🏆 *reviewed paper*

Rethinking the Urban Green Spaces by the Lens of GIScience: the Experience of the Project Living Urban Parks

Edoardo Crescini, ,Francesca Peroni, Francesco Facchinelli, Giuseppe Della Fera, Daniele Codato, Salvatore Pappalardo, Massimo De Marchi

(Edoardo Crescini, University of Padova, Department of Civil, Enviromental and Architectural Engineering, Via Marzolo 9, Padova, edoardo.crescinidimontevecchiobenedetti@phd.unipd.it)

(Francesca Peroni, University of Padova, Deparment of Civil, Enviromental and Architectural Engineering, Via Marzolo 9, Padova, francesca.peroni@unipd.it)

(Francesco Facchinelli, University of Padova, Department of Historical and Geographic Sciences and The Ancient World (DiSSGeA), Via del Vescovado, 30, Padova, francesco.facchinelli@phd.unipd.it)

(Giuseppe Della Fera, University of Padova, Deparment of Civil, Enviromental and Architectural Engineering, Via Marzolo 9, Padova, giuseppe.dellafera@unipd.it)

(Daniele Codato, University of Padova, Deparment of Civil, Environmental and Architectural Engineering, Via Marzolo 9, Padova, daniele.codato@unipd.it)

(Salvatore Pappalardo, University of Padova, Deparment of Civil, Enviromental and Architectural Engineering, Via Marzolo 9, Padova, Salvatore.pappalardo@unipd.it)

(Massimo De Marchi, University of Padova, Deparment of Civil, Enviromental and Architectural Engineering, Via Marzolo 9, Padova, massimo.de-marchi@unipd.it)

1 ABSTRACT

In Italy, soil sealing is a major threats in terms of soil degradation and the loss of urban ecosystem services. The increase in new artificial surfaces or settlement areas at the expense of green and rural areas is intensifying the effects of climate change, in particular extreme weather events, such as the increase in intense precipitation and heatwaves. In this context, the Municipality of Padua is a paradigmatic case study. According to the Italian Institute for Environmental Protection and Research (2022), almost 50% of the municipal territory is completely sealed, making it the Italian city with the fifth highest values of soil sealing. To contrast the phenomenon, the EU soil strategy for 2030 suggested, among other strategies, the implementation of Nature-Based Solutions, strengthened with the participation and involvement of non-expert actors to be more efficient and effective.

This study was developed within the Living Urban Parks (LUP) project (Key Action 3, Erasmus + Programme EU) during two years of research and participatory activities (2020–2022) within the Municipality of Padua. It aims to involve youths aged 18–30 in a public process to reconceive of the urban green spaces of the city and to develop ideas and proposals for more sustainable urban planning, promoting participatory methodologies by using geographical tools (digital and traditional cartography).

More than 400 participants were directly involved in the project. All the ideas and proposals mapped during the seminars and workshops have been uploaded to the geoplatform Geocitizen. This geotool is usable on smartphones and tablets and, thanks to its interactive features and a geodatabase, allows the collection of georeferenced ideas, good practices and urban issues regarding green areas and parks. By the end of the project, 118 points had been collected on Geocitizen. Beyond the Geocitizen platform, the participants had the opportunity to test other geotools, such as Geopaparazzi and Google Earth Pro. In addition, the participants were able to present their ideas collected on the platform and directly interact with the local decision-makers who were involved to discuss and promote effective and efficient actions for the enhancement of the green areas and urban parks of the city. The use of different geographic technologies combined with participatory mapping approaches allowed an increase in the knowledge of the urban territory by making people more aware of the issue of soil sealing and urban regeneration opportunities. Finally, LUP allowed to reconception and design of green spaces to promote the restoration of degraded and abandoned areas and to propose the implementation of Nature-Based Solutions.

Keywords: geographical tools, green areas, participatory approach, Nature-based Solution, Soil sealing

2 INTRODUCTION

2.1 Nature-based solutions in the urban context: Strategiesto mitigate soil sealing

At present, soil sealing is one of the major threats in terms of soil degradation and the loss of ecosystem services in urban and rural contexts. It is considered one of the main forms of land take by the increase of new artificial surfaces at the expense of green and agricultural areas. This phenomenon is intensified by local

effects of climate change, in particular extreme weather events, such as intense rainfall and heatwaves. The scarcity or lack of permeable and vegetated surfaces can drastically affect the urban drainage systems and can exacerbate the urban heat island effects during heatwaves (Todeschi et al., 2022; Pappalardo et al., 2023). In addition, it decreases other soil functions and ecosystem services, for example, carbon sequestration, microclimate regulation, groundwater reserves, biodiversity and food production (Peroni et al., 2020).

According to the EU soil strategy for 2030, a hierarchy to contrast land take is identified in the pathway of four key actions: i) avoiding new soil sealing, ii) reusing surfaces and soil that are already sealed, such as abandoned or underused buildings and areas, iii) minimizing by using infertile agricultural areas and iv) adopting compensation or mitigation measures and strategies to reduce the loss of soil functions and its ecosystem services (European Commission, 2021). In addition to the four actions of the EU soil strategy for 2030, the adoption of mitigation measures to restore ecosystem services through the implementation of Nature-Based Solutions (NBS) is also encouraged. The strategy promotes cooperation with nature to address societal challenges and provides benefits for both human well-being and biodiversity by using, for example, green roofs, green facades, green buildings, urban forests and community gardens. Moreover, NBS could be utilised as a tool to restore urban brownfield sites by renaturalising or 'greening' these areas. Finally, the design and the process of the implementation of the NBS could be improved with the participation and involvement of citizens to be more efficient and effective. As reported by the European Environment Agency Report on NBS (EEA, 2021), some case studies present the co-creation of NBS by involving local communities and stakeholders, as, for example, the creation the green roofs in France and Germany. Thanks to citizen participation, the quality in urban NBS has fostered a higher degree of multifunctionality in the solutions than the NBS built by urban planners or architects.

2.2 Objectives

The study aims to test the participatory methodologies and technologies to involve youths and non-expert actors in re-thinking urban green spaces to identify abandoned buildings, brownfields and urban parks and to develop ideas and suggestions to restore these spaces by proposing NBS or other strategies. The participatory methodologies are based on the use of geographical tools combining digital and traditional cartography and mapping tasks on paper and in the field with Geoapp.

The specific objectives are as follows: i) to involve non-expert actors, in particular young people, in urban sustainability issues, such as soil sealing and in mitigation measures, ii) to spread the use of geotools for an increase in geographical knowledge of the urban territory and iii) to increase the empowerment of participants regarding their awareness of urban regeneration and planning.

2.3 The Living Urban Parks Project

This study was supported by the Living Urban Parks (LUP) project (Key Action 3, Erasmus + Programme EU). LUP was developed during two years of research and participatory activities between January 2020 and January 2022 within the Municipality of Padua. The project was implemented by the Italian NGO L'Osteria Volante in collaboration with the Municipal Administration of Padua and the research group Climate Change, Territory, Diversity, Department of Civil, Environmental and Architectural Engineering (ICEA) of the University of Padua. A participatory mapping approach was adopted to create a formative pathway and raise awareness among the participants regarding different issues (soil sealing, soil policy, climate change, NBS etc…). The results of the participatory mapping were shared with the different actors (NGOs and researchers) that are developing bottom-up designs and proposals to promote the implementation of NBS and sustainable planning in the green areas and urban parks. Moreover, LUP allowed the participants to have a greater knowledge of the importance of urban parks and green spaces in Padua through the use of geotools and urban walks and events within the parks and green areas. This paper is organised in six sections. The third section is an overview of the general aspects related to the participatory methodologies through the use of information and communications technology (ICT) and geotools, presenting their possible purposes in the context of sutainable urban planning and urban regeneration with the involvement of youths aged 18–30. The fourth section presents the geographical context and the methods and technologies employed during the project. The fifth section shows the results of the project and a critical reflection on the participatory process. Finally, the sixth section highlights some observations that can be takenfrom this study.

664

REAL CORP 2023: LET IT GROW, LET US PLAN, LET IT GROW
Nature-based Solutions for Sustainable Resilient Smart Green and Blue Cities

3 PARTICIPATORY METHODOLOGIES FOR THE IMPLEMENTATION OF NATURE-BASED SOLUTIONS (NBS)

Until recently, the main sources and producers of spatial data were governmental agencies, cartographic centers, private companies and local policymakers; indeed, high fees and copyright restrictions were a barrier to more widespread access to geodata (Arsanjani et al., 2015). However, in previous decades, the development of ICT and geomedia completely changed the methods of mapping and collecting spatial data, shifting them from a completely professional activity to one involving the engagement of non-experts (See et al., 2016). In particular, the emergence of open-source software and the lowered cost of the equipment played a key role in democratising the access to ICT (Gatti and Zanoli, 2022).

Hence, different terms have been created to refer to the involvement of citizens in the activities related to data collection and community participation, such as 'citizen science', 'neogeography' and 'crowdsourcing'. These terms are usually classified by considering the active or passive contributions from the citizens and the type of collected data, for example, spatial or no spatial data (See et al., 2016). In this context, citizen science is an umbrella term that refers to the involvement of non-expert audiences that contribute to research activities. In most cases, citizen science improves the research by increasing the amount of data collected or granting access to situated knowledge (Pristeri et al., 2019). Simultaneously, participants can increase their knowledge of specific research topics, learning the use of new tools, acquiring new skills, adding new value to the research and better understanding the scientific work in an appealing way. Hence, citizen science represents a unique opportunity to connect citizens to contribute to sustainable urban planning issues by collecting and analysing new data. For example, some studies have demonstrated how citizen science could contribute to the introduction, implementation, management and monitoring of NBS (Restemeyer and Boogaard, 2021).

Finally, if the collection of spatially explicit data is oriented for public purposes, the scientific community refers more specifically to the term Public Participation GIS (PPGIS), defined as the field within geographic information science that focuses on ways the public uses various forms of geospatial technologies to participate in public processes, such as mapping and decision making (Tulloch, 2014).

4 METHODOLOGY

4.1 Geographical Framework

The city of Padua is located in the Veneto region in the northeastern sector of Italy (see Figure 1). The municipal territory spans 93 km² with almost 210,000 inhabitants. Since the last decades of the 20th century, due to demographic growth and new needs linked to economic and industrial development, many low-density residential buildings sprawled throughout the urban core at the expense of green or cultivated fields, as in many other European cities (Peroni et al., 2020). This caused the spread of mixed rural-urban neighborhoods driven by the presence of industrial or commercial complexes and infrastructures. As a result, the Municipality of Padua reflects 49,6% of its territory covered by impervious surfaces (ISPRA, 2022). Among the various impacts of soil sealing, urban heat islands are becoming a serious risk for the local population, particularly the elderly (Todeschi et al., 2022). Moreover, there is also a scarce presence and unequal distribution of green and vegetated spaces. Indeed, only 10% of green areas are municipal and open and accessible to the public. In addition, studies report a low quality of the urban green spaces, with some neighborhoods with only 2.5 m² per capita (Pristeri et al., 2021).

4.2 The Participatory Mapping Process

The involvement of young people was achieved by adopting different participatory methodologies with the contribution of some specific geotools: i) urban walks and in-site laboratories to know the territory of the city and to better understand specific urban management issues and ii) the geo-app Geopaparazzi and the geo-platform Geocitizen to map, collect spatial data and create ideas and proposals to implement and restore the degraded or underused urban green areas of the city.
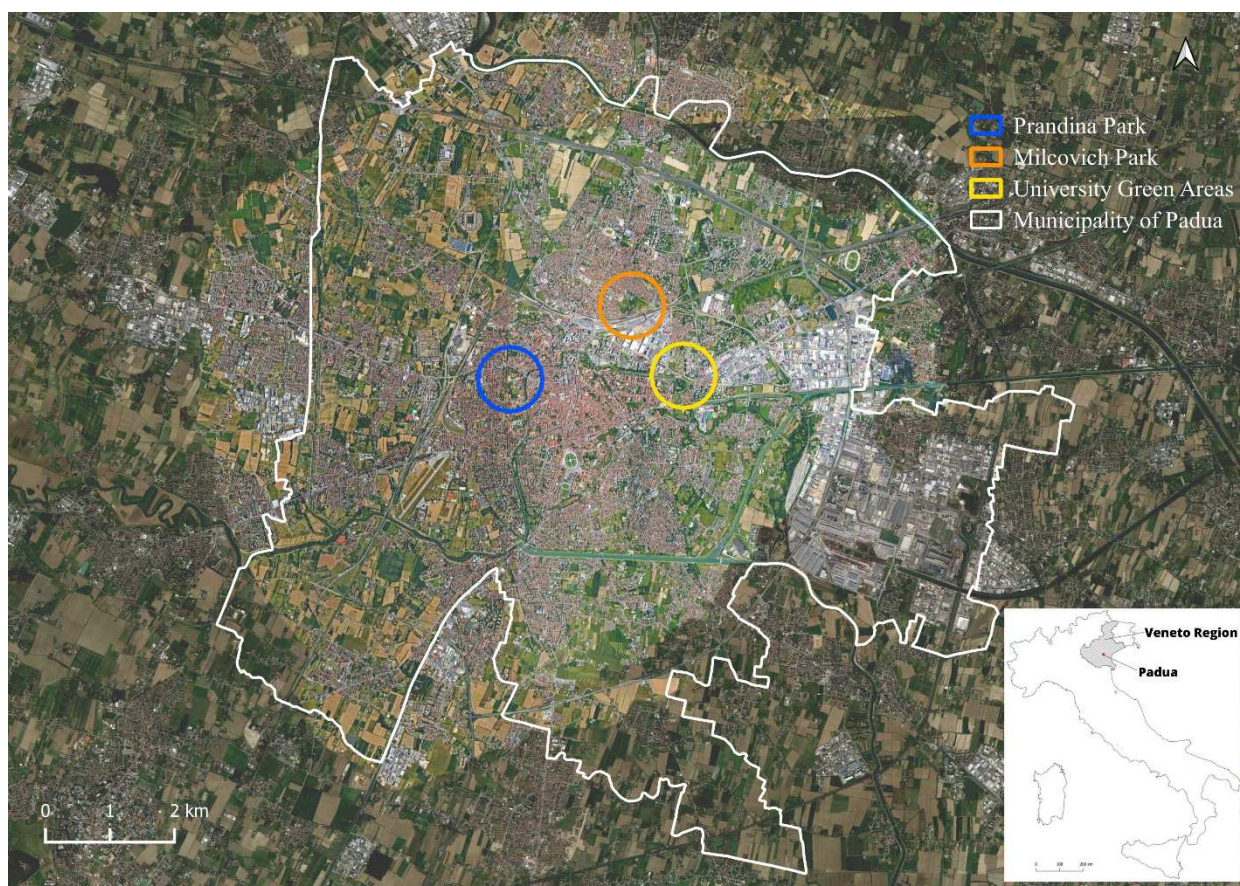
Fig. 1: The Padua municipality with the three study cases thatadopted the participatory mapping process

The participatory mapping activities led by the researchers from the University of Padua were developed during nine events that were open to the public. Each event started with an in-site workshop focused on the LUP project, its importance in promoting urban sustainability and the design of possible NBS. The workshop also included a contextualisation of the area in which the activity would take place (usually an urban park) and, in some cases, an historical excursion. Each time, the participants received an introduction to the geographical tools needed. In addition, a test trial was carried out to ensure the capacity of the participants to use the geotools efficiently. Each workshop focused on one topic related to sustainable urban planning, such as soil sealing, climate change, the importance of the ecosystem services provided by the green areas and the possible restoration and implementation with NBS.

Six events dedicated their second part to the presentation of the Geocitizen platform and to the collection of data. The remaining three events had their second part dedicated to an urban walk with the participants through three different areas of the city: i) the university green areas in the Portello neighborhood, which is a key area for university students, ii) the Milcovich Municipal Park, located in the north sector of the city and closed to the train station and iii) the Prandina Park, in the city center (See Figure 2).

The first area was selected on the basis of the presence of a large number of young people, mainly students. They mainly live in this neighboorhood and are familiar with the area, its advantages and problems. This aspect is crucial to implement the effective and successful collection of proposals and ideas. The Milcovich Municipal Park was selected as a best practice location supported by the municipality. Indeed, years ago, good management and a dialogue with the public administration enabled the restoration of the area that was completely underused and now it is one of the most popular parks in the city and hosts various socio-cultural initiatives. The last area, the Prandina Park, an ex-military zone, at present hosts one of the few urban forests within the city walls. It was chosen as a location due to the intense public debate within the city regarding its future uses.

4.3 Geotools and methodologies for the participatory process

Urban walks are a well tested method in geographical research to support the sharing of people's perspectives regarding different aspects of the cities they live in (Husar et al., 2020). Walking through places
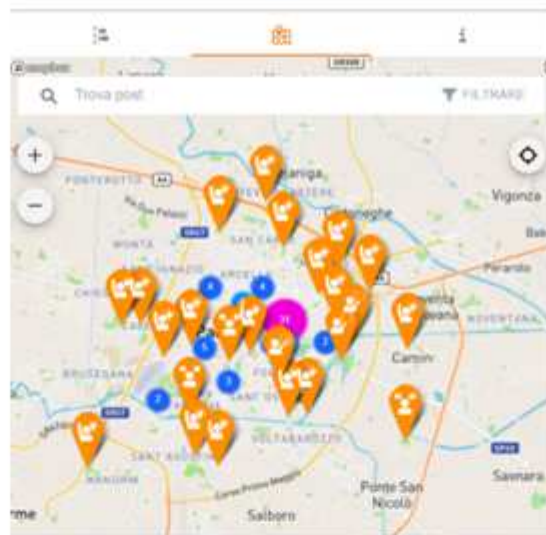
allows discussion on the basis of a direct contact with spaces, integrating the stimuli of all the human senses. During the participatory process, urban walks succeeded as a way to collect data from the ground and as a method for the participants to elaborate and share their ideas. Notably, the two processes became intertwined, resulting in data collection that evolved and changed according to the proposals of the participants while they took part in the construction of the same proposal.

Fig. 2: Identification and geographical details of the three study cases selected for the PPGIS process

During the urban walks, the open-source and open-access mobile app Geopaparazzi was used. The app was developed in 2010 from HydroloGIS to facilitate GIS data collection (HydroloGIS, 2023). GIS data collection allows the user to access and edit spatial data during fieldwork with the support of smartphone GPS functionalities. Geopaparazzi was used to elaborate proposals on how to reconceive of the green spaces within the case studies by suggesting possible NBS. Finally, Google Earth Pro was used to visualise the collected data allowing a better understanding of the points' locations and assessment of their quality.

Geocitizen is a geotool that allows the implementation of participatory processing in which users can propose spatially referenced ideas and comment on the suggestions of the others participants. It is available both as an online platform and a mobile app and it was built in collaboration with the Fundación Centro de Competencia Educativa para Espacios Comunitarios (Ecuador). In the participatory process of the LUP project the Geocitizen platform (https://app.geocitizen.org/lup_padova) worked both as an informative tool that allowed interactive access to various cartographies of the Padua municipality as the main container of the mapped points and as a place to debate the suggestions among the participants through the comment function. The mapped points pertained to four different categories (or tasks) corresponding to: i) ideas to improve the urban spaces (idea task), ii) good practices carried out by the local population (good practices task), iii) existing problems within the spaces (problem task) and iv) questions for the local policy-makers (question task) (see Figure 3). As an online platform, Geocitizen collected data both from the youths who participated in the in-site laboratories and the urban walks and from a larger audience of users not directly involved in the activities but still interested in sharing their perspectives.

(a)

(b)

(c)

(d)

(e)

Fig.3:a) Screenshots of Geocitizen with examples of different tasks (idea, problems and best practices);b) a possible good practice to be implemented along the embankment of the San Benedetto Riviera for recreational and sports activities; c) a problem mapped near the station of a disused green area; d) and e)two ideas for using abandoned green areas, respectively the activationand promotion ofsocio-cultural activities, and the safeguarding of the riverbank biodiversity that presents several species of birds.

5 RESULTS

This study featureed a high participation of young people. More than 400 participants were involved and were able to approach and understand geographical concepts and issues related to sustainable urban planning. In general, the LUP project achieved two main results: the first concerns the use of geographical instruments and geotools by non-experts and young people to collect spatial data related to urban territory

668

REAL CORP 2023: LET IT GROW, LET US PLAN, LET IT GROW
Nature-based Solutions for Sustainable Resilient Smart Green and Blue Cities

Edoardo Crescini, ,Francesca Peroni, Francesco Facchinelli, Giuseppe Della Fera, Daniele Codato, Salvatore Pappalardo, Massimo De Marchi

and its green areas. From a practical point of views, the second outcome is related to the direct involvement in the participatory mapping process (PPGIS) of young people to address issues such as soil sealing, climate change and the possible measure and actions for more sustainable and inclusive urban planning focused on the improvment of green areas, including discussions with decision-makers of the municipality. Furthermore, the approach to the use of ICT and new geographic technologies allows participants to develop new skills and to explore the importance of geographical data in the perception of the territory and the creation of possible proposals to enhance its local context.

5.1 The Geocitizen Platform

The Geocitizen platform represents a useful and powerful tool for spatial data acquisition, providing to local decision-makers opinions and ideas from young people. In total, 118 points were collected and 97 were georeferenced. The majority of them are related to proposed ideas (83%), suggesting a desire to rethink the mapped urban spaces, for example, green areas, urban parks, empty or abandoned spaces and buildings, stream buffers or ecological pathways. The ideas and practices proposed by the youths in this task aimed to achieve a more sustainable city and developing NBS by introducing community gardens, food forests or bug hotels.

All the proposals are related to the improvement of the quality of life through the increase of different ecosystem services. The cultural and social services were the most cited, as well as the regulating and supporting ecosystem services. For example, one idea was proposed to deseal an empty space to create a green area and to implement different ecosystem services by introducing NBS. In addition, other ideas were related to the restoration of green spaces that are abandoned, badly managed or lacking basic equipment, such as benches, tables and drinking fountains. Moreover, the participants highlighted that these lacks often lead citizens to not frequent these areas and thus waste the green areas that could be used for both recreational and sporting purposes.

Many of the collected points concerned river banks or ecological corridors along the water network of Padua. These ideas emphasised the need to create health trails to improve and facilitate outdoor sports activities. Other ideas concerned the preservation of biodiversity, especially related to the avifauna that can be observed along the ecological corridors and canals of the city. The young people suggested restoring some buildings near these areas that could be transformed into birdwatching stations. This idea has a twofold function: the first is to bring citizens closer to the local fauna, which is often unknown, and to understand in a different way the importance of green areas in the city. The second is linked more to tourism as a natural attraction for visitors.

The category related to good practices, reporting virtuous experiences throughout the city, and represented 13% of all the mapped points. These examples allowed the effective and efficient valorisation of specific green areas of Padua with the help of civil society organisations, strengthening different ecosystem services. An example of good practices reported by the participants could be the presence of different agroecological farms in Padua or the requalification of green spaces promoted by different stakeholders and NGOs.

The points mapped as issues to be managed by public authorities (14% of the total) were mainly focused on proposals regarding the restoration of the urban parks and green areas that are totally abandoned, as well as agricultural fields. Another issue was related to the scant valorisation of the ancient city wall system of Padua that are an important cultural heritage and tourist attraction; the walls system includes green areas that are underused at present.

Finally, the last category concerns question tasks that were mainly directed toward knowing whether or not there are any projects to restore or rehabilitate various green areas or infrastructures located within the parks.

5.2 Urban walks with Geopaparazzi

During the urban walk activities, the collection of spatial data and the process of re-thinking urban green spaces were conceived through different geographical tools, from the use of cartography to the geo-technologies such as Geopaparazzi and Google Earth Pro. These geotools increased the engagement during the urban walks and stimulated the participants to use the 'eye-thinking approach' by adopting a double view of the study areas – from below through their own eyes and from the top through the use of cartography and aerial images (see Figure 4).

Fig.4: The photos show some examples of data collection usingGeopaparazzi and Google Earth Pro for the visualisation and the PPGIS activities

The first urban walk was performed in the Portello neighborhood within the university green areas. During the urban walk, the two parks closed to the university green spaces, the Parco Europa and Parco Venturini-Natali, were also crossed and surveyed. The proposals mapped by the young people during this activity mainly concerned the regeneration of the infrastructures and abandoned areas along the urban walk. In addition, a restoration of the Piovego canal banks was proposed with naturalistic dissemination paths presenting the flora and fauna. In addition, the possibility was proposed of transforming the area during the spring and summer seasons into a study area with the installation of temporary structures such as geodesic domes to encourage outdoor teaching activities.

Prandina Park is at the center of an important decision-making process, since the southern area of the park is now used as a car park; currently, the administration seems to be planning to increase the number of parking spaces in the next few years at the expense of the present green area. In this area, the participants proposed a series of very promising interventions for the management of urban greenery and ecosystem services. Among these, one of the most interesting included a redevelopment of the car park area with temporary architectural structures, such as exhibitions, art shows and local markets, in order to turn it into a place of

670

REAL CORP 2023: LET IT GROW, LET US PLAN, LET IT GROW
Nature-based Solutions for Sustainable Resilient Smart Green and Blue Cities

aggregation for the city and to create new local economies. Moreover, the participants proposed to better equip the green area with benches, fountains and a dog area in order to transform it into a multifunctional space. Some ideas proposed to restore and safeguard the urban forest, with the involvement of the NGOs that are already active in the park, into a hotspot area with high biodiversity.

During the last urban walk, performed in the Milcovich Park, the participants developed proposals aimed at increasing the services and activities offered by the area. For example, an open-air cinema was proposed for the centre of the park, which is often not utilised. The creation of a bridge in the eastern sector would connect the park with the surrounding neighborhoods, allowing for greater attendance. Finally, the expansion of the area designated for urban gardens was also proposed with the possibility of creating an educational farm with the introduction of beehives.

5.3 Geographical Approach and Geotools in Sustainable Urban Planning

The use of different technologies allowed the understanding that geotools could be suitable according to the activity planned and the context in which it is used. For example, Geopaparazzi works very well for urban walks and less so as a point collection hub to support a dialogue with the public administration. The Geocitizen platform in that case is more effective, allowing social network interactions with reactions and comments and allowing the discussion of the different proposals directly online.

Furthermore, thanks to geotools, it is possible to strengthen the spatial skills and geographical awareness of the participants. In addition, this type of activity brought them closer to relevant topics, such as soil sealing and the importance of safeguarding and increasing the size and number of the urban green areas, while also presenting the guidelines that have been published and promoted by the EU as the EU soil strategy for 2030 and, thus, an acquisition of the geographical and notional knowledge that allows higher quality data collection.

Finally, this study emphasised the importance of developing and supporting such methodologies in the urban environment, not only to produce open-access spatial data and collect geographical information, but also to make the decision-making processes more inclusive and to turn non-expert actors into active participants who create data and participate in the rethinking of urban spaces. These practices also enable the development of more effective and efficient sustainable urban planning and the design of NBS with a variety of environmental and social benefits.

6 CONCLUSIONS

This study highlights the importance of the production of geodata through the implementation of citizen science and the PPGIS approach in an urban context to design and implement adaptation, compensation or mitigation measures in reducing the loss of ecosystem services mainly caused by the soil sealing phenomenon, and improve sustainability and well-being in the cities. The activities promoted in LUP through the testing of different geotools allowed the reconceptualization of some of the green spaces of Padua, promoting the implementation of NBS. Moreover, other ideas were proposed to realise the multifunctional green spaces directly by youths and non-experts actors. The LUP project is an attempt to enhance bottom-up participatory processes for the promotion of more inclusive decision-making processes that aim to involve local communities, their perceptions and visions in order to operate more effectively within the areas in which mitigation and adaptation actions are taken.

7 REFERENCES

Arsanjani, J.J., Zipf, A., Mooney, P., Helbich, M. An Introduction to OpenStreetMap in Geographic Information Science: Experiences, Research, and Applications. In: Springer, OpenStreetMap in GIScience. Lecture Notes in Geoinformation and Cartography, pp.1-15. Berlino, 2015

European Commission, EU Soil Strategy for 2030. Reaping the benefits of healthy soils for people, food, nature and climate. Brussels, 2021

European Environmental Agency (EEA), Nature-based solutions in Europe: Policy, knowledge and practice for climate change adaptation and disaster risk reduction. Brussels, 2021

Gatti, A., and Zanoli, A. Revolution in Precision of Positioning Systems: Diffusing Practice in Agroecology and Organic Farming. Drones and Geographical Information Technologies.In: De Marchi, M., Diantini, A., Pappalardo, S.E. (Eds.). Agroecology and Organic Farming Contributions to Technological Sovereignity, 75–98. Boca Raton, 2022.

HydroloGIS, Geopaparazzi Reference Manual. 2023. Retrieved from: https://www.geopaparazzi.org/geopaparazzi/index.html

Husar, M., Ondrejicka, V., Scacchi, M. Involving Citizens through Walking: Urban Walks as a Tool for Awareness Raising in Historic Built Areas. In: IOP Conf. Ser. Mater. Sci. Eng. 960, 022087. Bristol, 2020

Pappalrdo. S.E., Todeschi, V., Zanetti, C. Mapping urban heat islands and heat-related risk during heat waves from a climate justice perspective: a case study in the municipality of Padua (Italy) for inclusive adaptation policies. In: Landscape and Urban Planning. 238, 104831. Amsterdam, 2023

Peroni, F., Pristeri, G., Codato, D., Pappalardo, S.E., De Marchi, M. Biotope Area Factor: An Ecological Urban Index to Geovisualize Soil Sealing in Padua, Italy. In: Sustainability, 12(1), 150. Switzerland, 2020.

Pristeri, G., Peroni, F., Codato, D., Pappalardo, S.E., Crescini, E., De Marchi, M. Urban geography and participation in the digital era: three studies in Padova between GIScience and VGI. In: Bollettino dell'Associazione Italiana di Cartografia, (166), 62-76. Trieste, 2019.

Restemeyer, B. and Boogaard, F.C. Potentials and Pitfalls of Mapping Nature-Based Solutions with the Online Citizen Science Platform ClimateScan. In: Land, 10(1), 5. Switzerland, 2021

See, L., Mooney, P., Foddy, G., Bastin, L., Comber, A., Estima, J., Fritz, S., Kerle, N., Jiang, B., Laakso, M., Liu, H., Milčinski, G., Nikšič, M., Painho, M., Pődör, A., Olteanu-Raimond, A., Rutzinger, M. Crowdsourcing, Citizen Science or Volunteered Geographic Information? The Current State of Crowdsourced Geographic Information. In: ISPRS Int. J. Geo-Inf., 5(5), 55. Switzerland, 2016

Todeschi, V., Pappalardo, S.E., Zanetti, C., Peroni, F., De Marchi, M. Climate Justice in the City: Mapping Heat-Related Risk for Climate Change Mitigation of the Urban and Peri-Urban Area of Padua (Italy). In: ISPRS Int. J. Geo-Inf., 11(9), 490. Switzerland, 2022

Tulloch, D. Public Participation GIS (PPGIS). In: K. K. Kemp, editor. Encyclopedia of Geographic Information Science. SAGE Publications, Inc., 352–355. Thousand Oaks, 2014