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Research article

Participatory processes for risk communication: The CITIES platform

Francesco De Pascale[1,*], Eleonora Guadagno[1], Marzia Mauriello[2], and Riccardo Rosa[2]

[1] GeoRiskEcoLab Centre, Department of Human and Social Science, University eCampus, Italy
[2] Department of Humanities and Social Science, University "L'Orientale", Italy

* **Correspondence:** Email: francesco.depascale@uniecampus.it; Tel: +39 3478964936

Abstract: Contemporary scholarship highlights the limits of purely top-down approaches to risk communication, particularly under conditions of uncertainty, vulnerability, and institutional mistrust, and supports more dialogic and participatory models. This article presents the design and participatory workflow of the CITIES platform, a digital environment that supports the co-production and circulation of knowledge between citizens, institutions, and stakeholders. Three Italian pilot cities (Enna, Macerata, and Bacoli) are used as case studies to assess a platform-based approach in order to read urban "riskscapes". Within this framework, the platform has been co-constructed by using a mixed-method approach (combining document analysis, data gathered from online surveys, qualitative interviews, and focus groups). The platform is discussed here as a civic infrastructure that can facilitate structured exchange between communities and public institutions, with possible implications for transparency, inclusion, and context-dependent transferability.

Keywords: risk communication; participatory platforms; citizen science; riskscapes; risk perception; CITIES; Enna; Macerata; Bacoli

1. Introduction[1]

In recent years, the study of risk governance has undergone a significant transformation, largely driven by the recognition that conventional, top-down approaches are no longer sufficient to address contemporary challenges [1,2]. Models based on linear information flows and expert-led decision-making have shown clear limitations when confronted with the complexity of environmental, climatic, and territorial risks, especially in contexts marked by uncertainty, social vulnerability, and declining levels of institutional trust [3,4]. As a result, risk communication has progressively shifted from being a unidirectional process of information delivery to a more dynamic and relational practice, involving interpretation, negotiation, and the co-production of meaning among diverse actors [2,5].

This transformation is closely linked to broader changes in the ways citizens engage with public decision-making. While participation in the twentieth century was largely mediated through institutional channels and collective organizations, contemporary societies increasingly demand more direct, flexible, and issue-oriented forms of involvement [6,7]. Such developments have created new opportunities for participatory approaches, particularly at the local scale, where the impacts of climate change and natural hazards are most immediately experienced [8,9].

Within this evolving landscape, approaches such as citizen social science have gained prominence by emphasizing the active contribution of non-experts to knowledge production. As highlighted by Senabre Hidalgo et al. [10], participants bring forms of situated knowledge rooted in everyday experiences, including those related to local environments, health, social inequalities, and climate-related practices [11–13]. Rather than being passive recipients of expert knowledge, citizens are increasingly recognized as capable contributors to the construction of socially relevant and context-sensitive insights. Co-creation processes play a key role in this framework, enabling the collaborative design of research activities through the integration of tools, practices, and shared methodologies [14].

Digital technologies have been central to enabling these shifts. Over time, digital platforms have evolved into key infrastructures for organizing communication, facilitating interaction, and supporting collective action [15].

While a significant body of research has critically examined the role of commercial platforms in shaping public discourse and extracting value from user-generated data [16], parallel developments have led to the emergence of civic technologies specifically designed to foster participation, deliberation, and bottom-up innovation in public policy [17]. These platforms are increasingly used by public institutions, research organizations, and civil society actors to enhance transparency, promote stakeholder engagement, and support evidence-informed decision-making.

In this context, citizen science has emerged as a particularly relevant framework, capable of bridging the gap between scientific research and societal needs [18]. By involving non-professionals in data collection, interpretation, and sometimes even in defining research questions, it challenges traditional distinctions between experts and lay audiences [19]. This approach has proven especially useful in situations that require extensive spatial coverage, the integration of local knowledge, and

[1] This contribution builds on and further develops the conceptual framework introduced in the volume dedicated to the CITIES project [26]; parts of this introduction are adapted from material previously published, in Italian, in that volume, here translated, partly reformulated while preserving its overall structure.

long-term monitoring. At the same time, it raises important questions regarding data reliability, inclusiveness, and the governance of participatory processes [20,21].

More broadly, citizen science can be understood as a collaborative effort that redefines the relationship between science and society. Beyond contributing to both formal and informal learning in STEM disciplines, it has the potential to strengthen the connections between scientific knowledge, policymaking, social innovation, and civic engagement. Achieving these outcomes, however, requires flexible and context-sensitive approaches, as well as continuous reflection on the tools and methodologies employed [18].

Within this framework, risk communication represents a particularly strategic domain for the application of participatory and digitally mediated approaches. Rather than being treated as a purely technical activity, it should be considered a core component of risk governance, requiring specialized competencies, ongoing training, and a strong awareness of contextual dynamics [22]. Recent scholarship increasingly advocates for dialogic and co-productive models [1,23], which emphasize interaction, reciprocity, and mutual learning between institutions and citizens. This perspective challenges traditional assumptions about the roles of senders and receivers, the nature of communicated content, and the potential effects—both intended and unintended—of communication processes. It also brings attention to the ethical boundaries that shape what can be communicated and how [22].

From this standpoint, citizen science contributes to the transition from linear and hierarchical models of communication toward more open, iterative, and negotiated forms of exchange. Participatory processes can thus play a crucial role in strengthening two-way communication, enhancing trust, and improving the legitimacy and effectiveness of risk management policies [2,24].

Despite the growing body of literature on citizen science, participatory platforms, and risk communication, these areas remain only partially integrated. Much of the existing research focuses on citizen science as a tool for data production, while fewer studies explore its role within structured digital environments designed to support risk communication and public policy [19]. Similarly, digital platforms are often examined either from a technological perspective or in relation to social mobilization, with limited attention to their function as intermediaries between scientific knowledge, institutional practices, and citizen participation in risk governance [17].

Addressing this gap, the present study adopts an applied and policy-oriented perspective to explore how digital participatory platforms can operationalize the principles of citizen science in the field of risk communication. In particular, it examines the Climate Initiative for Transforming and Improving Environmental Sustainability (CITIES) platform [25] as an integrated environment designed to support the co-production and circulation of geographically grounded knowledge, facilitate dialogue among stakeholders, and enhance local risk communication strategies. The platform combines multiple functions: it provides access to territorial information and risk-related data, enables interaction between different forms of knowledge, and supports decision-making by identifying mismatches and potential areas for intervention relevant to local governance processes [26].

By situating the CITIES platform within the broader debate on participation, citizen science, and geographic information, this paper aims to critically assess both the opportunities and the limitations of such an approach in promoting more inclusive, transparent, and effective forms of risk governance. In this sense, the platform should not be interpreted merely as a repository of data or as a standalone citizen science application but rather as a participatory digital infrastructure that integrates institutional

datasets, quantitative indicators, georeferenced information, and narrative and visual materials within an accessible and multifunctional environment.

2. A snapshot of democratic participation and digital technologies

For most of the twentieth century, citizens' demands for participation were expressed through involvement in mass organizations such as political parties and trade unions. Later, with the crisis of representative democracy, these demands were redirected toward forms of participation confined to different spheres [9].

The crisis has led to the opening of a political space that has gradually been filled. On the one hand, groups and parties have emerged—mostly populist in nature—that, by openly expressing hostility toward the ruling classes, capitalized on the anti-political sentiment of parts of the population. On the other hand, citizens' and collective actors' need for participation has given rise to movements, including mass movements, and to proposals for civic leadership and self-organization [27,28].

During the 1990s, the concept of "participatory democracy" (which was theorized almost three decades earlier) was taken up again and updated by theorists and grassroots activists [6,7,29,30]. The idea of an institutionally recognized form of citizen involvement in decision-making gradually established itself as "an interaction—within public procedures, primarily administrative but also regulatory—between society and institutions, aimed at producing, through both collaboration and conflict, a unified outcome attributable to both parties" [8,31].

At the same time, the global spread of the Internet carried great hopes, particularly for those who believed that it could contribute to building a fairer and more just future. Its founding characteristics [32] were free and immediate access to information, freedom of expression, cooperative work, and the decentralization of power, in a model at the opposite end of the privately owned commercial service infrastructure—the so-called Corporate Platform Complex—that dominates the Internet today [17] (p. 137).

Far from being a new model of cyber infrastructure, the platform network today represents an all-encompassing experience of social and productive relations, a key element in one of the cyclical evolutions in which capital plays a leading role. The platform records every single transaction—not only commercial but also social or affective—between user-subjects, collecting data that can be used to "optimize production processes, provide information on consumer preferences, monitor workers, and lay the groundwork for new products and services" [17] (pp. 40–41). It has, therefore, become essential to question whether voluntary work (and, with it, the data produced by users) can escape the subsumption of the production system, potentially reversing the condition of exploitation and transforming it into a practice of civic engagement and/or political claims.

By the first decade of the 2000s, many international movements had used the Internet and social networks as tools for civic engagement. In that period, scholars, such as Nick Dyer-Witheford, and philosophers, like Jaime Brenes Reyes and Michelle Liu [33], identified initial attempts to use the technology supporting platform to counteract capitalism by individuals, groups, and communities—a reversal that contributed to the emergence of the so-called "riot platforms" [34,35] (p. 18).

Alongside the spread of the giants of the Corporate Platform Complex—whose aggregating potential, in terms of mobilization capacity, is well documented [15,36]—over the past twenty years,

other infrastructures have also emerged that can be defined as "platforms for democratic participation", also known as civic technologies or decision-making software. It is important to not only consider the different purposes but also the different areas of application of these tools. Examples of this are i) commercial platforms, which are capable of shaping public opinion, bringing protesters to the streets, and raising funds; and ii) participation platforms, designed to build shared proposals and make decisions, especially within groups and communities that are already organized or are in the process of organizing [17].

Some of these civic technologies have achieved significant success over the years, particularly in terms of spreading innovative forms of collective participation. Platforms such as LiquidFeedback [37], based on the model of liquid democracy, allow users to express preferences on specific issues or delegate them flexibly, facilitating transparency in decision-making processes. A different case is Mastodon, a federated social network, which promotes the creation of autonomous but interconnected communities, encouraging horizontal communication practices and public discussions that are capable of bypassing algorithmic centralization. Others, like Loomio [38], provide tools for making proposals and making decisions collectively. Despite their differences, all of these technologies share a common feature: an open digital infrastructure based on collaborative processes that can be used for shared planning, supporting the co-creation of ideas, and facilitating a consensus on complex decisions.

With regard to the research focus of this paper, it is worth mentioning the spread of technological tools that, already in the first decade of the 2000s, facilitated neogeographic practices [39] and the aggregation of volunteered geographic information (VGI) [40]. These are certainly specific practices, but they can be situated within a broader reinterpretation of the ways in which scientific knowledge is produced and of the reflections on potential new interactions between science and society [4].

Haklay et al. defined geographic citizen science (GCS) as "the scientific work undertaken by members of the public where the data generated has an explicit geographic aspect" [20] (p. 15) and in which the recording of spatial information is conducted systematically and objectively. The fact that many of the tools that were previously used exclusively by the scientific community—such as geographic interfaces and technologies—are now accessible and usable by the global public [41] (p. 257) represents a great opportunity but also calls for the management of risks and complexities. The literature on citizen science has long addressed issues related to data quality and coverage, while less attention appears to have been paid to topics such as cartographic design choices and their relationship with the enhancement of collective participation.

It cannot be ignored that citizen science has historically involved a participant demographic that is highly educated and primarily from the Global North, albeit from diverse cultural contexts and age groups, with different skills and motivations, as well as heterogeneous know-how regarding digital and geospatial technologies [42]. In more recent years, however, citizen science scholars have begun to pay greater attention to the inclusion of new users from the Global South, marginalized communities, and "invisibilized" groups—a crucial opening that also adds further layers of complexity relating to literacy, familiarity with digital technologies and maps, (sometimes) limited technological infrastructures, and heterogeneous socio-technical dynamics [43].

Many scholars have reflected on the ways to address these barriers and the best methodologies to follow to make inclusion, usability, and accessibility strategic priorities. This attention is contributing to a deeper understanding of how application design can be improved to enhance user engagement [44].

In the specific case of geography, the consolidation of public web mapping applications and the improvement of interactions between users and online mapping have highlighted the importance of examining these issues. Scholars in the fields of participatory geographic information systems (PGIS) and critical GIS, for example, have discussed power asymmetries [45,46] and addressed the design of digital cartographic elements to improve usability, usefulness, and overall interaction in planning contexts [47,48]. It is precisely in line with these premises that the co-constructed methodology of the CITIES project and the results derived from it can be understood.

3. The proposed methodology of the CITIES project

The CITIES platform is part of the broader framework of the project of the same name, which was created to develop a participatory and consultative tool for citizens, institutions, and stakeholders, in order to improve how urban risks are perceived, understood, and communicated in the current context of climate change [26]. Fischer observed that "the tension between professional expertise and democratic governance is an important political dimension of our time" [49] (p. ix). In this regard, the project proposes a platform, where local knowledge can be enhanced, and a virtual space, through participatory mapping—a crucial tool in approaching "citizen science" [50]. The difficulties related to risk communication by institutions are highlighted, with a view to increasing the ability to find shared tools for risk reduction and defining everyday geographies of prevention, mitigation, and adaptation [51]. It also offers a replicable structure that can potentially be applied in other contexts.

The research methodology was, therefore, designed with an operational purpose from the outset, to provide the CITIES platform with comparable, integrable data that can represent the different urban "riskscapes", namely the socially and spatially constructed field in which risks are perceived, shaped, and governed [52,53], in both cartographic and narrative form, and that non-specialist users can query directly. Citizen involvement in the project took an intermediate form between advanced consultation and co-production, as participants were not only asked to provide data but also to contribute to the emergence of relevant themes, the critical restitution of results, and the definition of communication needs and feedback modalities to be incorporated into the platform.

While not configuring a full initial co-definition of the entire research design, the process—referring to level C.6 "partnership", according to the participation ladder identified by Arnstein [54]—went beyond an extractive model of participation, valuing citizens as bearers of situated knowledge and as active interlocutors in the construction of the digital environment and its contents.

Each phase of the empirical work was designed to generate georeferenced, narrative, and visual information that can be directly integrated into the platform's architecture and be meaningful to citizens and local authorities, in line with the idea of recognizing citizens as bearers of situated knowledge, which is indispensable for truly democratic environmental and risk management policies [48].

Building on the theoretical framework for the co-design of risk mitigation strategies outlined in the previous paragraph, and grounded in specific Italian urban contexts used to test the structure of the shared platform, the project adopted a mixed and multi-sited methodological approach. In this paper, the concept of "riskscape", although it may exclude some questions such as who or what is considered "at risk" or which authorities might be held accountable for risk management and governance [55,56], is understood as a dynamic field in which material infrastructures, governance systems, and practices intersect and

overlap; it includes the perceptual, cognitive, affective, and social representations of danger, uncertainty, and security. These concepts structurally shape spatial practices and emphasize spatial and temporal dimensions, acknowledging the power dynamics inherent in various practices [57–60]. In this sense, the term "risk" is not understood in a purely technical-probabilistic sense but is rather interpreted as a social and spatial construct formed as a product of the interaction between hazard, vulnerability, and exposure, but also memory of events, daily practices, and institutional trust. Precisely for this reason, then, the riskscape does not coincide with the mere distribution and cartographic structure of hazards but designates a much more complex field within which risks are perceived, shaped, and governed: this interpretative approach seems particularly useful in multi-hazard contexts, where citizens live with multiple cumulative risks.



Figure 1. Overview of the integrated phases of the CITIES project (screenshot from the official CITIES project website) [25].

The pilot cities—Enna (Sicily Region), Macerata (Marche Region), and Bacoli (Campania Region)—each have specific characteristics within the Italian peninsula; however, they are not analyzed comparatively. The three cities were selected to analyze local risk perceptions in relation to different risk typologies and governance settings, rather than to enable statistical generalization or cross-site comparison. Therefore, the objective was not to "compare" the three cases but to understand whether the same methodological architecture could be adapted to different local configurations of risk. Instead, they serve as case studies to test a model that is both transferable and capable of improving risk governance by integrating citizens' perceptions into the decision-making processes presented on the platform. The three cities (Bacoli, Enna, and Macerata) were selected on the basis of comparable demographic criteria (25,000–40,000 inhabitants), proximity to a university—useful for ensuring scientific and institutional support networks—and exposure to specific risks in different areas of the municipality. These features were identified on the basis of classifications provided by the Italian Institute for Environmental Protection and Research (ISPRA) [61]. The three cases identified, as will be seen, present specific characteristics that are one of the reasons for their selection; their selection,

in fact, also reflects the desire to test the platform's transferability to contexts with different risk profiles. This is not a comparison, but rather a potential test of the model's adaptability to non-homogeneous riskscapes.

The methodological design was divided into integrated phases, each of which produced data sets designed to be geocoded and displayed on the platform (Figure 1): the different illustrated phases shouldn't be considered as separate components but rather as interdependent and overlapping sections of a single process. In this view, document analysis defined the institutional and regulatory framework for "risk"; the survey produced comparable indicators on perception, trust, and information behavior; interviews, transect walks, and mental maps captured the experiential and affective dimensions of risk; and focus groups allowed for critical discussion of these materials with stakeholders and institutional actors, helping to define organizational, language, and public reporting criteria within the platform [26].

First, a documentary analysis of existing civil protection plans and planning tools was carried out with scientific support from the Promos Ricerche consortium [62]. This made it possible to map institutional risk instruments and the "narratives" associated with them (that is, a set of meanings and interpretations, but also memories and interpretative or discursive frames through which subjects define the meaning of risk and place the elements related to it within the lived space) [63,64], thus defining the top-down framework within which the platform operates. An online survey was then conducted, designed with the support of the YouTrend Agency [65] and distributed among residents (345 respondents for Macerata; 355 for Enna; 354 for Bacoli). The questionnaire consisted of 24 items, comprising three main sections: (1) socio-demographic data; (2) perception and knowledge of risk; and (3) spatial distribution of risk within the municipality, based on the neighborhood of residence. The results generated aggregate quantitative indicators for a map display. This was followed by qualitative interviews (articulated in life histories, transect walks, and mental maps), conducted with 46 participants per city and aimed at capturing deep experiential and emotional dimensions of risk that are difficult to reduce to numerical scales or quantitative modeling. Focus groups, with institutional representatives and key informants, made it possible to identify gaps in governance and asymmetries in communication between the different involved actors, as well as to co-define the most appropriate language and methods of feedback for the platform.

On the analytical side, structural equation modeling (SEM) was applied to test the relationships between variables such as perceived risk, institutional trust, and information-seeking behavior. The results were then translated into summary indicators for integration into the platform. The final phase involved the design and technical implementation of the CITIES platform, developed by YouTrend as a digital environment in which to bring together, in an integrated form, statistical data, interview excerpts, images, and cartographic materials derived from the various phases of the research. The structure of the layers, filters, and interaction modes was defined based on the needs that emerged during the fieldwork, so as to allow users to explore urban riskscapes from multiple perspectives (institutional, perceptual, and territorial). All of the data analyzed—quantitative indicators, interview segments, images, and cartographic materials—were brought together in the CITIES platform. As will be explored in greater depth in the following paragraph, the combined results of the different methodologies show that risk perception is a multidimensional construct in which cognition, trust, and emotions interact. The platform is designed to make this complexity navigable and to function as an operational tool for both citizens and institutions.

4. Results

Functionally, the platform allows users to explore urban riskscapes (in the three pilot cases) through a navigation that connects cartographic bases, official data, synthetic indicators, narrative excerpts, and visual materials related to specific locations. Users can thus "immerse" themselves in the risk representation and the perceptions and experiences of residents, visualizing convergences, misalignments, and emerging critical areas.

Riskscapes are therefore presented not as mere cartographic backdrops, but as dynamic socio-spatial configurations in which risk, memory, trust, vulnerability, and territorial practices intertwine.

On the one hand, quantitative analysis has shown that institutional trust and information-seeking behaviors play a significant mediating role in shaping risk perception and awareness levels. On the other hand, the qualitative component was designed to highlight aspects of risk that are difficult to reduce to numerical variables, such as memories of past events, perceptions of abandonment or protection, daily practices of traversing the territory, relationships of trust, and attributions of responsibility. Finally, the interviews, structured as life histories, transect walks, and mental maps, allowed these contents to be anchored to concrete places, trajectories, and spatial configurations. The focus groups, on the other hand, fostered a dialogic reading of the collected materials, connecting citizens, stakeholders, and institutional actors. In this sense, qualitative materials were interpreted as useful sources for identifying thematic recurrences, narrative nuclei, forms of territorial memory, and local configurations of vulnerability. Three broader interpretative themes emerge:

- First, risk perception is not only an awareness of danger but also the recognition of interdependence (i.e., the idea that vulnerability is shared and co-produced).
- Second, a high level of concern does not automatically translate into greater awareness, but it can stimulate civic initiatives and demands for inclusion in planning processes.
- Third, institutional communication seems to play a decisive role: where trust in institutions is higher, citizens tend to rely on formal sources; where trust is lower, alternative networks proliferate and may amplify misinformation.

4.1. Multi-source data integration and riskscape construction

Considering the three case studies (Enna, Macerata, and Bacoli), the CITIES platform also enabled the systematic integration of heterogeneous data sources (Figure 2). Institutional datasets derived from civil protection plans, land-use regulations, and hazard zoning were combined with citizen-generated quantitative and qualitative data explicitly designed for geo-referencing and public visualization. This integration seems to produce spatial representations, in which official risk classifications also coexist with residents' perceptions, narratives, and lived experiences. The results highlight a recurrent misalignment between institutional framings of risk and citizens' geographies and practices.

Generally speaking, official maps tend to segment hazards into monolithic categories (e.g., seismic, hydrogeological, volcanic), while participatory mapping reveals how risks are locally perceived as being cumulative, relational, and spatially uneven.

In all cases, citizens identified micro-areas of heightened vulnerability—often linked to infrastructure decay, accessibility constraints, or socio-demographic fragilities—that are weakly represented or entirely absent in formal planning documents.

The platform architecture makes these discrepancies visible through layered visualization: the choice to organize information into levels, filters, and gradual consultation paths responds to the need to avoid information overload and to facilitate the orientation of users with different levels of digital literacy. The platform was not designed to replace moments of direct interaction but to extend and support them, offering a consultation structure clear enough to allow the public use of complex materials without presupposing advanced skills [17]. This feature emerged as a key output of the participatory process, transforming volunteered geographic information from a supplementary dataset into an integral component of risk communication [66].

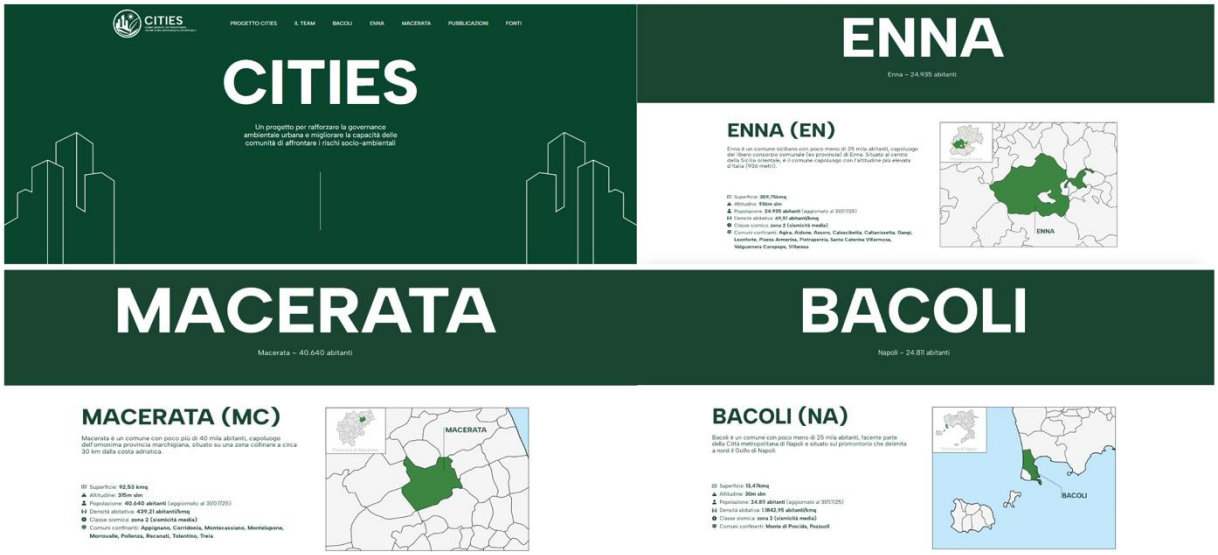


Figure 2. Homepage of the CITIES project platform (with pilot cities), presenting the project's visual identity and mission statement focused on strengthening urban environmental governance and enhancing communities' capacity to address socio-environmental risks [25].

The homepages shown in Figure 2 represent the entry point to the platform and the city pages of the three case studies, but they do not provide a complete overview; the digital environment is thus structured as a multilevel consultation system, where institutional data, indicators, georeferenced content, and qualitative materials can be accessed through differentiated navigation paths. The platform's function also allows for comparison of official frameworks and knowledge located within the same digital space.

The integration of quantitative and qualitative data is one of the project's key procedural outcomes. Survey data (for which risk perception, trust in institutions, information-seeking behavior, and the spatial distribution of perceived criticalities were measured on a Likert scale) and SEM models allowed us to identify recurring patterns in risk perception, institutional trust, and information-seeking behavior. At the same time, interviews, transect walks, mental maps, and focus groups enabled us to interpret

these patterns in light of local memories, daily practices, and the region's affective configurations. In this sense, qualitative materials do not serve a merely illustrative function, but explain, clarify, or complicate the trends emerging from the quantitative data, providing a more comprehensive understanding of urban riskscapes.

4.2. Patterns of risk perception

Survey data, spatialized at a neighborhood level, help to reveal differentiated patterns of risk perception across the three pilot cities, reflecting distinct socio-environmental configurations. For example, in Bacoli, risk perception is strongly shaped by the coexistence of volcanic, coastal, and environmental risks, intertwined with long-standing memories of bradyseismic crises and environmental degradation. Here, perceived exposure is closely linked to proximity to specific sites (coastal lagoons, densely urbanized waterfronts, volcanic areas, etc.), reinforcing place-based narratives of vulnerability.

In Enna, perceptions of risk are dominated by hydrogeological instability, water scarcity, and demographic decline. Risk is frequently articulated through narratives of territorial marginality, infrastructural isolation, and institutional neglect: in this case, citizens tend to frame environmental risks as an element considered inseparable from socio-economic vulnerabilities (particularly depopulation and the erosion of public services).

In Macerata, risk perception seems to be shaped by socially mediated vulnerabilities and by the interplay between seismic memory, flood-related risks, and slope-instability risks. Moreover, participatory mapping clearly highlights spatial differentiation between the neighborhoods: the historic center, peri-urban areas, and outlying settlements, where residents identify localized risk configurations linked to building stock conditions, physical accessibility, and the perceived effectiveness of emergency communication.

Across all cases, the survey results show that higher levels of perceived risk do not necessarily correspond to higher levels of formal knowledge about hazards [67]. Instead, perception appears to be mediated by lived experience, social memory, and trust in institutions, confirming the relevance of a relational, rather than a purely cognitive, understanding of risk [67].

These elements show cross-cutting patterns across all three cities, namely the misalignment between official and experiential risk framings, the mediating role of institutional trust, and the importance of place-based memories and everyday practices in shaping how risk is perceived, narrated, and communicated.

4.3. Institutional trust, information pathways, and mediation effects

Quantitative analysis using hybrid structural equation models highlights the mediating role of institutional trust and information-seeking behavior in shaping risk perception and awareness. At an aggregate level, institutional trust is positively associated with reliance on official sources of information, whereas lower trust environments correspond to greater use of informal and peer-based information networks.

The results indicate that risk perception exerts both direct and indirect effects on awareness of appropriate behaviors and adaptive actions. Information-seeking behavior functions as a key mediator: individuals who actively search for information—across multiple channels—display higher levels of awareness, regardless of their initial trust in institutions. This pattern is consistent across the three cities, although its intensity varies according to local context.

Importantly, the platform's capacity to visualize these relationships spatially allows users to identify neighborhoods where low trust and high perceived risk coexist, potentially signaling areas more exposed to misinformation or disengagement from institutional communication strategies [68–70].

4.4. Narratives, memory, and affective dimensions of risk

The qualitative materials collected (Figures 3 and 4) enrich the quantitative findings by capturing affective and narrative dimensions of risk that are not reducible to numerical indicators. In all three cities, risk is embedded in collective memories of past events, such as earthquakes, bradyseismic crises, or water shortages, that continue to shape present-day perceptions and expectations.



Figure 3. Participatory mapping activity during the focus group in Bacoli. Source: Giorgia Manfredonia's personal archive (2025).

Participants frequently articulated their definition of risk through relational concepts such as "care", "responsibility", and "belonging", always emphasizing interdependence among residents and between communities and institutions. These narrative dimensions reveal a strong demand for inclusion in decision-making processes and for more context-sensitive forms of communication that acknowledge local situated knowledge and emotional attachments to a place. By anchoring these qualitative insights to specific locations, the CITIES platform enables the coexistence of statistical patterns and situated accounts within the same analytical environment, offering a more comprehensive representation of urban riskscapes.

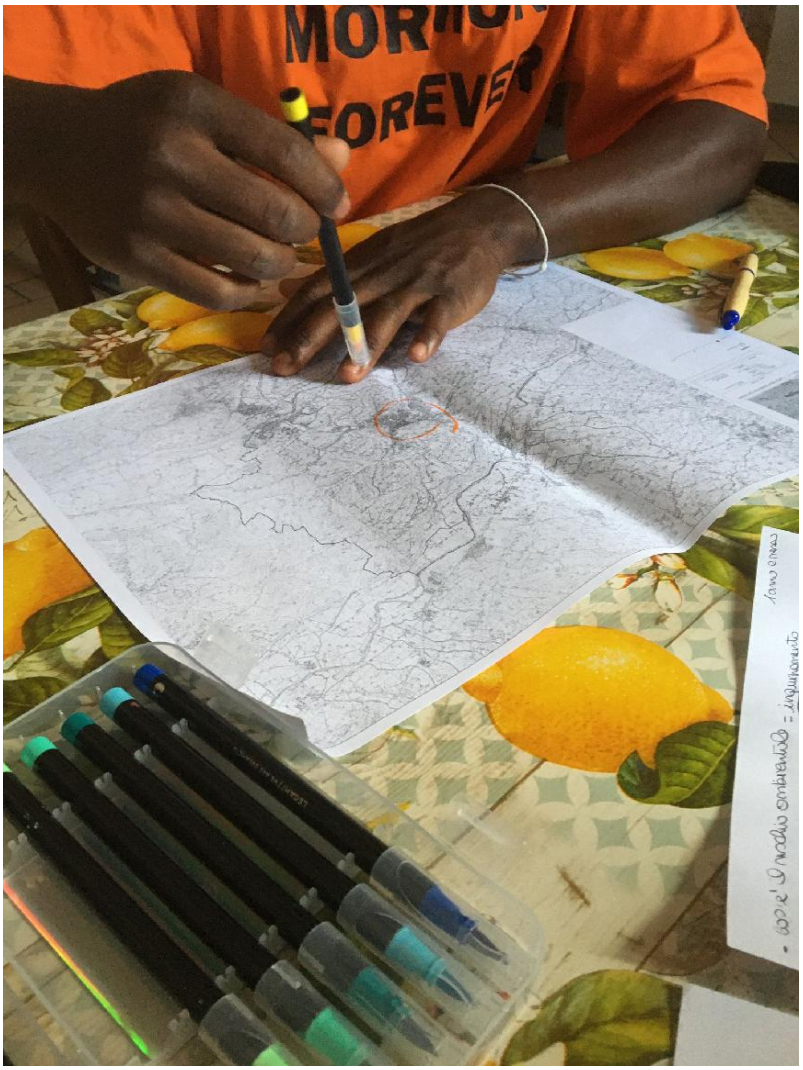


Figure 4. Participatory mapping activity during the focus group in Macerata. Source: Noemi Marchetti and Giulia Messere's personal archive (2025).

4.5. Platform outputs for risk communication and policy support

From an operational perspective, the platform produced a set of outputs directly relevant for risk communication and policy design. These include (i) spatially differentiated profiles of risk perception and awareness, (ii) identification of communicative gaps between institutional narratives and local experiences, and (iii) visualization of trust-related dynamics affecting information circulation [71].

Rather than generating prescriptive solutions, CITIES functions as an enabling infrastructure that supports reflexive dialogue between citizens and institutions. The results demonstrate the platform's capacity to facilitate evidence-informed discussions on prevention, mitigation, and adaptation strategies, grounded in geographically explicit and socially robust knowledge (Table 1) [72]. Rather than producing an automatic decision-making outcome, the platform enabled the emergence of several concrete operational results:

- The localization of areas perceived as particularly vulnerable but poorly represented in official documents.

- The identification of gaps between institutional language and local interpretations of risk.
- The visualization of neighborhoods where low trust and high-risk perception tend to overlap.
- The construction of a knowledge base useful for guiding subsequent discussions between citizens and institutional stakeholders.

Table 1. Main linkages between analytical dimensions and results emerging from the CITIES platform.

Analytical dimension	Empirical evidence (results)	Observed relationships	Relevance for risk communication and policy design
Risk perception	Spatially differentiated perception profiles across historic centers, peri-urban areas, and outlying settlements	Risk perception is strongly context-dependent and shaped by everyday spatial experience	Need for territorially differentiated communication strategies
Formal hazard knowledge	Technical knowledge levels are not consistently high, even where perceived risk is elevated	Higher perceived risk does not necessarily correspond to higher formal knowledge	Risk communication cannot rely solely on increasing technical information
Memory and lived experience	Recurring narratives related to past events (earthquakes, bradyseismic crises, floods, environmental degradation)	Collective memory reinforces perception and shapes spatial practices	Local memory should be acknowledged as a communicative resource
Institutional trust	Significant differences across contexts with higher or lower trust in institutions	Trust mediates the relationship between perceived risk and information sources	Strengthening institutional credibility improves information circulation
Information channels	Differentiated use of official sources and informal networks	Lower trust contexts show greater reliance on peer-to-peer information	Higher risk of misinformation where trust is weak
Participation	Strong demand for inclusion in decision-making and institutional listening	Participation is perceived as recognition and shared responsibility	Participation should be integrated as a structural component of governance
Data integration	Co-presence of institutional data, surveys, and georeferenced qualitative materials	Communicative gaps emerge between official narratives and lived experience	Platforms can make such misalignments visible and actionable
Role of the platform	Integrated navigation across maps, indicators, and narratives	The platform acts as an enabling, non-prescriptive infrastructure	Supports dialogic and evidence-informed decision-making
Overall output	Production of participatory riskscapes	From data integration to collective reflection	Strengthening environmental citizenship and adaptive capacity

CITIES operates along a continuum, ranging from knowledge to engagement and from engagement to co-decision. The aim is for the platform to function as a community of practice, where data sharing is accompanied by the construction of new social relationships. Its added value is, therefore, not merely informational but deeply relational: the platform brings into dialogue different worlds—the citizen and the researcher, the public administrator and civil society organizations—within a process of collective intelligence that can strengthen territorial resilience. In this perspective, the digital platform does not replace face-to-face interaction but rather amplifies it, fostering a participatory ecosystem in which local and scientific knowledge intersect and hybridize. So, the

platform's effectiveness must be measured not only in terms of information output but also in its ability to highlight communication issues and otherwise dispersed territorial priorities.

4.6. Limits and perspectives

The proposed methodology for the construction of the platform has some limitations. These are first linked to the place-based nature of the model: the conceptual and operational framework is strongly anchored to the specific territorial characteristics of the analyzed context (e.g., the actors, local networks, availability of official data, institutional structures, administrative culture, and the previous degree of socio-environmental conflict). While this characteristic is a strength, in terms of adherence to the field and interpretative capacity, it also reduces the possible transferability of the model, which may not be replicable "by simple transposition" in territories with different social, economic, or institutional geographies. Second, potential biases emerge in connection with the definition of the sample using snowball sampling. Although effective in identifying informal networks and individuals who are difficult to reach through probability sampling, this approach can generate distortions: it could over-represent some groups that are already connected and visible, to reproduce existing relational hierarchies and to exclude "marginal" actors who are less "recognizable" within the dominant networks. This can result in a participatory framework that is only apparently inclusive, in which the platform risks amplifying already strong voices and attenuating minority positions that are, nevertheless, relevant to environmental governance, as previously illustrated.

The collection, selection, and delivery of georeferenced and narrative content could raise questions regarding data ownership, privacy protection, the possibility of indirect re-identification in local contexts, and the responsibilities associated with content mediation. Furthermore, the use of a digital platform does not in itself eliminate inequalities in access and participation, because differences in digital literacy, device availability, familiarity with cartographic language, and public speaking skills can translate into new exclusions. In the absence of adequate methodological adjustments, the platform therefore risks not only reflecting but also reinforcing pre-existing power asymmetries, giving greater visibility to those actors already best equipped to participate. In addition to these aspects, there are also more pragmatic constraints. The limited duration of the project can affect both the quality of data collection (in terms of longitudinality and difficulty in capturing seasonal or cyclical dynamics) and the stabilization of the communities necessary to make the platform an effective tool in the medium to long term. At the same time, the cost of the technological infrastructure (e.g., development, hosting, maintenance, user support) can be an obstacle to replicability—especially in contexts with limited resources or reduced administrative and technical capacity. Furthermore, due to limited funding, the hosting service (currently provided by Youtrend) will remain limited until 2027, affecting the reproducibility and replicability assessment of the research: in any case, it will be possible to store open-access data on personal servers for future longitudinal research.

Taken together, these limitations bring two structural issues to the surface: on the one hand, the ambivalence of citizen science, which can oscillate between empowerment and a new form of data extraction and voluntary labor; and on the other, unequal access to "more or less democratic" tools for knowledge building and decision-making processes. In this sense, the platform is not neutral; its effectiveness and fairness depend on the material conditions (time, resources, skills)

and political conditions (who decides, who validates, who represents whom) within which it is designed and implemented, with direct implications for the quality and inclusiveness of environmental governance processes.

5. Discussion and conclusions

The CITIES platform was created as an attempt to bridge the existing and observed gap between the highest and lowest levels of perceived environmental risk, i.e., between the way that risk is perceived and experienced from below and the way it is managed from above, as represented by the bodies and institutions that measure it. The platform takes shape as a space that supports the fundamental need to make visible the central importance of implementing dialogue between institutions and citizens in contexts characterized by environmental risk.

In this case, the CITIES platform, by virtue of not only being communicative but also participatory, appears as a democratic communication tool that does not flatten expertise but rather mobilizes it and brings it into a system, refunctionalizing it through sharing. In this way, co-production does not emerge as a simple sum of contributions but as a process of connecting heterogeneous knowledge that acquires meaning through mutual comparison [54]. The dialogic model of risk communication is confirmed by the fact that the reception of institutional messages depends on trust, memory, experience, and territorial context, and not on the sole transmission of technical content [55]. Finally, in line with the encoding/decoding perspective, the platform demonstrates how the meaning of risk is not established once and for all by the institutional broadcaster but is continually reworked in local contexts of consumption and interpretation.

Thus, digital spaces are not merely tools for dissemination and communication but true sites of knowledge production, traversed by the sharing of information among differentiated stakeholders. They should, therefore, be understood as processes of public participation, participatory paradigms in which the presence of diverse stakeholders plays a central role. Studies on different types of risk show the central relevance of this multifaceted presence, reflecting on how to make genuine co-participation possible: the active involvement of multiple actors in risk management and governance requires the participation of stakeholders of different kinds, ranging from citizens to sector experts, volunteers with varying levels of experience, and institutions of various types [73] (p. 228). From this perspective, the platform functions as a mediation device rather than a simple visualization tool. Its theoretical value lies in demonstrating how dialogical models of risk communication can be operationalized in digital environments that do not eliminate interpretative conflict but rather make it legible and debatable. Its practical value, however, lies in offering administration support for designing communication interventions that are more situated, inclusive, and sensitive to intra-urban differences. Crucial questions regarding sustainability over time, equitable participation, and data governance remain open; for this reason, rather than a closed model, CITIES should be considered an experiment transferable only through contextual adaptations and ongoing negotiation with local communities.

This is why we speak of spaces of sense-making, rather than merely communicative spaces. Such digital environments make it possible not only to inform but also to engage different types of social actors who reflect collectively. A very recent study on climate change, from the perspective of cultural studies [74], focused on how communication is a key factor, not only at the level of information about

the causes of climate change but also because of the transformative potential it carries. In particular, the study highlights the need to situate the production of knowledge and the meanings that communities attribute to climate change—which we can more broadly include within the field of risk perception—by focusing on the modes and contexts in which this knowledge is produced. On the one hand, attention is placed on the necessary intersection between "top-down" and "bottom-up" approaches [74] (p. 2); on the other, on the "context of consumption", which is understood to be the set of conditions in which a message is received and processed. As the authors of the article argue, "without dismissing the value of researching 'top-down' media messaging in climate change communication, this article emphasizes that the context of consumption is just as important for understanding climate meaning making and politics" [74] (p. 3).

The central point is the way in which messages are received and what the preconditions are for it to happen, one way or another. So, in consideration of policy implications, operationally, the findings suggest that local governments should avoid uniform communication campaigns and adopt tailored place-based strategies. Particularly, in contexts where risk perception is high but trust in institutions is low, it is necessary to complement official channels with forms of proximate mediation, such as public meetings and ongoing listening mechanisms. In neighborhoods where significant gaps emerge between institutional representation and daily experience, the platform can be used to revise communication, priorities, and informative methods: from this perspective, risk communication must be conceived not as a linear transmission but rather as a situated practice oriented to building public credibility.

In line with Stuart Hall's (1980) [75] argument, the modes and conditions of a message's reception are just as important as its production. This is how we understand the "context of consumption" and, in this case, the platform positions itself as a producer as well as a communicator of meaning, in an attempt to establish a symmetrical positioning between "encoding" and "decoding" [75]. From this perspective, the CITIES platform can be read as one possible context of consumption, since it presents (in dialogic form) the results of an investigation that brought together top and bottom quantitative and qualitative data, making it visible and accessible to the very same communities, in the same ways in which they construct and incorporate risk perception in relation to their lived experiences and interactions. At the level of the relationship with institutions, it is clear that risk perception is not built solely through top-down communication—where such communication exists and proves effective—but always through meaningful interaction with the context in which communication is consumed. Both risk perception and the trust and credibility of institutions take shape within contexts of information consumption, where messages are reworked on the basis of one's lived experiences and existing knowledge. Taking up Stuart Hall's thinking once again, "the 'message form' is a determinate moment; though, at another level, it comprises the surface movements of the communications system only and requires, at another stage, to be integrated into the social relations of the communication process as a whole, of which it forms only a part" [75] (p. 164). In the same way, the content presented on the CITIES platform makes it clear that the meaning attributed to risk is not given but is process-constructed through the constant interaction between territorial, social, and media dimensions, starting from the idea of an "audience as the source and the receiver of the message" [75] (p. 165). With regard to media audiences of climate change, Litherland and Wood emphasized that there is a lack of ethnographic studies on this topic; according to the authors, research in this area—developed mainly within the field of communication studies—tends to focus on measuring the effects of messages produced and disseminated by top-down

media on "audience understanding, intentions and actions, rather than understanding audiences on their own terms". Their study reflects on this gap with the aim to "improve the efficacy of climate messages and thus improve public perceptions and behaviors" [76] (p.4). The importance of sharing and the opportunity to engage with other voices experiencing similar conditions are likely to lead to an increased awareness of risk. Likewise, as in the case of the CITIES platform, the possibility of not only engaging with peers but also with institutions and with the scientists involved in the research—who interpreted and elaborated the data collected through interviews, dialogues, and focus groups—represents a concrete and additional opportunity for knowledge. Moreover, by not only operating as a space for feedback but also for active and ongoing exchange, the platform makes it possible to extend research over time, positioning itself as a continuous space of knowledge.

Supplementary materials

The following supporting information can be downloaded at: https://www.progetto-cities.it/progetto-cities/.

Author contributions

Conceptualization, Francesco De Pascale; Methodology, Eleonora Guadagno; investigation, Marzia Mauriello, Riccardo Rosa; writing—original draft preparation, Francesco De Pascale; writing—review & editing, Eleonora Guadagno; visualisation, Riccardo Rosa; supervision, Eleonora Guadagno; project administration, Marzia Mauriello; funding acquisition, Eleonora Guadagno.

All authors have read and agreed to the published version of the manuscript. For Italian evaluation purposes: Francesco De Pascale, Eleonora Guadagno and Marzia Mauriello wrote paragraph 1; Francesco De Pascale wrote paragraph 4; Eleonora Guadagno wrote paragraph 3 and the sub-section 4.5; Riccardo Rosa wrote paragraph 2; Marzia Mauriello wrote paragraph 5.

Use of Generative-AI tools declaration

The authors declare that they used Artificial Intelligence (AI) tools for the English language revision of this article.

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Conflicts of interest

Prof. Francesco De Pascale is an editorial board member for AIMS Geosciences and was not involved in the editorial review or the decision to publish this article. All authors declare that there are no competing interests.

References

1. Stilgoe J, Lock SJ, Wilsdon J (2014) Why should we promote public engagement with science? *Public Underst Sci* 23: 4–15. https://doi.org/10.1177/0963662513518154
2. Renn O (2008) *Risk Governance: Coping with Uncertainty in a Complex World*, Routledge: London, UK. https://doi.org/10.4324/9781849772440
3. Beck U (1992) *Risk Society: Towards a New Modernity*, Sage: London, UK.
4. Funtowicz SO, Ravetz JR (1993) Science for the post-normal age. *Futures* 25: 739–755. https://doi.org/10.1016/0016-3287(93)90022-L
5. Kasperson RE, Renn O, Slovic P, et al. (1988) The social amplification of risk: A conceptual framework. *Risk Anal* 8: 177–187. https://doi.org/10.1111/j.1539-6924.1988.tb01168.x
6. Rosanvallon P (2008) *La légitimité démocratique: Impartialité, réflexivité, proximité*, Seuil: Paris, France.
7. Blondiaux L (2008) *Le nouvel esprit de la démocratie: Actualité de la démocratie participative*, Seuil: Paris, France.
8. Allegretti U (2010) *Democrazia partecipativa: Esperienze e prospettive in Italia e in Europa*, Firenze University Press.
9. Catanzaro A, de Sanctis A, Morganti C (2021) *Un'altra democrazia in arrivo? La democrazia diretta e le sue declinazioni*, ETS: Pisa, Italy.
10. Senabre Hidalgo E, Perelló J, Becker F, et al. (2021) Participation and co-creation in citizen science. In: Vohland K, Land-Zandstra A, Ceccaroni L, et al. Eds., *The Science of Citizen Science*, Springer: Cham, Switzerland, 199–218. https://doi.org/10.1007/978-3-030-58278-4_11
11. Vicens J, Bueno-Guerra N, Gutiérrez-Roig M, et al. (2018) Resource heterogeneity leads to unjust effort distribution in climate change mitigation. *PLoS One* 13: e0204369. https://doi.org/10.1371/journal.pone.0204369
12. Cigarini A, Vicens J, Duch J, et al. (2018) Quantitative account of social interactions in a mental health care ecosystem: Cooperation, trust and collective action. *Sci Rep* 8: 3794.
13. Cigarini A, Vicens J, Perelló J (2020) Gender-based pairings influence cooperative expectations and behaviours. *Sci Rep* 10: 1041. https://doi.org/10.1038/s41598-020-57749-6

14. Senabre Hidalgo E, Ferran-Ferrer N, Perelló J (2018) Participatory design of citizen science experiments. *Comunicar* 26: 29–38.
15. Castells M (2012) *Networks of outrage and hope: Social movements in the Internet age*, Polity Press.
16. Srnicek N (2017) *Platform Capitalism*, Polity Press: Cambridge, UK.
17. Deseriis M (2024) *Piattaforme e partecipazione politica*, Mondadori Università: Milano, Italy.
18. Vohland K, Land-Zandstra A, Ceccaroni L, et al. (2021) *The Science of Citizen Science*, Springer: Cham, Switzerland. https://doi.org/10.1007/978-3-030-58278-4
19. Bonney R, Phillips TB, Ballard HL, et al. (2016) Can citizen science enhance public understanding of science? *Public Underst Sci* 25: 2–16. https://doi.org/10.1177/0963662515607406
20. Haklay M, Dörler D, Heigl F, et al. (2021) What is citizen science? The challenges of definition. In: Vohland K, Land-Zandstra A, Ceccaroni L, et al., Eds., *The Science of Citizen Science*, Springer: Cham, Switzerland, 13–33. https://doi.org/10.1007/978-3-030-58278-4_2
21. Balázs B, Mooney P, Nováková E, et al. (2021) Data quality in citizen science. In: Vohland K, Land-Zandstra A, Ceccaroni L, et al., Eds., *The Science of Citizen Science*, Springer: Cham, Switzerland, 139–157. https://doi.org/10.1007/978-3-030-58278-4_8
22. Cerase A (2017) *Rischio e comunicazione: Teorie, modelli, problemi*, Egea: Milano, Italy.
23. Bauer MW (2009) The evolution of public understanding of science: Discourse and comparative evidence. *Sci Technol Soc* 14: 221–240. https://doi.org/10.1177/097172180901400202
24. Den Broeder L, Devilee J, Van Oers H, et al. (2018) Citizen science for public health. *Health Promot Int* 33: 505–514. https://doi.org/10.1093/heapro/daw086
25. Progetto CITIES. 2025. Available from: https://www.progetto-cities.it/progetto-cities/.
26. Mauriello M, Guadagno E (2026) *CITIES. Paesaggi, percezioni e culture del rischio*, Il Sileno: Lago (CS), Italy. Available from: https://www.ilsileno.it/geographiesoftheanthropocene/wp-content/uploads/2026/06/VOLUME-CITIES-AGGIORNATO.pdf.
27. Ginori A (2002) *Le parole di Genova. Idee e proposte dal movimento*, Fandango Libri: Roma, Italy. Available from: https://www.librinlinea.it/search/public/appl/dettaglio.php?bid=TO01035954.
28. Prince M (2015) *Revolution Is My Name*, The American University in Cairo Press: Cairo, Egypt.
29. Heidenreich F (2019) Organising the Political: Understanding the Crisis of Democracy with Rosanvallon. In: Flügel-Martinsen O, Martinsen F, Sawyer SW, et al. Eds., *Pierre Rosanvallon's Political Thought: Interdisciplinary Approaches*, Bielefeld University Press: Bielefeld, Germany, 175–198. https://doi.org/10.14361/9783839446522-011
30. Blondiaux L (2001) Démocratie locale et participation citoyenne: la promesse et le piège. *Mouvements* 18: 44–51. https://doi.org/10.3917/mouv.018.0044
31. Allegretti U (2011) La democrazia partecipativa in Italia e in Europa. 1–12. Available from: https://www.rivistaaic.it/old_site/sito_rivistaAIC_2010-2018/download/yHiYLVKV94bGbO6OnfSgbOPYbdhPijh2cx9TmA4Cwpw/ALLEGRETTI.pdf.
32. Goodman EP, Kornbluh K (2025) Social media platforms need to flatten the curve of dangerous misinformation. Slate 2020. Available from: https://slate.com/technology/2020/08/facebook-twitter-youtube-misinformation-virality-speed-bump.html.

33. Dyer-Witheford N, Brenes Reyes J, Liu M (2020) Riot logistics. PPPR (Project++). Available from: https://projectpppr.org/riots/blog-post-title-one-h8epr.
34. Terranova T (2004) *Network Culture: Politics for the Information Age*, Pluto Press: London, UK.
35. Terranova T (2024) *Dopo Internet: Le reti digitali tra capitale e Comune*, Nero: Roma, Italy.
36. Tufekci Z (2018) How social media took us from Tahrir Square to Donald Trump. Available from: https://www.technologyreview.com/s/611806/how-social-media-took-us-from-tahrir-square-to-donald-trump/.
37. LiquidFeedback. 2025. Available from: https://liquidfeedback.com/en/.
38. Loomio. 2025. Available from: https://www.loomio.com/.
39. Turner AJ (2006) *Introduction to Neogeography*, O'Reilly Media: Sebastopol, CA, USA.
40. Goodchild MF (2007) Citizens as sensors: The world of volunteered geography. *GeoJournal* 69: 211–221. https://doi.org/10.1007/s10708-007-9111-y
41. Trojan J, Schade S, Lemmens R, et al. (2019) Citizen science as a new approach in geography and beyond: Review and reflections. *Morav Geogr Rep* 27: 254–264. https://doi.org/10.2478/mgr-2019-0020
42. Skarlatidou A, Haklay M (2021) *Geographic Citizen Science Design: No One Left Behind*, UCL Press: London, UK.
43. Pejovic V, Skarlatidou A (2020) Understanding interaction design challenges in mobile extreme citizen science. *Int J Hum-Comput Interact* 36: 251–270. https://doi.org/10.1080/10447318.2019.1630934
44. Skarlatidou A, Ponti M, Sprinks J, et al. (2019) User experience of digital technologies in citizen science. *JCOM* 18: 1–8. https://doi.org/10.22323/2.18010501
45. Corbett JM, Keller CP (2005) An analytical framework to examine empowerment associated with participatory geographic information systems (PGIS). *Cartographica* 40: 91–102. https://doi.org/10.3138/J590-6354-P38V-4269
46. Sieber RE, Haklay M (2015) The epistemology(s) of volunteered geographic information: A critique. *Geo Geogr Environ* 2: 122–136. https://doi.org/10.1002/geo2.10
47. Skarlatidou A, Cheng T, Haklay M (2013) Guidelines for trust interface design for public engagement Web GIS. *Int J Geogr Inf Sci* 27: 1668–1687. https://doi.org/10.1080/13658816.2013.766336
48. Butt MA, Li S (2015) Usability evaluation of collaborative PPGIS—GeoCWMI for supporting public participation during municipal planning and management services. *Appl Geomat* 7: 139–161. https://doi.org/10.1007/s12518-014-0141-0
49. Fischer F (2000) *Citizens, Experts, and the Environment: The Politics of Local Knowledge*, Duke University Press: Durham, NC, USA. https://doi.org/10.1215/9780822380283
50. Skarlatidou A, Moreu M, Haklay M (2024) The utilization of maps in geographic citizen science: A preliminary analysis of usability and user experience issues and opportunities. *Ann Am Assoc Geogr* 115: 1–18. https://doi.org/10.1080/24694452.2024.2426714
51. Müller-Mahn D, Everts J (2012) *The Spatial Dimension of Risk: How Geography Shapes the Emergence of Riskscapes,* Routledge: London, UK, 22–36. https://doi.org/10.4324/9780203109595

52. Müller-Mahn D, Everts J (2018) Stephan, C. Riskscapes revisited: Exploring the relationship between risk, space and practice. *Erdkunde* 72: 197–213. https://doi.org/10.3112/erdkunde.2018.02.09
53. Bohle JT (2018) Hurricane-riskscapes and governmentality. *Erdkunde* 72: 125–134. https://doi.org/10.3112/erdkunde.2018.02.04
54. Arnstein SR (1969) A Ladder of Citizen Participation. *J Am Inst Plann* 35: 216–224. https://doi.org/10.1080/01944366908977225
55. Rosa EA (1998) Metatheoretical foundations for post-normal risk. *J Risk Res* 1: 15–44. https://doi.org/10.1080/136698798377303
56. Ward PJ, Buijs SL, Ciurean R, et al. (2026) Reducing risk together: Moving towards a more holistic approach to multi-hazard and multi-risk assessment and management. *Nat Hazards Earth Syst Sci* 26: 1325–1345. https://doi.org/10.5194/nhess-26-1325-2026
57. Gebreyes M, Theodory T (2018) Understanding social vulnerability to climate change using a "riskscapes" lens: Case studies from Ethiopia and Tanzania. *Erdkunde* 72: 135–150. https://doi.org/10.3112/erdkunde.2018.02.05
58. Innis P (2023) Official risks and everyday disasters: The interplay of riskscapes in two unplanned settlements in Monrovia. *Urban Forum* 34: 53–77. https://doi.org/10.1007/s12132-022-09465-9
59. Müller-Mahn D, Moure M, Gebreyes M (2020) Climate change, the politics of anticipation and future riskscapes in Africa. *Camb J Reg Econ Soc* 13: 343–362. https://doi.org/10.1093/cjres/rsaa013
60. White I, Lawrence J (2020) Continuity and change in national riskscapes: A New Zealand perspective on the challenges for climate governance theory and practice. *Camb J Reg Econ Soc* 13: 215–231. https://doi.org/10.1093/cjres/rsaa005
61. ISPRA. 2025. Available from: https://www.isprambiente.gov.it/it.
62. Promos Ricerche. 2025. Available from: https://www.promosricerche.org/.
63. Blaikie P (1995) Understanding environmental issues, In: Morse S, Stocking M, Eds., *People and Environment,* University College London Press: London, UK, 1–30. https://doi.org/10.4324/9781315831022
64. Castree N (2015) The Anthropocene: A primer for geographers. *Geography* 100: 66–75. https://doi.org/10.1080/00167487.2015.12093958
65. YouTrend. 2025. Available from: https://www.youtrend.it/.
66. De Pascale F, Travis C (2022) The COVID-19 testimonies map: Representing Italian "pandemic space" perceptions with neogeography technologies, In Travis C, Dixon DP, Bergmann L, et al. Eds., *Routledge Handbook of the Digital Environmental Humanities*, Routledge: London, UK, 419–427. https://doi.org/10.4324/9781003082798-34
67. Doyle EEH, Thompson J, Hill SR, et al. (2025) Communicating natural hazards science advice: Understanding scientists', decision-makers', and the public's perceptions of the scientific process. *Int J Disaster Risk Reduct* 128: 105731. https://doi.org/10.1016/j.ijdrr.2025.105731
68. Shkembi A, Smith LM, Neitzel RL (2023) Risk perception or hazard perception? Examining misperceptions of miners' personal exposures to noise. *Int J Hyg Environ Health* 254: 114263. https://doi.org/10.1016/j.ijheh.2023.114263

69. De Pascale F, Guadagno E (2025) Climate change and high-quality agri-food production: Perceptions of risk and adaptation strategies in the Calabria region (Southern Italy). *Sustainability* 17: 3553. https://doi.org/10.3390/su17083553
70. De Pascale F, Bernardo M, Muto F (2014). Hazardscape, territorial and individual resilience in an interdisciplinary study: The case of Pollino, Southern Italy. In: Lollino G, Arattano M, Giardino M, et al. Eds., *Engineering geology for society and territory—Volume 7*, Springer. https://doi.org/10.1007/978-3-319-09303-1_21
71. De Pascale F, Antronico L, Coscarelli R (2019) La percezione del rischio idrogeologico in Calabria: Il caso studio della Costa degli Dei. *Archivio di Studi Urbani e Regionali* XLX: 171–199. https://doi.org/10.3280/ASUR2019-124008
72. Klonner C, Usón TJ, Aeschbach N, et al. (2021) Participatory Mapping and Visualisation of Local Knowledge: An Example from Eberbach, Germany. *Int J Disaster Risk Sci* 12: 56–71. https://doi.org/10.1007/s13753-020-00312-8
73. Onencan AM, Meesters K, Van de Walle B (2018) Methodology for Participatory GIS Risk Mapping and Citizen Science for Solotvyno Salt Mines. *Remote Sens* 10: 1828. https://doi.org/10.3390/rs10111828
74. Wehn U, Rusca M, Evers J, et al. (2015) Participation in flood risk management and the potential of citizen observatories: A governance analysis. *Environ Sci Policy* 48: 225–236. https://doi.org/10.1016/j.envsci.2014.12.017
75. Hall S (1980) Encoding/decoding. In: Hall S, Hobson D, Love A, et al. Eds., *Culture, Media, Language: Working Papers in Cultural Studies, 1972–79,* Hutchinson: London, UK, 128–138.
76. Litherland B, Wood R (2025) Meme-ing while the world burns: Climate change news on Reddit and the cultural politics of platform participation. *Eur J Cult Stud* 29. https://doi.org/10.1177/13675494251356427



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