

The Role of Citizen Science in Enhancing Local Climate Adaptation Strategies

Honors Thesis

Presented in Partial Fulfillment of the Requirements for the
University Honors Program
Colorado State University

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Spring 2026

Abstract

As climate impacts grow in both intensity and frequency, the need for effective adaptation strategies is becoming increasingly urgent. Citizen science, known as public participation in scientific research, has emerged as a promising approach to inform climate adaptation decision-making and policy. By utilizing digital tools and bottom-up engagement, citizen science initiatives create opportunities for community members to contribute local knowledge, lived experiences, and place-based observations of climate change. This inclusive approach strengthens the relevance of data while also building awareness, trust, and engagement in adaptation efforts. By developing community-driven solutions, citizen science can lead to more context-specific and socially accepted outcomes. However, despite the potential, challenges remain. Issues related to data credibility, uneven power dynamics, and failure to fully address community needs can limit the effectiveness of these initiatives. Additionally, disciplinary constraints and limited governance capacity may restrict the integration of citizen-generated data into formal decision-making processes. This review emphasizes that although citizen science can play a valuable role in strengthening local climate adaptation efforts, its full potential depends on addressing key structural and institutional challenges.

Keywords: citizen science, community, climate adaptation, governance, policy

Introduction

Citizen science, known as the public participation in scientific research to address real-world problems, has emerged as a powerful way to take on environmental challenges (Sauermann et al 2020). By engaging non-professionals in data collection, monitoring, and analysis, citizen science not only broadens what researchers can study, but also helps people feel more connected to the issues affecting their own communities (Sherbinin et al., 2021). Through the use of tools such as the internet and mobile devices, it has become simple for community members to join and participate in citizen science projects happening in their area. This accessibility not only expands participation, but also strengthens the role of citizen science in addressing complex issues. When it comes to climate change, for example, citizen science is often seen as a bridge, linking scientific research, policy decisions, and lived experiences in a more meaningful and accessible way (Hügel and Davies, 2020).

Citizen science is often used interchangeably with related terms such as “community science,” “participatory science,” and “participatory research,” all of which emphasize the involvement of non-professional, community members in the research process (Eitzel et al., 2017; Cooper et al., 2021). While these terms share a common foundation, they can differ in how they frame participation, power, and inclusivity (Eitzel et al., 2017). For the purposes of this review, “citizen science” is used to describe the involvement of community members in local research because of its wide recognition and frequent use in the literature (Turbe et al., 2019). At the same time, alternative terms have become more common because they address concerns about the exclusivity of the word “citizen,” and recognize all the diverse groups who are contributing to research (Cooper et al., 2021).

Recent literature notes that citizen science has gained significant recognition as a strategy for addressing complex social, environmental, and spatial issues (Albagli and Iwama, 2022). It is also seen as contributing to advancements in climate research by enhancing the monitoring of climate patterns and supporting methodological innovation, particularly in the statistical analysis of diverse datasets (Albagli and Iwama, 2022). Citizen science initiatives have the power to generate large volumes of geographically dispersed data that would otherwise be difficult for professional scientists to collect alone, which enables broader spatial coverage and more detailed ecological insights than traditional research alone can typically achieve (Sherbinin et al., 2021). As a result, projects are increasingly driven by local conservation priorities, reflecting a shift to place-based environmental concerns (Newman et al., 2017). Together, these characteristics position citizen science as a tool with high potential to support climate adaptation efforts grounded in community contexts.

The Need for Climate Adaptation

Local communities are experiencing the impacts of increasingly severe and frequent climate events, highlighting the need for climate adaptation. Climate adaptation is the process of taking action and making adjustments in response to current or anticipated climate impacts to reduce harm (IPCC, 2022). This need is particularly pronounced in densely populated areas such as cities, which are some of the largest contributors to greenhouse gas emissions while also being some of the most affected by climate change (Orsetti et al., 2022). Coastal communities, for example, face growing threats from sea-level rise, increased storm intensity, and increased flooding (Reimann et al., 2023). At the same time, inland communities are increasingly affected by hazards such as wildfire, drought, and extreme heat. Together, these varied and location-

specific impacts highlight the importance of developing a more localized approach to climate adaptation.

Citizen science offers a way to enhance the climate adaptation process by involving community members in the collection of environmental data and monitoring of local conditions (Manteaw et al., 2022). Traditional top-down approaches to environmental governance often struggle to capture the place-based knowledge that is necessary for effective policy design (Hügel and Davis, 2020; Newman et al., 2017). However, citizen science has the potential to strengthen local climate adaptation planning by integrating community-generated data into formal decision-making processes (Albagli and Iwama, 2022). When incorporated effectively, these community contributions can improve risk assessments, identify vulnerabilities, and support context-specific adaptation solutions (Manteaw et al., 2022; de Sherbinin et al., 2021).

Challenges in Translating Citizen Science into Climate Adaptation Planning

Creating positive environmental change from citizen science research is no simple matter. The gap between collecting data locally, and turning that research into real policy-building efforts still needs to be addressed. While citizen science initiatives can generate large volumes of locally relevant observations, the data does not always translate to decision-making processes. Local governments and planning institutions often rely on standardized datasets, established scientific methods, and formal expertise when developing adaptation strategies (Turbé et al., 2019; Sherbinin et al., 2021). As a result, data produced through volunteer-driven projects may face questions about credibility, consistency, and compatibility with the planning frameworks that already exist (Sauermaun et al., 2020; Clement et al., 2026).

In addition, the way climate problems are defined strongly influences how citizen-generated data is interpreted and used. Research processes must be clearly structured, with transparent decisions about how knowledge is produced and how it will be recognized within scientific and policy contexts (Albagli and Iwama, 2022; Hügel and Davies, 2020). Without this clarity, citizen science data may struggle to gain legitimacy in formal planning environments. At the same time, climate adaptation challenges vary widely across communities because of different vulnerabilities, priorities, and lived experiences (Orsetti et al., 2022). If citizen science initiatives fail to acknowledge these differences, the information they generate may not align with the needs of the specific communities they aim to support.

Bridging this gap requires more than simply collecting data. Overcoming these challenges involves building capacity through approaches that encourage stronger collaboration and engagement between citizens and government institutions (Baldelli et al., 2025). Meaningful connections between policymakers, researchers, and participants are also going to be vital for the adaptation-planning process. By designing citizen science projects with policy action in mind, the pathway from local observations to climate adaptation plans can be strengthened by aligning data collection with planning needs, ensuring transparent methodologies, and incorporating community priorities (Neset et al., 2021).

Outline of the Literature Review

This literature review examines how citizen science can inform and shape local climate adaptation decision-making. As a tool, citizen science has the potential to strengthen local planning by involving community members directly in the research process. By enabling residents to document climate impacts in their own areas, they can provide valuable insights to help guide adaptation strategies. By synthesizing the successes, challenges, and failures of

citizen science for climate adaptation in recent years, a clearer understanding of its real-world applications can be achieved.

The review is organized into four parts. Part 1 explores how citizen science data is integrated into official climate adaptation planning. Part 2 discusses key challenges, including issues of data credibility and policy uptake. Part 3 compares insights across different governance contexts, and Part 4 presents case studies that illustrate these themes in practice. The review concludes with a discussion about barriers of current citizen science practices and offers recommendations for improving future adaptation efforts.

Part 1: Integration of citizen science data with official climate adaptation planning

Incorporating Local Knowledge and Insights

Citizen-generated data offers a powerful way for integrating local knowledge into official climate adaptation planning by providing more perspectives to inform the decision-making process (Jameson et al., 2020). Because this data is collected by community members in relation to issues that affect their environments, it is grounded in lived experience and place-based observation (Jameson et al., 2020). This makes it relevant for informing adaptation strategies that need to address local climate risks.

To strengthen community resilience toward climate impacts, diverse and well-informed perspectives must be incorporated, which includes local knowledge and a variety of forms of engagement (Sittenfeld, 2022). Engagement strategies such as project forums, easily accessible data collection activities, and post-surveys can help ensure that citizen input is being incorporated into broader planning processes (Sittenfeld et al., 2022). These strategies help

encourage continuous inclusion of citizen science data in planning frameworks, rather than just leaving the data unused.

It is important to note that translating citizen-generated data into formal planning processes requires flexibility and collaboration among community members, researchers, and governments officials involved (Neset et al., 2021). Turning citizen science into climate adaptation strategies is not achieved by only local community members or scientists. Rather, it requires a delicate balance between all parties involved to ensure adaptation plans are scientifically eligible, while also meeting community needs. Co-designing climate services is not a linear process, and instead it involves continuously adapting to changing ideas, expectations, and perspectives about what the service should include as stakeholders engage throughout the process (Neset et al., 2021). This structure is essential for ensuring that citizen science contributes meaningfully to official planning and decision-making processes.

Utilizing Citizen Science Tools and Features

Digital citizen science platforms support the integration of community-generated data into climate adaptation planning by making participation more accessible. These platforms provide tools for data collection, classification, analysis, and visualization that allow for community contributions to be incorporated into larger environmental datasets (Stein et al., 2023). Platforms such as CitSci, Scistarter, iNaturalist, and Zooniverse demonstrate how digital infrastructure can support standardized data flows that are more readily usable in policy and planning contexts (Stein et al., 2023).

Mobile and web-based applications can also strengthen collaboration between volunteers and researchers, making participation both more accessible and effective. Digital platforms allow

volunteers can contribute to data collection through a variety of methods, including graphic user interfaces, photo upload and validation, web applications based on geographic information systems, and simple online data-sharing platforms (Albagli and Iwama, 2022). These tools increase accessibility and improve environmental data quality relevant to climate impacts such as flooding, wildfire, and sea-level rise. As a result, citizen science data can support official monitoring systems and strengthen evidence for adaptation decision-making (Albagli and Iwama, 2022).

In addition to data collection, digital platforms also support knowledge exchange and behavioral change (Sauermann et al 2020). Features such as discussion forums, blogs, and interactive dashboards create spaces that connect diverse knowledge communities, enabling people to share perspectives on local impacts, exchange personal experiences, and collaboratively develop adaptation strategies (Neset et al., 2021). In this way, citizen science platforms function not only as a data collection tool, but also as a source to connect community knowledge with formal climate adaptation planning processes.

Part 2: Challenges in terms of data credibility and policy uptake

Developing policy across different governance levels is intended to enhance the safety and security of communities in the face of already unavoidable climate impacts (Albagli and Iwama, 2022). In this context, citizen science appears promising because it can broaden the scientific knowledge base by mobilizing local, lay, and expert knowledge, and by generating data across scales that would otherwise be inaccessible (Newman et al., 2017). However, significant challenges still remain, particularly around grounding decisions in community experience and ensuring data is credible and policy can be implemented.

One major concern relates to the perceived credibility and legitimacy of citizen-generated data. Although citizen science can generate large and locally relevant datasets, critics argue that many projects produce limited scientific results and have exploitive relationships with participants (Hall et al., 2022). When projects fail to clearly demonstrate the methods used or data validation processes, policymakers may question whether the data meets the standards for official decision-making. Furthermore, many initiatives are designed and led primarily by academic researchers (Sauermann et al 2020). This exclusive leadership can make it harder to integrate interdisciplinary perspectives or balance scientific objectives with community-defined priorities. If problem framing and research design remain concentrated within research institutions, projects may struggle to produce knowledge that is both scientifically relevant and socially legitimate.

The way problems are defined also shapes data credibility and uptake. Research steps must be clearly structured, with clear decisions about how knowledge production and technological development will be recognized in the future (Sauermann et al 2020). However, not all climate adaptation challenges are the same; they reflect the interests, vulnerabilities, and priorities of particular social groups (Sauermann et al 2020). If citizen science initiatives fail to acknowledge these differentiated needs, they risk producing data that lacks relevance for local adaptation planning. On the other hand, when interactions between scientists and community members foster mutual learning and the exchange of diverse perspectives, they can strengthen social trust and improve shared understanding (Sauermann et al 2020). This relational dimension must receive attention because credibility is not only technical, but also social. Although concerns about citizen science often focus on data quality, a more significant challenge lies in

clearly documenting and publicly reporting quality assurance and quality control practices throughout the research process (Sherbinin et al., 2021).

There is also a clear disconnect between the potential relevance of citizen science for policymaking and its practical integration into policy processes (Turbé et al., 2019). Decision-makers are seeking innovative ways to broaden the evidence base, involve citizens, and support multiple stages of the policy cycle (Turbé et al., 2019). However, institutional barriers such as rigid data standards, limited administrative capacity, or skepticism toward non-traditional knowledge sources can prevent citizen-generation data from being formally adopted. Without methods for data validation and alignment with regulatory frameworks such as environmental monitoring standards and land-use planning methods, valuable local insights may be overlooked, demonstrating the need for more co-designed and bottom-up projects (Turbé et al., 2019).

To address these challenges, more intentional engagement practices between community members and policy makers are needed to strengthen both the credibility of citizen science data and its uptake in policy processes. Two key points of interaction can support this. First, project leaders can actively seek feedback from participants about the value they perceive in the project and incorporate their suggestions for improving project structure (Hall et al., 2022). This not only enhances participant retention and alignment with community priorities, but also improves data quality by refining methods and ensuring that the data produced is relevant and reliable for decision-making contexts. Second, clearly communicating the intended outputs and applications of the project from the beginning helps participants understand how their contributions will inform planning and governance decisions (Hall et al., 2022). When participants see how their data is being used, it can increase both the consistency and credibility of the data collected.

Transparent communication of project outcomes through the use of reports, datasets, or policy briefs can enhance accountability and build trust, both of which are essential for policy uptake. When engagement processes are simple and accessible, citizen science initiatives are more likely produced standardized and usable data that can be incorporated into policy frameworks (Turbé et al., 2019). Additionally, building new initiatives on existing, well-established data infrastructures rather than creating entirely new platforms can improve efficiency and support stronger connections between collected data and decision-making processes (Sherbinin et al., 2021).

While citizen science holds a great amount of potential to inform local climate adaptation strategies, its effectiveness depends on overcoming challenges of credibility and policy uptake. Strengthening transparency, diversifying project leadership, framing projects with community inputs, and embedding citizen-generated data with formal decision-making processes are all important steps for addressing these barriers. Engaging decision-makers early in the project design phase can also help ensure that citizen science efforts focus on relevant data needs and research questions that directly support policy development (Newman et al., 2017). When these conditions are met, citizen science can move beyond symbolic participation and become a meaningful contributor to adaptive, community-centered climate governance.

Part 3: Comparative insights across different governance contexts

Governance Structure for Adaptation

Literature suggests that the effectiveness of citizen science and public participation in climate adaptation is deeply shaped by governance structures, leadership models, and power dynamics (Hügel and Davies, 2020). Across contexts, climate adaptation requires coordinated

action, yet public engagement remains consistently low despite the recognized urgency of the issue (Cruz et al., 2023). This gap between acknowledged need and meaningful participation illustrates the structural shortcomings in existing governance systems and calls for innovative, participatory approaches (Cruz et al., 2023).

Leadership and institutional design play a critical role in shaping these outcomes. When climate related initiatives, like citizen science projects, are led by professional scientists, they may struggle to bridge disciplinary divides and integrate both scientific and non-scientific objectives (Sauermann et al 2020). This limitation becomes especially pronounced in adaptation governance, where success depends on collaboration across scientific, social, and community spaces. In practice, adaptation involves complex interactions between top-down institutional guidance and bottom-up community-driven efforts. If leadership structures prioritize expert authority without incorporating community values, participatory tools may not initiate change or action. There must be a delicate balance between local expertise and experiences with researchers and stakeholders when co-designing adaptation plans, and citizen science projects reflect this much needed balance.

Urban and High-Vulnerability Governance Contexts

Both urban and high-vulnerability governance structures face climate impacts, however, the different capacities of these governments dictate how they address climate impacts and the role of citizen science throughout the process. Because of this, they each face their own unique, yet different challenges for enhancing local climate adaptation. Comparative research demonstrates that climate adaptation outcomes are shaped by governance structure, institutional capacity, and access to climate knowledge (IPCC, 2022). In urban and institutionally resourced contexts, adaptation governance tends to be ineffective because it does not meaningfully engage

affected communities, and instead focuses too heavily on scientific expertise (Cruz et al., 2023). These findings suggest that formal institutions alone are insufficient, and meaningful participation depends on how climate risk is framed, communicated, and integrated into social contexts. For citizen science initiatives to be effective in urban contexts, existing power imbalances must be addressed to ensure that community members can meaningfully participate in the decision-making process.

In highly vulnerable regions, governance challenges are more structurally pronounced. Climate change impacts are already severe, particularly in regions where existing vulnerabilities intersect with weak institutions and limited adaptive capacity (Manteaw et al., 2022). As a result, adaptation responses in vulnerable countries tend to be slow to develop, with inequities further constraining participation. Many communities lack access to the climate knowledge and decision-support resources needed to guide adaptation choices, and climate information systems often fail to provide locally relevant or context-specific data (Manteaw et al., 2022; Vogel et al., 2019). In contrast, studies in more institutionally resourced countries show that when individuals and communities have access to reliable and usable climate information, they are more likely to participate in adaptation efforts (Manteaw et al., 2022).

Across both governance contexts, place-based and participatory approaches emerge as a helpful tool. The way climate risk is framed often overlooks social and cultural dimensions that shape how people perceive and respond to environmental change (Cruz et al., 2023). Similarly, research in vulnerable contexts highlight the importance of territorial and locally specific understandings of climate impacts in shaping effective adaptation strategies (Manteaw et al., 2022). Participatory frameworks such as citizen science networks and collaborative climate information systems are becoming increasingly recognized as tools for fostering knowledge co-

production and social learning between scientists, policymakers, and communities (Manteaw et al., 2022; Vogel et al., 2019). Therefore, while urban systems often struggle with coordination and sustained engagement within relatively strong frameworks, highly vulnerable contexts face deeper structural and informational barriers. In both settings, effective adaptation depends on governance systems that integrate scientific expertise with accessible, place-based, and collaboratively produced climate knowledge.

Improving Governance

Participatory risk assessment methods offer one potential avenue for strengthening bottom-up approaches. Community risk assessment, for example, is positioned as a collaborative approach to evaluating local vulnerabilities and capacities in disaster risk reduction planning (Hügel and Davies, 2020). However, even participatory tools still face governance challenges. It is also rare that literature addresses how to confront power imbalances within these processes (Hügel and Davies, 2020). Structural barriers like the exclusion from decision-making spaces or unequal access to resources, continue to constrain who participates and who's knowledge is going to be taken seriously (Hügel and Davies, 2020).

Taken together, these studies suggest that improving climate adaptation governance requires shifts across institutional and social contexts. Strengthening public engagement is not simply a matter of increasing participation rates, it involves rethinking leadership models, addressing systemic inequities, integrating emotional and cultural dimensions of risk perception, and building networks that help intertwine different sectors. Comparative insights demonstrate that without confronting these interconnected governance challenges, citizen science and participatory adaptation efforts may struggle to translate into equitable and impactful climate resilience outcomes.

Part 4: Case Study Analysis

This case study analysis is intended to highlight how citizen science has been used to inform climate adaptation in real-world scenarios. The selected case studies illustrate specific frameworks and methods that can be used to integrate citizen science into adaptation processes while also reinforcing key points outlined throughout this review.

Co-Designing a Citizen Science Climate Service

This study on the co-design of a citizen science service has been developed to support citizens and local authorities in preparing for, responding to, and adapting to climate impacts (Neset et al., 2021). This citizen science service is called “Citizen Sensing,” and it consists of a mobile app that was developed through the collaboration and involvement of citizens and stakeholders in four different European cities. This study demonstrates the use of digital features and tools to help incorporate local knowledge and perspectives on climate resilience such as health, education, vulnerable groups, environmental issues, and infrastructure (Neset et al., 2021). Participants were able to assist with app functionality, content, and design to develop an effective way to share observed impacts, recommended adaptation measures, and insights (Neset et al., 2021). These community insights and observations of climate impacts such as heat waves have been used to help other citizens of the European cities develop knowledge of local conditions in relation to climate change. This knowledge better informs how these communities can adapt and respond to climate-related risks like extreme temperatures and heavy precipitation (Neset et al., 2021).

This case study highlights how participatory, digitally enabled approaches for monitoring climate impacts can strengthen the connection between data collection and decision-making. By embedding citizen input into both the design of the tool and the generation of climate data, the study demonstrates how citizen science can produce more locally relevant, context-specific knowledge. This supports more effective and inclusive adaptation strategies, demonstrating that when communities are actively involved in knowledge production, adaptation efforts are better aligned with lived experiences and local priorities.

Citizen Science, Civics, and Resilient Communities Project

The Citizen Science, Civics, and Resilient Communities project is designed to address the potential impacts of climate hazards by actively involving local communities. Built around the “science-to-civics” framework, this project combines community-developed resilience plans with participatory data collection to evaluate local vulnerabilities and gather public perspectives on proposed climate policies (Sittenfeld, 2022). Its goal is to strengthen collaboration between resilience planners and the public by enhancing the relevance and usability of community-generated knowledge while also creating ongoing opportunities for citizen scientists to remain engaged (Sittenfeld, 2022).

The science-to-civics framework is composed of three main parts: agenda setting, decision-making, and policy-informing. These different components encourage a cycle of agenda co-production, peer-to-peer deliberation, community research projects, project monitoring, and solution implementation (Sittenfeld, 2022). This framework has proved successful in a campaign called “Wicked Hot Boston” where volunteers were engaged in urban heat island mapping and making policy recommendations for mitigating the impacts of extreme heat events in Boston, Cambridge, and Brookline. Community-generated heat maps were shared with participants and

community resilience planners, allowing them to consider and discuss potential strategies for reducing temperatures.

The project resulted in positive changes in participants' learning and attitudes with respect to extreme heat and other climate vulnerabilities. When relating this to the themes previously discussed throughout this review, it is evident this study is a leading example of improvement within governance to support bottom-up approaches for climate adaptation. While the study does not test the framework across different governances, the framework introduced shows potential for leverage across different contexts because of the strong emphasis on citizen-generated data, local knowledge, and community values in order to address unique climate impacts.

Citizen Science for Risk Mapping and Adaptation

By integrating citizen science approaches with Participatory Geographic Information Systems (PGIS) and social cartography, communities in Brazil were able to identify and map risks such as landslides and flooding while developing locally grounded adaptation strategies (Albagli and Iwama, 2022). This action-research initiative was intentionally designed around community priorities, using interviews and local knowledge to inform and enhance official risk mapping processes.

Social cartography played a key role in capturing how community members perceive and experience environmental risks by allowing their perspectives to be formally represented. This approach not only supports local and traditional communities in producing place-based knowledge, but also empowers them to share their experiences, values, and insights.

By incorporating community-generated data and interview findings into a geographic database, the mapped hazards became publicly accessible, increasing both transparency and usability. This study highlights how combining scientific expertise with local knowledge can strengthen risk identification and adaptation planning. Now that local communities have a broader representation of their watershed, they are better equipped to identify risks related to floods, landslides, strong winds, and gas leak hazards, as well as plan evacuation routes to safer areas (Albagli and Iwama, 2022).

Barriers to Practice and Implementation

While the use of citizen science for local climate adaptation has grown, significant challenges remain in translating these approaches into effective, real-world applications. The frameworks, methodologies, processes that have been designed and piloted demonstrate great potential for climate adaptation use, however, their consistent implementation in policy and practice is still limited. These key barriers include power imbalances between community members and decision-makers, disciplinary constraints, and limited governance capacity.

One major challenge is the unequal distribution of power between community members and decision-makers, which can limit the influence of citizen-generated data in practice. Scientific expertise is often prioritized over local knowledge and insights in decision-making. Running a successful citizen-science project using a bottom-up approach can be difficult to achieve when policymakers continue to favor scientific data over locally collected data. Research suggests that difficulties often stem from tensions between scientists, decision-makers, and participants, as well as the complexities of co-producing knowledge across different cultural contexts (Clement et al., 2026).

Disciplinary limitations also restrict the full potential of citizen science. Many initiatives are focused on environmental issues rather than other areas such as public health or social systems. This narrow focus can limit the scope of adaptation strategies because climate impacts often interact with other sectors such as health and infrastructure. Expanding citizen science into more interdisciplinary areas could improve their relevance and applicability for addressing complex, real-world climate challenges. For example, projects related to heat-related illnesses or air quality impacts could directly inform local adaptation planning, yet they remain underutilized in practice.

Governance capacity is another barrier that limits the implementation of citizen science in local climate adaptation strategies. Despite increasing attention to climate resilience, many local governments still lack the resources and institutional support needed to implement effective adaptation strategies. Even though there is growing awareness, most local governments struggle to translate goals into meaningful action (Susskind and Kim, 2022). Many local governments do recognize the value of participatory approaches, but they lack the support and infrastructure to sustain community-based projects over time. To incorporate citizen science initiatives into policy and governance, more institutional support and relationships between policymakers, decision-makers, and community members will be needed.

Conclusions and Recommendations

Moving forward, to further enhance citizen science for local climate adaptation, the barriers outlined need to be addressed. This includes rebalancing power dynamics between communities and decision-makers, opening citizen science to a wider variety of disciplines, and offering more governance capacity for citizen science. Fixing the issue related to power

dynamics requires mechanisms that ensure citizen-generated data will be incorporated into planning processes through decision-making frameworks and getting community members involved in planning processes. Linking climate impacts directly with human systems may help diversify citizen science initiatives, and governance can be strengthened with increased institutional support with dedicated funding, staff, and technical resources to sustain citizen science initiatives over time. Addressing these constraints may help increase the use of citizen science to address and plan around local climate impacts.

While case studies offer promising frameworks like community developed resilience plans and climate services, these approaches are rarely applied in practice. Therefore, these well-designed frameworks tend to be underutilized, with limited impacts on real-world climate challenges and community needs. That said, it may be effective to develop stronger networks that document and showcase the successes of citizen science initiatives. Although adaptation-focused projects exist around the world, information about their outcomes, long-term impacts, and lessons learned tends to be under-reported and difficult to access. Creating a place to highlight these success stories could make knowledge more accessible to researchers, policymakers, and stakeholders. This would not only help guide the development of future citizen science projects, but also demonstrate the real value of using community-led initiatives to address climate risk. Sharing this success could help fix disciplinary challenges and provide more reasons for government support. Citizen science can inform adaptation strategies, but more people need to know about citizen science to begin with, and offering a way for people to get educated and inspired could bring more participation and power into this growing field of research.

It is evident that citizen science has growing potential to inform climate adaptation strategies. Local knowledge of climate impacts is a key component of developing adaptation strategies in any community, and citizen science offers an opportunity for people to get involved in research happening in their area. While citizen science continues to advance, researchers should consider some of the challenges that have become evident such as data quality, participant retention, power dynamics, and governance structures that lack the resources for community-led projects. By confronting these barriers, citizen science can move beyond current limitations and become a more effective and inclusive tool for climate adaptation. Strengthening collaboration between communities, researchers, and policymakers, while investing in long-term support and infrastructure, will be key to ensuring that citizen-generated knowledge is integrated into official decision-making processes. Realizing the full potential of citizen science will depend on its ability to translate participation into action that is grounded in locally driven climate solutions.

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