



LIFE URBANGREEN  
With the contribution of the LIFE Programme of the European Union  
(LIFE17 CCA/ITA/000079)

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# LIFE URBANGREEN

## Innovative tools for green areas management and citizens involvement

Paolo Viskanic | R3GIS

3° Virtual ADAPTtoCLIMATE Conference

19-20 April 2021

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# LIFE URBANGREEN



# Project partners



R3 GIS srl – Bolzano (IT) - **Coordinator**



Progea 4D – Cracovia (PL)



Università degli Studi di Milano (IT)



Università degli Studi di Firenze (IT)



Anthea Srl - Rimini (IT)



Zarząd Zieleni Miejskiej – Cracovia (PL)

## External partner



City of Taipei (TW), Tayouan City (TW)



National Central University of Taiwan



Duration:	07/2018-12/2021
Budget	2.513.784 €
EU Contribution:	1.310.335 €

# GREENSPACES

Existing urban green management platform includes monitoring, management of maintenance, GIS, tree inventory and assessment, playground inspections, all asset of green area management





# The new functions of the URBANGREEN platform



**SMART IRRIGATION**



**EFFICIENT JOB PLANNING**



**ECOSYSTEM SERVICES CALCULATION**



**INTEGRATION OF IoT, METEO E RS DATA**



**CITIZENS INVOLVEMENT**



# Smart irrigation system



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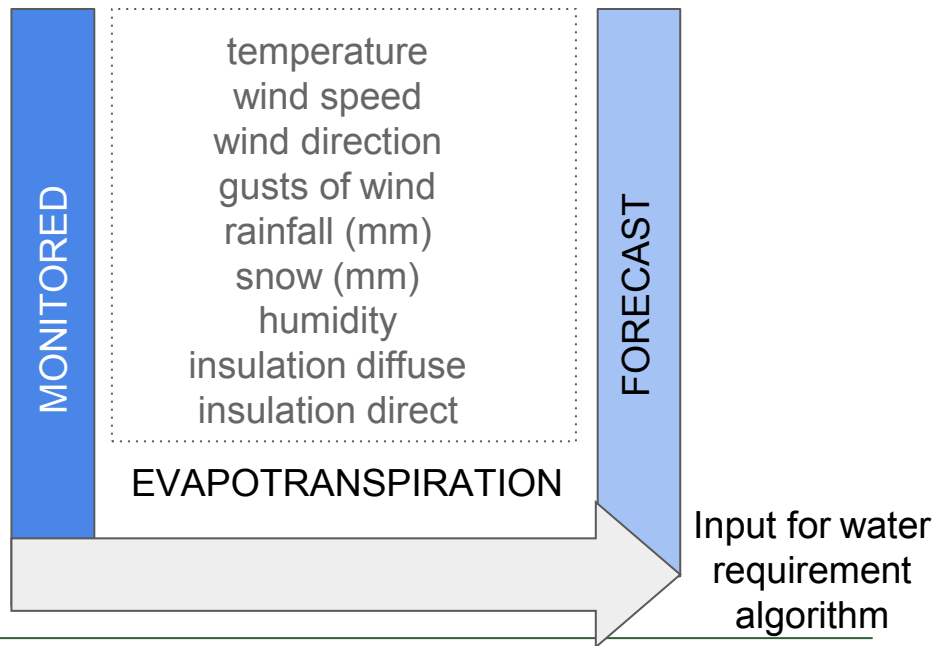
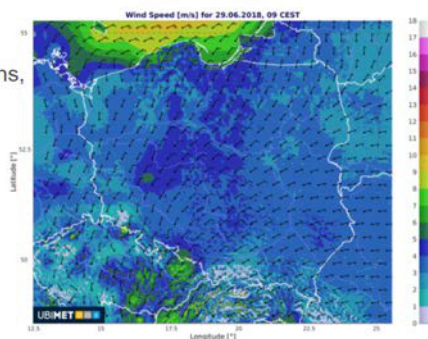
# Smart irrigation system

**OBJECTIVE:** improvement of water resource delivery and management through the identification of critical thresholds based on climatic models, plant water requirements and meteo forecasts

## Background: UBIMET Analysis HYDRA<sup>®</sup>

HYBRID DOWNSCALING BASED ON REGRESSION AND ANALYSIS

- Patented Algorithm
- Numerous input data (Weather Stations, Radar, Satellite, Lightning)
- Downscaling via „Fingerprints“:
  - Topographic effects
  - Hydrographic effects
  - Thermal effects
- Weighted spatial regression method





# Smart irrigation system

## ALERT ON TREES REQUIRING WATER

R3OTREES admin

General

Trees

Site	Tree nr.	Tag Nr.	Taxonomy	Calculated tr..	Date TRA	Risk class	Height	Water
BIM1 - Centro Direzionale Piazza del Popoloparco	5	4680	Populus nigra italica (Pioppo cipressino)	55			13,50	🔵
BIM1 - Centro Direzionale Piazza del Popoloparco	15	4671	Quercus ilex (Leccio)	63			11,00	
BIM1 - Centro Direzionale Piazza del Popoloparco	23	4125	Tilia x europaea (Tiglio)	71			11,00	
BIM1 - Centro Direzionale Piazza del Popoloparco	53	4175	Pinus pinea (Pino domes...)	68			12,50	🔵
BIM1 - Centro Direzionale Piazza del Popoloparco	44	4002	Populus alba (Pioppo bia...)	68			12,00	
BIM33 - Parco del Gelso	6	1339	Tilia x europaea (Tiglio)	70			10,50	
BIM33 - Parco del Gelso	10	1439	Pinus pinea (Pino domes...)	-			12,50	
BIM33 - Parco del Gelso	50	2160	Celtis australis (Bagolaro)	-			10,00	🔵
BIM33 - Parco del Gelso	50	2160	Celtis australis (Bagolaro)	44			10,00	
BIM33 - Parco del Gelso	33	2462	Quercus robur (Farnia)	50			13,05	🔵
BIM33 - Parco del Gelso	42	2552	Pinus pinea (Pino domes...)	50			13,05	
BIM33 - Parco del Gelso	88	3476	Tilia x europaea (Tiglio)	35			9,00	
BIM33 - Parco del Gelso	89	3477	Tilia x europaea (Tiglio)	36			9,50	

Open map

Weather Data

Sets

Objects

Statistics

Communications [0]

• Trees

Plant with planned TRA

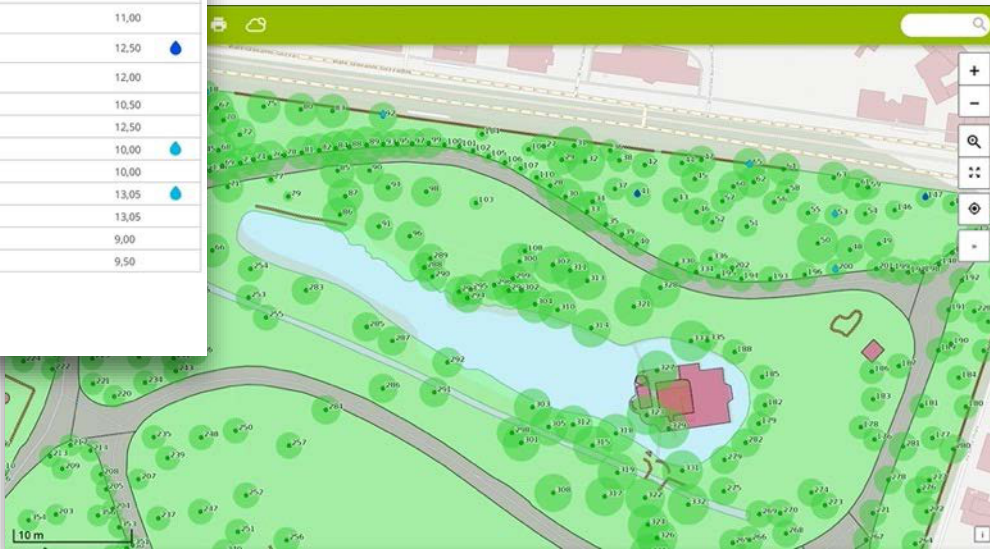
TRA

Shrubs, shrubs areas, hedges

Playground/Sporting Area

Equipment

< Close menu



# Smart irrigation system

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Taking into account the efficiency of different irrigation methods when planning interventions





# Efficient programming of jobs and control activities



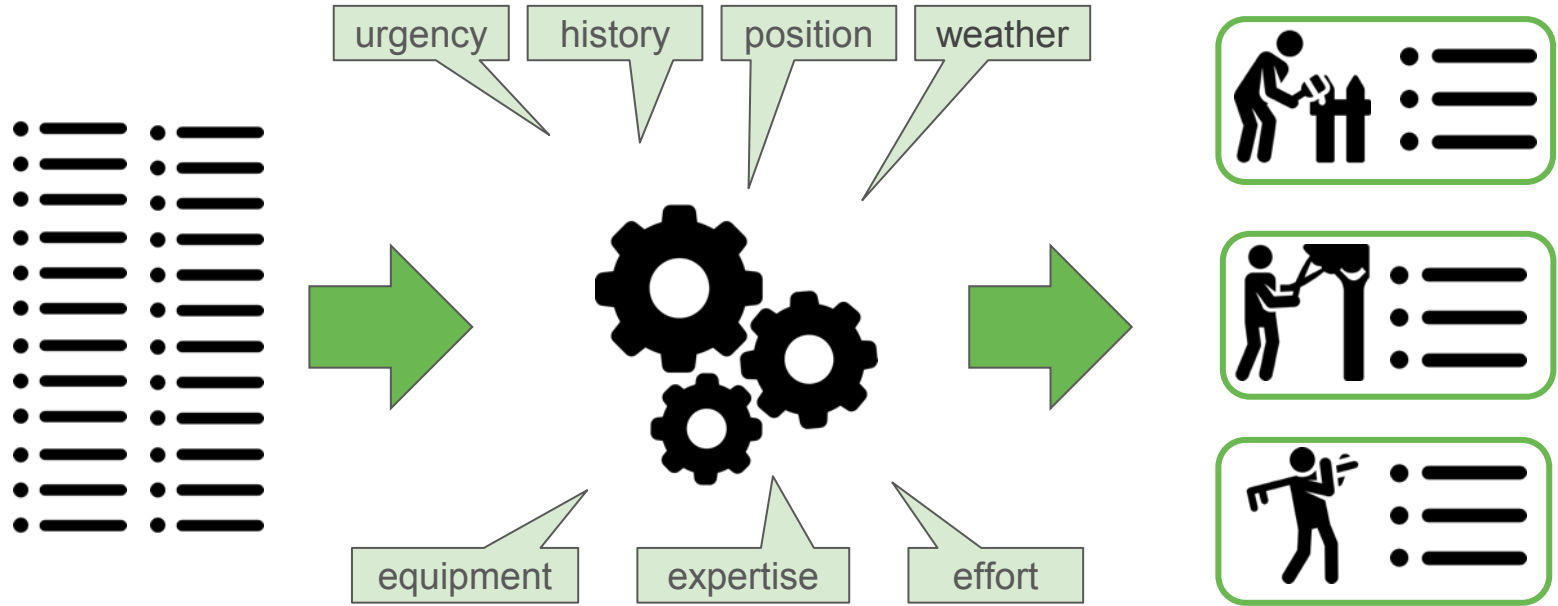
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# Efficient programming of jobs and control activities

**OBJECTIVE:** Determine the sequence of daily scheduled works to make maintenance activities more efficient and reduce their carbon footprint.




# Efficient programming of jobs and control activities

MONIT-AIR Kraków
Calendar
Administrator

- General
- Irrigation scheme
- Non compliance
- Jobs
- Planned jobs
- Issues (MON)
- Unit price updates
- Jobs to include in progress report
- Calendar
- Configuration
- Users

March 2020 < Week 12 >

	Monday 16	Tuesday 17	Wednesday 18	Thursday 19	Friday 20	Saturday 21	Sunday 22
<b>AGATA KUTYBA WYKONAWCA</b>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Placze Krakowskie 0119 - Tree harvest. 1</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Aleja Palski 0612 - Sanitary cuts. 2</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>14.001 - Aleja Pokoju 0612 - Correction cuts. 2</small> </div>	<div style="border: 1px solid black; padding: 2px;"> <small>14.031 - Park Lotników Polskich 0207 - Sanitary cuts. 1</small> </div>				
<b>AGNIESZKA PAJAK WYKONAWCA</b>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Aleja Pokoju 0612 - Correction cuts. 2</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>14.031 - Park Lotników Polskich 0208 - Sanitary cuts. 1</small> </div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Aleja Palski 0612 - Sanitary cuts. 2</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>14.001 - Aleja Pokoju 0612 - Correction cuts. 2</small> </div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>14.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div>				
<b>ANDRZEJ POPEK WYKONAWCA</b>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div> <div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>14.001 - Aleja Pokoju 0612 - Correction cuts. 2</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>14.031 - Park Lotników Polskich 0208 - Sanitary cuts. 1</small> </div>	<div style="border: 1px solid black; padding: 2px;"> <small>14.001 - Aleja Pokoju 0419 - Correction cuts. 2</small> </div>	<div style="border: 1px solid black; padding: 2px; margin-bottom: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div> <div style="border: 1px solid black; padding: 2px;"> <small>1.001 - Placze Krakowskie ZM OFFICER - Monitoring ZM</small> </div>				

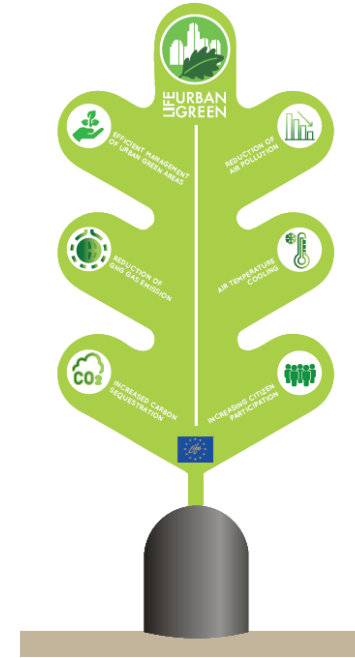
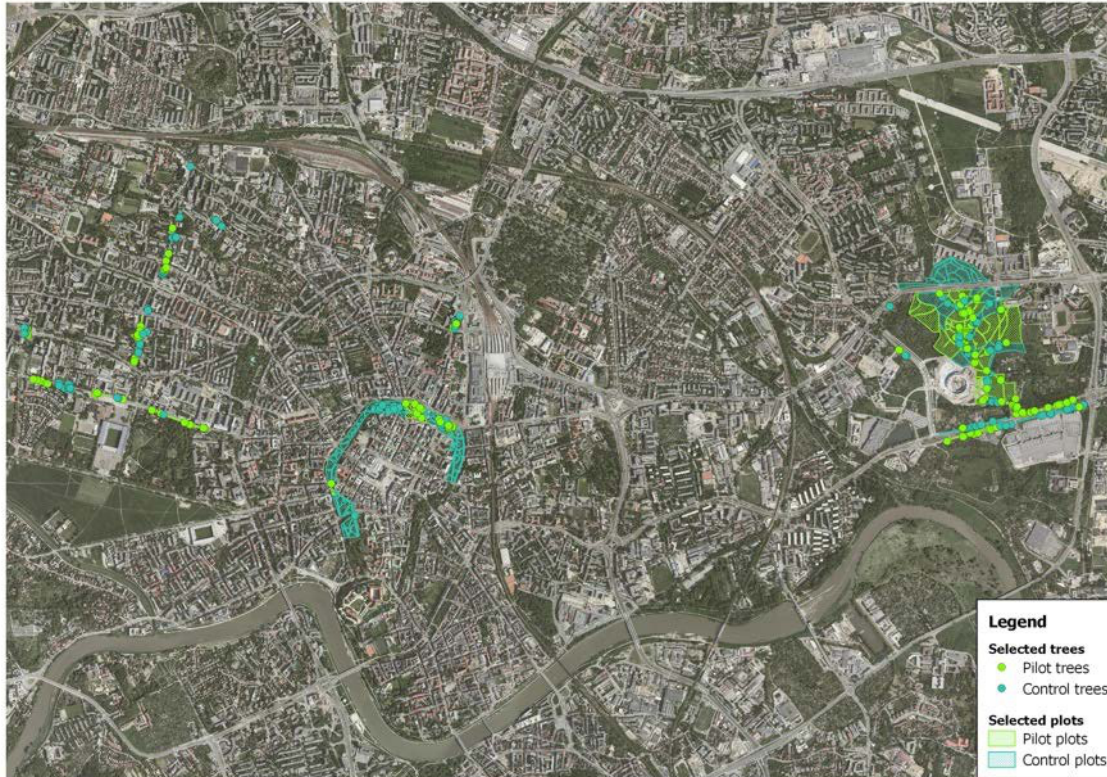




# Ecosystem services calculation



# Selection of project areas





# Selection of project species

## REPRESENTATIVE TREE SPECIES (selected from analysis of existing inventory)

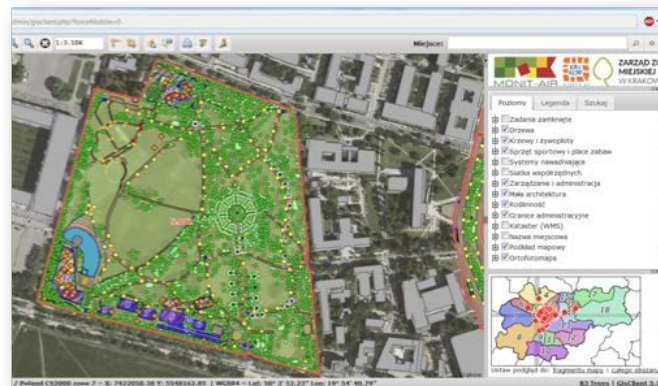
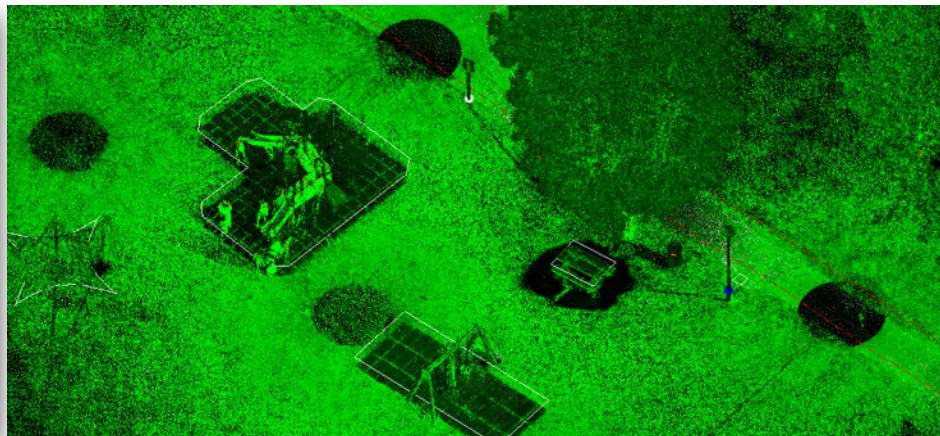
### RIMINI

Specie	Habitus
<b><u>Quercus robur</u></b>	Latifoglia decidua, grande
<i>Platanus x acerifolia</i>	Latifoglia decidua, grande
<b><u>Populus nigra</u></b>	Latifoglia decidua, grande
<i>Quercus ilex</i>	Latifoglia sempreverde, grande
<b><u>Pinus pinea</u></b>	Conifera sempreverde
<b><u>Tilia x europaea</u></b>	Latifoglia decidua, medio/grande
<b><u>Aesculus hippocastanum</u></b>	Latifoglia decidua, medio/grande
<b><u>Acer negundo</u></b>	Latifoglia decidua, media
<i>Ligustrum lucidum</i>	Latifoglia semi-decidua, piccola
<i>Prunus laurocerasus</i>	Arbusto sempreverde

### KRAKOW

Specie	Habitus
<b><u>Quercus robur</u></b>	Latifoglia decidua, grande
<i>Fraxinus excelsior</i>	Latifoglia decidua, grande
<b><u>Populus nigra</u></b>	Latifoglia decidua, grande
<i>Ulmus laevis</i>	Latifoglia decidua, grande
<b><u>Pinus nigra</u></b>	Conifera sempreverde
<b><u>Tilia cordata</u></b>	Latifoglia decidua, medio/grande
<b><u>Aesculus hippocastanum</u></b>	Latifoglia decidua, medio/grande
<b><u>Acer platanoides</u></b>	Latifoglia decidua, medio/grande
<i>Sorbus aucuparia</i>	Latifoglia decidua, piccola
<i>Cornus alba</i>	Arbusto deciduo

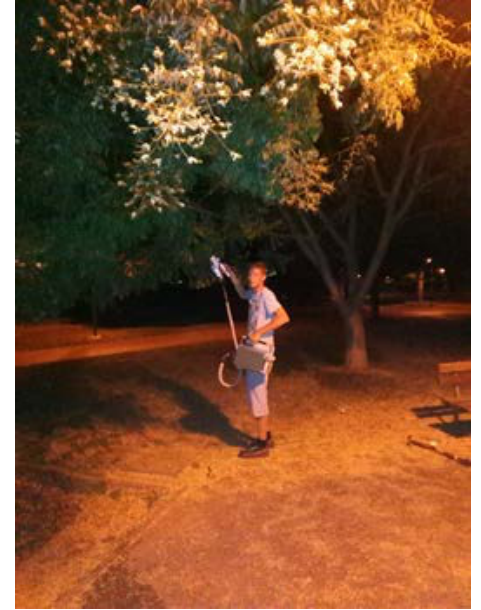
# Park mapping with LiDAR technology



# Measurement campaigns

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To define the ecosystemic performance of the selected species in of Krakow and Rimini



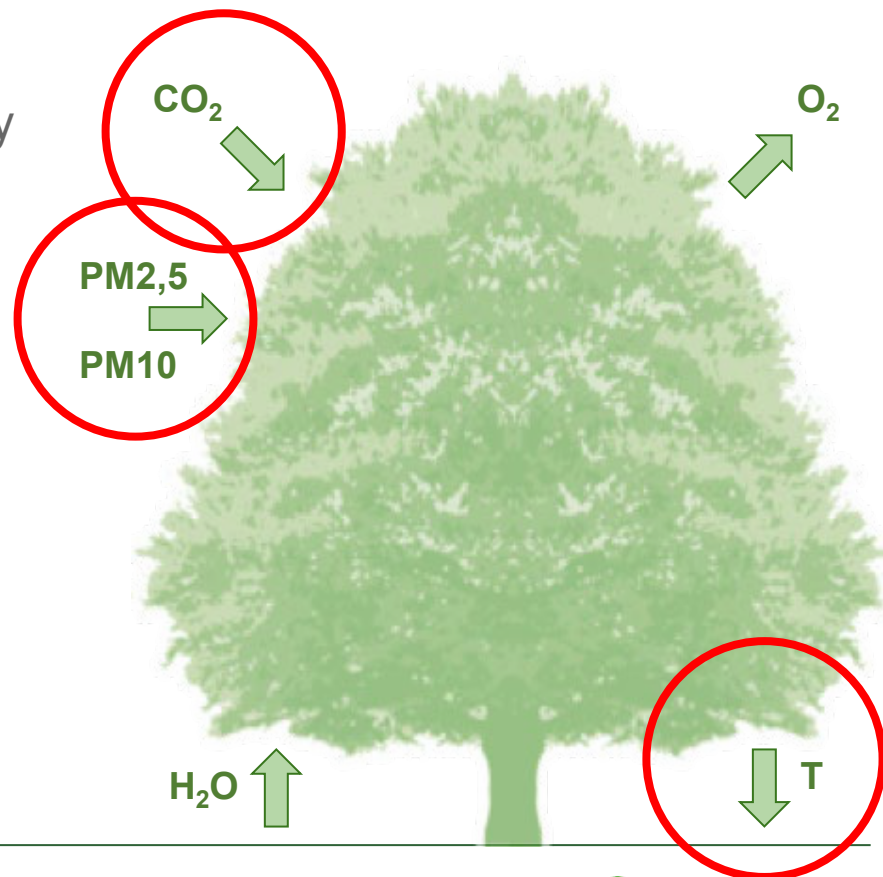


# Ecosystem services calculation

**OBJECTIVE:** estimation of benefits of green areas for a sustainable and healthy urban environment

**DESCRIPTION:** Understand environmental benefits provided by selected tree species in the two cities

- 1- Carbon storage
- 2- Carbon assimilation
- 3- Pollution adsorption on leaves
- 4- Thermoregulation



# Ecosystem services

Greenspaces - Ecosystem Services

Kraków

Ecosystem Services Administrator

General Jobs Non compliance Life Urbangreen Weather Dashboard TreeTalker TT Cloud Smart Irrigation Ecosystem Services Irrigation scheme Costs Configuration Users

Date	Site	Tree Nr.	Tag Nr.	Taxonomy	Calculated tree age	CO2 absorbed (kg)	CO2 stocked (kg)	PM10 deposited (g)	PM2,5 deposited (g)	NOx absorbed (g)	Water transpired (l)	Energy saved (kWh)	Tree
01/01/2019 00:00:00	5.158 - Ulica Wroclawska	005036		Acer platanoides (Acer riccio)	3	0.00	0.23	0.04	0.01	-999.00	0.57	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	047101		Acer platanoides (Acer riccio)	2	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	050239		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.068 - Ulica Reymonta	008396		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	050321		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	050240		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.121 - Aleja Kijowska	050328		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.068 - Ulica Reymonta	008397		Acer platanoides (Acer riccio)	3	0.00	58.65	0.63	0.16	-999.00	9.05	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	9		Acer platanoides (Acer riccio)	3	0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	6		Acer platanoides (Acer riccio)	3	0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.158 - Ulica Wroclawska	026672		Acer platanoides (Acer riccio)	12	0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.158 - Ulica Wroclawska	026674		Acer platanoides (Acer riccio)	12	0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.158 - Ulica Wroclawska	026673		Acer platanoides (Acer riccio)	12	0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.150 - Ulica Mazowiecka	026647		Acer platanoides (Acer riccio)		0.00	66.26	0.67	0.17	-999.00	9.62	-999.00	
01/01/2019 00:00:00	5.121 - Aleja Kijowska	050327		Acer platanoides (Acer riccio)	2	0.00	74.33	0.71	0.18	-999.00	10.19	-999.00	

Legend: Living tree Dead tree Tree stump Felled Tree in process

Items per page 25 1 - 25 of 2798649



Name: London plane  
Species: *Platanus acerifolia*

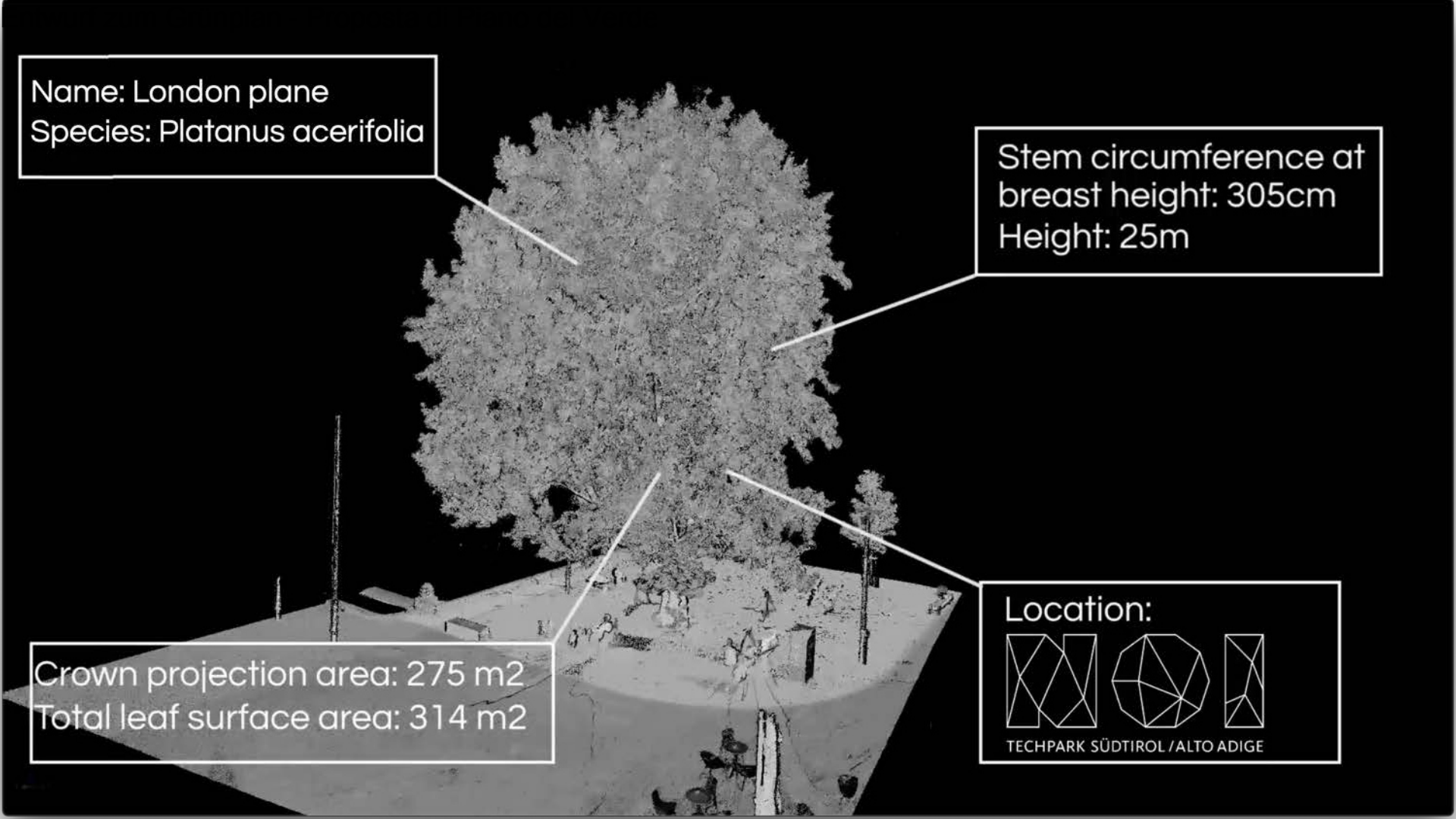
Stem circumference at  
breast height: 305cm  
Height: 25m

Crown projection area: 275 m<sup>2</sup>  
Total leaf surface area: 314 m<sup>2</sup>

Location:



TECHPARK SÜDTIROL / ALTO ADIGE



Solar radiation  
☀️ 2 W/m<sup>2</sup>

Evapotranspiration  
⤴️ 0.00 mm/h

Carbon dioxide  
assimilation

CO<sub>2</sub> 9860 g

Temperature sun  
☀️🌡️ 27.8 °C

Temp. tree shadow  
☷🌡️ 26.6 °C

Energy  
saving

5.07 kWh



Solar radiation  
☀️ 2 W/m<sup>2</sup>

Evapotranspiration  
⤴️ 0.00 mm/h

Carbon dioxide  
assimilation

CO<sub>2</sub> 9860 g

Temperature sun  
☀️🌡️ 27.8 °C

Temp. tree shadow  
☕🌡️ 26.6 °C

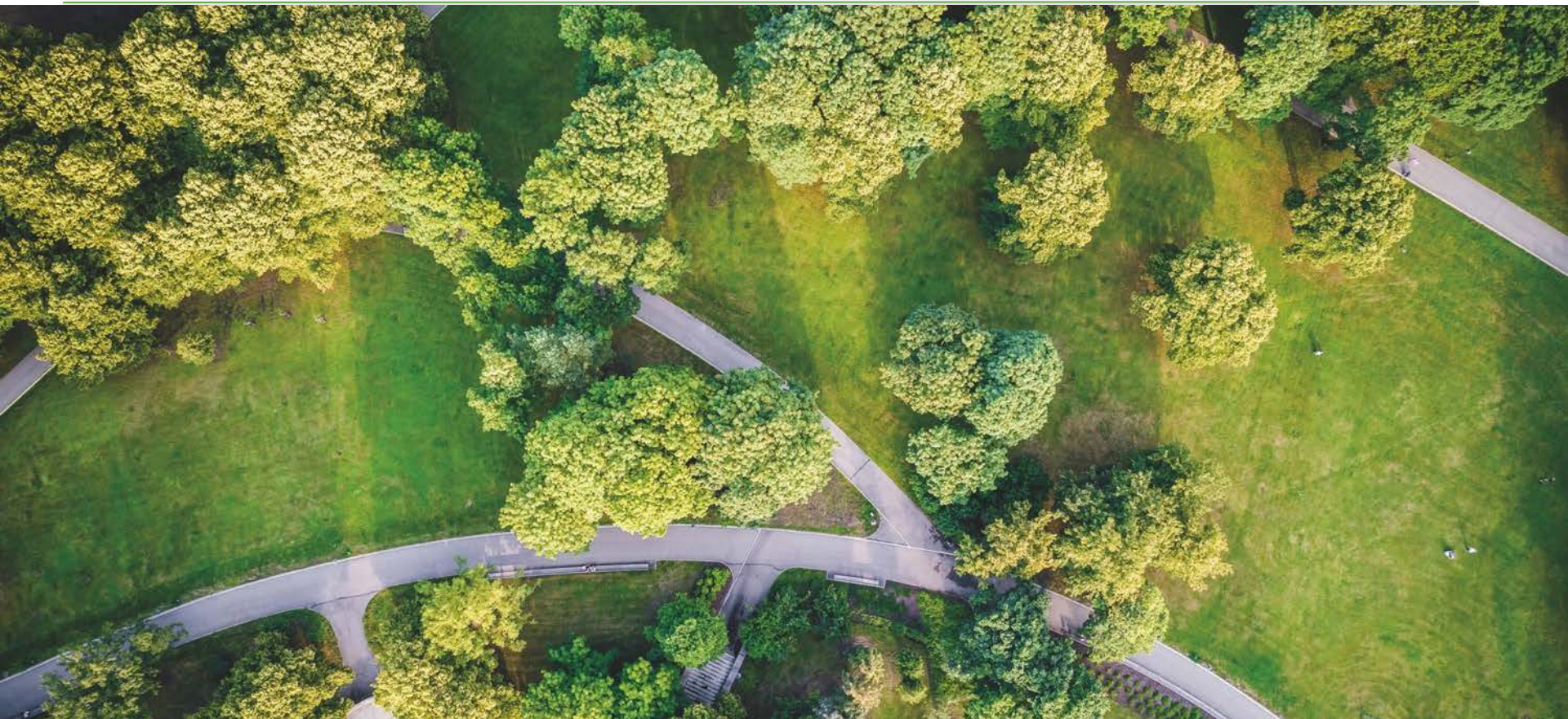
Energy  
saving

5.07 kWh

CO<sub>2</sub> assimilation: 2,5 T CO<sub>2</sub>/Year  
Energy savings: 893 kWh/Year  
PM10 + 2.5 sequestration: 1,22 kg/Year



# Monitoring through IOT, meteo and RS data



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# Monitoring through IOT, meteo and RS data

Use weather, remote sensing and sensors data to improve green area management and maximise ecosystem services:



meteo-data for irrigation efficiency, work planning and severe weather alerts



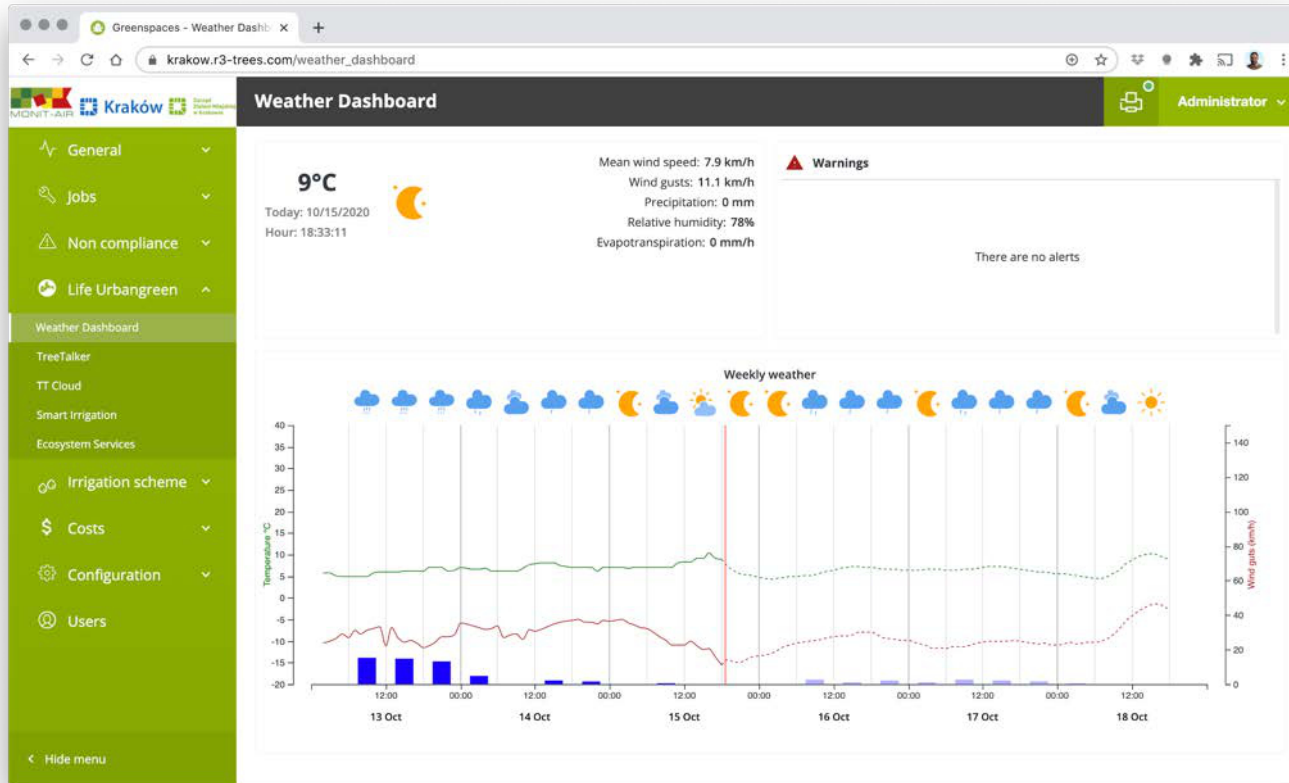
IOT sensors to collect environmental and tree physiology data



RS data for tree health monitoring and vegetation assessment



# Weather Dashboard



# Severe weather warnings

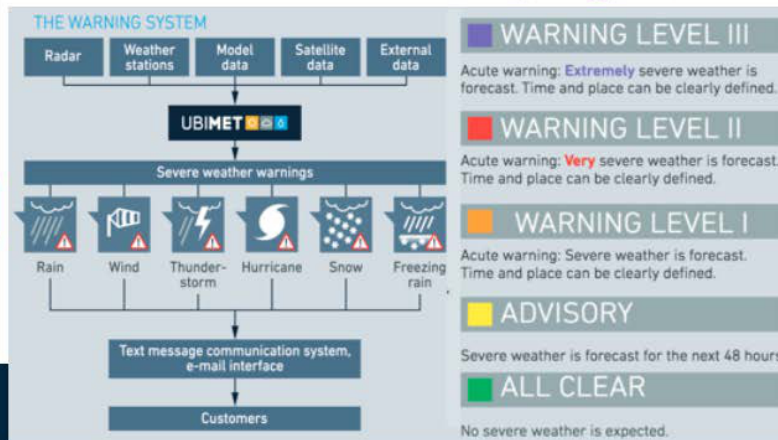
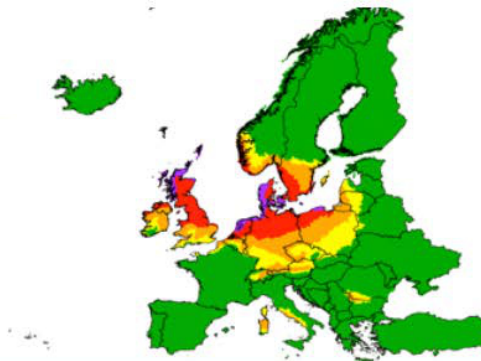
## PRECISE WARNINGS TO PREVENT DAMAGE

### Features & Benefits

- Hyperlocal severe weather warnings via SMS/E-Mail
- Helps customers in preventing or reducing damage
- Warnings are sent out in advance (48 hours to 15 minutes prior to the event)
- 24x7 manned Severe Weather Centrale

### UBIMET - SWC

- 100 Mio. alerts in the last years
- 1 Mio. recipients in Europe



# IOT environmental sensors

## SENSORS USED IN THE PROJECT

- Temperature sensors (Lansitec)
- Air quality sensors (airly)
- Tree sensors (Tree Talker)
- People counters (Bosch cameras)



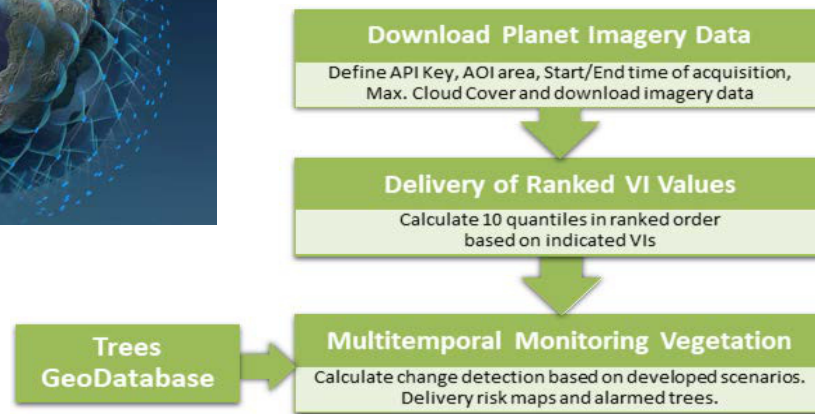


# Tree monitoring through RS data

## USE OF SATELLITE IMAGES

Through a weekly comparison of the pixels where the same tree species occur, health problems in trees should be detected early.

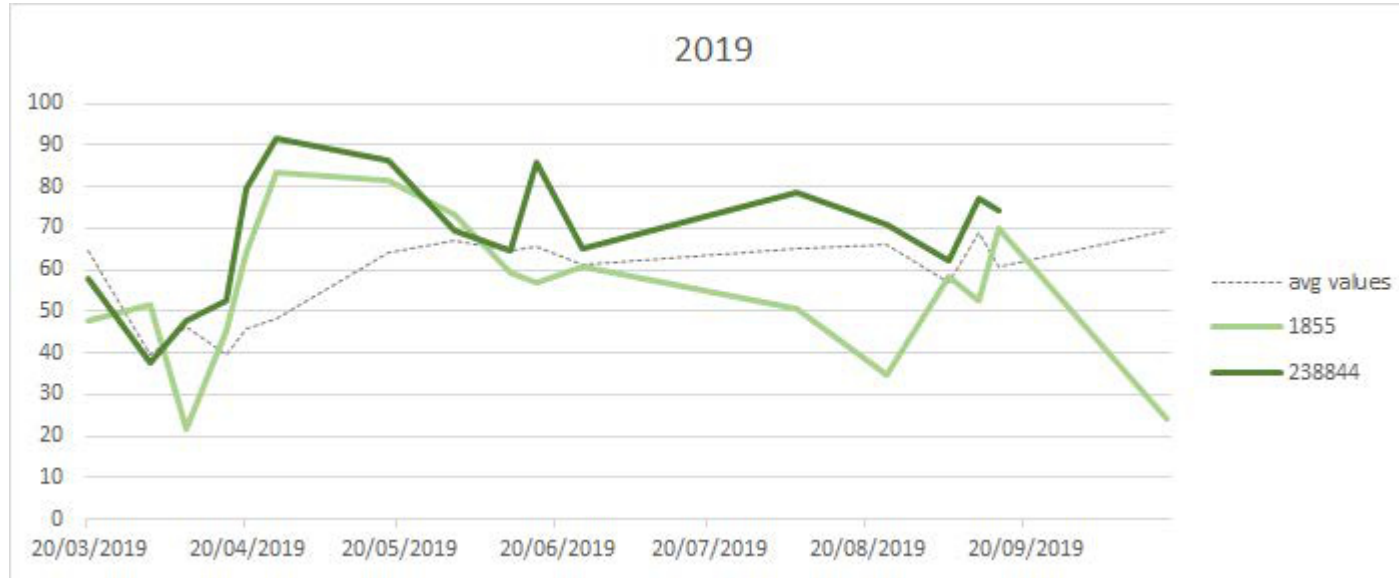
In addition, the satellite data will be used to determine further indicators for the entire vegetation of the urban area.



# Tree monitoring through RS data

## TREE HEALTH MONITORING WORKFLOW FROM SATELLITE IMAGES

[V.I. calculated for *Aesculus hippocastanum*]



TREE 1855:  
Adult tree  
Ø stem DBH [cm]: 95,87

TREE 238844:  
Young tree  
Ø stem DBH [cm]: 40,43

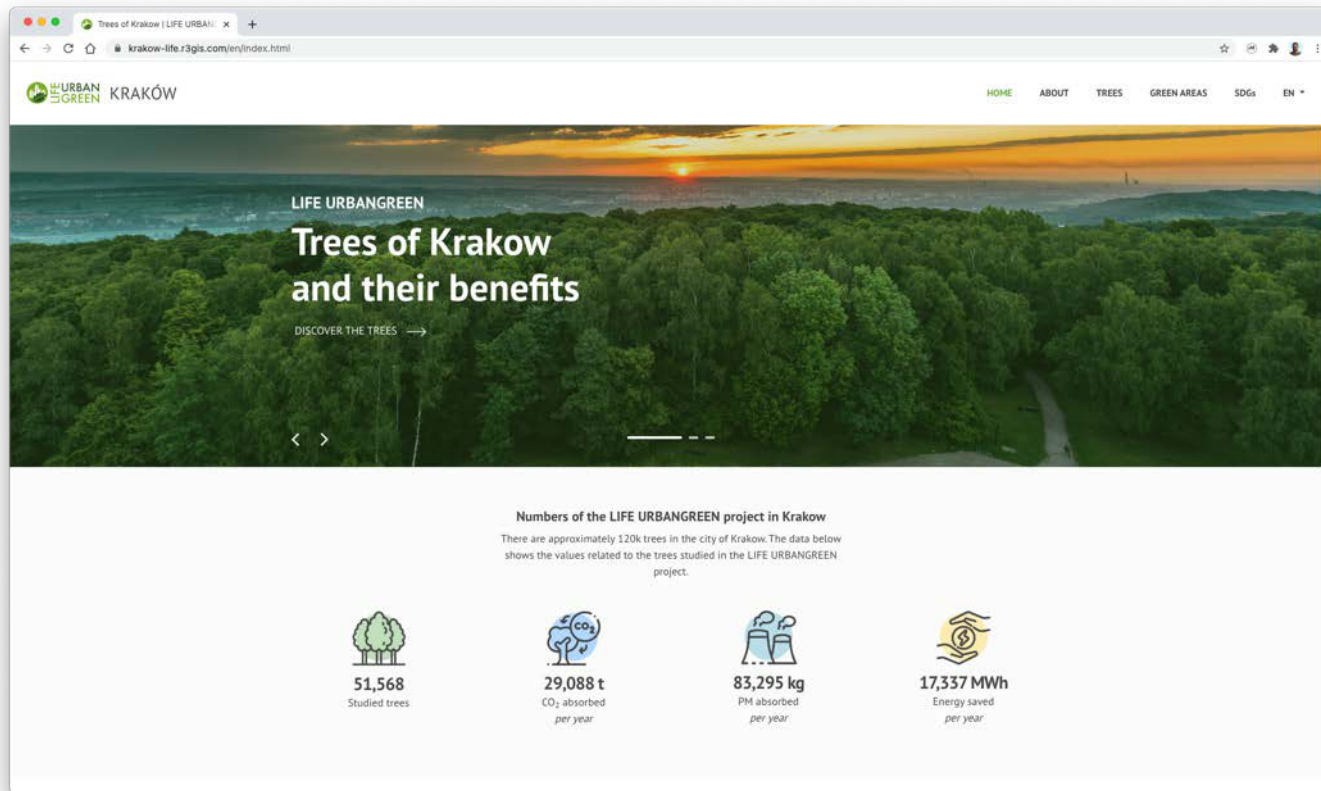
# Citizens engagement

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# Draft public website



# Draft public website

**Discover The Trees of Krakow**

TREE BENEFITS | **URBANGREEN TREE SPECIES**

### About the tree species

Every tree species is different and each has its "powers", providing different benefits for the environment, animals and inhabitants. These differences allow for a range of different uses in the urban context.

For example some species are more resistant to pollution and can withstand being on the sidewalk, while others promote biodiversity providing food and shelter for birds, little animals and insects. Others instead are very good at absorbing pollutants but do not provide much shading or are less aesthetically pleasing.

In the LIFE URBANGREEN project, close attention was paid to the 10 most representative tree species of the city, that were studied in order to provide an estimate of the ecosystem services provided by the urban greenery. Results of the analysis carried out on these species were then extended to other assimilated species.

Explore below the tree species that were analysed for the city of Krakow.

Tree Species	Number of trees	CO <sub>2</sub> assimilation	Air quality amelioration	Cooling by transpiration
<b>Austrian pine</b> <i>Pinus nigra</i>	495	10/10	10/10	10/10
<b>Black poplar</b> <i>Populus nigra</i>	259	2/10	1/10	2/10

**Description**

Black poplar is a native species in Europe. It is an extremely fast-growing deciduous species that can reach 25 m height at maturity. The canopy can be broad or columnar, in the case of the 'Italica' cultivar. It is short lived at urban sites, where it rarely exceeds 40 years. It has simple, triangular leaves. It flowers from February to April. Male and female flowers appear on different individuals, so planting

**Assimilated species**

- Populus nigra 'Italica'
- Populus nigra 'Plantierensis'
- Populus sp.
- Populus +Androscoffin'
- Populus +berolinensis'
- Populus +berolinensis 'Berlin'



# Draft public website

**Trees in this area**

**Horse chestnut**  
*Aesculus hippocastanum*

**Site name**  
Planty Krakowskie

**Tree number**  
103926

**TAG number**

**Height**  
15-20 m

**Crown diameter**  
11.2 cm

**Stem circumference**  
161.01 cm

**Ecosystem services**

YEAR TODAY

1.122 t CO<sub>2</sub> absorbed per year

2.9 kg PM<sub>10</sub> absorbed per year

0.501 MWh Energy saved per year

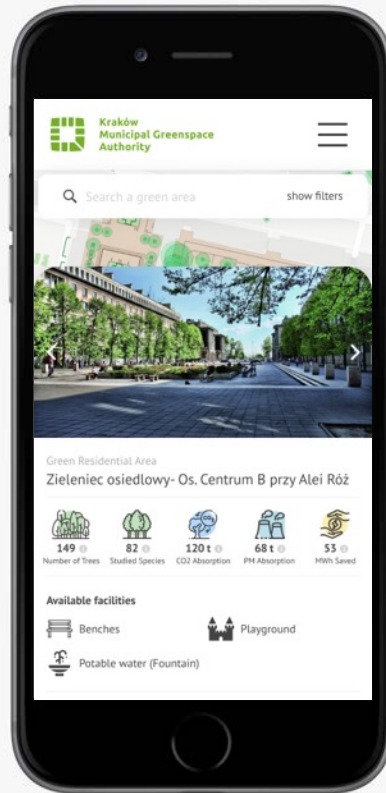
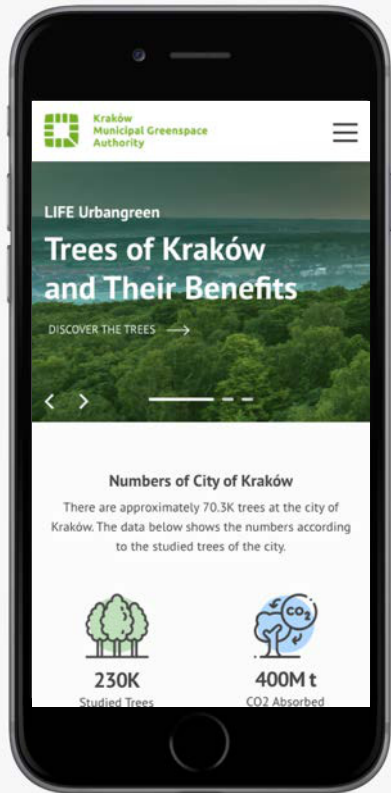
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LIFE17 CCA/ITA/000079





# Draft public website



## Register to our Newsletter!



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