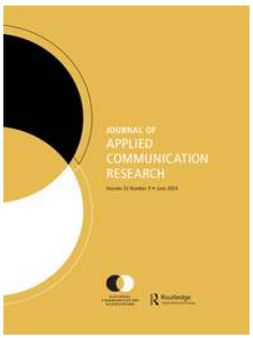

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FIELD REPORT

Rectifying a flood data desert one step at a time: a co-created, engaged scholarship approach

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ABSTRACT

Attention to public problems is increasingly being driven by data. Given that data is used as a communication tool, a lack of data may further exacerbate existing inequities when allocating public resources, especially around infrastructure. Using a co-creation and power-sharing approach to community involvement, this field report describes how a rural community and academic partners worked together to collect photo and video data to create a community-driven flood map that communicates flood issues. The results indicate community members felt like they belong, are valued, and their flooding challenges are visible. These are all important steps to achieving attention and support to address their flooding infrastructure challenges. We end by offering six concrete suggestions, ranging from centering community needs to interdisciplinary collaboration, for how this approach can be used in other applied communication projects.

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Co-creation; flooding; data gaps; engaged scholarship; environmental communication

Nestled less than a mile off the US/Mexico border and an hour south of El Paso, Texas is a growing community by the name of Fort Hancock. Several hundred people have lived in this 97% Hispanic and mostly Spanish-speaking community for generations. It is a scenic desert town flanked by mountains on both the US and Mexico sides, and there are farming operations located west and abutting the Rio Grande River. Fort Hancock is the largest community in Hudspeth County (around 1000 people), geographically the third largest county in Texas, but one of the most sparsely populated counties with only 3300 people filling the over 4500 square mile area. There is a problem in Fort Hancock: the latest official flood data indicates a minimal presence of flooding, even though every year, even a small amount of rain causes flash flooding in this desert landscape.

This field report details the process through which our research team intervened to help Fort Hancock residents gather their own community data that documents their flooding challenges and communicates the need for funding to address their infrastructure issues. To accomplish this, first we discuss data as an important communicative resource. Next, we provide an overview of the Digital Risk Infrastructure Program

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(DRIP), explain how the Fort Hancock project developed, and discuss the specific co-creation and power-sharing approaches used. The rest of the report details Fort Hancock's story and the process the researchers used to involve community liaisons in the quest to capture photographic evidence of flooding. We end with a concrete list of six ideas, derived from this project, that can be applied to other communities in efforts to conduct meaningful engaged research (Wolfe & Champine, 2023).

Emergence of co-creation: the DRIP overview

The Digital Risk Infrastructure (DRIP) Pilot program was funded by the Texas Legislature to address gaps between the production of flood-related data in highly technical models and the ways rural communities use data for flood awareness, community improvement, and infrastructure improvement requests. Flood-related data provides documented evidence (often quantitative) that a community is in a flood hazard area or is experiencing flooding.

While DRIP sought to address data gaps in rural areas, the importance of communicating about data emerged as both a challenge and an opportunity. Data is not only a technology but also a communicative tool (Zuboff, 2019), and it is associated with power and information inequality. Specifically, flood risk data is often depicted as hydrologic and hydraulic models (Stephens et al., 2023), and working with it requires special knowledge and the ability to communicate across different interfaces with software such as Geographic Information Systems (GIS).

The need to communicate with data can reveal issues of information inequality. 'Data deserts,' places lacking digitized data (Lee & Butler, 2019) face data communication gaps when compared to other locations. For example, urban counties and incorporated communities, especially those with a higher tax base, have the resources to access and analyze their data, present it in persuasive ways, and show the scale of potential improvement in lives if they receive funding. They often have experts in flood modeling, economic analysis, and professional grant writers or funding specialists who can effectively translate that data into the formats needed to satisfy bureaucratic reporting processes. But having access to experts who can present the data correctly and navigate administrative systems is a privilege. Rural communities may lack budgets to access specialized data-handling products and the workforce capacity to work with that data.

Issues associated with data gaps became apparent as DRIP began exploring county-wide needs in Texas, particularly in the counties of Comanche, Fayette, Jim Wells, Upper Rio Grande, Willacy, and Wise. Fort Hancock in Hudspeth County, the focus of this field report, became a focus after their local emergency manager (who later was elected the County Judge) approached the team. She was concerned that she could not find flood data about her community, and it was keeping her from applying for much needed infrastructure funding. County Judge Joanna E. MacKenzie grew up in this community, and she knew the history of flooding in her area. Once our team did research and learned how they were truly a data desert, we began working together.

The interdisciplinary research team included two primary groups: technical experts who were mainly responsible for flood-data product development, and on-the-ground field communication researchers who spearheaded community engagement. Community visits were part of the engaged research process, and involving the community

meant DRIP´s field and technical teams needed to train community members to collect photos.

Considering the complexity of this data collection effort, the research team met with the Institutional Review Board (IRB). They recommended we continue using informed consent and treat the interviews and map-related conversations with the county leaders, data collectors, and community members as the research portion of the project. The community collection of photos, used to prove the impact of flooding, would be considered a community project, and not research. The field team trained the data collectors to use media release forms with the community members who were sharing their photos. These forms explained that the photos would be shared publicly and used to create a flood map. On our photo collection protocol, we included instructions to not share images that contained children, or people. The photos only needed to demonstrate the physical flooding problems. Table 1 provides a timeline for the DRIP Project, but it also explains which parts of the project were research and community photo collection. To clearly distinguish the research from the data collectors' community photo project, in Table 1 we mark research with an 'R' and the Community Project data collection of photos and videos to be shared publicly with a 'CP.' The next section describes how we co-created the community data collection approach.

The co-creation and power sharing approaches defined

From the beginning of this engaged research project, the DRIP team recognized that knowledge about the community is situated in the experiences of its members and

Table 1. Project timeline with community project and research activities identified.

March 2022	DRIP Project began with technical team and field research team identifying eight communities of focus.
April–May 2022	Exploratory phone calls and background research on Hudspeth County
June 2022	R: Trip to Hudspeth Co. to meet key county personnel and listen to flooding concerns. Learned about capacity limits and needs for maps and data.
January 2022	R: Visit to show Hudspeth County leaders hydrologic and hydraulic maps. Learned about Fort Hancock's lack of flood data at this meeting.
	Co-Creation Process Began
April 2023	CP&R: Visit to show refined versions of maps. Trusted community leaders – churches – were included in meetings and the process became co-created.
April 2023	CP: Church leaders suggested researchers meet four community members interested in co-designing the project with us.
June 2023	CP & R: Visit to meet with data collectors and gather ideas that helped refine the plan. Attended church and spoke with the congregation.
June 2023	CP: & R: Three-day training of data collectors on privacy protection standards in gathering photos and videos from community members. The Spanish-speaking community engagement leader created a WhatsApp group to communicate with the field team.
June 2023	CP: Data collectors informed Fort Hancock neighbors about the opportunity to update their public flood map together. They posted flyers, used social media, and word-of-mouth communication. The local paper published a note on the project.
June 2023	CP: Meeting with data collectors to develop a system to invite neighbors to share photos and videos and keep track of parcels visited respecting privacy.
June 2023	CP & R: Open meeting with the community to show the maps and invite them to participate in the community project and the research.
July 2023	CP & R: Visit to hear data collector's experiences of progress and provide assistance.
October 2023	CP: Visit to give back to the community by conducting a resume workshop for the data collectors and providing shareable materials they can use to further build on the citizen science skills acquired.

Notes: Community Project (CP) activities were not research, and data gathered was shared publicly. Research (R) activities used informed consent and all data confidential.

thus we were not the community experts. Furthermore, we knew the academic literature around data and information inequality, so we leaned into a bottom-up communicative practice that created capacity for them to show their issues with flooding. This approach could generate data in a way that community members were informed of the process, free to participate in the creation of the map or not, and able to express their opinion while having their privacy respected.

As the DRIP project began, the field team leader said she did not want to know all the sophisticated data analysis options available to work with flood data. Instead, she insisted the team of communication experts go into the rural communities, listen, learn, and co-create ways to fill these data gaps. She was concerned that the team might fail to adapt and customize cutting-edge tools to the distinct needs of smaller communities, which significantly differ from those of larger ones.

The DRIP team embraced a co-creation approach to the applied research project. Co-creation is defined as mutually privileging the expertise of the local community and the researcher while also viewing research as an intervention focused on joint inquiry and action (Barge, 2023). The co-creation approach is part of a critical cultural dimension of practice, which means that the intervention pays attention to issues of power within human systems and is concerned with equity, voice, and cultural processes in meaning-making and action. In this way, it also generates research that serves common interests and builds the community's capacity for change while considering local communicative practices and culture.

The process was informed by Barge's (2023) theorizing of intervention orientations. Barge highlights the challenges implicit in power differentials and prompts researchers to create what he calls 'a productive tension between bottom-up and top-down approaches to social change' (p. 491). Barge's (2023) framework coincides with conversations in the community participation literature about power, control, and ownership. Some orientations claim that substantive interventions must include the community in idea generation, responsibility sharing, and decision-making (McCloskey et al., 2011, p. 13).

We also built on a link between Barge´s concern for power differentials in co-creation and community participation, and Morgan and Lifshay's (2006) 'Ladder of Community Participation' conceptual framework for varying degrees of involvement. The ladder characterizes interventions as 'power-sharing' when communities define solutions and solve problems together with researchers. This category includes establishing partnerships and collaborations, calling meetings jointly, allowing community oversight and monitoring of activities, and funding community groups to implement projects.

Our intervention is an example of co-creation through power-sharing because in the different meetings and visits shown in Table 1, county and community leaders, data collectors, and neighbors provided substantial input in decision making. Participation was imbedded in the interactions with the data collectors and leaders and occurred with the public in open meetings where people spoke of flooding and shared stories, mental representations, examples, and images that reflected individual and collective memory.

In the following section, we tell the story of how our partnership developed and allowed us to co-create a community flood data map.

Communication practices in a data desert

At the end of 2021, The Infrastructure and Investment Jobs Act was passed by the US Congress to spend billions to 'rebuild America's roads, bridges and rails, expand access to clean drinking water, ensure every American has access to high-speed internet, tackle the climate crisis, advance environmental justice, and invest in communities that have too often been left behind' (The White House, 2021). Fort Hancock is one of the communities that has been left behind in different respects. They are not able to tap into these funds to improve their community because no official data shows their community is at risk for floods. The unincorporated town is considered a *colonia*: a community containing primarily dirt roads and having limited access to clean drinking water, safe wastewater disposal, and high-speed internet. Residents suffer disproportionate effects of climate change and decades of environmental injustice, in addition to a lack of data and risk communication that is common in other parts of the U.S.

Like other small (often rural) communities, Fort Hancock, has not been flood-mapped since 1985. This means that when the Federal Emergency Management Association (FEMA) documented flooding potential in the colonia, the population was less than 200, but today they are over 1000. Looking at the FEMA-generated flood hazard area map, only three to four structures appear to be at risk for flooding (see this link for FEMA flood maps: https://www.fema.gov/flood-maps/national-flood-hazard-layer). Today, almost 40-years after the area was mapped, when it rains, the paths the water takes coming down the mountains have changed and expanded. When this area receives only an inch of rain in a couple of hours, their dirt roads turn into mud pits, bridges wash away, fences are knocked down, people are trapped in their homes for days, and homes and property are damaged. These are all effects of *arroyos*. While the term, *arroyo*, is defined as a dry creek bed, people in Fort Hancock use it to describe the flash flooding that invades their community (Figure 1).

The case of Fort Hancock clearly illustrates several issues around the availability and accessibility of data, as well as the need to harness its rhetorical potential to justify funding that improves their infrastructure void. Without current data, the flooding is not acknowledged and, as another Hudspeth County Official stated during one of the visits, it is as if 'their challenges with the *arroyos* are not real.'

Understanding community data needs

Every time our team met with people in Hudspeth County, they told us stories and showed us photos of the rushing water. County Judge MacKenzie explained:

> One long-term, elderly resident grinned from ear to ear while telling me she just opens her back door and front door and lets the arroyo run through her home when it rains. When it is over, she sweeps out the mess and watches for the next rain because flooding happens nearly every time. My biggest concern is that she has completely normalized flooding, and there is absolutely nothing normal about water flowing through homes when it rains! No one in this community should have to accept this as normal!

Early engagement with County leaders not only enhanced the team's comprehension of the issue but also sparked the development of innovative approaches to tackle the data scarcity challenge within this community. The field research team, which comprised

Figure 1. Photo of an *arroyo* (dry creek bed) that becomes a rushing river with as little as half an inch of rain.

communication researchers and a subgroup of flood modeling experts, quickly realized that this community needed help. By directly witnessing the accounts of County officers, and seeing photos and videos, it became evident there was an opportunity create value by building a flood map together.

During our third meeting with the county officials we realized: One area of their county, Dell City, was accurately flood mapped in 1987, but Fort Hancock showed no risk. As we worked together to identify an approach to get data for Fort Hancock, we held more meetings and included the pastor of the local church and his wife, both highly trusted members of the community. The pastor's wife took the map of Dell City and said, 'How is this fair? The map shows they [Dell City] flood, but it doesn't show our flooding in Fort Hancock. We have to do something to fix this.'

The field team took this idea as a cornerstone for a brainstorming session with the rest of the DRIP researchers. We realized that many community members have photos and videos of past flooding. Once collected and post-processed, geo-referenced photos and videos could be used to develop maps of flooding hotspots and inundation of the area. The purpose of this effort was twofold: first, to provide a more accurate depiction and clearer understanding of the area's current flood hazard and its various drivers based on the community members' collective knowledge and experiences (i.e. a community-driven flood hazard map), and second, serve as evidence or supporting material for the community leaders to pursue future grants or funding to address the area's flooding issues. Every conversation we had involved showing photos, and the research

portion of this project used photovoice or photo-elicitation interviewing (Stephens et al., 2020; Wang & Burris, 1997) to address the research questions. The field team leader asked the pastor and his wife if they thought community members would be willing to share those photos to help prove the flooding, and without hesitation they answered 'yes!' Then the field team lead said she had the funds to hire three to four people for a month to go door to door and attend community events to collect photos. The pastor, his wife, County Commissioner Sergio Quijas, and Judge MacKenzie all said they could help us identify community members compatible for this project and four people were hired.

Planning the photo data collection

The meetings between the field team and the non-traveling technical team were collaborative. The data-modeling experts proposed many solutions around creating an app for data collection and providing a map of the community visible on an iPhone screen. The field team explained that some of the data collectors would have difficulty navigating a small screen, and that some of them were unfamiliar with apps. While they all had mobile phones, two of them used them little due to the cost of data plans and had limited need to see things on a phone. Another assumption of the non-traveling team was that community members used computers regularly, and the field team had to clarify that this was not always the case.

The field team had iPhone 6's left over from a prior project, so we decided to use those along with data plans from a provider with good service in the Fort Hancock area. We felt strongly that we needed to provide the community liaisons with the technology required to collect the data. While iPads would have been ideal, we satisficed considering our timeline and budget. Our team also spent considerable time determining the best way to capture geo-referenced images while protecting the privacy of the community members. As we began this process, we searched Google Earth and found that there were already detailed aerial maps that showed structures (including homes, vehicles, and property improvements) and even a limited view of the dry creek beds in this community.

Finally, we decided to raise the visibility and transparency of the project among the inhabitants of Fort Hancock by creating a website, with photos of the community data collectors and the county commissioner. Data collectors were advised to share this URL with community members to increase awareness of the project, the dates they would be asking for images, and how the data would be used. The local county paper interviewed the data collectors and county commissioners, and the data collectors hung flyers about the project in every location they could. Finally, our team spoke at a church Sunday service to raise awareness of the project. At some points, trust building was challenging, but transparency, a quick surge of word of mouth, and researchers dialoguing with community members using their own words helped the field team explain the value of the project and gain acquiescence.

Recruiting and training community members

We were fortunate to recruit four dedicated community members – data collectors – to spend a month collecting photos and videos from their town; they served as citizen

scientists (Fischer et al., 2023; Fischhoff, 1995). The data collection team was led by two well-established community members in Fort Hancock who lived on the street most affected by flooding. They were a source of knowledge themselves and had a desire to improve their community. Two additional community members were young adults with great technical skills and enthusiasm for learning and improving their community. This team of four had a good internal dynamic and they worked fast to gather information. Two data collectors were very comfortable using an iPhone and apps on a daily basis, and two were in a different situation. One of them had never heard of an Apple ID.

By this time, the field team in charge of community engagement had a Spanish-speaking leader. Both field leaders strove to make community members comfortable during the field training and Spanish was used freely. The field research team took a culturally competent, yet unconventional approach to training the community data collectors. Leads scheduled three meetings, three hours each. The curriculum was fluid and it allowed them time to get to know one another, know the community, and incorporate their ideas and feedback. The field leads spent several afternoons talking to both the community data collectors and the technical DRIP team to incorporate requests from them. The Spanish-speaking leader created a WhatsApp group and walked all four data collectors through how to install the app on the iPhone 6. This proved extremely valuable and WhatsApp was constantly used to communicate about project details, emerging flood risk, and helping the data collectors with their own sensemaking processes while they collected important data from their neighbors.

An important element of training was using a system that did not identify participants. We determined the best way to identify all the homes in the community, note the people who had been contacted, and use a technology solution where flood images and information could be uploaded. We used maps of Fort Hancock with random parcel numbers created by the technical team. The parcels were not physical addresses, so the data collectors uploaded photos using the parcel number instead of personal data.

The community data collectors' local knowledge of flooding prompted the field team to be reflexive and adjust our strategies. Frequent conversations with them about life in Fort Hancock helped the researchers understand their own positionality better. Data collectors became our teachers on several occasions. For example, when the research team gave data collectors over 25, 8.5 × 11 map pieces showing parcel numbers, they assembled this into a street map to track the homes visited. The data collector most affected by flooding noticed a disconnect between the printed map pieces and the *arroyos* that flooded her street. Almost in a frenzy, she started drawing the real water paths in blue, using her local knowledge to correct the printed maps. She kept naming different flooded streets and recalling episodes of damage to her neighbors, as she highlighted the trajectories of water. The research field team heard stories and visited homes (often mobile homes) located squarely in an *arroyo*.

Expressing their personal experiences and knowledge helped the research field team better understand what it might be like to constantly fear that water will inundate their yards, fill their septic tanks, and demolish their property. The local data collectors' knowledge of their town also revealed some homes that did not appear on the printed maps because they were in less populated areas. After incorporating the feedback and creating more precise maps, the data collection team reassembled them, divided the work, and started visiting neighbors.

The field research team knew that community trust was essential to the success of the project. They shared the lack of flood information with the data collectors and county commissioners who suggested calling a town meeting. At that meeting, the researchers stood back and learned a considerable amount by listening and witnessing how the data collectors gathered people interested in fixing the flood problems. As people arrived, they saw the maps on the walls and located sources of flooding. The community members most affected did not hesitate to tell their stories. Over time, the data desert changed and looked more like a floodplain showing an urgent need for public investment (Figure 2).

Figure 2. Data collector teaching community members about flooding at the community meeting.

Stories shared at the meeting spoke of the constant perils of driving when it rains and of how Fort Hancock relies on itself for rescuing those at risk. Other stories spoke of the desperation felt by those living on the streets most impacted by the floods since they are often trapped by two *arroyos*:; it is impossible to get out even if they need to take an ill person to the hospital. One woman shared that several family members, including children, were in a truck when it started to rain, and that vehicle got stuck in the mud. Soon, there was water up to their necks, and they were crying, yelling, and calling the police and firemen. Now, she worries every time it rains because that was such a traumatizing experience.

People most affected by *arroyos* seemed eager to be heard and seen, and one person suggested,

> [Outsiders with capacity to provide funding] should come here, and walk, and with their eyes and they will see the situation. If you want, one day I can walk with you … we will gather people and walk with those who make decisions, so they see our problems. If physical work is needed, we will do it; what we want is for our town to be inhabitable. (research participant)

Through the DRIP team's commitment to supporting the community and allowing them to use their assets to decide how to address their challenges, they felt heard and empowered. Even before the community data collection effort was complete, comments from the community leaders suggested our approach to the fieldwork had value. County Commissioner Quijas said,

> This project has made us feel like we belong. Other people come into our community once and promise to help us, but we never see them again. The DRIP team has come back repeatedly, understood what we want to do, and allowed our community to build capacity.

We cannot promise that funding agencies will accept the image-based flood map and image data our team generated as sufficient for providing resources. However, creating a record of Fort Hancock´s needs around flooding has yielded a body of knowledge that can explain risk and damage from the voices of the community, and the process we used of co-creation and power sharing may help other applied communication projects. Furthermore, building an environmental representation of community needs driven by evidence of flooding could be helpful when the state and federal agencies develop more current flood maps of Fort Hancock, and this project may serve as a model to help other rural communities get their voices heard. This is particularly relevant since data is not often discussed in the environmental communication literature unless it concerns data visualization (e.g. Ganesh et al., 2023; Metze, 2020).

Applying this approach to other communities

Upon reflection of the approach undertaken by our DRIP project team, and from the communicative practices enacted through the process, we have identified six factors that contributed to its success. We believe these can help other engaged communication scholars involved in co-created field initiatives.

#1: Let the community be the expert on their needs

Although we conducted a thorough literature review, we did not go into the project assuming what they needed; the approach was truly co-created and relied on community expertise. The two fieldwork leads openly and critically reflected on how their subjectivities, priorities, feelings, and opinions interacted with those of the data collectors and the community itself. They did this based on the co-creation and power sharing approach, and by following good ethnographic practice (Pacheco-Vega & Parizeau, 2018), and engaged scholarship models (Wolfe & Champine, 2023).

#2: Let the community define the value of the project in their own words

One of the data collectors said, 'We are helping our community get on the map!' This became the pivotable vision of the project, and the idea was generated within the community. All four data collectors used this phrase repeatedly with their friends, family, and community members to help others understand the value of the project.

#3: Allow the pace of fieldwork activities to respect the culture of the community partners

Developing successful collaborations takes time, and co-creating an approach to engage a community needs to be guided by cultural norms. Our communication-focused approach to entering the community with little knowledge of potential technology solutions meant we could not prematurely assume the problems. By listening and learning from multiple angles, we built community relationships and trust. We listened to their stories, hopped into their pick-up trucks and saw the flood-related damage with our own eyes. We made multiple field visits, and each time we brought them updated maps and a better photo ingestion app that incorporated their input from the prior visits.

When training the data collectors, we realized we could not rush that process because they needed time to interpret options, provide their input, and experiment. The field researchers listened to their ideas, coordinated with the technical team to iterate solutions, and provided them different types of maps and technological options so their experimentation could continue. This slow, but deliberate process allowed them to develop confidence around the solutions we were co-constructing. We scaffolded the training, but let ideas emerge, and the actual approach to collect the community data was driven by the local expertise of the data collectors.

#4: Set aside adequate resources to support the community in equitable ways

Successful community engagement requires time and resources to be able to hear the community's needs. Our communication field team budgeted significant resources for the community engagement part of this project even though DRIP was originally supposed to focus on developing technology solutions. We compensated the data collectors and provided them cell phones and data plans. We included people on the team who spoke Spanish and had cultural familiarity with the area, and when we lacked specific knowledge, we invited the community members to fill the gaps.

#5: Provide opportunities for community members to learn new skills and to lead

Looking back on what the community members accomplished made us realize how, through power-sharing communication, they learned STEM-related skills, became citizen scientists, and took leadership roles. Allowing them to become citizen scientists is a key recommendation Fischer et al. (2023) made in their study of rural Appalachia. Like their study, community members in Fort Hancock developed the core messages used to communicate the importance of data to their neighbors, and they decided the types of visual maps needed to make those messages clear and understandable. One community data collector became the technology expert on the team, and because he planned to attend a computer trade school, the project gave him the space to demonstrate his leadership. Another data collector became the confident leader of the full team and took responsibility for creating a system to track which homes had been visited and which ones remained.

#6: The communication field research team and the technology development team must work closely together, build trust, and step into interdisciplinarity

Trust was also an essential part of the relationship between the field research team and the technology development team. Interdisciplinary collaboration often renders significant challenges because members need to overcome the lack of understanding of disciplinary expertise, technical language, and approaches different from their own fields. A lack of interpersonal relationship and trust can hamper such collaboration. We saw many best practices in interdisciplinary teams present during this project. For example, team science mentions strong interpersonal relationships as key to teamwork (Love et al., 2021), and having groups travel together, discuss their observations, and learn together strengthened our trust. We also established strong bi-weekly meeting norms, also important in team science (Love et al., 2021). This provided structure and support for the interdisciplinary efforts.

Summarizing the contributions of this work

Communication scholars are in an ideal position to conduct community-engaged research that involves environmental data and citizen science. By carefully combining the power available as an academic partner with communities, we can co-create sustainable ways for communities to decide how to solve their own challenges, and work toward the long process of repairing historical inequities and redistributing benefits to communities that need them the most.

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