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PROJECT

*Revitalization of
Public Space
in historic cities.*

Good Practice Manual

Sustainable & Green Public Spaces in Historic Cities

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PART II

Green areas in historic public spaces

Table of contents

I INTRODUCTION

The integration of nature within cities has become a critical subject of study, especially in the context of climate change and its growing impact on urban environments[1]. This section explores the evolving relationship between nature and public spaces in historic cities, highlighting how urban ecology can foster resilience within the frame of environmental challenges. As society becomes more aware of the importance of sustainable development, creating green, inclusive spaces within urban areas becomes increasingly vital.[2]

Historically, cities have been perceived as the antithesis of nature[3]. However, as urban planners and researchers emphasize, contemporary urbanism increasingly recognizes the vital role that natural elements play in cities[4]. From public parks, green corridors, and urban wetlands to innovative urban farming, the incorporation of natural features not only enhances the quality of life for all people, but also strengthens the ecological balance of urban areas[5]. These efforts contribute to the city's economy and resilience, a concept central to urban planning, as cities seek to withstand and adapt to the pressures of climate change, including rising temperatures, extreme weather events, and biodiversity loss. The coexistence of nature and urban development provides critical ecosystem services, such as flood mitigation, improved air quality, and temperature regulation.[6]

Moreover, the inclusion of nature reflects the unique ecology and character of each city. Cities are dynamic systems shaped not only by their architecture and infrastructure but also by their interaction with natural landscapes. By fostering diversity, inclusion and equality, and considering the diverse needs of different local communities, urban planners can ensure that public spaces are accessible and beneficial to all, promoting social cohesion and enhancing resilience. These connections help cities build their resilience against climate-induced disruptions while preserving their cultural and ecological identity.

Historic cities, with their rich cultural and architectural heritage, hold unique challenges and opportunities. These were often built with a deep understanding of the natural landscape, but modernisation demands have altered this balance. Reinventing historic cities requires not only protecting their legacy but also rethinking how a green infrastructure can be introduced in urban design, to enhance ecosystemic services and nature based solutions. This involves reintroducing nature while simultaneously respecting the heritage values of architectural ensembles and monuments.[7]

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[1] International Union for Conservation of Nature (2023); Hobbie et al. (2020); United Europe (2023); Tiberghien and Desvigne (2009).
[2] Hervás Más (2023); Haley (n.d.);
[3] Kowarik (2013); Thompson (2016).
[4] Waldheim (2016).
[5] Mostafavi and Doherty (2010);Syrbe et al. (2021).
[6] Woodruff and BenDor (2016), p. 199-210; Nevzati et al. (2024).
[7] Fariña (2011);

By referencing key academic sources and thought leaders in the field, this chapter provides a comprehensive overview of how urban areas can embrace nature to strengthen their ecological foundation and address the pressing realities of climate change.

In addition to a theoretical framework, it introduces two primary focuses on greenery: Greenery Typologies and Nature Based Solutions. Each focus works around a range of best practices, global case studies, and direct site visits to key reference sites within both the regional context of Andalusia and the broader national landscape of Spain. These exemplary projects and case studies, embody the theoretical concepts presented, showcasing diverse strategies for creating more resilient, sustainable, and livable cities.

II FOCUS 1. GT_GREENERY TYPOLOGIES IN PS

Greenery classification refers to the systematic categorization of plant species and types based on characteristics such as taxonomy, habitat, and ecological function. This classification helps in understanding plant diversity and its role in ecosystems.

GT1. Vegetation Type: tree, bushes or subarboreal, surface vegetation (meadow or lawn).

GT2. Aggregation Scale: Isolated or monumental tree, group or line of trees, tree pit or little green fragment, planter or medium green fragment, park or large green fragment.

GT3. Position: main or ground level, elevated or roof level, vegetation on balcony, patios or block interiors, party walls and other thresholds, vertical, temporary or movable.

GT4. Function: ornamental, usable, ecosystemic, green infrastructure network part, NBS implementation, ecosystemic services provision.

Figure 1 Mosaic of images taken during fieldwork in Córdoba and Málaga (Spain).

2.1 GT1. VEGETATION TYPE

A vegetation type refers to the classification of plant communities that share similar ecological and physical characteristics, allowing urban planners to effectively design and manage green spaces within historic cities.

Vegetation types are defined by their composition (e.g., trees, bushes, surface vegetation), structure (height and density), and dominant species, which vary based on local climate, soil conditions, and historical land use.

In historic city contexts, each type interacts differently with urban fabrics by enhancing cultural heritage, improving biodiversity, providing shade and microclimates, and contributing to social cohesion and community well-being.

Main topics: Tree, Bushes or subarboreal, Surface vegetation (meadow or lawn).

These topics ensure:

- **Habitat Provision,** by offering critical habitats that provide food, shelter and support biodiversity by creating spaces for pollinators and other wildlife.

- **Photosynthesis and Oxygen Production**, by converting carbon dioxide into oxygen.

- **Air Pollution Filtration,** by filtering air pollutants, enhancing urban air quality.

- **Climate Regulation,** by influencing local climate conditions through humidity and temperature.

- **Soil Protection**, by stabilizing soil and preventing erosion through their root systems.

- **Shade**, by creating cooler spaces, making outdoor areas more comfortable for humans and other species.

- **Aesthetic Appeal,** by enhancing visual interest and beauty in gardens and landscapes.

- **Privacy and Windbreaks**, by creating natural barriers that shield spaces from view and reduce wind speed.

- **Noise Barrier,** by introducing dense natural elements to reduce noise.

- **Soil Fertility,** by contributing to organic matter and nutrients.

- **Ecological Functions and Biodiversity,** by contributing to urban cooling and recreational spaces.

- **Environmental Protection,** by filtering pollutants and managing stormwater runoff, reducing water pollution and soil erosion.

- **Environmental Functionality,** by aiding in soil erosion control and water management through their root systems.

- **Maintenance,** by ongoing care to maintain appearance and health.

- **Social Benefits**, by providing spaces for recreation, relaxation, and social interactions.

- **Property Values,** by enhancing property values through aesthetic and functional improvements.

TREE

A tree is a perennial plant with a long, woody trunk that distinguishes itself from other plants for their height and woody structure. They play crucial roles in ecosystems and human environments.

Trees have a woody trunk and branches, can reach various heights (from a few meters to over 100 meters), and include species like oaks, pines, and maples. Their structure consists of a trunk, branches, leaves or needles, and roots.

They have been vital throughout history for their resources, such as wood and fruit, and are deeply embedded in cultural traditions and myths, symbolizing life and continuity[8].

*Figure 2 **ZA01** Petar Zoranic Square, Zadar, Croatia*

*Figure 3 **COR01** Main tree in the Jardines Huerto de Orive, Córdoba, Spain*

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[8] Oxford University Press (n.d.); Encyclopaedia Britannica (n.d.); Miller (1988); Bazzaz (1996); Gibbons (2002); Ecolandscaping (n.d.); UNECE (2024); Stevenson (2024); Lutz (2020)

The project of Petar Zoranic Square in Zadar, Croatia, by Architects Kostrenčić-Krebel, is a thoughtfully designed urban space that features several ancient sycamore trees, which play a central role in the square's character and ecological balance. These towering trees, with their sturdy, woody trunks and extensive branches, provide a striking contrast to the surrounding historical ruins, including Roman and medieval remains.

The sycamores not only enhance the aesthetic appeal of the square but also contribute significantly to the local ecosystem. Their height and expansive canopy create shaded areas for visitors, offering a respite from the sun and making the space more inviting for community gatherings and events. These trees are not only a visual focal point; they also support various wildlife, contributing to the area's biodiversity.[9]

The main tree in the Jardines Huerto de Orive in Córdoba, Spain, is a majestic jacaranda mimosifolia, known for its unique size and significance. As one of the oldest and most imposing trees in the garden, it surpasses the typical dimensions of jacarandas, making it a remarkable specimen.

This tree is not only a striking visual element due to its height and sprawling branches but also one of the largest jacarandas in the city. Its presence adds to the cultural and ecological value of the garden, symbolizing both life and continuity in this historic setting.[10]

BUSHES OR SUBARBOREAL

Bushes or subarboreal plants are woody plants with multiple stems or branches that typically grow to moderate heights, often found in landscaping and natural environments.

Bushes are generally under 6 meters tall with a dense appearance, while subarboreal plants have a slender trunk or central stem with multiple branches and intermediate characteristics between shrubs and trees. [11]

In historic city contexts, bushes or subarboreal plants contribute to the aesthetic appeal and greenery of public spaces, offering visual separation, enhancing biodiversity, and softening hard edges of urban infrastructure while often complementing historical architecture and landscaping designs. [12]

[9] Centre de Cultura Contemporània de Barcelona (n.d.); Kostrenčić-Krebel (2014)
[10] Tamajón (2018); Ayuntamiento de Córdoba (2014), p. 112-115
[11] Oxford University Press (n.d.), Bush.; Encyclopaedia Britannica (n.d.), Bush; RHS (n.d.).; Collins Dictionary (n.d.), Subarboreal; Andrés-Doménech (2021)
[12] Pal (2022); Dobson, Ryan (n.d.), p. 3; Biocca (n.d.);

Figure 4 **BCN01** *Plaça del Mercat del Ninot, Barcelona, Spain*

Figure 5 **SEV01** *Gardens of the Plaza de España, Sevillla, Spain*

The project of the Plaça del Mercat del Ninot in Barcelona, Spain, promoted by the Barcelona City Council features a vibrant landscape enhanced by carefully chosen bushes and subarboreal plants. These, typically under six meters tall, create a lush and inviting atmosphere in the public space. Their dense appearance offers visual separation and enhances the aesthetic appeal of the square.

The integration of these natural elements not only complements the historical architecture and traces of the old fire station's foundation walls but also contributes to local biodiversity, providing habitats for various species. With low maintenance requirements and significant visual impact, these plants play a crucial role in making the plaza a welcoming environment for the community.[13]

Plaza de España, located in Seville, Spain, is a grand semi-circular plaza built for the Ibero-American Exposition of 1929, designed by architect Aníbal González. It showcases a blend of Renaissance Revival and Moorish Revival styles, with a central fountain, an ornate canal crossed by picturesque bridges, and tiled alcoves representing each Spanish province.

Surrounding this monumental architecture are beautifully landscaped gardens, featuring neatly arranged bushes and subarboreal plants. These woody plants, under 6 meters tall, frame pathways and soften the plaza's imposing structure, enhancing both its aesthetic appeal and biodiversity, while providing a natural complement to the intricate historical design.[14]

SURFACE VEGETATION (MEADOW OR LAWN)

Surface vegetation refers to the layer of plants growing on the ground surface, forming a cover that can include different plant communities.

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[13] Col·legi d'Arquitectes de Catalunya (2018), Plaza del Mercat del Ninot.
[14] Turespaña (n.d.); Junta de Andalucia (2024); Andalucia.com (n.d.)

This surface can include meadows, which are diverse grasslands with grasses, herbs, and wildflowers; and lawns, which are managed grassy areas with a uniform appearance and limited plant diversity. Meadows vary in size and species composition depending on the environment, while lawns are generally smaller, uniform, and artificially maintained. [15]

In historic city contexts, surface vegetation like meadows and lawns enhances public spaces by providing open areas for recreation and social interactions, sustaining livestock and contributing to the overall ecological health of the urban environment, while also reflecting social and aesthetic values within a specific landscape. [16]

Figure 6 **LOGE01** *UNESCO Weltkulturerbe Kloster Lorsch, Germany*

Figure 7 **VIT01** *Plaza Amárica, Vitoria, Spain*

The UNESCO World Heritage Site of Lorsch Abbey in Germany showcases a carefully designed landscape by Lorenz Dexler and Rein-Cano Martin, recovers the footprint of a historic abbey, transforming it into a meaningful green space. This project features expansive meadows filled with a rich diversity of grasses, herbs, and wildflowers, promoting biodiversity and providing habitats for wildlife. Managed lawns complement these meadows, offering uniform grassy areas for visitors to enjoy.

Plaza Amárica in Vitoria, Spain, originally built twenty years ago to honor local painter Fernando de Amárica, has recently undergone a significant transformation by Apraiz Arquitectos. This site was once home to the painter's family garden, donated to the city in 1967, which later approved a partial reform plan to construct the plaza. The original design featured rigid geometry and obstructive walls that limited access and interaction.

The updated project now embraces a more organic approach, integrating diverse meadows and

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[15] Britannica Academic (n.d.); Meadow; Merriam-Webster (n.d.), Lawn;Grime (2001); Floodplain Meadows Partnership (2016), p. 5-9
[16] NWT (n.d.); Floodplain Meadows Partnership (2016), p. 10-18.

This landscape not only enhances the aesthetic value of the site but also serves as an important recreational area for social interactions. By bridging the historic context with the natural environment, Lorsch Abbey fosters ecological health and reflects the cultural heritage of the region, making it a vital green node in the urban landscape.[17]

manicured lawns, fostering a welcoming atmosphere for recreation and social interaction. This lush greenery enhances ecological health while reflecting the site's historical significance and memory, creating a vibrant public space that invites visitors to enjoy its beauty and rich community heritage.[18]

2.2 GT2. AGGREGATION SCALE

The aggregation scale refers to the level at which individual green spaces or elements are grouped, categorized and analyzed to understand their collective impact on urban ecosystems and human well-being.

In urban or historical contexts, understanding these scales help in planning and managing green spaces to maximize ecological benefits, enhance cultural heritage, and improve environmental resilience, while maintaining the character of historic landscapes. [19]

Main topics: Isolated or monumental tree, Group or line of trees, Tree pit or little green fragment, Planter or medium green fragment, Park or large green fragments.

These topics ensure:

- **Cooling and Comfort,** by providing shade, creating small climatized resting places that help reduce temperatures in public spaces, contributing to the overall cooling of urban areas.

- **Cultural and Historical Significance**, by serving as symbols of local heritage and history, reflecting community traditions, ceremonies and a deep cultural significance.

- **Educational Value**, by serving as natural examples to learn about history and nature.

- **Biodiversity Support**, by offering habitats for wildlife and resources for human consumption. They also facilitate the exchange of nutrients and moisture between the soil, trees, and air, supporting a balanced ecosystem.

- **Aesthetic Enhancement**, by improving the visual appeal of urban environments and enhancing the beauty and harmony of public spaces.

- **Environmental Benefits**, by improving air quality through plant-based filtration and managing stormwater runoff by absorbing rainwater. They play a crucial role in reducing flooding and maintaining a healthier urban environment.

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[17] Col·legi d'Arquitectes de Catalunya. (n.d.). UNESCO Weltkulturerbe Kloster Lorsch
[18] Duque (2012); Ayuntamiento de Vitoria-Gasteiz (n.d.)
[19] Gill (2007), p.115-133; Alberti (2005).

- **Social Well-being**, by providing pleasant spaces for people to gather, walk, or relax, they act as social areas for community activities, strengthening social bonds and fostering a sense of togetherness.

- **Urban Resilience**, by managing stormwater runoff and reducing heat, they help cities adapt to climate change and mitigate the urban heat island effect, creating more resilient and sustainable urban environments.

- **Tree Health**, by ensuring adequate space for root growth and proper soil conditions.

ISOLATED OR MONUMENTAL TREE

An isolated or monumental tree is a single, often large and visually striking tree that stands alone within an urban environment, serving as a significant historical or cultural landmark and contributing to the aesthetic and ecological value of the area.

These trees are typically very tall with large trunk diameters and broad canopies. They are commonly found in open spaces like the center of plazas, at street corners or ends, or in parks.

They generally hold cultural or historical significance, as they may be associated with important events, figures, or traditions, and are often considered symbols of heritage or continuity.[20]

*Figure 8 **ZA01** Petar Zoranic Square, Zadar, Croatia*

*Figure 9 **COR01** The Coral Tree in the Garden of Orive, Córdoba, Spain*

The Petar Zoranić Square, by Kostrenčić-Krebel Architects and, located in Zadar

The Coral Tree in the Gardens de Orive is a historic and distinctive specimen located within the ancient

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[20] Asciuto (2015), p.55, 56; Pareira (2020); Jim (2017), Abstract, p. 220, 221; Reynolds (2019); Haviset (n.d.), p. 200-213; Wordsworth Trust. (n.d.). Landmark trees; University of Derby. (n.d.); Machar (2019); Rotherham (2021), p. 137-139.

(Croatia) centers around a monumental tree species called Sicomoros, that serves as a symbol of the plaza's identity, standing prominently alongside the ruins below. This isolated tree is surrounded by wooden urban furniture that integrates seamlessly with the public space, creating a harmonious blend of nature and urban design. The tree's cultural and historical significance anchors it as a notable landmark in the area. [21]

orchards of the Palacio de Orive in Córdoba, which were transformed into public gardens. Due to its unique lean and position, it has often been used for play and as a seating area. After suffering damage to its bark, protective fencing was installed to ensure its preservation. This isolated tree stands as a notable landmark, symbolizing cultural heritage and historical continuity in Córdoba. [22]

GROUP OR LINES OF TREES

A group or line of trees refers to a series of trees planted close together, either forming a cluster (group) or arranged in a straight or slightly curved alignment (lines), often used to define spaces, provide shade, and enhance the aesthetic of urban areas.

These trees can be small to medium-sized and are often placed in a recognizable order, such as in rows along streets (avenues) or gathered in parks and courtyards. They are typically spaced to create a uniform look, with patterns varying depending on location and purpose.

In historic city cores, these formations play a crucial role in softening the urban fabric, offering cooling shade, framing important views or landmarks, and enhancing walkability, while respecting the architectural and cultural heritage of the area. They often follow the alignment of streets or plazas, preserving the historical city planning character of the urban landscapes. [23]

Figure 10 **TL01** Saint Sernin Square, Toulouse, France

Figure 11 **MAL01** Centennial Ficus trees lined up in the Alameda Principal, Málaga, Spain

[21] Centre de Cultura Contemporània de Barcelona (n.d.); Kostrenčić-Krebel (2014)
[22] Tamajón (2018); Ayuntamiento de Córdoba (2014), p. 56-59
[23] Fekete, A.(2005); The English Garden (2014); Baker, A. (2020), p. 188-189; Jim (2017), p. 181-199.

The Saint Sernin Square project in Toulouse, designed by BAU, Joan Busquets, and Pieter-Jan Versluys in 2016, converts a former parking lot into a public plaza, enhancing the historic Basilica of Saint Sernin. By adding groups of trees around the basilica, the project integrates greenery into the urban landscape, creating a space that respects the site's Romanesque heritage while fostering environmental sustainability and public enjoyment.[24]

The century-old ficus trees on Málaga's Alameda Principal create a stunning natural canopy, offering shade and coolness. Since its 19th-century origins, the Alameda Principal has undergone several changes, including paving that has impacted the trees' health. The latest transformation has expanded pedestrian areas by 86%, added over 2,000 m² of green spaces, and planted 120 new trees, reducing 395.6 tons of CO_2 annually. The ficus trees not only improve air quality and create a cooler microclimate but also serve as historical landmarks, preserving the character and identity of the Alameda Principal. [25]

TREE PIT OR LITTLE GREEN FRAGMENT

A tree pit or little fragment refers to concentrated areas of vegetation often found in urban environments where space for greenery is limited. These fragments of green are embedded within hard surfaces like sidewalks or streets, providing essential greenery in densely developed areas.

They are generally small in size, often just a few square meters and they consist of soil and plants, and may include a single tree or a small assortment of plants. Tree pits are commonly found in urban streets, sidewalks, or other types of public spaces and are designed to be integrated into the built environment.

In historic city cores, tree pits or small green fragments help preserve a connection with nature in highly dense areas, improving air quality, enhancing aesthetic appeal, and providing a sense of greenery, while maintaining the historical character of the area. [26]

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[24] Col·legi d'Arquitectes de Catalunya (n.d.); Centre de Cultura Contemporània de Barcelona (n.d.), Saint-Sernin Square; Arquine (n.d.); Metalocus (2021).
[25] Ferrary (2010); Mérida (2023); R. (2019; R. (2023);
[26] Bowler (2010); Novak, Kabelkova, Hora, Stransky (2023); Gilbertson, Bradshaw (1990), p. 287-309; Craul (1992); Gilbertson, Bradshaw (1990), p 287-309; Gill (2007); Tan and Shibata (2022); Doherty et al. (2003); GreenBlue Urban (n.d.)

*Figure 12 **TL01** Saint Sernin Square,Toulouse, France*

*Figure 13 **SEV02** Almeda de Hércules, Sevilla, Spain*

The Saint Sernin Square project in Toulouse, France, converts a former parking lot into a public plaza, enhancing the historic Basilica of Saint Sernin.

In this project, trees were added to reshape the space. Planted in defined pits within the paved square, they introduce small pockets of green amidst the surrounding dense urban fabric. These green fragments, though modest in scale, help break up the hard surfaces and bring nature into the city, improving air quality, reducing heat, and enhancing the overall aesthetic of the urban environment. [27]

The Alameda de Hércules in Sevilla, Spain, is a great example of how tree pits are integrated into the public space design. In this project, the design of these pits is unique, with a rhomboid shape that is created by the angles of the surrounding cobblestones, which are part of the overall pavement design. These small green areas provide a natural contrast to the stone and concrete surfaces, bringing a touch of greenery into the heart of the urban setting. [28]

PLANTER OR MEDIUM GREEN FRAGMENT

A planter or medium green fragment refers to a designed contained area within urban settings that supports vegetation such as shrubs, plants, or small trees.

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[27] Col·legi d'Arquitectes de Catalunya (n.d.); Centre de Cultura Contemporània de Barcelona (n.d.), Saint-Sernin Square.
[28] Public Space (n.d.), Rehabilitación de la Alameda de Hércules; Ayuntamiento de Sevilla (n.d.), Alameda de Hércules.

These areas usually consist of freestanding containers or green beds designed to support medium-scale vegetation, with sizes larger than tree pits. They are made from materials like stone, concrete, or wood, designed to fit within hardscaped areas like plazas, streets, or building fronts.

These green fragments support local biodiversity, and help integrate natural elements into the urban environment without disrupting the historical architecture or infrastructure. They reflect a city's natural and cultural heritage and promote sustainability. [29]

Figure 14 **ZA01** Petar Zoranic Square, Zadar, Croatia

Figure 15 **VIT02** Plaza Etxauri, Vitoria, Spain

The project at Petar Zoranić Square, by Kostrenčić-Krebel Architects, in Zadar, Croatia, is a great example of how medium-sized green areas can be incorporated into an urban setting. In this project, the space was carefully planned to preserve and support the square's century-old trees. These trees are housed in large, contained green beds that are integrated into the paved areas of the square. The planters are constructed to allow the trees to flourish while harmonizing with the historical ruins and modern public features surrounding them. These green areas act as natural elements that coexist with the urban infrastructure, promoting biodiversity and contributing to the sustainability of the square, all while preserving its historical and cultural character.[30]

The project of the Plaza Etxauri in Vitoria,Spain, features ecosystem planters that play a crucial role in enhancing the area's greenery.

These planters are integrated directly into the natural soil of the plaza, creating a seamless connection between the vegetation and the existing landscape. Designed to support a diverse range of plants, they are strategically placed throughout the plaza to maximize their impact.The use of these planters enriches the local biodiversity, providing habitats for various species while also improving air quality and enhancing the overall aesthetic of the space.[31]

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[29] Oke (1989); Nowak (2002); Carmona (2010); Getter (2006), p. 1276-1277; Li (2019); Mumford (1961); UrbanPot (2024); Getter (2006).
[30] Centre de Cultura Contemporània de Barcelona (n.d.); Kostrenčić-Krebel (2014).
[31] Equipamientos y Servicios Municipales (2023); Vitoria en Construcción (2023).

PARK OR LARGE GREEN FRAGMENT

A park or large green fragment refers to a sizable natural area within a city, designed for recreation and environmental benefits, often featuring a diversity of natural elements, and various facilities for public use.

Typically spanning several hectares, parks include a mix of lawns, tree groves, flowerbeds, and sometimes water features, pathways, and seating areas. They support a variety of species, from large trees to smaller shrubs and grass, creating diverse green environments.[32]

In historic city centers, parks serve as vital breathing spaces, offering contrast to dense urban fabrics while preserving th cultural and social heritage. Historically, they played a crucial role in urban planning, serving as public gathering spaces that provided a means to integrate natural landscapes within the built environment. [33]

Figure 16 **TL02** *Niel Garden,Toulouse, France*   *Figure 17* **SEV03** *Maria Luisa Gardens, Sevillla, Spain*

The Niel Garden in Toulouse, France, by Michele & Miquel is a vibrant urban park that transforms a significant area of a former military site into a green oasis for recreation and environmental benefits. Spanning several hectares, this park features a diverse landscape, including expansive lawns, tree

Maria Luisa Gardens, located in the heart of Seville, Spain, is a historic urban park spanning over 34 hectares. Originally part of the San Telmo Palace's private gardens, the park was donated to the city in 1893 and transformed into a public space. Designed by French landscape architect Jean-Claude Nicolas Forestier, the gardens feature lush lawns, tree-lined avenues, ornate

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[32] Benedict, McMahon (2002); Carmona (2021); Nowak (2006), p. 4, 8, 9; NRPA (n.d.); Benedict, McMahon (2002), p. 12-17; Gil (2007), p. 115-133
[33] Urban Green Blue Grids (n.d.); Rabbitts (n.d.); Mumm et al. (2006), p. 4-9; National Parks UK (n.d.); AGi Architects (n.d.); Young (1995).

groves, and colorful flowerbeds, which provide a habitat for various plant species and wildlife.

The design incorporates remnants of the site's archaeological history, blending natural elements with historical significance. Earth from nearby construction excavations has been repurposed to create rolling mounds and a varied topography, enhancing the park's ecological diversity and visual appeal. These elevations, along with a well-planned sequence of trees, not only add interest to the landscape but also foster a variety of habitats.[34]

fountains, and beautifully designed pavilions, blending Moorish, Renaissance, and Romantic styles.

The park is home to a wide variety of native and exotic plant species, making it a key green oasis within the dense urban fabric of Seville's historic center.[35]

2.3 GT3. POSITION

Position refers to the specific location or arrangement of greenery within urban spaces, influencing accessibility, visibility, and the overall impact on the environment.

It can vary in composition (e.g., trees, shrubs, flower beds), type (e.g., vertical gardens, street trees), and dimensions (ranging from small planters to large parklands), depending on urban design and ecological needs.

In specific urban contexts, the positioning of greenery plays a crucial role in enhancing the cultural and historical landscape, improving pedestrian experiences, mitigating environmental issues (such as heat islands), and promoting biodiversity within the urban fabric.

Main topics: Main or ground level, Elevated or roof level, Vegetation on balcony, Patios or block interiors, Party walls and other thresholds, Temporary or movable.

These topics ensure:

- **Environmental Functionality**, by managing stormwater runoff, controlling soil erosion, and contributing to air purification. They aid in rainwater management, reducing flooding and easing pressure on urban drainage systems.

- **Recreational Spaces**, by providing green areas for public use, enhancing social interactions and community life while offering aesthetically pleasing environments and recreational spaces in dense urban settings.

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[34] Centre de Cultura Contemporània de Barcelona (n.d.). Niel Garden; ArchDaily (n.d.), Ceramic paving in Niel Garden
[35] Seville City Guide (n.d.); Andalucía.org. (n.d.), Parque de María Luisa.

- **Ecological Balance**, by supporting biodiversity through the provision of habitats and interactions with the surrounding ecosystems. They promote urban biodiversity by creating spaces for urban wildlife, such as birds and insects.

- **Ground Contact**, by establishing direct contact with the immediate natural or transformed soil, contributing to biodiversity continuity and ecosystem resilience.

- **Aesthetic Enhancement and Continuity**, by improving the visual appeal of urban and natural spaces through the careful selection and arrangement of vegetation. They enhance the aesthetics of historic buildings while adding natural beauty and color.

- **Thermal Insulation**, by providing insulation and helping buildings maintain internal temperatures. They contribute to temperature regulation, offering shading and reducing heating and cooling costs.

- **Air Quality Improvement**, by filtering dust and pollutants from the air, enhancing urban air quality.

- **Noise Reduction**, by absorbing and deflecting urban noise, contributing to quieter and more pleasant living environments.

- **Optimal Space Utilization**, by maximizing the use of limited urban space and creating green areas in compact or high-rise environments.

- **Green Infrastructure**, by integrating vertical or horizontal greenery systems into a broader urban infrastructure, enhancing environmental sustainability and connectivity within the city or area.

- **Ventilation and Daylight**, by allowing natural airflow through buildings and courtyards, improving indoor air quality. They also cool surrounding areas while enabling sunlight to penetrate into adjacent buildings, reducing reliance on artificial lighting.

- **Urban Mutation and Undensifying Urban Fabric**, by creating urban voids that can change over time. They allow cities to adapt and add new uses without major rebuilding, while providing open areas within dense neighborhoods.

- **Community and Private Spaces**, by providing areas for social interactions, relaxation, and growing food. They help build a strong neighborhood sense and contribute to residents' mental well-being while offering quiet, semi-private outdoor spaces where residents can enjoy fresh air and sunlight.

- **Traditional Archetype**, by creating continuity in local cultural and architectural practices.

MAIN OR GROUND LEVEL

The main or ground level refers to the lowest, base level of a structure or landscape where elements interact directly with their surroundings, such as vegetation or built surfaces.

It typically includes low-growing vegetation such as grass, flowers, shrubs, and small trees, covering open ground areas, often within landscaped zones or planters, and can be a mix of native or ornamental species depending on the local climate and cultural preferences.

Ground-level greenery creates a visual and ecological connection between the built environment and nature, reinforcing historical and cultural continuity by preserving traditional planting practices and emphasizing the area's historical and natural heritage. Historically, ground-level vegetation has played a vital role in traditional gardens, courtyards, and urban spaces, reflecting the social, and environmental practices of different cultures.[36]

Figure 18 **TI01** *Renovation of Skanderbeg Square, Tirana, Albania*

Figure 19 **SEV01** *Plaza de España, Sevilla, Spain*

The renovation of Skanderbeg Square in Tirana, Albania, by the architectural firm 51N4E, received the European Prize for Public Space in 2018. It focuses on enhancing the ground level to foster interaction between the natural landscape and the designed built environment. This revitalization incorporates low-growing vegetation, including grass, flowers, shrubs, and small trees, which are thoughtfully integrated into landscaped zones and planters. The use of native and ornamental species reflects local cultural preferences and climate considerations.

By prioritizing ground-level greenery, the project aims to create a visual and ecological

The Plaza de España in Seville, Spain, located within María Luisa Park, is a stunning architectural masterpiece designed by Aníbal González for the Ibero-American Exposition of 1929. Completed between 1914 and 1929, the plaza features a vast semicircular building adorned with intricate tilework and bridges over a reflective waterway.

Ground-level elements play a crucial role, with lush vegetation, including grass, shrubs, and small trees, enhancing the plaza's aesthetic appeal. This thoughtfully designed greenery not only creates a visual connection between the architecture and nature but also honors Seville's rich horticultural traditions, reinforcing the area's historical and

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[36] RHS (n.d.), Ground covers; Ground cover; Hough (2004); Ak (2021), p. 85-97; Ruggles (2008); Turner (2005).

bridge between historical architecture and the natural environment. This approach not only preserves traditional planting practices but also emphasizes the square's historical and cultural significance, reinforcing a sense of continuity within the urban landscape.[37]

cultural heritage while providing a serene space for visitors.[38]

ELEVATED OR ROOF LEVEL

An elevated or roof level refers to spaces located above ground level, often on building rooftops, terraces, or platforms, designed for various uses, such as vegetation, gardens, or functional installations, and contributes to the green infrastructure above ground.

Typically composed of structural surfaces such as concrete, metal, or reinforced membranes, these spaces often host vegetation like small shrubs, grasses, or sedum, depending on the climate and design and are often designed in modular or layered systems. [39]

The implementation of elevated or roof-level greenery enhances the urban environment by adding greenery in otherwise unused vertical spaces, improving air quality, reducing urban heat, and creating more sustainable cities. In historic city cores, it preserves the visual integrity of the architectural landscape while introducing modern ecological solutions, maintaining a balance between conserving heritage and promoting environmental health. It also supports biodiversity and extends the continuity of green spaces throughout the city, even in densely built areas. [40]

*Figure 20 **OP01** Praça de Lisboa, Oporto, Portugal*

*Figure 21 **COR01** Green pergola located in the Jardines Huerto de Orive, Córdoba, Spain*

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[37] Metalocus. (2018). Renovation of Skanderbeg Square by 51N4E winner of the European Prize for Public Space 2018
[38] Turespaña (n.d.); Junta de Andalucia (n.d.); Andalucia.com (n.d.)
[39] ISDM (2016); Dunnett (2008), Oxford English Dictionary, Roof garden; RHS (n.d.),
[40] Al-Zu'bi (2017), p. 12.; National Park Service (2023); Jim (2017), p. 32-42; Cantu (2012).

The Praça de Lisboa project in Oporto, Portugal, revitalizes an urban square with an innovative elevated green roof designed by Balonas & Menano. Positioned between the historic Clérigos Church and the Portuguese Photography Center, the project blends modern ecological design with the city's cultural heritage. The green roof, featuring an olive grove, enhances urban biodiversity, improves air quality, and reduces stormwater runoff. It consists of layered systems for waterproofing, drainage, and vegetation, including drought-resistant plants.

The centennial olive trees symbolize Oporto's history, while the roof-level greenery creates a serene, sustainable space that respects the visual integrity of the historic surroundings.[41]

The Green Pergola at the Jardines Huerto de Orive in Córdoba, Spain, serves as a transitional space that seamlessly connects the Palacio de Orive to the gardens. Elevated above ground level, the pergola is designed as a functional installation that supports the growth of various vegetation, bridging the gap between natural elements and non-natural elements.

This structure enhances the urban landscape, improves air quality, and promotes biodiversity, while respecting the historical context of the area and contributing to the city's green infrastructure.[42]

VEGETATION ON BALCONY

Vegetation on a balcony refers to the cultivation of plants and small green spaces on the balconies of residential or commercial buildings, contributing to the vertical green infrastructure of cities.

These spaces are typically made up of containers, planters, or vertical gardens that hold a variety of plants such as flowers, herbs, or small shrubs, with dimensions varying based on available balcony space and structural support. [43]

The implementation of vegetation on balconies enhances the visual appeal of historic city facades, blending nature with the architectural heritage. It also improves air quality, provides shade, and contributes to biodiversity, while creating a visual continuity of greenery throughout the city. In historic cores, balcony vegetation helps humanize dense urban environments and fosters a connection between private spaces and the public realm, promoting ecological awareness and cultural preservation.[44]

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[41] Archquisition (2014)
[42] Turismo de Córdoba (n.d.), Jardines de Orive.
[43] Köhler (2008); Pauleit (2017); Wahba (2018); Krzyminska (2020).
[44] Kumar et al. (2022), p. 117-122; Waheed and Naeem (2024), p. 215-228.; Krzymińska et al. (2020), p. 180-187.

Figure 22 **VIE01** *Hundertwasser House, Vienna, Austria*

Figure 23 **COR01** *Vegetation on balconies around the Jardines del Huerto de Orive, Córdoba, Spain*

The Hundertwasser House in Vienna, designed by artist Friedensreich Hundertwasser, is an iconic residential building that embodies the integration of nature within urban architecture. The structure features colorful, undulating façades adorned with irregular windows and terraces filled with vegetation. These balconies, planted with diverse greenery, enhance the building's aesthetic appeal while promoting biodiversity and improving air quality. By blending vibrant colors and natural elements, the design humanizes the dense urban environment and fosters a connection between residents and nature.

This celebrated landmark not only preserves the cultural heritage of the area but also advocates for ecological awareness in city living. [45]

The Vegetation on balconies around the Jardines del Huerto de Orive in Córdoba, Spain, aims to enhance the city's vertical green infrastructure by introducing lush plant life to residential and commercial balconies. Drawing inspiration from Córdoba's UNESCO heritage recognized "patio" culture, this initiative encourages the use of containers, planters, and vertical gardens to cultivate a variety of plants, such as vibrant flowers and aromatic herbs.

By incorporating greenery into historic facades, the project not only beautifies the urban landscape but also improves air quality, fosters biodiversity, and strengthens the connection between private and public spaces, promoting ecological awareness within the city.[46]

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[45] Widewalls (n.d.), Hundertwasser House

[46] Turismo de Córdoba (n.d.), Concurso de rejas y balcones de Córdoba; Miller (2008), p. 114-126; Rappe and Lindén (2004), p. 75-81; Krzymińska et al. (2020), p. 180-187.

COURTYARDS OR BLOCK INTERIORS

Courtyards or block interiors are open, often enclosed spaces situated between or within buildings in urban areas, commonly contributing to green infrastructure and enhancing the quality of urban living environments.

These spaces typically have rectangular or square shapes but can also be circular, triangular, or polygonal. They are enclosed by walls or buildings and vary in size according to the block dimensions. They may feature trees, shrubs, lawns, or paved areas for recreational use and often serve as private or communal gathering spots.[47]

In many cultures, courtyards served as an archetype of urban planning, enhancing sanitation, ventilation, and light access, and they often reflected architectural styles and cultural practices. [48]

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[47] Al-Hafith (2017), p. 889-894; Abass (2022); Oxford University Press (n.d.), Courtyard; Al-Hafith (2017), p. 889-894; Han et al. (2023); Gotham & Levit (2016); Gil et al. (2007)
[48] Mahdavinejad et al (2013); Praha City Council (2021); Carmona & Tiesdell (2013)

*Figure 24 **BCN02** Jardins del recinte històric de l'Hospital de la Santa Creu i Sant Pau, Barcelona, Spain*

Figure 25 COR02 Patio de los Naranjos, Córdoba, Spain

The project of the Jardins del recinte històric de l'Hospital de la Santa Creu i Sant Pau in Barcelona, by the architects Claudi Aguiló Aran, Isabel Bennasar Félix, Albert Domingo Ollé, Roberto Gonzalez Peñalver and Sergi Serrat Guillen, revitalizes the courtyards within the historic hospital complex, enhancing the quality of urban living. Designed to align with the principles of the Cerdà Plan, the project creates a spacious garden that harmonizes with the distinctive modernist architecture of the hospital. The courtyards feature a variety of trees, shrubs, and lawn areas, providing recreational spaces for both private reflection and communal gatherings. These enclosed areas not only promote sanitation, ventilation, and natural light but also serve as a cultural reflection of urban planning practices, emphasizing the integration of green infrastructure within the city's heritage.[49]

The Patio de los Naranjos in Córdoba, Spain, is a vibrant courtyard that serves as a serene urban oasis amidst the historic architecture of the Mosque-Cathedral. Originally established in the 8th century as a site for ritual ablutions, it transformed into a key ceremonial space for Catholic worship, marked by the construction of chapels after the Christian conquest.

Enclosed by ancient stone walls, this rectangular space is adorned with approximately one hundred orange trees, which bloom beautifully in spring, infusing the area with their fragrant blossoms.

The courtyard not only provides a peaceful gathering spot for locals and visitors but also reflects Córdoba's rich cultural heritage. Each year, around 1.7 tons of bitter oranges are harvested, supporting local food initiatives and preserving the city's unique traditions while enhancing the overall urban environment.[50]

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[49] Fundació Privada Hospital de Sant Pau (n.d.).
[50] Catedral de Córdoba (n.d.); Art en Córdoba (n.d.).

PARTY WALLS AND OTHER THRESHOLDS

Party walls and other thresholds are vertical structures that separate different properties or spaces within a building or between adjacent buildings.

Typically composed of masonry or concrete, party walls are solid, vertical barriers built to ensure privacy and structural stability between adjoining buildings or units, often extending to full height and varying in thickness based on building codes and structural needs. They provide opportunities for different plant species such as ivy, climbing roses, or other vertical gardens.[51]

In densified city contexts, party walls and other thresholds contribute to the urban landscape by softening hard surfaces, enhancing aesthetic appeal, and promoting biodiversity, while maintaining the overall character of the urban historical context. [52]

*Figure 26 **MD01** Vertical garden CaixaForum, Madrid, Spain*

*Figure 27 **SSE01** Plaza Trinidad, San Sebastián, Spain*

The Jardín Vertical at CaixaForum Madrid, Spain, is a striking vertical garden created by renowned botanist Patrick Blanc. Spanning 460 square meters, it showcases over 15,000 plants from nearly 300 species, all thriving in a hydroponic system without soil. The design cleverly utilizes the party wall of the former power station, transforming an otherwise stark vertical surface into a lush, green space. This installation not only enhances

The Plaza Trinidad in San Sebastián, Spain, transforms an urban void into a vibrant public space, leveraging the backdrop of Mount Urgull. Utilizing reclaimed materials, the design harmonizes with the steep landscape, creating an inviting area for social interaction and recreation. The project incorporates party walls as vertical elements that define boundaries while facilitating biodiversity through vertical gardens, featuring climbing plants.

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[51] Wheed and Naeem (2024), p. 183-188; RHS (2016); Kumar et al. (2022), p. 117-122; Wesołowska and Laska (2019); Zazzini and Grifa (2018), p. 1143-1150.

[52] Georgi et al. (2019), p. 85-91; Carmona & Tiesdell (2013); Municipal Institute of Urban Landscape and Quality of Life (2023)

the aesthetic appeal of the historical building but also improves thermal insulation and air quality.

Situated near the Paseo del Prado, it exemplifies the harmonious integration of nature into urban architecture.[53]

This approach not only softens the hard urban surfaces but also enhances the aesthetic appeal of the plaza, contributing to the historical character of the area while encouraging community engagement through activities like fronton and traditional games.[54]

TEMPORARY OR MOVABLE

A temporary or movable green infrastructure refers to vegetation or green elements designed to be easily relocated or adjusted over time, providing flexible solutions to urban environments and historic settings.

These movable elements typically consist of portable planters, modular green walls, or transportable trees, with materials such as wood, metal, or lightweight composites, often involving species like small shrubs or hardy perennials that can adapt to varied conditions and sizes ranging from small planters to large containers. [55]

Movable greenery is significant in urban areas for revitalization and offering flexible green spaces in redeveloping zones, while in historical contexts, it allows for environmental improvement without permanent alterations to heritage sites.

[53] Fundación "La Caixa". (n.d.). Descubre el jardín vertical de CaixaForum Madrid
[54] Docomo Ibérico (n.d.); La Casa de la Arquitectura (n.d.)
[55] Ak and Gölbey (2021); Ajuntament de Barcelona (2017); Stevens et al. (2024); UrbanPot (2024)

Figure 28 BCN01 Plaça del Mercat del Ninot, Barcelona, Spain

*Figure 29 **COR03** Los patios de flores de Córdoba, Spain*

The Plaça del Mercat del Ninot project in Barcelona, Spain, promoted by the Barcelona City Council, revitalizes a previously unused plot of land, transforming it into a vibrant green space. This temporary park features a design inspired by the remnants of an old fire station, preserving the historical context while introducing flexible and movable greenery. The design includes a crisscrossing path made of porous concrete, which enhances urban permeability and water retention. Various deciduous trees and a meadow of native plants provide seasonal changes in color and texture. The project emphasizes sustainability through the use of recycled materials and movable elements, enriching the urban landscape without permanent alterations.[56]

Los patios de flores" in Córdoba, Spain, showcases a vibrant tradition that transforms the city's interior courtyards into colorful floral displays. Recognized by UNESCO as Intangible Cultural Heritage, these patios reflect the unique Andalusian architectural style, characterized by introspective spaces that invite light and air. The project employs movable greenery, including portable planters and modular installations, allowing for dynamic floral arrangements that enhance the historical ambiance without altering the original structures. This flexibility not only revitalizes urban environments but also preserves the integrity of heritage sites, creating lush, inviting spaces that celebrate nature and culture in harmony.[57]

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[56] Col·legi d'Arquitectes de Catalunya. (n.d.). Plaza del Mercat del Ninot.
[57] Alcoceba (2018)

2.4 GT4. FUNCTION

Function in the context of greenery refers to the specific role or purpose that vegetation and green spaces serve within a historic city's urban fabric. This can include aesthetic, social, ecological, and infrastructural benefits that contribute to the overall quality of life and environmental sustainability.

Functionally, greenery can be ornamental (decorative plants), usable (parks, gardens), or ecosystemic (trees for air purification), with species varying by climate, space, and purpose, from small shrubs to large trees, and covering diverse scales from private courtyards to large public spaces.

In a historical city context, greenery functions not only as beautification but also as a connector between the urban environment and nature, providing cooling, enhancing biodiversity, and preserving the cultural landscape by blending historic architecture with natural elements while improving livability and sustainability.

Main topics: ornamental, usable, ecosystemic, green infrastructure network part, ecosystemic services provision.

These topics ensure:

- **Aesthetic Value**, by enhancing the visual appeal of urban environments, contributing to cultural and heritage preservation.

- **Cultural Expression**, by reflecting local traditions through the use of indigenous or symbolic plant species.

- **Historical Continuity**, by maintaining the cultural integrity of historical areas.

- **Tourism Appeal**, by attracting visitors, boosting the local economy.

- **Cultural Events**, by serving as venues for local festivals and markets, enhancing social fabric.

- **Biodiversity**, by supporting various species, providing habitats, and promoting ecological health.

- **Pollination Services,** by attracting pollinators, supporting food production and plant reproduction.

- **Air Quality**, by filtering pollutants, improving the overall air quality.

- **Water Quality Improvement**, by filtering pollutants from runoff, promoting healthier ecosystems.

- **Water Management**, by helping with stormwater absorption and filtration, reducing flooding.

- **Carbon Sequestration**, by capturing and storing carbon dioxide, mitigating climate change.

- **Soil Health**, by enhancing soil fertility and structure, preventing erosion.

- **Microclimate Regulation**, by enhancing local climate conditions through shade and evapotranspiration.

- **Urban Cooling**, by mitigating the heat island effect, making cities more comfortable.

- **Social Cohesion**, by fostering community interaction and engagement with nature.

- **Psychological Well-being**, by creating calming environments that reduce urban stress and improve mental health.

- **Recreational Space**, by providing areas for physical activities, promoting healthy urban living.

- **Community Education**, by providing platforms for ecological education and sustainability awareness.

- **Sustainable Practices**, by supporting urban agriculture and community gardening, enhancing food security.

- **Economic Benefits**, by increasing property values and attracting tourism, contributing to local economies.

ORNAMENTAL

Ornamental refers to plantings or greenery primarily used for decorative and aesthetic purposes in public or private spaces. These natural areas are generally not intended for human use or interaction.

Ornamental plants are usually small to medium in size, selected for their colorful flowers, attractive foliage, or unique shapes, and may include species such as roses, lavender, or small ornamental trees (e.g., Japanese maple). [58]

They play a vital role in enhancing the visual appeal of historical cities and patrimonial spaces, reflecting local culture and heritage through its integration into urban landscapes. [59]

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[58] Şenik, Uzun (2022), p.203-219; Gujarat University (n.d.)
[59] Pataki (2020); Hernandez et al. (2014).

Figure 30 **BCN01** Plaça del Mercat del Ninot, Barcelona, Spain
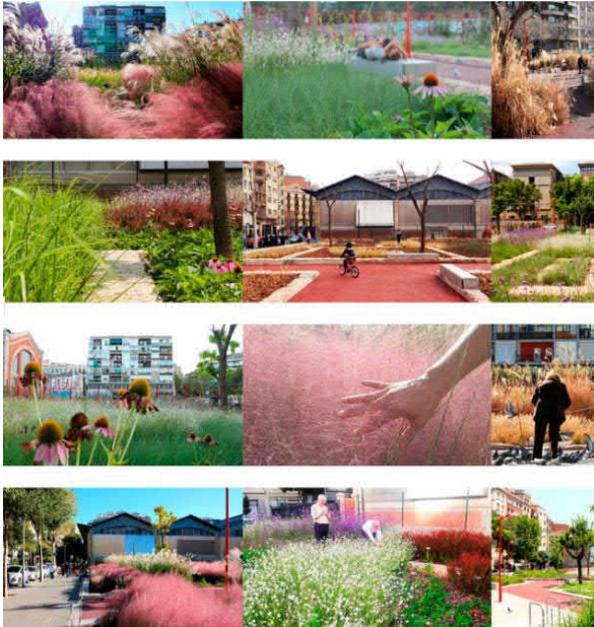
Figure 31 **COR03** Los Patios de Flores de Córdoba, Spain

The Plaça del Mercat del Ninot project in Barcelona, Spain, promoted by the Barcelona City Council, revitalizes a formerly derelict plot adjacent to the historic Ninot Market and the remnants of an old fire station. This public space is adorned with a diverse range of ornamental plants, chosen for their aesthetic appeal and seasonal variations. The design creates a dynamic landscape that changes throughout the year, showcasing vibrant flowers and foliage.

This park not only enhances the visual charm of the area but also contributes to the cultural heritage of the neighborhood.[60]

The Patios de Flores in Córdoba, Spain, celebrate the city's rich cultural heritage, transforming traditional interior courtyards into stunning floral displays. While the patios themselves are protected under the Catalog of Protected Properties of the Special Protection Plan for the Historic Ensemble of Córdoba, the Fiesta of the Patios in Cordova is recognized by UNESCO as Intangible Cultural Heritage of Humanity[61], inscribed in 2012. This festival highlights the unique Andalusian architectural style, with vibrant colors and intricate floral arrangements.

By incorporating movable greenery, such as portable planters, the project fosters creative expression while preserving the historical integrity of these spaces, revitalizing urban life.[62]

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[60] Col·legi d'Arquitectes de Catalunya. (n.d.). Plaza del Mercat del Ninot.
[61] UNESCO (2012)
[62] Alcoceba (2018)

USABLE

Usable refers to green spaces designed for practical use and functionality, such as recreation, social interaction, and environmental services, rather than purely for aesthetic purposes. These areas are thoughtfully designed to encourage people to linger, enhancing their sense of place and fostering a deeper connection with the natural elements.

It includes areas such as parks, community gardens, green roofs, or other plantings that support human activities or environmental sustainability, usually involving native or adaptable species and varying in size from small plots to large parks. [63]

In urban or historical city contexts, usable greenery plays a crucial role in revitalizing public spaces by providing areas for social interaction, recreation, relaxation, and food production, while helping to preserve the historical character of the area. [64]

*Figure 32 **CRU01** Huertas de Caramoniña, Santiago de Compostela, Spain*

*Figure 33 **COR04** Muralla y puerta de Almodóvar, Córdoba, Spain*

The Huertas de Caramoniña project in Santiago de Compostela, Spain, designed by the architectural firm Ábalo Alonso Arquitectos, integrates functional green spaces within a historic context, revitalizing the use of traditional gardens. This initiative addresses accessibility issues while transforming underutilized areas into productive and recreational landscapes. The design incorporates native species and

The gardens close to the Muralla y Puerta de Almodóvar in Córdoba, Spain, revitalizes this historic site by creating usable green spaces that foster social interaction and community engagement.

The surrounding gardens and parks serve as a backdrop for human connections, inviting visitors to relax and enjoy the area's rich history. Known as the "Puerta del Nogal" during the Arab period, this gateway connects the city to its past, and the newly designed landscapes enhance its cultural significance.

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[63] Gómez-Baggethun et al. (2013), p. 175-251; Moreno et al. (2023).
[64] Moreno et al. (2023); Opoku et al. (2024), p. 13-18; Grafius et al. (2020).

encourages community engagement, allowing residents to connect with nature through activities like gardening and social interaction.

By blending productive gardens with recreational areas, the project not only preserves the historical character of the site but also fosters a sense of place and belonging among the community, enhancing the urban environment.[65]

By incorporating native plants and thoughtful layouts, these gardens not only preserve the historical character but also promote environmental sustainability and recreational opportunities for all.[66]

ECOSYSTEMIC

Ecosystemic refers to anything related to an ecosystem, emphasizing the interconnectedness and interactions between living organisms (plants, animals, microorganisms) and their physical environment (air, water, soil) within a defined area. The term highlights the complex, interdependent relationships that support the functioning and sustainability of ecosystems. [67]

This type of greenery includes diverse plant species, such as trees, shrubs, grasses, and flowering plants, often arranged in layers and varying in size from small community gardens to larger green corridors, typically designed to mimic natural ecosystems and enhance ecological functions.

In urban historical contexts, ecosystemic processes support functions such as regulating microclimates, preserving cultural landscapes, and maintaining the environmental balance in historically dense areas, where modern development and heritage coexist. [68]

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[65] ArchDaily (2016), Huertas de Caramonina; Ábalo Alonso Arquitectos (n.d.).
[66] Art en Córdoba (n.d.), Puerta de Almodóvar.
[67] MEA (2005); GEO BON (n.d.); National Geographic Society (n.d.); Hedmark University of Applied Sciences. (n.d.). *Ecosystem processes.*
[68] de la Fuente Arana (2024); Fu et al. (2013), p. 4-10

*Figure 34 **BCN03** Parque dels Tres Turons, Turó de la Rovira, Barcelona, Spain*

*Figure 35 **VIT03** Jardineras plaza de la memoria, Vitoria, Spain*

The Parque dels Tres Turons in Barcelona, Spain, is an ecosystemic project that revitalizes an area with historical military infrastructure and informal settlements. This park integrates local flora and fauna, creating a diverse landscape that mimics natural ecosystems. The design features layered vegetation, including native trees, shrubs, and flowering plants, enhancing biodiversity and ecological functions.

By promoting connectivity between historical elements and natural habitats, the park not only preserves cultural landscapes but also improves urban microclimates. It serves as a vital green corridor, supporting environmental balance in a densely populated area, fostering community engagement with nature. [69]

The Jardineras de la Plaza de la Memoria project in Vitoria,Spain, introduces ecosystemic principles into a historically challenging urban environment. By integrating diverse plant species, the plan enhances biodiversity while creating a welcoming atmosphere. The strategically designed planters improve spatial qualities, regulating light and temperature, absorbing rainwater, and offering ornamental value. This green infrastructure not only revitalizes the square but also fosters connections between nature and the community, making the space more inviting. By mimicking natural ecosystems, the project preserves cultural landscapes and supports environmental balance, demonstrating how modern development can harmonize with historical heritage in urban settings.

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[69] Centre de Cultura Contemporània de Barcelona (n.d.), Restauración de la cumbre del Turó de la Rovira.

GREEN INFRASTRUCTURE

Green infrastructure refers to a strategic framework of interconnected green spaces that collectively support ecological functions, enhance urban resilience, and improve the quality of life in cities.

This infrastructure typically operates as a cohesive system that utilizes natural processes to filter pollutants, manage water runoff, and create habitats for wildlife, thus promoting ecosystem services essential for sustainable urban living. [70]

In urban areas or heritage sites, green infrastructure networks play a vital role by preserving cultural landscapes, and providing spaces for community interaction, which are crucial for resilient and sustainable cities.

*Figure 36 **TL02** Niel Garden,Toulouse, France*

*Figure 37 **VIT04** Anillo verde, parque Salburua, Vitoria, Spain*

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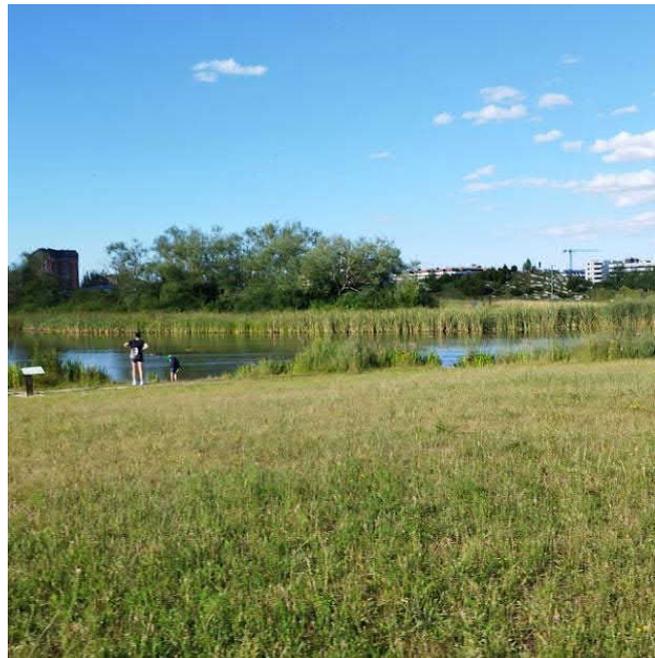
[70] Benedict et al. (2005); Tzoulas et al. (2007), p. 167-178.; European Commission (n.d.), Green infrastructure.; World Green Infrastructure Network (n.d.); TCPA (n.d.); Live Green Howard (n.d.); Natural England (n.d.)

The Niel Garden in Toulouse, France, by Michele & Miquel, is an innovative urban project designed as an extensive network of interconnected green spaces that enhance biodiversity within a historical context. This green infrastructure promotes ecological functions by utilizing natural processes to manage water runoff and filter pollutants, thereby improving urban resilience.

By preserving cultural landscapes, Niel Garden fosters community interaction through parks and recreational areas, creating vital social hubs. The project not only contributes to environmental sustainability but also enriches the quality of life for residents, embodying a commitment to creating resilient and livable urban environments that harmonize nature and heritage.[71]

The Green Ring project, particularly the Salburua Park in Vitoria, Spain, creates a vast network of green infrastructure surrounding the historic city. This project preserves and enhances the area's rich ecosystem, featuring extensive wetlands, forests, and green spaces that serve as vital habitats for local flora and fauna.

Launched in 1994, the project aims to reactivate and protect these ecologically valuable landscapes, promoting biodiversity and improving urban resilience. By integrating natural processes, the Anillo Verde also addresses urban challenges such as pollution and water runoff, while providing community spaces that foster social interaction and cultural heritage within the city.[72]

ECOSYSTEMIC SERVICES

Ecosystemic services refer to the benefits provided by natural ecosystems, which improve human well-being and support the sustainability of urban environments. In urban greenery, these services help regulate climate, air quality, and water cycles, offer habitats for species, and enhance the aesthetic and cultural value of cities.

Typically characterized by a diverse composition of vegetation types, such as trees, shrubs, grasses, and flowering plants, ecosystemic functions can be found in various dimensions, from small community gardens to expansive parks, all designed to promote biodiversity and habitat connectivity. [73]

In urban contexts, ecosystemic functions are crucial for addressing environmental challenges such as air and water quality, mitigating urban heat islands, and preserving biodiversity, thereby contributing to the overall sustainability and cultural integrity of the city. [74]

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[71] Centre de Cultura Contemporània de Barcelona (n.d.). Niel Garden; ArchDaily (n.d.), Ceramic paving in Niel Garden
[72] Vitoria-Gasteiz (n.d.), Anillo verde; Verde Norte (n.d.).
[73] Haase et al. (2014); GEO BON (n.d.); Imperial College London (2011); Department for Environment, Food & Rural Affairs (2023), p. 21-29, 229. MEA (2005); Earth.Org. (2023); MA (2005); NatureScot. (n.d.); UNECE (n.d.), Ecosystem services
[74] Department for Enironment, Food & Rural Affairs (2023).

Figure 38 **BCN04** *Recovery of the Thermal Water Canals, Caldes de Montbui, Barcelona, Spain*

Figure 39 **COR05** *Guadalquivir River and Soto de Albolafia, Córdoba, Spain*

The Recovery of Thermal Water Canals project in Caldes de Montbui, Barcelona, Spain, led by the architecture firm Ciclica, aims to restore ancient Roman thermal irrigation channels that supply water to local agricultural gardens near the historic center. This initiative involves the implementation of a water collection and purification system that uses aquatic plants to enhance water quality.

By revitalizing these canals, the project not only improves food provisioning through sustainable agricultural practices but also re-establishes essential ecosystem services that benefit urban greenery. This restoration fosters biodiversity, enhances habitat connectivity, and preserves the cultural heritage associated with traditional farming methods in the area.[75]

The Guadalquivir River and the Soto de Albolafia in Córdoba, Spain, emphasize the ecological and recreational value of this natural landscape. The river's sedimentation has fostered a rich habitat, supporting diverse flora and fauna.

This area not only serves as a vital ecosystem, promoting biodiversity and offering refuge for various species, but also enhances the city's air and water quality. Visitors can enjoy scenic walks that connect the historical city to the river, providing opportunities for relaxation and exploration in this natural monument. Additionally, the project addresses urban heat island effects, making it a crucial green space for sustainability and cultural appreciation in Córdoba.[76]

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[75] Ciclica. (n.d.). Recuperació del sistema de reg a les hortes termals.
[76] Andalucía.org. (n.d.), Córdoba: Espacios naturales – Sotos de la Albolafia; Junta de Andalucía (n.d.), Monumento natural Sotos de Albolafia; Peinazo and Sánchez (n.d.).

III FOCUS 2. NBS_NATURE BASED SOLUTIONS

Nature-based Solutions (NbS) refer to strategies that leverage natural processes to address societal challenges such as climate change, disaster risk reduction, food security, and water management.

These approaches focus on protecting, restoring, and managing ecosystems in ways that benefit both biodiversity and human well-being.[77]

NBS1. Climate change response and risk management: River Floodplains, Rain gardens, Permeable pavements, Bioswales, Other ecosystem drainage systems (tree pits, planters, roundabouts, etc.),

NBS2. Restoring degraded ecosystems and habitat improvement: Ecosystemic regeneration of forests, parks and meadows, Planting trees and native vegetation, Green roofs, Green walls, Bioretention Areas, Rivers and coasts restoration, Natural Inland Wetlands, naturalization of fountains and ponds, habitats for pollinator species, habitats for other species

NSB3. Enhancing sustainable urbanisation: Urban Farming, Community gardens, shade furniture (umbracle, awning, pergola etc.), other ecofriendly street furniture.
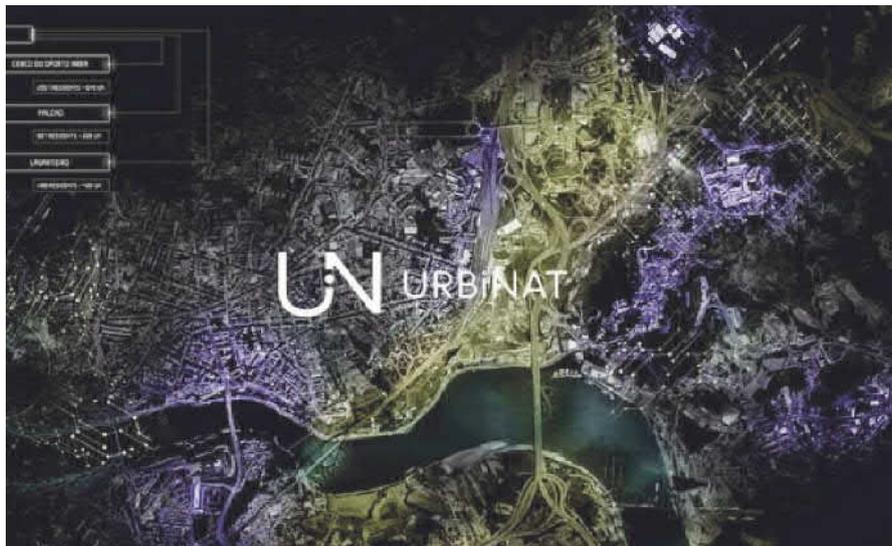
Figure 40 URBiNAT focuses on the regeneration and integration of deprived districts in urban development through innovative Nature-Based Solutions (NBS) – an Urban Inclusive Nature – ensuring sustainability and mobilizing driving forces for social cohesion. IAAC Department.Advanced Architecture Group. https://urbinat.eu/

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[77] European Commission (n.d.), Nature-based solutions; IUCN (n.d.), Nature-based Solutions; World Bank (2008)

3.1 NBS1: CLIMATE CHANGE RESPONSE AND RISK MANAGEMENT

Climate change response and risk management involves using natural processes and ecosystems to mitigate the impacts of climate change, enhance resilience, and reduce risks. In terms of nature-based solutions (NBS), they play a vital role in managing climate risks, improving air quality, enhancing biodiversity, and preserving cultural heritage, thereby fostering community well-being and resilience.

These solutions typically involve features like river floodplains, rain gardens, and other ecosystems, which use native plant species and local metabolic processes to manage and respond to climate change.

In historic city centers, climate change response and risk management are integrated into public spaces through specific Nature-Based Solutions that help reduce heat, control stormwater, and provide cooling, all while preserving the cultural and architectural heritage of the area. [78]

Main topics: River Floodplains, Rain gardens, Permeable pavements, Bioswales, Other ecosystem drainage systems (tree pits, planters, roundabouts, etc.).

These topics ensure:

- **Flood Control**, by absorbing excess river water and capturing rainwater runoff. They can reduce flood severity, protect urban infrastructure, and prevent erosion in areas prone to heavy rainfall.

- **Biodiversity Protection**, by preserving ecosystems and providing habitats for diverse species. Natural habitats support aquatic and riparian wildlife while enhancing urban biodiversity by offering spaces for pollinators like bees and butterflies.

- **Water and Air Quality Improvement**, by filtering pollutants through soil and plants, water filtration improves water quality before it recharges groundwater and reduces pollution.

- **Climate Resilience**, by storing floodwaters and allowing groundwater recharge, they help cities adapt to changing rainfall patterns and manage water sustainably to build resilience against climate change.

- **Carbon Sequestration**, by absorbing atmospheric CO_2.

- **Urban Cooling**, by increasing green spaces, reducing heat island effects and cooling down the city through evapotranspiration from plants.

- **Recreational and Aesthetic Values**, by offering green public spaces that enhance urban livability and beautify public areas with natural landscapes.

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[78] Welden et al. (2021), p. 996-977; UNDRR, UNU (2024); Benedict (2005); European Commission (2020), Nature-Based Solutions.

- **Educational Opportunities**, by teaching about ecosystems, hydrology, and sustainable urban development. Outdoor learning provides educational opportunities for community engagement and climate awareness.

- **Cost-Effective Solutions**, by using the inherent functions of hydrological and ecological systems.

- **Social Cohesion**, by encouraging the use of open spaces to promote social cohesion.

RIVER FLOODPLAINS

River floodplains are biological productive systems that leverage natural processes and ecosystems to address and mitigate environmental challenges. They are flat or gently sloping areas next to rivers that naturally flood during periods of high water, serving as crucial ecosystems that provide natural water storage, habitat for wildlife, and flood management.

Floodplains are primarily composed of sediments like sand, silt, and clay, with dimensions that vary widely depending on the river and its surrounding ecosystem. They host vegetation like grasses, shrubs, and wetland species, such as willows, reeds, and poplars, which thrive in periodically flooded conditions. [79]

In urban and historical city contexts, floodplains function as natural buffers, mitigating flood risks and protecting the integrity of the urban fabric and cultural heritage sites by controlling excess water and reducing erosion. [80]

*Figure 41 **LJU01** Area 4 of Ljubljanica Riverbanks, Slovenia*

*Figure 42 **COR06** Exterior paths along Córdoba's Alcazáres, Cordoba, Spain*

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[79] Correia et al. (1999); Mitsch et al. (2015); Tockner et al. (2002), p.308-330.; National Geographic Education (2013); Doll (n.d.); European Environmental Agency (2020); Freshwater Network (n.d.); FEMA (2024)
[80] Correia et al. (1999); UFCOP (2017), p. 2, 5-7, 8, 11.; British Geological Survey (n.d.); D'Elia et al. (2017)

The transformation project of the Ljubljanica Riverbanks in Slovenia, focuses on revitalizing various areas along the river as it flows through the historic city. The initiative aims to restore and enhance public infrastructure while preserving the river's valuable natural reserve, transforming it into a vibrant space for the community.

The design includes floodable terraces, platforms, and urban furniture, promoting both ecological health and public engagement. This project highlights the importance of floodplains in managing water, supporting biodiversity, and enhancing the urban landscape.[81]

Along the Guadalquivir River, Spain, pathways meander along the exterior walls of Córdoba's Alcázares, weaving between gallery forests and riparian vegetation of the river's floodplain.

These ecosystems absorb excess water during floods, providing vital habitat for wildlife and acting as natural buffers. Composed of rich sediments and featuring plants like willows and reeds, they help protect the urban landscape and historical sites from flood risks and erosion.

RAIN GARDENS

A rain garden is a shallow, planted depression designed to capture and absorb rainwater runoff from impervious surfaces like roofs, streets, and sidewalks, helping to manage stormwater and reduce flooding in urban areas.

They are usually 10-20 cm deep and composed of soil, mulch, and specific water-tolerant plants such as sedges and native grasses that help absorb excess rainwater while filtering pollutants. They range from small, residential installations to larger urban gardens.[82]

In urban densified contexts, rain gardens can be integrated within green corridors, parks, or near cultural landmarks, contributing to the preservation of built heritage by reducing the risk of water damage by urban flooding.[83]

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[81] Centre de Cultura Contemporània de Barcelona. (n.d.). Reestructuración de las orillas del río Ljubljanica; European Commission. (n.d.), Restoration of the Ljubljanica River corridor and improvement of the river's flow regime.
[82] Environmental Protection Agency (n.d.), Soak up the rain: Rain gardens.; Royal Horticultural Society (n.d.), *Rain gardens*.; Kasprzyk et al. (2022); Burszta-Adamiak et al. (2023);
[83] Malaviya et al. (2019), p. 141-166; Abi Aad et al. (2009); Lin et al. (2023); Osheen et al. (2019), p. 29-37

*Figure 43 **TL02** Niel Garden,Toulouse, France*

*Figure 44 **COR01** Jardines huerto de orive, Córdoba, Spain*

The Niel Garden in Toulouse, France, by Michele & Miquel architects, integrates rain garden principles to manage stormwater in a densely urbanized area. The design features mounds and valleys that naturally guide and capture rainwater runoff from paved surfaces, reducing the risk of flooding. Water-tolerant plants such as sedges and native grasses are strategically placed in these shallow depressions to absorb excess rainwater and filter pollutants.

This green infrastructure not only enhances biodiversity and urban resilience but also preserves the historical environment by mitigating water damage.[84]

The Jardines Huerto de Orive in Córdoba, Spain, is an urban rain garden designed to manage stormwater in a historic setting. Situated in the heart of the city, the garden features shallow depressions integrated into the pavement to capture and absorb rainwater runoff.

This is crucial for Córdoba's climate, where infrequent but intense downpours can cause flooding. By using native plants and specially designed soil layers, the garden helps filter pollutants while reducing flood risks. It also contributes to the preservation of Córdoba's heritage by preventing water damage in this dense, historic urban landscape.[85]

PERMEABLE PAVEMENTS

Permeable pavements are special surfaces designed to allow rainwater and runoff to pass through them and be absorbed into the ground, helping to reduce flooding, manage stormwater, and improve water quality.

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[84] Centre de Cultura Contemporània de Barcelona (n.d.). Niel Garden; ArchDaily (n.d.), Ceramic paving in Niel Garden
[85] Turismo de Córdoba (n.d.), Jardines de Orive; Puerta de los Patios (n.d.)

They are composed of porous materials like permeable concrete, asphalt, or paving stones, typically with an underlying stone reservoir, allowing water to infiltrate the soil beneath, reducing surface runoff.[86]

In historic city centers, transforming existing pavements into permeable surfaces can seamlessly integrate with the surrounding urban fabric by preserving the aesthetic continuity of traditional materials. This transformation not only enhances visual harmony but also offers other benefits, such as mitigating flood risks and reducing urban heat islands.[87]

Figure 45 **TL02** *Niel Garden,Toulouse, France*
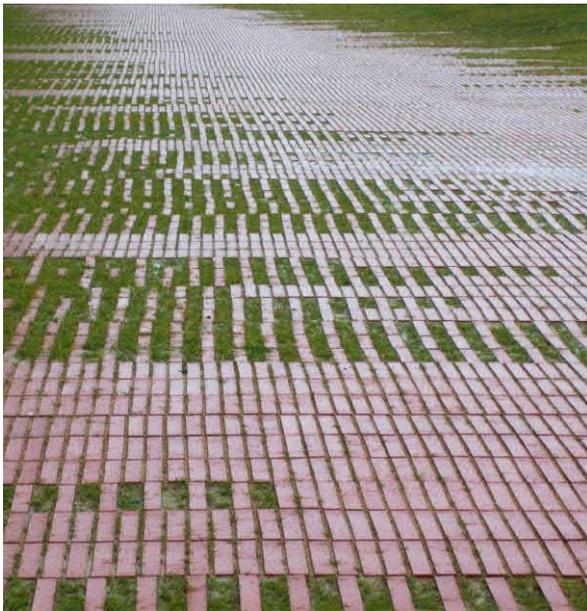
Figure 46 **COR07** *Jardínes de los poetas, Córdoba, Spain*
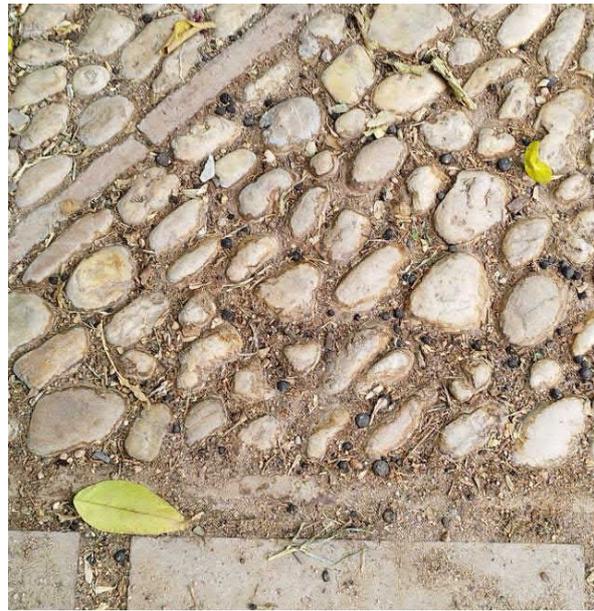
The Niel Garden project in Toulouse, France, integrates permeable paving systems to manage stormwater in a historic urban setting. The ceramic tiles, placed on a mesh support, are arranged with intentional gaps between them, allowing rainwater to filter through. This design reduces surface runoff, helps prevent flooding, and promotes groundwater recharge.

The permeable surface blends with the traditional aesthetic of the area, maintaining the visual harmony of the city while offering modern environmental benefits. The use of permeable materials also helps mitigate the urban heat

The Jardines de los Poetas in Córdoba, Spain, incorporate permeable pavements to manage stormwater and enhance the historic urban landscape. The design uses traditional materials such as compacted earth, ceramic pieces, and river stones to create surfaces that allow rainwater to filter into the ground, reducing runoff and preventing flooding. This approach integrates seamlessly into the city's historic fabric, maintaining the aesthetic of traditional streets while offering modern environmental benefits.

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[86] Brattebo et al. 2003), p. 4369-4376; Ferguson (n.d.), p. 1-17; U.S. Environmental Protection Agency. (n.d.). *Soak up the rain*; Zhu et al. (2019), p. 373-382; Lee et al. (2023)
[87] Earley (2023); Pérez-Martínez et al. (2018); Ferguson (n.d.); Qamhia et al. (2024), p. 1-10

island effect, enhancing sustainability within this historic district.[88]

The permeable pavements not only improve water management but also help to mitigate urban heat, preserving the heritage and functionality of the urban space.[89]

BIOSWALES

Bioswales are landscape features designed to manage stormwater runoff by using vegetation, soil, and microbes to filter pollutants and promote infiltration, thus enhancing urban resilience against climate change and flooding.

They typically consist of gently sloped channels lined with native vegetation, soil media, and gravel, usually 1 to 5 meters wide measuring between and 0.5 to 1 meter deep, and often feature diverse plant species like grasses, shrubs, and flowering plants.

In urban contexts, bioswales can integrate with existing urban infrastructure, improving water management and aesthetic value while maintaining the character and cultural significance of the historic core through sustainable landscaping that enhances biodiversity and public space.[90]

Figure 47 VIT03 Plaza de la Memoria, Vitoria, Spain   *Figure 48 **VIT05** Avenida Gasteiz, Vitoria, Spain*

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[88] Centre de Cultura Contemporània de Barcelona (n.d.). Niel Garden; ArchDaily (n.d.), Ceramic paving in Niel Garden
[89] CanalPatrimonio (2017).
[90] National Association of City Transportation Officials (NACTO). (n.d.). Bioswales; Milwaukee Metropolitan Sewerage District (n.d.); Davis et al. (2021), p. 5-14; National Association of City Transportation Officials (n.d.d); Urban Green Blue Grids (n.d.d), Bioswales; Lu et al. (2024); Branković et al. (2019); Indianapolis (2015); Chen et al. (2023), Unlocking;

The Plaza de la Memoria project in Vitoria, Spain, integrates bioswales into the redesign of this historic square to enhance both ecological function and public use. These bioswales, shallow channels planted with native vegetation, help manage stormwater runoff by filtering pollutants and reducing flood risks, thus addressing climate resilience.

The project seeks to blend nature-based solutions with the existing urban fabric, using sustainable landscaping that promotes biodiversity. By introducing green infrastructure, it enhances the aesthetic value and environmental health of the square, while maintaining the cultural and historical character of this significant public space.[91]

The Avenida Gasteiz project in Vitoria, Spain, revitalizes the urban axis by implementing a bioswale system to manage stormwater sustainably. This system integrates gently sloped channels with native vegetation to filter rainwater, reduce runoff, and prevent flooding. It promotes biodiversity by using a variety of plants, including grasses, shrubs, and flowering species. The design enhances the aesthetic and environmental value of the area while preserving the cultural significance of the avenue.

This project transforms public space into a resilient, green corridor, blending modern water management solutions with the character of Vitoria's urban landscape.[92]

3.2 NBS2. RESTORING DEGRADED ECOSYSTEMS AND HABITAT IMPROVEMENT

Restoring degraded ecosystems and improving habitats involves the rehabilitation of natural environments that have been damaged or destroyed, using sustainable practices to enhance biodiversity, ecological functions, and resilience against climate change.

These processes typically include the restoration of native vegetation, soil enhancement, and water management practices across various scales, ranging from the ecosystemic regeneration of forests to habitats for pollinator species.

In the context of Nature-Based Solutions, these restoration efforts contribute to the cultural and historical identity of urban areas by integrating green spaces that enhance livability, promote community engagement, and preserve historical landscapes while also providing ecosystem services like stormwater management and urban heat mitigation. [93]

Main topics: Ecosystemic regeneration of forests, parks and meadows, Planting trees and native vegetation, Green roofs, Green walls, Bioretention Areas, Rivers and coasts restoration, Natural Inland Wetlands, Naturalization of fountains and ponds, Habitats for pollinator species, Habitats for other species.

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[91] Ayuntamiento de Vitoria-Gasteiz (2022)
[92] NetworkNature (2023); Ayuntamiento de Vitoria-Gasteiz (2021); Conociendo Álava y Vitoria (n.d.)
[93] Hobbs and Harris (2001), p. 239-246; Sudding et al. (2015), p. 638-640; Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ). (2022); Gann et al. (2019), p. S1-S46; Waylen et al. (2024); da Rocha et al. (2017); Cohen-Shacham et al. (2016), p. 5-7, 13-18, 26-37, 68, 70.

These topics ensure:

- **Biodiversity**, by promoting a diversity of species, providing habitats and food sources, and enhancing balanced ecosystems that support pollinators and other wildlife.

- **Carbon Sequestration**, by absorbing CO2 and capturing carbon.

- **Habitat Improvement**, by restoring living conditions for various wildlife species, they provide essential habitats for pollinators and other urban wildlife.

- **Water Management**, by enhancing natural water filtration and retention, they filter pollutants from stormwater before it enters drainage systems and absorbs rainwater, thereby reducing runoff and minimizing flooding risks.

- **Social Cohesion**, by creating spaces for recreation and relaxation, fostering community interactions and engagements, enhancing a sense of belonging.

- **Cultural Value**, by preserving historical landscapes and integrating green spaces into the urban narrative, reinforcing historical identity and promoting local heritage.

- **Health Benefits**, by improving mental and physical well-being, encouraging physical activity and enhancing overall health through access to green spaces and nature.

- **Climate Resilience**, by increasing the city's ability to withstand climate-related challenges, such as sea-level rise.

- **Aesthetic Appeal**, by enhancing the visual character of urban environments.

- **Ecosystem Services**, by providing essential functions such as air purification, stormwater management, and climate regulation. They support a diverse range of species, and improve urban ecological networks.

ECOSYSTEMIC REGENERATION OF FORESTS

Ecosystemic regeneration of forests involves the restoration and enhancement of forest ecosystems through sustainable practices that improve biodiversity, resilience, and ecological functions while integrating them into urban environments.

Forest ecosystems consist of diverse plant species, including trees, shrubs, and ground cover, typically spanning several hectares, with tree heights ranging from 10 to 30 meters and common species like oak, maple, and pine, adapted to local soil and climate conditions.[94]

In a densified urban fabric context, ecosystemic regeneration of forests through Nature-Based Solutions (NBS) plays a vital role in enhancing urban biodiversity, improving air quality, and providing green

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[94] United Nations Decade on Ecosystem Restoration. (n.d.). Forests.; Aerts and Honnay (2011); Löf et al. (2019), p. 139-151; Piana et al. (2021)

spaces for recreation and education, thereby fostering community well-being and the cultural and natural heritage that these areas imply.[95]

Figure 49 **TI01** *Renovation of Skanderbeg Square, Tirana, Albania*

Figure 50 **VIT06** *Parque de la Florida, Vitoria, Spain*

The renovation of Skanderbeg Square in Tirana, Albania, transformed the city's central plaza into a green, pedestrian-friendly urban space. The project emphasizes the integration of nature within a densely populated area, increasing green spaces and prioritizing vegetation.

By creating clear boundaries between pedestrian areas and vehicle traffic, the design promotes walkability while enhancing biodiversity with the introduction of local plant species. The square now serves as a multifunctional space for public gatherings and recreation, improving air quality and offering residents a natural refuge in the heart of the

The Parque de la Florida in Vitoria, Spain, is a historic urban park, established in 1820, known for its romantic French garden design. Initially a small garden connected to the former Santa Clara convent, it has evolved into a vital green space in the city's dense urban fabric. The park showcases over 250 plant species, including towering willows, poplars, chestnuts, plane trees, and conifers, providing ample shade and enhancing biodiversity.

Its winding paths lead visitors through diverse features like a grotto, waterfall, and musical kiosk, promoting recreation, education, and community engagement while fostering ecological resilience and the city's cultural heritage.[97]

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[95] European Environment Agency. (2024), *Forests and forestry.*; AFOCO (2022); Wang et al. (2022), p. 1369-1386; Parrotta et al. (2005).
[97] Vitoria-Gasteiz (2023); Vitoria-Gasteiz (2023), Parque de la Florida: Historia, flora y fauna;

city, fostering a connection between urban life
and environmental sustainability.[96]

PARKS AND MEADOWS

Parks and meadows are designated green spaces within urban environments that prioritize ecological restoration, biodiversity enhancement, and recreational opportunities for city dwellers while integrating seamlessly into historic urban landscapes.

Typically ranging from small urban parks to expansive meadows, these areas consist of diverse plant species, including native grasses, wildflowers, and trees, with dimensions varying from a few hundred square meters to several hectares, designed to support local wildlife and promote ecosystem health. [98]

Parks and meadows function as critical ecological infrastructures that enhance urban resilience, improve air and water quality, foster social interaction, and serve as habitats for biodiversity. Within the urban context, they play a crucial role in preserving cultural and natural heritage by enhancing the aesthetic appeal of urban landscapes, fostering community engagement, and serving as a reminder of the region's ecological history.[99]

Figure 51 **LOGE01** UNESCO Weltkulturerbe Kloster Lorsch, Germany

Figure 52 **VIT04** Parque Salburua of the Anillo verde, Vitoria, Spain

The UNESCO World Heritage Site of Lorsch Abbey in Germany has been revitalized with a landscape design by Lorenz Dexler and Rein-Cano Martin, which reimagines the abbey's historic footprint. The

Parque Salburua, part of Vitoria's Green Ring, is a vital green infrastructure project that harmoniously blends recreational areas with rich biodiversity. Launched in 1994, it

[96] Metalocus. (2018). Renovation of Skanderbeg Square by 51N4E winner of the European Prize for Public Space 2018
[98] Keenan (n.d.); Marshall et al. (2023); Miller et al. (2022); Dunnett (2011); Garmendia et al. (2023); Bele at al. (2024); Nature Based Solutions Initiative (2020), Project seagrass.
[99] Manchester Lit and Phil (2024); Lhomme-Duchadeuil (2018), p. 7-9, 33-47, 57-58; NWT (n.d.); Floodplain Meadows Partnership (2016), p. 10-18.; Hoyle et al. (2017), p. 139-149; Bele at al. (2024).; Southon et al. (2017), p. 105-118

project incorporates vast meadows featuring a diverse mix of native grasses, wildflowers, and herbs, enhancing biodiversity and creating wildlife habitats. Managed lawns offer open green spaces for visitors to relax and gather.

This design seamlessly blends ecological restoration with cultural preservation, transforming the site into a multifunctional space that honors its historical significance while providing opportunities for recreation and connection with nature.[100]

revitalizes degraded urban spaces on the city's periphery by restoring wetlands, forests, and meadows. This expansive park enhances local ecosystems, offering habitats for various flora and fauna while improving urban resilience. It addresses challenges like pollution and water runoff through natural processes.

Salburua Park serves as a community hub, encouraging social interaction and preserving the region's cultural heritage, all while enhancing the aesthetic and ecological integrity of Vitoria's historic landscape.[101]

PLANTING TREES AND NATIVE VEGETATION

Planting trees and native vegetation involves integrating diverse plant species native to a region into urban areas to enhance biodiversity, improve environmental quality, and restore ecological functions.

This practice typically includes a variety of tree species, shrubs, and ground cover, with dimensions varying according to the space available; commonly, urban settings utilize species that thrive in the local climate. [102]

In the urban context, planting trees and native vegetation plays a crucial role by improving air quality, providing shade, reducing heat island effects, enhancing aesthetic value, and offering habitats for urban wildlife, thereby contributing to the ecological, cultural and natural integrity of the historic fabric. They generally hold cultural or historical significance. [103]

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[100] Col·legi d'Arquitectes de Catalunya. (n.d.). UNESCO Weltkulturerbe Kloster Lorsch
[101] Vitoria-Gasteiz (n.d.), Anillo verde; Verde Norte (n.d.)
[102] Berthon et al. (2021); Kaplan et al. (2023), p. 1006-1018; World Science Festival (n.d.); Zhang et al. (2020), Cultural tree.; Landbridge Ecological Design (2023);
[103] Forrest Keeling Nursery (2023); Isaifan et al. (2020); Asciuto (2015), p.55, 56; Pareira (2020); Jim (2017), Abstract, p. 220, 221

*Figure 53 **BCN02** Jardins del recinte històric de l'Hospital de la Santa Creu i Sant Pau, Barcelona, Spain*

*Figure 54 **COR01** Jardines huerto de Orive, Córdoba, Spain*

The Jardins del Recinte Històric de l'Hospital de la Santa Creu i Sant Pau in Barcelona, designed by Claudi Aguiló Aran and team, revitalizes the hospital's historic courtyards while preserving the original 1901 winter and summer garden designs. The project reintroduces native plant species to enhance biodiversity and ecological function, creating shaded green spaces that complement the hospital's modernist architecture.

These gardens provide serene areas for reflection and social interaction, improve air quality, and reduce heat island effects. By integrating nature into the historic urban fabric, the project strengthens both environmental sustainability and cultural heritage.[104]

The Jardines Huerto de Orive in Córdoba, Spain, is a beautifully designed urban park that blends contemporary landscaping with historical architecture, specifically the Palacio de Orive. Inaugurated in 2004, the gardens focus on preserving and promoting local biodiversity by incorporating native plant species such as pomegranates, orange trees, pines, cypress, and aromatic herbs, along with a notable jacaranda that enhances the landscape. The park features vertical greenery that climbs the palace walls, creating a vibrant ecosystem.

This design not only improves air quality and aesthetic value but also connects the community to Córdoba's rich cultural and natural heritage.[105]

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[104] Fundació Privada Hospital de Sant Pau (n.d.).
[105] Turismo de Córdoba (n.d.), Jardines de Orive; Puerta de los Patios (n.d.); Murillo et al. (n.d.); Tamajón (2018); Ayuntamiento de Córdoba (2014), p. 112-115

GREEN ROOFS

Green roofs refer to a living roofing system that supports vegetation, soil, and other materials, providing ecological benefits by enhancing urban biodiversity, improving air quality, and mitigating stormwater runoff.

A green roof typically consists of multiple layers, including a waterproof membrane, drainage layer, growing medium (soil), and a variety of drought-resistant plant species, ranging from sedums to native wildflowers.

In the urban contexts, the implementation of green roofs serve as Nature-Based Solutions (NBS) by restoring degraded ecosystems and improving urban habitats, enhancing urban biodiversity, and integrating ecological functions into the urban fabric while preserving the character and heritage of historic cores. They help consolidate a green infrastructure while linking people to natural ecosystems.[106]

Figure 55 **OP01** *Praça de Lisboa, Oporto, Portugal*

Figure 56 **COR08** *Green roof close to Plaza Jerónimo Páez, Córdoba, Spain*

The Praça de Lisboa project in Oporto, is a revitalized urban square featuring a unique green roof design by Balonas & Menano. Situated between the Clérigos Church and the Portuguese Photography Center (a former prison turned museum), it enhances the city's historical and cultural settings. The green roof, covered with an olive grove, integrates sustainable architecture by promoting urban biodiversity, improving air quality,

The green roof near Plaza Jerónimo Páez in Córdoba, Spain, is an innovative urban project designed to enhance biodiversity and improve environmental quality within the historic cityscape. This living roof incorporates layers of soil, a drainage system, and drought-resistant plants, such as climbing vines that provide shade in the summer and allow sunlight in during winter.

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[106] Carter et al. (2008); Dunnett et al. (2004); Ajuntament de Barcelona (2022); Köhler et al. (2011), p. 4730-4754; World Green Infrastructure Network (n.d.).; National Park Service (2020); Wooster et al. (2022); Coulibaly et al. (2023).

and managing stormwater. Its layers of waterproofing, drainage, and soil support drought-resistant plants, creating a natural space within the city.

The centennial olive trees reflect Oporto's heritage, offering a peaceful space for both locals and visitors while preserving the area's historic character.[107]

Located atop the Renaissance Palacio de los Páez de Castillejo, the roof serves as a sustainable extension of the building's gardens, which originally belonged to the Islamic scholar Ybrahim Ben Nacer. This green space not only mitigates stormwater runoff but also connects residents to the region's ecological heritage.[108]

GREEN WALL

Green walls, also known as living walls or vertical gardens, are structures that integrate vegetation into building facades or interior walls, creating a sustainable way to enhance urban environments by providing ecological benefits and aesthetic value.

Green walls typically consist of a support framework that houses a growing medium, such as soil or a lightweight substrate, and various plant species, often including native flora that can range from 1 to 5 meters in height, depending on the building's design and the species selected. [109]

Integrating this vertical feature into historical buildings seamlessly blends modern environmental technologies with traditional architecture, enhancing sustainability while preserving the building's historic significance. [110]

[107] Living Architecture Monitor (2021)
[108] EACordobea (n.d.); Córdoba Accesible (n.d.).
[109] Köhler et al. (2011); Manso et al. (2015); World Green Infrastructure Network (n.d.); Dunnett et al. (2004); Mulhern (2020); Beatley (2011); Thorpert et al. (2023)
[110] Kumar et al. (2022), p. 117-122; Wheed and Naeem (2024), p. 183-188; National Park Service (2022); Virtudes et al. (2016).

*Figure 57 **MD01** Vertical garden of CaixaForum, Madrid, Spain*

*Figure 58 **SSE01** Plaza Trinidad, San Sebastiáan, Spain*

The Jardín Vertical at CaixaForum in Madrid, designed by botanist Patrick Blanc, is a 460-square-meter vertical garden featuring over 15,000 plants from nearly 300 species. It transforms a once-bare wall into a lush, living façade, enhancing both the aesthetics and environmental performance of the historic former power station. The garden employs a hydroponic system that supports plant growth without soil, improving the building's thermal insulation and air quality.

Situated near the Paseo del Prado, this vertical green space creates a striking visual contrast while blending modern sustainability techniques with the site's historical context.[111]

The Plaza Trinidad in San Sebastián, Spain, transforms an urban void into a vibrant public space, leveraging the backdrop of Mount Urgull. Utilizing reclaimed materials, the design harmonizes with the steep landscape, creating an inviting area for social interaction and recreation. The project incorporates party walls as vertical elements that define boundaries while facilitating biodiversity through vertical gardens, featuring climbing plants.

This approach not only softens the hard urban surfaces but also enhances the aesthetic appeal of the plaza, contributing to the historical character of the area while encouraging community engagement through activities like fronton and traditional games.[112]

Bioretention areas are landscape features designed to manage stormwater runoff, enhance water quality, and provide habitat for urban wildlife by utilizing natural processes and vegetation to filter and absorb water.

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[111] Fundación "La Caixa". (n.d.). Descubre el jardín vertical de CaixaForum Madrid
[112] Docomo Ibérico (n.d.); La Casa de la Arquitectura (n.d.).

Bioretention areas typically consist of a shallow depression filled with engineered soil, sand, and gravel, mostly planted with native non-invasive vegetation.[113]

In urban contexts, bioretention areas play a vital role in mitigating urban flooding, improving water quality, and enhancing biodiversity. They help integrate natural processes into the urban fabric while respecting and preserving the cultural and historical built landscape. [114]

Figure 59 **BCN05** *Eje verde Bolivia, Barcelona, Spain*　　　Figure 60 **VIT03** *Surroundings of the Plaza de la Memoria, Vitoria, Spain*

The Eje Verde Bolivia project in Barcelona, designed by architects Lluís Lamich and Dolors Febles in collaboration with the Instituto Municipal de Urbanismo and the Ayuntamiento de Barcelona, revitalizes a formerly closed urban space by introducing a green infrastructure solution that respects its industrial heritage. The project opens a wall along the historic factory site, creating a new 265-meter-long public corridor where bioretention areas manage rainwater. These areas, planted with native species, reduce urban flooding risks, filter stormwater through engineered soil layers, improve water quality, and allow for future reuse.

The Plaza de la Memoria project in Vitoria, Spain, revitalizes this historic square by incorporating in its surroundings bioretention areas and bioswales to manage stormwater and enhance biodiversity. These green islands consist of shallow depressions filled with engineered soil and native plants, effectively filtering rainwater and reducing flood risks. The design not only improves air quality and aesthetic appeal but also creates a welcoming environment for community interaction.

By integrating nature-based solutions into the urban landscape, the project preserves the

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[113] Geosyntec Consultants (n.d.); U.S. Environmental Protection Agency (2021); CIRIA (n.d.); University of Florida IFAS Extension (n.d.); Narragansett Bay Commission (n.d.); Bjørn and Howe (2023); Davis et al. (2001); Li et al. (2021); Laurenson et al. (2013), p. 223-274.
[114] Nazarpour and Palla (2023); Ellis and Bettis (2022); Chocat et al. (2007), p. 273-285; Larsen and Gujer (1997), p. 3-10.

By integrating bioretention into this busy urban street, the project harmonizes modern sustainable practices with the area's cultural and historical context.[115]

cultural significance of the surroundings while promoting ecological health, showcasing a harmonious blend of modern sustainability and historical heritage.[116]

RIVERS AND COASTS RESTORATION

Rivers and Coasts Restoration refers to the process of rehabilitating and revitalizing riverbanks, coastal areas, and their surrounding ecosystems to enhance biodiversity, improve water quality, and provide recreational spaces, while integrating these natural features into urban settings.

It typically consists of natural water bodies bordered by wetlands, riparian zones, and vegetated shorelines, characterized by diverse flora and fauna, including native aquatic plants, migratory birds, and fish species. [117]

Restoration efforts facilitate the preservation of cultural and historical continuity by revitalizing natural landscapes that reflect the region's ecological and cultural heritage. This process fosters a connection between residents and their historical environments, enriching the urban fabric and promoting sustainable urban development. [118]

*Figure 61 **MD02** Project Madrid-Río, Rio Manzanares, Madrid, Spain*

*Figure 62 **COR05** Riverbanks of the Guadalquivir, Cordoba, Spain*

[115] Arquine (n.d.), Eje Verde Bolivia.
[116] Ayuntamiento de Vitoria-Gasteiz (2022).
[117] UNIVERSITAT POLITÈCNICA DE CATALUNYA. (2021). *REST-COAST*; REST-COAST (n.d.); European Environmental Bureau (2022), Living Rivers Europe.; Bash and Ryan (2002), p. 877-885; Bernhardt et al. (2005), p. 636-637; Palmer et al. (2005), p. 208-217;
[118] STOWA (2003), p. 65-75; Young et al. (2005), p. 558-568; Clewell and Aronson (2013); Balaguer et al. (2014); Interreg Europe (2022);; Haslam (1997)

The Proyecto Madrid-Río revitalizes the banks of the Manzanares River in Madrid, transforming formerly neglected areas into vibrant green spaces. Designed by Burgos & Garrido, Porras La Casta, Rubio A. Sala, and West 8, the project incorporates parks and recreational zones that connect the city to its riverbanks. By restoring the river's edge with vegetated shorelines, the initiative enhances biodiversity and improves water quality. This ecological restoration fosters habitats for native plants and migratory birds while providing residents with spaces for leisure and social interaction.[119]

Madrid-Río enriches the urban environment, preserving the region's cultural heritage and promoting sustainable urban development.

The Riverbanks restoration of the Guadalquivir in Córdoba, Spain, focuses on restoring the river's banks to enhance biodiversity and improve water quality. Meandering pathways now connect the exterior walls of Córdoba's Alcázares with lush gallery forests and riparian vegetation, creating a vibrant ecosystem. This restoration integrates native plants like willows and reeds, which absorb excess floodwater and provide crucial habitats for wildlife.

By revitalizing these natural landscapes, this natural landscape protects historical sites from erosion while fostering a stronger connection between residents and their cultural heritage, promoting sustainable urban development and enriching the urban fabric of the city. [120]

NATURAL INLAND WETLANDS

Natural inland wetlands are ecosystems characterized by saturated soils and waterlogged conditions, supporting diverse plant and animal life, and providing essential ecological functions such as water filtration, flood regulation, and carbon storage.

They typically consist of marshes, swamps, and bogs, ranging from small ponds to extensive areas spanning hundreds of hectares, with a variety of native species such as cattails, sedges, and diverse aquatic flora and fauna. [121]

In terms of Nature-Based Solutions, natural inland wetlands play a vital role in urban areas by facilitating the restoration of rivers and coasts, preserving cultural and historical continuity, and enhancing ecological diversity. They provide a natural buffer against flooding, improve water quality, and promote biodiversity, thereby enriching the connections between nature and the urban fabric. [122]

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[119] Burgos & Garrido et al. (n.d.); Europa Press (2013)
[120] iAgua (2023); Berrocal (2019).
[121] Ramsar Convention on Wetlands (2018); Ministry for Primary Industries & Manatu Ahu Matua. (2023); Wetland Trust (2021); Environment Canterbury (n.d.), Wetland management; Zelnik and Germ (2023); Zedler and Kercher (2005), p. 247-263.
[122] ICLEI (2001); Rogerson et al. (2021); Alikhani et al. (2021); Ferreira et al. (2023); Ramsar Convention on Wetlands (2018); Department of Climate Change, Energy, the Environment and Water (2016); Tolentino (2007), p. 155-162; Vente et al. (1981).

Figure 63 TXC01 Parque Ecológico Lago de Texcoco, Mexico

Figure 64 VIT04 Parque Salburua of the Anillo verde, Vitoria, Spain

The Parque Ecológico Lago de Texcoco in Mexico is a transformative project focused on restoring the historic wetlands of the drained Texcoco Lake area, covering over 14,000 hectares. Aimed at enhancing biodiversity and water quality, the park features native plants like cattails and sedges, creating habitats for wildlife while serving as a natural flood buffer and carbon dioxide sink. With an investment of over 4.5 billion pesos by 2024, the project is expected to generate more than 7,600 jobs for local communities.

Key initiatives include environmental restoration, conservation of water bodies, and public access to wetlands. This project reconnects urban areas with nature, preserves cultural heritage, and improves living conditions for over 12.5 million residents in the Valley of Mexico.[123]

The parque Salburua, part of Vitoria's Green Ring, is a significant ecological restoration project aimed at revitalizing degraded urban edges through the recovery of natural wetlands. Launched in 1994, the park restores former wetlands that were drained for urban development, enhancing the local ecosystem by increasing biodiversity. It features diverse habitats, including marshes and forests, which support native flora and fauna, while providing critical ecological functions like water filtration and flood regulation.

This green infrastructure not only improves urban resilience against pollution and runoff but also fosters community engagement and preserves the cultural heritage of Vitoria, enriching the urban landscape.[124]

NATURALIZATION OF FOUNTAINS AND PONDS

The naturalization of fountains and ponds refers to the process of integrating these water features into urban environments in a way that mimics natural ecosystems, promoting biodiversity, enhancing

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[123] Comisión Nacional del Agua (n.d.); Parque Ecológico Lago de Texcoco (n.d.)
[124] Euskadi Turismo (n.d.); Heras Pérez and Infante Sánchez (2011), p. 21-43; Wetlands International (n.d.)

ecological functions, and improving overall urban resilience. This approach helps to restore degraded ecosystems while providing aesthetic and recreational benefits to the community.

Typically, they consist of a mix of native aquatic plants, such as reeds and water lilies, alongside various substrates like gravel and sand, with dimensions varying from small garden ponds to larger urban water bodies, designed to facilitate natural water filtration and provide habitats for diverse species, including amphibians and pollinators. [125]

The integration of these water features in historic urban settings is essential for enhancing ecological integrity and cultural continuity. They support biodiversity, improve water quality, and contribute to climate resilience, all while preserving the cultural heritage linked to historic water systems and fostering community engagement. [126]

*Figure 65 **BCN04** Recovery of the Thermal Water Canals, Provincia de Barcelona, Spain*

*Figure 66 **COR04** Fountains of the Muralla y Puerta de Almodóvar, Córdoba, Spain*

The Recovery of Thermal Water Canals project in Caldes de Montbui, Barcelona, designed by the architecture firm Ciclica, focuses on restoring ancient Roman thermal irrigation channels that supply water to local gardens. This initiative incorporates a water collection and purification system utilizing native aquatic plants and ponds to enhance water quality. By revitalizing these canals, the project aims to improve food provisioning through sustainable agricultural

The project surrounding the Muralla y Puerta de Almodóvar in Córdoba, Spain, focuses on naturalizing a historical waterway by transforming an ancient stream into an aesthetically pleasing pond. This initiative enhances the ecological value of the area while providing environmental benefits, such as mitigating heat island effects and improving urban

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[125] Freshwater Habitats Trust (n.d.); ScienceDirect (n.d.), Naturalization.; Vasco et al. (2024), p. 1117-1137; Biodiversity Ireland. (n.d.); Horizon Magazine (2023); Zamora-Marín et al. (2021); Clawson (2018);
[126] Aguilar Rojas and Naeth (2015); González Ramil (2023), p. 10-21

practices while re-establishing vital ecosystem services that support urban greenery.

The restoration promotes biodiversity, enhances habitat connectivity, and preserves the cultural heritage linked to traditional farming methods, fostering community engagement and environmental resilience in the historic area.[127]

resilience. The pond features a mix of native aquatic plants, creating habitats for local wildlife like amphibians and pollinators.

By integrating this water feature into the historic landscape, the project not only enriches the visual appeal of the site but also reinforces the cultural heritage of Córdoba.

HABITATS FOR POLLINATORS SPECIES

Habitats for pollinator species refer to designated areas within urban environments that provide essential resources, such as food and shelter, to support various pollinators, including bees, butterflies, and birds. These habitats are a critical component of Nature-Based Solutions (NBS), as they contribute to ecosystem restoration, enhance biodiversity, and improve the resilience of urban environments while addressing challenges related to habitat loss and degradation. [128]

These habitats typically comprise native flowering plants, shrubs, and trees, occupying dimensions that vary from small garden plots (a few square meters) to larger green corridors (up to several hectares), fostering species such as honeybees (Apis mellifera), monarch butterflies (Danaus plexippus), and various native bee species.[129]

The implementation of habitats for pollinator species in the dense urban fabric helps balance ecological functions and urban development. They enhance biodiversity and improve the resilience of ecosystems, contributing to a healthier urban environment while reinforcing cultural heritage through the integration of natural elements.[130]

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[127] Ciclica. (n.d.). Recuperació del sistema de reg a les hortes termals.
[128] Washington State Department of Agriculture (n.d.); Decourtye et al. (2010), p. 264-277; Haaland et al. (2011), p. 60-80; Tilman et al. (1994), p. 65-66; Wratten et al. (2012); Pindar and Raine (2023)
[129] Xerces Society for Invertebrate Conservation (n.d.); Washington Department of Fish and Wildlife (n.d.); Pollinator Academy (n.d); U.S. Forest Service. (n.d.). Who are the pollinators?; iNaturalist (n.d.), Apis mellifera.
[130] Silva et al. (2023); Theodorou et al. (2020); Katumo et al. (2020), p. 429-435; Bucholz and Egerer (2020), p. 2779-2801; Maggi et al. (2023), p. 33-48; Duong (2024); Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) (2016).

The Plaça del Mercat del Ninot project in Barcelona promoted by the Barcelona City Council, aims to transform an underutilized urban space adjacent to the historic Ninot Market and remnants of an old fire station into a vibrant public park. By incorporating a variety of ornamental plants, the design promotes seasonal changes in aesthetics, enhancing the area's visual appeal. This urban habitat is specifically designed to support pollinator species, such as bees and butterflies, contributing to biodiversity and ecological resilience.

Furthermore, it integrates natural elements into the urban fabric, reinforcing the cultural heritage of the neighborhood while fostering environmental sustainability through nature-based solutions.[131]

The Pedro Luis Alonso Gardens in Málaga draw inspiration from Hispano-Muslim and French garden designs established in 1947. This urban green space is thoughtfully curated to support pollinator species by incorporating native flowering plants and shrubs that provide essential food and habitat.

By fostering environments conducive to the survival of bees, butterflies, and birds, the gardens enhance local biodiversity and promote ecological resilience. This initiative not only contributes to the restoration of urban ecosystems but also enriches the cultural heritage of Málaga, demonstrating how natural elements can be integrated into the urban fabric for the benefit of both wildlife and the community.[132]

HABITATS FOR OTHER SPECIES

Habitats for species are integrated natural environments within urban settings that aim to enhance biodiversity and support various wildlife species by providing essential resources, such as food, shelter, and breeding grounds, thereby contributing to the ecological balance and resilience of the city.

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[131] Col·legi d'Arquitectes de Catalunya. (n.d.). Plaza del Mercat del Ninot.
[132] Ayuntamiento de Málaga (n.d.).

These habitats typically consist of native plants, shrubs, and trees, creating ecosystems that are designed to attract pollinators and other wildlife species, including birds, butterflies, and beneficial insects.

The implementation of these habitats within dense urban fabrics, particularly in historic city cores, helps balance ecological functions by enhancing biodiversity while fostering community engagement with nature. They facilitate relationships between humans and non-human species, creating hybrid ecosystems that allow for social interactions among residents, promote educational opportunities, and contribute to the overall well-being of urban inhabitants. [133]

*Figure 69 **LJU01** Rearrangement of the Ljubljanica riverbanks, Slovenia*

*Figure 70 **COR05** Riverbanks of the Guadalquivir, Cordoba, Spain*

The rearrangement project of the Ljubljanica riverbanks in Slovenia aims to revitalize areas along this historic waterway, enhancing its ecological and community value. By restoring natural habitats, the initiative creates environments that support a variety of wildlife, including birds and pollinators, through the incorporation of native plants and trees. The design features floodable terraces and platforms that encourage public interaction while managing water flow and enhancing biodiversity.

This transformation not only preserves the river's ecological integrity but also fosters community engagement, promoting a harmonious coexistence between urban residents and the natural

The project along the riverbanks of the Guadalquivir in Córdoba, Spain, focuses on enhancing biodiversity by integrating natural habitats within the urban landscape. As sediment deposits from the river have created new islets, these areas have become crucial for local flora and fauna. Native plants, shrubs, and trees have been introduced to attract various wildlife, including pollinators and birds. This project not only fosters ecological balance by supporting diverse species but also encourages community interaction with nature. By connecting residents to their environment, the project

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[133] Neath Port TalEuropean Commission. (n.d.). Restoration of the Ljubljanica River corridor and improvement of the river's flow regimebot Nature (n.d.); Malcolm-McKay and Lucero (2024); Sullivan et al. (2005); Norton et al. (2016), p. 78-192; Marinelli (2021); Berger et al. (2024); Gentili et al. (2024), p. 219-230; McKinney (2002), p. 883-890.

environment, ultimately enriching the urban landscape.[134]

enriches urban life and promotes educational opportunities, enhancing the overall well-being of the city's inhabitants.[135]

3.3 NBS3. ENHANCING SUSTAINABLE URBANIZATION

Enhancing sustainable urbanization through Nature-Based Solutions (NBS) involves integrating natural processes and ecosystems into urban areas to improve environmental sustainability, resilience, and quality of life. Sustainable urbanization leverages natural features like vegetation, water systems, and biodiversity to create metabolic and production processes that occur at different scales within the local environments.

It involves urban farming, community gardens, shade furniture and mixed-use areas, all designed to reduce pollution, conserve resources, and improve quality of life for urban residents.[136]

In a historic city center, enhancing sustainable urbanization integrates modern principles with the preservation of heritage. This involves adapting old buildings with eco-friendly technology, creating pedestrian-friendly areas, and revitalizing public spaces, ensuring they speak of the city's past while supporting future growth and livability. [137]

Main topics: Urban Farming, Community gardens, shade furniture (umbracle, awning, pergola,…), other ecofriendly street furniture.

These topics ensure:

- **Food Security**, by increasing access to fresh products, reducing reliance on imported food and dependency on commercial food systems.

- **Biodiversity**, by promoting diverse ecosystems and incorporating various plant species.

- **Community Engagement**, by fostering social connections and encouraging community interactions, strengthening neighborhood ties among residents.

- **Climate Resilience**, by mitigating urban heat islands, enhancing stormwater management through green spaces and boosting urban resilience to climate change impacts with local food production.

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[134] Espacio Público (2011); EUMies Award (n.d.); Centre de Cultura Contemporània de Barcelona. (n.d.). Reestructuración de las orillas del río Ljubljanica; European Commission. (n.d.).
[135] UNA (2021); Sáez-Gómez and Prenda (2022); Berrocal (2019)
[136] Network Nature (n.d.); Raymond et al.(2017), p. 15-24; UN-Habitat (2019); Funds for NGOs (n.d.); Omole et al. (2024), p. 1020-1030; Mani (2024), p. 391-400; Fang and Ma (2023); Shao and Kim (2022); Maury et al. (2022); Braubach et al.(2017), p. 187-205; Zhang and Qian (2024); Pradhan et al. (2024); Giyarsih et al. (2024).
[137] Al-Alawi et al. (2022); Yawer et al. (2023), p. 257-270; Mària and Salvadó (2017), p. 29-40; Bogdan et al. (2022); Fu et al. (2023).

- **Education**, by providing hands-on learning experiences, offering opportunities to learn about sustainable practices and environmental stewardship.

- **Economic Opportunities**, by creating jobs and stimulating local economies through food production and sales.

- **Health Benefits**, by promoting physical activity and providing access to fresh food, encouraging healthier lifestyles and enhancing mental well-being through gardening activities.

- **Cultural Heritage**, by preserving and promoting local traditions related to food cultivation, while maintaining the historical context and character of urban spaces, fostering local identity.

URBAN FARMING

Urban farming is an innovative approach to cultivating, processing, and distributing food within urban areas, enhancing sustainable urbanization by promoting local food production, biodiversity, and community engagement while minimizing environmental impacts.

Urban farming can encompass a range of structures and practices, including rooftop gardens, vertical farms, community gardens, and urban orchards, typically varying in size from small plots of a few square meters to larger parcels of land, and can include a variety of edible plants such as vegetables, herbs, and fruit-bearing trees.[138]

Urban farming creates vital connections within the historical city fabric by transforming underutilized or open spaces into productive landscapes, enhancing community cohesion, preserving cultural heritage through traditional farming practices, and contributing to the city's ecological resilience by improving air quality and supporting local wildlife. [139]

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[138] Halllet et al. (2016); Panagopoulos et al. (2017), p. 55-70; Romiel and Basan (2021); U.S. Department of Agriculture (n.d.), Urban agriculture; ScienceDirect, (n.d.), Urban agriculture.
[139] Saputra et al. (2024); Ferris et al. (2001), p. 559-568; Flachs (2010), p. 559-568; Smit et al. (2006), p. 146-171; Zhu et al. (2024).

*Figure 71 **CRU01** Huertas de Caramoniña, Santiago de Compostela, Coruña, Spain*

*Figure 72 **VIT07** Huertas de Urarte, Vitoria, Spain*

The Huertas de Caramoniña project in Santiago de Compostela revitalizes traditional gardening practices within the city's historic core. Designed by Abalo Alonso Arquitectos, it transforms underutilized spaces into accessible urban farms, promoting local food production and enhancing community cohesion. The project features native plant species and offers residents opportunities to engage in gardening, fostering social interactions and connections with nature.

By integrating productive gardens with recreational areas, the initiative preserves the area's historical character while contributing to ecological resilience.[140]

The Huertas de Urarte, located in the Zadorra Park within Vitoria's Green Ring, represent a community-driven initiative to promote urban farming. Organized by the city council, these diverse gardens serve as urban amenities where local residents can cultivate vegetables, herbs, and fruits. The project not only enhances sustainable food production but also provides educational services focused on urban horticulture.

By transforming previously underutilized spaces into productive landscapes, the Huertas de Urarte foster community engagement and cohesion, while also contributing to ecological sustainability and resilience, ultimately enriching the local environment and preserving cultural farming practices.[141]

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[140] ArchDaily (2016), Huertas de Caramonina; Ábalo Alonso Arquitectos (n.d.).
[141] Ayuntamiento de Vitoria-Gasteiz (n.d.); Ruiz Muñoz (2022).

COMMUNITY GARDENS

Community gardens are collective green spaces managed by local residents to grow fruits, vegetables, and flowers, fostering environmental sustainability, enhancing urban biodiversity, and improving community resilience.

Typically, community gardens consist of individual plots measuring approximately 10-20 square meters, where a variety of native and non-native species are cultivated, such as tomatoes, peppers, and sunflowers, often enclosed by fences and equipped with compost bins.[142]

Community gardens integrate into the urban fabric by transforming underutilized spaces into productive green spaces, enhancing local food security, promoting social cohesion, and providing educational opportunities related to agriculture and sustainability in historical city centers. [143]

Figure 73 **NYC01** *Liz Christy Community garden, New York, USA*

Figure 74 **COR09** *Huertos Ecológicos Comunitarios de la Asomadilla , Córdoba, Spain*

The Liz Christy Community Garden, established in 1973 in Manhattan, New York, is recognized as the city's first community garden. Located at the northeast corner of Bowery and Houston Streets, this garden emerged from a derelict lot transformed by local residents and activists, including Liz Christy and the Green Guerillas. Volunteers cleared debris, enriched the soil, and planted 60 raised beds with vegetables. Over the years, the garden has expanded, promoting urban agriculture and

The Huertos Ecológicos Comunitarios de la Asomadilla project, initiated in October 2011 in Córdoba, Spain, promotes urban agroecology as a means to enhance food sustainability, biodiversity, and climate resilience. Managed by the Instituto Municipal de Gestión Ambiental (INGEMA), it transforms 5,143 m² of underutilized park space into vibrant community gardens. Groups of 8 to 12 residents cultivate individual

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[142] Ferris et al. (2001), p. 559-568; Soil Science Society of America. (n.d.). Community gardens; National Parks Board (n.d.); Ong et al. (2019);

[143] Flachs (2010), p. 559-568; Kanosvamhira (2024), p. 1-18; Bieri et al. (2024); Bitušíková (2016), p. 33-42; Truong at al (2022)

community engagement through workshops and plant giveaways.

plots averaging 260 m², growing various fruits, vegetables, and flowers.

Dedicated to fostering resilience and sustainability, it remains a vibrant green space that enhances local food security and environmental education.[144]

The initiative emphasizes education, intergenerational cooperation, and gender equity, fostering community engagement and improving local food security while enriching the urban landscape and promoting ecological practices.[145]

SHADE FURNITURE (UMBRACLE, AWNING, PERGOLA, etc.)

Shade furniture, including structures like umbracles, awnings, and pergolas, serves as a Nature-Based Solutions that enhances sustainable urbanization by providing shaded areas that improve microclimates, reduce urban heat, and promote outdoor social interactions, ultimately contributing to the resilience and livability of historic cities.

Shade furniture typically comprises materials such as wood, metal, or fabric, varying in dimensions from small portable canopies to large, permanent structures covering several square meters, often incorporating climbing plants or trees, such as vines or deciduous species, to enhance its cooling effect and aesthetic value.

In historic urban contexts, shade furniture integrates with architectural styles and public spaces, offering both functionality and historical continuity; it fosters social engagement and enhances pedestrian comfort. [146]

[144] Liz Christy Garden (2007); Community of Gardens (n.d.)
[145] IMGA (n.d.); OSALA(n.d.)
[146] Bolkaner et al. (2019); Crisostomo and Porras (2020); NetZeroCities (n.d.); Palomo Amores et al. (2023); Cherian and Subasinghe (2023); Malibu Shade (n.d.)

*Figure 75 **CAS01** Una pérgola abierta a la huerta, Sot de Ferrer, Castellón, Spain*

*Figure 76 **COR01** Pérgola en jardines huerto de Orive, Córdoba, Spain*

The project "Una pérgola abierta a la huerta" in Sot de Ferrer, Spain, by Bona Fide Taller, introduces a shaded structure that serves as a transition between the irrigation channel and the orchard. This pergola is designed to enhance the microclimate of the area, reducing urban heat and providing a comfortable space for social interaction. Constructed with materials like wood and metal, it incorporates climbing plants that not only add aesthetic value but also improve cooling effects. The design harmonizes with the historical context, fostering community engagement while preserving the cultural identity of the region. Overall, this pergola embodies sustainable urbanization principles.[147]

The pergola in the Jardines Huerto de Orive, Córdoba, serves as a functional and aesthetic addition to the garden, addressing the region's extreme climate. Designed to create shaded areas, it features layered structures that foster transitional spaces between indoor and outdoor environments. This design encourages social interactions while providing relief from the intense heat, making the garden more enjoyable for visitors. Integrating climbing plants, the pergola not only enhances the cooling effect but also adds to the garden's visual appeal. This installation harmoniously blends with the historic context, promoting both ecological sustainability and community engagement in this urban setting.

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[147] ArchDaily (2023), Bona Fide Taller.

OTHER ECO-FRIENDLY STREET FURNITURE

Other eco-friendly street furniture encompasses a range of sustainable urban elements, designed to enhance public spaces while promoting ecological health, improving urban aesthetics, and fostering social interaction in historic cities.

Typically composed of recycled local materials such as plastics, sustainably sourced wood, or metal, eco-friendly street furniture includes items like benches, bike racks, and planters, designed with ergonomic features for comfort, and can incorporate native plants to support local biodiversity.

In historic city settings, eco-friendly street furniture enhances public spaces, encouraging both active and passive interactions with the surrounding historical context. This approach not only fosters a sense of community but also promotes sustainable design principles in urban furniture, harmonizing modern needs with the preservation of cultural heritage.[148]

Figure 77 **ZA01** Petar Zoranic Square, Zadar, Croatia

Figure 78 **VIT03** Plaza de la Memoria, Vitoria, Spain

Petar Zoranic Square in Zadar, Croatia, designed by architects Kostrenčić-Krebel, is a thoughtfully designed urban space that emphasizes ecological sustainability while honoring its rich historical context. At the center of the square stands a monumental Sicomoros tree, a living symbol of the area's identity, positioned to draw attention and foster connection. Surrounding this tree, the street furniture includes benches and planters that promote social interaction and contemplation. Crafted with ergonomic features and

The "Plaza de la Memoria" project in Vitoria, Spain, aims to harmonize nature with the urban landscape by integrating eco-friendly street furniture that celebrates the city's historical context. The design emphasizes the existing shade-providing sycamore trees, using sustainably sourced wood to create benches that invite visitors to relax and engage with their surroundings. This approach not only enhances comfort but also promotes biodiversity through the incorporation of native plants. By blending green infrastructure with sustainable

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148 Bolkaner et al. (2019); Güney (2016), p. 37-45; Jaramilloo et al. (2018); Munteanu (2021), p. 60-70; Sewandono (2020); https://www.man-city.co.uk/the-impact-of-street-furniture-on-community-well-being/ ; Yasar (2023);

incorporating native plants, this furniture enhances biodiversity and the overall aesthetics of the square.[149]

This design harmonizes contemporary needs with the preservation of cultural heritage, creating a vibrant community space that respects its historical significance.

landscaping, the project enriches the square's aesthetic appeal while preserving its cultural heritage, fostering community interaction and ecological health in this vital public space.[150]

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[149] Kostrenčić-Krebel (2014); Centre de Cultura Contemporània de Barcelona (n.d.)
[150] Komunikazio Zerbitzua/ Servicio de Comunicación (2022).

IV PART 3_IMPLEMENTATIONS AND EFFECTS OF PS MODERNISATION IN HISTORIC CITIES

4.1. DESCRIPTION OF CASE STUDIES AND FIELD VISITS

This section begins with a description of case studies focusing on 19 exemplary projects of public space renewal in historic cities. Each of these projects has been carefully chosen for its innovative approach and successful integration of nature-based solutions, green infrastructure, and ecosystem services.

By translating the concepts discussed earlier in Part 2, we aim to illustrate how these principles can be effectively implemented in real-world scenarios, showcasing the transformative potential of thoughtful urban design and sustainable practices in enhancing public spaces. Below, we present a list of the projects along with brief descriptions that highlight their unique contributions to urban revitalization:

TXC01 Texcoco Lake Ecological Park: Restores a desiccated lake in Mexico City, creating a vast ecological park that manages stormwater and enhances biodiversity.

TL01 Saint Sernin Square: Converts a historic area in Toulouse, previously organized as a chaotic urban area, into a pedestrian-friendly plaza, emphasizing green spaces and historical preservation.

TL02 Niel Garden: Reimagines a former military site in Toulouse, creating a dynamic landscape with varied topography and sustainable water management.

BCN04 Recovery of the Thermal Water Canals: Revives ancient irrigation systems in the outskirts of Barcelona, in a historic agricultural area, integrating modern water management techniques.

TI01 Renovation of Skanderbeg Square: Transforms a central square in Tirana, prioritizing pedestrian mobility and integrating native plant species.

BCN01 Mercat del Ninot Square: Converts a disused site in Barcelona into a vibrant public space, utilizing existing structures and diverse vegetation.

BCN02 Santa Creu i Sant Pau Hospital gardens: Restores a historic hospital garden in Barcelona, emphasizing ornamental and medicinal plant species.

CRU01 Caramoniña orchards: Revitalizes urban gardens in Santiago de Compostela, improving accessibility and reintroducing traditional agricultural practices.

CAS01 "Una pérgola abierta a la huerta": Creates a shaded structure in Sot de Ferrer (Castellón, Spain), enhancing microclimate and fostering community engagement around the orchard.

LOGE01 Kloster Lorsch: Preserves the historical footprint of a former monastery in Germany, creating a green space that highlights its past.

BCN03 Tres Turons Park: Restores a site with historical military significance in Barcelona, enhancing accessibility and preserving historical remnants.

ZA01 Petar Zoranic Square: Enhances a historic square in Zadar (Croatia), exposing archaeological finds and integrating green islands with seating areas.

OP01 Lisboa Square: Revitalizes Oporto's urban square with an elevated green roof, promoting biodiversity and blending modern design with historical context.

VIE01 Hundertwasser House: Blends vibrant colors and greenery in Vienna, creating a unique residential landmark that enhances urban biodiversity and ecological awareness.

MD01 CaixaForum Madrid Vertical garden: Transforms a Madrid power station wall into a vibrant 460m² garden, enhancing aesthetics, insulation, and air quality.

LJU01 Rearrangement of the Ljubljanica riverbanks: Revitalizes historic riverbanks in Ljubljanica, enhancing ecology and community interaction through native vegetation and floodable terraces.

BCN05 Bolivia green axis: Revitalizes a former industrial space in Barcelona, creating a green corridor with bioretention areas for stormwater management.

MD02 Project Madrid-Río: Transforms Manzanares Riverbanks in Madrid into vibrant green spaces, enhancing biodiversity and community access while preserving cultural heritage.

NYC01 Liz Christy Community garden: Transforms a derelict lot in Manhattan into New York's first community garden, promoting urban agriculture and community engagement.

The next part of this section highlights additional projects, featuring six main public spaces identified during field visits in three distinct cities in Spain: Cordoba, Vitoria, and Seville. Two specific projects or areas have been selected within each city.

SEV Sevilla

SEV02 *Alameda de Hércules: Revitalizes a historic promenade in Seville, enhancing public spaces with lush greenery, seating areas, and art, while celebrating its cultural heritage and community spirit.*

SEV04 *Encarnación Square: Transforms Seville's historic center with a modern wooden structure, integrating public spaces, archaeological remains, and panoramic viewpoints, enhancing urban life and cultural preservation.*

COR Córdoba

COR01 *Huerto de Orive: Revitalizes a historic garden in Córdoba, blending green spaces with remnants of an ancient palace, offering a serene public area that preserves its historical essence.*

COR02 *Patio and surroundings of the Mezquita: Revitalizes Córdoba's iconic mosque courtyard, enhancing accessibility and integrating green spaces while preserving its historical and cultural heritage.*

VIT Vitoria

VIT08 *Virgen Blanca Square: Revitalizes Vitoria's central square, improving accessibility, integrating water features, and enhancing its historical features while providing new public seating and gathering areas.*

VIT09 *Etxauri Square - Etxanobe Gardens: Revitalizes a historic square in Vitoria, enhancing public space with greenery and seating, while preserving its cultural heritage and urban significance.*

4.2 EFFECTS OF PS MODERNIZATION

Modernizing public spaces in historic cities can have a profound impact on the urban environment, community well-being, and cultural heritage. The integration of green infrastructure and nature-based solutions plays a crucial role in this transformation. Below is a detailed description of the effects, followed by a list of specific impacts observed in various exemplary projects.

The modernization of public spaces in historic cities involves the incorporation of contemporary design elements, sustainable practices, and innovative technologies. This process aims to enhance the functionality, aesthetics, and environmental performance of urban areas while preserving their historical and cultural significance. By integrating green infrastructure, such as parks, green roofs, and urban gardens, cities can improve air quality, reduce urban heat islands, and promote biodiversity. Nature-based solutions, including rain gardens and permeable pavements, help manage stormwater, mitigate flooding, and enhance the resilience of urban infrastructure.

Moreover, modernized public spaces foster social interaction, community engagement, and economic development. They provide inclusive and accessible environments where people can gather, relax, and participate in cultural and recreational activities. These spaces also contribute to the mental and physical well-being of residents by offering opportunities for exercise, relaxation, and connection with nature. Additionally, the revitalization of public spaces can attract tourists, boost local businesses, and create job opportunities, thereby stimulating the local economy.

However, the modernization process must be carefully managed to avoid potential negative impacts, such as the loss of historical character, gentrification, and displacement of local communities. It is essential to involve stakeholders, including residents, businesses, and heritage conservation experts, in the planning and implementation phases to ensure that the modernization efforts align with the community's needs and values.

Next, a detailed list of **effects** will be presented, followed by a list of selected case studies and field visit cases.

The field visit cases will be written in *italic*.

1. Improved Air Quality: Green infrastructure reduces air pollution by filtering particulates and absorbing CO2 (e.g., Boca de la Mina Walk, Hundertwasser House).

2. Reduced Urban Heat Island Effect: Green roofs and urban greenery lower temperatures in densely built areas (e.g., Texcoco Lake Ecological Park, CaixaForum Madrid Vertical garden, Lisboa Square, *Mezquita*).

3. Enhanced Biodiversity: Urban gardens and parks provide habitats for various species (e.g., Project Madrid-Rio, Mezquita, *Huerto de Orive, Echanove Square*).

4. Stormwater Management: Permeable pavements and rain gardens reduce flooding and improve water quality (e.g., Restoration of the Irrigation Channels of the Thermal Gardens).

5. Increased Social Interaction: Modern public spaces encourage community gatherings and social activities (e.g., Saint Sernin Square, *Alameda de Hércules, Echanove Square*).

6. Economic Development: Revitalized areas attract tourists and boost local businesses (e.g., Renovation of Skanderbeg Square, *Virgen Blanca Square*).

7. Cultural Preservation: Integrating modern elements while preserving historical features maintains cultural heritage (e.g., Kloster Lorsch, *Encarnación Square*).

8. Mental and Physical Well-being: Access to green spaces promotes health and well-being (e.g., Santa Creu i Sant Pau Hospital gardens, *Encarnación Square, Huerto de Orive, Mezquita, Echanove Square*).

9. Community Engagement: Inclusive design processes involve local residents in decision-making (e.g., Caramoniña Orchards, Liz Christy Community garden).

10. Resilience to Climate Change: Nature-based solutions enhance urban resilience to climate impacts (e.g., Niel Garden).

11. Historical Preservation: Respecting and highlighting historical elements while modernizing (e.g., Tres Turons Park, Rearrangement of the Ljubljanica riverbanks, *Virgen Blanca Square, Alameda de Hércules*).

12. Enhanced Connectivity: Creating spaces that connect historical and modern urban elements (e.g., Petar Zoranic Square, Bolivia green axis, *Alameda de Hércules, Virgen Blanca Square*).

13. Climate Adaptation: Implementing solutions to address climate challenges (e.g., ENGHAVEPARKEN – CLIMATE PARK, *Huerto de Orive*).

4.3 NEEDS, LIMITATIONS, AND PROSPECTS

The renewal of public spaces in historic cities requires a comprehensive approach that addresses various needs, acknowledges limitations, and explores future perspectives. This section outlines the

essential requirements, challenges, and potential directions for successful public space, attending needs, limitations and prospects in historic cities public space, that are listed below (the field visit cases will be written in italic):

Renewing public spaces in historic cities involves addressing the unique challenges posed by the existing urban fabric, cultural heritage, and community dynamics. The primary needs include sustainable design practices, stakeholder engagement, and adequate funding. Sustainable design practices ensure that the renewal efforts contribute to environmental conservation, social equity, and economic viability. Stakeholder engagement is crucial for understanding the community's needs, preferences, and concerns, thereby fostering a sense of ownership and support for the projects. Adequate funding is necessary to implement high-quality interventions and maintain the renewed spaces over time.

However, several limitations can hinder the renewal process. These include regulatory constraints, limited financial resources, and potential conflicts between preservation and modernization goals. Regulatory constraints may involve strict heritage conservation laws that restrict certain types of interventions. Limited financial resources can affect the scope and quality of the projects, making it challenging to achieve the desired outcomes. Conflicts between preservation and modernization goals may arise when contemporary design elements clash with historical aesthetics or when gentrification displaces local communities.

Despite these challenges, there are promising perspectives for the future of public space renewal. Technological advancements, such as smart city solutions and digital tools, can enhance the planning, implementation, and management of public spaces. Collaborative approaches that involve public-private partnerships and community-driven initiatives can leverage diverse resources and expertise. Additionally, a growing emphasis on sustainability and resilience can drive innovative solutions that address environmental, social, and economic challenges.

Below is a list of needs, limitations, and perspectives. It highlights connections between essential requirements, challenges, and potential directions for improving the selected case studies and field visit cases.

The field visit cases will be written in *italic*.

<u>Needs:</u>

N1. Sustainable Design Practices: Incorporating eco-friendly materials and technologies

(e.g., Boca de la Mina Walk, *Alameda de Hércules*, *Huerto de Orive*, *Virgen Blanca Square*).

N2. Stakeholder Engagement: Involving community members in the planning process

(e.g., Saint Sernin Square, Liz Christy Community garden, Project Madrid-Río, Bolivia green axis, Ljubljanica riverbanks, *Alameda de Hércules*, *Encarnación Square, Huerto de Orive, Mezquita*, *Virgen Blanca Square*).

N3. Adequate Funding: Securing financial resources for implementation and maintenance.

(e.g., Texcoco Lake Ecological Park, Bolivia green axis, CaixaForum Madrid Vertical garden, *Echanove Square*).

N4. Interdisciplinary Collaboration: Engaging experts from various fields.

(e.g., *Echanove Square*).

N5. Policy Support: Ensuring supportive regulatory frameworks.

(e.g., Renovation of Skanderbeg Square, Lisboa Square, Liz Christy Community garden, *Mezquita*).

Limitations:

L1. Regulatory Constraints: Navigating heritage conservation laws.

(e.g., Kloster Lorsch, Alameda de Hércules, Huerto de Orive, Mezquita).

L2. Limited Financial Resources: Addressing budgetary limitations.

(e.g., Caramoniña Orchards, Bolivia green axis, Virgen Blanca Square).

L3. Conflicts Between Preservation and Modernization: Balancing historical and contemporary elements.

(e.g., Santa Creu i Sant Pau Hospital gardens, Ljubljanica riverbanks, Huerto de Orive, Echanove Square).

L4. Gentrification Risks: Preventing displacement of local communities.

(e.g., Niel Garden, Project Madrid-Río, Ljubljanica riverbanks, Lisboa Square, Alameda de Hércules, Encarnación Square).

L5. Maintenance Challenges: Ensuring long-term upkeep of renewed spaces.

(e.g., Restoration of the Irrigation Channels of the Thermal Gardens, Liz Christy Community garden, Ljubljanica riverbanks, CaixaForum Madrid Vertical garden, Encarnación Square, Virgen Blanca Square, Echanove Square).

<u>Prospects:</u>

P1. Technological Advancements: Utilizing smart city solutions.

(e.g., Texcoco Lake Ecological Park, Lisboa Square, Encarnación Square, Echanove Squar).

P2. Public-Private Partnerships: Leveraging diverse resources.

(e.g., Renovation of Skanderbeg Square).

P3. Community-Driven Initiatives: Empowering local residents.

(e.g., Caramoniña Orchards, Project Madrid-Río, Lisboa Square, Bolivia green axis, CaixaForum Madrid Vertical garden, Alameda de Hércules, Encarnación Square, Huerto de Orive, Mezquita, Virgen Blanca Square).

P4. Sustainability and Resilience Focus: Prioritizing eco-friendly and resilient designs.

(e.g., Liz Christy Community garden, Ljubljanica riverbanks, Huerto de Orive, Virgen Blanca Square).

P5. Innovative Funding Mechanisms: Exploring new financial models.

(e.g., Saint Sernin Square, Liz Christy Community garden, Encarnación Square).

V LIST OF FIGURES: