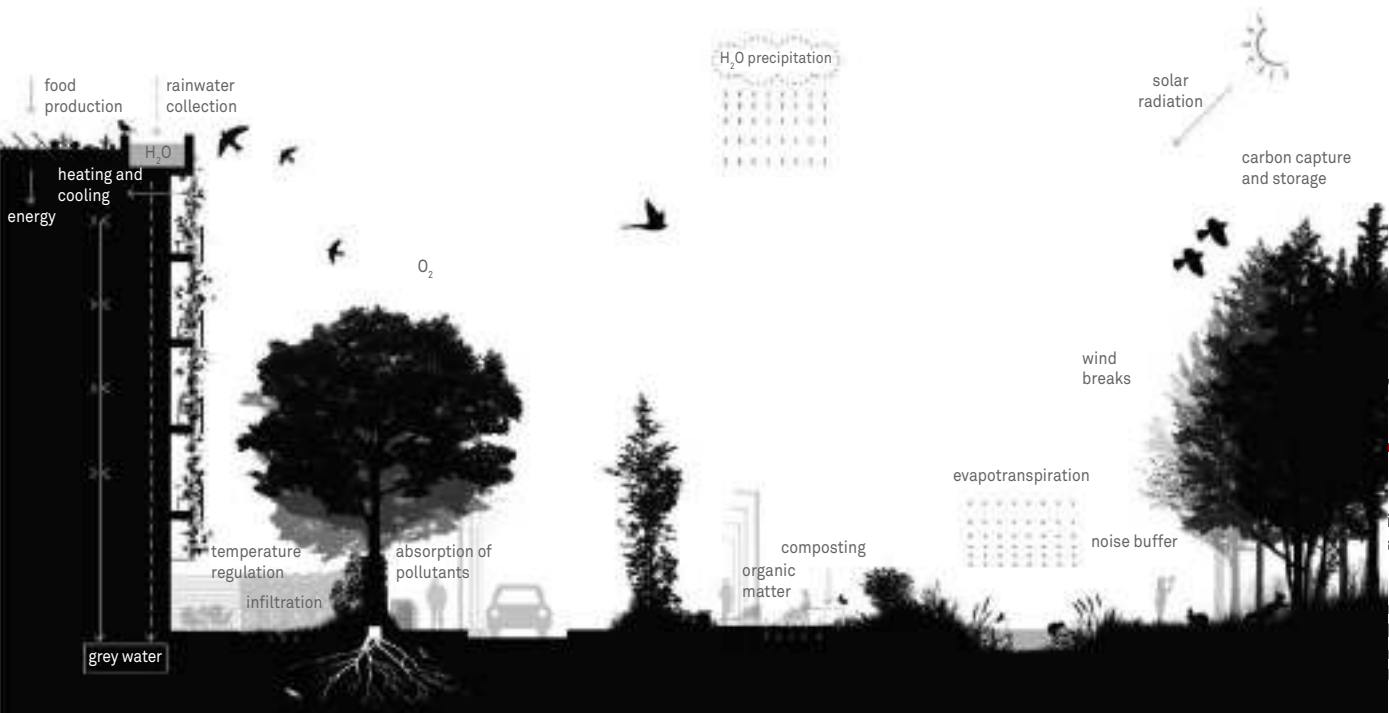
In relation to Barcelona specifically, a variety of types of areas have been classified which best represent the city’s green infrastructure: natural open space, river area, coastline, forest, park, garden, square, vegetable garden, tree-lined street, landscaped street, ponds and lake, green roof and green wall. In order to assess the benefits afforded by these spaces, a number of their features have been taken into consideration: **habitat quality, biological quality, environmental quality, sensory quality, carrying capacity and cultural interest**. Moreover, each feature has been broken down into a range of parameters to make it possible to assess each feature in quantitative terms. Poster 6 shows a table setting out the characteristics and values of green infrastructure and the features, functions and types of areas that have

been assessed. The functions fulfilled by these areas can be enhanced with careful space planning, design and management.

However, objectively determining how a specific category of green infrastructure behaves in environmental or social terms is no easy task. By attempting to assess the benefits provided we can shed light on the significance of the various features of these areas, making it easier to improve their design and to make decisions concerning planning. In this respect, each area has been assessed on an individual basis and the results have been compiled in a bar chart. By gauging these contributions we can help to design and balance out a living, active green system. The habitat and environmental quality of an urban forest is not the same as that of a park or garden, just as the carrying capacity and cultural interest also varies, for instance.

Posters 7 to 19 show the assessment made of each of the green areas. A bar chart indicates the assignment of values which is a general approach in the case of Barcelona, applied using an expert criterion, though studies to provide a precise objectification and comparison are lacking. Indeed, such studies are feasible in the case of ecological and environmental components, though complex when it comes to social and cultural components. For instance, it is simple to quantify the size of an area, the wealth of species and the acoustic comfort of a place, but assessing visual quality, scope for socialisation or artistic interest is somewhat more complex. As a result, the value of assessing such features is merely indicative and provides comparison among categories. Lastly, next to each figure there is a photograph representing the area indicating aspects attaining a value of more than five in the assessment. Thus, a more simple, direct reading is given for the specific contributions an area affords.

Poster 5.
Metabolism of the urban fabric in terms
of green infrastructure and biodiversity



Poster 6.

Functions and features of green infrastructure and biodiversity

Summary of the main contributions of green infrastructure and biodiversity with a list of the types of areas providing these services in Barcelona

Values >>	Features >>		Functions >>	Types of spaces >>
Environmental nature diversity complexity connectivity	Habitat quality	Surface Soil quality Topographic diversity Permeability Presence of water	Ensures the presence of nature in the city Preserves nature Preserves soil Produces organic matter and food Reduces air pollution Sequesters and stores carbon	Open natural space River area Coast Forest Park Garden
	Biological quality	Species richness Wealth of habitats Autochthonous/allochthonous index Density Stratification Health of flora and fauna Representation Uniqueness	Reduces noise pollution Regulates the water cycle Provides moisture Moderates temperatures Saves on heating/cooling costs Creates landscaping Improves livability in the city Opens up pockets of space and contributes to pacifying the city Contributes to physical and mental wellbeing Creates environments for life and sensory enjoyment Creates environments for social interaction Provides spaces for leisure, recreation and physical activity Provides opportunities for cultural, educational and research activities Generates tourist appeal Promotes contact and interaction with nature Generates added value Generates business opportunities	Vegetable garden Pond Square Tree-lined street Landscaped street Green roof Green wall and/or vertical garden
Sociocultural health beauty culture welfare relationships landscape	Environmental quality	Acoustic comfort Climate comfort Air quality		
	Sensory quality	Olfactory quality Acoustic quality Colour quality Visual quality Seasonal and temporal variability		
	Reception capacity	Proximity Accessibility Calm traffic Miscellaneous uses Socialisation opportunities		
	Cultural interest	Identity Historical interest Artistic interest Educational interest		

The diagrams below provide a quantitative overview of the features in each type of space, illustrating how the various spaces contribute in differing ways.

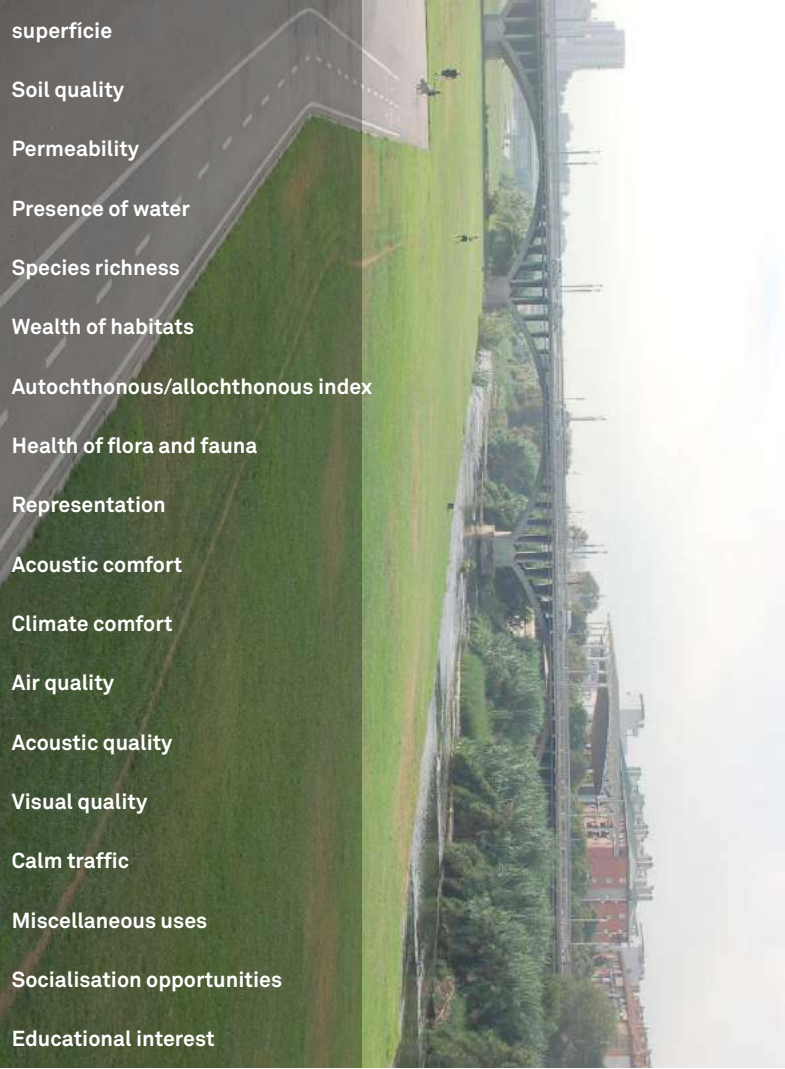
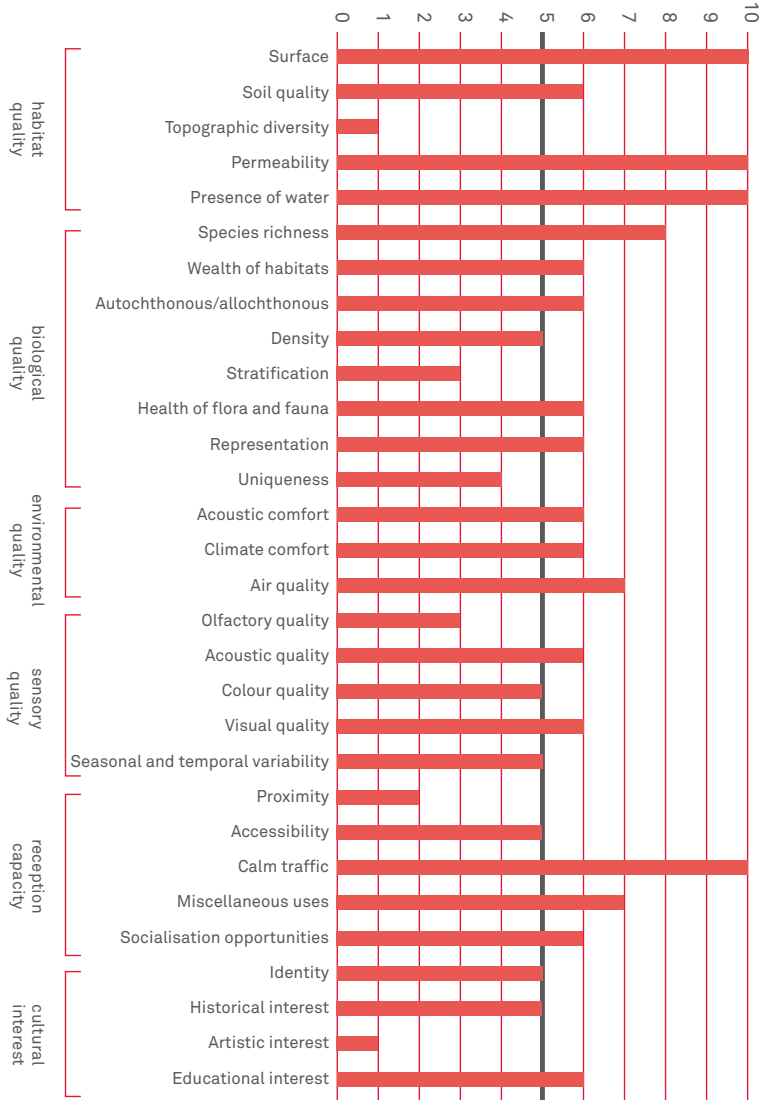
The accompanying photographs show aspects that stand out as they have been given a rating of more than five.

Poster 7.
Assessment of features and foremost contributions. Natural open space



Cliffs of Montjuïc

Poster 8. Assessment of features and foremost contributions. River area



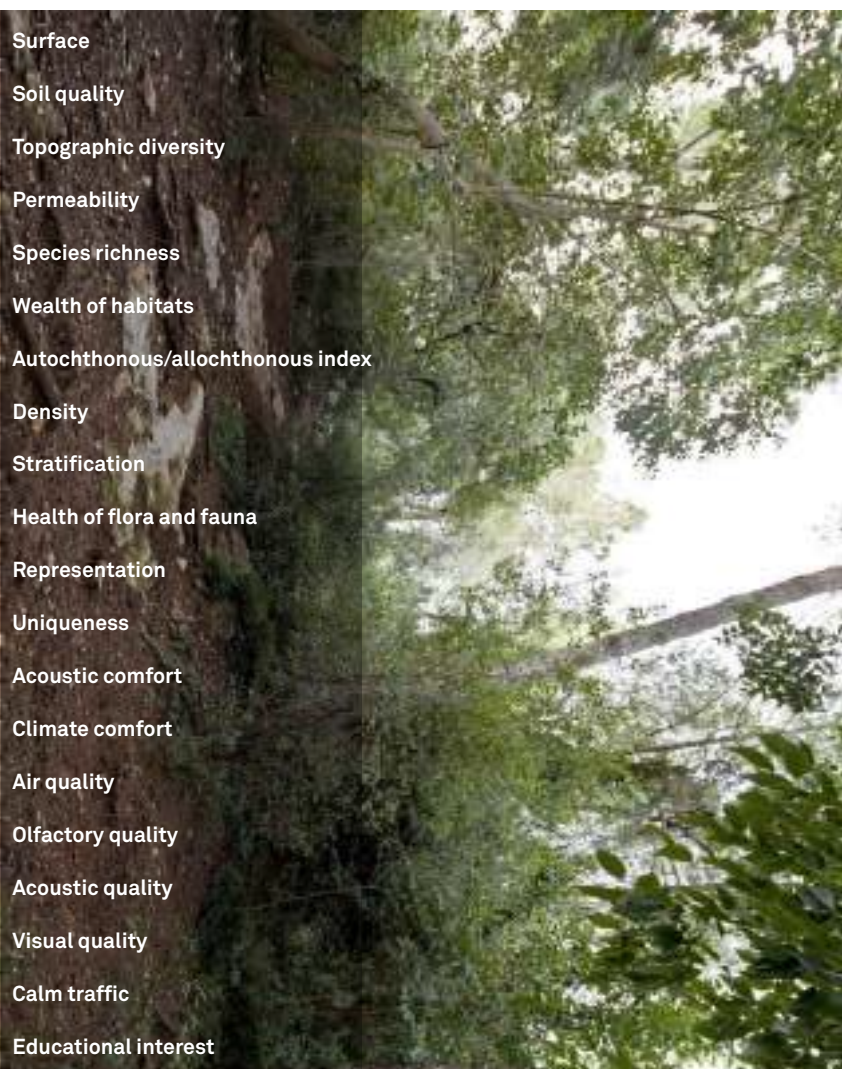
Parc Fluvial del Besòs

Poster 9.
Assessment of features and foremost
contributions. Coastline



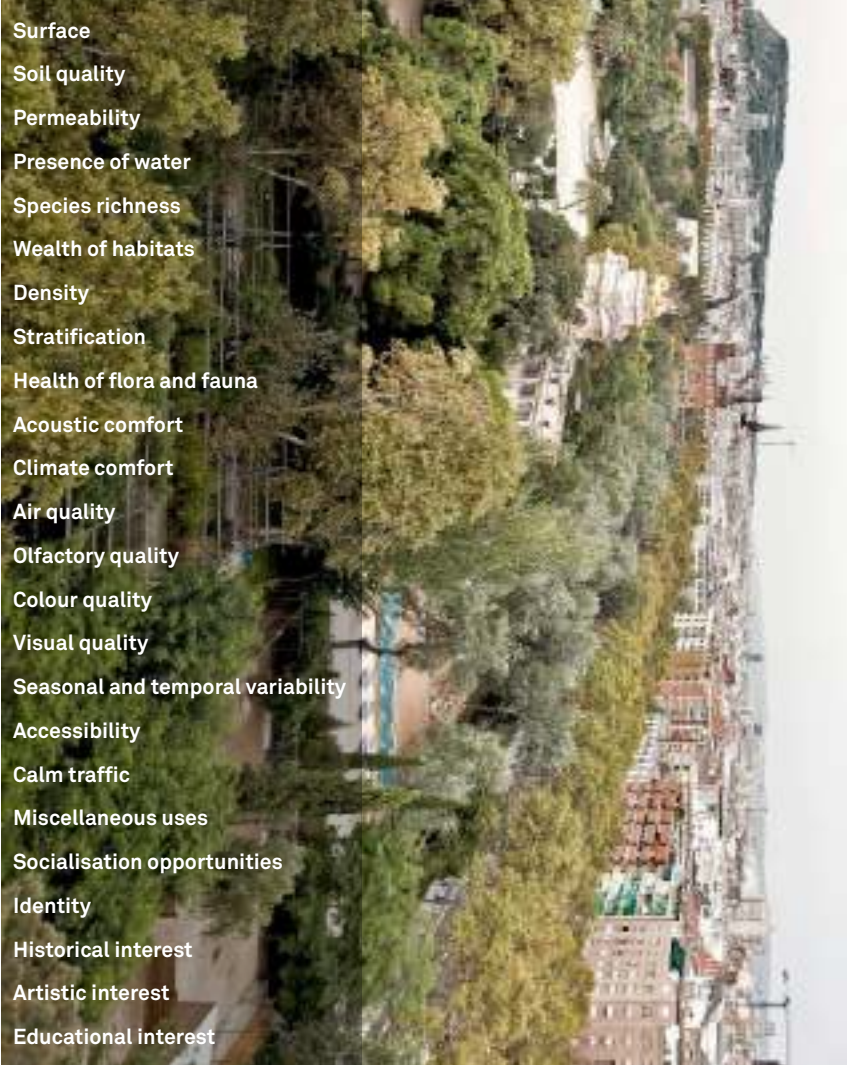
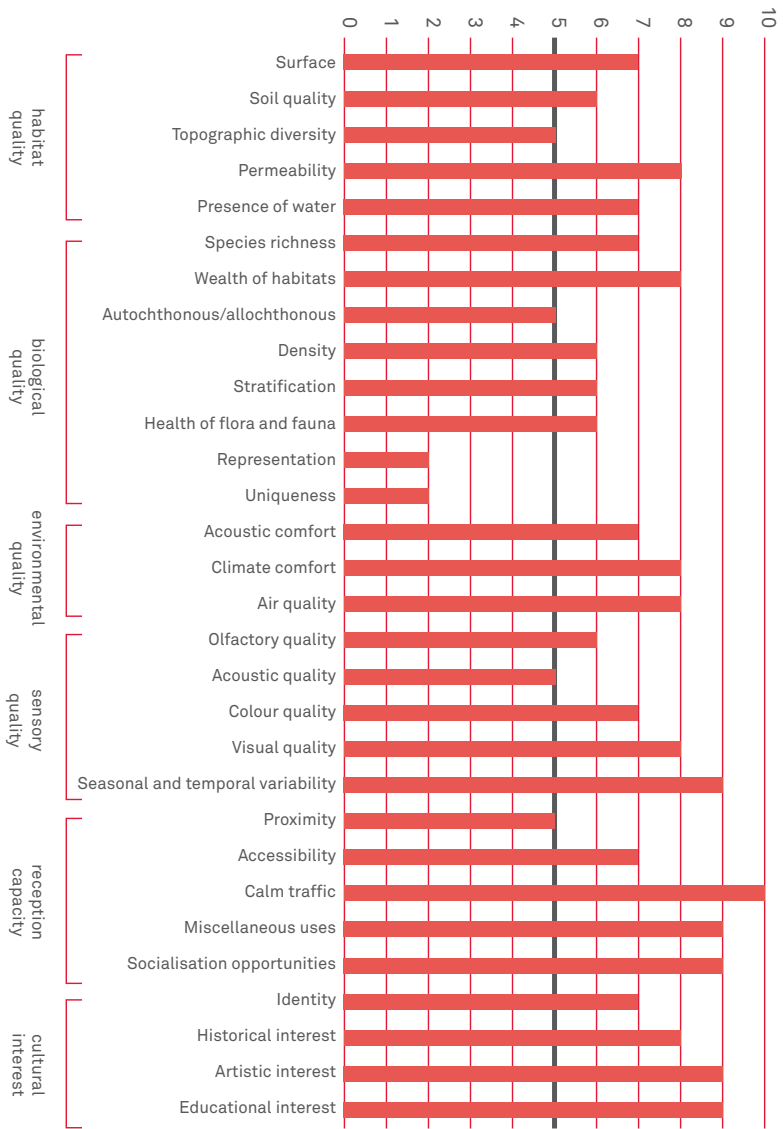
Mar Bella beach

Poster 10.
Assessment of features and foremost
contributions. Forest



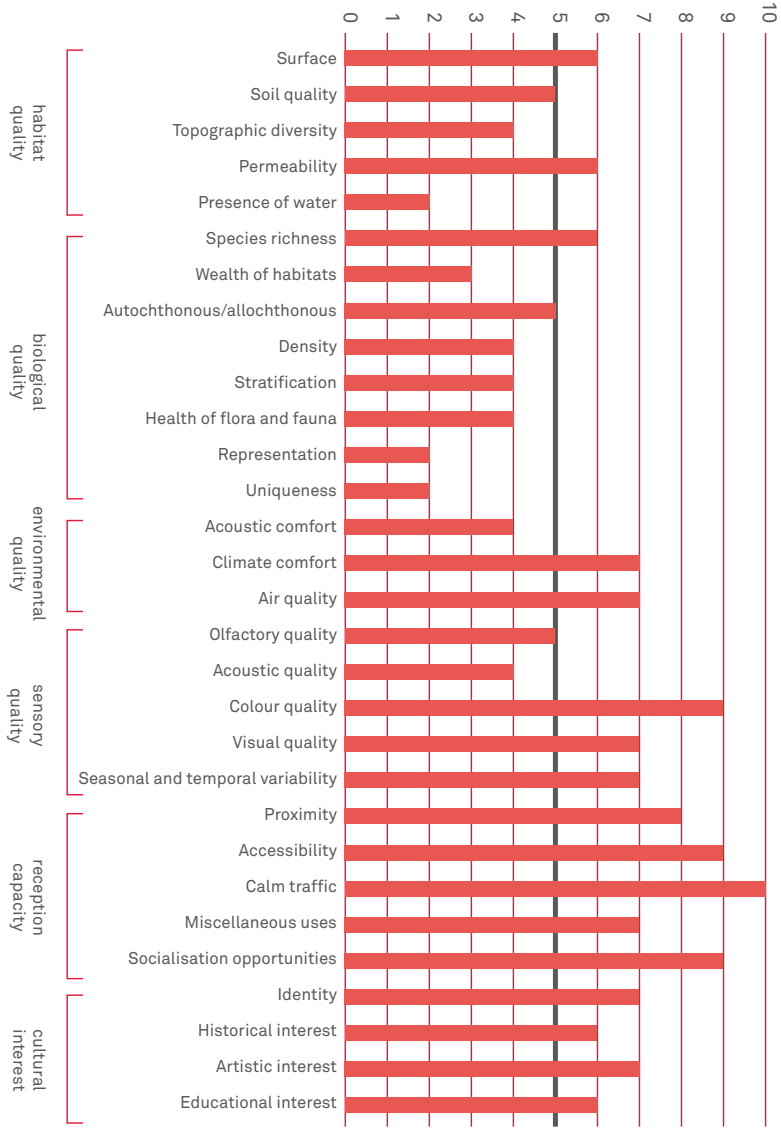
Park Güell

Poster 11.
Assessment of features and foremost
contributions. Park



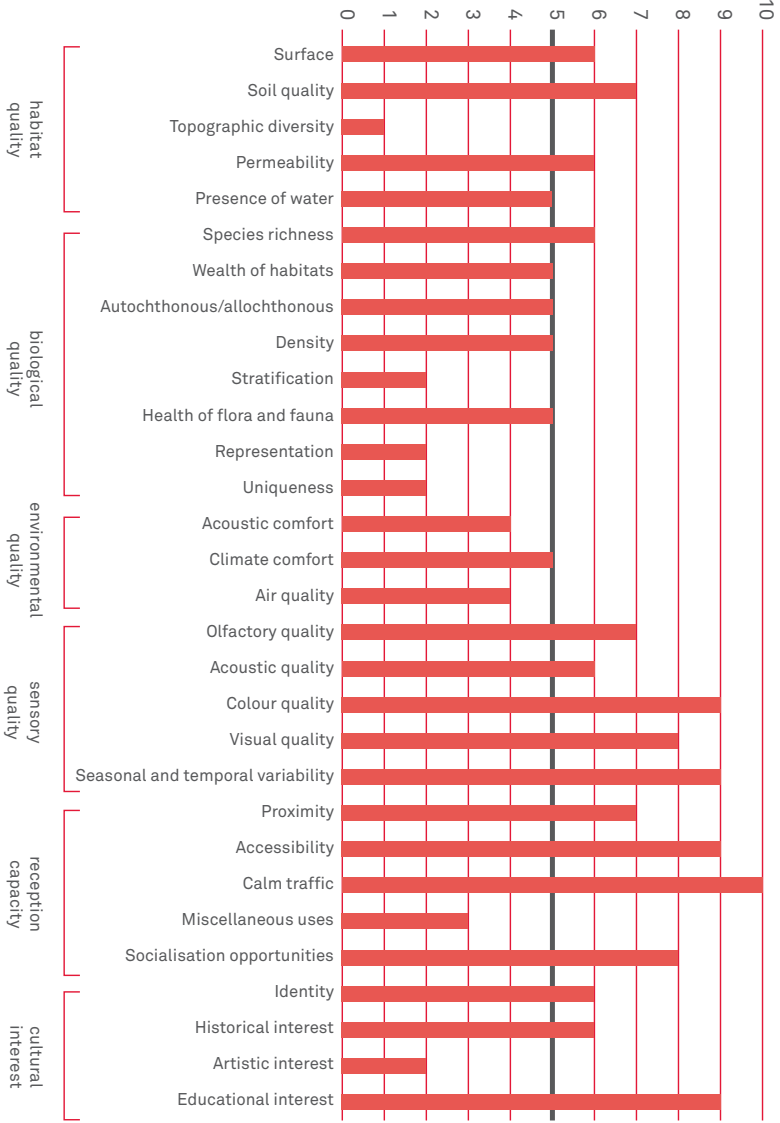
Parc de la Ciutadella

Poster 12. Assessment of features and foremost contributions. Garden



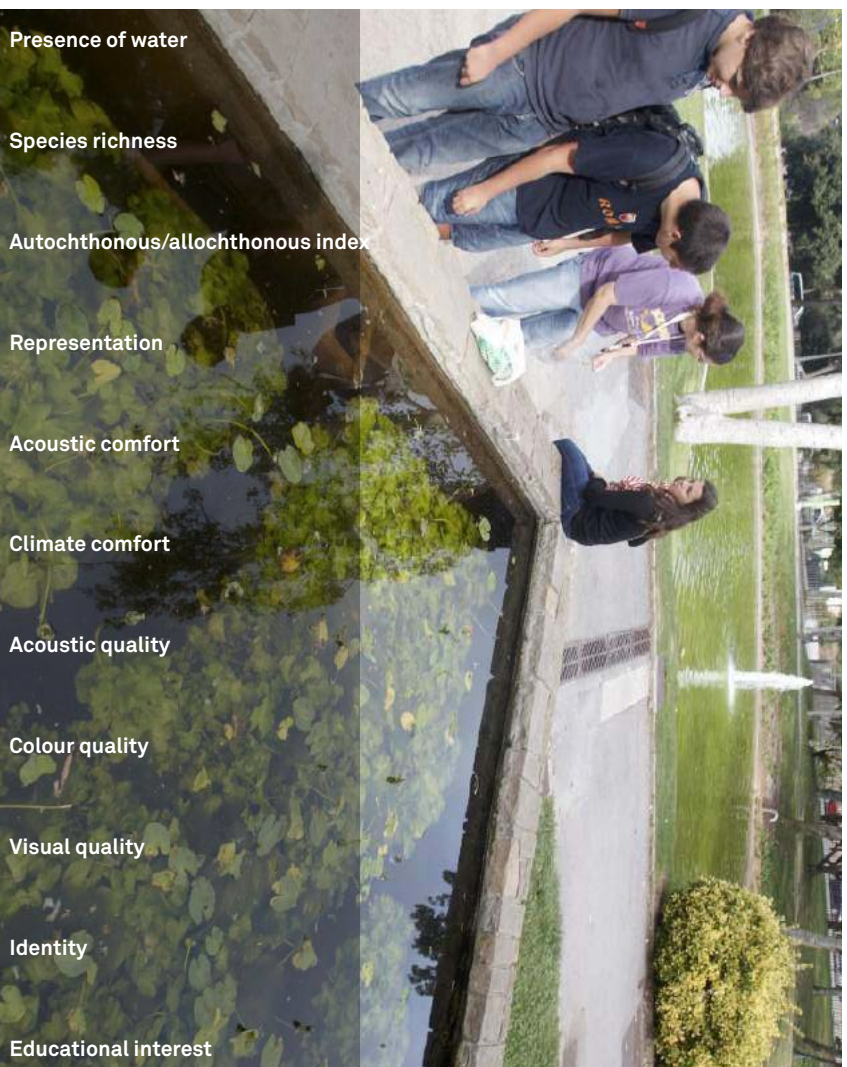
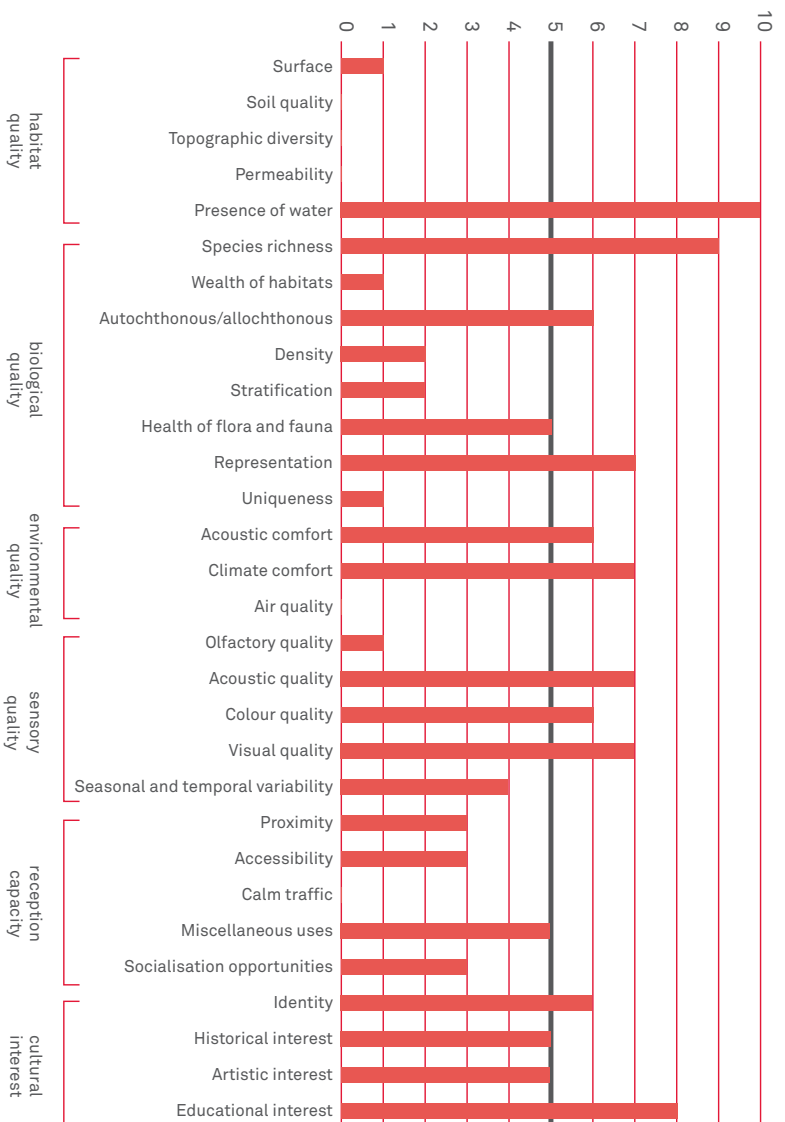
Jardins de Vil·la Amèlia

Poster 13.
Assessment of features and foremost
contributions. Vegetable garden



Hort de Can Mestres

Poster 14.
Assessment of features and foremost
contributions. Pond

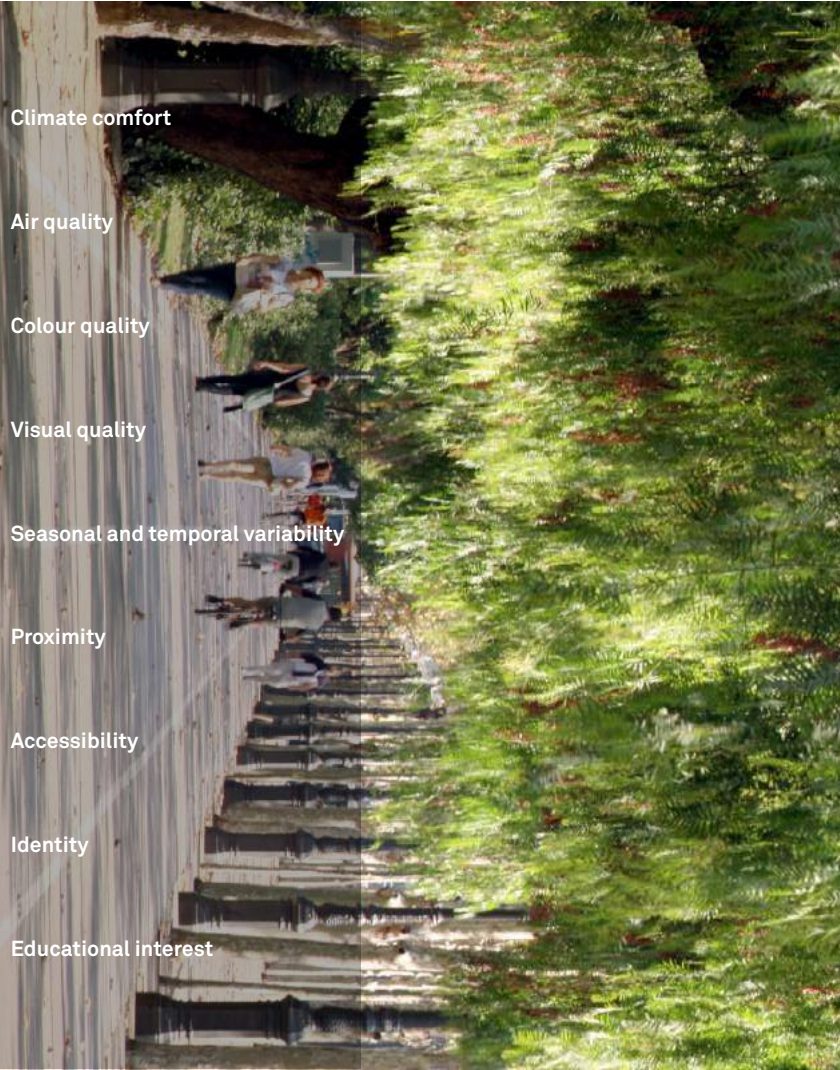
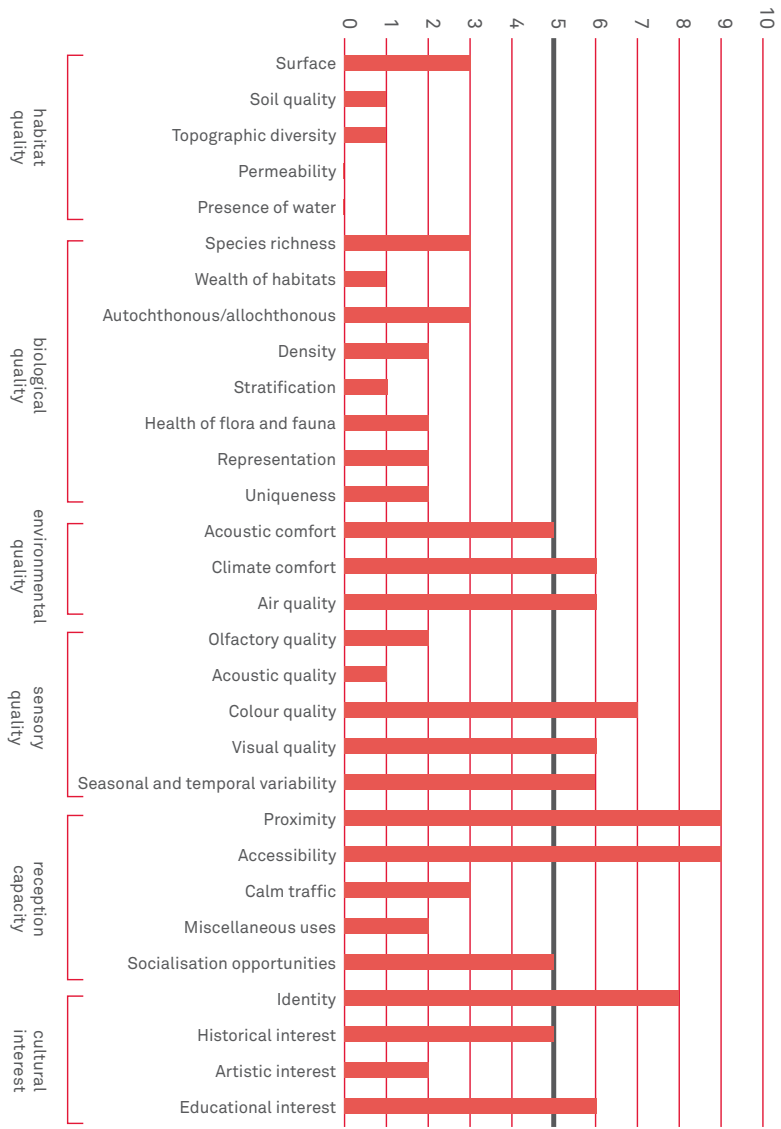


Poster 15.
Assessment of features and foremost
contributions. Square

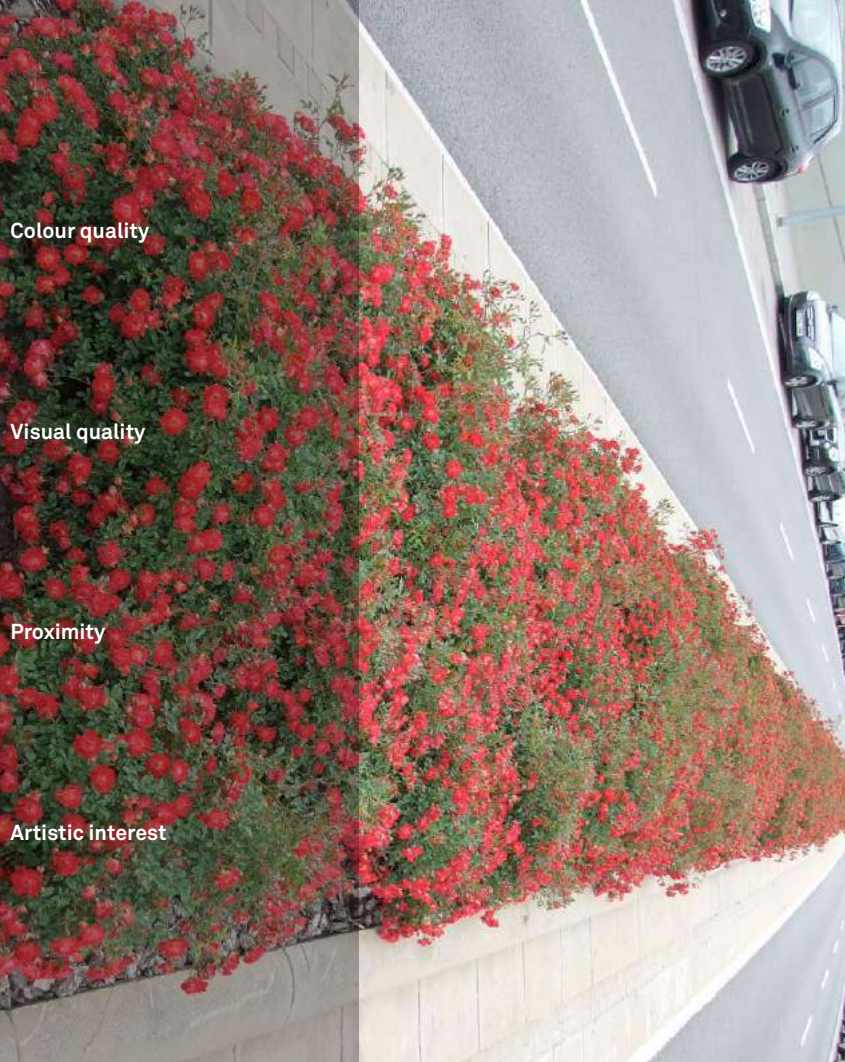


Plaça doctor Ignasi Barraquer

Poster 16.
Assessment of features and foremost
contributions. Tree-lined street



Poster 17.
Assessment of features and foremost
contributions. Landscaped street



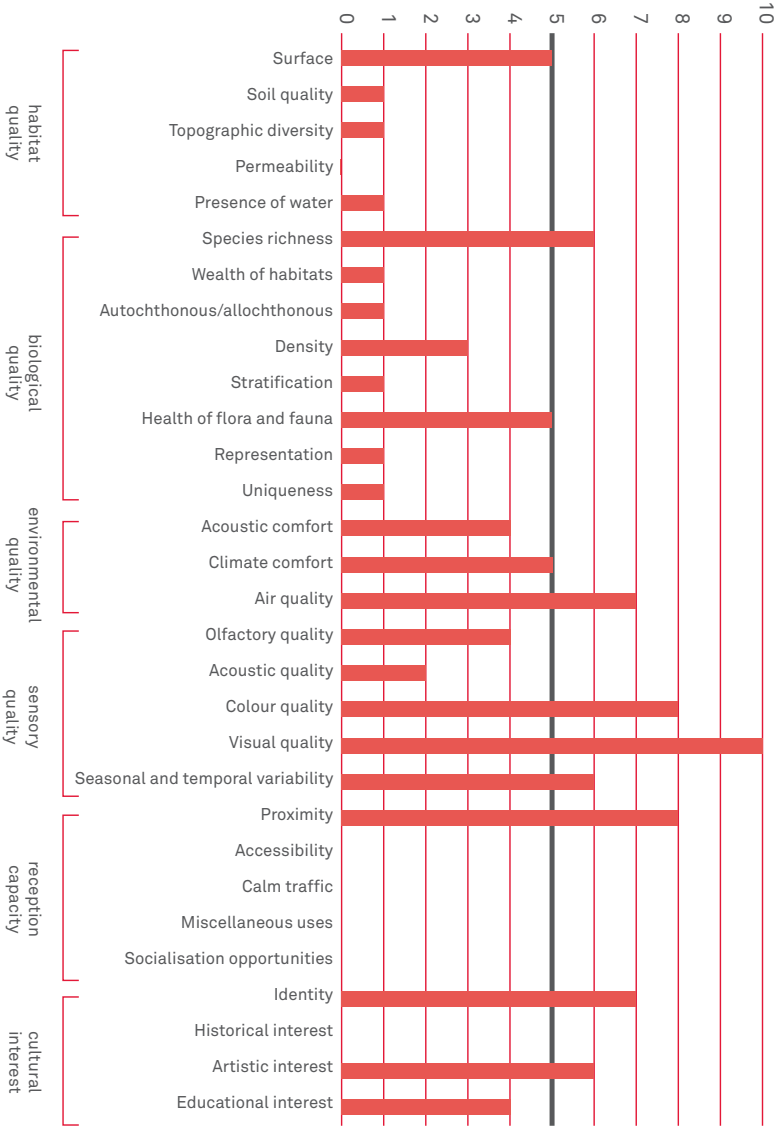
Ronda General Vives

Poster 18.
Assessment of features and foremost
contributions. Green roof



Bibloteca Zona Nord

Poster 19.
Assessment of features and foremost
contributions. Green wall and/or
vertical garden



Jardi Tarradellas

2. DIAGNOSIS OF GREEN INFRASTRUCTURE AND BIODIVERSITY

2.1 Presentation of diagnosis

This section describes the situation concerning green infrastructure and biodiversity in Barcelona. The diagnoses made have been prepared through parallel processes using the same methodology, which consists of the following:

- Compiling information.
- Detecting shortcomings in knowledge and processes.
- Developing supplementary internal reports and studies.
- Investigating the experiences of other cities.
- Extracting the most significant data.

One major aspect in the preparation of Barcelona Green Infrastructure and Biodiversity Plan has been the organisation of participatory processes carried out during several meetings which helped to share the diagnosis made, to agree on the long-term challenges and goals and to gather proposals on biodiversity and green infrastructure in order to draw up the plan of action.

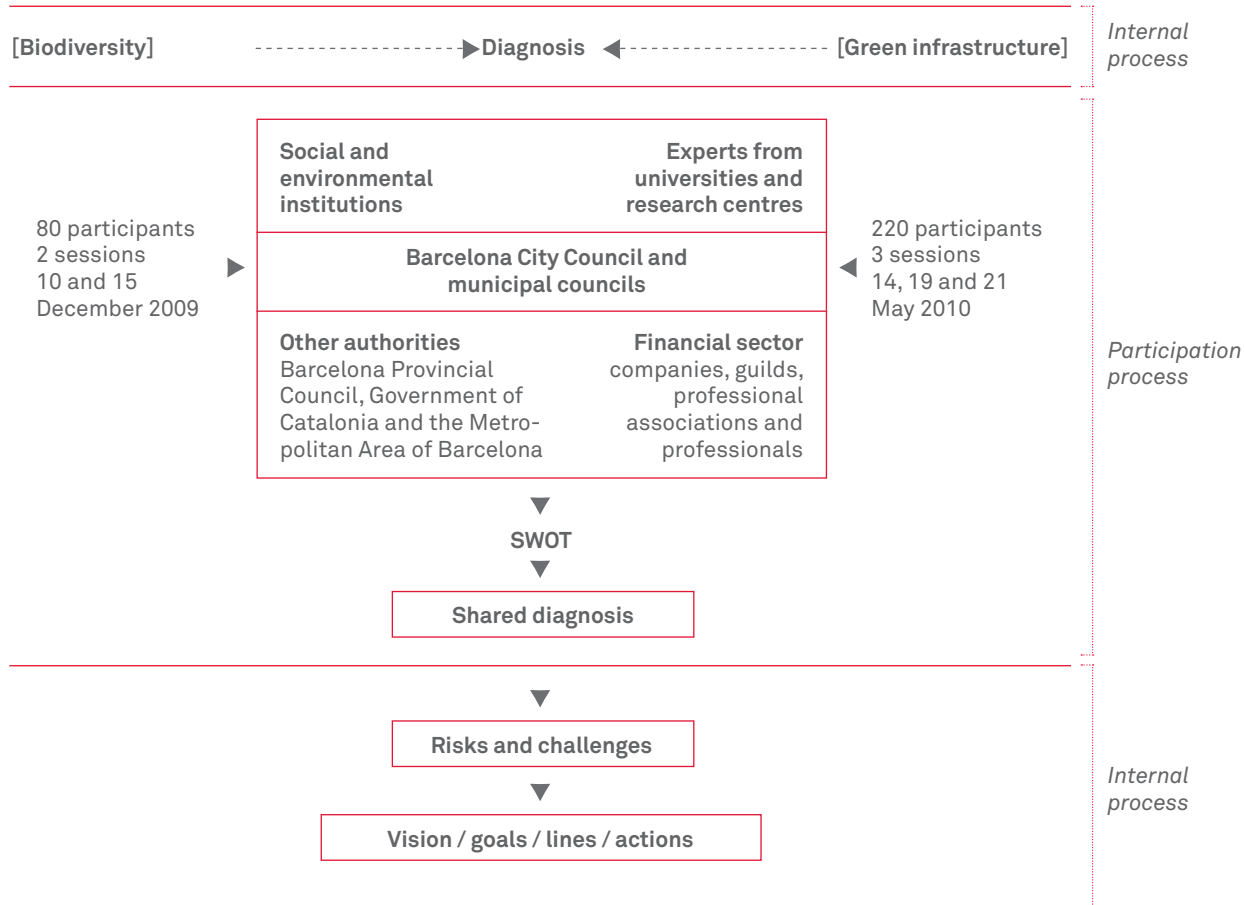
The conclusions of the diagnosis are summed up in two blocks: one on the work carried out to date and on the situation regarding biodiversity; the other on green infrastructure according to the various spheres covered.

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Barcelona Green Infrastructure and Biodiversity Plan 2020



The green network of Barcelona



2.2

Diagnosis of biodiversity (2010)

2.2.1 Work carried out to date

Strengths

Biodiversity has been incorporated into the **local political commitments** and human and financial resources have been allocated to it. Moreover, work is carried out in a coordinated manner ensuring goals are aligned with other similar municipal local projects and plans, other institutions and other bodies affording knowledge, energy and action with a view to bringing about change. Similarly, Barcelona has taken on commitments in the IUCN Countdown 2010, the first international cities and biodiversity project – Local Action Biodiversity (LAB), ICLEI-Local Governments for Sustainability – and the Spanish Network of Local Governments + Biodiversity 2010. The recently enacted environment bylaw incorporated the concept of *biodiversity* for the very first time.

It is worth highlighting improvements made in **the preservation of territory**. Indeed, progress has been made in **metropolitan urban planning** in taking care of open spaces (Territorial Plan for the Metropolitan Region of Barcelona), and in the protection and management of Parc de Collserola – currently part of the Natura 2000 network – which is included in the Plan for Areas of Natural Interest and has been declared a nature park. Preservation criteria and measures have also been incorporated into current urban planning projects and endeavours are made to establish conditions to avoid the impact of works and population on fauna.

The improvement of green infrastructure in the city and the creation and restoration of habitats have involved the creation of urban vegetable gardens and underwater reefs, the improvement of marine and river abutting systems, city greenery planning works and the commitment to increase the extent of

green infrastructure (new gardens, city block inner courtyards) and its sustainable management. Efforts are also being made in order to envision the future of the city with green walls, roofs and corridors and in preparation to adapt the green infrastructure of the city to climate change.

Management for the preservation of species and habitats has also taken on a broader horizon in recent years with noteworthy, positive results in cases such as protected, listed trees, amphibians, birds, hedgehogs, and non-captive birds in Barcelona zoo, or in a case such as the falcon, whose reintroduction programme has reached a successful conclusion. A wealth of experience has been gained on how to preserve birds in walls and amphibians in ponds, with progress having been made in managing excessive animal populations (cats, wild boars, pigeons, tortoises, etc.). When it comes to international commitments, since 2004 Barcelona has implemented an ethical wood purchase policy.

In the sphere of **knowledge**, significant progress has been achieved in recent years in describing the values of spaces of natural interest and habitats, of ecological areas in Barcelona and of the environmental services in those areas; progress has also been made in knowledge concerning the history of the city's nature, and in relation to the trees and shrubs in parks, gardens and streets, allergenic flora, invasive flora and fauna, and vertebrate fauna. The biodiversity of Collserola and its development are widely known.

The **social commitment** has been reflected through improvements in the social and educational potential of green infrastructure and by promoting responsible ownership of animals. As regards dissemination, education and participation, it is significant to note that a majority of the 283 schools taking part in the Agen-

da 21 for Schools (as at 2010-2011) work on projects linked to nature (vegetable gardens, gardens, fauna, etc.). Moreover, facilities for dissemination and research on the values of biodiversity in the city (museums, Barcelona zoo, the Botanic Garden, etc.) should be highlighted along with their renovation projects and the range of activities and publications they offer. The Fàbrica del Sol (CRBS), the journal *BVerda* and Aula d'Ecologia are initiatives that have been responsible for major dissemination in recent years.

Scope for improvement

There has been very little progress in **protecting** areas aside from Collserola, despite the advances made in protecting the cliffs of Montjuïc and the surrounding area (initial approval has been given). Although this constitutes a major milestone in achieving the goal of the commitment ("protecting all open spaces"), more needs to be done. Difficulties have also been encountered in **preparing a design to foster biodiversity and develop green infrastructure** in public and private constructed areas, to launch the network of green corridors and to offset the scant introduction of pervious surfaces. The reporting and pursuance of **illegal animal trading** is also an outstanding issue, as is the achievement of more proactive management of invasive species.

With regard to knowledge, further information is required on native urban flora, on invertebrates and on the situation in terms of biodiversity (loss of flora, fauna and habitats), along with information on the likely development of the structure of biodiversity in the city in relation to climate change. Information on biodiversity needs to be more systematically organised (database) and there is similarly a need for a monitoring system to be set up (indicators).

Furthermore, it is necessary to gain an awareness of the **impact of the city** on

the Earth's biodiversity (exotic species, use of resources, ecological footprint). Nonetheless, it would not be daring to state that Barcelona's ecological footprint must have increased in recent years in parallel to that of Catalonia as a whole. This is significant because a large part of the city's impact on biodiversity as a whole is seen beyond the municipal district: in Catalonia, in Spain and the world over.

When it comes to **preserving natural heritage** certain areas of outstanding natural interest found within the city are subject to notable urban pressure (e.g. the Rec Comtal irrigation channel), and a number of habitats and species have been lost. Indeed, the lives of species closely linked to buildings has been hindered owing to construction work even though endeavours are being made to preserve them.

Despite the progress made on a local level as regards the **consideration given to biodiversity and its benefits**, there is still a long road ahead. It is no trivial matter that not enough acknowledgment is given to the role nature plays as green infrastructure providing environmental services that are essential to the city. Similarly, the benefits afforded to humankind as a result of contact with nature and the extent to which humans depend on it are also not socially recognised. Society's knowledge of nature is lacking as is its involvement in preserving natural heritage and there is a great deal to be done when it comes to promoting urban biodiversity and providing a series of means for people to become involved in and reap the benefits of preservation locally and worldwide. In order to make progress, an **organisation is needed to focus efforts** on the challenges we face because the benefits to be obtained from addressing these challenges and engaging in projects on a major scale are patent, as indeed can be exemplified by Barcelona and other cities analysed.

The Agenda 21 has laid the foundations for the efforts undertaken by Barcelona City Council in terms of biodiversity in recent years. Goal number 1 (“Protecting open spaces and biodiversity and expanding green infrastructure in the city”) set out in the Citizen Commitment to Sustainability (2002), and the 10 lines of action stemming from it, have served as a guide for making progress.

The Commitment dates from 2002 and the horizon envisaged was 2012. Work on the lines of action involves many agents and although progress has been made on the whole, the aims envisaged have not fully been accomplished. On the one hand, the goals were ambitious, and on the other hand, work is also being undertaken in other areas not originally envisaged (international commitments and exchanges, invasive fauna, adaptation to climate change, and so on).

2.2.2 The situation in terms of biodiversity

Barcelona houses **remarkable natural heritage** thanks to the size of the Serra de Collserola mountain range, which rises over the city (encompassing more than 8000 ha) providing a mosaic of habitats which generate a wealth of species. The EU Habitats Directive, approved in 1992, designates three such habitats (holm-oak forests, pine forests and dry grasslands) as places to be preserved. The ecological map of Barcelona (analysing its development since 1977) leads to the conclusion that there has been an increase in the city’s green areas and forests with few crops being observed at present.

Rivers and the sea complement Barcelona’s natural environment, albeit highly man-made. There are notable parks and gardens in the city centre (comprising 1,076 ha), laying the foundations for the **urban green infrastructure**, with particularly important features: Montjuïc (with the cliff included in the Inventory of Areas of Geological Interest of the Government of Catalonia), Els Tres Turons and Parc de la Ciutadella. With some 153,000 units and more than 150 different species and cultivars, street trees constitute a major part of Barcelona’s urban green infrastructure. Private green infrastructure makes up some 740 ha, but its contribution to quality of life in the city has not been valued. The city is still home to 54 areas of natural interest in the centre which have been listed, although they are not protected.

Areas of natural interest in Barcelona



1. Areas linking with collserola

- 1.1 Can Caralleu
- 1.2 Ciutat Meridiana
- 1.3 Finestrelles
- 1.4 Horta
- 1.5 Montbau
- 1.6 Sant Gervasi

2. Areas with natural and semi-natural features

- 2.1 Torrent de Sant Joan (stream)
- 2.2 Torrent de Bellesguard (stream)
- 2.3 Torrent Maduixer (stream)
- 2.4 FGC railway in Sarrià
- 2.5 Cliffs in Parc de la Creueta del Coll
- 2.6 Can Móra forest
- 2.7 Turó del Carmel (hill)
- 2.8 Turó de la Rovira (hill)
- 2.9 Turó de Vallbona (hill)
- 2.10 El Morrot de Montjuïc (spur)
- 2.11 Camí de l'Esparver and other drylands in Montjuïc
- 2.12 Torrent de les Monges

3. Water areas

- 3.1 Besòs river
- 3.2 Former Llobregat riverbed
- 3.3 La Foixarda bassin
- 3.4 Diagonal Mar ponds
- 3.5 La Ciutadella pond
- 3.6 L'Espanya Industrial pond
- 3.7 Rec Comtal irrigation channel
- 3.8 Tres Pins nursery
- 3.9 Parc del Laberint

3.10 Port breakwater and artificial reefs

4. Agricultural areas

- 4.1 Torrent d'en Marcel·lí (stream)
- 4.2 Urban vegetable garden network – Hort de l'Avi
- 4.3 Urban vegetable garden network – Hort Can Mestres
- 4.4 Urban vegetable garden network – Hort Can Soler
- 4.5 Urban vegetable garden network – Hort Turull
- 4.6 Urban vegetable garden network – Hort Trinitat
- 4.7 Urban vegetable garden network – Hort Can Cadena
- 4.8 Urban vegetable garden network – Hort Sant Pau del Camp
- 4.9 Urban vegetable garden network – Hort Torre Melina
- 4.10 Urban vegetable garden network – Hort Sagrada Família
- 4.11 Urban vegetable garden network – Hort Collserola
- 4.12 Urban vegetable garden network – Hort Casa de l'Aigua
- 4.13 Urban vegetable garden network – Hort Pedralbes
- 4.14 Urban vegetable garden network – Hort Peguera

5. Areas of geological interest

- 5.1 Limestone on Turó de la Rovira
- 5.2 Slope of Sant Josep de la Muntanya
- 5.3 Geological section of El Guinardó
- 5.4 Edge of Park Güell
- 5.5 Mare de Déu del Port slope
- 5.6 Marls and sandstones of Montjuïc
- 5.7 Quarries at El Morrot de Montjuïc
- 5.8 Small slopes of Montjuïc
- 5.9 Roman wall in Correu Vell
- 5.10 Ronda de Dalt slope
- 5.11 Sedimentary materials in Park Güell

The **presence of vertebrates** in the city has been well-documented, with a total of 103 native species listed and 75 species of common birds (most vertebrates in Barcelona are **protected** by law: 55 birds, 2 amphibians, 8 reptiles and 7 mammals). Accordingly, there is a great deal of natural heritage for a city. The presence of a colony of hedgehogs in the zoo and several species of bats are astonishing examples of the natural phenomena one can find in a city. However, such heritage is constantly under threat due to urban pressure and needs protection. Amphibians, which are under a major threat all over the world, also bear the brunt of the impacts of Barcelona, although careful management is carried out in their favour. It is known, however, that two species of amphibians and one species of reptile disappeared from the city some years ago.

There are certain species of birds present in Barcelona which are important to Catalonia's avifauna: the grey heron, the alpine swift, the peregrine falcon and the western jackdaw. Other significant birds include owls and kestrels. Avifauna differs from winter to spring demonstrating the city's carrying capacity. Furthermore, Barcelona is also a staging point for migratory birds. However, these aspects are accompanied by a less optimistic fact: it would appear that the **general trend with common birds** in Barcelona is that they have been witnessing a gradual decline in the past few years (although this needs to be confirmed), while such a decline has not taken place in the rest of Catalonia.

In addition, it is necessary to underline the huge **potential afforded by aquatic habitats** (fresh waters and the sea), a

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Great tit (*Parus major*). Source: Galanthus

fact that has been demonstrated in certain cases. A host of aquatic flora and fauna can be found in the few naturalised ponds situated in parks and gardens, the colonisation of reefs has been swift involving a variety of species, and there have been clear improvements in biodiversity around the Besòs river. Likewise, one successful experience in creating habitats has been the network of city vegetable gardens that are rapidly colonised by weeds and native fauna typically found in agricultural areas.

Certain **animal and plant species** do show **invasive behaviour in Barcelona**, they damage habitats and native species as well as the city heritage, they pose problems in terms of safety and may pose risks to health. When it comes to flora, tree of heaven is one species showing invasive behaviour. In terms of fauna, certain animals are subject to management in order to contain their numbers (pigeons, cats, wild boar, parakeet, tortoises, fish and snout beetles), although more still needs to be done. Presently the monk parakeet, the rose-ringed parakeet, the red-billed leiothrix, the red-eared slider and the mosquito fish are all invasive species.

In conclusion, it can be stated that Barcelona's natural heritage is highly rich and diverse, although it is impossible to establish what is disappearing in terms of species and habitats and what is being gained (or is ceasing to decline) given current urban pressures on the one hand and on account of the preservation management being carried out on the other. The importance of knowledge for

improved management **should not stop action being taken**, even if all the information needed is not available. Given that it would be impossible to ever gather all detailed information regarding the reasons behind the evolution of animal populations, it is vital to manage species and create habitats because, generally speaking, the outcomes are patently positive.

It is not known what would have happened in Collserola if efforts had not been made to protect it over so many years. The protection of an area does not appear to improve biodiversity but there is no doubt that lack of protection would result in it getting worse. Some years ago, Collserola did not form part of the lives of Barcelona's people; however, at present, many people are familiar with the park and enjoy it. Consequently, greater value must be lent to such urban heritage; more species and habitats must be prevented from disappearing; and these values must be made more visible by demonstrating how they benefit people in their everyday lives, how they can further improve quality of life and, lastly, how humankind survives thanks to the Earth's natural resources. Ignorance with respect to the values of local and global biodiversity does not help to bridge the gap between the urban setting and nature, or at least does not prevent the city from having a predatory effect on such nature, and it results in people losing sight of the extent to which humans depend on nature, not simply to lead an excellent lifestyle but merely in order to survive.

Summary

Barcelona is home to the following natural heritage:

- Collserola: 1,795 ha in the municipal district with more than 8,000 ha in total.
- Two rivers and the sea forming its borders.
- 1,076 ha of public parks and gardens, 30 ha of beaches, 30 ha of crops and 740 ha of private greenery.
- Montjuïc, Els Tres Turons and Parc de la Ciutadella are its main natural strengths.
- 53 local listed areas of natural interest.
- Constructed space serving as a habitat for fauna.
- Plant heritage with exotic and native species in the parks and gardens with nigh on 77,000 trees (excluding forest areas).
- 153,000 street trees from 150 species.
- Aquatic flora and fauna in naturalised ponds.
- 103 native species of vertebrates in the city centre.
- 75 native species of common birds in the city centre.
- Barcelona's birdlife: swifts and other birds, as well as bats.
- Migratory birds.
- Key vertebrates: falcon, jackdaw, heron, alpine swift, squirrel, hedgehog, owl, amphibians, etc.

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Formally recognised values of Barcelona:

- Collserola incorporated into the Natura 2000 network and recognised as a nature park.
- Three kinds of habitats designated as needing preservation in the EU Habitats Directive from 1992: holm-oak forests, pine forests and dry grasslands.
- Cliffs of Montjuïc included in the Inventory of Areas of Geological Interest of the Government of Catalonia with initial approval as a protected natural open space.
- 72 vertebrates protected by law in the city: 55 birds, 2 amphibians, 8 reptiles and 7 mammals.
- 138 trees in the Listing of Trees of Local Interest in Barcelona.

How it has evolved and what we gain:

- Increase in forests and urban green infrastructure.
- New habitats created in Barcelona and the surrounding area successfully colonised by flora and fauna: network of urban vegetable gardens, underwater reefs, Besòs shores, Vallvidrera reservoir, etc.
- Habitats where nature is taken care of: buildings (where alpine swifts, swifts, swallows and bats are preserved, etc.), ponds, Barcelona zoo (where the colony of grey herons and herons is growing).
- Habitats securing protection: cliffs of Montjuïc and the surrounding area.

How it has evolved and what we lose:

- Virtual disappearance of crops.
 - Disappearance of wasteland, meadows and scrubs.
 - Valuable habitats that may be lost: part of the agricultural area of the Rec Comtal.
 - Gradual loss of unacknowledged local areas of geological interest.
 - Slight trend of a decline in avifauna (to be confirmed).
 - Loss of fauna owing to urban pressure (construction, collisions): swallows, swifts, jackdaws, sparrows, hedgehogs, snakes, etc.
 - Detriment to natural systems caused by invasive or excessive volumes of specific flora and fauna: tree of heaven, red-eared slider, exotic fish, parakeets, cats, etc.
-

2.3

Diagnosis of green infrastructure (2009-2010)

2.3.1 Local green infrastructure

Barcelona has **3,611 hectares of green infrastructure covering 35.3% of the city land** (according to 2009 data). Of this area, 1,076 hectares are strictly urban greenery, 1,795 pertain to the municipal district within Collserola Nature Park and 740 are private greenery generally in the highest part of the city. This is equivalent to **17.71 m² green space/inhabitant** (6.64 m² within the urban setting not including Collserola). Consequently, the overall abundance of green areas is rather high, but only 30% accounts for strictly public, urban greenery: 20% of the remainder belong to private greenery – which contributes to make the city greener and provides environmental benefits, albeit without the possibility for public use – and the 50% corresponds to wooden greenery in Barcelona municipal district in Collserola.

The **1,076 hectares of public city greenery** are essentially situated in three districts: Sants-Montjuïc (27.8%), Sant Martí (15.4%) and Horta-Guinardó (11.3%). On the other hand, districts with historic centres, such as Gràcia (3.6%), Sant Andreu (5.1%) and Ciutat Vella (5.9%), have a less abundant presence of green areas owing to the compactness of the urban fabric and the smaller area they cover. If we add Collserola, Sarrià-Sant Gervasi would be the district with the greatest area of greenery with over 1,266 hectares.

Despite the size of the two major wooded parks (Collserola and Montjuïc), green infrastructure within the city tends to cover **small areas** (between 1 and 5 hectares) and given its distribution amid the urban fabric, it is well within the reach of citizens. 57% of green areas cover a surface of less than 1,500 m² and, generally, there is very scant connectivity between them.

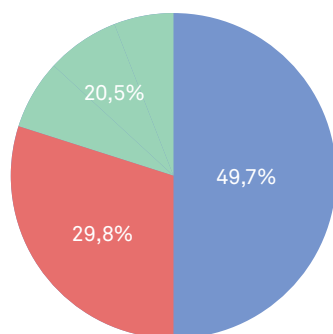
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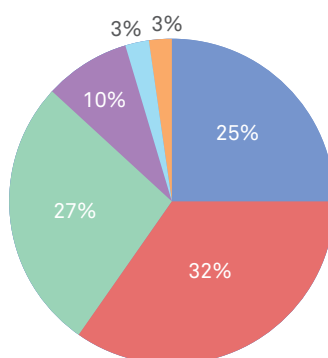
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Green infrastructure in Barcelona (2010)



- Wooded greenery (Collserola)
1,795 ha
- Public greenery (parks and gardens)
1,076 ha
- Private greenery
740 ha

Classification of green areas according to size



- 0 - 400 m²; 403 areas
- 400 - 1,500 m²; 512 areas
- 1,500 - 5,000 m²; 423 areas
- 5,000 - 20,000 m²; 160 areas
- 20,000 - 50,000 m²; 51 areas
- More than 50,000 m²; 46 areas

Green infrastructure in the city also includes **street trees**. During the past thirty years, the number of trees has been doubled to its current number of 153,000 (1 for every 8.6 m of street).

Currently there are 3.5 ha of **green roofs** in Barcelona, although the potential area, simply by including public buildings alongside proposed green corridors, is 65 ha, a figure that is even greater when considering private, business initiatives. As far as **green walls** are concerned, there is only the odd private case known.

A few years ago, the Urban Landscape and Quality of Life Municipal Institute launched a line of grants for private parties to create **green roofs in buildings**. To a lesser extent, Barcelona City Council has encouraged **flowering on balconies and terraces**, by giving plants and seeds in a host of dissemination and citizen campaigns and through balcony flowering photography contests.

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Distribution of public green infrastructure according to district – city and Collserola – in hectares (2009)

District	Green area open to the public	Collserola area	Total green area
1. Ciutat Vella	63.32	-	63.32
2. Eixample	49.47	-	49.47
3. Sants-Montjuïc	300.29	-	300.29
4. Les Corts	73.2	41	114.2
5. Sarrià-Sant Gervasi	95.04	1,171	1,266.04
6. Gràcia	38.87	-	38.87
7. Horta-Guinardó	122.27	409	531.27
8. Nou Barris	112.18	175	287.18
9. Sant Andreu	55.02	-	55.02
10. Sant Martí	167.07	-	167.07
Total	1,076.74 ha	1,795 ha	2,871.74 ha

District	Public green area per inhabitant in m ² (1)	Total public green area per inhabitant in m ² (2)
1. Ciutat Vella	5.89	5.89
2. Eixample	1.85	1.85
3. Sants-Montjuïc	16.46	16.46
4. Les Corts	8.82	13.77
5. Sarrià-Sant Gervasi	6.6	87.97
6. Gràcia	3.15	3.15
7. Horta-Guinardó	7.14	31.03
8. Nou Barris	6.67	17.07
9. Sant Andreu	3.75	3.75
10. Sant Martí	7.3	7.3
Total	6.64 m²/hab	17.71 m²/hab

(1) Green areas open to the public except Collserola / (2) Green areas open to the public including Collserola

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The following table shows the volum of urban green area per inhabitant in Spanish cities over 500 thousand inhabitants.

m ² /hab	
Barcelona	6,6
Madrid	17,0
Malaga	5,7
Sevilla	6,2
Valencia	5,4
Average	6,2

Source: prepared by OSE using data from, INE and the OMAU-OSE survey, 2009

However, because **expanding green areas** in Barcelona is a complex task owing to the city’s structure and layout, one local goal is to make the most of urban transformations in order to create new green areas linked to them. At present, the City Council is endeavouring greatly to transform the city, for instance, with the high-speed railway station in La Sagrera, the new Marina del Prat Vermell neighbourhood in Zona Franca or Vallbona eco-neighbourhood. Moreover, actions are being carried out in five major areas of the city – Collserola, Els Tres Turons, Montjuïc, Parc de la Ciutadella and the city blocks in the Eixample district – in order to improve the overall network of green infrastructure.



Castell de Montjuïc



Interior d'illa de l'Eixample. Jardins de Safo

Summary

- 3,611 hectares of green infrastructure: 30% is strictly public urban greenery, 50% pertains to the local area of Parc de Collserola and 20% to private property.
 - 17.71 m² of green infrastructure/inhabitant (6.84 m² in the city area).
 - Significant extension of natural greenery (Parc de Collserola).
 - Heightened areas of public green infrastructure in the districts of Sants-Montjuïc, Sant Martí and Horta-Guinardó. If we include Collserola, Sarrià-Sant Gervasi is the district with the highest degree of green infrastructure.
 - Green areas not interconnected.
 - Small green areas: 57% are below 1,500 m².
 - 1 tree lining every 8.6 m of street (153,000 in all).
 - Scant presence of green walls and green roofs.
-

2.3.2 Green infrastructure: make-up, structure and ecological services afforded

Barcelona has a broad variety of **habitats and natural areas** which characterise the city from an ecological standpoint whilst hosting a diverse number of plant species and animals. However, the physical limitations of the city and the high population density mean that green heritage is fragmented and is formed by many small-sized areas.

The green areas with the greatest number of habitats, acting as the city's lungs, are situated in **Montjuïc, Els Tres Turons and, in particular, Collserola**. However, within the urban fabric there are also various kinds of urban green infrastructure affording varied biodiversity: parks, gardens, squares, vegetable gardens, flowerbeds, ornamental lakes and ponds, green walls, green roofs, etc. All of these features form a **network of areas of varying sizes**. Moreover, Barcelona is acknowledged as one of the cities in Europe with the greatest number of street trees.

According to the study *Environmental Services of Green Infrastructure* prepared by CREAM (the Centre for Ecological Research and Forestry Applications) in 2009 for Barcelona City Council, the city has a **plant layer covering the local area** 25.2% of which is formed by trees (generally small with 50% having a perimeter below 47 cm) with 7.3% formed by shrubs. The three predominant species are the holm oak or *Quercus ilex* (22.1%), the Aleppo pine or *Pinus halepensis* (20.5%) and the London plane or *Platanus x acerifolia* (6.6%), which account for 49% of all trees, 50.5% of the tree foliage area and 43.1% of the total tree biomass. This means that a plague or specific disease could have a major effect on Barcelona's green infrastructure. In addition, both the Aleppo pine and the holm oak are species considered

to be vulnerable to climate change.

The same study also detailed the **environmental and social services** afforded by urban vegetation which are highly important in helping to improve the quality of the city and forge a healthier environment: support for fauna, infiltration of rainwater, reduction in pollution and noise, etc. Although the overall environmental services provided by green infrastructure are less notable – given the scant maturity of the vegetation, the overall coverage of trees and the lack of shrubbery in the urban fabric – suitable management increases the benefits for the environment and people's health. Indeed, it is estimated that in 2008 trees were responsible for removing some 5,000 net tonnes of CO₂ from the atmosphere and they eliminated more than 305 tonnes of pollutant compounds: 166 tn of PM10, 72.6 tn of O₃, 54.6 tn of NO₂, 6.8 tn of SO₂ and 5.6 tn of CO. Additionally, street trees help to reduce the noise reaching the inside of buildings and members of the public walking along the pavements. Parks and gardens are also silent areas where noise can be reduced to under 45 decibels.

According to the *Study on Plant Biodiversity in Barcelona's Parks and Gardens*, prepared by the Catalan Foundation for Agricultural Engineering in 2009 concerning 197 green areas in the city, **the make-up of Barcelona's parks and gardens is as follows**: 20% trees, 40% shrubs, 20% lawns and the remainder formed by other types of plants. Indeed, there are some 1,172 plant species to be found in them, including trees, shrubs, climbing plants and persistent perennial plants. The most common species is the English ivy, which is found in 72.6% of the parks analysed. With regard to trees there are more than 200 different species, although the most common include the cypress, the stone pine, the Canary Island date palm, the London plane, the Mediterranean hackberry and the glossy

privet. The most common shrubs include the Japanese pittosporum, the oleander and the bay laurel (55.8%). In recent years there has been a change in the composition of ornamental species in parks and gardens with a slight increase in native species. The use of **native species** provides a clear advantage when it comes to gaining a greater level of environmental services from the vegetation, such as attracting wild fauna, naturalising spaces and, in particular, reducing consumption of water resources and the need for maintenance. Today 22.6% of ornamental plants are native.

Nonetheless, in the city's parks and gardens there is still a **scant number of plant layers** as well as some invasive plants, even though they apparently do not pose any problems.

There are some 150 species and cultivars of **street trees**. The most common street tree planted is the plane, accounting for 27.5% of the total, followed by the Mediterranean hackberry, at 12%, and pagoda trees, accounting for nigh on 6%. Overall, there are many species but most appear

in small quantities. Four of them (the London plane, the Mediterranean hackberry, the pagoda tree and the black poplar) almost account for 50% of all street trees.

Street trees often have very little space in the ground for the roots, with very little organic material and compact soil with little structure (entailing low oxygen levels giving rise to radicular asphyxia) and deficient nutrition. In most instances, this is caused by the small width of the pavements and the tree pits. It would therefore be suitable to find solutions to ensure that this vital element of urban greenery can be aptly preserved. The waterproof surface in Barcelona has increased by 12% in the past thirty years.

When it comes to the role of parks as **havens for biodiversity**, the world over there are excellent examples of green spaces that have been designed to encourage biodiversity and which, in addition, have given rise to spaces with a huge potential for education and popularisation. Nonetheless, there has been no specific green area developed in Barcelona to this end.

Summary

- Recovering the local area with plant species has involved 25.2% of trees and 7.3% of shrubs.
- The three dominant species are the holm oak or *Quercus ilex* (22.1%), the Aleppo tree or *Pinus halepensis* (20.5%) and the London plane or *Platanus x acerifolia* (6.6%), accounting for 49% of all trees, 50.5% of the tree foliage area and 43.1% of the total tree biomass.
- Almost 50% of trees are small with a perimeter of less than 47 cm.
- Trees remove 5,000 tn/year of CO₂ and 305 tn/year of pollutants from local atmospheres.
- The plant composition of parks and gardens is as follows: 40% shrubs, 20% trees, 20% lawns and the remainder formed by other plant types. In general, plant layers tend to be rather poor.
- 22.6% of ornamental plants are native species, a slight increase in recent years in this regard.
- There are some 200 tree species in Barcelona, 150 of which line the streets.
- Four tree species account for almost 50% of the trees found aligning the streets (the London plane, the Mediterranean hackberry, the pagoda tree and the black poplar).
- The waterproof surface has increased by 12% over the past 30 years.

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2.3.3 The social and health context

Aside from being visually appealing and enabling citizens to enjoy natural urban heritage and tranquillity, the city's parks and gardens offer the public many services and facilities in order to carry out health, social and leisure activities. Urban greenery constitutes a landscape of tangible and intangible elements providing the backbone for and establishing a balance in a setting to bring about positive effects on the health of citizens. Parks and gardens of a certain size are practically the only urban areas providing acoustic comfort and enabling the public to benefit from soundscapes.

The use of and demand for green areas has been increasing in parallel with the development of the city and it has taken on a metropolitan scale. The increased number of users both from the city and other neighbouring towns, particularly in the larger parks, shows how important

these spaces are from a social standpoint, though it also reveals the need for managing the pressures stemming from a greater human presence. Studies regarding occupancy and use of city parks show that certain parks witness mass, heightened use bringing about certain social conflicts.

In general, Barcelona's parks and gardens are widely used by citizens. Nonetheless, there is a **degree of imbalance in pressure on green spaces** meaning some are heavily frequented (such as Parc de la Ciutadella, Park Güell and Trinitat and Poblenou parks), while others are visited to a much lesser extent on comparison. Therefore, the use of green spaces must be redistributed within the city fabric and they must be ready for mass presence of individuals and heavy use where necessary. Similarly, parks are home to many activities: more than 1,500 each year, although most are carried out in merely 10 parks.

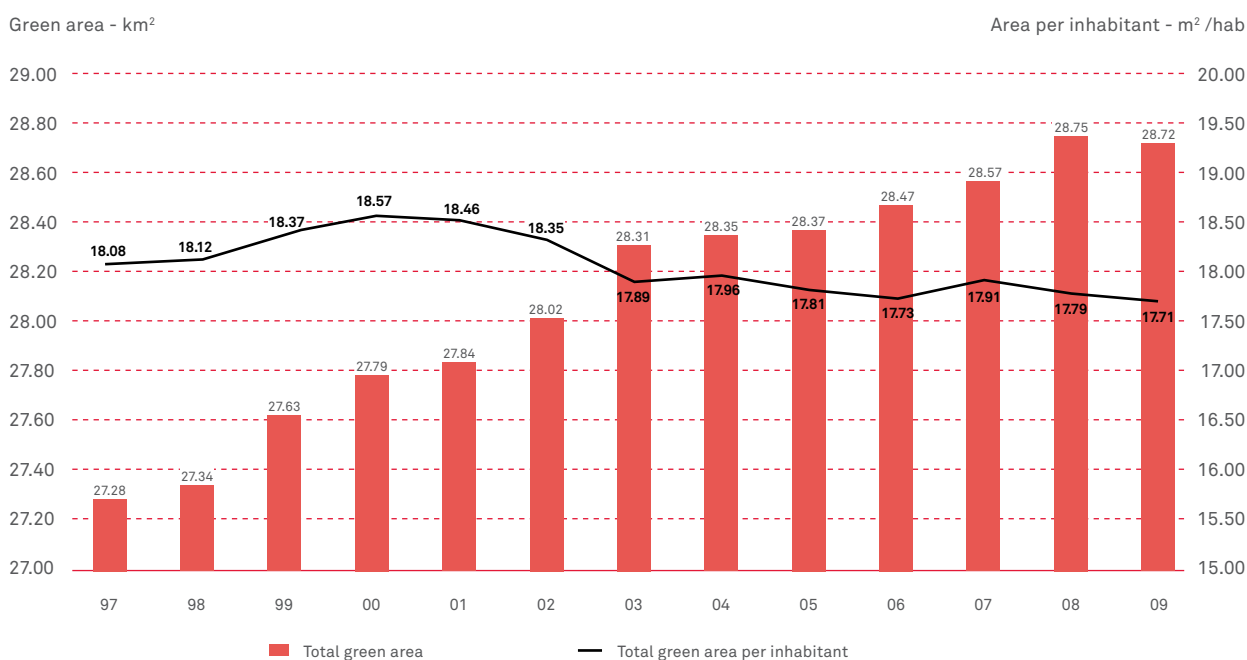
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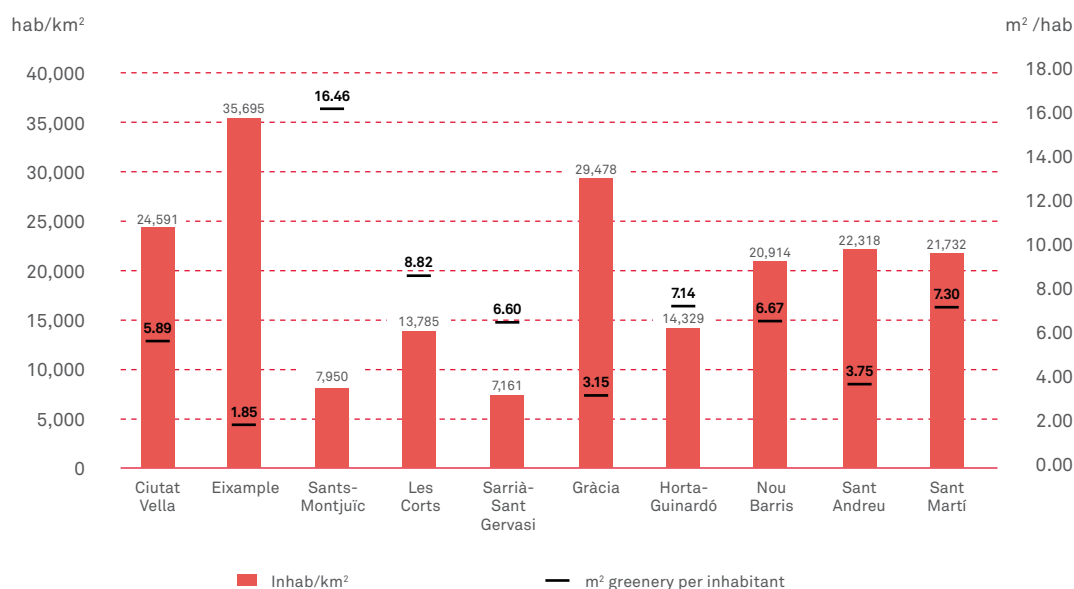
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Total green area per inhabitant (1997-2009)



Population density and green area per inhabitant, by districts (2009)



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One of the added values afforded by green spaces is **the presence of facilities and elements intended for practising sports**. At present there are currently 900 such facilities, although there is a degree of imbalance in how they are distributed among districts and in the fact that more than 50% of such elements are pétanque rinks that are mainly used by the elderly. When it comes to **children's playgrounds**, in recent years Barcelona has endeavoured to provide parks, gardens and squares with such facilities and there are presently some 717, some of which have been designed based on **accessible, inclusive play** criteria. However, there has similarly been an imbalance observed in the provision of playgrounds in the various areas of the urban fabric.

The most common use citizens make of parks are as follows: strolls, taking children to play, resting, enjoying nature, practising sport and walking dogs. None-

theless, these uses have been changing in recent years as has the demographic make-up and number of people visiting parks and gardens. The emergence of **new forms of use of green areas** and the diversification in the profiles of users of Barcelona's parks are key factors to be considered when planning, designing and managing the city's green spaces as all users bear different motivations and habits.

In this respect, it is important to gain an acquaintance of the opinions and perceptions of the individuals who visit Barcelona's parks and gardens. Generally speaking, citizens show high regard to green areas and value them. They associate them with nature, health, places of freedom and for unwinding, although they would like to see more flowers, trees and lawns, as well as greater security and cleanliness (data from the citizen opinion survey on green areas in Barcelona. Idèria. Parks and Gardens, 2008).

Green areas are a meeting point uniting many citizens but the presence of plentiful vegetation and silent spaces also affords major benefits having a positive effect on wellbeing and quality of life, which in turn has a bearing on people's physical, psychological and emotional health. As a result, it is necessary to continue to promote programmes aimed at transforming parks and gardens into **spaces of health and for sporting practice**, making the most of the sensory resources provided by the vegetation and associated elements.

Urban vegetable gardens are one example of a programme with major social values for the people who take part as they enable people to occupy their time and encourage the creation of a host of new relations, whilst allowing people to improve their quality of life by engaging in a physical activity with positive effects on health. The programme was launched in 1997, although the first vegetable garden that actually began operating was Hort de l'Avi in Gràcia in 1986 stemming from a request by a number of residents. Since 1994 there have been 546 users of urban vegetable gardens to which we must add 205 users at risk of social exclusion; nonetheless, demand is far greater.

Another notable aspect of urban vegetable gardens is their function in the field of environmental education: by organising activities intended for schools, children can gain an acquaintance of the world of agriculture and the principles of organic farming. Similarly, it is worth highlighting their social function in encouraging coexistence among generations because the educational activities carried out make it easier for children to engage with the elderly. On the context of the Agenda 21 for Schools programme, more than 185 schools work in contact with vegetation and the production of food in **vegetable gardens situated in school playgrounds**.

Vegetation, however, does have **effects on health** in the case of individuals with an allergy to certain species of pollen. 98% of the pollen present in Barcelona each year belongs to a pollen category which can spark off respiratory allergies. 87% pertains to species cultivated in the city's parks and gardens; pollen stemming from London planes is the most abundant and accounts for 38% of the total, followed by the pollen from the olive tree and that of the glossy privet. Nonetheless, the most common sensitivity is to dust mites.

With regard to **participation programmes** linked to the city's parks and gardens, the City Council works with certain sector-based and territorial associations and institutions generally in relation to a specific space or group. Nonetheless, at present there is no programme to promote volunteers to cooperate with information and preservation tasks on the parks and gardens of Barcelona.

Citizen involvement is also channelled through other means of participation, such as cooperation in the design of green spaces. The formation of these spaces by technical services often derives from participation processes including both residents and the district. Such participation often involves brainstorming and the identification of needs by users which are then reflected in definitive projects. Likewise, **coexistence in public green spaces** is established through programmes and activities specifically designed with this aim in mind to avoid – or at least limit – the impact of certain anti-social behaviour.

Summary

- There is mass, heightened use of certain parks giving rise to certain social conflicts.
 - Parks are used intensively and some are hyper-frequented.
 - More than 1,500 activities take place in parks every year although most take place in merely 10 parks.
 - Many sporting practice programmes are organised (with 900 such facilities, although more than 50% are pétanque rinks used by the elderly).
 - Barcelona has 717 children's playgrounds, some designed with accessible, inclusive criteria in mind, although they are not evenly distributed.
 - Citizens place great value on green spaces though they do call for more flowers and greater security and cleanliness.
 - Programmes are in place focussing on green infrastructure and health, including the one on the 12 urban vegetable gardens. Since 1994, urban vegetable gardens have been used by 546 people, to whom we must add 205 users at risk of social exclusion. School vegetable gardens are also operated.
 - There is a structured social network for creating more and better volunteer programmes.
 - About 38% of all pollen in Barcelona comes from the London plane, which can be a major allergen for sensitive people.
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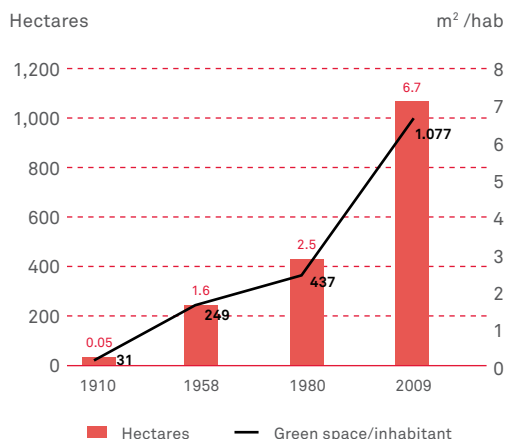


Hort Sagrada Família

2.3.4 Historical and heritage-based aspects

The history of public green heritage in Barcelona dates from the 19th century and has evolved in a manner similar to all other European cities, though with some distinguishing features. The first public park was Ciutadella formed in 1873. However, the major increase in green areas began as of the 1980s as a result of the town planning policy promoted by Barcelona City Council following the first local elections after Franco's death. Residents and associations made specific claims in this regard which had a decisive role in the recovery of land for public use and the design of these spaces.

The development of green areas in Barcelona (1910-2008)



The parks and gardens of Barcelona are home to **green heritage** with highly special characteristics in comparison to the public parks and gardens in Spain's main cities. Moreover, the same can be said of **the artistic and architectural elements** located in many spaces, particularly in historical gardens. Aside from public parks and gardens, Barcelona has a significant heritage of private gardens some of which stand out owing to their unique design or the historical value of their structures and plants.

So 30% of currently public green spaces are former **private gardens of artistic quality**, 27 of which are included in the Barcelona City Council Architectural Heritage Listing, a document that is still under preparation, as it needs to include certain city gardens with undeniable artistic value. Historical parks and gardens are fragile structures as they are mainly formed by living, perishable materials. They are also dynamic works of art that evolve over time. Indeed, their protection is particularly complex given the fact that the structures have a limited life. In international terms, the preservation and restoration criteria followed are those adopted in the Florence Charter from 1981.

Montjuïc mountain is one of Barcelona's key garden heritage locations as it has housed 16 gardens occupying an area of 70 hectares in 7 different styles since 1915. **Historical parks** par excellence – Parc de la Ciutadella, Park Güell and Parc del Laberint d'Horta – are most frequently visited and bear the greatest demand for activities. However, citizens still place very little value on the historical heritage of parks and gardens. Preparing management and use plans for historical gardens would help to lend these areas greater value.

The high number of **trees** in the city is another **valuable aspect of heritage**, especially with regard to historical plant species that can be deemed as **species marking identity**. This is the case of the London plane in the Eixample district, orange trees in mediaeval courtyards and embankments, and the date palm and the southern magnolia in the city's cloisters and courtyards. Similarly, the Mediterranean cypress, the Aleppo pine and the holm oak are characteristic species of Barcelona's landscape, especially in Montjuïc and Collserola. These species have decreased in numbers in recent years for various reasons, and it is important to prepare a plan in order to ensure they do not disappear. There are also some examples of individual or groups of trees which, given their value or the reason for their being planted, are worthy of protection. There are currently **138 trees of local interest** listed.



London plane in Les Rambles. Source: Arxiu Històric de Barcelona

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Summary

- The major increase in green areas begins in the 1980s as a result of the town planning policy implemented following the first local elections after Franco's death.
 - About 30% of currently public green spaces are former private gardens of artistic quality, 27 of which are included in the Barcelona City Council Architectural Heritage Listing.
 - Montjuïc is a paradigm of historical and urban garden styles.
 - The three exemplary historical parks (Park Güell, Parc de la Ciutadella and Parc del Laberint d'Horta) host the most visitors and activities.
 - There is a lack of use and management plans for historical gardens.
 - A decline has been recorded in the species that identify the city.
 - So far 138 trees of local interest have been listed.
-

2.3.5 Communication and environmental education

The City Council **communication and education strategy** focuses on two highly distinguished themes: knowledge of the natural urban environment and its benefits, and respect for green spaces. With regard to the former, the aim is to cast value on urban green infrastructure as vital heritage to the city, disseminate knowledge of biodiversity among citizens and encourage them to become familiar with Barcelona's network of parks and gardens, as well as their history and architectural and artistic wealth. With regard to the latter, the aim is to focus on green spaces as settings where a variety of user profiles converge and a host of activities can take place.

In the case of urban greenery, it is vital for citizens to become engaged and indeed the communication policy must reach out to all segments of the community through the regular channels. The communication tools used so far have been publications on paper (books, en-

vironmental education guides and leaflets), the website (which gets more than 326,000 hits a year) for general dissemination and series of conferences, and forums for reflection on more technical and scientific aspects. Nonetheless, a formal communication strategy still needs to be established.

The endeavours in communication and dissemination are channelled by means of the **environmental education programme** which was promoted during the early 1990s. It incorporates proposals for various school levels, and has been strengthened and has evolved in both the number of schools and the issues addressed. The "Come to the parks" programme is one such example; "Transform your house into a garden" is another. The latter was launched in 2010 in conjunction with the Ornamental Horticulture Federation of Catalonia and involves a series of gardening workshops intended for families which take place in several parks and gardens in Barcelona during the holiday period. In 2010, the programme comprised 7 workshops

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Spring Fest. Parc de la Tamarita

with a specific theme – bulbous plants, rosebushes and the domestic vegetable garden – which were attended by nigh on 500 people.

Specific signs have also been included in green spaces in order to guide visitors and allow the public to become acquainted with the species present.

The **Parc del Laberint Training Centre** contributes to disseminating information about the landscape and garden plant heritage. The centre was set up during the 1993-94 academic year to organise the enthusiasts' courses which began in 1947 at the Municipal School of Gardening and in order to launch a new educational line for professionals and technicians of town councils and companies. Practical classes are given in the Parc del Laberint and other green spaces and facilities, such as Tres Pins nursery. It is estimated that the centre is running at 50% of its potential with regard to courses for enthusiasts and

technicians, and as a means of support for organising environmental education activities.

Moreover, parks and gardens form the backdrop for numerous **citizen and popular activities**, such as the Spring Festival which has been held for 23 editions to date.

Citizens and organisations see the tree as a symbol for commemorations. As a result, Barcelona is home to some 35 trees or groups of **memory trees** which honour important individuals and events from the city's history.

On today's context marked by environmental and social challenges on a global scale, Barcelona has no specific defined strategy for **international relations and renown**; however, exchanges and involvement within networks of technicians and experts is regular and is deemed essential in order to progress with internal policies on green spaces.

Summary

- More than 326,000 hits on the parks and gardens website are recorded each year.
 - Barcelona benefits from consolidated education programmes, such as “Come to the parks”.
 - In 2010, 13,451 children from Barcelona's schools took part in supervised educational activities.
 - It is estimated that the Parc del Laberint Training Centre is running at 50% of its potential with regard to courses for enthusiasts and technicians, and as a means of support for organising environmental education activities.
-

2.3.6 Management and maintenance

Vegetation is the foremost element of green spaces. It is a living element which, unlike the furniture and other urban elements, has seasonal cycles and a specific lifecycle meaning it is necessary to define and apply management and maintenance procedures adapted to each type of plants: trees, shrubs, herbaceous plants, lawns and flowers. However, given their complex nature, the trees lining the streets require management and maintenance that differ greatly from those required by the trees found in the city's parks and gardens.

Managing more than one thousand hectares of green areas unavoidably entails standardising maintenance processes and establishing uniformity among them. However, it is also necessary to know how to manage differences in order to prevent the distinguishing features of each of the parks and gardens which enrich the city's green heritage from disappearing. In line with the **differentiated landscaping criteria** implemented in Barcelona in 1993, the city's green areas are classified in several categories according to the **type of maintenance** carried out. These categories have undergone reviews and updates to the present date.

New definition of current maintenance levels (2010)

Level	Description	Spaces and features
A	HIGH: intensive maintenance, subject to the characteristics of the space or its location.	Parks, gardens, squares and flowerbeds in the public highway that are historical, theme-based or emblematic, as well as inner block courtyards in the Eixample district
B	MEDIUM OR STANDARD: medium maintenance, especially subject to high frequentation.	Parks, gardens, places and flowerbeds in the public highway
C	LOW: less intensive maintenance, below medium or standard maintenance given the types of plantations or a reduced frequency of use.	Parks, gardens, squares and flowerbeds in the public highway
D	MINIMAL: very low intensity maintenance seeking to ensure that vegetation preserves its wild characteristics.	Parks and gardens
E	PREVENTIVE: maintenance actions carried out mandatorily or by law in order to prevent forest fires.	Plots

Around 56% of green areas are subject to level B, standard maintenance, particularly given the plant structure housed and the extent to which they are used. These areas are essentially urban parks, neighbourhood gardens, landscaped squares and flowerbeds in the public highway and in streets open to traffic. The allocation of maintenance levels for the various kinds of green infrastructure is currently under review in order to optimise resources and maintenance. Several parks have a specific maintenance plan which is fulfilled to a large degree (87%).

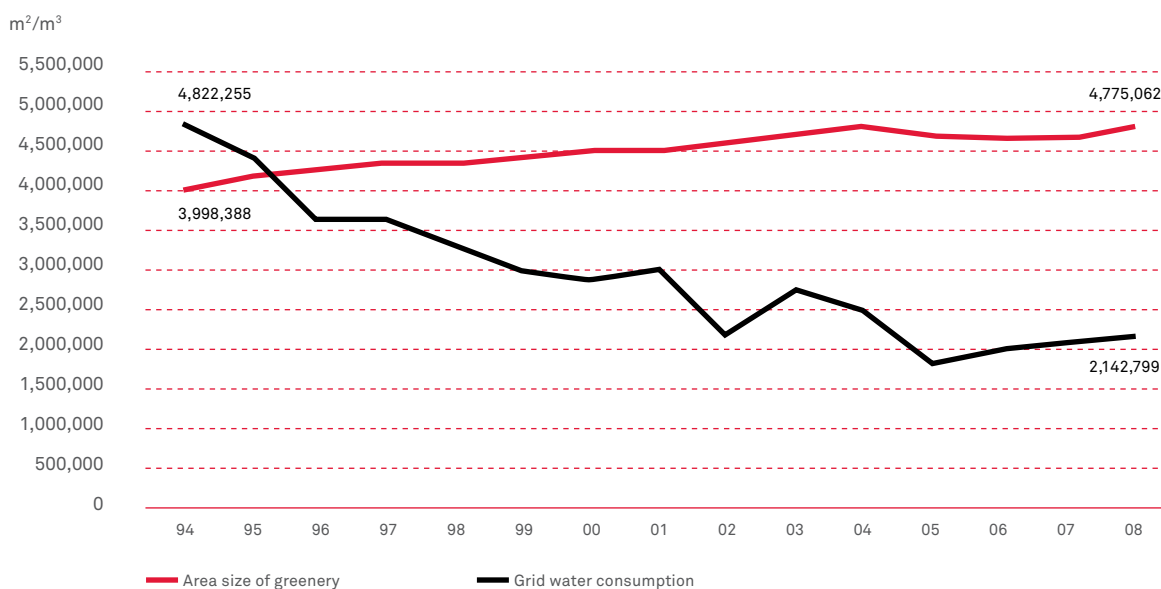
Likewise, the **preservation of a green space** is entirely subject to the design, the history of the space and the manner in which it is used. Design and maintenance are two intimately tied aspects when it comes to the smooth development of the city's parks. About 41% of parks and gardens that have been regenerated in the past 10 years were built or regenerated in the past 25 years, with a total investment of 22.5 million euros. Overall, more resources are earmarked for regeneration and full renewal of parks than on their maintenance and it is considered that this trend should be reversed.

Comprehensive actions in consolidated green spaces always affect part of the mature, established vegetation of the park and they can also affect the delicate natural balance in the area. However, currently there are no maintenance plans established or implemented in order to define the tasks to be carried out in the long-term to prevent all the elements of the space from ageing simultaneously once work has been carried out and a space has been renewed. Indeed, it is considered necessary to prepare an **individual dossier** for each of the major parks and gardens in the city detailing their origin, the maintenance criteria needed to ensure they remain unique and a short-, mid- and long-term maintenance and renewal plan.

The maintenance of plant heritage means it is necessary to benefit from **water resources and irrigation systems and technologies** making it possible to meet the demand for water of all species in a sustainable manner. In recent years, although the area of green spaces in Barcelona has increased substantially, **consumption of drinking water** has fallen extraordinarily thanks to the control of leaks, the use of groundwater, automation of irrigation and the use of plants with lower demand for water resources. Thus, 12% of the area in spaces and all recently-planted street trees are irrigated using groundwater and 10 green spaces have been designed using sustainable drainage techniques (TEDUS). Automated irrigation currently accounts for 52% of the total.

Barcelona water resources plan also envisages irrigating virtually all green areas using resources other than drinking water, such as rainwater or groundwater, as these resources are widely available and a distribution network is currently being developed.

Change in area size of irrigable green infrastructure in m² and in grid water consumption in m³ (1994-2008)



Source: Ajuntament de Barcelona.

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The city has 217 ha of traditional lawns. In order to reduce the **vegetation's demand for water**, warm climate lawns have been planted and account for 9.5% of the total. The transformation is slow and there are still currently too many lawns with high water consumption and inappropriate water associations.

At present, work is being carried out on a computer application for managing green spaces while the inventory and management of street trees have both been 100% computerised.

With regard to the **management of street trees**, a **programme to transform street trees** has been followed since 1994 in order to reduce the major presence of London planes in public streets (which then accounted for approx. 47% of all street trees). These specimens showed general ageing and entailed a significant risk in terms of plagues and disease. The replacement also envisaged the reduction of

problematic species, such as *Ulmus pumila*, *Robinia pseudoacacia* and *Acer negundo*. In this substitution process, the Mediterranean hackberry (*Celtis australis*), which is well-adapted to urban conditions, took on a particularly important role. However, in subsequent reviews it was observed that if this programme was followed further, the Mediterranean hackberry would end up becoming excessively abundant in the city. As a result, efforts have focussed in increasing the biodiversity of alignment trees with priority given to those species that are best adapted to cope with the stressful conditions of city life, and at present an internal project is underway in order to determine the appropriate percentage of each species to form a good balance of street trees.

Since 2005 a visual analysis has been conducted to predict the risk of trees or branches falling. Since it was applied, damaged trees or those in poor condition

have been reduced by 87% and actions needed to avoid such situations have reduced the risk by 86%.

At present, a **comprehensive plague control** is carried out on 100% of trees, although the implementation of ecological phytosanitary treatments and biological defences is slow. With regard to the management of organic resources, **plant remains are treated for use as mulch and compost** (more than 10,100 tonnes per year).

Particular attention must be focussed on **coastal vegetation** as it is subject to the typical conditions of the coastline and the species chosen are not always appropriate. This is a particular problem when it comes to trees as they suffer more directly from the brunt of sea winds which results in a large part of their plant mass falling and the tree structure suffering erosion. The result is lifeless vegetation providing no aesthetic or environmental purpose. Trees in the Plaça del Mar and along the seaside promenade at La Barceloneta, Nova Icària and Bogatell are particularly affected, as are the trees in the Parc dels Auditoris.

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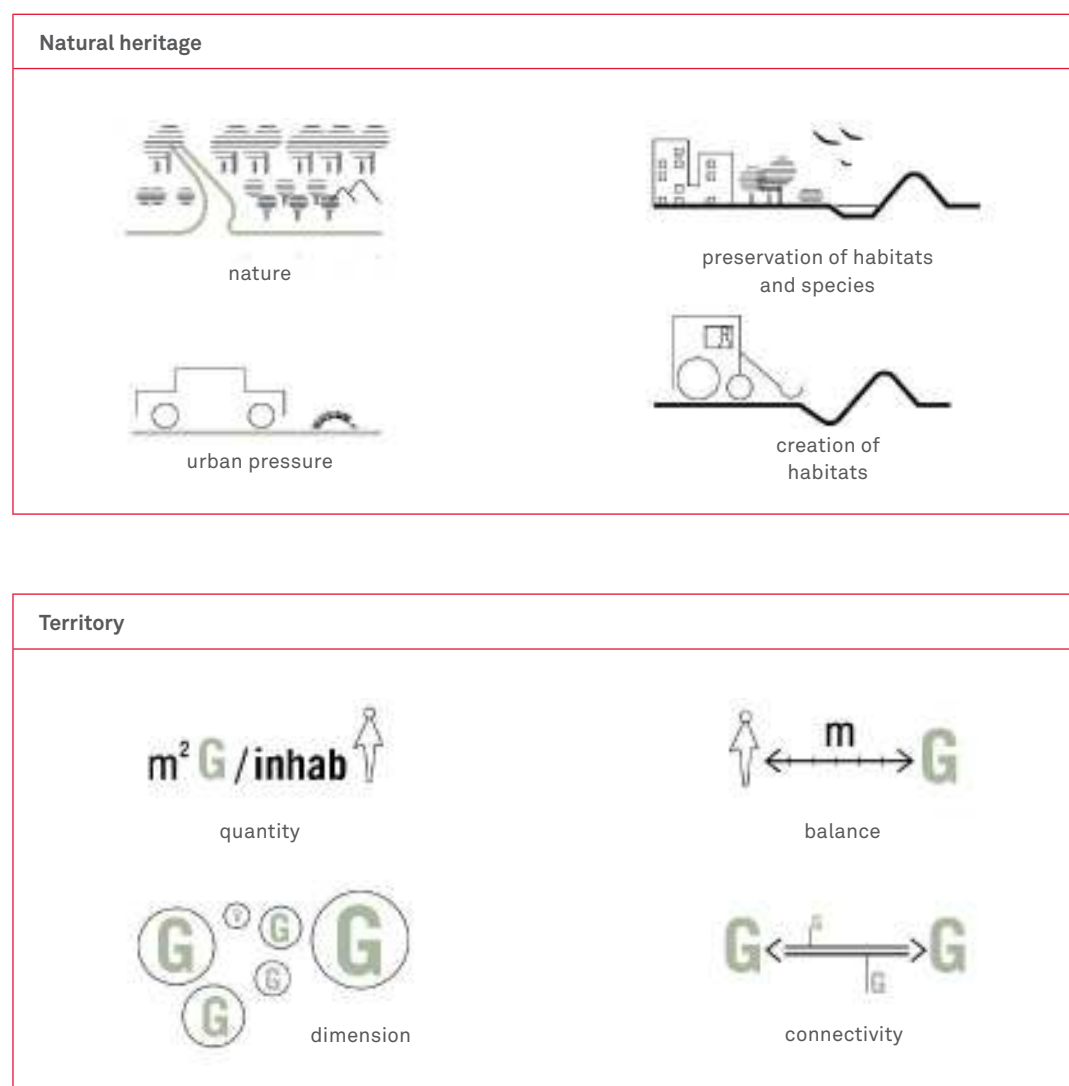
Summary

- About 50% of green spaces receive medium level maintenance. Several parks have a specific maintenance plan which is fulfilled to a broad extent (87%).
 - Around 41% of parks and gardens that have been regenerated in the past 10 years were built or regenerated in the past 25 years.
 - Barcelona has certain areas built using sustainable drainage techniques.
 - There is sufficient non-domestic water to be allocated to irrigating parks and gardens: 12% of green spaces are irrigated using groundwater; 52% of all irrigation is automated.
 - Around 9.5% of lawns in Barcelona are warm climate lawns.
 - Currently 100% of trees are computer managed although the specific computer application for green areas is still under development.
 - The implementation of a visual analysis of street trees has increased their safety by 87%.
 - The 10,000 tonnes of plant remains generated by the pruning and maintenance of green spaces is transformed into mulch and compost to be reused in green spaces.
 - The vegetation on the coastline bears problems in adapting to its specific conditions.
-

2.4

Key concepts of the diagnosis

The review carried out has highlighted the fact that the following aspects should be subject to specific improvements:



Structure and ecological services



layering



diversity of species



mosaic of habitats

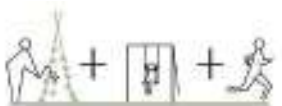


pro-ecological
service design

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Quality of life



uses and activities



enjoyment



wellbeing



participation and interaction

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Cultural heritage



identity, heritage



preservation of historical gardens



listing and protection

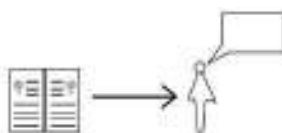


preservation of species marking identity

Communication and education



educational activities



dissemination



education



debate and reflection

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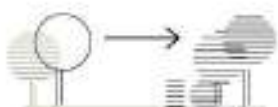
Management and maintenance



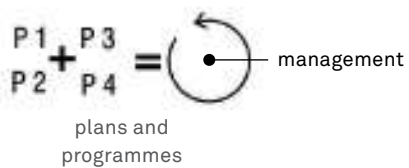
maintenance



eco-efficiency



preservation of street trees



plans and programmes

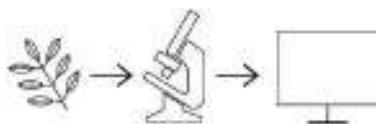
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Commitment



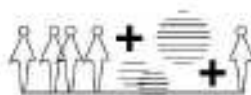
global commitment



knowledge of biodiversity



citizen involvement



networking

3.

WHAT KIND OF GREEN INFRASTRUCTURE AND BIODIVERSITY DO WE WANT?

Defining the future of Barcelona in relation to green infrastructure and biodiversity is one of the key goals of the plan. The formation of a vision has taken place based on an analysis of the current situation, the gleaning of experiences from other cities and a joint prospective effort to re-conceive and imagine the city we would like.

Barcelona Green Infrastructure and Biodiversity Plan envisages Barcelona in 2050 as a **city where nature and urbanity interact and enhance one another** by ensuring the connectivity of green infrastructure:

- A city which has **green infrastructure** that reconnects the city itself with the broader territory and offers social and environmental services: resilience, landscape, health, beauty, culture and opportunities for people to socialise.
- A city where **biodiversity is appreciated** as the Earth's natural heritage and **is preserved and strengthened** as being beneficial to individuals and present and future generations.
- A city where **every opportunity should be taken in order to make way for nature** and encourage people to come into contact with natural elements.

In accordance with this vision, the plan is organised into ten strategic lines which are defined in actions aiming to strengthen and lend value to green infrastructure and biodiversity in the city.

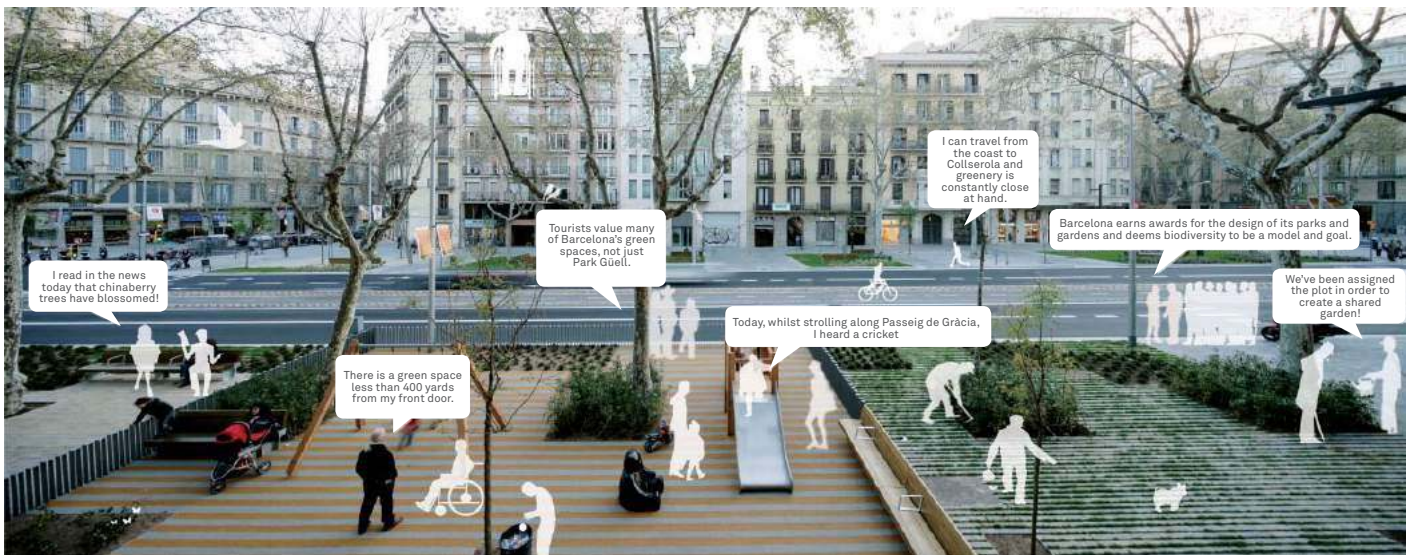
In addition to setting out an action plan, the plan itself envisages a **model of an urban green network** and, accordingly, a city model where green infrastructure is not an ornamental compliment but rather constitutes genuine green infrastructure.

This model is developed on the basis of two key concepts, connectivity and renaturalisation, and is defined by means of two instruments:

- **Urban green corridors**, to constitute a real, robust and functional network of green infrastructure.
- **Opportunity areas**, of varying kinds and sizes ranging from unoccupied plots to green roofs and balconies which can be identified in all neighbourhoods in Barcelona and are likely to be subject to renaturalisation and revitalisation.

These instruments are set out on the following pages.

Poster 21.
City vision for 2050: Barcelona, a city
where nature and the urbanity converge
and enhance one another



Barcelona in 2050 may look something like this

3.1

Green corridors

Urban green corridors are strips with a high presence of vegetation which are exclusively – if not with priority status – used by pedestrians and bicycles. These paths cross the urban fabric, ensuring connectivity and connections between the various green spots within the city.

All the green corridors form a functional green network connected to outlying natural spaces affording genuine green infrastructure within the city.

Likewise, urban green corridors are axes that stand out owing to the quality of their areas for walking or resting, and on account of the presence of nature in proximity to citizens. This presence makes the city more affable while it creates appealing habitats for fauna and multiplies the social and environmental benefits. Indeed, urban green corridors also play a strategic role in attaining a sustainable city.

In order to showcase this proposal, four illustrations are shown: poster 22 “Green corridors, metropolitan area” illustrates this relationship with the closest setting in the metropolitan region, and with the four natural areas surrounding the city: Collserola, the coastline, the river Besòs and the river Llobregat. Poster 23 “Urban green corridors” shows the proposed layout of the network of corridors and its vital role in Barcelona’s green infrastructure. Poster 24 “Depiction of corridors in the eastern area of the city” shows a simulation of corridor formation in this area. Lastly, poster 25 “Visual tour of three urban green corridors” depicts photographic trails showcasing the corridors lying between Collserola and the Fòrum, and Ciutadella and Montjuïc, which demonstrate the viability of connecting existing green spaces in the urban fabric with one another and with the natural environment.

Poster 22.
Green corridors, metropolitan area

Barcelona's network of urban green corridors links the green spaces within the city to the four major natural areas surrounding it: Collserola mountain range, the coastline, the river Besòs and the river Llobregat.



Poster 23.
Urban green corridors

Green corridors connect outlying natural areas with the urban fabric and provide a backbone for the city's ecological infrastructure to thrive by incorporating green spaces and fostering biodiversity.

- urban green corridors
- landscaped areas or areas with natural vegetation
- urban area with major presence of private greenery



Poster 24.
Depiction of corridors in the eastern
area of the city



Poster 25.
Visual tour of three urban green corridors

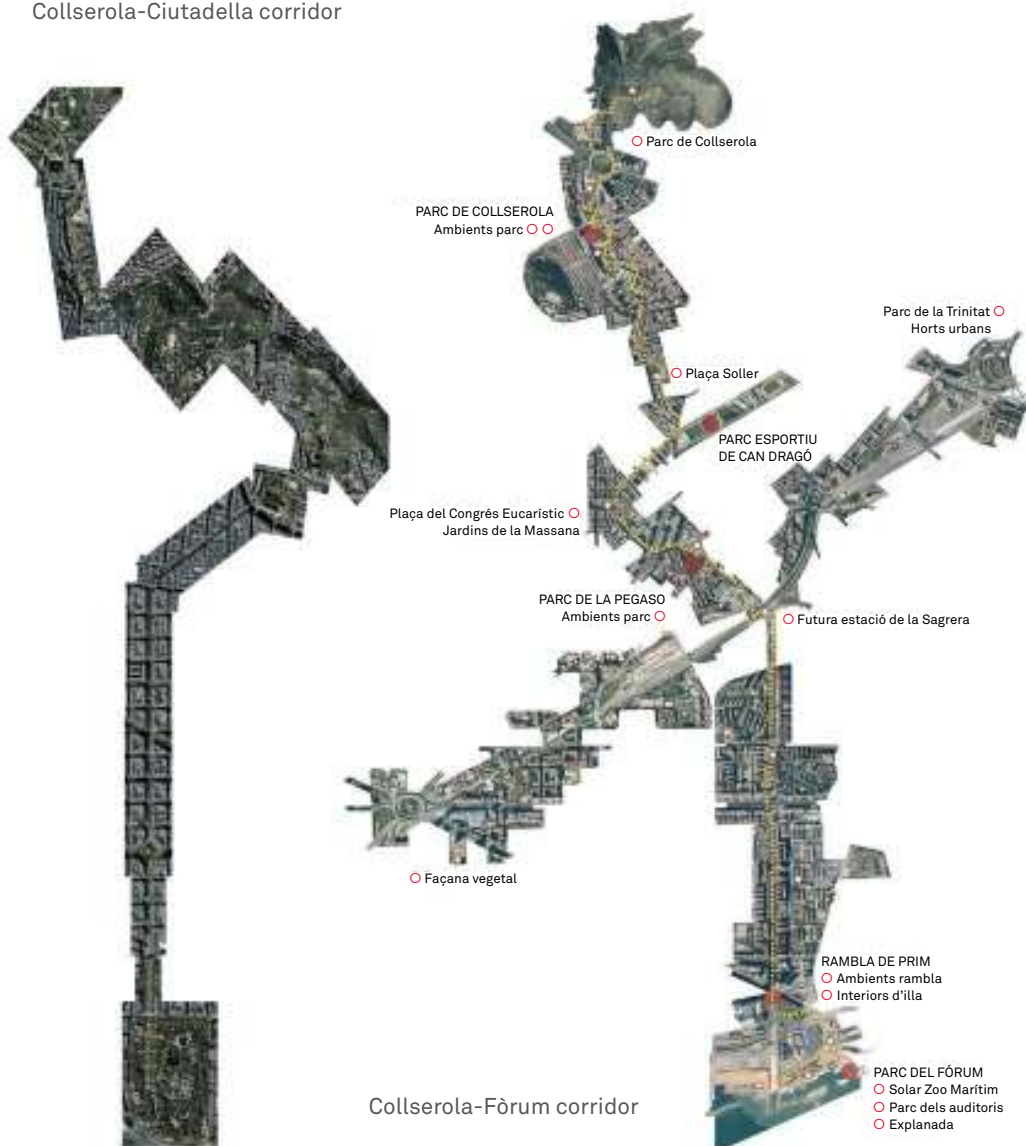
This poster illustrates Barcelona's urban green corridors connecting Collserola with the coastline. There are three different views based on a photographic trail along the streets, squares, parks and gardens on each route.



Collserola-Montjuïc corridor



Collserola-Ciutadella corridor



Collserola-Fòrum corridor



3.2 Opportunity areas

Naturalisation of urban spaces entails introducing nature into a constructed setting and bringing greenery into a city structure to the greatest extent possible. A city is home to countless areas within the urban fabric affording opportunities for green infrastructure and biodiversity. Abundant vegetation close at hand balances the environmental conditions and provides a range of ecological services that improve people's quality of life and health.

Plant cover absorbs dust and pollutant particles in the air; reduces noise pollution and ground erosion; regulates dampness in the atmosphere and increases city comfort; balances the water cycles; reduces energy consumption in buildings; creates ecological connectivity, and serves as a habitat for more flora and fauna. Likewise, urban greenery forms a landscape that can serve as a place for

socialisation or gatherings, a location for taking a stroll or engaging in leisure activities in the open air, whilst reaping the benefits afforded by agreeable, rejuvenating settings.

The following posters recreate the various spaces of opportunity in the city illustrating how Barcelona's green network can tie in with the implementation of the Barcelona Green Infrastructure and Biodiversity Plan.

Poster 26. Filling gaps with green

Traditionally, greenery has flourished in Barcelona filling up empty, unused areas of the city and enhancing existing gardens. Since this strategy has seen its day, we can progress by incorporating nature into as many city gaps as possible.

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Poster 27.
The pace of nature

Thanks to the presence of green infrastructure in the city, it is possible to create dynamic urban environments that conjure up a sense of time passing by. The change of the seasons, chromaticity, and the activity of fauna generate visual and acoustic settings rich in colours, smells, sounds, textures and shapes.



Poster 28.

**New forms of urban green spaces,
within reach and productive**

Decks, roofs, balconies and walls are all elements within reach – often private – which are likely to be transformed into gardens or vegetable gardens for use by the community. They may also be converted into spaces for production and for carrying out healthy activities.



Poster 29.
From passive platforms to dynamic
and vital spaces

The city's streets and avenues can serve as settings for coexistence and socialisation provided there are peaceful areas with spaces for resting and walking within a high quality green environment.



Poster 30.

Nature is a garden and gardens are nature

Parks and gardens are privileged areas for plant and animal life within an urban setting. They host species that spontaneously live and reproduce there. Improved ecological management of gardens enhances biodiversity and boosts the natural and social interest of these spaces.



4. PLAN OF ACTION

4.1 Mission and goals of the Barcelona green infrastructure and biodiversity plan

Mission

Long-term planning of actions to achieve green infrastructure that can offer the following advantages:

- Creating benefits for people.
- Providing environmental and social services.
- Creating havens of life within the urban setting.
- Bringing nature into the city.
- Connecting and reuniting the city with the broader territory.
- Making the city more fertile and resilient in the face of future challenges.

Goals

- Preserving and enhancing the natural heritage of the city and preventing species and habitats from disappearing.
- Achieving the maximum amount of green infrastructure and ensuring its connectivity.
- Obtaining the maximum number of social and environmental services from green infrastructure and biodiversity.
- Making progress in educating society to place greater value on green infrastructure and biodiversity.
- Making the city more resilient in the face of future challenges such as climate change.

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Pardal comú (*Passer domesticus*). Plaça de les Glòries. Galanthus.

4.2

Strategic lines and actions

1. Preserving the city's natural heritage

Preserving the natural heritage is one of the key challenges of sustainable development. In the city, this particular challenge entails preserving and enhancing urban biodiversity and preventing species and habitats from disappearing. The following actions are envisaged:

- 1.1** To develop biodiversity preservation protocols for areas of major interest and to implement associated guidelines.
- 1.2** To implement preventive and corrective measures for activities in public spaces that may have an impact on biodiversity.
- 1.3** To identify and implement measures to preserve biodiversity in private gardens and other areas of special interest.
- 1.4** To consolidate vertebrate conservation programmes.
- 1.5** To prepare action plans for the conservation of special interest flora and fauna and to implement associated guidelines.
- 1.6** To launch measures to control exotic, invasive flora.
- 1.7** To prevent and control invasive and excessive animal populations.

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Parc Natural de la Serra de Collserola

2. Planning green infrastructure to ensure connectivity and strike a balance in distribution

In order to bolster green infrastructure, it is necessary to re-conceive the city's current green system. The aim is to transform it into a mesh that connects existing green spaces with one another and with the surrounding natural areas. Barcelona's network of urban green corridors must be interconnected with the entire metropolitan area, especially with the Collserola mountain range and the Llobregat and Besòs rivers. Acknowledging green infrastructure as the envi-

ronmental backbone of the city entails working to expand green areas, mainly favouring the districts with the least green spaces to ensure a fair distribution of services and benefits contributed by green infrastructure and biodiversity. The following actions are envisaged:

- 2.1** To identify the city's green infrastructure.
- 2.2** To boost projects in the city outskirts and metropolitan area for connecting green infrastructure and preserving biodiversity.
- 2.3** To implement the green corridor network project.

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Parc de Joan Miró

3. Designing the city and its green spaces taking into account environmental services and integrating criteria to enhance biodiversity

The environmental services provided by the green fabric and the biodiversity it houses are parameters that must be considered when designing the city or when taking actions that affect public areas. Green spaces help regulate the urban microclimate, they intervene in the water cycle and provide support for biodiversity. Therefore, they must be conceived and designed with these benefits in mind in order to enhance them. The following actions should be carried out:

- 3.1** To develop a Green Infrastructure and Biodiversity Charter.
- 3.2** To make ground in public areas permeable.
- 3.3** To diversify street tree species.
- 3.4** To incorporate efficient landscaping criteria in areas with limited water resources and maintenance.
- 3.5** To adapt coastal vegetation to environmental conditions.

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Parc de les Aigües

4. Creating new spaces for nature and increasing the presence of green infrastructure and biodiversity

Barcelona is a compact city with a high population density and few natural areas. Beyond the Collserola mountain range, there is very little scope for the presence of flora and fauna. Broadening this scope entails enhancing the role as a habitat played by green spaces, by providing them with more abundant, mature and layered vegetation and expanding green infrastructure to the city's various types of spaces. The following actions should be carried out:

- 4.1** To organise and create a network of local nature reserves by restoring sites of natural interest.
- 4.2** To create new green spaces in the city.
- 4.3** To increase biomass in the city by increasing the number of trees and shrubs in parks, gardens and public spaces.
- 4.4** To enrich existing green infrastructure and to enhance its habitat function.
- 4.5** To promote silence in parks so people can enjoy soundscapes.
- 4.6** To promote green decks, rooftops, walls and courtyards.
- 4.7** To create green spaces in temporarily unused plots.
- 4.8** To promote organic agriculture in urban and peri-urban areas.
- 4.9** To create seasonal gardens in urban squares.
- 4.10** To provide more soil space for street trees.



5. Managing parks, gardens and other green spaces with sustainability and efficiency criteria, fostering biodiversity

Reducing demand for water in green areas by using groundwater resources, undertaking comprehensive pest and disease control actions, using the most suitable soils, making use of plant remains and ultimately implementing management and maintenance procedures tailored to each type of vegetation... All these actions should allow city residents to enjoy a first-class urban natural heritage. Resource efficiency and optimisation are two pivotal concepts when it comes to implementing a sustainable urban greenery management model. The following actions are envisaged:

- 5.1** To improve the management of green spaces and street trees.
- 5.2** To prepare park dossiers.
- 5.3** To develop a park and garden rehabilitation programme following rationalisation criteria.
- 5.4** To optimise irrigation carried out in green areas.
- 5.5** To implement a biodiversity-friendly pest, disease and weed management programme.
- 5.6** To replace high water consumption lawns with warm climate cespitosa plants and carpeting plants.
- 5.7** To develop a protocol of action for greenery management in the event of weather-related incidents.

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Galanthus



Jardins de Mossèn Cinto Verdaguer

6. Preserving and enhancing the value of cultural heritage, especially in historical gardens

The city's parks and gardens (as a whole and in terms of their sculptural and architectural elements), as well as certain species of trees, all form part of Barcelona's cultural and historical heritage. These areas entail specific preservation and conservation requirements calling for special protection and management measures. The following actions should be carried out:

- 6.1** To prepare management plans for historical and themed parks and gardens.
- 6.2** To review local and national heritage listings so that they include all relevant historical gardens.
- 6.3** To designate Montjuïc as the benchmark of Barcelona's landscaped heritage.
- 6.4** To develop a plan for the preservation of Barcelona's distinguishing tree species.
- 6.5** To preserve and promote Barcelona's trees of local interest.

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Jardins del Palau de Pedralbes

7. Improving knowledge for the management and conservation of green infrastructure and biodiversity

In order to plan, manage and maintain our natural heritage from the standpoint of scientific and technical rigour, we must advance in our knowledge about green infrastructure and biodiversity, the behaviour and needs of the species present in our urban setting and the environmental and social benefits they generate. The conservation of biodiversity in the urban environment is a new challenge faced by local governments around the world, that still lack theoretical and practical knowledge to address it. In particular, it pays to be aware of and to monitor the transformation process that climate change is bringing about on the environment. The following actions should be carried out:

- 7.1** To undertake monitoring on the state and development of natural heritage by implementing a database and system of indicators on green infrastructure and biodiversity.
- 7.2** To prepare and update the map of green infrastructure and biodiversity.
- 7.3** To extend and pursue studies on the environmental benefits associated with green infrastructure and biodiversity.
- 7.4** To gain greater applied knowledge about the effects of green infrastructure on health.
- 7.5** To encourage research on the effects of climate change on natural heritage.
- 7.6** To determine the water demand needed to ensure the quality of vegetation.
- 7.7** To seek out and test new plant species in cooperation with research institutions and centres.
- 7.8** To gain greater knowledge of the impact of the city on global biodiversity.

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View of Tres Turons

8. Spreading knowledge of green infrastructure and biodiversity and their values, fostering training

The public is still quite unaware of biodiversity-related concepts. It is therefore very important to raise awareness of its richness, its significance, its benefits and the impacts it is subjected to. Outreach can easily highlight the city's green spaces, their associated biodiversity, the historical elements they contain and also the city's range of street trees. These issues can also be the focus of communication, education and training strategies for the citizen. The following actions are envisaged:

- 8.1** To develop and implement a communication strategy on green infrastructure and biodiversity.
- 8.2** To promote green spaces as settings for education and knowledge.
- 8.3** To set up and provide a green infrastructure and biodiversity interpretation centre in Barcelona.
- 8.4** To foster the Parc del Laberint Training Centre as a platform for promoting gardens and landscaping.
- 8.5** To promote BioBlitz-style citizen initiatives for build collective knowledge in a festive mood.
- 8.6** To raise awareness about the value of biodiversity among professionals.
- 8.7** To create resources for and provide support to schools.
- 8.8** To educate citizens in managing conflicts in coexisting with animals based on conservation criteria.

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Escola del Bosc. Montjuïc

9. Fostering green spaces as places for health and enjoyment as well as promoting citizen involvement in their creation and in the conservation of biodiversity

The city's green spaces contribute to improving people's quality of life, well-being and health. The diversity of people using the green spaces in Barcelona is an important factor to consider when planning, designing and equipping them. It should not be overlooked that, at present, for many people, parks and gardens in the city are the only chance they have to enjoy nature, and that green spaces positively contribute to interaction between people and coexistence. They also provide the perfect setting for activities that promote the social and recreational values of urban nature and foster biodiversity awareness. The major challenge for upcoming years is to encourage greater citizen involvement as a key to the preservation, management and promotion of biodiversity. The following actions are envisaged:

- 9.1 To prepare and implement a plan on social uses of green spaces in Barcelona.
- 9.2 To increase and improve the number of recreational and health facilities offered in parks.
- 9.3 To improve and diversify children's playgrounds by involving schools, associations and the community.
- 9.4 To promote private greenery by encouraging landscaped vegetable gardens, balconies, terraces, roofs, decks, walls and courtyards.
- 9.5 To open private green spaces for public use.
- 9.6 To set up a volunteer programme for the conservation, information and dissemination of green infrastructure and biodiversity.
- 9.7 To design and implement a programme of accessible neighbourhood-run flower and vegetable gardens.
- 9.8 To organise idea contests related to green infrastructure and biodiversity open to various groups.

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Parc Esportiu de Can Dragó

10. Strengthening local leadership, networking and the commitment to the conservation of green infrastructure and biodiversity

The city's footprint has an impact on nature well beyond the limits of the municipal district (resource consumption, emissions, impact of leisure, etc.). Working on improving the city means in fact working to preserve the natural heritage of all humankind; sharing experiences brings quality of life, and formalising commitments boosts projects. In order to further advance and bolster local leadership, networks need to be created and institutional relations strengthened with the organisations involved in the conservation of biodiversity and green infrastructure in the city. The following actions should be carried out:

- 10.1** To turn Barcelona into a green benchmark.
- 10.2** To actively take part in city networks and with the foremost bodies committed to addressing biodiversity issues.
- 10.3** To strengthen cooperation with the network of institutions and work hand in hand with the authorities involved.
- 10.4** To foster networking with organisations and secure their commitment to biodiversity.
- 10.5** To engage economic stakeholders in sponsorship programmes for the conservation of green infrastructure and biodiversity.
- 10.6** To promote a land stewardship system as a tool for nature conservation.
- 10.7** To make progress towards an environmentally friendly procurement policy.

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Barcelona from Montjuïc

4.3

Catalogue of actions

Action 0. Maintenance of green areas

The objective of the catalogue of actions set out in the Green Infrastructure and Biodiversity Plan is to implement a strategy for improving existing green heritage and for preserving and enhancing Barcelona's biodiversity. The maintenance and preservation of this heritage is **Action 0** in the Plan.

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Selective harvest. Parc de la Trinitat. Foto: Joan Guitart



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LINE 1. Preserving the city's natural heritage

1.1 To develop biodiversity preservation protocols for areas of major interest and to implement associated guidelines

Goal

To lend recognition to the richness of the parks and publicly-owned estates with the greatest level of biodiversity and to take care of them.

Description

This goal entails developing protocols for preserving biodiversity in green areas of major natural interest and implementing the guidelines stemming from them. These protocols shall form part of the park dossier and will include a description of the primary values in terms of minerals, flora, fauna and landscape to be conserved and an operative proposal regarding how to preserve these values.

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1.2 To implement preventive and corrective measures for activities in public spaces that may have an impact on biodiversity

Goal

To protect natural heritage, minimising the impact of urban pressures and activities.

Description

This goal involves implementing measures in relation to specific activities and actions in public areas that may have an impact, such as building works in the street and in parks (for certain works, pursuant to the Mayor's Decree on Greening of Works, approved on 15/10/2009, it is mandatory to draw up an environmental report and a greening plan detailing the specific measures adopted), recreational activities, traffic, helicopters flying overhead or the presence of individuals in breeding grounds, etc.

1.3 To identify and implement measures to preserve biodiversity in private gardens and other areas of special interest

Goal

To lend recognition to and enhance natural heritage within private gardens and other areas of interest.

Description

This goal implies becoming acquainted with the main benefits of biodiversity found in private gardens and other areas of interest. Strategies will be fostered aimed at conserving such biodiversity based on advice and support for the various zone managers.

1.4 To consolidate vertebrate conservation programmes

Goal

To preserve amphibian species in Barcelona and species of avifauna linked to the city's buildings.

Description

This goal entails incorporating the protocols under trial – on preservation of species of amphibians and avifauna – within regular upkeep and restoration tasks. The excellent results attained in experiences carried out lay the foundations for a permanent commitment to this form of initiative, provided aspects with scope for improvement are addressed.

1.5 To prepare action plans for the conservation of special interest flora and fauna and to implement associated guidelines

Goal

To conserve species of flora and fauna which are protected, under threat or of major interest in Barcelona city.

Description

This goal entails identifying the species of flora and fauna that require specific support and implementing actions to protect them, establishing criteria and systematically setting out the tasks to be carried out. It also includes preserving those ornamental plant species that are traditional or emblematic to Barcelona owing to their unique nature and their ability to adapt: it is necessary to draw up a selection of the foremost species and endeavour to protect them.

1.6 To launch measures to control exotic, invasive flora

Goal

To ensure Barcelona does not become a haven for the spread of invasive plants in the local natural environment, especially in Collserola Park and along river courses.

Description

This goal encompasses drawing up and implementing the Plan for the Management of Invasive Plants, which will include such actions as measures to prevent colonisation by invasive plants using suitable gardening practices; control strategies to be carried out, including the maintenance of public green areas to avoid problematic species expanding in the setting; the establishment of a system for assessing the risk of invasion of new species that are being introduced; work coordinated with the competent authorities, and communication actions addressed to the owners of private gardens.

1.7 To prevent and control invasive and excessive animal populations

Goal

To prevent and control invasive and excessively abundant animal populations for the purposes of public health, safety, avoidance of damage to public and private property and for the preservation of biodiversity.

Description

This goal involves being familiar with and monitoring animal sales outlets, checking compliance with the local bylaws.

It also incorporates promoting responsible ownership of animals and avoiding abandonment and accidental disappearances.

It is necessary to set out plans of action relating to invasive fauna populations already settled in the environment and apply measures to contain them and avoid them having an impact beyond the city limits. Moreover, populations of animals with excessive presence (wild boar, pigeons, cats, etc.) shall be monitored and actions carried out to avoid their proliferation.

LINE 2. Planning green infrastructure to ensure connectivity and strike a balance in distribution

2.1 To identify the city's green infrastructure

Goal

To establish which natural forest, agricultural or landscaped areas form part of ecological infrastructure or the green system.

Description

This goal involves studying Barcelona's ecological infrastructure in order to design the city's green system as a whole based on the environmental and social advantages provided by the natural and green areas forming part of the urban fabric, ensuring the distribution is balanced.

2.2 To boost projects in the city outskirts and metropolitan area for connecting green infrastructure and preserving biodiversity

Goal

To foster natural systems on the outskirts of the urban fabric and within the metropolitan area and ensure they merge with the city to improve connectivity.

Description

This goal involves promoting projects in the metropolitan and outlying areas to preserve biodiversity by taking part in initiatives to improve Collserola, river courses, beaches, the seabed, etc., and fostering projects in cooperation with other cities in the metropolitan area.

2.3 To implement the green corridor network project

Goal

To implement the urban green corridor project as a basic component of Barcelona's green infrastructure.

Description

This goal entails implementing the network of green corridors connecting the natural areas of Collserola and the coast to existing green areas in the urban fabric. In order to do so, the Study Defining Barcelona's Green Corridors is used as a basis to prioritise those corridors that are viable to be integrated into the setting. It is necessary to continue to endeavour in promoting the notion of green corridors and their benefits based on the exemplification of a stretch of street.

LINE 3. Designing the city and its green spaces taking into account environmental services and integrating criteria to enhance biodiversity

3.1 To develop a Green Infrastructure and Biodiversity Charter

Goal

To benefit from an instrument setting out the technical and design-related criteria for projecting green areas and city trees.

Description

The Green Infrastructure and Biodiversity Charter shall constitute the instrument that sets out all the technical elements to be fulfilled by a green area or street tree plantation project in one single document: quality of earth, volume of soil, plantation distances, distances between trees and streetlights and other street furniture, etc. It shall also determine the selection of the most suitable species and make recommendations for gaining major environmental benefits.

Indeed, the Green Infrastructure and Biodiversity Charter shall set out minimum percentages for shrubs, trees, carpeting plants and lawns in order to guarantee plant and animal diversity in areas; it shall set out a minimum percentage for permeable areas; it shall study the continuity or seasonal nature of plant life, including colour calendars, and it shall also focus on sensory-based aspects such as fragrances and sound buffering in zones.

3.2 To make ground in public areas permeable

Goal

To increase the area of permeable ground in public spaces and green zones.

Description

Actions aimed at improving the permeability of the ground are linked to both the project stage and to minor initiatives carried out in consolidated green areas and public spaces.

In this respect, the following is proposed: to determine a maximum area of waterproof ground in newly-established green areas (except for roof gardens) and in public city spaces through the recommendations of the Green Infrastructure and Biodiversity Charter; to promote the reconversion of waterproof surfaces into permeable ones in consolidated green areas (particularly in Montjuïc, where many disused tracks are covered in asphalt); to improve the knowledge and application of permeable surfaces in green areas and public places, and to dig continuous tree pits in newly-developed wide streets and in existing ones.

3.3 To diversify street tree species

Goal

To increase the variety of street trees in Barcelona working to ensure that no species exceeds 15% of all trees planted to improve their viability and environmental benefits.

Description

This goal entails continuing with the programme for replacing species of street tree: to review existing species, to detect those encountering difficulties in adapting and to seek acceptable alternatives. It also entails to plan the species to be planted in Barcelona city on a neighbourhood-based scale, working street by street.

3.4 To incorporate efficient landscaping criteria in areas with limited water resources and maintenance

Goal

To achieve quality green infrastructure in areas that are not easily accessible or have limited resources.

Description

In accordance with the levels of upkeep of green areas and the principles of xeriscaping, the aim is to reconvert small green spaces in public streets that are not easily accessible into level C areas (entailing low maintenance given the type of vegetation and the fact that the areas are used less). To do so, it will be necessary to locate such spaces, assess the current situation, conditioning factors and needs for maintenance and resources, and put forward a proposal for improvement in each case.

3.5 To adapt coastal vegetation to environmental conditions

Goal

To select the most suitable vegetation for the environmental conditions of Barcelona's coastline.

Description

This action entails drawing up a list of the species that are adapted to the coastline taking into consideration distance from the sea and those that have been tested in Barcelona and on coastal areas with similar characteristics.

It is necessary to assess the current condition of plantations on the city's coastline and set out priorities for action. Also, we shall define the sections needing more action to renew vegetation, taking into consideration the fact that especially affected areas are the trees in Plaça del Mar, the seaside promenades at Barceloneta, Nova Icària and Bogatell, as well as the trees in Parc dels Auditoris.

LINE 4. Creating new spaces for nature and increasing the presence of green infrastructure and biodiversity

4.1 To organise and create a network of local nature reserves by restoring sites of natural interest

Goal

To endow the city with quality local nature, preventing open spaces and habitats of interest for biodiversity from disappearing by reviving natural areas and creating local nature reserves.

Description

This goal involves drawing up a network of local nature reserves and implementing it in line with the proposals gathered in the Catalogue on Natural Areas to preserve local biodiversity and enable citizens to enjoy it, raising awareness about the ecosystems specific to the Barcelona plain, as it is called (dunes, marshes, mountain stream vegetation, crops, bank forests, etc.).

In order to revive areas of natural interest and create local nature reserves, specific focus shall be given to the following areas of interest: Rec Comtal irrigation channel and its agricultural surroundings, the Tres Turons area and the Besòs river park.

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4.2 To create new green spaces in the city

Goal

To endow the city with more public green spaces.

Description

This goal entails increasing green space in the city in accordance with urban planning applicable at any given time, taking advantage of the transformations envisaged for the city, such as the covering of La Sagrera high speed railway station, Marina del Prat Vermell neighbourhood, Avinguda de l'Estatut and the special plans envisaged in various city neighbourhoods.

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4.3 To increase biomass in the city by increasing the number of trees and shrubs in parks, gardens and public spaces

Goal

To increase the presence of trees and shrubs in the city's green areas in order to create a more mature, dense mass of plants improving environmental services in terms of urban vegetation.

Description

Work is carried out to increase the presence of greenery in the city, particularly in urban parks and gardens, planted areas that are likely to receive many trees and shrubs. Action will focus especially on preserving mature trees, which provide the greatest environmental advantages, and on selecting plant species based on two criteria: species shall be chosen which are not prone to climate change *a priori*, and a variety of trees and shrubs shall be chosen in terms of species, size and shape, and height in order to achieve vertical and horizontal continuity.

4.4 To enrich existing green infrastructure and to enhance its habitat function

Goal

To create more habitats in the city by providing more abundant, mature and layered urban vegetation with species that attract native fauna.

Description

This goal entails promoting the formation of wild gardens and carrying out pilot actions to make parks and gardens more appealing to native fauna, reproducing the structures found in nature as much as possible: varied vegetation in terms of layers and species, sheltered areas for avifauna, vegetation that attracts butterflies, old trees with holes, dead wood as a habitat for other species, nest boxes, ponds for amphibians, water sources, stone structures for reptiles, as well as food for wild fauna.

A garden for biodiversity shall be designed incorporating plant elements and the structures needed to create a habitat in the city, supplemented with a management plan in keeping with the pace and needs of the species living there. This garden shall serve as a means for promoting biodiversity in the city and it should therefore incorporate specific signage to detail the various processes unfolding within it.

4.5 To promote silence in parks so people can enjoy soundscapes

Goal

To promote the sound of nature in the city and raise awareness about the importance of soundscapes.

Description

This goal involves promoting soundscapes based on isolating sources of sound, designing areas to encourage the attraction of biodiversity, and incorporating trembling foliage vegetation and the presence of water jets and fountains.

4.6 To promote green decks, rooftops, walls and courtyards

Goal

To increase the volume of green space in Barcelona by landscaping rooftops and courtyards and promoting and building green decks and walls in the local area.

Description

A database shall be set up to record existing green decks and walls detailing their characteristics and making it possible to monitor them.

More greenery shall be provided on the façades and dividing walls of buildings, on green decks, courtyards and inner block areas, with a green deck being created on local buildings in each of the ten city districts.

4.7 To create green spaces in temporarily unused plots

Goal

To create local green spaces in temporarily unused spots.

Description

The formation of short-term gardens on unused plots requires a specific programme and development methodology incorporating the following stages: studying the experiences in Ciutat Vella and Gràcia; establishing minimum conditions, requirements and the short-term nature of the allocation; assessing the availability of plots that meet the conditions needed, especially in districts with a lack of local green areas (Ciutat Vella, Eixample, Gràcia and Sant Andreu); designing and implementing short-term green spaces in accordance with availability of space and in a way that ensures they incorporate the facilities needed to enable people to enjoy them and endowing them with vegetation adapted to the short-term nature of the allocation.

4.8. To promote organic agriculture in urban and peri-urban areas

Goal

To promote agriculture in the city and outlying areas by applying a model of exploitation that provides social, economic and ecological benefits.

Description

Social and economic changes entail new models of development and there is a particular need to focus on the potential of urban agriculture, which must be carried out in a manner that fosters employment integration, local consumption and ecological production.

Ecological agriculture systems use techniques that promote sustainable ground use and exclude synthetic chemical products, among other strategies. They contribute greatly to preserving biodiversity and protecting the environment.

4.9 To create seasonal gardens in urban squares

Goal

To provide vegetation and street furniture – or increase the presence thereof – in public urban areas in spring and summer.

Description

An example can be taken from other European cities where it is typical practice in spring and summer to establish short-term gardens on paved areas (such as Place de l'Hôtel de la Ville in Paris or Place du Commerce in Lyon) and plant at least one short-term garden in each district if the layout of public spaces allows for it.

Paved areas liable to be occupied with a short-term garden shall be located especially in less favoured districts and in the busiest spots. A small landscaping project shall be prepared for each area with vegetation that is expansive, in containers and street furniture.

4.10 To provide more soil space for street trees

Goal

To establish strategies for providing more soil space for street trees in Barcelona.

Description

A pilot experience on structural soil carried out recently on Barcelona is being monitored and is currently undergoing assessment. Once its viability has been assessed the experience can be extended to the other districts.

In the public area, streets wider than six metres shall be located as they provide scope for transforming individual tree pits into continuous pits. Tree pit conditions shall also be improved in the remaining areas with street trees.

LINE 5. Managing parks and gardens and other green spaces with sustainability and efficiency criteria, fostering biodiversity

5.1 To improve the management of green spaces and street trees

Goal

To benefit from quality green spaces and street trees.

Description

The processes and instruments available for managing green spaces – quality control programmes, environmental certifications, etc. – shall be analysed and reviewed along with the procedures for carrying out maintenance in green areas in order to identify potential best techniques, such as a review of purchase specifications for materials and plants, soil, etc. With regard to street trees, the process for planting new trees will be assessed and irrigation of newly-planted trees will be prolonged throughout the first four years. Current pruning criteria will also be examined to ensure the actions carried out guarantee the quality of the trees and the environmental benefits they provide, whilst preserving biodiversity and adhering to safety criteria.

The NEV computer application for managing green spaces and street trees will be improved and the plan for the renewal of street trees will be defined.

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5.2 To prepare park dossiers

Goal

To benefit from a dossier setting out the history, the maintenance criteria and the criteria for the future management of each park.

Description

An individual dossier shall be prepared for all of Barcelona's major parks and gardens detailing their origin, the maintenance criteria needed to preserve their unique nature and biodiversity, along with a short-, medium- and long-term maintenance and management plan. This dossier can be subject to changes and additions, and it must serve as the road map for all actions carried out in each space.

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5.3 To develop a park and garden rehabilitation programme following rationalisation criteria

Goal

To improve preventive maintenance and renovation of green spaces, particularly infrastructure, in order to avoid or delay action needed for rehabilitation or restoration.

Description

Constructed elements and infrastructure in green spaces need a maintenance programme that focuses on their preservation and adaptation to new uses, regulations and safety. A civil engineering maintenance plan may be included in the park dossier (see 5.2) setting out the maintenance and renovation tasks in a planned manner.

5.4 To optimise irrigation carried out in green areas

Goal

To ensure the irrigation needs of plants in green areas and nurseries are provided for making wise use of water.

Description

An inventory is to be compiled on all areas with an irrigation system installed depending on whether they are programme-operated or manual. Those that are manual shall be automated.

The current state of irrigation systems shall be assessed and a decision made as to what system is most appropriate to ensure they are optimal.

Tele-management will continue to be implemented: it is necessary to define the areas that can be adapted to this system.

The groundwater network shall be extended to more green spaces in accordance with the Alternative Water Resource Plan of Barcelona.

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5.5 To implement a biodiversity-friendly pest, disease and weed management programme

Goal

To preserve a setting of environmental quality to provide support to the city's natural systems.

Description

Endeavours will continue along the lines already established of conducting plague management on urban vegetation using less aggressive products and systems, and performing biological control tests.

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5.6 To replace high water consumption lawns with warm climate cespitose plants and carpeting plants

Goal

To reduce water consumption and maintenance costs in green spaces by reducing the area of high consumption lawns and expanding the use of warm climate cespitose plants (C4) and low consumption carpeting plants.

Description

An inventory shall be prepared on spaces and areas with lawns, identifying their composition.

A list shall be prepared on places and surfaces where C4-type lawns are to be laid following criteria regarding use of the areas, their location and their level of maintenance.

In areas that are not easily accessible for maintenance, low water consumption carpeting plants can be studied as an option.

5.7 To develop a protocol of action for greenery management in the event of weather-related incidents

Goal

To find out how to act in the event of adverse weather conditions. To define preventive actions and prepare protocols in order to be familiar with how to act once such conditions have occurred.

Description

There is a need to define a protocol for action in the event of a drought, strong winds and frost. With this aim in mind, data shall be compiled on previous years when wind, frost or drought occurred to use as a reference. The most sensitive areas will be considered as a priority.

LINE 6. Preserving and enhancing the value of cultural heritage, especially in historical gardens

6.1 To prepare management plans for historical and themed parks and gardens

Goal

To benefit from an instrument for managing each of the city's historical and themed parks and gardens.

Description

A historical garden management plan must detail the history, development and actions implemented in the park, incorporating an inventory of all elements and a garden maintenance plan, in addition to a short-, medium- and long-term vegetation, architectural structure, sculpture and civil engineering renewal programme. Moreover, the management plan shall detail the specific regulations for use of these spaces to preserve their values which in some cases will entail the preparation of specific studies on their carrying capacity.

Themed gardens need specific management plans setting out the actions needed to maintain their valuable elements – collections – in excellent condition and to plan renewal in the long-term to ensure the garden upholds its essence.

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6.2 To review local and national heritage listings so that they include all relevant historical gardens

Goal

To ensure the protection of parks and gardens in Barcelona with historical or artistic relevance by including them in Barcelona Architectural Heritage Listing and the Property of Cultural Interest Listing of the Government of Catalonia.

Description

A review shall be conducted on the parks and gardens included in Barcelona Architectural Heritage Listing in order to detail the preservation actions and recommendations needed in accordance with the guidelines set out in the Florence Charter. This shall include areas of artistic and historical value that are not incorporated. Furthermore, an application shall be submitted for the Laberint d'Horta gardens to be declared Property of Cultural Interest.

6.3 To designate Montjuïc as the benchmark of Barcelona's landscaped heritage

Goal

To disseminate the heritage value of the gardens in Montjuïc.

Description

Urban transformations carried out in Montjuïc mountain throughout the 20th century have given rise to a landscape heritage comprising more than 15 gardens of varying styles and from varying eras occupying a total surface area of 70 hectares. This mosaic, which most citizens and visitors are unaware of, is a manifestation of Barcelona's history mirrored by its landscape.

6.4 To develop a plan for the preservation of Barcelona's distinguishing tree species

Goal

To ensure the presence of certain species of trees forming part of the identity and image of Barcelona.

Description

Barcelona has certain species of plants that are part of its landscape and which constitute the city's identity. Indeed, some have done so for many centuries. This is true of the plane in the Eixample district, orange trees in courtyards and mediaeval embankments, and the date palm and the Southern magnolia in the city's cloisters and courtyards. Similarly, the Mediterranean cypress, the Aleppo pine and the holm oak are characteristic species of Barcelona's landscape, especially in Montjuïc and Collserola. The preservation plan shall include an inventory, locations and the distribution of the aforementioned species, as well as any planning to replace them in the future.

6.5 To preserve and promote Barcelona's trees of local interest

Goal

To protect tree heritage by expanding and maintaining the Local Listing of Trees of Interest in Barcelona.

Description

Declaring trees to be of local interest is incumbent on town councils in line with Decree 214/1987 on declaring trees monumental of the Government of Catalonia. Barcelona benefits from a Local Listing of Trees of Interest which was launched in 1993 and sets out the most valuable trees in Barcelona on account of their size, age, rare nature, aesthetical or historical quality, unique characteristics and botanical interest. A motion to include a tree or group of trees in the listing – whether it is public or privately owned – is assessed by the Listing Committee which forwards the motion to the Plenary Board for approval. Although listed trees are suitably signposted, in many cases it is considered necessary to highlight their value by engaging in projects to improve their immediate environment by carrying out specific maintenance and working to raise awareness about such heritage.

LINE 7. Improving knowledge for the management and conservation of green infrastructure and biodiversity

7.1 To undertake monitoring on the state and development of natural heritage by implementing a database and system of indicators on green infrastructure and biodiversity

Goal

To create a global database to become acquainted with the development of species, habitats and ecological areas in Barcelona and establish a system of indicators linked to the global nature of the green infrastructure and biodiversity present in the city.

Description

It is necessary to create a database on green infrastructure and biodiversity that includes the development of species and all areas with natural vegetation or landscaping. In terms of green infrastructure, the database will include the following aspects: ownership, management, use and access relating to the area, the type of green infrastructure and other data.

Moreover, it will be necessary to set up a system of indicators on the overall status of green infrastructure and biodiversity to monitor the development of natural heritage in all aspects: environmental, social, heritage, etc.

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7.2 To prepare and update the map of green infrastructure and biodiversity

Goal

To benefit from a map of green infrastructure and biodiversity in the city to improve the management, preservation and dissemination of such areas.

Description

It is necessary to map information on species and habitats with information from the database.

The existing application for street tree and green space management (Natura Espais Verds – NEV) shall be reviewed and suitable amendments for its improvement shall be put forward. It is also necessary to map green areas that are pending inclusion in the NEV, as well as existing private green infrastructure.

7.3 To extend and pursue studies on the environmental benefits associated with green infrastructure and biodiversity

Goal

To broaden knowledge on the environmental benefits of vegetation and green spaces.

Description

This goal entails examining the benefits of vegetation and biodiversity for quality of life. Certain pertinent aspects include reduction of pollution in the atmosphere, reduction of noise pollution, moderation of temperatures, regulation of the water cycle, and so on.

Indeed, it is necessary to implement joint research projects seeking support from universities and institutions that provide knowledge, whilst transferring the knowledge gained by establishing permanent management criteria in the protocols to be implemented and gaining experience along the way.

7.4 To gain greater applied knowledge about the effects of green infrastructure on health

Goal

To gain greater knowledge on the effects of green infrastructure on health.

Description

This goal entails gaining greater knowledge of the positive and negative effects linked to vegetation and green spaces. Along this line of research, the aim is to establish ties with health and research centres, as well as a host of institutions, in order to work jointly on this issue.

It is vital to minimise the effects of allergies caused by vegetation among sensitive individuals.

7.5 To encourage research on the effects of climate change on natural heritage

Goal

To envisage the potential effects of climate change on biodiversity and green spaces.

Description

It is necessary to study the vulnerability of vegetation and biodiversity when it comes to climate change, in order to keep natural heritage in excellent condition, adapted and affording the greatest number of environmental and social benefits to people,. Proposals shall be included on how to adapt vegetation to climate change.

7.6 To determine the water demand needed to ensure the quality of vegetation

Goal

To benefit from the water needed to meet the needs of Barcelona's vegetation in the future.

Description

It is necessary to envisage water demand in light of the increasing number of green areas: Parc de la Sagrera, Marina del Prat Vermell, Vallbona eco-neighbourhood, future green corridors, Tres Turons area, etc. It is necessary to envisage the likelihood of having to irrigate trees along emblematic city streets in order to guarantee their survival.

It is also vital to examine alternative water solutions (regenerated or groundwater) for irrigating green spaces, as well as to determine the quality of the water and its effects on plants and the irrigation system.

7.7 To seek out and test new plant species in cooperation with research institutions and centres

Goal

To seek new species in order to broaden plant diversity and forge more natural green spaces that are less susceptible to the effects of climate change.

Description

In conjunction with the plant production sector, a listing shall be drawn up of the foremost species that are likely to be planted in Barcelona including the main vital forms (trees, shrubs, perennial plants, carpeting plants, climbing plants and cespitose plants), preferably native and supposedly scarcely vulnerable to climate change.

The viability of their introduction shall be examined.

Information will be compiled on the most suitable plants serving as a refuge and food for native wild fauna.

7.8 To gain greater knowledge of the impact of the city on global biodiversity

Goal

To gain knowledge of the impact of the city beyond Barcelona as a requirement for establishing priority measures to reduce this impact.

Description

The manner in which Barcelona city makes use of the Earth's natural resources, as well as how the impact this entails can be reduced (forest resources, earth and fertilisers, plants, animals and food, etc.) shall be studied, fostering sustainable use of natural resources.

In particular, knowledge of illegal trade in species must be gathered.

LINE 8. Spreading knowledge of green infrastructure and biodiversity and its values, fostering training

8.1 To develop and implement a communication strategy on green infrastructure and biodiversity

Goal

To disseminate the values of urban nature and the environmental and social benefits of green infrastructure and biodiversity among the general public.

Description

A communication plan shall be defined which sets out the strategy for disseminating the values of Barcelona's natural heritage and the benefits of biodiversity. To this end, it is important to draw up a dissemination programme that showcases green spaces and their contribution to the wellbeing of citizens, identifying the various public groups and segments of society to be addressed, determining the most suitable media needed to do so whilst establishing short-, medium- and long-term goals and implementing the actions stemming from them.

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8.2 To promote green spaces as settings for education and knowledge

Goal

To improve knowledge, awareness and respect for urban nature among citizens, promoting green spaces as educational forums.

Description

This goal entails expanding and improving the range of educational activities organised for all segments of society with new subjects and approaches: gardening workshops at a variety of times and for varying audiences, excursions, discussions, courses and debates on natural heritage and green spaces. It also encompasses preparing plans for interpretation describing the values of each space and how to show them to the visiting public whilst forging resources for conservation and enjoyment.

8.3 To set up and provide a green infrastructure and biodiversity interpretation centre in Barcelona

Goal

To illustrate the values of urban biodiversity and green spaces at an interpretation centre in order to promote those values and encourage preservation and enjoyment of them.

Description

A centre will be set up for the interpretation and documentation of biodiversity and green spaces in order to spread knowledge of urban nature and provide resources to enable people to enjoy it and for it to become a benchmark of Barcelona.

8.4 To foster the Parc del Laberint Training Centre as a platform for promoting gardens and landscaping

Goal

To establish the Laberint Training Centre as a benchmark and vehicle for technical training on green infrastructure and landscaping in Barcelona.

Description

This goal entails implementing the strategic plan of the Laberint Training Centre, which sets out the following priorities: expanding the training courses and resources offered to educate citizens and green infrastructure professionals; offering a programme of activities and training intended to improve knowledge of landscaping, and establishing channels for communicating, promoting and disseminating the centre and its activities.

8.5 To promote BioBlitz-style citizen initiatives for building collective knowledge in a festive manner

Goal

To encourage initiatives to promote involvement, knowledge and enjoyment of local nature by citizens.

Description

A BioBlitz is a citizen initiative aimed at collective identification of the plants and animals living in the city. It takes place in the form of an intense workshop. The initiative benefits from the participation of citizens, academic institutions, nature entities and the authorities. Other actions pursuing the same goals should be fostered.

8.6 To raise awareness about the value of biodiversity among professionals

Goal

To promote awareness of the values of biodiversity among professionals linked to urban planning, architectural and environmental practices.

Description

It is important to engage in training and technical debate initiatives (working sessions, conferences, debates, workshops, publications, etc.) for professionals involved in the planning, design, construction, restoration, maintenance and management of areas. Consultancy shall be on hand and protocols will be in place for specific cases.

8.7 To create resources for and provide support to schools

Goal

To strengthen the task carried out by the school network by creating resources to foster the values of green infrastructure and biodiversity.

Description

Support shall be given to the school network on the context of Agenda 21 in the form of advice, teaching resources, new project proposals, experience sharing among schools, etc. Lines of assistance will be provided to create school gardens and vegetable gardens; plants, technical information, debates and exchanges shall be offered, etc.

8.8 To educate citizens in managing conflicts in coexisting with animals based on conservation criteria

Goal

To enable native animals to survive in the city alongside the population and their pets.

Description

It is necessary to prepare specific educational materials and programmes intended to promote coexistence among individuals and animals, both wild and captive, based on a criterion of safety for the people and preservation of biodiversity.

These programmes are pertinent in order to avoid the domestication of native animals (wild boar), to prevent possible attacks in homes by birds of prey on caged birds, and to avoid the destruction of nests or the removal of holes of interest to protected birds in buildings, among other initiatives.

LINE 9. Fostering green spaces as places for health and enjoyment as well as promoting citizen involvement in their creation and in the conservation of biodiversity

9.1 To prepare and implement a plan on social uses of green spaces in Barcelona

Goal

To provide a tool for planning and management defining uses of green spaces in the city and providing the services and facilities needed to address the increasing number of users and meet new demands.

Description

The preparation of the Plan for Social Uses of Green Spaces initially entails an analysis on a city scale of the services and facilities currently found in green spaces. This will be carried out by broadening knowledge of the social and cultural circumstances, verifying existing uses and taking into consideration the criterion of proximity. Work will be conducted in cooperation with institutions and experts familiar with the territory.

The plan shall similarly identify new needs for uses, services and facilities according to the various types of users whilst defining criteria for adaptation in spatial, time-based and social terms.

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9.2 To improve and increase the number of recreational and health facilities offered in parks

Goal

To ensure that green spaces benefit from facilities and services suited to the variety and age of users.

Description

The evidence of a different social demand, marked by demographic aspects, changes in the population structure and the consideration of green spaces as areas for health and recreation gives rise to new circumstances, behaviours and uses in public spaces. Indeed, it is necessary to endow green spaces with elements for people's recreation and health, whilst strengthening their role as a place for socialising. It is also necessary to review, improve and/or set up new facilities, such as health areas for senior citizens, health circuits for young people, and therapeutic circuits or reception areas for children and teenagers.

9.3 To improve and diversify children's playgrounds by involving schools, associations and the community

Goal

To benefit from children's play areas, designed with the cooperation of schools, institutions and citizens, to encourage independence and creativity among children.

Description

Progress needs to be made in aspects of design and improvements must be made to playground equipment to promote independence and creativity among children whilst guaranteeing the safety of users. This must be a joint endeavour on the part of authorities, the educational community and social entities.

It is essential to organise and develop the participation process and forums for debate, and to conduct pilot experiences based on the result of joint efforts.

9.4 To promote private greenery by encouraging landscaped vegetable gardens, balconies, terraces, roofs, decks, walls and courtyards

Goal

To encourage civil society to become involved in creating green spaces in the private sphere.

Description

The expansion of private green infrastructure shall be part of local policies, in light of the contribution the green spaces in the city make as a whole to the environment, regardless of the means of ownership. Actions to be carried out include: the landscaping of roofs for use by residents, based on technical support from professional associations in the relevant sectors; the placement of green decks on newly-constructed buildings, thanks to grants and promotion of examples, and gardening on balconies and terraces in order to create small green spots to improve the urban landscape and serve as a refuge for the respective fauna. It is also necessary to progress in involving shops and companies, promoting the placement of green decks and walls as well as the landscaping of inner courtyards that are open to the public during opening hours.

9.5 To open private green spaces for public use

Goal

To afford citizens greater opportunities to access gardens and courtyards the use of which is currently restricted.

Description

The need to increase nearby green infrastructure in less favoured areas of the city entails looking for several possible formulas, including making courtyards and gardens belonging to public and private institutions, and the use of which is currently restricted to the owners or associates, available for public use. The tasks to be carried out in this regard are as follows: identifying the places that may be opened to the public, establishing agreements with owners and putting forward a motion for regulating use of these areas.

9.6 To set up a volunteer programme for the conservation, information and dissemination of green infrastructure and biodiversity

Goal

To promote volunteering in relation to knowledge and preservation of urban biodiversity and increase the number of people who enjoy the natural heritage and contribute to its preservation.

Description

One of the challenges for Barcelona City Council is to involve citizens in the preservation and promotion of natural heritage. To do so, it is initially necessary to determine the viability of setting up a volunteer programme in conjunction with city institutions and associations, and designing and implementing it with people of varying profiles.

9.7 To design and implement a programme of accessible neighbourhood-run flower and vegetable gardens

Goal

To foster the use of provisional plots by means of landscaping or by creating community vegetable gardens with the involvement of residents.

Description

The strategy for carrying out this action essentially entails locating public and private plots available in the city on which no construction is planned for a certain time so they may be allocated to groups interested in managing a communal garden in the short-term. Moreover, the possibility of allocating certain plots in public parks and gardens shall be examined where they meet certain characteristics in terms of location and management problems. In order to implement this strategy, it is necessary to look into the legal viability of allocating plots in the short-term free-of-charge to institutions, associations and residents. It is essential, too, to establish certain terms of use, for instance, stipulating that such allocations must be open to the general public during a timetable established beforehand. This programme will make it possible to extend the current local urban vegetable garden project to new groups in society, exploring new forms of management which make it possible to involve citizens to a greater extent without breaking ties with the local authorities.

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9.8 To organise idea contests related to green infrastructure and biodiversity open to various groups

Goal

To promote the participation of citizens in the design of city green spaces through brainstorming competitions.

Description

Brainstorming competitions will be organised for various groups (representatives of the social and educational fabric, and professionals in the sector) and the general public with the aim of involving citizens in the complexity of the design and management of green spaces, whilst encouraging knowledge and respect for them.

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LINE 10. Strengthening local leadership, networking and the commitment to the conservation of green infrastructure and biodiversity

10.1 To turn Barcelona into a green benchmark

Goal

To transform Barcelona into a benchmark for urban green infrastructure nationally and internationally.

Description

On the current context of environmental and social challenges on a global level, exchanges and participation in networks of technicians and experts is essential in order to progress with internal urban green infrastructure policies.

It is planned to conduct a search for institutions, bodies and associations working on the various aspects of urban green infrastructure nationally and internationally. A network will be set up with national and international institutions. Participation in conferences and workshops will be organised and the best practices of the city in relation to green heritage will be disseminated in specialist journals in the sector.

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10.2 To actively take part in city networks and with the foremost bodies committed to addressing biodiversity issues

Goal

To strengthen the city commitment to preserving the Earth's biodiversity and to strategies for action on a local scale.

Description

Active participation shall be planned in city networks and with the foremost bodies committed to the preservation of biodiversity (ICLEI-LAB, UICN, Network of Local Governments + Biodiversity 2010) engaging in an exchange of experiences and thus showing a commitment to a global problem.

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10.3 To strengthen cooperation with the network of institutions and work hand in hand with the authorities involved

Goal

To work hand in hand with the various institutions for preserving urban biodiversity.

Description

It is necessary to strengthen the commitment to Collserola Park, to cooperate with the Natural Science Museum, the Botanic Institute and Barcelona Zoo, the Public Health Agency and the authorities involved.

10.4 To foster networking with organisations and secure their commitment to biodiversity

Goal

To establish an organisational network committed to biodiversity and strengthen cooperation with nature and animal protection institutions.

Description

It is necessary to strengthen the work of all institutions, as well as the ties between them and the local authorities, whilst engaging in common work and debate processes to jointly achieve the goals of preservation.

10.5 To engage economic stakeholders in sponsorship programmes for the conservation of green infrastructure and biodiversity.

Goal

To secure financial support through sponsorship for green infrastructure and biodiversity preservation programmes.

Description

It is necessary to involve economic stakeholders in sponsorship programmes for the conservation of green infrastructure and biodiversity with the aim of helping to enhance the effects of current initiatives and engaging in new ones.

10.6 To promote a land stewardship system as a tool for nature conservation

Goal

To explore new means of preserving natural areas, such as the land stewardship system.

Description

It is necessary to promote the land stewardship system as a successfully explored route to pave the way to other possibilities for managing natural spaces.

The system shall be disseminated and the authorities shall act as a steward and/or allocate areas to institutions for them to take care of.

10.7 To make progress towards an environmentally friendly procurement policy

Goal

To make ethical purchases, promoting environmentally friendly products and materials.

Description

It is necessary to set up mechanisms to enable Barcelona City Council to enhance its environmentally friendly procurement and purchase policy based on social and environmental criteria (wood, earth and fertiliser, food, etc.). Moreover, a list of the most purchased products shall be drawn up to verify their suitability and promote those that are environmentally friendly.

4.4 MONITORING OF THE PLAN

Barcelona Green Infrastructure and Biodiversity Plan will include a **monitoring system** with a set of **indicators** to ensure that the goals of the plan are met.

The **monitoring system** consists of a regular assessment of the degree to which the tasks set out in the actions of the plan are attained over time, that is, a system measuring the volume of activity carried out for each action. The level of attainment of each action will be classified using a percentage to be determined according to the stages established in the respective file.

The set of **indicators** will assess how the condition of the city has evolved as a result of the implementation of the plan. The indicators must meet certain basic requirements, such as the interest of what is measured, availability of data over time, ease of calculation and ease of interpretation. Indicators from other

existing Catalan, Spanish, European and world systems will also be used and the most suitable will be chosen. This group of indicators will be assigned to the plan as a whole. In some cases, they may even be used to compare Barcelona to other cities around the world. The systems of indicators referred to include: the Environmental Statistics prepared by the Government of Catalonia, the Report on the Condition of and Trends in the Natural Environment in Catalonia prepared by the ICHN (Catalan Institute of Nature History), the Local Strategy and Systems of Indicators for the Preservation and Increase of Biodiversity prepared by the Local Government Biodiversity Network, the Streamlining European Biodiversity Indicators 2020 prepared by the European Environment Agency and the City Biodiversity Index or the Singapore Index stemming from the Convention on Biological Diversity signed in Rio in 1992.



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