



Prato Urban Jungle

Placing Nature at the Heart of the Urban Redesign

Final Publication



Co-funded by the European Regional Development Fund through the European Union initiative 'Urban Innovative Actions'





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Edited by the Prato Urban Jungle Partners:

Municipality of Prato

PNAT srl

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Co-funded by the European Regional Development Fund through the European Union initiative 'Urban Innovative Actions'



EUROPEAN UNION
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Introduction

The challenge of addressing climate change by designing new ways of sustainable development and the protection of all forms of life on the planet touches upon the urban areas of the world.

It is a well known fact that cities are most responsible for the ongoing climate change, contributing as they do to 75% of climate-altering emissions overall, while simultaneously constituting focal points where the effects of climate change most violently manifest. Since 2007, the global population living in urban areas has exceeded that living in rural areas - this urbanization trend will inevitably persist, raising huge concerns about how to outline new urban paradigms that place environmental issues at the center of urban development.

The environmental crisis comes with additional issues. In-depth studies on urban phenomena bring to light the very close connection between neighborhoods marked by environmental vulnerability (e.g. lack of natural areas with consequent heat island phenomena, the sealing of soils with consequent runoff phenomena, the presence of traffic arteries with consequent air pollution, etc.) and the social vulnerability of the residing population. These studies make the case for defining urban development policies that take into account both environmental aspects and social inclusion by the same stroke.

The European Union, starting from its Urban Agenda programme, has placed urban areas at the heart of political action, by upholding a number of subsequent and coherent programmes - such as the Green Deal and the European Urban Initiative - that focus on tackling the Union's sustainable development right from the cities.

The political and cultural aftermath of the Prato Urban Jungle project falls within this framework. It constitutes the contribution of a medium-size European city of around 200,000 inhabitants to the definition of new urban paradigms that place environmental and social issues at the core of urban planning and development.

Starting from 2014 the city of Prato has launched a public all-round reflection on its sustainable development. Its vision is contained in two documents developed within the Urban Agenda - the first approved in 2015 and the second in 2020 - which outline the scenarios and policy strategies for the medium-to-long term planning of the city that promote the interaction between urban, environmental and health prevention interventions. The general strategy of Prato's urban policies advocates the involvement of citizens through participatory and co-design processes, placing social inclusion at the heart of every action, and upholds the definition of data-driven policies through a transparent decision-making model based on research and scientific insights.

Prato's first Urban Planning document that dates to 2018 is the Municipal Operational Plan. This Plan is one of the first examples in Italy of a new generation of urban planning tools, that place the environment and nature at the center of its strategies: the slogans at the heart of the document are: "nature is health" and "a tree instead of a pill".

The Operational Plan includes Prato's Urban Forestry Plan - that was developed by two partners of the PUJ project, i.e. the PNAT Start-up and the Stefano Boeri Architects Studio - which is, at the European level, one of the first general forestry documents that covers the entire municipal area in the form of a real and concrete action plan. The Urban Forestry Plan adopts the "landscape urbanism" approach, which holds the idea that cities are made of an interconnected network of natural areas and green infrastructures, wherein built "islands" are included, thereby turning former traditional urban planning approaches the other way round.

This approach holds that built “islands” play a central role to deliver innovative strategies and environmental policies, especially at sites where greater environmental vulnerability is felt. These are sites where fewer natural areas are found, where socially weaker people with lower per capita incomes live, where higher school dropout rates are found, homes hold lower-than-average property values, etc. Such areas represent the front line of European urban environmental and social inclusion policies.

The Prato Urban Jungle project focuses just here, by providing a new urban paradigm in the most densely built areas of the city, where the most vulnerable part of the population lives. The project places nature at the heart of redesigning such areas, while promoting a data-driven approach and involving the citizens right from the start, for the co-design of both the construction and management phases of the Nature Based Solutions (NBS) implemented by the project.

The Prato Urban Jungle project outlines a holistic approach advocating the extensive use of Nature Based Solutions to “renaturalize” existing buildings and their neighborhood. Its NBS are designed by the Stefano Boeri Architects Studio and PNAT. Digital twins of the target areas have been developed by PUJ Partner CNR IBE to support designers in their work and simulate the medium-to-long term effects of the NBS, particularly as concerns the lives of the citizens who either live in or use the buildings and the neighborhood.

Alongside its technical actions, PUJ has defined a new urban governance model. An ad-hoc digital platform - developed by PUJ Partner Treedom - has been developed to support the overall urban forestation program of the city. The Prato Forest City platform integrates the forestation projects of the Municipality with those promoted by the citizens, that are funded through crowd-funding campaigns.

The project’s urban governance model, which places nature and sustainable behavior at the center of urban development, has also aimed at building knowledge and awareness in the younger generations. PUJ Partner Legambiente has involved thousands of students from the schools in Prato through dedicated workshops and the delivery of guidelines on how to create one’s own urban jungle. Local economic sectors and businesses have been encouraged to adopt environmentally conscious activities thanks to the reward system developed by PUJ Partner Green Apes, which through its app has mapped and rewarded tens of thousands of sustainable behaviors. Through the Prato Urban Jungle project, the city of Prato has implemented its environmental and urban forestation strategies: the project has triggered a broad public debate that is helping raising the awareness of both the Municipality and the citizens, and is encouraging businesses and local associations to work together with the Municipality towards the green transition of the city.

Valerio Barberis

Municipality of Prato

Councilor for Urban Planning, Environment, Circular Economy.

Partners

The City of Prato. With a population of 194,793 residents, Prato is the second largest city in Tuscany and the third largest in Central Italy. Given its size and location, Prato assumes a crucial and strategic role in the metropolitan and wider regional area. The Municipal Administration has developed a medium-to-long-term vision based on a thorough analysis of the existing conditions and guided by the principles of Sustainable Development Goals. Prato boasts a rich tradition of innovation, not only in its manufacturing sector but also in the local government's commitment to experimenting with citizen services.

More info available on: <https://www.cittadiprato.it/en/>

PNAT is an academic spin-off of the University of Florence, made up of designers and plant scientists who develop creative strategies and solutions based on scientific discoveries. PNAT deals with transferring knowledge on plant behaviour into technological innovations inspired by the plant model. The goal is to build and promote synergic relationships between the natural and artificial environment, the central theme of sustainable design.

More info available on: <https://www.pnat.net/>

Stefano Boeri Architetti is dedicated to design and research in architecture and urban planning, but also in the cultural, design and interior design fields. "Multiplicity" is the guideline that has oriented a multifaceted activity in over 20 years and spread through design themes and urban and social geographies of the world. An approach that has allowed the studio to establish itself as a reference point at an Italian and international level in areas such as the architecture of sustainable biodiversity, social housing, urban development strategies at different scales.

More info available on: <https://www.stefanoboeriarchitetti.net/en/>

The Institute for BioEconomy of the National Research Council (CNR IBE) works in the definition of strategies and in the development of technologies and operational solutions that trigger the resilience and sustainability of territorial and productive systems with respect to global emergency resources affecting the agri-food and non-food sectors, climate and meteorology. CNR IBE has collaborated on many projects in order to study the impact of climate change on agriculture and climate systems with particular regard to the qualitative and quantitative effects on vegetation and populations.

More info available on: <https://www.ibe.cnr.it/en/>

The Estra Group, one of the leading operators in Central Italy in the distribution and sale of natural gas, also active in the sale of electricity, was founded in 2010. To date, the four Estra partners (Consiag, Coingas, Intesa, and Viva Servizi), represent 143 municipalities in the provinces of Ancona, Arezzo, Florence, Grosseto, Macerata, Pistoia, Prato, and Siena. The Estra Group operates, through subsidiaries, joint ventures and associates, mainly in Tuscany, Umbria, Marche, Abruzzo, Molise, Puglia, Campania, Calabria, and Sicily and is active in the distribution and sale of natural gas and LPG, in the sale of electricity, as well as in telecommunications, in the design and management of energy services and the production of energy from renewable sources. Recently it also operates in some segments of the value chain of the environmental services.

More info available on: <https://www.estra.it/>

Legambiente is one of the most prominent Italian environmental associations, active since 1980. A non-profit association, made up of citizens who care about the protection of the environment in all its forms, the quality of life, and a fairer, just, and supportive society. Legambiente bases its mission on scientific environmentalism and has been fighting for beauty, protection, and a better quality of life for the last 40 years.

More info available on: <https://www.legambientetoscana.it/>

greenApes is a digital platform that involves and rewards actions and sustainable lifestyles: users accumulate reward points through their sustainable actions, exchanging ideas, and completing challenges. Points can be spent to access experiences, gifts, and discounts in the world of sustainability. greenApes is easy to integrate with local services and initiatives to automatically certify (and reward) the sustainable actions of users. greenApes has received various awards over the years for the innovation and quality of its solutions such as the 2014 Sustainable Development Award with the President of the Republic's medal.

More info available on: <https://www.greenapes.com/en/>

Treedom is the only web platform in the world that allows you to plant a tree remotely and follow it online. Since 2010, more than 1,000,000 trees have been planted in Africa, Latin America, Asia, and Italy. All trees are planted directly by local farmers and contribute to environmental, social, and economic benefits. The Treedom tree involves people and is at the same time a communication and marketing tool for companies.

More info available on: <https://www.treedom.net/en>

The background features a dark teal color with several large, overlapping, abstract shapes filled with white hatching. The hatching consists of parallel lines that create a textured, organic feel. The shapes are somewhat irregular and layered, suggesting a sense of depth and movement.

THE PILOT SITES OF PRATO

URBAN JUNGLE

San Giusto neighbourhood, Via Turchia

Among the pilot areas of the Prato Urban Jungle project, the building complex in Via Turchia, owned by EPP - Edilizia Pubblica Pratese (Prato social housing company) Edilizia Popolare Pratese (Prato social housing company), is located in the San Giusto district, an urban area with a high population density, characterized by the presence of large green areas and social housing. Designed by Riccardo Roda and Carlo Terpolilli in 1984 and completed in 1994, the complex consists of three blocks - which house a total of 102 public residential units and 224 residents - connected by a pedestrian square overlooked by two low buildings used as cellars .

The public housing buildings owned by the Municipality of Prato and managed by EPP in Via Turchia, during the period of their construction, were an experimental reference project for the drafting of Law no.10 of 1991 on energy saving in the building sector. In the context of this experimental approach, bioclimatic greenhouses were built, i.e. south-facing verandas that were supposed to serve as a thermal flywheel, which proved to be unsuitable over time.

Several years after the initial project, the intervention in the context of Prato Urban Jungle aims to improve the quality of life in the spaces of the residential complex, helping to enhance the cohesion between the San Giusto district and the city of Prato.



Fig.1 - Rendering of the south façade of the executive project of Via Turchia social housing complex (credits: Stefano Boeri Architetti)

The project starts by considering the role of greenery and its significant ecosystem services including the mitigation of pollution caused by road traffic, the absorption of CO₂, the production of oxygen, the regulation of the microclimate and the reduction of noise pollution. On a territorial scale, the intervention therefore has the objective of redeveloping the existing urban fabric starting from the principles of securing and implementing nature-based solutions in the urban context of Prato. With this objective, a first punctual intervention is foreseen on the vertical surfaces, with a system of green facades which create, between inside and outside, a vegetal screen of climbing plants.

In the main access to the courtyard at the gap between the two buildings to the south, a green pergola is designed to transform a space now used for passage into a resting and meeting place. The principle is on the one hand to symbolically enhance the entrance space and on the other to create a green and shaded area that can be used by all. The pergola covers an area of about 100 square meters (8x12 meters) and consists of a metal structure with 5 box section beams with a section of 300 x 150 mm in steel which cover a span of about 12 meters. The beams placed at intervals are connected by stainless steel metal cables and form the support for the climbing plants. As regards the intervention on the existing facades, currently covered with a brick facing, the project envisages - after the necessary maintenance phases - the covering of the elevations with 2850 m² of climbing vegetation, on a self-supporting structure.



Fig.2 - Current view the south façade of Via Turchia social housing complex (credits: Davide Virdis)

In relation to the existing conditions, two types of structure were designed for the support and tutoring system of the climbing greenery:

- Type 1. When the system interacts with blind facades, it is characterized by a sequence of stainless steel cables anchored to the facades with approximately 20 cm spacers - in this case the plants are housed in linear pots placed on the ground floor, or directly in the ground, and directed to growth along the metal cables.
- Type 2. In correspondence with the windowed portions in place of the greenery adhering to the façade, brise-soleils projecting approximately 75 cm from the façade are provided and made with brackets and vertical taut cables for the growth of climbing vegetation.

In turn, the typologies are declined in six variants according to the specific characteristics of the place in which they are arranged.



Fig.3 - Current view the south façade of Via Turchia social housing complex (credits: Davide Virdis)

The presence of vegetation affects both types of facades envisaged by the project; the selection of the species is purposely studied on the one hand to enhance the overall architectural result and on the other to optimize the need for maintenance linked to the management of the green areas: this means, for example, particular attention in the relationship with the openings. Furthermore, the greenery project was developed starting from the choice of climbing species able to reach the top of the buildings, combining with these other species – including *Campsis grandiflora*, *Fallopia baldschuanica*, *Hedera hibernica*, *Lonicera henryi* – with a more contained development in height but with complementary aesthetic characteristics or able to offer a more diversified effect. To achieve as

interesting an effect as possible, in addition to the climbing component, the plant elements that grow on the ground play an equally important role: small tree species, shrubs and herbaceous species have been identified, which are characterized by large, elongated, lacinate, or fine and composed – natural combinations and contrasts to return a diversified whole.

Also in the second phase of the intervention, the project takes into consideration the design of the common spaces, such as the condominium areas or the interstitial space between the residential blocks. In the central space between the buildings and the cellars, currently used as a garden, there are a series of common functions designed to encourage moments of sociality among the residents of the complex, through various activities: two outdoor educational workshops are arranged around with two existing trees, community vegetable gardens consisting of 4 wooden tubs, a playing area for children and a table with seats.



Fig.4 - View of the internal court of Via Turchia social housing complex (credits: Davide Virdis)

Lastly, in the southern car park, the complete refurbishment of the asphalt paving is planned, which is replaced by paving made with draining self-locking blocks, with the aim of increasing the permeable surfaces of the area, avoiding the phenomenon of rainwater runoff.

With the same design approach, the intervention by Stefano Boeri Architetti also includes a transformative proposal for the main and busiest road infrastructures, through environmental mitigation with the planting of trees and the demineralization (depaving) of the parking lots, with the goal of increasing the shaded surfaces and thus reducing thermal stress and the heat island effect that afflicts contemporary cities with increasing intensity. In terms of urban planning, the EPP buildings in Via Turchia are located on the western edge of the Agricultural

Gulf of San Giusto: the main green connection axes in this case allow a reconnection of the area, divided by the inaccessible agricultural fields. On the grounds of the intubated mill-race, in particular, a naturalistic cycle-pedestrian path is proposed which would connect the Don Milani school with the residential areas, the sports association and the Church of San Giusto.

In the vision elaborated by Stefano Boeri Architetti, the areas for urban forestation planted or used for the creation of orchards could in the future be usable for the students of the Don Milani school: with a long-term perspective, the project in fact also imagines the possibility to create a close relationship with the students of the Don Milani school, through the creation of educational workshops for the involvement of the classes in the management and maintenance of urban gardens and orchards.

The project for the buildings in Via Turchia goes beyond the traditional concept of urban forestation, generally applied to already green areas or to their reconstruction; instead it is a real green colonization that aims to use large re-naturalised surfaces to increase the energy savings of buildings, transform the common areas into a social garden, a place that can be used by the inhabitants and become the cornerstone of the city's reconversion and ecological transition.

The numbers of the final executive project for the EPP buildings in Via Turchia:

- 100 m₂ of entrance pergola to the shared garden
- 2850 m₂ of green facades on blind facades
- 670 m₂ of green facades with sunscreens
- 2650 m₂ of new permeable flooring
- 573 kg/year of CO₂ absorbed (preliminary analysis by CNR-IBE)
- 5,147 g/year of pollutants removed (O₃, NO₂, SO₂, PM2.5) (preliminary analysis by CNR-IBE)
- Lowering of the local temperature by 2° / 3° C
- Lowering of the temperature of the facade surfaces from 11° to 20° C

Project by Stefano Boeri Architetti

Preliminary project: Director: Francesca Cesa Bianchi; Coordinators: Maria Chiara Pastore, Livia Shamir;
Project team: Benedetta Cremaschi, Sofia Paoli, Mattia Tettoni

Final and executive project: Director: Hana Narvaez; Coordinators: Maria Chiara Pastore, Livia Shamir;
Project team: Sofia Paoli, Yulia Filatova, Daniele Barillari
Consultants: SCE Project srl (Structural Engineering)

Macrolotto Zero neighborhood, City Market

Most of our cities are hot, dry, polluted and impermeable. At the same time, climate change is bringing more frequent and extreme weather events such as summer storms, flash floods and heat waves. Research has already amply demonstrated that plants and the solutions they inspire us, when integrated into urban constructions, can simultaneously provide environmental, social and economic benefits and help build resilience. Green is essential in our cities, from an energy, ecological, social and economic point of view. The use of green infrastructures and solutions based on the use of plants is an essential choice for facing current and future challenges and for dealing with the impact that climate change is having on our daily lives. In addition to the fundamental role that plants and greenery have in urban planning, equally important are the solutions based on the use of plants that can be applied directly to the scale of the building and its appurtenances. The advantages and benefits that plants offer in an urban environment must not in fact be limited to canonical, albeit fundamental, places such as parks, avenues, gardens and flower beds. The use of plants in an innovative way to cover the facades of buildings, produce food on the horizontal surfaces of buildings, purify the internal environments, phytoremediate or re-naturalize small abandoned and degraded areas pertaining to buildings, regulate and purify water, capture CO₂ and filtering atmospheric contaminants, responds effectively to the needs of the environment, society and citizens' health. Nothing prevents a city from being completely covered in plants.



Fig.5 - View of the entrance of the City Market at the Macrolotto Zero neighborhood (credits: Davide Virdis)



Fig.6 - View of the entrance of the City Market at the Macrolotto Zero neighborhood (credits: Davide Viridis)

The challenge of the Prato Urban Jungle is to pilot green solutions in buildings located in the city of Prato, to create exemplary designs in these areas that can serve as models for other cities in Europe. Through this pilot, Prato seeks to showcase innovative and sustainable approaches to urban design, demonstrating the potential benefits and replicability of integrating green solutions into building projects.

The first action carried out by PNAT was the creation of a measurement system to evaluate the effectiveness of natural solutions applied to the scale of the building and its appurtenances. This experimental system – which has been called Urban Jungle Factor – relies on pioneering studies carried out by some European and North American cities, to assign a score to green interventions in the city. The score is calculated with a formula that takes into account the green area compared to the total area of the building, and a factor that estimates the quality of the intervention with respect to the criteria of air, water, soil, food, health and well-being, comfort and biodiversity, as well as with respect to the use of resources. It is a scientifically validated tool that can be effectively applied to various scenarios. Its purpose is to quantify and assess the benefits that plants provide in urban environments. By using this tool, people can gain a better understanding of how incorporating plants and natural-based systems into the built environment can significantly enhance its livability, promote good health, and create a more comfortable atmosphere. It serves as a valuable tool for evaluating and promoting the positive impact of greenery on our urban landscapes, emphasizing the importance of integrating nature into our cities for the well-being of individuals and the overall urban ecosystem. The Urban Jungle Factor served as a guiding principle for implementing an initial enhancement project on the new building of the City Market. In this project, greenery was strategically incorporated both on the exterior and interior of the building, transforming it into a living entity capable of functioning as a biological machine.



Fig.7 - View of the entrance of the City Market at the Macrolotto Zero neighborhood (credits: Davide Virdis)
(credits: Davide Virdis)

The presence of vegetation on the main facade and inside the building contributes to various benefits such as purifying polluted air, mitigating the building's impact on the surrounding environment, and providing natural cooling effects during warmer periods. This integration of greenery not only enhances the aesthetic appeal of the building but also demonstrates its functional role in creating a healthier and more sustainable urban environment.

The Market is proposed as an active reference in the urban demineralization system thanks to punctual actions that increase the presence of green areas. This goes beyond simply utilizing the external space of the building and extends to the integration of plant species within the market's interior. The inclusion of functional greenery aims to serve a purpose beyond mere decoration, actively contributing to the overall environmental quality and well-being of the space.

The internal spaces dedicated to the area for the consumption and administration of food and drinks are a large green lung, i.e. a space capable of removing atmospheric pollutants through plants in an innovative way. The external intervention focuses on utilizing nature to transform the facade of the building into a green surface. This approach serves multiple purposes, including mitigating the building's impact on the surrounding environment, reducing heat buildup during the summer, and capturing atmospheric pollutants throughout its lifespan, leveraging the power of nature to enhance sustainability, improving microclimate conditions, and contributing to a healthier urban environment. An area of about 215 m² has been created inside the Market, separated

from the rest of the space by a glass that can be crossed in two points. This area dedicated to consumption and refreshment is characterized by the constant presence of plants that integrate the vegetation with the furnishings. This will develop a series of benefits, from psychophysical ones to others with a more functional character, isolating the workstations acoustically and visually from the nearby ones. The most innovative aspect is the improvement of the air quality that the plants will produce thanks to the innovative “Air Factory”, a botanical purification system with which the pollutants present inside the premises will be largely removed and degraded thanks to the green “friends”. The Air Factory is an innovative air purification system that utilizes plant-based biofiltration to effectively and sustainably address the need for clean indoor air, acting as a natural and eco-friendly solution for indoor air quality improvement. According to the European Union “air pollution remains the most serious environmental health problem in Europe, with a mortality rate more than 10 times higher than that of road accidents” and the indoor air quality often falls short, with pollutants reaching higher levels indoors compared to the outdoor environment. This is because indoor air pollutants come from a variety of sources and include particles of external origin that migrate indoors and particles that come from internal sources.



Fig.8 - Internal view of the City Market at the Macrolotto Zero neighborhood (credits: Davide Virdis)

Two “Air Factories®” have been strategically positioned along the glass partition that separates the interior of the market from the external environment, specifically designed and sized to effectively purify the air inside the market. Both elements use the Stomata® system, an innovative plant filtration technology developed by PNAT which significantly amplifies the natural ability of plants to absorb and degrade airborne pollutants. As regards the intervention relating to the external area of the building facing via Giordano, the greenery transforms the facade of the building into a large natural setting thanks to the massive presence of climbing plants that rise up a metal mesh and to the presence of plants along the whole base of the facade. The placement of plants

in tubs positioned on the sides of the entrance spaces, integrating the seats, offers a unique and innovative approach to incorporating greenery into the design of the market. The benefits relating to this intervention are extensive, and vary from the improvement of air quality to the reduction of temperatures in the hottest periods. This drainage system allows for the removal of excess water from the tanks to prevent waterlogging and maintain optimal growing conditions for the plants. The drainage pipes are connected to the existing network, ensuring that the water is efficiently directed away from the tanks. The selection of plants for the intervention has been based on criteria of low maintenance and ease of management.



Fig.9 - Internal view of the City Market at the Macrolotto Zero - construction phase (credits: PNAT)

Prato Urban Jungle serves as a collaborative platform aimed at experimenting with nature-based solutions within an urban environment. This initiative stands out for its innovative approach in implementing a range of natural solutions that generate various benefits, encompassing environmental improvements, as well as personal and community well-being. By incorporating technical-ecological synergies, these systems enable the creation of high-quality spaces that enhance the environmental conditions within our cities. These spaces offer more than mere aesthetics; they provide an opportunity for local communities to reconnect with nature and agriculture, ultimately fostering a renewed urban identity. The greenery implemented is not purely decorative but serves functional purposes.

The solutions proposed by Prato Urban Jungle are designed with flexibility in mind, allowing them to be adapted and implemented in various locations within the city or even in different cities. This approach overcomes the numerous constraints typically associated with diverse urban spaces, ensuring that the benefits of these nature-based solutions can be extended widely.

Despite facing challenges, particularly due to the unprecedented circumstances such as the Covid-19 pandemic and the ongoing conflict in Ukraine, the projects driven by Prato Urban Jungle embody an innovative and experimental spirit, making them a unique and unparalleled experience in Italy. These initiatives not only offer practical solutions but also inspire ideas for future contemplation by all. The constraints posed by the specific characteristics of each location should not discourage us, no matter how complex they may seem. Through collaboration, negotiation, and involvement of all stakeholders, in the first place citizens and public administrations, these challenges can be overcome. What truly matters is the shared objective of making a significant and transformative ecological change. If not now, then when?

Project by PNAT

Preliminary project

Director: Cristiana Favretto e Antonio Girardi;

Coordinator: Antonio Sarpato;

Project team: Livia Pacini; Matteo De Rossi; Werther Guidi Nissim

Final Executive project

Director: Cristiana Favretto e Antonio Girardi;

Coordinator: Antonio Sarpato;

Project team: Livia Pacini; Matteo De Rossi; Werther Guidi Nissim

Consultants: SCE project srl (Structural Engineering)

Soccorso Neighbourhood, Consiag - Estra Headquarters

The Consiag – Estra headquarters, one of the pilot intervention areas of the Prato Urban Jungle project, is located in Via Ugo Panziera in the Soccorso area of Prato, a historic area with a high building and residential density where over 50,000 vehicles transit per day. The theme is to promote, starting from the implementation of urban forestation strategies, the redevelopment of the neighborhood both at an environmental level, for example through the ability of plants to store CO₂ from the air and remove fine dust emitted by vehicular traffic, and at a social level, improving the physical and mental well-being of citizens and employees of the company.



Fig.10 - Rendering of the executive project of Consiag - Estra Headquarters at the Soccorso Neighbourhood
(credits: Stefano Boeri Architetti)

The strategic vision of the project area envisages the demineralization of the area as the first step of the intervention, both on the ground and on the buildings: on the main and busiest road infrastructures we intervene with an environmental mitigation strategy with green works, providing planting of trees or shrubs, based on the section of the road and the height of the buildings present. The car parks, in Stefano Boeri Architetti's project, are entirely demineralised, replacing the waterproof flooring with a draining one and providing for the planting of trees or shrubs, or the construction of pergolas with climbing plants or photovoltaic panels.

As regards the intervention on the Consiag-Estra building, the construction of a green façade is envisaged in order to create a plant screen that performs a function of mitigation and reduction of atmospheric pollution - through the absorption of the fine particles released by the road traffic - and noise



Fig.11 - Rendering of the north façade of the executive project of Consiag - Estra Headquarters at the Soccorso Neighbourhood (credits: Stefano Boeri Architetti)

In particular, the project for the southern facade, characterized by large ribbon windows, involves the use of a specially designed brise-soleil system: the climbing plants run on steel cables up to cover the overall height of the building. In this way the southern elevation, more exposed to solar radiation, is covered in a significant way by vegetation and guarantees, through shading, a reduction in the temperature of the surfaces of the facades estimated between 11° and 20° Celsius.

The brise-soleil system provided for the support and tutoring of the climbing greenery is made with a structure consisting of a series of stainless steel shelves projecting 120 cm from the facade and fixed to the floors of each floor using metal plates dowelled on site. The lower anchoring of the cables is achieved at each brise-soleil by a reinforced concrete ballast built at street level, to guarantee the stability necessary for the best growth of climbing vegetation.

The intervention on the north elevation, on the other hand, is composed of a system of checkerboard vases which, following the rhythm of the existing structure, are positioned in correspondence with the blind elements of the building's façade, creating space for significant portions of greenery (trees and shrubs), without obstructing the lighting and ventilation inside the building. The project defines a metal structure that crosses the existing attic on the ground floor to rest directly on the ground. This structure is, at the same time, the support on which the technological system necessary for the irrigation of the facade vegetation travels.



Fig.11 - Rendering of the north façade of the executive project of Consiag - Estra Headquarters at the Soccorso Neighbourhood (credits: Stefano Boeri Architetti)

The intervention on the north elevation, on the other hand, is composed of a system of checkerboard vases which, following the rhythm of the existing structure, are positioned in correspondence with the blind elements of the building's façade, creating space for significant portions of greenery (trees and shrubs), without obstructing the lighting and ventilation inside the building. The project defines a metal structure that crosses the existing attic on the ground floor to rest directly on the ground. This structure is, at the same time, the support on which the technological system necessary for the irrigation of the facade vegetation travels.

The 106 trees and 2500 shrubs housed on the facade were selected from the autochthonous species or those most suitable for growing healthily in the specific climatic conditions of the city of Prato - among these, *Wisteria Floribunda Alba*, *Floribunda Rosea*, *Floribunda Issai*, *Parthenocissus Quinquefolia* and *Hedera Hibernica* - but also in order to obtain different chromatic effects during the different seasons of the year, such as in spring with the flowering of the wisteria or in autumn when the Canadian vine lights up red.

In addition to the vertical surfaces, the green project also involves the horizontal ones with specific implementation strategies that take into account the orientation, functions and needs of the users, with the aim of creating new usable green spaces, increasing the permeable surfaces - in with a view to saving water and energy - and become an example of an urban biodiversity hotspot. With this perspective, the roof of the building is transformed into a green roof, accessible to collaborators, visitors and employees, to respond to the guidelines of the Action Plan of the Municipality of Prato.

In particular, a green pergola transforms the roof of the building into an island of biodiversity, usable by employees as a place for socializing, for small events or for physical activity, favoring the creation of corporate welfare spaces. The pergola covers an area of about 345 square meters and is made up of painted steel box beams and steel cables to support 618 square meters of climbing vegetation. The plants are housed in two linear tanks placed against the blind walls to cover both the horizontal surface of the pergola and the walls of the building themselves. In the shade of the pergola, wooden steps are provided, which face each other to create a space for resting and meeting.

The project for the Consiag-Estra building also takes into consideration a maintenance plan for the structure, in order to maintain the functionality, quality characteristics, efficiency and economic value of the work over time, as designed. The maintenance of the structure consists in the visual inspection to be carried out annually, aimed at detecting possible anomalies ranging from phenomena of detachment of the surface protection layer, to the onset of corrosive phenomena of the steel structures, up to anomalies in the connections between elements,

and identify the causes. Since these are structures that support the plant system, in fact, the frequency and care of green maintenance will be crucial to improve the durability of the metal structures and in particular to avoid anomalous increases in the loads to be supported.

Again, with reference to the redesign of the horizontal surfaces, the bio-solar system is used on the roofs of the buildings facing Viale Leonardo da Vinci: a solution that combines the green roof with photovoltaic panels to optimize energy efficiency together with green ecosystem services. As regards the energy performance of the project, the objective of installing photovoltaic panels on almost all the roofs is precisely oriented towards the energy self-sufficiency of the district, with energy hubs dedicated to storage and distribution between the buildings. While in terms of impact on local biodiversity, biosolar roofs provide for the presence of specifically selected vegetation to attract pollinating insects, especially in the case of roofs near existing agricultural areas.

The project also proposes a vision on a larger scale: the Consiag-ESTRA building could become the fulcrum for a large green system consisting of the Pace park with sports facilities, the enclosed agricultural territory, the Agriurban Park system to the city made up of the former Banci and Fonti parks, the Declassata park and the Tirante Verde. On the one hand, the project envisages enhancing the main green connection axes through naturalistic cycle-pedestrian paths that make the system more accessible; on the other, the tree-lined roads also act as ecological corridors, multiplying their ecosystem potential through the connection of the green areas.

The intervention for the Consiag – Estra headquarters, in line with the vision of Prato Urban Jungle, is a project that puts living nature at the center of the planning objectives, to contribute to having a healthy and resilient city thanks to the use of Nature-based Solutions in architecture, through the creation of three types of green facades around the entire perimeter of the building to improve the energy efficiency of the entire building. Great positive impact is guaranteed by the construction of an urban forest that mitigates the impact of the avenue, creating green connections and becoming an accessible and usable space for citizens.

The numbers foreseen in the vision/preliminary project for the Consiag – Estra headquarters are:

- 1958 m₂ of green facades with pools
- 1450 m₂ of green facade with vines
- 158 vases on the facade, containing 106 trees and 2500 shrubs
- 345 m₂ of accessible roof
- 160 m₂ of solar panels
- 618 m₂ of green roof covering
- 415 m₂ of pergolas on the roof
- 43 T CO₂/year absorbed by the trees on the facade (estimated by CNR-IBE)
- Production of oxygen sufficient to cover the daily needs of 424 people
- Lowering of the local temperature of 2° / 3° C
- Lowering of the temperature of the facade surfaces from 11° to 20° C

Project by Stefano Boeri Architetti

Preliminary project: Director: Francesca Cesa Bianchi; Coordinators: Maria Chiara Pastore, Livia Shamir;

Project team: Benedetta Cremaschi, Sofia Paoli, Mattia Tettoni

Final and executive project: Director: Hana Narvaez; Coordinators: Maria Chiara Pastore, Livia Shamir;

Project team: Sofia Paoli, Yulia Filatova, Daniele Barillari

Consultants: SCE Project srl (Structural Engineering)



ENVIRONMENTAL MONITORING

The AirQino stations

The presence of air pollutants in the urban area of Prato has been detected through low-cost environmental monitoring stations called “AirQino” (Fig. 12). These devices have been developed by the Institute for Bioeconomy of the National Research Council within the context of scientific projects and provide continuous and reliable data on air pollutant concentrations (particulate matter, ozone, nitrogen dioxide, and carbon monoxide), greenhouse gases (carbon dioxide), and environmental parameters (air temperature and relative humidity). Thanks to their design, these stations are easy to use and install, making them particularly useful for establishing large-scale networks in the municipalities under study.



Fig.12 - Images of the AirQino sensors (credits: CNR IBE)

Within the context of the Prato Urban Jungle project, a network of 30 devices has already been deployed across the territory to analyze air quality and other environmental parameters. This network has been established and will continue to expand through other projects, including:

- i) The Experimental Program of Interventions for Urban Climate Change Adaptation (15 stations).
- ii) The GIDA network (3 stations).

Remote Sensing

The installation of urban jungles transforms the city's surfaces. The addition of greenery affects surface temperatures through various phenomena, including increased evapotranspiration specific to each plant and changes in the amount of reflected light when a surface becomes darker or lighter. Lighter surfaces with more plants result in cooler temperatures, providing significant benefits during hot summers. During the project, the Institute for BioEconomy of the National Research Council conducted assessments at different scales to evaluate the impact of urban jungles on the fabric of the city of Prato. This involved combining the use of Copernicus satellite constellations, special sensors carried on board an aircraft for overflying the city, and handheld thermal cameras to investigate surface temperature variations in intervention areas in detail. The results of these investigations have provided valuable information on the characteristics of surfaces and urban jungles, and have provided the necessary data to simulate their effects on the microclimate of Prato and the well-being of its citizens.

Modeling Simulations

In Prato Urban Jungle, the Institute for BioEconomy of the National Research Council studied the effects of urban jungles even before their installation through computer simulations using data collected from AirQino stations and remote sensing. The Envimet model was used to create 3D representations of regenerated areas and evaluate the effect of greenery in improving thermal comfort during summer heatwaves. The model can simulate interactions between the atmosphere, surfaces, and urban jungles to obtain the perceived temperature by citizens. The I-Tree model allows quantifying the ecosystem service value of the greenery integrated into urban jungle designs. Specifically, it estimates the amount of pollutants deposited on the greenery, which are not inhaled by citizens, and the mitigation of greenhouse gas emissions through carbon dioxide absorption. These models have shown that the urban jungle in Via Turchia can lower air temperature by up to 1°C and wall temperature by nearly 10°C, resulting in significant energy savings and an increase in the psychophysical well-being of residents.

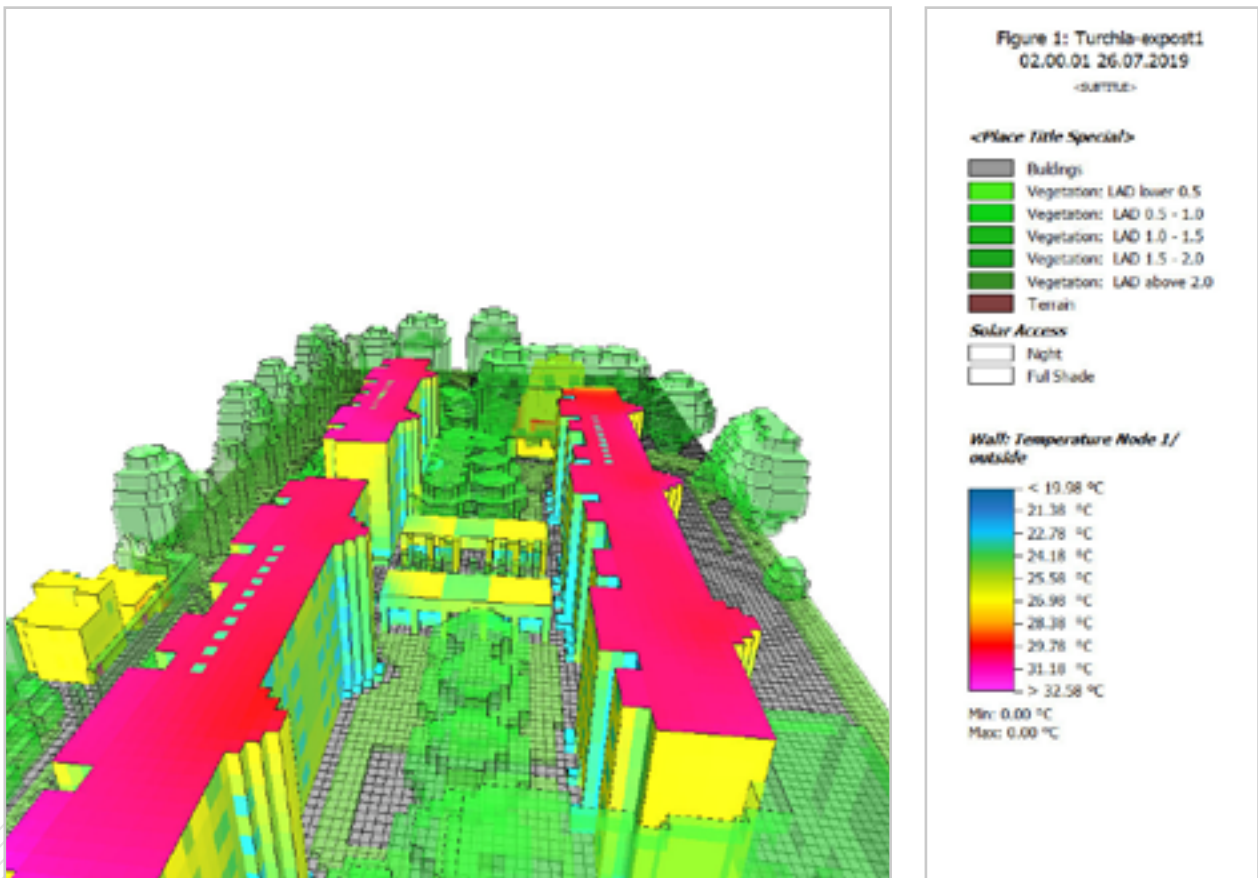


Fig.13 - 3D modelling of Via Turchia's site by means of Envimet software. Colors indicate the temperatures of the walls and the roofs (credits: CNR IBE)

Soil Restoration

Among the benefits derived from the creation of urban jungles, there is an improvement in soil quality. In the context of the Prato Urban Jungle project, the assessment of microbial biodiversity and Volatile Organic Compounds (VOCs), including pollutant compounds, was carried out for two sites in the Prato area. The first sampling was conducted at ESTRA at 3 points and two depths (0-5 cm and 5-15 cm), followed by Via Turchia at 18 points (Fig xx), where soil samples were taken from four different areas: an urban area characterized by the presence of Tilia plants, an area characterized by Quercus robur, an area characterized by Quercus ilex, and a park area adjacent to the considered urban zones characterized by the presence of these tree species. After sampling, the soil samples were kept at -80°C until DNA extraction and at 4°C for Volatile Organic Compounds analysis. Other representative samples were used for standard soil analyses such as texture, pH, and conductivity.

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Fig.14 - Area location and sampling details (credits: CNR IBE)

A dark teal background with a large, stylized leaf pattern. The leaves are filled with a fine, white, diagonal hatching pattern. The pattern is composed of several overlapping leaf shapes, creating a sense of depth and texture. The text is centered in the upper half of the image.

ENVIRONMENTAL AWARENESS

Prato Urban Jungle has provided an opportunity to test the experimental and innovative thesis of designing a city where vegetation can thrive on all available surfaces, both horizontal and vertical, providing the necessary ecosystem services (such as climate regulation, air and water purification, food supply, psycho-physical regeneration, etc.) for the sustainability of urban communities and the future of our planet. Fortunately, in recent years, environmental awareness has been spreading, as it is an essential factor in implementing new models of development. In addition to resources, nature also offers us lessons on what a model of society can be based on collective effort and sharing of strengths and skills. Nature pursues evolution towards its goal of self-preservation, and humanity can only learn from it. In this process, culture plays a strategic role by providing the necessary tools for a better understanding of the environment: “The subject of learning, whether it is the environment or sustainability, is complex. Therefore, it is necessary to be educated for complex thinking, capable of connecting facts to compose reality and recognize different solutions. A thinking that is trained to perceive the emergent properties of systems rather than reducing them to the sum of simpler components.”

Environmental awareness allows us to acquire these tools of understanding, which, as we have seen through our experience, are gradually assimilated through learning.

Regarding the topics of the urban jungle, plant life, seemingly indifferent to what we define as culture, is the foundation and substance of the world, not just an accessory. And it is not just a matter of learning, but of doing so with a fresh perspective, free from commonplaces and prejudices that have populated this branch of knowledge.

In this context, Legambiente has implemented a series of activities for environmental awareness: newsletters, “small” tools (toolkits for citizens and schools) to understand the relationship between the city and nature, courses, environmental education in schools, public meetings with speakers chosen to gather different voices and discuss various topics related to urban greenery. And, as is the case in collective work, we come out stronger and more capable of transmitting new environmental awareness.



Fig.15 - Environmental education activities in schools (credits: Legambiente)

The activities in cooperation with schools

Introduction

One of the main objectives of the awareness-raising actions implemented by Legambiente Toscana was to raise awareness and involve schools in the territory, and consequently, their families, in the key themes of the PUJ project.

The focus on environmental education is one of the main areas of action for Legambiente and represents an important opportunity to disseminate an environmental culture that is attentive to scientific approaches and open to the new challenges of contemporary complexity.

To reach the important target of students, several strategies were employed. Firstly, the development of didactic and laboratory proposals aimed at supporting teachers and stimulating the initiation of virtuous paths related to urban afforestation and the fundamental role of insects. We also created an operational manual that could be used not only by the six schools identified by the project but also by all schools in the Prato area and beyond. The invitation to engage in the presented laboratory proposals was accompanied by encouragement to propose and share other ongoing educational paths within the Prato schools community, utilizing the virtual space offered by the Prato Forest City portal. This created a real showcase for the exchange of good educational practices among schools in the area.

1) The educational project “Petals, Pollen, and Wings: Creating a Oasis for Pollinators”

The educational project proposed to the schools selected by the Urban Jungle project involved the creation of spaces dedicated to pollinator insects in school gardens by the participating students. The initiative was implemented in 6 school complexes, selected by the Municipality of Prato based on the characteristics of their school gardens. Specifically, 12 workshops were conducted - 2 per school complex - in the following primary and secondary schools:

- Istituto Comprensivo Prato Nord (Fermi Secondary School);
- Istituto Comprensivo Lippi (Lippi Secondary School);
- Istituto Comprensivo Puddu (Don Bosco Secondary School);
- Istituto Comprensivo Don Milani (Sem Benelli Secondary School);
- Istituto Comprensivo Tintori (Tintori Secondary School);
- Istituto Comprensivo Iva Pacetti (Santa Gonda Primary School).

The initiative involved approximately 300 students and around twenty teachers over the course of two academic years: 2021-22 and 2022-23. Each school was offered a customized program. Based on site visits to the school gardens, specific activities were agreed upon with the coordinating teachers, taking into account the existing conditions (garden type, irrigation system, available space and equipment, etc.), future educational programming prospects, and the willingness of the school staff to continue the activities even after the completion of the PUJ project.

This approach allowed for the precise planning of the educational pathways envisioned by the PUJ project, tailored to the specific school's reality, ensuring their sustainability and replicability. The basic format included: two classroom sessions to design the space for pollinators, maintenance activities, and area monitoring; two practical sessions to implement the designed spaces in the school garden. These sessions were supplemented by on-site visits by our staff to support the classes in the practical realization of their flower beds or to assist the teaching staff in finding tailored solutions for maintaining green spaces or the created structures. The first academic year focused on creating spaces to attract pollinators (flower beds and insect hotels), while the second year allowed for the maintenance and expansion of the established flower beds and monitoring of pollinator presence.

The participating classes were encouraged to keep a "logbook" to document their experiences and share their journey with other classes within the same school complex or ideally with other schools in Prato.



Fig.16 - Activities with students participating at the educational project "Petals, Pollen, and Wings: Creating a Oasis for Pollinators" (credits: Legambiente)

2) The "Green Generation" Toolkit

The educational pathway was accompanied by the development of an important communication tool: the "Green generation" toolkit, a practical guide designed for teachers of secondary school students and usable in all school cycles, from early childhood to upper secondary school. All schools in the area received multiple printed copies of the toolkit, along with the option to download the online version from the Prato Forest City portal at <https://www.pratoforestcity.it/spazio-scuole/>.

This manual is a comprehensive resource, rich not only in thematic insights and theoretical references but also in practical classroom and school garden activities to be carried out with students. Through an approach that promotes interaction and direct involvement of students in the learning process, the selected educational proposals provide an opportunity to experiment with numerous botanical concepts and approaches.

Teachers and students can explore the characteristics of plants, their influence on the quality of air, water, and soil, as well as learn about the living beings associated with plants. The manual also offers suggestions for creating themed green spaces that can be cared for, and from which students can learn through citizen science initiatives. These are just a few of the proposals that teachers can select to integrate into their educational pathways, aided by the practical instructions provided in the manual regarding timing, necessary materials, duration, and seasonal aspects. For each proposed activity, the manual includes the objectives to be achieved and the skills that students can acquire, in line with the 8 key competences for lifelong learning as recommended by the EU in 2018.

The manual was presented to the school community through several webinars, which were attended by numerous teachers.



Fig.17 - The “Green Generation” Toolkit (credits: Legambiente)

The opportunity to accompany the participating classes over the course of two school years allowed us to witness a progressive engagement from the students towards the topic of pollinating insects and, more generally, towards gardening and DIY practices.

Handling hoes, spades, and rakes, planting seedlings and seeds, nailing boards, and selecting pinecones, branches, rocks, and other reclaimed materials to create shelters for pollinators represented an exciting challenge for the young students. They had just emerged from a difficult period of inactivity due to the pandemic, which had largely confined them to immaterial and predominantly digital activities. It is fascinating to observe how, from initial skepticism towards manual activities involving contact with the earth, they gradually developed real horticultural competence, sometimes learning even complex techniques, and above all, understanding the sense of waiting, seasonality, and life cycles of plants and animals.

Teachers have highlighted how this type of activity brings cognitive and experiential benefits, allowing students to acquire skills and improve their psychophysical well-being.



Fig.18 - Activities with students participating at the educational project “Petals, Pollen, and Wings: Creating a Oasis for Pollinators” (credits: Legambiente)

Know to Protect, Observe to Understand: Nurturing Urban Biodiversity through Community Engagement

In today's rapidly urbanizing world, the need to appreciate and safeguard the natural world within our cities has become increasingly vital. In Prato Urban Jungle, a unique approach to raising awareness and fostering a deep connection with urban nature has emerged. Through a series of diverse and engaging activities, Prato Urban Jungle has embarked on a mission to empower citizens and highlight the importance of urban biodiversity and our intricate relationship with it, promoting the mantra of "know to protect, observe to understand."

Rather than presenting a mere checklist of plant species, Legambiente has adopted an approach that portrays urban jungles as complex ecosystems. By doing so, we have emphasized the numerous benefits that urban nature bestows upon us, including environmental well-being, physical health, and mental rejuvenation. Simultaneously, we have stressed the responsibility we have in nurturing and preserving these ecosystems, as they require our attention, planning, care, and expertise.

One of the primary goals of these initiatives was to engage the entire population of Prato and its surroundings. Recognizing the power of collective action, Prato Urban Jungle organized hands-on activities to nurture a sense of ownership and stewardship among the citizens. Collaborative clean-up campaigns and tree planting initiatives involving local students and universities served as transformative experiences, connecting people directly with the environment they inhabit.

The strategic utilization of cultural and community spaces has greatly contributed to the success of these endeavors. Locations such as Officina Giovani, Biblioteca Lazzerini, Centro Pecci, and the newly established covered market at Macrolotto Zero have provided welcoming environments for participants to gather, share knowledge, and ignite a sense of collective responsibility. These public venues have served as vibrant hubs for fostering connections, engaging a diverse audience, and promoting accessibility to these vital initiatives.

"Know to Protect, Observe to Understand" has become more than just a slogan; it was a call to action that has resonated deeply within the community of Prato. Through a diverse range of engaging activities, this initiative has successfully bridged the gap between urban life and the natural world, fostering a deeper appreciation and respect for the intricate ecosystems that exist within our cities.



Fig.19 - Guided walk along the Bisenzio River (credits: Legambiente)

The initiatives implemented to engage and inform citizens in recent years can be categorized into two main types: awareness-raising events and training courses.

The awareness-raising events were designed in various formats to cater to different interests and preferences. They included activities such as guided walks along the Bisenzio River to discover biodiversity, clean-up and planting actions involving high school and university students, workshops for creating portable “flying gardens,” dialogues on the value and management of urban nature, and its impact on health and society.

Many of these events took place in person, utilizing cultural and gathering spaces such as the transformed “jungle” version of Officina Giovani, Lazzarini Library, Pecci Center, the new covered market of Macrolotto Zero, as well as public parks provided by the city of Prato. However, some events were also held online, specifically on Facebook, which ensured broad accessibility for both members and non-members, with the added benefit of being able to access recorded sessions at any time.

For each of these activities, which ranged from 10 to 100 participants depending on the type of event, we sought the collaboration of experts with technical and informative skills capable of effectively communicating with a diverse audience, encouraging questions and participation. The aim was not to provide formal education but to inspire a fresh perspective on nature within the city and highlight the active role that citizens can play in its protection.

On the other hand, the “Create your own jungle” training course was more extensive, accommodating approximately 30 to 35 participants at a time. The course was offered in three editions: winter 2021, autumn 2021, and 2022. It comprised five two-hour classroom sessions held on a weekly basis. The objective of the course was to empower citizens to reforest cities by providing ideas, practical suggestions, and guidance on creating, maintaining, and observing their own green spaces.

Each edition of the course, the first of which was conducted online and the subsequent ones in person at the Manifatture Digitali Cinema in Prato, covered the theoretical foundations of natural and urban ecosystems, principles of design and maintenance, and presented relevant case studies in urban planning. Each cycle of sessions concluded with a practical sixth meeting in the garden of the Ex Hippodrome, where participants had the opportunity to engage in pruning, planting, and the construction of small irrigation systems.

While the core structure of the course remained consistent, we continuously updated and improved the program and organization based on feedback received from participants and tailored them to the audience profiles. Andrés, the instructor, also provided slides and recommended reading materials to facilitate further exploration of the topics covered.

As part of this experience, three instructional video clips were produced, offering practical advice on green space management. These videos are available on the project's Facebook page.



Fig.20 - "Create your own jungle" training course (credits: Legambiente)

Another valuable resource that emerged from Prato Urban Jungle is the "City of Plants" toolkit. This manual was specifically developed to enhance citizens' ability to choose and apply nature-based solutions, with the aim of improving the livability and quality of urban spaces. The toolkit, provided in both digital and printed formats, serves as a "toolbox" for citizen-gardeners, offering guidance on recognizing the importance and usefulness of greenery in ecosystems, as well as providing information on creating, caring for, and maintaining green spaces. All the aforementioned initiatives, along with the numerous actions proposed by our partners, were documented and shared through a project newsletter, diligently curated by our team. The newsletter served as a valuable resource for interested citizens, keeping them informed and up-to-date with the latest news and developments within the world of Prato Urban Jungle. Its publication frequency was adapted to the evolving activities, with intensified releases during periods of significant updates and promotions.

Our approach has yielded significant impacts and positive outcomes. Throughout our work, we have adapted and reorganized based on the feedback and requests received from the community. This flexibility has allowed us to effectively meet the needs and interests of our participants.

We have witnessed remarkable levels of engagement and interest from the public, prompting us to double certain events to accommodate the overwhelming response. We have also revamped our topics to address the specific questions and concerns raised by citizens. Additionally, there were initiatives that had to wait patiently for the right time to be implemented, ensuring the safety and well-being of all participants.

Our aim has always been to reach and involve as many people as possible, employing various strategies to maximize participation. While we have utilized online platforms for certain topics, we have always provided a virtual space for discussions, ensuring a sense of community and interaction.

The “Create Your Jungle” course stands as a testament to our commitment to education, as we have provided almost 40 hours of training to approximately 100 individuals. Furthermore, our events have had a profound impact, with over 3,000 people reached and inspired over the course of three years. We have also created informative content that will continue to circulate, serving as a valuable resource for the community and amplifying the project’s impact in the years to come.

We are delighted with the results and the experiences gained throughout this journey. Looking ahead, our sincere hope is that the proliferation of these urban jungles will continue to flourish, benefiting both our community and the environment.

A stylized illustration of a vine and grape cluster, rendered in white lines on a dark teal background. The vine is thick and textured with diagonal hatching, and the grape cluster is composed of several round grapes, also with hatching. The illustration is positioned on the right side of the page, partially overlapping the title.

THE GREENAPES APP

One of the distinctive elements of Prato Urban Jungle is linked to the ambition to accompany reforestation interventions (present and future) with actions to raise awareness and actively involve citizens towards the adoption of sustainable lifestyles. The diffusion of sustainable lifestyles favors not only the reduction of environmental impacts, but also the construction of more aware communities and support for local economies. Harnessing the potential of new technologies, such as apps and digital tools, for engagement activities enhances citizen participation. These platforms serve as channels for regular interaction among stakeholders, enabling the monitoring of sustainability progress and the impacts of implemented initiatives.

To ensure that these digital solutions effectively promote and instill positive behaviors, they should be developed based on behavioral models and involve citizens in the planning process through co-design techniques and collaborative approaches.

By actively involving citizens, we not only foster the creation of more inclusive technologies but also cultivate a stronger sense of connection between citizens and the services provided to them. This collaborative approach enhances the effectiveness and acceptance of sustainable practices, resulting in a more engaged and environmentally conscious community.

Objectives

The role of greenApes in the project was to develop and deliver an app that could be accessed via smartphones and the web. The app aimed to achieve the following objectives:

Provide citizens with access to educational content related to sustainability, promoting cognitive factors and raising awareness.

Facilitate the adoption of tangible and measurable sustainable behaviors by offering concrete examples and encouraging the sharing of best practices in a horizontal manner, thus implementing factors of behavioral change.

Create incentive mechanisms, including economic incentives, to actively engage citizens without imposing direct costs on the public administration.

Foster a sense of community cohesion by linking individual actions and behaviors to shared results, allowing citizens to feel a part of a collective effort (social incentives).

Offer a digital platform for citizens to connect and interact with local stakeholders, such as NGOs, local businesses, and the public administration, thereby enhancing an ecosystem of diverse stakeholders.

The involvement of local actors served two main purposes. Firstly, it aimed to raise awareness among citizens about the positive actions that can be taken within the local community, promoting the commitment of local organizations and services in various dimensions of sustainability, such as circular economy, sustainable mobility, local consumption, and cultural experiences. Secondly, it aimed to create a sustainable and long-lasting network of stakeholders who could contribute to the growth and development of the project.

Lastly, an important objective was to customize the app experience in order to effectively reach different sub-communities of citizens. The greenApes platform enabled engagement activities to be tailored for the general public as well as specific groups such as employees of local companies, students in Prato schools, volunteers, and citizens reached through NGOs.

Development of the activities

The greenApes team actively participated in co-design activities during the Junglathon, coordinated by Co-Design Toscana. Citizens had the opportunity to express their expectations regarding the app's features and content, as well as to test the interfaces as they were being developed.

The team worked simultaneously on three fronts, incorporating ideas that emerged from the co-design sessions. Firstly, they focused on enhancing the app's functions and improving existing features based on citizen feedback. Secondly, they created educational, informative, and interactive content to be included in the platform. Engaging "challenges" were developed around topics of interest to citizens, including educational content, real-world activities, and the sharing of good practices within the app's social space. Lastly, the team worked on building partnerships with local stakeholders, particularly those involved in the reward scheme. This involved formalizing agreements and seeking ways to maximize collaboration benefits, such as visibility for partners on the platform and vice versa.

After a successful pilot in January 2021 (as part of a project between Legambiente and the Municipality of Prato), the official launch of the app took place on May 20, 2021, receiving excellent feedback from citizens and partners, despite the challenges posed by the pandemic. Since then, the greenApes team has focused on community management within the app, including content management, thematic challenges, dialogue facilitation, and user support. They have also worked on strengthening stakeholder engagement and further developing the digital platform.

In the summer of 2021, a collaboration was established with the cultural initiatives of "Prato Estate", bridging sustainable citizen actions with the city's cultural activities and offering free gifts and discounts.

Additionally, a digital version of the "Green Generation" Toolkit aimed at schools, edited and published by Legambiente, was created on greenApes.

Throughout 2021 and early 2022, efforts were made to strengthen partnerships in the area and enhance interactions between citizens and local operators, both within the app and in real life.

In 2022, the platform underwent a significant restructuring to incorporate the most requested feature from co-design sessions: the ability to donate to environmental and social projects. The app's user experience was redesigned to include three key activities:

- Collect: Users can earn virtual credits by engaging in sustainable actions.
- Donate: Virtual credits can be spent to support environmental and social projects.
- Reward yourself: Donations unlock reward boxes of increasing value and seasonal rotation.

The launch of this new feature and user experience occurred in October 2022, resulting in an excellent response from citizens and increased engagement rates. The success of this approach led to its extension to all users of the greenApes platform, not limited to Prato.

Simultaneously, a tailored experience for employee communities was co-designed with ESTRÀ. Personalizing the experience for employees encouraged the adoption of sustainable behaviors in the workplace, with ESTRÀ making donations to the Prato Forest City platform's reforestation project in Parco Alda Merini on behalf of employees.



Fig.21 - Engagement activities with local companies (credits: Alexandra Korey)

Impacts

The Prato Urban Jungle platform has seen more than 1,000 citizens register and actively participate in various activities. These have included real actions such as walking, cycling, engaging in circular economy practices, and checking in at local markets, as well as thematic challenges related to energy, mobility, recycling, nutrition, and waste reduction. Citizens have interacted with educational content like videos, quizzes, and infographics and have also participated in local events such as clean-up days and museum visits. In the social section of the app, citizens have shared over 6,470 good practices and testimonials, inspiring each other along the way.

For their virtuous actions, citizens have earned virtual credits, which they used to collect rewards related to sustainable consumption and cultural activities. More than 25 companies and organizations have participated in the reward scheme, providing over 500 prizes and subsidies.

In October 2022, the platform introduced the ability to use virtual credits to support environmental and social projects by converting them into financial donation credits. The first projects were funded through investments by greenApes and local companies like ESTRA, which financed the reforestation project of Alda Merini Park. Citizens have continued to contribute to projects at regional, national, and international levels, supporting initiatives related to schools, biodiversity protection, and projects by organizations like the African Medical and Research Foundation (AMREF) and the World Wide Fund for Nature (WWF).

In terms of numbers, the platform has achieved the following:

- Registered citizens: 1,005
- Tasks completed in challenges: 7,375
- Recorded sustainable trips: 72,590
- Prizes received: 505

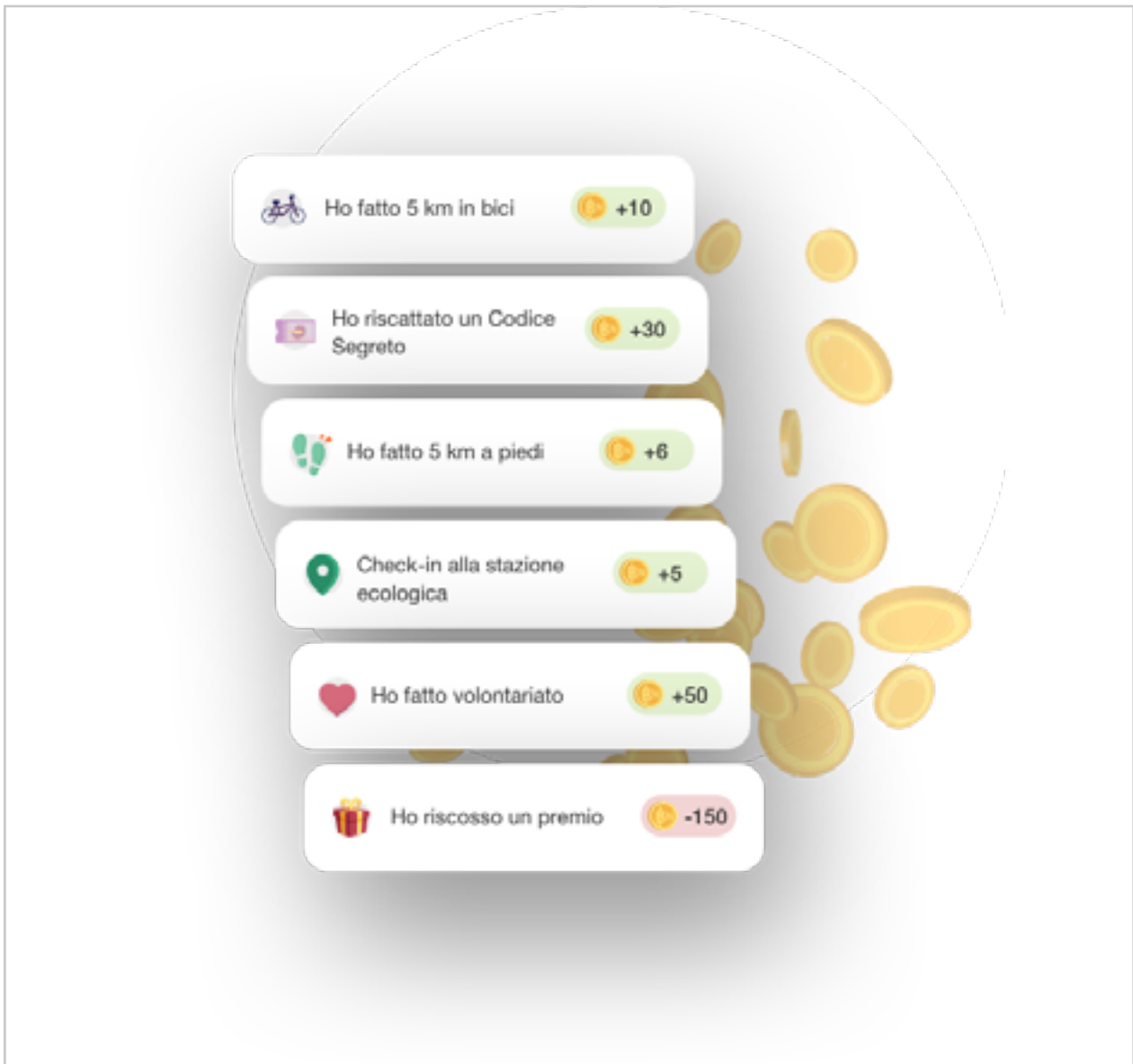


Fig.22 - Examples of rewards provided by the greenApes platform (credits: greenApes)



THE PRATO FOREST CITY PLATFORM

In the context of Prato Urban Jungle, the term “governance model” refers to the framework and processes through which decision-making and coordination among various stakeholders take place. Traditionally, urban planning and decision-making have been centralized and led primarily by local authorities or government entities. However, in a more inclusive and participatory approach, the governance model recognizes the importance of involving a broader range of actors such as local communities, businesses, and non-governmental organizations in decision-making processes related to public life and the management of green spaces.

The shift from “government” to “governance” implies a move away from a top-down decision-making approach to one that embraces collaboration, participation, and shared responsibilities among stakeholders. It recognizes that multiple actors have a stake in urban development and should have a voice in shaping decisions and policies that affect them.

The governance model encompasses both formal and informal institutions, rules, mechanisms, and processes that enable stakeholders to influence and coordinate their interdependent needs, interests, and interactions with the environment (1). It promotes collective decision-making and aims to create a more inclusive and responsive system where stakeholders work together to address the needs and aspirations of the community.

By integrating urban green spaces into urban planning and governance, the aim is to ensure that these spaces are valued, protected, and effectively utilized for the benefit of the local community. This approach takes into account the specific needs and challenges faced by marginalized or socio-economically disadvantaged communities, ensuring that interventions and policies are tailored to address their real needs and promote equitable access to green spaces (2).

Objectives

The intervention of Treedom and the Municipality of Prato aimed to establish a network and foster relationships among various stakeholders in the area, enabling an integrated co-management approach for public and city green areas. This initiative was implemented through Prato Urban Jungle, which sought to create an ecosystem of both public and private actors involved in green activities and specifically focused on urban reforestation strategies within the municipality.

By facilitating the implementation of the 2019 Operational Plan of the Municipality of Prato, as outlined in the **“General report: strategies for urban forestation”**, the goal was to promote a comprehensive approach to urban greening. The governance model adopted for this purpose was called Prato Forest City, which aimed to provide a simplified framework for the reforestation of Prato and the care of its green areas.

Prato Forest City aimed to encourage active participation from citizens, businesses, associations, and local actors, empowering them to personally and directly contribute to the reforestation efforts and the maintenance of the city’s green spaces. This governance model sought to engage and mobilize these stakeholders, fostering a sense of ownership and shared responsibility for the city’s environmental well-being.

Through Prato Forest City and the collaborative efforts of the diverse actors involved, the aim was to create a more sustainable and vibrant urban environment, where the community actively contributes to the greening and enhancement of Prato’s natural assets.

Development of the activities

To achieve the goal, we have identified two levels of intervention: the first offered a relational path between the various players, while the second allowed the implementation of this path through digitization and communication.

At the administrative and organizational level, a network of participants was established to facilitate their coordinated involvement in the municipality's green and reforestation plan. Clear administrative and bureaucratic procedures were outlined, providing a straightforward framework for implementing reforestation activities and ways to contribute to them. This created the Prato Forest City Network, which operates within a defined organizational, administrative, and bureaucratic structure.

Regarding digitization and communication, the identified tools were translated into a digital service that enables citizens, schools, associations, and companies to directly contribute to the reforestation and environmental plan through:

- the direct planting of trees and the implementation of environmental activities;
- the economic contribution to projects proposed by the administration;
- the direct participation in afforestation activities, for example through volunteering.

A web portal was developed to fulfill these purposes, reflecting the needs of the administration and citizens, and highlighting the complexity of certain operations that should be simplified to maintain the system. The platform's features allow the Prato administration to manage the relationship between local authorities, citizens, and individuals involved in the management of public parks in a simplified and automated manner.

The platform's functions are divided into two categories: on one side the public administration, on the other citizens, associations and businesses and companies.

Administration of the Municipality of Prato: The platform enables effective management and communication of public-private partnerships in urban greenery management within the municipality. Through a modular content management system, the municipality can enter various projects, associating them with citizen and individual actions, and providing relevant information.

Citizens, associations and businesses and companies: Users can view and monitor the municipality's activities related to promoting urban greenery. They can participate directly and easily, communicate their commitment, and interact with proposed actions. The user interface allows viewing of different projects in a gallery format, providing information and enabling engagement. Citizens and companies can also access information on creating partnerships with the municipality, communicating independent environmental projects for visibility, and contributing through donations to environmental initiatives.

The platform includes a map displaying all urban and environmental reforestation interventions within the municipal area. This map can be regularly updated with actions carried out through the platform, providing visual representation and tracking of progress.

“Donate a Tree” campaign

The “Donate a Tree” campaign is a specific initiative within the Prato Forest City platform that enables users to donate a tree. Through the platform, individuals can make a donation and choose to dedicate the tree to someone. The donated tree is equipped with a QR code and can be geolocated.

A donation of 150 euros covers the cost of purchasing the selected tree and the necessary consumables for planting and initial care, such as irrigation, for the first two years of its life. The Municipality takes care of the installation, maintenance, and possible replacement of the tree if it fails to establish.

Users can select one of the active projects, choose a tree from the map, and follow the instructions provided on the website. They can also add a dedication to accompany the donated tree. Each donated tree is marked with an engraved plate containing its identification number and a QR code. The QR code can be scanned on-site or online to view the associated dedication.

Donors will receive an email notification informing them about the planting of the tree. The email will include all the necessary information to locate and identify the tree.



Fig.23 - Map of the green urban areas included in the Prato Forest City platform (credits: Treedom)

Impacts

The development of the Prato Forest City platform prioritized accessibility, ease of use, and affordability to cater to the needs of the administration and the local community. It serves as an experimental digital solution that encourages user feedback, enabling continuous improvements and adaptations to meet evolving requirements. Through the platform, citizens can actively engage and monitor the initiatives undertaken by the Municipality of Prato to promote urban greenery.

The platform fosters direct interaction between citizens, businesses, schools, local associations, and the administration, facilitating transparent and straightforward contributions to enhance the city's green areas. A memorandum of understanding has been established among various stakeholders, including the Municipality of Prato, the Ami Foundation, and Consiag Servizi. This agreement enables the municipality to conduct fundraising campaigns, accept donations, and seek sponsorships for urban forestation projects.

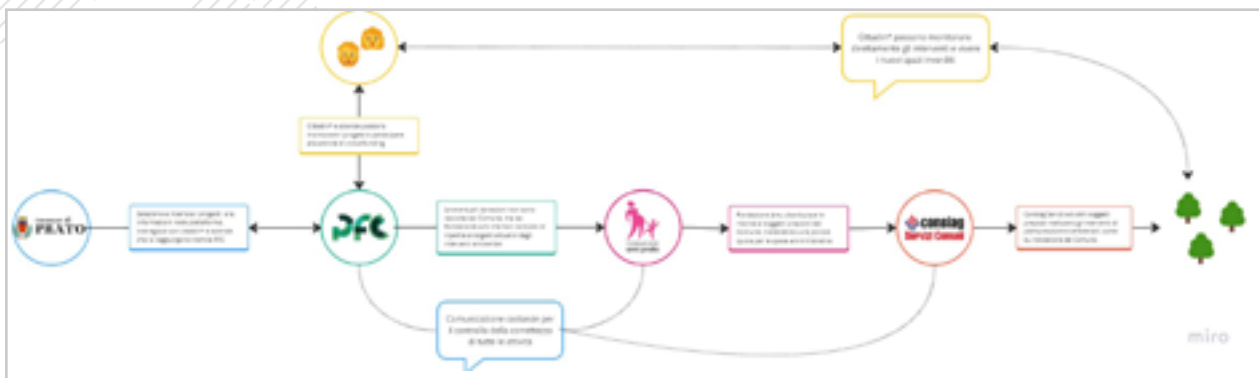


Fig.24 - Governance model of Prato Forest City (credits: Treedom)

The Prato Forest City web platform provides users with the ability to view and track the activities of the municipality, actively participate, and share their commitment. Currently, Prato Forest City boasts the following achievements:

- 43 urban afforestation projects and mapped environmental interventions, including 8 projects carried out by local school students.
- 3 sites activated for the “Donate a tree” campaign in the Galcetti, Maliseti gardens, and Via Picasso areas.
- 117 donations made by citizens to contribute to urban afforestation efforts.
- 12 local companies that have contributed to the activities of Prato Forest City.
- 149 trees and 95 shrubs donated to the city by citizens and companies.

The platform has witnessed over 72,000 interactions from more than 6,500 users, resulting in a conversion rate of 1.7% (the average conversion rate of an e-commerce website ranges from 1% to 4%), just 18 months since the platform’s launch.

[1] Ambrose-Oji, Bianca & van der Jagt, Alexander & Stewart, Amy & Branquinho, Cristina & Bujs, Arjen & Buizer, Marleen & Delshammar, Tim & Elands, Birgit & Fors, Hanna & Geróházi, Éva & Hansen, Rieke & Havik, Gilles & Konijnendijk van den Bosch, Cecil & Nastran, Mojca & Pauleit, Stephan & Rall, Emily & Santos, Artur & Smith, Mike & Møller, Maja & Ambrose, Bianca. (2015). The governance of urban green spaces in selected EU-cities.

[2] “Strategia nazionale del verde urbano”, Comitato per lo sviluppo del verde, Ministero dell’Ambiente e della Tutela del Territorio e del Mare.



UPSCALING EXPERIENCES

One of the ultimate goals of the European Commission by supporting financially innovative actions with the European Urban Initiative is to ensure that learnings in cities can be shared, replicated and upscaled throughout Europe. Although there are no widely accepted definitions, one definition used by UN agencies in the context of rural development (IFAD, 2015) and others (Jowett & Dyer, 2012) describe scaling up as: the expansion, adaptation and sustainment of successful policies, programmes or projects in different places and over time to reach more people.¹

Sustaining and scaling up are ways in which cities can leave a legacy from their project. Cities participating in EU funded projects should be able to find ways to continue their activities after developing good practices. It is also important to ensure that practitioners and decision makers at all levels have access to the knowledge and know-how that was created during an innovative project to improve the design and implementation of integrated territorial development strategies and action plans in the new programme period. Some key learning points in this direction are:

1. Dedicate specific resources and work towards sustaining and scaling up the project from the outset.
2. Every project should plan for its financial sustainability for the medium term after the UIA financing ends.
3. Replication starts at home. For any administration it is important to understand from the outset what it entails, in organisational terms, to replicate the actions of a project previously implemented elsewhere.
4. Engage in transnational exchange and transfer activity.
5. Mainstream the approach developed under UIA for future strategies at local and national level.

For this reason, the fact that the Municipality of Prato has been selected by the European Commission amongst the cities that will participate in the mission “100 smart and climate-neutral cities by 2030”, the so-called “Cities Mission”, is a highly relevant upscaling experiences for the Prato Urban Jungle project.

In the two-year period 2022-23, the mission will be able to count on approximately 360 million euros of funding from the Horizon Europe program, to launch innovation paths to achieve climate neutrality by 2030, based on these key sectors:

- Energy efficiency and production;
- Transportation;
- Waste management;
- Industrial processes;
- Agriculture, forestry and other land uses.

Fundamental to the realisation of these goals will be the effective involvement of citizens at large, including civil society, private sector and research organisations, working in close collaboration with public institutions. This is what the City of Prato will continue doing based on the Prato Urban Jungle participatory practices carried out up until now.

¹ More information on upscaling and replicating can be found here: <https://www.uia-initiative.eu/en/sustaining-and-scalingup#analysis-of-the-case-studies-and-key-takeaways>

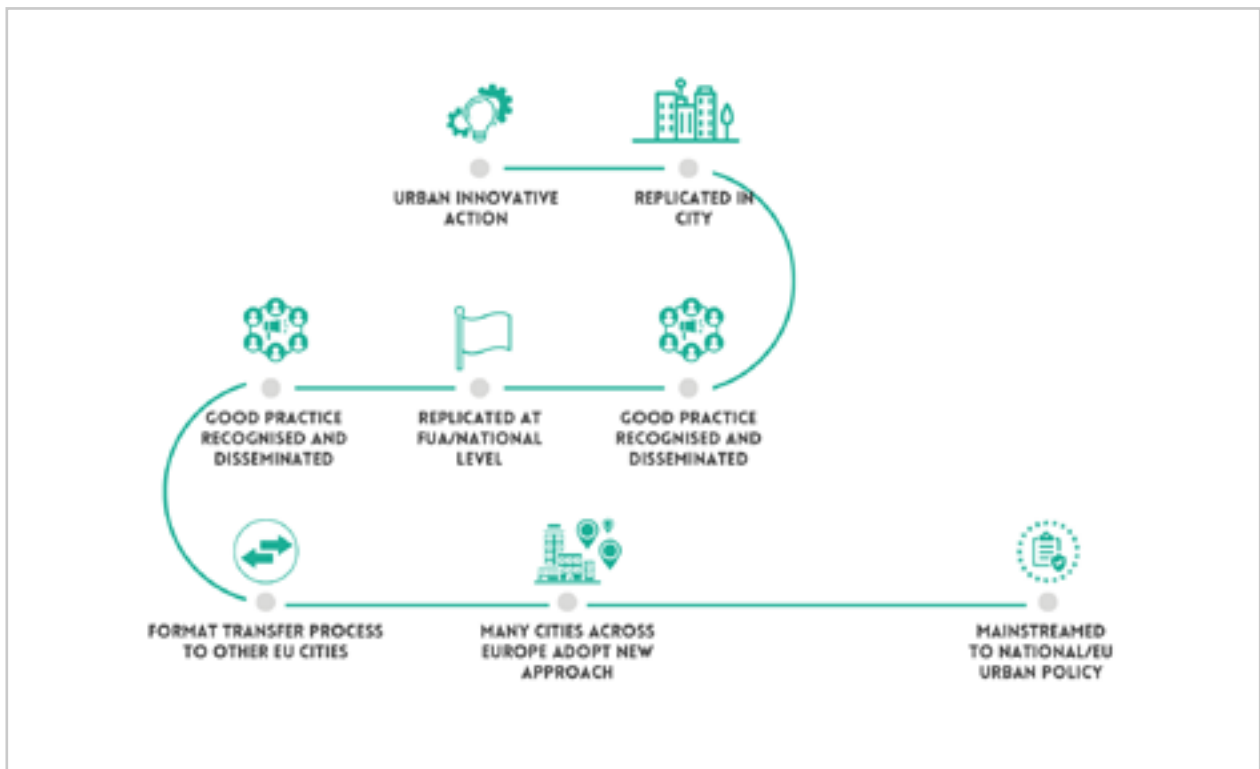


Fig. 25 - Idealised Spiral model of replication and mainstreaming (adapted from Mulgan/Nesta versions)

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