BDC

Università degli Studi di Napoli Federico II

24

numero 2 | anno 2024

BDC

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BDC - Bollettino del Centro Calza Bini Università degli Studi di Napoli Federico II
Registrazione: Cancelleria del Tribunale di Napoli, n. 5144, 06.09.2000
BDC è pubblicato da FedOAPress (Federico II Open Access Press) e realizzato con Open Journal System

Print ISSN 1121-2918, electronic ISSN 2284-4732

Journal home page www.bdc.unina.it

BDC volume 24, issue 2, year 2024

print ISSN 1121-2918, electronic ISSN 2284-4732

Inclusive governance for water areas and coastal landscapes. Participatory planning in the Phlegraean Fields

Governance inclusiva per gli spazi d'acqua e i paesaggi costieri. Pianificazione partecipativa nei Campi Flegrei

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ABSTRACT AND KEYWORDS

Inclusive governance for water areas and coastal landscapes
Over the last century, coastal transformation has mainly dealt with urban waterfronts, the enhancement of logistic and economic demands, and the recovery of coastal aesthetic value. However, the current condition of urban shores highlights the need for planning and management to focus on the theme of coastal socio-environmental issues, which require a more inclusive approach. The paper describes the international project 'WAVE: Water Areas Vision for Europe', whose main aim is to propose innovative design and analytical methodologies to balance the gap between local strategies and community demands in coastal areas. Through multi-actor and multi-disciplinary cooperation, the research dealt with the issue of functional and ecological fragmentation of water areas in order to support the establishing of a lasting socio-ecological balance, working at a local and micro-local scale. This contribution explores the 'living lab' tool, applied in the Phlegraean Fields, as an innovative and integrated learning environment, both physical and virtual, in which it is possible to face community problems and propose solutions at a local level, supporting the governance processes underlying sustainable and inclusive changes.

Keywords: coastal areas, sustainable planning, Living labs, water spaces, Phlegraean Fields

Governance inclusiva per gli spazi d'acqua e i paesaggi costieri
Nell'ultimo secolo, le trasformazioni costiere hanno principalmente riguardato i waterfront urbani, il soddisfacimento delle istanze logistico-economiche, nonché il recupero del valore estetico delle coste. Tuttavia, l'attuale status delle coste urbane evidenzia la necessità pianificatoria e gestionale di approfondire il tema delle questioni socio-ambientali costiere, che richiedono un approccio maggiormente inclusivo. Il contributo descrive il progetto internazionale "WAVE: Water Areas Vision for Europe", il cui obiettivo principale è proporre metodologie analitico-progettuali innovative per bilanciare il divario tra le strategie locali e le esigenze della comunità nelle aree costiere. Attraverso una cooperazione multi-attoriale e multi-disciplinare, la ricerca ha affrontato il tema della frammentazione funzionale ed ecologica degli spazi d'acqua a favore di un equilibrio socio-ecologico duraturo, agendo a scala locale e micro-locale. Questo paper esplora lo strumento del "living lab", applicato nei Campi Flegrei, come ambiente di apprendimento innovativo e integrato, sia fisico sia virtuale, in cui è possibile affrontare i problemi comunitari proponendo soluzioni a livello locale, sostenendo i processi di governance alla base di cambiamenti sostenibili e inclusivi.

Parole chiave: aree costiere, pianificazione sostenibile, Living labs, spazi d'acqua, Campi Flegrei

1. Living Labs and the role of the university

The scarcity of natural resources, in the context of progressive demographic growth on our planet, calls for the urgent need for the pursuit of global sustainability and highlights the importance of addressing the challenges of material, water, land and energy consumption efficiency. The 2030 Agenda and the SDGs have clearly spelled out the goals that the global community will be forced to pursue in order to strike a balance between economic development and the conservation of natural resources. The problems of sustainable growth are articulated in different spheres of knowledge and each region on the planet has its own particular characterisation, yet it is clear that there are many actors involved in these dynamics who address them with their own objectives and instruments, almost always in conflict between different interest groups. Therefore, transdisciplinary, innovative and user-centred approaches are required to deal with this complexity. Universities, as centres of knowledge, are seen as crucial players in achieving sustainability goals because they can lead by example, collaborate with stakeholders, connect with industrial sectors and, above all, train future operators capable of managing sustainable processes. Unlike local administrative bodies and business operators, universities have the advantage of long-term planning and are generally regarded as reliable institutions in innovation processes. Within their organisation, students also play a significant role in leading sustainability movements, both locally and globally, by demanding sustainable practices from their universities and engaging in natural resource management projects. It is crucial to enable young graduates and future facilitators of sustainable practices to remain ambitious and proactive in addressing contemporary challenges, especially when entering the professional world. Academic bodies, with their expertise in research and emerging technologies, have the potential to drive global transformation, acting above all as neutral entities, and can contribute through rigorous scientific research, educating students and testing sustainable solutions (ENoLL, 2015). The adoption of a thoughtful approach to sustainability within university communities will have significant global impacts in the short and long term. Consequently, universities are entering a new era in which the concept of ‘co-creation for sustainability’ emerges as a central mission. This involves collaborative efforts, engaging various stakeholders, to collectively develop sustainable solutions and drive positive change.

An effective tool, globally recognised in the scientific community, is the Living Lab, a dimension where local communities find space for dialogue and discussion on needs and requirements for conserving resources and improving quality of life.

1.1 Living Labs as user-oriented tools

Living Labs (LL) are innovative approaches that revolve around open and fundamentally user-centred innovation ecosystems. These ecosystems act as practice-driven organisations that facilitate the development of new solutions through changemaking, rapid prototyping of services, co-creation and other systems of innovation management. They provide environments in which users’ development processes can be studied, tested and implemented.

Numerous studies have contributed to the understanding of Living Labs, leading to a general systematisation of approaches. Verhoef and Bossert (2019) established a useful overview of the main bibliography, which is summarised here for further exploration of the topic: Steen and van Bueren (2017) developed a detailed organisational and management approach based on an analysis of 90 innovation projects in Amsterdam; Maas et al. (2017) highlighted the characteristics that

differentiate Living Labs from other similar experiences, emphasising the importance of user co-creation and adherence to concrete issues emerging from local communities; Keyson et al. (2017) gathered knowledge from the European SusLab project, highlighting the relevance of electronics and digital tools to enhance citizen participation; finally, McCormick et al. (2017) developed a checklist for Urban Living Labs.

From the scientific literature (Schaffers & Kijl, 2019) it can be deduced that when sustainability is the focus of these co-creation environments, the term 'Sustainable Living Labs' is preferred, but there are also other interesting approaches to sustainable development such as Real-World Laboratories or Transformation Labs. The former, for example, provide more freedom in the form of research and user participation, while Transformation Labs adopt a facilitator-led approach with a focus on social issues.

In all cases, however, it emerges that Living Labs require a careful assessment of the operational context prior to implementation and are structurally designed to address complex challenges and multi-stakeholder problems. First of all, some crucial aspects for the participation process have to be established: location, available funds and objectives. Furthermore, Living Labs have the potential to accelerate participatory processes through the adoption of new technologies capable of increasing user involvement and fostering rapid innovation, along with the co-creation of research questions, goals and research settings.

In particular, Living Labs have progressively become a place where universities take on the role of coordinator and/or facilitator of the processes. Verhoef and Bossert (2019) propose in their volume 'The University Campus as a Living Lab for Sustainability. A Practitioner's Guide and Handbook' the concept of the university campus as a Living Lab for sustainability, which involves using this location as a valuable resource to investigate, test and demonstrate innovative technologies and services. Globally, several universities have already launched campus-based Living Lab projects, such as the 'Harvard Living Lab initiative' to improve health and the environment, the 'EnSign Reallabor' for a climate-neutral campus and the 'Green Village' at TU Delft to accelerate radical innovations.

The book raises the question of how university communities can catalyse the transformation of global sustainability and suggests that creating links between education, research and campus operations through Living Labs can be an effective approach for capitalising on local energies and solving concrete problems. Furthermore, it emphasises the need for rigorous research to analyse the impacts and methodologies employed by Living Labs, beyond simple case study descriptions.

In addition, it points out that university communities are composed of highly motivated users, yet often with different priorities and stakes. This variety is resolved by segmenting academic stakeholders and aligning them with their respective interests and responsibilities in relation with the local area. This means involving the research community to test ideas and obtain concrete outputs, involving students for training experiences, engaging the campus community and collaborating with external stakeholders such as the neighbourhood, municipality and companies. In summary, the authors promote the concept of the university campus as a Living Lab for sustainability, emphasising the potential for transformative change and the importance of interdisciplinary collaboration within the university community and beyond.

1.2 The BacoLIving L@b

Within the framework of this experimental field of research and along the lines of

the theoretical and applicational suggestions for the establishment of a Living Lab, although not strictly referring to a university campus, the Erasmus+ WAVE (Water Areas Vision for Europe) project attempted to start up and develop the creation of 7 living labs in Europe (Germany, Romania, Belgium, Estonia and Italy) in about 30 months and to compare the results. In particular, the development of the BacoLIving L@b in the coastal metropolitan area of Naples, coordinated by the authors, was also characterised by the adoption of digital tools useful for the acceleration of co-design activities.

The main objective of the WAVE project was the experimentation of a new international online university course focusing on the sustainable development of water areas in urban and peri-urban contexts in Europe, combined in a highly innovative way with the building of local Living Labs. The realisation that the sustainable development of areas characterised by the presence of water is not yet fully defined, although there are policies referring to them, stimulated the implementation of an academic education programme based on the following two innovative elements:

- Integration of interdisciplinary knowledge on marine, lake and river areas by merging the expertise of teams consisting of geographers, architects, urban planners and landscape architects.
- Active community involvement with a living lab approach: each university partner set up one around a specific challenge of its water landscape.

In this way, the universities led the process with local communities in joint learning environments and explored innovative methods for spatial analysis, strategy building and transformative scenarios. In addition, activities were conducted through ICT approaches using methods such as GeoDesign and online GIS.

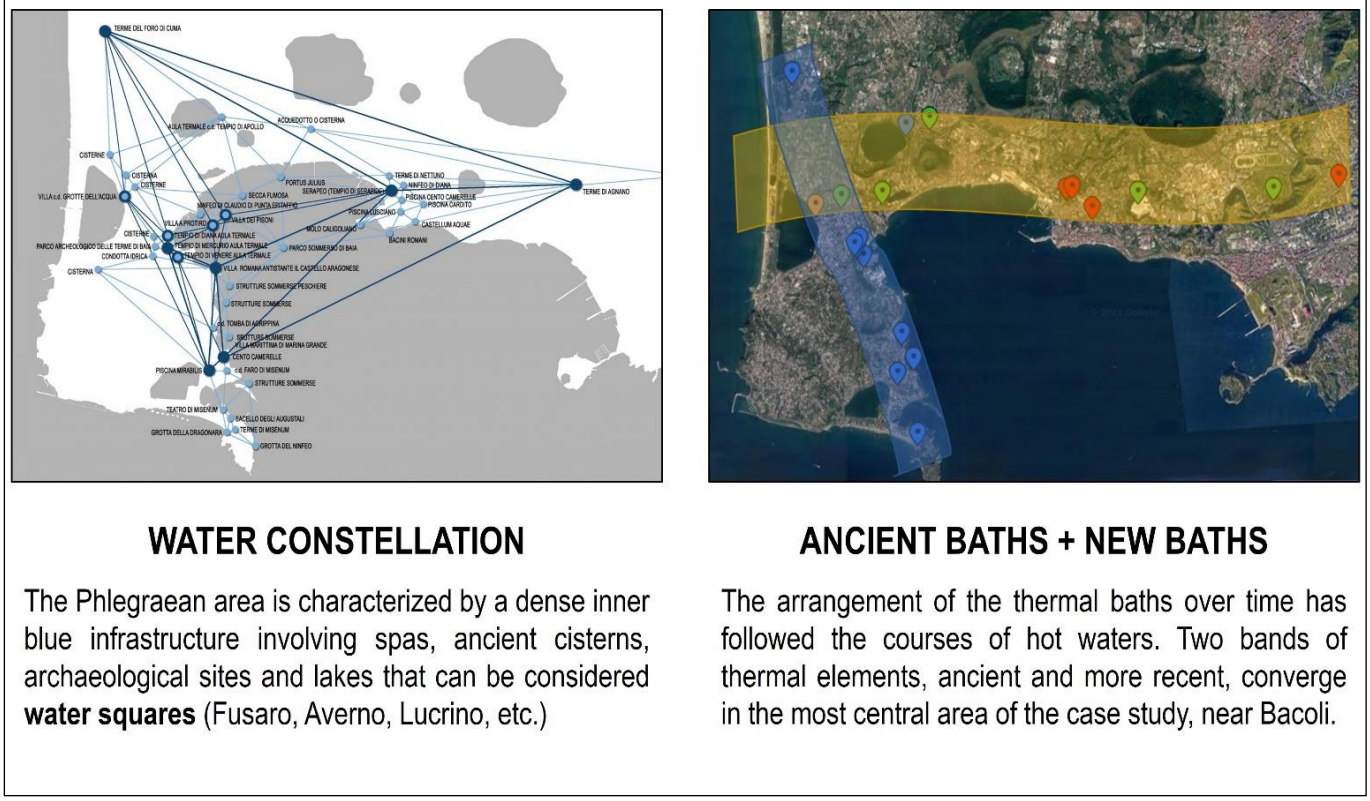
The project model was severely tested by the pandemic situation that marked almost half of its duration, however, the digital approach greatly helped to overcome these difficult circumstances.

In this context, the Italian local operational unit, led by the authors, set up a living lab on the territory of the municipality of Bacoli in the Phlegraean Fields, in the western part of the Neapolitan metropolitan area. The Phlegraean Fields zone represents one of the most complex territories in Campania due to the particular stratification of historical and geological events. Its naturalistic-environmental perimeter includes the wide valley located between the Posillipo hills to the east and the Licola plain to the northwest, including the municipalities of Pozzuoli, Bacoli, Monte di Procida, Quarto and part of Naples with a population of about 200,000 inhabitants. It is a volcanic area composed of 20 extinct craters that define the vast Phlegraean caldera, characterised by an articulated morphology composed by the presence of 4 lakes (Fusaro, Averno, Lucrino, Miseno) and a weak hydrographic network. The presence of volcanic activity has enriched the landscape with a wealth of thermal springs used since ancient ages, particularly in Roman times, for recreational and medical purposes. The area was the site of vast aristocratic villas and military garrisons, hosting the imperial fleet first in Lakes Lucrino and Averno and later in Lake Miseno.

The choice of this water landscape was based on the awareness of the local uniqueness that integrates archaeology, crater morphology and volcanism expressed in the widespread presence of thermal waters. The identification of a ‘constellation of ancient and modern thermal waters’, which connects ancient cisterns, thermal halls, minor archaeological remains and modern thermal centres in activity, constitutes the framework of the living lab project around which it is possible to define policies for the redevelopment, conservation and valorisation of the

landscape. The main challenges of the area are the difficult accessibility due to the rugged orography, the preservation of a vast archaeological heritage subject to increasing degradation because of the difficulty of maintenance, the need for redevelopment of high-density settlement fabric that has depleted environmental resources, and the response to the demand for socioeconomic development (Acierno, 2024).

Figure 1. The BacoLIving L@b revolves around some of the main water socio-ecological resources of the Phlegraean Fields



Source: Image elaborated by A. Pagliano

The Living Lab constitutes the instrument to attract stakeholders and open discussions and consultation boards for the transformation of the areas near the lake and the coast by prefiguring thematic itineraries for the enhancement of water landscapes.

The Living Lab of the Municipality of Bacoli was established on the basis of a collaboration between the Department of Architecture of the Federico II University of Naples and the municipal administration. The latter is particularly active in the area and is supported by numerous associations whose aim is to improve the area's living conditions by enhancing the exceptional landscape and environmental resources, as well as to solve the numerous critical issues of a densely urbanised territory with evident effects on the environment in growing degradation.

The administration had already developed research projects with the university in the past, and the establishment of the Living Lab within the WAVE project was the natural continuation of a now consolidated relationship. In particular, the administration is part of the Domitio-Flegreo Masterplan, a programme for the redevelopment of a 73 km long stretch of coastline involving 14 municipalities promoted and financed by the Campania Region. The municipality of Bacoli had

participated in the Masterplan by proposing a number of projects on its territory, involving the restoration and enhancement of various archaeological sites, as well as actions to improve the sustainable mobility network. These include the restoration of the 'Grotte dell'Acqua' site and the development of a green parking area near the Casina Vanvitelliana on Lake Fusaro, projects that have already been financed and are being implemented. The Living Lab idea stems from the administration's specific request to the university to provide support for the funded projects and especially to develop new proposals for the Domitio-Flegreo Masterplan. The university, in response to this request, promoted the idea of developing a Living Lab with the aim of involving the local community and listening to the needs of the population, in order to co-plan interventions that would emphasise the water landscapes characterising the municipal territory, from the two lakes of Miseno and Fusaro to the widespread presence of ancient and modern thermal sites.

Figure 2. Framework of the Bacoli Living Lab: the activity involved a wide range of stakeholdesrs to promote lake Fusaro and relative coast enhancement

Source: Image elaborated by A. Acierno

The Living Lab of the Municipality of Bacoli (hence the name 'BacoLIving L@b') was built from an existing network of local associations invited to participate by the city administration together with a number of companies working in the spa sector, tourism operators, schools and ordinary citizens. The Living Lab started in the early months of 2021 in the midst of the Covid-19 pandemic, so in the initial phase it made

use of digital tools, employing an online platform for presentation meetings and opening discussion on the objectives to be pursued. The activities continued in this mode until the summer of 2021 with the participation of university students who carried out targeted interviews and field trips together with some stakeholders. In this first phase, the students worked out design solutions for the creation of equipped spaces and cycle paths along Lakes Miseno and Fusaro in Bacoli, which were published in a booklet. In a subsequent phase, co-mapping and survey activities were implemented using digital tools such as Google My Maps and Google Forms, and all the evidence gathered was brought back to the workshop organised at Lake Fusaro in September 2022, as a basis for co-design activities. The prevailing method used in the living lab was the 'Mapping Resources through neighbourhood Exploration technique,' which was introduced during the site visits.

This method allows students, stakeholders, residents and local authorities to walk around the area and discuss the shared results together, finding co-designed solutions.

Its phases are listed below:

1. Living Lab kick-off meeting: stakeholders introduce themselves and present their knowledge and objectives for the study area.
2. Collection of key spatial data (maps, social data, description of natural and social systems).
3. Setting up the shared platform via the 'Google My Maps' tool with identification of the layers of interest.
4. Planning the routes to be taken during the explorations (number and type of participants, time to spend, devices, definition of the limits of the exploration area).
5. Site trip with exploratory walk (the group and selected leaders visit the study area, taking and posting their own photos on the platform to document their personal point of view).
6. Discussion of the results collected on the shared platform to highlight common problems, different perspectives and proposed solutions. These solutions can then be further classified and categorised by defining different priorities of intervention.
7. Realisation of a shared workshop with the participation of stakeholders and the central role of students and academics in guiding activities.
8. Elaboration of design solutions developed with the members of the living lab in the form of graphs and hypertexts (videos, interviews, images, etc.).

The community's expectations mainly concerned the provision of public facilities, squares, playgrounds for children and resting areas for the elderly, as well as the mitigation of the negative effects of mass tourism in the area. Citizens were involved in the living lab not only through direct interviews with privileged subjects (economic operators, teachers, students, members of associations) but also through a questionnaire, elaborated in Google Forms and distributed online by means of QR codes disseminated in schools, by the municipality and by university students on their social channels.

The activities were supported by digital technologies, mainly through videos and augmented reality, which made it possible to speed up the processes and, above all, to disseminate the results of the workshop at the same time. Finally, digital tools allowed the process and results to be kept alive on platforms that are still usable even more than a year after the conclusion of the project.

2. Digital technologies for landscape knowledge and representation in the BacoLIving L@b

The analysis, reading and understanding of landscape address numerous spatial, dimensional and multidisciplinary problems. The present-day polysemy of the very concept of landscape is determined by the multiple fields of research in which this term is applied, such as physical geography, the natural and social sciences, as well as urban planning, economics and anthropology, etc. Within this broad and varied range of approaches and disciplines, the 2000 European Landscape Convention stated that the term 'landscape' refers to the perception that populations have of a certain portion of territory whose character derives from the action of natural and/or human factors and their interrelationships that the observer is able to recognise. This interpretation configures the landscape as a 'mental image of the territory', produced by the sensitive experience of the observer and determined certainly by visual perception, but also by the interaction of many emotional, cultural and psychological factors; understanding, recognising and being able to transform a certain area into a landscape requires the ability to orient and control the locations on the territory together with the ability to recognise the visual identity of the individual 'scenic units', as defined in New York's Special Scenic View District, a planning tool that aims to protect and preserve the city's most significant views from invasive transformations[1]. A complete and conscious representation of the landscape, as a tool for analysis and protection, as a prefiguration of possible impactful transformations, as well as a way of sharing among local communities to trigger virtuous participatory processes, thus requires a multi-scalar multiplicity of geometric methods and graphic tools.

'Recently, the attention of researchers has then mainly turned to the objective measurement of the visual quality of the landscape in terms of the aesthetic preferences of observers. The representation of the landscape is elusive, ephemeral, always partial and incomplete, always subjective. This representational difficulty is countered by the multiplicity of means, tools and techniques of representation, which, however, sometimes neither simplify nor clarify' (Balestrieri et al. 2020, p. 56). In the current Italian legislation, landscape reports specify that the landscape must be analysed by recognising the morphological, material (natural and artificial), chromatic aspects, construction techniques, elements and visual relationships that characterise the place; however, they do not provide a methodology for analysing those aspects that they instead invite us to identify. There is in fact no univocal method and the reading of the landscape is absolutely subjective and relies exclusively on the experience of the planner. During the BacoLIving L@b an integrated methodology of digital technologies for communication and representation was therefore experimented with a participatory approach by the students and local communities from the initial stages of analysis and knowledge for the project to the evaluation of the impacts produced by the transformations proposed during the international workshop. The phases of the process were marked by objectives and specific tools of representation. The first, defined in the international workshop as '*Understanding, empathising and building awareness of landscape'*, was aimed at activating a process of identification of those characteristics that contribute to the constitution of the image of the landscape surrounding Lake Fusaro, centred on the visual and mental processes of recognising and enhancing the aesthetic qualities of the landscape experienced through the instinctive enjoyment of a non-specialised observer. A dynamic perception technique was chosen, to be implemented through conscious walking along the lake and its surroundings, so as to affirm the role of perception in the act of getting to know the landscape, while

going beyond the concept of static contemplation (Sabbion, 2022).
'Landscape, then, as an *empirical manifestation of territoriality*' (Turco, 2002, p. 39), that can only be understood in relation to the territorial (physical and human) factors and dynamics of which it is precisely the 'manifestation'. For the same reason, it is not only constituted by the materiality of its elements, but also by their immaterial representation, through the meanings and values that we attribute to it (Farinelli, 1991). Landscape therefore has a double dimension, always co-present: 'it is both what we see and how we see it' (Castiglioni et al., 2020, p. 66).

Figure 3. Process of the integrated analysis of community spaces

Source: Image elaborated by A. Pagliano

A particular attention was given to the educational dimension linked to the concept of landscape, providing elements of knowledge of landscapes and, at the same time, promoting a training of the gaze that would allow participants to acquire a greater awareness of the form and spatial relations of the territory, linked to that perception of oneself in that space that builds a conscious relationship between the individual and the landscape. The digital tools adopted during the shared exploration (*Go-Along Walk*) were those of co-mapping, digital storytelling and augmented reality.

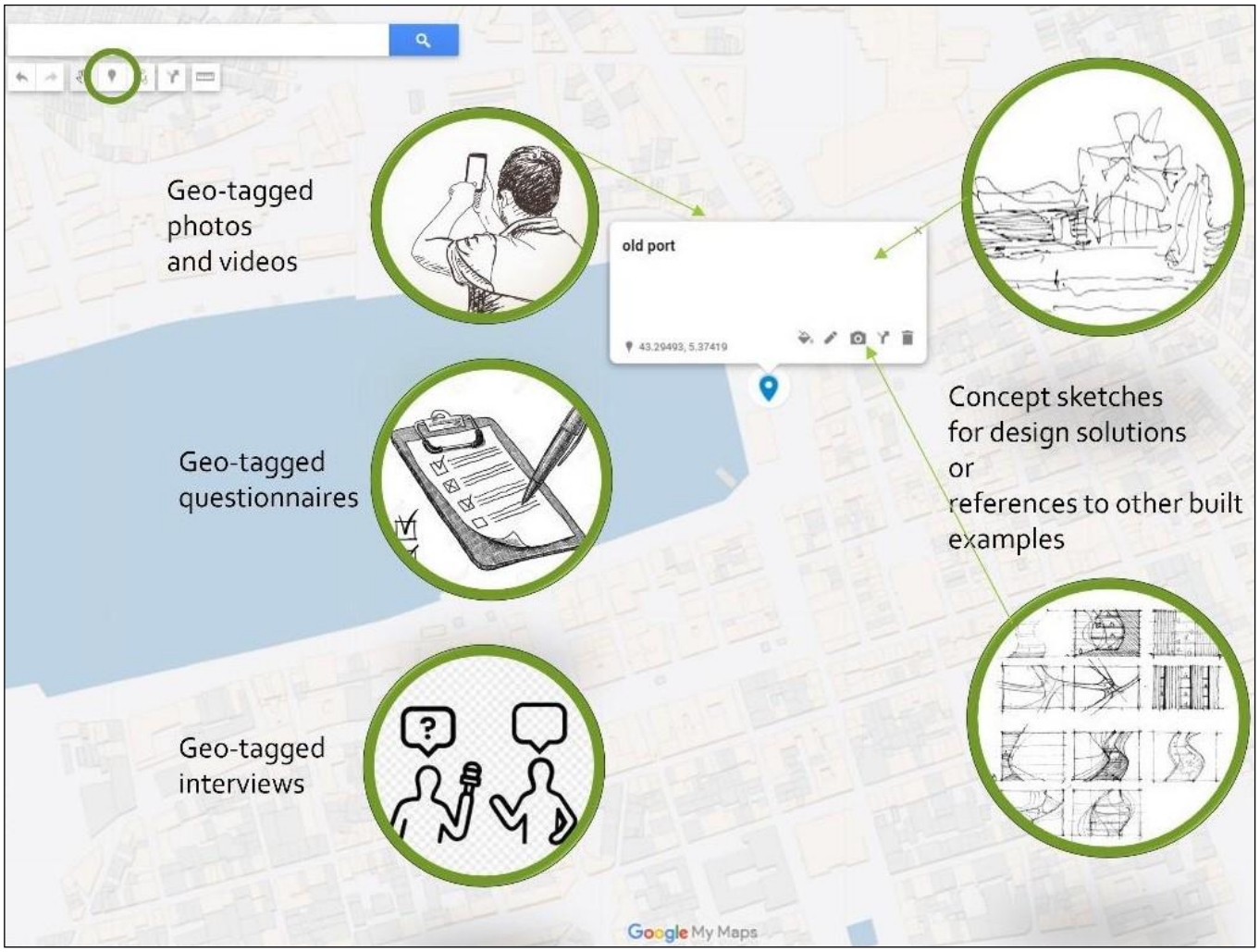
2.1 Co-mapping

Sharing data in real time can increase awareness and knowledge of places while on site: all participants were asked to adopt a digital map specially created through Google My Maps as a co-mapping tool, intended as a shared digital place to collect data from on-site surveys, according to a participatory process. This direct connection with the site is fundamental to develop solutions based on a real knowledge of the complex dynamics of the investigated territory. The digital map, which was GIS based but suitable for the non-expert audience of stakeholders, the local community and the students who walked together during the first cognitive experience, was prepared in advance by identifying the categories of data to be co-

mapped (video-interviews, geo-localised questionnaires, photographs, historical images, project sketches, design references or simple written notes with suggestions or descriptions of the critical issues encountered) and setting up the related thematic layers for their coherent organisation. The thematic layers in the digital map were organised as follows:

1. *concept schetches or notes, design solutions*;
2. *strengths, assets and opportunities*;
3. *weaknesses.*

Figure 4. Arrengement of participated databases through co-mapping

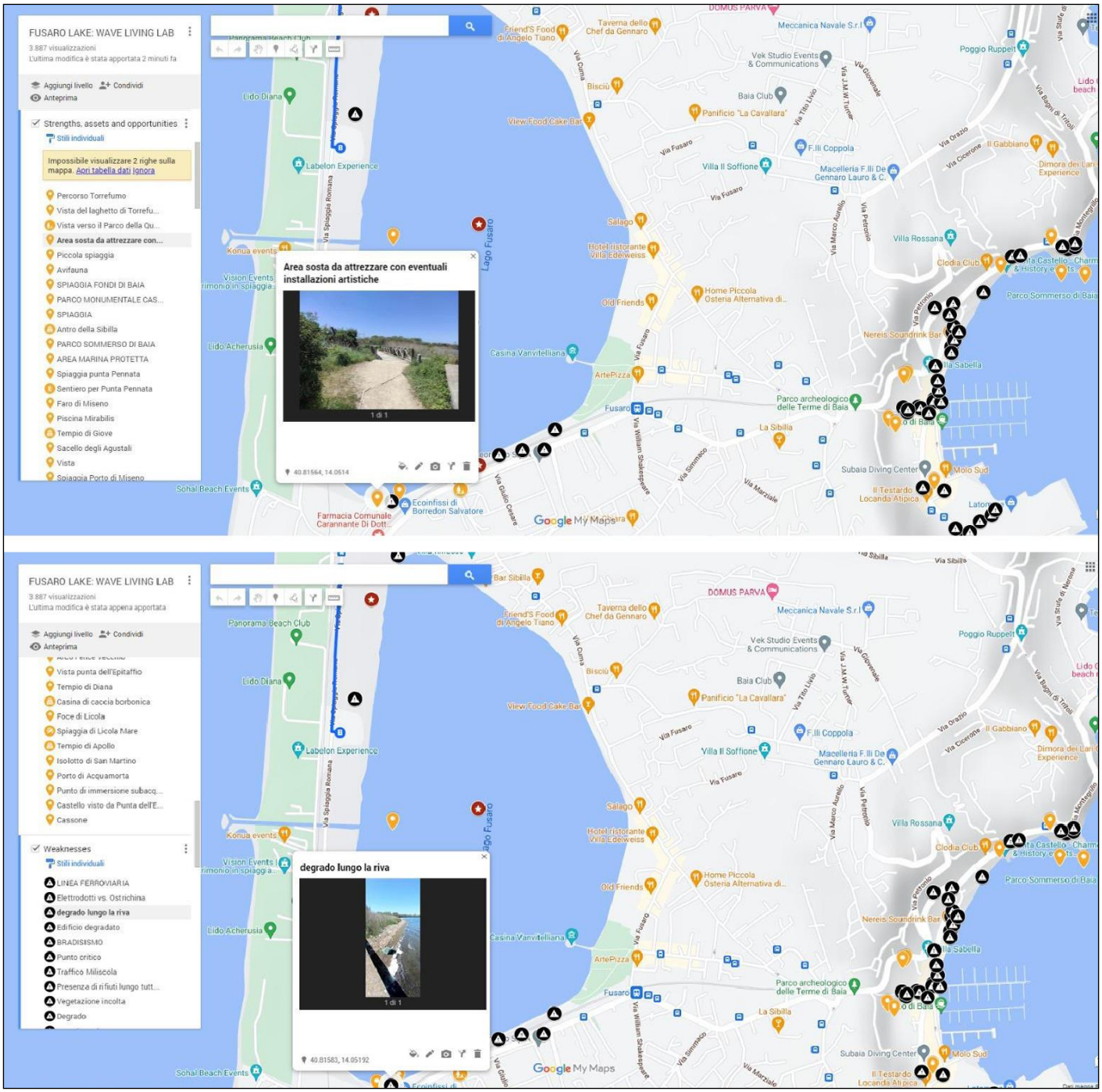


Source: Image elaborated by A. Pagliano

Each layer is easily identified on the map by a colour and can be queried selectively. The subsequent critical reading of the map plays a particularly important role: collaboratively analysing the survey data makes it possible to establish shared parameters for evaluation and to define project objectives, but above all it makes it possible to translate the strategic objectives into a spatial vision that is consciously embedded in the explored landscape and territories. The possibility of spatialising, with reference to the map, the photographic images portrayed during the route allowed a subsequent assessment of the aesthetic quality of that particular scenic landscape unit, assisted by recent foreign experiences in the field of visual impact assessment: 'A specific tool related to the assessment of visual impacts is the London View Management Framework[2] of the city of London (London Greater Authority,

2005 and subsequent updates), which identifies viewpoints, destinations and protected visual cones' (Balestrieri et al. 2020, p. 56). The London assessment tool is based on the integrated multi-scalar combination of maps and photos, understood as perspective landscape viewpoints.

Figure 5. Google My Maps tool applied to the Bacoli case study



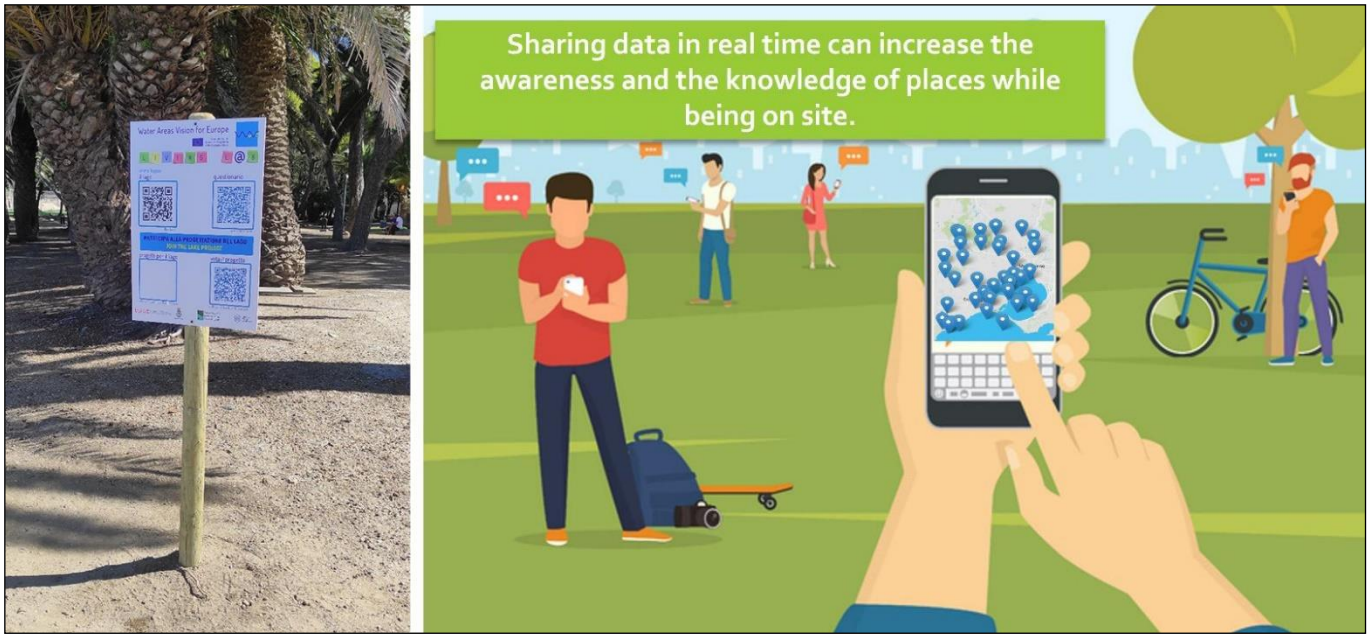
Source: Image elaborated by A. Pagliano

2.2 Digital storytelling and Augmented Reality

Signs of the historic layered landscape are often difficult to recognise in the current combination due to the stratification of the natural and man-made history of those places. The participatory exploration (Go-Along Walk) was therefore designed to provide an engaging and interactive route to knowledge. An appropriate digital storytelling was therefore designed to accompany the observers along four stages

through a narrative of the landscape and its valuable aspects. A number of exhibition signs were installed at strategic points along the route to provide information to the participants and request their interaction. By means of QR codes, it was possible for everyone to activate, from their smartphones, a series of videos appropriately created in two languages to provide territorial, historical or geographical information, as well as to describe the value of the cultural assets along the itinerary. In particular, on the panel placed next to the so-called 'Cassone', i.e. the Bourbon deposit of fishing products on Lake Fusaro, the video is activated in augmented reality, in other words, by superimposing additional digital content on the view framed by the smartphone in order to trigger a process of reading, knowledge and valorisation of the observed landscape resources.

Figure 6. One of the QR totems along the Fusaro Lake. Its implementation allows users to participate in co-mapping activities



Source: Image elaborated by A. Pagliano

The Living Lab's last activity assisted by digital technologies was a process of co-evaluation: interactive panels allow for the collection of suggestions and assessments from citizens through questionnaires developed with Google Form, as will be shown in the following paragraphs.

The data collected were processed by the university in order to understand the population's needs and desires to guide the Living Lab's discussions, thus contributing to the important result of establishing a permanent digital Living Lab in the Bacoli area, which allows for the constant and continuous collection of comments, suggestions and preference ratings of citizens and tourists in relation to the developed project solutions.

Figure 7. Digital storytelling of the Fusaro Lake's heritage

Source: Image elaborated by A. Pagliano

3. Socio-perceptive values of coastal-lake spaces

The complexity of the contemporary city increasingly influences the liveability of its community areas, with a significant impact on the quality of life they can offer to the users. Social, economic, recreational and environmental instances contribute to the definition of spaces that must respond to the emergence of contingent and more and more pressing issues: for these reasons, the presence of adequate highly natural spaces within the urbanised fabric is fundamental.

The extent to which natural spaces are harbingers of wellbeing within the urban

community framework is now well established, not only for their ability to implement the naturalistic value in heavily anthropized areas and to increase the recreational functionality of cities, but also for the aesthetic-landscape importance they hold, enhancing the place attachment of local society. In this perspective, the value of blue spaces is emphasised, in the sense of public places intrinsically characterised by a dominant aquatic element (such as coastal landscapes or river and lake areas). Such zones can be compared to green spaces in terms of the benefits they bring to environmental quality and human health and can thus be seen as cornerstones of landscape design, although not always as well managed as their terrestrial counterparts (Ahmad Shafee et al., 2023).

Planning should therefore more organically incorporate the public awareness of these urban areas in relation to the development of positive social and recreational practices that serve the community and benefit the quality of life, in line with sustainable development goals. In fact, this makes it possible to increase interaction between the different urban users, conveying social but also economic values: water spaces increase the appeal of places, contributing to the maintenance of healthy lifestyles and to the rate of frequentation by citizens. Moreover, there are numerous studies investigating the positive relationship between water basins and the decrease in pathogenic factors and diseases especially related to the pneumo-vascular system (White et al., 2020; Völker & Kisteman, 2011).

Direct contact with coastal-lake environments can in fact amplify the adaptive capacity inherent in communities that experience such peculiar spaces on a daily basis. As a matter of fact, the relationship with concepts of an ecological-environmental matrix, such as the presence of green-blue infrastructure elements, is evident: the advantages brought to the liveability of places are variegated, from the improvement of air and water quality to the increase of biodiversity and the reduction of polluting factors, up to the implementation of ecosystem services for the benefit of more or less large user basins. This is clearly combined with an improved urban resilience, which allows for a more adequate response to the impacts that anthropisation has on those public places within the natural system, through natural thermoregulation and the presence of green areas that act as a buffer zone between the urban core and the body of water itself (Sander & Zhao, 2015). Although it is complex to assess the economic value of these benefits that water areas bring to communities, also in relation to their intrinsic aesthetic, social and affective qualities, there is no doubt that there is a substantial advantage in carefully planning these areas, increasingly introducing the participatory component into the process, in order to steer interventions and strategies in the most appropriate directions, according to the desires and needs of those who will personally experience the outcomes.

In this regard, the question of the social perception of the coastal-lake areas of contemporary cities emerges. In fact, the elements of naturalness within the urbanised fabric play a leading role in the functions of psycho-physical recovery and restoration: the presence of green areas, urban vegetation spots, and water basins such as lakes and the sea, combines its values to the very important effects that sociality has on the well-being of citizens; for these reasons, natural assets are essential within the social perception of public places (Neale et al., 2021). At the same time, urban planning must appropriately manage the spaces available for community functions in order to limit the occurrence of overcrowding phenomena and the overburdening of ecosystem services, factors that can undermine users' perception of well-being. (White et al., 2016).

Blue spaces are therefore elements of particular unifying force within local communities, generating socioeconomic and ecological impacts that must be

carefully managed, exploiting their spatial, geographical and functional contingent potential from a design perspective. Thus, there is a need to understand how the average user perceives the impact of water landscapes on the spaces that are most pertinent to them.

3.1 Quantitative approach to assess social perception of public blue spaces

Thus, it appears to be important to understand how users of the coastal public spaces interpret the role of these areas in their daily lives, comparing personal experiences with the actual functional offer that is currently present. At the same time, it is relevant to estimate the extent to which this information is objectively altered by more or less exogenous factors that influence its restitution in the form of analysable data: one thinks, for example, of the socioeconomic and cultural status of the users involved, which may indeed affect the perception of climatic and meteorological risk, but also the issue of accessibility to resources as well as tolerance to the state of degradation and possible overcrowding of spaces (Fonseca et al., 2023).

All this is particularly pertinent with respect to the planning aspects of coastal-lake management because, as mentioned above, these areas possess an intrinsic economic and functional value that could be enhanced by targeted urban transformation interventions, with a view to boosting the ecological-recreational areas that are their own, producing important cascading effects on the various segments of the local community, understood not only as simple residents, but in a broader sense, including those who specifically mobilise to enjoy the benefits that only blue spaces can offer, such as contact with water: indeed, the presence of functional uniqueness in such areas produces an urgent need to know what ecosystem services are really available and which ones are most desired by the population, also with a view to environmental protection (Heino et al., 2020). As a matter of fact, great are the expectations that local communities place on the regeneration and enhancement of natural spaces within the urban fabric, especially when linked to strongly iconic bodies of water such as city lakes, since there are vast possibilities to strengthen the environmental and recreational capacity of the public space. In order to examine these social desires, the psycho-social approach is explored through quantitative field research.

The reasons for this lie in the inherent ability of quantitative research to handle a large amount of data by transforming it into manageable and analysable figures in a relatively simple manner, meeting the need to study presumably large population samples that frequent public water spaces. On the basis, therefore, of a theoretical study that supports the choice of investigating a certain urban area from a psycho-perceptual point of view, empirical data can be found through field studies, subsequently generalising the social perceptions gathered regarding certain spheres of investigation. In this way, the research can preliminarily define generic hypotheses that will then be validated or rejected through the application of the field investigation tool, simplifying the processing of the expected results and predetermining possible fields of study, although without influencing the actual community response that will be operationally recorded (Aithal & Aithal, 2020).

The research therefore applied the quantitative method through the definition of a questionnaire, as it is considered one of the most widespread tools in this type of studies: the importance of this survey medium lies precisely in its ability to develop a broad sociological data base that planners and designers can draw on in order to direct development strategies towards efficient and inclusive spatial policies, by means of targeted insights, articulated in advance in the preparatory phase, gathering opinions from a certain segment of the population in an organised manner and

intersecting these data with broader demographic structures (Beatty et al., 2019).
Indeed, it is possible to refer to the concept of representativeness, namely the possibility of studying, through the delivery of questionnaires, a relatively small social sample and then reporting empirically generalisable results on a larger scale (De Singly, 2020). This is linked to the theoretical assumption that the characteristics inherent to a given community (consisting of a large number of users who are extremely heterogeneous and difficult to categorise as a whole) can also be extrapolated by referring to a portion that is numerically smaller than the demographic totality, as long as certain generalities are respected in a relatively strict manner, such as the subdivision of the chosen sample by age, gender and geographical origin. This peculiarity of quantitative studies and questionnaires is particularly useful for studying the desires and needs of users pertaining to public blue spaces: as a matter of fact, these social groups cannot be defined univocally because their composition constantly changes, depending on the great importance that functional resources like lakes and shores hold for everyday life, from a recreational-cultural perspective, but also from economic and ecological aspects, driving even distant users to make substantial trips to enjoy specific public areas that provide access to unique and non-replaceable ecosystem services (Gascon et al., 2017).
However, it must be assumed that the data obtained according to the principle of representativeness will only be effectively valid for a specific sample that meets the preconditions defined in advance. While admitting the existence of other variables relating to a phenomenon, such as the socio-recreational use of coastal-lake water spaces, which could be explored, it would in fact be impossible to investigate all of them in depth according to the chosen demographic sample: for this reason, the aforementioned principle will therefore offer acceptable empirical validity even if it does not reflect the statistical wholeness of the entire reference catchment area, without losing its reliability in generalising the data collected (Omair, 2014).
Thus, quantitative research uses the questionnaire method to gather useful information to define the demands of a community particularly attached to blue spaces, empirically standardising the results obtained in order to coherently generalise the behaviour and desires of the community as a whole, in terms of the use of specific socio-environmental resources. Based on these methodological premises, it is now illustrated the process of psycho-perceptual data collection in the WAVE BacoLIving L@b. This action is of paramount importance as it can be a very helpful element within local governance frameworks in order to implement community desires and needs in local-scale planning.

3.2 Definition of the survey tool for psycho-social analysis

In the case of the WAVE Living Labs, the area of investigation is circumscribed to the Fusaro lakefront, an element of particular relevance for local society of Bacoli in terms of culture, sociality, recreation and economy, and to the adjacent stretch of maritime coastline, from the municipal limit of Torregaveta to the boundary of the Quarantena Park, thus incorporating bathing areas and large parks and green spaces. Specifically, the field analysis involved a questionnaire built to meet the peculiar characteristics of the Bacoli case study. Its structure consisted of 11 questions divided into sections, as shown below.

A. Accessibility to water areas

1. How important is it for you to have physical contact with water (e.g. swimming, bathing, fishing, diving)?

2. How often do you go to the coast and to the lake for recreation?
3. From where you live, how easy is it to reach the coast and the lake? *(By walk; Bicycle; Bus; Train; Car; Motorbike; Boat)*
4. Do you think access to the coast is limited by physical barriers (gates, barbed wire, fences), pollution or poor water quality and legal constraints (regulations, prohibited areas)?

B. Public uses and spaces of the coast and lake

5. Along the coast and the lake, are there enough of the following public areas, in your opinion? (*Promenade, pedestrian areas and cycling lanes; Parks; Squares; Sport areas; Jettys, water walkpath; Beaches)*
6. Along the coast and lake, what facilities would you like to develop or improve in the future?
7. What activities would you like to promote along the seashore?
8. What activities would you like to promote along the lake?

B. Perception of the sea and lake coast and future scenarios

9. What is the landscape value of the coast and lake, according to you?
10. In your opinion, how this area is likely to evolve in the next five years from an environmental point of view?
11. How would you like this area to evolve over the next five years to improve its social and recreational value?

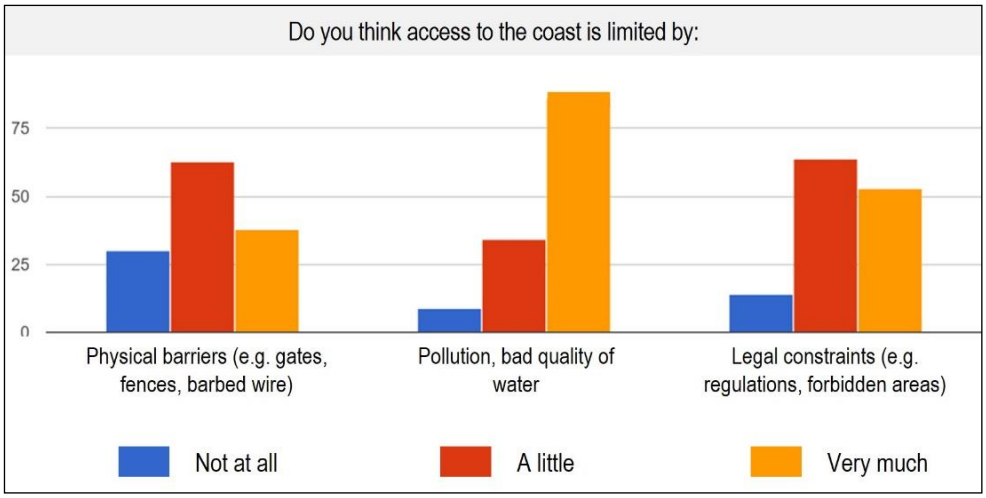
The aforementioned questionnaire has been disseminated both on the field, by interviewing users visiting the study areas, and in an indirect way, by placing totems at specific points of the site: as mentioned above, these elements are in fact equipped with QR codes, referring to the questionnaire form translated into a digital model. The totems have been designed to remain in place even after the end of the workshop activities, establishing a permanent living lab for the city of Bacoli. The data analysed in this research refer to the period comprehended between September and November 2022: 138 users (70 female and 68 male) have been interviewed. According to the data collected, most of the social sample analysed came from the more or less immediate vicinity, specifically 37% from Bacoli and 34% from Naples, while only 4% from Pozzuoli, the largest urban pole of the Phlegraean system.

3.3 The social representation of the coastal and lake area of the Bacoli community

The first parameter analysed by the psycho-social survey of the Living Lab concerns the usability of water spaces in the lake-sea area. It emerged that more than half of the users (about 51%) consider physical contact with the water, for recreational activities, very important, followed by a substantial 30.1% who consider it even fundamental: however, two thirds of the social sample declare that they go to the lake or along the urban coast very rarely or at any rate not often. This is connected to the actual criticality of the mobility system highlighted by the users of the area: it emerges that 65.4% of those interviewed believe that it is very difficult to reach the shore of Lake Fusaro and the nearby stretch of beach by foot, while 53.4% hold this opinion regarding bicycle travel; the easiest way to reach the coast for recreational purposes are motorbikes and two-wheeled vehicles in general, with about 64% of the votes in favour. There is a strong lack of accessibility to the water areas by soft mobility: this is a paradox because most users come from nearby places.
With regard to the possible existence of constraints to coastal usability, the majority of the sample involved in the survey is particularly affected by the poor state of the

lake and sea waters, which are indeed subject to pollution: the value in this case stands at 66.9%. On the contrary, it seems that the presence of physical barriers and legal constraints forbidding access to lake or sea areas does not create particular difficulties for users, since in both cases 48% of the interviewees show little concern in this regard; it should be noted, however, that with regard to the presence of physical obstacles, a value of 22.6% of the entire social sample was recorded, a percentage that is not possible to overlook.

Figure 8. Pollution is considered the main limit to water accessibility in Bacoli



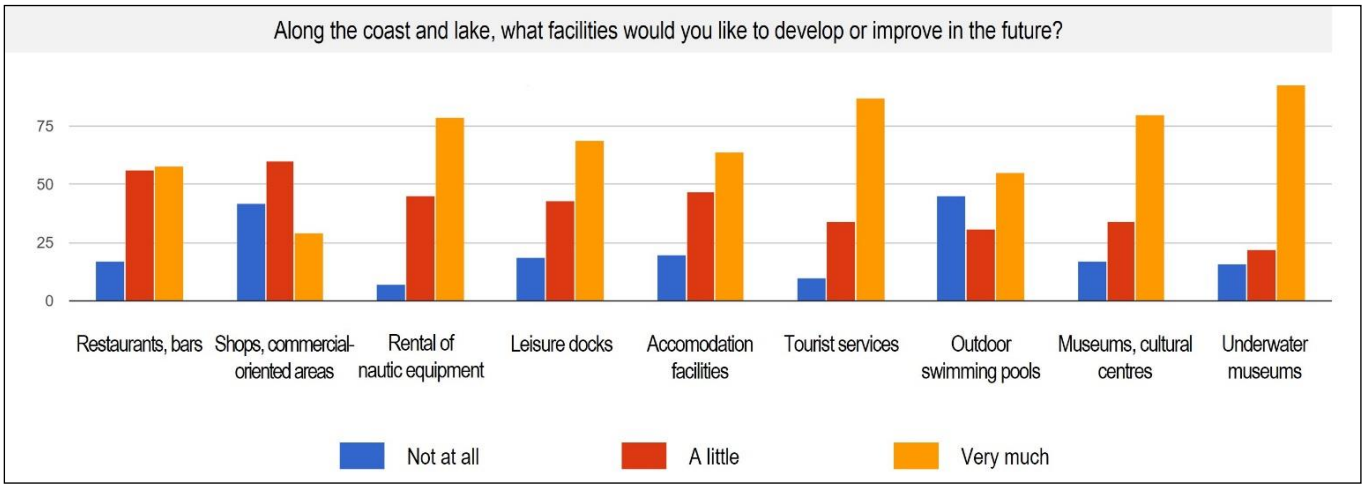
Source: Image elaborated by I. Pistone

Concerning open spaces and social uses of the coast and lake, according to the interviewees, the research area is lacking most of the main types of public areas. In particular, the most relevant data concern promenades, bicycle and pedestrian areas or paths, assessed as strongly lacking by 61.5% of the users, but also park areas, natural areas and gardens: in this case, social disappointment reaches 60%; the presence of sports areas is considered strongly lacking by 74.4% of the sample. However, there is general satisfaction with the current amount of jetties (49% of users) and bathing areas (41% of users). Citizens also showed a real interest in facilities related to the tourist development of the area: in particular, there is a strong propensity to develop accommodation facilities (46.6%), tourist harbour (52.6%) and visitor information services (66.9%), while there is an equal number of users who consider themselves either poorly or highly interested in the development of restaurants and bars (in both cases, 43.6% of the votes). The commercial growth of the area meets a mild approval, as 45.9% denote little interest in this option. On the contrary, the social sample attributes great value to the development of facilities linked to cultural activities (the strong desire to increase museum or cultural centre spaces reaches almost 62%) and to uses involving direct contact with the water, such as the installation of rental points for rowing or diving equipment (60% of respondents are extremely interested) or the increase in the surface dedicated to underwater museums, with 71.4% of responses in favour: this information is relevant since the city of Bacoli already has the Underwater Archaeological Park of Baia, located nearby the case study of the Living Lab, corroborating the hypothesis that the great cultural and recreational potential of coastal-lake zones needs to be increased and planned in the best possible way.

With regard to the uses that should be most promoted along the reference stretch of maritime coastline, the data show a general propensity for many of the proposed options, recalling the actual need of the local coastal society for places destined for

sociality and recreation; the same situation is found in relation to the promotion of socio-recreational functions along the shores of Lake Fusaro. Generally speaking, it can be said that the most desired activities are walking, jogging and cycling: this is linked to the perceived lack of an adequate system of soft mobility that would facilitate these uses; bathing and sports activities are also very popular. The only use that registers slightly lower approval ratings is fishing, probably due to the fact that this is one of the activities already practised without particular difficulty in the area.

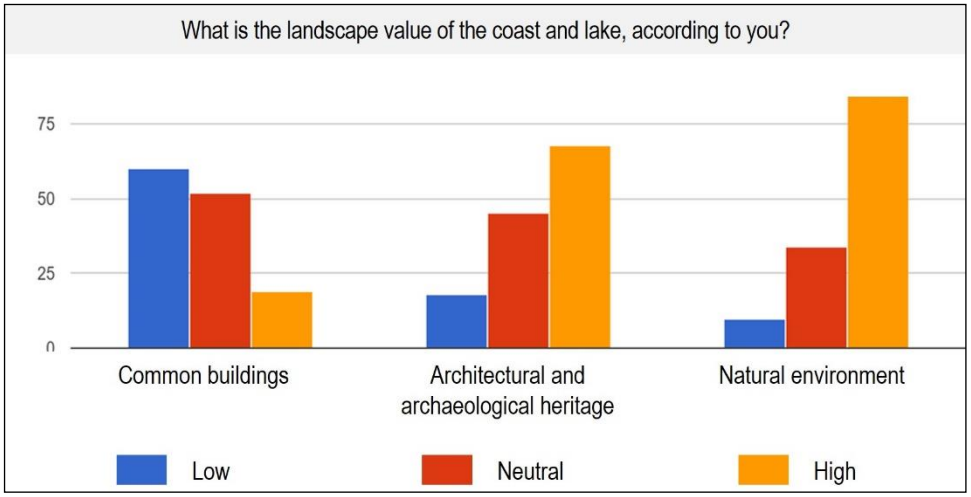
Figure 9. The data show an interest in developing tourism and related facilities, with an attention to direct contact with water and underwater museums



Source: Image elaborated by I. Pistone

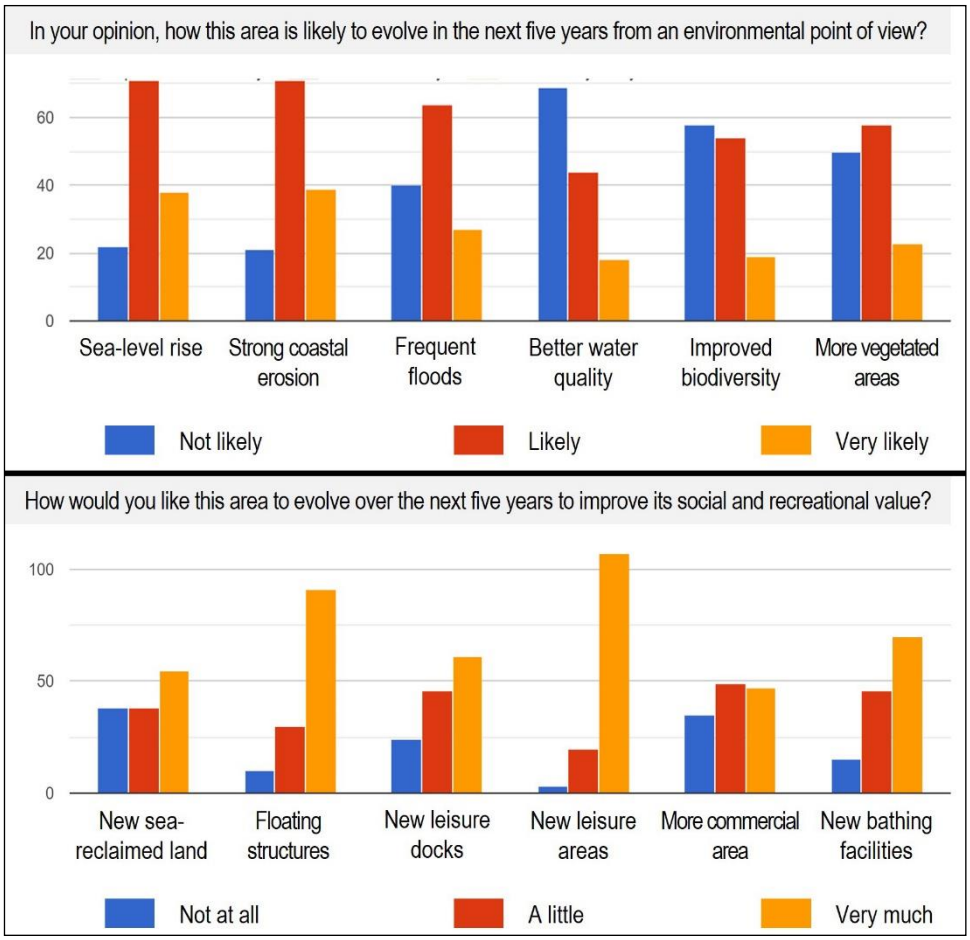
The users also declared the value they give to certain areas of the coastal and lake landscape in the Fusaro area. Although environmental pollution represents the greatest constraint to the usability of the lake and the sea, as previously demonstrated, the questionnaire showed that the natural environment is considered the main asset of the local landscape: 67% of the users expressed this opinion, while a significantly lower value is recorded for the architectural and archaeological heritage present, whose landscape weight is estimated to be high by 51.9% of the respondents. Ordinary buildings, on the other hand, are rated negatively by the social sample, with 45.8% of the users giving them a low quality within the local landscape. From the environmental point of view, users showed a general mistrust regarding the qualitative improvement of the area in the next five years. In particular, 51.9% of the citizens involved in the study do not consider plausible that water quality will undergo any amelioration, just as 43.6% do not believe in a future enrichment of marine biodiversity; however, approximately 44% of the interviewees was cautiously more confident in relation to the possibility that the lakefront and the reference maritime coastline could be improved with new vegetated areas in the short term. At the same time, there is a fairly marked awareness of the possible effects of climate change in the near future. Specifically, about 55% of users believe it is probable that sea-level rise will worsen over the next five years and that coastal erosion will seriously affect the currently available land resource; a further cause for concern is the increase in the frequency of flooding, considered plausible by almost half of the social sample.

Figure 10. Despite the pollution issue, the natural environment has been evaluated as the most important landscape element



Source: Image elaborated by I. Pistone

Figure 11. Users show low confidence in a possible improvement of the environmental quality, while preferring public areas for sport-recreation activities rather than commercial evolutions in the short term



Source: Image elaborated by I. Pistone

With reference to desired functional scenarios over the next five years, users showed a preference for the increase of public areas for recreational and sports purposes and for bathing: in the first case, there is a substantial 82% of people who would very much like such a coastal-lake development, while in the second case, the data

highlight a still solid 53%. On the other hand, fewer participants showed interest in the commercial development of the study area, with 37.6% of responses expressing a lukewarm approval. Another interesting fact is that 69% of the social sample would appreciate the installation of floating structures such as walkways and solariums, while possible land reclamation operations were coldly received by almost a third of the users.

4. Final remarks. Permanent living lab and social involvement for integrated project indications

Within the WAVE research framework, the BacoLIving L@b offered the opportunity to test a learning environment strongly marked by participatory resolution of design problems, through physical and virtual spaces that involved stakeholders and actors engaged in urban growth and development, leading to constructive moments of dialogue and confrontation aimed at consolidating the functional and spatial knowledge of relevant blue spaces.

Initially, the study process investigated the perception of the community with respect to the lake-coastal area in which it was located, from a landscape and functional point of view: the processing of the collected data showed that, with respect to the specific social sample analysed, the water spaces of Bacoli clearly represent a valuable resource for socio-community, ecological and tourism-economic reasons, highlighting the importance of future water-related recreational developments. The value attributed to the natural landscape is also particularly high, despite the presence of various problems related to environmental pollution; furthermore, there is a strong awareness of the possible environmental risks that are currently taking place. Subsequently, the research operations flowed into meetings with the local population, where interaction took place between the academic world and representatives of various categories of local society.

The installation of the QR totems thus enabled the establishment of a permanent Livng Lab along the shores of Lake Fusaro, translating the outcomes of the discussions with the community into integrated project proposals, on which local users were able to express their opinions. Indeed, the social listening sessions enabled a better understanding of the needs and expectations of social demand, related to the reconnection of open spaces through ecological approaches, in the context of climatic dynamics and the socio-cultural, tourist and recreational enhancement of the lake and coastal area.

In essence, one must emphasise the strong debt that BacoLIving L@b had with local associations in order to gather consensus and become truly operational. It is clear, however, that such an initiative needs constant support from dedicated figures who can keep the interest alive and monitor the collection of data and the digital offer underlying the project: in this way, further initiatives could be proposed and the results of the research conducted so far could be put to good use. At present, it is still the university that manages the ongoing analysis process of the permanent living lab: this therefore highlights the complexity of integrating a structured figure within the municipal administration who can be accountable for the social and planning benefits of the WAVE initiative; likewise, it is not always possible to intercept the interests and efforts of the local NGOs for the purpose of being given a role of responsibility in the management of the implemented tool.

In conclusion, the paper reflects on the conceivable possibility of setting up a public municipal body dedicated to the management of the permanent living lab, implementing its functions and, if possible, extending its range of action in a flexible

manner, integrating academic input with community needs and the initiatives of local stakeholders. This could lead to the creation of a decision-making facilitation system that might serve as a core for organised events on key issues within the community of reference, in order to enhance the functional offer of the public place and activate regenerative actions for the benefit of local society and the enhancement of the Phlaegrean socio-cultural and environmental heritage.

Notes

1. https://zr.planning.nyc.gov/article-x/chapter-2#102-00
2. https://www.london.gov.uk/programmes-strategies/planning/implementing-london-plan/london-plan-guidance-and-spgs/london-view-managemen-0

Author Contributions

The paper was jointly conceived and structured by all three authors. Specifically, A. Acierno is the author of paragraph 1, A. Pagliano is the author of paragraph 2 and I. Pistone is the author of paragraph 3. Conclusions are credited to all authors.

Funding

This research was funded by the Erasmus+ project WAVE (Water Areas Vision for Europe) and became part of the project: Changes "Cultural Heritage Active Innovation for Sustainable Society". "PE5. Humanities and cultural heritage as laboratories of innovation and creativity". Spoke 1 – Historical Landscapes, Traditions and Cultural Identities. Project Code MUR: PE00000020 – CUP E53C22001650006).

Conflicts of Interest

The authors declare no conflict of interest.

Originality

The authors declare that this manuscript is original, has not been published before and is not currently being considered for publication elsewhere, in English or any other language. The manuscript has been read and approved by all named authors and there are no other persons who satisfied the criteria for authorship but are not listed. The authors also declare to have obtained the permission to reproduce in this manuscript any text, illustrations, charts, tables, photographs, or other material from previously published sources (journals, books, websites, etc).

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