UPLanD
Journal of Urban Planning, Landscape & Environmental Design

Research & experimentation
Ricerca e sperimentazione

Soil de-sealing and participatory urban resilience actions: the "Green in Parma" case study

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Highlights

- Soil de-sealing actions can be an effective bottom-up intervention in urban adaptation strategies.
- A co-design participation process has been experimented in a private-public setting.
- The dissemination and participatory process has gathered interest among citizens and stakeholders, who established a collaboration network going beyond the success of the single initiatives fostered by the project.
- Third Mission activities on the topic of climate change adaptation provided an important opportunity to test new participatory techniques for urban planning and regeneration processes.

Abstract

In the last centuries, urban areas have been increasingly facing climate change-related thermal stresses and extreme events. Within this context, soil de-sealing might become a relevant part of urban adaptation processes, as well as an opportunity to activate citizens' participation, in a bottom-up logic that virtuously integrates top-down interventions.

This paper reflects on the outcomes of the applied research experiences with Third Mission traits carried out within the project "Green in Parma", with the purpose to investigate the role of soil de-sealing in participatory processes, and to face the impacts of climate change with a bottom-up logic. These experiences allowed to gain insight about the role of academic research in this context and to link it to the more traditional Italian top-down urban planning tools.

"Green in Parma" was promoted in 2021 by voluntary organizations, private companies, and the University of Parma. The initiative can be divided into a first dissemination module about the multifunctional benefits of green at urban scale, followed by a participatory and co-design module which aims at a bottom-up desealing intervention. Within this second module, several activities are taking place or are being planned.

This contribution presents the first phases of these applied experiences, as well as a discussion about the first results and some of the outcomes of the questionnaire proposed to the citizens of Parma on their perception of the local climate change effects.

Article history

Received: March 19, 2023
Reviewed: May 31, 2023
Accepted: June 08, 2023
On line: July 05, 2023

Keywords

Soil de-sealing
Urban resilience
Climate change
Participation
Public survey

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1. Introduction

As it has been reported in the “Cities, Settlements and Key Infrastructure” chapter of the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC, 2022), cities are being affected by more and more extreme weather phenomena, while authorities, institutions and the scientific community are increasingly investigating adaptation and mitigation strategies, as well as actions to reduce climate change risks. Floods and heat waves, and the increasing soil sealing result in more exposed and vulnerable urban systems (Apreda, 2016). According to the periodic report on the risk posed to the Italian population by landslides and floods of the Research Institute for Hydrogeological Protection (“Rapporto Periodico sul Rischio posto alla Popolazione italiana da Frane e Inondazioni dell’Istituto di ricerca per la protezione idrogeologica”), published by the Italian National Research Council (Consiglio Nazionale delle Ricerche), 636 Italian cities were affected by floods or landslides in 2020 (Bianchi & Salvati, 2021). The trend of maximum, minimum, and average temperatures recorded in major Italian cities is increasing, with a rise of 0.3°C from 2006-2015, and tropical nights are becoming more frequent (Istat, 2022). Moreover, the increasing sealing of open spaces is intensifying these phenomena. Indeed, covering the natural soil with impervious artificial materials causes the loss of its ecosystem services provided: from regulation and maintenance services - which affect water resource flows, subsurface biodiversity, and air quality - to supply and cultural services, thus leading to a decrease in the quality of urban life (Munafò, 2022). Therefore, new needs emerge in cities, and urban areas acquire a central role in experimenting adaptation and mitigation actions (Gerundo, 2018), also through the implementation of green and blue infrastructures (Perini & Sabbion, 2016; Salata & Yiannakou, 2016). One of the known techniques to increase green infrastructure and soil permeability is soil de-sealing, which, according to European policies, can contribute to achieving the goal of no net land take by 2050 (Science for Environment Policy, 2016). De-sealing, i.e., the removal of the impermeable layers of soil to restore its permeability and ecological functions, is a possible solution to be mainstreamed in cities, in order to reduce surface temperatures and mitigate the urban heat island effect (Adobati & Garda, 2018; Tobias et al., 2018; Jobstman et al., 2011), thus giving back to the soil its climate and microclimate regulator role. At present, the issue of soil protection and soil consumption is dealt with in Italian city planning and land-use regulations mainly by limiting urban expansion (land take) and only indirectly by preventing soil sealing. This is the case in the most recent Italian regional regulations. However, the term de-sealing is used in the Emilia-Romagna urban planning law (L.R. 24/2017) with the dual role of an incentive measure for urban regeneration operations and a compensatory measure for new soil sealing processes. At the European level, the experience of the SOS-4Life Project "Save our soil for life" (https://www.sos4life.it/), which has dealt with soil consumption mainly through de-sealing actions, as well as education and dissemination of tools and information to institutions and civil society, has been significant. The project led to the implementation of pilot actions of soil de-sealing in urban areas in three small and medium-sized towns in Emilia-Romagna (Forlì, Carpi and San Lazzaro di Savena). The outcomes of this project have highlighted the value of de-sealing interventions in bottom-up processes, recalling several initiatives and movements at the international level promoted by associations and volunteers sensitive to the issue. Among the others, as the American association “Depave” (1) and the Canadian project “Depave Paradise” (2). De-sealing action requires a widespread regeneration of public and private open spaces. Moreover, as it concerns local neighbourhoods and communities, it raises issues related to social and environmental sustainability, public consensus, and the possible involvement of stakeholders and citizens in the decision-making and urban transformation design processes (Lafortezza & Sanesi, 2019). Several research contributions, in fact, investigate and experiment possible methods and techniques to involve stakeholders and citizens in spatial planning and urban design processes with attention to the issue of climate adaptation (i.a. Uittenbroek et al., 2019; Amenta & Arena, 2020). Therefore, it seems appropriate to investigate the role of de-sealing in bottom-up processes, in order to improve the integration of knowledge areas and reach a higher consensus on the adaptation strategies (Burton & Mustelin, 2013; Conway et al., 2019). This contribution aims to illustrate and discuss an example of collaborative and participatory community project, “Green in Parma”, which involved the research group in Urban and Regional Planning of the University of Parma in an applied research experience with Third Mission traits. The next paragraphs outline the main features of the project through a description of the actors involved, the main objectives, and developed processes. This contribution will focus on some of the project's initiatives, including the attempted co-design of a de-sealing intervention in a parish in the city of Parma. Moreover, this contribution will present the public survey, promoted by partners of the “Green in Parma” project, aimed at starting a public debate and acquiring insight on citizens' perception of the urban impacts of climate change. The public survey represents the most recent initiative of the project “Green in Parma”, thus only a descriptive analysis of the initial findings will be discussed.

2. The "Green in Parma" project: objectives and phases

The “Green in Parma” project focuses on the role of greening in local strategies for the adaptation to the effects of climate change. “Green in Parma” is, in fact, a community project that aims to make the effects of climate change on the quality of urban life understandable to individual citizens, civic associations and other organised realities in Parma, to document and inform on the role of urban greenery, and to involve residents in participatory processes leading to the realisation of experimental interventions for the conversion of sealed soil to green spaces (Centro Etica Ambientale, 2021).
The project is promoted and led by Centro Etica Ambientale di Parma (CEA), a third sector organisation (3) that is part of the Italian Network of Centres for Environmental Ethics (CepEA) and promotes actions in accordance with the Sustainable Development Goals (SDGs) of Agenda 2030 coordinating a rich network of local partners, i.e., different social and economic actors.
In the early months of 2021, CEA organised a series of Open Science Webinars together with different local organisations and institutions, including the University of Parma, regarding the implications of climate change on the city of Parma. The debate triggered by the events brought out the need to transfer knowledge to active citizens, in order to stimulate and support urban transformations as solutions to fight against the challenges posed by climate change. Within this context, the community project “Green in Parma” was developed. The project responds to the specific need to pursue a participatory approach to implement more effective greening interventions that meet the needs of the community.
In addition to the CEA, many other partners co-operated in the project initial development bringing expertise in environmental and social issues or funding (4). In April 2021, the project won the call proposed by IREN Territorial Committee (5) to receive co-funding and, subsequently, additional local associations, enterprises and institutions got involved in the project as partners (6), including the University of Parma engaged in Third Mission activities for knowledge transfer. “Green in Parma” was launched and presented to the public the following autumn.
The project focuses on three main aspects: (i) defining a model of action to transform the urban fabric according to resilience principles; (ii) involving different social, environmental, and institutional organisations; (iii) making participatory processes a central component of the regeneration interventions to be implemented in the city, with a focus on soil de-sealing and greening actions.
“Green in Parma” can be intended as a pioneer project in Parma. It is the first participatory-oriented project in the city which, through the collaboration of the University of Parma and the local stakeholder, envisions an increased urban resilience with a focus on green areas and soil de-sealing. The project can be therefore intended as an experimentation, which relies mainly on the experience of its members. For instance, the researchers of the University of Parma provided the technical and theoretical expertise concerning climate adaptation actions and participatory processes, while the CEA had a strong knowledge regarding awareness raising and dissemination strategies, gained from the activities that it presented in the recent years.
Various meetings among the project partners were organized, as well as seminars and public meetings to promote the project (7) and to discuss the local effects of climate change, as well as possible adaptation responses, including the benefits of urban greening, greening actions, and increased shading in urban areas.
As shown in Figure 1, the main initiatives of the “Green in Parma” project refer to three main modules. The first info-documentation module (A) includes the dissemination and awareness-raising actions proposed by the organizers, with the aim of making the local effects of climate change

understandable to the citizens and stakeholders involved. This module also allowed the creation of a network of partners and contacts. This network was meant to gather, through a bottom-up approach, the availability of an area for the implementation of a possible de-sealing intervention.
Since the end of October 2021, a series of public and partner meetings occurred, with the aim of raising awareness of the local effects of climate change and presenting the vision and structure of the project also to the city's stakeholders. Certain dissemination seminars adopted a more technical communication approach, hosting experts who discussed the benefits of greenery and ecosystem services. The seminars included, among others, speakers from the CNR's Istituto di BioEconomia (BioEconomy Institute).
The second module (B) of the project "Green in Parma" includes participation and co-design actions, aimed at actively involving citizens and companies in initiatives of public relevance, to raise interest on issues related to climate change impacts, and to initiate co-design activities. The above-mentioned module includes the outline of strategies for de-sealing interventions in areas chosen with bottom-up process that involves the project's partners, the stakeholders, and the community that would eventually be in charge of the management of the redeveloped area. Module B also includes various "practical" initiatives, which will be thoroughly explained in the following paragraphs, such as the de-sealing experiment in the San Bernardo Parish. The initiative involved the "Comitato di Quartiere Manifesto San Leonardo" (San Leonardo Neighbourhood Committee) and the community of the parish, as well as the local realities that were willing to support this soil transformation intervention. Participation activities also include initiatives aimed at reaching and involving citizens, both adults and young people, in resilient open space co-design activities and awareness rising of the local effects of climate change.
Within this phase the project partners developed a public survey "Parma si interroga sugli effetti locali del cambiamento climatico" (Parma wonders

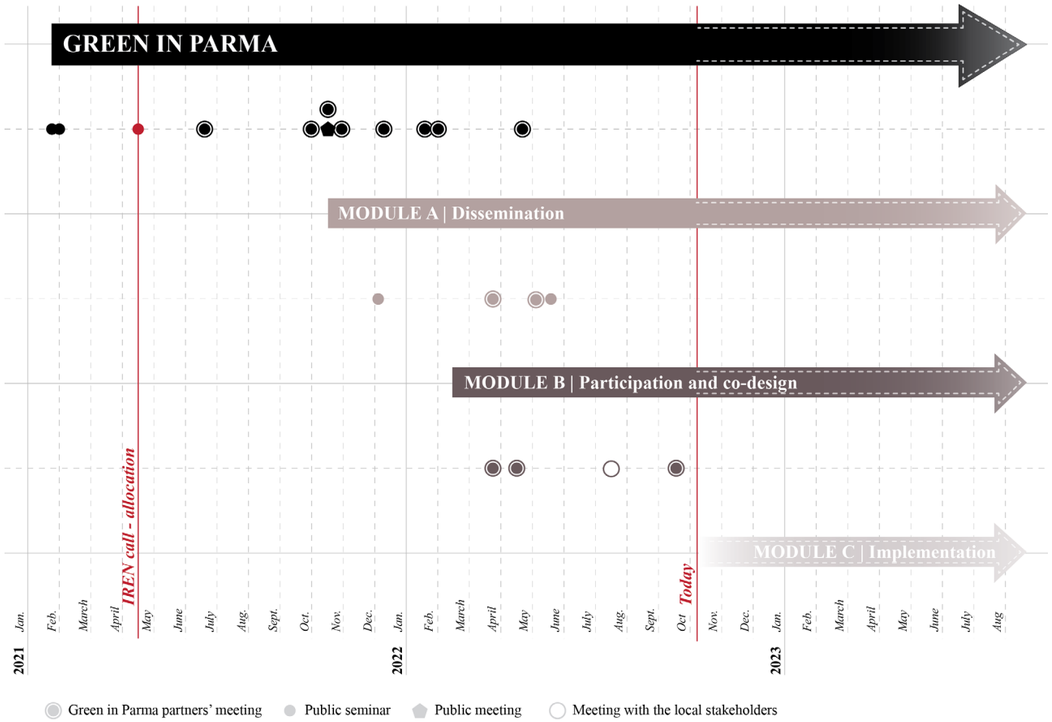

Figure 1: Timeline of the project phases. *Source: own elaboration.*

about the local effects of climate change), launched at the end of 2022, by spreading a questionnaire through an online platform.
The third module (C) envisages an executive phase consisting of the effective realisation of an urban de-sealing or greening intervention, for which innovative financing methods are envisioned, with the involvement of a community foundation and the use of crowdfunding actions. However, this Module presents no active initiatives to this date.
The technical support for the activities of the first two modules was provided by the research group in Urban and Regional Planning of the University of Parma, whose research activity focuses on cities' adaptation to climate change, investigating on the one hand, the in-depth studies about soil de-sealing actions and its possible implementation in urban planning tools, and on the other, the study of participatory processes from the point of view of their impact on spatial planning and transformation processes.

3. The main initiatives of the "Green in Parma" project

The "Green in Parma" project has generated several applicative activities, which are currently in different implementation stages. These synergic but distinct activities can mobilize and involve a large number of stakeholders, enriching the debate with different perspectives, skills, and sensibilities. All these ongoing initiatives are part of the second phase of the project (module B).
A co-design initiative focused on soil de-sealing was launched in February 2022 in the San Leonardo district to the north of the city of Parma. It is divided from the historic centre by a railway axis, characterised by a high population density and marked multiethnicity. This area has frequently been the scene of significant redevelopment by the municipal administration, to improve the quality of the urban and territorial landscape of the city, to overcome those critical safety and degradation issues that have emerged over the years, and thus increase local wellbeing.
The initial idea was to involve the Parish San Bernardo and the local neighbourhood committee "Manifesto di San Leonardo" in a participatory co-design process to de-seal the courtyard of San Bernardo's church. The front yard had in fact been reported in previous public events as a highly impermeable area and particularly critical in the summertime due to the heat island effect. Moreover, the dual nature of this area - private but available for public use - allows for more direct intervention procedures compared to those of public areas and offers the advantages of an established and active community.
The research group of the University of Parma proposed an initial analysis of the area and its context, focusing mostly on the low ecological value and the high degree of imperviousness of the parish front yard. Then, some representatives of the parish were involved in a meeting, where the university research group shared some preliminary planning hypotheses to activate the community co-design process. To frame the preliminary analysis, representative photographs of the site were used, as well as images more understandable to the common citizens to support the proposed natural solutions. An attempt was also made to use language that was not too technical in explaining the intervention hypotheses with the aim of reaching the attention of even those who are not in the sector.
The following critical issues emerged from the debate triggered on that occasion: (i) the lack of shade in the parish courtyard, (ii) the resulting high summer temperatures, and (iii) the small size of a tree-lined flowerbed. Thus, one of the possible proposed hypotheses was the incremental removal of asphalt paving and interlocking concrete pavers, following a 3mx3m grid (Figure 2), in a temporary-to-permanent intervention perspective.
Based on the outcomes of the co-design process in the San Bernardo Parish, it is possible to deduce that the collaboration which was established between stakeholders and citizens went beyond the scope of a single initiative. For this reason, the CEA, the University of Parma and ARPAE proposed an exploratory public survey to gather insight on the perception of city residents and regular users on the local effects of climate change in the city of Parma. Objective and first results of the survey are illustrated in the chapter 3.1.
A collateral activity of the "Green in Parma" project, in which the University of Parma is involved, is planned for the future. It was proposed in March 2022 by a Parma agronomist with expertise on the enhancement of small-scale urban greenery. The initiative is aimed at developing a manual with up-to-date solutions to implement and enhance green spaces pointed out by citizens through a Community Voluntary Survey. The intention is to identi-

fy potential green areas to be upgraded through voluntary surveys conducted by a selected group of Parma citizens. For the time being, the development of the initiative includes: (i) the preparation of a "catalogue of typical cases" to guide the identification of potential areas for intervention; (ii) the organisation of a Community Voluntary Survey, a form of Citizen Science that allows citizens' reports to be collected through a collaborative GIS platform; and (iii) the drafting of a handbook with a "catalogue of interventions" illustrating the value of high-quality green areas.
A pilot experimentation of the first two points was experimentally implemented during an orientation course for high school students delivered by the research group as part of the Transversal and Orientation Skills Pathways, which took place in April 2022; the students could take part in a collaborative data collection experience through a GIS platform implemented with the Mergin Map application. The results of this first application will be used to calibrate the structure of the official survey.

3.1 An urban-scale survey for further resilience scenarios

A public survey has been proposed and developed by CEA, the University of Parma and ARPAE, with the contribution of additional partners (8), with the aim of investigating citizens' perception of the local risks posed by climate change. The questionnaire, titled "Parma si interroga sugli effetti locali del cambiamento climatico" (Parma questions local effects of climate change), has an exploratory nature. The theoretical framework of the questionnaire can be traced back to the Community-based participatory research principles - which envision the democratic collaboration

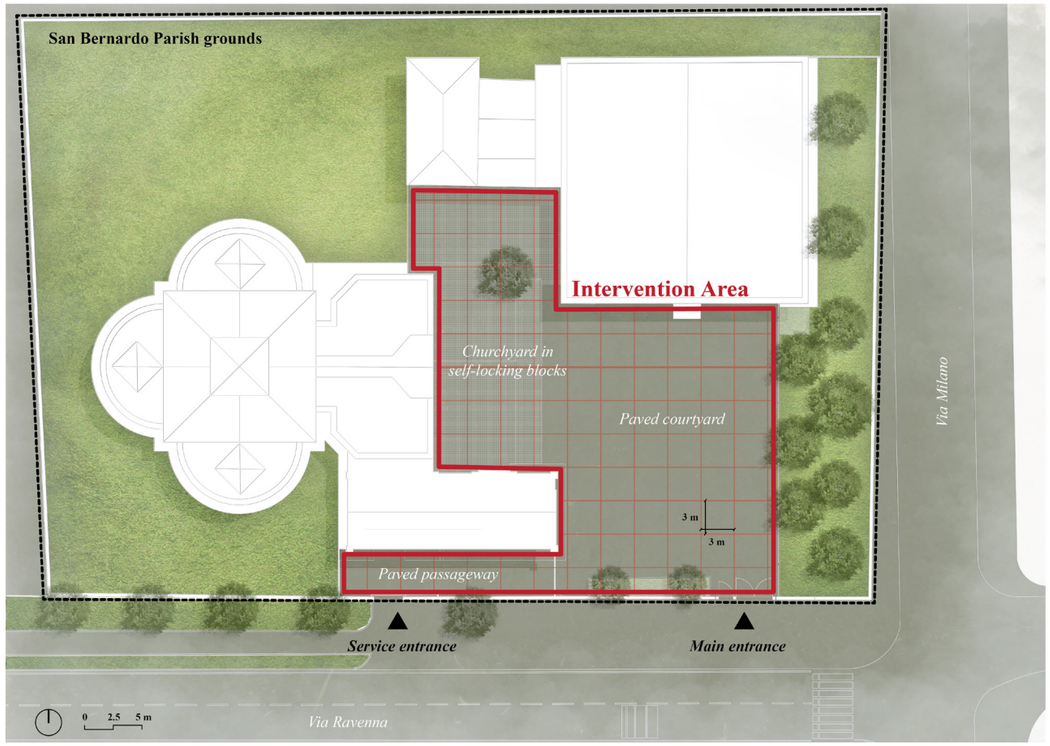

Figure 2: Hypothesis of intervention from temporary to permanent for the San Bernardo Parish: overlapping of a 3mx3m grid identifying regular guiding sectors for a co-designed process of progressive de-sealing of the courtyard. *Source: own elaboration.*

of researchers and communities (Lepore et al., 2021) - and, for what concerns the questions, on the case study of the Climate Transition Strategy (STC) of Brescia. The Municipality of Brescia, in the context of the STC, distributed the questionnaire "Brescia e Il Clima Che Cambia" (Brescia and changing climate) (9) to its employees to investigate their perception about climate change. It should be noted that, given the experimental nature of the project "Green in Parma", the questions were strongly based on the previous phases of the project, along with the theoretical framework. Moreover, an interesting feature of the survey is its participatory nature, acquired through the dialogue of the researchers of the university and some members of the CEA that connotated its setup.
In the drafting phase, given the potential differences in the age groups, as well as in the levels of knowledge on the subject, the questions were designed to be as simple and comprehensible as scientifically correct. The questionnaire was developed in September 2022, and was then implemented on the EU Survey online platform, which allows for complete anonymity of the respondents. In terms of structure, the questionnaire consists of 13 questions, which pertain to three parts. The first part collects the participants' demographic data and the geographical location of the participants in the city (the neighbourhood of residence or usually frequented); the second part investigates the perception of climate risk at various scales (sub-regional, urban, and neighbourhood); while the last part requires the participants to report which adaptation solutions they consider most urgent in their neighbourhood. The survey, which has been available on the platform since December 2022, was promoted through local newspapers, through the institutional channels of the University of Parma (such as students' and employees' mailing lists, and newsletters), and the CEA's address book. Over a period of two months, the questionnaire was filled out by 1343 respondents. The analysis of these first answers was presented at a press conference on March 4, 2023. It covers the data acquisition period between December 27, 2022, and February 28, 2023. The initial, descriptive analyses show that the participants mainly belong to the 21-30 age group (Figure 3), are predominantly women, and mostly live in the Parma Centro neighbourhood. In terms of occupation, participants are mainly students (36%) and only half say they are not engaged in any social or community activities. Ninety per cent of participants think that climate change has a very relevant role on the increasing trend of dry springs and winters and big summer droughts, heavy rains, hailstorms, and tornadoes. Similarly, 89% of the participants consider climate change very relevant on the trend of increasing temperatures and frequency of heat waves. When asked whether, due to heavy rains, hailstorms, high winds, and tornadoes, damage occurred to public or private property in their neighbourhood, 54% of respondents chose "some", 10% chose "many", and 10% chose "none". The most voted impacts of climate change on the city were in order: (i) negative health effects due to poor air quality; (ii) flooding and inundation tied with reduced usability and liveability of the outdoor environment for people and animals; (iii) restricted drinking water supply; (iv) degradation of green areas and street greenery; (v) increased mortality among the very elderly and frail tied with (vi) negative effects on the safety and well-being of workers in the outdoor environment (Figure 4). More than half of the participants do not know whether there have been incidents in their neighbourhood in which people have been se-

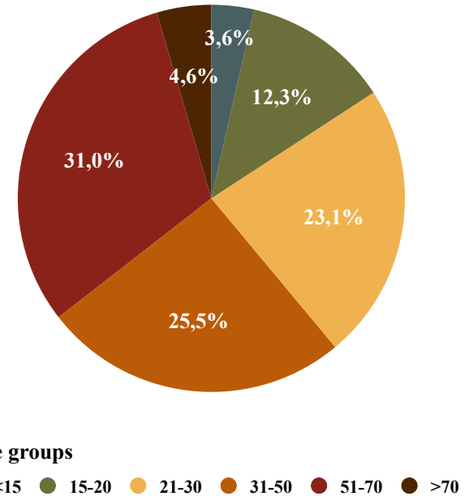

Figure 3: First results of the public survey: diagram of the age groups of the participants. *Source: own elaboration.*

riously inconvenienced, while 40% are aware that green areas are decreasing. Moreover, more than half of the participants are aware that there have been some incidents of flooding or damage to public/private property. The interventions considered most urgent in the built-up areas in the selected neighbourhoods, in order to reduce climate risk, are soil de-sealing and rain barrel construction. On the other hand, when considering open spaces, the interventions considered most urgent are the planting of trees and shrubs, new green spaces connected to the existing ecological network, and the creation of infiltration trenches along roadsides.

4. Discussion on the preliminary results and future research perspectives

The experience in which the group engaged for specific research interests allowed for some initial insights into the role of de-sealing interventions in public engagement processes. From an initial monitoring of the outcomes of the early project stages, it is possible to say that the first initiatives generated widespread interest among the public and stakeholders for its exploration of adaptation and de-sealing actions in an urban environment where the issue of climate change seems to be particularly felt.
Module A, in presenting specific applicative cases, succeeded in stimulating citizens and contributed to consolidate and expand the network of local actors involved. The coordination among partners, with their mixed expertise, enhanced the proposed initiatives, creating a fertile ground for constructive discussion, which was only sometimes limited by the different backgrounds and agendas. Indeed, a positive initial outcome could be the identification of active community members willing to collaborate to implement open space greening interventions. The development and maintenance of a network of stakeholders who are sensitive to these issues was also considered a value because it provides an operative framework for future Third Mission activities, beyond the specific success of the current project.
However, some critical issues were encountered in proposing an initial experiment of soil de-sealing co-design in a real pilot case, i.e., the San Bernardo Parish, where the purpose was to verify the feasibility of de-sealing and to involve the community that would live and manage the area. The opportunity to study an area lived by the community revealed significant challenges that were addressed through the proposal of small greening interventions. De-sealing the unnecessarily sealed areas could play an important role in the ongoing regeneration process of the analysed neighbourhood, providing an increased environmental and social urban quality. The role of the University in this initiative was to illustrate the environmental benefits produced by the possible de-sealing action with the help of some preliminary ideas, and to suggest possible methodological approaches to the co-design process, such as the implementation of exploratory surveys and targeted interviews.
It was proposed to start with temporary actions

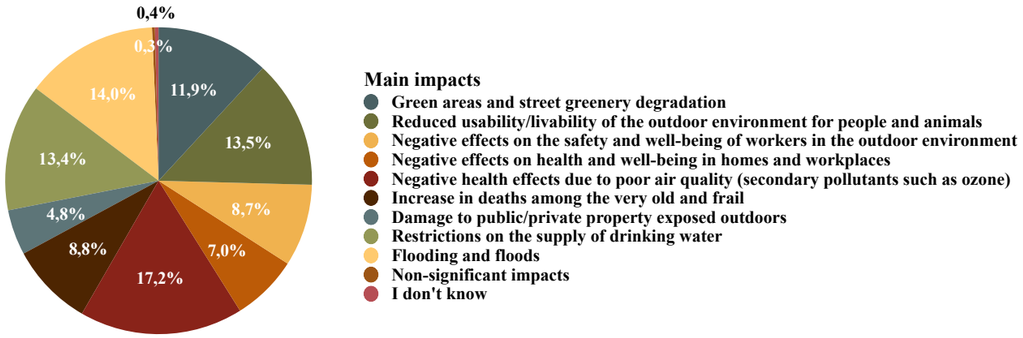

Figure 4: First results of the public survey: diagram of the main climate change impacts voted by participants. *Source: own elaboration.*

first, inspired by tactical urbanism (Greco, 2012), to test the most suitable and enjoyable solutions, and then to proceed, in a second phase, with the permanent de-sealing of the area, to be carried out eventually in self-construction (with the economic support of the "Green in Parma" funds and the technical support of local voluntary associations, partners of the project). It should be noted that the proposed de-sealing action has a "pilot" nature and deals with a small intervention area. The project, also given the economical constraints, was aimed at having a climate impact at the local scale, and hopefully word of mouth relapses at the neighbourhood and city level. A positive environmental impact at the city scale, on the other hand, would require a different economical and planning effort.
Although the intention was to respond to concrete needs of the parish community, several resistances emerged, related in particular to the issue of maintenance costs of the new green areas, the problem of changing some established functional uses, and the need to allow full access to the area by motorised vehicles, both for the elderly and for possible emergency needs. This experience raised questions about whether the trade-off between speed of the process and probability to succeed is favourable on the side of choosing a private area instead of a public one. The general agreement of the parish community on the projects' ideals and scopes did not directly translate in the willingness to discuss changes in the usual functions of the spaces. The difficulties encountered made it possible to draw useful considerations on how to approach specific urban communities with sometimes conflicting needs and expectations, in order to propose more targeted and accepted resilience-enhancing pathways (Meyer et al., 2018).
Another lesson drawn from the experience is to carefully consider how to propose pre-planning ideas (even if purely preliminary and indicative), as people may perceive them as imposed and final. In this context, the Dutch "Steenbreek" Program could provide useful insight for the future developments of the project. First of all, Steenbreek is a foundation that involves, among the others, municipalities, provinces, water boards, various groups (such as NGOs), ecologists, and universities, creating a network of cities to take action against the trend to pave private gardens. Stobbelaar et al. (2021) analysed Steenbreek initiatives and their influence on behavioural change, highlighting, among the others, the influencing factors, and the way in which the program deals with barriers. For instance, it was noted that the foundation funds the removal of the tiles and provides for the new greenery; that it focuses on the advantages of increasing soil permeability, such as the low maintenance of the de-sealed areas and that it keeps in mind social factors, combining them with environmental factors or supporting projects that stem in society.
The role of the economic resources involved has been twofold. First, the presence of a fund issued by a third-party institution has been carefully explained to stakeholders, in order to ease the early planning and co-designing phases. However, when the community members faced the preliminary budget estimates concerning the pre-design de-sealing proposals, resistances arose. It should be emphasized that a clear budget analysis that could assess the feasibility of the initiative cannot be put in place without at least some design hints and preliminary choices, which must be carefully communicated to the stakeholders for what they are: tools for discussion and the budget dimensioning.
Nonetheless, clarifications on the practical advantages of de-sealing, together with the involvement of society issue could constitute valid future strategies to remove some of the encountered barriers. To date, it is not possible to establish whether a bottom-up participatory process focusing on climate change and de-sealing has more or less transformative power than a traditional participatory planning process led by city institutions. However, it is possible to state that a certain lack of knowledge and awareness on these issues is still present among citizens, which might therefore limit the possibilities of successful intervention in privately owned urban areas. The community members involved, in fact, have exerted the freedom to place limitations on the proposed intervention when the environmental benefit produced was not deemed to outweigh the social benefit of space use.
The first "unsuccessful" attempt of the co-designed de-sealing process of a semi-public space, however, has been useful because it suggested recalibrating the activities, focusing on the public city instead, in agreement with the municipal administration, as an opportunity to continue to stimulate and nurture citizens' awareness. The imagined path, which still aims at involving the public, could find a valid methodological support in the approach of community-based research (Lepore et al., 2021), adapting it to the case of Parma, and to the issues of climate change adaptation.

A first exploratory phase, the submission of an initial simple questionnaire to local communities through neighbourhood committees, might help to disseminate more information, gauge their sensitivities, and map out the actors which could be potentially interested in getting involved in more operational activities (e.g., Urban Labs experiences, such as exploratory neighbourhood walks, applicative workshops, community voluntary surveys). In a second phase, the identified groups could be engaged to gather ideas and stimuli with the purpose of co-designing new project areas in the public open space. This two-stage approach led the "Green in Parma" partners to decide to promote an urban-scale public survey, with the aim of addressing de-sealing co-design pathways at a later stage, having first acquired a greater awareness of public awareness and opinion.

The results of the survey, which are currently being elaborated, firstly revealed the desire of expression of citizens, which was understood by widespread participation and the number of responses collected. Second, the responses made it possible to derive some indications of what, in the participants' perceptions, are the most significant impacts of climate change on the urban area of Parma. For example, the worsening air quality, probably due to its effects on health, flooding and inundation, and reduced liveability of open spaces were considered very relevant. These results are probably due, on one hand, to the media and institutional attention to the issue of air quality, with the public imposition of restrictions on the most polluting activities, and on the other hand to the still vivid experience in the citizens of Parma of extreme events such as the floods that occurred in Parma in 2014 or the anomalous summer of 2003. The public questionnaire was intended to prepare the ground for further developments and to gauge the interest of the general public. However, the results of this exploration are also useful material for research, for the possibility of analysing the reports and perceptions according to the demographic and socio-economic characteristics of the participants and spatialising them on the basis of the neighbourhoods indicated in the questionnaire's answers (Taylor et al., 2014; Conway et al., 2019). These indications may also be useful for the advancement of the "Green in Parma" project, on the one hand, offering cues to continue and better target the dissemination and training activities of module A, on the other, identifying urban neighbourhoods where climate change phenomena are most perceived, in order to propose more targeted and effective soil de-sealing processes in an ongoing dialogue with the most interested local communities (module B). Participation, which is supported also by regional legislations (Regione Emilia Romagna, 2016), and co-design allow for the integration of demands arising from environmental issues related to climate change, with critical social issues that can only emerge with citizen involvement (Frantzeskaki et al., 2019).

Finally, the initiative to map green spaces to plan greening measures, although still in the early stages, was illustrated to emphasize how the dialogue between the stakeholders may result in novel activities proposals that could probably lead to interesting outcomes for research as well.

The "Green in Parma" project stands as an example of collaboration among groups and associations with the common goal of making the existing city more resilient to climate change with a better management of the urban green infrastructures. One of the most interesting aspects of this experience was to examine the role of the University, represented here by the research group in Urban and Regional Planning, as technical support in dissemination, participation, and co-design activities. The research group's activities are aimed at understanding the criteria and tools with which de-sealing actions can contribute to the climate change adaptation strategies of urban plans, also by testing the role of public participation and dissemination actions.

In this sense, participation in the "Green in Parma" project, although the de-sealing action envisaged in the project has not yet been implemented, represents an important opportunity for the university to establish an ongoing dialogue with local stakeholders committed to environment and climate change issues, to transfer knowledge as in typical university's Third Mission activities, but also to acquire awareness, thanks to public involvement, of the needs and sensitivities that can stimulate effective bottom-up dynamics of urban space transformation.

The experience gained in this project can be useful as a case study for future applications in different urban contexts. It has highlighted some possible strategies for Third Mission initiatives to encourage the dialogue and the exchange of ideas between research groups, and stakeholders, such as the transposition of practices and technical insight in easy and open proposals.

This contribute suggests future research perspectives committed to defining what effects the outcomes of public participation on adaptation and soil de-sealing may have on urban planning and city regeneration processes.

ENDNOTES

1. The "Depave" association was founded in 2007 in Portland (Oregon). Its scope is to stimulate the activation of de-sealing projects for collective space by actively involving thousands of resident and citizen volunteers. https://depave.org/

2. "Depave Paradise" is a project of Green Communities Canada and its local partners in communities across Canada, that supports volunteers and neighbourhoods to remove unwanted pavement and plant gardens filled with native species in its place. https://depaveparadise.ca/

3. CEA Parma is a third sector entity that coordinates and develops projects in accordance with the Sustainable Development Goals of Agenda 2030 and the values and themes of Pope Francis' Encyclical "Laudato Sì". See also: https://www.centroeticambientale.org/

4. The social cooperative Cigno Verde and Federconsumatori Parma bring their expertise in environmental and social issues, and the Fondazione di Comunità Munus (Munus Community Foundation) acted as a fundraising partner.

5. Organizations which connect Iren Group, an energy multiutility, and local stakeholders regarding the company's services and sustainability. See also: https://www.gruppoiren.it/it/sostenibilita/coinvolgimento-degli-stakeholder/comitati-territoriali.html. For the co-founding and support activities of IrenCollabora see: https://www.irencollabora.it/projects/6017c061257f5792056d520e/green-in-parma/6017c061257f5792056d520d

6. Additional partners are Manifattura Urbana, Parma Sostenibile and Legambiente Parma, the Consorzio Forestale KilometroVerdeParma (non-profit Forestry Consortium in charge of the "KilometroVerdeParma" project, whose main purpose is the creation of permanent forests in the province of Parma. https://www.kilometroverdeparma.org/consorzio/) Emilia-Romagna Agenzia Regionale Prevenzione Ambiente Energia (Arpae, the Regional Agency for Prevention, Environment, and Energy), and the Parma-based remote-piloted aircraft survey company AeroDron.

7. The materials of the events can be found at the link: https://www.centroeticambientale.org.

8. The survey was sponsored by: the ecologist association Associazione Donne Ambientaliste (ADA Onlus); the Associazione Medici per l'Ambiente di Parma (ISDE), which gathers doctors engaged in environmental issues; the Azienda Unità Sanitaria Locale di Parma, the local public health institution; the Confederazione Nazionale dell'Artigianato di Parma (CNA), a local entrepeneurs association; the Liceo Gian Domenico Romagnosi di Parma, a Parma high school and La Repubblica Parma, as media partner.

9. The results of the survey can be found on the website of the Municipality of Brescia, see: https://www.comune.brescia.it/aree-tematiche/urban-center/progetto-un-filo-naturale/un-filo-naturale-una-comunita-che-partecipa/un-filo-naturale-una-comunita-che-partecipa

Acknowledgements

The authors composing the research group in Urban and Regional Planning of the University of Parma involved in the project have the following skills: all authors, coordinated by Professor M.Z. deal with urban regeneration, in particular the research interests of B.C. concern the integration of urban planning and active mobility systems with a focus on urban accessibility and open space planning. G.T. has focused its research activities on the exploration of climate change adaptation policies; M.C. and I.D.N. on soil de-sealing and climate change adaptation strategies in urban contexts, and I.D.N. also investigated the main features of participatory processes and Community-based participatory research, also by submitting public surveys.

This work was carried out in collaboration with the PhD Students Arch. Marianna Ceci (M.C.) and Ing. Arch. Ilaria De Noia (I.D.N.), whose PhD programme is funded by the National Operational Programme on Research and Innovation 2014-2020 (CCI 2014IT16M2OP005), FSE REACT-EU funds, Action IV.4 “PhD programmes and research contracts on innovation” and Action IV.5 “PhD programmes on green related topics”. CUP: D91B21004730007; scholarship code and number: DOT1321814 n. 2 (M.C.) and DOT1321814 n. 6 (I.D.N.).

Attributions

The authors jointly designed and contributed to the paper. Conceptualization: M.Z., B.C., G.T., M.C. and I.D.N.; supervision: M.Z., B.C.; writing-original draft, M.C., I.D.N. and G.T.; writing-review and editing, B.C., M.C., I.D.N. and G.T. Corresponding author: B.C.

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