Co-funded by the European Union

GREEN SKILLS FOR CITIES

GreenWave was developed during the Green Skills for Cities project, co-funded by the Erasmus+ Programme of the European Union under the KA220-HED - Cooperation partnerships in higher education call.

WU Wirtschaftsuniversität Wien Vienna University of Economics and Business

Advanced Architecture Group | Iaac

Università di Genova

alda European Association for Local Democracy

GREEN
SKILLS
FOR CITIES

GREENWAVE:

SUSTAINABLE DESIGN FOR CIRCULAR CO-PRODUCTION OF ECOLOGICAL SERVICES.

2023

BEN BELLO, CAN XU, ERUM KHALED, MANUELBECA,
LUCIA MACK, PARSHAV SHETH AND ZERIHUN TASSANO.

Università di Genova

WU

Iaac

SOURCE: GETTY IMAGES

TABLE OF CONTENTS

SOURCE: GOOGLE EARTH IMAGES

1. INTRODUCTION

SITE: LARGO SANTA MARIA DEI SERVI
USE: SURFACE PARKING

Genoa is a beautiful coastal city that has been facing significant challenges related to surface flooding and habitat loss. As a response, the municipality has been actively transforming the city's urban fabric, focusing on the development of green infrastructure to promote biodiversity and ecological services. Our proposed project, GreenWave, builds on these efforts by creating a tactical, community-driven, hyperlocal approach that takes advantage of underutilized surface parking zones to create green spaces that provide essential ecological services and enhance the quality of life for residents.

GreenWave is a transformational project that seeks to take the city's ongoing efforts to the next level by leveraging the power of community engagement to create a network of hyperlocal green spaces that promote biodiversity and ecological services. By focusing on surface parking zones, GreenWave offers a strategic opportunity to create green infrastructure that benefits the environment and enhances the quality of life for residents. The project's community-driven approach ensures that local residents are actively involved in the design and implementation of the green spaces, creating a sense of ownership and pride in the transformation of their neighborhoods.

GreenWave is a practical and scalable model for creating green infrastructure that can be replicated across Genoa and beyond. The project's focus on hyperlocal solutions creates a network of interconnected green spaces that enhance the resilience and sustainability of the city's urban fabric. The implementation of GreenWave will help to reduce surface flooding, combat habitat loss, and promote biodiversity, while also enhancing the aesthetic appeal of the city. By working together to create a sustainable and vibrant urban ecosystem, we can ensure that Genoa remains a beautiful and thriving city for generations to come.

2 . HISTORICAL BACKGROUND

LA FOCE:

From 1798 until 1873, La Foce served as a small autonomous town and is currently a neighborhood in Genoa, Italy. Originally inhabited by fishermen and farmers, this village was nestled near the rocky slopes of the promontory, adjacent to the Albaro hill on the west. Over time, the village expanded eastward, reaching the plain on the banks of the Bisagno River. As the 20th century brought urban development, the area underwent significant transformation, eventually becoming an upscale residential neighborhood characterized by long, orthogonal streets. With the passage of time and the influence of urban development, La Foce gradually underwent a remarkable metamorphosis, evolving into an affluent residential neighborhood distinguished by its extensive network of long, straight streets.

SOURCE: GABRIELE RASTALDO

CHIESE SANTA MARIA DEI SERVI:

Originally located in a different part of the city, the Church of Santa Maria dei Servi witnessed the initiation of its construction on February 6, 1327, within the protective walls at the base of Carignano hill. Unfortunately, the destructive bombings of August 1943 inflicted substantial damage on the church, resulting in the emergence of new cracks in its walls. Tragically, on the stormy night of October 13, 1944, the church and its bell tower succumbed to the forces of nature, reducing them to a heap of rubble. Consequently, the cleared space underwent a remarkable transformation, blossoming into a captivating square adorned with warehouses constructed during the postwar period, breathing new life into the once-devastated landscape.

Fifteen years after the devastating impact of the war, in 1957, a new temporary chapel was blessed and inaugurated on February 17th, assuming the role of the parish church within the newly allocated area for the Servites, known as the 'Foce.' Simultaneously, plans were set in motion for the construction of a new convent and a grand temple. The architectural vision of Bucci and Trinci, guided by Engineer Giovanni Canepa, took shape as the new church, which was ultimately unveiled by Cardinal Siri in 1972. Through the relocation and reconstruction of the church, Largo Maria dei Servi, the square it now graces, gained enhanced significance and value, becoming a cherished gathering place that weaves together history, faith, and community bonds.

SOURCE: STUDIO CANEPA ASSOCIATI

3 . SITE ANALYSIS

Strength: Historic Significance

The site's historical significance is a significant strength, as it provides a unique opportunity for preserving and showcasing Genoa's rich heritage. It can attract visitors interested in exploring the area's historical landmarks. Transforming the parking lot courtyard into a public space could enhance its appeal and contribute to the overall cultural experience of the city.

Weaknesses: Lack of Biodiversity

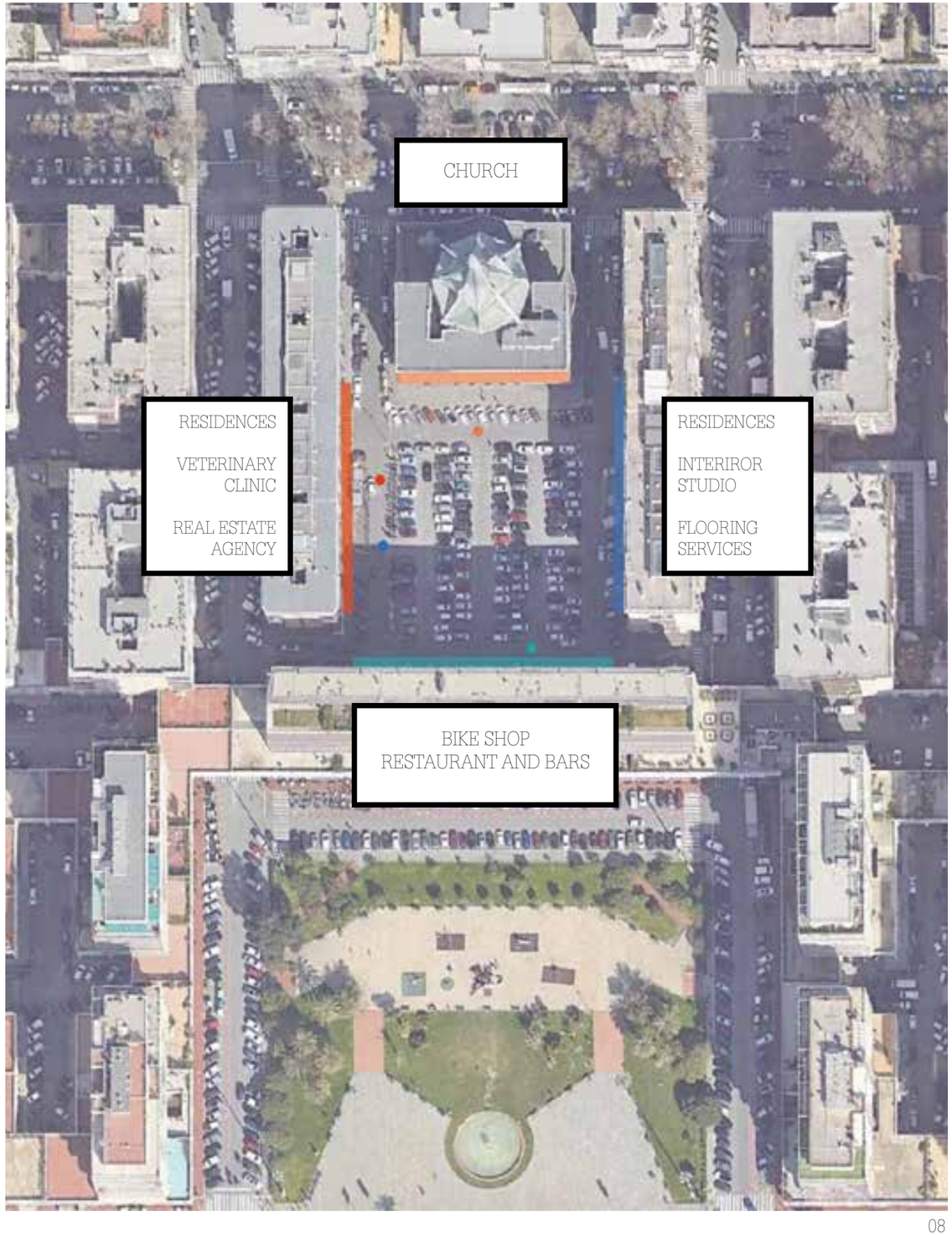
One of the weaknesses associated with the site is the lack of biodiversity. Surface parking lots often lack greenery and natural elements, resulting in reduced ecological value. The absence of diverse plant species and wildlife habitats contributes to the overall environmental degradation of the area. Addressing this weakness is crucial to promote sustainability and enhance the site's ecological balance.

Opportunities: Ecological Potential

The site presents an opportunity to integrate ecological features and promote sustainability. By incorporating green infrastructure such as trees, plants, and sustainable drainage systems, the surface parking lot courtyard can be transformed into an environmentally friendly space. Such interventions can improve air quality, mitigate stormwater runoff, and benefiting the local community.

Threats: Microclimatic Vulnerability

Microclimatic vulnerability poses a threat to the site's usability and comfort. As a surface parking lot courtyard, the lack of shade and insufficient ventilation can lead to uncomfortable conditions, particularly during extreme weather events. To address this threat, incorporating shaded areas, pergolas, and natural ventilation systems can improve the microclimate, ensuring the site remains comfortable and accessible throughout the year.



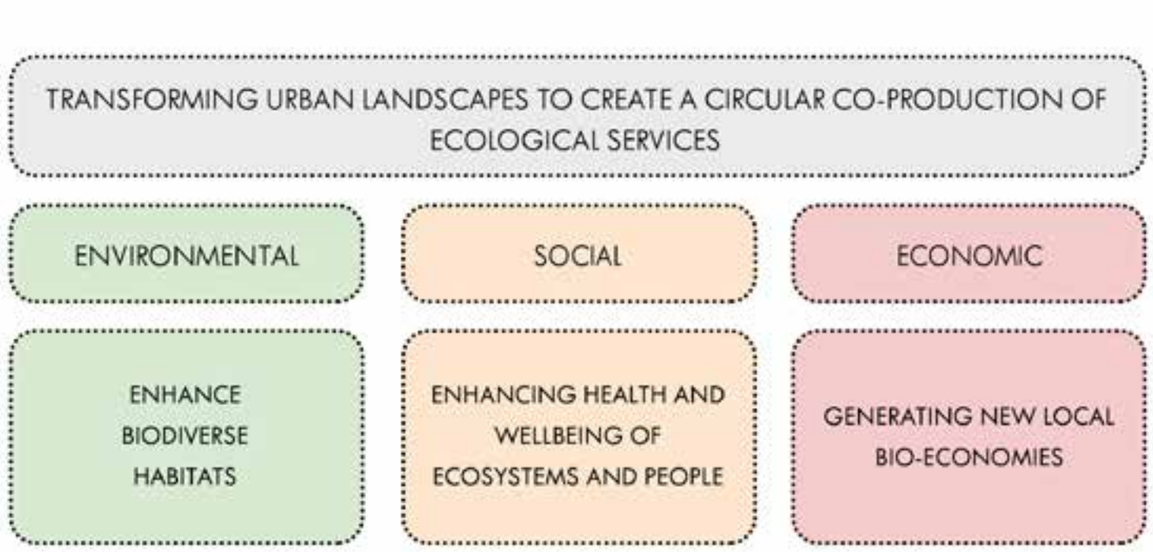
4. GREENWAVE PROPOSAL

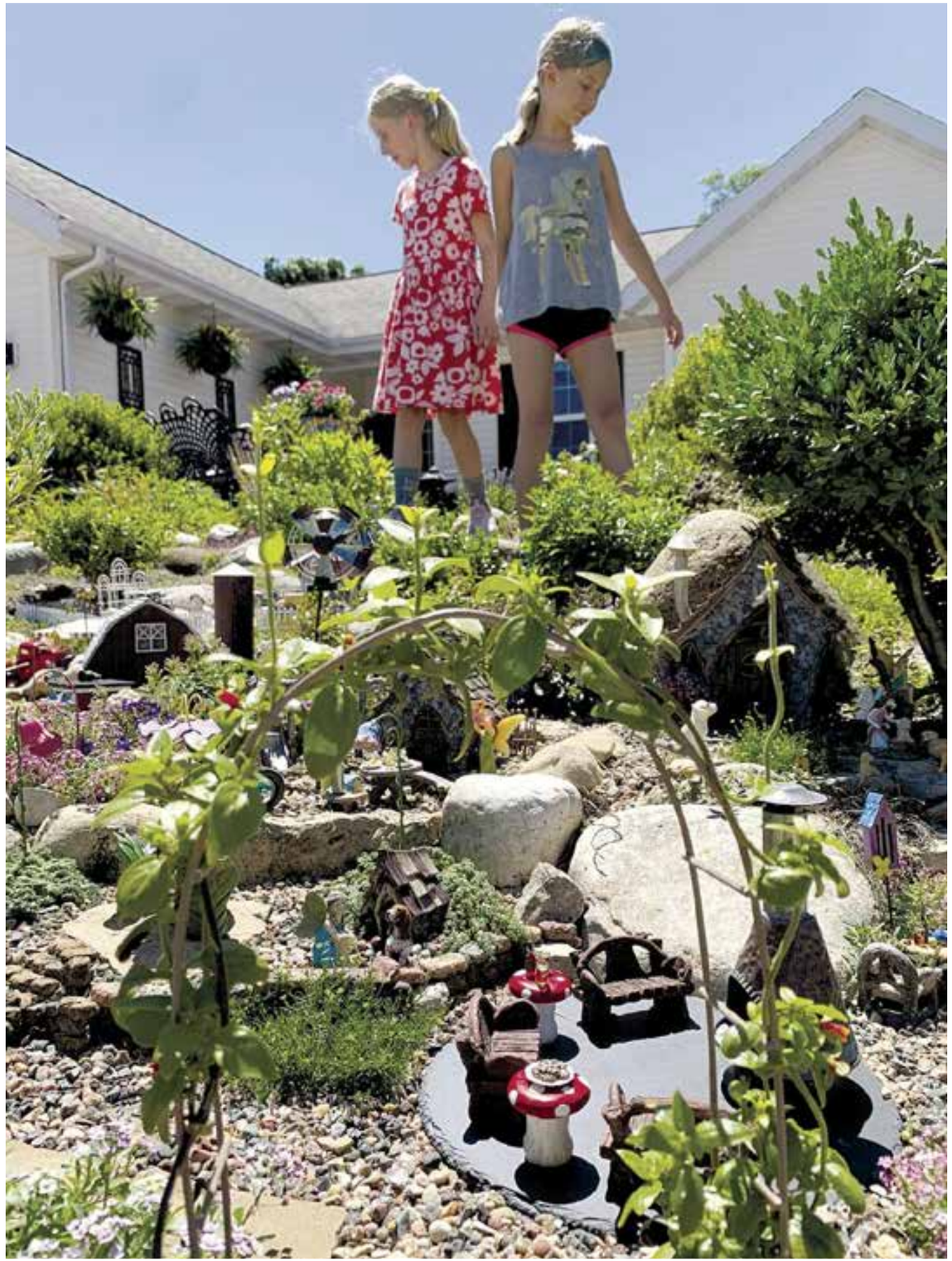
4.1 DESIGN OBJECTIVES

The design objective of transforming urban landscapes to create a circular co-production of ecological services is a key element in promoting sustainable development and urban planning. The concept of circularity aims to eliminate waste and create closed-loop systems, where waste from one process becomes a resource for another. This approach can be applied to urban landscapes, where the built environment can be integrated with nature and the surrounding ecosystem to create a more sustainable and resilient city. In terms of environmental objectives, promoting biodiverse habitats is a crucial aspect of creating a circular urban landscape. This involves designing green spaces that support a range of plant and animal species and creating habitats that are interconnected to support migration and gene flow. By creating more diverse and resilient ecosystems, cities can better adapt to environmental changes and support the well-being of their inhabitants.

Social objectives for circular urban landscapes include enhancing the health and well-being of ecosystems and people. Access to green spaces and nature has been shown to have a positive impact on physical and mental health, as well as social cohesion. By designing urban landscapes that provide opportunities for recreation and connection with nature, cities can improve the quality of life for their residents.

Lastly, economic objectives for circular urban landscapes involve generating new local bio-economies. This involves identifying and developing new economic opportunities that are based on the principles of circularity and the co-production of ecological services. By creating new markets for locally sourced materials and products, cities can reduce their dependence on external resources and generate new jobs and economic growth.





SOURCE: GETTY IMAGES

4.2 DESIGN STRATEGIES

The city of Genoa is at the forefront of promoting sustainable development and urban planning, and to this end, we have developed a few design strategies under the umbrella of environmental, social, and economic objectives. These design strategies aim to revive the parking lot and transform the landscape into a circular co-production of ecological services that will benefit the environment, the people, and the economy.

The whole idea behind these strategies is based on co-creation, co-operation, and co-execution, making citizen participation a key component of urban transformations. We believe that involving citizens in the process of designing and implementing sustainable urban solutions is crucial to achieving long-lasting, positive outcomes. This approach creates a sense of ownership and pride in the community and fosters a culture of sustainability.

These design strategies are intended to support the municipality's existing plans to create a huge garden near the coast. The idea is to use urban acupuncture and circular interventions to promote the overall objectives through strategies and stakeholder interaction. By using a holistic approach that combines environmental, social, and economic strategies, we can create a sustainable and thriving urban ecosystem that benefits all.

To achieve these objectives, we have identified a range of design strategies which include:

Rain gardens: To manage stormwater runoff.

Native rewilding: To create biodiverse habitats.

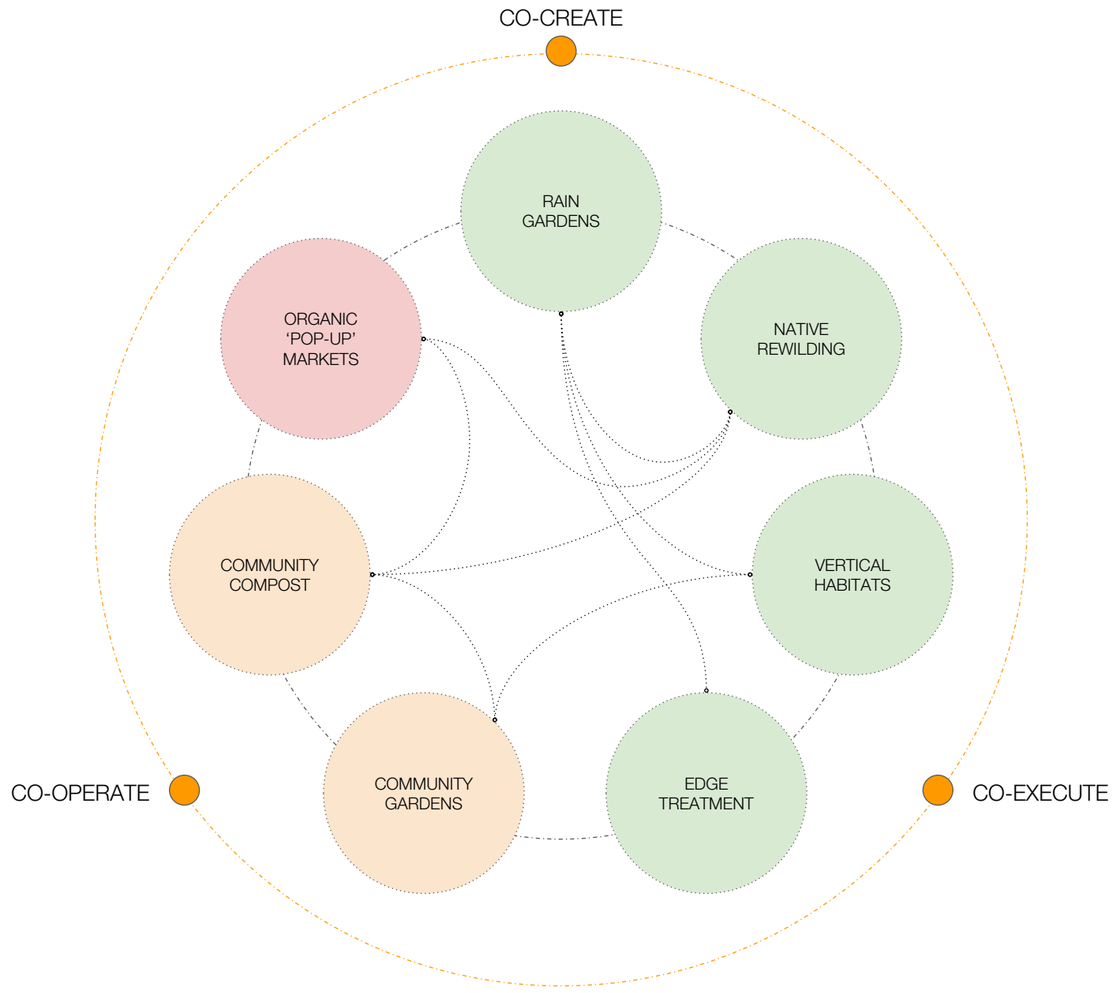
Organic markets: Generate new local bio-economies.

Vertical habitats: Installing green walls and roofs.

Community composting: Promote sustainable waste management practices.

Community gardens: Promote health and wellbeing

Edge treatment: Create transition zones.



The transformation of the parking lot into a circular co-production of ecological services represents a holistic approach to urban development that addresses the challenges of environmental degradation, social inequality, and economic stagnation. The combination of environmental, social, and economic strategies aims to promote a sustainable and resilient urban ecosystem that provides multiple benefits to the city and its residents.

By promoting citizen participation and co-creation, we can ensure that the design strategies are tailored to the needs and preferences of the local community, fostering a sense of ownership and belonging. Co-operation and co-execution involve working with stakeholders from different sectors and disciplines, including urban planners, landscape architects, ecologists, and community organizers, to ensure a collaborative and integrated approach to urban transformation.

The design strategies are intended to support the municipality's existing plans to create a huge garden near the coast, but they also have the potential to generate new opportunities for local bio-economies, such as eco-tourism, green jobs, and sustainable agriculture. The use of urban acupuncture and circular interventions aims to enhance the ecological and social connectivity of the site, creating a network of green spaces that provide habitats for biodiversity, promote physical and mental health, and foster social interaction.

In summary, by incorporating environmental, social, and economic objectives, promoting citizen participation and using a circular approach, we can create a green and vibrant space that benefits the environment, the people, and the economy, while supporting the municipality's vision for a more sustainable and livable city.

4.3 DESIGN MASTERPLAN

The masterplan for the transformation of the parking lot into a green and vibrant space involves the selection of five zones across the site to create an integrated ecological landscape. Each zone has been carefully chosen to address specific environmental, social, and economic objectives, and the masterplan is designed to be implemented in four phases to promote community-driven development and daily urbanism while integrating ecological services into the neighborhood.

Through the implementation of this masterplan, we aim to create a sustainable and thriving urban ecosystem that supports the municipality's existing plans to create a huge garden near the coast. By selecting the five zones, we can strategically address specific environmental issues such as water management, biodiversity, and soil health while enhancing social and economic objectives such as community engagement and local bio-economies.

The masterplan is designed to be implemented incrementally, allowing for flexibility and adaptability in response to community needs and feedback. By involving the community in the design process, we can ensure that the interventions meet the needs of the local residents while promoting a sense of ownership and pride in the transformed space. Overall, the masterplan is a comprehensive approach to transforming the parking lot into a sustainable and thriving urban ecosystem. It aims to address the key issues facing the site through the implementation of specific interventions and strategies while promoting community engagement and participation.

The design masterplan for the site is aimed at creating a sustainable and vibrant urban ecosystem that benefits both the environment and the people. The plan is a 4-phase approach that focuses on community-driven development, daily urbanism, and the integration of ecological services into the neighborhood following a detailed account of every species recommendation and ecosystemic services is covered in the next chapter.

4.3 DESIGN MASTERPLAN

PHASE 1: GENERATION [0 - 1 YEAR]

ORGANIC POP UP MARKETS

An opportunity for the community to come together, build relationships and engage with sustainable practices. These markets will provide fresh, locally-grown produce to the neighborhood and offer a platform for entrepreneurs and small businesses to sell their products. In addition, the markets will serve as an avenue for promoting healthy living, building awareness around sustainable practices, and cultivating a sense of community ownership.

EDGE TREATMENT

Involves introducing a variety of native plants and trees, creating a visually appealing landscape and increasing the habitat for local wildlife. The introduction of permeable surfaces, such as porous pavers, will provide a natural stormwater management system, which can capture and treat runoff water from the parking lot, reducing the negative impact on the surrounding environment. The primary objective of this phase is to increase the edged and permeable surfaces of the parking lot by introducing plantations along the edges in a non-linear pattern.

PHASE 2: PROPOGATION [1 - 2 YEARS]

NATIVE REWILDING

plants and animals back into the environment, restoring the natural ecosystem. This intervention will help to enhance the ecological value of the area, by promoting pollination, improving soil quality, and creating a natural habitat for local wildlife. This approach will create habitats for birds, insects, and other wildlife, promoting a healthy and balanced ecological system and creating a more sustainable and biodiverse community.

VERTICLE HABITATS

Butterflies play a crucial role in pollination and ecosystem health, and their populations have been declining due to habitat loss and fragmentation. By incorporating vertical habitats, such as green walls and vertical gardens, we can create new habitats for butterflies to thrive. These habitats will provide food sources and shelter for the butterflies, promoting their populations and enhancing biodiversity in the area. By focusing on vertical habitats, we can also make the most of limited space in urban environments and enhancing the overall ecological services of the area.

PHASE 3: INTERACTION [2 - 5 YEARS]

CITIZEN GARDENS

Community gardening involves creating a shared green space where residents build relationships, and engage in sustainable practices. This intervention will serve as a platform for educational workshops on sustainable gardening practices, flowers, and environmental awareness. By engaging the community we can create a stronger sense of community ownership and pride in their neighborhood.

CITIZEN COMPOSTING

Community composting involves creating a system for residents to compost their organic waste and turn it into valuable soil for the community garden. This intervention will reduce waste, reduce greenhouse gas emissions, and promote soil health. It will also serve as a platform for educational workshops on composting and waste reduction. By engaging the community in the process of composting, we can create a more sustainable and resilient urban ecosystem.

PHASE 4: GREEN WAVE [5 - 10 YEARS]

RAIN GARDEN

The final phase of our urban transformation plan involves a tactical transformation of the site into a hyperlocal rain garden, which will significantly improve the site's permeability and help combat surface flooding. This transformation will involve the integration of green infrastructure elements such as bioswales, rain gardens, and green roofs to capture, store and treat rainwater in a natural and sustainable way. This hyperlocal rain garden will act as a sponge, capturing and filtering rainwater, improving the water quality, and reducing the negative impact of stormwater runoff on the surrounding environment. The rain garden will also create a new habitat for local wildlife and promote the ecological value of the area. By creating a hyperlocal rain garden, we can also create opportunities for other ecosystemic services. The stored water can be used to irrigate the plants, support the community gardens and even recharge the groundwater table. This approach to water management will create a more resilient urban ecosystem, providing a range of ecological services and supporting the overall health of the ecosystem.

4.4 SURFACE PERMEABILITY

The interventions in all four phases of this urban transformation project are designed to improve the permeability of surfaces and promote infiltration of water into the ground.

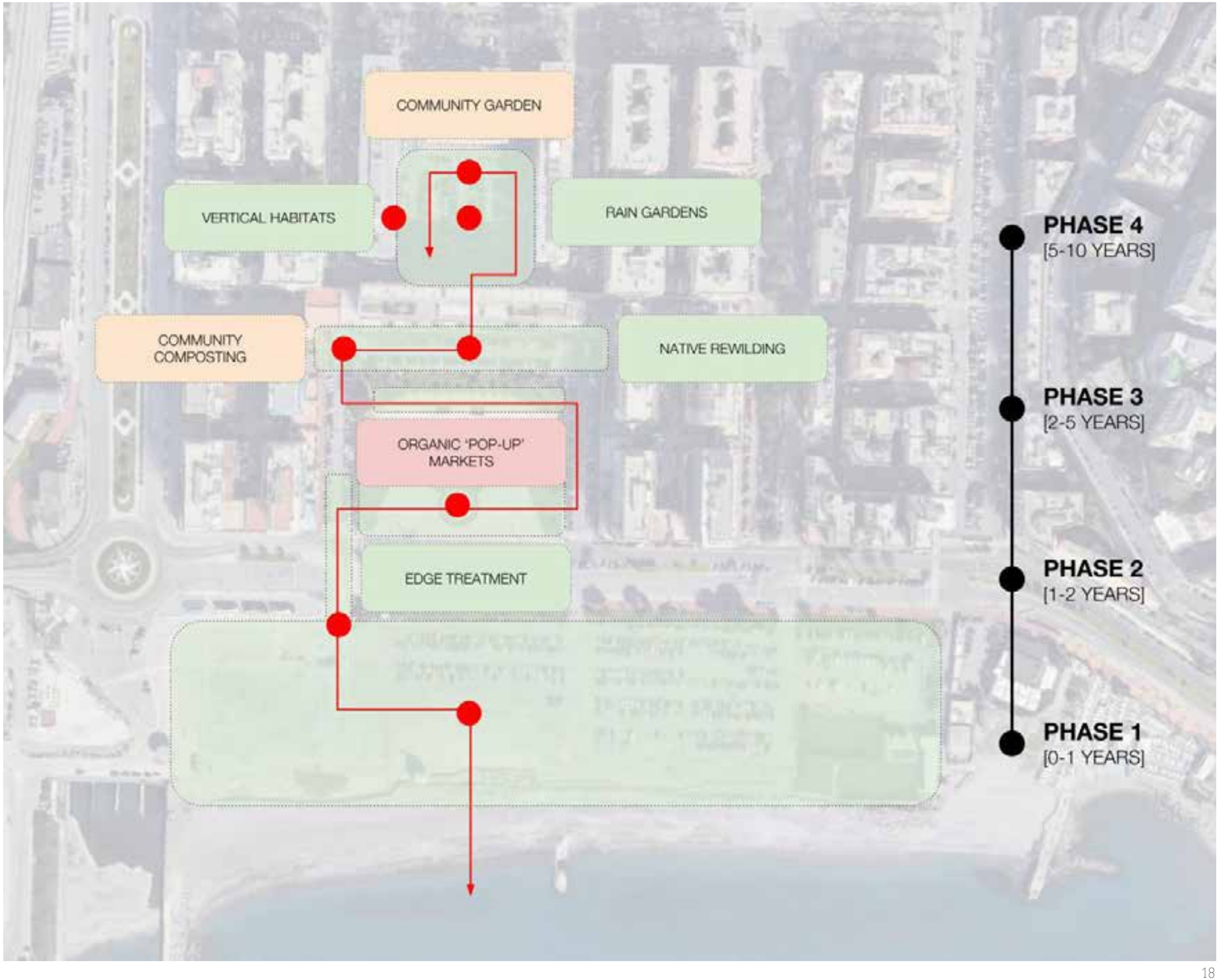
Phase 1 focuses on the introduction of permeable surfaces to provide a natural stormwater management system, reducing the negative impact on the surrounding environment. This involves creating permeable surfaces such as porous pavers and introducing a variety of native plants and trees.

Phase 2 builds upon the foundation laid in Phase 1 by introducing vertical habitats and promoting native rewilding, creating new habitats, improving water retention and enhancing the natural habitat for local wildlife.

Phase 3 brings local communities to the forefront of urban transformation. These interventions help to promote the permeability of surfaces by introducing more green spaces in the neighborhood.

Phase 4 represents the most ambitious phase of the project, with the creation of a hyperlocal rain garden. This intervention involves the transformation of the entire site into a permeable surface, with a network of rain gardens designed to store and supply water for other ecosystemic services. The water can then be used for irrigation or other purposes, reducing the demand on municipal water supplies.

All of these interventions are designed to transform the site into a more sustainable and biodiverse urban ecosystem that complements the municipality's vision. The project starts small with edge treatment and moves on to larger-scale interventions like rain gardens, with each phase building on the previous one to create a comprehensive and integrated approach to urban sustainability. By promoting infiltration and permeability of surfaces, we can create a healthier and more resilient urban ecosystem that benefits both the environment and the community.



4.5 PLAN FOR THE CITY

The success of our hyperlocal strategies in transforming surface parking into green and vibrant spaces has inspired us to think bigger. We believe that these strategies can be implemented on a city-wide scale, transforming surface parking zones and gardens across Genoa into integrated ecological services that benefit both the environment and the community.

By actualizing our interventions along heightened platforms, we can create a network of interconnected green spaces that provide essential ecological features and enhance biodiversity. Our interventions, including rain gardens, vertical habitats, native rewilding, community gardening, and community composting, will work together to create a sustainable and biodiverse urban ecosystem.

Large and small gardens across Genoa will play a crucial role in kick-starting habitation and promoting biodiversity. By transforming neighborhood surface parking into green infrastructure, we can create a more resilient and sustainable urban ecosystem that benefits both the environment and the community. The integration of these surface parking with other ecological services will create a network of interconnected green spaces that promotes ecological services such as pollination, water filtration, and soil improvement.

Our strategy is not a one-off solution but rather a policy recommendation that can be replicated and iterated for the entire city. By transforming surface parking zones and gardens into integrated ecological services, we can make the most of limited space in urban environments, promoting sustainable development and enhancing the overall ecological services of the city. Our hyperlocal strategies can be implemented in other cities as well, promoting sustainable development and enhancing the quality of life for communities across the world.

5. SPECIES SELECTION

One objective of the project is to increase the number of pollinators in Genova. To achieve this we will focus on the attraction of bees and butterflies that are already present in Liguria, in particular the following species:

Butterflies: Iphiclides podalirius, Vanessa cardui and Euplagia quadripunctaria

Bees: Apis mellifera and Amegilla quadrifasciata

To attract these pollinators to the local ecosystem that the project will generate, it is necessary to select particular species of plants. It's important to understand that it is mandatory to have two groups of species for a long-term accentuation of the pollinators: one that can feed adult pollinators and another one that can feed larvae. The first group of plants will allow the local environment to attract some individuals from other local ecosystems and encourage them to stay because of the pollen disponibility. The second group will permit the success of the reproduction of the pollinators, because the conditions will be good for the growth of the larvaes of the selected species.

Focusing on the plants that are already present in Liguria and that comply with the characteristics mentioned for the previous defined species, the following plants species selection was made:

For butterflies attraction: Prumus spinosa, Prumus cerasifera, Prumus laurocerasus, Prumus avium, Prumus amygdalus, Prumus mahaleb, Silybum marianum, Cirisum vulgare, Carduus pycnocephalus, Carduus defloratus, Cardus litigiosus, Cirisum acaule and Cirisium lobelli.

For bees attraction: Salvia rosmarinus, Thymus vulgaris, Lavandula stoechas, Lavandula angustifolia, Amapola rhoeas, Papaver dubium, Oenothera rosea and Papaver somniferum.

For larvae feeding: Malva multiflora, Roseda lutea, Anethum foeniculum, Raphanus raphanistrum.
This species will be present mainly in the parking lot and in the closest terrains that we are going to intervene. By doing this, it's possible to have a transition in which the size of the species will increase, from small species in the smallest terrains (parking lot area) to bigger species at the bigger terrains (near to the sea).

Also, a selection of tree species was made. For this, the conditions for the selection was that the species need to be present in the Liguria region, they need to be resistant to the sea erosion and they need to have to grow fast. By those felters the species selection was made:

Tree Species: Pinus pinaster, Tamarix gallica, Olea europaea, Ceratonia siliqua and Pistacia lentiscus.

This selection has species that complete all the conditions. It's possible to transplant young individuals of each species, and they will be available to grow in a relatively short time if the municipality takes care of the specific condition of each plant.

t is s important to consider that each specie have different requirements, so we develop some tables that should be follow to growth and conserve the species: Is important to be careful in the processes that are shown in table one. The use of pots or containers for the movement of small species is easy, but the excavation and transplant for big species is more difficult. For this last method, it is recommended to take away with the tree all the roots, protect them while the transportation is done and transplant it with the entire roots.

In Table 2, it is possible to observe the specific types of soil that the species requires. Is important that there is very specific information for each group. Is important to follow this condition to be sure that the plants will survive at the different places in which they will be placed. Because of this, it is proposed to divide zones by type of soil, so it will be easy to manage the requirements of these species.

TABLE 1: TRANSPLANT

TRANSPLANT TECHNIQUE	USE OF POTS/CONTAINERS FOR SMALL SPECIES	ESCAVATION AND TRANSPLANT FOR BIG SPECIES
SPECIES	Prumus spinosa, Prumus cerasifera, Prumus laurocerasus, Prumus avium, Prumus amygdalus, Prumus mahaleb, Silybum marianum, Cirisum vulgare, Carduus pycnocephalus, Carduus defloratus, Cardus litigiosus, Cirisum acaule, Cirisium lobelli, Salvia rosmarinus, Thymus vulgaris, Lavandula stoechas, Lavandula angustifolia, Amapola rhoeas, Papaver dubium, Oenothera rosea, Papaver somniferum, Malva multiflora, Roseda lutea, Anethum foeniculum, Raphanus raphanistrum and Hedera helix.	Pinus pinaster, Tamarix gallica, Olea europaea, Ceratonia siliqua and Pistacia lentiscus.

SOURCE: ROBERTPRZYBYSZ//GETTY IMAGES

TABLE 2: SOIL

TYPE OF SOIL	CLAYEY, LOAMY-CLAYEY	SANDY TO CLAYEY	SANDY	SANDY T0 LOAMY-CLAYEY
REQUIREMENT	Well-Drained and Fertile	Well-Drained and Nutrient rich	Well-Drained	Well-Drained and Deep soils
pH	6.0 - 7.5	5.5 - 7.5	6.0 - 7.5	6.0 - 8.0
SPECIES	Prunus spinosa, Prunus cerasifera, Prunus laurocerasus, Prunus avium, Prunus amygdalus, Prunus mahaleb	Silybum marianum, Cirsium vulgare, Carduus pycnocephalus, Carduus defloratus, Carduus litigiosus, Cirsium acaule	Salvia rosmarinus, Thymus vulgaris, Lavandula stoechas, Lavandula angustifolia, Malva multiflora, Roseda lutea, Anethum foeniculum, Raphanus raphanistrum and Hedera helix	Pinus pinaster, Tamarix gallica, Olea europaea, Ceratonia siliqua and Pistacia lentiscus

TABLE 3: WATERING

WATERING INSTRUCTIONS	REGULAR WATERING ONLY DURING PERIODS OF EXTENDED DROUGHT OR WHEN THE SOIL IS EXTREMELY DRY	REGULAR WATERING TO STAY HEALTHY, ESPECIALLY DURING PERIODS OF EXTENDED DROUGHT OR WHEN THE SOIL IS EXTREMELY DRY
SPECIES	Prunus spinosa, Prunus cerasifera, Prunus laurocerasus, Prunus avium, Prunus amygdalus, Prunus mahaleb, Pinus pinaster, Tamarix gallica, Olea europaea, Ceratonia siliqua and Pistacia lentiscus	Silybum marianum, Cirsium vulgare, Carduus pycnocephalus, Carduus defloratus, Carduus litigiosus, Cirsium acaule, Cirsium lobelli, Salvia rosmarinus, Thymus vulgaris, Lavandula stoechas, Lavandula angustifolia, Malva multiflora, Roseda lutea, Anethum foeniculum, Raphanus raphanistrum and Hedera helix

TABLE 4: PRUNING

PRUNING SEASON	WINTER	SPRING OR EARLY SUMMER
SPECIES	Prunus spinosa, Prunus cerasifera, Prunus laurocerasus, Prunus avium, Prunus amygdalus, Prunus mahaleb, Pinus pinaster, Tamarix gallica, Olea europaea, Ceratonia siliqua and Pistacia lentiscus	Silybum marianum, Cirsium vulgare, Carduus pycnocephalus, Carduus defloratus, Carduus litigiosus, Cirsium acaule, Cirsium lobelli, Salvia rosmarinus, Thymus vulgaris, Lavandula stoechas, Lavandula angustifolia, Malva multiflora, Roseda lutea, Anethum foeniculum, Raphanus raphanistrum and Hedera helix

SOURCE: ELITE TREE CARE

In this classification it is possible to observe that there is a group of plants that needs more water supply than the others. This is considered at the disposition of the plants in the design, so it is possible to bring more water to those plants that have the biggest requirement. At table 4 we can see two different groups. For the 'winter' group it is recommended the pruning of dead, damaged or diseased branches. On the other hand, the 'Spring-Early Summer' group is recommended to maintain the shape and promote the growth of new branches.

Following the developed instructions is extremely necessary to have success on this project, because it will increase the survival possibilities for the selected species. This way, the terrain will get the green component necessary for get the ecosystem services that will achieve the project goals.

SOURCE: URBAN HIVES

6. ECOSYSTEM SERVICES

The use of nature based solutions for this project will give some advantages. It's possible to classify them in three categories: social, economic and environmental. It is important to note that the solutions are linked, therefore the fulfillment of these objectives will be carried out jointly. Each of them is developed below.

SOCIAL

The social services that the project will bring to Genova is an increase in human health and well-being. This will be achieved by creating parks with green areas, which will give people space to relax, share, play sports and breathe less polluted air. Creating these parks will also increase carbon sequestration, which will contribute to improved air quality throughout the city. In the long term, this will help protect the health of the city's residents. In addition, the green areas will reduce the heat produced in summer in the areas to be intervened, due to the presence of pavements. This also seeks to improve the quality of life of the neighbors, since they will be able to take better advantage of their neighborhood during the hot months.

ECONOMIC

The project will provide two economic services. The first one is the reduction of the economic impact of floods. These events affect the population, delaying their day-to-day activities and affecting commerce in the area. With the proposed project, runoff will be reduced and infiltration will increase, which is why the economic losses in this aspect should disappear. Secondly, new places for commerce will be created, which do not currently exist, where local economic activities will be generated. In these spaces, the aim is to empower the sector's enterprising neighbors.

ENVIRONMENTAL

This project will generate an increase in the biodiversity of Genova. This will be achieved with the attraction of local pollinators and plant species. The amount of both groups inside the city is very low, because there aren't too many green areas. Increased biodiversity is a fundamental tool for climate change mitigation. This project is contributing locally to the fight against climate change. In addition, this increase in biodiversity is directly linked to the creation of green areas and spaces that allow us to provide the ecosystem services presented in the social and economic point of view.

7. BUSINESS MODEL

We are looking at the transformation of Largo Santa Maria Dei Servi (LSMDS) and the surrounding area. The historic site is currently an open air surface parking lot with no ecological assets, but a lot of potential. We are planning on enhancing the area around LSMDS through the use of nature-based solutions and revitalizing the neglected urban space through community-driven approaches. A Social Business Model Canvas (SBMC) was created, which can be viewed in Appendix 1.

7.1 KEY ACTIVITIES

The remodeling of the Largo Santo Maria dei Servi and the adjacent areas is accompanied by a number of activities. In addition to the initial implementation of the master plan (see chapter 4.3), the maintenance of nature-based solutions is a key activity. Plants need a lot of care and expertise to be able to maintain them. Even if some activities are handed over to the community (e.g. composting), it will be supervised throughout and supported in case of questions. They are also provided with sufficient information, including Do-It-Yourself Nature based Solutions ideas to implement on their own. Another activity is the dissemination of information about the project and Nature based Solutions in general to the public. In this way, people should learn about it, become curious, and visit the area. In order to keep the area attractive it will also be necessary to plan, organize and carry out events on a regular basis. This is particularly relevant as events are a major source of funding for the project.

7.2 KEY RESOURCES

The necessary resources for the project can be divided into physical, intellectual, (human) labor, and financial resources.

Physical: Physical resources refer in part to the necessary greenery, which are plants, meadow, trees, shrubs and also soil. For maintenance, especially water and biological fertilizer is used. Other physical resources are the equipment for installation and implementation (e.g. garden tools, excavators, wheelbarrows, watering hoses) and other materials for construction (e.g. park roof, benches)

Intellectual: Implementation requires some knowledge and appropriate strategies in spatial planning, engineering, proper handling and maintenance, horticultural and landscape design expertise. The knowledge of locals in relation to the needs of the local population is also consulted.

(Human) labor: For the implementation and maintenance / care labor is needed. Thus physical workforce as well as time. This is done on a voluntary basis, within the framework of the community or also paid (especially for the initial implementation).
Financial: Financial sources are also needed for implementation (payment for materials, labor, etc.). For a more detailed description of the cost structure, see point 6.6.

Financial: Financial sources are also needed for implementation (payment for materials, labor, etc.). For a more detailed description of the cost structure, see point 6.6.

7.3 PARTNERS AND KEY STAKEHOLDERS

We define partners and stakeholders as all those individuals, groups, and organizations that may contribute to the implementation of the project or are affected in any way. One is the University of Genoa, which strongly supports implementation through consulting. All other consultants and experts who contribute intellectually to the project are also relevant partners. The municipality is also a stakeholder through its decision-making authority. All investors (private or public) who provide a financial contribution are also included (e.g. the European Union). Furthermore, all suppliers of materials and plants, workers, local companies, and the local community are relevant.

This multi-stakeholder approach is crucial as it involves collaboration between various groups. These groups each have a different stake in this project and will bring considerable skills, resources, and perspectives. Moreover, this multi-dimensional approach ensures that the project is well-rounded, addressing the needs and concerns of more than one sub-set of people.

7.4 BENEFICIARIES

We define beneficiaries as all those individuals, groups and organizations that derive a direct or indirect benefit from the transformation of the area. Here the church of Santa Maria dei Servi could be identified as it is located directly in the central square of the project. Also the residents of the area, who will benefit from a greener and healthier living environment. The Citizens of Genoa will benefit, as the project will contribute to the overall urban ecosystem and climate. Local Businesses, especially shops, bars and restaurants, benefit from the increase in attraction, allowing them to generate more revenue. Local plants and animals will find a sanctuary in this new green space. Tourists will be attracted to the innovative and sustainable development of the area and its educational opportunities. The local government benefits, as the project makes the city more livable and thus more attractive. Last but not least, there are private investors who can expect a Return on Investment (ROI) from their input.

Funding Gains for Different Stakeholders:

1. Municipality of Genoa: The Municipality will gain from the increased revenue due to the attraction of local businesses and improved property values. It can also benefit from a more attractive, sustainable, and healthy city, contributing to its overall reputation and quality of life.

2. European Union (Funds): The EU's involvement aligns with its sustainability and climate action commitment. Successful projects also contribute to the EU's reputation and influence, demonstrating their commitment to funding sustainable urban development.

3. Material and Plant Suppliers: Suppliers can benefit from the business generated by the project. Moreover, they could gain recognition and potential future business opportunities from being associated with a high-profile, successful sustainability project.

4. Local Businesses: These businesses can enjoy increased patronage due to the greater footfall in the area. They may also benefit from the improved local environment, making the site more attractive for business.

5. Residents: Residents of Genoa are perhaps the most vital stakeholders in this project. As the primary beneficiaries, they will experience the direct impacts of the transformation. They stand to gain a more sustainable, attractive, and healthy environment. Their support and involvement are key to the project's success and longevity. They might also contribute as volunteers, advocates, or even financial contributors in some instances.

7.5 CHANNELS

There are several channels through which we want to reach the relevant stakeholders and beneficiaries. Interested parties can learn about the project and follow its progress through the city's website. Announcements and updates will also take place via social media as well as local radio, television and newspaper. For example, news broadcasts can report on the project and social media can be used to reach a young target audience in particular. Through the University of Genoa, students and faculty will be informed and encouraged to contribute. Many people will also be attracted via events and workshops to learn about the project.

7.6 COST STRUCTURE AND FUNDING

Fixed costs relate to maintenance (materials, labor, etc.), initial implementation and installation.

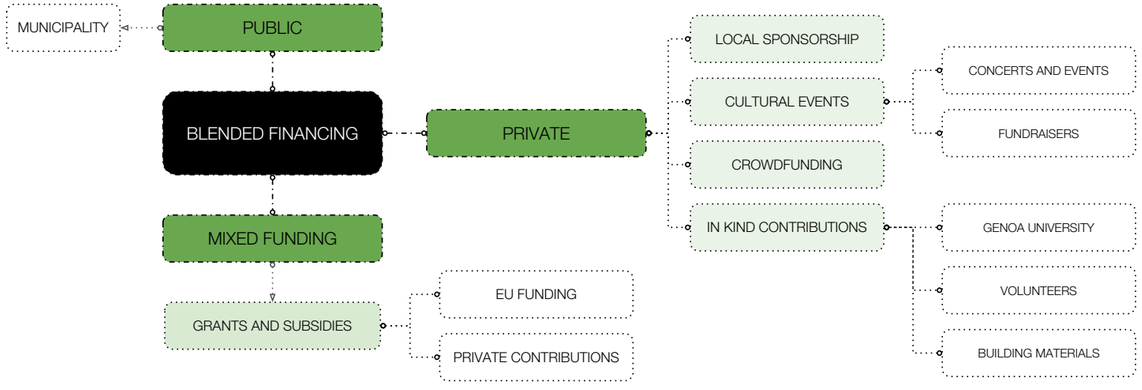
Variable costs are incurred for repairs, expansions/ landscape updates, events, advertising and for seasonal plants.

Revenue is primarily generated from events. These are tickets and admission fees, as well as cost contributions for event organizers (sports clubs, market booths). Another source of revenue is the increase in tax revenue due to the attraction of local businesses, which will increasingly locate in the area as it gets more attractive. Furthermore, revenue is generated by advertising space provided for companies (e.g. billboards) and sponsorships. The surplus will be reinvested in the maintenance of the area, it's expansion and to finance similar projects around Genoa.

The financing method used is blended financing. This means that there are various sources of financing, both public and private. The public sector, which in this case is the municipality, provides a basic amount that is necessary for the initial implementation. For this, the municipality can turn to institutions such as the EU to obtain funding and subsidies for the project. If a basic amount is available, the rest will be covered by private investors and funding sources. These can be local companies, income from events, crowdfunding (in return for tickets to events, for example) and also sponsorships and donations in kind.

In addition to public and private financing sources, the GreenWave project can also benefit from community involvement and engagement. Community involvement can take various forms, including volunteers helping with maintenance and upkeep, local residents contributing to the project through crowdfunding, and community organizations organizing events and activities in the area. Engaging the community can not only generate additional funding for the project but can also foster a sense of ownership and pride in the local area. This can lead to increased community cohesion and a greater appreciation for the benefits of green spaces in urban environments. Therefore, community involvement and engagement should be an essential part of the financing strategy for the GreenWave project

EU funds will be particularly relevant for the GreenWave project. This way, the city can get some seed money for implementation. Funds such as URBACT or LIFE may be eligible for GreenWave. All funding opportunities of the European Union for cities can be found here.



SOURCE: OCEAN ROBBINS

SOURCE: MICHELLE

8. FUTURE IMPACTS

GreenWave's primary focus is the transformation of Largo Santa Maria dei Servi and revitalizing nearby neglected areas using sustainable, eco-friendly practices. The project's centerpiece involves reworking the parking lot, converting it into a green space for the residents and local flora and fauna.

8.1 PROJECT OUTCOMES PER PHASE

Phase 1: (0-1 years)

The first phase focuses on creating visually appealing edge treatments, which involve designing and managing the perimeters of the parking lot to improve aesthetics, functionality, and ecological value. This will contribute to a more inviting and vibrant environment. Additionally, the establishment of organic pop-up markets will stimulate the local economy.

Phase 2: (1-2 years)

The second phase will introduce vertical habitats, creating additional green spaces on walls and other surfaces, improving air quality and biodiversity. Native rewilding efforts will restore indigenous plant species, which will help enhance the area's biodiversity. These initiatives will attract local wildlife and encourage residents and tourists to appreciate the native flora and fauna, promoting a stronger connection with the natural environment.

Phase 3: (2-5 years)

The third phase focuses on fostering community involvement in gardening and composting initiatives in the area. These activities will empower residents to take ownership of the green spaces, cultivate their plants, and utilize compost to enrich the soil. This will create a sense of community ownership and responsibility, improving the area's maintenance and ensuring long-term sustainability.

Phase 4: (5-10 years)

In the final phase, rain gardens will be constructed to effectively manage stormwater runoff, prevent flooding, and reduce water pollution. These gardens will add to the area's aesthetic and contribute to a more sustainable water management system.

8.2 KEY IMPACTS

Environmental Impact: The project will foster new habitats for plants and animals, contributing to enhanced biodiversity. By incorporating greenery, soil, water, and waste management systems, air quality will improve, urban heat island effects will diminish, and the urban ecosystem will be strengthened. Using rainwater collection systems also ensures sustainable water management and prevents harmful runoff from reaching the ocean.

Social Impact: It will boost residents' well-being with a healthier, better-looking living space. Benefits include a better microclimate, less noise pollution, and increased community connections.

Economic Impact: Renewing the area will attract businesses, encouraging new ventures and boosting existing ones. The project will raise property values and create tax income for local authorities. Any extra funds will be used for maintenance and other city-wide projects supporting sustainable urban growth.

Tourism Impact: The innovative and sustainable nature of the project will attract tourists. The project's events, workshops, and DIY nature-based solution initiatives will provide engaging learning experiences for visitors, boosting tourism revenue for the city.

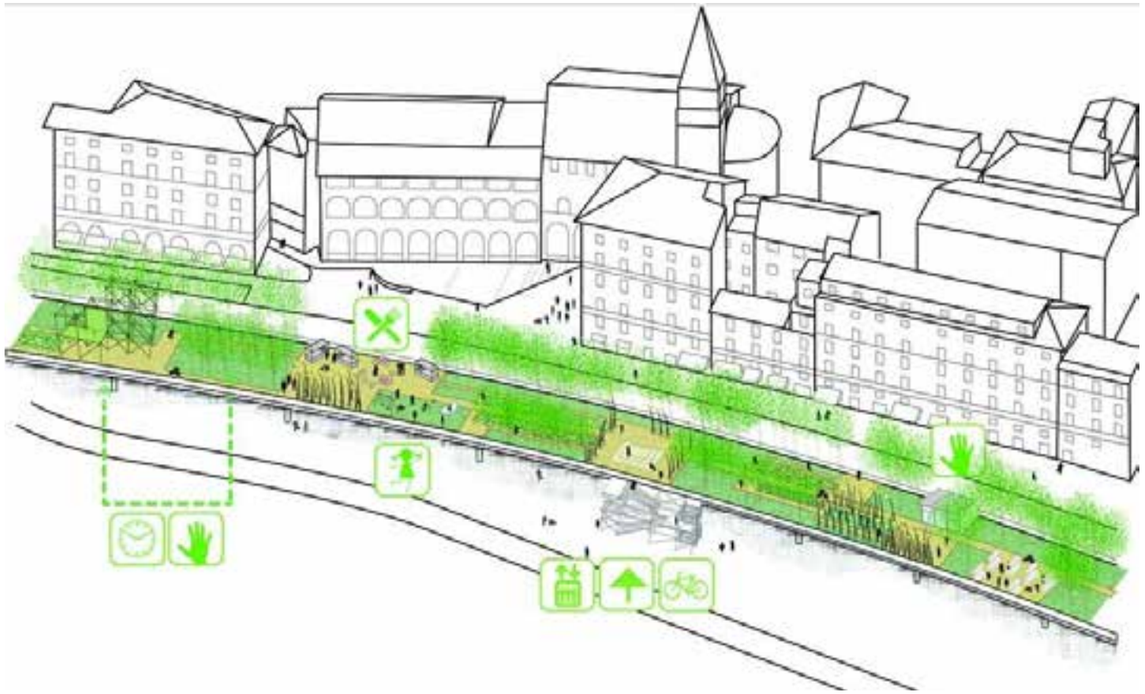
9. CASE STUDIES

9.1 BAMBOO, GENOA

The project proposes a new coexistence between citizens, between citizens and the flyover, between the flyover and the territory, between the urban area and the historic port. A civil coexistence with an impacting infrastructure that will now be transformed into a green park and a lifeblood for the city. NEW PUBLIC SPACES The project idea foresees the formation of a public space for everyone with a new "identity": a green, sustainable area in which one can meet, lie down, play, study, work, dance, relax, contemplate the visual and sensory beauty of the marine landscape, get information, educate children, cook, cultivate and self-build.

The interventions were planned to reduce costs and limit following a time schedule :

– Phase 1: Area naturalization ,
– Phase 2: Cutting and construction,
– Phase 3: Creating spaces ,
– Phase 4: Self Built and educational activities.



SOURCE: DIEGO STEFANI

9.2 THE HIGH LINE, NEW YORK

The project began with a unique definition of “park” inspired by a competition that gathered the ideas of novices and professionals alike. The Commissioner of the New York City Department of Parks and Recreation has described it as, “A park unlike any other, the High Line will be lifted 29 feet above the street, linking 22 blocks, connecting three neighborhoods, even passing through the interiors of buildings.”

The High Line offers the New York community a wealth of environmental, social and economic value. It brings wildlife and plant life to an otherwise industrial area mostly covered in cement and asphalt. The wilderness brings more than much needed public recreational space; it also serves as a cooling agent to offset heat reflected from seemingly endless blocks of concrete and glass. At a time when the climate change crisis demands action from all sectors, the environmental benefits of adding green space in urban areas are gaining more attention.

SOURCE: THE WASHINGTON POST

9.3 URBAN HIVES, BEIRUT

As large green areas in cities are becoming increasingly rare, smaller public and even private gardens are now also disappearing. The city's inadequate public transportation system drives people towards using cars, encouraging landowners to convert green spaces into parking lots. Urban Hives seeks to reintroduce the urban garden into these parking lots, and potentially into other public, hard-surfaced spaces.

Urban hives is conceived as a module that raises above 2 cars. Modules can be multiplied or reduced to suit the site and easily assembled and disassembled for maximum flexibility. Thus, the parking lot retains its commercial use, but is also transformed into a site for communal gardening and food growing activity.

SOURCE: URBAN HIVES

10. PROJECT TEAM

Ben Bello
Ben is an architecture student pursuing his master's at the university of Genoa .Coming from a country (Gabon) where 87% of the total area is covered with trees he has been used to living in harmony with nature . Unfortunately, there is a lack of parks, recreational areas, and maintenance of public spaces. He would like to contribute to improving the quality of life and living conditions of the population in his country. With his background and the knowledge he believes that it will be possible.

Erum Khaled
Erum is currently studying business management at WU Executive Academy. She has a strong interest in sustainable change management and evolving business practices. Having directly experienced the distressing repercussions of rampant urbanization in her hometown in India, particularly the detrimental impacts of industrialization and water pollution, Erum was motivated to enroll in this program. Her primary objective is to gain an in-depth understanding of Nature-Based Solutions and to contribute to mitigating these environmental challenges.

Lucia Mack
Lucia is a master's student in socioeconomics at WU Vienna. She completed her Bachelor's degree in Economics also at WU Vienna. She is particularly interested in the intersection of social and environmental issues and is currently writing her master's thesis on the impact of climate policies on people with disabilities. For the last three years she has also been an active member of oikos Vienna, students for sustainable economics and management education. In addition to her studies, she works as a Junior Researcher at the Competence Center for Nonprofit Organizations at WU Vienna, where she conducts research in the social sector.

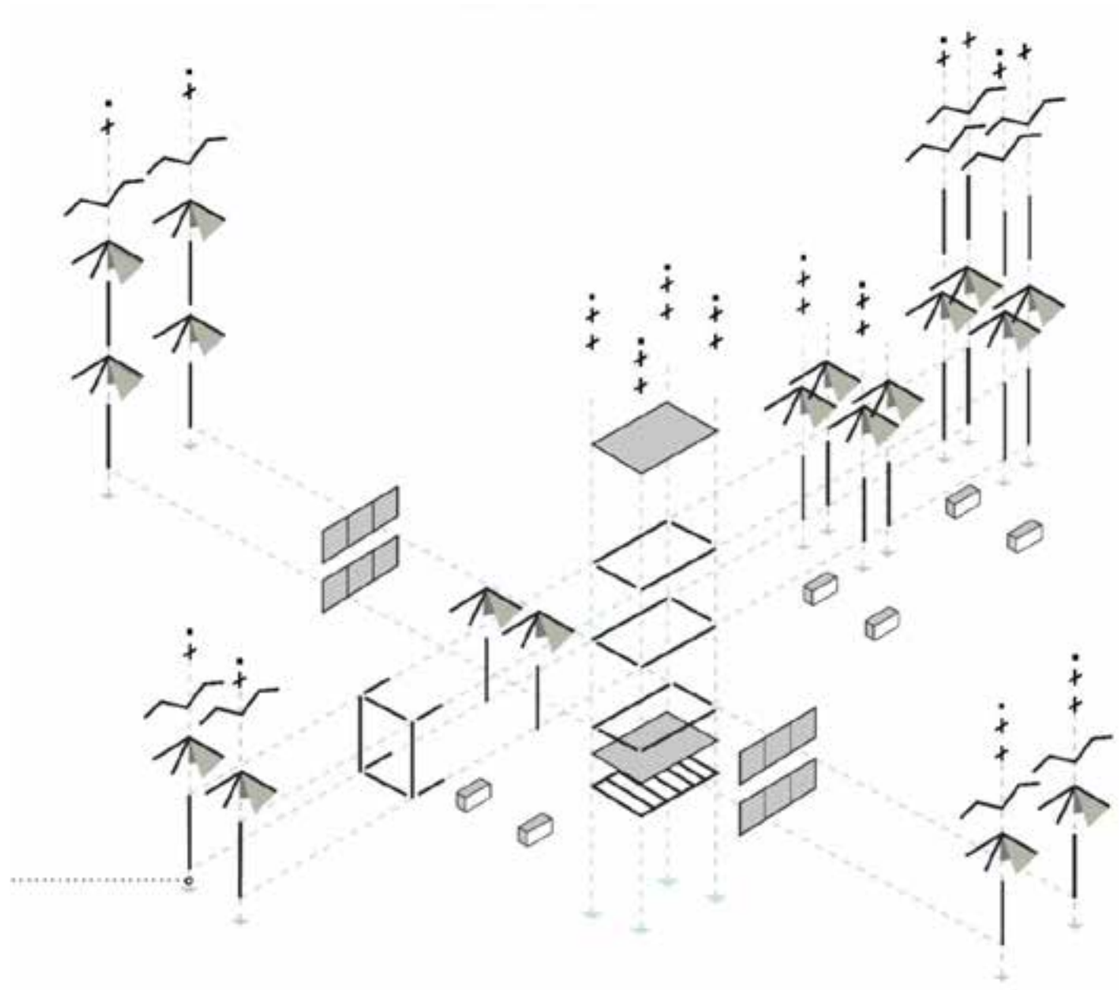
Manuel Beca
Manuel is an engineering student at Pontificia Universidad Católica de Chile. This semester he is studying in Genoa due to an academic exchange. He is Chilean and his interests are focused on climate change, sustainable energies, green cities and water resources. He is very happy to have the opportunity to participate in this program, to have the chance to work with people from all over the world and to visualize the way they work on this kind of projects in Europe.

Parshav Sheth
Urban Strategy and Planning specialist from Mumbai, India. Currently pursuing Master's in City and Technology at the Institute for Advanced Architecture of Catalonia, developing thesis on democratizing city technologies and using AI to transform mass transit infrastructure into ecological commons in developing megacities. Has a background in developing projects which act as catalysts for architecture, urban design, and planning with special emphasis on building multilateral stakeholder relationships that enable the creation of circular policies.

Zerihun Tassano
Zerihun is an architecture student who is completing his master's degree and will soon leave for Ethiopia, his native country to write his final thesis.
He currently works in an architectural studio and his wish is to return to Africa to practice the profession of architect. Zerihun loves being outdoors, in green spaces and is often lucky enough to go on horseback rides in the woods.

Can Xu
Come from another beautiful mountain city of China, Chongqing. Trained as an architect, currently pursuing his Master's in City and Technology at the Institute for Advanced Architecture of Catalonia. He is always very much interested in designing connections with the beautiful green nature and the everyday physical space, in a practical way.

10. APPENDIX



KIT OF PARTS

WOODEN PALLETS OR CRATES:
1 x 1 M PANELS

SCAFFOLD PLANKS:
3 METERS

GEOTEXTILE FABRIC:
10 RUNNING METERS

LIGHTWEIGHT SOIL MIX:
2 KG

PLANT CONTAINERS:
12 TO 24 INCHES

TRELLISES:
1 x 3 M PANELS

FOOTINGS:
0.3 X 0.3 M

WATER TANKS:
0.3 X 0.3 X0.5 M

DRAINAGE CHANNEL:
20 RUNNING METERS

CORNER BRACINGS

KEY RESOURCES

Physical:
Greenery (plants, trees, lawn), soil, water, fertiliser, material for car park roof, equipment for maintenance, rainwater collection systems, benches, gardens and waste management system

Financial:
Blended financing (private, public, grants and subsidies, donations, crowdfunding, events).

Intellectual:
Urban planning, technically correct implementation, proper maintenance, local horticulture and landscape design expertise, incorporating indigenous knowledge

Human:
Workforce for implementation and maintainance (voluntary, paid, community)

KEY ACTIVITIES

Remodelling the area

Maintenance of nature based solutions

Supervision of community tasks (e.g. composting, gardening)

Information dissemination about the project and NBS in general

Event planning and implementation

DIY NBS projects

PARTNERS

University of Genoa
Municipality of Genoa
European Union (Funds)
Material/ Plant supplier
Local businesses
Environmental consultants and experts

COST STRUCTURE

Fixed costs: maintenance costs , initial construction and installation
Variable costs: Events, reparation, advertising, seasonal planting or landscape updates

SEGMENTS

Environment
Residents
Citizens of Genoa
Businesses
Tourists
Local Government
Wildlife

TYPE OF INTERVENTION

Enhancing the area around Largo Santa Maria Dei Servi through the use of nature-based solutions.

Revitalizing neglected urban spaces through community-driven approaches

CUSTOMER

Residents of the area:
Citizens of Genoa
Tourists
Local Businesses
Local residents
looking for volunteer

CHANNELS

City of Genoa Website
Social Media
Advertisements in the local newspaper
TV, radio (e.g. news shows)
Local workshops and events

VALUE PROPOSITION

Beneficiary Value Proposition

Environment: Creating new habitats for plants and animals, enhancing biodiverse habitats

Residents: will benefit from a greener, healthier living environment

Citizens of Genoa: the project will contribute to the overall urban ecosystem and climate

Businesses: the area becomes more attractive, new business models emerge and existing ones are visited more often

Tourists: will be attracted to the innovative and sustainable development of the area and its educational opportunities

Local Government: benefits from the increase in value due to the better living conditions

IMPACT MEASURES

m2 of Green space
Reduction of dirt particles in the air
Change of the microclimate
Noise reduction
Community Cohesion
Decreased urban heat island effect

CUSTOMER VALUE PROPOSITION

Sense of ownership and belonging within the community
Promotion of healthy and sustainable living

REVENUE

Mainly from Events: Ticket/ Entrance fees
Contributions to costs from organisers (e.g. sports clubs, booths at markets)
Tax revenue through business
Sponsorships and advertising from local businesses

SURPLUS

Reinvestment in maintenance using revenue for similar projects around the city