LIFE CRITICAL

Lessons Learned in the City of Dordrecht and Opportunities for Replication

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About this report

This report is written as a part of the Life programme funded project LIFE CRITICAL. It aims to showcase the project's progress and share the lessons learned so far from the implementation of the LIFE CRITICAL approach to climate resilience in the municipality of Dordrecht in the Netherlands. The goal of the project is to replicate these methods to other areas in the municipality and to other cities. The report targets professionals in urban greening, climate adaptation and citizen science with the aim of stimulating and activating investments into urban climate adaptation with intensive citizen engagement in the project cities and all over Europe.

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About LIFE CRITICAL

LIFE CRITICAL is coordinated by Gemeente Dordrecht and involves the City of Bradford Metropolitan District Council as the main replication partner and IMEC – OnePlanet Research Center and the technical partner. The cities of Ghent in Belgium and Bergen in Norway are following the project aiming for replication. The project runs from 15 June 2019 to 31 December 2025 with a total budget of €4,894,460 (€ 2,021,915 financial contribution from the Life Programme of the European Union).

The goals of the project are to:

- Use innovative design of urban parks to help old city neighbourhoods adapt to climate change.
- Involve citizens in the process to create co-ownership of the initiative and the renovated urban spaces and to increase awareness about climate change and climate adaptation.
- Scientifically monitor the implemented actions to measure the results and demonstrate the impact.

Read more about the project at **lifecritical.eu/en**

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LIFE CRITICAL's approach to climate resilience

Image: Dordrecht City Centre, by the Drone Team of the Municipality of Dordrecht

Image: Drone photo of Tromptuinen in Wielwijk (19 September 2023), by the Drone Team of the Municipality of Dordrecht

Adapting cities to withstand the impacts of climate change is a crucial part of adapting to the climate crisis. Urban populations are on the rise, meanwhile the effects of the crisis, such as floods, droughts, wildfires, and extreme weather events, are increasingly tangible (Grantham Research Institute, 2022). The LIFE CRITICAL Project aims to increase climate resilience in older, more densely populated neighbourhoods through the involvement of local citizens in the design, implementation and evaluation of blue and green infrastructure (BGI). The method focuses on three main principles to build climate resilience in areas where it has the greatest impact:

1. Consciously planned blue and green infrastructure

Blue and green infrastructure is an effective way for cities to mitigate climate impacts. Existing green spaces, such as urban parks, offer an exciting opportunity to help climate-proof neighbourhoods. In dense areas, their ability to improve air quality, mitigate heat stress, prevent flooding, and support mental and physical health makes them powerful climate adaptation tools.

2. Involvement of the community in the process

It is important to put citizens at the centre of urban climate adaptation, especially in lower-income communities that are more vulnerable to the impacts of the climate crisis. Involving the residents and other stakeholders in a targeted neighbourhood in the climate adaptation activities is highly valuable; it can help to strengthen the resilience of the neighbourhood by increasing social cohesion, create positive experiences in the local surroundings, and improve awareness around climate issues.

3. Monitor, evaluate, learn, and replicate

Climate adaptation strategies need impact monitoring to thoroughly evaluate the effectiveness of specific measures. The data obtained through monitoring allows us to track changes over time and draw conclusions that generate new knowledge, such as ideal types of trees to plant for the highest reduction of peak temperatures in summer.

Benefits of the LIFE CRITICAL approach:

1. Blue-green infrastructure (BGI) leverages natural features like water bodies and green spaces, providing sustainable solutions that enhance resilience, biodiversity, and overall environmental and human well-being.
2. Citizen engagement in vulnerable communities improves the outcomes of climate adaptation by ensuring the challenges are properly understood and addressed by the solutions, and by increasing the citizens' awareness and understanding of climate issues, which strengthens their commitment to building a liveable environment.
3. Data collection and evaluation of results provides new knowledge and improves decision making on both local and international scales.

Blue and green infrastructure in Wielwijk Park

In the municipality of Dordrecht in the Netherlands, the Wielwijk neighbourhood and park have been the testbed of new climate adaptation and citizen engagement efforts during the first four years of the LIFE CRITICAL project. The area, which had been under redevelopment following a citizen participation process in 2006, was selected for its unique geographic and demographic position.

Image: Drawings of the Tromptuin area of the Wielwijk Park showing the plan to extend the park into the neighbourhood, creating a green corridor

Flooding, traffic and extensive grey pavement

The original design of the area had made the Wielwijk neighbourhood subject to high traffic flows, air pollution, and water management challenges over the years. One major issue was the heavily trafficked street, Maarten Hapertsz Trompweg, that passed through the heart of the neighbourhood. Leading to one of the busiest highways in the Netherlands, the street brought noise and air pollution and excessive grey pavement. Another challenge was that the Wielwijk Park was frequently unusable since it suffered from severe flooding due to impermeable ground surface, causing water to pool on and around the main road after heavy rainfalls.

Image: Flooding in Wielwijk Park (2021)

Social vulnerability to climate change

Demographically, Wielwijk is considered a lower-income area and therefore a more socially vulnerable neighbourhood. This is significant because research in the Netherlands and elsewhere has shown that socially vulnerable individuals and communities are often the most susceptible to the impacts of climate change (Breil et al., 2018). Lower income areas are typically situated next to big polluters such as highways or factories, which impact the health outcomes of the inhabitants. The high building density, extensive grey pavement areas, poor-quality building materials, and limited resources to improve their conditions worsen the situation. Neighbourhoods like Wielwijk are often where the most pronounced effects of climate change are felt, and where interventions can have the greatest impact.

Redesign of the neighbourhood

Image: Before (Maarten Hapertsz Trompweg road, 2017) and after (Tromptuinen, 2023)

In response to the challenges in the neighbourhood, the climate adaptation measures for Wielwijk took shape through a combination of citizen involvement, implementing innovative solutions, and drawing from lessons learned from prior projects. The design process for Wielwijk started in 2006 and was largely finalised by 2017. From a list of 10 citizen wishes, climate adaptation emerged as a top priority. Residents required more blue and green spaces, especially to support outdoor pastimes like jogging and dog walking. A top request was to relocate the Maarten Hapertsz Trompweg road alongside the motorway and create a new road in its place called Tromptuinen (translated to 'Trompgardens') that frees up space for greenery. With the support of LIFE CRITICAL, the construction work of the whole area started in 2019 and is expected to be finished in 2025.

Image: Construction work in Wielwijk neighbourhood to create more green space (May 2022) by Caitlin Ball

Image: Flowers blooming in the newly created green and blue space of Tromptuinen (May 2024) by Dr. Özlem Bozkurt

The value of urban greening

Harnessing green spaces in cities for climate adaptation makes the most of their roles as natural buffers, mitigating the impact of extreme weather events, reducing heat island effects, and enhancing biodiversity. Adapting these spaces helps preserve ecosystem services, fosters community resilience, and contributes to a more sustainable and climate-resilient urban environment.

Climate adaptation actions

The vision for Wielwijk is to create a resilient, liveable, and green central axis that is accessible from every corner of the neighbourhood through a connected park and a large square. This redevelopment has a special focus on innovative solutions that address frequent flooding issues, for instance creating varying heights and small canals to guide water flow, and introducing specific plants adapted to diverse conditions. However, the park's design considers many factors: protecting old trees, introducing biodiversity-friendly plants, connecting waterways for an open system, and creating a range of grassy areas, from cleared grass for community activities to tall grass for animals and insects.

The ultimate goal for Wielwijk is not just environmental enhancement but also a tangible improvement in the well-being of the local residents. By integrating blue and green spaces, the project not only addresses climate concerns but also contributes to the creation of a more sustainable, liveable, and enjoyable urban environment. Furthermore, city parks provide shelter from climate impacts like heat waves for the most vulnerable groups, such as children, the elderly and residents with low socio-economic status and limited climate adaptive capacity.

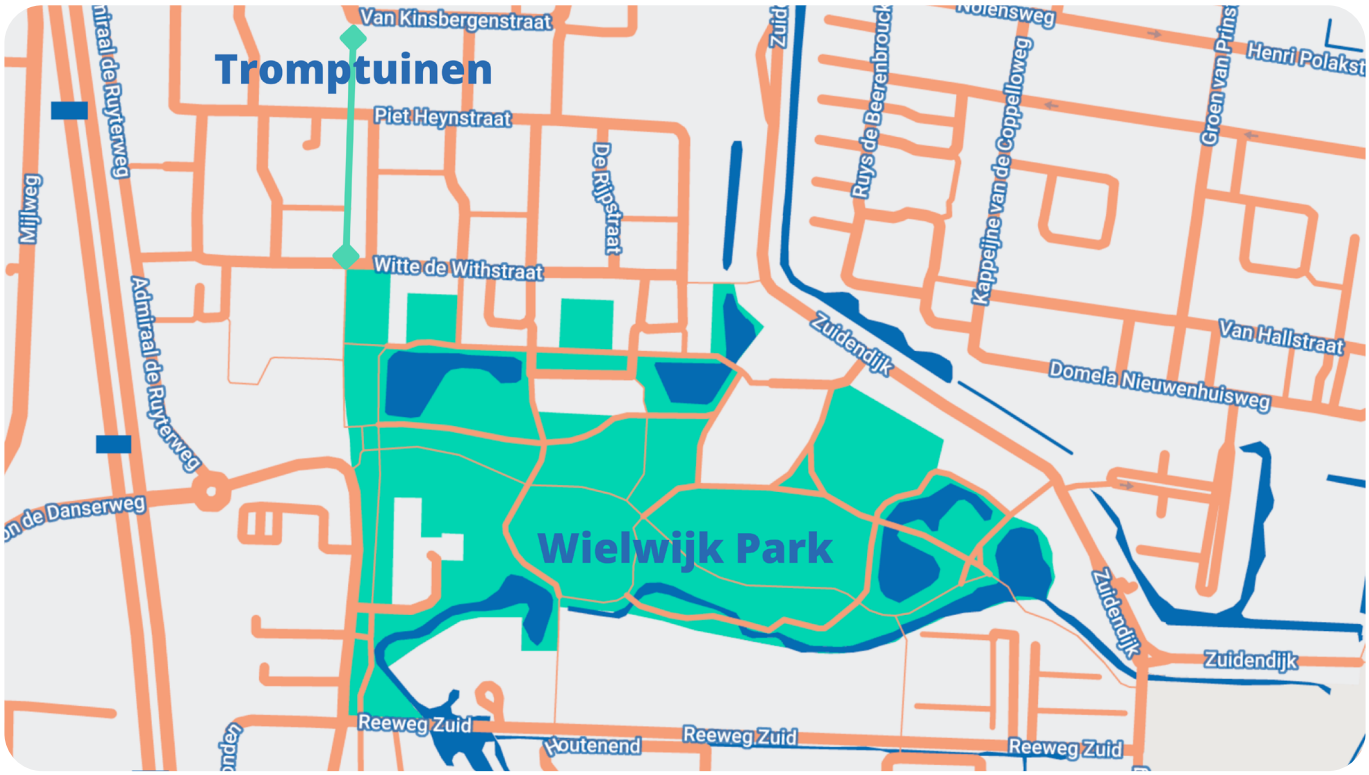
LIFE CRITICAL serves as a testing ground for innovative climate adaptations, evaluating their effectiveness and engaging the citizens in the process. The rebuilding of the area within the scope of the LIFE CRITICAL project has focused on achieving four main impacts:

1. Reduced flooding risks and better water retention
2. Lower peak temperatures during heatwaves
3. Improved traffic management
4. Increased use of the Wielwijk Park

Long before this project began in 2007, poor air quality brought the area to the municipality's attention. The prolonged duration of the rebuilding of the area and the adaptation efforts has allowed for many new lessons to be incorporated in the plans. The first idea offered was to relocate the schools that were impacted the most by traffic risks and pollution, but it was clear that this would not sufficiently address the root issues. A more extensive approach, championed by the local social housing association and involving residents, called for relocating the main traffic route next to the highway, closing the inner neighbourhood to most of the traffic. Due to financial restrictions this was delayed for years, and as the climate crisis became a greater concern, new considerations were added into the plans to address climate adaptation.

Image: Plants start to take root in Tromptuinen after construction (2024) by the Drone Team of the Municipality of Dordrecht

Results and impacts



Improved water management and flood prevention

Image: BioBlocks installed along the new canal in Tromptuinen (2022) by Dr. Özlem Bozkurt

Goal: Manage stormwater effectively and mitigate flooding by securing additional water storage capacity and permeable pavement in the area.

Expected impact: Reduction in flooding risk.

Actions implemented

- **Harnessing topography in the park:** Height variations were strategically created within the park, determining the best locations for various functions. Vulnerable uses such as spaces for walking, cycling, and play are placed in higher areas, while the lower areas are used for water-loving plants and vegetation that can coexist with occasional water issues.

- **Creating small canals:** By guiding water flow in a controlled manner, canals mitigate flooding and serve as a water reserve and natural cooling mechanism during periods of prolonged heat or drought. In addition, these blue spaces provide valuable habitats for biodiversity.

- **Improved rainwater drainage and water infiltration:** Increased drainage and infiltration helps to avoid flooding during heavy rainfall. This extends to water from drainpipes that would normally go to the sewage as it is drained into the canal, which could result in flooding elsewhere. BioBlocks, units of permeable organic material that facilitate plant growth, were installed along the canal to filter the water that drains from the pavement into the canal.

Intermediary results

By October 2023, 2,070 m^3 of water storage and 6,450 m^2 of permeable pavement had been installed at Tromptuinen. This is expected to promote better water infiltration, reducing runoff, and supporting groundwater recharge.

Reduced heatwave peak temperatures

Image: Heat sensor drones compared to real-life image demonstrating the temperature difference between green, blue, and grey spaces (18 august 2023 between 12PM and 15PM). Highest measured temperature difference between green and grey areas was 21-23°C and 43-45°C, respectively. Image by the Drone Team of the Municipality of Dordrecht.

Goal: Mitigate the urban heat island effect by replacing grey pavement with green or permeable pavements.

Expected impact: Temperature reduction during heatwaves.

Actions implemented

- **Replacing trafficked road with gardens at Tromptuinen:** The highway access road, which once ran through the middle of the neighbourhood, has been relocated to the periphery as a result of the citizen consultation process. In its place, the park has been extended, forming a central green corridor that includes blue spaces. This design brings the park into the neighbourhood, creating a cooling effect during hot days and improving air quality.

Intermediary results

The implementation of BGI in Tromptuinen has likely already begun to positively affect temperatures. Baseline monitoring through microclimate stations shows lower peak summer temperatures around green infrastructure compared to grey. The highest measured difference between urban and park sensors was +4.7°C, -10% Relative Humidity (RH) during a heatwave. Additionally, drone surveys with heat cameras captured temperature variations between green spaces and pavement areas, confirming the sensor station results and showing substantial temperature differences.

Reduce car traffic and alleviate congestion

Image: A cyclist on their way through Wielwijk Park (May, 2022) by Caitlin Ball

Goal: Upgrade traffic planning to alleviate congestion, enhance traffic circulation efficiency, improve safety, and mitigate pollution.

Expected impact: Reduction in urban traffic and improved traffic mitigation efforts will alleviate congestion and enhance overall transportation efficiency, making the city more resilient to future challenges.

Actions implemented

- **Directing cars to the outskirts of the neighbourhood:** This reduces noise and air pollution and further enhances the appeal of outdoor activities like walking to the nearby shopping centre and other places of interest.
- **Traffic management interventions:** To further reduce traffic and congestion, many roads were made one-way, traffic lights were replaced with roundabouts, and the traffic speed was lowered in the inner city.

Intermediary results

In Dordrecht, changed traffic conditions and infrastructure improved traffic handling by decreasing congestion and increasing road safety.

More access to and use of green areas

Image: Blue and green space created within Wielwijk, Tromptuinen, with connected walkways and blue space located at the lower altitude for better water drainage (2024) by the Drone Team of the Municipality of Dordrecht

Goal: Create new urban green spaces, fostering biodiversity, recreational areas for residents, and improving social safety, particularly for children.

Expected impact: Increase in park usage and accessibility.

Actions implemented

- **Planting for (bio)diversity:** Plants used in the park's redesign were selected for their ability to support biodiversity and local flora and fauna populations. For example, old nettle plants were left in place and new nettles were planted to feed butterfly species.
- **Variations of green:** Different spaces were specifically created to serve different purposes in the park, including a range of grassy areas - from cleared grass for community activities to tall grass for animals and insects.
- **Protecting the old value:** The park's redesign was planned in such a way that old, large trees weren't harmed, as these trees offer far more value than new trees in terms of carbon capture, shade, and shelter.
- **Engaging newcomers to keep gardens green:** To encourage residents of newly built housing to maintain their private gardens, they were provided with reference designs and guidance on implementing the garden that best matched their preferences. This initiative aimed to seamlessly connect the front gardens with the green corridor.
- **Cooperation agreements:** Residents were encouraged to apply for a cooperation agreement with green space provider A-garden. Options included a facade garden or a tiny square garden, or residents could adopt planters in public spaces. The materials and plants were provided by A-garden and paid for by the municipality, but the residents who applied were responsible for the maintenance of these areas.

Intermediary results

In the Tromptuinen area, an additional 6,450 m^2 of green space was created, connecting new homes directly to the green axis and providing direct access to the Wielwijk Park.

In the private gardens, there has been a trend of repaving that the municipality plans to address with their citizen scientists. This is often motivated by inhabitants wanting lower maintenance outdoor spaces with less habitat for insects, prioritising limited outdoor space for family time, such as barbeques.

Several cooperation agreements between A-garden and citizens have now been drafted and signed, with plans for more to come.

Success factors

Image: The new blue and green space created in Wielwijk neighbourhood to replace the highway (2023) by the Drone Team of the Municipality of Dordrecht

Engage stakeholders to understand local context

Begin any climate initiative by first understanding the specific local climate issues and engaging with key stakeholders, such as Water Boards, safety regions, and the provincial government, to gain a comprehensive overview of the challenges. Additionally, consult with citizens to ensure their needs are integrated into the plans.

Forecast future scenarios

Assess the city's resilience to extreme weather events with tools like stress tests and historical data.
Be realistic about potential severity to properly evaluate vulnerabilities and forecast future scenarios both in the specific location and in the city as a whole.

Align priorities and integrate with neighbourhood projects

Blend climate adaptation measures into ongoing programmes and projects to ensure that climate considerations are mainstreamed into broader urban planning goals and to avoid isolated implementations.

Promote collaborative efforts at all levels

Integrate climate adaptation into broader strategies by emphasising collaboration across departments and regions. Recognise that certain climate issues may extend beyond local control. Collaborate at the national level to align efforts, especially in cases where substantial investments are required, e.g. for initiatives like heavy rain management.

Monitoring of climate indicators

Image: A solar-powered NO2 sensor located in Wielwijk Park near the highway (May 2024) by Caitlin Ball

Environmental impact monitoring in Dordrecht is aimed at measuring how climate adaptation actions address the area's climate-related challenges, including air quality, heat stress, flooding and biodiversity. This type of monitoring is not new to the city - prior to this project, monitoring infrastructure with professional weather stations was available around the pilot area, and meteorological stations used by the Dutch Royal Meteorological Institute (KNMI) were available in Rotterdam (~25 km) and Gilze-Rijen (~30 km) to extend the sensor network. These stations automatically measure macroclimate indicators such as humidity, temperature, and soil humidity.

Emerging technologies provide easier access to data

Low-cost sensors (LCS) for air quality monitoring have transformed the monitoring landscape. Though LCS can be less reliable than high-end sensors and more susceptible to interference, the increased accessibility of compact and affordable LCS enables a greater number of monitoring stations. This mitigates the limitations of sparsely distributed, official high-end monitoring stations, and allows for collection of more granular and localised data. As a result, we can better monitor the effects of climate adaptation measures at a local scale, pinpointing locations that require immediate attention.

Customisation for specific insights

To measure climate-resilience parameters, a pollutant of interest is NO_2. At the start of the project, commercially available integrated sensors for NO_2 faced some reliability challenges for monitoring over time. Technologies used in low-cost gas sensing (such as electrochemical cells) often need a continuous power supply and are sensitive to environmental conditions, so they are prone to signal drift and loss of sensitivity over time. To meet the needs of monitoring the climate adaptation measures, technical partner IMEC – OnePlanet Research Center developed a solar-powered NO_2 sensor unit prototype; allowing full control over how the sensor signal is acquired and interpreted.

Calibration for reliable results

Both the LCS and the newly developed NO_2 sensor unit were calibrated using high-end equipment before being deployed, and their accuracy is continuously managed using advanced calibration algorithms. Additionally, a small set of sensors for temperature and humidity have been placed at the reference station, which provides ground truth data around Dordrecht to monitor sensor and calibration performance over time by comparing the two measurements.

Transparency and communication for increased awareness

Monitoring technology can sometimes create fear of privacy intrusion in the public space. Dordrecht has seen vandalism in multiple sensor locations, including Wielwijk Park - incidents in which sensors were tampered with or removed, and measurements were disrupted. In response, information billboards were installed to explain the purpose of these monitoring efforts and explain the thorough privacy protection built into the technology. Further transparency is supported by sharing monitoring data in a platform open to the public. Unfortunately, vandalism incidents persist, so it is likely that these motivations go beyond privacy concerns.

Monitoring activities

To monitor environmental impacts of the new Wielwijk Park implementation, technical partner IMEC – OnePlanet Research Center designed and deployed a highly granular environmental sensing network targeting the selected impact KPIs. The sensing network's dual aim is to generate scientific proof of the impact of the physical interventions in the park, and to demonstrate a suitable monitoring approach to climate adaptation projects. The sensor network deployment was strategically designed to monitor expected impact indicators based on the type of interventions planned. Where possible, existing monitoring infrastructure was used to provide data or serve as a benchmark.

Key considerations for set up of extended sensor network

- **Sensor metrics:** focus on useful metrics, detectable in ambient air and where impacts by the urban transformation would be expected.
- **Power:** Consider self-supportive systems (battery, solar panel) if continuous on-site power supply at the sites cannot be guaranteed.
- **Connectivity:** ensure sensors support IoT connectivity (LoRa, GPRS, NBIoT,...) to be able to provide real-time measurements.
- **Sensor location:** select meaningful locations with sensor mounts (lampposts, trees, poles) that wouldn't be relocated during reconstruction works.

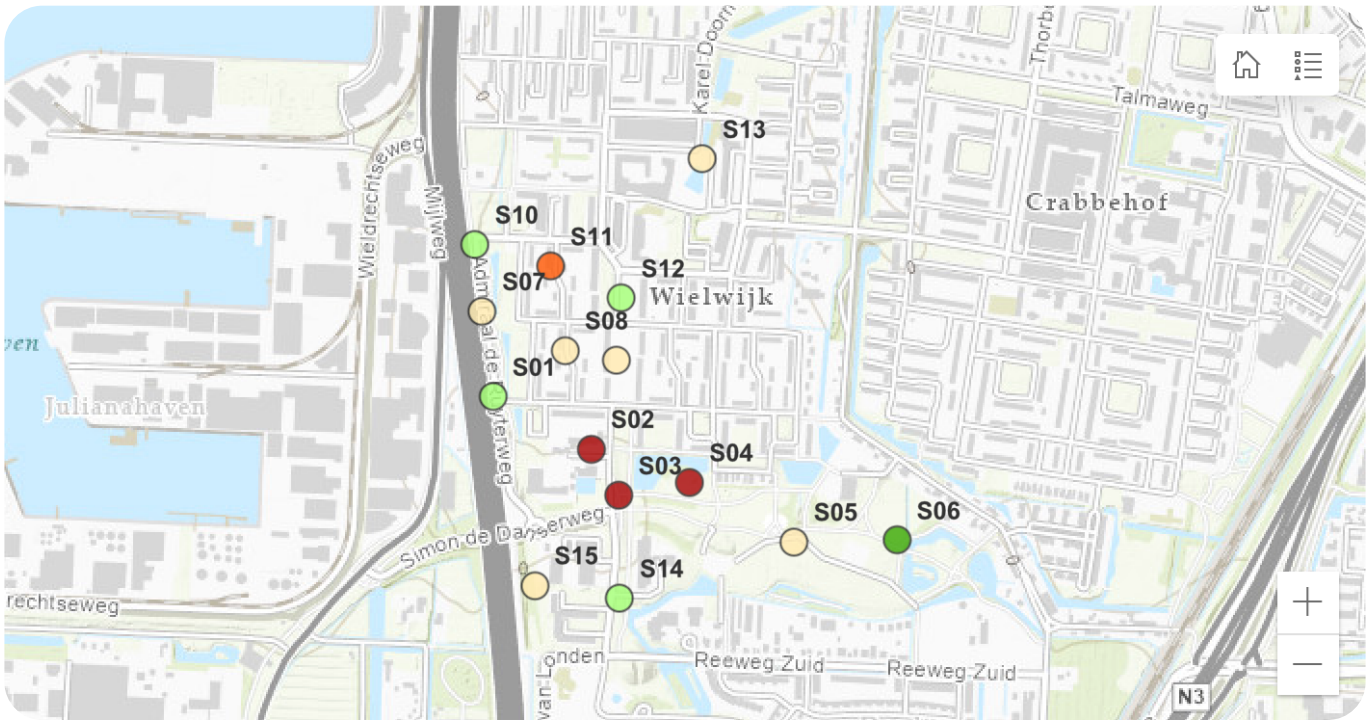


Image: Screenshot from publicly available real time monitoring platform showing placement of sensor in the neighbourhood, to monitor temperature, humidity, and NO2 (May 2024)

Air quality monitoring

To monitor the impact of the BGI measures on air quality, sensors were strategically placed in diverse locations – some by the road, some by old trees, some by playgrounds. These placements allow comparisons across the area to see how measures impact air quality in these niche environments.

Microclimate monitoring

Following the phase of validation and calibration, 15 microclimate sensors were installed at 15 locations in the Wielwijk Park during the period June – October 2020 and they have been collecting data since.

Variables monitored around the pilot area

- Soil moisture
- Soil water (monitoring well)
- Irradiation (W/m^2)
- Wind speed (m/s)
- Wind direction (°)
- Air temperature (°C)
- Relative humidity (%)
- Air pressure (hPa)
- Precipitation (mm)

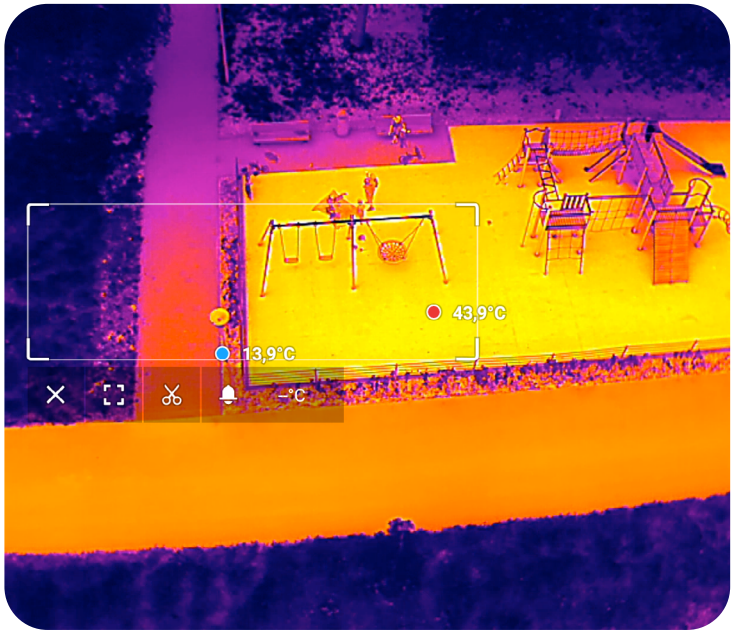


Image: Drone footage still of heat measurements at playground (August 2023) by the Drone Team of the Municipality of Dordrecht; the surface of the yellow paved area reaches 43.9°C

Additionally, temperature has been measured with drone surveys using heat cameras. These measurements will continue periodically until the end of the project. The measurements quantitatively assess the impacts of adaptation measures, capturing temperature variations between green spaces and pavement areas. This method is very effective to understand the impacts of greening and visually explain it to stakeholders. For instance, it can spotlight areas of concern like high-temperature playground surfaces and help advocate for improvements. On a technical level, it can shed light on the optimal density and types of trees to plant, with the goal of reducing summer peak temperatures by a significant 3°C.

Flooding and water management monitoring

Citizen science reports are the main method of tracking flooding and water management. This typically comes in the form of pictures submitted to the municipality, or self-reported flooding in homes. Poles with QR codes to facilitate citizen reports will be added in the park and in Tromptuinen.

Biodiversity monitoring

Biodiversity will be monitored through citizen science efforts. In the first citizen science fair hosted by the municipality, attendees took the initial measurement, the first of three, aimed at tracking the increase of water species over the coming years in response to changes in the park.

Image: Wielwijk's Citizen Science day (23 September 2023) by the Drone Team of the Municipality of Dordrecht

Citizens use, perception, and awareness

To track park usage, the city is deploying a groundbreaking sensor technology that counts visitors in a privacy-friendly manner by using radio magnetic signals, which are affected by the water in human bodies (SCORE Crowd Flow). This disturbance in the signal allows us to measure the number of people in a large area like a park and pinpoint the areas of highest use at different times of the day or year. To understand perception of park visitors, this crowd monitoring is combined with QR code surveys that inform people about the monitoring efforts and invite them to participate in a survey about the park, why they visited it, and how often they visit it.

Success factors

Ensure data relevance and targeted monitoring

First identify which climate adaptation measures must be monitored and determine if existing sensor networks are sufficient or if expansion is needed. The selection of sensors should be based on their relevance to climate resilience measures, the sensor unit requirements (e.g. power and connectivity), and the accuracy and long-term reliability they offer. To quantify the impacts of climate resilience measures, it is necessary to compare sensor data before and after urban transformation. Deploy any necessary additional sensors and document baseline measurements before any transformation.

Perform continuous sensor evaluation for data accuracy

Continuously evaluate sensor performance, especially for sensors that are more likely to drift over time. This practice ensures the accuracy of data collected. Consider deploying sensor prototypes alongside traditional monitoring stations to assess sensor performance under relevant climate conditions.

Leverage low-cost citizen science sensors

Monitoring is not just about gathering data; the impact here is also about creating awareness and driving changes in attitude at both the governmental and citizen levels. Embrace the use of LCS to empower citizen science and strengthen climate adaptation efforts, enabling citizens to transform their concerns into actionable questions and actively engage in the discovery process. The integration of citizen science sensors not only motivates community members to improve their own spaces and neighbourhoods, but also fosters trust among all stakeholders while building interest in science.

Open data sharing for citizen engagement

Share sensor data on a public platform, accessible to all citizens. Open data sharing establishes transparency and encourages citizen engagement. This practice enhances collaboration between local municipalities and residents, fostering a mutually beneficial relationship. Citizens, when given access to sensor data, become more involved with the areas in which these sensors are deployed. This increased interaction allows citizens to provide valuable feedback to technicians, aiding in the interpretation of observed data and ensuring a more informed decision-making process.

Effective communication and collaboration

Good communication between the municipality and collaborators with technical and scientific expertise is vital. It forms the foundation for defining research questions related to the quantification of climate resilience and technologies to measure. This open collaboration allows for a more thorough analysis of the data collected and ensures that the monitoring efforts align with the overarching goals of climate adaptation projects.

Citizen science for increased engagement

Citizen science plays a dual role in climate adaptation strategies - both by providing useful data and by fostering ownership and awareness in the community. This engagement helps to ensure a holistic perspective in the project and offers residents the opportunity to co-create their environment, build trust with the local government, and feel empowered to have a meaningful impact in their community.

Dordrecht's citizen science has brought the municipality many benefits, especially regarding monitoring efforts and support for climate goals. By decentralising climate monitoring, the municipality has opened themselves up to greater data collection and to first-hand perspectives from the community on what to monitor, which all contribute to strengthening the project. This information, in turn, builds support for the project within the community and the local government.

Internally, strong data and stakeholder feedback can increase buy-in from other departments by demonstrating clear proof of the impact of climate adaptation measures. Externally, community engagement grows climate awareness and, as a result, support for climate adaptation. The climate crisis itself remains a subject of debate, unfortunately, and the citizens or representatives who might question allocation of resources to climate adaptation will be more supportive of this allocation if the impact can be clearly demonstrated.

Like many communities, Dordrecht faces certain familiar challenges in connecting with residents. Reaching out at a local scale and building interest in climate change can be difficult since Wielwijk has faced various levels of apathy or opposition regarding climate issues. Common communication channels like social media or city newspapers are too widespread for the specific target audience, so a more time-intensive investment is required to make face-to-face contact. Even so, convincing people to invest their time and volunteer for something they may not believe in or find interesting is challenging.

Image: Wielwijk's Citizen Science day (23 September 2023) by the Drone Team of the Municipality of Dordrecht

To deepen the connection with locals, the city of Dordrecht is working with two intermediaries, the "citizen engagement facilitators". First, Buurtbinders, an organisation focused on connecting residents, policymakers, and administrators to improve quality of life in neighbourhoods and districts. Second, PULSAQUA, a consultancy for organisations, NGOs, knowledge institutes, and governments that empowers communities to actively participate in scientific endeavours.

The value of citizen science

Citizen science provides invaluable scientific and informational value by enabling the collection of extensive data on both local and global scales. This approach amplifies the data's viability and expands its spatial and temporal reach. By incorporating citizen science methods, it becomes possible to obtain a wealth of measurements that meticulously track the effects of climate adaptation measures.

Citizen engagement actions

Image: Citizen Science festival in Wielwijkpark (23 September 2023) by the Drone Team of the Municipality of Dordrecht

Getting in touch with the community

To make first contact with the community, the city's citizen engagement facilitators went door-to-door to distribute flyers and start the conversation directly with residents living near the adaptation measures, such as the park and the adapted streets. The team explained the project's purpose and significance, providing information about the value of participating and how to get involved. Follow up visits were made to households where no one was at home to ensure each resident received the information in person. Importantly, the team made it clear that signing up was not binding and put no pressure on the community to join.

This approach to engagement has been effective. Some residents were immediately interested and provided their contact information on the spot, while others signed up later after some consideration. A first open information meeting was held and after this a group of around 25 volunteers joined to collaborate with the project on various measurements in the initial phase.

To further grow the group, recruitment will be done targeting local schools and the team will place QR codes in the area that share project information and opportunities to participate. Passersby can scan the code, take pictures, and submit them as data for the project. Not only is this a useful way to gather information, but the hope is that this interactive element will garner more interest among residents and encourage them to join the core group of citizen scientists.

Building relationships

Above all, Dordrecht emphasises personal connections and engagement between all key stakeholders, including the project leader from the municipality. Bridging residents to the project leader provides a deeper understanding of the municipality's perspective and can lead to more meaningful interactions. This ongoing connection between residents, researchers, and the municipality helps foster a sense of community and ensures the sustainability of the project.

Residents are encouraged to suggest additional measurements they believe are relevant, offering more ownership to volunteers and opening the project up to new horizons. Testing these suggested measurements with participants can determine their viability and encourage others to join those measurements if successful. As a result, the project is responsive to residents' needs while empowering them to take the lead in citizen science.

Personalised citizen science activities

The personalised citizen science approach brings endless value to the project, enabling truly effective co-creation with the community. Many residents have been living in the neighbourhood for decades and notice changes over time that a technical team might miss, bringing unique perspectives to the project. For example, one local highlighted a drastic drop in the number of frogs in the area over their lifetime and proposed tracking if adaptation measures could bring them back.

Many volunteers do not come from a technical background, so initially they were unsure about what options were available or what they could measure. Dordrecht's team gave them the tools needed to participate in this co-creation by offering some background, providing materials, and proposing methods. This helped to guide them in selecting measurements that would provide valuable information for the project.

Empowering volunteers to choose measurements that align with their interests and observations creates a powerful sense of ownership and dedication among participants. They are contributing to answering questions they genuinely care about, so they are more motivated to engage with the project. Combining top-down guidance and bottom-up input, this personalised approach builds a co-creative environment where everyone's input is valued.

Through this approach, Dordrecht hopes that residents will come to view the park as their own garden. The park area is not only for recreational purposes but also for improving their quality of life with the many benefits of green spaces and climate adaptation. Furthermore, the changes will cause housing prices to eventually go up, making residents' property more valuable.

Image: A woman cycles between public and private green spaces in Wielwijk neighbourhood (2023) by Dr. Özlem Bozkurt

Cooperation agreements

As part of the strategy to create greener neighbourhoods, several cooperation agreements were signed between green space provider A-garden and residents. Beyond greening private gardens, the aim of this cooperation is to engage residents in taking ownership over public spaces, giving them responsibility and insight into managing the public space.

Image: A PULSAQUA representative and an alderman of Dordrecht engage with citizen science monitoring to measure biodiversity in the water during the first citizen science fair (23 September 2023) by the Drone Team of the Municipality of Dordrecht

Citizen Science Festival

In September 2023, Dordrecht launched its first Citizen Science Festival in Wielwijk. Strategically aligned with the city's Neighbourhood Day, the event drew enthusiastic participation from across the community. Two of the city's aldermen joined the festival – one responsible for participation and the other dedicated to blue-green initiatives. The goal of the day was to engage the community in pressing environmental issues through the first round of monitoring to document and track the impact of climate adaptation measures in Wielwijk Park. Not only did this offer valuable data collection, but the festival showcased the value of awareness building around environmental issues. Perhaps more importantly, it made climate issues fun for the community – a key part of maintaining long-term interest from volunteers.

Image: Engaging locals at an information fair in Wielwijk (September 2022) by Buurtbinders

Success factors

Customise the approach

Engagement strategies and methods must be tailored to the specific context, demographics, and goals of the project. Consider and assess all factors that could influence the structure of engagement, such as neighbourhood characteristics, the type of climate adaptation measures being implemented, and the desired outcomes.

Seek expertise

Citizen science is unique to general community participation, so it is essential to involve individuals and/or organisations with the right experience. This support is needed to guide and advise participants about measurements and observations.

Consider an intermediary role

Intermediaries can be powerful partners to help establish trust and collaboration between citizens and local authorities. This neutral perspective can avoid the pitfall of focusing on past failures, as they had not been involved in past municipal work, and so can focus on building an open and constructive dialogue. If possible, explore intermediaries to support governmental citizen science initiatives.

Collaborate and learn from others

Look to other cities or organisations that have done similar work for inspiration. Engage with these entities to share experience, knowledge, and best practices to learn from both failed and successful approaches, building on the field's existing expertise.

Ensure data utility and feedback

Collect data through citizen science that is genuinely useful and will be used in decision-making processes. Inform participants about how their data will be used and update them regularly on the project's progress to keep citizens engaged. Neglecting to use citizen inputs and to share updates can lead to participants feeling deceived by the initiative and undermine their commitment.

Manage expectations

Be transparent and clear about the purpose of the citizen science initiative from the very beginning of engagement. Highlight the important contributions of this work to answering specific questions or addressing climate adaptation challenges. Managing expectations and being open about the project's intentions from the outset can help build lasting trust and avoid later disappointment.

Sources of information and references

This report was published as a part of the LIFE CRITICAL project. The project is ongoing until December 2025. New resources and insights are published on the project website regularly.

This report is written based on the experiences in the municipality of Dordrecht. Content in the report is collected directly from the project team of the 'Green-blue city department'.

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