



Deliverable C7.1: Report on the implementation and evaluation of adaptation measures in the Reggio Emilia, Strovolos and Lakatamia municipalities



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Acknowledgements

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Executive summary

In the current report, the adaptation measures implemented in the Pilot Areas of Reggio Emilia (Italy), Strovolos (Cyprus) and Lakatamia (Cyprus) as well as of the evaluation/monitoring measures adopted, are described. The report is divided in three main chapters, each one related to a pilot area. Each chapter describes and shows the main project's objective specific for the PA, the typology of adaptation actions implemented, indicating to which main problems they aim at responding to, and the results obtained.

The scope of the report is to show how and where the local partners put in place physical adaptation measures reduce the impact of climate change in their territory. The actions, mainly selected during the project's writing, where and when possible have been localized in the municipal areas most exposed and vulnerable to hydrological and/or atmospheric climate impacts, according to the analysis performed in actions C1-C5.

1. Reggio Emilia Municipality

1.1 Project objectives and measures typologies

As part of the UrbanProof Project on adaptation to climate change, of which the Municipality of Reggio is a partner, it is envisaged that the involved cities will carry out, at a local level, some of "green and soft" adaptation demonstrative measures, selected by the Municipalities in order to:

- increase public awareness of climate change adaptation;
- integrate the UrbanProof Toolkit with examples of real good practices;
- prepare the ground for the implementation of adaptation strategies.

In the initial project draft, the Municipality of Reggio Emilia should have implemented three demonstrative measures:

- the redevelopment of the green of the ring roads;
- a green roof on the ex Gasometro parking lot;
- the redevelopment of the CIM area.

During the implementation of the project, the Municipality of Reggio Emilia has chosen to enrich these proposals with a broader and more diversified set of measures. The new measures have been chosen from projects already envisaged in Municipal programming tools (and therefore already financed by the competent Authority) by strengthening, where possible, the adaptive aspects for actions not yet definitively designed.

The present document reports the description of the demonstrative measures implemented, or in course of implementation in Reggio Emilia, through specific descriptive sheets. The sheets constitute a set of 24 projects which, although not explicitly born as resilience measures, can be considered as demonstrative measures for their significance in terms of adaptation to changes climate.

The prevailing types of intervention of the selected measures are:

- Urban requalification projects - albedo improvement
- Planting Projects
- Urban Agriculture Projects
- Planning Measures
- Experimental studies
- Green roofs
- Measures for flooding-drought
- Educational Projects

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Follows a list of projects/measures organized by typology, and among them those:

★ The asterisk indicates the only two projects not yet started, as they in course of evaluation

- Green roof library of San Pellegrino,

- Green roof sports hall,

◆ The rhombus indicates the projects-measures still in progress:

- Redevelopment of Piazzale Europa;

- Mediopadana Station parking;

- Campovolo entertainment area;

- RIE building impact reduction index;

- Pozzo Oasi di Marmiolo.

All the other projects/measures have already been completed.

Urban redevelopment and albedo enhancement	<ol style="list-style-type: none"> 1. Piazzale Europa redevelopment ◆ 2. Improvement of Mediopadana parking station -◆ 3. Via Guasco redevelopment 4. Piazza Vallisneri redevelopment 5. Piazza Gioberti redevelopment 6. Via del Carbone stone paving
Plantings	<ol style="list-style-type: none"> 7. viale del Mille green areas redevelopment 8. “gran mutuo green” urban forestry project 9. ReggioRespira - Project to increase new trees in the city – 10. Campovolo entertainment area ◆
Projects on urban agriculture, vegetable garden, orchards	<ol style="list-style-type: none"> 11. Orchard of ancient fruits in the Acque Chiare park 12. Food fores “Sberveglini” park 13. Canali edible park
Planning measures	<ol style="list-style-type: none"> 14. Index of the building impact reduction “RIE” ◆ 15. Analysis of areas to address new plantings and adaptation guidelines for plantings
Experimental studies	<ol style="list-style-type: none"> 16. Experimental grove "heat islands"◆ 17. Experimental study on the beneficial effects of parks on the microclimate and air quality
Green roof	<ol style="list-style-type: none"> 18. San Pellegrinio Library green roof ★ 19. Sport Hall green roof ★
Measures for flooding and droughts	<ol style="list-style-type: none"> 20. Restructuring of the Comunela kennel 21. Pozzo Oasi di Marmiolo ◆
Educational projects	<ol style="list-style-type: none"> 22. Weed guide - educational project 23. Parco Nilde Iotti project

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De-proofing <ul style="list-style-type: none"> Via Guasco redevelopment Campovolo entertainment area Piazza Vallisneri redevelopment via dei Servi redevelopment 	Plantings <ul style="list-style-type: none"> “Gran Mutuo Green”urban forestation “Regguiorespira Più verde in città” project viale dei Mille green redevelopment AV train station parking redevelopment Campovolo entertainment area Piazzale Europa redevelopment Piazza Vallisneri redevelopment Parco Nilde lotti project Orchard of ancient fruits in the Acque Chiare park Canali edible park Food Forest "Sorelle Sberveglieri" park Via Guasco redevelopment 	Vegetable gardens and orchards <ul style="list-style-type: none"> Orchard of ancient fruits in the Acque Chiare park Canali edible park Food Forest "Sorelle Sberveglieri" park
Education – Information <ul style="list-style-type: none"> Parco Nilde lotti project Weed guide - educational project 	Planning <ul style="list-style-type: none"> Index of the building impact reduction “RIE” Analysis of areas to address new plantings and adaptation guidelines for plantings 	Experimentation <ul style="list-style-type: none"> Experimental study of the beneficial effects of parks on the microclimate and air quality Experimental Grove of Clear Water Park (and AV Parking)
Flooding/ droughts <ul style="list-style-type: none"> Restructuring of the Comunela kennel Pozzo Oasi di Marmiolo- 	Green Roof <ul style="list-style-type: none"> San Pellegrino library green roof project Sport hall green roof 	Albedo enhancement <ul style="list-style-type: none"> Via Guasco redevelopment Piazza Roversi redevelopment Via del Carbone stone paving AV Station Parking

Among the information reported in the measures’ sheets, is possible to find t data related to some specific indicators in order to quantify the relevance of the measure with respect to climate change adaptation effort:

- square meters (sqm) areas of new greens (planted)
- sqmof draining floors
- sqm green roofs
- n. of planted trees
- sqm de-proofing surfaces to green

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- sqm of water squares
- sqm pavements with a best albedo
- n. of new shrubs
- total area of intervention (sqm)

As indicated in the application form, for some of these measure, the UrbanProof project set targets to be reached. In particular, the expected targets for the Reggio Emilia measures were the following:

- 19,000 sqm of new public green areas,
- 70 sqm of green roofs or 1,900 sqm of permeable flooring or 9 sqm of water squares or a combination of the three.

Considering the already implemented projects or measures, and the one still in progress, the results achieved by the Municipality of Reggio Emilia are much higher than what was estimated:

sqm green areas	260.887
n. of planted trees	8.742
n. of new shrubs	10.800
sqm of draining paving	14.300
sqm of paving with a best albedo	26.840

The values related to the green roofs are only estimates and not what has already been achieved or funded. In fact, the two green roof projects are still under evaluation.

Moreover, 8 specific banners have been developed by Iuav University to be place in the area of intervention of the most significant measures.

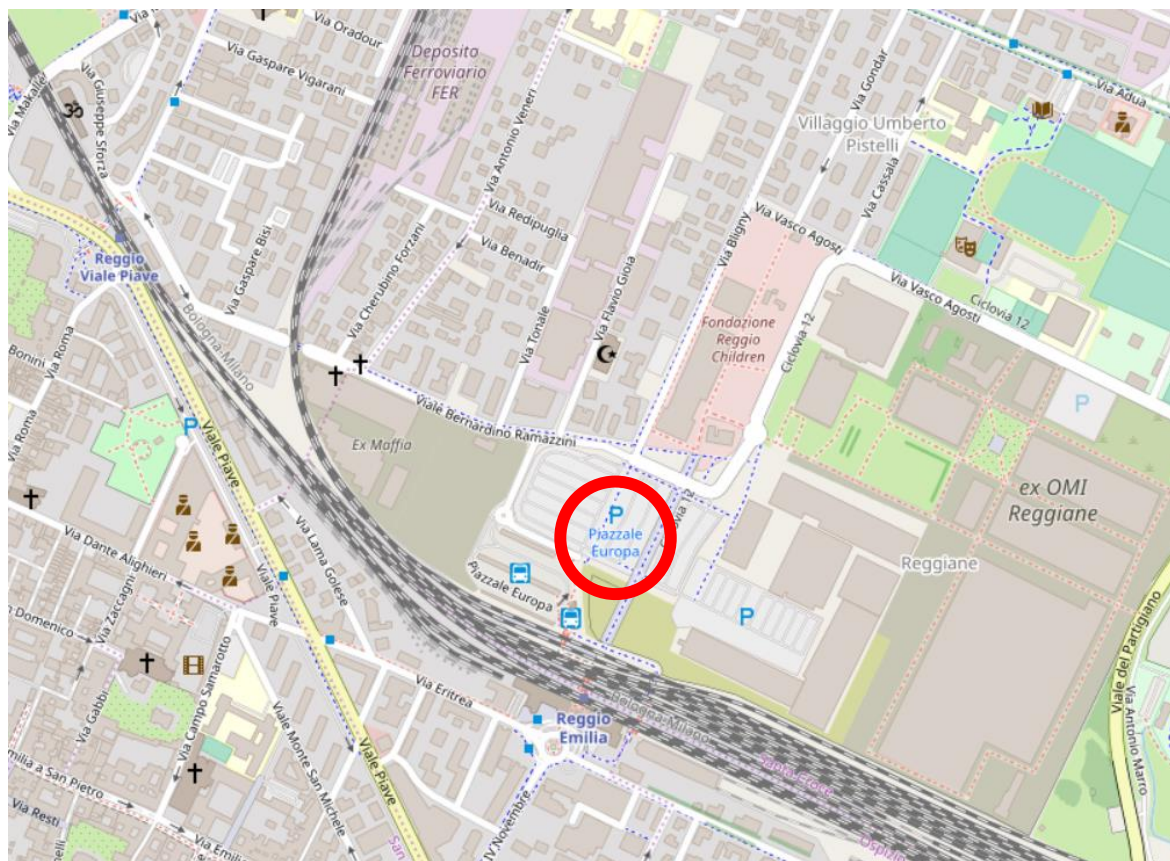
Follows the sheets related to the implemented measures/projects and, where available, the related banner.

1.1.1 URBAN REDEVELOPMENT MEASURES

<i>Piazzale Europa Redevelopment</i>	
GENERAL INFORMATION	
Description	<p>Piazzale Europa is a large car park built for ten years near the historic railway station FFSS Milan - Bologna, with modal interchange functions: in fact, there is also the suburban bus station.</p> <p>Starting in May 2016, this car park was the subject of a large urban redevelopment project, of which the first lot (completed in 2018) included the redesign of parking stalls (376 parking spaces), the reorganization of the road network, the redevelopment of public lighting and the green layout of the entire area. In particular, the reorganization of the parking areas on a wider area has allowed to increase the green and pedestrian spaces by creating a new urban green system: this arrangement of the greenery concerned the flower beds and the planting of various tree species, that, once ripe, will give the impression of natural-looking wooded 'wings'. Fifty of the already existing plants in the parking area (hornbeams and maples), new trees (127), shrubs (about 7,000), decorative grasses and lawn, irrigated thanks to an artesian well were introduced. Furthermore, the new flooring used for parking areas has a modular self-locking structure with concrete blocks specially designed for this project which helps to preserve the natural balance of the water cycle. The sewage and first rain water treatment plants were also redesigned (with the installation of 2 tanks for the collection of rainwater to wash the square) also to help respond to the frequent flooding of the area recorded in the past on the occasion of intense rainfall. The project also includes a second section to complete the system of connections with the city.</p>
Action typology	Trees planting; de-proofing- draining pavements; flooding reduction
Start	01/05/2016
End	01/02/2020
Typology of hazard addressed	Heatwaves and health; Water availability reduction
Budget e/o expenses	(not available)
Sqm of green areas	5.300
draining pavements (m2)	4.300
Sqm of green roofs	-
n. of planted trees	127
Sqm of permeable surfaces	5.300
Sqm of water squares	-
surfaces with a better albedo	-
n. of new shrubbery	7.000
Total area of intervention	30.405 m2
Additional information	Reference person: Daniela Lepori - Area Territorio e Beni Comuni

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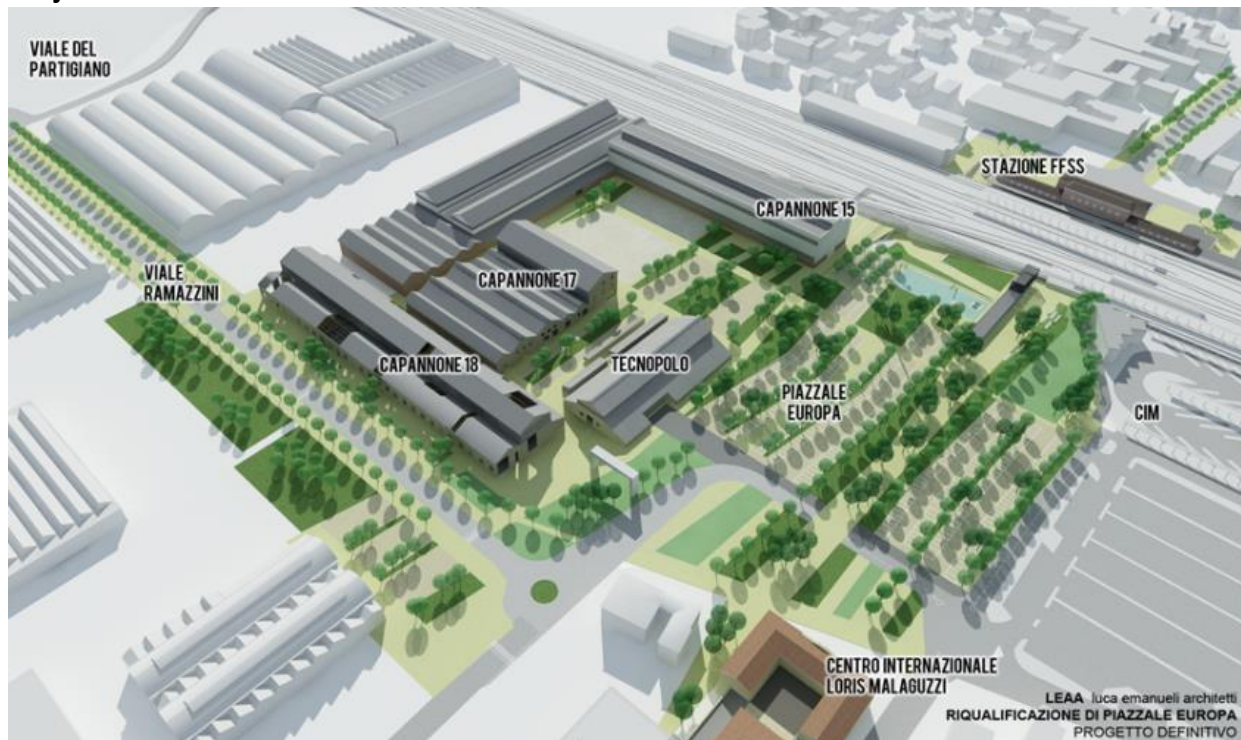
Location



Before the action implementation



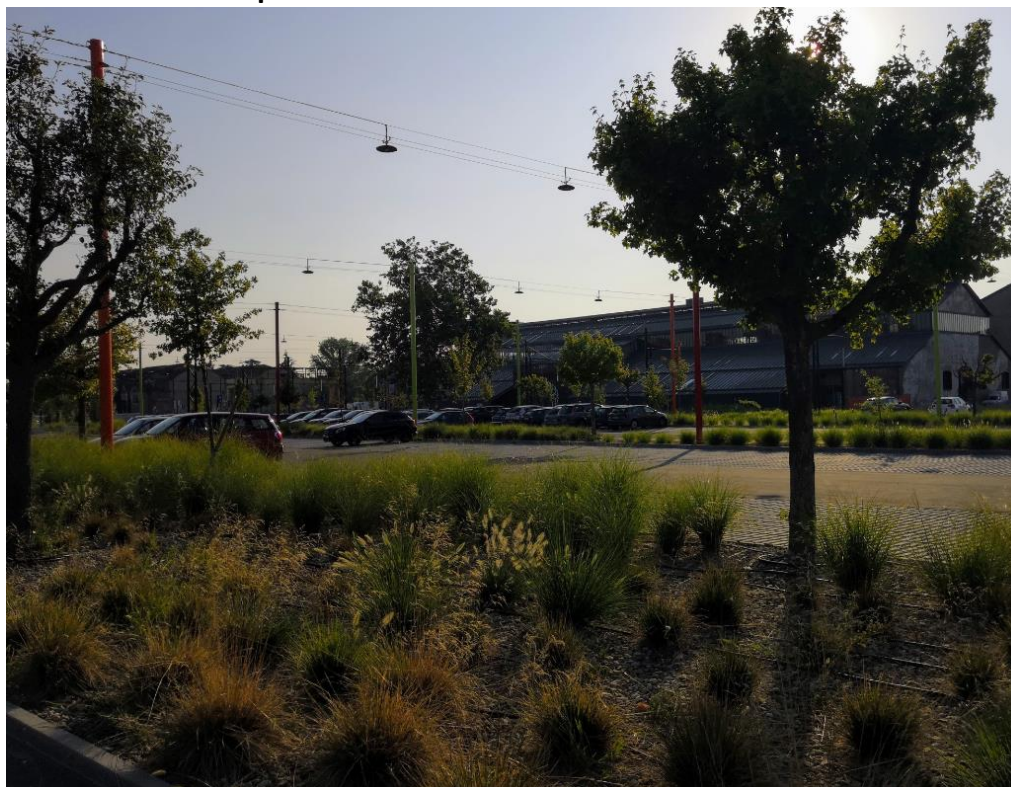
Project



Project rendering



After the action implementation

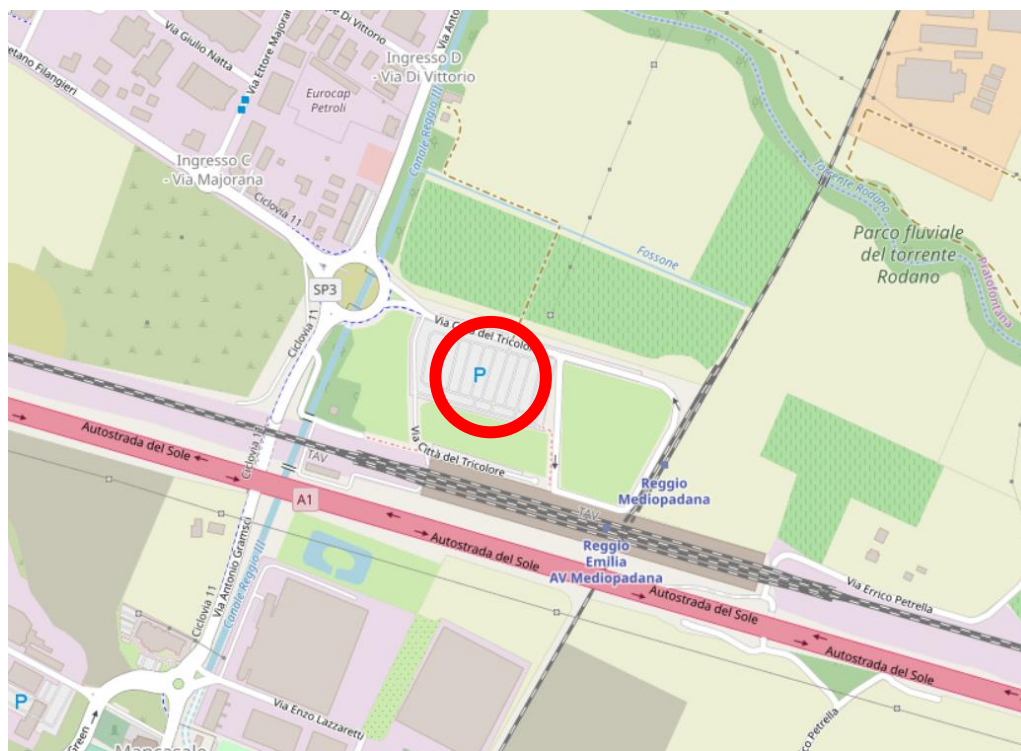


<i>Mediopadana AV Railstation parking redevelopment</i>	
GENERAL INFORMATION	
Description	<p>The car park of the Reggio Emilia high-speed railway station (Mediopadana) is the subject of a major new redevelopment and expansion project which, although aimed at improving service and accessibility to the station, also pays great attention to the theme of climate change adaptation. In fact, the project provides for various interventions to contrast the islands of heat and water regulation already in the phase of work assignment. In particular, the intervention foresees: a) construction of two first rain tanks, serving respectively the existing parking lot and the expansion area, and a lamination tank to complete and upgrade the water collection networks and their disposal systems b) organic design of the green which provides the planting of numerous new tree and arbus species, creating tree-lined avenues, a green box system in the parking area and new verdic flowerbeds; c) Interventions related to the paving of parking areas, draining into the new part and with technical characteristics specifically aimed at improving the albedo both the new part and the existing one. In particular, the water collection system is structured around the collection facilities of the individual car parks that merge into two underground tanks of first rain (for a volume of 100 + 100 cubic meters) in turn connected to the sewage system and to the pool Laminating. For the greenery, the construction of a double row of plane trees (80) is expected on the initial section of Via Città del Tricolore with a planting layout of approximately 9 meters in continuity with what was built on Via Filangieri. The plants used will be of the Vallis Clausa variety; inside the parking areas, instead, Morus alba "Fruitless" (285) will be used, planted with a planting span of 5 m inside the curbs separating the parking lots. All the essences have been selected according to the ease of maintenance that is expected to settle at full capacity in one intervention per year or less. In the flowerbeds of the parking lots will be planted the essences of the grass family (Miscanthus, Pennisetum and Liriope, for a total of 3,800) with the dual function of demarcation of parking stalls and environmental mitigation. The green areas currently cultivated with alfalfa will be reshaped and then sown again in the grass. Finally, in order to guarantee correct irrigation, a specific well and an irrigation system will be provided to serve the new rows of trees and the system of flower beds. With regard to the parking paving, the new part will be draining (10,000 square meters), while both the new part (10,000 square meters) and the existing part (14,500 square meters) will have a higher albedo thanks to improvements requested in the public tender phase for the entrusting work.</p>
Action typology	<p>Trees planting draining pavements pavements with a better albedo Measures to reduce flooding</p>
Start	Summer 2019
End	Summer 2020

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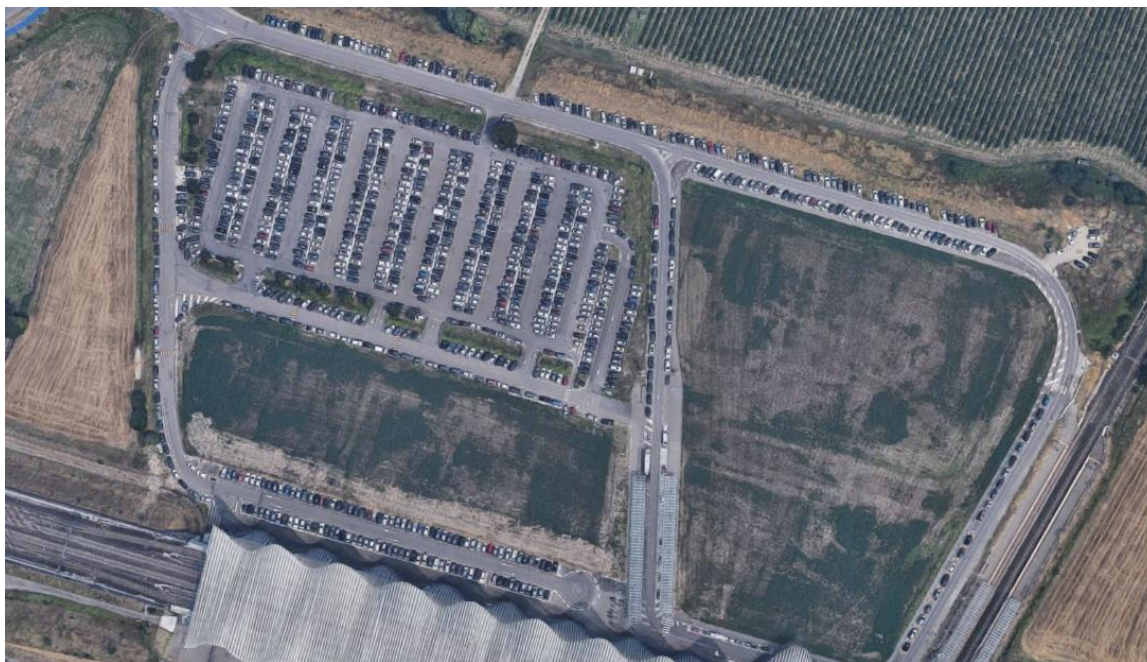
Typology of hazard addressed	Heatwaves and health Floods
Budget e/o expenses	Total project amount 4.100.000 € of which 729.000 € works related to adaptation (40.000 for shrubs, 149.000 for trees, 420.000 for lamination tanks and 120.000 for first rain tank)
Sqm of green areas	980
sqm of draining pavements	10.000
Sqm of green roofs	0
n. of planted trees	365
Sqm of permeable surfaces	490
Sqm of water squares	0
Sqm of surfaces with a better albedo	24.500
n. of new shrubbery (if available)	3.800
Total area of intervention (sqm)	50.981
Additional information	Tecnico riferimento: David Zilioli Localizzazione : Mancasale Zona Nord

Location

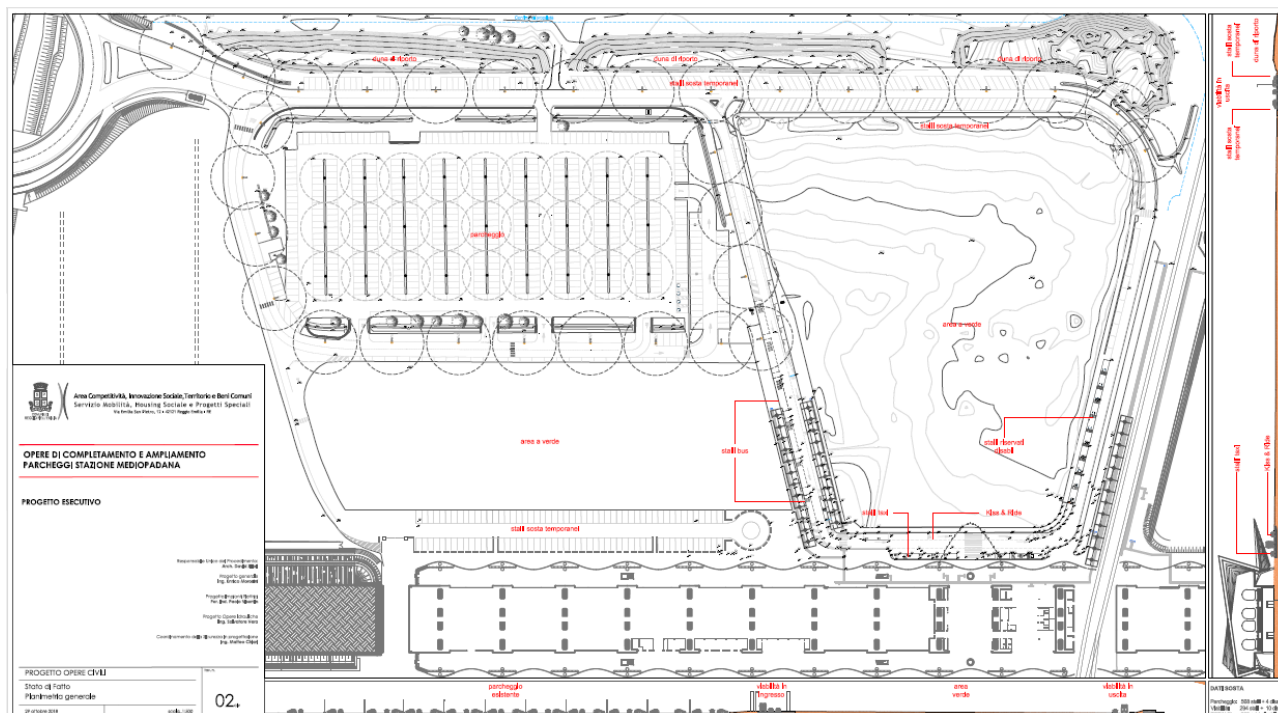


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Before the action implementation



Project



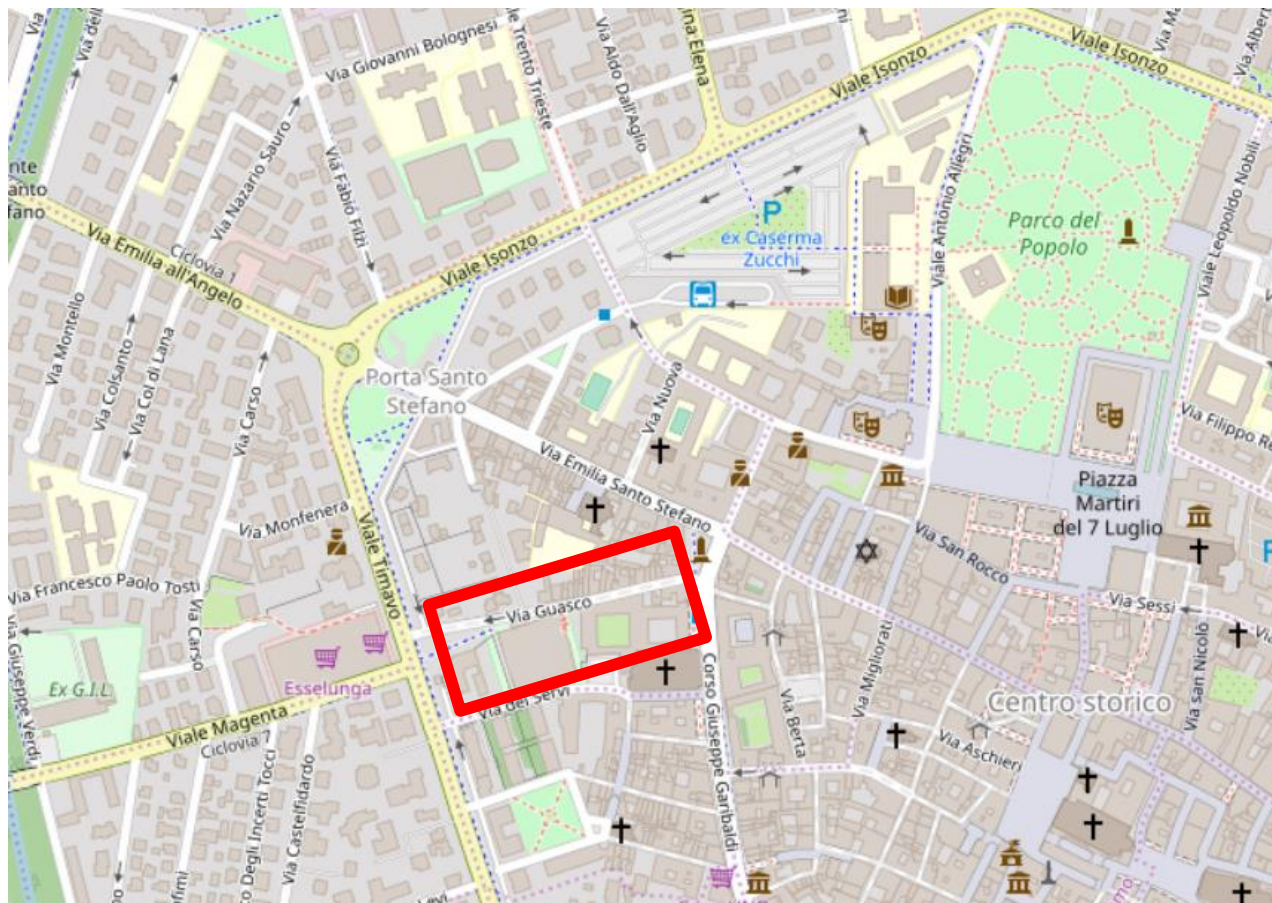
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<i>Via GUASCO Redevelopment</i>	
GENERAL INFORMATION	
Description	<p>The intervention involves the redevelopment of Via Guasco, a street located between the historic center and the avenues of circumvallation, through:</p> <ol style="list-style-type: none"> 1. the reorganization of the road system in combination with the pedestrianization 2. the rehabilitation of road surfaces and pavements 3. the redevelopment of public green areas and the creation of new flowerbeds 4. the removal of architectural barriers. <p>In particular, with regard to the paving, the intervention led to the replacement of the asphalt of the roadway and pavements with Luserna Stone - with better albedo. The intervention on the public green has led to the creation of new large flowerbeds towards the avenues of ring road arranged as a lawn with a prevalence of shrubs and flowering species and a double axis of ash trees of the species "Fraxinus Oxicarpa", planted within flowerbeds of 3.00 x 3.00 meters forming large areas of shade and creating ideal conditions for the usability of space. Via Guasco has thus been transformed into a slow-moving street with mobility, especially for pedestrians and cyclists, with the final part overlooking the avenues of the ring road transformed into a tree-lined urban square with green flowerbeds.</p>
Action typology	paving – albedo; de-waterproofing – green; tree planting
Start	June 2018
End	December 2018
Typology of hazard addressed	Human discomfort Health and heatwaves
Budget e/o expenses	<p>total amount € 450,000 of which:</p> <ul style="list-style-type: none"> - tree planting: € 16,440 - creation of flowerbeds: € 21,900 approx. - flooring: € 185,000
Sqm of green areas	650
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	13
Sqm of permeable surfaces	650
Sqm of water squares	0
Sqm of surfaces with a better albedo	1.800
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	1.932
Additional information	Tecnico riferimento: C. Bigliardi - Servizio Ingegneria

Location



Before the action implementation



Project



After the action implementation

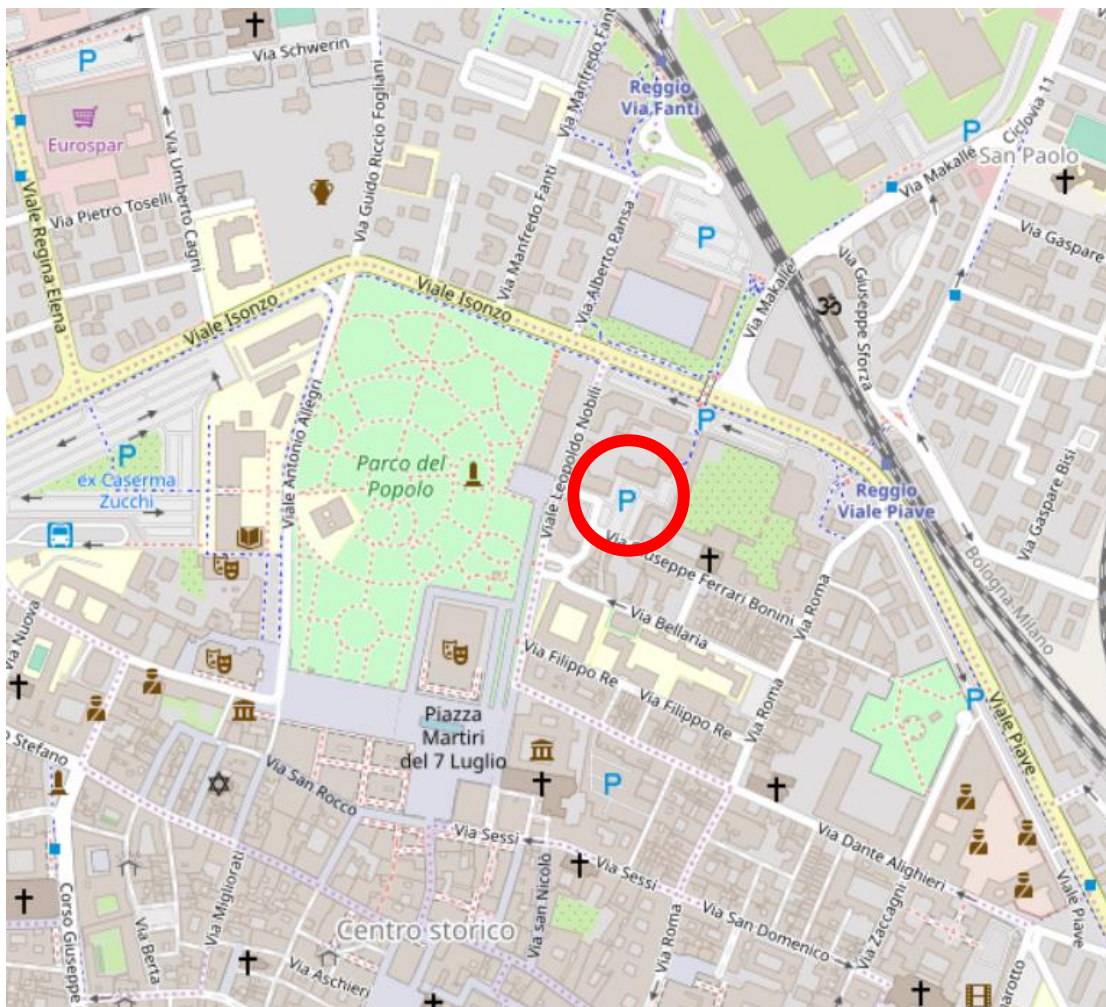


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<i>Piazza Vallisneri redevelopment</i>	
GENERAL INFORMATION	
Description	The project is an urban redevelopment of a large paved square located in the historic center of Reggio Emilia, used exclusively for parking cars, with poorly defined vehicle routes, with no pedestrian routes and no green areas. The intervention involved the redefinition of the parking areas, providing 25 new flowerbeds between the stalls in which 20 trees were planted (19 ash trees and 1 hornbeam), the construction of specific pedestrian paths in self-locking, new sewerage works for the collection of rainwater as well as the preparation for a new public lighting system.
Action typology	-waterproofing - green -planting trees
Start	May 2018
End	December 2018
Typology of hazard addressed	Human discomfort Health and heatwaves
Budget e/o expenses	- tree planting: € 8,000 - creation of flowerbeds: approximately € 3,000 (of which € 1,300 for the creation of the irrigation system)".
Sqm of green areas	184
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	20
Sqm of permeable surfaces	184
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	2.922
Additional information	Reference person: C. Bigliardi - Servizio Ingegneria

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Location



Before and after the action implementation



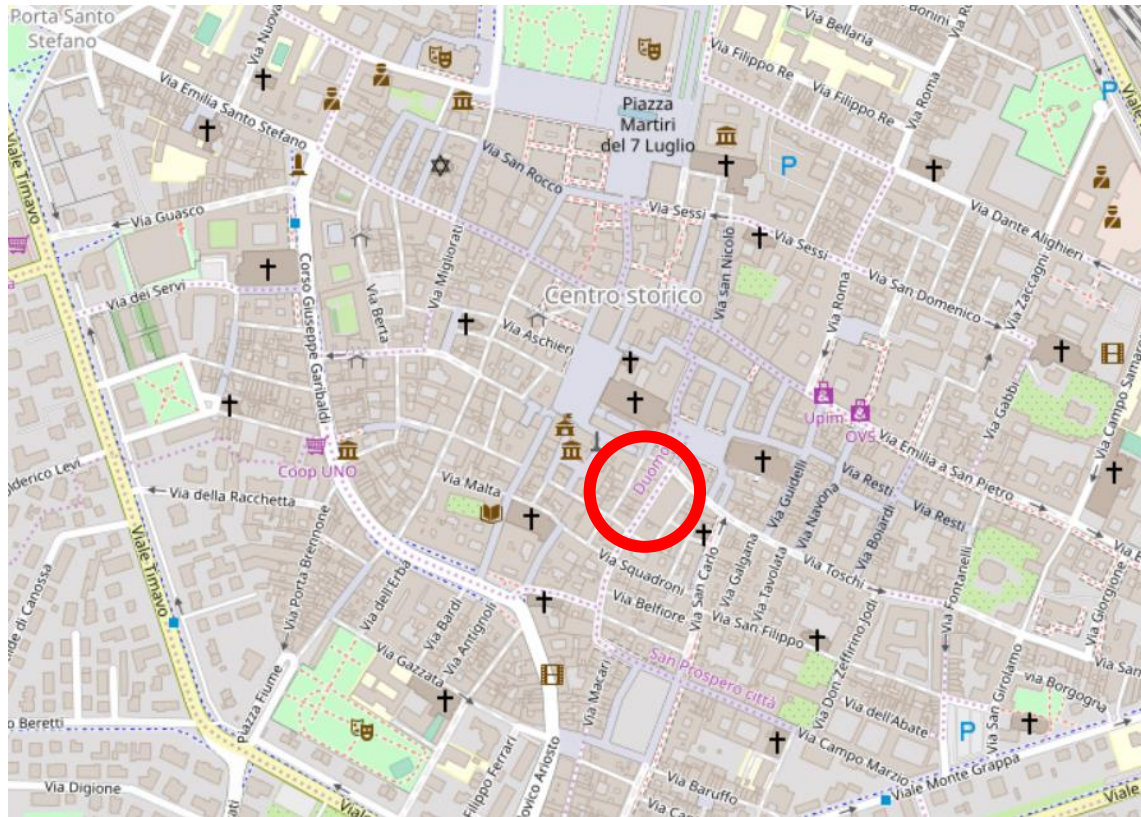
Stone paving of Via del Carbone

GENERAL INFORMATION

Description	The project involved the redevelopment of Via del Carbone in the historic centre of the city of Reggio Emilia. The redevelopment, carried out with public and private interventions, involved the replacement of the asphalt pavement with a pavement in Luserna stone, in analogy with the overall urban redevelopment project of the historic center, which began several years ago and continued in a massive way between 2005 and 2006. The design solution involves the construction of two strips of split Luserna stone made of slabs of 8 cm thick and 40x50 cm in size, laid along the edges of the road, while a third strip made of slabs of the same type made in the middle of the road, at a lower altitude, because it will serve as a collection of rainwater, then moved away with cast iron embrasures. The remaining part of the road surface will be paved with slabs of split Luserna stone with a thickness of 8 cm but dimensions of 30/40 cm for a length equal to 1.5/2 times the width, laid orthogonally to the bands described above.
Action typology	- Paving - albedo
Start	Spring 2018
End	September 2018
Typology of hazard addressed	Human discomfort Health and heatwaves
Budget e/o expenses	A total of € 100,000 of which the stone flooring amounts to about € 37,000
Sqm of green areas	0
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	0
Sqm of permeable surfaces	0
Sqm of water squares	0
Sqm of surfaces with a better albedo	395
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	395
Additional information	Reference person: Ermes Torreggiani , Servizio Ingegneria

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Location



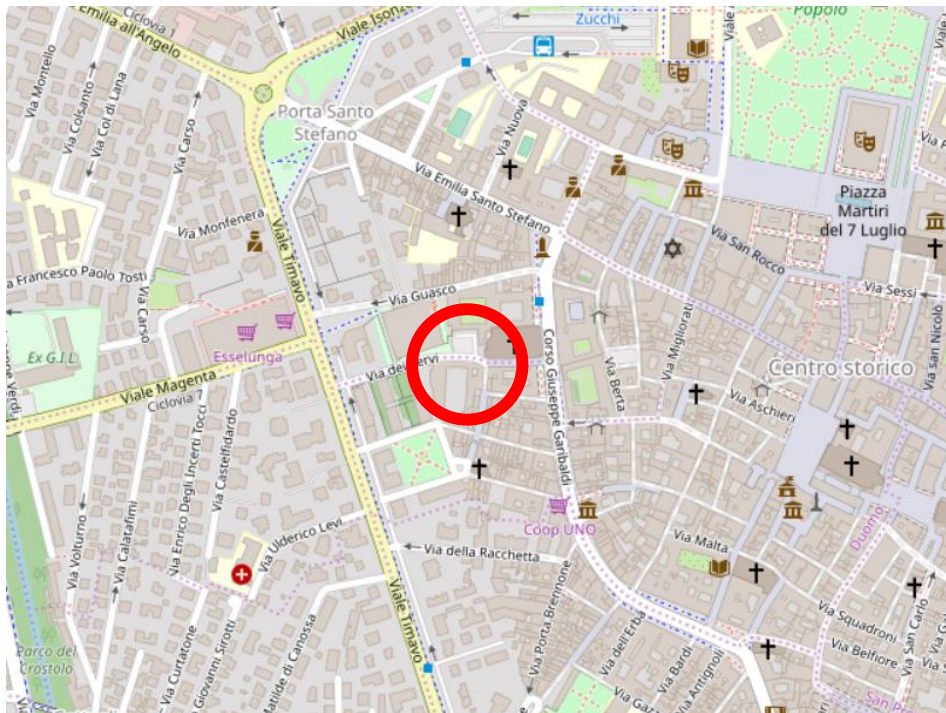
Before the action implementation and project rendering



<i>Via del Servi redevelopment</i>	
GENERAL INFORMATION	
Description	<p>The area of Vicolo dei Servi, owned by the municipality, subject to redevelopment, was an indefinite widening used mainly for parking cars and, although located in the historic center, appeared in general state of neglect. The area in question is of interest as it is framed by prestigious buildings such as the Basilica of the Madonna della Ghiara with the Cloisters and the homonymous Hostel, and to the west by the recently renovated Palazzo dello Sport Giulio Bigi.</p> <p>The redevelopment of this parking area of Via dei Servi has contemplated: the creation of a raised green flowerbed with planting of 5 olive trees creating a stone wall of Luserna.</p> <p>To complete the work has been rearranged the vertical and horizontal signs.</p>
Action typology	- waterproofing – green areas
Start	Spring 2018
End	Spring 2018
Typology of hazard addressed	Health and heatwaves
Budget e/o expenses	- tree planting: €2,350 - flowerbeds: €2,830 approx. (of which € 580 for the realization of the irrigation system)
Sqm of green areas	36
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	5
Sqm of permeable surfaces	36
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	108
Additional information	<p>Tecnico di riferimento: Claudio Biliardi - Servizio Ingegneria</p> <p>Localizzazione : Santo Stefano – CS Citta' Storica</p>

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Location



Before and after the action implementation

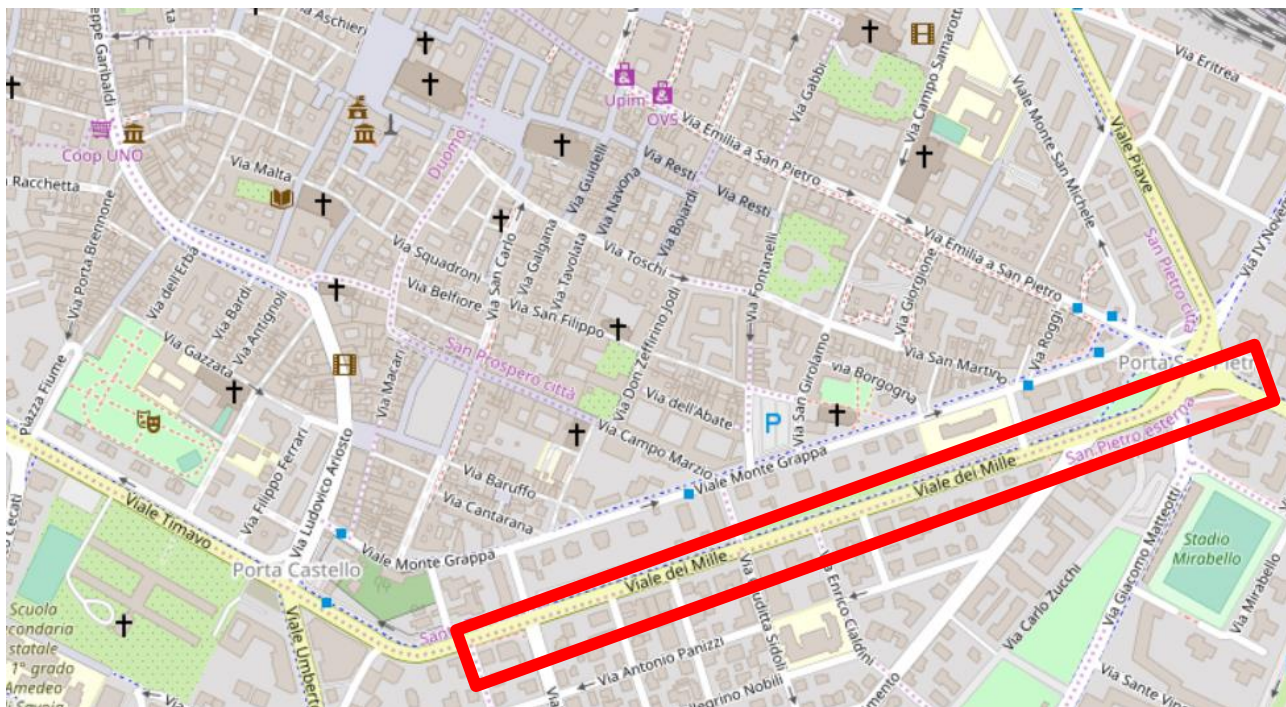


1.1.2 PLANTINGS INTERVENTIONS

<i>Green redevelopment of Viale dei Mille</i>	
GENERAL INFORMATION	
Description	The intervention is aimed at redeveloping the greenery of one of the avenues of the ring road in the historic center of Reggio Emilia. Viale dei Mille is one of the sides of the hexagon that delimits the historic center of Reggio Emilia to the south, where in the nineteenth century there was a walk with a double tree-lined avenue, recreated after the war. Over the years, the trees have gradually thinned out in all the avenues of the ring road and this deterioration, contained on the other avenues of the hexagon planted mostly with plane trees, linden and hackberry, was instead relevant on Viale dei Mille, where there were maples Negundo. The green redevelopment project of Viale dei Mille provided for the demolition of the remaining maple trees, replacing them with new linden trees planted at a distance of about 10.00 m from each other in order to leave a space for growth and not to create competition for light. The intervention has provided for the maintenance of the internal maple row, so as not to "deforest" the avenue completely (the possible felling of which will be evaluated later, once the lime trees are in the growth phase). The new trees have a circumference of 16/1m cm (1 m from the collar) and have been planted in holes measuring 70x70 cm, enriched with fertilizer and filled with vegetable soil containing organic substances. The intervention of Viale del Mille is also part of a larger project for the redevelopment of the entire ring road in the historic center, currently under evaluation.
Action typology	Planting trees
Start	February 2018
End	April 2018
Typology of hazard addressed	Health and heatwaves; Human discomfort
Budget e/o expenses	- tree planting: €70.000
Sqm of green areas	1.600
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	80
Sqm of permeable surfaces	0
Sqm of water squares	0
Surfaces with a better albedo	0
new shrubbery (if available)	0
Total area of intervention (sqm)	20.600
Additional information	Reference person: Canossini - Servizio Ingegneria

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Location



Project and status after the action implementation



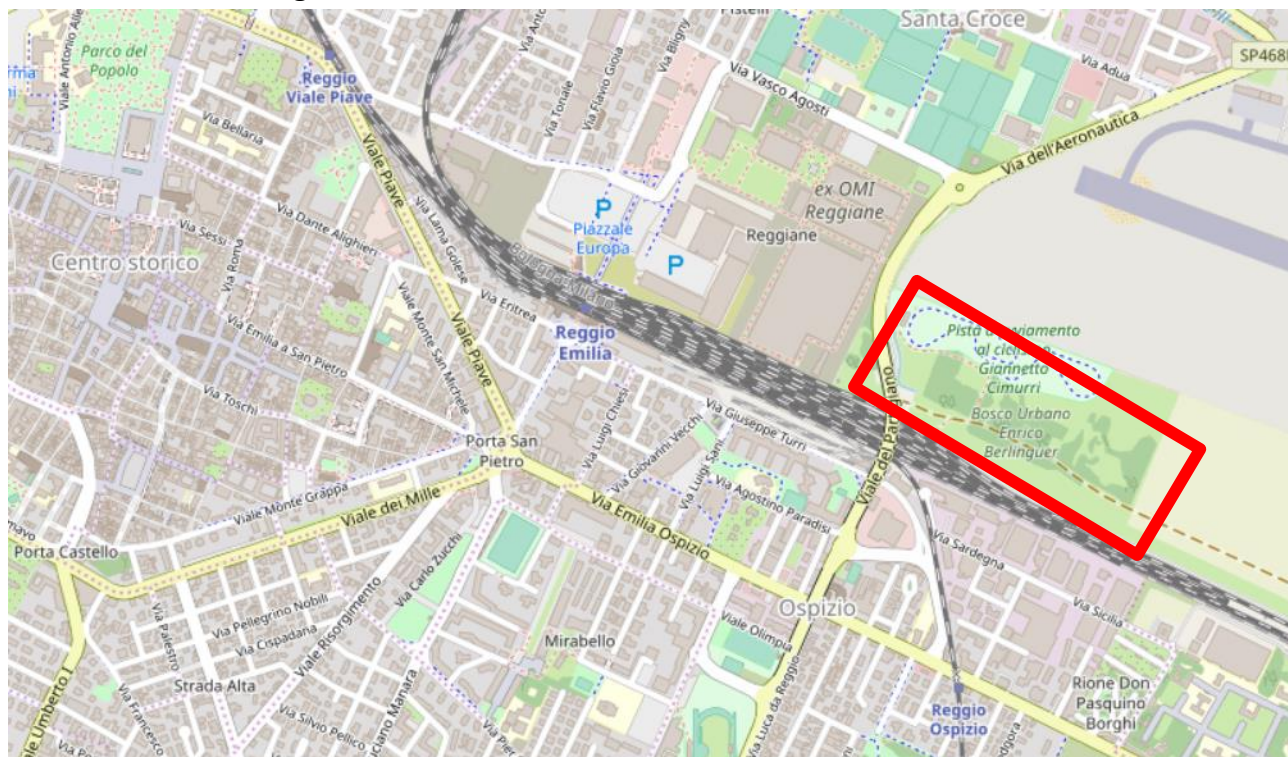
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<i>Urban forestry project "Gran Mutuo Green"</i>	
GENERAL INFORMATION	
Description	<p>Gran Mutuo Green is an urban forestry project promoted by AzzeroCO2 s.r.l. and co-financed by the Cariparma - Crédit Agricole Group, which allowed the planting of 1,500 new trees of native species between 12 and 20 November 2016 (close to the National Tree Day).</p> <p>This project mainly concerned the area of Campovolo where 1,050 new plants were planted in the current Berlinguer Wood (to complete the same) and 270 in the area of via Marro, adjacent to the ecological island of IREN (to implement a redevelopment of an area currently degraded). The remaining plants have been placed in urban or peri-urban residential areas, already destined for parks, where the main need is to increase planting, in order to mitigate the climate and make the parks more usable: Park "Serge Reggiani", in via Settembrini, and "Field of Mars II", in via Papa Giovanni XXIII. Finally, it should be noted that the new trees of the urban forestation project "Gran Mutuo Green" have been planted thanks to the valuable collaboration of various voluntary associations.</p>
Action typology	- planting trees
Start	November 2016
End	December 2016
Typology of hazard addressed	<p>Bioclimatic discomfort on ecosystems</p> <p>Human discomfort and health</p>
Budget e/o expenses	Project carried out through sponsorship contract with Cariparma Credit Agricole of 15,000 euros and collaboration in planting by voluntary associations
Sqm of green areas	67.347
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	1500
Sqm of permeable surfaces	0
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	67.347
Additional information	Reference person: Susanna Ferrari Bergomi

LINK:

<http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESDocumentID/5EE8D279A577C276C125806700352673?openDocument>

Location Bosco Berlinguer



During the planting works



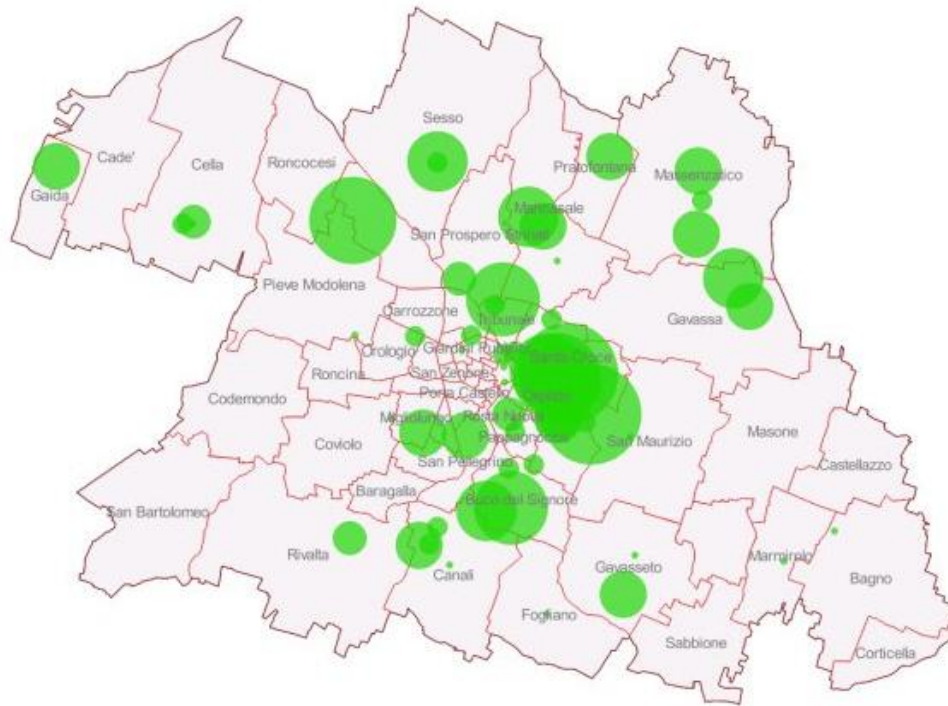
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<i>"Reggiorespira" – More Green in the city</i>	
GENERAL INFORMATION	
Description	<p>The planting project implements a specific program of interventions of the institution ("ReggioRespira") approved by the City Council in March 2016, with the aim of improving the air quality of the city through integrated actions related to environmental issues and mobility.</p> <p>Tare the numerous actions provided for under this program in particular one concerned the increase in planting.</p> <p>From 2016 until the end of the mandate (June 2019) numerous plantings were carried out in public parks and school areas, starting to pay attention to the fight against climate change.</p>
Action typology	- planting trees
Start	November 2016
End	June 2019
Typology of hazard addressed	<p>Bioclimatic discomfort on ecosystems</p> <p>Human discomfort and health</p>
Budget e/o expenses	
Sqm of green areas	179.090
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	4.473
Sqm of permeable surfaces	0
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	179.090
Additional information	<p>Reference person: Susanna Ferrari Bergomi</p> <p>Location : Santa Croce Zona Nord</p>

LINK

<http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESDocumentID/5EE8D279A577C276C125806700352673?opendocument>

Planting location



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<i>Campovolo Entertainment Area</i>	
GENERAL INFORMATION	
Description	The Arena Campovolo project will provide the city with an outdoor structure, equipped for major concerts and events of national and international importance, with a capacity of up to 100,000 attendants, at the same time by enhancing the surrounding parks with a new green and cycling area accessible throughout the year. The project is characterized by its character of sustainability expressed through the reuse of the non-operational area, north of the runway, redeveloping it with new functions without land consumption. With regard to climate change, the temporary grouping of companies, which won the tender, presented a large number of improvements, including the construction of the connection between the Reggio-Gavassa cycle-pedestrian runway and Campovolo for a stretch of about 700 meters and an increase in the permeable surface area compared to the current state of 20,000 square meters. As part of the enhancement of the urban parks surrounding the airport area, provided for in the project, a new cycle path of over 4 km will be built, which connects the urban park Berlinguer, the park of the Rhone and runs on the northern edge of the arena to reconnect to via dell'Aeronautica. In addition, more than 1.850 trees will be planted to enrich the greenery of the existing parks, as well as improving the permeability of the existing area.
Action typology	planting trees; de-proofing; green areas
Start	June 2018
End	August 2019
Typology of hazard addressed	Bioclimatic discomfort on ecosystems Water availability reduction
Budget e/o expenses	Approximately €7 million is financed for €1.7 million from the regional funds of the Por-Fesr-Asse 5 call for proposals and for the remaining part entirely from the private funds
Sqm of green areas	0
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	1.850
Sqm of permeable surfaces	20.000
Sqm of water squares	0
surfaces with a better albedo	0
n. of new shrubbery	0
Total area of intervention (sqm)	34.427
Additional information	Reference person: Maddalena Fortelli e Elisa Bonoretti

Location



Before the intervention



Project rendering



1.1.3 PROJECTS OF URBAN AGRICULTURE

<i>Orchard of ancient fruits in the Acque Chiare park</i>	
GENERAL INFORMATION	
Description	The intervention involved the realization of an orchard of ancient fruits in an urban park located in a peripheral area (Acque Chiare park), characterized by a low presence of vegetation and therefore not very usable in the summer season. This orchard is part of an integrated project of agriculture and urban forestry, in synergy with the policies of adaptation to climate change of the administration, which also provide for the creation of an urban garden and an experimental grove for the study of the role of trees in mitigating heat islands. The intervention consisted of the planting of 60 trees of 2nd size of 41 different varieties of ancient native fruits, which, in the past, were grown in the territory of Reggio Emilia, more resistant to disease and generally requiring less maintenance. The plants chosen for the orchard's realization are at least 3 years old and are able to bear fruit as early as the third year. The ancient fruits play an important role in the revival of sustainable agriculture, the conservation of biodiversity, positively influencing climate change. Ancient plants, more resistant and plastic, survive for many years to climatic and parasitic adversities thanks to some of their characteristics: - high resistance to water and thermal stress such as cold, heat waves, summer droughts; - high efficiency in the use of water in the soil; - high efficiency in the absorption and use of reduced but balanced nutritional supplies; - high resistance to diseases; - low need for phytosanitary treatments. The 60 plants are equipped with an irrigation system fed by a well. The orchard is accompanied by a legend with information and explanatory infographics.
Action typology	gardens – orchards; tree planting
Start	January 2018
End	December 2018
Typology of hazard addressed	Bioclimatic discomfort in ecosystems Bioclimatic discomfort in the population and health
Budget e/o expenses	Total cost: 9000 euro
Sqm of green areas	2000
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	60
Sqm of permeable surfaces	-
Sqm of water squares	-
surfaces with a better albedo	-
n. of new shrubbery	0
Total area of intervention	2000 m2

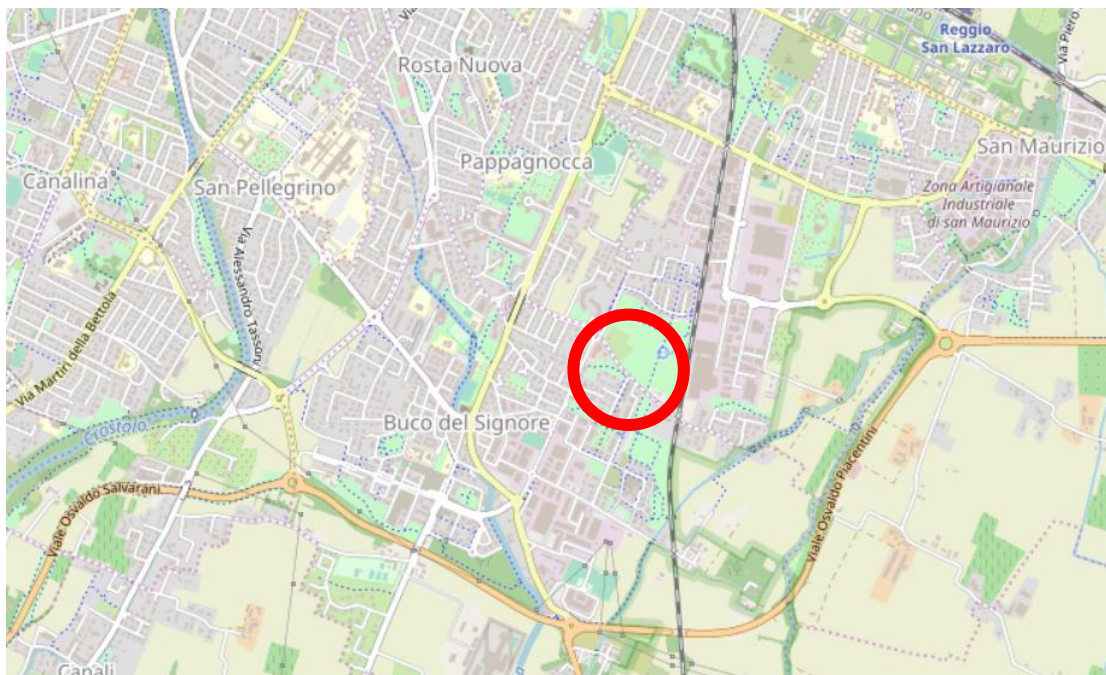
Deliverable C7.1: Implementation and evaluation of adaptation measures at the Reggio Emilia, Strovolos and Lakatamia municipalities

Additional information	Reference person: Giampaolo Santangelo
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LINK

<http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESDocumentID/DD0AB1968EAF8258C12582980031C5F9?ope ndocument>

Location



The project of the Grove, garden and orchard



After the action implementation

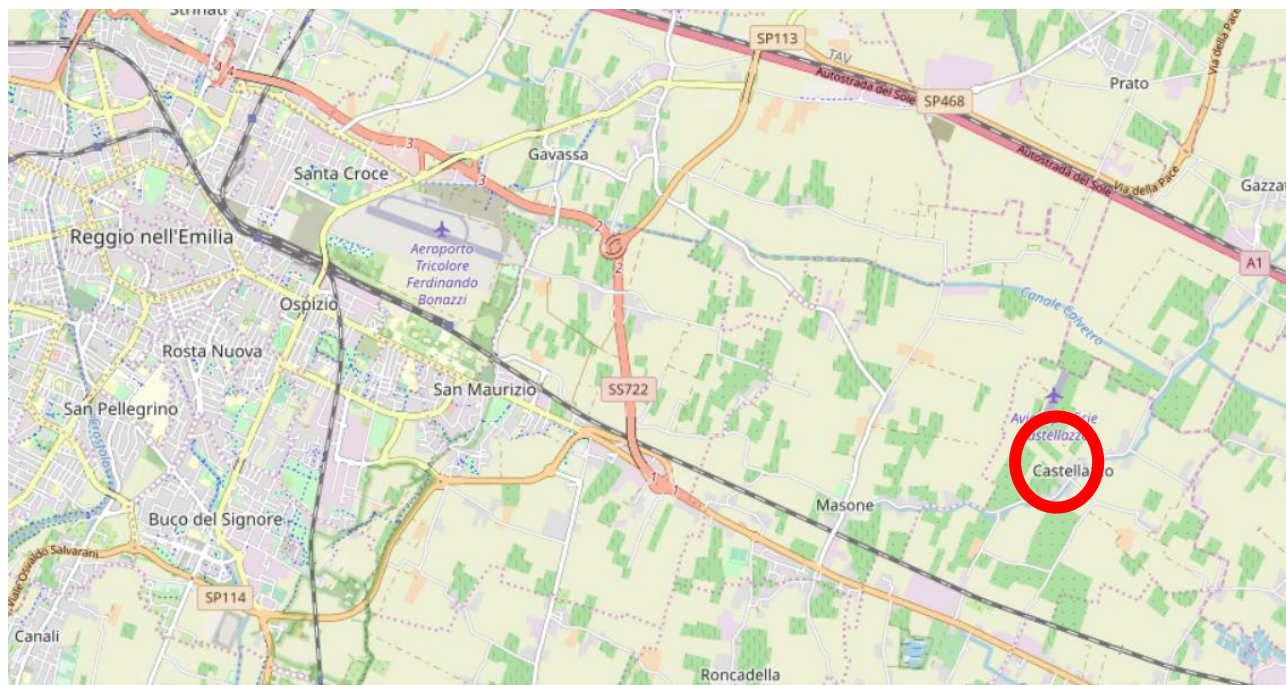


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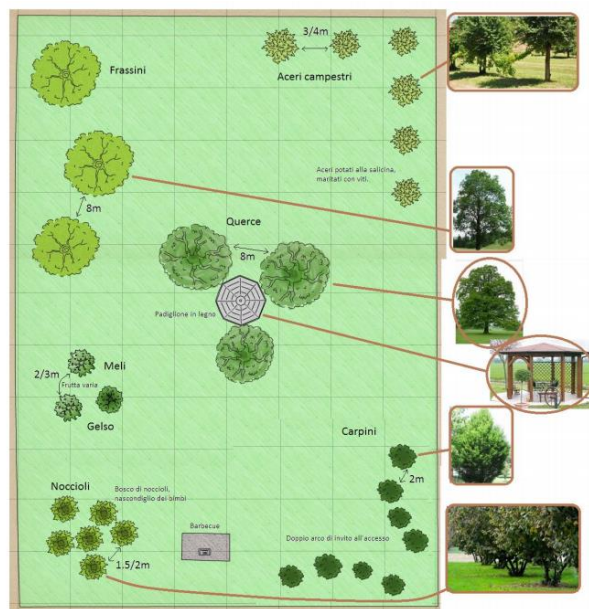
Orchard park at Villa Castellazzo

GENERAL INFORMATION	
Description	The idea of an orchard park at Villa Castellazzo was born two and a half years ago, thanks to the interest of 'I Care Castellazzo', a group of residents who, voluntarily, take care of their village by organizing moments of meeting and socializing for children and families and taking action in the care of the spaces and the greenery. The project was promoted by 'I care Castellazzo' and the Municipality of Reggio Emilia within the framework of the Citizenship Agreement of Masone, Marmirolo, Castellazzo and Roncadella. The realization of the project was made possible thanks to the contribution of the Municipality of Reggio Emilia, which provided the trees and financed the purchase of furniture. In detail, three ash trees, eight hornbeams and six country maples have been installed in the park, as well as a number of fruit trees - six hazelnuts, one mulberry tree and two apple trees - that can be used by the entire community, which uses the food forest and food garden model, which provides for low-maintenance multifunctional cultivation according to the forest ecosystem model. Fruit plants and walnuts, wood plants, vegetables, aromas, flowers, medicinal herbs, textile fibres, honey plants and much more are grown here, in harmony with the needs of man and nature. It is a production system resilient to climate change that reduces dependence on fossil fuels and brings carbon back to the soil (reduction of the greenhouse effect), reduces water consumption (generates rainfall, collects moisture and recharges the underground aquifers; when mature it does not require irrigation) and mitigates soil and environmental temperatures (both in winter and summer). The project of the orchard park has provided for low costs, coming from the participants in the course for the creation of this park food forest and food garden and for the purchase of seedlings and seeds.
Action typology	gardens - orchards tree planting measures for water saving
Start	2015
End	2016
Typology of hazard addressed	Bioclimatic discomfort in ecosystems Water availability reduction
Budget e/o expenses	No Municipal costs
Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	26
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery	0
Total area of intervention	1628 m2
Additional information	Reference person: Giampaolo Santangelo. Location : Castellazzo –Zona Est

Location



Project and status after the action implementation



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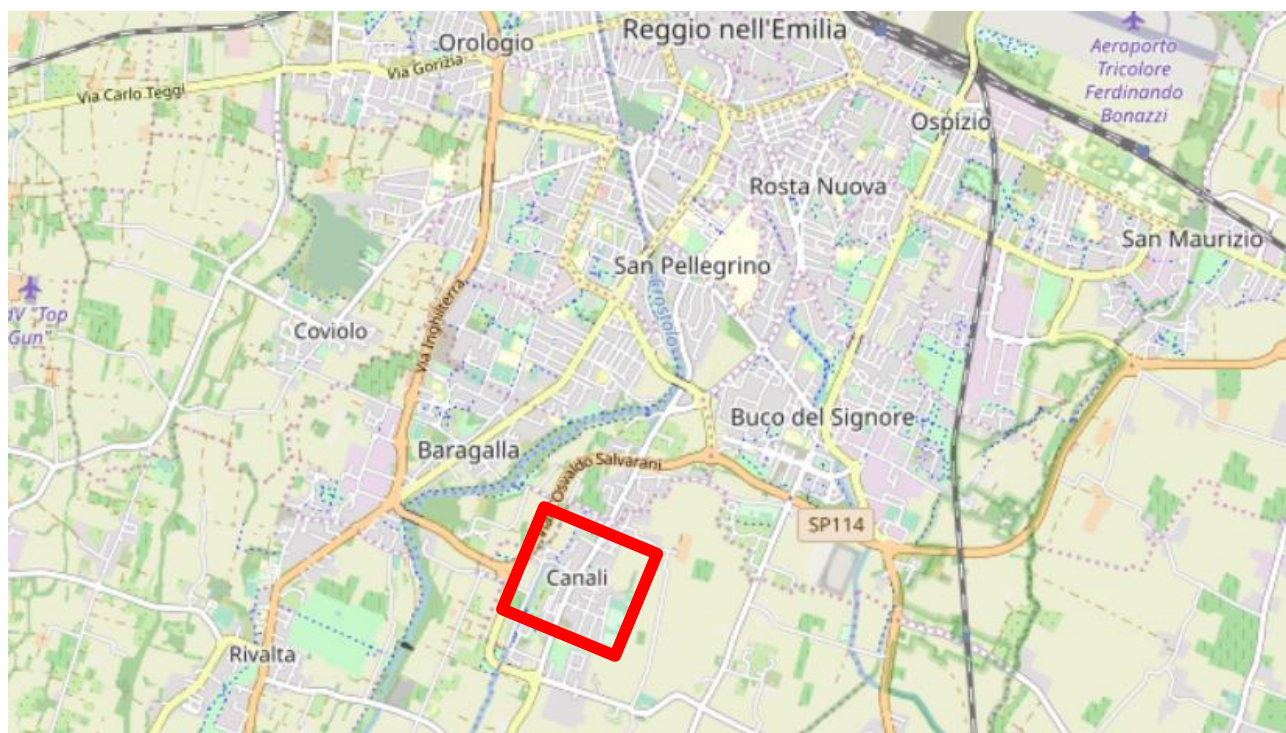
<i>Parco Commestibile di Canali</i>	
GENERAL INFORMATION	
Description	The “Parco Commestibile di Canali” project aims to validate a model of diversified farm activity, replicable in other contexts of the region, that reconstructs the natural rural vocation of the peri-urban territory by restoring the rows of trees among the herbaceous crops and that practices an efficient management of water resources, fertilizers and pesticides. Specifically, on a plot of almost one hectare, the project provides for the planting of more than 70 mulberry trees of different varieties, arranged in three rows with the aim of reconstructing the traditional agricultural landscape on a small scale and increasing biodiversity: among the rows of mulberry trees, different vegetable species are cultivated with methods with low environmental impact, encouraging as far as possible manual operations.
Action typology	gardens - orchards tree planting
Start	2016
End	End of 2017
Typology of hazard addressed	Bioclimatic discomfort in ecosystems Bioclimatic discomfort in population and health
Budget e/o expenses	Project presented by a group of lead partners CRPA and financed by POR FESR funds. The Municipality has made available the land owned by it
Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	70
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	24.458
Additional information	Reference person: Annalisa Sansone. Location : Canali –Zona Sud

LINK

<http://parcocommestibile.crpa.it/>

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Location



Project



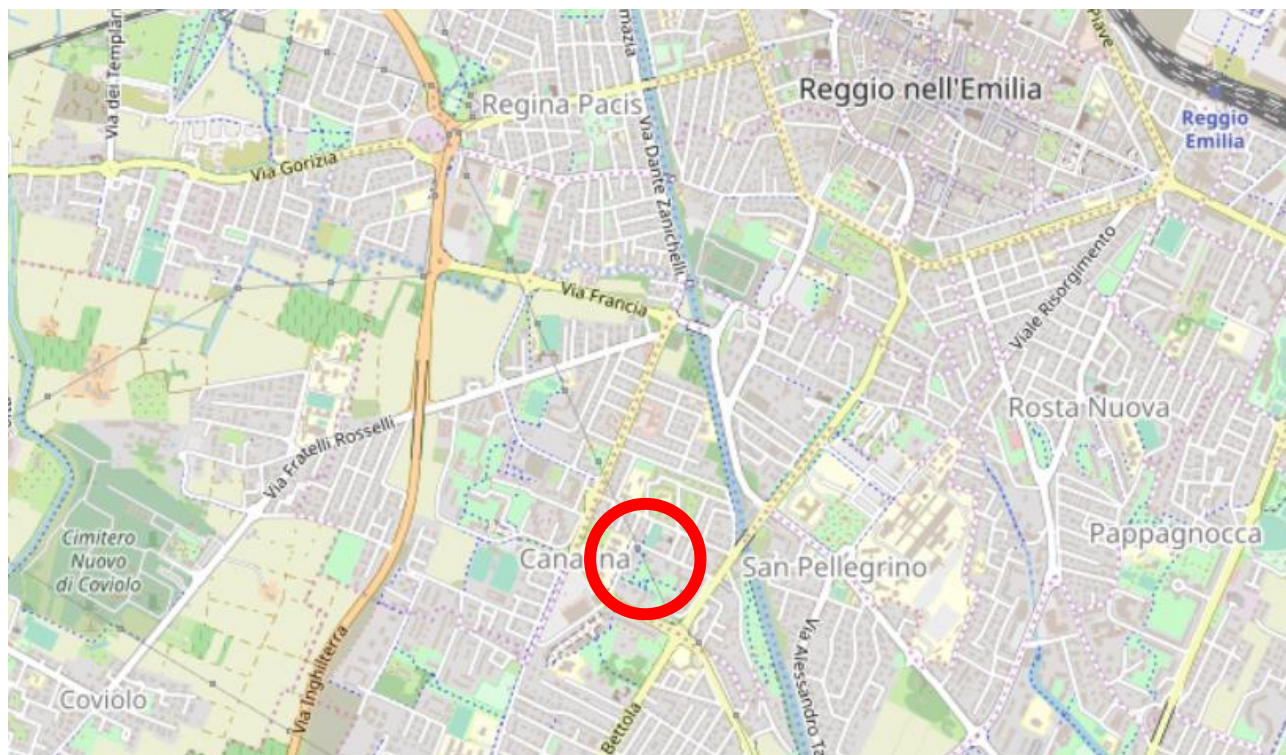
1.1.4 GREEN ROOFS

<i>Green Roof on the San Pellegrino Library</i>	
GENERAL INFORMATION	
Description	The new library of San Pellegrino has been realized in the widening of the rooms of the old library of the district. The building, built in energy class B, has a flat roof, which since 2016 has caused problems with rainwater infiltration. In 2017 it was also decided to match the maintenance of the roof with a project for its use, also starting a path of co-design ("Future - gardens in the clouds"), rethinking this space as a usable green roof. From the path of co-design were born 4 green roof design ideas that will be subject to verification and technical selection by the Engineering Services, before proceeding to the design and execution of the works. The design ideas identify almost all parts of the roof to be destined to green (mainly in caissons), new green flooring (eg. wood), perimeter walls or pergolas shielding and also interventions to vertical green on the south facade or new plantings. In the project phase, the Environment Service and the IUAV have contributed to define more specific criteria for adaptation to climate change.
Action typology	Green roofs
Start	In evaluation
End	
Typology of hazard addressed	Bioclimatic discomfort in population and health Heatwaves and health Water availability reduction
Budget e/o expenses	Indicative project cost: 70.000 € in 2019 (indicative data)
Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	290
n. of planted trees	
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	145
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	290
Additional information	

LINK

[http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESIdDoc/48E4778240545CDFC12580910057C3FF/\\$file/Report%20-%20Futura.pdf](http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESIdDoc/48E4778240545CDFC12580910057C3FF/$file/Report%20-%20Futura.pdf)

Location



Before the action implementation



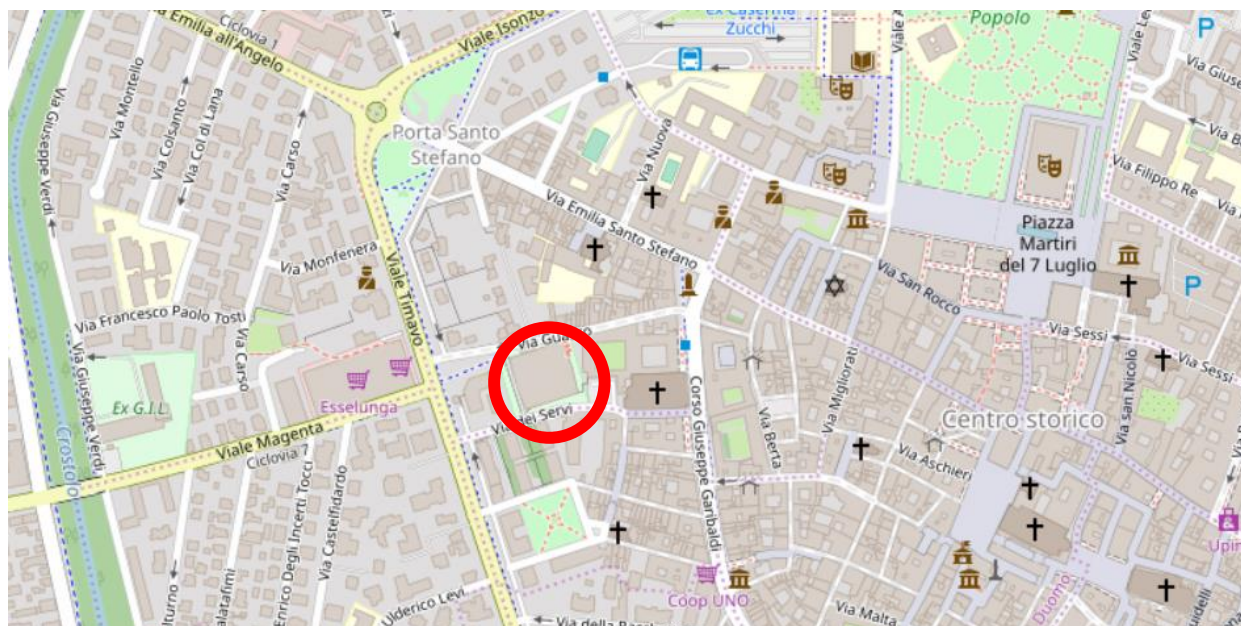
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Green Roof on the Sport Building

GENERAL INFORMATION	
Description	<p>The project, under evaluation, would provide for the construction of a green roof with briophytes on the current sports hall located in the historic center of Reggio Emilia adjacent to the boulevards of the city bypass with high vehicular traffic.</p> <p>The sports hall is a building of the '60s subject a few years ago to a partial renovation that has not, however, invested the old roof with bituminous sheath of over 3,200 square meters on which would be built the green roof.</p> <p>The proposal to use briophytes for the construction of the green roof, developed in agreement with the University of Freiburg, meets some of the technical and structural requirements related to the roof renovation project (to create a covering to protect the bituminous membrane from atmospheric events; to use materials that do not have an impact from the point of view of weight) and at the same time implement a highly innovative project from the environmental point of view for the use of a moss with the capacity to withstand sudden changes in temperature and absorption of air pollutants, in particular polycyclic aromatic hydrocarbons, heavy metals and fine dust. The construction of large green roof areas in the historic center would also respond to the need to mitigate the heat islands and at the same time could have a function of communication and awareness of the possibility of creating green roofs in our city.</p>
Action typology	Green roofs
Start	In evaluation
End	
Typology of hazard addressed	Bioclimatic discomfort in population and health Heatwaves and health
Budget e/o expenses	
Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	3.200
n. of planted trees	0
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	145
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	3.200
Additional information	Reference person: Ermes Torreggiani , Servizio Ingegneria

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Location



Before the action implementation



1.1.5 PLANNING MEASURES

<i>Index of reduction of building impact RIE</i>	
GENERAL INFORMATION	
Description	<p>In the variant to the RUE (Urban Building Regulation) of the Municipality of Reggio Emilia, adopted in 2018, was introduced in experimental form the R.I.E. index (Reduction of Building Impact) mainly for new construction or renovation of residential buildings. The RIE is an index aimed at reducing the building impact of building interventions, both in terms of permeability and for green elements.</p> <p>The RIE is the result of the experience of the Municipality of Bolzano, which was the first to introduce, 10 years ago, the obligation to respect certain intervals in the value of this index in all building interventions.</p> <p>The R.I.E. expresses a report where, with reference to a given area under evaluation, the numerator is inserted to the green surfaces and the denominator to the surfaces not to green. The surfaces inserted, suitably multiplied by the flow coefficient or by the reciprocal of the same and with the addition, to the numerator, of the trees present (expressed in equivalent surfaces), contribute to giving back a number with a range of variation between 0 and 10. The value 0 corresponds to a completely sealed surface and the value 10 to a completely permeable surface.</p> <p>The RIE therefore imposes well-defined standards for soil permeability and outflows, encouraging green roofing and alberature.</p> <p>The formula of the RIE is as follows:</p> $RIE = \frac{\sum_{i=1}^n S_{v_i} \frac{1}{\psi_i} + (Se)}{\sum_{i=1}^n S_{v_i} + \sum_{j=1}^m S_{i_j} \psi_i}$ <p> <i>S_{v_i}</i> = i-esima superficie trattata a verde <i>S_{i_j}</i> = j-esima superficie non trattata a verde <i>ψ_i</i> = i-esimo coefficiente di deflusso di superficie trattata a verde <i>ψ_j</i> = j-esimo coefficiente di deflusso di superficie non trattata a verde <i>Se</i> = Superfici equivalenti alberature </p> <p>The following values are required for the granting of a building permit or housing permit in the Municipality of Bolzano: - RIE greater than or equal to 1.50 in the case of buildings in a production area (e.g. warehouses, production plants...) - RIE greater than or equal to 4.00 in the case of residential areas (e.g. condominiums, but also schools, churches...). The RIE, experimentally introduced in the variant adopted by the Municipality of Reggio Emilia, mainly relates to residential areas.</p> <ul style="list-style-type: none"> - RIE ≥ 4,00 for residential use, small business and car parks in structure - RIE ≥ 2,50 for flush wards <p>In analogy with what has already been done by Bolzano, also for the calculation of the RIE of the Municipality of Reggio Emilia, a special calculation program has been prepared that allows you to easily enter the starting data and data of the different design solutions in order to verify the achievement of the required RIE values.</p>
Action typology	Planning measure
Start	RUE adoption with introduction of the RIE - spring 2018
End	Approval of the RUE expected in Autumn 2019
Typology of hazard addressed	heat waves and health floods/floods reduction of water availability
Budget e/o expenses	

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Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	0
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	0
Additional information	Reference person: Francesca Bosonetto – Servizio Rigenerazione Urbana

LINK

<https://rigenerazione-strumenti.comune.re.it/strumenti-di-pianificazione/varianti-agli-strumenti-urbanistici-vigenti-psc-rue-e-poc/adozione-variante-rue/>
[https://www.comune.re.it/download/pscre/8-VARIANTI/17 RUE Tessuti/Adozione/A6 Riduzione Impatto Edilizio RIE.pdf](https://www.comune.re.it/download/pscre/8-VARIANTI/17_RUE_Tessuti/Adozione/A6_Riduzione_Impatto_Edilizio_RIE.pdf)

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Analysis to address new planting works and guidelines for adaptation and planting

GENERAL INFORMATION	
Description	<p>In consideration of the planning commitment of the Body relating to the increase of the arboreal heritage in the city already present in the 2014-2019 legislature, the Environment Service has carried out since the autumn of 2017 an analysis of the territory aimed at selecting areas of municipal property on which to make new plantings. The objective was to include the planting activities within a single program aimed at beginning to respond to the critical issues of the territory in terms of heat islands reported by citizens and that were already emerging within the project Life UrbanProof. To do this, the report that reports the identification of the areas also contains some operational guidelines on how to plant them, so that they are able in the future to create compact wooded areas that can better counteract the heat islands and make more usable urban parks. In 2019, the areas identified were the subject of a further evaluation aimed at establishing the priority of intervention with respect to the criticality of the territory emerged within the UrbanProof project.</p> <p>These considerations are now merging into a new urban forestation strategy to combat heat islands, which the new administration is defining under the new mandate 2019-2023. To implement this Strategy will be prepared in autumn 2019 an expression of interest aimed at identifying private stakeholders who want to collaborate in urban forestry interventions by co-financing the various projects.</p>
Action typology	Planning measure
Start	September 2017
End	December 2019
Typology of hazard addressed	<p>Bioclimatic discomfort on ecosystems</p> <p>Bioclimatic discomfort on population and health</p>
Budget e/o expenses	No costs foreseen
Sqm of green areas	
sqm of draining pavements	0
Sqm of green roofs	0
n. of planted trees	0
Sqm of permeable surfaces	
Sqm of water squares	0
Sqm of surfaces with a better albedo	0
n. of new shrubbery (if available)	0
Total area of intervention (sqm)	
Additional information	Reference person: Susanna Ferrari and Giampaolo Santangelo

1.1.6 EXPERIMENTAL STUDIES

<i>Experimental study on the beneficial effects of parks on microclimate and air quality</i>	
GENERAL INFORMATION	
Description	The project consists in the experimental study of the differences in microclimate and air quality that occur in the urban environment in three different conditions for the presence of greenery and traffic: in a park (place with high shading), in a pedestrian square (in conditions of high sun exposure) and along a road to high traffic (average shading). The main objective is to study the effect of urban planting and green areas in reducing urban heat islands and on the concentration of pollutants such as ozone and nitrogen oxide. The experimental study was carried out by placing two mobile air quality control units in the city centre of Reggio Emilia during the month of July 2018 and analyzing the recorded data, also in comparison with the information simultaneously collected by the two fixed control units present on the territory. In particular, the monitoring stations are located in four different points of the city with different characteristics in terms of arboreal heritage and traffic: the Parco del Popolo (urban park in conditions of wide shading), the Campus del San Lazzaro (urban park in conditions of high exposure to the sun), Piazza della Vittoria (urbanized pedestrian area in conditions of high exposure to the sun) and Viale Timavo (urban traffic area in conditions of high exposure to the sun).
Action typology	Other
Start	July 2018
End	January 2019
Typology of hazard addressed	Heatwaves and health
Budget e/o expenses	unquantifiable
Sqm of green areas	
sqm of draining pavements	-
Sqm of green roofs	-
n. of planted trees	-
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	-
Additional information	Reference person: Luca Torreggiani ARPAE

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<i>Experimental grove "heat islands"</i>	
GENERAL INFORMATION	
Description	The intervention consists in the creation of an experimental grove (in collaboration with the University of Modena and Reggio Emilia) to study the growth of species and planting criteria most suitable for climate mitigation. The more general objective is to carry out plantings that contribute to mitigating heat islands, making urban parks more usable in the summer months. The experimental grove is also part of an integrated project of agriculture and urban forestry, in synergy with the policies of adaptation to climate change, which also includes the creation of an urban garden and an orchard of ancient fruits. The experimental grove, located in the Park of Clear Waters, consists of 108 new trees of four different species - Bagolaro, White Mulberry, Wild Linden, Manna ash - planted with a sixth planting "narrow", taking into account the following indications and characteristics of the plants: - species with high evapotranspiration and with structural solidity of the canopy - creation of continuous plant masses (forest effect) ensuring continuous shading compact - species little hydro-needed and/or able to adapt in conditions of water shortage - species with rapid growth and low maintenance. The intervention area has been divided into four quadrants, in each of which rows of plants of only one species have been planted. In these quadrants the following parameters related to the mitigation effect of the microclimate will be controlled over time: light intensity (shading effect), air temperature, soil temperature, relative humidity of the air. For information purposes, a lectern explaining the project is located in the area of the grove.
Action typology	Trees planting
Start	April 2018
End	May 2018
Typology of hazard addressed	Bioclimatic discomfort in the population and health heat waves and health deterioration of air quality
Budget e/o expenses	Cost about 700 € (including only planting and purchase of lime trees). All other plants have been supplied by the Emilia Romagna Region. The costs of the irrigation system have already been included in the orchard project as the system serves both of these purposes
Sqm of green areas	3.700
sqm of draining pavements	-
Sqm of green roofs	-
n. of planted trees	108
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	3.700
Additional information	Reference person: Susanna Ferrari Bergomi

1.1.7 FLOODING – DROUGHT

<i>Renovation of municipal kennels</i>	
GENERAL INFORMATION	
Description	<p>The area on which the municipal kennel stands has been subject in recent years to several floods in conjunction with intense rainfall events, because of the general difficulty of the area of drainage of water. These episodes, which have intensified in recent years, have led to emergency interventions for the flooding of areas intended for dog beds.</p> <p>In addition, the soils on which the kennel structures are located are subject to cyclical swelling due to the presence of water, causing injuries in the masonry in concrete blocks. In order to overcome these critical issues, it was decided to intervene with a project aimed at raising the height of the floor of at least 20 cm. compared to that of the existing boxes. To this end, a concrete slab was created that was firmly connected to the existing walls in order to achieve greater resistance to periodic movements of the ground. The water collection system has been revised to try to facilitate the drainage of water in the cockpit of the courtyard area.</p>
Action typology	Flooding measure
Start	March 2017
End	April 2017
Typology of hazard addressed	flooding
Budget e/o expenses	Contracted works € 35,387.87 + VAT (of which 28,287.87 + VAT relating to the renovation of the box that provides for an increase in the floor level)
Sqm of green areas	-
sqm of draining pavements	-
Sqm of green roofs	-
n. of planted trees	-
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	895
Additional information	Reference person: Giorgia Lombardini

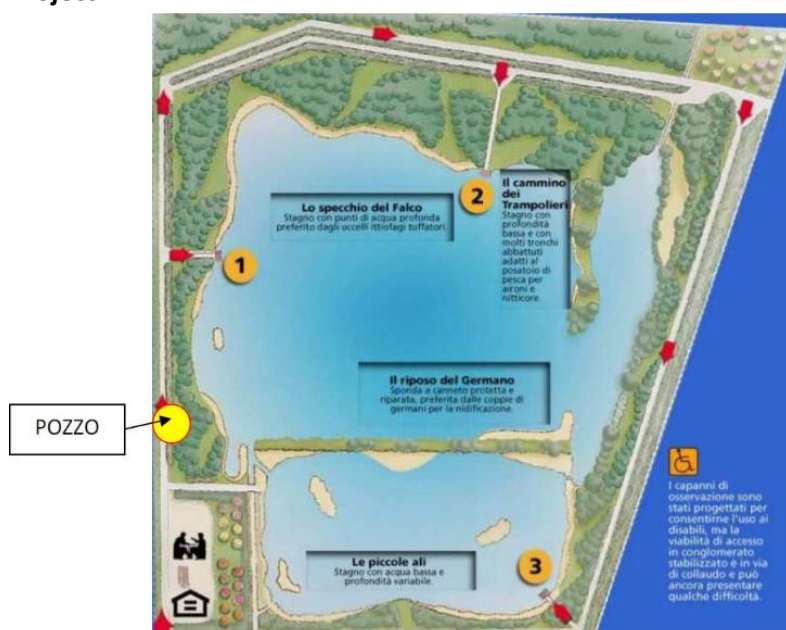
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"Oasi di Marmirolo" Well

GENERAL INFORMATION	
Description	The Marmirolo Oasis, owned by the Municipal Administration and covering an area of 8.00 hectares, is located in the eastern part of the Municipality of Reggio Emilia. The Oasis is part of a SCI Site IT4030021 "Rio Rodano, Fontanili di Fogliano e Ariolo and Oasi di Marmirolo" and is also an oasis of protection of wildlife under the R.L. 8/94 and Ecological Rebalancing Area (A.R.E.) under L.R. 6/2005. The change in climatic conditions with hot summers has led to the need to improve the quality of water in the quarry basin, also, from analysis, it was found that in summer the quality of the water itself decreases and increases the organic matter present, with repercussions on the fauna, including species of Community interest. Therefore, it is considered that the introduction of more oxygenated and fresher waters could improve the situation. The intervention consists therefore in the realization of a new well inside the Marmirolo Oasis in order to allow a sufficient exchange of the waters of the two present basins, that in the last years has become more and more problematic because of the reduction of the underground contributions from superficial stratum and of the difficulties of contributions from the drainage channels, both consequent to the climatic changes.
Action typology	Other
Start	Spring 2019
End	Spring 2019
Typology of hazard addressed	Bioclimatic discomfort in ecosystems reduction of water availability
Budget e/o expenses	19,345.00 euro total of which € 12,170.00 + VAT for the construction of the well
Sqm of green areas	-
sqm of draining pavements	-
Sqm of green roofs	-
n. of planted trees	-
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	87.343
Additional information	Reference person: Cristina Bondavalli

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Project



1.1.8 EDUCATIONAL PROJECTS

<i>Weed species guide - Educational Project</i>	
GENERAL INFORMATION	
Description	<p>In the school year 2017-2018, a series of free public meetings was held for children and adults in primary and secondary schools on the correct behaviour to adopt with regard to weed species, which are increasingly widespread and present in our reality.</p> <p>The educational project was born from the awareness that trade with faraway countries and climate change are also changing the local fauna and we are witnessing a sharp increase in non-native species (not originating in our area, but imported) or an increase in the species originating in our territory. The increase in knowledge about individual species and the appropriate behaviour to adopt is also part of the actions of adaptation to climate change.</p> <p>The project involved the creation of a specific manual to learn about the various weed species and the behaviour to adopt. This manual, which also contains references to the UrbanProof project, is also used as information material by the office that deals with infesting species.</p>
Action typology	Education -Information
Start	January 2018
End	May 2018
Typology of hazard addressed	increase in weed species
Budget e/o expenses	8.710 euro
Sqm of green areas	-
sqm of draining pavements	-

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Sqm of green roofs	-
n. of planted trees	-
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	-
Additional information	Reference person: Lisa Baricchi

LINK

<http://www.municipio.re.it/retecivica/urp/retecivi.nsf/PESDocumentID/DB93BEA8CB70C020C1258243004306E9?openDocument&FROM=Cmpltrmgntc>

<i>Environmental Education Project - Parco Nilde Iotti</i>	
GENERAL INFORMATION	
Description	<p>The environmental education project "Living and knowing the Iotti Nildes Park" was born within an urban laboratory dedicated to the Iotti Nildes Park (conducted by the district architects of the Municipality of Reggio Emilia as part of the QUA project), aimed at the redevelopment of this urban park. The environmental education project, coordinated by the Environmental Education Centre of the Municipality of Reggio Emilia, aims to make citizens and pupils of the schools involved understand the importance of the park ecosystem not only for its naturalistic aspects but also for its beneficial effects in terms of temperature regulation and mitigation of heat islands.</p> <p>The project, which lasted two years, involved the students of the Fontanesi middle school (about 90 children) in a first phase of frontal classroom lessons conducted by experts and environmental associations that addressed the environmental issues related to the park, describing its natural features, flora and fauna. In the second cycle of the project, instead, were conducted multimedia workshops in the classroom to conduct interviews with the support of an expert, in order to create material to be uploaded to the dedicated website and qr tails that will be placed in the park benches and specifically in 8 points. In the park there are also notice boards describing the park and the project carried out, indicating where the "talking benches" are located, which explain, to those who want to know the park, its environmental and natural characteristics.</p> <p>The project has seen the collaboration of Officina educativa, Legambiente, WWF, LIPU, ASP Villa Le Magnolie, Centro sociale La Mirandola and GGEV.</p> <p>During the course of the project, 45 new trees were planted</p>
Action typology	education - information tree planting
Start	2016
End	2019
Typology of hazard addressed	Bioclimatic discomfort in the population and health heat waves and health
Budget e/o expenses	6000 euro

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Sqm of green areas	-
sqm of draining pavements	-
Sqm of green roofs	-
n. of planted trees	45
Sqm of permeable surfaces	-
Sqm of water squares	-
Sqm of surfaces with a better albedo	-
n. of new shrubbery (if available)	-
Total area of intervention (sqm)	77.114
Additional information	Reference person: Giampaolo Santangelo – Servio Ambiente

2. STROVOLOS Municipality (Cyprus)

2.1 Project objectives and measures typologies

<i>An innovative adaptive park area</i>	
GENERAL INFORMATION	
Brief description	The green area infrastructure in Strovolos is 1909 square meters and has a perimeter of 245 meters. The plants used will be harmonized in the natural environment of the area. The plants selected have reduced irrigation needs and drought-resistant water requirements. The planting techniques that will be used aim at water retention at the level of plant rhizosphere. Construction of a rainwater collection system as well as the surplus of irrigation water and its reuse will be created in one part of the area. All pathways coatings will be covered with water-permeable materials. For the irrigation needs of the plot a drilling has been completed and the water was analyzed positive for suitability for irrigation purposes. The plot includes a small green corner for recycling so materials gathered can be reused for educational purposes. The creation of the plot aims to contribute in student on the field learning as it will be promoted for visits from schools. Also the creation of a green roof in a shelter type construction is included in the master plan but it will be promoted later on thus to the high budget cost. The uses that will be included in the green space will be proportional to the available budget and further constructions will be promoted at a later stage.
Type of action	<i>Implementation of green area infrastructure</i>
(Expected) starting date	<i>In progress</i>
(Expected) closing date	<i>30/10/2019</i>
Typology of "hazard" to which the action responds	<i>Bioclimatic, heat waves, atmospheric pollution, flooding water pollution (order them from the most to the less addressed)</i>
Budget and/or costs	<i>€38,883 is the total budget of the action C7 to be implemented.</i>
Square meters of green areas	<i>1909 m²</i>
Square meters of draining pavements	<i>0 m²</i>
Square meters of green roof	<i>0 m²</i>
Number of planted trees	<i>About 95</i>
Square meters of permeable surfaces	<i>150 m²</i>

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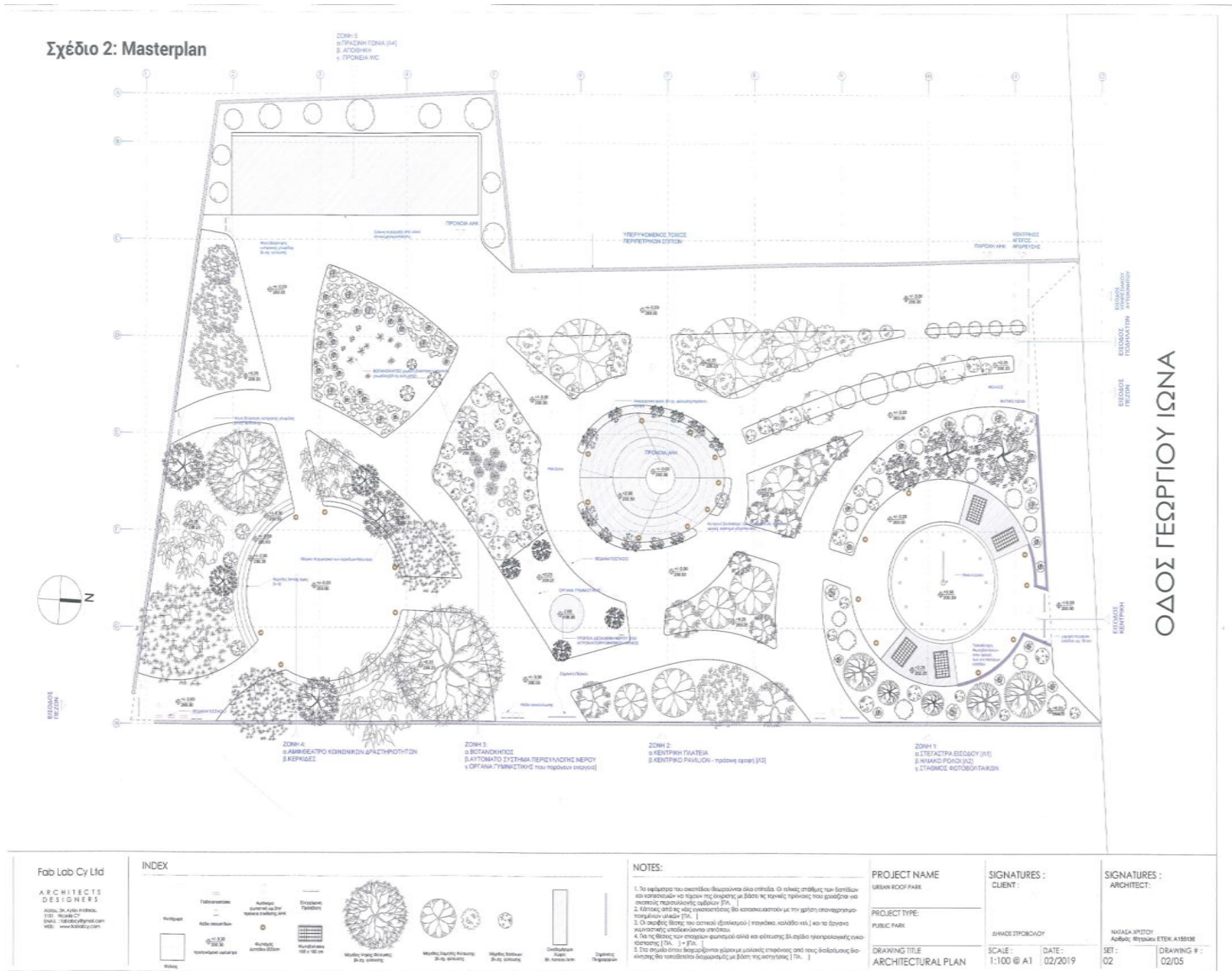
Square meters of water squares	<i>0 m²</i>
Square meters of surfaces with a better albedo	<i>1000 m² (areas covered by trees)</i>
Number of new shrubbery (if available)	<i>About 550</i>
Total Area of intervention (m2)	<i>1909 m²</i>
Notes/ additional information	<i>The budget of the project (C7 action) will not be enough for the implementation of the whole landscape study as it's produced. The municipality will continue adding figures of the study after the project is finished in order to complete the landscape study.</i>

In the framework of the implementation of selected green and soft adaptation measures in Strovolos Municipality, the referent local Administration identified in the creation of a sustainable and innovative green area the most interesting measure.

The selection of the measure implemented was based on the results of the vulnerability and adaptation assessment performed in actions C3 and C4 (refer to Deliverables C.3 and C.4).

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Project



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Project details

Central PAVILLION is an innovative constructions with green roofs and use of recycled materials.



The other section of the are composed of:

- Botanical garden with drought reistant plants
- Plant techniques for enhancing water retention
- Rainwater collection system
- Use of adbvanced irrigation systems
- Use of permeable materials
- Fitness equipment producing energy



Fig X

3. Lakatamia Municipality (Cyprus)

3.1 Project objectives and measures typologies

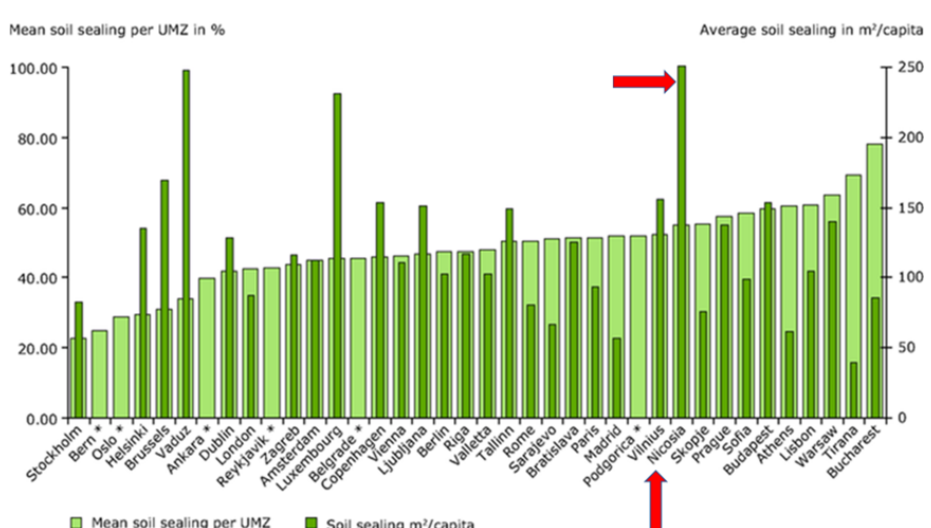
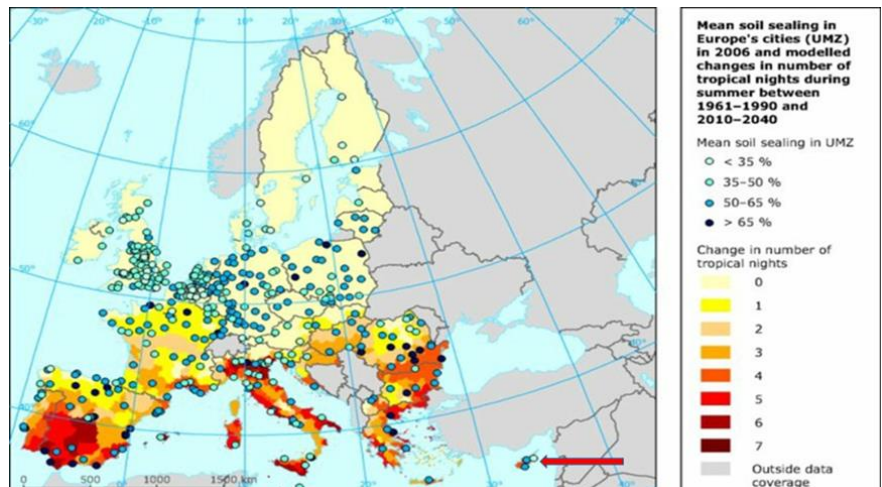
Melina Mencouri roundabout	
GENERAL INFORMATION	
Brief description	<p>The Municipality of Lakatamia, under the Life project, will upgrade the roundabout of Melina Merkouri Avenue. A dominant element in the design of the project is the use of permeable materials such as permeable concrete. In addition, there will be the element of collection and use of rain water. Cyprus, according to the European Environmental Agency, holds a high position on soil sealing in the European Union. Indicative of the current situation are Figures 1 and 2.</p>
	 <p>Figure 1. Mean soil sealing in European Capitals (UMZ – Urban Morphological Zone) and soil sealing per inhabitant (EEA, 2011).</p> 

Figure 2. *Degree of mean soil sealing in Europe's cities (UMZ – Urban Morphological Zone), in 2006 and modelled change in number of tropical nights ($T_{min} > 20^{\circ}C$) during summer between 1961-1990 and 2010-2040 indicating higher risks for heat waves (EEA, 2011).*

Global rapid urbanization resulted in considerable soil sealing. Paddy soils of the highest quality were the most vulnerable to be sealed. Quantitative changes of soil landscapes under urbanization were identified (Xiao et. al, 2013). Sealing has a strong impact on soils. The degree of sealing is related to the type of land use and to the population density. Sealed areas are still increasing, and it is often the most fertile soils which are sealed (Burghardt, 2006). Artificial soil sealing in urban areas has attracted increasing attention because of its potential hazard to urban ecosystem (Długosz and Charzyński, 2015).

The sealing of soils by impervious materials is, normally, detrimental to its ecological functions. Exchanges of energy, water and gases are restricted or hampered and an increasing pressure is being exerted on adjacent, non-sealed areas. The negative effects span from loss of plant production and natural habitats to increased floods, pollution, and health risks and consequently higher social costs. In general, porosity, color, geometry of the materials used in the sealing of soils, the quality of sealed soil and aspect ratio of urban infrastructures are key aspects in preserving soil functions (Scalenghe and Marsan, 2009; Burghardt, 2006).

Covering soils with impervious materials has a significant impact on their properties and is essentially an irreversible process. In contrast to natural, open soils, sealed soils undergo a significant alteration of their physicochemical properties, and in turn, negatively influence microbial biomass and enzymatic activity. The artificial sealing in urban areas can significantly alter the soils by reducing their carbon and nitrogen content as well as microbial biomass and its activity compared with open soils (Długosz and Charzyński, 2015).

Beside the loss of fertile soils with a direct impact on food security, soil sealing modifies the hydrological cycle. This can cause an increased flooding risk, due to urban development in potential risk areas and to the increased volumes of runoff (Ungaro, Calzolari, Pistocchi and Malucelli, 2014). As a solution to the soil sealing, permeable concrete is presented as an alternative pavement material, which has an astonishing significance in the field of environmentally friendly pavement design because of its overall hydrological and environmentally beneficial aspects (Debnath and Sarkar, 2018).

The increasing use of pervious concrete as sustainable and environment-friendly paving materials is primarily owed to its ability to reduce pavement runoff (El-Hassan and Kianmehr, 2016). Pervious concrete typically has an infiltration rate far exceeding any expectation of precipitation rate (Tyner, Wright and Dobbs, 2009). In comparison to ordinary cement concrete, pervious is a more sustainable paving solution, offering a decrease in cost, heat island effect, and embodied energy, while also reducing carbon emissions by 54% (El-Hassan and Kianmehr, 2016).

This permeable pavement system allows storm water runoff to infiltrate through the pavement and percolate into the subdrainage system or directly into the subgrade soil. The permeable pavement system is gaining popularity in municipal applications across the United States (Nantasai and Nassiri, 2017). Concreting everywhere leads to

environmental issues such as reduction in recharge of rainwater into the ground hence constant fall of water table which degrades the quality of life.

The benefits of pervious concrete are: a) it reduces the storm water runoff, b) eliminates the need for detention ponds and other costly storm water management practices, c) replenishes the aquifers and water table, d) allows for more efficient land development, e) minimizes flash flooding and standing water f) prevents water and polluted water from entering into stream and g)mitigates surface runoff. Consequently, permeable concrete can be used to manage intense precipitation in pavements, walkways, driveways and parking lot (Ganpule and Pataskar, 2011).

As a result, it is necessary to present new ways to the public for soil sealing and the collection of rainwater for other uses such as irrigation purposes. The soil sealing by impermeable materials is, as a rule, detrimental to the ecological functions of the soil. The presentation of permeable concrete to the public, may be an example for use in both private and public spaces.

In the design of the roundabout, an important role is played by the presentation of the traditional way of irrigation, which in the past was widely used in the area. That is, the use of irrigation channels, tanks and wells, which is also the emblem of the Municipality. Consequently, an irrigation channel, reservoir and an artificial well will be constructed at the roundabout which will operate with photovoltaic panels. The artificial traditional irrigation system will pass through the plantings.

The water needs of the irrigation channel and the well will be covered by the collection of rainwater through the rainwater collection channel. From there it will be stored in an underground tank. It must be noted that in cases where additional water is needed for irrigation only recycled tertiary treatment water will be used, for which there is a pipeline at the roundabout. This will be an example of safe use of recycled water to the public.

For the plantations of the roundabout will be used endemic plants and trees of the area. A presentation will be made to the public on how to plant endemic trees and shrubs. Soil cover with low shrubs and ground cover plants reduces the requirements of larger trees in water. This way of planting is expected to be a good practice for the public to create private gardens with plants and ways that have lower water requirements.



Figure 3. Traditional way of irrigation in the area of Lakatamia

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	Figures 4 and 5 (below the table) show the position of the roundabout as it is today. Specifically, the roundabout is at the main point of the Municipality, where a significant percentage of the people of Lakatamia passes daily, as well as those who want to head south. Figure 6 shows the area as it was in 2005 and is indicative of the human intervention that has taken place.
Type of action	Trees planting draining pavements pavements with a better albedo Measures to reduce flooding
(Expected) starting date	August 2019
(Expected) closing date	November 2019
Typology of "hazard" to which the action respond	Heatwaves and health Floods
Budget and/or costs	€81,000 including VAT
Square meters of green areas	1400
Square meters of draining pavements	1300
Square meters of green roof	Not applicable
Number of planted trees	50
Square meters of permeable surfaces	1300
Square meters of water squares	70
Square meters of surfaces with a better albedo	1500
Number of new shrubbery (if available)	1500
Total Area of intervention (m2)	area 2800 m²
Notes/ additional information	1400

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In the framework of the implementation of selected green and soft adaptation measures in Lakatamia Municipality, the referent local Administration identified in the creation of a sustainable roundabout the most interesting measure.

The selection of the measure implemented was based on the results of the vulnerability and adaptation assessment performed in actions C3 and C4 (refer to Deliverables C.3 and C.4).

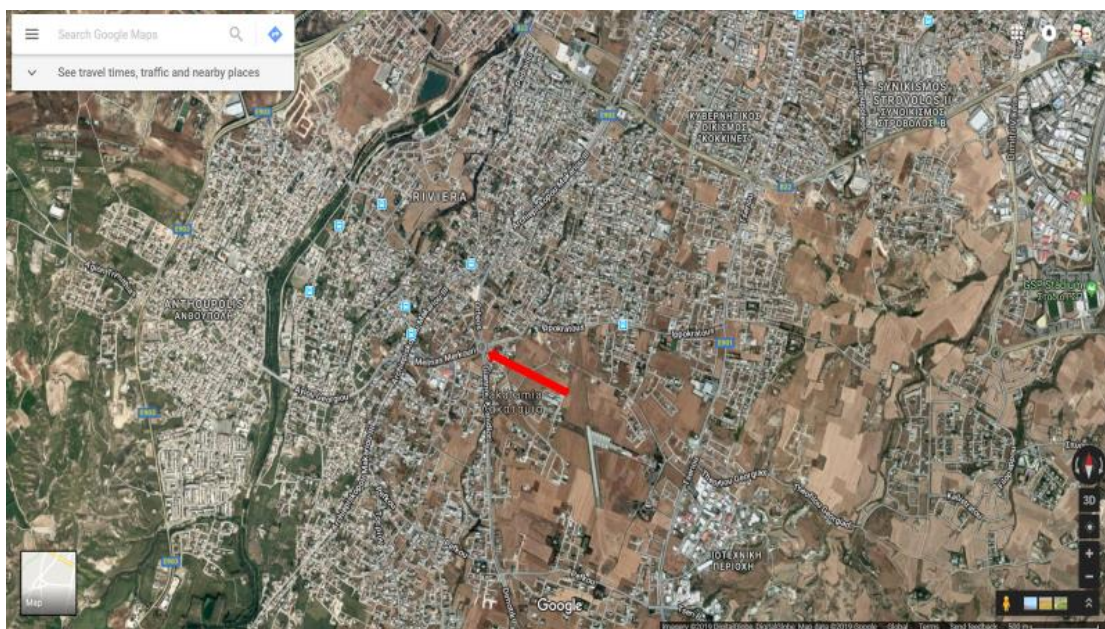


Figure 4. Location of the roundabout (Google Maps, 2019).

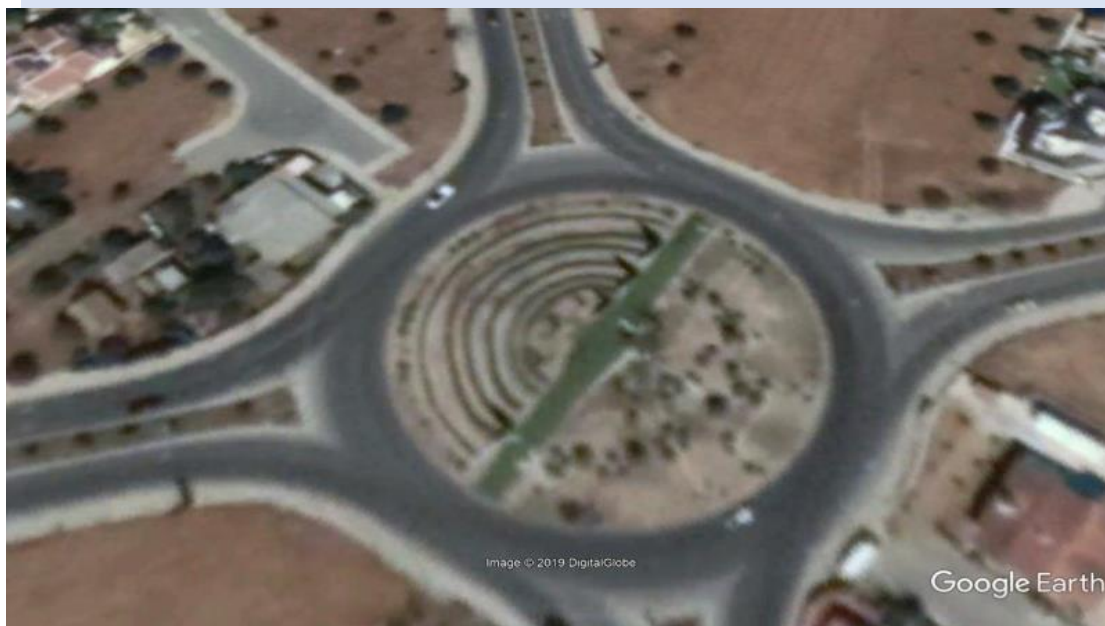


Figure 5. Picture of the roundabout as it is today (Google Earth, 2019a).



Figure 6. Picture of the site as it was in 2005 (Google Earth, 2019b).

The municipality has also called for public tenders to redesign the roundabout. Figure 7 shows the suggestion for the roundabout reconstruction by applying permeable concrete in various colors and shapes. There will also be compositions with stones that will be permeable. Figure 8 shows the detail of the construction of the artificial well.

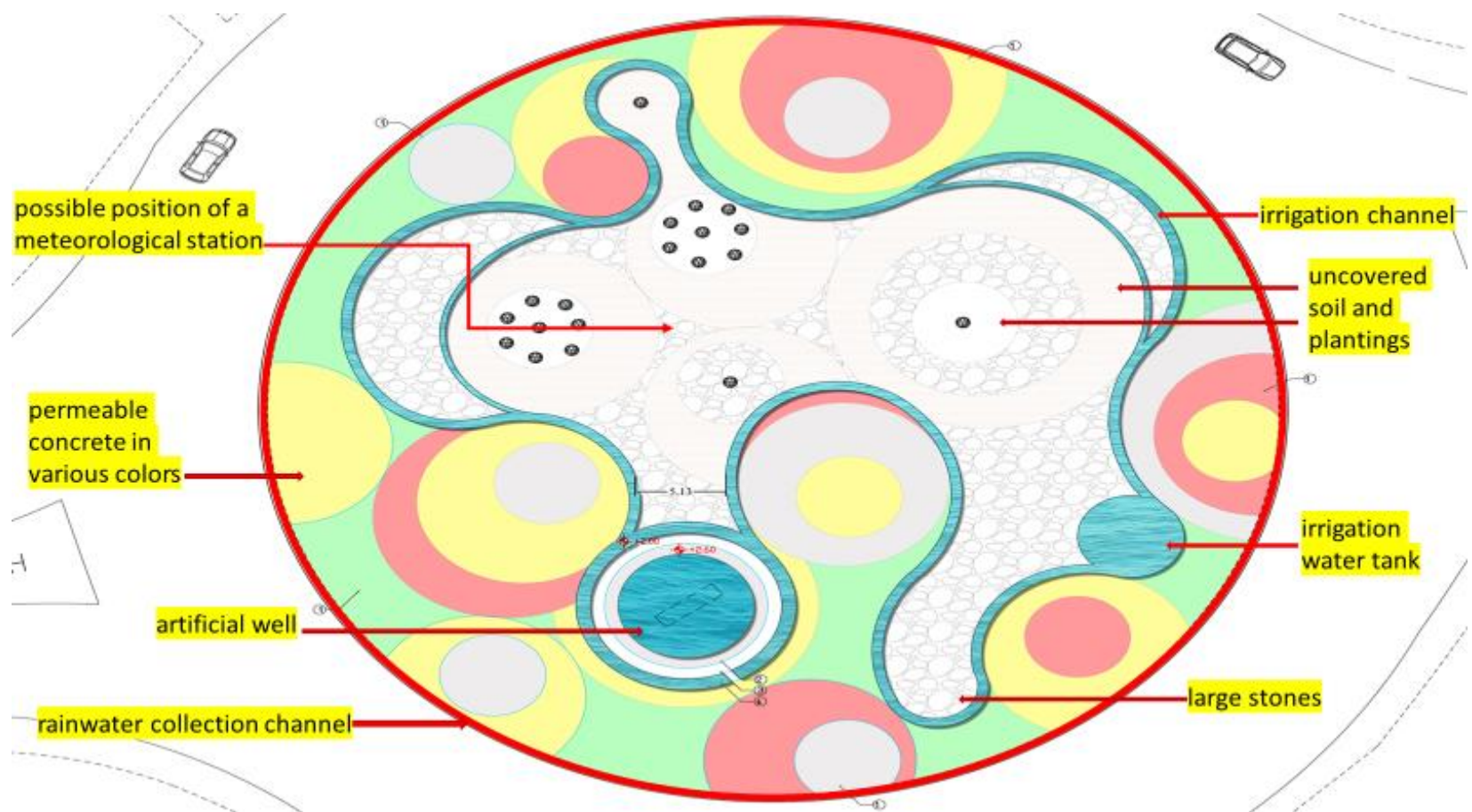


Figure 7. The suggestion for the roundabout reconstruction

Details of Artificial Well

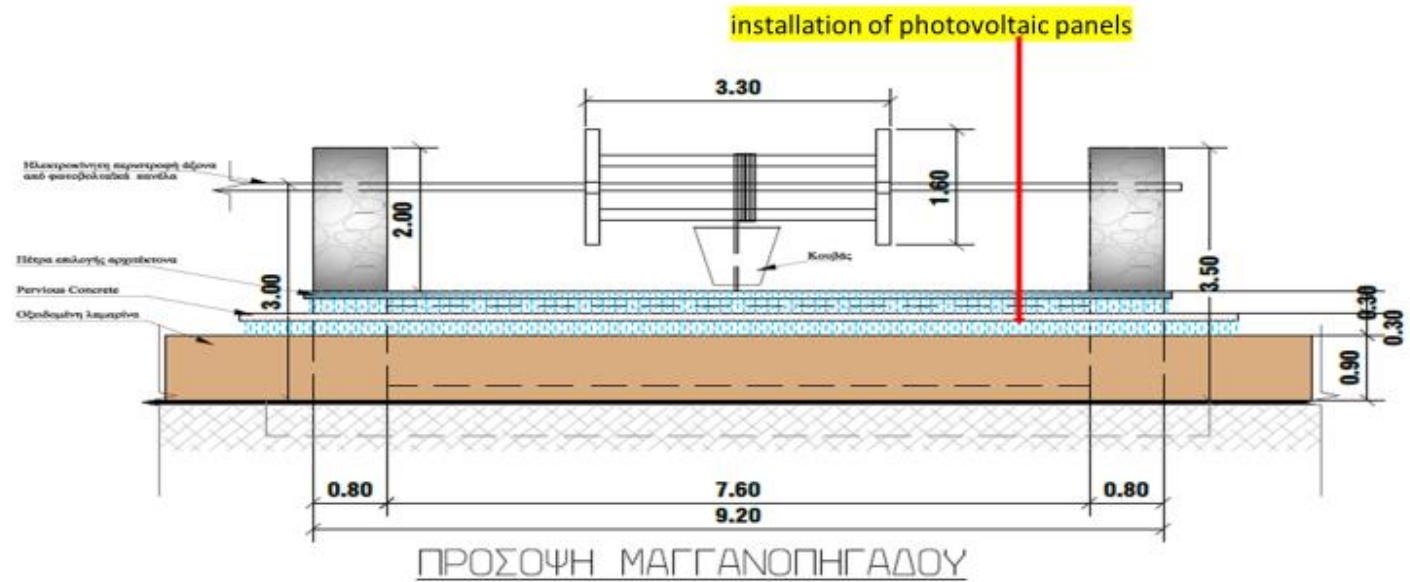
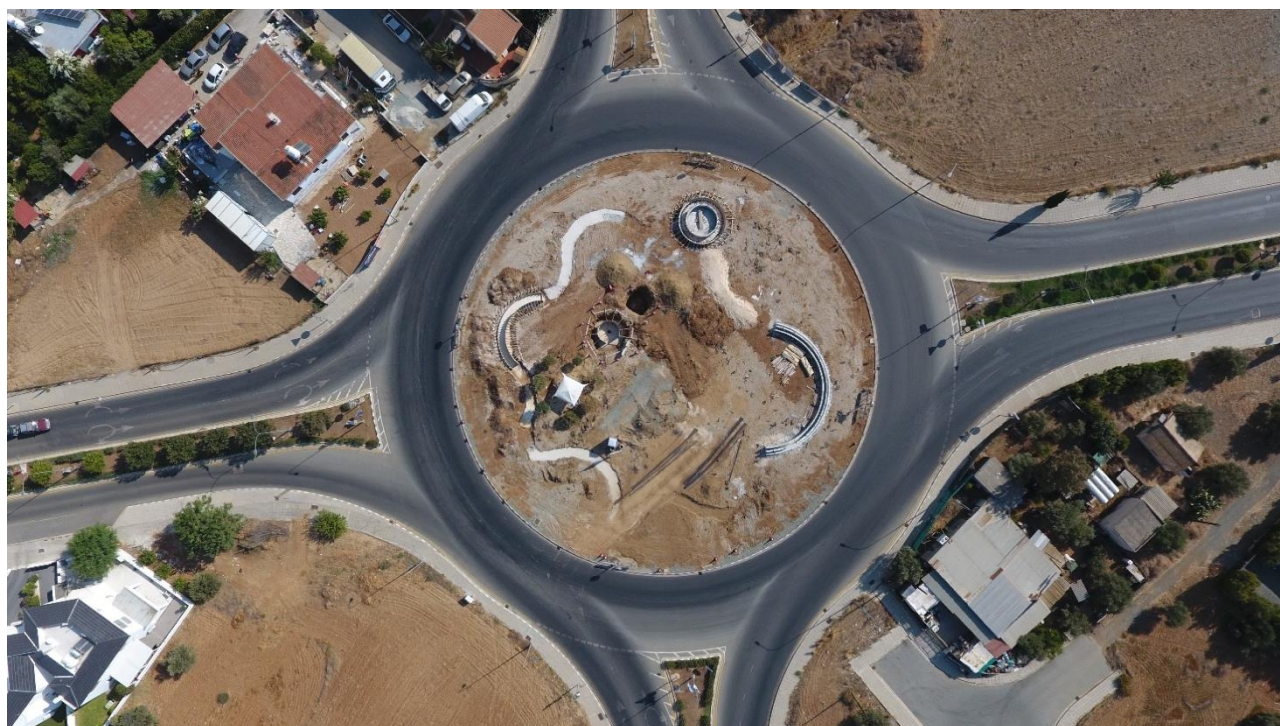


Figure 8. Detail of the construction of the artificial well

The above design of the roundabout is expected to be a predominant element for the Lakatamia Municipality. The use of permeable concrete, other permeable materials such as stones, planting of endemic trees and shrubs with low irrigation requirements and the use of recycled water will be good practices for use in private and public spaces. In addition to all these uses, the presentation of the traditional way of irrigation of the area will be an important additional value to the project.

These actions are also in line with the climate change adaptation measures presented in the National Climate Change Adaptation Strategy and the Climate Change Adaptation Action Plan of the Department of Environment of Ministry of Agriculture, Rural Development and the Environment.

Pilot action implementation- status



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