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URBAN INNOVATIVE ACTIONS

The Urban Lab of Europe !

# The CLAIRO Project Journal N° 1

*Project led by the **City of Ostrava***

**AIR QUALITY**

European Union
European Regional Development Fund

Région Hauts-de-France

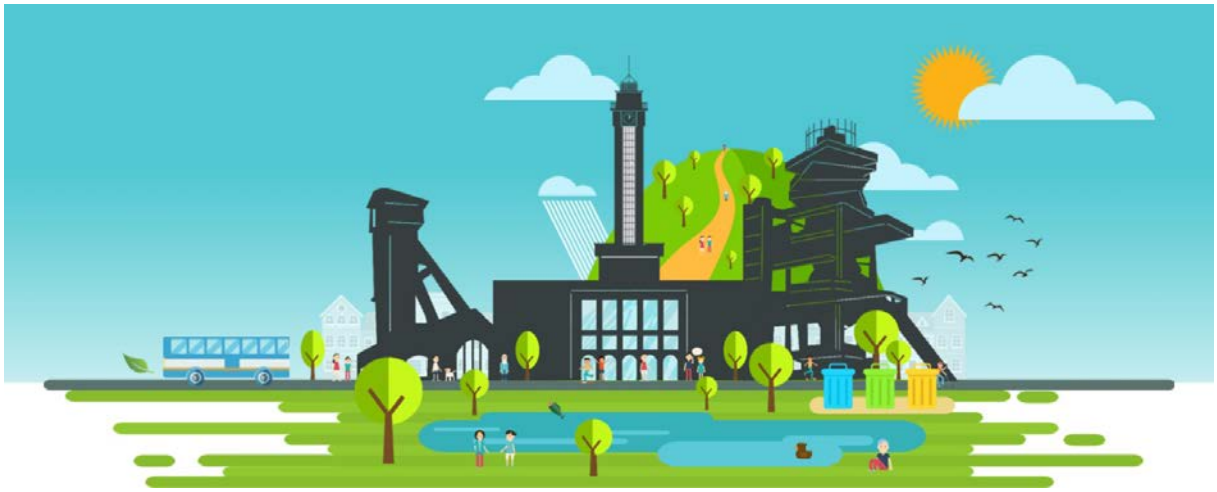
# The CLAIRO Project

The **CLAIRO** project aims at the systematic reduction of air pollution through comprehensive planning and planting of greenery with a positive impact on air quality. The project involves the following steps:

- measurement of air pollutants using innovative solar panel-powered measurement sensors, and evaluation of the gathered data to support the design of the greenery;
- development of a methodology helping the design of the most effective composition and structure of urban green spaces in order to reduce air pollution (based on the above data);
- identification and application of plant species that are the most tolerant to air pollutants and which have the most positive impacts on air quality,
- planting of greenery and their maintenance;
- increasing the tolerance of plants to air pollutants with a special treatment;
- creation of a platform of trained experts, informed cities;
- transfer of experience to other cities.

**Partnership:**

- City of Ostrava
- Moravian-Silesian Region
- Silesian University in Opava
- Technical University of Ostrava
- Palacky University Olomouc
- Regional Association of Territorial Cooperation of Teschen Silesia (RSTS)
- SOBIC Smart & Open Base for Innovations in European Cities and Regions



# Table of Contents


**1. EXECUTIVE SUMMARY 5**

**2. GENERAL CONTEXT 7**

2.1 Air quality and urban greenery 7

2.2 EU Policy context 7

2.3 Local context in Ostrava 8

**3. KEY ACTIVITIES AND INTERIM RESULTS 10**

3.1 Continuous measurements support the design of new greenery 10

3.2 Preparatory work enabling greenery planting well underway 11

3.3 A survey shows that air quality is key for residents 13

**4. CHALLENGES FOR IMPLEMENTATION 15**

4.1 Leadership 15

4.2 Public procurement 15

4.3 Organisational arrangements within the urban authority 16

4.4 Participative approach for co-implementation 16

4.5 Monitoring and evaluation 17

4.6 Communication with target beneficiaries and users 17

4.7 Upscaling 18

4.8 Damages in the greenery 18

4.9 Impacts of the new coronavirus pandemic 18

**5. LESSONS LEARNT 20**

**6. CONCLUSION 21**

**7. REFERENCES 22**

# 1. EXECUTIVE SUMMARY

With the rapid rate of urbanisation and with the rising number of motor vehicles, authorities struggle to provide adequate air quality improvements through emission control strategies alone and are often turning to complementary methods, such as the use of green infrastructure.

Since the 19th century Ostrava grew to become one of the largest Czech industrial centres. Despite the restructuring of the city's industrial base and numerous effective measures, air pollution remains one of the city's biggest environmental problems. Under the CLAIRO project new greenery will be planted in Ostrava that will function as a living lab for cities in the Upper Silesian metropolitan area and beyond, providing long-term information on air quality improvement. The vegetation will be installed on two separate plots in the most polluted neighbourhoods of Ostrava.

As part of the project activities measurements of air pollutants and climatic conditions are undertaken in Ostrava and also in other neighbour cities with an overall aim and to provide essential information for the development of a model of captured pollutants, and to enable the design of the most effective composition and structure of the greenery to be planted in the target area. Measurements in Ostrava have started in September 2019. The data on the measured concentrations are sent at 5-minute intervals to a central monitoring station. The monitoring activity outside Ostrava already started in Třinec and Opava, where sensors were installed in December 2019 and January 2020, respectively.

The design of the greenery structure and composition for the two target areas of the project was created in December 2019. The details of the method linked to an innovative soil and plant treatment that increase the tolerance of vegetation to air pollution was defined. From mid-October to mid-November 2019 a public opinion survey was carried out in the streets of Ostrava and nearby towns. Survey results indicated that residents consider air quality as an important topic. The vast majority of respondents are in favour of planting new greenery; and believe that the structure of greenery in urban areas can influence air quality.

Due to the complexity of CLAIRO, as it addresses at the same time air quality management, green space governance, and stakeholder management, and also due to the innovativeness of the solutions applied, a number of challenges might arise during project implementation.

Several challenges are associated with the development and operation of an applicable monitoring framework. These include the identification of appropriate indicators that allow verification of the achievement of targets set by the project, and the relatively short project lifetime that hinders the demonstration of mid-term and long-term impacts of project activities.

The vision of the project is quite ambitious, but the relatively small size of the target areas allows only local and moderate improvements in air quality. Therefore, potentially high expectations of decision makers and the general public will need to be managed by clearly explaining the

scope of the project activities and the catalysator role of CLAIRO.

One of the greatest challenges faced by project partnership is to effectively scale up the approach supported by CLAIRO. Upscaling evidently depends on the viability of the tested methodology, i.e. the ability of the installed greenery to effectively improve air quality.

In terms of future prospects, it is encouraging that the results of the first survey indicated that the objectives of the project are relevant for the people living in the region, and that local stakeholders will be willing to actively participate in project activities.

# 2. GENERAL CONTEXT

## 2.1 Air quality and urban greenery

With the rapid rate of urbanisation and with the rising number of motor vehicles and as distances driven increase world-wide, authorities struggle to provide adequate air quality improvements through emission control strategies alone and are often turning to complementary methods. After reducing emissions and physically extending the distance between polluting sources and receptors, the use of green infrastructure can be a complementary option for mitigating air pollution.[1]

Vegetation plays an important part in controlling the flow and distribution of pollutants by controlling their dispersion; as well as in removing air pollutants by the process of deposition to leaf surfaces.[2] In an open-road environment a vegetation barrier (i.e. a hedge) can halve the concentrations of pollutants in its immediate vicinity.[3]

Urban vegetation can remove air pollution by deposition, when pollution sticks to the surface of a leaf and is removed from the air.[4] Due to its relatively large surface area, plant canopy functions as a sink for particulate matter. Plant leaves are estimated to span on a global scale nearly 80% of the total surface area of the earth. Growing evidence indicates that plant leaves can capture particulates and act as biofilters. The ability of a plant to accumulate particulate matter depends on the physical characteristics of the leaf, such as leaf shape, the surface structure, the amount of surface waxes, as well as on the composition leaf-associated microbes. Depending on the selected plant species there can be a ten-fifteen-fold difference in particulates accumulation.[5] Vegetation with higher surface area (deciduous broad-leaved trees), greater rates of transpiration, and longer in-leaf periods result in the greatest enhancements in deposition.[6] Furthermore, parks can also draw people away from polluted areas, thus indirectly protecting them from air pollution.[7]

## 2.2 EU Policy context

The Seventh Environment Action Programme (7th EAP), that provides the framework for Union action in the field of the environment has set the objective to attain 'levels of air quality that do not give rise to significant negative impacts on, and risks to, human health and the environment'. A dual-track approach is followed by the EU air pollution legislation, as both air-quality standards and emission mitigation controls are implemented.

The Ambient Air Quality Directive (2008/50/EC) establishes standards for a range of pollutants including $SO_2$, $NO_2$ and other nitrogen oxides, particulate matter ($PM_{10}$ and $PM_{2.5}$), lead, benzene ($C_6H_6$), carbon monoxide (CO) and ozone. In areas, where target or limit values are exceeded, air quality management plans must be developed and implemented.

The Industrial Emissions Directive (2010/75/EU) is the main EU instrument regulating pollutant emissions from industrial installations. It aims to reduce emissions, promote resource efficiency and restrict the use of hazardous chemicals by

setting standards for different industrial activities. More than 50,000 industrial installations in the EU are subject to the rules set in the directive.

The National Emission Ceilings Directive establishes national emission reduction commitments for Member States and the EU for five important air pollutants: nitrogen oxides ($NO_x$), non-methane volatile organic compounds (NMVOCs), sulphur dioxide ($SO_2$), ammonia ($NH_3$) and fine particulate matter ($PM_{2.5}$), which are applicable from 2020 and from 2030.

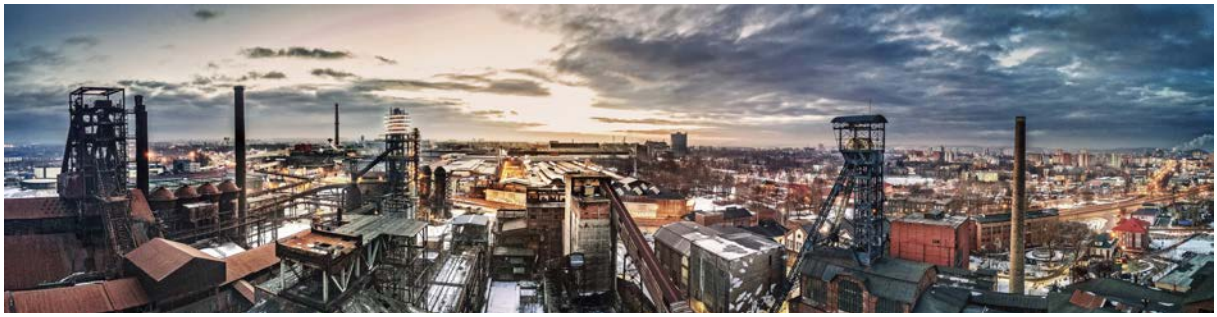
CLAIRO is linked to three priority themes of the Urban Agenda for the EU, i.e. Air Quality; Sustainable Use of Land and Nature-Based Solutions; and Climate Adaptation. As regards the Action Plan of the Air Quality Partnership, Action 4 'Better focus on the protection and on the improvement of citizens' has a particular relevance for the project. One of the two main objectives of the Sustainable Land Use Partnership, 'to mainstream and promote nature-based solutions as a tool to build sustainable, resilient and liveable urban spaces' is directly addressed by CLAIRO.

## 2.3 Local context in Ostrava

Ostrava, the third largest city of the Czech Republic, is the capital of the Moravian-Silesian Region. Ostrava forms part of the Upper Silesian metropolitan area, an international industrial agglomeration in southern Poland and northeast Czech Republic with approx. 5 million inhabitants.

Following the deposition of a major coalfield in the area and the establishment of first ironworks in 1828, Ostrava has become significant industrial centre of the country. Ostrava's high concentration of heavy industry in the second half of the 20th century created various environmental problems in the city, particularly in relation to air quality.

Due to a major restructuring of the industry the situation has significantly improved over time resulting in a nearly 90% pollution decrease in the city. Despite the restructuring, air quality remains one of the city's biggest environmental problems. The main sources of air pollution in Ostrava include stationary sources (metallurgical production and power generation), domestic heating, and transport. In the case of Ostrava, a fourth major factor is cross-border pollution from the nearby industrial conurbation of Katowice in Poland. The situation is further aggravated in Ostrava by local meteorological conditions in winter, which is characterised by frequent inversions that result in poor dispersion of pollutants. The major pollutants in the city are particulates; the legal limit value for the annual mean was often exceeded in case of $PM_{2.5}$ and $PM_{10}$ over the period between 2004 and 2014. Monitoring data in Ostrava have shown that exposure to benzo(a)pyrene is high, as for many years the legal limit has been exceeded at all locations where concentrations of this pollutant are measured.



The trends however are reassuring, as air quality in Ostrava has been significantly improving in the long term. The results for 2019 are the best in the history of measurements so far. This positive trend apart from meteorological conditions (i.e. a mild winter leading shorter heating season, and shorter periods of temperature inversion) is a result of a package of measures initiated by the City of Ostrava that include among others emission control measures implemented in the industrial sector, a household boiler replacement programme, the development of the public transport system, intensive road cleaning that reduces secondary air pollution caused by vehicle traffic, the operation of a bike share system, the conversion of municipal fleet to low-emission or electric vehicles, rehabilitation of parks and the planting of tolerant greenery on roads.

In light of the significance of the issue, air quality is a key priority of the city. Currently, Ostrava implements the third update of the Action Plan for reducing air pollution (2017). Under the action plan the city has signed a memorandum with Katowice stressing the joint intention of the two cities to achieve air quality improvements in the Czech-Polish border region. As part of the action plan, Ostrava provides funds for a programme enabling the replacement of obsolete solid fuel boilers with modern low-emission equipment. As a result of the programme, over 2100 boilers have been replaced by February 2020. In addition, the plan includes measures supporting the construction and reconstruction of tram and trolleybus tracks, construction of cycling infrastructure, expansion of pedestrian zones in the city, planting greenery and establishing new parks, and construction park and ride car parks.

# 3. KEY ACTIVITIES AND INTERIM RESULTS

Under the CLAIRO project new greenery will be planted in Ostrava that will function as a living lab for cities in the Upper Silesian metropolitan area and beyond, providing long-term information on air quality improvement. The vegetation will be installed in the most polluted neighbourhoods of Ostrava, Radvanice and Bartovice. The greenery will be established on two separate plots close to a metallurgical plant that is one of the largest polluters in the region. In Radvanice an over 12000 $m^2$ area, while and in Bartovice a nearly 8000 $m^2$ land will be forested. The planting will not take place until March 2021. Before that, measurements will have an important role in supporting design and producing baseline data as a tool for data comparison, to assess the effectiveness of the methodology. The long-term goal is to share with other districts and cities the novel experience gained at the urban greenery living lab, and to inspire them with innovative green solutions.

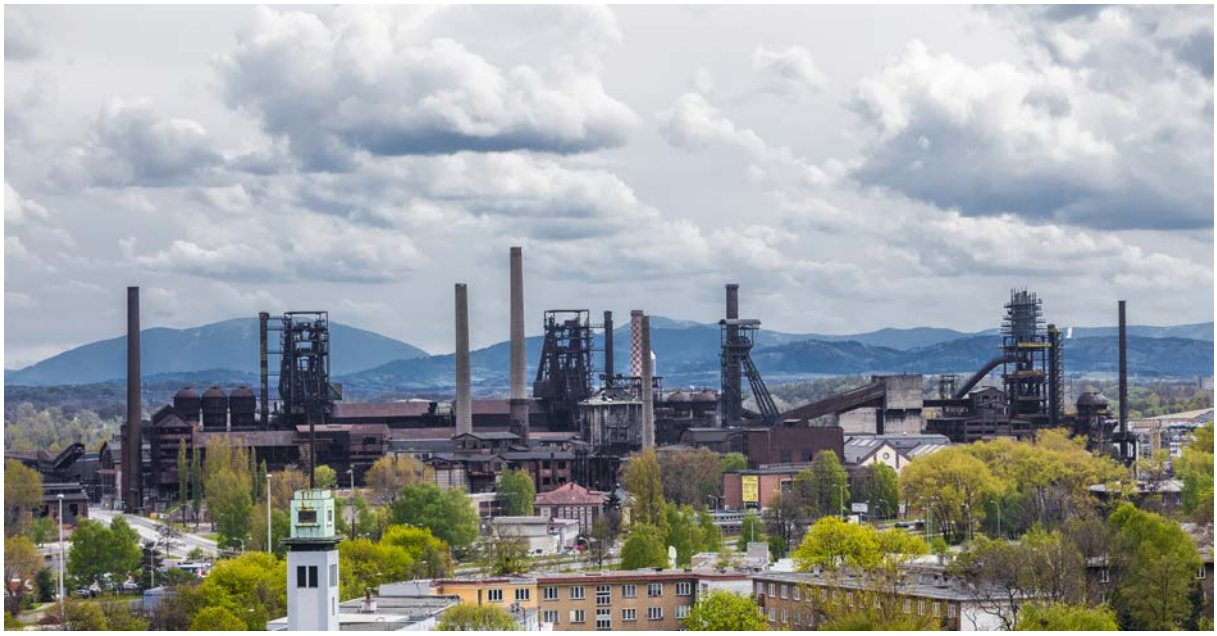
## 3.1 Continuous measurements support the design of new greenery

Under the project accurate measurements of air pollutants and climatic conditions are undertaken in Ostrava and also in other neighbour cities with an overall aim and to provide essential information for the development of a model of dispersion, deposition and capture of pollutants, and to enable the design of the most effective composition and structure of the greenery to be planted in the target area. The data gained through the measurements will also be vital for transferring project results to other cities in the region and Europe.

Altogether, 19 measurement units were installed in August 2019 by the Technical University of Ostrava in the city. Out of the 19 units, 18 were placed in or in the direct vicinity of the area that will be greened, while one of them serves as a control unit at the premises of the Technical University of Ostrava. A new generation of sensor units are used, which allows on-line monitoring of concentrations of one of the most potent carcinogenic pollutant, benzo(a)pyrene, without the need for complicated laboratory analysis, as opposed to standard measurement processes. The sensors units allow fast, short-term measurements of both organic and inorganic substances. Solar panels ensure that the units are energy self-sufficient. The concentrations of particulate matter in various fractions ($PM_1$, $PM_{2.5}$ and $PM_{10}$), nitrogen dioxide ($NO_x$) and ozone ($O_3$), volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons (benzo(a)pyrene) are monitored by the measurement units.

Following a testing phase, the measurements have started in September 2019. The data on the measured concentrations are sent at 5-minute intervals to a central monitoring station at the campus of the Technical University of Ostrava. As huge volumes of data will be gathered during and after the lifetime of the project, data processing

is done by a supercomputer. Sensors will be collecting pollutant concentration data before, during and after the planting of the new greenery to provide information on the effectiveness of the technology. Before planting, data is gathered throughout an entire year to cover all seasons and weather conditions. Data on climate conditions, such as wind force, the direction of the wind, temperature, pressure, humidity, and rainfall is also collected to complement detailed information on air quality.



Measurements of air pollution will also be undertaken in other neighbouring cities in the Ostrava- Karvina Industrial Agglomeration. The six towns identified as pilot areas are Třinec, Opava, Frýdek-Místek, Karviná, Havířov and Rychvald. The aim is to formulate based on the evaluation of the data gathered, a set of recommendations on future urban greenery and the most appropriate plants in the selected cities.

There are 6 sensors available for measurements in the selected cities. The sensors will be moving from city to city and monitoring will be undertaken in two cities at a time with three sensors installed in each of them. The sensors are planned to be placed in areas with the highest concentration of pollutants. Data will be collected in the cities over a several months-long period that include both the winter and the summer seasons.

The monitoring activity outside Ostrava started in Třinec and Opava, where sensors were installed in December 2019 and January 2020, respectively. Measurements are undertaken in the most polluted areas of the towns, close to roads with heavy traffic and major junctions.

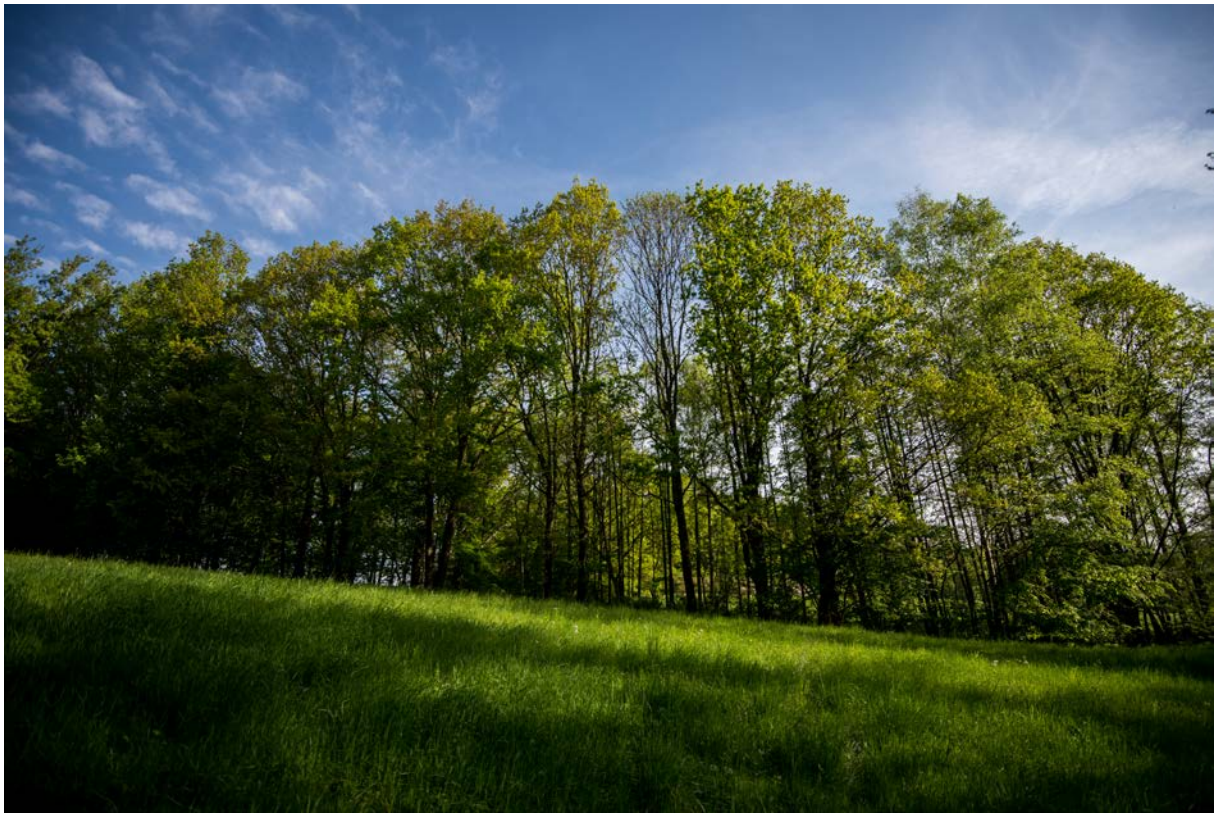
## 3.2 Preparatory work enabling greenery planting well underway

A series of four separate models will be developed under CLAIRO by the Silesian University in Opava on the capture of air pollutants by the greenery. These will focus on the original, the designed and the planted greenery, and also on the predictions of the future capture, respectively. In 2022 the separate models will be integrated under a comprehensive model of dispersion, deposition,

capture and resuspension of pollutants that will enable to propose the most effective composition and structure of the greenery in a given location.

The first model, linked to the capture of air pollutants with original greenery, was developed at the end of 2019 on the basis of continuous measurements of concentration of pollutants, meteorological parameters and natural conditions. The model quantified the capture of particulate matter ($PM_{10}$), ozone and nitrogen dioxide by trees and also herbaceous plants in both target areas of the project.

In December 2019 the Silesian University in Opava created the design of the greenery structure and composition for the two target areas of the project. The optimal structure of the greenery was defined on the basis of measured climatic and natural conditions. When defining the composition of the greenery, the filtering ability of woody plants, and also their tolerance to air pollution and to deposition of dust particles in the canopy were considered. Based on a field research that included soil mapping, an assessment of functions, and a survey of existing tree populations in the target localities, the dominant species were determined that include black pine, common oak and black poplar. Basic planting density, tree species in the mixture, planting materials and the methods for care of trees following planting were also defined. Maximized pollutant capture is ensured by growing trees in a continuous canopy. Exclusively domestic tree species were selected for planting. Care for planting will include individual protection of trees against game and rodents by a mesh around tree trunks, and precautionary measures against theft.



Under CLAIRO, as part of an experiment, an innovative soil and plant treatment will be applied by the Palacky University Olomouc on the new greenery to increase the tolerance of plants to abiotic stress, i.e. air pollution. The team of Palacky University has defined the details of the method to be used. During the treatment biostimulants will be applied, which will be fortified by plant hormones (cytokinins).

Biostimulants are preparations made from natural raw materials, such as components of humus or plant extracts, that improve the general health, vitality, and growth of plants. The application of cytokinins delays biological aging of the plant and has a positive effect on branching, rooting, and nutrient remobilization.

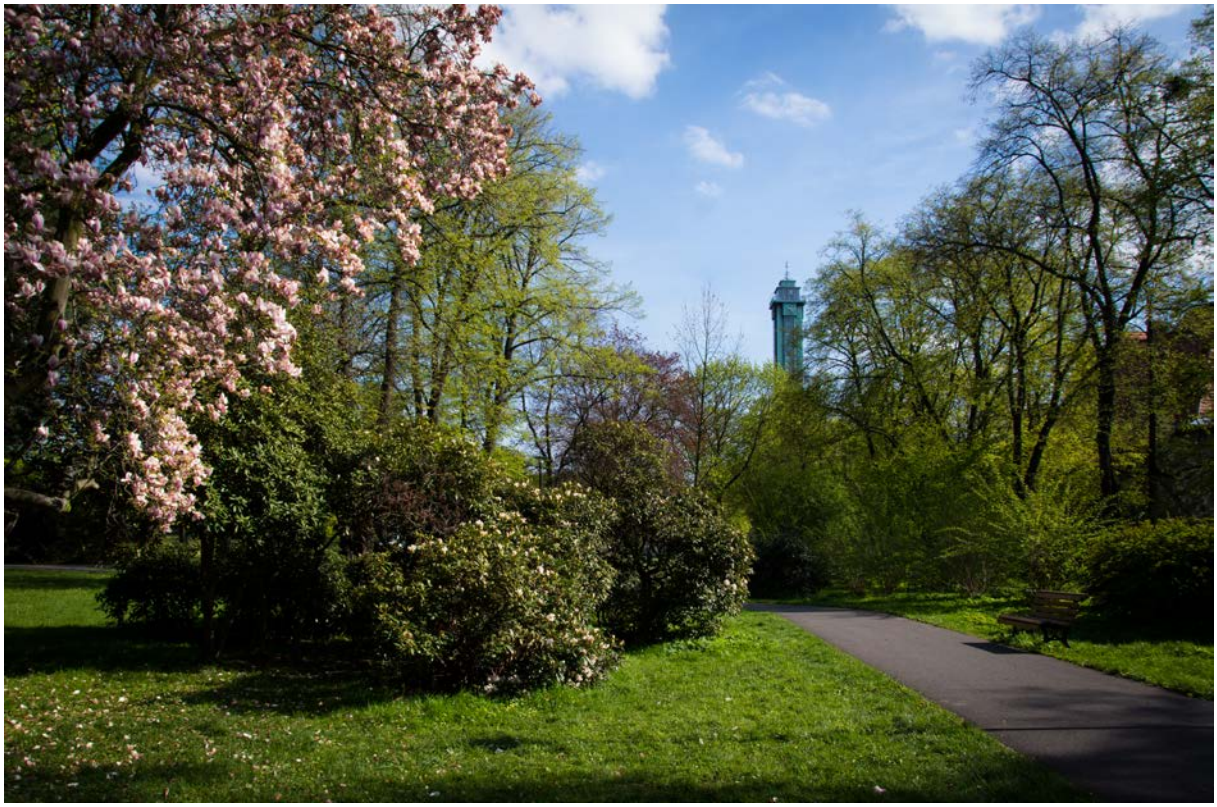
For experimental investigations the various sections of the plots to be greened will be divided into three areas respectively. The three areas will be treated differently: one with water and fertilizer, the other with water and biostimulants, and the third with water and biostimulants fortified by plant cytokinins to be able to compare the effectiveness of the various options.

## 3.3 A survey shows that air quality is key for residents

To support interventions targeting at the use of vegetation to improve air quality in cities of the Moravian-Silesian Region, and to support awareness raising among residents in the region, public opinion surveys are undertaken in CLAIRO.

The first one of two surveys was carried out by Regional Association of Territorial Cooperation of Teschen Silesia (RSTS) and SOBIC in the streets of Ostrava and nearby towns from mid-October to mid-November in 2019. The survey sought answers to questions such as, whether residents perceive air quality as an important issue, how people rate air quality where they live and work, or whether they would be prepared to change their own lifestyles in order to achieve environmental improvements. The survey addressed 602 residents from the largest towns and cities in the Moravian-Silesian Region and the surrounding municipalities, including Bohumín, Český Těšín, Frýdek-Místek, Havířov, Karviná, Opava, Hlučín, Ostrava and Třinec. The results will be made available to local authorities in the Moravian-Silesian Region to support them in developing measures targeting air quality improvements. During the survey, respondents also received detailed information on sources of pollution in their neighbourhoods, the CLAIRO project, various options for urban greenery, and the importance of choosing the right types of greenery which can potentially improve air quality, and mitigate the negative impacts of climate change.

Survey results indicated that over 50% of the people in the Ostrava agglomeration take an active interest in air quality and consider it an important topic, but only 2.7% of the respondents are satisfied with it in the region. Due to poor air quality, around a quarter of the respondents are considering or have considered moving away from the area. It was also pointed out that almost 60% of the respondents are willing to play an active role in improving the environment and air quality in the region. The results also showed that residents support the activities of the CLAIRO project, as 86% of respondents are in favour of planting new greenery, and over 80% are convinced that the structure of greenery in urban areas can influence air quality.



# 4. CHALLENGES FOR IMPLEMENTATION

Implementing a project that applies and disseminates a comprehensive methodology maximizing the positive impact of urban greenery on air quality, exploits innovative solutions will lead to a number of challenges that have to dealt with. Potential risks and challenges that are foreseen to be faced by Ostrava during the implementation of the project are outlined below.

## 4.1 Leadership

Due to the complexity of CLAIRO, as it addresses at the same time air quality management, green space governance, and stakeholder management, and also due to the innovativeness of the solutions applied, the project represents a relatively high degree of risks for the urban authority. The fact that at political level the CLAIRO project is strongly supported by the mayor Tomáš Macura, provides legitimacy for the activities to be undertaken. The political leadership is also complemented by more diffuse, administrative leadership. Within the city administration the two main managers (responsible for day-to-day operation) are supported by a risk manager and a thematic expert responsible for activities linked to green infrastructure interventions. Meetings of core team members of the city administration are held on an average on a weekly basis to support the coordination of various activities.

As the project consortium includes partners with different backgrounds, working methods and responsibilities, one of the most significant challenges linked to leadership is to harmonize various activities that are running simultaneously.

To ensure coordinated action, Ostrava maintains intensive internal communication among project partners, organizing a large number of project meetings and using a wide array of communication channels. Throughout project duration ten physical project partner meetings are held that are complemented by smaller group meetings focusing on various specific aspects of CLAIRO.

In the first year the implementation of CLAIRO was seriously hampered by an unforeseen event. At the very start of the project two separate plots were needed for greenery planting. The city council purchased one of the plots using its own budget. Second plot was planned to be leased from ArcelorMittal, a steel producer company that operated facilities in Ostrava. However, ArcelorMittal was recently sold to a new owner, Liberty Ostrava. The change in ownership brought about complications and critical delays in the process of negotiations on the terms and conditions of land use. In response the project was granted an extended by April 2022.

## 4.2 Public procurement

Under CLAIRO public procurement procedures are linked to the purchase of the measurement equipment, the laboratory equipment that support the strengthening of plant resistance, as

well as the purchase of the new greenery. The procurement was undertaken as expected in case of the measurement and the laboratory equipment. No major procurement issues are foreseen linked to the upcoming purchase of the new greenery. Ostrava has efficient internal processes in the field of public procurement, and through its specialists the city can provide consulting assistance to university partners for the execution of specific contracts.

## 4.3 Organisational arrangements within the urban authority

CLAIRO is a horizontal project requiring collaboration across a range of city departments. The Strategic Development Department is leading project activities. Other organizational units that are directly involved in project implementation include the Financial Department, the Department of Public Procurement and the Department of Environmental Affairs.

Organisational arrangements within the city administration could be an issue if other departments lose their commitment over time. Given the experience of Ostrava linked to similar activities, and the intense cooperation among the departments so far, the associated risk is only moderate. Yet, attention should be taken to ensure effective internal communication among the various organizational units and the synchronize and follow up ongoing activities.

## 4.4 Participative approach for co-implementation

There are certain challenges associated with making the collaborative system of CLAIRO work by ensuring the full participation of all project partners and external stakeholders. Effective collaboration among project partners is ensured by large number of physical and online project partner meetings and smaller thematic group meetings.

Apart from project partners, a large number of external stakeholders will be actively involved in the activities of CLAIRO. Experts on air pollution and urban greenery will be trained through workshops and individual consultations to transfer the project methodology to other cities. Similarly, workshops and consultations will be organized to train city representatives so that they can transfer the project knowledge to the regional cities of the Ostrava-Karvina Industrial Agglomeration and to Polish border cities. The wide public will be engaged through public seminars and public events with active participation.

The results of the first survey revealed that the objectives of the project are relevant for the people living in the region. The majority of the residents of the Ostrava agglomeration considers air quality an important topic and are willing to play an active role in improving it. Most of the respondents were in favour of planting new greenery and were also convinced that urban green infrastructure could influence air quality. These findings indicate that local stakeholders will be interested and willing to actively participate in project activities.

In addition, the fact that originally air pollution measurements were planned to be undertaken in 3 to 6 neighbouring cities, and eventually more than 6 towns volunteered to be pilot cities, suggests that cities will be actively engaged in project activities.

At this point it is important to the CLAIRO project to develop the key messages with which relevant external stakeholders can be targeted and with which their active engagement can be ensured.

## 4.5 Monitoring and evaluation

In CLAIRO monitoring of air pollutants and climatic conditions is vital for the design of new greenery and for the quantification of its impact on local air quality. A number of challenges are associated with the development and operation of an applicable monitoring framework, such as the identification of appropriate indicators that allow verification of the achievement of targets set by the project, or the relatively short project lifetime hindering the demonstration of mid-term and long-term impacts of project activities. As a result of measurements, enormous amount of data will be collected during the lifetime of the project. The processing and evaluation of raw data, and their interpretation for formulating key messages will be particularly challenging. To address all these challenges a separate work package is dedicated in the project to monitoring, data evaluation and modelling.

The relatively short project duration and the extremely tight schedule for implementation directly affects the monitoring activity. Although measurements will still be carried out one year following greenery planting at the end of the project, yet the full potential of the vegetation cannot be demonstrated during the lifetime of the project. Decades are required for a new plantation to become a mature forest, which can effectively capture air pollutants with the extensive surface of the canopy. As a consequence, the quantification of air pollutants captured by the planted vegetation, and through this the achievement of key project indicators will need to be verified by a comprehensive model that allows predictions of future capture. The model will also be essential in verifying the practicality of the project method. Accurate measurements will be key pre-requisites for the development of a reliable composite model that enables correct estimation of future capture of air pollutants. The development of a series of four separate models, which will be building blocks of the final model, will contribute to the application of a loop learning process, allowing continuous improvements.

## 4.6 Communication with target beneficiaries and users

While seminars for experts and cities and the relevant training materials are aiming at stakeholders with direct impact on urban greenery, the awareness-raising activities based on in-depth surveys are targeting the wide public as residents directly influence air quality through their own behaviour and lifestyle. Accordingly, communication activities, that will continue throughout the project lifetime, aim at both awareness raising regarding project outputs and long-term behaviour change. As part of the communication activities, tips will be provided to the general public on planting greenery in private gardens that contribute to improved air quality.

The findings of the first survey show that there is only a low risk that there would be a lack of interest of citizens or city representatives in the project. However, because of the complexity of CLAIRO, difficulties may arise in effectively communicating the objectives and the results of the project.

The vision of the project is quite ambitious, but the relatively small size of the target areas allows only local and moderate improvements in air

quality. Therefore, potentially high expectations of decision makers and the general public will need to be managed by clearly explaining the scope of the project activities and the catalysator role of CLAIRO.

## 4.7 Upscaling

One of the greatest challenges faced by project partnership is to effectively scale up the approach supported by CLAIRO. Upscaling evidently depends on the viability of the tested methodology, i.e. the ability of the installed greenery to effectively improve air quality.

CLAIRO has an adequate framework in place for transferring the knowledge gained in Ostrava to cities in the region and also across Europe.

To mainstream the project methodology the Upper Silesian metropolitan area, both experts and city representatives will be trained through targeted workshops and individual consultations.

Apart from these seminars, the comprehensive model of dispersion, deposition and capture of pollutants, an online database of plants that effectively impact air quality, together with a detailed methodology and a more concise manual will support both scaling the activities up in the City of Ostrava and rolling them out in the Upper Silesian metropolitan area and across Europe.

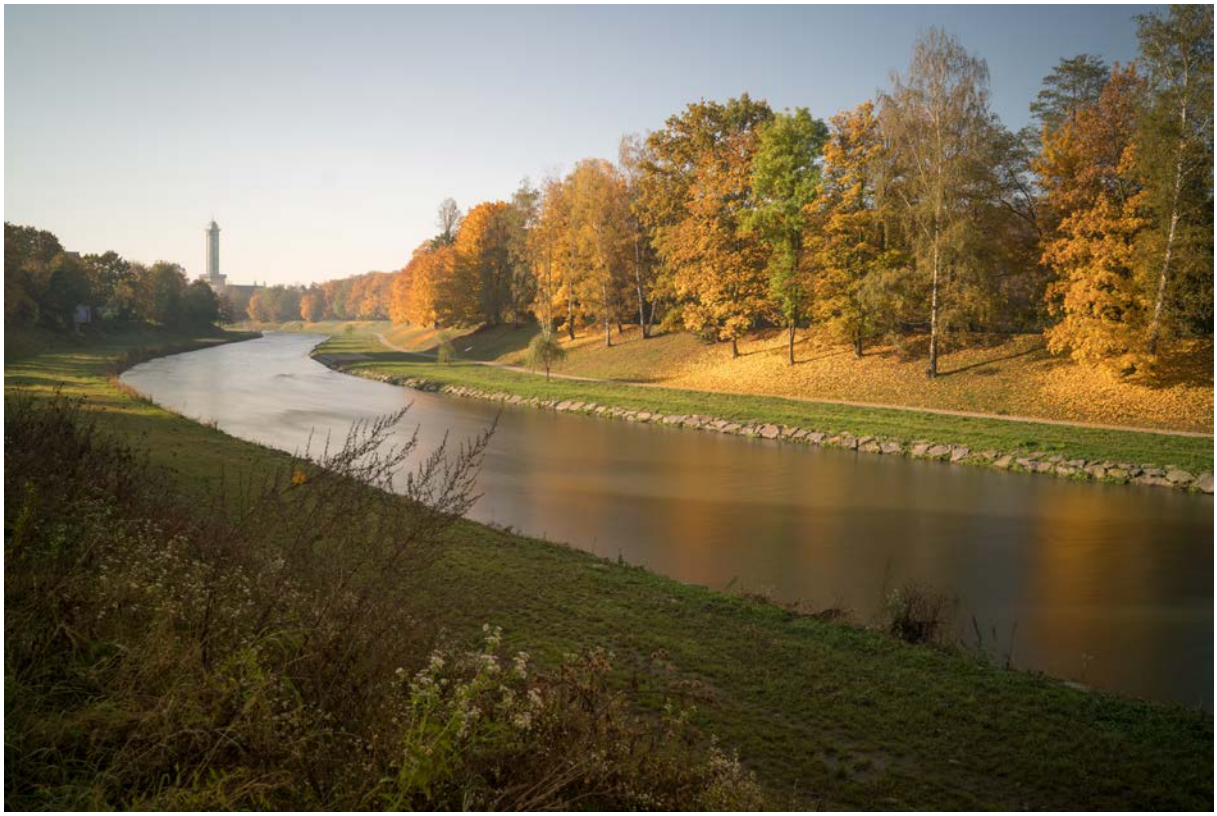
## 4.8 Damages in the greenery

The planted new greenery can be threatened by a number of factors that can adversely affect the capacity of the vegetation to improve air quality. Paradoxically, although the canopy of the plants captures pollutants, at the same time as the result of exposure to air pollution, a significant proportion of trees can wither up. In response, an innovative soil and plant treatment will be applied to increase the tolerance of plants to air pollutants.

Vandalism, including theft and damage is also a problem that could happen at the new greenery plantations. To prevent vandalism security cameras will be placed on the two target areas.

## 4.9 Impacts of the new coronavirus pandemic

As in the case of other UIA projects, the new coronavirus pandemic could heavily impact project implementation, disrupting or delaying a number of activities. In case it is not possible to freeze the project for several months, then the reorganization of a number of activities, or a complete reprograming of the project might be necessary. In the short-term, actions that can be implemented without the organization of physical meetings would need to be prioritized, while other ones should be postponed. It should be also explored which of the foreseen face-to-face meetings can be organized with the help of virtual tools and how.



# 5. LESSONS LEARNT

Although CLAIRO is still in an initial phase of project implementation, there are some early learning points that can be made from the project.

- An experimental project that is based on co-creation, such as CLAIRO, requires a change in the way of working both in the case of the representatives of the City of Ostrava and of the partners. Openness, transparency, an ability to innovate, and to work together towards a common vision will be key prerequisites for successful project implementation.
- The results of the first survey, conveyed a positive message about the relevance of the project, signalling that air quality is an important topic for the general public, and that residents are in favour of mitigating air pollution by planting new greenery.
- It was also justified that air quality is a relevant issue in other neighbouring cities in the Ostrava-Karvina Industrial Agglomeration, as exceeding initial expectations, more than six towns volunteered to act as pilot cities in the project activities.
- It soon became apparent that data interpretation will be a key factor for successful implementation. The huge amount of raw data to be gathered throughout project duration after their processing and the modelling work, will need to be converted into easily digestible messages that enable both scaling up and rolling out of the practice tested by CLAIRO.

# 6. CONCLUSION

The big challenge faced by Ostrava is to reliably quantify the impacts of vegetation on air quality during the relatively short, 3-year long duration of the project, and through this to verify the viability of the tested methodology. Credible project results will directly influence the ability of the project team to effectively transfer the solution tested in Ostrava to other in cities in the region and Europe. The partnership has already developed the model of air pollutants captured by original greenery, one of the components of a comprehensive model that allows accurate estimations in terms of captured pollutants. Work has already started on another model that will show the capacity of the designed greenery for capturing pollutants. Another problem is associated with coordination. Given the complexity of CLAIRO, harmonization of various interdependent activities will be particularly challenging, calling for intensive internal communication.

In terms of future prospects, it is encouraging that the results of the first survey indicated that the objectives of the project are relevant for the people living in the region, and that local stakeholders will be willing to actively participate in project activities.

In the upcoming months the partnership will be working on some of the key building blocks of the project. The measurements and the related data processing and evaluation will be continuous. An on-line database of plant species that can effectively decrease air pollution is being developed. The details of the method linked to the innovative soil and plant treatment that will increase the resistance of the new greenery to air pollution are being worked out. And most importantly, preparations will be undertaken for the plantation of the new greenery in Ostrava.

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