

# GREENGAGE

ENGAGING CITIZENS - MOBILIZING TECHNOLOGY - DELIVERING GREEN DEAL

## **Training and Campaigning Report and Community Building 1**

**Work Package 5, Deliverable D5.3**

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## List of Acronyms

AIT	Austrian Institute of Technology (AIT)
ARPA	Regional Environmental Protection Agency Lazio
BCC	Bristol City Council
Borghi	I Borghi più Belli D'Italia
BSYV	Bristol Somali Youth Voice
BUAS	Breda University of Applied Sciences
CE	Collaborative Environment
CO	Citizen Observatory
COs	Citizen Observatories

CObs	Citizen Observers
CS	Citizen Science
EBLN	The East Bristol Liveable Neighbourhood
GA	Grant Agreement
GO	GREENGAGE Observatory
GOs	GREENGAGE Observatories
EU	European Union
IA	Innovation Action
IAB	Innovation Action Board
KPI	Key Performance Indicator
KWMC	Knowle West Media Centre
MPA	Miljøpunkt Amager
PNRR	National Recovery and Resilience Plan
PST	Pilot Support Team
UWE	University of the West of England

## Glossary

Active intermediation	GREENGAGE seeks to mediate between public authorities and citizens, green initiatives, researchers, tech providers and other potential stakeholders of COs. Mediating here is the process of enabling authorities of urban policy making to democratically respond to a community's understanding of the local needs for effective and sustainable innovation. This includes the navigation of legal and regulatory requirements, the negotiation of appropriate institutional arrangements, the mobilisation of resources and the facilitation of active participation of citizens in decision-making processes of urban planning. GREENGAGE COs will enable the active dialogue between authorities and communities by co-designed observation and analysis of real-world environments. Through active intermediation with the pilot's situations, GREENGAGE COs will shape policy innovation in five different contexts of urban planning. Through active intermediation GREENGAGE CO coordinators aim to meet the needs of communities and serve the improvement of their well-being through the process and its outcomes (cf. May & Perry, 2017, p. 24).
Bottom-up approach on citizen science and co-creation	The GREENGAGE Innovation Action is building on a bottom-up logic on co-creation, participatory research and citizen science. We propose to draw on the established approach of Extreme Citizen Science (ExCiteS) to approach science-based, community-led policy innovation towards strong sustainability. [Reference: D2.1 - GREENGAGE Methodological Framework]
Citizen Observatory	According to EU project WeObserve, "Citizen Observatories (COs) are community-based environmental monitoring and information systems, that invite individuals to share observations, typically via mobile phone or the web. Throughout these activities citizens become able to participate in environmental management/local governance." [Reference: D2.1 - GREENGAGE Methodological Framework] In GREENGAGE is a place like a Living Lab (a laboratory in a real context, putting stakeholders at the centre of the process) for collective learning that exploits the opportunity of using sensors and the use of Earth observation technology where citizens collect data and are empowered

	by the information generated from these data to improve environmental management towards an innovative governance of the territory.
Citizen Science	“In Citizen Science, a broad network of people collaborates. Participants provide experimental data and facilities for researchers, raise new questions and co-create a new scientific culture. While they add value, volunteers acquire new learning and skills and gain a deeper understanding of the scientific work in appealing ways. As a result of this open, networked and transdisciplinary scenario, science-society-policy interactions are improved, leading in turn to a more democratic research, based on evidence and informed decision-making” (Socientize consortium, 2014, p. 10).
Collaborative Environment (CE)	The Collaborative Environment platform acts as the front-end visualisation of Knowledge Assets and tools that help organise the co-creation of thematic co-explorations. The co-production processes modelled by the CE hyperlinks the resources, e.g., data chart or geospatial visualization, from the tasks where they were generated.
Citizen Science campaign	A Citizen Science (CS) Campaign comprises a period when a group of Citizen Observers with a shared mission and hypothesis gather data at different places and regularly get together to analyse together the correlation of their collected data with other external data sources to validate such hypothesis
Communities of interest	Communities of Interests (Cols) are characterized by their shared interest in the framing of and responding to a problem of common concern. Cols often are more temporary than CoPs and bring together stakeholders from different CoPs and/or spatial communities in the context of a specific project and dissolve after the project has ended (Fischer, 2001, p. 4)
Communities of practice	Communities of Practice (CoPs) consist of practitioners who work as a community in a certain domain undertaking similar work, such as researchers, Citizen Observers, urban planners (Fischer, 2001, p. 3) who deepen their knowledge and expertise in this area by interacting on an ongoing basis.’ (Wenger et al., 2002, p. 4).
Experiments	Within use cases, experiments are data-based co-production processes pursuing a co-created objective that are situated in GREENGAGE Observatories to drive policy innovations or other local interventions, e.g., campaigns, public debates, exhibitions, urbanistic demonstrations or public services.
GREENGAGE Academy	The GREENGAGE Academy hosts the emerging GREENGAGE Community of Practise and is the central platform for sharing understandings of the process of developing GREENGAGE COs. As such, the Academy serves as the central interaction platform between CO coordinators, Citizen Observers and other participants of COs. The Academy acts as a knowledge base and toolbox around the setting up and effective coordination of citizen observatories. The Academy stores and indexes training resources, MOOCs, success stories, findings and best practises collected from the four GREENGAGE pilots as well as generated or adapted to guide the setting up of the pilots.
GREENGAGE Citizen Observatory Methodological Framework	The GREENGAGE Citizen Observatory Methodological Framework suggests core concepts, processes and guidelines on how to develop Observatories in GREENGAGE in ways that are ethical, democratic and responsive to common urban challenges and their situational manifestations in GREENGAGE’s five Pilots.
GREENGAGE Engine	The GREENGAGE Engine is the set of tools and software applications that make up the GREENGAGE toolset. They will be used to support the GREENGAGE COs in fulfilling the objectives of the Innovation Pilots.

GREENGAE Observatories	See Citizen Observatories. An update of the term Citizen Observatory to comply with equity, diversity, and inclusion frameworks, as some of the participants and target groups of these associations do not necessarily possess citizenship.
GREENGAGE Toolbox	The GREENGAGE Toolbox is the main stack of data processing and management tools. It comprises the set of tools within the “Data crowdsourcing and capture” and the “Data analysis and insights generation” layers of the GREEN Engine. Some of the tools included are MindView, MODE and HOPU apps, GREENGAGE app, Urban TEP/VISAT, Data Quality and Structure Dashboards, DIGITWIN, DataHub, Superset, Druid or NiFi.
Innovation Actions	Innovation Actions are "primarily consisting of activities directly aiming at producing plans and arrangements or designs for new, altered or improved products, processes or services. For this purpose they may include prototyping, testing, demonstrating, piloting, large-scale product validation and market replication. [...] Projects may include limited research and development activities" (EU HORIZON 2020). For GREENGAGE COs this means participatory research for innovation is not the focus but a means for understanding the GREENGAGE innovation action collectively.
Living Labs	According to the European Network of Living Labs, “Living Labs (LLs) are open innovation ecosystems in real-life environments using iterative feedback processes throughout a lifecycle approach of an innovation to create sustainable impact. They focus on co-creation, rapid prototyping & testing and scaling-up innovations & businesses, providing (different types of) joint-value to the involved stakeholders.”
Marginalized groups	“Different groups of people within a given culture, context and history at risk of being subjected to multiple discrimination due to the interplay of different personal characteristics or grounds, such as sex, gender, age, ethnicity, religion or belief, health status, disability, sexual orientation, gender identity, education or income, or living in various geographic localities” (European Institute of Gender Equality).
Observatory Participant Journey	The Observatory Participants Journey depicts the generic process of newcomers or people that are already participating in GREENGAGE Observatories becoming GREENGAGE Observers, then contributing to thematic co-explorations (in response to urban challenges as they are understood in different locations).
Pilot Owner	The city or authority responsible for the implementation of a particular GREENGAGE innovation pilot.
Planio	Planio is a project management platform based on Redmine: “Redmine is a free and open source, web-based project management and issue tracking tool. It allows users to manage multiple projects and associated subprojects. It features per project wikis and forums, time tracking, and flexible, role-based access control. It includes a calendar and Gantt charts to aid visual representation of projects and their deadlines. Redmine integrates with various version control systems and includes a repository browser and diff viewer.” (Source: Wikipedia, 2024)
Situational onboarding of CO participants	Situational onboarding conceptualises the GREENGAGE engagement methodology. Situational onboarding is sensitive to context, time, capacities and other variables that impact on the ability of citizens to actively participate in COs. It seeks to meet people where they are, be inclusive, and extend and diversify the contributions of participants at different stages of the co-creation process. The methodology suggests reflexive questions as a tool for develop engagement strategies with the different pilot partners.



Thematic Co-Explorations	<p>A thematic co-exploration involves a group of people that combines already available datasets (Open Data, Copernicus) with those datasets that citizenry can contribute with. The idea is that heterogenous datasets are combined and correlated to give place to indicators and visualisations that are widely understandable by laypeople. Besides, the conclusions or insights driven by each pilot will be mapped into storylines, i.e., narrative and visual communication to raise awareness about the issues associated to Green Deal and possible solutions that as society we can tackle.</p>
Top-down approach on policy innovation	<p>The GREENGAGE Innovation Action is informed by a top-down logic. That means the developed frameworks are setting boundaries for meaningful experimentation:</p> <ul style="list-style-type: none"> <li>• The ethical framework is defining procedures on how to apply ethics in GREENGAGE COs.</li> <li>• The governance framework is defining the metrics through which the innovation potential of pilots will be captured</li> <li>• The methodological framework is setting core concepts and guides the development of the GREENGAGE approach on COs</li> <li>• The citizen science methodology frames how CO campaigns will be co-designed and co-delivered through exploring and exploiting existing technologies in piloting COs.</li> </ul> <p>[Reference: D2.1 - GREENGAGE Methodological Framework]</p>
Use cases	<p>Generally, use cases are specific situations in which a product or service could potentially be used. In GREENGAGE we experiment in place-based, co-created and living platforms and learn about the useability of GREENGAGE COs as mediators of urban policy innovation. The products that are tested on their usefulness for driving transformative urban planning are existing technologies, tools and practices that brought into play by the GREENGAGE consortium to build tech-aided and co-created environmental monitoring and information systems, or GREENGAGE COs.</p>

## Executive Summary

The "Training and Campaigning Report and Community Building" (Deliverable D5.3) provides a detailed account of the activities undertaken during the GREENGAGE project's first iteration of the piloting phase, focusing on training, campaigning, and community-building efforts. GREENGAGE, funded under the Horizon Europe program, is dedicated to advancing the European Green Deal by fostering citizen-driven environmental governance. The project aims to bridge the gap between top-down policies and bottom-up civic engagement by co-creating solutions to issues such as mobility, air quality, and healthier urban living. This approach is implemented across five European locations—Bristol, Copenhagen, North Brabant, Turano Valley, and Gerace—where local communities actively participate in citizen observatories.

The report describes how these observatories encourage collaboration between citizens, local authorities, and other stakeholders to generate and utilise environmental data. By embracing citizen science and co-creation methodologies, GREENGAGE aims to empower communities to shape policies and actions that positively and actively affect their environment. It also provides an account on how training and campaigning were designed to foster participation, while community-building efforts helped solidify engagement among various groups, so citizen-led initiatives are sustainable and impactful over time. The deliverable outlines the successes and challenges during this phase, focusing on how localised citizen engagement can enhance governance, and illustrating the process and preliminary results of each pilot's co-exploration.

The report emphasises the importance of continuous outreach, digital literacy, and the adaptation of technological tools to facilitate effective participation. The insights gained during this period have provided a foundation for refining GREENGAGE's strategies in ensuring that citizen observatories are not only data-driven but also socially inclusive and politically relevant. By fostering trust, building capacity, and maintaining strong community ties, the project has made significant strides toward integrating high-quality, citizen-contributed data into local policymaking, advancing the European Green Deal's mission.

## Related Documents

- D2.1 GREENGAGE CO Methodological framework.
- D2.6 GREENGAGE Technological requirements 1.
- D3.2 CO Solution mapping to pilots, recruitment, and training report
- D3.3 GREENGAGE CO Academy Roadmap
- D5.1 GREENGAGE Piloting and Citizen Observer Activities Report 1

# 1 GREENGAGE Summary

The pan-European Innovation Action, funded under the Horizon Europe Framework Programme, aims to promote innovative governance processes, and help public authorities in shaping their climate mitigation and adaptation policies. To achieve this aim, the GREENGAGE project will leverage citizens' participation and equip them with innovative digital solutions that will transform citizen's engagement and cities' effectiveness in delivering the European Green Deal objectives for carbon neutral cities.

Focusing on mobility, air quality and healthy living, citizens will be inspired to observe and co-create their cities by sensing their urban environments. The aim is to complement, validate, and enrich information in authoritative data held by the public administrations and public agencies. This will be facilitated by engaging with citizens to co-create green initiatives and to develop Citizen Observatories (CO). In GREENGAGE, Citizen Observatories will be a place where pilot cities will co-examine environmental issues integrating novel bottom-up process with top-down perspectives. This will provide the basis to co-create and co-design innovative solutions to monitor environmental problems at ground level with the help of citizens.

With two interrelated project dimensions, the project aims to enhance intelligence applied to city decision-making processes and governance by engaging with citizen observations integrated with Copernicus, Global Earth Observation System of Systems GEOSS, in-situ, and socio-economic intelligence, and by delivering innovative governance models based on novel toolboxes of decision-making methodologies and technologies.

The envisioned citizens observatory campaigns will be deployed and fully demonstrated in 5 pilot engagements in selected European cities and regions including: Bristol (the United Kingdom), Copenhagen (Denmark), Turano and Gerace (Italy) and the region of North Brabant (the Netherlands). These innovation pilots aim to highlight the need for smart city governance by promoting citizen engagement, co-creation, as well as gathering new data which will complement existing datasets and evidence-based decision- and policymaking.

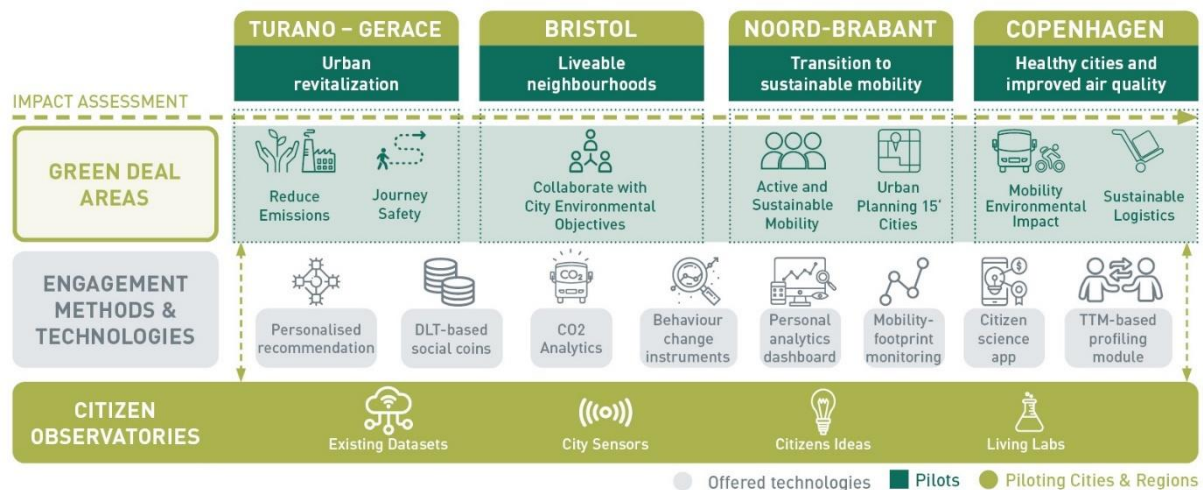


Figure 1: Structure of project GREENGAGE.

## 2 Object of the Deliverable

This report offers a comprehensive overview of the methods and activities carried out for campaigning, training and community building during the exploring stage of the Piloting Phase. Having the GREENGAGE CO Methodological Framework as a guiding background for the development of GREENGAGE Observatories as a Living Labs, this report covers task 5.2 Continuous Campaigning and Training as well as 5.3 Pilots community building and knowledge sharing. These tasks build on the outcomes of the Preparing phase tasks and represent the starting operation of the GREENGAGE Observatories. This deliverable provides - in conjunction with deliverables 5.1 Piloting and citizen observer activities report 1 and GREENGAGE CO Academy - a first overview of the GREENGAGE Observatories implementation. It aims to provide insights and lessons learned that can be useful for the application in the consolidation stage of the Piloting phase.

### 3 Introduction

GREENGAGE is a pan-European research Innovation Action aiming to foster transformative urban policy-making. It leverages digital solutions to engage citizens and enhance cities' efficacy in meeting the objectives of the European Green Deal. Within GREENGAGE, the Innovation Action relies on participatory research to collectively bolster innovative governance for climate mitigation and adaptation policies. It involves citizens in co-creating green initiatives and establishing Citizen Observatories (COs) focused on mobility, air quality, and promoting healthy living, hereafter referred to as GREENGAGE Observatories (GO).

GREENGAGE Observatories (GO) serve as community-based and evidence-led ecosystems, encouraging individuals to share observations and interpretations via digital platforms to tackle pan-European urban and regional environmental planning challenges. The GOs are knowledge ecosystems living labs-like founded on citizen science principles. They foster collaboration between lay citizens, local stakeholders and professional researchers to create a more inclusive research environment through experimental learning, sharing insights and recommendations. By doing so, GREENGAGE Observatories seek to enhance knowledge and policy production transparency, thereby building trust in scientific practices and generating insights to tackle urban challenges amidst the ongoing climate crisis.

The GREENGAGE project is being implemented by adopting a phased approach to develop Observatories in five EU pilot cities/regions: Turano Valley (Italy), Gerace (Italy), Bristol (UK), Copenhagen (Denmark), and North Brabant (the Netherlands). The approach comprises three continuous stages of experimentation: preparation, piloting, and collective learning, all directly contributing to conceptualization and knowledge-sharing activities. GREENGAGE phases are iterative and build on experimentation, improvement and constant learning to deliver the project goals: i) Raise citizens' awareness, interest, and engagement in urban environmental issues ii) Provide scientifically sound and rigorous methods for citizen understanding of environmental data iii) Promote and ensure broader acceptance of data collected by citizens in policy- and decision-making iv) Promote the co-creation of data solutions for the urban environment v) Establish synergies to exchange best practices, ensure transferability, uptake, and replication of successful.

The preparation phase involves the agreement on concepts and processes for structuring GREENGAGE's governance, including building communities of practice and co-designing tools and technologies. It also entails planning the activation of GOs before implementation. This phase delineates three initial steps necessary to launch a GREENGAGE Observatory: (a) defining the objectives of the GO, (b) analysing the current situation of the pilot area, and (c) engaging the first community of citizens or citizen observers.

The Piloting process entails recruiting, training, and running citizen science experiments, monitoring, and collecting citizen observations through the GREENGAGE engine and toolbox of technologies (running data collection campaigns/street walks/citizen surgeries/workshops) and building a citizen observer community. It also includes prototyping, testing, monitoring, data gathering, and collaborative sense-making with GO participants.

Collective learning encompasses reflexive activities where participants interpret and produce knowledge to address shared concerns, refining the conceptual architecture as needed.

The piloting phase involves synchronizing the activities concurrently carried out during the preparation phase in the different work packages of GREENGAGE to activate and run the Observatories. Several tasks from GREENGAGE Work Packages contribute to the piloting, including updating use cases, awareness campaigns, continuous participant onboarding, training, new software features for experiments, data analysis, visualisation and interpretation, community building across pilots, and advocacy for the uptake of GO solutions. The piloting phase lasts 16 months and is divided into a first 6-month exploratory stage and a 10-month consolidation stage.

The GREENGAGE Methodological Framework is the background for this report - a set of singular principles and processes that guide the GREENGAGE Co-creation process of Citizen Observatories as Living Labs in which the phased approach is embedded (Figure 2).

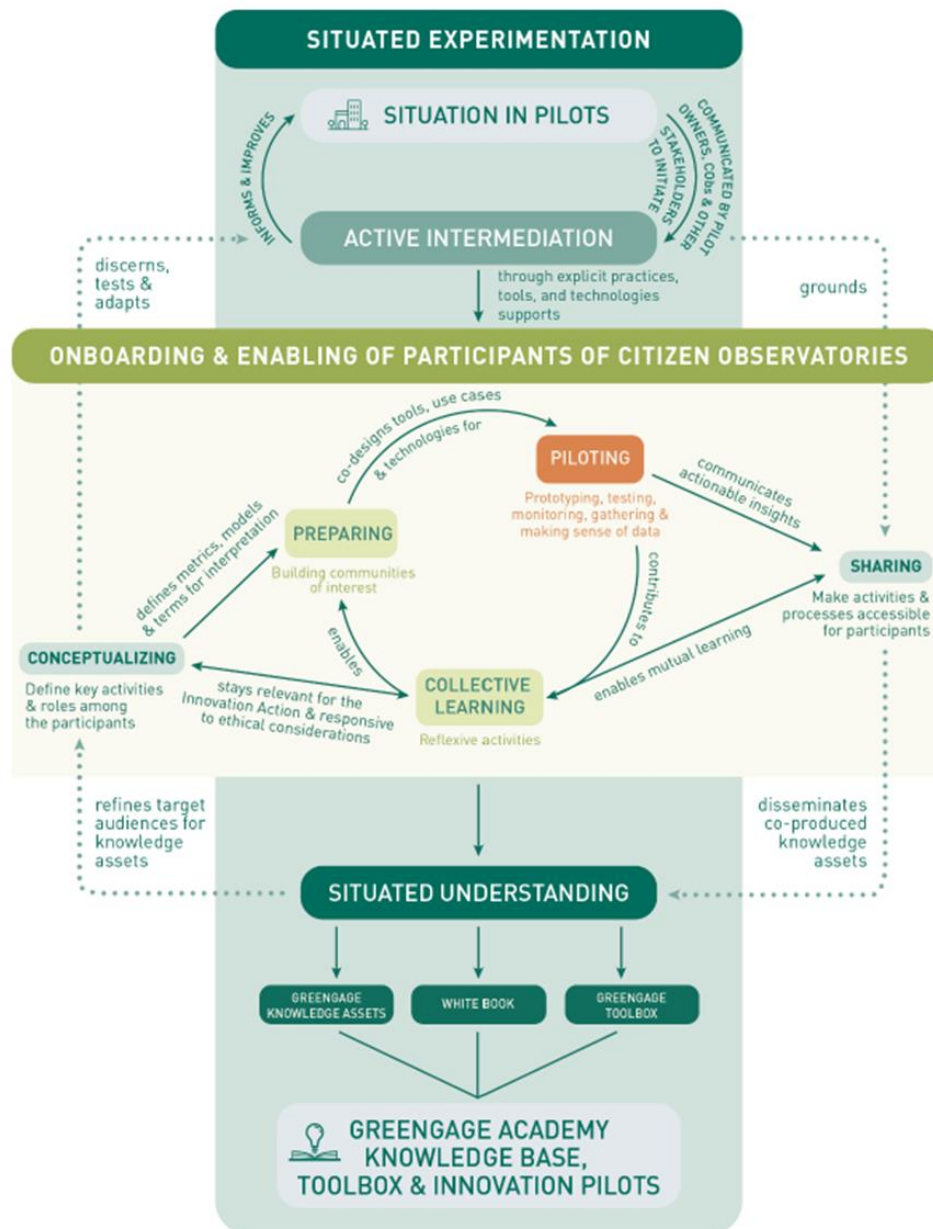


Figure 2: Methodological Framework of GREENGAGE project

The GREENGAGE Methodology defined situated experimentation as a process model guiding the design of GOs as Living Labs where real-world scenarios serve as platforms for research and development activities, allowing for testing existing technologies, tools, and practices. Situated experimentation refers to the idea that that experimentation processes should fit within the pilots' socio-political contexts while simultaneously addressing the Pan-European governance innovation efforts.

Furthermore, two guiding principles serve this vision: active intermediation and situational onboarding. By active intermediation, the project addresses the need to translate local complex and changing scenarios with the policy-making authorities at different levels. It also implies addressing different sources of knowledges as part of the innovation effort in environmental governance. As Living Labs, GOs are mediators between public authorities and citizens, researchers, tech providers, and other stakeholders. The mediation process involves enabling urban policymakers to respond democratically to community needs, navigating legal and regulatory requirements, and facilitating the active participation of citizens in decision-making processes. GOs enable a dialogue between authorities and communities through co-designed observation and analysis of real-world environments, generating new datasets through citizen involvement and allowing stakeholders to interpret and design local policies adaptive to climate change.

Situational onboarding is a principle that reconceptualises recruitment as a continuous process of involving, training, and creating communities of practice and interest that aims at empowering GO members as planning agents in their communities. “Situational onboarding is sensitive to context, time, capacities, and other variables that impact the ability of citizens to actively participate in Observatories. It seeks to meet people where they are, be inclusive, and extend and diversify participants' contributions at different stages of the co-creation process” (D3.3).

Under this umbrella, the report at hand focuses on the activities carried out to implement the GREENAGE Observatories during the exploratory stage. It provides an overview of the activities carried out to operationalize the tasks performed during the preparation phase and their development between months 12 and 18 of the project. The report is organized as follows:

Chapter 4 provides an account of the GREENGAGE Innovation Action structure and the thematic co-exploration process in the piloting phase. Designed and tested in the preparation phase, the GREENGAGE Innovation Action structure is an organisational edifice aiming to support and mediate during the different phases. This chapter describes its activities concerning piloting. The thematic co-exploration process is a step-by-step operational and development of use cases and guides the GREENGAGE collaborative environment platform.

Chapter 5 describes the training activities and production of training material. Following the preparation phase, the training of Pilot Owners and the core team of observers will be described.

Chapter 6 reports on the experimentation process per pilot. It updates the pilots' cities' situation, the adaptative measures taken correspondingly, and the new opportunities opened in such contexts for developing GOs. In line with the situational screening and analysis that informs the methodology (see D.2.1), the chapter focuses on the continuous development of the GOs in relation to the political and social context. It describes the general logic of each GO, the thematic co-explorations developed during the first iteration, and recounts the activities per pilot in terms of engagement, training, and experimentation.

Chapter 7 will outline lessons learned and opportunities to strengthen the piloting phase during the project's consolidation stage.



## 4 Situational Experimentation

By situational experimentation, GREENGAGE understands a model process that creates structures and roadmaps to deliver GO as localised, place-based living labs able to respond to the pilot's social and political particularities while simultaneously supporting the implementation of the European Green Deal objectives within a pan-European governance innovation ecosystem. As explained in the introduction, the situational experimentation involves the principles of active intermediation and situational onboardings. The first one implies a mediation between the diverse and complex pilot local situation and the different knowledge involved in the consortium, stakeholders and participants, while the second one attempts to provide sensitive and recurrent opportunities to involve potential stakeholders and observers. In practice, active intermediation and situational onboarding have been developed through an Innovation Action Infrastructure and the development of a thematic co-exploration process.

### 4.1 Innovation Action Structure

During the preparation phase, the project set up an Innovation Action Structure as part of the activities aimed at developing and testing the GREENGAGE co-creation approach. As explained in more detail in D2.1, D3.2, and D3.3, this structure consists of two interlinked support structures: the Innovation Action Board (IAB) and the Pilot Support Teams (PST).

The Innovation Action Board (IAB) is a collaborative and interdisciplinary team comprising partner representatives that oversee the whole GREENGAGE IA and steer the PSTs. The IAB assists pilot projects and ensures the replicability of the GREENGAGE approach across GOs. Some of the key functions of the IAB are a) Methodological conceptualisation and validation of the GREENGAGE approach, b) Encouraging pilots' collective learning and sharing, c) Ensuring that Planio and the Collaborative Environment as platforms for R&D of the GREENGAGE as Innovation Action are understood, maintained & used for that purpose by all participants that take part in learning within the Innovation Action, d) Build up close connections & peer learning opportunities with EU sister projects.

The Pilot Support Teams (PSTs) are interdisciplinary groups of partner representatives that assist the five pilot initiatives in developing their use cases and fostering the constitution of functioning GOs. The Pilot Support Teams are designed to facilitate each phase of the Innovation Action. Key focus areas of the PST include assistance in clarifying a) the mission and vision of CO, b) the process of co-creation, c) Ethics guidelines and procedures, d) onboarding activities, e) exploring and exploiting existing tech, f) generating, managing, analysing & telling stories with data g) collaborating & learning across GOs.

During the piloting phase, the IAB and PSTs were active and developed their activities regularly. PST meetings have been held approximately every second week. The IAB, on the other hand, meets regularly, almost every week, and serves as a gathering for updates to the consortium partners on the GOs process, challenges, and advances; discusses common requests or concerns of pilots; and conveys information from consortium coordination to pilots.

In line with the methodological framework (D2.1) and its update (D3.3), the innovation structure has aimed at addressing the active intermediation, a methodological principle guiding the GREENGAGE Innovation Action that understands that a mediation and translation process is needed in interdisciplinary endeavours to create communication channels between knowledge specialities. It also involves addressing the local situation of each pilot while simultaneously framed in the Pan-European goal of fostering the Green Deal. In this sense, the IAB and PST have been working more decisively in a bottom-up direction during the piloting phase.

Recurrent activities of PST in all the pilots were:

- Review and validation of pilot situation: Each pilot reviewed the pilot's local situation by validating the general description, policy frame to impact, possible target audiences, possible stakeholders, and technologies of interest. The changes in local political and social contexts or advances in activities with stakeholders or potential participants were constantly addressed.
- Review and validation of pilots' use cases: Each PST reviewed the pertinence of the predefined use cases and made changes if necessary. Bristol for example proposed to develop an extra use case based on Bristol's 1st GO, focussing on the methodological dimension of GREENGAGE Observatories (co-design process, public engagement, self-reflexive development of policy and



governance innovation) and targeting the focus on the impact of GOs in terms of policy and governance innovation.

- Identification of needed support for each PST: Each PST reviewed the foreseeable needed support for the piloting phase. As a result, new members were involved, and new roles were identified as needed. The roles were systematised in the PST role sheet, where the partner with the role and expected support were registered (e.g., providing support of a specific technology, data management, ethics, engagement, and documentation).
- Adaptation of organisational structure of the PST: Some PST and Pilot Owners decided to try out different PST structure (Copenhagen PST for example is organized on working group addressing concrete technical tasks).
- Draft Calendar of activities for the first iteration: Using the thematic co-exploration process as a reference, pilots drafted an initial calendar to foresee activities during the exploration phase. Most pilots decided that the exploratory phase would focus on low-technology onboarding, gaining trust with observers, and addressing stakeholders' relations.
- Definition of questions, type of data needed, and possible methods of analysis and visualisation: During the PST sessions, specific questions concerning the expected data to be captured, and the possibilities of the technologies were discussed on the basis of the actual availability offered to the pilots and the available budget. Common issues addressed were the air quality sensors' specifications, the image capture's analytical possibilities, and engagement concerns.
- Planning of engagement and training activities: The PST also helped to coordinate activities on the field when required for the pilot (e.g. engagement and training activities in Gerace and Turano Valley, translation of material, technical support for presentation, formats).

Some of the common topics addressed on the IAB have been:

- Review of leaders and members of the PSTs: The IAB proposed a new leadership in which a second leader was meant to support the principal one.
- Provide solutions for specific needs asked by Pilots: The IAB and the project coordination provided needed support to pilots (e.g. identification of statistical experts or specific ethical support for new data captured methods).
- Supervision of pilot activities: An almost weekly update of pilots was carried out in the IAB. It serves as a space for alignment and mentoring activities in search of common or specific solutions.
- Steering innovation: The IAB was a space to share the innovations or solutions found by the pilot in order to share them with other pilot cities.

As part of the coordination of the support to pilots each one of the PSTs developed an initial plan of activities. This initial plan included a brief description of the initially defined use cases, a short description of envisaged tasks and tentative dates to be carried out. It also contemplated the possible GREEN Engine technology needed, the number of people that might be involved in each activity and the next steps to carry on with the pilot activities. The plan of activities was adapted by each PST to fit their needs. A pilot for example, shifted to a Miro Board format in which the available information of the pilot status was included, and each session information was added. Some other decided to organize the information in an Excel table.

The plan of activities made evident the need to structure the support to the pilots by assigning concrete roles and tasks to the participants of the PSTs. By partially advancing on suggestions included on D3.3 the pilots developed a system of roles sheet to identify the required skill, the correspondent partner and their expected responsibilities. Common member roles identify by all pilots were: a) Technical support according to the selection of data capturing GREEN technologies in each pilot: here for example specialist on air quality sensors, MindEarth and the GREENGAGE app were common; b) Data visualisation and analysis specialist c) Citizen engagement d) Training needs e) Policy and governance f) Documentation e) Ethics.

The member and responsibilities sheet allowed to identify missing roles needed on each PST and find the proper help. In some cases, specific extra roles were identified such as survey expert or specialists in geographical data that force the consortium to investigate and find capacities of partners to supply

the pilots demands. Other cases made the need evident to find stakeholders outside the consortium and to open the discussion on the social capital needed to guarantee the sustainability of the Observatories once the project has ended.

## 4.2 Thematic Co-exploration Process

The thematic co-exploration process is a step-by-step guideline for the development of use cases of each GO (see Figure 3). By thematic co-exploration, we mean the development of the use cases identified during the preparing phase and registered in Planio. The thematic co-exploration set the initial questions and hypotheses to be addressed by the GO, the type of data expected to be captured and analysed, all under the encompassing process of engaging stakeholder and participants through situational onboarding strategies.

The process is meant to provide a common frame of action for all pilots and provide a logical structure for the iterative process involved in the GREENGAGE methodology. It is intended to complement the situated experimentation process model as much suggest an operative series of steps during the piloting stage. A thematic co-exploration is a collaborative and iterative process: several iterations may be needed over some of the process's steps. It is not intended to be a straitjacket. It must be understood as adaptable in its components and allow adaptations, changes and improvements according to each pilot situation. The steps are indicative, and different journeys through them could occur (e.g. some steps may not be pertinent for a specific case, and new steps might be added if the co-producers of a thematic co-exploration consider it). It allows a panoramic view of the beginning, start, and definition of milestones to plan the GOs' operative activities.

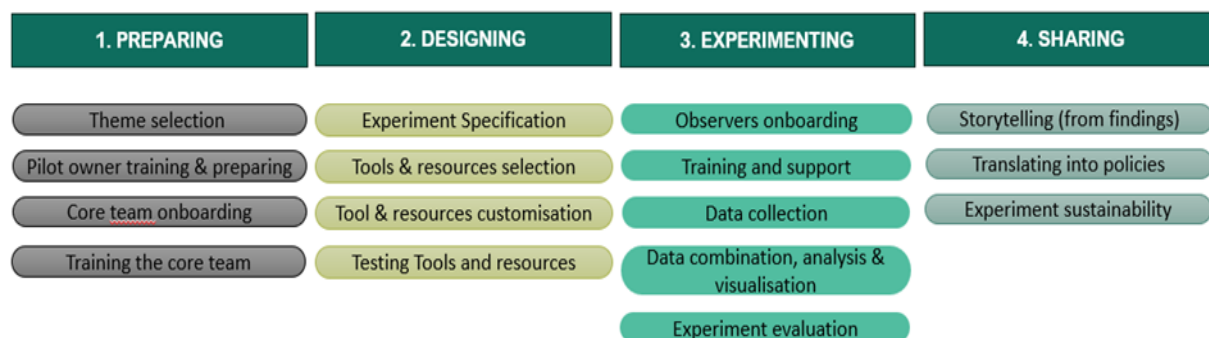


Figure 3: Thematic co-exploration process

The thematic co-exploration process is composed by four stages: preparing, designing, experimenting, and sharing. Each phase is divided into steps that follow a simple but logical path. The preparation phase starts by a theme selection based on the already identified use cases (see D2.6) and its specification in questions and hypothesis to be developed considering their political relevance. It also involves engaging and training activities in which Pilot Owners and partners share knowledge and socialize citizen science principles and the technological capacities needed for the development of the collaborative exploration. Designing is the phase in which the structure of the experiment begins to come to life. Based on the identified themes, pilots should start the definition of tools and resources as well as their testing. The experimenting phase is the one in which the observers come on board, are part of training activities and actively participate in data collection, analysis and visualisation. The last phase of sharing involves communication, debate, and political incidence. The collaborative process is reflected in a thematic co-exploration specification template (see Annex 1), whose content is described in the Pilots activities section bellow in this report. During the exploration phase, Pilots mostly work on the preparing and designing phase and some addressing experimenting steps.

The thematic co-exploration was shared with consortium partners and pilots during two consecutive training sessions for Pilot Owners (see Chapter 5). It was also refreshed during the third consortium meeting as part of the presentation of the Collaborative Environment. The thematic co-exploration process in those scenarios provided a guide specifying the objective of each step, the responsible actors (e.g. PSTs, Pilot Owners), suggested a way to implement the step, and provided a possible free access resource relevant for it.

Based on the phases and steps of the thematic co-exploration, an initial calendar of activities for the first iterations was devised in each of the pilots (see Annex 3). These calendars were adapted for each pilot

city by Pilot Owners and PST members based on the particularities of the situation. For example, North Brabant included activities of landing and engagement with local association of bikers, Copenhagen contemplated a process of sampling for a possible onboarding based on a district survey, and Bristol more stages of engagement based on schools. Some of the activities of the thematic co-explorations happened simultaneously and fit the GREENGAGE pace of activities. In this sense for example, the pilot owner training and preparing was happening at the same time as the theme selection and some pilot had already a clear idea of the experiment specification in advance.

Thematic co-exploration phases and steps were structured in coherence with the Observers Journey (see D3.3) and the development of the Collaborative Environment, the interactive platform designed to foster the GOs' Co-Creation process and enhance community building through online tools (see <https://demo.greengage-project.eu/dashboard>). The Collaborative Environment suggests each phase and step of the co-exploration process and guides the users on how to carry out a GREENGAGE citizen science project. It proposes online material and resources to carry on the tasks involved and move forward to the following steps and allow to define a time plan, stakeholders, responsible of activities, status of each phase and manage the permissions to participate on it. It also proposes a reward system based on gamification principles and facilitates the customisation of the process by allowing it to include or adapt the different steps of the stages as required.

During the first iteration of the piloting phase, all pilots adopted a low-tech strategy, which facilitated reflection, discussion, and understanding of how technology aligns with their key political goals and social expectations. This approach was crucial in reconnecting with and earning the trust of potential and existing GOs members. By validating, adjusting, or creating narratives based on data to support each GO's objectives, the pilots fostered engagement and reaffirmed the value of using storytelling to interpret data. Given that GREENGAGE's primary aim is to advocate for Green Deal adoption in local policies through citizen-led science, the project progressed in establishing connections between engagement, high-quality data, and citizen-contributed data collection and analysis. Most of the pilot's work aimed at paving the ground to the co-creation of the GOs by identifying and narrowing down key themes and geographical point of interest to be fully developed during the second iteration. Having this in mind, the first phase resulted in each pilot having a plan that aligned the various GREEN Engine possibilities with their specific objectives (see Annex 2).

In some cases (Bristol, Turano Valley, and Gerace), participants' interest stemmed from the technological capabilities of the project and how they provided a new perspective on local issues. Aware that user-friendly apps with clear visuals and intuitive design encourage participation, the project has tested, developed, and integrated technology to achieve significant impact through hands-on tech engagement. This effort has been significant, as the project identified technological and digital literacy gaps among participants. In pilots where interest was not primarily driven by technology (North Brabant and Copenhagen), the focus was on emphasising GREENGAGE's unique value proposition, particularly its storytelling approach to data, while reinforcing the project's commitment to social inclusion and linking well-validated data to meaningful political influence. The detailed description of each of pilots' activities during the first iteration is provided in chapter 6 of this report.

## 5 Training

An important component in the piloting phase of the GREENGAGE Observatories is training. It has played and continues to play an important role in knowledge exchange, capacity building, collective learning, and community engagement among the partners, the Pilot Owners, and the GO participants.

Training has been an ongoing activity in the project even before piloting began. In December 2023, the Stage I of the training activities, Train-the-Trainers, commenced. In May 2024, the Stage II, Train-the-Core-Team followed suit. Chapter 7 of the D3.2 deliverable laid out the details of the former, whilst this chapter will report on the completion of Stage I and the ongoing activities that take place as part of Stage II.

### 5.1 Train-the-Trainers

As mentioned in D3.2, the first stage of the GREENGAGE training programme was comprised of a series of weekly webinars. In the end, a total of 11 sessions were realised. These were spread out between December 2023 and April 2024, and the table below summarises the topics addressed, date and number of attendees per session.

Table 1: Topics of the Train the Trainers phase

Nr.	Theme	Focus	Date	Attendees
1	Ethics	<ul style="list-style-type: none"> <li>Public Ethics Awareness /Contact of care</li> <li>GREENGAGE Privacy Notice</li> <li>Participation Information Sheets</li> <li>Personal Consent Forms</li> <li>FAQs ethics for Pilot Owners &amp; CObs</li> </ul>	07-Dec-23	23
2	Data I	<ul style="list-style-type: none"> <li>Introduction to data science, data governance and machine learning</li> <li>Data standards</li> <li>Conceptual reflection on the use of data and interpretations of qualitative data and extensions</li> </ul>	18-Jan-24	25
3	Data II	<ul style="list-style-type: none"> <li>Open data (Copernicus, OpenStreetMap and Bristol Open Data)</li> <li>Sensory data from the street and from earth (collection, formats and processing)</li> <li>Location-based mobility data and data analysis</li> <li>Data visualisation and cartographies for decision-making</li> </ul>	26-Jan-24	24
4	Co-design I	<ul style="list-style-type: none"> <li>General principles of Citizen Science (objectivity, data quality, reproducibility, science methods and participatory methodologies)</li> <li>Overview of participatory methods &amp; tools (analogue &amp; digital &amp; visualisation tools)</li> <li>Citizen Science &amp; Citizen Observatories: How to co-design a contract of care/guiding principles together with CObs</li> <li>Roadmapping &amp; Strategies to sustain motivation (screening and mapping, effective communication, reporting findings)</li> </ul>	02-Feb-24	25
5	Co-design II	<ul style="list-style-type: none"> <li>Presentation on Thematic Co-exploration roadmap for GOs, Part I: Preparing and Designing</li> </ul>	16-Feb-24	22
6	Co-design III	<ul style="list-style-type: none"> <li>Presentation on Thematic Co-exploration roadmap for GOs, Part II: Delivering and Sharing</li> </ul>	23-Feb-24	---
7	Technology I: Community & coproduction process management	How-to-use video training: <ol style="list-style-type: none"> <li>1) Collaborative Environment (CE)</li> <li>2) Keycloak authentication &amp; integration</li> <li>3) Discourse</li> </ol>	29-Feb-24	15

8	Technology II: Air Quality Monitoring & Technology	<ul style="list-style-type: none"> <li>Air pollution (definition, key pollutants and sources, potential health impacts)</li> <li>Legislation and air quality objectives across countries</li> <li>Air quality monitoring at the level of national governments and local authorities</li> <li>Low-cost air quality sensors (strengths and weaknesses)</li> <li>Atmotube wearable sensors and their role in GREENGAGE (capabilities, data capture, performance in comparison to other devices)</li> <li>Air quality monitoring in Citizen science</li> <li>How-to-use video training:               <ol style="list-style-type: none"> <li>Atmotube sensor</li> </ol> </li> </ul>	07-Mar-24	21
9	Technology III: Data Management, Quality & Preprocessing	How-to-use video training: <ol style="list-style-type: none"> <li>Copernicus data demonstration</li> <li>Open Street Map data demonstration</li> <li>Data Quality and Structure Dashboard</li> <li>DataHub</li> <li>Apache NiFi</li> </ol>	15-Mar-24	21
10	Technology IV: Data Visualisation & Analysis	How-to-use video training: <ol style="list-style-type: none"> <li>Apache Druid</li> <li>Image Analysis &amp; Realtime Mapping (MindView)</li> <li>Apache Superset</li> <li>DIGITWIN</li> <li>VISAT</li> </ol>	21-Mar-24	19
11	Technology V: GREENGAGE app	How-to-use video training: <ol style="list-style-type: none"> <li>GREENGAGE app (with MODE integration)</li> <li>GREENGAGE app (with MindView integration)</li> </ol>	12-Apr-24	12

Stage I covered the following themes: (1) ethics, (2) data science, (3) data types and use, (4) citizen science and observatories, (5-6) GO-specific approach on thematic co-exploration, and (7-11) tools and technologies used in the GREENGAGE project. A final session on policymaking and governance was delivered in person during the 3<sup>rd</sup> project meeting in Den Bosch (North Brabant Province) in April 2024.

The programme helped produce 16 lectures and 12 video user guides for different technologies, which now constitute knowledge assets. They will be further processed and uploaded online on the GREENGAGE website and will be used to deliver additional trainings in the project in the forthcoming months. Furthermore, a total of 21 speakers with different expertise from different organisations were involved in the delivery of the training during its first Stage. Almost all the GREENGAGE partners, from universities to SMEs, contributed to the preparation of the training material, whilst the curation of the programme and overall management was coordinated by AIT.

A feedback survey was administered after each session to ask for input and suggestions from the consortium, ascertain the relevance of the topics, and assess the impact of the activity. We report below four issues that surfaced from this process.

At the beginning of the training programme, we received a few suggestions about making the training more visually engaging and more relevant to the GREENGAGE pilots so that non-expert audience can better grasp the applicability of concepts and relate to the topics discussed. The curatorial team responded to the feedback by adopting a more propositional role in the preparation of the training material. This included an active process of selecting, organizing, and looking after the training material and of providing guidance on narrative development, visual presentation, storytelling, use of engagement techniques such as interactive presentation tools like Mentimeter, practical examples from

GREENGAGE use cases, and success stories from other relevant projects. Most of the lectures and videos were co-developed through an iterative process.

Another lesson learned from the feedback survey was how to best pace a session in terms of timing as well as amount of content delivered to avoid overwhelming attendees with an overload of information. Q&A sessions at the end of the presentation were essential sections and they worked very well in this case. They were used by the participants to go in detail and expand further on the topic, investigate the relevance of topics to GOs, and discover cross-links with other pilots. For instance, one of the Pilot Owners commented (about the DATA II session) that the “short presentation times and possibility to ask questions” worked well and the format can be continued in future sessions.

One observed shortcoming was the lack of interactivity during the training, a fact which is inevitable to a certain extent due to the online format of the webinars. Although a variety of tools were used to partially overcome this limitation, it would have been useful to include at the end of the sessions simple exercises or follow up after their end of the session with homework that would allow attendees to put into practice what was being taught, as one person mentioned. This was attempted in two sessions, Co-Design II and Co-Design III; however, participation was rather limited.

A last comment that is worth mentioning here was: “Do you have you any examples of training material to be adapted for the Citizen Observatories?” This question was dealt during Stage II of the training programme and prompted the strategy for the training of the core teams of GOs during the exploratory stage.

## 5.2 Train-the-Core-Team

Stage II of the training activities focuses on Train-the-Core-Team of the GOs in the different pilot cities. Unlike the first Stage, these activities are organised and delivered on an if-and-when-needed basis and happen in connection with the five PSTs. This means they are more tailored to the needs of the different Observatories and the lay citizens that are part of them, taking into consideration limitations such as digital illiteracy and language. They are also first tested by the GO core teams, as the Stage title implies. By core team, we mean the Pilot Owners and initial GO members who participate in the exploratory stage and help lead the GOs. The core team is the first to experiment with the GREENGAGE technologies, receive training, and provide feedback and strategic insights to the project partners. Some other possible responsibilities of the core team include a) engaging and involving more community members in the Observatory, b) helping to ensure that data collection, analysis, and reporting activities are organised and on track, and c) communicating first findings to and discussing them with Pilot Owners and partners.

So far, two training sessions from Stage II have been planned during May and June 2024, in Turano and Bristol, respectively. Despite the pilot specifications for training, we have developed an overall strategy in the Train-the-Core Team stage. The strategy includes the following points:

### 1) **Specify a catalogue of training tools and resources:**

This includes the selection of videos from Stage I that can be pertinent to the core team and their editing into friendly resources for the GREENGAGE website and the Collaborative Environment.

### 2) **Deliver two types of training:**

- i. **Synchronous**, to be defined with a pertinent partner. These can be delivered either online or on-site if necessary. They can also be delivered by expert partners or Pilot Owners.
- ii. **Asynchronous**, with videos and other written materials deposited or distributed digitally. In this case, GObs can visit the material on their own time and their own convenience.



Table 2: Training sessions for the core team

Nr.	Pilot	Focus of Training Sessions	Date	Attendees
1	Turano (+Gerace)	Use of Atmotube Pro sensors	09-March-24	20
2	Turano (+Gerace)	Air Quality and monitoring Mobility data	30-May-24	24
3	Bristol (School Observatory)	Citizen Science Citizens Observatories	23-April to 24- June-24	35
4	Bristol (BSYV)	Citizen Science Citizens Observatories	10-Jun-24	15
4	North Brabant	Participatory Compass	25-Mar-24	7
5	North Brabant	Assessment biking infrastructure	28-May-24	30

The above table summarises the training sessions that have already taken place. The full extent of the activities is reported in each of the pilot's sections. Training is an ongoing activity through the exploratory and consolidation phases. Therefore, we expect the list to grow as we go forward. In the paragraphs that follow, we report on these realised sessions and provide an update on what is planned to date.

Both training sessions in Turano and Bristol were synchronic; yet some of the material used for these sessions will be used for asynchronous trainings during the second phases of GOs. In the case of Turano, two videos were created. The first was an edited version of the lecture on air quality monitoring delivered in Stage I. The recording was edited with the help of video editing software; sound and content were montaged, and the text was transcribed, translated in Italian and reinserted using AI voice-over technology. The second video was an Italian version of the user guide created for Stage I on how to use the Atmotube sensor. Unfortunately, due to limited time and connection issues on the day, the first video was not shown. Based on the feedback received from attendees, the second video was clear, yet a little hard to engage with because of the mechanical and robotic sound of the voice over.

For this event, new materials were also created. These included:

- A lecture on “Studying the territory from the point of view of human mobility: Smartphone data to get to know the municipalities of the Turano Valley”.
- Dashboard on Superset where live data tracking and first data visualisations were shown with accompanying slides that facilitate storytelling based on evidence and interpretation of quantitative data in everyday life. The aim was to use these as visual aids to facilitate the communication, the engagement, and the understanding of non-expert citizens during the focus group discussion.

Initially, citizens from Gerace's core team were planned to attend the training session in Turano remotely. However, due to connectivity issues this was not possible and a follow-up training session will be scheduled for them.

In the case of Bristol, one video addressing the topics of citizen science and the role of citizen observer in Citizen Observatories including ethics of care was created. The audience of this training session was the Bristol Somali Youth Voices (BSYV) group. The requirements were then shaped accordingly:

- training should be short, simple and succinct and ideally take the form of a pre-recorded video so that participants can go through it in their own time;
- images should feature young people and teenagers for relatability;
- the accent for the voiceover should be British for relatability;
- videos should be less than 5 min in total to deal with short attention spans;
- use examples from the Bristol pilot area for reference.

To respond to these requirements, a new script was created. The text explained complex concepts like citizen science in simple terms and brief sentences. With help from AI, the script was then enriched to include possible "scenes" that could visually accompany the text.

Training in North Brabant was delivered to the core team on two main subjects. One was the participatory frame of the province and its relation with GREENGAGE. The main goal was to clarify how the tenets established by the Regional Authority are fulfilled during the GO activities. The second one was based on the Fietzersbond team (the key stakeholder of the GO) and had as focus to share how to assess collectively biking infrastructures. North Brabant training sessions did not use specific training materials from GREENGAGE as they intended to explain the main goal and objectives of the project and focused on pilot stakeholders' input. Training in Copenhagen is expected to start in September. A detailed description of the training activities is presented in each of the pilot sections.

In the next chapter, the activities of each pilot during the first iteration are reported. The thematic co-exploration process with the system of roles was used to identify how each PST and pilot owner addressed the first iteration. In general, the pilots focused in one of the initially identified use cases to be developed and implemented during the first iteration. In the following pages a description of how the thematic co-exploration was developed (how the use case was break down into concrete questions, hypothesis and activities) and the actual task carried out during implementation in the first iteration.



## 6 Activities per Pilot

### 6.1 Bristol

#### General description

The pilot is a step towards realising Bristol City Council's (BCC) vision for the East Bristol Liveable Neighbourhood Scheme (EBLN). Liveable Neighbourhoods are areas of a city where improvements are designed in partnership with local communities to achieve a better balance between the use of streets by vehicles and people. In June 2021, Bristol's Citizens' Assembly called for the city's neighbourhoods to be reimagined so that they are people-centred and more 'liveable', meaning they are safe, healthy, inclusive, and attractive places where everyone can breathe clean air, have access to better quality green and play space, and feel a part of a community. The West of England Combined Authority (WECA) has provided funding to use an area-wide approach to develop a Low-Traffic Neighbourhood (Liveable Neighbourhood) rather than just designing linear infrastructure for route improvements. Bristol's mayoral priorities included rolling out two Liveable Neighbourhood pilot projects, with the East Bristol Liveable Neighbourhood being the first scheme piloted in the city. In January 2024, the previous Bristol Administration approved the advertising of the Traffic Regulation Order (TRO) for the full EBLN scheme. This scheme aims to empower local communities to transform their neighbourhoods into places that provide better access to green and play space, more seamless and convenient connections to local amenities using sustainable forms of travel, and more space for social and community activity.

The East Bristol Liveable Neighbourhood pilot is located in the inner east of Bristol, covering 1.7 sq. km. It has approximately 6,000 properties and businesses within the area. The project area covers parts of five wards of Bristol: Lawrence Hill, Easton, St George West, St George Central, and St George Troopers Hill, south of Church Road and north of the River Avon (see figure 4).

BCC has completed an extensive and rigorous engagement process to develop the East Bristol Liveable Neighbourhood pilot scheme. Much of this has been in phases of co-discovery, co-design, and co-production of the EBLN programme, working with the local communities to fine-tune proposals and end goals for how streets can be prioritised to inspire and encourage active travel and traffic reductions. The pilot owner, The Liveable Neighbourhoods Team, envisions at least two GREENGAGE Observatories (GO) aiming to seek feedback and input from the local community to help co-design a re-imagined streetscape that realises the vision set through the Citizen Assembly. The first GO refers to the first iteration activities that mostly rely on co-creation using low-tech methods and tools of engagement. The outcomes of the first iteration will inform the second GO to be carried out during the second iteration, which is supported by different technologies of the GREENGAGE Toolbox and runs in coordination with the EBLN trial scheme calendar (to be started on the second semester 2024).

The first GO will allow re-engaging with the local community, especially with those members concerned about the EBLN scheme and its future trial interventions (trial scheme map is available at <https://eastbristolliveableneighbourhoods.commonplace.is/en-GB/map/trial-scheme-map2>). Through means of engagement that go beyond data collection, the pilot seeks to discover issues of shared concern (around journeys, traffic displacement, perception of and actual safety, air quality/pollution, opportunities for increased green infrastructure, etc) amongst participants and support them to envision their neighbourhoods together. Grounding the GO in issues that still matter to the people is important for rebuilding trust in BCC, ensuring participation of historically underrepresented groups, and supporting the co-design of forthcoming interventions that will be part of the second GO.

The second GO will consider what was learned from the first GO and the issues that must be addressed to successfully deliver the first phase of the trial scheme (to be developed during the second semester of 2024). Ensuring representative participation, the Pilot Owners aim to monitor and explore the effects of the interventions performed by the EBLN scheme. This means validating whether the interventions are delivering positive effects in line with policy objectives for a more equitable city and just transition towards becoming climate-neutral by 2030. This should inspire local authorities to adopt and adapt the scheme to the contexts of their neighbourhood, considering policy demands for climate mitigation.

The East Bristol Liveable Neighbourhood Pilot encompasses various stakeholders. On one hand, public institutions, such as the Council Committee members, Bristol ward members, Members of Parliament, and Bristol City Council internal project teams. On the other hand, organised groups like the Bristol One City Transport Board (such as Sustrans and Bristol Walking Alliance) and accessibility and equality

groups (such as West of England Centre for Inclusive Living, Green and Black Ambassadors and Black Seeds Environmental Social Justice Network). It also involves unorganised groups, including community champions (e.g., paid professionals, community animators, connectors from local organisations, and active residents), residents and commuters of the pilot area, local businesses, shops, and services, and local schools and other educational establishments.

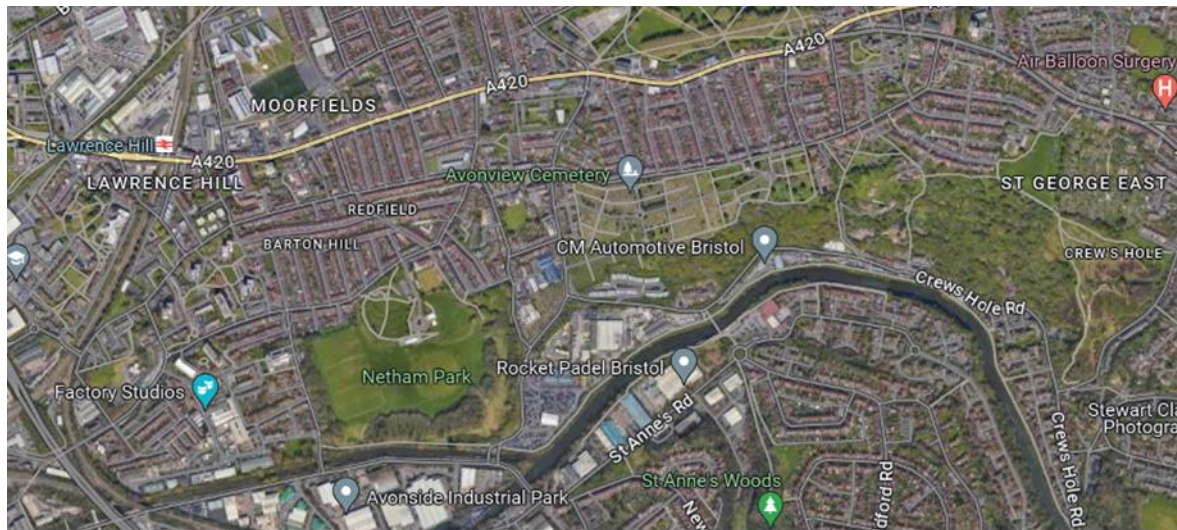


Figure 4: East Bristol Liveable Neighbourhood Area

The stakeholders will engage in the development and co-creation of the following initial use cases:

- Analyse and visualise the impact of road closures on mobility patterns: use historical mobility and road closure data and analyse mobility patterns before and after road closures. It will also compare traffic flow, travel times, and congestion levels before and after road closures and identify any significant changes in mobility patterns and potential causes.
- Air quality/ Environment monitoring: Monitor and visualise the neighbourhood's air quality at different times.
- Monitor the environment and identify safety/threat levels
- Mobility Pattern Analysis to determine accessibility to shops, schools, services, and other local amenities: Use techniques such as GPS tracking to determine routes that citizens take to local amenities and identify improvements. Categorise routes by mode of transport and analyse alternative travel modes.

With the implementation of the GOs, the pilot expects to increase trust in the scheme and insights on the effects of interventions (e.g., removing cut-through routes for non-local vehicle traffic) on local people's everyday lives by partnering with local communities and empowering people from marginalised groups, such as children and families in East Bristol, to participate meaningfully in the co-creation of EBLN. The GO is also an opportunity to gain an understanding of success conditions and feed the learning into the city-wide scheme of Liveable Neighbourhoods to inform future plans, policies and strategies in the context of LN by preparing, testing, and evaluating the community-led performance of mitigation policies through EBLN. Enabling the co-creation of liveable neighbourhoods together with the local citizens and community anchor organisations is expected to make urban planning interventions more responsive and lead towards manifested long-term citizen participation as an integral part of municipal governance.

### Preparing activities

The pilot developed an engagement plan document early in the process, where engagement objectives, stages, target groups and risks to mitigate were identified while drafting the first and second GO's. Bristol's GREENGAGE engagement strategy is linked with the EBLN timeline. Effective engagement in Citizens Observatories was defined as providing a platform for the community to help shape their local area, whether they are connected by geographic location, special interest, or affiliation, to identify and address issues affecting their well-being. The plan is defined as a call to action to i) Influence decision-making and policy ii) influence the design of the permanent scheme of the EBLN.

It also identified as target groups for the First GO: a) Residents most affected or concerned by the EBLN scheme, b) Historically underrepresented or marginalised groups such as families, young people, or diverse ethnic minorities, c) Members of community anchor organisations. A full-scale representative sample of local residents was decided as part of the Second GO.

The Engagement Plan consisted of 5 stages:

- Stage 1, Understanding Citizens Observatories: involves agreeing on groups to focus on during preliminary informative events, informing potential participants of the GREENGAGE COs offer, and outreach to schools and youth groups to discuss the CO process and explain its potential. It also implied identifying who is interested in participating in the COs, potential barriers to participation in the COs, and opportunities to be addressed.
- Stage 2, Early development of GO: involves engaging with more people to Identify potential locations and scheduled events for Cos, fully briefing those involved, signing off on ethical approval for young people's participation, and determining in more detail the hard objectives, potential opportunities, and concerns that surround their neighbourhood.
- Stage 3, GREENGAGE Observatory 1: involves working directly with groups to determine a process of co-produced research, via workshops, drop-ins, and a soft introduction to some of the technology that will be used as part of the GOs.
- Stage 4, GREENGAGE Observatory 2: covers the preparation and implementation of the second GO, ensuring that the findings are properly heeded. It will focus on those who have already participated in the first CO, plus a full-scale representative sample of local residents and members of wider community groups.
- Stage 5, GO Evaluation: assesses the GO after their implementation in the context of the EBLN.

The engagement plan was also helpful in defining several key messages: a) BCC is committed to ensuring all community members can have their voices heard and impact policy and the EBLN permanent scheme. b) BCC wants to review the previously completed perception surveys to confirm whether challenges remain relevant. c) Young people are often excluded from decision-making but are most impacted by poor air quality, road collisions, and other negative impacts. d) BCC wants to empower communities to use technology.

A key message for engaging with schools was the BCC's willingness to assist schools in furthering their Modeshift Stars accreditation by aligning the GO objectives to reach the targeted initiatives. The Modeshift Stars accreditation encourages schools nationwide to join in a major effort to increase sustainable and active travel levels to improve the health and well-being of children and young people. It does so by achieving specific targets with the help of GO activities.

Possible rewards and incentivisation schemes for travel support were identified from the institutional offer of BCC to promote the engagement of individuals, communities, and business.

## Designing activities

The pilot considered analysing the threat levels of various neighbourhoods and visualising them for further analysis and input to policy-making. Initial categories to identify the threats could come from a) cars or traffic (e.g. road crossing, vehicle speed, inconsiderate parking, driving or biking behaviour); b) environmental pollution c) public realm concerns (e.g. littering, poor lighting, accessibility, bike theft and other anti-social behaviour).

The pilot developed two thematic co-exploration. The first one addressed the air quality monitoring use case and is in a draft state. This thematic co-exploration is based on the consideration that NO2 concentrations are the most relevant data for the EBLN context. The city has already deployed diffusion tubes on major streets of the EBLN, collecting monthly data that feeds an Air Quality dashboard. The BCC is aware of a correlation between NO2 and traffic counts (the air quality changes with the traffic volume) and depending on the season (it is higher in autumn and winter). This thematic co-exploration faces the challenge of identifying mobile, accessible, and economical technological solutions to capture NO2 able to augment the BCC already existing data. This issue is still addressed with the partners of the consortium and thus seeks to be developed during the second iteration.

The pilot decided to focus on a second thematic co-exploration gear towards the safety in traffic and public realm concerns. This thematic co-exploration aims to empower local people to help shape EBLN

and improve local streets, making them safer, healthier, and more attractive places for the community. The co-exploration will help underrepresented groups feel a stronger sense of inclusion in the decision-making process for EBLN and the wider sustainable transport policy, articulating the goals to reengage with the programme in the pilot area. The Pilot focused on children and young people who are historically underrepresented in engagement and consultation for transport schemes.

The Bristol City Council Active Travel Engagement Team promotes thematic co-exploration, but the GO aims to involve teachers, parents, and youth group leaders as local experts on the theme under study. Schools in and around EBLN, young people, and traditionally underrepresented groups in decision-making were defined as the primary beneficiaries of the thematic co-exploration. They were meant to collaborate in various data capturing, analysis and interpretation activities and will contribute to the design and feedback process of the EBLN.

Typically, schools are subject to traffic build-up, an unintended source of transport emissions. Also, children and young adults often feel unsafe walking, cycling, or taking public transport due to road safety concerns or more general safety concerns in the surrounding area. Not less importantly, air pollution and sedentary lifestyles directly result from car-based transport, contributing to deteriorating health standards for young people in Britain and presenting threats to general lifestyles.

The thematic co-exploration aims to provide a meaningful space for children and young people to input into decision-making and policymaking. The exploration expects to feed what they consider 'valuable' into hard policy to promote more desirable and functional street transport choices for young people. This will be done through their own observations and 'research', giving them a platform and basis for their ideas. If our anticipations are correct, the Citizens Observatory will build ideas and solutions to the above problems, observing and commenting on their experiences and providing ideas for overcoming them.

The thematic co-exploration intends to:

- Analyse traffic counts on streets close to schools
- Analyse threat levels and related factors
- Analyse the actual and perceived safety of spaces due to the prominence of vehicles and their activity
- Analyse the actual and perceived safety of pedestrian footpaths, road crossings, bicycle lanes, parking, road hazards including potholes, etc
- Analyse behaviour of population distribution/mobility patterns before/during/after school hours
- Analyse the safety of streets for walking, cycling, and using e-scooters
- Identify environmental barriers in local stress (for redesigning purposes)

The participants are predominantly young people from primary schools, secondary schools, and youth groups in the East Bristol Liveable Neighbourhood. The first iteration activities involved the Redfield Educate Together school (primary school), The City Academy, and Bristol Somali Youth Voice. However, most of the activities ultimately focused on the Redfield with Year 5 students (age groups 9-10) and the Bristol Somali Youth Voice (ages between 11 and 19). Sessions with City Academy Secondary School, mainly for students in year 7 to year 9 (age 12-15), couldn't go ahead due to the teachers' strike.

Bristol Somali Youth Voice (BSYV) is a grassroots community organisation that advocates for and empowers disadvantaged people and families in Bristol and nearby areas. As a BAME-led group (Black, Asian, and Minority Ethnic), it strives to inspire and enable young people to lead active, healthy, productive, and law-abiding lives, particularly in the city's most deprived areas.

The co-exploration aims to use a low-tech approach while carefully introducing GREEN engines to some of them according to their age. The plan involves using travel diaries to set the scene for participants to reflect on their main priorities and current concerns surrounding their journeys and how these can be improved. Also, stick post-it notes on sections of an EBLN map to identify comments relevant to the local environment, safety, and threat levels. Participants can assess what could be causing barriers to their 'active' travel journey and how to address these. The information captured by these means should help set up the missions, points of interest and surveys in the GREENGAGE and MindView apps.



The co-exploration also contemplates testing GREENGAGE technological possibilities, such as automatic detention, to deepen the monitoring of the local environment through MindView, the GREENGAGE app. In this sense, objective and subjective data validation is intended as a feature relevant to the political acceptance of co-exploration results. For this purpose, it is planned to measure people's perceptions (e.g., gathering people's opinions through qualitative surveys) and consider objective parameters, as in the case of the [Healthy Street Index](#). This data is expected to complement existing data sets that might be focused on main streets and become part of the wide EBLN project.

The results of the thematic co-exploration are expected to impact all local residents in the East Bristol Liveable Neighbourhood – as they can influence how we design the scheme and, thus, how people travel in the area. The policies for which the results of this exploration could be of help are primarily the liveable neighbourhood policy and the active travel policy. However, other policies such as traffic infrastructure, road safety, schools, regeneration, community development, environmental and health and well-being policies can potentially benefit from the data collectively retrieved by the thematic co-exploration. Some possible impacts of the expected political incidence include improved active travel experiences, safer journeys, healthier lifestyles, less air pollution, and more equitable use of street space.

The implementation of the thematic co-exploration involves the following steps:

1. Finalise specification
2. Recruitment and on-boarding of CO members
3. Session design planning, identifying themes/engaging
4. Setting up CO groups
5. Setting scope and research question/s
6. Citizen and stakeholder comms
7. CO meetings
8. Launch of initial research findings
9. Full write-up and report
10. Evaluation

In the next pages the designing, experimenting, and sharing activities are described in detail.

### Greengage Observatory with Bristol Somali Youth Voice (BSYV)

A vital purpose of the first iteration was to test possible approaches and inform a larger-scale second iteration. The primary goal of the GO is to empower local residents to actively contribute to the development of East Bristol Liveable Neighbourhood (EBLN). This involvement will make streets safer, healthier, and more appealing for the community. Furthermore, it will serve as a platform to ensure the inclusion of underrepresented groups in the decision-making process for EBLN and broader sustainable transport policy.

The GO count on the local leader of the Bristol Somali Youth Voice (BSYV) as a key stakeholder and with whom keeps weekly sessions as a discourse-based process, where participants can regularly give their opinions and tell their stories. The activity involved meetings/workshops with a focus on exploring the feelings and experiences of the young ethnic minority community in East Bristol. This approach was designed to identify and gain a deeper understanding of safety and environmental concerns in East Bristol. The ultimate goal was to use these insights to guide the changes that should be implemented as part of the East Bristol Liveable Neighbourhood.

The pilot expects to achieve this by creating a meaningful space for children and young people to input into decision-making and policymaking. This would be done through their own observations and 'research', giving them a platform and basis for their ideas. The Citizens Observatory should build ideas and solutions to the above problems, observing and commenting on their experiences and providing theoretical ideas on overcoming them.

The pilot reached 20 youth groups to introduce the project and invite them to take part. This network was sourced from the monthly 'Big Up Barton Hill' Network that operates in East Bristol. The network has close links to local youth groups and community organisations. From here, we were able to spread the word about GREENGAGE—the objectives of the project and how people could get involved. The pilot ultimately funded the youth group (Bristol Somali Youth Voice) to do all community outreach and

encourage them to participate. The group used its network of existing members and community contacts to onboard participants. The participants were a majority ethnic minority and were below 18 years old (the target audience). The numbers varied throughout each session, but a core group of about 14 came to every session.

Beginning with an initial meeting to identify key points of interest and themes from the view of Bristol Somali Youth Voice, the GO focused on some fixed topics. These included:

- Low air quality
- Anti-social behaviour
- Concerns over road safety
- Poor bus services
- Insufficient cycle storage for high-rise flats
- Maintenance of built infrastructure
- Lack of working CCTV to prevent crime
- Insufficient street lighting
- Lack of pavement space/quality
- Lack of safe green spaces

These themes then helped to build the following weekly sessions. The goal was to continuously narrow down categories according to what matters to participants the most to identify the most crucial themes and use cases and make them more relevant to participants. Each theme was used to formulate discussions and eventually on-street observations from the citizen observers. The GO listened to young people's direct experiences of the above problems, validating the above topics. The principal messages to the audience consisted of what the East Bristol Liveable Neighbourhood (EBLN) pilot trial scheme would be doing to address some of these concerns. Issues such as the lack of green spaces, lack of pavement space/quality, insufficient street lighting, concerns over road safety, low air quality, and, to some extent, the lack of cycle storage would be directly improved as a result of EBLN. Nonetheless, any issues raised outside the immediate scope of the EBLN project were considered to inform the final, permanent scheme. As part of the sessions, the purpose of GREENGAGE was explained in the context of building on their lived experiences and local knowledge to improve the EBLN project.

In total, six sessions were held between May and July 2024. During the first session, participants brainstormed and filled out a Bristol City Council's adapted perception survey on survey. The survey was initially used as part of the initial co-design phase of the EBLN Project. It was adapted to encompass the local community's needs and convey how the pilot approaches the GO. Participants evidenced areas that they were either concerned about in general or had previous experience of negative things happening there, such as antisocial behaviour, road traffic accidents, difficulty travelling, or general discomfort due to various factors. This helped us to ascertain our priority locations for this CO's POIs. This exercise was deepened in a second session with a mind-mapping exercise in which street safety was co-defined from the youngster's perspective, the baseline of the collaborative research. This dynamic shaped the GO street observations exercise, in which the group went out to the local area and manually collected the data from apps like the GREENGAGE app and MindView.

The previous work came together in the third session, which had the goal of setting up and planning the points of interest for data collection. In this session, training on citizen science concepts was introduced in the context of the project to confirm POIs, mission areas/routes, and what physical objects could be detected by the GREENGAGE app. As a result, the following areas were co-identified as POIs from the experience and making use of the local knowledge of the participants (see figure 5):

- Barton Hill Urban Park
- Gaunts Ham Park
- Netham Park
- Beam Street
- Marsh Lane
- Ducie Road Car Park

- Barrow Road roundabout
- Barton Hill Academy

Additionally, some of the categories related to the perception of safe points and transport were: “Street is easy to cross”, “Easy and convenient to walk, cycle and use public transport”, “Bike storage is available, secure and well maintained”, “Car parking is safe”, “Area has good bus service and good bus stops”, and Pavements wide enough to walk”. Other categories arising with a perception of physical safety were: “CCTV cameras are clearly displayed”, “Area appears to be well lit”, “The environment feels safe and relaxed enough to spend time in”, “Air quality is good”, “Area is free of the litter”, “Buildings seem well maintained and tidy”.

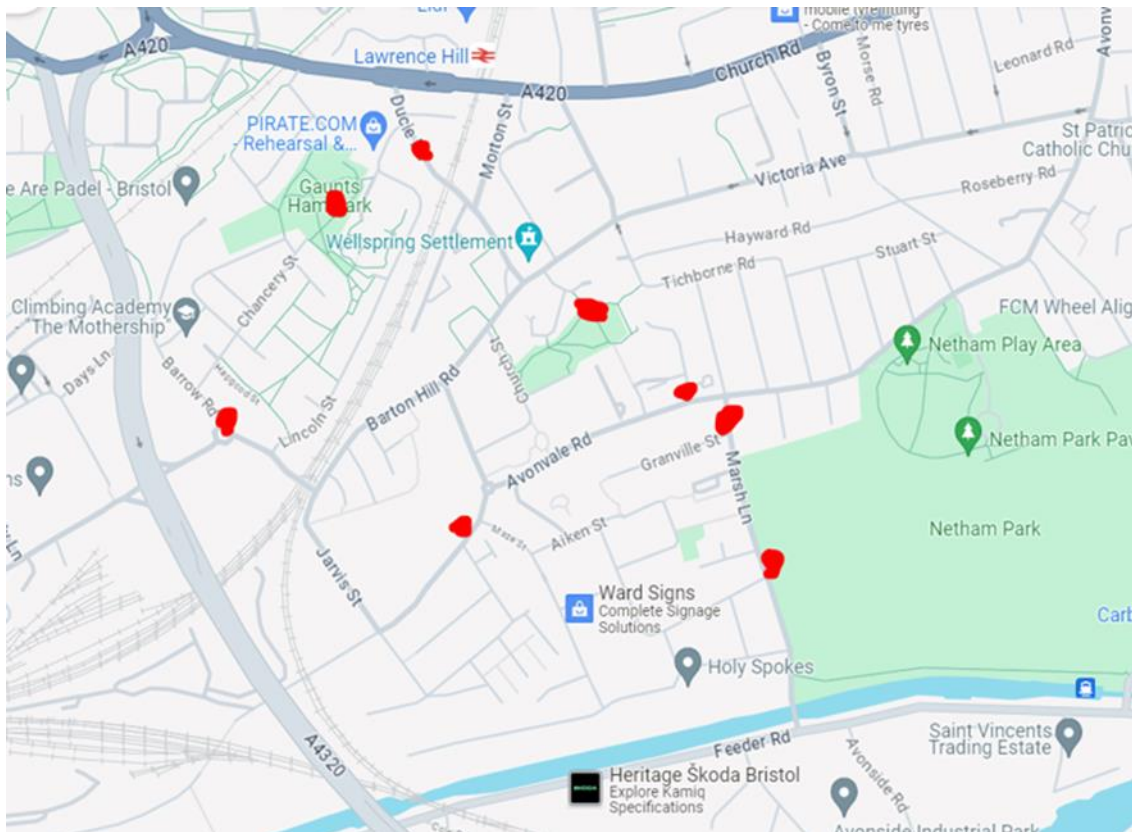


Figure 5: Overview of the POI's identified within East Bristol.

As part of the sessions, the Pilot Owners, the PST members, and the BSYV coordinators met to co-develop the tech by testing the preliminary version of the GREENAGE app and reflecting on its usability. The group walked around the area to initially confirm issues in the POIs, such as litter, illegal parking, poor lighting, and various other variables that could affect active travel. The test allowed the project to identify concerns and shortfalls to improve the application's usability before being introduced and used to the participants. Nonetheless, the GO co-identifies topics and POIs, co-creates questionnaires/surveys, and co-designs missions for the MindView app and what objects should be detected automatically or what analysis should be performed.

In the following session, participants informed the data collection campaigns on such a preliminary data capture structure while continuing with qualitative approaches as the primary data collection methods, replicating the data collection with direct observation instead of apps. The in-depth approach allowed participants to add comments on top of their initial scoring, effectively use their voices to find out what matters most to them in the local area and begin structuring ideas for solutions fed directly into the EBLN project team and decision pathway.

During the last session, the GO, with representation from the entire core team, the EBLN project manager, and local ward councillors, shared and discussed the conclusions and recommendations that had emerged from the exercise. After discussing these key themes, local councillors, the EBLN project manager, and the wider project team could all take these conclusions to feed directly into local decision-

making and policy choices. This has helped shape additional elements of the EBLN trial and informed the next steps of the GO in the face of the permanent EBLN scheme. The main conclusions were:

- Anti-social behaviour and local crime seemed to rank the highest among the reasons participants did not want to walk or cycle around the area as a primary mode of transport. Suggestions included better lighting and CCTV functionality.
- Road maintenance was identified as another barrier to active travel in conjunction with road safety. Suggestions included reducing speeding traffic, introducing improved crossings, building segregated cycle lanes, and banning parking on the pavement. Bus reliability was a major concern for young people who expressed a lack of confidence in the service of the bus system. The EBLN trial should seek mechanisms to improve bus service due to the lower traffic levels.
- Improving the maintenance of the local area. Suggestions included better maintenance of local parks, better waste provision, funding more art in the local area, and regenerating neglected buildings.

The final session was particularly relevant because it identified key priorities within the project's parameters, resulting in actionable recommendations for decision-makers. The involvement of local councillors in the final wrap-up session was a highlight, as it provided participants—particularly young people from Barton Hill and the Somali community—with direct access to those who could implement change. This process of co-design, combined with active listening and understanding of community needs, left participants feeling valued and motivated, as evidenced by their eagerness to engage in the second iteration of the GREENGAGE Observatory.

### Citizen Observatory sessions with Redfield Educate Together

This GO group's main focus was on understanding issues of safety in the local area, including road safety, social safety, and environmental safety. The purpose and delivery of the observatory were the same as those carried out with the Bristol Somali Youth Voice. However, due to the participants' age, it was led in a more guided manner, and from the outset, GREENGAGE technology was not used but used qualitative methods predominantly.

Initially, the Pilot contacted every school in East Bristol via its email database and worked specifically with Bristol City Council's School team to engage with schools, having various initial descriptive meetings with teachers to explain the basis of the project. Ultimately, only Redfield Educate Together Primary School could commit to the necessary time for this work. Redfield Educate Together School was regularly in contact with Bristol City Council due to its involvement in the council's "mode shift stars" initiative, which rewards and incentivises schools to reduce their carbon footprint. All of the other schools were too time constrained. In the case of another initially committed school (City Academy Bristol), strikes made the development of the activities impossible.

This process involved students from the year 5 group, around 35 pupils, participating in the bi-weekly sessions. Four (4) one-hour slots were carried out bi-weekly from 23 April until 24 June. The profile of attendees was very varied, including people from various social, cultural, religious, and ethnic backgrounds. The participants were all 9-10 years old.

The activity involved an initial presentation (assembly) where we described the context and purpose of GREENGAGE and how Citizen Science works. This was followed by mind-mapping, street observations, and discussions of lived experiences. The mind-mapping exercises gauged experiences and opinions well, and we were able to draw some solid conclusions about safety and their local environment.

Session 1 developed an introductory assembly for the whole 'upper school' – year groups 4, 5 and 6. The pilot owner delivered it with assistance from a Bristol City Council School's team representative who had already engaged with the school and was familiar with the teachers and children. The assembly presentation began by asking the schoolchildren how they got to school. Most had not driven (a positive start). The activity also involved reflecting on transport means by asking students to guess how many cars drive past their school each day. Very few guessed a high enough number – the actual number (3700 on average), which surprised them. The activity was accompanied by a short, animated video describing citizen science in a very simplified way so that the children could understand what we were about to do. Using images of streets with poor cycling/walking infrastructure versus futuristic, colourful street spaces with good cycling/walking infrastructure, children were asked to interpret the pictures and



answer questions such as: What does a daily journey look like for you? How does your street feel? Many believed that there were too many cars on the roads and wanted more space and freedom to walk, cycle, and play safely. At the end of the presentation, we showed them the EBLN map and explained the project's concept.

In session two, the GO focused only on year five students, the level with more proficiency in managing figures. Starting with an initial brain-storming session to gauge themes and ideas from participants, a large copy of the EBLN map was used to locate where each pupil lived, where their favourite and least favourite points were on the map, and the related sentiment. Many noted the local parks as their favourite locations. This point was retaken during the next session with a mind map for each of the above concerns to explain exactly what led them to have these thoughts and experiences. Comments included:

- **Dangerous to cross the street.** There is too much traffic, traffic going too fast, insufficient designated crossings, and unconfident crossing of specific roads.
- **Parks and streets feel dangerous after dark.** Anti-social behaviour, drunk people, stories of knife crime, gangs, strangers.
- **The area can feel boring.** It is not colourful enough, needs more play areas, and needs to be made more fun.
- **Pavements in bad condition make it hard to cycle.** It can be dangerous to cycle because it's too bumpy, and there are stories of crashes due to uneven surfaces/holes.
- **Bad air quality.** Too much traffic, traffic building up and not moving, people leaving their engines on idle, lack of green spaces.

Children did not always identify the exact location of the POIs, though the Pilot used their earlier brainstorming comments to roughly gauge the most important POIs and sentiment-measuring metrics, using a mix of our local knowledge and their experiences.

In the last session, pupils were invited to a street observation session similar to the one undertaken with BSYV. The exercise was particularly helpful in gauging people's feelings about the local area and identifying the critical infrastructure, maintenance, and planning shortcomings that EBLN should address. The chosen locations were Pile Marsh, Grindell Road, Netham Park, Avonvale Road, and Roseberry Road. Each location was rated out of 10 (in terms of 10 being complete agreement), of the following metrics, developed as a result of the comments made in the previous session:

- There are lots of people around
- People in the area seem friendly
- Street is easy to cross
- CCTV cameras are clearly displayed
- Easy and convenient to walk, cycle and use public transport
- Bike storage is available, secure and well maintained
- The area is well lit
- The environment feels safe and relaxed enough to spend time in
- Air quality is good
- Car parking is safe
- Area is free of litter
- The area has a good bus service and good bus stops
- Buildings seem well-maintained and tidy

After visiting each POI, with logistical assistance from school staff, the Pilot could input the sentiment/observation [data](#) alongside BSYV data for overall analysis. It was challenging to manage the excitement of the 9-10-year-olds leaving school on a school day and ensure they were focussing on the task, and each student finalized the task with a different level of compliance. However, it was clear that pupils wanted to see changes in levels of anti-social behaviour, maintenance of green spaces and improved road safety. The mind-mapping exercise saw regular calls to improve road safety, reduce crime and make the local area look nicer. However, there were very few outright suggestions of practical solutions for this from the group of pupils. The activity allowed me to explain to the pupils about EBLN and describe how the trial measures can directly improve the situations of concern raised in the GO. Therefore, pupils learned particularly about what EBLN is, how it will affect their daily lives and how they

can use the changes to cycle, walk, scoot or take the bus more. The exercise, nonetheless, allowed the Pilot to gain a deeper understanding of where problems were occurring and how certain safety issues might discourage children and youngsters from travelling to school by foot, bicycle, bus, or other low-carbon, active modes.

### Final remarks and lessons learned

Through implementing activities, participants gained a clearer understanding of how the EBLN efforts could contribute to improving their local areas. However, it became evident that the greatest insights were gleaned by the Pilot Owners and council officers, who learned valuable lessons from the community on how to tailor and refine the proposed measures to suit the specific needs of the residents better. This underscores the importance of community input in shaping local interventions.

As researchers, while we may approach these projects with rigorous methodologies and structured research questions, it is crucial to remain mindful of the depth and value of local knowledge. The lived experiences of the people in these communities should inform and shape the research. Therefore, our questions and approaches should be adaptable, ensuring they align with the priorities and realities of those who live and work in the area.

While technology offers powerful tools for data collection and engagement, it is important not to overlook the value of qualitative data, particularly in this context. Qualitative insights provide a rich understanding of the community's lived experiences and are crucial to interpreting the broader implications of the trial.

Many young people may not have access to mobile phones; if they do, their devices may not be compatible with the required technology. As part of future planning, it is essential to explore whether the provision of mobile phones or other tools might be necessary to ensure equitable participation in data collection.

Working with young people, particularly those aged 9-10, was a positive and challenging experience. While their ambitious ideas added enthusiasm and creativity to the project this age group struggled to engage deeply with policy ideas or approach the project as older participants might have brought. The project originally aimed to engage with students from City Academy Bristol, a local secondary school. However, teacher strikes led to the cancellation of this plan, leaving the project with a narrower and younger age group than initially intended. This experience underscores the importance of flexibility in project planning and the need to adapt when unforeseen circumstances arise.

One key lesson from this trial is the need to strike a balance between Bristol City Council's objectives, those of citizens' observers, and those of local stakeholders such as BSYV. If the concerns and needs of the local population are not adequately considered, future engagement and participation from these communities may wane.

## 6.2 Copenhagen

### General description

Amager Vest is a district in Copenhagen located to the southwest of the city centre on the island of Amager, along the nature reserve of the 'Common'. It is a mixed area that expands over historic working-class neighbourhoods, social housing, and areas with larger one-family houses. Within the last 20 years, the district has expanded significantly with the addition of Ørestad and Nokken, two new brownfield developments. Apart from adding approximately 25.000 new residents, new expansions of the university and a business district add another 25.000 university students plus 25.000 professionals to the district.

Expansions of this magnitude bring stress to the existing infrastructures, most visible within mobility. Although a new metro line and regional train stations connect the area to public transport, the old roads maintain historical dimensions where congestion is inevitable. To add to this, Amager is located as a bridge between the national road network and new large developments in Copenhagen; one is the construction of a new island, Lynetteholm, from a landfill into the ocean as an expansion of the City. To residents, this is a cause of concern as these infrastructure projects add approx. 300 large lorries per day adding to the congestion and the insecurity for the residents.

Partly from a popular claim coordinated by the Amager Vest Local Council, the City of Copenhagen has agreed as part of Budget 2024 to initiate a new paradigm of 'Local Traffic Plans' and include the public in developing these. GREENGAGE project aims to support the Amager Vest Local Council in engaging citizens in this effort and promoting data collection that can support the development of new solutions to the traffic jams imposed on the area.

As defined by the City of Copenhagen, the new local traffic plan aims to reduce CO<sub>2</sub> emissions by increasing infrastructure for active travel modes, improving road safety, reducing excessive speed, and limiting heavy truck traffic in residential areas. However, the new paradigm does not include local knowledge and inclusion of citizens in the decision of which criteria that matters at local level. This is the motivation of the pilot.

The pilot owner is Miljøpunkt Amager, a local citizen-centric NGO operationally responsible for engagement. The local Council of Amager West intends to involve all people living, studying, and working in the district. The goal is to engage them in collecting traffic data, stories, and lived experiences on the consequences of a car-centric economy to address climate and behaviour change towards responsible consumption and cross-sector benefits such as health and social cohesion.

The overall vision for the GREENGAGE Observatory in Copenhagen is to align urban planning with climate change goals while improving conditions for urban living. This includes transforming the local neighbourhoods into places where people enjoy living and working, spending time, and interacting with others. It seeks to:

- Test and investigate whether citizen science and crowdsourced data collection can be designed to form a data set that all stakeholders acknowledge and use.
- To test if data collection positively helps to engage citizens in local democratic dialogues in the pursuit of new solutions to creating a climate-positive neighbourhood.
- Illuminate the lived experience and neighbourhood conditions as a baseline for generating citizens' ideas about where to improve the urban layout with collected data.
- Use new digital solutions to democratise data collection and analysis to support citizens' understanding of mobility, including local, hyperlocal, and commuting, as well as wider perspectives of how integration into city planning processes can improve conditions.

The Copenhagen Observatory will rely on citizen science methods and investigate if new AI methodologies can assist in transforming data into insights, that will form inputs to live activities like civic gatherings and workgroups within the realm of the Local Council to allow for direct participation, achieve large-scale engagement and improved data validity that supports the formation of the local traffic plan, with special focus on the following use cases:

- Analyse citizens' usage of public spaces and determine the attractiveness of public spaces.
- Participatory environmental monitoring.
- Mobility Pattern Analysis to determine accessibility to shops, schools, services, and other local amenities.

### Preparing activities

The district's urban life, currently stressed due to heavy traffic congestion, has the potential for significant improvement. It has undergone important changes due to its location as a passing corridor to new large developments in Copenhagen's coastal area. The number of heavy trucks carrying construction materials and soil (approximately 300 per day) has impacted the safety and use of public spaces. With the implementation of the Citizen Observatory, these issues can be addressed. Schools will be able to resume their physical activities in local parks, and residents' complaints of noise and increased traffic will be heard. Validated data on such changes will augment existing data and inform the Local Traffic Plan to identify places actively used and enjoyed by local residents and commuters and those that might have been affected by the change in traffic dynamics.

The pilot seeks to create a truly citizen-led local traffic infrastructure plan for the district of Amager West in Copenhagen. The project will use citizen science methods and participatory data collection to produce data sets and recommendations validated by both professionals and the local public. This validated data will form the basis for professional planning and further democratic debate and engagement. The project will inform local planning by augmenting planning parameters with local knowledge to support quality in planning and the addition of climate-friendly activities that planners cannot add through formal instruments. This means empowering the local eye-level perspective and building a new model for committed citizen engagement in public planning processes.

Data collection will be an important part of this citizen-centric perspective and will support local democratic dialogue and decision process. It will be carried out by residents, commuters, and other participants of the GREENGAGE Observatory in Copenhagen, and the initial results will provide locals with insightful information and tools to reflect on and comment on the local traffic infrastructure plan for the district of Amager West.

The pilot envisions achieving the observatory objectives by following strategic steps:

- Establish a baseline with the help of citizens to document existing living and environmental conditions in a manner where data are trustworthy and verifiable.
- Enable a shared dialogue - a feedback loop to the neighbourhood on data and findings recognised by main stakeholders. From this 'shared dialogue,' key actions to follow and monitor are determined.
- Plan the implementation - work to secure financing and political mandate for delivering long-term outcomes.

The pilot's use cases will build on previous and existing initiatives in the neighbourhood. The efforts have followed a two-pronged approach. The first is trying to reverse the physical structures that hinder quality of life. This may include ambitious attempts to cover the motorway to combat noise and air pollution and smaller-scale initiatives to seek out spaces for greening the urban environment. The second approach involves transforming the area into a resilient, people centred. A few initiatives have tried to identify citizens' needs without solid take-up from decision-makers.

The CO will engage different societal segments representing the current population and professionals in the neighbourhood. Once part of it, the GREENGAGE Observers (GObs) will collect data, which will then be shared with the community. Data collection will be centred around how the current design of the neighbourhood influences its use and will be augmented with open data from various publicly available sources. The intention is to start a conversation through data that will spur more people to engage in data collection and instigate cross-sector dialogues towards new solutions. The thematic co-exploration will inform the Local Traffic Plan from the City of Copenhagen. As such, it also will impact the Copenhagen Climate Plan 2035 and its focus on reducing consumption-based emissions. The pilots expect to benefit residents, students, and workers of Amager West by improving mobility, air quality and health conditions and fostering a collaborative environment where citizens, planning officers, and other

stakeholders can come together to strengthen the use of public spaces and augment the local planning parameters with their local knowledge.

The main stakeholders are the municipality of Copenhagen, the Local Council of Amager, National Laboratory of Workplace Environment and the University of Copenhagen.

The Copenhagen pilot foresees the following milestones in its implementation:

- Mobilisation (onboarding): Local citizens are invited per city e-mail (65.000) or local panel (4.000) to participate through digital planning tools and to join a citizen task force. Commuters are invited through the business network.
- Task force (Core Team): Approximately 100 residents from diverse backgrounds are selected to join the citizen task force through a stratified selection process. Similarly, 100 commuters are engaged in collecting travel data.
- Data collection (Experimenting): Residents are divided into two groups: One is responsible for setting up sensors, and another is responsible for interviewing fellow residents on local mobility issues.
- Local debate (Sharing): The district of Amager West organises civic meetings to discuss the data collection findings and get input. The task force will present data and findings through digital representations and maps (visualisation).
- Prioritisation (Sharing): Based on broader local inputs from civic meetings, the task force members design local criteria for using and designing mobility infrastructure. The project group develops co-analyses of planning parameters and local data.
- Political delivery (Sharing): The local “Traffic Plan” is expected to be delivered to the politicians of Copenhagen City Hall, along with a visual geo-based data interface for exploration.

Based on this particular activity planned, the Pilot has decided that most of the exploring stage activities were devoted to the preparation phase to a) gain the trust of participants, b) reinforce the relation with stakeholders, c) identify possibilities to augment data retrieved by stakeholders d) test technologies before large data capture.

Some of the risks that may face the pilot are:

- Inadequacies between Municipal and co-exploration times (loss of contributing opportunities).
- Lack of diversity of participants (usual participants).
- Data quality and validity are insufficient to gather different actors and inform the Local Traffic Plan.
- Distrust to European-funded projects in local actors.

The pilot developed thematic co-explorations over selected use cases as follows:

Analysing citizens' usage of public spaces and determining the attractiveness of public spaces in public policy processes, there are dynamics where some groups are more successful in passing arguments and influencing the outcome. As a result, elected politicians are known to hesitate to listen to citizens too strongly, as they are afraid to follow partisan interests and be subject to criticism from other groups and stakeholders.

To counter this hesitation, the project pilot in Copenhagen aims to establish a data foundation that strives to be as unbiased as possible, ensuring stakeholders and decision-makers of the quality of the collected data and analytical results.

Urban space data collection is meant to be a foundation data layer upon which analyses can be directed by augmenting the usage of urban spaces in the district to other data sets such as traffic volumes, morphological data, open GIS data, air pollution, etc.

The objective of the thematic co-exploration is to analyse the usage profile of public spaces by identifying usage patterns with respect to time, activities, and population segment, among other things. Using different data sources, including image capturing and AI-assisted registration, the objective is to capture

the dynamics of different types of urban space, usage of specific places, etc., and in this way, to register in a way that can complement surveys and other citizens' evaluations.

The thematic co-exploration seeks to identify use patterns of local urban spaces, if and how urban features (like trees, building morphology etc.) together with traffic volumes determines use patterns, how the urban fabric is used during different seasons and weather conditions in order to provide an input to which areas and types of areas that could be protected from traffic, and which street types can accommodate larger traffic volumes.

Miljøpunkt Amager promotes the thematic co-exploration in partnership with the Local Council of Amager and the Municipality of Copenhagen. The participants will be residents and commuters of Amager West. Initially, the thematic co-exploration identifies two main tasks: a) data-capturing activities and b) interviewing residents.

The GO has planned the following data-capturing and analysis steps:

*Analyse data from stakeholders:* Together with the Local Council of Amager Vest MPA, a survey has been launched investigating how citizens perceive their local environment according to a set of parameters. These parameters include street safety and heavy traffic, noise, perceived air quality, and parking availability, among other urban life variables. Based on a preliminary analysis of the Survey, the GO plans to capture and analyse citizens' self-reports to deepen our understanding of urban features related to the use patterns.

*Augment urban space data with citizens' evaluation:* The pilot is testing MindEarth image analysis technology for this purpose. It has analysed 20 km of 360-degree images captured by biking on Amager West. As part of the test, the pilot and MindEarth (GREENAGE partner) will test the capacity to identify use patterns of urban spaces based on:

- Number of people using public spaces at different times and days of the week.
- Identify morphological features and location of trees.
- Other potential features

The pilot is also testing new ways to democratise data capturing using AI. In particular, new large language models (LLMs) have opened up a verbose and non-specialised way of instructing data analysis without deep coding skills. On top of that, LLMs have shown a surprising capability to interpret pictures that allow for extracting new knowledge from images, e.g. registering if people are engaged in social talks if they are in solitary use of mobile devices. These capabilities are being tested to learn if more profound knowledge of using urban spaces can be obtained. As an environmental organisation, MPA is interested in finding resource-efficient ways to conduct these studies. At present, a cluster of raspberry pis is used. The raspberries will also be used in the data collection.

The thematic co-exploration aims to visualise the results by creating maps using MindEarth and Superset possibilities.

### Participatory traffic and environmental monitoring

The island of Amager is heavily influenced by traffic going in and out of Copenhagen. The area has seen rapid local development, with 20,000 new residents over the last 20 years and a new business district of 25,000 commuters. As Amager districts connect Copenhagen to the national road network, the island is also a connection for heavy trucks servicing other large developments in all of Copenhagen, like the current project of creating a new artificial island, Lynetteholm, outside the harbour of Copenhagen.

As a result, heavy-loaded trucks run through the district without complementary investments in the local road network. Instead, the national government seeks to expand the motorway connecting to Sweden and the European road network. Local community groups have advocated for a physical covering of the motorway going through the residential area of Ørestad to reduce exposure to air and noise pollution.

A clear understanding and monitoring of traffic volume and composition and the consequences of the new traffic dynamics on air and noise quality will help inform the Local Traffic Plan. The thematic co-exploration seeks to identify spots with high concentrations of air pollutants in high-traffic areas compared to residential ones. It will do it by:

- Register the level of traffic volumes in the area and the composition of modal splits, including vehicle types (trucks/cars/cyclists, pedestrians)



- Analyse the concentration of air pollutants in selected areas of Amager West.
- Analyse levels of noise pollution in selected areas of Amager West.

Miljøpunkt Amager promotes the thematic co-exploration in partnership with the Local Council of Amager and the Municipality of Copenhagen. The results will be analysed in conjunction with the University of Copenhagen. The participants will be residents and commuters of Amager West. Initially, the thematic co-exploration identifies two main tasks: a) calibrating sensors and b) taking measures with wearables sensors.

The data-capturing and analysis activities involved different combined activities:

*Cameras to count traffic volumes.* The traffic volume in Amager Vest is largely undocumented. The municipality has installed a few sensors along the main corridor of Ørestads Boulevard. However, due to three narrow roundabouts on this boulevard, the heavy trucks use other routes, especially during rush hour, where map services like Google Maps, Apple, or TomTom direct traffic towards the least congested routes. A consequence is that the locals report heavy traffic on narrow residential streets close to schools, institutions, and green areas. Data from digital devices cannot detect traffic composition but only the presence of a mobile device.

The purpose of the data capture is, therefore, to document traffic composition and volume using a combination of static cameras, mobile registrations in representative circuits, object detection, and LLM-based AI in combination with other data sources to obtain a district description of traffic volume and flows.

*Understanding particle pollution.* One of the challenges of thematic co-exploration is finding reliable and politically relevant data to inform local planning actors. Science has documented a strong and well-documented correlation between PM2.5 and health issues. The pilot will use a combination of stationary and mobile sensors to capture the pollution. A large proportion of PM2.5 arrives with the wind from areas outside Copenhagen, decreasing the opportunities for political incidence at the very local level. As a result, the pilot tested how to measure Ultrafine Particulates, which are mainly produced locally. However, UFP sensors are outside the pilot's budget. For this purpose, the pilot has succeeded in borrowing sensors from the National Laboratory of Workplace Environment and the University of Copenhagen to capture the locally produced pollution.

*Augment noise pollution.* The pilot has conducted a noise pollution test. The test involved 20+ interested citizens borrowing a sensor and installing it outside their houses for a week near the motorway. The test indicates a need for adding height as a parameter in the data collection as results show that citizens living on top floors are exposed to above-limit values in contrast to government noise maps, which are based on regulatory methodology stipulations of data capturing noise data at street level. As many of the buildings in Amager Vest are above six storages, this discrepancy is highly relevant to investigate, as the traditional building code in Denmark is five storeys.

The pilot is assessing the possibility of increasing accessibility to noise pollution. The American National Institute of Occupational Safety and Health has developed an app for measuring noise. The app uses iPhones, which internally have similar components and calibration and, therefore, can measure within a margin of 2 dBA. Whereas these measurements cannot replace specialised equipment, a large number of data can provide a pattern that can substantiate further investigation into the potential breach of limit values. As iPhones are highly distributed in Copenhagen, the potential to collect a large amount of data from citizens using similar equipment and the same app is an interesting contribution to environmental monitoring.

The thematic co-exploration aims to visualise the results with GREENGAGE (maps or dashboards) and analyse the data in relation to the other use cases for a comprehensive view of urban public life in the Amager West (for example, the presence of air pollutants, heavy traffic, hours of the day).

A key element of preparing the thematic co-exploration was the draft of an air quality protocol for capturing pollution data in connection with high-quality standards. Expert partners (DEUSTO and LIBELLIUM) designed the protocol as part of the Copenhagen PST activities.

The protocol outlines quality measurement strategies focusing on organizing campaigns or missions to collect pollution data using wearable sensors and mobile apps. These campaigns are divided into two main types: area investigations (Type I) and source investigations (Type II). Type I campaigns can either be short-term, lasting a few hours, to map pollution across a specific area, or longer-term, spanning days

to weeks, to analyse pollution trends over time. Citizens identify a particular area that needs to be investigated/captured to test a pre-defined hypothesis. It aims to cover the entire area by creating a map as soon as possible. It needs several measurements per sub-area in the given time and it would be advisable to have a similar number of measurements in each sub-area (see figure 6).

Type II campaigns focus on monitoring pollution sources like traffic hotspots or factories within a short time frame, using concentric circles to measure pollution dispersion (see figure 7). Participants identify a particular target that needs further investigation. Participants will have to cover the area around the source, expanding the measurement in concentric circles throughout the time to analyse then how pollution spreads (see figure 7). The protocol also emphasises the importance of sensor calibration and maintenance to ensure data accuracy (like comparing sensor data with reliable sources or collocating multiple sensors to check consistency).

The protocol is aimed at designing campaigns with the Atmotube Pro sensor, which uses laser scattering for particulate matter detection and MOx technology for volatile organic compounds (VOCs) and requires careful handling, particularly in terms of maintaining battery life, avoiding moisture, and ensuring the sensor is not obstructed during measurements. Environmental variables such as weather conditions and urban structures can also affect measurement accuracy, necessitating careful planning and repetition of measurements under varying conditions. The protocol includes guidelines on the proper usage, storage, and maintenance of the Atmotube Pro sensor to ensure its longevity and data reliability.

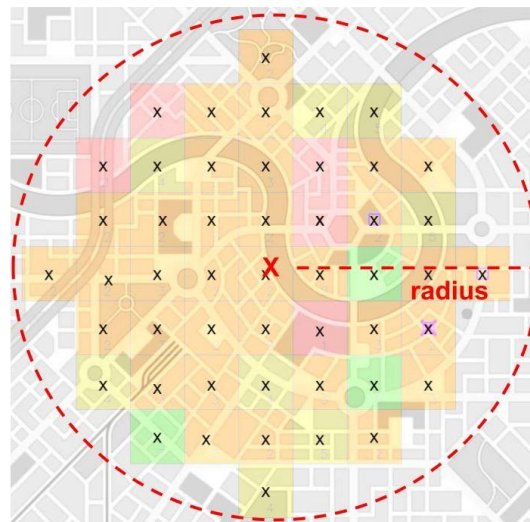


Figure 6: Example of blueprint for air quality campaign (type I).

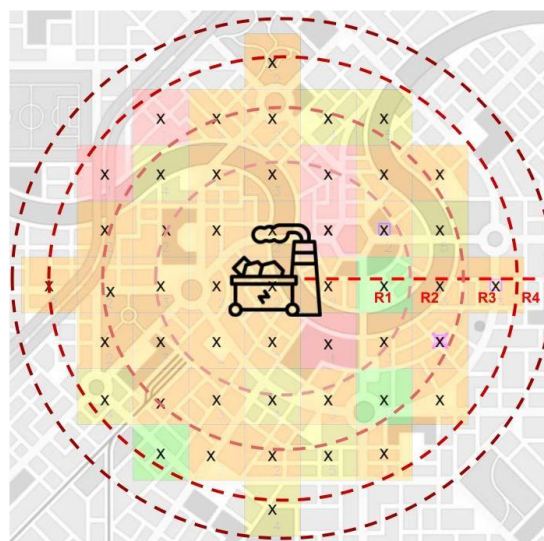


Figure 7: Example of blueprint for air quality campaign on an area (type II)



This thematic co-exploration seeks to understand citizens' mobility, including local and hyperlocal, about environmental variables. It aims to identify high-traffic streets and the number and type of vehicles across Amager West.

The thematic co-exploration departs from the hypothesis that the municipal segmentation of streets (primary, secondary, and tertiary) does not accurately reflect the traffic volume in the district or the number and type of vehicles. For this purpose, the pilot has focused on creating a data set of traffic volume in the district with GREENGAGE partners to identify a more reliable volume traffic segmentation of streets. The traffic volume data set was compared to the stakeholders' Perception Survey to compare citizens' perceptions and identify hot spots and areas of high interest.

This thematic co-exploration relies on MindEarth's capabilities to automatically analyse images captured by citizens. A critical step has been the draft with MindEarth's GREENGAGE partner of an automatic image capture protocol that aims to guarantee the highest quality possible in terms of representativity and control of variables involved.

The protocol describes systematic methodologies to ensure the accurate detection of urban elements. Features extracted from street imagery are categorised into time-invariant (e.g., buildings, trees, infrastructure) and time-variant (e.g., people, vehicles) types. Time-invariant features generally require a single collection effort, while time-variant features necessitate repeated data collection to capture temporal variations. Different collection mission types include standing campaigns for stationary observation, moving campaigns for broader area coverage, and punctual campaigns for specific object documentation. The protocol highlights how effective street-level image collection relies on clearly defined objectives, including identifying features of interest, geographic area specification, and selecting suitable collection times and locations. For time-variant features, imagery should be collected multiple times during the day, week, and month to capture dynamic changes. The protocol also explains the quality control checks needed to maintain high standards, with any unusual circumstances documented to ensure data accuracy during data capturing activities and in a post-collection phase through reprocessing, extraction and evaluation of effectivity of models such as F1 Score, Average Precision (AP) per class, and Mean Average Precision (mAP).

### Comprehensive pilot data capturing and analysis protocol

As part of the Pilot activities, the Copenhagen pilot effectively combined the different use cases to develop a tailored data capture and analysis approach that fit the pilots' objectives. The work towards a single protocol seeks to fill the gap that usually exists between the quality of data captured by citizens and the needs of authorities to enable policy changes.

Relying on stakeholders' surveys of perception of urban spaces, the data set of traffic volume, and the air and image capturing protocols, the Pilot designed a protocol in which air pollution data could be related to b) the number and type of vehicle, and c) type of roads segmented by traffic volume. In this manner, the different use cases build into each other to provide meaningful data with enough quality to foster and establish a trustworthy and verifiable baseline and, thus, capable of enabling a shared dialogue between citizens and between citizens and local authorities.

The key elements of the Copenhagen protocol are:

- Definition of the different types of streets based on traffic volume instead of merely primary, secondary, tertiary
- Definition of hot spots for air and traffic image data capture activities organised in circuits (with equal street distribution) of 1 to 1.5 km +/-.
- Identification of authoritative stationary air quality sensors in each circuit.
- Capturing pollution and traffic images simultaneously, at least three times per day and at least two seasons during the project time.

The protocol seeks to guarantee accuracy through the relation to authoritative sensors and robustness with the extrapolation or interpolation of satellite data (an ongoing process carried out with the expert pasterns in remote sensing and Copernicus). The protocols have been instrumental in feeding engagement communication and planning of resources (people and time) cantered in the capacity of citizens' data to inform local policy-making through specific collaborative tasks indisputably. The

development of the protocols provides an example of tailored material for pilot purposes, though generic protocols can be used for other pilots.

### Final remarks and lessons learned

The GO in Amager West, Copenhagen, presents a remarkable case of how citizen engagement and modern data collection techniques can address urban challenges, particularly regarding mobility and environmental health. Through integrating citizen science and crowdsourced data, the project illustrates the power of community participation in shaping public policy.

The Copenhagen GO is an original model for integrating community-driven data into urban planning. It highlights the importance of creating feedback loops that engage citizens meaningfully and utilising technology to bridge the gap between local knowledge and policy decisions.

Involving citizens directly in collecting traffic, environmental, and urban data enhances the data's relevance and strengthens democratic dialogue between citizens, planners, and policymakers. This fosters a sense of ownership and responsibility, increasing the likelihood of sustainable outcomes. Ensuring the validity and reliability of data is crucial to maintaining trust among stakeholders, including residents and decision-makers. Addressing these challenges requires a balanced approach that aligns citizen input with professional standards and public policy requirements and keeps the pace of municipal processes and citizen-led initiatives connected.

## 6.3 North Brabant

### General description

North Brabant, a province in the southern Netherlands, spans 5,081km<sup>2</sup> and houses around 2.5 million residents. Its rapid growth brings challenges, notably urbanisation, which creates a demand for 12,000 dwellings annually. To address this, the province envisions transitioning to sustainable traffic, aiming for a 20% increase in cycling by 2027 and 40% by 2040. This entails promoting biking and supporting infrastructure for everyday use, recreation, commuting, and multimodal traffic.

The Province of North Brabant, as a meso-scale level of government, sets up long-term visions and public transport plans and funds local initiatives. The Province pursues widespread citizen engagement, particularly focusing on car users, to empower them to overcome their deterrents and help them transition to cycling. Despite the presence of bicycle highways in the province, many short- and long-distance trips are made by car, specifically due to differences in accessibility per area. Biking policies, often shaped by white, older males, may not fully address broader societal needs, or reflect the demographics of current and potential bike users. This oversight can neglect challenges like 'Mobility Poverty'. Additionally, the declining public transport service in remote areas exacerbates reliance on cars. Thus, promoting biking and public transport while acknowledging the continued necessity of car travel is crucial for sustainable transport options in the province.

The pilot project in North Brabant is a collaborative effort between Breda University of Applied Science (BUAS) and the Province of North Brabant (PNB). The project aims to engage a wide range of stakeholders, from invested citizens – both bikers and non-bikers – to employers with a stake in mobility. Building on past participatory experiences, the project plans to integrate GREENGAGE Observatories into existing governance processes. This will involve a two-way interaction where participating residents are familiarised with governmental processes, and ealdormen are confronted with the accessibility, understandability, and possible improvements of the government apparatus. Organising and exploring the benefits and position of a GREENGAGE Observatory within a governmental institution can enhance citizen participation, with the ultimate goal of empowering the community to actively contribute to the future of sustainable traffic and transport in the province, which explicitly facilitates the government apparatus.

The North Brabant pilot addresses traffic safety, health, inclusivity, and energy issues by focusing on sustainable traffic and transport. Working alongside the central and decentralised government, the Observatory seeks to empower citizens to use a data-driven approach to assess their cycling infrastructure, identify cycling obstacles, and map their travel activities. Next to this quantitative data gathering, the experiences and decisions of the citizens will offer qualitative data on possible apprehensions about switching from cars to sustainable transport. Involving citizens in the gathering and signification of this data can strengthen the policy agenda through a more grounded understanding of obstacles to sustainable travel and the decision process that precedes it.

The Observatory aims to generate knowledge on achieving a higher shift to sustainable transport, specifically from car to bike. The specific objectives are:

- To collect, validate, and interpret qualitative and quantitative data on travel patterns and modality choice and ensure they are structurally integrated into a dialogical approach to governance that discusses Brabant's liveability and sustainability.
- To include women and historically marginalised groups such as ethnic minorities, disadvantaged populations and disabled persons in the gathering and signification to ensure an inclusive perspective on the assessment of liveability and sustainability;
- To generate additional knowledge on shifting to sustainable transport through different data analyses (e.g., why is the car still used when efficient and effective bike highways exist) and on involving citizens more intensely in governance through co-creation.
- Use data and citizen engagement to improve conditions for sustainable transport, for instance, on a spatial, environmental, and community level.
- Provide a qualitative metric to map and measure the bikeability of a neighbourhood based on the maintenance quality of the network, supported by citizen-gathered data.

The pilot project is enabled by the Argaleo DigiTwin technology, a data aggregation and visualisation tool that can be used to support governance decision-making. This digital tool already holds detailed data shared by municipalities (such as traffic and traffic light data) and transporters (such as bus performances), which will be complemented by the microdata of routing and citizen preferences gathered by the pilot project. The gathered dataset will be analysed and visualised for the gatherers to discuss and combine with other available datasets. This allows for the generation of insights and recommendations for easing the transition to bike use on regional and urban routes and the sustainable inclusion of observer participation in the formation of biking policy (see figure 8).



Figure 8. Example of DigiTwin visualisation. Accessibilities of Primary schools by bike in 5 to 10 minutes in Breda 2024 (North Brabant).

To ensure citizen observatories are set up in places where an increase in sustainable travel is possible, the pilot takes a two-phase approach: (1) a GPS-data localisation phase and (2) a Sustainable Transport Data deep dive. The first phase will gather multimodal travel patterns to pinpoint a promising site for sustainable travel behaviour change, while the second phase will investigate citizen motivations and obstacles at the promising site to enhance the performance of sustainable transport options.

The first phase is collaborating with the Verplaatsingsdata (Movement data) project, a province-wide GPS gathering scheme through a local app. This quantitative data is used in a GO called the Cycling Lab in partnership with Breda University of Applied Sciences (BUAS). Here the quantitative movement patterns and modality choices are integrated and complemented with quantitative data to update their dataset on bike use and routes and increase their insight into the decision process of modality choice. It leverages existing apps and data-gathering projects, such as the Multimodal Tracking Project, and builds upon past research on cycling patterns. The initiative is focused on creating a comprehensive inventory of multimodal travel patterns to identify bikeable routes and areas, which is essential for addressing the province's high number of car trips.

The second phase aims to identify cycling obstacles and to attempt to overcome them. The BUAS Cycling Lab started this endeavour. This entails a local observatory that dives into the decision-making process related to biking. On a larger scale, the surmounting of cycling obstacles is tackled with observatories in areas where the GPS data collected from the first phase identifies as carrying potential or serving as bottlenecks for sustainable transport. In these regions, localised COs will function as pilots that study the collaborative mapping and addressing of obstacles or motivators in the current bike network in order to improve sustainable transport options in the neighbourhood.

At least two GREENGAGE Observatories are planned within this scheme:

**BUAS Cycle Lab OBSERVATORY:** It aims to study obstacles and motivators for bike use at the BUAS campus and co-design hands-on solutions within the local university mobility policy. By diving deeper into the current obstacles to taking the bike to work, and providing data to support these shortcomings,



a constructive dialogue with the Mobility Policy Makers within the university can be set up. This CO will investigate these issues through qualitative methods, and the resulting insights will inform the quantitative data-gathering possibilities in the second CO.

**MAINTENANCE DATA OBSERVATORY** (The North Brabant GO): The second CO will be set up in an area with a high potential for sustainable transport improvements. The area selection will be based on the first phase and the collection of movement data via the Verplaatsingsdata app for a representative group of users. Further focus will be brought in through interactions with local data and the advisory stakeholder – The Fietzersbond. Within this area, a pilot will be set up to involve resident cyclists and non-cyclists in the policy making around cycling. The focus of this GO pilot is bike infrastructure maintenance, as a recognised topic and deterrent, as well as an organised policy element. Participants will be familiarised with the current policy process around maintenance, will co-create their possible contribution to the policy process, will gather maintenance data of their own local environment, and qualify this data to be a richer dataset to be considered. While focused on maintenance, this exploration of how an observatory can contribute to policy should be applicable to different focus topics.

In both Observatories, people from different societal groups will contribute to data gathering via digital devices (mainly their smartphones), answering surveys and helping co-to co-design the hypothesis and associated experiments/campaigns to allow for data validation or rebuttal. They will also reflect on aggregated and analysed data to issue decisions collectively.

The pilot intends to achieve these goals through the development of the following use cases:

*Analyse multimodal travel patterns:* Use GPS data to understand vehicular travel patterns, such as route choices and road network quality and visualise mobility statistics using different parameters.

*Investigate deterrents to bike usage:* Collect quantitative (such as number of trips by bike, trip distances by car or bike etc.) and qualitative (such as decision models) data to generate insights on shifting to sustainable transports and identify obstacles to the use of bike as primary mean of transport. Next to these data, georeferenced data on physical obstacles around the region preventing the use of the bike could be gathered through digital apps.

*Facilitate sustainable transport in areas of mobility poverty:* gathering mobility data (GPS tracking) from multimodal users. This data will be integrated into the DigiTwin platform, where the mobility patterns (routes, intensities, modalities) can be overlayed on existing datasets.

### Preparing activities

The North Brabant Pilot focused on developing and implementing a deterrent to bike usage use cases for the project's first iteration. As part of the preparation activities, the pilot worked on onboarding key members of its Core Team. In March (20th), a meeting with the Fietzersbond was held. Fietzersbond is the Dutch cyclists' union, which represents cyclists' interests and works towards expanding and improving bicycle-friendly infrastructure. The union is organised into 150 local branches nationwide, gathering 32,000 members and more than 1500 active volunteers. This meeting was a key step, and its purpose was to onboard the Fietzersbond to the Core Team and, together with them, determine the theme of the North Brabant GO, especially regarding how to approach cycling through volunteer observation specifications. Three people from the Province specialised in Bicycling and Data, one person from the Breda University of Applied Sciences, minding the link to GREENGAGE and discussing operations, and five people from the Fietzersbond (experts on biking and familiar with their own organisation and the person responsible for the data archive and policy embedding) attended the meeting.

As a collective of cyclists, the Fietzersbond acts as an auditor or research agency to the Dutch cycling infrastructure and policy. Through many projects over the years, they have gathered data on various aspects of biking. They do this through a nationwide network of volunteers that can be sent out to cycle specific routes and gather data on the routes in the Fietzersbond App. Because of their network of observers, data archive, and expertise in biking, this organisation is key to have in the core group.

The Fietzersbond already works with the Province of North Brabant, so the meeting focused on common interests that can be addressed collaboratively. This meant discussing the Fietzersbond approach to volunteer engagement and general activities and inventorying their demands and preferences against the possibilities of GREENGAGE objectives, GO principles, and Green Deal Policies to identify contrasts and complementation.

An intrinsic challenge was differentiating the possibilities of GREENGAGE from what the Union was already doing. On the one hand, this situation was overcome by the direct involvement of a governmental body as pilot owner, which was interpreted as an original project feature that opened possibilities to experiment within policy discussions. On the other hand, the explicit objective aims to impact policy frameworks. A key motivator was the link between biking advocacy and policymaking, as Fietzersbond's main goal is to integrate its activities into policy. Different possible policy links were explored, and data from the subscription survey was discussed. Particularly interesting was that 50% of the respondents indicated that the Fietzersbond should pay attention to the 'maintenance' of roads. The province also considered this topic pertinent, and current in-situ checking is absent in the policy field.

Participation Compass Training for Core Team Members was an activity carried out in March (25th) specifically geared towards aligning engagement and participation strategies. The [Brabants Participatiekompas](#) is a tool created for the Province of North Brabant to promote effective and coherent participation. As part of the Environmental Law, government agencies must actively involve citizens in policy-making. The degree and form to which this must happen depends on the assignment. The Participation Compass guides policymakers through the possible forms of participation, the required communication actions, and the management of participants' expectations.

The training was developed through a series of questions and discussions on diverse options for determining project participation. The activity involved reviewing the general description of the GREENGAGE project and the GREENGAGE Observatories and drafting a possible direction for tracking maintenance on bike paths building on the Fietzersbond activities.

Specifically, the degree of participation required was discussed. A higher degree is required as GREENGAGE relies on gathering data through observers and their influence on policy-making. The compass guided how the Province could position itself and what communication means to use. This required specifying the challenge for the Province and the map of the related stakeholders. Distinguishing between the level of involvement from the Province (ranging from acting, networking, informing, and responding) determined the baseline of required resources (time, commitment, legal basis, etc.). Apart from self-reflection, the identification of target audiences was also discussed. What degree of involvement was imagined for them was held against the intended interaction of the Province. This helped shape the GO on maintenance as a pilot into collaborative policy making, which requires more active involvement from both with plenty of space to experiment but also to learn from and compromise with each other. The Compass trainer suggested some strategies and associations for contacting bikers, keeping maintenance questions in mind. The engagement of underrepresented groups was also discussed, and it was deemed challenging from the beginning, though essential to include. For this purpose, the GO was divided into several phases – a phase that explores and shows the initial contribution of a GO, and a phase that fully exploits this contribution by involving specific participating groups. This scale up is first focused on the initial pilot area, but later can potentially be spread to other locations and topics.

While a path to follow for the Province was identified, specific strategies, methods, or approaches were not discussed. The participation perspective increased the interest in a topic as mundane as maintenance by making it concrete and experiential but also revealed how participation can be hijacked by administrative logic instead of focusing on interaction with people.

### Designing activities

The thematic co-exploration aims to enhance citizen involvement in planning and reporting maintenance issues on bike roads in the North Brabant region. Although generally cooperative cyclists support existing procedures, the goal is to find effective ways for participants to identify and report these issues collaboratively. The associated missions include identifying maintenance criteria for bicycle routes with volunteers, shortlisting problematic urban, peri-urban, and rural routes, scoring the bike paths and cycling experiences based on these criteria, exploring efficient storytelling strategies with various stakeholders, and enhancing governmental maintenance uptake. Geographically, the co-exploration will cover the City of Breda and the neighbouring village with the regional bike roads connecting the two. The involved municipal and provincial authorities are involved at first, but later the methodology and contribution of GOs should be able to be spread to other locations.

This initiative is highly relevant for the district, as 41% of bike accidents are attributed to poor road conditions, including lack of maintenance, inadequate communication, or faulty design. Improving these conditions is essential to making cycling in North Brabant safer and more appealing. Currently,



maintenance is under-monitored in municipal and provincial plans, and there is no standard data on maintenance states or a clear reporting structure. Although feedback portals exist for citizens to report infrastructural problems or barriers to biking, these platforms are not fully exploited.

The research question guiding the thematic co-exploration is how citizen participation can engage with the bike path maintenance agenda within a municipal-provincial governance framework. The research will explore how current maintenance frameworks can be expanded through public interviews, assess the current state of bike paths in the city of Breda, and determine if better bike paths lead to more appealing bike infrastructure.

The objectives of this co-exploration are:

- Defining maintenance criteria.
- Collecting data on the state of rural, peri-urban, and urban bike paths in North Brabant.
- Conducting qualitative assessments of routes by different target groups.
- Clarifying the governance process and participant roles.

With this co-exploration, the pilot expects to create standardised and simplified maintenance inventories, define comprehensive and experiential maintenance criteria, implement effective data-gathering strategies, and specify a clearer reporting structure. The pilot seeks to ensure that participants can report maintenance issues as a community rather than individually and are valued as contributors in the policy cycle.

The co-exploration aims to capture data on maintenance from volunteer cyclists through the Fietzersbond app - (most likely) [Toertje<sup>1</sup>](https://www.toertje.nl/), which can provide assessment tools and photo mapping. The app is already known and trusted by the union's volunteers. The data analysis process will capture various types of data, including link-based Likert scale assessments, positioned photographic evidence, and maintenance reporting experiences. Data collection will focus on subjective measurements, with adapted criteria for maintenance quality, creating a new dataset integrated into road evaluation. Visualisation and metrics will support decision-making, with DIGITWIN integration showing maintenance states, route cut-offs due to maintenance issues, and an overview of governance and reporting platforms.

Fietzersbond will collaborate with BUAS and the province through community engagement (volunteers), biking and path data (through their app), and expert knowledge. Other stakeholders include the GREENGAGE consortium as data gatherers and biking organisations to discuss metrics, cycle, assess, and prepare feedback strategies. Parents and expats will also participate in reflecting on route visualisations. To disseminate the outcomes, social collectives and influencers such as the Fietzersbond, the Province, BN De Stem, and BUAS will play crucial roles through their networks, policy documents, news items, and publications on the metrics.

Commuters, recreational bikers, biking organisations, and governments are the primary beneficiaries of the co-exploration. They will gain metrics and extra mobility-related data through their participation to establish clearer communication and stronger links between government bodies and citizens.

The potential societal, environmental, and economic impacts include a decrease in single-bike accidents, increased bikeability in the province, enhanced resident input on safety, and promotion of a healthier lifestyle through more biking. The findings from this exploration may inform several policies and plans, such as Mobiliteitsvisie, Fietsplan North Brabant, and the expenditure of both provincial and local maintenance budgets.

The co-exploration covers the following phases and activities:

*Onboarding:* It involves contacting some Fietzersbond volunteers, presenting evidence of the relation between accidents and maintenance, contacting bike organisations in the Province, implementing informal sessions to inventory experiences and anecdotes, and inviting people to join the observatory.

*Criteria Setting Phase:* This phase encompasses organising meetings with biking groups and volunteers, discussing maintenance criteria (what they mean by it), exploring how maintenance is currently reported

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<sup>1</sup> <https://www.toertje.nl/>

and mapping current weak maintenance spots, The Fietsersbond app will also be introduced to update the maintenance criteria list during this step.

*Data Gathering:* Realisation of a bike path assessment session, volunteer assignment to cycle routes in North Brabant, scoring maintenance in the app and pictures capturing, and assessment of different bike paths on the urban, peri-urban, and rural levels.

*Data Processing:* BUAS data scientists gather the data and clean it up. Then, neighbourhood scores are revised, and the maintenance scores are uploaded to DIGITWIN.

*Data Presentation:* Volunteers are invited to a reflection event where the findings are mapped and shown in the DIGITWIN. The aim is to identify problematic trajectories or routes and identify missed issues to be added. The pilot plans to repeat the activity with different target groups (expat students and parents from specific schools).

*Governance exploration:* This step involves presenting aggregated data to the municipal council, diving deeper into the feedback system with core group members, and linking the governance structure to the citizens to determine clear agreements.

## Experimenting activities

### *Cycling Lab Observatory: Second Cycling Lab Session: Recreational Cycling Motivators and Obstacles*

A second session of the Cycling Lab was carried out as part of the onboarding activities (28<sup>th</sup> of May). It has onboarding, training, and co-design purposes. The first session, developed in December 2023, was reported in D3.2, where some participants got involved. The first Cycling Lab introduced participants to GREENGAGE and the motivators and obstacles to cycling. During this first session, a query was sent out to determine which motivator/obstacle participants wanted to explore further. Recreational cycling was chosen (figure 9). This session aimed to onboard new participants, provide them with a co-created tool to gauge recreational cycling and assess bike routes for recreation. This involved exploring the metrics, co-creating a measurement tool, training the assessment, and selecting target routes.

This second Cycling Lab session looked for a methodology to co-create a maintenance-focused assessment tool in the North Brabant GO. As a result, the pilots' first and second planned observatories were linked. The session continued developing the BUAS Cycle Lab Observatory in that it explored the needs and data gathering capabilities of employers functioning within a cycling policy, and simultaneously, it served the North Brabant GO by helping provide frameworks for co-creating assessment measures and onboarding activities. Knowing how to co-create a data-driven assessment metric is useful when experimenting with policy makers on the topic of maintenance in the North Brabant GO.

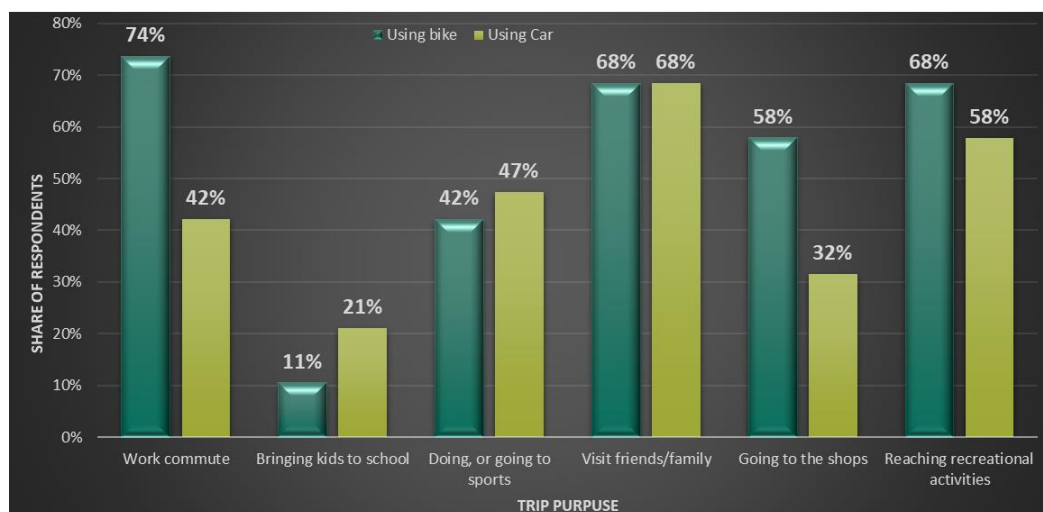


Figure 9: Data results on biking behaviour from Cycling Lab 1

This GO event was integrated into a larger symposium to gather a larger community of interest for the purpose of co-creation. The Sustainable Tourism and Mobility Forum was a two-day event connecting the mobility sector to tourism. This international event ensured experts and interested parties from

multiple locations gave input on the biking matter. This forum was advertised on the Breda University website and through posters in the school. The event was further shared in research networks such as POLIS and heavily published on LinkedIn. It required registration but also allowed hybrid participation.


A total of 30 people joined the second Cycling Lab session, half of whom participated online. About 12 new people were onboarded in the GO, for a total of 36 participants in the Cycling Lab Observatory. Of these 36, about 50% are male and 50% are female, all aged between 20 and 50. Furthermore, about 35% of these participants have a non-Dutch background and had to learn to bike at a later state in life. Government members, researchers on biking and tourism, recreational biking, students, non-bikers, and marketing agencies joined. Understanding what makes a cycling route interesting and what can motivate people to cycle was of common interest across the different types of participants.

The sessions started with a short presentation by several speakers that provided an overview of elements that can influence motivation or deterrence in biking from the local perspective. The first speaker discussed the possibility of infusing recreational bike routes with stories – as a means to increase motivation for cycling. The second speaker, a Logistics legal expert BUAS, instead discussed key selection criteria when planning a recreational bike route, giving a hint of key characteristics to consider. Finally, the Research Coordinator BUAS, reflected on the role of bikes in the Netherlands in general, diving much further into the degree of motivation that can be present per person. The speakers did motivate people to try cycling, which in itself is a support on the larger goal of getting people to bike.

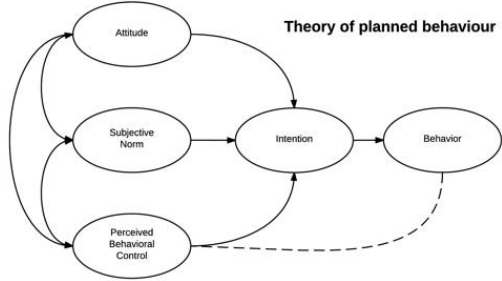
**GREENGAGE**

## NORTH BRABANT PILOT


- Get more people biking!
- Understand variables that influence modal choice




**Theory of planned behaviour**



**Today: Biking for fun**



Funded by the European Union



UK Research and Innovation

Project funded by




Figure 10: Slide from the second cycling lab on recreational biking

The session continued with an in-depth workshop and discussion on assessing cycling routes and the relevance of revising the evaluation metrics to assess a bike route's appeal. Although some criteria already exist, participants are asked to assess existing bike routes and identify missing criteria. To this end, a photographic survey of bike routes was presented, participants were trained on how to assess bike paths, and a discussion on motivating elements and obstacles was carried out.

To co-create the selection procedure and an assessment tool, the participants were asked to complete a questionnaire about elements influencing their cycling choices. This questionnaire was based on researched markers of motivation and deterrence. The results were subsequently discussed and expanded. The actors' diversity is valuable as people from different industries highlighted a variety of variables that were not included in the research overview but mattered to them – like the presence of water stops or bike maintenance spots for sport cyclists. Some others were deemed less important.

Subsequently, participants were invited to co-create an assessment tool for recreational routes that allows them to assess their preferences and tailor bike routes to their profile. These comments were later integrated into a tool—a questionnaire—to reflect on the selection procedure and assess the route itself. While currently quite low-tech, these variables can be integrated into tracking apps where

participants can add data to a route. The assessment tool was equipped with photographic examples of standardised criteria.

Finally, people were asked to select a route they would cycle and assess before the next session. Regardless of whether people joined, everyone had access to the tool and was periodically reminded to fill it in. An overview of bikeable routes in the vicinity facilitated this activity. Ultimately, the observers present were informed of the North Brabant GO to query whether they would be interested in joining that observation as well. This was largely dependent on the location of the observations – if it is close, they were open to it.

While the session was successful, some challenges were also identified. The hybrid co-creation was quite tough, as attested by online participants. In the same sense, a longer-term plan to ensure participants do the data gathering was required, which should involve overcoming the gap that exists between doing a workshop and engaging and activating the REENGAGE website, registration, and other possible means.

#### *North Brabant Observatory*

As part of this GO the Pilot has been further aligning expectations and working with the Fietzersbond to build a strong case and establish a comprehensive plan for the initial piloting phase. The main steps of the plan are:

- Onboarding additional stakeholders, specifically municipalities.
- Initiating the call to action and onboarding municipalities through regional coordinators.
- Kick-off with the workgroup and volunteers, followed by data gathering.
- Collecting qualitative data from the workgroup.
- Combining qualitative and quantitative data, analysing the sets, and establishing a foundation for debate.
- Have live collective meetings with citizens to analyse and discuss the data and determine the follow-up plan.

The pilot identified appeals to efficiency, citizen engagement, transparency, and alignment with higher policy goals as compelling reasons for municipalities to participate in the GO. By involving citizens directly in data collection and decision-making regarding bicycle infrastructure maintenance, municipalities can become more responsive to the needs of their residents. Furthermore, the GO aligns with trends in transparent governance, allowing municipalities to showcase accountability by giving citizens a direct role in shaping infrastructure priorities. It also offers flexibility and scalability, allowing cities to begin with specific areas or routes and expand their involvement over time and in connection with broader European and national objectives.

They selected possible specific municipalities to approach and drafted a pitch to onboard them. The working group decided to focus on two municipalities that meet the following criteria:

- One larger municipality with significant financial resources and a considerable number of employees, featuring cycling infrastructure in an urban setting.
- One smaller municipality with cycling infrastructure in rural areas.
- Both municipalities should be adjacent to each other.
- Both municipalities should have a strong presence of Fietzersbond volunteers.
- There should be provincial cycling infrastructure passing through or near the municipalities.

With these criteria, the pilot established a solid foundation to begin experimenting with the collection of maintenance data, which will also guide the selection of focus areas in the future. Although a single municipality could meet the first two criteria, the team aims to onboard two adjacent municipalities to compare strategies across different-sized localities. This approach will also help address citizens' knowledge gaps regarding responsibility for road maintenance. By selecting areas where the Fietzersbond is already active, they can promptly commence data collection and expand or refine the focus throughout the following year of piloting.

#### *Data Collection and Stakeholder Engagement*

The Fietzersbond is already gathering preliminary data from the piloting phase as part of its SPI monitoring. Therefore, a quantitative assessment over a longer time by multiple Fietzersbond volunteers already provides a numeric scoring of main bike paths in the Netherlands. Yet this remains a snapshot of the quality of the bike paths, ignoring side roads or shortcuts that act as bottlenecks for aspirant bikers. By forming a workgroup that includes road managers (from municipalities and the province), volunteers, and other bike-focused stakeholders, the pilot seeks to focus the data collection on a single subject—maintenance—and complement it with additional qualitative feedback. This process aims to foster deeper discussions and provide a more comprehensive understanding of the data. This includes the assessment of bike paths not commonly used by different target audiences (e.g. school travelling children), the qualification of the urgency of maintenance requirements, and the inclusion of non-bike users (such as the SmartwayZ panel) to expand maintenance requirements.

To attract and involve cities and municipalities to participate in the Observatory, a clear communication plan is essential. As the Observatory reflects on the way bike route maintenance is handled within governments, an accusatory tone of problematics should be avoided in order to ensure motivated participants. To this end, a communication plan to municipalities, focusing on the benefits of the qualitative reflection and earlier identification of maintenance faults, is essential. During July and August, the specific nuances of such communication to municipal members were tested and compiled.

Moreover, the team is investigating improved utilisation of available and collectable general cycling datasets, such as GPS information, traffic counting data, route choices, and the accessibility of key locations. For this purpose, it is seeking to align with the provincial multimodal tracking data project, coordinating with Argaleo regarding available datasets and the potential for additional datasets, and discussing valuable insights for cycling policy with field experts. The collaboration between these organisations requires the treading of data exchange agreements. Withing North Brabant, a lot of data is already available on the status of bike roads and travel patterns. Yet to ensure a concrete contribution of the GREENGAGE Observatory for policy makers and citizens alike, the specific data gap needs to be identified. For this, a synchronization of datasets among stakeholders is required. Regrettably, this is a slow-moving process.

These datasets will help provide additional insights and context to the citizen-collected maintenance data, facilitating more informed discussions. The data will also assist in identifying future focus areas, such as essential school routes.

### Final remarks and lessons learned

Convincing people to join stakeholders in the Observatory required a clear understanding of stakeholders' motivations. The Fietzersbond's policy integration worked well, but it is not guaranteed to work the same for other potential participants.

A communication plan has to be clarified early on. A strong focus on data gathering solely will not entice anyone to join, both as observer or as implementer in policy discussions. The contributions of a GREENGAGE Observatory must be clear cut – albeit adaptable to local contexts. Having this sales pitch ready from the get-go can accelerate the preparation phase.

There is a constant concern that the data gathered will not be bountiful or objective enough to be representative and, thus, effectively useful for shaping public policies. This topic shows the relevance of further exploring and developing validity criteria around the maintenance metrics.

Participation and policymaking involved institutional frames and approaches. The Participation Compass, for example, is a gateway to participation integration but remains rather general and is naturally focused on the government agency. This helps square activities but ultimately engages less with the citizens themselves. The training allowed participants to identify the need to find a middle point between outlined parameters (e.g., this many participants; this many of a specific group) without risking hijacked participation by administrative matters and sliding away from actual interaction. In this case, the workshop facilitator provided a constant reminder of such balance. It was useful to revisit the Compass after specific citizen questions had been detailed and the experiment had taken shape.

Even if some participants were interested in non-substantial elements of the activities carried out (like the food or speakers of the meetings), their presence was an opportunity to trigger their participation when asked to share their experience regarding biking.



## 6.4 Turano Valley

### General description

The Turano Valley, a unique geographical gem, is nestled northeast of Rome (Italy), on the first hills that rise about fifty kilometres from the urban settlement of the capital. Encompassing a geographical area of 322.14 km<sup>2</sup> and home to 10,250 inhabitants, the valley's very high naturalistic and landscape value is a testament to its distinctiveness. However, this uniqueness also presents great difficulties due to the roughness of the territory and its morphology (see figure 11).

Although there are 4 municipalities active for the activity of the Greengage Citizen Observatory (Collalto Sabino, Castel di Tora, Paganico Sabino and Ascrea), it is important to specify that overall, 11 villages are part of the valley which, based on their geographical location, are grouped into:

- The villages that dominate and overlook the Turano Lake: Ascrea, Castel di Tora, Colle di Tora and Paganico Sabino.
- The villages gravitating along the “Via Salaria” road: Belmonte in Sabina, Rocca Sinibalda, Longone Sabino.
- The innermost villages: Collalto Sabino, Collegiove, Longone Sabino, Nespole, Rocca Sinibalda, Turania.

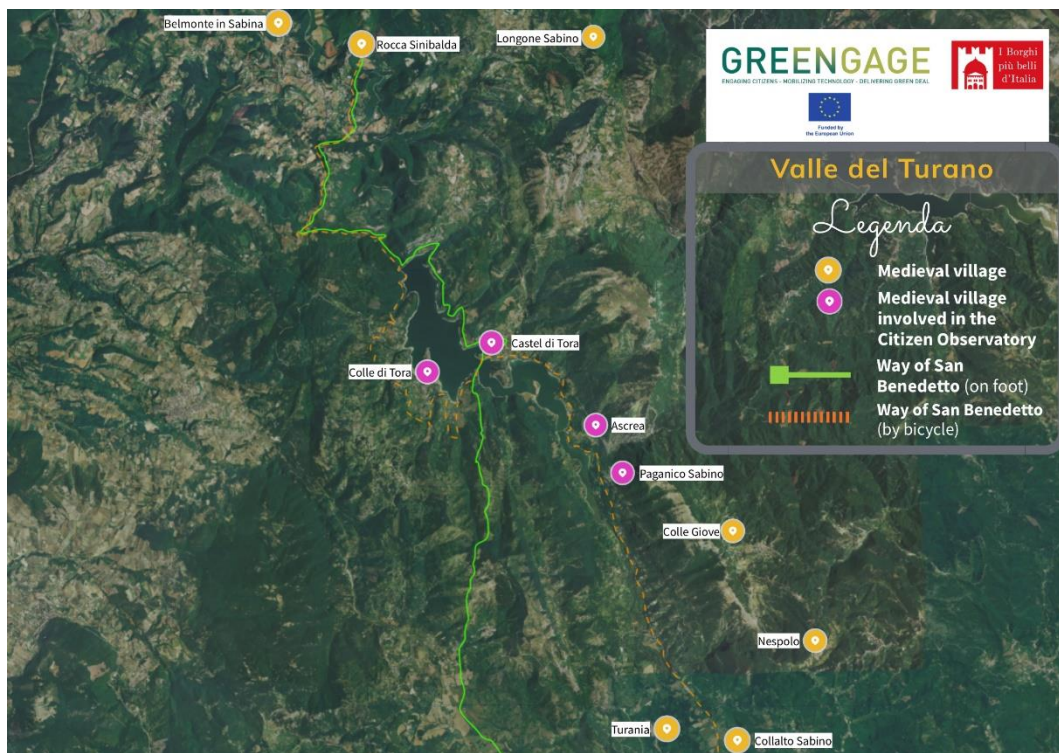


Figure 11: Overview of the Turano Valley

The valley is dominated by Turano Lake, located 536 m above sea level along the course of the Turano River. The lake is about ten kilometres long and has a perimeter of about 36 km. It extends at the foot of the nature reserve of Mount Navegna/Cervia (1506 m), which is covered by woods. The lake is surrounded by ancient villages and castles, which are reflected in the clear waters.

The Turano Valley, within its territorial context, is a place of strong potential in terms of liveability compared to the metropolitan city of Rome, nearest. Its villages, acknowledged as some of the most beautiful in Italy (Collalto Sabino and Castel di Tora), operate in collaboration with the association “I Borghi Più Belli d’Italia”. The most developed areas, which are flatter and closer to the lake, are the economic hubs of the villages, linked to rural resources, craft businesses, and tourism.

However, the Turano Valley is not without its challenges. It grapples with hydrogeological issues, a growing elderly population, the phenomenon of depopulation, the erosion of rural cultural heritage, and an increasing number of unoccupied houses. These issues underscore the need for concerted efforts to preserve the valley's unique character and ensure its sustainable future.



Population ageing and intra-regional migration and depopulation trends constitute critical challenges and widen the urban-rural divide. In Italian villages, the population reached 289,000 residents, with less than 10,000 inhabitants from 1951 to 2019. This is because remote regions face difficulties keeping families and young adults because of the loss of services and infrastructure. Internet connection is either lacking or rather slow in the area. The Ultra Broadband project financed by the Lazio Region ([Link](#)) aims to tackle this by providing high-speed Internet connection of at least 30 Mbit/s in 53 municipalities. Yet, the infrastructural development prioritises historic centres over rural areas, where fibre optic connections are fewer or still await implementation. Meanwhile, young adults leave to study and work in cities, whilst older populations decide to move into quieter villages as residential preferences change during life course. Economic changes and environmental factors put additional pressure, raising questions about the adequate provision of health services, schools, and labour, as well as the diversification and sustainable future of the local economy.

The inadequacy of the road infrastructure system in Turano Valley hinders the movement and economic activities of and between the residents. The lack of a direct train connection between Rome and the Valley (the nearest railway being in Carsoli, approximately 25 km away) makes it difficult for people to commute to and from the capital city by public transport only. Also, the absence of a cohesive and integrated public transport system within and between the municipal areas of the Valley further prevents access to essential services, like education and job opportunities.

Without adequate support in remotely sparsely populated areas, low levels of schooling are observed, including school dropouts, low educational levels, and lack of alternative educational resources. Meanwhile, the Valley is facing constant growth of both "secular" and religious excursion tourism, which will require the provision of more services and infrastructure in the future.

The Turano Valley is part of the EU Next Generation (PNRR action – National Programme for Resilience and Recovery), specifically with the project titled “United Villages of Turano Valley for Territorial Resilience and Recovery”. This project aims to revitalize the historical and cultural heritage of the Turano Valley, in specify the programme was launched in the Turano Valley between 2022 and 2026, was funded by the National Recovery and Resilience Plan, and was led by the municipality of Paganico Sabino. Its primary purpose is to counteract the phenomenon of depopulation, improve liveability in the region, and strengthen the attractive potential of its villages. While with Greengage it is expected to collect reliable and detailed data on mobility and air quality to provide input to Lazio’s Mobility, Transport and Logistics Plan (PRMTL), the primary regional planning tool in the regions, drawn up in collaboration with the State, the Regions and the Metropolitan city of Rome.

The goals of this GO, led by “I Borghi Più Belli d’Italia, Association”, align with the "Borghi United for the Cultural and Social Regeneration of the Turano Valley” programme. The GREENGAGE project will help achieve these goals by engaging citizens in collecting and analysing mobility and environmental data that can support evidence-based decision-making in urban regeneration efforts. The Turano Valley GO aims to bring together the municipal authorities of the valley towns (especially those overlooking the lake), local associations, local businesses, and citizens as stakeholders of the GO.

- Mobility data analysis involves analysing patterns of movement and travel using data from different sources such as GPS devices, mobile phones, and transportation systems. This can provide insights into how people move and interact between different areas, which can help policymakers and planners make more informed decisions about allocating resources and planning for future growth.
- Urban regeneration efforts refer to a collaborative process of revitalising urban areas involving residents, businesses, and community groups. This can help create more attractive and liveable neighbourhoods, improve access to services and amenities, and enhance social cohesion and community pride. The project can take advantage of the after-the-pandemic momentum, which freed workers from large urban centres and encouraged them to repopulate more remote areas to push an agenda for urban revitalisation and sustainable growth.

The Pilot identified the following use cases to develop in the GO:

Participatory environmental monitoring: Monitor environmental data such as air quality and noise levels. Citizens would capture such data using portable sensors and then analyse and visualise it using a shared platform to identify sustainable improvements.

Mobility Pattern Analysis to determine accessibility to shops, schools, services, and other local amenities: a) Determine citizens' routes to local amenities and identify improvements. Categorise routes by mode of transport and analyse alternative travel modes by analysing six months of regional GPS data (Lazio) for flow analysis. b) Tracking the availability and use of parking spaces will facilitate commuting from and to key destinations. Monitoring this information will not only address traffic concerns but will also inform urban planning strategies, ensuring parking facilities align with community mobility patterns. Beyond quantitative data, collecting citizens' opinions and feedback on the accessibility and use of urban space will help policymakers and planners adapt their future strategies. Specifically, understanding community sentiments will help create targeted interventions aligned with residents' needs and preferences.

Analyse citizens' usage of public spaces and determine the attractiveness of public spaces: Use GPS data to analyse the usage profile of public spaces. Identify spaces that are the most and least used at different times of the day.

Four main phases characterise the Turano Valley GO:

1. The activation phase, which is characterised by stakeholder involvement and engagement, inviting the communities identified in the stakeholder mapping and recruiting them as Citizen Observers.
2. The design and co-creation phase is characterised by the training of Citizen Observers and their involvement in developing shared participatory activities that relate to critical issues in the natural and built environment and the political and societal sectors.
3. The implementation phase uses tools, methods, and resources from Citizen Observers to collect, analyse, and reflect on data. This phase, in turn, implies a. "Discovery & sensing": collecting and sharing data using sensors and observations. b. Understanding data through meetings and workshops c. "innovation", using new and existing data to define with stakeholders' new points of view that have emerged thanks to the data and prototype potential new services and tools that address problems to improve integrated sustainability.
4. The celebration phase features a closing event to illustrate the results achieved, show the usefulness of datasets to support policy, science, and technology decisions, and thank all stakeholders involved for their commitment and contribution.

The expected impacts of the GO activities are:

- Map out local challenges in intra-municipal commuting, digital infrastructure, and air quality to influence decision-making regarding mobility, life quality, and residential attractiveness.
- Build a database that integrates quantitative data through satellites and sensors with qualitative information from surveys, interviews, and focus groups to generate intelligence for regional planning.
- Collect data on mobility flows and monitor environmental phenomena, like air quality, to support mitigation planning for hydro-geological hazards and extreme atmospheric phenomena.
- Gather opinions from various stakeholders to draw impactful planning scenarios and formulate suggestions for targeted political decisions.
- Develop guidelines for the Municipalities of Turano to improve urban and transport planning and quality of life while tackling depopulation and promoting cultural and social regeneration.
- Based on the evidence gathered, citizens should be provided with the opportunity to experience and reflect on their environment in terms of mobility and liveability.

## Preparing activities

### *Onboarding Core Team: Inaugural meeting Turano Valley GO*

The meeting was held in Paganico Sabino on 9 March 2024. Its objective was to launch the Citizen Observatory for the Turano Valley and onboard the core team. It involved presenting the GREENGAGE project's objectives, explaining the main topics to be addressed, describing the GREENGAGE tools, clarifying the synergies with other initiatives, and delivering a first batch of 10 Atmotube sensors to participating citizens.

The activity was advertised and communicated through different channels to reach a broad range of target groups. A public invitation was created on the Association "I Borghi più belli d'Italia" and the GREENGAGE website. Invitations were also sent via e-mail to people who had shown interest during the pilot's socialisation activities in previous months (see D3.2). Additional flyers and posters were distributed in the main town of the Valley.

The event was well attended, with 24 active participants (including representatives from the 4 involved municipalities, environmental experts, and interested citizens.) demonstrating a strong desire to contribute to the well-being of the Turano Valley. Of these, 20 have officially registered with the City Observatory (7 women and 13 men). Other participants have expressed interest in following the work of this citizen initiative.

The event featured various activities, including presentations on the GREENGAGE and the main synergy at the local level with the "Borghi united for the cultural and social regeneration of the Valle del Turano" funded by the National Recovery and Resilience Plan (PNRR), discussion sessions, planning of future activities, distribution of Atmotube sensors for measuring air quality, and instructions for their use.

The critical points conveyed to the audience were the purpose of the GO to operate with a methodology typical of Citizen Science to a) provide guidance to improve the strategy on mobility infrastructure and services, b) observe aspects related to liveability or quality of life with particular attention to air quality through sensors and geospatial data, comparing it with data on the metropolitan city, c) consider the attractiveness of villages and points of interest to counteract the phenomenon of depopulation.

Participants and every local actor in the Turano Valley were also invited to indicate possible synergies with ongoing or planned projects to strengthen any intent for the common objectives of regeneration and sustainable growth of the Valley. The highlighted projects were i) "United Villages for Cultural and Social Regeneration in the Turano Valley" (funded by the PNRR) coordinated by the Municipality of Paganico Sabino in partnership with the Municipality of Collalto Sabino and Castel di Tora; b) the SusTourTraining project - Strengthening the tourism value chain in small and charming Mediterranean towns through sustainability-focused adult education (funded by the European Erasmus programme and managed by I Borghi più belli d'Italia) and iii) the "HotSpot Navegna On-air" project curated by the Monte Navegna and Monte Cervia Nature Reserve. Interaction with ongoing projects is a distinctive feature of the GO, which aims to support all stakeholders. There were claims for strengthening the work in networks and as a system for the Valley, bringing together the different municipalities that are part of it.

The meeting offered an essential opportunity for discussion and planning of future activities, with the participation of representatives of the municipalities involved, environmental experts, and interested citizens. The day's highlight was the citizens' active and participatory engagement during the discussion sessions, when participants expressed their enthusiasm for contributing to creating a sustainable future for the Valle del Turano. Some of the discussions tackle, for example, the importance of understanding the environmental differences, for instance, between Rome and the Turano Valley, as well as identifying any relevant characteristics emerging from the data collected, which was shown as part of the interest in working with Turano. This feature was also highlighted as pertinent to continuing to develop the links between environmental monitoring and valley regeneration that guide the interests and aims of the Turano Valley GO.

As part of the discussion about the regeneration of the Valley, problems with internet connectivity, a lack of quality regional public transport (especially on Sundays when there is no public connection to the train station and between the valley towns), and the need for clearer territorial marketing and better health and education services arise. Although the Citizen Observatory cannot foresee the participation of all residents, it was interpreted as valuable because the more information and data coming from the participants, the more valuable information will help to achieve the common objective of culturally and socially regenerating the valley. For instance, participants found the possibility of understanding how long and how many mobile users wait for public transport at certain stations so that the public service can take this data into account to get closer to a service more appropriate to the changing habits of users in the area.

During the meeting, the plans to use the regional mobility data from Lazio were described in connection with the mobile sensors and the air quality data from the Copernicus Atmospheric Monitoring Service (CAMS). Sensors were presented, and participants filled out information sheets and informed consent. The session included an explanation of how they should have been used through a video and the reading of its instructions on manipulation and care. During the meeting, 10 Atmotube sensors were distributed

among citizens to familiarise them with the use and possibilities of mobile sensors and air quality data (4 Collalto Sabino; 2 Castel di Tora; 2 Paganico Sabino; 1 Ascrea; 2 Rome; 1 Orte).

### Designing activities

For the first iteration the pilot work on a joint thematic co-exploration for Turano Valley and Gerace GO by focusing on those elements common to the two pilot areas. The purpose of this GO thematic co-explorations and its associated missions is to enhance territorial resilience and recovery in the Turano Valley by engaging local citizens in data collection and analysis to support evidence-based decision-making, particularly in urban regeneration effort.

Turano Valley municipalities, such as Castel di Tora, Paganico Sabino, Ascrea, and Collalto Sabino, face various challenges that contribute to a complex socio-economic landscape. On the one hand, the inadequacy of the road infrastructure system hinders the movement and economic activities of and between the residents. Population ageing, together with intra-regional migration and depopulation trends, widens the urban-rural divide economic crisis that receives insufficient support in remotely sparsely populated areas. The region faces low levels of schooling, lack of internet connection (or access to low-quality connectivity), and suffers from steady growth of "secular" and religious tourism. The GO is an opportunity to identify strategies for counteracting the phenomenon of depopulation, improve liveability in the region, and strengthen the attractive potential of its villages.

The Citizen Observatory's main objective is to use citizen-sourced data to enhance decision-making processes that foster urban regeneration and improve infrastructural resilience. By influencing Lazio's Mobility Transport and Logistics Plan (PRMTL) and supporting broader initiatives under the EU's Next Generation program, the GO aims to benefit local residents, businesses, policymakers, and researchers focusing on rural development and urban planning.

Currently, the Turano Valley faces fragmented data collection efforts and limited community engagement in regional planning processes. It is expected that establishing a cohesive and comprehensive GO that actively involves local stakeholders in continuous data collection and analysis and a level of integration of data analysis will help transition to a more informed and community-driven approach to regional development and planning. The Turano Valley GO is expected to support the core aspects addressed by the Next Generation EU with community-based data: the inadequacy of the road infrastructure system and boost urban revitalisation upon careful territorial planning and services to progressively counter depopulation.

This involves engaging local communities to collect and analyse data concerning mobility, environmental quality, and public services to support evidence-based decision-making in urban regeneration efforts. Urban regeneration involves stakeholders collaborating to revitalise urban areas hand in hand with residents, businesses, and community groups. This mechanism is believed to generate more attractive and liveable neighbourhoods, improve access to services and amenities, and enhance social cohesion and community pride. Citizens of the Turano Valley, particularly from villages like Collalto Sabino, Ascrea, Castel di Tora, and Paganico Sabino, are the main participants in the pilot's co-exploration.

Some of the general questions guiding the thematic co-exploration are: a) What are the specific mobility patterns within the valley, and how can they be improved to enhance accessibility and economic activity b) How does the quality of infrastructure affect population retention and thus the economic stability c) How monitoring environmental features such as air quality can ultimately support the regeneration of the communities.

The pilot assessed that quantitative and qualitative data is required to answer these questions. Quantitative data will include environmental measurements (e.g., air quality indicators), mobility data (e.g., GPS tracking, mobile network data), and demographic statistics. Qualitative data will encompass community feedback, perceptions, and satisfaction levels regarding local infrastructure and services. The exploration involves objective measurements (e.g., sensor readings, GPS data) and subjective measurements (e.g., survey responses, interviews). Participants collect data using multiple instruments, including environmental sensors, mobile devices equipped with data collection apps (like the REENGAGE app), and traditional survey methods.

The initiative co-exploration primarily involves creating new datasets, although it may also integrate and enhance existing datasets with additional data points to provide a more comprehensive view. Data collection is planned to cover all villages within the Turano Valley, with a temporal scope stretching from

April to June 2024. A second iteration will take place in 2025. Data will be collected to capture variations and trends over time in a second iteration.

The analytical methods planned to be applied within the Citizen Observatory's thematic co-exploration are:

- **Spatial and Temporal Analysis:** Utilizing GIS tools to perform spatial analysis of data related to environmental conditions, mobility patterns, and infrastructure. Temporal analysis will help observe changes and trends over the project duration.
- **Statistical Analysis:** Employing statistical methods to analyse survey data and sensor readings, identify correlations, and test hypotheses about factors affecting the valley's quality of life and economic activity.
- **Predictive Modelling:** Based on collected data, developing models to predict future trends in demographic changes, environmental impacts, and infrastructural needs.

During the first iteration, the pilot focused on:

- **Data capture and analysis of air quality monitoring:** 12 Atmotube sensors were bought to collect air pollutants such as PM10, PM2.5, PM1 and other values that we will discuss with specialists in the field (e.g. HOPU-LIBELLIUM).
- **Analysis of mobility data:** I Borghi Piu Belli d'Italia bought eight months of mobile network data from 2023 to study traffic flows in the area and understand values such as travel times, public and private transport models used, and other aspects that we will address with experts (MindEarth).
- **Mobility infrastructure data capturing and analysis:** GREENGAGE bought a dashcam and installed it in an Observer, which automatically detects images and analyses them to identify the infrastructure state between Rome and the Turano Valley Municipalities. A dashcam was installed in a volunteer observer vehicle on May 29<sup>th</sup> which recorded images between Castel di Tora and Roma. The dashcam collected GPS data and road condition (based on detailed specification in process of being defined).

## Experimenting activities

### *Air pollution: data capturing, aggregation, visualisation, and analysis*

A data-capturing process started due to the inaugural meeting of the Turano GO. The starting activity aimed to promote spontaneous data collection with mobile sensors in the different towns while comparing some measurements in Rome. This approach aimed to address the fears and possible doubts regarding the sensors, given the age of most participants and their lack of familiarity with the technology. This initial data capture activity was an exploration that had an immense impact on practical learning and experimental understanding of the use of mobile sensors to interiorise how to take care of the sensors themselves, their use (for example, when turn in and off and their use in with different battery levels) the type of data that is captured and the reach of those data in the context of the broader aim of the GO.

Participants recorded over 920K measurement points between April and August, and they are still collecting data. They were instructed to take measures of particular matters (PM10, PM2.5, and PM1) and Volatile organic compound (VOC) to understand their meaning in the local context better later. Some participants also observed indoor detection with the sensors as many of them spend a lot of time inside buildings. Monitoring indoor air quality sparked participants' curiosity as it was considered useful for identifying any sources of pollution, helping assess the effectiveness of ventilation and taking possible corrective measures to improve comfort and health. In this sense, the lack of mobility of some participants due to their age and lifestyle was used as a trigger to develop citizen science research as the data captured inside and outside differ greatly and generate questions regarding the air quality factors in daily life.

In some cases where the data showed significant outliers, it was necessary to recalibrate the sensors for correct data-capturing processes, and other technical aspects (like data transfer) were optimised. Citizens have also been kept in constant contact with the staff of the Association the Most Beautiful Villages in Italy.



The collected data was gathered and aggregated in Apache Druid. Data shown in the Apache Superset visualization contain data from the Atmotube devices the observers carry through the day. The project created a script that every day, at 02:00, gathers data from all the devices and uploads it to Apache Druid. Then, data from Apache Druid is imported into [Apache Superset](https://superset.greenengage-project.eu/)<sup>2</sup> to create the dashboard that will show the information from the Atmotubes. Through several iterations and versions, the platform generates updated information regarding PM and VOC for all the data, Turano Valley and Rome with the possibilities of showing daily, hourly and localized analysis.

Figure 12 shows an example of the Turano Valley Superset Dashboard with several components related to air quality measurements, such as average PM values, maps to identify the highest and lowest concentrations of particulate matter, and time-based graphs to determine peak levels on specific days. The dashboard also allows nuanced visualisations by day, and hour, compare the collected data between different sensors and check on the distribution of points per observer. As an example, Figure 13 provides a graph depicting the aggregation of different particulate matter (PM) levels per hour and their respective average values shown across the hours of the day. It shows how particulate matter levels fluctuate throughout the day, with peaks in the early morning, midday, and late evening. The levels of PM10 are consistently higher than PM2.5 and PM1, which aligns with their particle size. The PM levels shown are lower than the average PM concentrations observed in urban areas of Italy, particularly for PM10 and PM2.5.

The preliminary results of the air quality monitoring were presented in a pedagogical format during the Workshop “City Observatory: exploring Air and Mobility in the Turano Valley and Gerace”, held the 30th of May. During the workshops, the data was discussed and interpreted with the Turano Valley authorities and observers. This activity is described in detail in the following section of data analysis and visualisation.

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<sup>2</sup> <https://superset.greenengage-project.eu/>



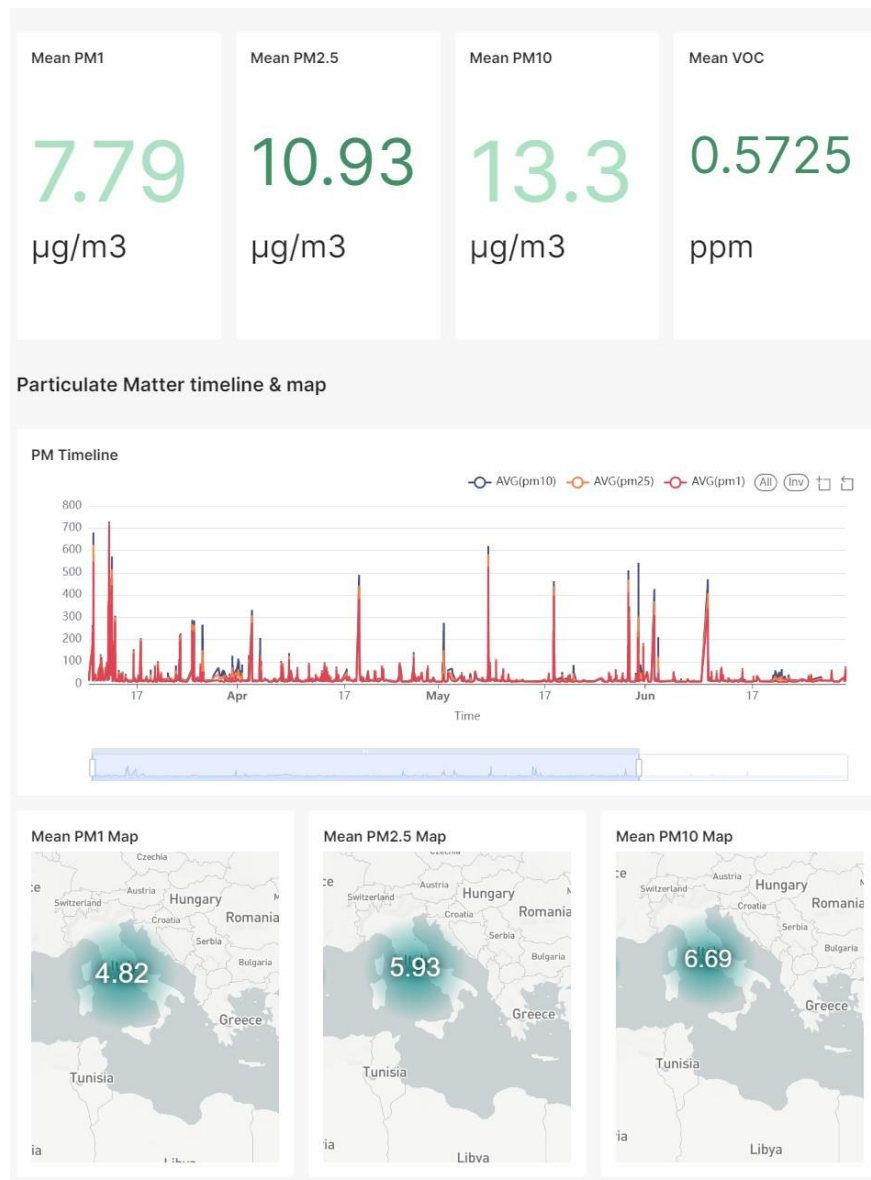


Figure 12. Example of Turano Valley Air Quality Superset Dashboard

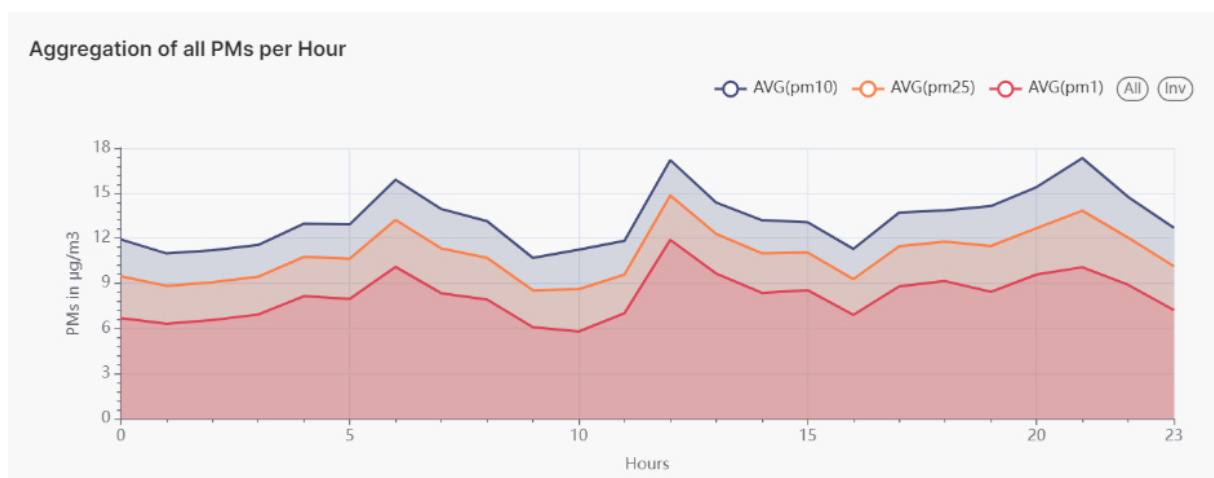


Figure 13. PMs aggregation per hour

The GREENGAGE findings highlight the need to continue monitoring and improving air quality in the Turano Valley through concrete actions that engage the community promoting the understanding of the data to leverage the air quality in the Turano Valley compared to the city of Rome and promoting more

sustainable and environmentally conscious lifestyles. This approach will help not only to preserve the area's clean air but also to further enhance its reputation as a healthy and desirable place to live and visit.

From the data gathered by citizens participating in the GREENGAGE Civic Observatory, it is clear that the air quality in the Turano Valley is significantly better compared to that in Rome, making the Turano area particularly attractive for both residents and tourists. This superior air quality is coupled with an increasing awareness of the impact of daily activities on the local environment, thanks to the use of devices like Atmotubes. These portable devices have enabled citizens to monitor real-time air quality in their homes and surrounding areas, revealing how activities previously overlooked - such as using wood-burning fireplaces, applying paint, using certain cleaning products, and air fresheners - can contribute to the emission of particulates and other pollutants. For example, while air fresheners make the air smell more pleasant, they do not actually clean the air; in fact, they can reduce indoor air quality.

In this context, the better air quality in the Turano Valley not only serves as a competitive advantage over more polluted areas like Rome but also as an incentive to maintain and further improve these conditions. Reducing emissions from private vehicles and promoting sustainable mobility solutions, such as electric vehicles and bike lanes, is seen as essential not only for preserving high air quality but also for enhancing the valley's appeal as a destination for sustainable tourism.

### *Mobility data analysis*

The data capture on mobility activity was carried by MindEarth through an initial analysis of the mobility data (GPS locations) for the Lazio region, purchased on behalf of Borghi Più Belli d'Italia for the spring and summer months of 2023 (eight months). The data included: a) vector geometries (road segments, administrative units, H3 hexagons) - timestamp data b) Travel speed (mapped on single street segments) c) Road congestion (mapped on single street segments) d) origin of trips arriving to a municipality in Turano (mapped on administrative units level). Several questions guided the analysis of this data:

- Which are the busiest and most congested stretches of road in the Turano valley?
- How quickly do people move around the Turano valley area?
- Where do people who visit the municipalities in the Turano valley come from?
- Where do people who live or work in the municipalities of the Turano valley go?

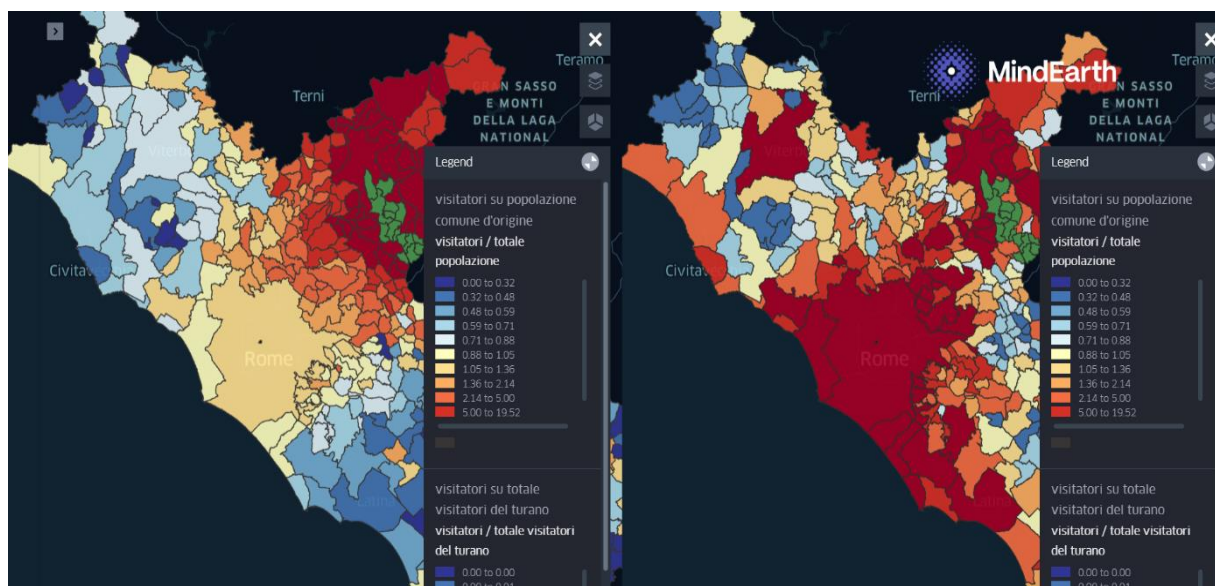


Figure 14. Test visualisation mobility data Lazio region and Turano Valley. Number of visitors over the total population of origin and the population of destination.

The data was analysed by GREENGAGE partner MindEarth, and several visualisation tests were performed. The dataset visualisations show the volume of tourists coming to the Turano Valley, the preferred destinations, the preferred routes, the time they spent in the Valley, and the places of origin. Charts were produced also for each of the different municipalities of the Valley to explore the flux of visitors over time, allowing comparisons between them. Some examples are given in Figure and Figure.

The preliminary results were shared with some citizens during the *Workshop “City Observatory: exploring Air and Mobility in the Turano Valley and Gerace* and discussed within the PST. Some highlights from the data are:

The data showed that people coming to the Valley spend there on average 1 to 2 days (they stay one night on average). This data is coherent with the fluctuation of people (the identification of low and high peaks for each municipality chart) that show that weekends are clearly more crowded.

Qualitative data suggest that there is an important number of weekend visitors who are part of the community working in Rome and coming back to the valley when possible. These observations align with the understanding that the data is more representative of tourists, as they rely on GPS to navigate to the Valley, which introduces a bias in the data. This method is less effective for identifying residents, as it poses more challenges in accurately capturing their data.

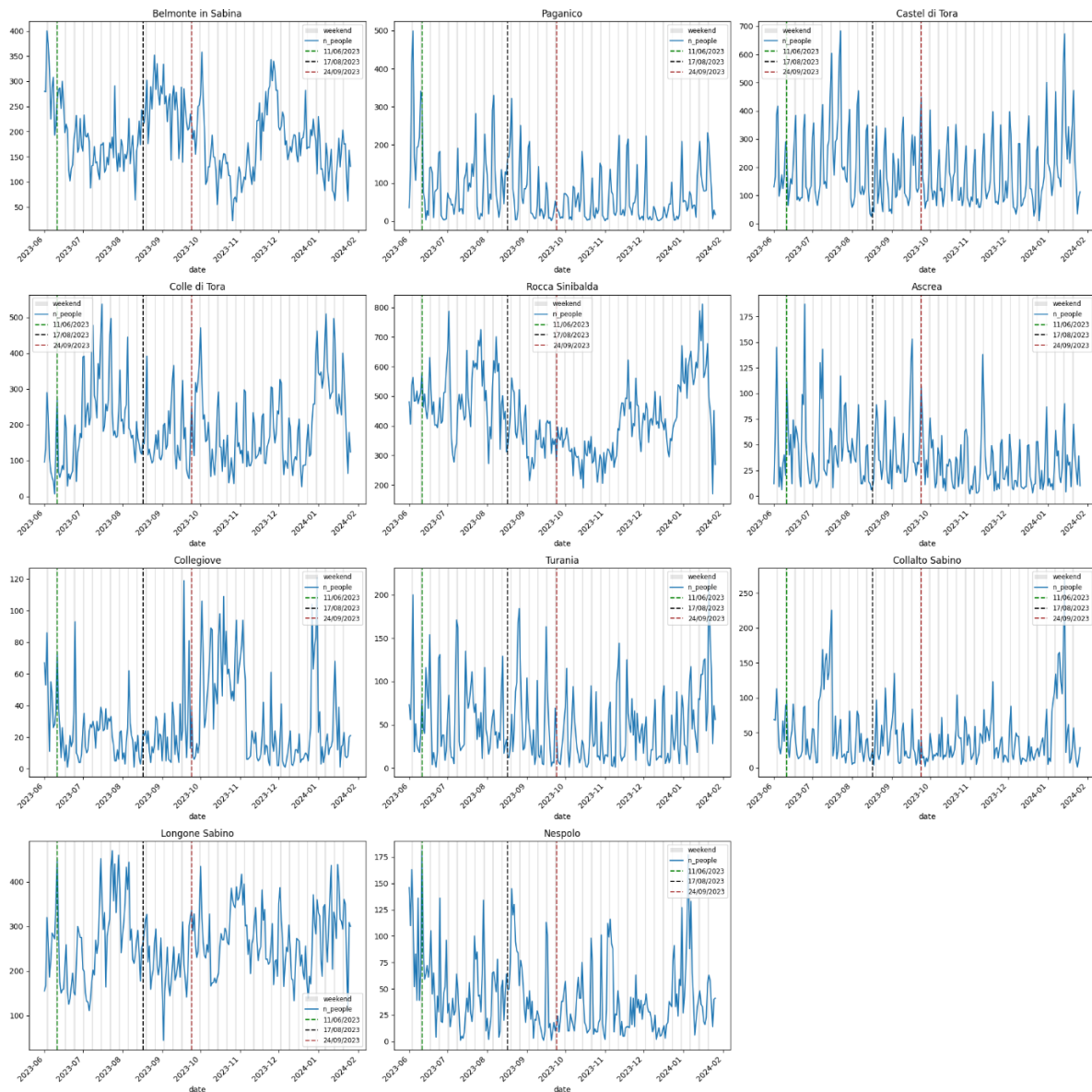


Figure 15. Timeline series of mobility data per municipality in the Turano Valley

Data show that 46% of the total visits are from Rome, which represents roughly 1% of the capital's population. Though visitors from nearby municipalities are less, they represent roughly 25% of the total population of municipalities, with a particular flux of visitors from Rieti.

The data also demonstrated the relationship between congestion and speed in relation to road selection, with the motorway being the preferred route to access the Valley. The spikes in visitor numbers across different municipalities indicate that improved mapping of local and seasonal activities may be necessary. For instance, local events or seasons typical for nut and mushroom picking attract a significant number of visitors, which could account for the variations observed in the timeline series (see for example, Figure 16).

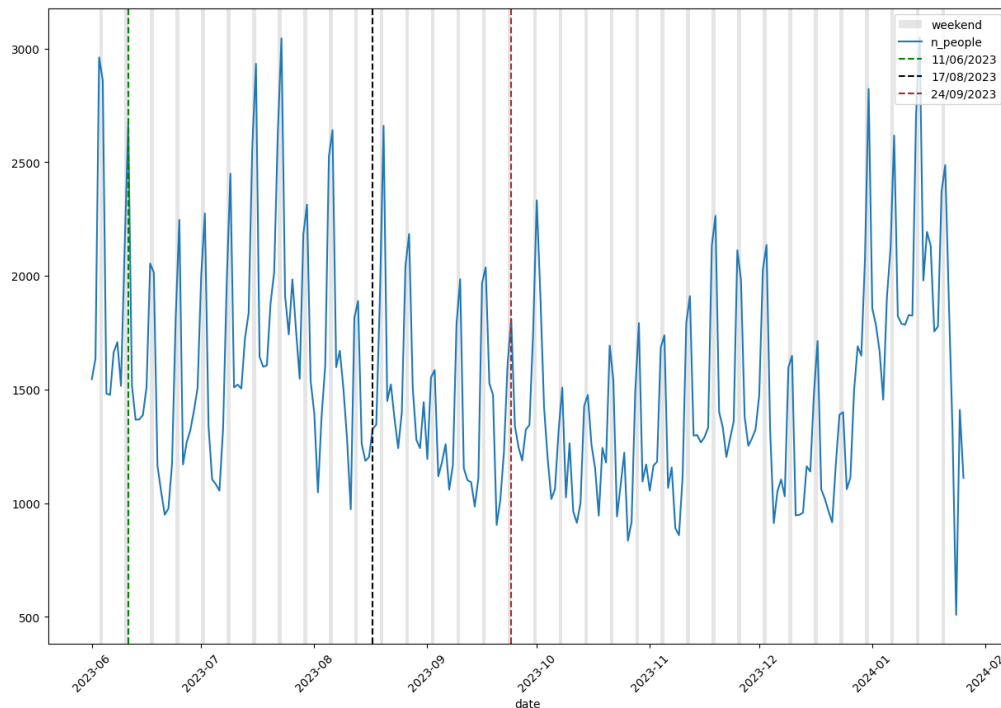


Figure 16. Timeline series of mobility data (mean) in the Turano Valley

#### Workshop “City Observatory: exploring Air and Mobility in the Turano Valley and Gerace

The meeting was held on Thursday, 30<sup>th</sup> May 2024, at the Council Chamber of the Municipality of Collalto Sabino. The meeting was planned as a hybrid gathering, and its purpose was to explain and discuss how air quality and mobility data are interpreted, how mobility habits affect the surrounding environment, and how crucial it is for citizens to be involved in evaluating this data to identify strategic actions that can improve the environment. The event saw the active participation of 24 citizens, plus the experts and representatives of public institutions. In addition, 14 people were connected online for the first 10 minutes, after which the connection was interrupted due to technical problems.

The meeting started with a presentation by the mayors of the Municipality of Collalto Sabino and the President of the Association “The Most Beautiful Villages in Italy”, in the presence of representatives of Paganico Sabino, Castel di Tora, Ascrea and Gerace. Also, a presentation by a representative of Regional Environmental Protection Agency Lazio (ARPA), Department of the State of the Environment Air quality service and monitoring of physical agents, specifically addressed how monitoring air quality through control units and the usefulness of the Citizen Science approach. In particular, it was emphasized that although portable sensors used by citizens are less expensive and complex than the official control units, they provide helpful and sufficiently precise data for a widespread knowledge of air quality in the area. The sensors can help better monitor and understand local pollution involving the community if periodically calibrated. ARPA, as a key stakeholder of the GO, helped validate that the purpose of mobile sensors is to provide capillary measures (in very detailed zones outside the reach of official instruments), promote community participation and promote widespread knowledge on the territory even beyond the purposes of the Agency.

During the ARPA presentation, historical data on PM10 and PM2.5 levels in the Apennine Area were presented to illustrate how air quality is below the danger limits. The significance of citizens' measurements was highlighted, as they help to gain knowledge and awareness of certain pollution phenomena, inform the public about regulatory parameters, and facilitate comparisons of air quality when considering moving to other areas. Referring to the relevant legislation (Directive 50/2008/EC, implemented in Italy with Legislative Decree no. 155/2010) was also helpful.

During the workshop, MindEarth presented how citizens' data can be helpful in urban planning. Other Italian cities' data exemplified its capacity to complement the census, especially when understanding the flux of people at different moments of the year or during the day. They also presented the analysis of the mobility data of summer 2023 (Figure 17) to show the origin location of the Valley's visitors (46% came



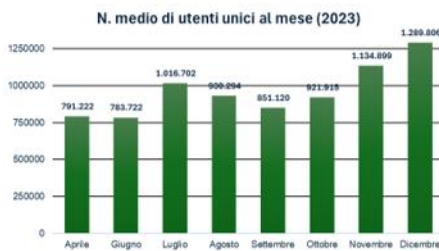
from Rome), the change over time, the used more roads, and the average speed of these roads, to exemplify possibilities of application to communication or planning strategies for the region.

## Mobility in the Turano Valley

**GREENGAGE**

### The mobility data on Lazio in 2023:

- 8 months of data (2023)
- 964,960 unique users per month
- Between 13% - 22.5% of the real population of Lazio each month



Funded by the European Union  
UK Research and Innovation

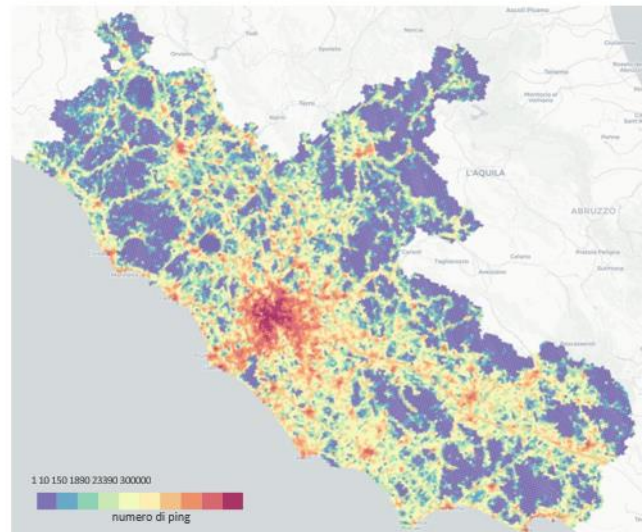
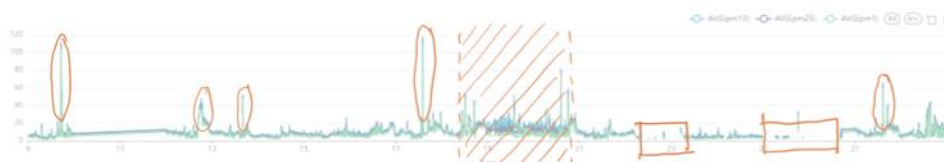


Figure 17. Mobility in the Turano Valley. Translated from original slides in Italian.

Additionally, a simplified explanation for basic interpretation of the collected air quality data was prepared by MindEarth. The differences between hourly, and daily data and possible relationships of specific data with relevant geographical landmarks of the Valley, like the Natural Reserve Monte Navegna were emphasized (Figure 18 and Figure 19).

**GREENGAGE**

### EXAMPLE: HOW POLLUTION LEVELS CHANGE EVERY DAY AND EVERY HOUR



...and observe the unusual values, the higher and lower numbers and all the patterns you see



Funded by the European Union  
UK Research and Innovation

Figure 18. Example of training on visualisation of air pollution in Turano Valley GO (daily and hourly data). Translated from original slides in Italian.



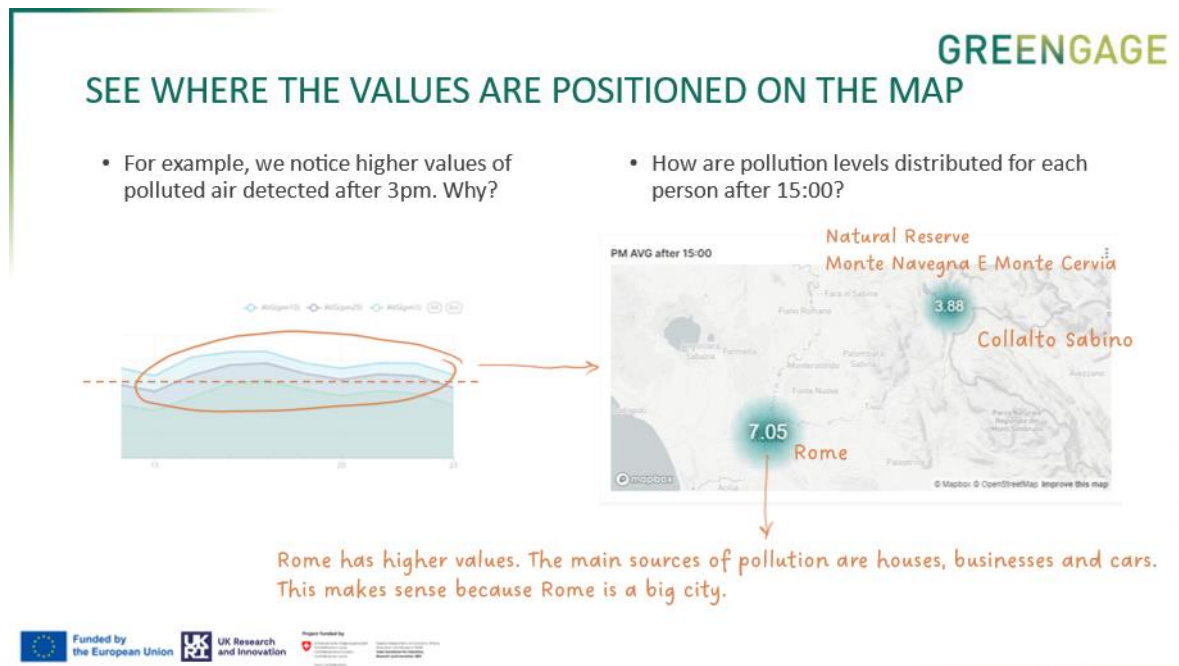


Figure 19. Example of training on visualisation in Turano Valley GO on values and geographical landmarks. Translated from original slides in Italian.

The fact that the Turano Valley has good-quality air in terms of how it can help promote the region's regeneration was another subject of the discussion. "Collalto was a health resort and actually, for those who live there (...) we also have this olfactory sensitivity and we realise this difference and we have precisely the sensorial perception of the quality of the air and obviously we are happy about this. We feel privileged". (Turano GO participant)

Some possibilities pointed out were, for example, socialising and making air quality more visible to those interested in getting to know this territory or providing more detailed information about sustainability plans. "What fascinates me is the way and approach to discovering where we live and how we breathe (...), And. This is the basis for not making small villages even more depopulated. This is what I hope for and what I wish for all the towns in the valley" (Turano GO participant).

Some participants also highlighted the possibility of paying more attention to the Valley's biodiversity when considering sustainable tourism. A concrete example was given when a tourist plucked flowers in the countryside, including a unique local orchid (half a meter tall), almost causing it to disappear from protected areas. "This allows me not only to evaluate the air quality but also to promote the territory and our beauty and, at the same time, prevent and protect the territory. Thus, also avoiding the phenomenon of "profiteering", in order to respect biodiversity. This is fundamental" (Turano GO participant).

The mobility data was useful to potentially address particular projects, like the plan for parking areas in the Valley towns. By analysing the relationship between the number of cars coming in a certain month into the certain area and the availability parking spaces, it is possible to develop strategies to support the municipalities of Turano Valley.

The discussion highlighted the potential risk of data being misinterpreted, which could, for example, contribute to concerns that chimneys and lawnmowers might be banned due to their pollution contributions. Participants also shared their experiences with the sensors, noting that the data indicated poorer air quality inside their homes compared to public spaces. They also discussed the effects of chimney use, house insulation, and the amount of time spent outdoors as a result.

A follow-up meeting took place on June 21<sup>st</sup> 2024, where several paper copies of the road maps were presented to select "ambassadors" of the GREENGAGE Citizens Observatory, along with related post-it notes for them to complete. The aim of these maps is to assist members of the Citizens Observatory in identifying critical areas by allowing them to add observations and suggestions for enhancing connections within and between the municipalities of Castel di Tora, Paganico Sabino, and Collalto Sabino in the Turano Valley. The ambassadors committed to distributing paper copies and accompanying post-it notes among the members of the GREENGAGE Citizens Observatory to gather additional insights on the current state of mobility in the Turano Valley. Overall, the activities have

resulted in a greater familiarity with air quality initiatives and the use of mobile sensors among the observers. *"I have acquired a good competence in the use of the "Atmotube Pro" instrument for air quality monitoring. I am pleased to share that last Sunday I identified, to my great surprise, a place that we can define as ideal for environmental comfort. The sensor recorded a stable air quality value of 98, with extremely low PM levels, which was unprecedented for me!" (Turano Valley Observer).* They have fostered the re interpretation of the region needs in look of connections between regeneration and valorisation of the valley. *"The use of the device is extremely useful. [...] I find that it is a tool to continue to use to improve awareness of air quality in Turano, helping to promote the health and well-being of the community. We are disadvantaged compared to cities in terms of services but advantaged in terms of environmental aspects". (Turano Valley Observer)*

## 6.5 Gerace

### General description

Gerace is an Italian village in the Province of Reggio Calabria. Located atop a cliff, it extends over 28.6 km<sup>2</sup> and has 2,399 inhabitants. Near the municipalities of Agnana Calabria, Portigliola and Canolo, Gerace is located 10 km north of Locri, the largest city nearby, at an altitude of 500 metres. It falls under the jurisdiction of the Aspromonte National Park Authority. Gerace (like the Turano Valley) is acknowledged as one of Italy's most beautiful villages and works with the "I Borghi Più Belli d'Italia" association to address its most pressing challenges.

Gerace urgently needs to revitalise its urban areas to preserve its rich historical and cultural heritage, position the municipality as an attractive investment destination, and promote socio-economic growth. At the social level, the declining demographic trends pose challenges to supporting local communities, just as the ageing population strains social services and limits the workforce's productivity. The town also faces a particular environmental challenge. Climate change and the accelerated environmental degradation of recent years due to the hydrogeological instability of Gerace's cliff have put the village at risk of severe damage and at risk of depopulation. For that reason, the hydrogeological instability of the Gerace cliff requires strategic planning to guarantee safety and sustainability.

By balancing preserving the city's unique identity and implementing contemporary amenities, Gerace seeks to increase its attractiveness for residents and businesses, stimulate job creation and local commerce, and contribute to a more dynamic and resilient economy.

Recently, the Calabria Region selected the municipality of Gerace to coordinate the "Porta del Sole", a project funded by the Next-generation EU Programme through the National Programme for Recovery and Resilience (NPRR) to regenerate, revitalise and enhance the heritage of Gerace village in support of the objectives of the EU Green Deal for sustainable city regeneration. Its objective is the town's cultural, economic, and social regeneration by rebranding it as a cultural attraction and, based on that, building an economic model that boosts local employment and residential attractiveness. With a budget of 20 million euros, the programme envisages nine interventions which aim at the recovery and enhancement of buildings, at improving the accessibility of the village, and at the provision of tourist, cultural and entertainment services, as well as training and incentives for businesses. All these actions will impact not only Gerace but also the entire Calabria Region and Italy as a model of sustainable regeneration. Porta del Sole will be implemented by 2026, involving citizens in data monitoring following the Do No Significant Harm (DNSH) principle. Overall, the regeneration of Gerace seeks to achieve a) community well-being, improving the quality of life of the community b) Social cohesion, bringing the community together c) Economic prosperity d) Environmental sustainability by reducing the negative impact and promoting sustainable practices, e Physical resilience, by building or renovating existing housing properties and infrastructures and assessing the current state of the built environment.

Gerace and the Porta del Sole project's vision is to increase the citizens' awareness regarding urban regeneration phenomena and identify how they can contribute to creating a robust and sustainable governance model for a small, historically preserved village. The future aspirations of the municipality are twofold. On the one hand, educating citizens on Gerace's hydrogeological instability is vital, considering the historical precedents recorded in the southeastern part of the region. In this sense, it is necessary to consider mobility and infrastructure planning at a strategic level, such as: a) developing a global mobility plan for the Gerace area to address the challenges of sustainable mobility and improve connectivity and accessibility for residents and tourists, b) Ensuring the active participation of the community in decision-making processes for collaborative urban planning capable of addressing different needs and preferences, c) Developing policies that promote long-term environmental and social sustainability to preserve the unique characteristics of Gerace.

On the other hand, the vision for the "Gerace porta del sole" project favours citizen science and a participatory approach to environmental monitoring. Thus, and at a societal level, the goal is to involve citizens in monitoring their environment through various means, advocating for more inclusive and participatory decision-making processes that improve the community's sustainability and resilience. Upon success, the experiment will allow other remote and rural villages in Italy and Europe to adopt the same governance approach.

In this context, the GREENGAGE pilot project supports the municipality of Gerace in creating a new local mobility plan, adopting measures against environmental degradation, and improving the residents'

quality of life through participatory decision-making processes informed by data and empirical evidence. The objective is to contribute to the sustainable transformation of Gerace into a shared treasure of history, art, culture, and tradition with the help of state-of-the-art technologies and without harming any of its unique natural, built, or social features, according to the DNSH principles. The pilot project operates in three ways regarding “Porta del Sole”: i) it will provide guidance for the regeneration and mobility of the territory, ii) it will employ citizen science methods in the making, iii) it will help evaluate the success of the Porta del Sole programme through the collection and analysis of data.

The Gerace GO, led by I Borghi Piu Belli d’Italia Association, aims to bring together the Gerace municipality, the Calabria region, local associations, citizens of the Gerace municipality, and local businesses as stakeholders. The Gerace GO seeks to collect data so that the community can actively participate in monitoring and evaluating the impact of various regeneration activities and projects in Gerace and hold parties accountable for any negative impacts. The involvement of Observatory participants in the monitoring process can promote transparency and accountability and increase community trust in decision-making processes. The indicators considered of most significant interest to the community of Gerace relate to its specific contextual conditions and touch upon air quality and water, noise levels, waste management practices, biodiversity conservation and social impacts on local communities.

The GREENGAGE pilot uses qualitative and quantitative data from GREENGAGE observations and official public services, like satellite data. The available data will increase the decision-making ability of citizens and local authorities and their analytical capacity for evaluating and implementing the regeneration process in Gerace.

The data is analysed and interpreted in the context of the project's goals and objectives, focusing on identifying areas for improvement and opportunities for future development. The pilot gives primarily the opportunity to citizens to: (a) collect and submit high-quality and frequent data; (b) participate in collective, educational and decision-making-oriented activities, such as discussion forums, where they will gain valuable insights for their built environment; and (c) design other relevant experiments and solutions to solve further community problems. The GREENGAGE pilot success will be evaluated thus on both its capacity to engage Observatory participants and its efficiency in collecting representative data and generating valuable insights and recommendations that will feed into the Porta del Sole regeneration programme.

The pilot identified the following use cases to be developed in the GO.

**Participatory environmental monitoring:** Monitor environmental data such as air quality, noise levels, and waste management in Gerace.

**Analyse citizens' usage of public spaces and determine the attractiveness of public spaces:** Classifying routes based on the mode of transport and analysing alternative travel modes and suggestions for a Sustainable Mobility Plan is recommended.

The expected impacts of the GO activities are to leverage data and active citizen participation to improve the analytical capacity of the municipality, offering valuable insights on the performance and execution of urban regeneration programs in terms of environmental sustainability and community well-being. This means:

- Offer the opportunity to integrate new data and analysis into the regional open data portal (<https://dati.regione.calabria.it/>).
- Develop a sustainable mobility plan for the Municipality of Gerace so that the latter serves as a model for sustainable urban regeneration practice.
- Create guidelines to improve the liveability of the village and increase its attractiveness throughout the year.
- Create a digital tool for participatory processes to support strategic decisions for urban, transport and environmental planning.
- Determine important indications on air quality and noise during the regeneration works of the "Porta del Sole" project.

- Establish a Do No Significant Harm (DNSH) monitoring system to ensure municipal development initiatives follow environmental conservation principles and prevent environmental damage from planned interventions.
- Promote community commitment and empowerment, instilling a sense of ownership and enabling citizens to play an active role in decision-making and shaping their locality.
- Ability to demonstrate good practices that can be shared with other municipalities and regions facing similar issues.

### Preparing activities

On December 21, 2023, the presentation meeting of the Citizen Observatory was held in Gerace, organized by the Association I Borghi più belli d'Italia, at the Council Hall of the Municipality of Gerace. The meeting was attended by the President of the Borghi più belli d'Italia, the Mayor of Gerace, and the head of the GREENGAGE project for I Borghi più belli d'Italia.

The potential opportunities for social and economic development in the village, made possible by the municipality's participation in the Greengage project, were presented to citizens, local business representatives, associations, and institutions. The presentation also highlighted the synergies and complementary aspects between this project and "Gerace Porta del Sole," a funding initiative awarded to the municipality under the Borghi Linea A call for proposals of the PNRR (Next Generation EU). During the event, Gerace Mayor underlined the importance of active citizen participation for the well-being and environmental sustainability of the territory, welcoming the GREENGAGE project as a precious synergy with the initiatives of the National Recovery and Resilience Plan (PNRR). The president of the association, illustrated the challenges and opportunities for small Italian villages, emphasizing the importance of sustainable regeneration and community participation. Representative of EUROKOM, with a remote intervention, reiterated the centrality of environmental policies and ecological transition, underlining how Gerace can become a model of eco-sustainable and participatory tourism. This meeting represents a significant step towards the valorisation of local resources and the implementation of effective environmental policies, with the aim of transforming Gerace into an example of sustainable development for other Italian villages.

A significant opportunity for visibility emerged from an interview conducted by the regional broadcaster of the national radio and television network (RAI) to the Borghi representative on the GREENGAGE project for the most beautiful villages in Italy. [The video can be accessed on the RAI webpage](#)

Subsequently, an invitation was forwarded to stakeholders to participate in the hybrid meeting on May 30th, 2024, which however had a limited duration of 10 minutes due to technical problems with the internet connection from the village of Collalto Sabino. However, [the link to a video](#) produced for the occasion was released to all participants.

A total of 16 citizens have signed up to the Citizen Observatory (10 male, 6 female) and other stakeholders have shown interest in receiving further updates.

The municipal elections that took place on June 8th and 9th saw the change of the council and this led to a postponement of the expected times for the involvement of the public administration which however recognized and confirmed the full interest in pursuing the objectives previously set in place.

Lastly, during the development of the questionnaires aimed at citizens and managers (more details in D6.5), telephone interviews were conducted, facilitating direct communication between the coordinator of the pilot area and all engaged citizens.

### Final remarks and lessons learned: Turano Valley and Gerace

The GREENGAGE project has set a precedent for leveraging citizen science and data-driven approaches to address complex regional issues. By fostering a culture of collaboration and active participation, it has paved the way for sustainable growth and improved quality of life in the Turano Valley, serving as a model for other regions facing similar challenges.

The co-exploration Citizen Observatory experience of the GREENGAGE project has demonstrated the significant potential of community involvement in addressing regional challenges such as depopulation, environmental sustainability, and urban regeneration in the Turano Valley. Through the active participation of citizens in collecting and analysing mobility and environmental data, the project has facilitated evidence-based decision-making processes that aim to improve the liveability and

attractiveness of the region's villages. The initiative's structured approach, encompassing activation, design, implementation, and moments of sharing phases, has effectively engaged various stakeholders, including local authorities, businesses, and residents, fostering a collaborative environment.

The project's impact is evident in several key areas. Firstly, it has mapped out local challenges related to commuting, digital infrastructure, and air quality, providing valuable insights for policymakers. The integration of quantitative data from sensors and satellites with qualitative information from community feedback has generated a comprehensive database to inform regional planning. Additionally, the collection of mobility and environmental data has supported mitigation planning for environmental hazards and informed urban planning strategies. The participatory approach has also strengthened community trust and empowerment, allowing residents to play an active role in shaping their locality.

The successful onboarding of the core team and the active engagement of participants during various workshops and meetings underscore the community's commitment to the project's goals. The distribution and use (both in Turano and Gerace) of Atmotube sensors for air quality monitoring have not only provided practical learning experiences but also highlighted the importance of understanding and improving both indoor and outdoor environmental conditions. Moreover, the project's collaboration with ongoing initiatives and the development of guidelines for urban and transport planning reflect its comprehensive strategy to enhance the cultural and social regeneration in the pilot areas.

The development of data visualization tools and interactive tools with citizens will further refine and develop the ongoing citizen observatory until October 2025.



## 7 Conclusions and Lessons Learned

This report provides a detailed account of the methods and activities undertaken for campaigning, training, and community building during the first iteration of the pilot phase of the GREENGAGE project (January to August 2024). Grounded in the GREENGAGE CO Methodological Framework, it describes the process and outcomes of continuous campaigning and training, community building, and knowledge sharing of the project pilots. These tasks build upon the results from the Preparing Phase and mark the beginning of operations for the GREENGAGE Observatories.

The GREENGAGE Observatories (GOs) are pivotal in fostering innovative governance and advancing climate action through active citizen engagement. These observatories combine the power of community-driven initiatives with the technical expertise of policymakers, scientists, and data analysts to co-create solutions for pressing environmental challenges. By engaging citizens in observing and co-creating their urban environments, the project aims to directly support climate mitigation and adaptation policies that contribute to achieving carbon-neutral neighbourhoods across Europe.

One of the core objectives of the GREENGAGE Observatories is to enhance the urban governance process by integrating citizen observations into existing data frameworks. Through this approach, the project enriches the data available to public administrations and empowers citizens to actively participate in shaping their cities. By blending authoritative data with insights collected by citizens, GREENGAGE ensures that decision-making processes are more inclusive, informed, and evidence-based, ultimately improving the effectiveness of policies aimed at achieving the goals of the European Green Deal.

The GREENGAGE project has made considerable strides in adapting its framework to the diverse local contexts of its pilot cities, reflecting a shift towards a more bottom-up approach. This flexibility is essential, yet there is a need to refine the methodology to ensure that it remains both adaptable and practical across different regions. During the first iteration of the piloting phase, the Innovation Action Board (IAB) and Pilot Support Teams (PSTs) work demonstrated the importance of interdisciplinary collaboration and structured support. This arrangement helped maintain consistency, provide oversight, and ensure cross-pilot learning, enhancing the observatories' replicability and scalability. Active intermediation and situational onboarding are vital principles that facilitate stakeholder engagement and knowledge sharing across the consortium. These practices have been instrumental in building trust, generating relevant data, and fostering a collaborative learning environment among the observatories.

The project sought to deepen citizens' engagement and provide them with the tools and knowledge necessary to observe their urban environments accurately. Training has been vital in developing and implementing the GREENGAGE Observatories, enhancing knowledge exchange, capacity building, and community engagement. The training programme generated significant learning resources, including lectures, video user guides, and interactive training materials. These assets are not only being used to enhance the current activities. The iterative nature of the training programme allowed for constant refinement based on participant feedback. Materials created in earlier stages are being reused and adapted for future sessions. This led to improvements in the visual and narrative presentation of training materials and the adoption of more engaging methods such as storytelling, practical examples, and interactive tools. Stage II training was more flexible and tailored to the specific needs of core teams in different locations. It focused on ensuring accessibility for lay citizens, including considerations for digital literacy and language barriers. Training was delivered both synchronously and asynchronously, depending on the requirements of the GOs.

Training remains an ongoing process as the project moves through different phases. As the observatories evolve, additional training will be provided to new participants and updated for core teams. Several challenges were identified, including the lack of interactivity due to the online format and the overwhelming content in some sessions. To address these, efforts were made to include Q&A sessions, refine session pacing, and incorporate practical exercises in specific modules. Future training sessions will continue to build on these adaptations to enhance participant engagement and comprehension.

Engagement strategies benefited from leveraging existing community networks, yet some areas faced difficulties in achieving high participation rates. Personalised engagement, such as focusing on themes like air quality or mobility, showed promise in increasing motivation and relevance for participants. Tailored onboarding and flexible recruitment methods, such as paper-based registration, improved participation, particularly in areas with lower digital literacy. The introduction of technological tools, such as the Atmotube Pro sensors, allowed participants to engage more directly with the project. A more

decisive engagement of marginalised groups remained challenging, requiring renewed focus and effort in the second iteration.

While the overall response to the project was very positive, one key takeaway is the challenge of managing participant expectations. Despite the enthusiasm and engagement of the community, there were moments when their expectations exceeded what the project could realistically deliver. This disparity arose because, while participants brought forward legitimate and vital concerns, the project's scope was limited by its predefined objectives and funding constraints. Nonetheless, by refocusing on the core themes and narrowing the scope to what was feasible within these boundaries, the project was able to harness the community's input. Clear communication about project boundaries, focusing on actionable outcomes within those limits, and fostering continued engagement through co-design and direct connections to decision-makers are essential to addressing participants' expectations. The first iteration highlighted the importance of storytelling in translating complex data into engaging and relatable narratives, enhancing community engagement and policy influence. Fostering more cross-pilot learning and developing thematic-based knowledge sharing will be vital to the project's continued success.

Collaborative creation is a central project pillar, with citizens collaborating closely with urban planners, data scientists, and environmental policy experts. Together, they develop and refine technological solutions that support environmental observation and validation. These collaborative efforts are essential to developing innovative urban governance practices driven by data and responsive to the community's needs and experiences. In general, all pilots adopted a low-tech approach during the first iteration, during which primary attention was given to reviewing stakeholders, target groups, engagement strategies, technological possibilities provided by the project and specification of policy frames and policy-making processes to impact. Pilots have focused on creating a solid ground for the co-creation of the GOs, seeking to guarantee their sustainability beyond GREENGAGE. Each pilot and PST designed and carried out co-creation activities during the first iteration within the GREENGAGE framework, adapting it to their specific contexts.

In Bristol, a strong emphasis was placed on the sensitive re-engagement of the local community of the EBLN and the work with young people at schools and the BSYV group to explore, with qualitative data and reflexive methods, the valorisation of youngster experiences to identify key themes and points of interest as input for future GO activities centred in the EBLN's trial scheme. Bristol pilot paid attention to how qualitative data could inform and complement the possibilities of the GREEN Engine in future endeavours (such as the GREENGAGE app and MindView app).

Copenhagen also developed formative research with stakeholders on citizens' perceptions of safety and urban attractiveness. It also tested several technological possibilities that served as the basis for designing future data-capturing campaigns and tasks. This pilot focused on bridging the gap between citizens' data collection and impactful contributions to the Local Traffic Plan in Amager, by developing methodologies to ensure the data's validity as a foundation for public participation and debate. This required the integration of previously distinct use cases through data collection and analysis protocols.

North Brabant strengthened links between government bodies, policy frameworks, and decision-makers. Their efforts were centred on using perception data of barriers and enablers to inform and collectively decide on a key theme: monitoring cycling infrastructure. This process led to increasing contact and firm collaboration with new relevant stakeholders, including Fietzersbond, a cycling union, and clarifying how citizen-generated data would influence regional and local policy decisions by involving municipalities in the GOs.

Turano Valley and Gerace aimed to establish and reinforce trust with the local community while exploring the intersection of regional regeneration efforts and environmental government objectives using the GREEN Engine in selected cases. In Turano Valley, GO has conducted extensive experiments on air pollution monitoring with mobile sensors, analysed mobility data, and used dashcams to generate data on mobility infrastructure. The Turano Valley and Gerace activities allowed high levels of familiarisation with technology and citizen science among an ageing population with limited access to technology and low IT literacy.

The activities carried out during this first iteration of the piloting phase have helped generate valuable insight for the consolidation stage of piloting. In the Bristol pilot, the preliminary identification of points of interest was helpful for better-adapting material and activities (including GREEN Engine) with youngsters, a population with particular pedagogical and communicational needs. The first iteration also

provided insights from the local organisations contacted to be included in the future trial scheme (to be started in the second semester of 2024) regarding key communitarian concerns, their local understanding of development and their success criteria. The trial scheme's collaborative character can help achieve a greater agreement on the merits of the EBLN and opportunities for improvement.

A similar situation can be foreseen in the Copenhagen pilot, whose main objective is to achieve enough validity of citizen-based data to influence the Local Traffic Plan's collective construction effectively (planned in the second semester of 2024). Using traffic volume as the basis for combining air pollution, type of streets, and urban elements will allow for more robust and accurate data. The several tests of technological means and the effort to define how different use cases can be merged to produce meaningful data for the municipality allowed a tailored protocol with high-quality standards. It will allow a much more transparent communication engagement, an efficient use of participants' time, and a better alignment with their expectations.

During the first iteration, North Brabant linked its two GOs by using preliminary data from Cycling Lab Go to inform the structuring phase of its second GO. The joint discussion on barriers and enablers for biking led to a collective decision to work with recreational cycling and biking infrastructure maintenance as the second GO's central theme. As a result of the intensive work of the pilot during the last six months, the alignment of the Province and BUAS, with newly introduced stakeholders (Fietzersbond and the municipal authorities) guarantees the future development of North Brabant's second GO, which has deepened the links with the GREEN Engine.

Turano Valley and Gerace constructed a broad citizen science experience in which the familiarisation and building of trust with residents, local and regional authorities, and local organisations. The pilot work allowed it to define better strategies for engaging and training activities that are more responsive to the particularities of participants (primordially analogue means, close communication contact, face-to-face activities as possible). The outcome of the first iteration of experimentation gave participants a hands-on understanding of the GO activities and scope, organically promoting a learning experience. It also provided helpful information on the local level useful for the mobility plans of the valley municipalities. The outcomes will be helpful in the consolidation phase when the main focus is the synergies with other projects and a more solid link to the regeneration process.

All pilots succeeded in identifying key priorities and stable links to decision-makers within their GOs. In Bristol, the involvement of local councillors in the final wrap-up session provided participants, particularly young people from Barton Hill and the Somali community, with direct access to those who could implement change. A similar outcome was achieved in Turano Valley and Gerace, where mayors have been involved since the beginning of the GO and have participated in collective activities. North Brabant and Copenhagen have established a broader network of stakeholders, and public authorities have been part of the collaborative construction of the GO. This process of co-design, combined with active listening and understanding of community needs, left participants feeling valued and motivated, as evidenced by their eagerness to engage in the second iteration of the GREENGAGE Observatories.

## Annex 1 Thematic co-exploration specification template

### Thematic Co-Exploration for GREENGAGE Observatory (GO) for Turano, iteration 1

**WHY – Reason why this Citizen Observatory’ thematic co-exploration is needed**  
(arguments for promoting the execution of this Citizen Observatory’s campaign)

**Purpose for the Citizen Observatory campaign** and its associated missions.

**Reasons why this Citizen Observatory’s thematic co-exploration’s realization is needed** for your district/neighbourhood.

**List beneficiaries** of this Citizen Science (CS) driven thematic co-exploration.

**Possible policies** for which the results of this CS campaign could help.

**Potential societal / environmental / economic impact expected.**

**Risks (describe potential failure factors and risks).**

**WHO – Involved and affected stakeholders’ groups in Citizen Observatory’s thematic co-exploration** (describe the target groups and their possible motivation)

Who is the **promoter and/or sponsor** of this Citizen Observatory’s thematic co-exploration?

Who are **responsible for the Citizen Observatory’s thematic co-exploration**?

Who are the **domain experts and leaders of the Citizen Observatory’s community** to be involved in this thematic co-exploration?

Who will be the **participants in this CS campaign of the Citizen Observatory** and what will be their **collaborative duties**?

What **social collectives, influencers, societal representatives** could help you disseminating the outcomes of this Citizen Observatory’s thematic co-exploration?

Who will be the **multi stakeholder members affected** by the Citizen Observatory’s **thematic co-exploration’s results**?

**WHAT – Actual endeavours of the Citizen Observatory’s thematic co-exploration** (describe what will exactly be done in this Citizen Observatory)

**The problem** (describe the problem statement and the challenge that you are addressing)

**Objectives** (describe the intended result)

**Added value** (describe the potential benefits for the Citizen Observatory’s thematic co-exploration’s stakeholders)

**Current and desired situation** (describe the current approach including existing practices, and the desired situation)

**CS hypothesis and research questions** (to be validated by the outcomes of the execution of the Citizen Observatory’s thematic co-exploration)

**Metrics definition** (of indicators of success for the Citizen Observatory’s thematic co-exploration)

**WHEN – Planning of activities and period when Citizen Observatory’s thematic co-exploration will be executed** (indicate for how long, what activities, where and for whom will be realized)

**Workplan: phases, milestones, and tasks** to be completed during the Citizen Observatory’s campaign execution, i.e., onboarding, the realization of a citizen science experiment, evaluation, and validation.

**Work assignment of tasks to participants** during the Citizen Observatory’s thematic co-exploration’s duration

**Engagement plan for Citizen Observatory’s thematic co-exploration’s participants**

**WHERE – Geographical locations where Citizen Observatory’s thematic co-exploration will take place** (actual geographical areas where data collection and analysis will be carried out)

**Geographical areas covered** by the Citizen Observatory’s thematic co-exploration.

**Types and number of measurements** to be taken by each area and period

**WHICH – Materials and resources** (actual materials and resources needed to execute the Citizen Observatory’s thematic co-exploration)

**Logistical and financial support** (describe what resources you will need to carry out the project):

**Needs regarding infrastructure** (e.g., number of sensors, and expected date for availability, maps to be used, access to the platform, etc?)

**Functionalities of tools from GREENGAGE or third parties** to execute this Citizen Observatory’s thematic co-exploration.



**HOW – Data analysis process to be able to capture, analyse and generate indicators and visualizations sought in Citizen Observatory’s thematic co-exploration**

**Data protocol for your Citizen Observatory’s thematic co-exploration:**

What type of data do you need?

Does it involve objective or subjective measurements?

Do you focus on one or more parameters?

Does it involve creating a new dataset or adding to an existing dataset?

What is the geographical and temporal scope of the data collection process?

Do you need a representative sample?

How will participants have to collect the data: via one or several measuring instruments?

**Analytical methods** which should be applied within the Citizen Observatory’s thematic co-exploration.

**Visualization and metrics to generate to support the decision-making** through Citizen Observatory’s realization.

## Annex 2 Summary pilots first iteration

Pilot	Data of interest	Capture	Visualisation	Analysis
Bristol	Urban space perception	Diaries	NA	Thematic analysis (in progress)
	Urban space perception	Mapping exercise	VRVIS (in progress)	Thematic analysis VRVIS (in progress)
	Validation exercise (qualitative and App data)	Greengage MindView	App, MindEarth	MindEarth
Copenhagen	Perception survey	Maptionnaire (with stakeholders)	GISAT (planned)	GISAT (planned)
	Air pollution	AtmotubePro (planned) + Satellite (planned)	Superset (planned) + GISAT (planned)	Superset+ GISAT+MindEarth
	Mobility data: Traffic volume, numbers and type of vehicle	MindView app (planned)	MindEarth (in progress)	MindEarth (in progress)
North Brabant	Maintenance biking infrastructure	Fietsersbond app)	DIGITWIN (planned)	DIGITWIN, Fietsersbond app (planned)
	Bike Use	Survey & Diaries	PowerBI (completed)	PowerBI + VRVis tech

	Recreational route decision criteria	Survey & Diaries	DIGITWIN, Google Maps, GISAT (in progress)	Forms (in progress)
Turano Valley	Air pollutants PMs VOC	Atmotube Pro	Superset dashboard	Superset with MindEarth
	GPS mobility data	Bought mobility data set	MindEarth	MindEarth
	Mobility infrastructure (maintenance points)	Dash cam 1	MindEarth (in progress)	MindEarth (in progress)
Gerace	Air quality	AtmotubePro (work in progress)	Superset (planned)	Superset with MindEarth (planned)
	Mobility infrastructure (maintenance points)	Dash cam 1	MindEarth (in progress)	MindEarth (in progress)

## Annex 3 Thematic co-exploration Gant charts

