Bisht, V., R. Carrillo, M. Franco, V. Angeles-Wann, J.-B. Rosales Chavez, S. Gomez, J. Hess, A. Kuhn, P. Mollen, J. Morales-Guerrero, J. Wann-Ángeles, C. Cheng, and M. Berbés-Blázquez. 2025. Enabling "barrio" innovation: a grassroots approach for centering community initiatives in just sustainability transformations. Ecology and Society 30(1):8. https://doi.org/10.5751/ES-15749-300108

Research, part of a Special Feature on Meaningful Transdisciplinary Collaborations for Sustainability: Local, Artistic, and Scientific Knowledge

Enabling "barrio" innovation: a grassroots approach for centering community initiatives in just sustainability transformations

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ABSTRACT. Sustainability transformations are most meaningful when communities take ownership of their collective futures and guide transformative processes that are rooted in their local traditions and value systems. Yet, researcher–community collaborations aimed at facilitating meaningful transformations can fall short of their objectives if they do not explicitly recognize bottom-up transformative processes that already exist in the community that enable grassroots ways of knowing and addressing sustainability challenges prevalent in the community. This paper addresses this gap in researcher–community partnerships by illustrating a transdisciplinary collaboration that emerged among researchers, educators, and advocates in South Phoenix, Arizona that sought to center recognitional and epistemic justice from the start. These collaborations led to the co-designing and execution of school curriculums in three learning centers in South Phoenix aimed at developing researcher capabilities among learners for exploring the pasts, presents, and futures, and contributing to transformative action in their community. This paper outlines the approaches that this group of collaborators, who are all co-authors in the paper, took toward forming reciprocal relationships and facilitating just transformations in the community. First, we describe our collaboration process, which was mindful of activating existing spaces of community leadership as well as cultivating spaces of reciprocal knowledge exchange and reflection among the collaborators. Next, we outline our approach toward facilitating just transformations, which we call "barrio" innovation, which is based on principles of embracing a mindframe of abundance, enabling transformative pathways, and focusing on the micro-scale. We further illustrate, through case studies, how our approaches to collaborations and transformations manifested in different learning centers and with different collaborators in South Phoenix. We conclude with our collective reflections and the practices that worked for us toward facilitating just transformations through meaningful researcher–community collaborations.

Key Words: *asset-based community development; environmental justice; epistemic justice; just transformations; transdisciplinary collaborations*

INTRODUCTION

Decades of research in sustainability scholarship suggest that facilitating long-term sustainability transformations requires deliberate collaborations between researchers and practitioners integrating diverse forms of knowledge, insights, and approaches for addressing complex environmental challenges (Lang et al. 2012, Page et al. 2016, Schneider et al. 2019). Consequently, there has been an increased focus on interdisciplinary and transdisciplinary research in sustainability sciences (Klein 2004, Spangenberg 2011) and the corresponding emergence of conceptual tools such as post-normal science (Funtowicz and Ravetz 1993), mode 2 knowledge production (Gibbons et al. 1994, Nowotny et al. 2003), and knowledge co-production (Cash et al. 2003, Wyborn et al. 2019, Norström et al. 2020), all of which signal the need for broadening the idea of experts beyond academia. These developments have led to the reshaping of the researcher's role in society (Pohl et al. 2010, Wittmayer and Schäpke 2014, Bednarek et al. 2018) and a push toward reevaluating relationships between universities and their surrounding communities (Trencher et al. 2014, König 2015, Leal Filho et al. 2022) to conduct more socially embedded and solutions-oriented research (Kemmis 2009, Miller et al. 2014, Balvanera et al. 2017).

The recognition of transdisciplinarity brings about questions of equity and justice (Sze 2018, McGreavy et al. 2021, Shandas and Hellman 2022). It is widely recognized in environmental justice scholarship that environmental issues disproportionately affect marginal and disenfranchised populations (Bullard 2019, Schlosberg 2007, Mohai et al. 2009, Dai 2011, Agyeman et al. 2016, Anand 2017), yet transdisciplinary collaborations in sustainability sciences often fall short in addressing the power disparities, politics, and histories that shape sustainability challenges (Turnhout et al. 2020, Egid et al. 2021, Kok et al. 2021). Even when the research has a participatory orientation, researchers have limited capacity to engage and thus tend to collaborate with the more powerful and socio-politically dominant actors for reasons of access and greater alignment with existing research goals and methodologies, further excluding the most marginalized among the groups from meaningfully engaging with sustainability research and its outcomes (Hage et al. 2010, Porter and Dessai 2017, Eidt et al. 2020). To foster just transformations, there is a need for researchers to build deliberate and genuine relationships with underserved communities that center issues of climate equity and environmental justice and actively contribute to the process of political change (Pereira et al. 2018*a*, Bennett et al. 2019, Scoones et al. 2020).

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This paper describes a transdisciplinary collaboration among researchers, educators, and advocates in South Phoenix, Arizona, USA that sought to center justice from the onset. It illustrates how building transdisciplinary collaborations rooted in recognitional and epistemic justice can lead to the development of transformative practices that are sustainable and meaningful for historically underserved communities. Recognitional justice means acknowledging the harms caused by historical policies and enduring practices in urban planning and education, while also seeking to recognize and celebrate the distinct cultural traditions and assets that exist within marginalized communities (Fraser 2008, Guo 2010). Focusing on epistemic justice means moving away from dominant ways of knowing and academic practices and embracing alternative paradigms and research methods that can provide meaningful contributions for the community (Fricker 2007, Turnhout 2024).

This manuscript is an outcome of the collective reflections of this group of collaborators, who are also co-authors in this paper, and outlines the approaches that we took toward forming reciprocal relationships and facilitating just transformations in the community. These collaborations led to the co-designing and implementation of school curriculums in three learning centers in South Phoenix aimed at developing research capabilities among learners for co-designing positive futures that are rooted in present and past injustices and guide transformative action in their community. Here, we describe our collaboration process and the principles of just transformations that this group developed and continues to refine through our work in South Phoenix. This paper takes a praxis approach (Seng 1998, Kemmis 2010) of learning through reflections on the ongoing researcher–community collaborations in South Phoenix and shares the collective insights of this group on the approaches that have and have not worked for us. Our objective is to share our experiences to inspire researchers and practitioners working with historically underserved communities worldwide in facilitating epistemically just transformative processes.

BACKGROUND

Phoenix is among the fastest-growing cities in the USA and has lately become a center of innovation, attracting an increasingly global population (Mack and Credit 2015). Located in the heart of the Sonoran Desert, the city of Phoenix is home to nearly 1.6 million residents and faces growing risks of extreme weather events due to climate change, including extended droughts, more frequent and severe flooding, rising temperatures, and wildfires (Prein et al. 2016, Elias et al. 2018). Embedded within the city of Phoenix, South Phoenix is as much an idea as it is an actual place. South Phoenix has geographical, historical, and symbolic boundaries that do not always correspond with one another. Geographically, South Phoenix corresponds more closely to South Mountain Village located south of downtown Phoenix, expanding from the Salt River in the north to the South Mountain Nature Preserve in the south, and from 48th Street in the east to 27th Avenue in the west. Figure 1 is an artistic representation of South Phoenix, created by a community artist and collaborator, and shows some of the community assets, learning centers, and community partners.

Fig. 1. An artistic map of South Phoenix, showcasing its geography as well as its socio-cultural and community assets. Source: Community artist, Jonelle Melville (with permission).

Historically, South Phoenix has been characterized by redlining, a financial instrument wherein banks and other lending institutions deemed racialized neighborhoods too risky for investment, resulting in the spatial segregation of socially and economically minoritized communities in the south of the city (Bolin et al. 2005, York et al. 2014). Symbolically, South Phoenix has been designated the more diverse part of the city where non-white Phoenicians lived, including Mexican Americans, African Americans, Japanese Americans, and Native Americans. Indeed, South Phoenix was not officially incorporated into the city of Phoenix until the 1960s, before which this region was denied access to essential services like sewage, greenspaces, health, education, and transportation infrastructure for its residents. Following these historical injustices, South Phoenix communities have been disproportionately exposed to environmental disamenities and climate risks, including more frequent, severe, and longer heat waves (Bolin et al. 2013, Yazar et al. 2022).

The above description of South Phoenix matches most definitions of the area found in the academic literature. Without denying the accuracy of the events mentioned above that undoubtedly have shaped the area, we also recognize that the characterization of South Phoenix as a "geography of despair," as per Bolin et al. (2005), is a damaging narrative as it obscures local efforts to overcome historical legacies. Despite the history of exclusion and environmental injustices, or perhaps because of it, residents in the south of Phoenix are extremely active and highly mobilized in driving political change in their community. Building on decades of activism at the confluence of farmer and labor rights, immigration, and anti-racism movements, there is a wealth of local initiatives, community organizations, and advocacy groups that have emerged over the years.

Furthermore, narratives of despair tend to position university researchers as saviors (Cole 2012), while ignoring the troubled history of these universities with communities of color (see, e.g.,

Drabiak-Syed 2010). These "saviors" often do not belong, ethnically or culturally, to the communities they are trying to "save," and that has created a disconnect between their approaches to finding solutions and the worldview of community members. The co-authors of this paper, who include both university researchers and community leaders from South Phoenix, continue to learn to navigate the uncomfortable space of researcher–communities collaborations. The discomfort comes from being scholars working in and benefiting from institutions that have caused harm and community members who at times have benefited from and at times have been harmed by associating ourselves with institutions of higher learning.

METHODS

This section describes the approach our group of authors used toward facilitating meaningful collaborations among researchers, educators, and advocates for exploring and co-creating transformative processes in South Phoenix. First, we describe our approach toward forming new partnerships, whether with researchers or community organizations, which was mindful of elevating existing community assets and allowed for reciprocal learning and reflection among the collaborators. Next, we describe the approach to community transformation that this group developed and continues to refine and document the heuristic principles that have worked for us in facilitating just transformations in South Phoenix. Together, our work takes an iterative approach to collaborations and transformations, interspersed with actions undertaken to build and maintain reciprocal relationships among collaborators and actions undertaken to facilitate just transformations. The importance of practicing this iterative approach to collaborations and transformations is that each informs the other. Maintaining healthy relationships in the community allowed us to develop transformation approaches that were rooted in place and honored local traditions, and focusing on transformative change as the objective of the collaborations allowed us to build strategic partnerships that elevate local assets and agents of change.

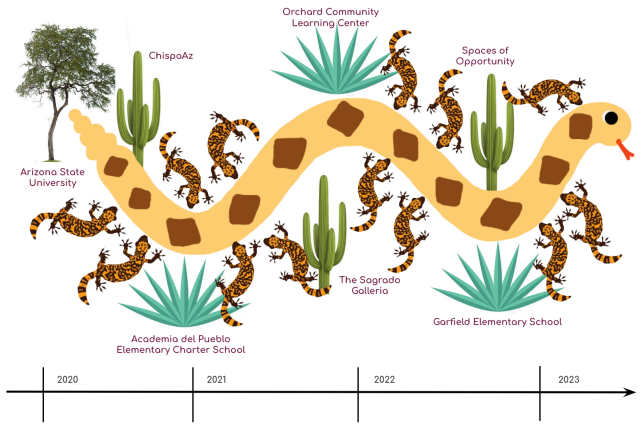
Approach to building collaborations

Our approach to collaboration was centered on activating existing spaces of community leadership, cultivating spaces of reciprocal knowledge exchange, and facilitating spaces for reflection that together helped build trust and accountable relationships between researchers and collaborators. Initially, two researchers from this group started participating in the community circles organized by Chispa, a Latinx environmental justice grassroots group in South Phoenix. Chispa community circles provide a safe space for residents to discuss environmental justice issues prevalent in the community and identify potential mechanisms to address them. Here, the researchers were introduced to an educator from the community (second author) teaching at the Academia del Pueblo Elementary Charter School at the time. The school teacher was interested in integrating participatory research approaches in his school curriculum to enable the understanding of local environmental justice issues and develop capabilities among school students to address them. Together, these researchers and educator started developing a framework for a social-science curriculum to be taught at middle-school level at Academia del Pueblo for engaging students in exploring the historical and current environmental injustices and imagining possibilities for the future to facilitate transformative change in their community. They further invited advocacy partners from Chispa and the Sagrado Galleria, a local arts-based cultural organization, an outreach and an education coordinator from the Central Arizona Phoenix Long Term Ecological Research (CAP LTER) site (third author) who belonged to the community and was a former educator in South Phoenix, and two additional researchers who were at the time graduate students at the university, to co-design various aspects of the curriculum including participatory design and visual storytelling methods. This curriculum was executed in the Spring 2021 term at Academia del Pueblo during which the educators, researchers, and advocates in our group facilitated classroom learning at different times to develop research and future visioning capabilities among students.

This initial group of collaborators continued meeting after the conclusion of the school term to reflect on our overall process of collaboration and the activities of the co-designed curriculum carried out by the students at Academia del Pueblo. These group reflections led to the conceptualization of heuristic principles for facilitating just transformations that were successful in this case. These principles, which we call the "barrio" innovation approach, are described in the following subsection (see also Berbés-Blázquez et al. 2022). In an effort to reach out to additional educators, advocates, and parents in the community, the original group organized a community event in partnership with the Rio Salado Audubon Center, a nature education and recreation center in South Phoenix. This event showcased student projects from Academia del Pueblo as well as artistic performances from dancers and musicians in the community. The integration of art with research, education, and advocacy in a place that was familiar to the community created a comfortable space for residents to have conversations about the socio-ecological issues prevailing in the community and the historical injustices that had caused them, as well as to celebrate the culture of the community. In the following months, this group participated in several community events organized by community partners in South Phoenix to continue engaging with community members through artistic means, sharing the work and the "barrio" innovation principles we had developed, as well as learning about ongoing initiatives in the community.

Participating in community events also helped to connect with additional educators in the community who resonated with the "barrio" innovation principles and were interested in doing similar work at their learning sites. We built collaborations with educators from the Orchard Community Learning Center (hereafter Orchard) and Garfield Elementary School (hereafter Garfield), two learning sites in South Phoenix that had experience engaging community members and children in local food systems. The group engaged in another round of co-designing curriculums focused on envisioning and implementing transformative community action. The collaboration process followed a similar approach to that at Academia del Pueblo wherein the researchers visited both learning sites to better understand their ongoing initiatives and share relevant research methods with the educators and their students. All the collaborators continued meeting regularly to reflect on our collaboration process and understand to what extent the "barrio" innovation principles had worked in each case. Our collective reflections and learnings from the overall processes of collaborations and transformations are detailed in the discussion section of this paper. Figure 2 shows an artistic illustration of our collaboration process.

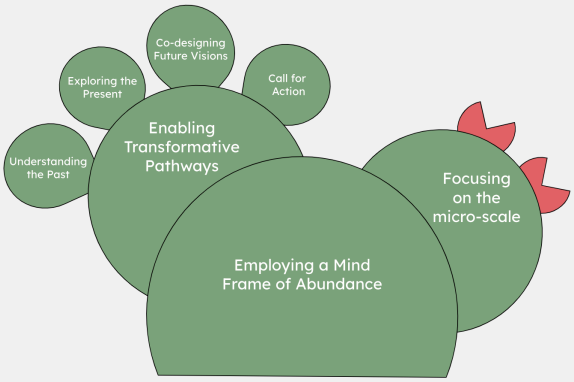
Fig. 2. An artistic illustration of our collaboration journey, where the different actors are represented through wildlife native to Arizona. The barrio innovation approach and its journey through the community is shown in the form of a rattlesnake, which regularly sheds its skin and grows new ones. This symbolizes the flexibility of our approach as we shed approaches that do not work while growing new approaches and practices that are rooted in the communities we work with. Our collaborators are represented as gila monsters, who have joined our journey at different stages. The agave plant represents the different educational spaces in the community where we have worked, the mesquite tree represents Arizona State University, where our researchers were based, and the saguaro represents the community advocacy groups that have supported us.



Approach to transformations

Our approach to facilitating just transformations in the community was co-created through reflections among the collaborators and continues to be refined as we engage with more learning centers and community partners in South Phoenix. It came out of the values espoused by the educators in this group and the lived experiences of South Phoenix communities. We call this approach "barrio" innovation, where the word "barrio" (Spanish for neighborhood) represents the rootedness of this approach in the local history and knowledge traditions of the communities it emerges from, whereas "innovation" refers to the use of the existing strengths and capabilities within these communities for identifying issues and designing transformative solutions. We particularly draw from the culture of activism in South Phoenix, which challenges the current scarcity narratives about the region in mainstream academic and political discourses (e.g., Bolin et al. 2005) into a mindset of abundance that communities have the capacities to transform their lived realities. Our approach also draws inspiration from the works of social justice scholars and public figures in both American and global history, which reflect the values of the educators in our group. Notably, the writings of Butler (2004), which call for bringing back agency to underserved communities, and Freire (2009), which emphasize the transformative potential of education in critically confronting and reimagining the lived realities of historically minoritized communities. We have outlined three principles that reflect the heuristics of our approach to facilitating just transformations. These principles are described below and illustrated in Fig. 3.

Fig. 3. The principles of barrio innovation, represented here as pads of the nopales plant, which is native to the Sonoran desert. The nopales pads are nourished by and provide a major source of nourishment for the community. The flowers of the nopales, tuna, represent the transformative outcomes that bloom in the desert and grow into emerging initiatives for building resilience both within and beyond South Phoenix communities.



A mindframe of abundance

In developing the "barrio" innovation approach, we were inspired by asset-based approaches to community development where the existing strengths and assets of communities are used to bring about transformations (Mathie and Cunningham 2003, Green and Haines 2015). We are deliberate in embracing a mindset of abundance by being intentional in identifying and mobilizing community assets for our projects instead of getting fixated with what is lacking. This means that our projects start with the understanding that communities are experts in identifying their struggles and the pathways needed to transform their living conditions. This way, our approach allows transformative pathways to be devised from the experiences and imaginaries of the communities we work with. This also means that the researchers in our team make a conscious effort to act as facilitators, elevating community knowledge, and allowing communities to see themselves as agents of change, instead of depending on external expertise or validation.

Our approach prioritizes the mobilization of physical, intellectual, and social assets available within communities. Physical assets are spaces that are being reclaimed by communities and provide an anchor for focusing future visioning efforts for urban transformations (von Stackelberg and Jones 2014). Physical assets exist in the form of urban commons or community spaces like gardens, parks, heritage sites, community-owned enterprises, art galleries, and learning spaces that are familiar and accessible. Intellectual assets represent the knowledge, perspectives, and

Table 1. A description of the phases within the principle of enabling transformative pathways of the barrio innovation approach and their corresponding purposes and activities, including the participatory research methods that can be used for exploring the pasts, presents, and futures of the communities.

Phases for enabling transformative pathways	Purpose	Examples of activities
Phase 1: understanding the past	To recognize the historical struggles and injustices that have shaped the present realities of our communities	Learning the history of the place, practicing local traditions and connecting to ancestral roots, listening to community elders, performers, and storytellers.
Phase 2: exploring the present	To explore the present lived realities through the lens of the community by developing research capabilities among community members for observing and inquiring about their surroundings while prioritizing their own frameworks for analyzing and interpreting how these surroundings affect their lives.	Participatory action research activities such as photovoice (Nykiforuk et al. 2011, Berbés-Blázquez 2012), or transect walks (Kanstrup et al. 2014, Diedrich and Farsø 2019)
Phase 3: co-designing future visions	To imagine desirable futures and the pathways needed to bring about transformative change in the communities based on the understandings of the past and present developed in the previous phases.	Envision positive futures of community spaces through participatory design activities (Fischer 2015, Maher et al. 2018) and narrative futuring methods (Sandercock 2004, Galafassi et al. 2018).
Phase 4: call for action	To acknowledge that transformative pathways do not stop at visioning and actively take steps to implement those visions through concrete social and political action in the community.	Partner with existing advocacy organizations in the community, participate in local social and political action, and community events to share future visions and bring about change.

values held within communities, including creative expressions in the form of art, music, and storytelling provided by individuals and organizations in the community. Social assets refer to the community networks and relationships that can be leveraged to drive transformative change. We draw on our existing relationships in the community to identify these assets and facilitate collaborations that build on and strengthen these community assets.

Enabling transformative pathways

The concept of transformative pathways is borrowed from academia, particularly the scholarship on social-ecological systems (Moore et al. 2014, Leach 2015) and climate adaptation (Wise et al. 2014, Werners et al. 2021), where it is broadly understood as a series of individual or collective actions that guide a system toward bringing about desired changes. Pathways become transformative when they enhance the capacity of social-ecological systems to imagine and create fundamentally new systems that are more resilient to environmental challenges (Walker et al. 2004). This requires shifting away from dominant, pre-existing pathways that have led to the current environmental crisis and injustices and creating deliberate spaces to experiment, innovate, and develop alternatives that can guide the system toward desirable states and increase its adaptability (Westley et al. 2011, Olsson et al. 2014, Ely 2022). Although transformative pathways are necessarily context dependent, these processes can be enabled by cultivating a combination of experimental and reflexive spaces that simultaneously facilitate horizontal transdisciplinary collaborations (Pereira et al. 2018*b*), reframe sustainability challenges, and shift individual values toward a personal commitment to alternative trajectories of action (O'Brien and Sygna 2013).

"Barrio" innovation is based on the notion that transformative pathways become most effective when they emerge from within communities. It recognizes that for environmental change to be truly transformational, it is important that the pathways are rooted in the historical struggles and lived realities of underserved communities (Temper et al. 2018, Wijsman and Feagan 2019), are owned and guided by the communities on their terms, and envision tangible mechanisms for communities to realize their desirable futures (Inayatullah 2008, Moore and Milkoreit 2020). To enable transformative pathways, our approach works through four interconnected phases of the past, present, future, and call for action, described in Table 1.

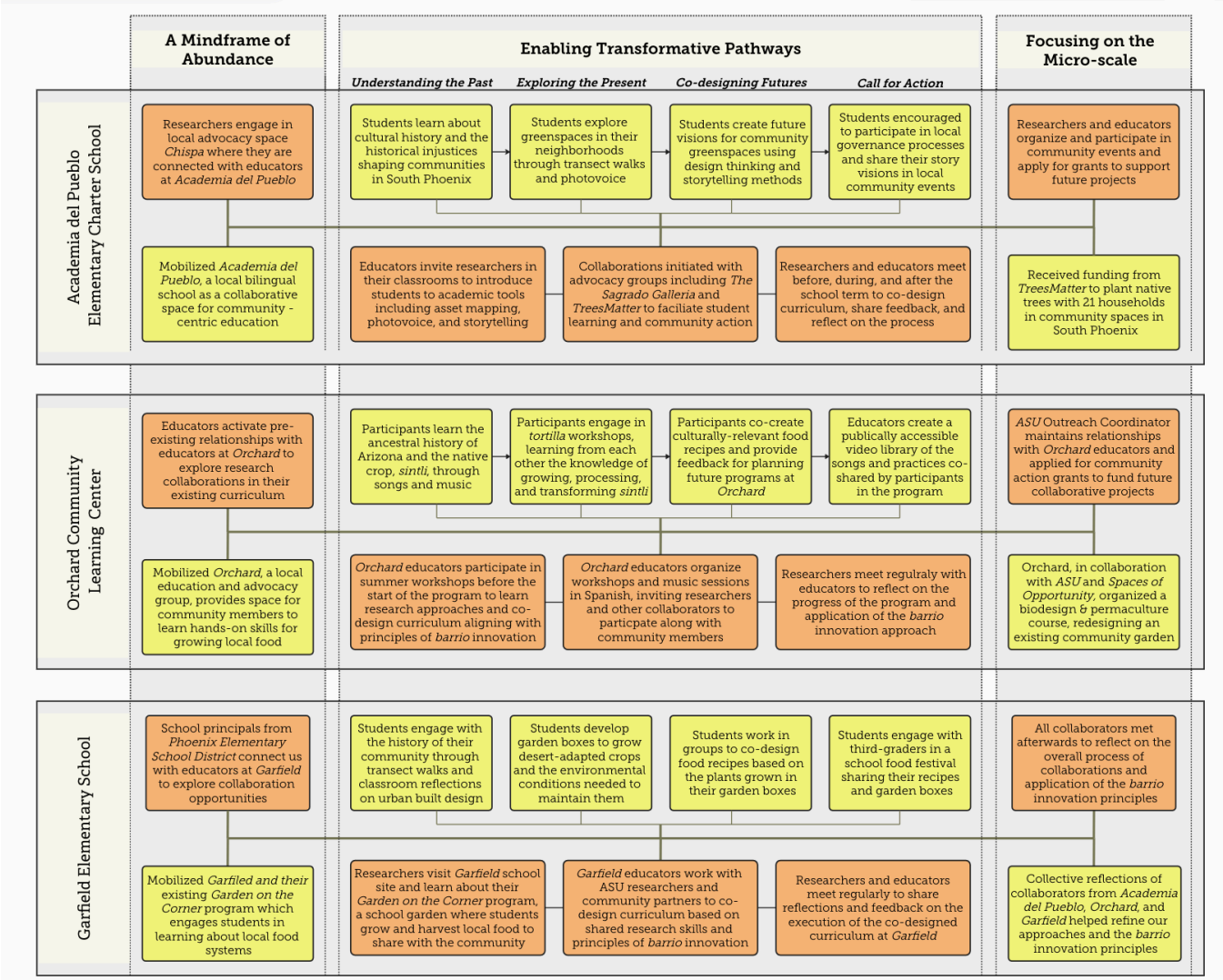
Focusing on the micro-scale

Typically, processes for amplification of innovative solutions consider scaling up, scaling out, and scaling deep (Moore et al. 2015). "Barrio" innovation espouses the principle of horizontal outscaling of transformative pathways rather than vertically upscaling community initiatives. This means that our efforts are directed toward replicating these principles through different projects in the community, where collaborators can learn from each other and guide transformative processes in ways that are mindful of the local particularities (Temper et al. 2018). Focusing on the micro-scale allows communities to bring their local identity, values, and narratives to the forefront in identifying needs and designing solutions that are rooted in the cultural traditions of the place. It also allows us to focus on creating genuine and reciprocal relationships, work at the speed of trust, and prioritize actions that are meaningful at the micro-community scale (Wise 2017).

CASE STUDIES

This section illustrates how we applied our approaches and the various activities that this group of collaborators carried out at each of the learning sites, Academia del Pueblo Elementary Charter School, Garfield Elementary School, and the Orchard Community Learning Center. Figure 4 summarizes these activities and showcases how our approaches to collaborations and transformations were intertwined in each case and together facilitated reciprocal relationships and transformative community action.

Fig. 4. An illustration of the specific activities carried out by the collaborators in each of the case studies at Academia del Pueblo, Orchard, and Garfield. Activities shown in orange boxes represent the efforts undertaken by the collaborators to build reciprocal relationships, whereas the activities in the yellow boxes represent those undertaken by students and participants in each learning center to implement the different phases of the barrio innovation approach.



Academia del Pueblo Elementary Charter School

Academia del Pueblo is an elementary charter school located in South-Central Phoenix that has historically served a mostly Latine population. We worked with middle school students in two classrooms at Academia del Pueblo to closely investigate and draw from local experiences to design community-centric solutions for South Phoenix. We began by educating students about the history of the place, focusing on the Indigenous life and culture, pre-colonial society, and the establishment of the United States of America. Emphasis was given to enhancing understanding of how federal policies over the years have impacted the lived experiences of communities in South Phoenix, particularly access to land, housing, and urban greenspaces. This part of the curriculum was largely instructional, familiarizing students with existing literature on South Phoenix and the experiences of low-income communities in the USA (e.g., Asante-Muhammad et al. 2017, Boucher et al. 2021).

The students were further encouraged to develop skills to become local investigators and see themselves as experts about their community. Students were introduced to concepts of asset mapping and participatory action research, and taken on transect walks to explore their neighborhoods. We used Photovoice as a participatory research tool to facilitate exploration of students' relationships with greenspaces in their community. Students took pictures of the urban nature they had access to and wrote short paragraphs describing their pictures (Fig. 5). These pictures and written narratives were analyzed by the educators and researchers,

Fig. 5. Engagement with students from Academia del Pueblo Elementary Charter School in South Phoenix. Photographs taken by two students during the photovoice activity, along with excerpts from their paragraphs describing these photographs.

(i) "This is a picture of a park on a sunny day. This is a good part of my community as it keeps children entertained and active."

(ii) "This is a picture of a trail in the Cesar Chavez park. It makes me feel calm and makes me want go there often so I can study or read peacefully with good weather."

and the results were presented to students in the classroom. We found that the presence of urban nature like public parks evoked positive emotions among students, whereas the presence of dry and unhealthy trees made the students feel sad about their community. Students expressed disappointment with the lack of youth-friendly infrastructure and made suggestions like replacing concrete surfaces with softer materials that are safe for youth.

The next part of our curriculum built on the insights developed by students through explorations of their communities and sought to use these insights for designing culturally relevant greenspaces in their community. We collaborated with a local arts-based advocacy group, The Sagrado Galleria, which was running their Design Empowerment program aimed at working with students to intentionally reimagine and redesign specific community spaces using craft supplies, building blocks, and annotations on sticky notes (Fig. 6). We also used storytelling techniques for enabling students to visualize and construct narratives about the futures of the community spaces they had redesigned. Students worked in groups to create stories centered around the people from the community and how they would use these redesigned spaces in the future (Fig. 7). Many of these stories reflected how the students envisioned participating in their community by mobilizing people for community action (e.g., cleanliness drives, volunteering), using the newly transformed community spaces (e.g., public parks, vegetable gardens), and caring for fellow community members (e.g., donating food, sharing pets, etc.). Students were also encouraged to attend the local city council meetings to understand and become part of the present city design and development plans and were connected with local advocacy groups to share their visions for the community.

After the end of the school term, we organized and participated in a series of community events in South Phoenix to share our work and network with educators and community organizations in the region. These outreach activities helped us connect with several community partners in South Phoenix who related to our approach and reached out to collaborate with us. We were able to receive funding from TreesMatter, a local non-profit to distribute and plant native trees with 21 households in community spaces in South Phoenix as per the visions of the students at Academia del Pueblo.

Orchard Community Learning Center

The Orchard Community Learning Center (hereafter, Orchard) is a community organization based in South Phoenix that organizes place-based educational experiences for community members focused on local food systems and developing hands-on skills for growing and harvesting local crops. This collaboration was initiated by educators in our group who had ongoing relationships with educators at Orchard, who had been leading food-based educational programs in the community for several years. The existing programs at Orchard are centered around principles of decolonial, recognitional, and environmental justice (Pulido and De Lara 2018, Álvarez and Coolsaet 2020), where local, ancestral knowledge is advanced and shared among learners through the medium of art and music in intergenerational community spaces. These principles aligned well with those of the "barrio" innovation approach.

We worked with the educators for the summer before the start of the term at Orchard, engaging them with the principles and methodologies of our approach, including photovoice and design thinking, which enabled them to think about the transformative potential of their programs. This collaboration resulted in co-designing of an educational program on local food history and practices to be implemented at Orchard, while integrating the principles and pathways of the "barrio" innovation approach. This program was entirely led by the collaborating educators at Orchard, with weekly check-ins and support sessions facilitated by the educators in our group.

Fig. 6. Photos of the worksheets that students developed in the design activity with Design Empowerment.

The program began the facilitation of monthly gardening workshops at Spaces of Opportunity, a local community garden and farmers market, and a physical asset in South Phoenix. These workshops were based on the notion of "Anawak," which is the ancestral land of various Indigenous people in Arizona, and "Tonantsin," which translates to Mother Earth. This provided the participants a starting point for exploring who we are and where we belong, along with other non-human beings whose existence is equally important to the land. The workshops were free and open to community members of all ages, as the focus was on learning from each other and the land, recognizing the knowledge that is alive and cherished by the families that are part of our community.

Through the medium of songs and music, participants explored the importance of "sintli" (maize/corn), and how it has co-evolved with humans in the "Anawak" through processes that have lasted thousands of years. Participants realized that their community has valuable knowledge of important aspects of growing, processing, and transforming "sintli" into "tlaxkalli" (tortilla), atolli, tlacoyos, piki bread, and other nutritious "sintli"-based foods that sustain us. Through the facilitation of "tallercito de tlaxkalli" (tortilla workshops), participants had the opportunity to learn from each other and from the land. Spanish was used as the language of communication and musical instruction as it is the first language for many of our community members, and provided a welcoming space and served as an intellectual asset for people to reaffirm their culture and value the ancestral knowledge of their families. The participants had freedom in all the workshops to improvise, modify, and incorporate these ideas in the music they created and shared.

At the end of every workshop, "platicas" (conversations) were held as a space for participants to reflect and share their feedback and suggestions for future programs at Orchard. These "platicas" also acted as spaces for co-creation of culturally relevant food recipes based on the individual and collective wisdom of the learners. The educators facilitated creation of a publicly accessible video library of the songs and recipes shared in these workshops.

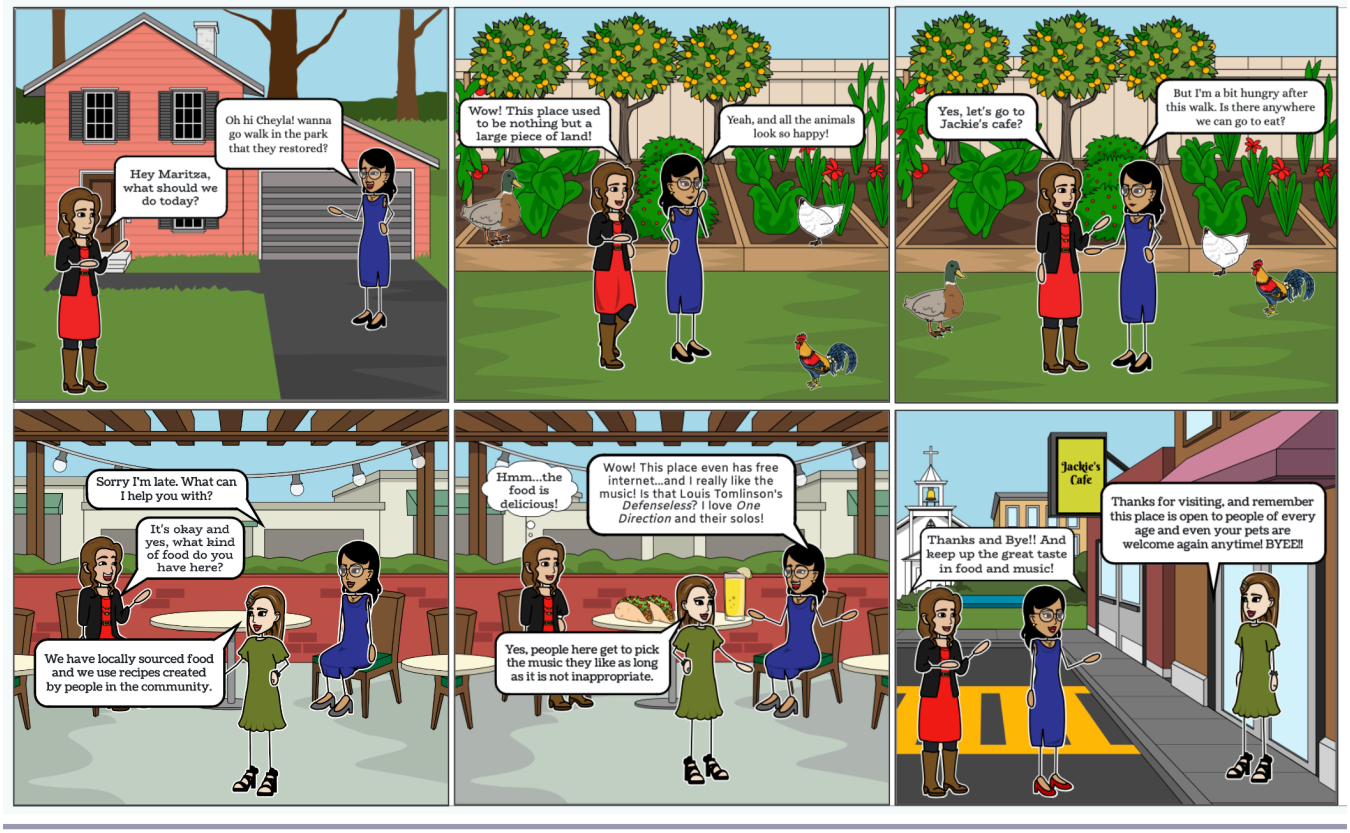
The "platicas" also helped the educators identify focus areas for planning future educational programs at Orchard. This program helped validate their existing educational approach based on the idea that people love nature and arts deeply and have a desire for creating space and time where they can learn and teach each other how to relate to the land and in creations in a genuine, culturally responsive manner. This continues to be an ongoing initiative at Orchard, inviting more community members into decolonial environmental justice programs where they can learn to grow and cook desert-adapted plants as well as provide opportunities for music lovers in the community to create and share their art.

Garfield Elementary School

This collaboration was facilitated through the recommendations of school principals in the Phoenix Elementary School District, who were instrumental in connecting us with educators at Garfield Elementary School. Garfield has an existing edible education program, Garden on the Corner, which provides a flourishing space for the students, and the community after school hours, to grow, create, and share meals. This program is supported by the local non-profit, Mollen Foundation, which has been working with schools in Phoenix for several years, offering inquiry-based educational programs for developing healthy relationships between students, food, the environment, and the community.

Our collaboration started the summer before the start of the school term at Garfield. We organized immersive experiences with the teachers at Garfield, engaging them with the principles and pathways of "barrio" innovation. This led to the development of a curriculum plan to be taught to eighth-grade science students at Garfield, which integrated both Garden on the Corner as well as "barrio" innovation for enabling students to learn about the relationships between urban design and human wellbeing. This curriculum was entirely taught and led by the collaborating educators at Garfield. Throughout the school term, support was provided to the collaborating teachers through the facilitation of weekly check-ins and interactions with our larger community of

Fig. 7. A rendition from a storyboard created by a student group in the future visioning activity.



educators and researchers. Sometimes, the researchers would also go to the classrooms to introduce students to various research methods and concepts of desert ecology and food systems.

As part of the curriculum, students went on transect walks in their community, observing their surroundings and reflecting on how the urban built environment affects their lives. Students created short videos based on their reflections from the community walk, which were used by the teachers to facilitate creative discussions in the classroom about what urban design meant for their community and initiate conversations about the history of place and environmental justice. Students later worked in groups to develop their own garden boxes as part of the Garden on the Corner program at Garfield, through which they learned about growing and maintaining edible plants in the desert environment. These garden boxes provided a tangible medium for the students to interact and learn about desert-adapted plants and the environmental conditions (pH, soil moisture, shade, etc.) needed to maintain them. Toward the end of the school term, as their plants matured, students again worked in groups to co-design food recipes based on the plants they had grown over the year. A food festival was organized at Garfield where students got the opportunity to engage with fellow third-grade students in the school and share the garden boxes and food recipes they had created.

This project showcased how integrating the "barrio" innovation approach with the existing initiatives at Garfield can facilitate incorporation of place-based knowledges and co-designing practices into the mainstream school curriculum. It also enabled students to feel empowered to not only grow their own food but also teach and guide juniors in the school in community gardening activities. In our reflection sessions at the end of the term, our collaborating teachers at Garfield shared that integrating the "barrio" innovation approach allowed them to be open-minded and go beyond the boundaries of what the district school board wants them to do and incorporate learning that is relevant for the community. However, they also shared that they still have to work within the constraints of the district board and school administration, which prevents them from teaching a more meaningful curriculum. For example, they were not allowed to invite the larger community in their food festivals and gardening activities, which prevented the students from making meaningful connections in the community. This way, this project helped us understand how school spaces can act as community assets as well as encouraged us to think about how to facilitate sharing of resources between schools and the community.

DISCUSSION

The collaborations presented in this paper showcase how it is possible to develop novel research approaches that emerge from the cultures of activism present within historically underserved communities, that employ local knowledge traditions and practices that are relevant and meaningful for the communities. In this section, we reflect on the various practices that we have

employed as part of this approach that have helped us in building healthy relationships in the community and enabled just practices in the context of urban transformations.

Our collaborations emerged organically among educators, advocates, and researchers, who had a strong presence in the community. This made it possible to develop approaches that are rooted in the place, incorporate the local narratives of struggle and cultures of transformations, and are truly meaningful for the place and its communities. It also allowed our collaborators to bring their existing practices that they have been developing by being present in the community for several years. For example, at Orchard, collaborators brought the practice of playing music and sharing songs about local food systems. At Garfield, they brought the practice of integrating food in the traditional school curriculum. Even though we were flexible with our approach, we also made sure that there is intentionality in some aspects like recognizing community assets and future thinking. This allowed our collaborators to develop new approaches in their curriculums, which strengthened community insights for supporting long-term sustainability projects in the community.

The presence of advocates throughout the execution of the projects made possible the mobilization of the assets and resources available within the community. In all the projects, educators made efforts to connect their learners with the larger community through the organization of community events in collaboration with advocates and organizations. Connecting learning spaces with advocacy spaces allowed learners to observe and participate in the transformative processes already active in their community, as well as generate sustainable outcomes that build from and enhance these processes. For example, collaborations between TreesMatter and Academia del Pueblo provided an avenue for translating youth visions into community action through planting native trees in the neighborhood, and collaboration with Spaces of Opportunity allowed students at Orchard and Garfield to participate in the ongoing gardening initiatives in South Phoenix. It also enabled the community to collectively build resources and share knowledge and skills that are relevant for addressing specific issues in the local context. For example, at Academia del Pueblo, students created and shared narratives of positive futures for the community, whereas at Orchard and Garfield, the community co-created a library of food recipes and songs for sharing knowledge about local food systems and connecting with plants native to the Sonoran desert.

To enable just transformations, it was important that our projects were led by people who are from the community and are tied to the place. Being tied to the place allows community leaders to center place-based narratives and experiences to develop transformative pathways that are relevant and rooted in local traditions and knowledge systems. In our collaborations in South Phoenix, partnering with existing community initiatives and having educators lead the projects also ensured the longevity of the projects even after the collaboration was over. As the "barrio" innovation principles emerged from the community, our collaborating educators and advocates took ownership of the approach and made efforts to strengthen place-based knowledge traditions and practices for supporting the design and development of just and sustainable transformations in the community.

However, being led by the community also means that it is important to acknowledge that just transformations are carried on the shoulders of the community, who are often working with limited time and capacity. Several of our collaborators, including educators, advocates, and researchers, had other full-time jobs and had been working on these projects on a voluntary and labor-of-love basis. Others were employed at institutes, including academic institutes and district schools, that often put constraints on what can and cannot be done. Therefore, it was important to understand the constraints under which our collaborators were working, and respect their time and capacity. This is where having a reflexive and emergent approach also proved useful as it did not require our collaborators to move very far from what they were already doing, and yet incorporate principles that would enhance their existing initiatives.

Incorporating flexibility and adjusting to the shifting times, capacities, and constraints of our collaborators also required integrating the practice of intentional and consistent reflection. Throughout the duration of all the projects, we held regular check-ins with our collaborators, providing the time and space for free and open communication where everyone could put forth their experiences and perspectives. Having intentional reflexive spaces proved crucial for building trust in our collaboration, as despite best intentions, conflicts do happen. During conflicts, it was important for us to ensure that our intentions are clearly communicated and that there is space for admitting mistakes and taking alternative courses of action. We observed that despite the conflicts, the focus of all collaborators was on justice, and having this overarching sense of doing what was best for the community helped us build trust and figure out the best pathways to move forward.

Although just transformations are most impactful when led by the community, researchers can also play a meaningful role by sharing research skills and facilitating co-designing of approaches that emerge from and are connected to the community. When working with historically underserved communities, researchers need to acknowledge that meaningful transformations can take place by recognizing the expertise and multiple efforts that already exist within communities and find ways to strengthen this knowledge and efforts by sharing relevant academic insights and skills. Researchers must also recognize that sustainable transformations occur through multiple pathways and not all of those pathways are compatible with the practices of academia. For example, in our collaborations in South Phoenix, the researchers in our team made a concerted effort to participate in community events held at spaces that were determined and controlled by the community as opposed to asking the community to participate in university spaces where the entire dynamics of engagement is generally controlled by the researchers (Muhammad et al. 2015). Moreover, our focus on mobilizing community assets allowed us to incorporate diverse forms of learning, such as through art and music, and explore alternative research outputs, such as artistic asset maps, story comics, food recipes, and co-created songs, besides the writing of this paper, that lead to more meaningful transformations in the community. Therefore, facilitating just transformations requires researchers to embrace alternative pathways, step back when needed, and work toward creating outputs that are meaningful for the community.

To conclude, our experiences in South Phoenix have shown how transformative efforts can have meaningful outcomes when they focus on recognitional and epistemic justice and celebrate existing values, initiatives, and practices of the communities with whom we work. Transformative action at local scales enables justice rooted in the history of the place and seeks to directly address the historical injustices that have shaped present realities (Raymond et al. 2023, Lillevold and Haarstad 2019, Till 2012). Working with existing initiatives in communities strengthens transformative processes that are already alive and vibrant within communities, especially those that are outside traditional academic discourses like using artistic expressions, community-driven education, and gardening approaches (Eizenberg 2016, Rodríguez-Labajos 2022). Without being prescriptive, it is our intent that sharing our experiences and learning might offer inspiration to scholars and practitioners worldwide for the kind of transformative processes that can emerge from collaborative spaces that center justice.

Acknowledgments:

The research conducted in this paper has been made possible with the financial support of the United States National Science Foundation under Grant nos. DEB-1832016 and DEB-2224662 (Central Arizona-Phoenix Long-Term Ecological Research Program) and the mentorship support provided by the Earth Systems Science for the Anthropocene (ESSA) Graduate Scholars Network at Arizona State University. We would like to recognize the many community members and allies who have supported our work, heartfelt thanks to Blanca Abarca, Teo Argueta, Dan Beaver, Sylvia Bernal, Aimee Esposito, Lauren Kennedy, Grace Logan, Frank Lomeli, Selina Martinez, Masavi Perea, schools Garfield Elementary School and Academia del Pueblo, and the following community spaces: Arizona Barrio Stories, Friendly House, the Sagrado Galleria, Orchard Community Learning Center, Watershed Management Group, Chispa Arizona, and Spaces of Opportunity.

Data Availability:

The data and code that support the findings of this study are available on request from the corresponding author, VB. None of the data and code are publicly available because of restrictions, e.g., they contain information that could compromise the privacy of research participants. Ethical approval for this research study was granted by Arizona State University.

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