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JOURNAL

PROJECT

CLAIRO - CLear AIR and Climate Adaptation in Ostrava and other cities

Ostrava, Czech Republic

TOPIC

Air quality

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The CLAIRO Project Journal N°2

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This is the second Journal of Tamas Kallay on the CLAIRO project covering an implementation period during which Ostrava was setting the scene for the creation of a living vegetation lab that will help in improving air quality in urban areas. The journal maps the progress made under the project linked to the design of the greenery, the measurements of pollutant concentrations, and the development of a model on pollutant capture. It is also outlined in the paper how challenges, such as the COVID-19 pandemic are tackled along the way by the partnership.

Executive summary

While the previous period of CLAIRO was dedicated to laying down the basic framework for project delivery, the second one was marked by a significant progress in activities, with first key results starting to appear. This second edition of CLAIRO Journal captures project implementation progress during the past period, from March 2020 to December 2020.

Core activities in this period were linked to the design of the greenery, measurements of pollutant concentrations, development of a model for quantifying air pollutant capture with the designed greenery, and the organization of a second round of a public opinion survey.

The detailed design of the greenery structure and composition to be established in Radvanice and Bartovice has been finalized in summer 2020. The objective is to establish communities of trees and shrubs in the two target sites of CLAIRO that form continuous and dense canopies that allow effective filtration of the air.

Communities of multiple plant species with similar ecological needs were specified that correspond to the habitat conditions of the target sites. The intention was to create a multi-level tree cover so as to maximise the capture of air pollutants.

By Autumn 2020 the team of Palacky University has refined the details of the method aimed to increase the tolerance of plants to abiotic stress, adapting it to the specific conditions at the target sites and the objectives of CLAIRO.

Measurements of air pollutant concentrations and climatic conditions that had started in September 2019, continued throughout 2020 and are to be performed also in 2021 and the upcoming years in Ostrava. The aim is to

provide essential data for the development of a model of pollutant capture. A modular sensor network is used in CLAIRO that allows real-time simultaneous measurement of gas pollutants and particulate matter in the air. The evaluation of air pollution situation, the meteorological parameters and natural conditions and the capture of pollutants by the existing greenery, allowed the development of a model of the designed new greenery.

Besides Ostrava measurements are also undertaken in other neighbouring cities in the Ostrava- Karvina Industrial Agglomeration to obtain background data, and to support additional green infrastructure interventions across the region. The monitoring activity outside Ostrava first was undertaken in Trinec and Opava between January and August 2020. In a second round, measurements are currently carried out in Frydek-Mistek and Karvina.

The second model that enables the quantification of air pollutant capture with the designed greenery was developed by Autumn 2020. With the help of the model, it can be tracked how the total leaf area, and with this PM10, ozone and nitrogen dioxide capture are changing at the target sites of CLAIRO when the current vegetation is replaced with the proposed one.

In Ostrava and nearby towns two public opinion surveys were conducted under CLAIRO on air quality in 2019 and 2020. The results showed that almost 60% of the people living in the Ostrava agglomeration take an active interest in air quality and also consider topic to be very important. The surveys revealed that people living in towns nearby Ostrava support the objectives of CLAIRO.

By providing details of the main activities and achievements linked to key project component, the second journal explores how the challenges identified are addressed, and outlines how changing circumstances as a result of the COVID-19 pandemic are handled by the partnership.

Use of urban biofilters

Evidence shows that trees and vegetation in general have the capability of cleaning the air by filtering out air pollutants (Vos et al., 2013). Due to its relatively large surface area, plant canopy functions as a sink for particulate matter (Wei et al., 2017). Most plants have a large surface area, increasing the likelihood of deposition of airborne particles compared with the smooth, hard surfaces present in urban areas. The amount of deposited material depends among others on the vegetation surface area, the deposition rate, and the concentration of the pollutant. (Janhäll, 2015)

Vegetation serves also as an effective windbreak, as on the leeward side, due to a decrease in flow velocity, suspended particles are deposited and their overall concentration in the air is reduced (Raupach et al., 2001).

Foliage longevity was found to be one of the most important traits for the capture of air pollutants (Grote et al., 2016). Since evergreen species retain functional leaves throughout the year, in terms of deposition, coniferous species are preferable to deciduous species. In case of deciduous species those ones should be preferred that exhibit longer in-leaf seasons. (Barwise and Kumar, 2020)

The various leaf characteristics influence the efficiency of air pollutant capture. Small leaf size, complex leaf shape, and various micromorphological features, such as a hairy or waxy surface or surface ridges, were found to be beneficial traits for the capture of particulate matter (Weerakkody et al., 2018). Due to the needle-like shape of their leaves, conifers are generally more effective for the accumulation of particulates (Chen et al., 2017).

Stomata that are the small pores found on leaf surfaces that control gas exchange have a relevant role in pollutant capture, particularly in case of gaseous pollutants (Lawson et al., 2014). Air pollutant removal may be enhanced by the selection of species that have stomata with extensive opening periods, such as poplar and some oak species (Grote et al., 2016). Growing evidence indicates that plant leaves have a role in bioremediation of air pollutants, acting as biofilters. Plant leaves and leaf-associated microbes are able to capture air pollutants, and biodegrade or transform them into less or nontoxic molecules (Wei et al., 2017).

Not only the structure and other properties of the leaves are relevant for particle capture efficiency, but also the canopy shape and shoot structure. There is an indication that tree species with more complex shoot structure have higher particle capture efficiency. (Watanabe, 2015) A higher density of vegetation generally results in lower downwind concentrations of particulates and gaseous pollutants (Barwise and Kumar, 2020).

Key activities and interim results

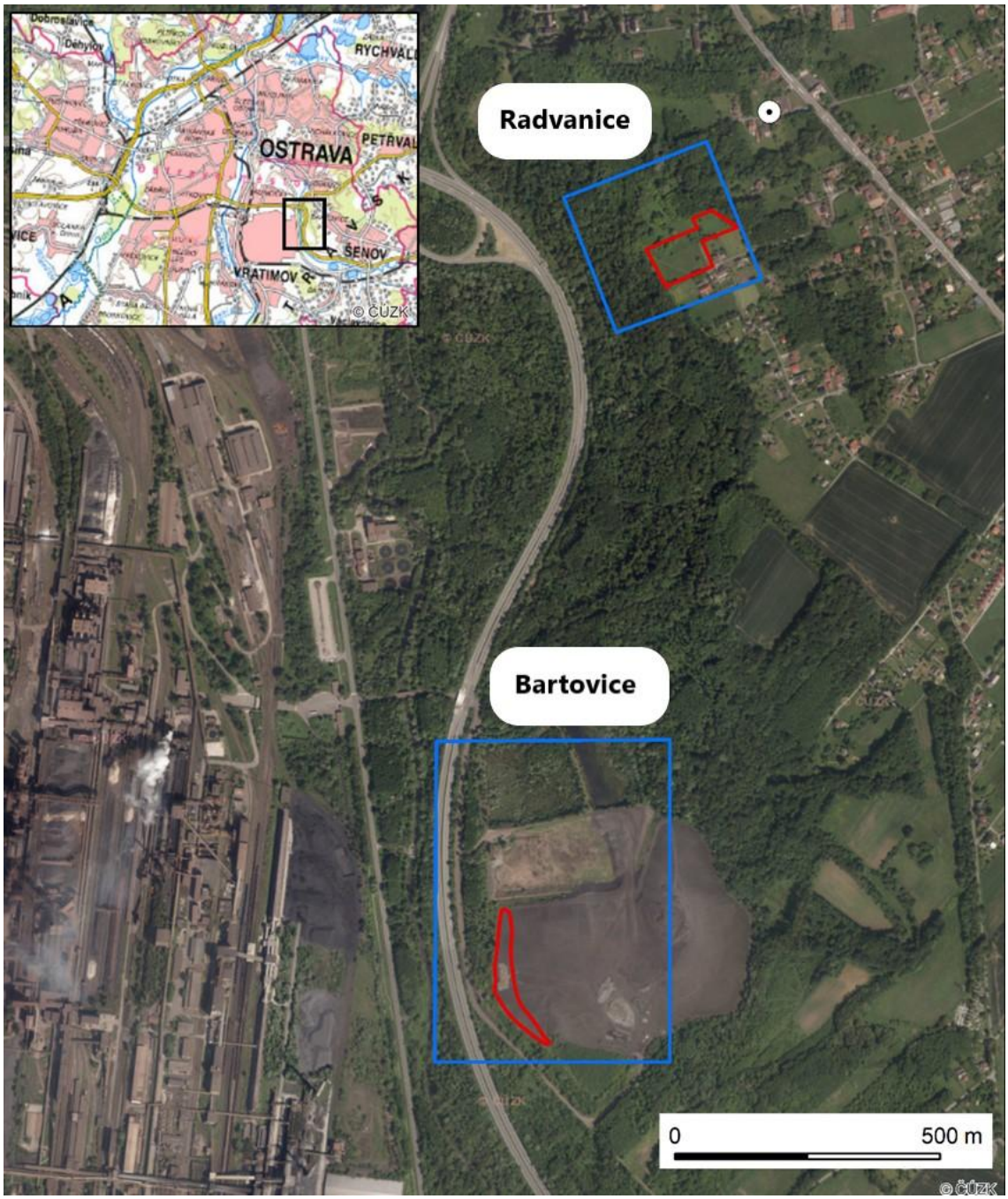
Designing for pollutants capture

Under the CLAIRO project new greenery will be planted in Ostrava that is aimed to 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 two plots located in the most polluted neighbourhoods of Ostrava, Radvanice and Bartovice. The two selected plots are close to a metallurgical plant that is one of the largest polluters in the region. In Radvanice an over 12000 m2 area, while and in Bartovice a nearly 8000 m2 land will be forested. The planting is foreseen to be undertaken between March and May 2021. The design of the composition and structure of the greenery was supported by measurements of air pollutants and climatic conditions. 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.

The detailed design of the greenery structure and composition to be established in Radvanice and Bartovice has been finalized in summer 2020. The objective is to establish communities of trees and shrubs in the two target sites of CLAIRO that form continuous and dense canopies that allow effective filtration of the air.

Communities of multiple plant species with similar ecological needs were specified that correspond to the habitat conditions of the target sites. The intention was to create a multi-level tree cover so as to maximise the capture of air pollutants.

Maximizing leaf surface that allows increased pollution deposition was an important consideration in the selection of the species. Preference was given to species with a densely branched crown and a large volume of green matter, as well as to evergreen tree species that can catch pollution all year round. In addition, the plant's tolerance of environmental stresses and particularly air pollution was a relevant criterion for selecting species. Exclusively domestic tree species were selected for planting and unbred plant forms are preferred.



Overview map of target areas

Monitoring the effectiveness of pollutant capture of various plant communities is one of the objectives of the project. As different types of plant communities will be planted in the targeted plots, their functionalities and reactions to experimental treatment methods can be compared.

Apart from designing the horizontal structure that corresponds to a mixture of plant species, the structure of the

planned planting was designed also vertically. The greenery to be planted will have two tree layers and a shrub layer to maximize canopy density. The tree layer will be divided into the upper and a lower tree layer. The height of vegetation was determined to be over 4 meters for species intended for the upper tree layer level, 2.5 meters for multi-stemmed species intended for the lower tree layer level, and less than 1 meter for shrubs. Planting material will be taken from nurseries grown in substrates.

As the design of the greenery structure is aiming at the establishment of stable mixtures, it has been differentiated along soil subtypes. Habitats were characterized by soil analysis. The Radvanice site is grassy area with occasional clusters of trees and shrubs. The Bartovice site, which is almost completely devoid of vegetation is located at the edge of a slag deposit area.

Target area in Radvanice

The Radvanice site is represented by transitions between soils with stagnating water (stagnosol) and soils with clay-enriched subsoil (luvisol). Brown earth occupy the largest segment of the site.

The plot in Bartovice representing a quite unfavourable habitat is made up of soils showing signs of intensive human activity (anthrosol) of which one segment has a significant humus content containing also ash and sludge, while the other includes mixtures of coarse-grained building debris, sand and dust particles.

Target area in Bartovice

In the larger part of the Radvanice site sessile oak (Quercus petraea) will make up one third of the planted trees, supplemented by sycamore (Acer pseudoplatanus), large-leaved linden (Tilia platyphyllos) and field maple (Acer campestre). The smaller part of the site that is characterized by stagnating water, the dominant species will be black poplar (Populus nigra) accompanied by European white elm (Ulmus laevis) and grey alder (Alnus incana). Shrub species to be planted in the area include among others guelder-rose (Viburnum opulus) and alder buckthorn (Frangula alnus).

As compered to the plot in Radvanice, the Bartovice site is characterized by a drier microclimate. In the northern part of the plot the forest stand will be dominated by conifers. Silver fir (Abies alba) will be the main tree species, with European red pine (Pinus sylvestris) and European larch (Larix decidua) included in the mixture. The lower tree layer level will include silver birch (Betula pendula), while in the shrub layer red elderberry (Sambucus racemosa) and wild privet (Ligustrum vulgare) will be planted. In the southern part of the area Austrian oak (Quercus cerris) will be the dominant tree species mixed with large-leaved linden (Tilia platyphyllos). The undergrowth will include spindle (Euonymus europaeus) and common dogwood (Cornus sanguinea).

The proposed composition of greenery in Radvanice

Plant treatment

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, including air pollution, draughts and temperature fluctuations. During the treatment biostimulants will be applied, which will be fortified by cytokinins that are a class of plant hormones that control plant growth and development.

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.

The mixture of biostimulants and plant hormones proposed for CLAIRO has been developed over almost two decades by the Palacky University Olomouc. By Autumn 2020 the team of Palacky University has refined the details of the method to be used, adapting it to the specific conditions at the target sites and the objectives of CLAIRO.

Under the experiment the segments of the plots occupied by different soil types will be further divided into three sections respectively. The planted greenery on the three subsections will be treated differently: one with commercial inorganic fertilizer, the other one with biostimulants, and the third one with an innovative preparation, biostimulants fortified by plant cytokinins. The effectiveness of the various options will be evaluated during the experiment. It is assumed that the mixture of biostimulants and plant hormones will improve photosynthetic efficiency and increase leaf area, resulting in an enhanced pollutant capture efficiency.

Measurements and data processing

Measurements of air pollutant concentrations and climatic conditions that had started in September 2019, continued throughout 2020 and are to be performed also in 2021 and the upcoming years in the target areas of CLAIRO. The aim is to provide essential data for the development of a model of pollutant capture, to support the design of the greenery to be planted in Radvanice and Bartovice neighbourhoods of Ostrava, and to facilitate the transfer of project results to other cities in the region and in Europe.

A modular sensor network is used in CLAIRO that allows real-time simultaneous measurement of gas pollutants and particulate matter in the air. The details about the system are outlined in the first Zoom-in document of CLAIRO on 'A modular sensor network to quantify air pollutant capture by greenery'. Within the network sensor boxes are installed, that monitor concentrations of particulate matter, nitrogen dioxide, ozone, volatile organic compounds (VOC), and polycyclic aromatic hydrocarbons.

Data transmitted from the sensor boxes is stored in a structured database of the Intelligent Identification System (IIS) that was developed by Technical University of Ostrava. The application of the modular sensor network allows the creation of concentration maps for individual pollutants, and the indication of places and time periods with unusual concentration values.

Sensor units in Ostrava

A huge amount of data is gathered during and after the lifetime of the project, the management of which requires the use of exceptionally powerful computing tools. Concentration values are recorded every 10 seconds, and the accumulated data is uploaded to the database at 5-minute intervals. In one day, the measurement of 8 substances by 20 sensor units results in more than 46,000 separate data values. Due to these enormous volumes of data, the database of IIS is stored on a supercomputer of the IT4Innovations National Supercomputing Centre that consists of 1,008 computational nodes, each of which is equipped with 24 cores. The data sent from the sensors is displayed in a map format on a geo-database that allows the selection of substances, sites and time periods.

The system used in the project can provide a good overview of how the air quality situation develops over a longer time period. The evaluation of air pollution situation, the meteorological parameters and natural conditions and the capture of pollutants by the existing greenery, allowed the development of a hypothetical model of the designed new greenery. In an iterative learning process the hypothetical model will be tested by continuous measurements of pollutant concentration levels after planting.

To obtain background data, and to support additional green infrastructure interventions across the region, measurements are also undertaken in six other neighbouring cities in the Ostrava- Karvina Industrial Agglomeration. The monitoring activity outside Ostrava started in Trinec and Opava, where measurements were undertaken between January and August 2020. In a second round, measurements are currently carried out in Frydek-Mistek and Karvina.

Assessing the impacts of the proposed vegetation on air quality

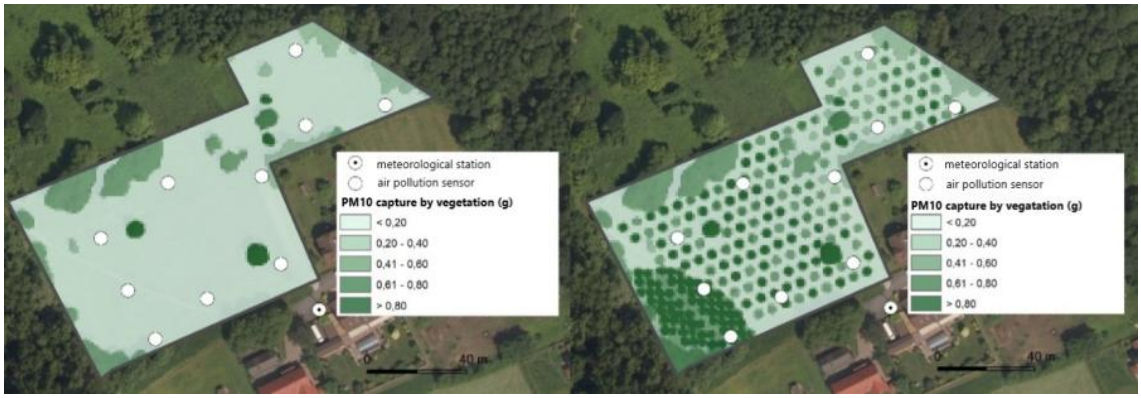
A series of four separate models will be developed under CLAIRO by the Silesian University in Opava on the capture of air pollutants by the greenery. These will focus on the original, the designed and the planted greenery, and also on the predictions of the future capture, respectively. These models will allow the comparison of pollutant capture efficiency at the target areas before and after planting and thus the measurement of the effect of greenery on the change in air quality. In 2022 the separate models will be integrated under a comprehensive model of dispersion, deposition, capture and resuspension of pollutants that will enable proposing 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 data on pollution concentrations, meteorological parameters for 2018, and natural conditions. A vegetation survey was undertaken using orthophoto images to quantify the representation of grassland and trees in both localities. The amount of pollutant (PM10, ozone and nitrogen dioxide) captured by vegetation in the target areas of the project was quantified on the basis of leaf area per ground area (Leaf Area Index), the rate of

deposition, the concentration of the pollutants, and time.

The second model that enables the quantification of air pollutant capture with the designed greenery was developed by Autumn 2020. Characteristics of the proposed vegetation relevant for creating the model, such as species composition, height of the vegetation, tree crown dimensions, spatial arrangements were accessed from the planting plan of the sites. Captured particulates, ozone and nitrogen dioxide were quantified with the same method that was used for the model of capture with original greenery.

With the help of the model, it can be tracked how the total leaf area, and with this PM10, ozone and nitrogen dioxide capture are changing at the target sites in Radvanice and Bartovice when the current vegetation is replaced with the proposed one. Results from the use of the model indicate that with the designed vegetation the capture of particulates at the Radvanice plot is expected to almost triple.



PM10 capture (g) with current and proposed vegetation at the Radvanice plot

Public opinion surveys

In Ostrava and nearby towns two public opinion surveys were conducted under CLAIRO on air quality in 2019 and 2020. The surveys were undertaken to support the replication of the approach promoted by CLAIRO, and also functioned as outreach campaigns supporting awareness raising on clean air among residents of the Ostrava agglomeration. During the interviews, respondents obtained basic information about the sources of air pollution in their area, examples and uses of different types of urban vegetation, the role of composition of greenery in improving air quality and about the activities of the CLAIRO project. Apart from Ostrava, respondents were from towns and smaller municipalities of the Moravian-Silesian Region. Both in 2019 and 2020 slightly over 600 respondents were interviewed using the same questions. The results of the two surveys will be analysed in detail by SOBIC and the Regional Association of Territorial Cooperation of Teschen Silesia in a study to be prepared by Autumn 2021.

The results showed that almost 60% of the people living in the Ostrava agglomeration take an active interest in air quality and also consider topic to be very important. Apparently, the pandemic highlighted the importance of air quality, as slightly more people considered the issue relevant in 2020 than in 2019. The survey also indicated that almost 50% of the population of the Ostrava agglomeration is dissatisfied with local air quality. The fact that a large proportion of the inhabitants perceive the air quality to be poor implies that people are not only interested but also concerned about the subject.

This general anxiety among locals in the region about the quality of air can partially explain the fact that three-quarters of the respondents would support the development of new forms of greenery, such as green roofs and green façade walls in urban areas. There were great differences though among typical responses depending on the level of education. Support for using these new forms of nature-based solutions was shown to be rising sharply with higher level of education. Local residents would not stop at passively supporting such initiatives. More than 40% of respondents would also be happy to support financially urban greenery planting. The survey results have confirmed that people living in towns nearby Ostrava are open for the adoption of the approach of CLAIRO that target at reducing air pollution with the help of urban greenery, clearly highlighting the relevance of clean air and nature for decision makers.

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. Various risks and challenges that are faced by Ostrava during the implementation of the project are outlined below.

Leadership

In 2020 the lockdowns associated with the global pandemic leading to significant falls in emissions of air pollutants provided a glimpse of cleaner air in many cities. It was no different in Ostrava, where the COVID-19 crisis has also contributed to better air quality compared to other periods through reduced traffic and industrial activities. The pandemic has added new perspectives to urban planning. It has underscored the need for cleaner skies and the importance of preserving and further developing urban green infrastructure. Recognizing the relevance of CLAIRO, Tomáš Macura, the mayor of the City of Ostrava, and Kateřina Šebestová, the deputy mayor responsible for the division of Environmental Affairs have provided renewed political support to the project activities. The political leadership gives a free hand to administrative leadership on coordination of the project activities.

Despite the difficulties arising from the pandemic, meetings of core team members of the city administration continue to be held on a weekly basis to support the coordination of various activities, only this time most of the meetings are held online.

Ostrava maintains intensive internal communication among project partners, organizing a large number of project meetings that are similarly held virtually recently. Larger physical project partner meetings are complemented by smaller group meetings focusing on various specific aspects of CLAIRO.

A change in ownership of the steel producer company that operates facilities in Ostrava delayed the implementation of CLAIRO in the first year of the project, hindering the leasing of the Bartovice plot, one of the target sites that will be greened. However, the City of Ostrava managed to agree with the new owner, LibertyOstrava on the terms of leasing, eliminating the problem.

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.

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 Department of Environmental Affairs, the Department of Public Procurement and the Financial Department. The Department of Environmental Affairs was involved in the design and planting of the greenery, ensuring that it complies with national and local regulations.

Since the beginning of the COVID-19 outbreak in the Czech Republic, in the past 9-10 months regular cross-departmental meetings were held mostly online to ensure that the various departments involved in CLAIRO do not lose their commitment. Nevertheless, a protracted crisis may dampen the enthusiasm of the various working teams involved in the project.

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 project partner meetings and smaller thematic group meetings. Because of COVID-19 most of these will need to be organized virtually in the upcoming months.

Apart from project partners, a great number of external stakeholders will be actively involved in the activities of CLAIRO. The pandemic necessitated a review of the planning of the various public events to be organized in the upcoming period.

The national workshop that aims at promoting the innovative aspects and outputs of CLAIRO was moved from April to June 2021 in the hope of holding a physical event. The organization of 16 public seminars were foreseen for smaller towns, schools, civil society organizations and the wide public. Although many of these seminars were originally planned to be held during 2020, because of the coronavirus pandemic most of them needed to be postponed to the first half of 2021, and a number of them might need to be virtualised. Similarly, four larger public events targeting the wider public might need to be rescheduled to the second half of 2021.

Should the public seminars and the larger public events need to be converted into virtual meetings, appropriate formats need to be identified for them that include also attractive visualization techniques, which are effective in actively engaging the future attendants. Ahead of these events it is relevant to develop and sharpen key messages with which relevant external stakeholders can be targeted and with which their active involvement can be ensured. The partnership has already started a targeted collaboration on this.

Monitoring and evaluation

Monitoring and evaluation remains one of the critical challenges in CLAIRO. Monitoring of the concentration of air pollutants and climatic conditions is vital for the quantification of the impact of new greenery on local air quality, and it was also essential for the design of the green infrastructure to be established in Ostrava. Measurement of indicators such as 'the amount of pollutants captured by newly planted greenery in the target area', and 'pollutant concentrations after the new greenery has been planted' will allow verification of the achievement of targets set by the project.

The evaluation of enormous amount of raw air quality data collected under CLAIRO, and their targeted use for building a sound model on the capture of air pollutants by the planted greenery will be particularly challenging. It will be essential to seamlessly connect data analysis with the work on the development of the models, requiring an active cooperation of separate working teams. The development of a reliable and user-friendly composite model is crucial for building a robust case for future green infrastructure interventions both for local scaling-up and for rolling out across the region and Europe.

Communication with target beneficiaries and users

As a result of the impacts of the pandemic, communication with target beneficiaries and other stakeholders requires a slightly different approach in the upcoming period. A detailed methodology and a more concise manual as main communication outputs, which will have a critical role in supporting replication of the CLAIRO

approach, will need to be made compatible with virtual communication activities. Both the methodology and the manual should include scores of visuals so that they can be used in online environments if needed.

Compared to the original plans, a much shorter time is available to organize larger public events and smaller-scale public seminars. This entails that the format and structure of these events will need to be adapted to the new circumstances. In case virtual events would need to be held, shorter sessions should be organized that mix creative divergent activities with convergent moments, and rotating moderation as well as the invitation of surprise guests can be considered.

The surveys functioned as effective outreach campaigns supporting awareness raising among residents of the Ostrava agglomeration on clean air and the role of greenery in improving air quality, reaching out to 1200 residents in the region. The findings of the surveys revealed that people living in towns nearby Ostrava support the objectives of CLAIRO.

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.

To mainstream the project methodology in the Upper Silesian metropolitan area, both experts and city representatives will be trained through targeted workshops and individual consultations. Apart from these seminars, a composite 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.

To effectively support replication of the CLAIRO method, the composite model should be general enough so that it can be used under different geographical conditions across Europe. The methodology and manual through introducing the model will be key tools for upscaling. The lengthier detailed methodology targeting at a professional and academic audience will be used during trainings of experts and students. The manual should be relatively short and simple, with illustrations, should provide clear guidance on potential pathways, steps to be taken, and should synthetize the lessons learnt along project implementation for other European cities.

Lessons learnt and conclusion

It is no surprise that the new coronavirus crisis has affected significantly the way CLAIRO was managed in the past 9-10 months. Despite all the hurdles brought by the pandemic, the project team could ensure that the delivery of key outputs that had been foreseen for this period were not affected by the changed working environment. The detailed design of the greenery structure and composition, and the model of pollutant capture with designed greenery were finalized, air quality measurements continued, and the second public opinion survey was conducted as originally planned. On the positive side, the pandemic has highlighted the need for urban air quality and the importance of preserving and further developing urban green infrastructure. Nevertheless, outreach to key external stakeholder groups might be adversely impacted by lockdowns. The planning of public events will need to be revisited, that can imply changes to their structure, format and frequency, so that they can have the same impact even under changed circumstances that do not favour socializing.

The fact that a series of models are built on each other under CLAIRO, makes the application of an effective iterative learning process possible, enabling continuous improvements. The hypothetical model of pollutant capture by designed greenery will be tested by continuous measurements of pollutant concentration levels after planting. The application of this loop learning process will enable the refinement of the general model. Still the appropriate use of the mass of data collected during the lifetime of the project that allow the development of a sound and user-friendly composite model will require the intensive cooperation of separate working teams.

Although the complexity of CLAIRO, that is addressing at the same time air quality, green space governance, and targeted stakeholder management, can make the harmonization of key project components difficult, it can also bring some benefits. Complexity can create a stronger narrative for the project that can be effective in mobilizing and bringing together representatives of relevant areas of expertise and help justify additional green infrastructure interventions.

In the upcoming months the partnership will undertake core activities, translating theory into tangible outputs. The planting of greenery will be undertaken in the target areas of the project between March and May 2021. The

planting will be followed by innovative soil and plant treatment in the two target sites. A model of pollutant capture by planted greenery will be developed by summer 2021. A more concise manual targeting decision-makers and urban practitioners, and a detailed methodology intended for the academic and professional community will be elaborated introducing the CLAIRO methodology. The next edition will explore the results of these key activities.

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