Deliverable 3.2

T3.2 Pilots. Co-created NBS in each Life-Lab: pilots initiated in Month 6 and completed before project end

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Cover Image: Urban Allotments, Barcelona [©Gmercado]

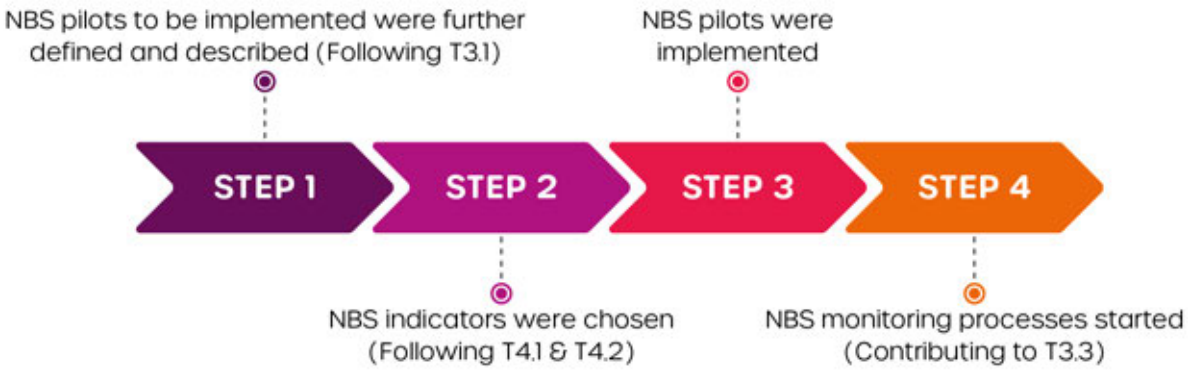
Contents

Executive Summary

This report presents Deliverable 3.2 of Work Package 3 (WP3) within the Conexus project, focusing on the co-creation of Nature-Based Solutions (NBS). The co-creation process across the seven Life Labs involved defining and describing NBS pilots, selecting appropriate indicators, implementing the pilots, and initiating monitoring processes. These steps, however, were not executed concurrently across all Life Labs due to varying circumstances such as the COVID-19 pandemic and political or organisational changes. Despite these challenges, each Life Lab followed a common trajectory, leveraging stakeholder engagement strategies and extensive networks to enhance the NBS co-creation process. Challenges included navigating complex administrative procedures and shifting local governments' traditional top-down decision-making processes to prioritise public consultation. Despite these obstacles, the enthusiasm for NBS initiatives was evident across all Life Labs, indicating a strong public interest in contributing to sustainable urban development. The future sustainability of NBS pilots hinges on continued citizen engagement and education, and local governments transforming and evolving to support this growing eco-consciousness. The Life Lab model offers a pathway for deeper community involvement and long-term impact through enhanced public awareness and participatory governance.

Introduction

This report corresponds to Deliverable 3.2 of Work Package 3 (WP3) within the CONEXUS project. Deliverable 3.2 aligns with Task 3.2 “Co-create NBS”. T3.2. is responsible for the co-creation and co-production of NBS interventions within each of the Seven Life Labs established under T3.1. During the project duration, a co-creation process took place in each Life lab, which consisted in the following steps:



However, these steps did not happen in parallel in each Life lab, due to different circumstances and contextual scenarios, such as i.e. Covid-19 and political/organisational changes in each city. Nevertheless, all the life labs have followed the same trajectory and strived to enhance the NBS co-creation process through different stakeholder engagement strategies, as well as building on their extensive networks and alliances.

In Barcelona for example, different measures were taken to ensure the development of their different pilots, including the participation of vulnerable and elderly populations in the allotment gardens and developing an online Urban Agriculture Observatory to facilitate information exchange across users.

In Buenos Aires, three different pilots were co-created in spite of the challenge of crossing administrative boundaries, due to their location in different administrative regions. This process has resulted in a successful cross-silo collaboration that has emerged to facilitate NBS co-creation and co-production. Moreover, the three pilots intervene at different scales and respond to different environmental challenges, with the Respirar pilot focusing on reducing air pollution at micro scale by the use of green infrastructure for the creation of outdoor classrooms; the Francia Street Rain gardens pilot testing and demonstrating Sustainable urban drainage systems (SUDS) at street level, and the Lago Lugano Wetland pilot focusing on habitat restoration at a larger scale.

In Bogota, the two pilots aimed to intervene in water streams restoration in two different areas in the south (Usme) and the north (Suba) of Bogota, these areas are located in the boundaries between the urban and the rural scene, and stakeholder engagement at multiple levels and scales was crucial for NBS co-creation and co-production. Hence, the Bogota life lab has dedicated significant efforts to promote community stewardship and collective action.

In Lisbon, two different pilots tested and demonstrated re-greening interventions at different scales. The Renatura pilot focusing on a meso level scale thorough renaturalization process of one of the largest green areas in Lisbon: the Vale da Montanha Park. The Ruas Verdes+ pilot focused on street level regreening and renaturalization processes by testing and demonstrating different NBS as micro-green solutions such as pocket gardens and street tree planting.

In Santiago, the development of the Santiago+ Green Infrastructure Plan catalysed the collective interest of the community and effectively coordinated various public, private, and citizen initiatives under a strategic vision of integrated planning. Coupled with this, the re-greening interventions at the neighbourhood level through the “Quiero mi Barrio” (I Love my neighbourhood) pilot provided the means to co-create and demonstrate NBS on a local scale through participatory community-building interventions.

In São Paulo, the Functional Forests pilot has achieved three years of monitoring data, focusing on carbon sequestration, thermal comfort, and air pollution mitigation in urban forests. The extensive data collected provides valuable insights for the city's planning and development strategies, as well as building citizens' awareness of the multiple benefits of urban forests.

In Torino, the Valdocco Vivibile pilot through a re-greening and re-naturalization process focused on the neighbourhood level, has become a platform for the community of stakeholders who supported its realisation, facilitating the dissemination of information on its objectives, developing knowledge on climate change and NBS as well as promoting dialogue on these issues. The Valdocco Vivibile pilot has been particularly effective in engaging local schools and the youth in the neighbourhood. It was a first time, integrated intervention that is going to be replicated in other areas of the City having represented an innovative way to rethink the urban ecosystem.

1. Co-creating NBS in the Conexus project

Through all the NBS pilots, the Life labs provided a framework for involving citizens directly in the care and maintenance of urban green spaces, enhancing their connection to nature and community. One of the most prominent difficulties for most of the Life labs was navigating through extensive administrative procedures, which often slowed down the co-creation processes significantly. Local governments are not used to the collaborative and inclusive co-creation processes that Life labs promoted, which sometimes resulted in resistance to change and preference for traditional top-down decision-making. Additionally,

co-designing projects with the local population was often a new and demanding task for local governments, requiring a shift in mind-set and a change in procedures in order to prioritise public consultation over top-down decisions.

Despite the challenges, adopting a Life lab perspective offered significant benefits for co-creating and testing NBS, particularly in fostering community engagement. The enthusiasm among citizens for participating in NBS initiatives was tangible in all Life labs, which proves that citizens are eager to contribute. Hence, NBS Life labs can pave the way for a new type of environmentally conscious citizenship, where citizens are not only more engaged, but also more informed about ecological practices and the benefits of NBS. On the other hand, the Life lab approach also helped non-governmental organisations and other external stakeholders to recognize and understand the complexities and time-consuming nature of municipal processes and public administration.

2. Future and Sustainability of the NBS pilots

The future and sustainability of the NBS pilots depend on the continued and enhanced engagement of citizens in environmental initiatives. As people become more environmentally conscious, there is a growing demand for participation in sustainable urban development. This shift requires that local governments evolve to accommodate and support the new wave of eco-conscious citizens. Embracing the Life lab model, could help local governments navigate through this process, by facilitating greater community involvement and fostering a deeper connection between citizens and their local environment. Moreover, prioritising education and awareness about nature and sustainable practices is crucial for local governments to ensure that these initiatives have a lasting impact.

3. The Conexus NBS pilots

Next, each Life lab presents a brief summary of the co-created NBS pilots, their objectives, reflections and possibilities for the future.

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PILOT 1. Monitoring naturalisation

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BARCELONA

PILOT 1. Monitoring naturalisation

Start date: April 2020 **End date:** August 2024

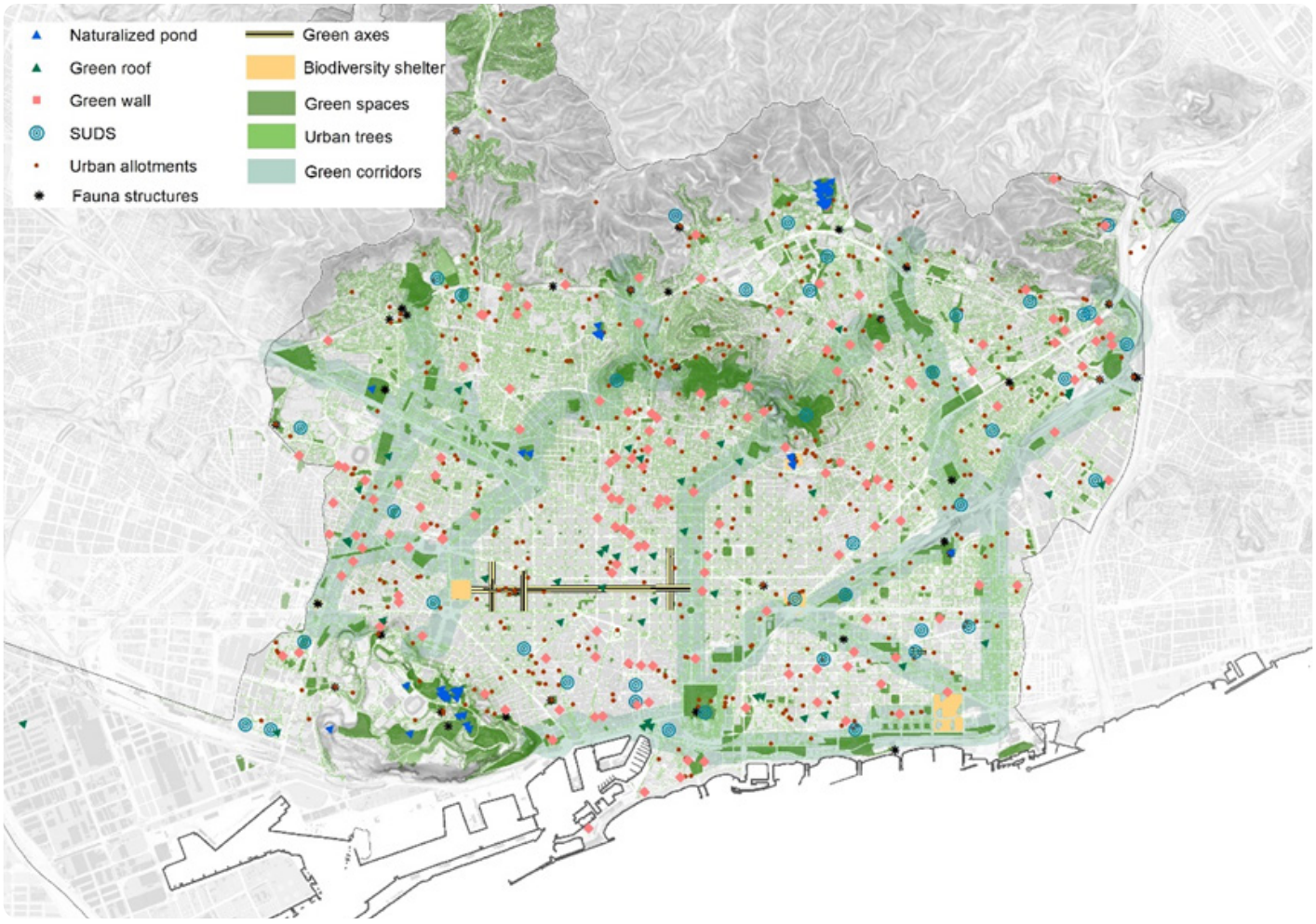
What and Where?

Barcelona committed itself, through the Green Horizon 2030 objectives, to increasing greenery by 1m² per resident by 2030, at the Paris Climate Change Conference (COP21) in December 2015. This climate change adaptation measure was equivalent to 160 new hectares of greenery at that time.

The aim of Pilot 1 has been to analyse the evolution of green infrastructure in Barcelona from 2019 to 2023. Pilot 1 has also shared with other cities the methodology carried out for the estimation of socio-environmental services and the calculation of accessibility to urban green infrastructure.

Location:	City scale (Barcelona).
NBS type, and habitat/s:	All kind of NBS, Mediterranean habitat.
Ecosystem services:	Physical and mental health, Well-being, regulating the quality of air, climate regulation, water regulation, recreation, social cohesion.
Management & maintenance:	The management and maintenance of these spaces is carried out by Barcelona City Council.

Map


Naturalized pond
Green roof
Green wall
SUDS
Urban allotments
Fauna structures
Green axes
Biodiversity shelter
Green spaces
Urban trees
Green corridors

Why?

Such assessments make it possible to identify which socio-environmental services need to be enhanced and which areas of the city need urban green spaces. In this way, it provides the city government with a useful tool for precise action in the planning and management of urban green infrastructure.

When?

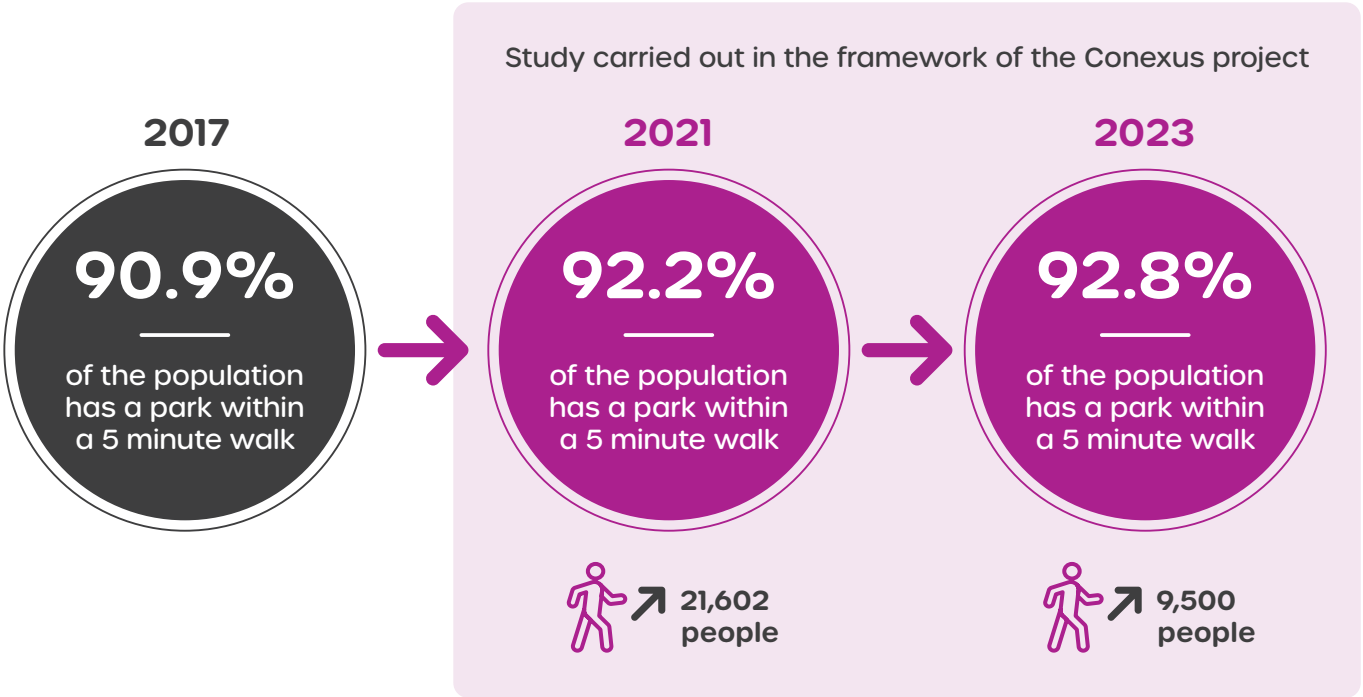
	Who	2021	2022	2023	2024
Previous work GIS and cabinet	BR	■			
Monitoring and evaluation of green infrastructure:					
• Monitoring of the actions and measures proposed and carried out by the government measure	BR		■		
• NDVI analysis	BR		■		
• Monitoring of the involvement of citizens	BR		■		
Processing data	BR			■	■
Results	BR			■	■
Creation of an observatory (Dissemination of information and communications)	BR	■	■	■	■

How?

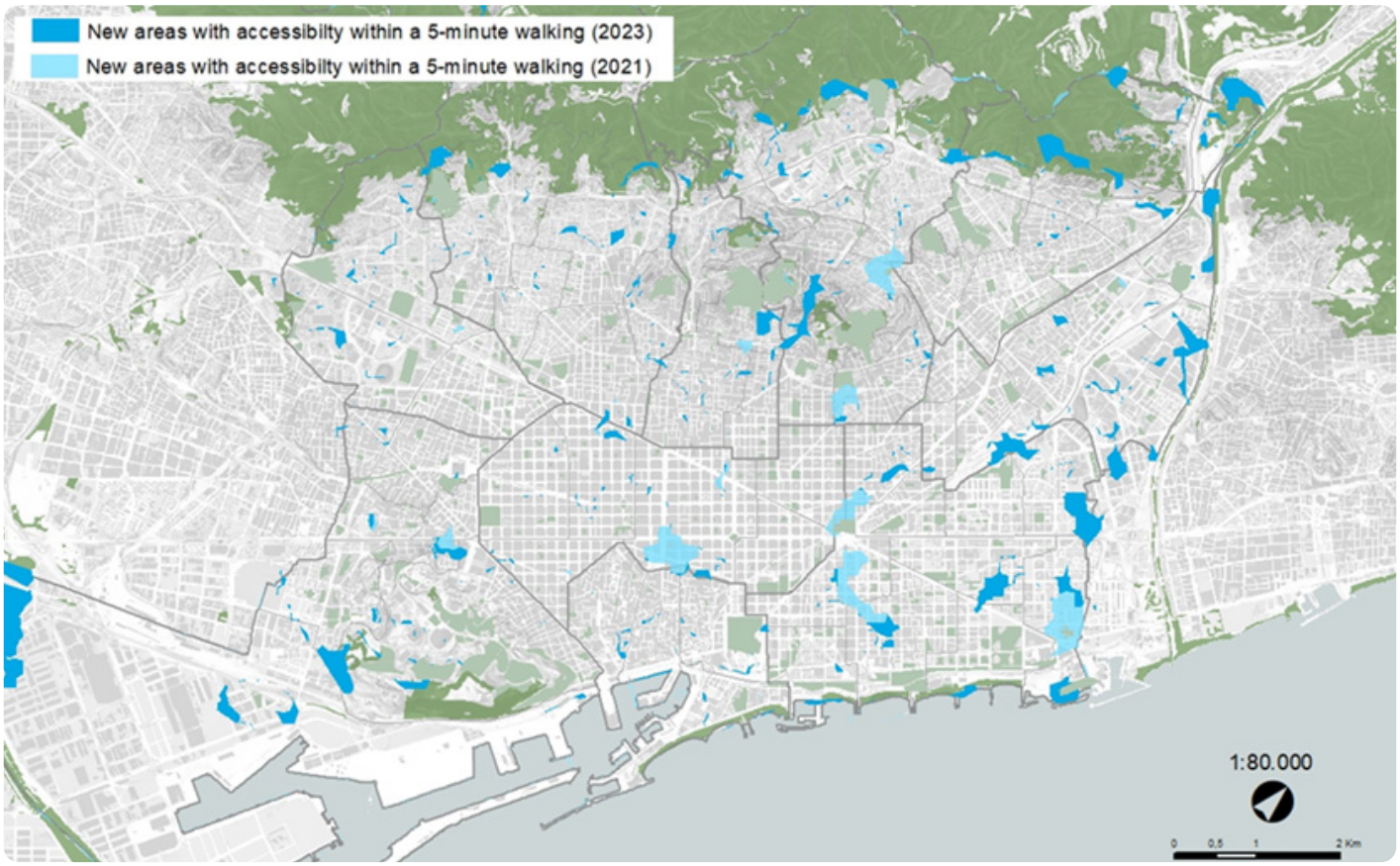
In 2017, Barcelona Regional developed a methodology to analyse socio-environmental services, which has helped Barcelona to significantly increase socio environmental services in urban green infrastructure since then. Using the same methodology and as part of the CONEXUS project, two updates were carried out to analyse socio-environmental services in 2021 and 2023. The methodology includes 52 representative indicators, which combined in the matrix, allows calculating a total of 29 socio-environmental services.
In addition, Pilot 1 has analysed the accessibility to urban parcs and the total urban parcs surface in 2021 and 2023. The green spaces are classified into four categories: historic parks; parks and gardens; interior courtyards of blocks; and green squares.

So what?

Pilot 1 has monitored the evolution of accessibility to urban parks through the indicator "Accessibility to urban green infrastructure" showing an increase from 90.9% of the population with a park within 5 minutes walking in 2017 to 92.8% of the population in 2023.



As a result, Pilot 1 has mapped the increase in new areas with accessibility to green spaces in 2021 and in 2023 compared to 2017.



Pilot 1 has also monitored the indicator **"Urban parks surface"** showing an increase of 35 hectares from 2017 to 2023.

Finally, in collaboration with CONEXUS LifeLab Exchanges, Barcelona life lab has organised a training session to show how to calculate green accessibility to other Lifelabs.

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PILOT 2. Monitoring Urban allotments. Social issues and ecosystem services

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BARCELONA

PILOT 2. Monitoring Urban allotments. Social issues and ecosystem services

Start date: April 2020 **End date:** August 2024

What and Where?

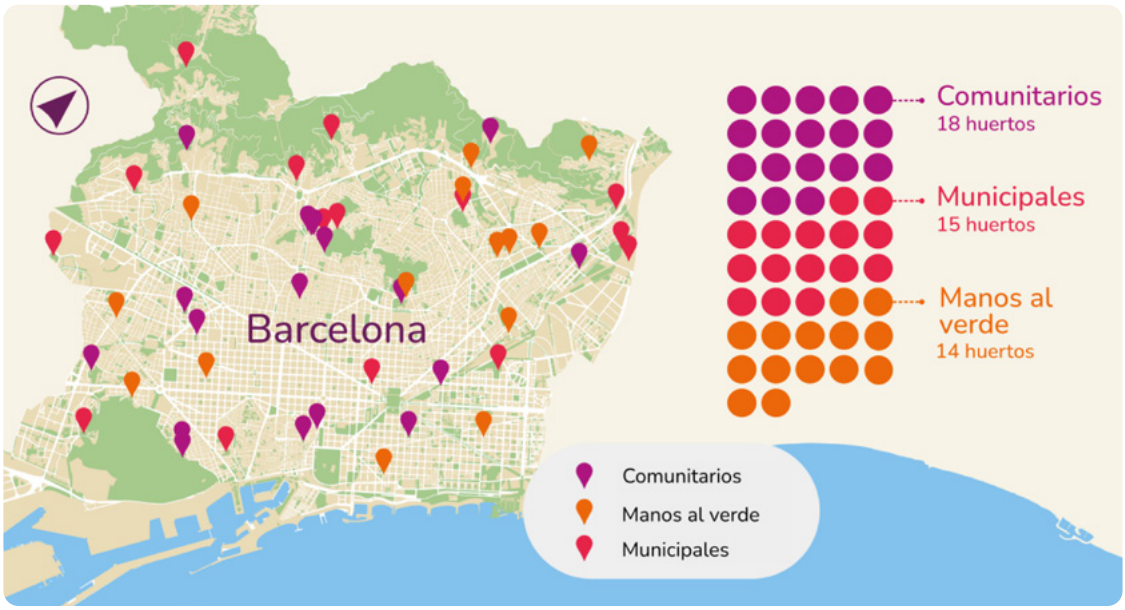
Barcelona city council has promoted several plans that include urban agriculture and urban allotments and their enhancement. The Urban Agriculture Strategy of Barcelona (2019–2030) set out the importance of urban agriculture for the present, and especially the future, of the city through various perspectives.

Despite this, there is an obvious lack of information and studies on urban allotments within Barcelona to provide a solid basis of data that serves the planning, promotion and management of these spaces.

In this sense, the Urban Agricultural Observatory's (Pilot 2) main objective is to establish an environmental and social database of urban allotments and analyse the environmental and social benefits that these bring to the city and its inhabitants.

Location:	Urban allotments in Barcelona (47 'pocket sites' which are public properties).
NBS type, and habitat/s:	All kind of NBS, Mediterranean habitat.
Ecosystem services:	Purification of air, climate regulation, food provision, social cohesion, environmental education, recreation experiences.
Management & maintenance:	The management and maintenance of these spaces is carried out by Barcelona City Council.

Map

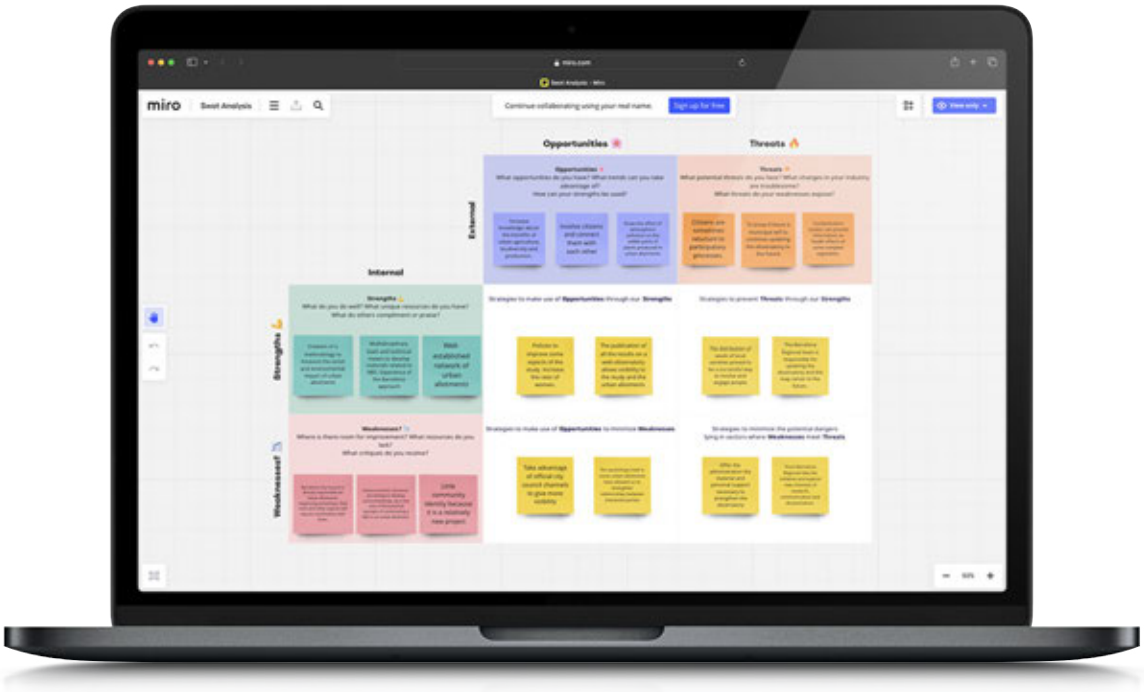


Why?

Increase knowledge about the benefits of urban agriculture, biodiversity, and production to give information to the City Council to plan and manage urban allotments.

Creation of a methodology to measure the social and environmental impact of urban allotments. Involve citizens and connect them with each other.

You can consult a SWOT analysis in this link.



When?	2021	2022	2023	2024
Previous work GIS and cabinet	■			
Data collection: urban allotment users		■		
Data collection: biodiversity		■		
Data collection: ecosystem services		■		
Data collection: food production		■		
Processing data		■	■	
Results			■	■
Creation of an observatory (Dissemination of information and communications)	■	■	■	■
Local engagement	■	■	■	■

How?

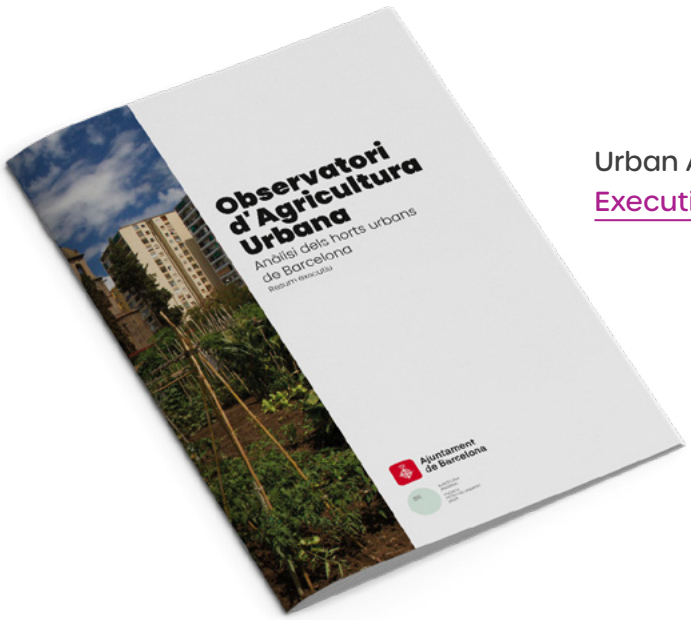
Pilot 2 has developed a methodology based on a combination of field and desk work. Pilot 2 studied 4 different aspects of urban allotments through different methodology:

- Users socioeconomic and health perception issues
- Socio-environmental services of urban allotments
- Estimation of agricultural production
- Estimation of cultivated biodiversity

In terms of fieldwork, 242 surveys have been carried out with users and entities to evaluate users socioeconomic and health perception issues, and estimate cultivated biodiversity, asking every user what they grew every year. In addition, socio-environmental indicators were collected across 53 urban allotments through field work and GIS work. To estimate agricultural production 10 users have participated to weight agricultural production for 9 months.

So what?

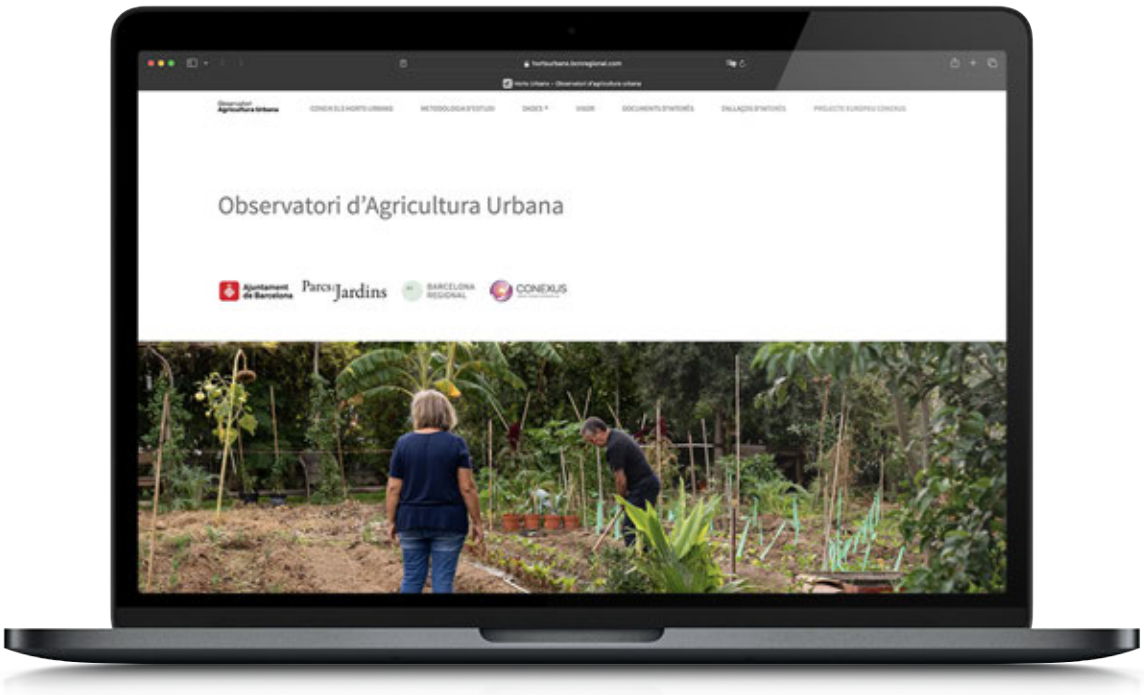
The Urban Agriculture Observatory, centralised through a website, collects the results of these studies and their dissemination and communication materials, with the ultimate purpose of disseminating this information and making it readily accessible to citizens and the administration. As a result, several materials has been created:



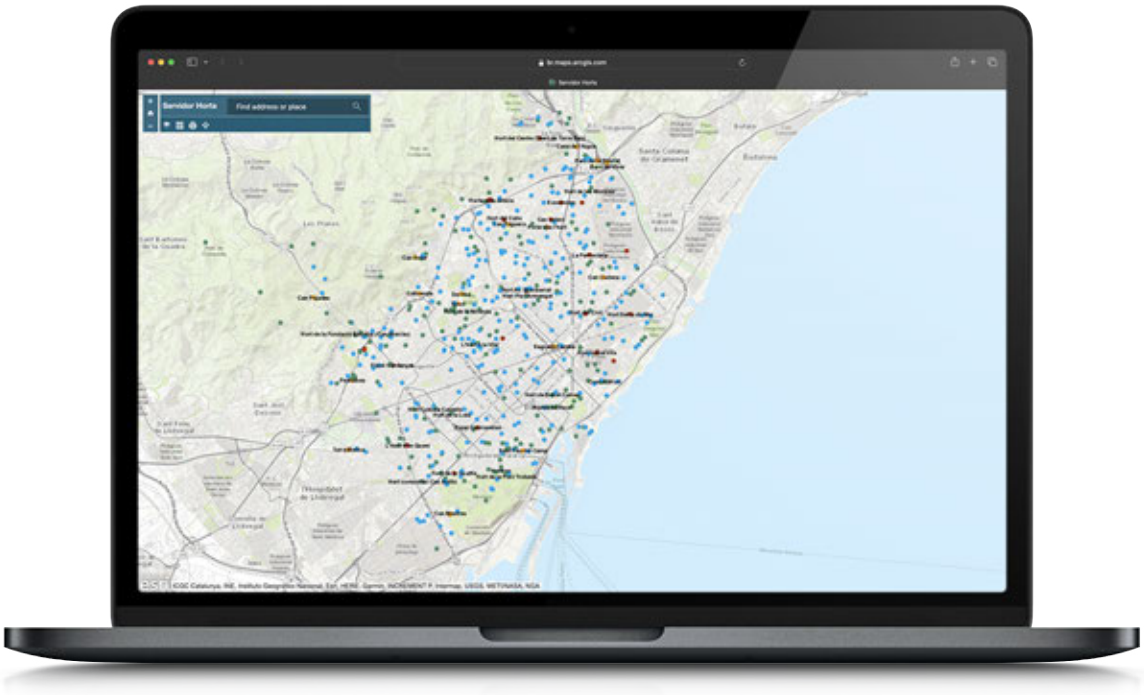
Urban Agriculture Observatory
Executive summary

Urban Agriculture Observatory
Conexus version

Urban Agriculture Observatory
Website



Global map of the green space system
Interactive map



Regarding the indicators used in Pilot 2:

	Municipal urban allotments	"Mans al verd" Urban Allotments	Community urban allotments
Number of species cultivated	**87**	**81**	**99**
Average number of active users	**38**	**19**	**27**
Average number of biodiversity structures	**6.1**	**3.5**	**4.8**

Agricultural production (Municipal urban allotments): 0,98 kg/m² urban allotment/month, which would cover the vegetable needs of 5.479 people in a year.

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PILOT 3. Monitoring Pollutants in Urban Allotments

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PILOT 3. Monitoring Pollutants in Urban Allotments

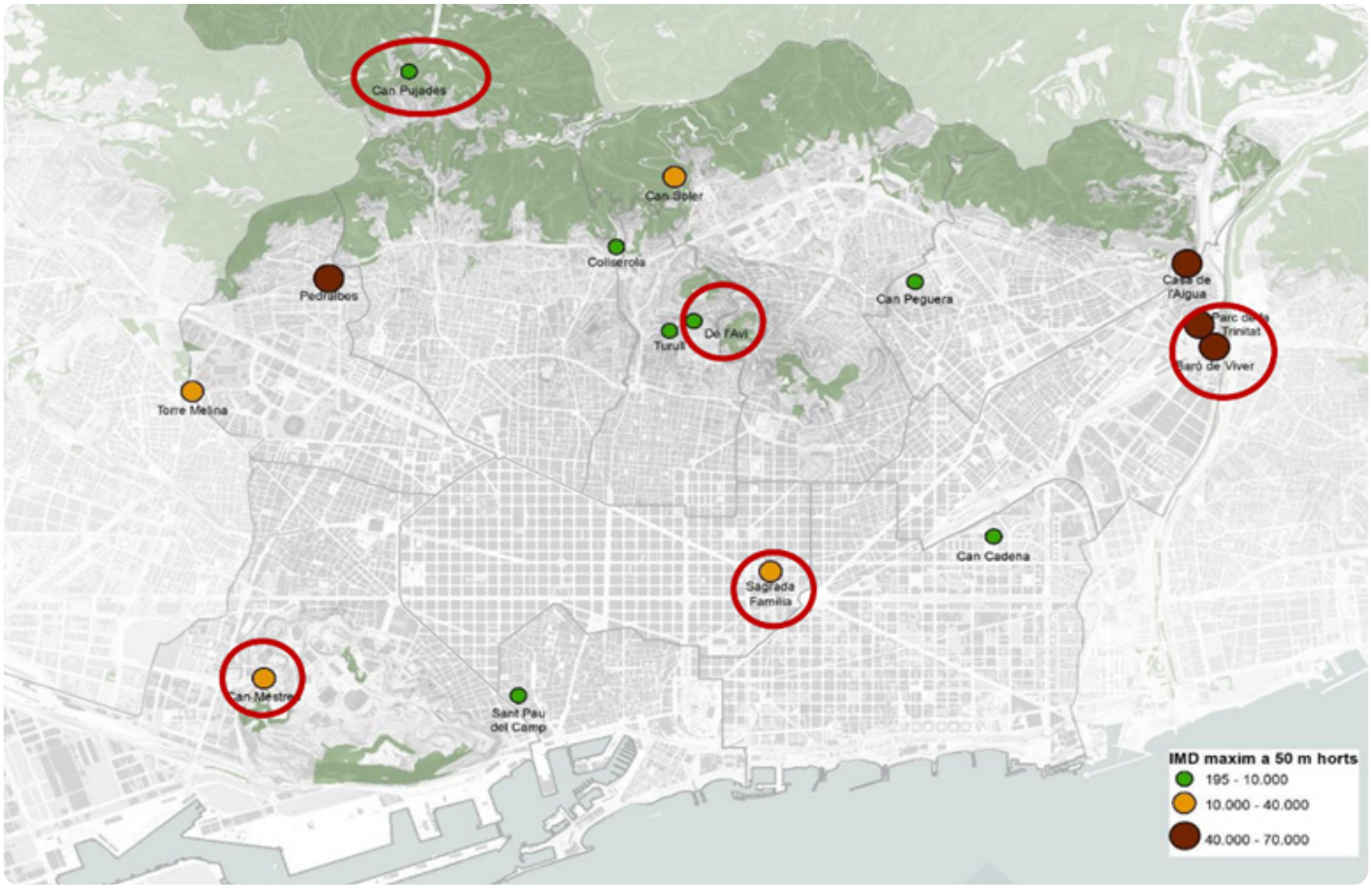
Start date: April 2020 **End date:** August 2024

What and Where?

Evaluate, process and analyse data on heavy metal contamination (Zn, Mn, Cr, Cu, Pb, Ni, V, Cd, Co) in chard leaves and in soil from municipal urban allotments (6 gardens).

Location:	• Urban allotment "Baró de Viver" (Carretera Santa Coloma, 125), • Trinitat (Carretera de Santa Coloma, 60), • Casa de l'Aigua (C/Garbí, 2), • Can Soler (carretera de Vallvidrera, 114), • Can Pujades (Múrgola, 13), • Sagrada Familia (Padilla, 199).
NBS type, and habitat/s:	Urban allotment.
Ecosystem services:	Purification of air, climate regulation, food provision, social cohesion, environmental education, recreation experiences.
Management & maintenance:	The management and maintenance of these spaces is carried out by Barcelona City Council.

Map


Can Pujades
Can Soler
Coll i Rola
Pedralbes
Can Peguera
Casa de l'Aigua
Parc de la Trinitat
Turó de Viver
Dé l'Avi
Turó
Torre Melina
Can Cadena
Sagrada Família
Sant Pau del Camp
IMD maxim a 50 m horts
195 - 10.000
10.000 - 40.000
40.000 - 70.000

Why?

Contamination studies can provide information on health effects of some sampled vegetables.

Know how atmospheric pollution can transfer to the edible parts of plants produced in urban allotments, and know how edible plants are affected by soil contamination.

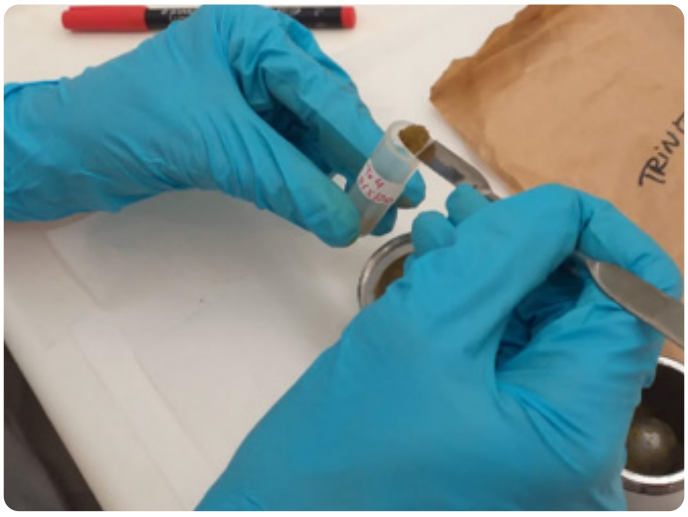
When?

	2021	2022	2023	2024
Urban allotment sites evaluation, prioritisation and selection considering the surroundings of each site in terms of air pollution emission sources, air pollutants dispersion model and emission values	■			
Definition of the approach of monitoring	■			
Monitoring air pollution deposition		■		
Processing data		■	■	
Results			■	■

How?

The soil samples were collected with a cylindrical probe that was vertically inserted into the soil up to 10 cm deep, in an area close to the roots (rhizosphere) of the Swiss chard. The same number of soil samples were taken (5 samples for each orchard, a total of 30 samples), to ensure a sufficient number of replicates.

The leaf samples were dried in an oven at 65ºC for 3 consecutive days, and the soil samples were dried at 105ºC for 2 consecutive days. All these samples were crushed in the CREAF laboratory and analysed in the SAQ (Chemical Analysis Service) of the UAB. Prior to ICP-MS analysis (Agilent, 7500ce), samples were digested with a microwave digester and sample acidified (HNO3 69%).



So what?

The soils of the orchards are not polluted and are within parameters accepted by various legislations and (ii) the intake of chard leaves from the orchards studied does not pose any risk to human health (from the point of view of heavy metals).

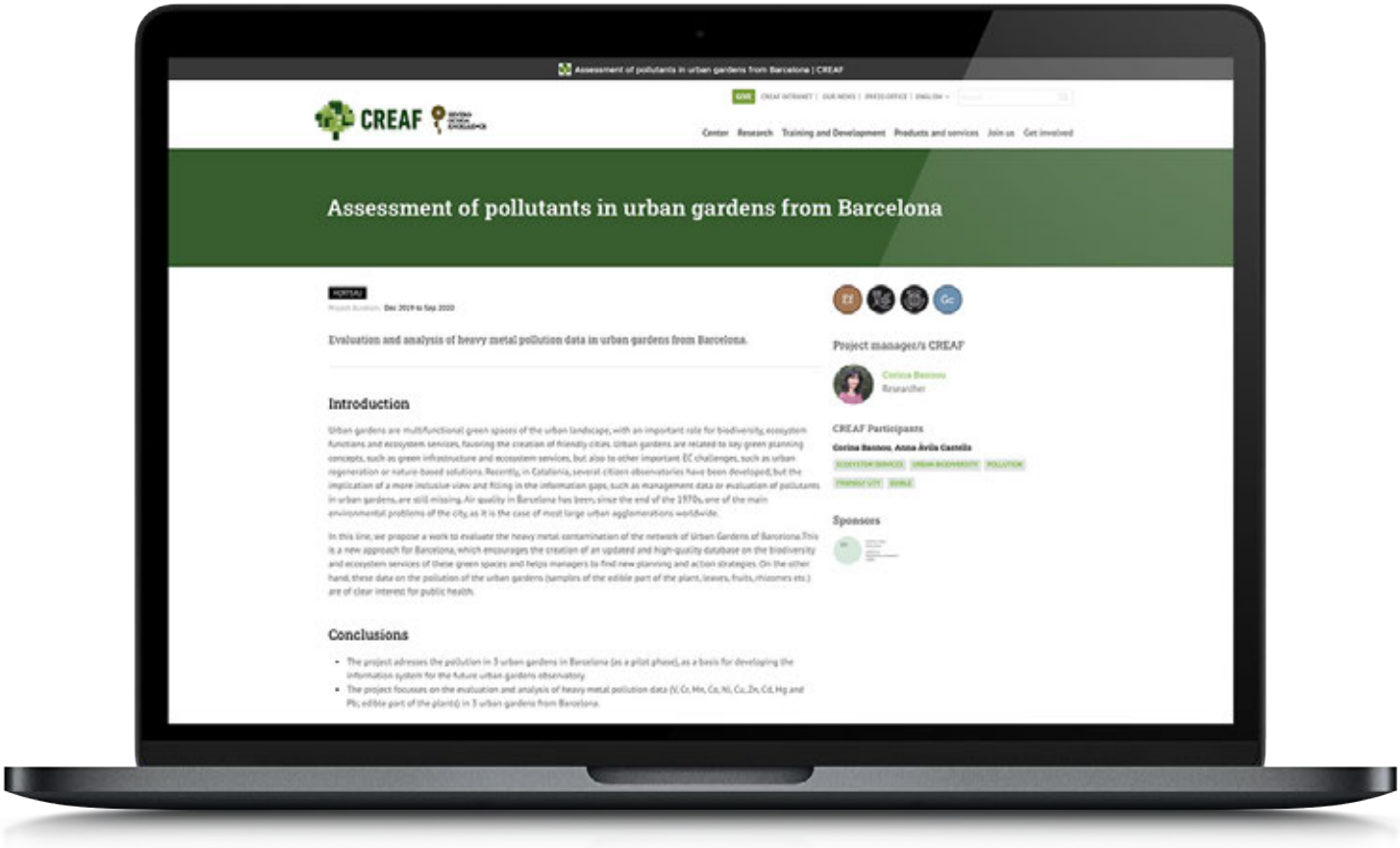
The study clearly shows that the intensity of vehicle traffic is related to the concentration of certain pollutants in all the orchards studied.

The main source of the metals Mn, Cu, Zn and Pb in the leaves is air/transit (uptake leaf epidermis and translocation). These results indicate that chard leaves, which are grown in almost all urban gardens in Barcelona, can be used in the biomonitoring of air quality (heavy metals).

Combining the methodology of this study with soil analysis has led to important advances in understanding bioaccumulation in plants grown in Barcelona's orchards. The results show that the soil-plant system is an important sink of particles.

Executive Summary

Publication and dissemination of results



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PILOT 1. Southern Border (SB)

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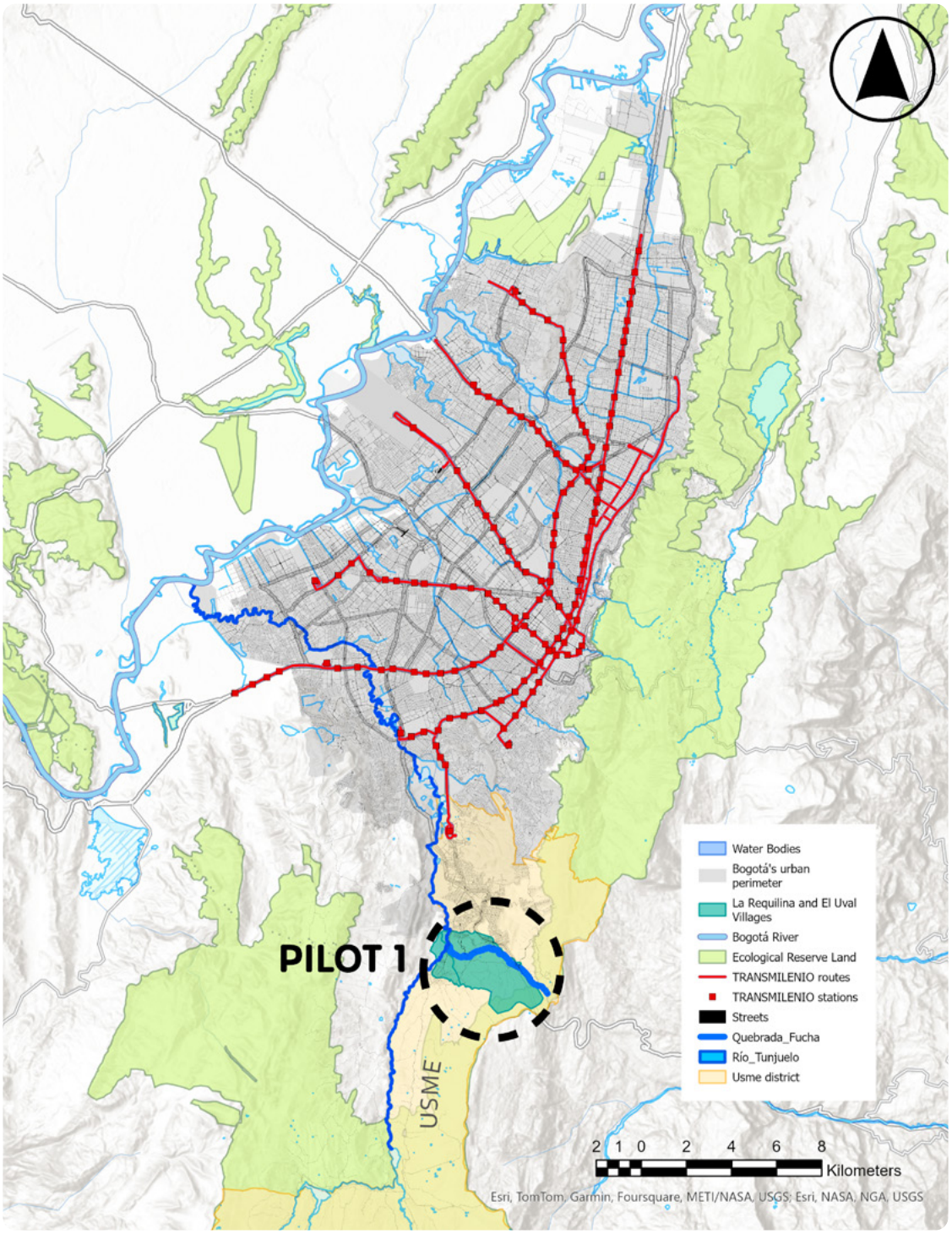
PILOT 1. Southern Border (SB)

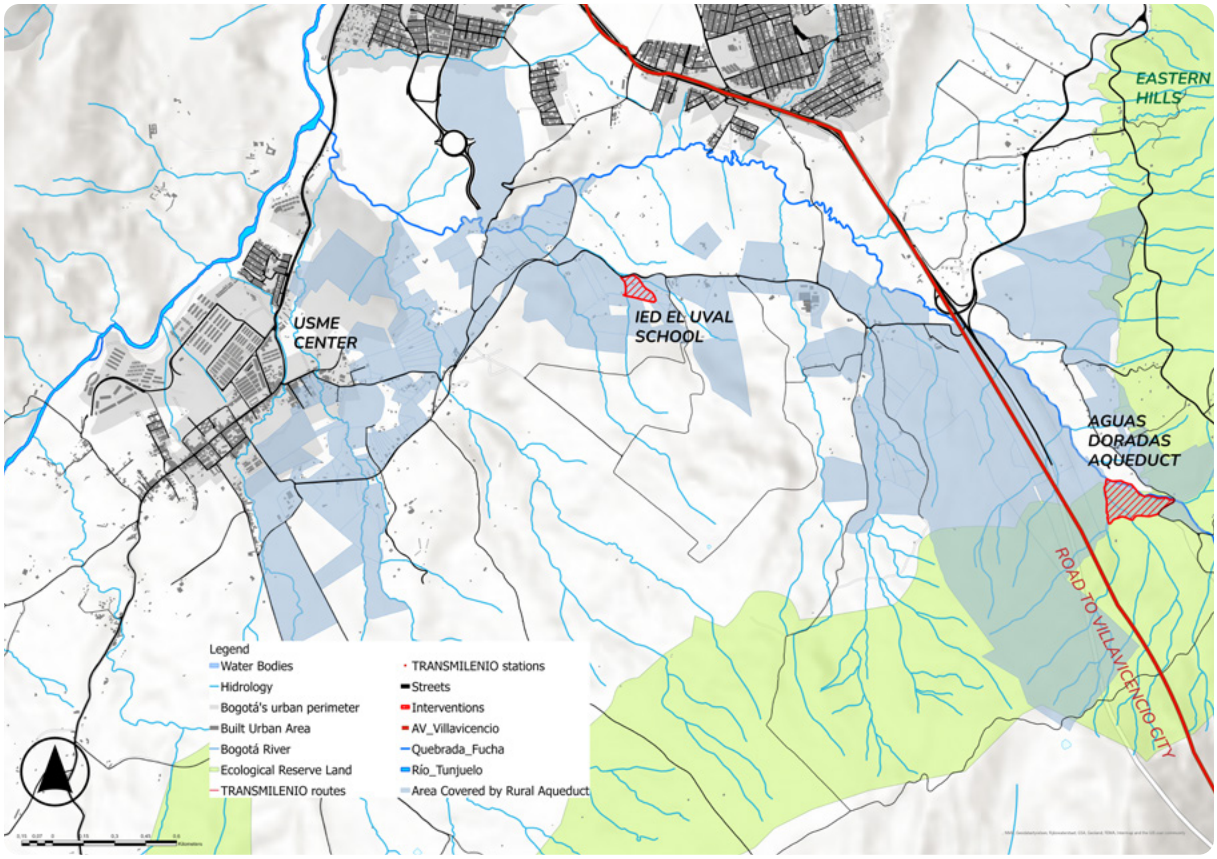
Start date: September 2020 **End date:** July 2024

What and Where?

Location:	The pilot established in the Southern border is situated in district of Usme, in the village of La Requilina and El Uval. This area is served by the Amoladero-Fucha stream, in the middle basin of the Tunjuelo River.
NBS type, and habitat/s to be created or restored:	• **Restoration:** Contributing to ecological restoration in 10 sites and contributing to the protection of water bodies in private lands. • **Management:** Testing water quality and implementing water resource education and environmental education to improve management for tributaries of the Tunjuelo river (including Amoladero-Fucha stream which serves the rural aqueduct). • **Environment and NBS capacity building:** Raise awareness and knowledge building among communities and local actors, around environment, NBS and climate change mitigation.
Ecosystem services:	• **Provisioning:** Fresh water (access to sufficient and quality water) • **Regulating:** Erosion control • **Cultural:** Education, cultural identity
Management & maintenance:	• **Aqueduct infrastructure enhancement:** The Aguas Doradas Aqueduct User Association is responsible for management and maintenance tasks, including future educational tours. • Locals are responsible for upkeep of restoration planting areas in their properties. • Local school IED El Uval is responsible for monitoring and maintenance of restoration areas.

Map


PILOT 1
USME
Water Bodies
Bogotá's urban perimeter
La Requilina and El Uval Villages
Bogotá River
Ecological Reserve Land
TRANSMILENIO routes
TRANSMILENIO stations
Streets
Quebrada_Fucha
Río_Tunjuelo
Usme district
2 1 0 2 4 6 8
Kilometers
Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS; Esri, NASA, NGA, USGS



Why?

Urban sprawl has significantly affected rural identity and livelihoods in peri urban areas while production activities cause contamination of water streams which are the community's main fresh water sources. This situation calls for strategies to bridge the gap between people and nature as well as supporting local self-organisation practices to empower people in these areas excluded from institutional aid and service infrastructure coverage.

	Strengths **Positive internal factors to build upon**	Weaknesses **Negative internal factors to overcome**
Opportunities **External factors that can give and advantage**	• The Colegio Rural El Uval's enthusiasm about managing their green areas and involving NbS for education processes. • The Life Lab's role in developing new activities and alliances with schools, the education sector, and the Aguas Doradas aqueduct. • Positive relationships created could allow for new projects to be developed in the future.	• Aguas Doradas aqueduct, as an environmental classroom, should continue with the management and engagement, regardless of new administrations. • The use of the aqueduct as an environmental classroom depends on the interest and will of the community and educators involved.

Threats
External factors that represent risk or can affect negatively
	• The risks in restoration actions associated with climate variability can be minimized by providing training to property owners and establishing informal communication channels with participants to address concerns as needed.
	• Urban sprawl and associated externalities such as an increase in insecurity can hamper community initiatives and deteriorate quality of life.
		• Ideally, community engagement and participatory processes should continue beyond Conexus project's completion. However, to some extent, it depends on external funding:
		  ○ Obtaining resources or technical assistance for The Colegio Rural to guarantee the continuation of the processes.
		  ○ Managers of the Aguas Doradas aqueduct are engaging in activities with other projects that could provide continuity to the actions carried out in the Conexus project.
		  ○ Property owners will be able to independently carry out actions to take care of restoration interventions in their land.

When?

Preparation activities started in early 2021. NbS planning and co-design went on from 2021 to 2022, and NBS interventions in 2023 and 2024. Educational workshops have been implemented in 2023 and 2024. Lastly, monitoring activities will be carried out until project's completion in August 2024.

How?

Nature with people:

- Environmental workshops involving activities for recognition and appreciation of local biodiversity, as well as emphasizing nature's role in human's well-being.
- Restoration and waterway protection buffer design with voluntary landowners' participation, SbN were customised for each case for ecological and social functionality, integrating better land management practices.

New organisational structure/NbS governance paradigm:

- Supporting local self-organised institutions through the enhancement of their image, aqueduct's infrastructure, and didactical materials to facilitate learning processes, water resource awareness and improve water quality.

Long-sighted perspectives:

- Local school students and community members were involved in environmental training and restoration monitoring activities to promote community stewardship and collective action.
- A prospective workshop served to foster knowledge exchange and discuss possibilities for a future where development was oriented to nature-people's harmonious coexistence.

Signage for infrastructure enhancement in Aguas Doradas aqueduct. Source: Sandra Caquimbo, 2024

Birding workshop in Usme.
Source: Bayron Pardo, 2023

So what?

Protect and improve local ecosystems that supply for inhabitants' basic needs, fostering a better dialogue with nature and its services for local communities. Also, contributing to sustainable urbanisation in rural-urban borders through water resource awareness, community empowerment, ecosystem conservation and sustainable practices.

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BOGOTÁ

PILOT 2. Northern Border (NB)

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BOGOTÁ

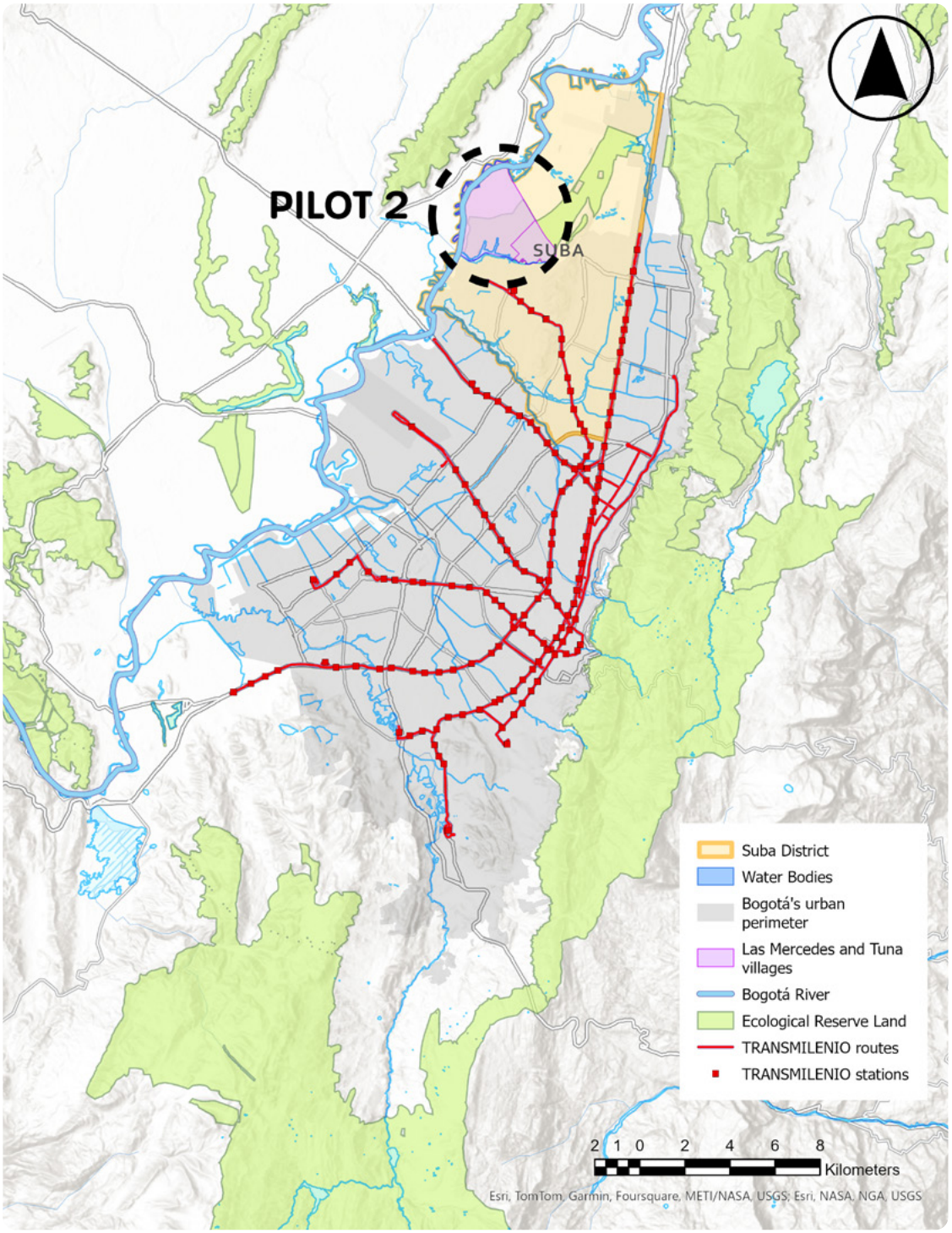
PILOT 2. Northern Border (NB)

Start date: September 2020 **End date:** July 2024

What and Where?

Location:	The pilot is located in the rural area of the northernmost district of Suba. Specifically, around La Conejera Wetland and Las Mercedes Forest.
NBS type, and habitat/s to be created or restored:	• **Restoration:** Contributing to ecological restoration and landscaping in private school. • **Management:** Wetland species and environmental education to improve management for wetland's surrounding areas. Also contributing to restoration knowledge with native species. • **Creation:** Design and implementation of pollinator gardens and living fences. • **Environment and NBS capacity building:** Raise awareness and knowledge building among communities and local actors, around environment, NBS and climate change mitigation.
Ecosystem services:	• **Regulating:** Pollination and invasive species regulation • **Cultural:** Aesthetic values (landscaping), education, well-being, and heritage resignification.
Management & maintenance:	• Local school Liceo Juan Ramón Jimenez is responsible for monitoring and maintenance of living fences and pollinator garden.

Map


PILOT 2
SUBA
Suba District
Water Bodies
Bogotá's urban perimeter
Las Mercedes and Tuna villages
Bogotá River
Ecological Reserve Land
TRANSMILENIO routes
TRANSMILENIO stations
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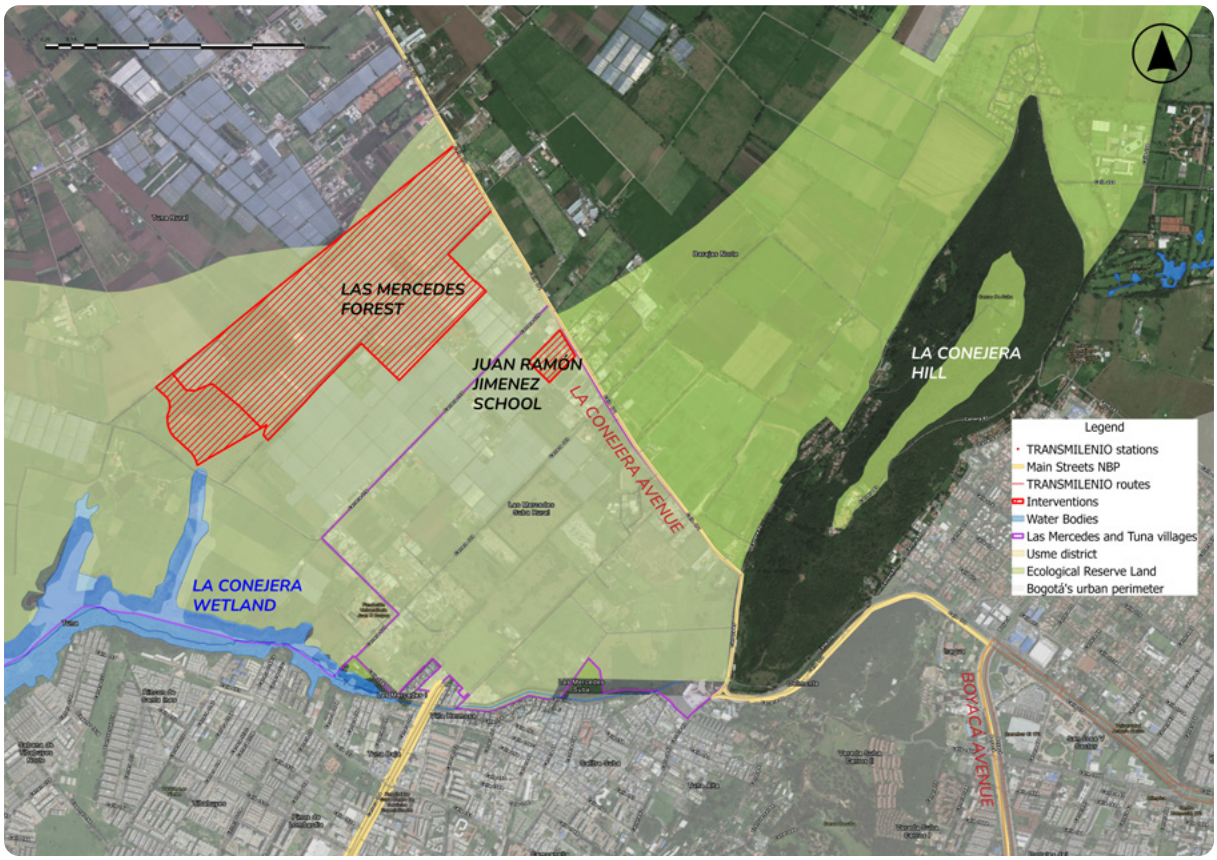
Kilometers
Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS; Esri, NASA, NGA, USGS



Why?

Urban sprawl has significantly affected freshwater ecosystems and human-nature relationships in the northern border of the city. This area contains the last remaining native forest in the city and the biologically rich La Conejera Wetland. Although these ecosystems are protected and belong to the Wetland District Ecological Parks (PEDH) system, the changing uses, pollution and reduction in perceived value and social appropriation of natural spaces in the nearby area calls for strategies to strengthen people-nature connection. Actions aim for fostering closer interactions for knowledge appropriation processes, heritage, and nature appreciation, benefiting wellbeing along with ecological conservation goals.

	Strengths **Positive internal factors to build upon**	Weaknesses **Negative internal factors to overcome**
Opportunities **External factors that can give and advantage**	• Communities interest in continuation of contemplation and education activities. • Local school commitment to management and education processes involving NbS intervention. As a member of "Red de Colegios Cerros de Bogotá", it can promote NbS amongst other schools of the area. • Alliances with the education sector created positive relationships that can allow new projects to be developed in the future.	• Bogotá Botanical Garden should maintain management and engagement with Las Mercedes, regardless of administrative changes. • Improvements should be made to enhance community's interest and engagement with visitor infrastructure (e.g. meeting and sanitation facilities). • Currently, there are no resources or alternative financing sources to continue actions.
Threats **External factors that represent risk or can affect negatively**	• Further strengthening the appropriation of the Las Mercedes area by communities and continue with strong institutional presence of the Botanical Garden of Bogotá to avoid change in land use as an external risk.	• Botanical Garden restoration programmes and "Centro de Pensamiento Ambiental" in Las Mercedes should be continued by new administrations. • Liceo Juan Ramón should remain commintted to increase environmental actions and maintain CONEXUS interventions, involving the students to guarantee continuation of processes.

When?

Preparation activities started in early 2021. NbS planning and co-design went on from 2021 to 2022, and NBS interventions in 2023 and 2024. Educational workshops have been implemented in 2023 and 2024. Lastly, monitoring activities will be carried out until project's completion in August 2024.

How?

Nature with people:

- Environmental workshops involving activities for recognition and appreciation of local biodiversity, as well as emphasizing nature's role in human's well-being.
- Restoration NbS were implemented with pollinator gardens and living fences as well as monitoring of effects on local biodiversity increase. In this way, children are encouraged to enjoy improved outdoors spaces and better value natural capital.

New organisational structure/governance:

- Diversity in participant attendance to workshops also presented an opportunity for creating new relationships and social bonds, as well as a chance to discuss governance issues and barriers for citizen participation and community's role in ecosystem conservation

Long-sighted perspectives:

- A prospective workshop served to foster knowledge exchange and discuss possibilities for a future where development was oriented to nature-people's harmonious coexistence.
- Students were involved in learning programmes to recognise wetland species, participate in planting and pollinator monitoring to realise NbS potential for bringing back nature in cities and services for human wellbeing. In this way, children could potentially act as ambassadors for heritage and nature protection.
- NbS restoration actions could serve to inspire more initiatives and upscaling of NbS actions for ecological connectivity and educational programmes promoting Wetland's conservation and improvement.

Birding workshop in Las Mercedes Forest.
Source: Ingrid Novoa, 2023

Pollinator Garden in NB school.
Source: Humboldt Institute, 2024

So what?

To improve provision of ecosystem services and contribute to the Wetland's resignification as a public asset and socio-cultural heritage good as well as ecological restoration practices for this ecosystem.

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BUENOS AIRES

PILOT 1. Breathe — Respirar

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BUENOS AIRES

PILOT 1. Breathe — Respirar

Start date: April 2020 **End date:** August 2024

What and Where?

Location:	Buenos Aires.
NBS type, and habitat/s:	to be created or restored: Habitats: schoolyards. NbS: Bioremediating living fences, green classrooms, edible gardens, biodiverse gardens, small urban forests of native/phytoremediating plants, eco-literacy. Ecosystem services: Cultural (recreational value/ environmental education/connection with nature) and regulatory (climate regulation, air filtration, rainwater slowdown, noise pollution mitigation, temperature reduction, thermal regulation).
Ecosystem services:	Cultural (recreational value/environmental education/connection with nature) and regulatory (climate regulation, air filtration, rainwater slowdown, noise pollution mitigation, temperature reduction, thermal regulation).
Management & maintenance:	The initial maintenance of green schoolyards is carried out by our team, but through workshops where management techniques are shared, we seek to involve the educational community to generate future self-management. Additionally, government collaboration is considered essential in this process, increasing the potential of renaturalized schoolyards as green classrooms.

Map

The city of Buenos Aires is located in the UTM zone 21S.
Within this zone, we can find:

- **Bernabe Marquez School,**
  located at -34.48904327696789, -58.55648546722264
- **Escuela Primaria Común N° 03 – Angela M. de Caviglia,**
  located at -34.63436473277316, -58.48119176604057
- **Escuela N°3 D.E. 7 "Primera Junta",**
  located at -34.61616652429541, -58.433440521040836

Why?

STRENGTHS

- Improvement of air quality in schoolyards
- Promotion of children's health and well-being
- Increase in biodiversity in urban environments
- Use of green classrooms as a learning enhancement
- Social cohesion benefit from the use of green spaces
- Forming new generations with environmental commitment and awareness

WEAKNESSES

- Lack of knowledge about the health benefits of green spaces
- Lack of green spaces in schoolyards
- Easy exposure of children to air pollutants
- Limited academic research on NbS in primary education

OPPORTUNITIES

- Support and collaboration from the local community
- Raising awareness about the importance of the environment and improving the school environment
- Potential to scale the program to other schools
- Projection of a network of green schoolyards in the future
- Creation of green jobs, changing the perspective on gardening work

THREATS

- Possible resistance due to lack of knowledge from the community
- Budget and resource limitations
- External conditions that could hinder project development
- Lack of public policies supporting green infrastructure interventions

When?

The project, which began in 2019, aims to maintain its long-term continuity, especially since the school community has embraced it as their own. Collaboration with Conexus ensures ongoing development and continuous improvements in implementing green barriers and biodiversity gardens in the re-naturalization of schoolyards. This long-term vision reflects our commitment to sustainably addressing psycho-socio-environmental challenges and working collaboratively to achieve lasting positive results.

How?

The project focuses on identifying and overcoming obstacles to implement green barriers in schoolyards in Buenos Aires.
To achieve this, formal and informal, multisectoral and transdisciplinary collaborations are established. Potential intervention schools and site-specific characteristics are evaluated, followed by the co-production and installation of green barriers in three schools as living laboratories. Comprehensive research is conducted to assess the effectiveness, multifunctionality, and co-benefits of green barriers, with air quality and biodiversity monitoring, while developing preliminary standards to support their inclusive construction. Additionally, the project emphasises sustainability and community ownership, highlighting aspects of learning in and with nature.

So what?

The project for implementing green barriers in schoolyards aims to improve air quality and create healthier, more conducive learning environments. By integrating natural elements into the built environment, it promotes a connection with nature, increases urban biodiversity, facilitates site bioremediation, and raises awareness about the importance of preserving urban ecosystems. In summary, the project seeks to generate a long-term positive impact on the health of the school community and the environmental sustainability of the city. Additionally, the project includes gathering and analyzing data on various indicators such as biodiversity, air quality, and psychological impacts. These indicators will help assess the effectiveness of the interventions and provide valuable insights into the benefits of green barriers in schoolyards.

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BUENOS AIRES

PILOT 2. Lago Lugano Wetland

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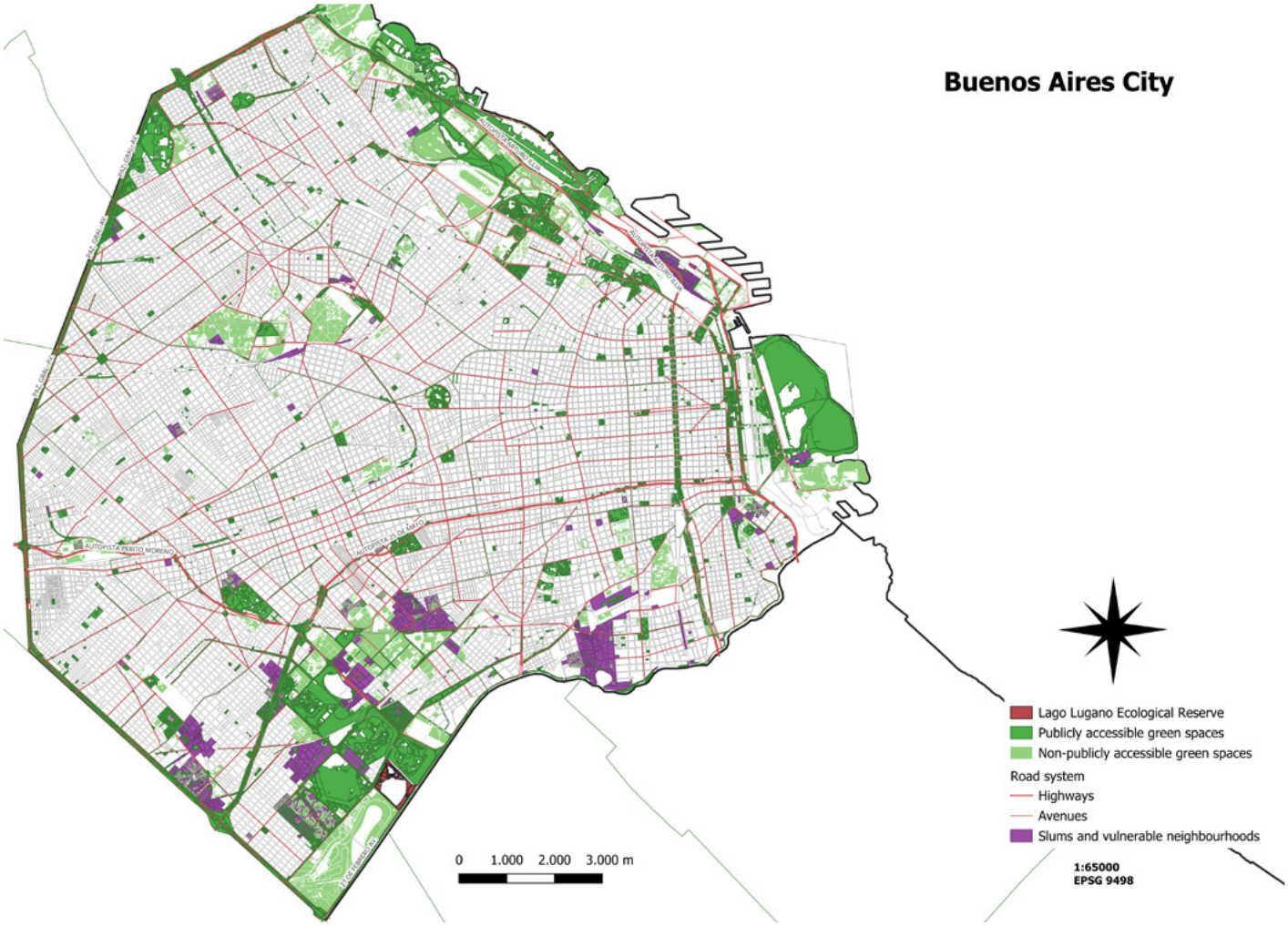
PILOT 2. Lago Lugano Wetland

Start date: April 2020 **End date:** August 2024

What and Where?

Location:	Lago Lugano Ecological Reserve
NBS type, and habitat/s:	To be created or restored: natural wetland to be reconstituted.
Ecosystem services:	Increased biodiversity (recovery of an almost extinct species).
Management & maintenance:	City managed and maintained.

Map



Buenos Aires City map with Lago Lugano Ecological Reserve highlighted

Lago Lugano Ecological Reserve (highlighted) detailed zone

Why?

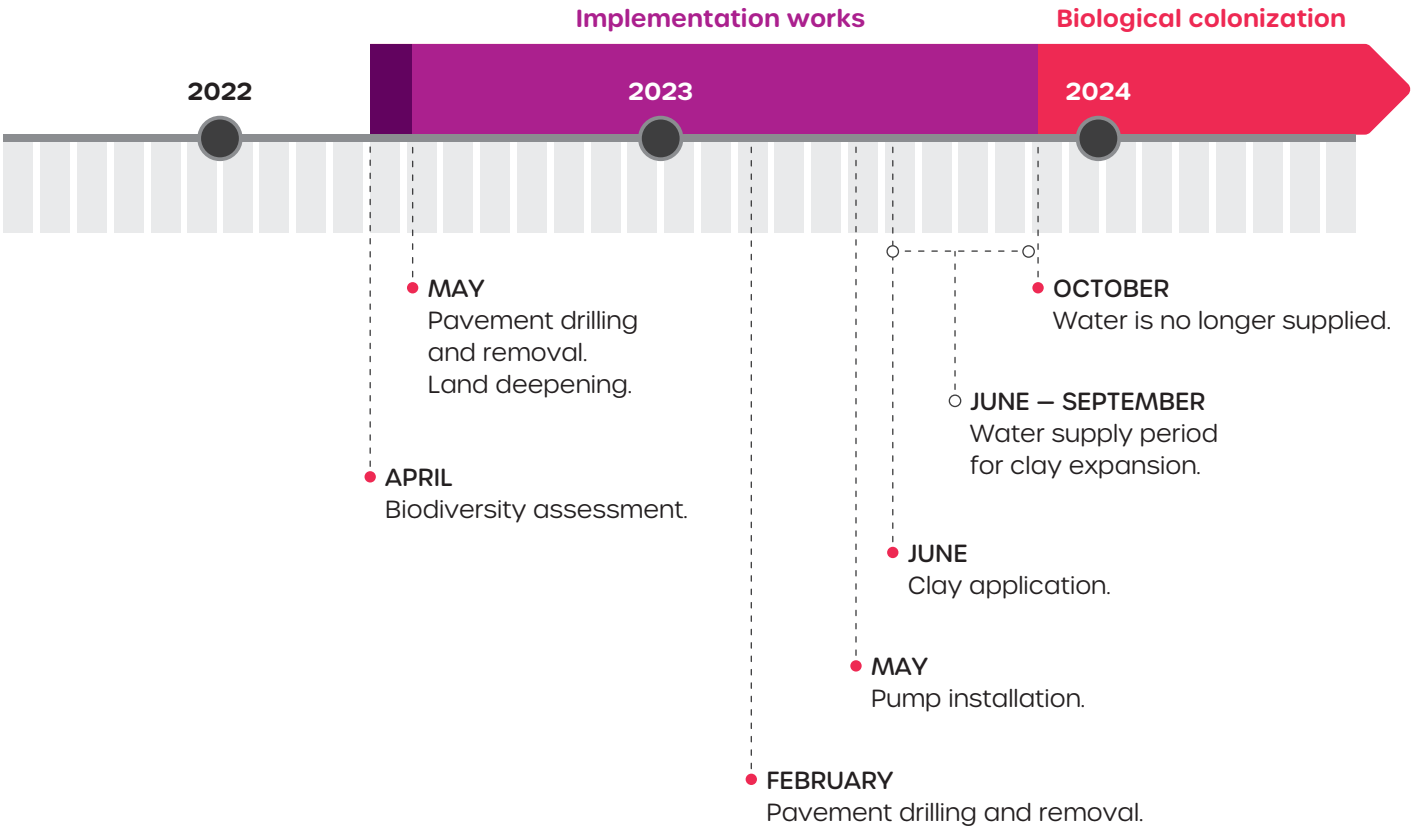
The intervention area has a paved street that was decommissioned when the reserve was created in 2018.

When it rains the water accumulates there and creates the ideal conditions for **Odontophrynus americanus** to lay their eggs, but with the rapid evaporation they can't survive. This amphibian hasn't been registered in any other site of the city yet, so it represents an important specimen to preserve.

The recreation of a wetland of shallow water means the incorporation of a new ecosystem that was lost and also the recuperation of the identity of the natural landscape.

When?

Implementation Timeline



How?

The project steps, so far:

- Chopping and removal of fractured reinforced concrete. Equipment to be used: machine with hammer and shovel, trucks for removal of material.
- Deepening of the wetland and l evelling of the future wetland bed.
- Waterproofing of the bottom of the wetland with gravel and bentonite clay.
- Edge profiling with slope to be determined in situ.
- Earth movement to enlarge the surface of the future wetland.
- Provision and installation of underground piping for an alternative water supply system to the wetland network of water supply to the wetland network (still unused, rains provided plentiful water this season).
- Biological colonisation (ongoing).

Next steps:

- Provision of wood walking platforms around some parts of the wetland and a new shelter, both for educational purposes (planned for the last trimester of 2024).
- Continuation and incrementation of schoolchildren site visits.

Remaining paving prior to the full wetland works. April 28, 2022

Remaining paving prior to the full wetland works. April 28, 2022

Last days of wetland implementation, water filling was completed. September 29, 2023

So what?

The project has demonstrated enormous potential and utility, making it a success in its own right. It has evolved beyond a mere pilot program to become an integral part of an ecological reserve within the city, located in an area characterised by slums and vulnerable neighbourhoods.

Ecologically, the project is fully completed, with only minor tasks remaining to enhance its educational impact on the surrounding communities.

We expect to be able to monitor biodiversity, mostly by counting numbers of native and invasive species (which should be controlled) with a special focus on specimens of Odontophrynus americanus which already appeared at the site and are expected to healthy proliferate. Water quality in the wetland is to be controlled, but only in the rainy season, when the wetland will have water. Considering the social aspects of the project, we expect to increase site visits from surrounding schools and communities, focusing on environmental education, as a way to improve openness to participation inside this pilot of the LifeLab.

From a public policy perspective, this initiative has now been incorporated into the city's policies on renaturalization as an example of a successful initiative.

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PILOT 3. Francia Street Rain gardens,
San Martín (Buenos Aires), Argentina

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PILOT 3. Francia Street Rain gardens, San Martín (Buenos Aires), Argentina

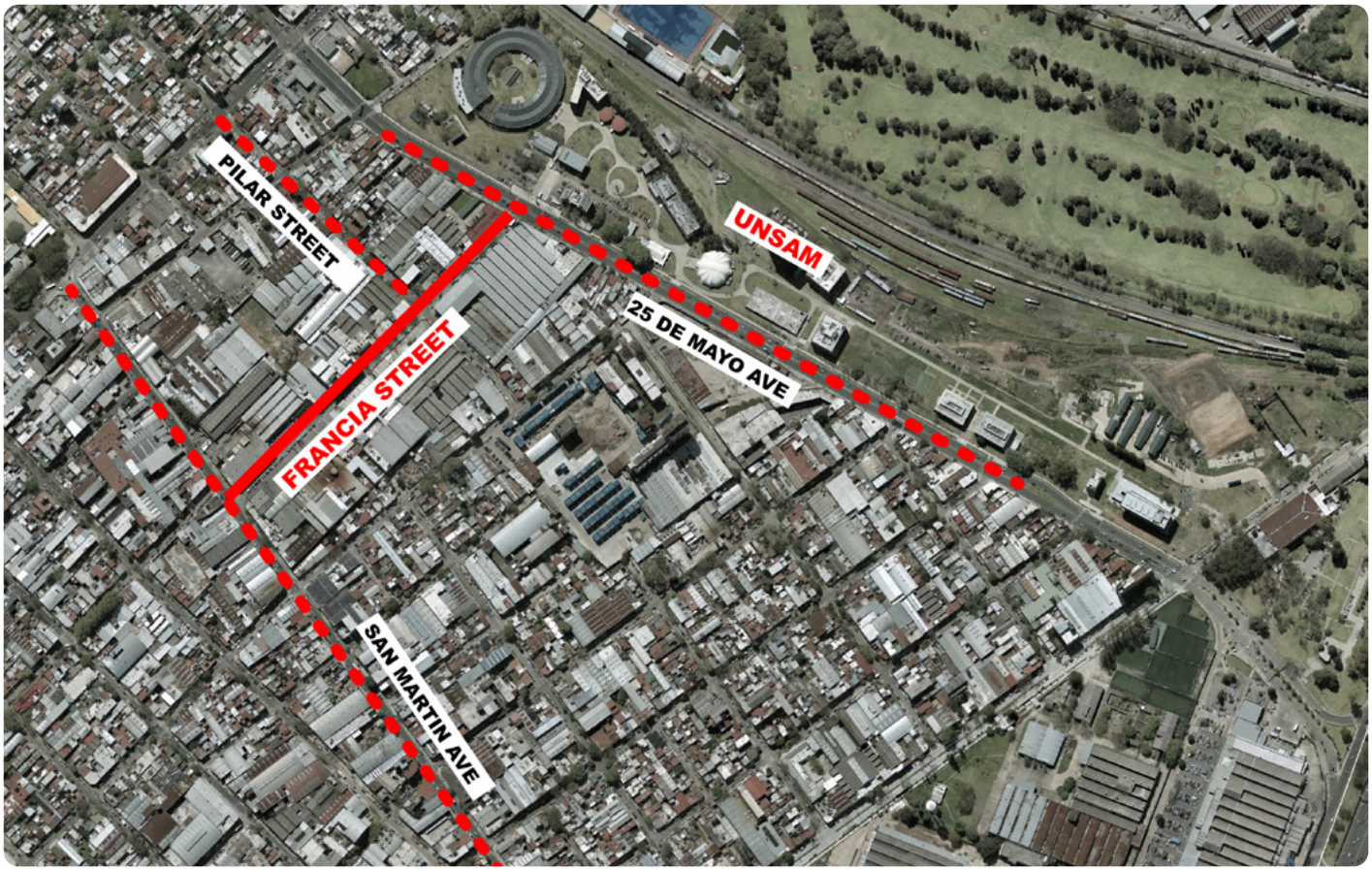
Start date: April 2020 **End date:** August 2024

What and Where?

Location:	Francia street, San Martín.
NBS type, and habitat/s:	To be created or restored: Rain gardens created.
Ecosystem services:	Water quality improvement (pollutant removal), Flood Risk Reduction (hydraulic protection), Land value uplift, Carbon sequestration and storage, Air quality improvement (pollutant removal), Amenity and aesthetics, Biodiversity increase, Temperature regulation.
Management & maintenance:	City managed and maintained.

Map

Medrano Basin, San Martín and Villa Chacabuco



Location of the rain gardens in Francia Street, Villa Chacabuco, San Martín

Why?

In 2023, the City of San Martín (Province of Buenos Aires, Argentina) carried out comprehensive upgrading works along Francia and Pilar Streets, which brought about an opportunity to incorporate linear raingardens (RGs). Specifically, a proposal was developed for Francia Street in the section that connects Av. San Martín and Av. 25 de Mayo, an industrial area with an informal settlement nearby. Francia Street acts as an important axis that connects a public transport corridor (Av. San Martín) with the main entrance of the National University of San Martín (UNSAM) and is traversed daily by local residents, industrial workers, and the higher educational community of UNSAM.

Consisting in a series of RGs, the Francia Street initiative is a pioneering pilot project in the Buenos Aires Metropolitan Area. It was designed with the aim of testing Sustainable Urban Drainage Systems (SUDS) and NBS for the region, for the wider goal of developing a Blue-Green Infrastructure (BGI) network.

When?

The pilot was installed within the following timeline:

2021–2022	masterplanning and design
2022–2023	construction
2023–2024	mural painting
2022–2024	monitoring of indicators
2024	intercept survey

How?

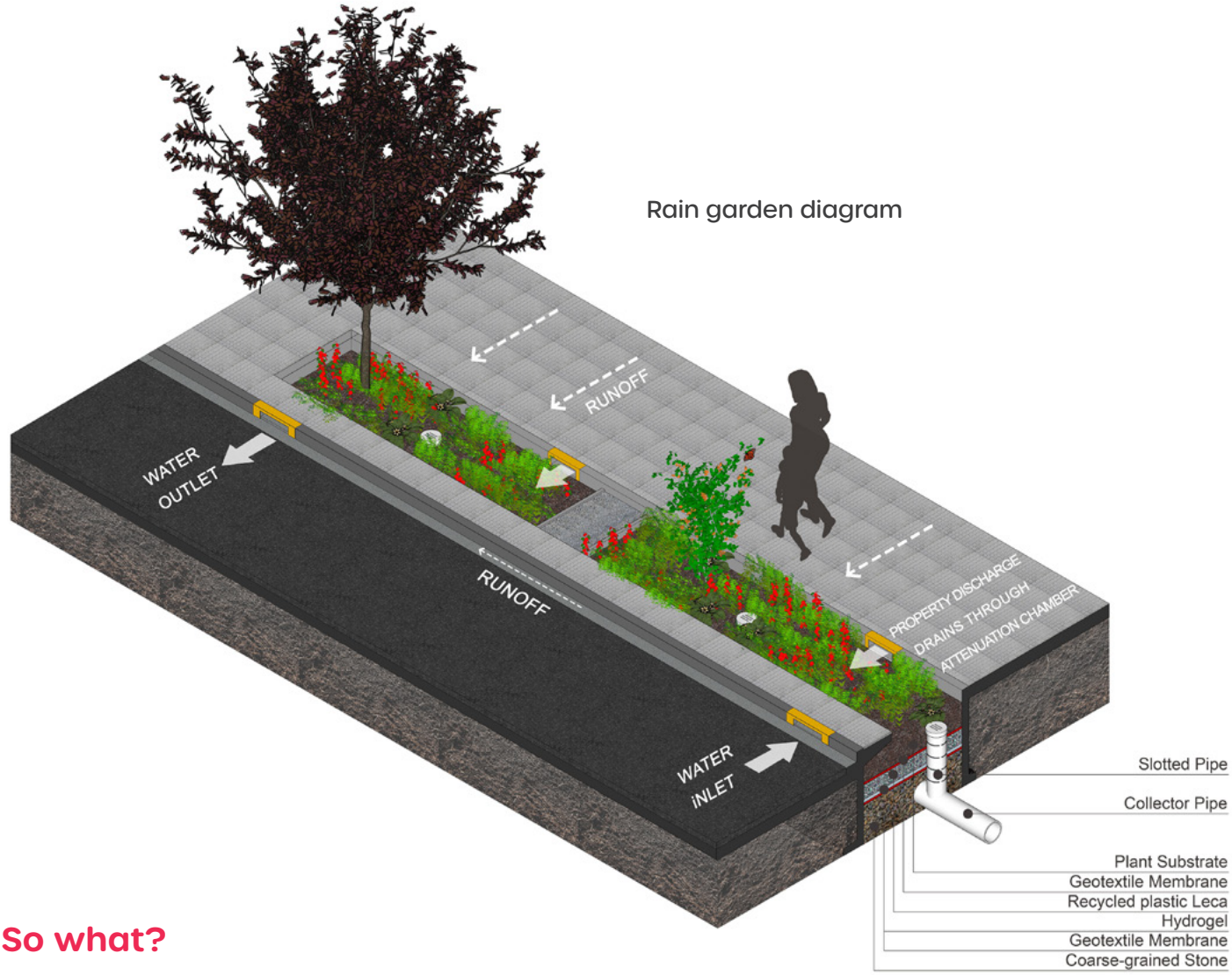
The main objective of RGs is to manage stormwater, reducing pressure on the drainage system and improving water quality by reducing its pollutant load. This is achieved through the retention and accumulation capacity the RGs provide as well as mechanical and biological filtering.

The Francia Street project aims to demonstrate that there are alternative solutions to the traditional approach of grey infrastructure that are capable of offering a cost-effective and efficient approach to stormwater management while also offering additional benefits such as improving water quality, reducing temperature by adding absorbent soil, increasing biodiversity by incorporating native and spontaneous species, improving air quality, and creating amenity, among other ecosystem services.

Stormwater runoff from streets and sidewalks together with rainwater from property discharge drains is directed towards the RGs either directly or indirectly. Within the gardens, which feature different layers of substrate, water is retained and stored until it reaches a certain level, at which time partially filtered water is redirected through a pipe to the stormwater network, enabling a greater volume of untreated water to enter the gardens. The water accumulated in the RGs is then used to nourish the vegetation growing in them, while a portion infiltrates into the natural terrain. This reduces pressure on the stormwater system that discharges into the Medrano Stream while also improving water quality, leaving part of the contaminants retained so that they can be treated by phytoremediation by the vegetation.

Rain gardens in the context of the comprehensive upgrading works along Francia Street

Rain gardens in action during rainfall



Rain garden diagram

So what?

CBA results

The benefits provided by RGs were measured and valued through a Cost-Benefit Analysis (CBA), demonstrating their significant long-term economic advantages. The CBA for this pilot used construction costs reported by MGSM, projected maintenance costs, and the benefits of the ecosystem services provided by the project. Benefits were measured using defined indicators and case-specific value equations. When specific data were lacking, parametric methods were used to account for the benefits, which refers to using equations and prices calculated in other studies and applying them to the present case, while considering the context differences between both cases for adaptation.

The socioeconomic performance of the RGs was evaluated using Net Present Value (NPV) and Internal Rate of Return (IRR) tools. NPV assesses the value of a project by comparing the present value of expected benefits to the costs, determining if the project's benefits outweigh its costs. A negative NPV suggests the project may not be worth pursuing. IRR is a metric that estimates the annual rate of return a project is expected to generate, given its cash flow. If the IRR is higher than the discount rate for the project, it can be considered socially profitable. These tools allow the comparison of various costs and benefits while comparing the social performance or yield of alternative projects. Considering the combined costs and benefits of the RGs, the NPV was calculated as €61,499, indicating social profitability (positive NPV) for the discount rate used (5%). The project's IRR is 13%. That means the discount rate used could be increased to 13%, while ensuring the project is socially viable.

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LISBON

PILOT 1. RENATURA — Restoring Urban Ecosystems with Nature-Based Solutions

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LISBON

PILOT 1. RENATURA — Restoring Urban Ecosystems with Nature-Based Solutions

Start date: April 2020 **End date:** August 2024

What?

This pilot aims to restore urban ecosystems using Nature-Based Solutions (NBS) designed and maintained through co-creation with local communities. It emphasizes social integration and place-keeping principles.

The RENATURA Pilot has two complementary main NBS interventions: Renatura I and Renatura II.

Renatura I is an experimental co-management of a public green space. The civil society proposed to the Conexus Team (municipality) the rehabilitation of low-used biodiversity spaces into high density small urban forests classified as mini-forests/fast-forests, applying the Miyawaki method, to enhance the existing ecosystem (already managed by the municipality services). The proposal favoured the introduction of low-maintenance endemic native species, with the involvement of the local community in carrying out several tasks of planting and maintaining these spaces. The proponents became the NGO URBEM, based in Lisbon, which aims to awaken citizens living in cities to nature. The works in the pilot started in a 300m² experimental plot, adjacent to the pedestrian bridge of Vale da Montanha I.

In 2023, a new plot, with 1.500m², less sloppy, on the other side of the bridge, started being co-managed co-design using the same municipal protocol, with the essential help of hundreds of volunteers with diverse backgrounds, ages (students, children, scouts, retirees, digital nomads, travellers, business employees, partners, among others.

Some species: Arum italicum, Arbutus unedo, Coronilla Glauca, Ceratonia síliqua, Jasminum fruticans, Lavandula stoechas, Lavandula multífida, Laurus nobilis, Olea europae, Prunus spinosa, Pistacia lentiscus, Quercus coccifera, Quercus faginea, Quercus róbur, Quercus suber, Rhamnus alaternos, Rosmarinus officinalis, Viburnum tinus.

Renatura II is the requalification of a 12.000 m² area in the continuity of Vale da Montanha I, foreseeing community urban allotment gardens, native and adapted plant species, vegetation cover with low maintenance requirements, preservation of structures with high heritage and historical value.

Lisbon participation in this inclusive project, based on the restoration, rehabilitation, and creation of innovative SBN, is an example of a coordinated intervention that is part of the ongoing municipal strategy to adapt the city to the effects of climate change.

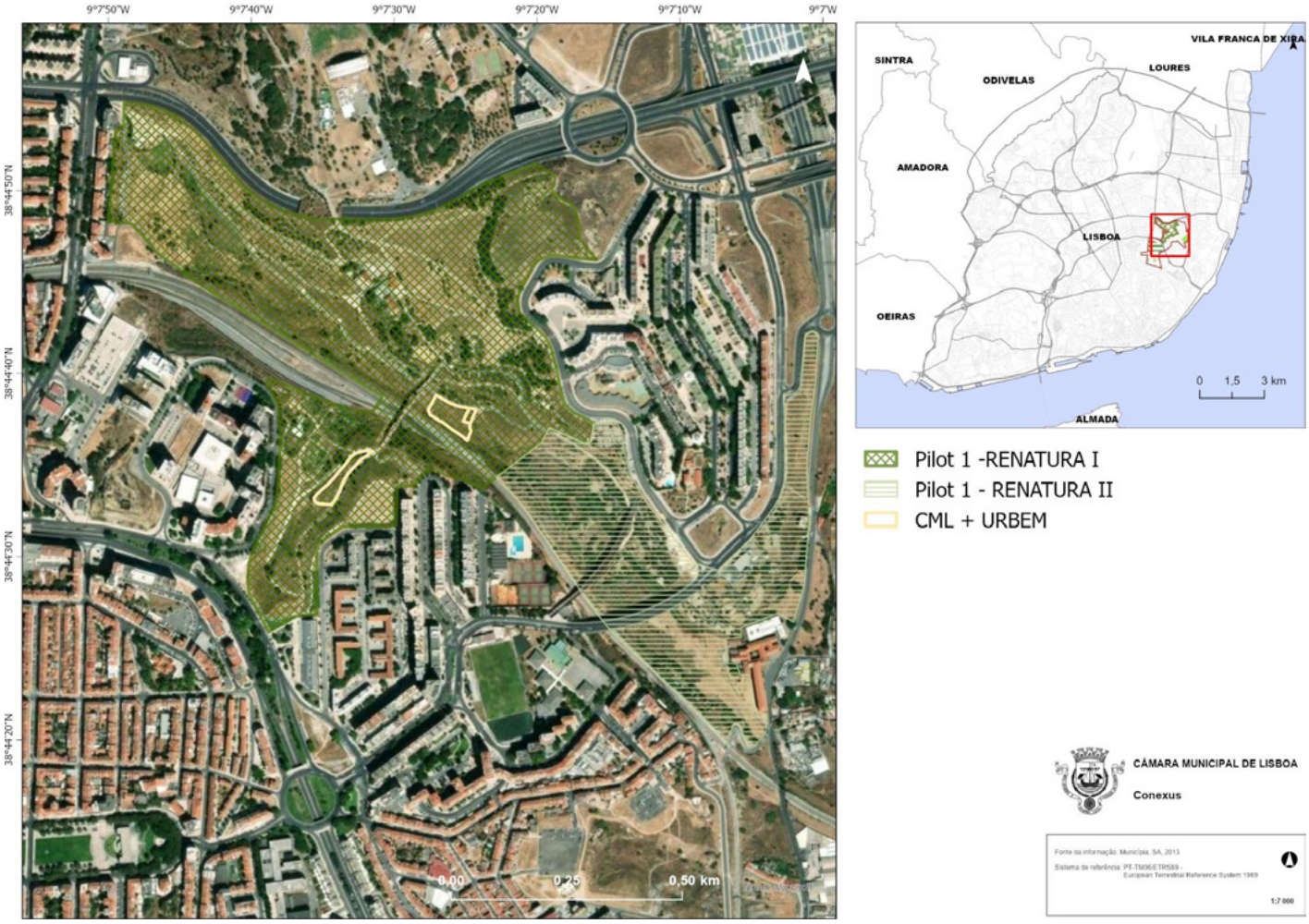
What and Where?

Location:	Lisbon.
NBS type, and habitat/s:	**NBS interventions on existing and future green corridors and parks include:** • Restoring degraded soil conditions with biodiverse rain-fed pastures. • Planting high-density small urban forests. • Implementing organic farming at urban allotment gardens. • Using rain garden principles (Sustainable Urban Drainage Systems - SUDs) to enhance the water cycle and address floods. • Redesigning public space highlighting the importance of biodiversity.
Ecosystem services:	**Regulating Services:** mitigate the urban heat island effect and air pollution, retain stormwater, sequester carbon, and regulate water cycles, pollination, provide habitat for a variety of species. **Services:** recreational opportunities, aesthetic enjoyment, spiritual and cultural enrichment, and inspiration for art, literature, and music. **Supporting Services:** nutrient cycling, soil formation, and photosynthesis.
Management & maintenance:	• Co-management with local communities and NGOs • Long-term monitoring and maintenance plans by the municipal services.

Where?

Renatura is situated in Lisbon, on the Vale da Montanha Park and surrounding areas, in a specific part of the Eastern Green Corridor of Lisbon, which merges to the inner city, in the Areeiro Parish. This area represents a legacy of 1960s—70s city planning, with clusters of municipal housing and semi-abandoned areas crossed by ring roads and railways. The green corridor started being implemented 15 years ago and serves as a natural interface between the inner-city and denser built areas, and it is based on the creation of large areas of extensive NBS landscape, a system of large parks connected to each other by pedestrian and bicycle bridges, representing 150 hectares of green. Some NBS´ techniques already employed were natural drainage, native planting, massive tree-planting schemes, and urban allotment gardens.

Map



Why?

Our Goals

- Enhance ecological connectivity and sustainable production.
- Promote climate justice by addressing urban heating and improving air quality.
- Trial resilient, low-cost, and low-maintenance NBS.
- Engage socially sensitive contexts through Nature-Based Entrepreneurship (NBE).
- Restore degraded urban ecosystems through innovative NBS, enhancing resilience to climate change and improving urban liveability.
- Co-creation with communities.
- Strategic location in Vale da Montanha II Park leverages existing green spaces for maximum impact.

STRENGTHS

- Change the image of the area, namely the perception of degradation.
- Revitalization of the space as a recreational and leisure area for the community to enjoy.
- Acceleration of territory adaptation to climate change.

WEAKNESSES

- **Low level of acceptance of NBS to be overcome during the project;**
  - The need to establish partnerships with citizens in co-management actions is an innovative step.
  - The need of mental shift in local services to accept new ways of working with the population.

OPPORTUNITIES

- Motivation/enthusiasm of civil society — More communities awareness about climate changes and the importance of the green structure.
- The existence of synergies and commitment between public, private entities, and the communities.
- Increase in social inclusion, social interaction, and sense of ownership within communities.
- Promotion of a healthier lifestyle connected to nature.

THREATS

- Low performance in space maintenance actions, with the risk of reverting to a state of abandonment and degradation.
- Difficulty in maintaining partnerships and community involvement.

When?

Trimester/Year	Activities
Nov 2021	URBEM (NGO) signed the first co-management protocol for a 300m² plot.
Dec 2022	A new plot of 2000m² was defined for co-management.
2022–2023	Ongoing local community engagement.
1st half 2023	Start of work on the new urban green park "Vale da Montanha II."
> 2024	Fast forest is growing and it has a very diversified agenda to engaged others actors (private sector, workshops, guided visits, team building).

How?

Renatura I , plot 1 and plot 2

Plot 2

Urbem´s call for volunteers,
Urbem´s facebook post with a school visit and maintenance day.

Guided visit to plot 2 and volunteers during a mulch transportation activity. School activity.

Challenges thrown at Conexus from outside: introducing shelters for biodiversity with bricks made from natural materials, carrying out a project and implementing the hola element for use in irrigating the microforest.

RENATURA II — Vale da Montanha II

Future Vale da Montanha II Park - location, project, 3D images.

So what?

RENATURA demonstrates the potential of NBS to transform urban landscapes, benefiting both the environment and local communities through the cooperation between civil society and local authorities.

1. Important Achievements:

- **Mainstreaming NBS:** RENATURA has successfully raised awareness about NBS, making them more accessible and accepted.
- **Engaging Local Services:** By involving municipal services, RENATURA has made them more open to NBS solutions.
- **Building Networks:** The project has facilitated connections between local services and civil society, leveraging their combined efforts.
- **Recognizing Partners:** The project acknowledges the importance of each partner's role in its success.
- **Involving Schools:** Schools and students of various ages actively participate in the project.
- **Knowledge Exchange:** Partners, including the municipality and Urbem, share knowledge and insights.

2. Nature-Based Thinking (NBT) Framework:

- **Nature with People, Not for People:** RENATURA prioritizes community engagement, social learning, and diverse local knowledge. Aft
- **New Organizational Structures:** LISGREEN develops innovative structures, coordinating across various municipal departments to ensure effective implementation.
- **Long-Term Perspectives:** The project aligns with nature's cycles and ecological processes, considering both short-term and long-term impacts. At this stage of the project, we have been contacted to support other NBS projects in other areas of the city and even in other municipalities. With the completion of the project in August 2024, it has not been possible to support these initiatives. However, in the continuity strategy we intend to carry out other actions with the community.

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LISBON

PILOT 2. RUASVERDES+ Greening Dense Urban Districts with Nature-Based Solutions

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LISBON

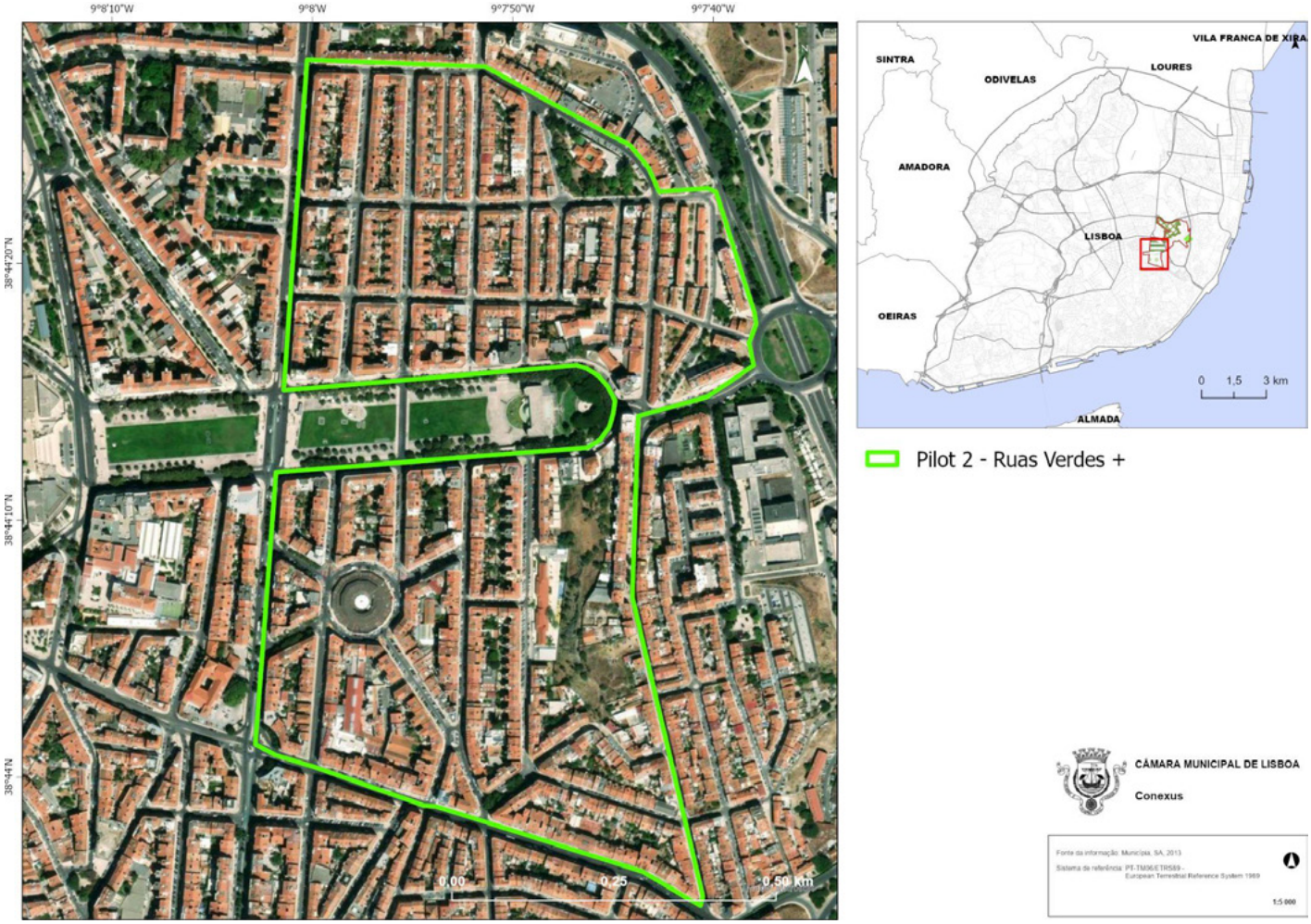
PILOT 2. RUASVERDES+ Greening Dense Urban Districts with Nature-Based Solutions

Start date: April 2020 **End date:** August 2024

What and Where?

Location:	Lisbon, focusing on Actores (Areeiro), Arroios, and Penha de França neighborhoods.
NBS type, and habitat/s to be created:	• Plant boxes in public spaces and private balconies. • Tree planting along streets and in green corridors. • Pocket gardens and other micro-green solutions.
Ecosystem services:	• Improved air quality. • Heat wave reduction. • Enhanced urban greenery and biodiversity.
Management & maintenance:	• Local authorities maintenance with support from the population (ideal). • Regular monitoring of planted species and ecosystem health.

Map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9°8'W
9°7'50"W
9°7'40"W
38°44'20"N
38°44'10"N
38°44'N
0,00
0,25
0,50 km
VILA FRANCA DE XIRA
SINTRA
ODIVELAS
LOURES
AMADORA
LISBOA
OEIRAS
ALMADA
0 1,5 3 km
Pilot 2 - Ruas Verdes +
CÂMARA MUNICIPAL DE LISBOA
Conexus

Why?

Our Goals

- Bring awareness to the communities of the importance of the present climate changes and the importance of green infrastructures to health (both mental and physical);
- Reclaim public space for green infrastructure and improve urban liveability.
- Address climate justice by enhancing ecosystem services in densely populated areas.
- Bridge green corridors and green spaces, linking existing green spaces for ecosystem connectivity.
- Experiment replicable NBS to address the challenge of greening dense urban districts.
- Ensure sustainable management and maintenance of green infrastructure amidst urban constraints through the community involvement in the co-decision and codesign process.

When?

Trimester/Year	Activities
2022–2023	Participatory workshops, local engagement, and brainstorming for NBS ideas.
2022–2023	Collaborative projects and brainstorming for micro-green solutions in Actores, Arroios, and Penha de França neighbourhoods.
2023	Gardening workshops on plant selection and maintenance.
> 2024	Install planters in public spaces like parks, squares and pavements; encourage residents to have planters on their private balconies; and starting the tree planting in two streets to establish a new 'green corridor' in the dense road network.

How?

Participatory sessions and gardening workshops.

"Pop-up trees": large vases with trees.

Plants and flower boxes and happy people after a Saturday morning gardening workshop.

So what?

Pilot 2 - Ruas Verdes+ exemplifies how NBS can enhance urban quality of life while fostering community cohesion, being decisive the inclusion of communities along the process.

1. Important Achievements:

- **Community Interest:** Ruas Verdes+ has sparked interest from other neighborhoods willing to collaborate.
- **Knowledge Dissemination:** The project has successfully shared its practices, creating awareness beyond its immediate context.
- **Local Demand for Green Spaces:** Despite potential trade-offs (such as parking spaces), there's a growing desire for green spaces near homes, especially post-COVID.
- **Individual Engagement:** Private individuals are actively seeking ways to care for public green spaces, seeking support from the project.

2. Nature-Based Thinking (NBT) Framework:

- **Diverse Voices:** Ruas Verdes+ actively involves diverse perspectives, including local residents, NGOs, and stakeholders. Their input shapes decision-making.
- **Social Learning:** The project fosters ongoing social learning through initiatives like the Community of Learning (CoL).
- **Empowering Local Knowledge:** Recognizing the value of local wisdom, Ruas Verdes+ empowers communities to challenge norms and contribute contextually relevant solutions.

New Organizational Structures:

- Multidisciplinary Coordination: Ruas Verdes+ coordinates across various municipal departments, ensuring alignment. Departments include Green Structure, Urban Planning, Public Space, Mobility, and more.

Long-Term Perspectives:

- Holistic Approach: Ruas Verdes+ considers long-term impacts on social and ecological systems, aligning with nature's cycles.
- Sustainable Development: The project prioritizes well-being for present and future generations.

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SANTIAGO

PILOT 1. Stgo+ Green Infrastructure Plan

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SANTIAGO

PILOT 1. Stgo+ Green Infrastructure Plan

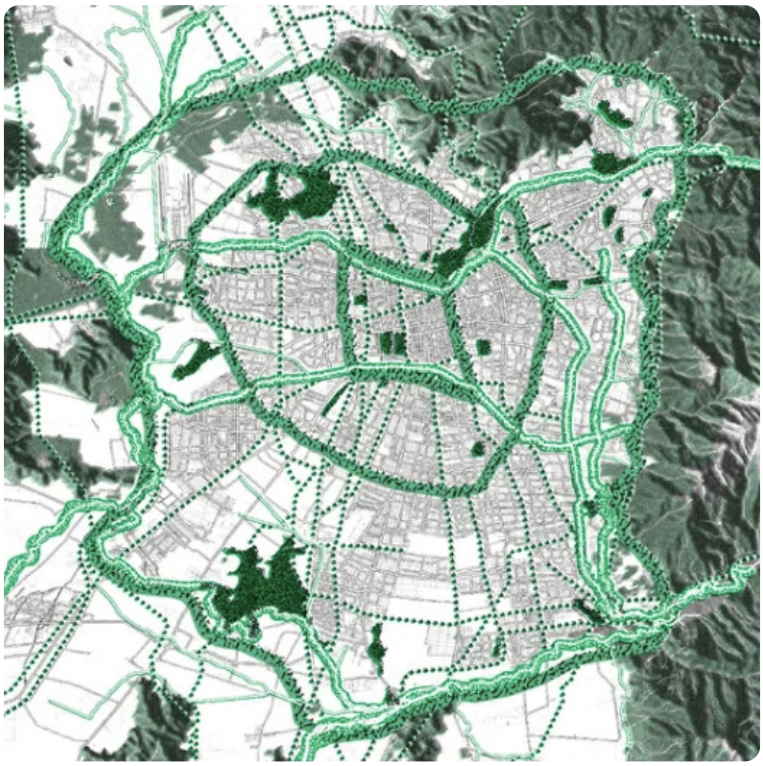
Start date: April 2020 **End date:** December 2023

What and Where?

Location:	Metropolitan area of Santiago.
NBS type, and habitat/s to be created or restored:	Diverse types.
Ecosystem services:	To be delivered (or in other words, **city priorities in such location/s):** Multiple ecosystem services.
Management & maintenance:	is it feasible to implement & test **3 different maintenance regimes?** Three different maintenance regimes will be assessed.

Map


COLINA
LAMPA
LO BARNECHEA
CURACAVI
MARIA PINTO
MAIPU
LAS CONDES
LA FLORIDA
PUENTE ALTO
SAN BERNARDO
EL MONTE
TALAGANTE
ISLA DE MAIPO
MELIPILLA
PIRQUE
SAN JOSE DE MAIPO
PAINE
SAN PEDRO
ALHUE



Why?

There are several initiatives from different public institutions to protect and develop green infrastructure and NBS in Santiago. In Santiago, these initiatives are isolated institutional efforts needing coordination and a systemic view. These isolated initiatives generate a dispersion and fragmentation of information, actions and decisions about green infrastructure and NBS. In parallel, the growing number of civil society initiatives demonstrates the interest of Santiago's citizens in green infrastructure and the diversification of relevant stakeholders.

The design and implementation of a green infrastructure plan in Santiago can catalyse this collective interest of Santiago's community for green infrastructure of different types and scales and articulate the different public, private and citizen initiatives with a strategic vision of integrated planning.

Therefore, in 2017, the University of Chile started a collaborative process named Stgo+ Green Infrastructure. This process involved different stakeholders from Santiago in defining the goals and the main spatial structure of a future green infrastructure plan. Starting from these findings, we propose to develop the Stgo+ Green Infrastructure Plan, including the definition of governance arrangements, strategies and actions, timetable, and a cost-benefit evaluation.

Conexus concepts to prove / test?

- Incorporating green infrastructure and NBS into urban plans and policies at multiple scales, applying indicators to demonstrate their effects and long-term viability
- Co-creating context-appropriate NBS for sustainable urbanisation

Links to Task (delete as appropriate)

- T1.1. Engage stakeholders: Identify and engage key actors and audiences.
- T3.1. Establish Life-Labs: Set up local communities of learning and trialling 'nature-based thinking' methods.
- T3.2. Co-create NBS: Develop a Green Infrastructure plan; plan NBS interventions, indicators and measures of success. The plan will be produced through a co-design process.

	Strengths **Positive internal factors to build upon**	Weaknesses **Negative internal factors to overcome**
Opportunities **External factors that can give and advantage**	**S-O Strategies** **E1:** Advance specific partnership with public institutions that involve the development of tangible products in the short and medium term. These can be pursued through presentations to public institutions. **E2:** Define a communications plan to disseminate the work of the LL and its pilots, aiming to attract the attention of new key stakeholders interested in SbN and related concepts. The plan may include creating digital and printed outreach materials, seminars, workshops, among others. **E3:** Promote the incorporation of the SbN concept into public policies through participation in outreach events, presentation to key stakeholders, among other activities. **E4:** Develop environmental education activities and awareness-raising initiatives that encourage community participation in green initiatives.	**W-O Strategies** **E1:** Actively seek diverse sources of funding. **E2:** Define specific goals, tasks and responsibilities to facilitate the distribution of responsibilities and establish roles among members of the LL. **E3:** Establish a work plan that aligns with the expectations of LL members, financial resources and professional capacities. **E4:** Communicate the progress of LL activities and its pilots actively and transparently.
Threats **External factors that represent risk or can affect negatively**	**S-T Strategies** **E1:** Maintain constant and proactive communication with key stakeholders to strengthen relationships and counteract instability and administrative barriers. **E2:** Define contingency actions based on different scenarios to address challenges stemming from political changes and administratives barriers.	**W-T Strategies** **E1:** Promote less formal instances of exchange to encourage direct communication among members of the LL. **E2:** Identify new key actors and promote their participation in LL activities. **E3:** Conduct activities in person and at times that facilitate the participation of civil society actors interested in the development of green initiatives.

When?

April 2020 to end of the project: Local engagement for co-designing the plan and learning community building. Regional government, University of Chile, local government, community.

May 2020 – October 2021: Masterplanning & Design. University of Chile and Regional government. Product: Plan

January 2021 to end of the project: Publicity. The regional government, University of Chile, Universidad Mayor. Product: brochures, videos and press reports.

May 2020 to end of the project: Monitoring. Community, University of Chile, Universidad Mayor. Product: value for perception and learning indicators.

How?

A participatory approach was implemented to co-design the plan and facilitate collaboration among public institutions, the private sector and social organisations. The assumption was that this could maximise the effects of the singular NBS initiatives and create more consciousness about their benefits. This process offered an innovative approach for the metropolitan areas of Santiago.

So what?

The relevance of the Stgo+ Green Infrastructure Plan development lies in coordinating different stakeholders and providing a strategic planning umbrella for multiple actions that did not work collaboratively. Based on this, the Stgo+ Green Infrastructure Plan offered a cost-efficient alternative for NBS development to tackle air quality, flood problems, social segregation, and environmental justice issues.

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SANTIAGO

PILOT 2. Restoration of the ecosystem of an abandoned public space, Miyawaki Forest

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SANTIAGO

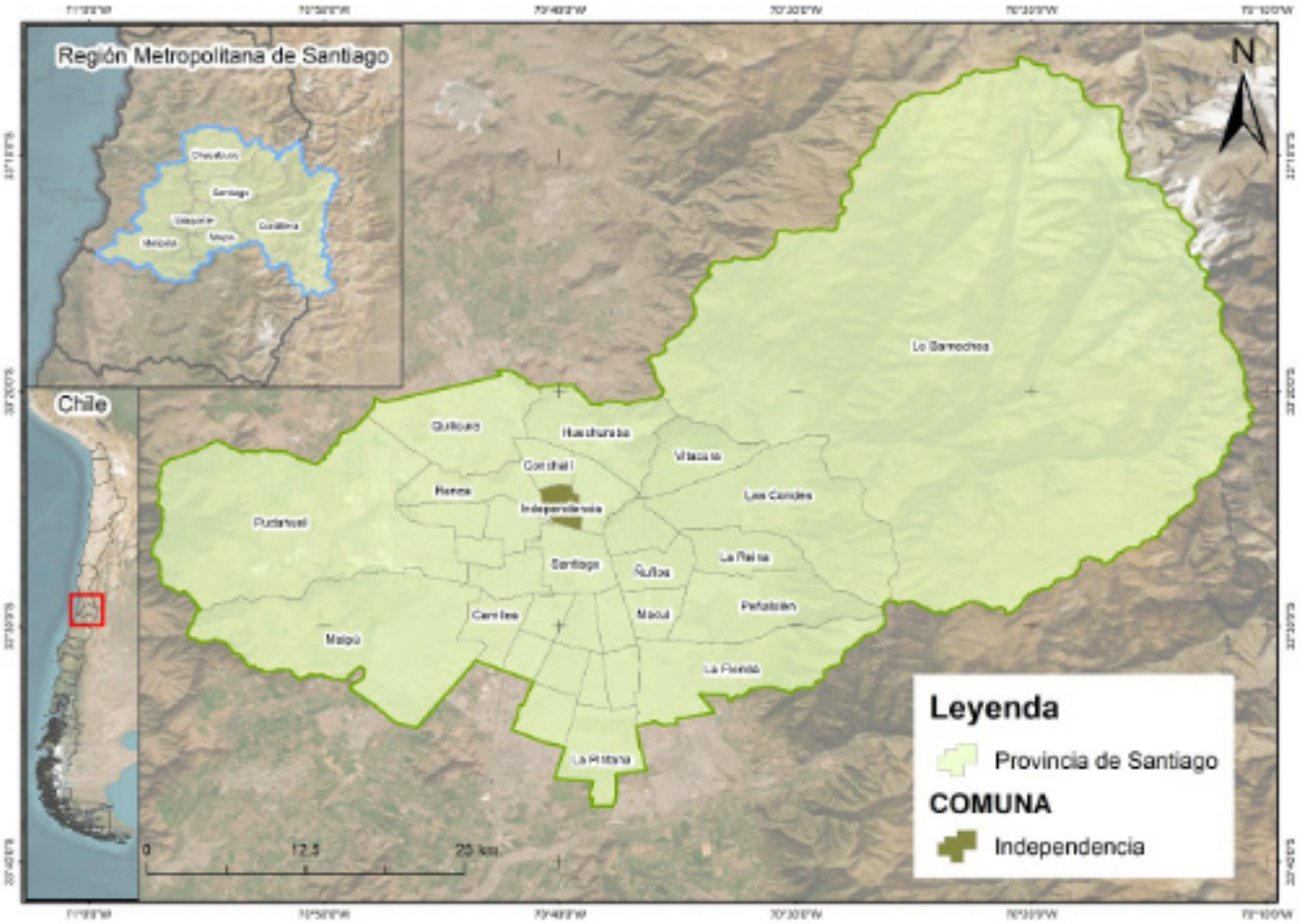
PILOT 2. Restoration of the ecosystem of an abandoned public space, Miyawaki Forest

Start date: July 2023 **End date:** September 2024

What and Where?

Location:	Comuna de Independencia.
NBS type, and habitat/s to be created or restored:	Ecosystem restoration in disused public space.
Ecosystem services:	Temperature regulation, increased carbon sequestration, increased pollination, increased biodiversity, nutrient cycling support services, soil erosion control, soil moisture control, and, in addition, cultural and recreational activities.
Management & maintenance:	

Map



Santiago Metropolitan Region

Why?

Repurposing an abandoned public space in a socially segregated municipal district. The public space is located adjacent to the educational centre, the Environmental Practice Center (EPC), which serves as a hub for the community, promoting sustainable activities such as developing community gardens and composting using organic waste contributed by the community's residents.

The pilot involved developing the Miyawaki forest, which benefits from having a specialised environmental centre responsible for its ongoing maintenance. The centre also welcomes students and residents who are interested in learning about conservation and restoration and are guided by its staff. The participants also have free access to the Miyawaki forest as part of the Municipality environmental education activities of Independencia.

The forest will be accessible to the community after two years of maintenance and temporary closure. This period of protection, monitoring, and restricted access is designed to ensure the forest achieves proper growth. This means the plant species develop deeper roots and vigorous vegetative growth, making them more resilient to long-term adverse conditions. During this time, the regional government has overseen the adequacy of the pilot project.

How?

The design of the urban forest using the Miyawaki technique was carried out in collaboration with a specialist consultancy firm, which incorporated the following parameters:

- Zoning of the space before planting, differentiating types of forests based on the orientation of species (greater or lesser solar radiation) and land topography, listing of species by type of forest, which were divided into xerophilic forest (species with lower water requirements), mesophilic forest (species with moderate water requirements), and hydrophilic forest (species with higher water requirements).
- During implementation, the main technical aspects were considered, such as Preparing and improving the soil before starting planting, installing a drip irrigation system, using tutors for each planted species, incorporating organic mulch over the entire planting surface, protecting the soil from moisture loss through evapotranspiration, and protecting the planting perimeter with the installation of a fence.

Key social aspects considered in this initiative:

- During the planting phase, the local and regional government engaged the local community, inviting many local actors, including community leaders, representatives from Indigenous communities, and neighbours. This participatory process reinforced a sense of belonging and commitment.
- The engagement of the environmental practice centre, EPC, was key in the process. They were trained on the Miyawaki technique and its maintenance.
- Additionally, educational workshops and guided tours were conducted with the local community to showcase the forest's fast growth and provide participatory environmental education.

During the maintenance and monitoring phase, relevant aspects were detected:

- The municipality, along with the regional government, agreed with the community EPC that they would be in charge of monitoring the forest for two years from the planting stage.
- The recorded indicators are (1) survival percentage, (2) average height of three species predominating in the forest, (3) identification of species in the forest listed under conservation, (4) Flora biodiversity, calculated using the Shannon index, and (5) air and soil temperature inside the forest versus pavement temperature.






So what?

The initial results from the environmental indicators were recorded in February 2024, six months after the intervention began. Key findings include:

1. **Plant survival rate: 84%**
2. **Heights of dominant species in the forest:**

Species (Científic name and common name)	Height measured after 6 months
2.1. Psoralea glandulosa (Culén)	3,6 mt height
2.2. Prosopis chilensis (Algarrobo)	2,10 mt
2.3. Senna candolleana (Quebracho)	1,8 mt

3. **Identification of species in the forest listed under conservation categories:**

Species (Científic name)	Species (common name)	Conservation category
3.1. Citronella mucronata	Naranjillo	VU (Vulnerable)
3.2. Lithrea caustica	Litre	LC (Preocupación menor)
3.3. Prosopis chilensis	Algarrobo	VU (Vulnerable)
3.4. Schinus latifolius	Molle	VU (Vulnerable)
3.5. Schinus polygamus	Huingán	LC (Preocupación menor)
3.6. Cordia decandra	Carbonillo o Carbón	NT (Casi Amenazada)
3.7. Monttea chilensis	Uvillo	EN (En Peligro)
3.8. Porlieri chilensis	Guayacán	VU (Vulnerable)

4. **Flora biodiversity was calculated using the Shannon index, which reflects the heterogeneity of a community based on species richness and relative abundance.** The index ranges from 0.5 to 5, with values under 2 indicating low biodiversity, values between 2 and 3 representing a normal range, and values over 3 indicating high biodiversity. The Shannon Index for the Miyawaki pilot forest is 3.7, indicating high biodiversity.

5 **Air and soil temperature records (inside the plantation and on the adjacent pavement) showed the following indicators:**

*Measurements were made in all three types of forests, xerophytic forest, mesophilic forest, and hydrophilic forest, for this indicator.

	Average air temperature	Average soil temperature
Xerophytic forest	28,3 °C	24,7°C
Mesophilic forest	27,7°C	23,3°C
Hydrophilic forest	27,3°C	22,7°C
Pavement right in the forest	32,3°C	35°C

These initial results suggest that the pilot project mitigated some of climate change's negative effects.

Furthermore, encouraged by the success of the results, the Santiago Government is promoting the development of Nature-based Solutions (NbS) in various ways:

1. Update the GS sustainability guide to incorporate the NBS approach for all public space investment projects funded by the Regional Government. This includes multidisciplinary participatory workshops to educate about NbS and integrate diverse perspectives from planning and evaluation teams.
2. Develop a program to build urban forests using the Miyawaki technique. Specifically, the Program **"33 Pocket Forests for 33 Municipalities of the Metropolitan Region."**
3. Incorporating the NBS concept and criteria into the two most important planning instruments at the regional level, i.e., the Regional Development Strategy 2035 (ERD) recently approved and the Santiago Regional Master Plan update (PRMS 2050 in progress).

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SÃO PAULO

PILOT 1. Functional forests

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SÃO PAULO

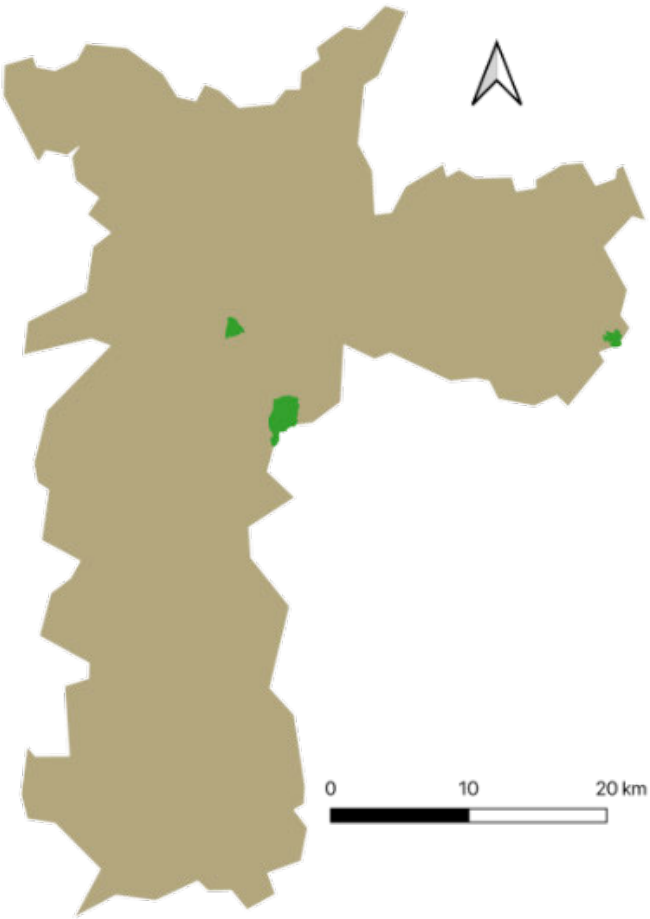
PILOT 1. Functional forests

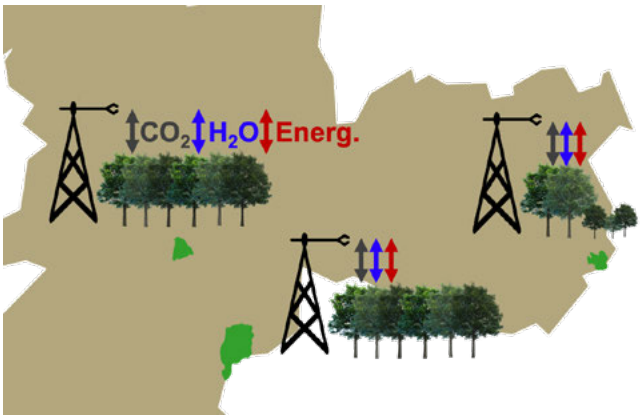
Start date: April 2020 **End date:** August 2024

What and Where?

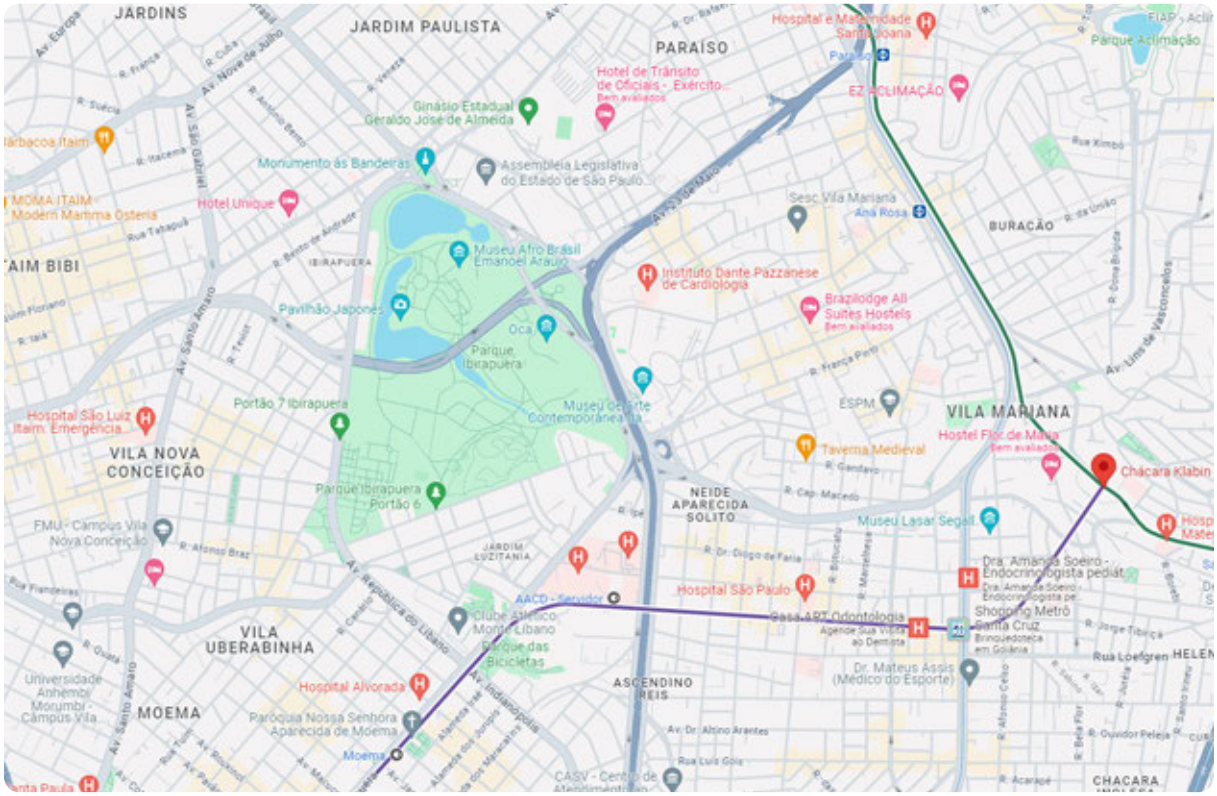
Location:	Ibirapuera and Fontes do Ipiranga Parks in the city of São Paulo.
NBS type, and habitat/s:	
Ecosystem services:	Carbon sequestration, thermal comfort, mitigation of air pollution.
Management & maintenance:	Carried out by the State of São Paulo, the city council and the concessionaire URBIA.

Map

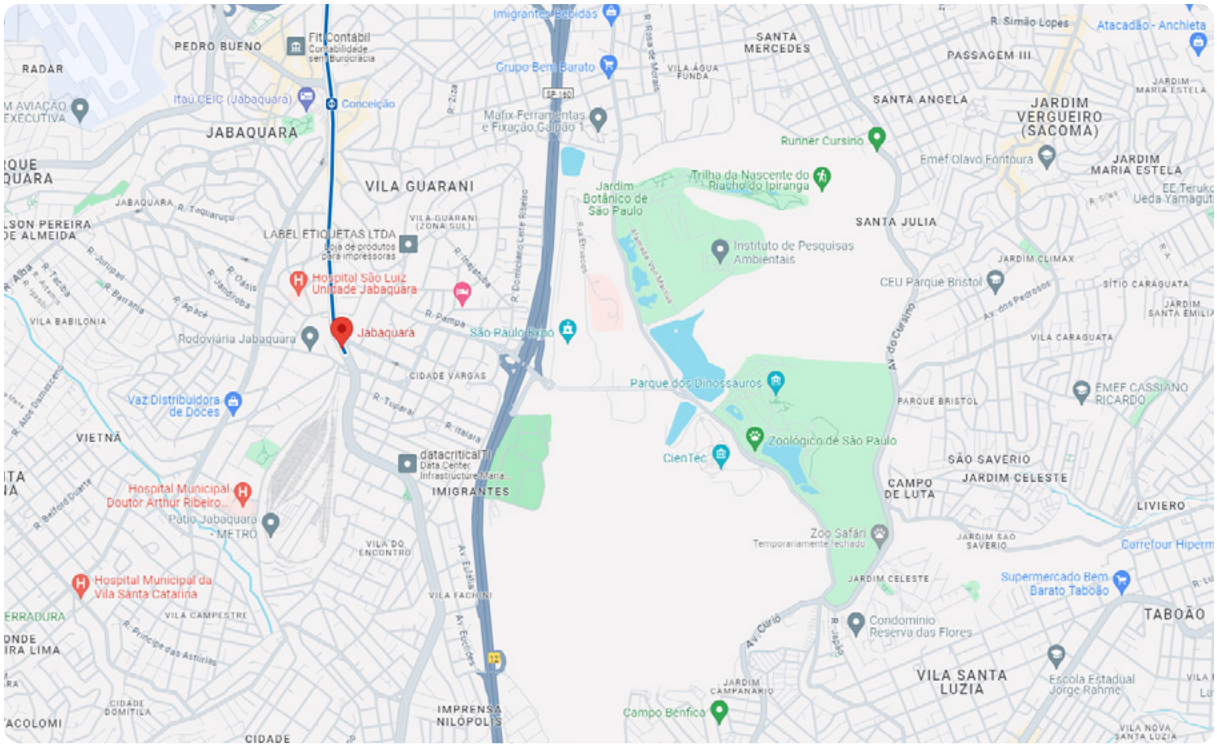




The city of São Paulo and the parks locations



Ibirapuera Park, with two subway lines (2 and 5) in surrounding area, and the 23 de Maio Expressway (North-South Corridor) along the park.



Fontes do Ipiranga Park, with subway Line 1 near the park, as well as Imigrantes Highway.

Why?

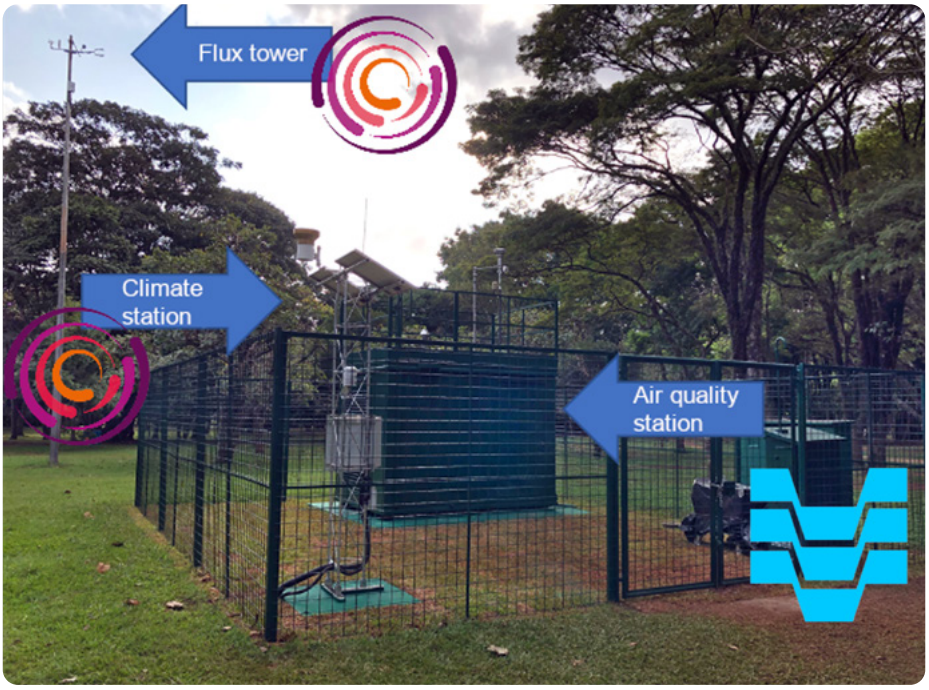
São Paulo is one of the largest cities in the world, where the population already faces the exacerbated impacts of climate change. Heatwaves, droughts, and floods are becoming more frequent and intense with great impact especially in the most vulnerable sectors of the city. Aiming at promoting a resilient city, this pilot builds on the need to optimise the ecosystem services of urban forests through the choice of species and vegetation structure.

When?

The pilot is based on a long-term monitoring experiment that started in April 2020, and is still running. We expect it to keep running for years to come, and we have a new grant funded by the São Paulo Research Foundation that will expand the pilot in the Ibirapuera Park.

How?

This pilot builds on a sophisticated monitoring network of ecosystem services at the urban forest level using eddy covariance towers and on the individual tree species using sapflow sensors, digital dendrometers and other ecophysiological analyses.
The longer the dataset the better for increasing our knowledge on urban forests benefits and functioning. From this knowledge we will support mechanisms like the Plan for Urban Trees, and Plan for Open Areas and Green Spaces from the city of São Paulo, directly influencing evidence-based decision making in the city.


Flux tower
Climate station
Air quality station

So what?

The Functional Forests pilot in the city of São Paulo has already three years of monitoring data, a wealth of information available to support decision-making in the city. It is already supporting the municipality to build guidelines for planning and managing the urban green-infrastructure. As next steps, the pilot is planning a platform to use the live data on ecosystem services in the parks to inform the users about the importance of these green areas to the city.

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TORINO

PILOT 1. Valdocco Vivibile

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TORINO

PILOT 1. Valdocco Vivibile

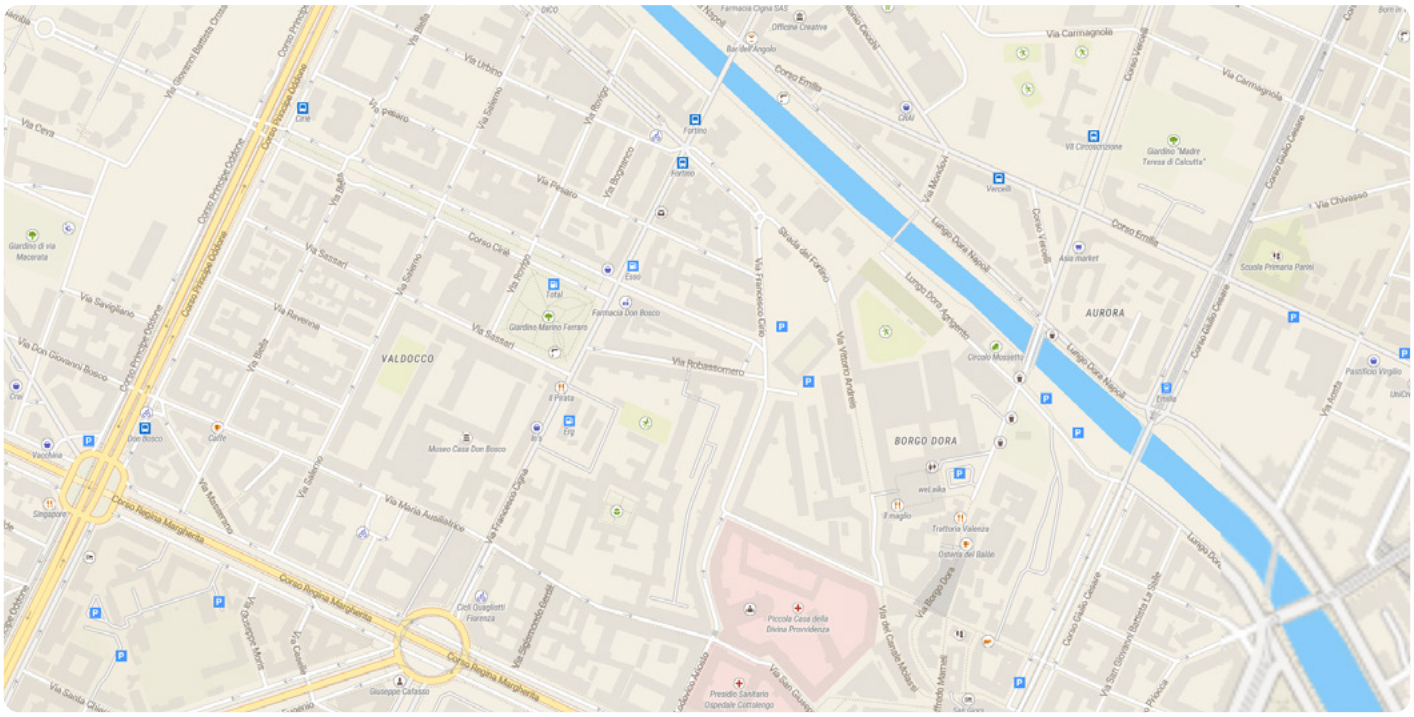
Start date: April 2020 **End date:** August 2024

What and Where?

Location:	Valdocco Vivibile site
NBS type, and habitat/s to be created or restored:	Plants, shrubs and small NBS solutions distributed along the roads, school entrances and parking slot, to restore built environment of the district Valdocco.
Ecosystem services:	Carbon storage in vegetation; Biodiversity: Shannon Diversity Index of Habitats; Cultural benefits: Pedestrian and/or Cycling Paths; Children involved in educational activities.
Management & maintenance:	The management and maintenance of these spaces is carried out by Turin City Council.

Map

Turin map and Valdocco Vivibile area



Why?

Over the past few years, the City of Turin has embarked on a path of change in waste collection management, moving from street-side bins to door-to-door collection. This choice has led to freeing up small but widespread areas of public space. This led the administration to seize this opportunity to transform and regenerate parts of the neighbourhoods affected by these changes, such as the Valdocco district.

The Idea was to give back to the citizens a usable space instead of a parking space; building a green environment in a dense and impermeable urban environment; using greenery to infrastructure the territory. It is a project that focuses on the well-being of citizens and is based on the concept of climate resilience through nature-based solutions.

STRENGTHS

- The implementation of the Life Lab is not an isolated project: the City of Torino has been working over the last 5 years to build an operational plan for the future.
- There are similar activities already in place (e.g. proGIreg).
  - update – Working actively with proGIreg representatives is enhancing knowledge and know-how among Conexus Life Lab.
- In the neighbourhood there are a lot of educational institutions.
- Headmasters and other teachers were very interested in the project.
- Some of the actors involved are aware of other related initiatives.

WEAKNESSES

- Currently only experts or interested people are involved in the project, so it is not yet open to public debate.
- In the neighbourhood there isn't much space for green areas.
- The planned interventions are very punctual and limited to specific areas.
- Economic resources are limited.
- It may be difficult to identify all the stakeholders in the neighbourhood
- Information asymmetry between municipality decision-makers and Life Lab representatives and stakeholders.
- Losing stakeholder throughout the 4 years project-process.

OPPORTUNITIES

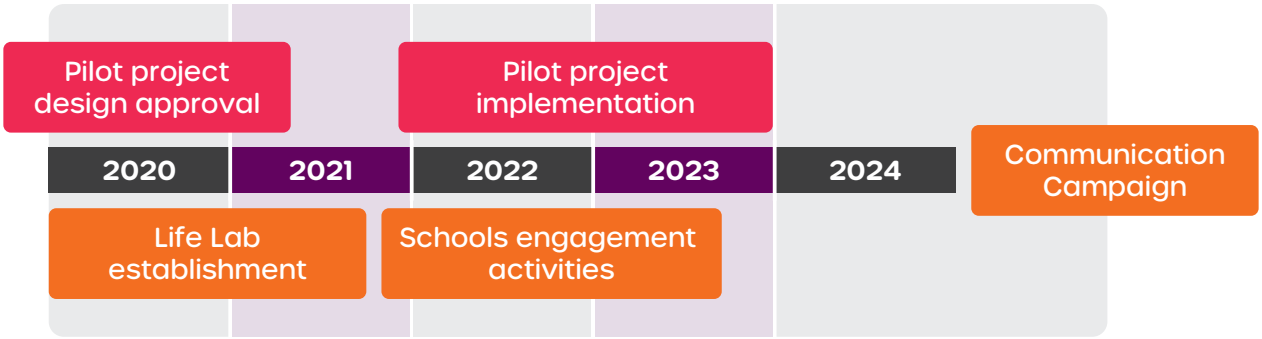
- It's the first project to deal with these issues in the neighbourhood, so it can become a good example.
- The project tests the implementation of NBS in non-peripheral locations, more similar to the rest of the city.
- Can be open to non-expert actors, educating them about environmental issues
- Building relationships with specific stakeholders can also lead to partnerships in the future.
- Co-creating the communication can introduce new tools better suited to specific targets.
- Connection with the EU Project ToNite, that is working near the Valdocco area.
- October 2021 local elections results have allowed a continuity in the project purposes.
- The possibility to co-define urban transformations of Masserano Park and Vicolo Grosso is an enhancement of Turin Life Lab.

THREATS

- There is a risk of "trivialisation", because the project can be confused with similar ones.
- Health emergency due to COVID-19 limits opportunities for live meetings with the stakeholders.
- Difficulties in obtaining availability from stakeholders.
- There is a risk of excluding some actors who are crucial to the success of the project.
- Since there is a participatory process, there is a risk of not being able to positively reply to citizen's requests from/for the neighbourhood, generating disillusion and distrust.
- The english term "Life Lab", since its not translated, could create confusion towards the community.

When?

The work of the pilot is closely connected to the construction of the Life Lab, the community of stakeholders that supported the realisation of the project, disseminating information on the objectives of the pilot, developing knowledge on the topic of climate change and promoting dialogue on these issues. In particular, the Life Lab activity addressed schools in the neighbourhood. The two activities therefore ran in parallel and synergistically from 2020 to 2024.



How?

Small NBSs and viability changes to reduce vehicle velocity

Before and after parking lot

NBS and a sample of the communication campaign installations

Engagement activities with pupils and teachers: final public event (June 2023)

So what?

The pilot benefits are being monitored through the ecosystem services analysis evaluation and they will continue it until the end of 2024. This activity already produced promising results in terms of carbon; Carbon sequestration and storage; Heat mitigation; Avoided Runoff; Permeability; Green Usability; Pollination; Pollutants removal; environmental education for targeted groups (pupils of the engaged schools). In addition, the Valdocco Vivibile pilot project has generated wider social benefits by improving the aesthetics of the public space along the intervening areas, making it more pleasant for passers-by.

The educational benefits mentioned above are directly linked to the activities carried out in our Life Lab. This result represents a concrete added value generated by the Conexus activities in Turin. In fact, based on the increased awareness of the importance of involving stakeholders and citizens in urban regeneration projects, the administration decided to extend the communication and awareness-raising activities and strategies carried out during the project to promote a communication and involvement campaign at city level to promote the benefits of NBS in relation to the risks of climate change.

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