LIFE URBANGREEN

INNOVATIVE TECHNOLOGICAL PLATFORM
TO IMPROVE MANAGEMENT OF GREEN AREAS
FOR BETTER CLIMATE ADAPTATION

LAYMAN'S REPORT

Project Details

PROJECT TITLE: Innovative technological platform to improve management of green areas for better climate adaptation

DURATION: 1st July 2018 - 31st December 2021

EU FINANCIAL CONTRIBUTION: 1,310,335 euros

SECTOR: Urban adaptation/planning

PROJECT COORDINATOR: R3 GIS

Partners

R3GIS managing spaces

Anthea

Kraków Municipal Greenspace Authority

Università degli Studi di Milano

ProGea 4D

With the contribution of the LIFE Programme of the European Union
LIFE17 CCA/IT/000079

Table of Contents

LIFE URBANGREEN: why green spaces matter

Climate change is one of the biggest challenges for our society. Extending green areas and enhancing green management efficiency are both promising efforts for limiting and counteracting the negative effects of climate change, improving the quality of life in our cities and fostering urban resilience. Green areas significantly improve the microclimate, prevent flooding during heavy rainfall, and reduce thermal stress on hot days. The World Health Organization recognises the importance of urban green infrastructures, which are essential to achieve healthy, sustainable and livable cities.

No other type of intervention is as effective as enhancing urban green spaces in terms of health, social equity, and environmental sustainability. Therefore, urban development strategies have begun to consider trees and public green spaces in general as key resources.

The definitions and functions of parks, gardens, tree-lined streets and many other types of permeable, vegetated areas, likewise, are also changing. From decorative elements, these green spaces have turned into components of public infrastructure systems by providing services for nearly all urban settlement patterns.

Ensuring sustainable maintenance of urban green areas is a key factor that contributes to the environmental benefits that trees, shrubs and plants provide. Cities are investing in green infrastructure not only to reduce the effects of extreme weather events, but also to create biodiversity hotspots and local recreational zones for citizens. Particularly after the COVID-19 outbreak, citizens have increasingly valued and appreciated urban green spaces, showing once more the importance of their maintenance.

COOLER TEMPERATURES

CLEANER AIR

ENERGY CONSERVATION

RUNOFF REDUCTION

PROTECTING BIODIVERSITY

CO_2 STORAGE

Efficient management of green areas

An increasing number of cities around the world use management tools for green infrastructures. Such tools include the platform **GreenSpaces** developed by R3GIS (Italy). GreenSpaces builds upon a detailed census of public green areas and helps municipalities to efficiently plan and monitor maintenance activities.

Information given on the platform shows when and how a tree was pruned, when the next tree stability assessment will be performed, when a lawn will be mown etc. The platform allows users to report internal costs for the municipality as well as the costs of external contractors, allowing limited resources to be managed efficiently.

The daily use of GreenSpaces ensures that activities are efficiently planned, carried out in a timely manner, and documented in detail by all stakeholders. Moreover, the daily update of activities ensures that the quantification of green surfaces and elements is always accurate. A historical database keeps track of changes and allows monitoring of indicators. Tracing tree monitoring activities and playground inspections improves safety in urban green areas.

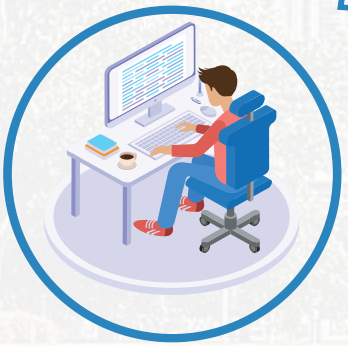
How do we make the ecosystem services of urban green areas and their benefits against climate change visible in real-time and even more effective? R3GIS, in conjunction with their technological and scientific partners, ProGEA 4D (Poland) and the University of Milan (Italy), addressed these topics in the **EU-project LIFE URBANGREEN within the cities of Rimini (Italy) and Kraków (Poland)**. This project not only enriched the GreenSpaces platform with new innovative modules, but also tested and evaluated their effectiveness on parks and avenues in Rimini and Kraków.

CENSUS

MAINTENANCE

GREEN SPACES

DB



OPERATORS

CITIZENS

Innovative management facing climate change

The project “LIFE URBANGREEN - Innovative technological platform to improve management of green areas for better climate adaptation” is upgrading the management platform GreenSpaces – already in use in over 200 cities all over the world, with new innovative tools aiming at:

1. Optimising water consumption, providing water only when and where needed;
2. Reducing the carbon footprint of maintenance activities by organising a more efficient working plan;
3. Quantifying ecosystem services provided by green infrastructure;
4. Monitoring health parameters in trees by using remote sensing data;
5. Increasing citizen participation in urban green management.

R3GIS coordinated the project, developed the new software tools and integrated them into the GreenSpaces platform. The algorithms forming the basis of these new tools were developed by the **University of Milan** with data recorded in field surveys and three dimensional inventories provided by the technological partner **ProGea 4D**.

The city of Rimini, with **Anthea**, and the city of Kraków, with **ZZM**, are testing and evaluating the tools developed and applying the recommended treatments suggested by the University of Milan. The New Central University in Taiwan is closely observing the implementation of the LIFE URBANGREEN project and adapting the results to the Asian context.

The knowledge gained and the tools developed through the LIFE URBANGREEN project will facilitate the understanding of urban forests and how to maximise their benefits for citizens. The new data provided by the platform supports decisions that will help cities better adapt to the effects of climate change.


Kraków
ProGea
R3GIS
managing spaces
Kraków
Municipal Greenspace
Authority
Rimini
Anthea
UNIVERSITÀ
DEGLI STUDI
DI MILANO

The Smart Irrigation module in GreenSpaces

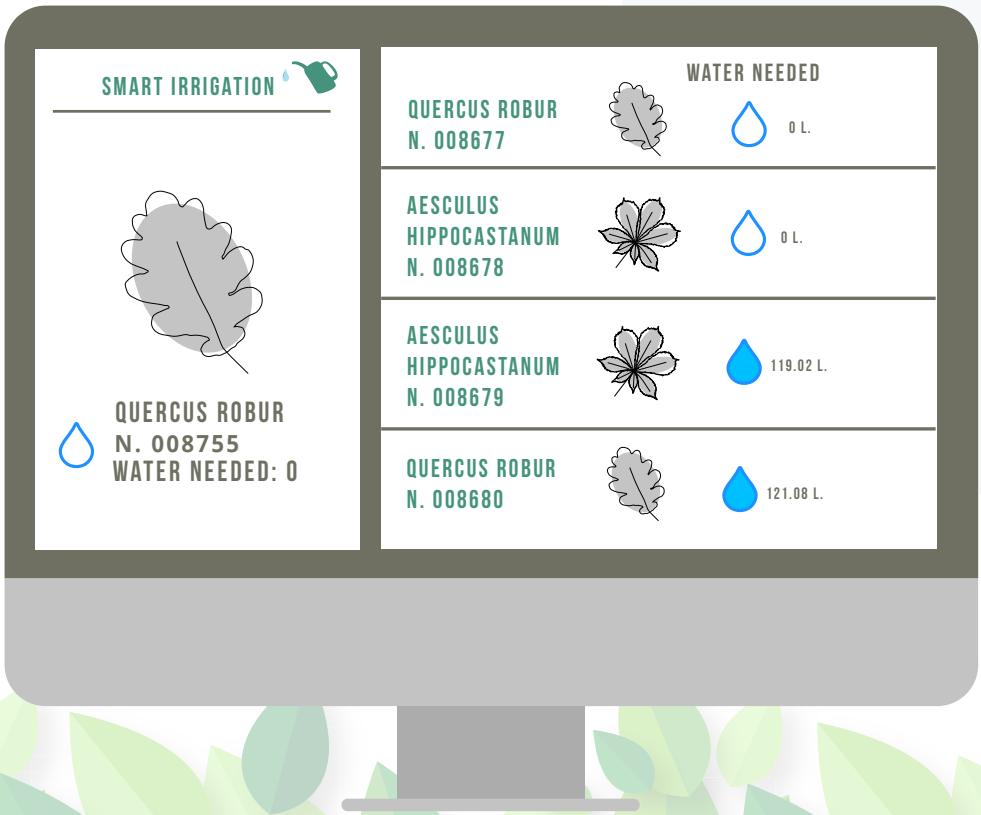
The LIFE URBANGREEN core objectives include the efficient management of maintenance activities of green areas in order to increase benefits for citizens and, ultimately, save resources. This way, the project contributes to the climate change adaptation of Rimini and Kraków.

Drought affects trees directly by inhibiting growth and indirectly by making them less resistant to pests and insects. The **Smart Irrigation** module developed by the LIFE URBANGREEN project considers meteorological data to calculate the water provided to trees (e.g. precipitation, irrigation) as well as water consumed by trees (e.g. transpiration). Gardeners receive a two-stage alert which shows if irrigation for a specific tree is recommended or urgent. If, according to forecasts, rain is expected, alerts change automatically in the system. Similarly, gardeners can record the water amount provided during irrigation. The system processes the information and calculates when the tree will need water again.

The Smart Irrigation module has the following advantages:

- In drought periods, cities save water by irrigating only the plants in need, ensuring the survival of young trees and fostering climate change adaptation strategies;
- The performance of trees in public spaces as natural air conditioners can be improved if the ideal amount of water is given to them;
- Trees are efficiently maintained if they are not watered when it rains soon after;
- Trees grow strong and healthy, ensuring long term benefits.

The Smart Irrigation module performs even better when combined with a device to release the water slowly, such us watering bags or similar devices. Green area managers have access to the meteorological data used in the Smart Irrigation module through a **Weather Dashboard** providing hourly meteorological data, 72 hour forecasts, and severe weather alerts.


SMART IRRIGATION
QUERCUS ROBUR
N. 008755
WATER NEEDED: 0
WATER NEEDED
QUERCUS ROBUR
N. 008677
0 L.
AESCULUS
HIPPOCASTANUM
N. 008678
0 L.
AESCULUS
HIPPOCASTANUM
N. 008679
119.02 L.
QUERCUS ROBUR
N. 008680
121.08 L.

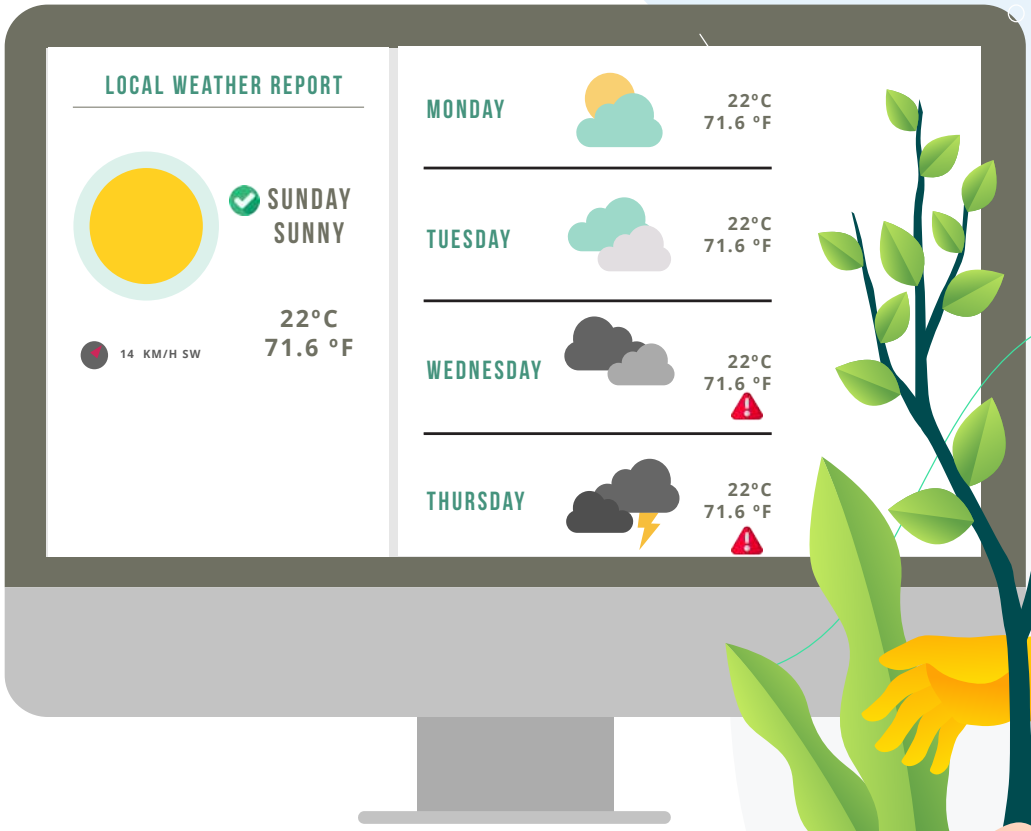
— Every action counts: reducing the carbon footprint —

The LIFE URBANGREEN project and the GreenSpaces platform support municipalities and green managers in their everyday work, setting new standards: the **Advanced job planning** module allows the definition of weekly schedules for each collaborator as well as for teams, bringing together municipality employees, external workforces and experts for specific tasks.

All planned activities are combined with weather forecasts, so that the execution of both generic tasks and emergency interventions is more efficient. In the Advance job planning module weather forecasts are linked to the planned work: if a planned activity is not compatible with the weather forecast in a given day, GreenSpaces alerts the gardeners. For example, if strong wind gusts are expected on a day when the basket elevator is planned to be used, the platform highlights this incompatibility and the activity can be rescheduled. Similarly, when heavy rain is expected, the weather dashboard would suggest rescheduling lawn mowing.

A controlling module can record the costs of the resources used to accomplish the task. In addition it calculates the ecological footprint of each maintenance activity. Citizens and administrators thus know exactly how many resources they need for conscientious and sustainable maintenance. At the same time, they can choose methods and instruments that have as little impact as possible, both on people and the environment.

This data helps municipalities to commission companies that work in the most environmentally friendly way and monitor their performance.

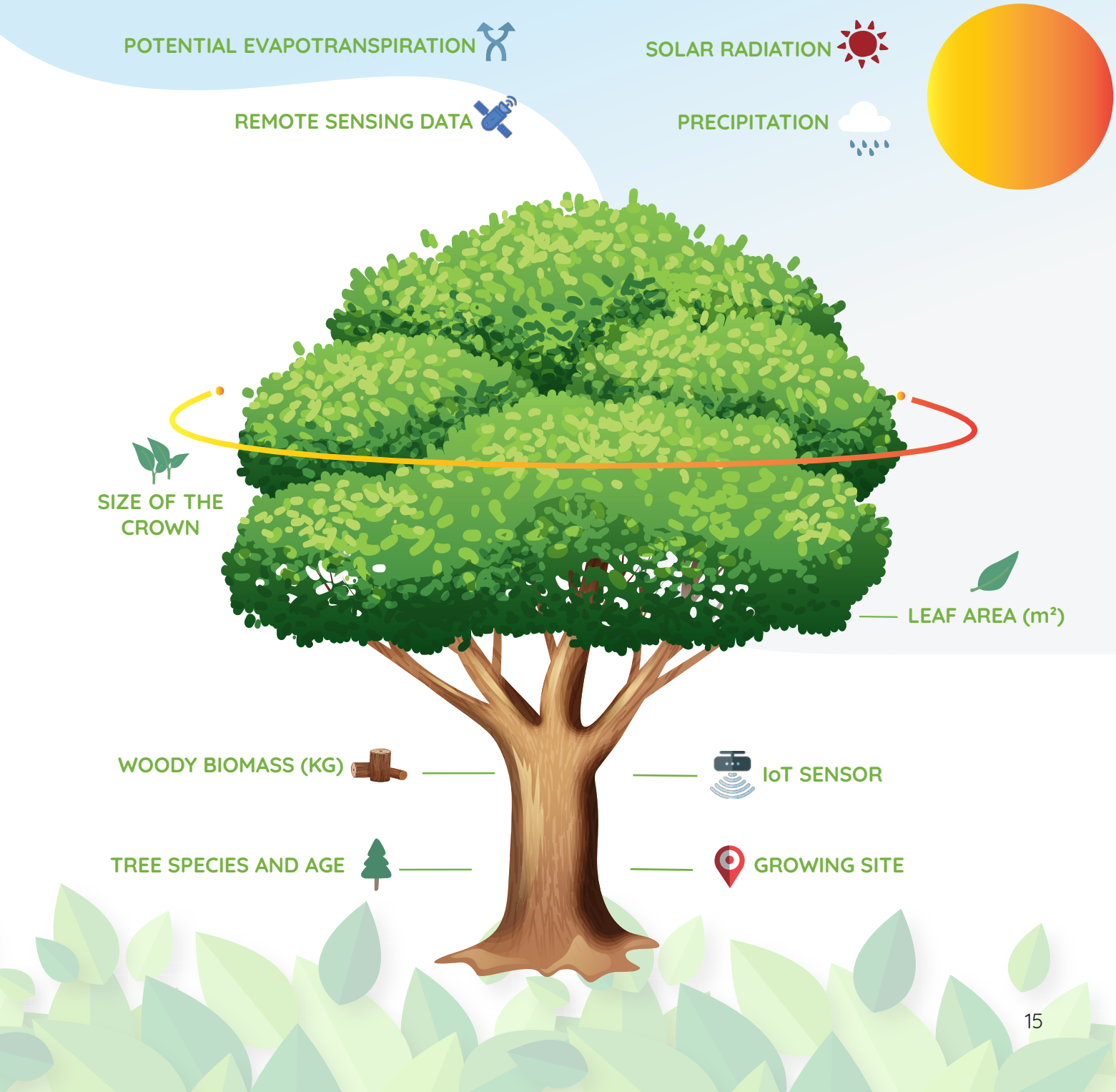

LOCAL WEATHER REPORT
SUNDAY
SUNNY
22°C
71.6 °F
14 KM/H SW
MONDAY
22°C
71.6 °F
TUESDAY
22°C
71.6 °F
WEDNESDAY
22°C
71.6 °F
THURSDAY
22°C
71.6 °F

—— Measuring urban trees... ——

LIFE URBANGREEN monitored individual trees from the most common species in Kraków and Rimini. The goal was to collect data on biomass, leaf surface and transpiration, achieved by carrying out measurements in spring, summer and autumn for three years. In addition, leaf samples were collected to assess the quantity of pollutants they removed from the air. With this data, we were able to develop and integrate an algorithm for GreenSpaces to calculate nature benefits provided by urban trees.

Within the **Ecosystem Services module**, meteorological data on potential evapotranspiration and solar radiation are used in combination with the tree species, age, and growing site to answer such questions as: how much CO_2 does each tree permanently store? How many particulates will the tree filter out of the air? By how many degrees does a row of trees cool down the street temperature?

In addition to weather data, weekly satellite images and “TreeTalker” sensors are used in Rimini and Kraków to monitor the health of trees. Satellite images monitor the vitality of trees along roads on a weekly basis. Anomalies are visible from multispectral satellite images long before they can be detected from the ground. If needed, the municipality can intervene quickly and arrange for the necessary maintenance measures.


POTENTIAL EVAPOTRANSPIRATION
SOLAR RADIATION
REMOTE SENSING DATA
PRECIPITATION
SIZE OF THE CROWN
LEAF AREA (m²)
WOODY BIOMASS (KG)
IoT SENSOR
TREE SPECIES AND AGE
GROWING SITE

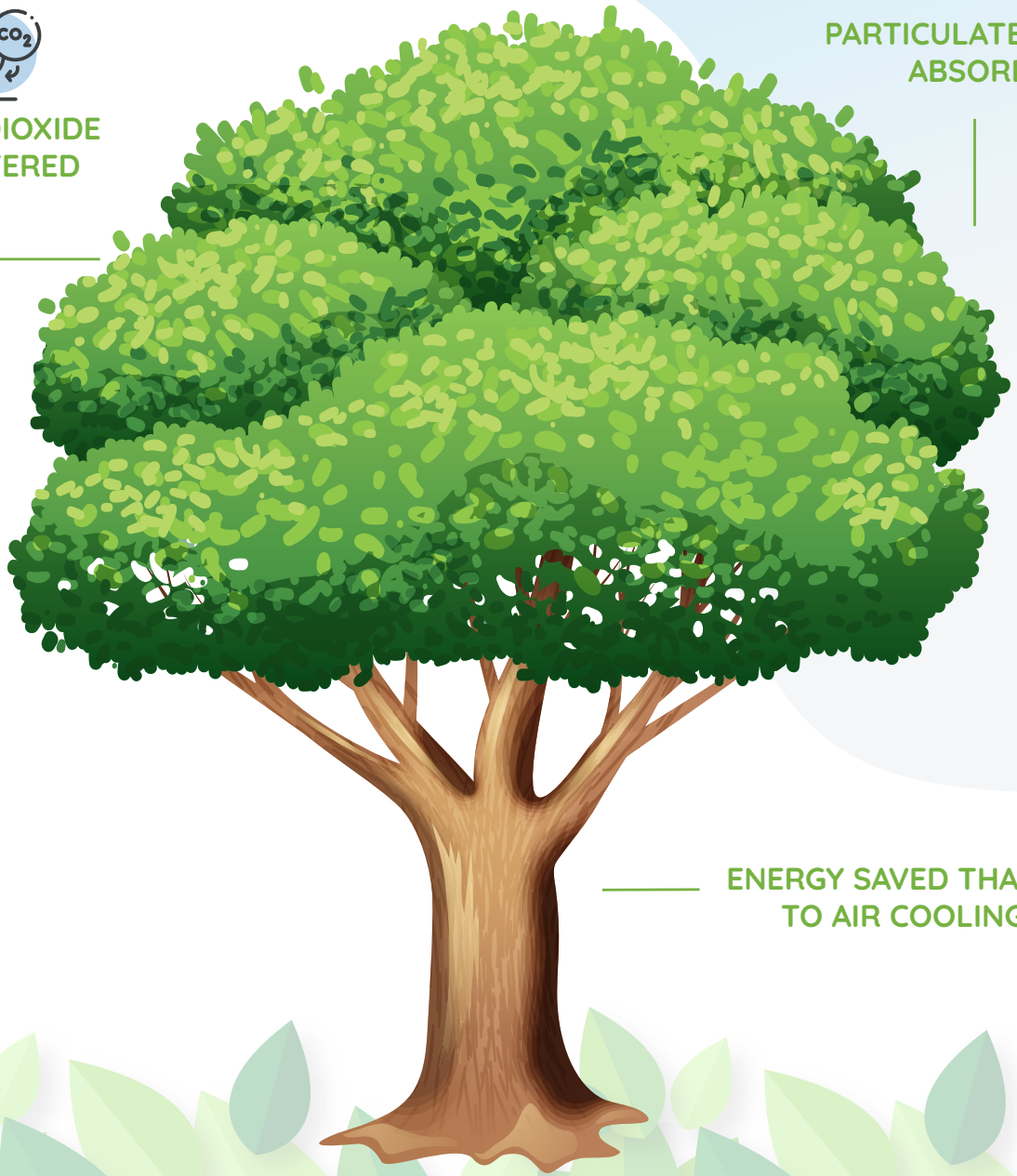
...and their benefits

How can we calculate the benefits of trees for city users? The LIFE URBANGREEN project sheds light on the most important **ecosystem services for climate change adaptation**: the leaf transpiration and cooling capacity as well as carbon sequestration and the deposit of particulate matter for air pollution mitigation. In order to measure climate change adaptation benefits provided by trees, not only is a comprehensive census of urban green areas needed, but also information about tree species.

Trees in cities behave differently from trees in woodland, e.g. due to the increased stress factors to which they are exposed: the use of salt during winter for ice melting or the underground infrastructure maintenance, which can cause damage to the roots.

In LIFE URBANGREEN the behaviour and benefits of individual tree species are studied on site and transformed into tools which can be applied to larger areas.

What is found, for example, is that each tree analysed in Rimini and Kraków absorbs an average of 1.5 tons of CO_2 per year, however a large part of CO_2 is released back into the environment before the end of the growing season. Furthermore, a tree permanently stores an average of 30 kilograms of climate-damaging CO_2 molecules per year. This corresponds to the quantity of CO_2 emitted by a car driving 200 kilometres.


CARBON DIOXIDE SEQUESTERED
PARTICULATE MATTER ABSORBED
ENERGY SAVED THANKS TO AIR COOLING

Citizens as gardeners: the public portal

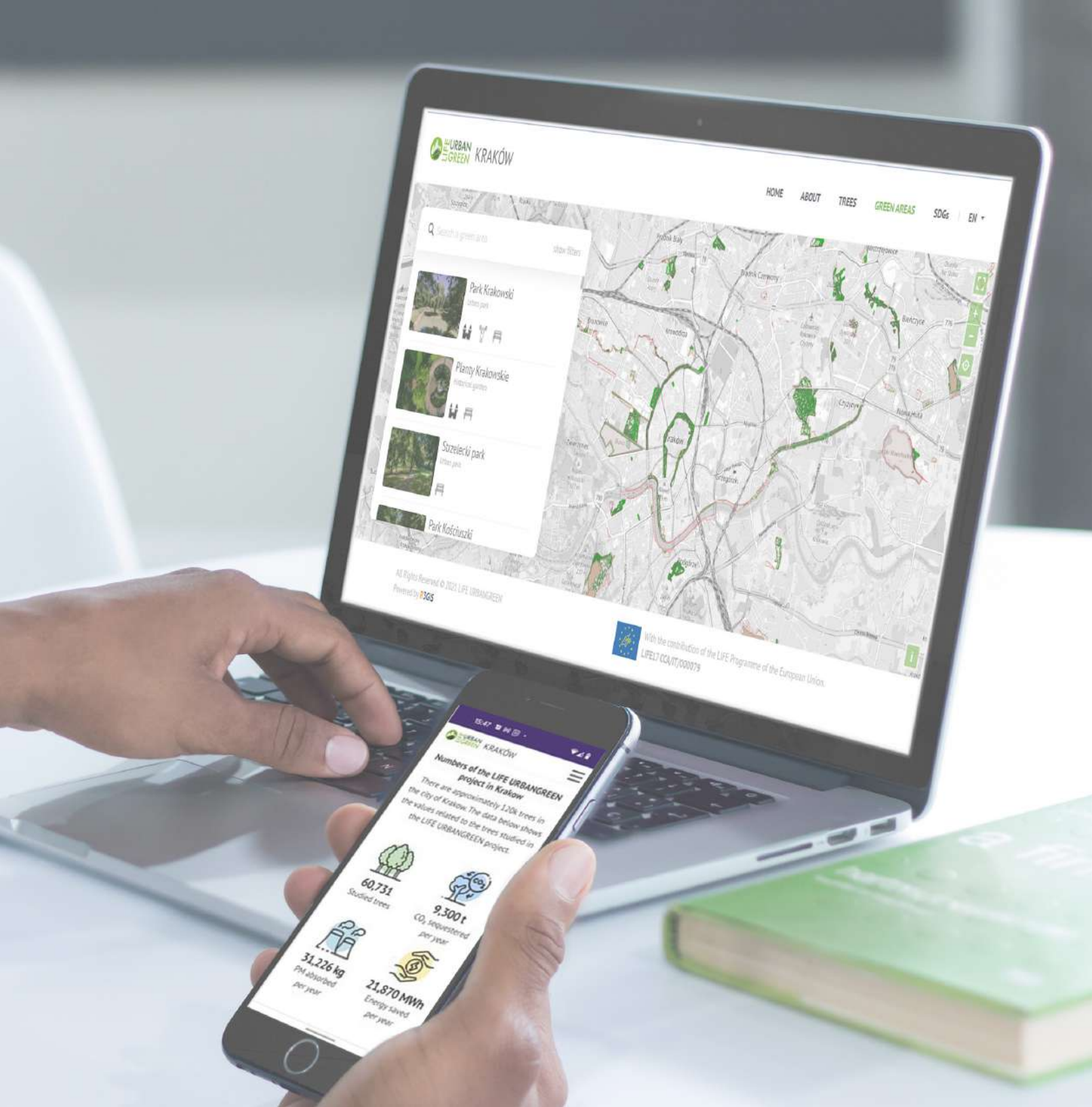
Climate protection and city adaptation to the increasing number of heatwaves, droughts, heavy rainfall and windstorm events cannot succeed without the involvement of citizens. In order to trigger a successful social and cultural transformation, all data and information gathered must be available to the public. In fact, a successful strategy would come with a renewed general consensus from citizens on the role that urban green infrastructure plays.

For this reason, results from the comprehensive survey of Kraków and Rimini green spaces are accessible to all interested parties. A **public portal** displays the main benefits of urban trees in real time, for example, how many kilograms of particulates all trees from a site remove from the atmosphere per year. This information can also be viewed for an individual tree per year or per day. Citizens can search for botanical descriptions of the common species and their environmental benefits.

For example, the Norway maple is the most common tree among those studied in Kraków, with more than 9,500 individual plants. The white dogwood, on the other hand, numbers only six trees!

A rating on a scale from 1 to 10 is given for all tree species studied according to their performance in respect of the following three benefits: CO_2 assimilation, air quality amelioration and temperature cooling through leaf transpiration.

In Rimini the public portal shows that the oak (*Quercus robur*) performs particularly well in regard to these three ecological benefits compared to other species.


URBAN GREEN KRAKÓW
HOME
ABOUT
TREES
GREEN AREAS
SDGs
EN
Park Krakowski
Planty Krakowskie
Szczelecki park
Park Kościuszki
With the contribution of the LIFE Programme of the European Union.
LIFE17 CCA/IT/000079
Numbers of the LIFE URBANGREEN project in Krakow
There are approximately 120k trees in the city of Krakow. The data below shows the values related to the trees studied in the LIFE URBANGREEN project.
60,731
Studied trees
9,300 t
CO2 sequestered per year
31,226 kg
PM absorbed per year
21,870 MWh
Energy saved per year

The city of tomorrow: conclusions

The LIFE URBANGREEN project studied ten different species of trees, both in Rimini and Kraków. Three of them are present in both cities (*Quercus robur*, *Aesculus hippocastanum*, *Populus nigra*). The project provides the first conclusions for the benefits and behaviour of urban trees in Central and Eastern Europe.

The list of tree species and locations still needs to be expanded in order to be able to draw reliable conclusions and provide decision-makers with sufficient information. **It is therefore recommended to extend the project to additional cities with different species and different climatic conditions**. The vision is to create a network of cities that would jointly research and test which are the most suitable urban trees and shrubs for climate change adaptation.

Long-term data on environmental quality is becoming increasingly important, including in economic terms. In fact, data allows administrators, businesses, and citizens to respond in a more targeted and efficient way to the challenges posed by climate change. Such data, as well as the methods and instruments used to collect the data, should consequently be made available to the public. Therefore, **the LIFE URBANGREEN public portal will become fundamental in building knowledge among different actors**, who can make use of this information for further improvements in green infrastructure management and research.

Climate change puts pressure on the urban environment, increases risks linked to green infrastructure, and undermines citizen security. Firefighters and emergency teams have to repeatedly intervene due to safety threats posed by falling branches and trees. The GreenSpaces platform and LIFE URBANGREEN results help improve monitoring and raise the discussion on public safety in a more technical and objective way.

GreenSpaces highlights **advantages that greener cities bring in terms of environmental benefits and indicate the way to efficiently organise supervision and maintenance activities of trees while minimising the related risks**. LIFE URBANGREEN helps municipalities to expand their green infrastructure and improves management and safety performances compared to traditional management systems. Climate models forecast an increase in number and intensity of extreme weather events, which is why accurate tree care and standard procedures are becoming more important.

The LIFE URBANGREEN project has analysed selected ecosystem services. However, green areas have far more positive effects on people and the urban environment than the project itself has highlighted. For example, some tree species foster biodiversity conservation by hosting a variety of insects and birds, while others perform less well. **Clearly, the maximum benefits from ecosystem services can be obtained by planting the right mix of tree species**. What trees cannot do alone is to invert climate change trends: a comprehensive strategy is therefore needed to quickly meet the Paris targets and limit global warming to 1.5 degrees.

Contacts

PROJECT COORDINATOR

Paolo VISKANIC
R3GIS
paolo.viskanic@r3gis.com

PROJECT MANAGER

Alice PASQUINELLI
R3GIS
alice.pasquinelli@r3gis.com

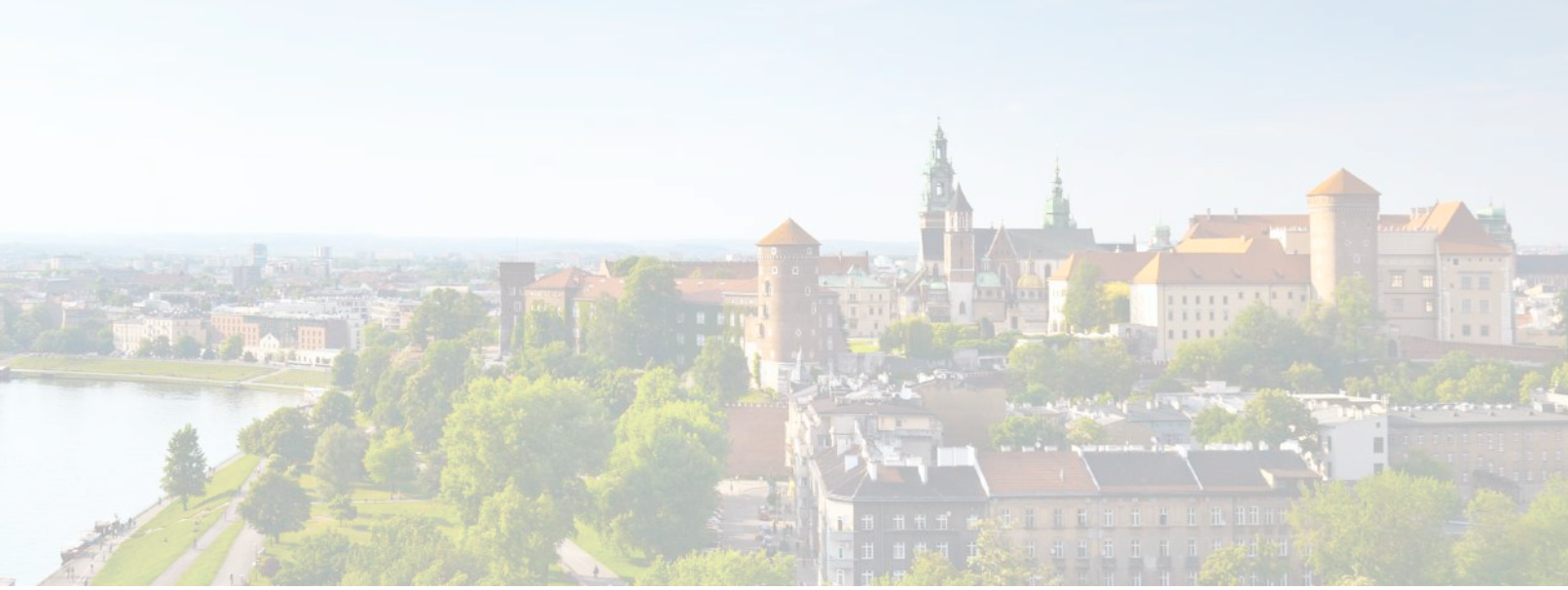
PROJECT PARTNERS

Edoardo CAGNOLATI
ANTHEA
edoardo.cagnolati@anthearimini.it

Przemysław SZWALKO
Gmina Miejska Kraków
pszwalko@zzm.krakow.pl

Alessio FINI
Università degli Studi di Milano
alessio.fini@unimi.it

Katarzyna BAJOREK-ZYDROŃ
ProGea 4D
katarzyna.bajorek-zydron@progea.pl



LIFE URBANGREEN

www.lifeurbangreen.eu

With the contribution of the LIFE Programme of the European Union
LIFE17 CCA/IT/000079