PROJECT INFORMATION

Project Director's Name*	Maria Carmen Lemos
Organization*	University of Michigan
Project Title*	Making Gulf Communities More Resilient: Scaling-up Customized Vulnerability Assessment for Extreme Events in Gulf Cities
Reporting Period*	10/1/19-5/30/23

Note to Grantees: In sections 1 to 5, we ask you to highlight your accomplishments (including outputs and outcomes) through this grant award. These sections of the final grant report will be made available to the public.

1. GOALS AND ACCOMPLISHMENTS

1.1 Please restate the goals and objectives of your project.*

Acting on interrelated stressors that affect Gulf cities is urgent and building the capacity of cities to prepare, respond and adapt is paramount. Access to data, knowledge and information (e.g., climatic, socioeconomic) has been often theorized as a determinant of Adaptive Capacity (AC). However, there is relatively little empirical evidence of how knowledge effectively shapes AC in the context of cities, especially small and mid-sized ones. The rationale for this project's overall conceptual model is that sustained engagement between producers and users of knowledge increases access to information through better understanding (especially of climate information) and increased credibility and legitimacy of the jointly produced knowledge. It also encourages knowledge use by overcoming problems of fit (or relevance), timeliness, and customization to decision-contexts, allowing the producers to better understand these contexts and tailor information accordingly. Yet there is also growing evidence that sustained interaction can be costly for practitioners in terms of logistics and time required to interact, time needed to build trust, and the facilitation resources required. Boundary organizations may offset some of these costs for practitioners on both sides of the spectrum (e.g., scientists, practitioners, decision-makers). However, most of the evidence of the role of boundary organizations in shaping knowledge use is from in-depth single case studies with limited impact. Often boundary work has been mostly contextual and is challenging to scale up.

This project addressed four main research questions:
1. Can sustained engagement build Gulf cities' capacity to adapt and become more resilient? Does access to tailored climate, social, equity and economic information lead to better strategies to respond to climate impacts? How?
Hypothesis 1.1: Sustained engagement will build AC by increasing cities' access to customized knowledge and decision tools over time.
Hypothesis 1.2: Tailored regional socioeconomic and equity information will lead to better decision-making by increasing cities' understanding of opportunities and barriers to adapt.
Methods & Analysis: We collected pre and post intervention (i.e., vulnerability assessment [VA] template and Neighborhoods at Risk tool) qualitative data to create a dynamic framework that allowed the cities to assess their AC to become more resilient. The initial aspiration was to develop a series of capacity indicators based on survey and interview data, but due to the challenges associated with the COVID-19 pandemic and its anticipated effect on recruitment, we decided to adjust plans. For each city, practitioners participated in the engagements and co-produced an assessment of the adaptive capacity of their stormwater systems. We then seeked to longitudinally assess whether, and how, the creation and use of the tools has affected the cities' AC.
Intellectual Merit: This portion of the research advanced knowledge by increasing our understanding of how access to knowledge builds AC and interacts with other determinants of AC in cities. It innovates by developing metrics longitudinally.
Broader Impacts: The AC framework can build cities' capacity to act and critically inform action that increases

resilience.

2. Whether and how can technology reduce the costs of sustained engagement?
Hypothesis 2.1: The credibility and legitimacy of the VA template will be equally high in all three treatments.
Hypothesis 2.2: Understanding and accessibility of the VA template will be higher in the face-to-face and webinar-assisted treatments than in the self-guided treatment.
Methods & Analysis: We designed and implemented a social experiment with city practitioners to understand the role of three technology-driven modes of engagement in shaping practitioners' understanding of the tools and perception of credibility and legitimacy.
Intellectual Merit: This phase of the project advanced knowledge relative to barriers of knowledge use, specifically understanding (access), credibility, legitimacy and trust. It innovated methodologically by using an experimental design and large 'n' approach to understand drivers of knowledge use.
Broader Impacts: Results from this experiment can significantly decrease the costs of sustained engagement and inform strategies for rapid dissemination of decision-tools among practitioners and decision-makers.

3. How can researchers and practitioners successfully recruit municipal employees for research when cities are facing compounding crises? What impact does previous severity of hurricane season and the COVID-19 pandemic have on capacity for cities to participate in research?
Hypothesis 4.1: Higher severity of the COVID-19 pandemic in a city will be associated with decreased likelihood of enrollment.
Hypothesis 4.2: Higher severity of 2020 hurricane season will be associated with increased likelihood of enrollment.
Methods & Analysis: We combined data collected from a survey fielded during our initial recruitment with existing data on the region, including county-level data on the COVID-19 pandemic, political climate, and 2020 hurricane severity. Analysis will use these multiple sources to predict the factors that make Gulf cities more likely to invest significant resources of time and personnel towards research.
Intellectual Merit: Quantifying the results of recruitment in a field experiment is crucial in normal circumstances. Here, the demands on the target population changed significantly since study conceptualization. This study provided an applied examination in our context, but one that generalizes to concerns many other researchers face when doing applied research.
Broader Impacts: This study sought to answer a practical and increasingly pressing question for researchers engaging with communities facing competing demands and limited resources for managing emergency response. The results of this study aim to provide guidance for researchers and practitioners doing applied work with stakeholders.

1.2 Describe the accomplishments of your project. You should include both the anticipated accomplishments that you outlined in your project proposal as well as any *unanticipated* accomplishments that have since occurred. Describe any activities you have conducted, programmatic progress made, or project benchmarks and milestones met.*

Project accomplishments are described chronologically by project year, beginning with a summary for each year with more detail by project topics. Accomplishments are listed together for all years at the end of this section.

YEAR 1 (10/1/19-9/30/20):

Summary: In Year 1, recruitment was delayed by the COVID-19 pandemic and a predicted active hurricane season. The team used the delay to shape recruitment protocols in tandem with other teams' efforts to support an intended 2021 intervention launch. The team also focused on research through two remote workshops in June 2020 to organize the work on experimental design (with key emphases on recruitment) and work on adaptive capacity (AC). The experimental design team informed the development of recruitment protocols that could also support answering unanticipated questions about the barriers the COVID-19 pandemic created for climate planning. The AC team conducted a broad academic literature review focusing on adaptive capacity and a gray literature review of existing climate or hazard related plans. Also in Year 1, the Neighborhoods at Risk tool was updated and made available nationally, a new user interface was designed for communities to complete assessments, and the climate team developed a regional summary.

Recruitment: In Year 1, recruitment efforts were delayed in 2020 due to the COVID-19 pandemic and anticipation of a predicted extremely active hurricane season. The team made this difficult decision based on information gathered from trusted city practitioners in the GLISA and SCIPP networks. Many practitioners we hoped to engage had been assigned to other more urgent duties and those still working in their roles were at reduced capacity and worried about furloughs. It became clear that city practitioners, and their communities, were unlikely to have the attention or bandwidth needed to consider participating in our project during the early stages of the pandemic. During this delay, the recruitment team developed a project timeline working in tandem with the tool team. Proposed recruitment plans included the development of a protocol that could increase data collection at the time of recruitment (see Research, Year 2).

VA Tool: In Year 1, nationally available historical and projected climate data were integrated into an expanded version of Neighborhoods at Risk, a free online tool developed by project partner Headwaters Economics. The high-level data provided by the Northeast Regional Climate Center (NRCC) offers an introduction to and complements the regional-level and city-level overviews that are described in the following "Climate" section. The integration of Neighborhoods at Risk and the NRCC Applied Climate Information System was needed to scale the tool and make it available to each of the Gulf communities recruited for the project. The data on climate history and

projections previously represented in Neighborhoods at Risk were generously provided by Jim Biard, Laura Stevens, and Liqiang Sun from the North Carolina Institute for Climate Studies (NCSU/CICS-NC) and represented LOCA Scenarios developed for the Fourth National Climate Assessment. Managing these data for use in Neighborhoods at Risk was labor-intensive and redundant with work being done by NRCC. Using NRCC's API to display the climate data in Neighborhoods at Risk was necessary for scalability. Neighborhoods at Risk was expanded to be available to all communities and counties in the nation. This guaranteed that all Gulf communities recruited for this project would have free access to the latest available data on demographic and economic trends. Also in Year 1, user interface and output improvements were added in direct response to requests from the 18 Great Lakes and Mid-Atlantic communities that co-designed the original VA template. The user interface was redesigned to present a friendlier and more engaging starting point. More instructive and interpretive text is presented to show users how to interact with the tool, including ways to customize which socioeconomic characteristics are presented. At the request of city users, descriptive language was added to explain the importance and relevance of the climate metrics. Cities can copy and paste this language into their planning documents. Finally, a socioeconomic summary report was added as a download option.

Climate: The project included tailoring climate information for each of the participating cities. The climate team identified that some cities may want more details than others, while some may prefer to have data they can plug directly into their modeling and decision processes. Consequently, the team decided to develop a regional report detailing an overview of the climate, observed changes, projected changes, and climate hazards pertinent to the Gulf Coast region overall. This report provides both detail and educational value, as processes and methodologies are discussed along with the presented data.

For the regional report, Year 1 focused on identifying relevant data sets, conducting the regional analysis, and writing the background report. The Climate of the Gulf States regional-level overview consists of four chapters that cover the following topics:
Chapter One - Summary of Gulf Coast climatology and the average state of non-extreme (temperature, precipitation, and their seasonality) Gulf Coast climate variables over the 1981-2010 climate normal period, summarizing the region's physical geography, climate regions, and average conditions;
Chapter Two - Observed changes in the Gulf Coast climate over the last 40 years based on non-extreme variables, as well as providing explanations for why the Gulf Coast's climate has already changed somewhat in that time;
Chapter Three - Projected changes in the future state of the Gulf Coast climate based on non-extreme variables, including discussion of the basic principle of climate modeling and why it is important and downscaled climate model projections to suggest possible futures for the region's climate; and,
Chapter Four - Examination of climate hazards pertinent to the Gulf Coast region (hurricanes, tornadoes, drought, flooding, severe rainfall, and sea level rise) in terms of their historical and future state; each hazard (sea level rise, hurricanes, tornadoes, droughts, floods, and wildfires) consists of a three-page summary that can be extracted and

used independently from the full report.

The decision to separate the presentation of non-extreme variables and climate hazards in this manner was thought better for the regional-level overview's organization. The regional-level overview was written with the intent of both summarizing the Gulf Coast climate and the mechanisms that drive the climate in this region, in a style that is accessible to the target audience. This analysis was conducted by integrating data from several publicly available datasets (see Data and Information Products for further details). ArcGIS Pro and programming in Python and R were used to process data and create data transformations, such as maps of average annual temperature and charts of state-averaged median date of first autumn freeze. See Year 2 (below) for a discussion of the city-specific Weather and Climate Profiles.

Research: In Year 1, virtual, internal team workshops on June 18, 2020 (experimental design and recruitment) and June 26, 2020 (adaptive capacity) strengthened the division of work between two aspects of research crucial to supporting intended research questions.

Experiment: The experimental design team informed the development of recruitment protocols that could also support answering unanticipated questions about the barriers COVID-19 emergency management created for climate planning. Chief among those protocol changes was a revision to a research question regarding the role of boundary organizations in recruitment. Boundary organizations could not be effectively randomly assigned to work with communities or not during recruitment, as doing so would hypothetically also affect yield for project recruitment. Instead, the project team revised a way to include boundary organizations in recruitment for all participants, including a plan to seek letters of support from key boundary organizations in the region as recruitment began.

With recruitment delayed until fall 2020, the research team saw an opportunity to collect data regarding what makes recruitment successful in the Gulf Coast for large scale climate projects, especially considering the competing demands small and large communities have on their constrained resources (time, budget, personnel). This group developed the plans to execute this data collection in Year 2 alongside recruitment efforts, lending a close relationship through Years 1-3 of the project between the experiment and recruitment teams.

Adaptive Capacity: The team conducted systematic academic literature review in the broader field of AC and gray literature review of Gulf Coast municipalities climate and hazard plans. The work done in this project will be a means of synergizing analysis of both generic and specific AC through a randomized intervention, thereby providing an opportunity to study the relationship between these forms of AC within the context of the Gulf Coast and its urban communities.

For the gray AC literature review of municipality plans, the AC team developed a database of 300+ cities along with

the types of agencies in each that are most related to stormwater management and climate (and the contact information of key staff in these agencies to eventually serve the recruitment team). The team started developing a large database of the different types of climate or hazard or stormwater management plans that these cities have. To further analyze the baseline AC of cities, the team started an in-depth secondary content analysis of the plans to see how climate is being discussed in the cities, what types of climate or related adaptive action is already being taken, what information or knowledge or tools they are using, what types of components are included or not included in the plans, who is involved in the planning processes, etc.

YEAR 2: (10/1/20-9/30/21):

Summary: In Year 2, recruitment launched in December 2020, and planning included robust workflows with data collection integrated throughout, such as a new project website; endorsements from boundary organizations in the region; written materials for phone calls, emails, and webinars; and a database of small and medium-sized cities in the region with contact information for key contacts. Recruitment proceeded in four waves through July 2021, which resulted in 60 community applications overall, 55 of which were deemed eligible participants. The new VA tool was launched, including embedded training videos, the regional climate summary was finished, and the format and content of the city-specific profiles were developed. Research again followed the sub-teams for experimental design (supporting recruitment and engagement) and adaptive capacity (AC), with a new team focused on overall research added to the group. The experimental design team worked closely with the recruitment team to develop data collection protocols to use during study recruitment, which led to a database of 588 phone calls with notes and outcomes. The AC team finished a large database of climate-related municipal plans and started conducting content analysis of the plans. Additionally, the AC team started expanding its initial AC literature review to focusing on equity and justice in the AC context. Lastly, the team created a FEMA Disaster Aid database for the five Gulf states from 2000-2020. Our new research sub-team met on a limited-term basis in 2021 to produce a conceptual model to synthesize the goals of our research in a framework. The results of this model made clear several pathways to publication out of this study, as well as creating a data collection protocol document specifically for participant observation.

Recruitment: In Year 2, the recruitment campaign started in December 2020 aimed at enrolling at least 60 communities in the newly branded ‘Floodwise Communities’ (FWC) program. We developed a protocol and tracking mechanism for recruitment. We started by investing in our team and trained 12 recruiters to reach out individually to more than 325 communities (that met the study criteria) through a coordinated series of emails and phone calls. We conducted recruitment in four waves, with each wave lasting about a month and culminating in a recruitment webinar. Each recruiter led outreach to a dedicated list of communities with the aim of getting those communities to sign-up for and attend a recruitment webinar and ultimately complete an application to the program. The first three waves were completed at the end of March 2021, with some ongoing efforts (wave four) extending into July 2021.

The suite of materials developed to support recruitment included: a spreadsheet of eligible communities with contact information, email invitation and follow-up language, one-page summary of the project, Floodwise Communities website (https://floodwisecommunities.org), phone call script, FAQ document, pilot phase quotes and outcomes document, list of recent extreme events in the Gulf, webinar presentation, webinar recordings, and a Qualtrics tracking program to catalog every recruitment effort with each community. We conducted a total of six public informational webinars on 12/10/20, 12/17/20, 2/25/22, 3/4/21, 3/25/21, and 5/6/21 with approximately 175 attendees across all dates. One innovative aspect to the effort was our engagement with a number of local and regional boundary organizations to complement our recruitment efforts and formal endorsements from the National League of Cities (NLC), the National Association of Counties (NACO), the National Association of Development Organizations (NADO), and Texas Sea Grant.

Eligible communities included those in the five Gulf states (Texas, Louisiana, Mississippi, Alabama, and Florida) within 100 miles of the coast with a population between 5,000 and 250,000. The population minimum was lowered to 1,000 in the 2021 waves of recruitment to increase the number of eligible communities and to reach those most in need of support. When a community outside these limits expressed interest, we explored ways to have them participate and accepted 5 “non-sample” communities. These “non-sample” communities received the same services in the self-guided treatment type. We are proud to have ultimately recruited 60 communities and enrolled 55 communities in the program (five communities of the 60 did not meet eligibility criteria, one of the 55 communities was dropped due to missing pre-test data, and seven of the 54 communities withdrew at some point after assignment to condition).

Our recruitment research and data explored the number of recruitment “touches” (e.g., emails, phone calls, webinars) that encourage applications, as well as the importance of networks of contacts across departments in stormwater and floodplain management, public works, engineering, environment, and public health. We collected survey data from a few participants in this population who did not enroll in the intervention, which helped us characterize what risk perceptions and capacity constraints may have prevented some communities from participating in the research project. We found that while the waves of effort “pushes” are resource-intensive and require a large recruiter investment of time, they are essential for driving remote recruitment. Also, collaboration with existing trusted contacts helped spread the word about the engagement opportunity and most communities waited until after participating in the recruitment webinars to gain a more complete picture of the program and complete the application process, highlighting that multiple “touches” are necessary to encourage participation.

Also in Year 2, the team’s engagement leads hosted a series of three internal “train-the-trainer” workshops in September 2021 to prepare the 20 people on the workshop facilitation team for the webinars and in-person engagements. The workshops covered the FloodWise Communities workshop content; Stormwater Management

101; tutorials on Weather & Climate Profiles, Neighborhoods at Risk, guidance on participant observation; and workshop facilitation best practices. The 20 individuals on the workshop facilitation team (i.e., 9 staff, 3 postdocs, and 8 graduate students) were drawn from the existing project team and new hires from existing partner institutions on the project team.

VA Tool: In Year 2, the tools team published the redesigned VA tool online and led the broader project team through a period of testing and improvement. Revisions were made to improve the friendliness of instructions, captions, and explanations that appear throughout the tool. The tool's functionality was enhanced to provide access from within the tool to each community's materials and resources, including the instructional videos, community-specific climate profiles, and community-specific socioeconomic profiles. This improvement to the tool was a direct result of feedback from the project team and communities that had used previous iterations of the VA tool and process. Previously, community partners found it confusing to navigate the project materials, which were accessed in a variety of ways (emails, shared drives, websites) and in a variety of formats (MS Word, GIS files, MP4s). In this new version, the tool has become the access point for all of the project resources. The tools team also created professional-quality training videos and hosted training workshops, including demonstrations and exercises, to prepare the engagement team for sharing the tools with communities. The short videos produced by the tools team, which range from two to five minutes in length, were embedded within the tool, allowing all of the participating communities (self-guided, webinar-assisted, and in-person) to view and rewatch the content at their own pace.

Climate: Year 2 included completing the Climate of the Gulf Coast States report (See Year 1 Accomplishments) and developing city-specific fact sheets (Weather and Climate Profiles). Each Profile is a four-page document that synthesizes climate data and flood risk information into a summary of each community's observed and possible future climate. The Profiles are structured such that the first page serves as a one-page summary of the entire document, containing a text summary of both the community's climate and hazards and a table of its high-level climate statistics. The second and third page of each profile summarize each community's temperature and rainfall climatology; the analysis of seasonal and annual climate statistics, along with average and extreme statistics, was done to more holistically capture observed and possible future climate trends at scales relevant to different decision makers. The final page provides visual summaries of flood risk (and potential sea level rise for coastal communities) in order to illustrate the most vulnerable areas of each community in the decades to come. The template used to generate the Profiles was produced after multiple rounds of feedback from the larger project team as well as GLISA's Practitioner in Residence, a former municipal sustainability professional in the Great Lakes. Adaptation International also sent the draft template to its network of city government officials in the Gulf Coast region for feedback on the design and content.

The data used to produce the profiles came from multiple sources, listed as follows:

-Products available through the SC-Applied Climate Information System were used to compute historical average states and historical average changes in each community's temperature and rainfall climatology over the years 1991-2020.
-Dynamically downscaled climate model data from the North American CORDEX project were used to compute projected changes in each community's temperature and rainfall climatology by the mid-21st (2041-2070) and late-21st (2071-2100) century, under the RCP8.5 emissions scenario. Using this particular scenario and these two 30-year periods conveys each community's "worst-case" extent for future climate change, and by extension for flood risk.
-Supplementary figures were created or obtained from multiple sources, namely the Southern Climate Impacts Planning Program, First Street Foundation, and the National Oceanic and Atmospheric Administration (NOAA). These figures provide key visualizations for each community's most flood-prone areas, and the risk these areas could face in the decades to come.
-The NOAA National Centers for Environmental Information's Storm Events Database provided data about recent severe weather events that impacted each community in recent years, highlighting the hazards to which these communities are most vulnerable.

Research: In Year 2, research expanded across a number of different focus areas.

Recruitment data collection: In collaboration with the recruitment team, this group collected data in real-time during waves 1-3 of recruitment among the 334 identified eligible communities. Data collection included record keeping for 588 phone calls and a database of recruitment emails sent between December 2020 and July 2021. The decision to manage recruitment as a data collection effort enabled the team to set up a research plan for exploring the barriers and contributors of participation in climate research for frontline communities, a research product that is ongoing in Year 3+ of the project.

Additional data collected at recruitment (N=60 communities) included information about interested participants' community eligibility and interest in vulnerability assessment for their stormwater system, as well as assessments of community risk, efficacy, and public opinion. Consultations with the recruitment team (see above) included clear language about eligibility, as well as who to include in the experimental trial out of communities who were nested within the same stormwater system or county.

Experimental design: The overall research team met weekly in Spring 2021 to devise a conceptual framework for what effects we may expect to see in the experimental trial before and after intervention. Development of the framework pointed to the relationships between hypothesized concepts and led the group to develop how to measure each concept using passive data collection, survey data collection, participant observation, and interview data. With the conceptual framework agreed upon by members of the research team, the experimental sub-group

developed a survey questionnaire to be deployed before and after intervention. Both questionnaires included measures of key grant outcomes, including adaptation intentions, how communities intend to use the tool and vulnerability assessment going forward, and perceptions of legitimacy and credibility of the team and boundary organizations. Questionnaires also included related topics such as perceptions of current and future risk, perceptions of their community's capacity to act, and perceptions of vulnerability and equity within their communities. Measures were designed for key study outcomes to be administered identically before and after the interventions, so as to best capture over-time change. Development of the instruments lasted from spring to summer 2021, before communities were randomly assigned to condition. Surveys were sent to all participating communities via email, with instructions for each team member (anticipated between 3-5 per community) to complete a survey on their own in anticipation of receiving access to the vulnerability assessment tool (self-guided condition) or scheduling a workshop (webinar-assisted and in-person conditions). In all, 219 pretest surveys were collected beginning in September 2021 and lasting through Year 3 of the grant.

Eligible communities (N=55) were randomly assigned to each condition beginning in July 2021, stratified by state to increase the chances of all three conditions assigned in states with fewer participating communities (e.g., AL, LA, MS). The research team supported the engagement team in deploying assignments to communities. Seven participating communities withdrew from the study. Three of those communities communicated their withdrawal from the study after they were informed that our team had randomly chosen to work with them in-person. One community withdrew from the study after we had begun to schedule a webinar-assisted engagement with their team. Three communities withdrew "silently" from the study, beginning in June 2021, when they would not reply to any attempts by the project team to contact them; all three of these communities were assigned to the self-guided condition. Those assigned to the webinar-assisted treatment were prioritized first for scheduling remote engagements for October 2021, as we anticipated that engaging with them would be less affected by the ongoing COVID-19 pandemic. The experimental design team worked closely with the engagement team in deploying interventions that could be as close to uniform as reasonable, given the differing team members involved in each (see "train-the-trainer" discussion above).

Plan Database and Content Analysis: The AC team created a database of existing climate, stormwater, or hazard-related plans in approximately 300 cities (criteria for inclusion were the same as those used to determine which cities were eligible to participate in the experiment). This database provides an overview of the prevalence of several different plan types in the Gulf Coast. The team started an in-depth content analysis of planning documents for cities enrolled in the FloodWise Communities program. The team identified a range of climate-related planning landscapes, with some cities having robust climate adaptation plans and others adopting a more circumspect or diffuse approach to climate adaptation (e.g. addressing "changing stormwater event metrics" without using the term "climate change" outright). This research is meant to have both practical and academic merit, contributing to a less linear understanding of adaptive capacity and offering practitioners insight into different

means of incorporating climate adaptation into their own communities' plans.

Expanding AC Literature Review: The AC team started expanding the initial AC literature review, to delve deeper into the equity and justice dimensions of adaptation planning. The team reviewed over 60 articles concerning AC and has written several research memos. Mirroring the dearth of knowledge on adaptation planning in small- and medium-sized cities, we find that literature on equitable climate adaptation planning has focused largely on large cities.

FEMA Disaster Aid: We developed a database of funding received throughout the five Gulf states from three FEMA programs from 2000-2020: Public Assistance funds for organizations received post-disaster, Hazard Mitigation funding for supporting preventative projects and planning, and Individual Assistance funding for individual homeowners and renters. For the Public Assistance funding, we have gone through 172,000 funded applications and associated this funding with statewide, county-wide, or local (city, village, or town) capacity. For the Hazard Mitigation funding, we associated about 10,000 funded applications with statewide, county-wide, or local capacity. To establish a common measure of aid received across all jurisdictions and years, for both the Public Assistance and Hazard Mitigation funding, adjustments were made for both population at each of these levels of government and for inflation for each year from 2000-2020.

YEAR 3 (10/1/21-3/31/23, including no cost extension):

Summary: In Year 3, recruitment had ended and the team focused on engagement, scheduling and conducting the 16 webinar and 16 in-person engagements and corresponding with community teams before and after these interactions. The team issued credentials for each community to the online VA tool, collected backend data on tool use, and developed city-specific weather and climate profiles. Our team managed four research modes (experimental data collection, participant observation, interview data collection, and FEMA disaster aid analysis and literature review) to explore our key research questions. In using these modes, the team collected data from 60+ Gulf Coast communities, with over 200 participants, between October 2021 - March 2023. Research efforts involved incorporating multiple methods to collect ephemeral data (participant observation) as well as using the latest statistical tools to explain the systematic variability we observed and better measure the effects of the interventions (multilevel modeling). Study design, data collection, data analysis, and results interpretation were led and supported by two co-PIs, three postdocs, eight graduate students, two staff scientists, and two project staff.

Engagement: In Year 3, to provide ongoing support to enrolled communities and ultimately schedule the engagements, we interacted with communities across a variety of mediums (described below), using a number of email and phone call templates and communications tracking systems. We used these interactions to stay connected with and learn more about the communities between the time they enrolled and the time of their

individual community engagements. This was especially critical given the multiple “wave” approach to recruitment.
-Newsletters: Regular newsletters were sent out to community project liaisons throughout the engagement period. They served as a way to maintain regular contact with communities and covered a variety of topics, including introductions to the workshop facilitators, updates to Neighborhoods at Risk, information about the customizable report template, and project reminders.
-Webinar scheduling: In August 2021, communities assigned to the webinar treatment were emailed a Google form with a calendar of workshop options and were asked to select all of the dates that worked for their team. The engagement sub-team worked with the training team’s schedules to match facilitators with communities. Webinar engagements generally occurred in the fall of 2021.
-In-person workshop scheduling: In November and December 2021, the engagement sub-team scheduled phone calls with the project liaisons from the communities assigned to the in-person treatment to discuss preferences, concerns, and COVID-19 safety protocols for the in-person workshops. Workshops were scheduled to match the communities’ preferences and the engagement team’s schedules. In-person workshops generally occurred in the winter and spring of 2022.
-Post-workshop follow-up: After each webinar engagement and in-person workshop, the community team members were sent a follow-up email that included a summary of the “next steps” actions that they brainstormed during the workshop, key resources from the workshop, and a timeline for completing their assessment.
-Post-survey and interview signup: After community teams submitted their completed assessments, they were sent a link to the post-survey and an invitation to sign up for an optional interview.
-Other miscellaneous communications: Engagement sub-team members monitor a FloodWise Communities project team email account, to which project liaisons periodically send questions or share updates.

The team conducted 32 community workshops (16 via webinar, 16 in-person) to train local practitioner teams on the FloodWise Communities VA tool. The webinar engagements took place between October 2021 and March 2022, while the in-person engagements took place between January and June 2022. Most communities had a team of at least three practitioners from different city departments and partner organizations working on the assessment. For each workshop, three members of the project team participated in the workshops filling one of three roles (lead facilitator, participant observer, support person). The 19 communities in the self-guided treatment interacted with the project team via pre-recorded videos, email, and phone. Team members from each community were asked to take a pre-engagement survey before launching their assessments and a post-engagement survey after the engagement. Some of the participants were asked to participate in optional post-interviews with project researchers as they completed their assessments.

Over the course of the project, a total of 50 communities completed their assessments and associated follow-up. Our team stayed in touch with all participating communities throughout their assessment process. Engagement team members communicated to teams via email, phone, and virtual conference platforms (i.e., Zoom, Google

chat, Microsoft Teams). Community team members had access to our engagement team to ask questions or troubleshoot technical issues. Over the course of the engagement process, communities were given deadlines to turn in their partial or completed assessments and were sent email and phone call reminders as their respective deadlines approached. A Google form was sent out for communities to check in with our team and each participant was given a chance to schedule a one-on-one meeting with our engagement team for assistance on any aspect of their assessment process.

In order to provide a final deliverable for each community who participated in the project, the team decided to facilitate the compilation of the assessment results into a final “report.” This final report provided an incentive to the communities to complete their assessment process and finalize the answers in their online community profile/assessment. While the online tool did provide the ability to print results and a short 2-page summary for decision-makers, it did not pull together all of the information provided by the communities in a user-friendly manner. These reports pulled from and consolidated the climate and weather summaries, Neighborhoods at Risk information, and the community assessment results. Each report was generally between 40-50 pages, included graphics, and a short four page executive summary along with detailed summary of community inputs for each stormwater system component evaluated. Ultimately 38 communities received final summary reports. The project team decided that this additional investment would help communities both finish their assessment and have something “tangible” to take away from the project. While it created a fairly significant additional investment in staff time, the reports provided a nice capstone to each community engagement.

VA Tool: In Year 3, the tools team maintained the VA tool, updating plugins and WordPress as needed. Community profiles, including climate and socioeconomic data, were added to the tool as communities joined the project. Associated logins for community participants were added. The tools team also created an internal web analytics dashboard and exported sample data for review by the project team.

Climate: In Year 3, customized weather and climate profiles were produced for each enrolled community.

Research: In Year 3, research continued along several focus areas.

Experimental data collection: Data collection before engagements included 219 pre-tests, and data collection after engagement included 89 post-tests, collected between May 2022 - February 2023. Post-tests measured key outcomes with the same language as the pre-test instrument to capture over-time change attributable to interventions. Key outcomes include: (1) adaptation intentions – how likely is a community to pursue each of 20 given actions for their stormwater system; (2) use – what kinds of actions are communities intending to use the tool to support; (3) tool fit with decision role – what kinds of day-to-day actions is the participant responsible for in their community, and how does the tool fit those actions?; and (4) legitimacy and credibility – what perceptions do they

have of the process and people involved in developing this tool, workshop, and the results of the assessment?

Post-engagement data collection was shaped by the impact of Hurricane Ian (2022) to 20 participating communities, especially in FL. In consultation with the engagement team, we made a decision to not pursue post-engagement data collection while communities were recovering from devastating impacts of Hurricane Ian. While some Florida communities still submitted post-test questionnaires, our desire to do no harm to those communities outweighed the benefits we may have from more relentlessly pursuing data collection at that time. Our team began data analysis of pre- and post-test data following pre-registering analysis plans on OSF in December 2022. After pre-registration, our team began managing data workflows in January 2023 to process, clean, and merge questionnaire datasets with project climate data as well as other passive data collection from CDC's Social Vulnerability Indices. After this process, we began analysis. Analysis included deploying multilevel modeling to answer key research questions, including (1) the effect of interventions on adaptation intentions, and (2) the moderating effect of tool fit based on role in community on adaptation intentions and tool use. Analysis of survey data involved one co-PI, two postdocs, and two Ph.D. students.

Literature review AC and equity: The AC team complemented the initial literature review on AC with a corpus of academic papers looking into the lens of justice and equity in adaptive capacity. Mirroring the dearth of knowledge on adaptation planning in small- and medium-sized cities, we found that literature on equitable climate adaptation planning has focused largely on large cities. The goal was to support the contextualization of forthcoming research papers.

Content analysis and plan database: To further analyze the baseline AC of communities that were participants of Floodwise Communities, we conducted an in-depth secondary content analysis of the plans from communities that participated in the engagement (32 cities total) to see how climate is being discussed in the communities, what types of climate or related adaptive action is already being taken, what information or knowledge or tools they are using, what types of components are included or not included in the plans, who is involved in the planning processes, etc. as well as a synthesized typology of different adaptation pathways that cities take to increase their adaptive capacity. This analysis will lead to a peer-reviewed publication and might support others.

Participant observation: Participant observation data were collected by researchers on the engagement team during 2021 and 2022 webinar and in-person engagements. Researchers co-facilitated VA workshops in the 'participant observer role' with other members of the engagement team. The researchers then wrote fieldnotes using a specific data collection protocol tailored to this project. We deidentified team members and communities from all participant observations to conduct analysis. Data will be used to support multiple analyses. Initial codes from analysis pertain to how stormwater system practitioners describe socially vulnerable populations and the broader public.

Interview: The research team developed an interview guide, an interview matrix, and conducted interviews with practitioners from the FloodWise Communities' teams. The interviews were voluntary, and they were conducted after the post-engagement survey to prevent contamination of data and preserve the integrity of the experimental design. The team interviewed a total of 35 participants so far. We recorded the interviews with consent of participants, transcribed, and de-identified (team members and communities). These interviews will support peer-reviewed publications.

Analysis of FEMA disaster aid: Our team analyzed capacity from FEMA disaster aid programs and disaster economic loss data from SHELDUS at county level in five Gulf of Mexico states (Alabama, Texas, Louisiana, Florida, and Mississippi) from 2000-2020. Additionally, the team gathered publicly available socioeconomic data from US census's County Business Patterns for the year 2000 and Bureau of Economic Analysis for the year 2001 and environmental data from National Land Cover Database from the year 2001 and US EPA's Environmental Quality Index. The team used the Capital Approach Framework to conduct the analysis, and a series of regression models were tested to explore the relationship between many types of conditions (i.e., social, financial, political, human, and environmental) with FEMA aid programs. A peer-reviewed publication related to this research is currently in preparation that seeks to highlight the complexity of understanding equity implications associated with efforts to deal with climate risks.

ANTICIPATED ACCOMPLISHMENTS (ALL YEARS): Anticipated accomplishments are listed below, reflecting what was described in the project's proposal. These are separated by focus area: recruitment & engagement, VA tool, climate, and research.

Recruitment & engagement: The project was successful at engaging a broad range of small and mid-sized communities representing all five Gulf states. Despite the COVID-19 pandemic, the significant investment in recruitment, ongoing engagement, and materials was enough to attract and retain communities, including those that frequently or traditionally do not have the capacity to engage in these additional planning activities.
-The project team aimed for 60 communities to enroll. Over 250 communities were recruited to participate, and 55 of the 60 communities who applied were eligible to enroll in the project. 55 of those communities were randomly assigned to condition, among whom 47 communities successfully completed all aspects (enrollment, team building, pre-survey, engagement, assessment, and post-survey). Attrition was attributed to staff capacity, hurricane impacts, disinterest, and recent completion of similar assessments.
-50 communities were randomly assigned to three engagement methods to complete a relative assessment of stormwater system vulnerabilities: self-guided (18), webinar assisted (18), and in-person workshops assisted (19).
-The project team aimed for each community to build an assessment team of four or more participants. The project team found that community assessment teams ranged from 1-9 participants with an average of four (4) members

per team.
-Teams were guided on how to collaboratively assess the risk and vulnerability of stormwater system components and develop VA results to help guide future investment and preparedness efforts. At the end of the process, webinar and in-person communities also had a list of next steps for implementing their assessment (self-guided community lists could not be confirmed). All communities left with continued tool access, a pdf of their VA, and an editable VA report template with a tailored executive summary and additional content that was not included in the pilot tool's auto generated report.

VA Tool:
-The integration of Neighborhoods at Risk and the NRCC Applied Climate Information System resulted in better and more accessible information for Gulf communities. The most important outcome of integrating these tools is that Gulf communities now have the ability to select thresholds for time periods and climate variables that are locally meaningful. For example, stormwater engineers in one community may need information on predicted rainfall in 30 years, while engineers in another community may be required to build infrastructure to last 50 years. Integrating climate data from the Applied Climate Information System into Neighborhoods at Risk allows each community to view information that is relevant for their decision making.
-The integration also enables users to view high-level climate data in more creative and engaging ways. The Applied Climate Information System delivers data on climate trends that can be displayed quickly and dynamically, allowing the data to be used in community outreach meetings, across departments, and in presentations to elected officials.
-The expanded version of Neighborhoods at Risk (i.e., the Vulnerability Tool) is accessible to more than 30,000 communities across the nation (10,137 cities, 9,725 Census designated places, 9,367 towns and villages, 3,007 counties, 93 parishes and boroughs, 41 independent cities, and the District of Columbia).
-The geographic expansion of the tool has and will continue to leverage resources contributed by many partners. For example, the IT infrastructure on which the expanded tool is built is supported by long-term partnerships with federal land management agencies that contribute to the update and maintenance of both the infrastructure and underlying socioeconomic data. Other partners – including the NOAA Climate Program Office, Climate Resilience Fund, Tableau Foundation and Mapbox Community Program – committed technology infrastructure resources and funding that made the expansion possible.

Climate:
-Location-specific climate summaries were co-produced with stakeholders from similar communities. The summaries included an overview of climate features affecting the location, current and future trends in temperature and precipitation, quantifiable annual and seasonal temperatures and precipitation (historical and projected), recent severe weather events and associated impacts, flood risk map, and inundation map for sea-level rise (if relevant). The information is also useful for applications beyond integration with the VA tool and project.

Research: Our team anticipates sharing results in an executive summary with participating communities (currently being developed), including how remote engagement can scale up to support community outcomes, as well as what the state of VAs are in our participating cohort.

Publications and manuscripts for scientific peer review in preparation include:

-Wimhurst, Joshua “Jay”, Kimberly Channell, Omar Gates, and Mark Shafer, 2021. Climate of the Gulf Coast States: An Examination of Climate Change’s Effects Across the Region. Southern Climate Impacts Planning Program, 78 pp. https://www.southernclimate.org/wp-content/uploads/Gulf_Coast_Climate.pdf

-Domingue, Simone, Erica Akemi Goto, Lisa Maillard, Teal Harrison, Alex Basaraba. 2023. “Unpacking Practitioner Perceptions of ‘Community’: Lessons from Participant Observation of Climate Vulnerability Assessment Workshops in the Gulf Coast Region. Community Science (manuscript in preparation).

-Kalafatis, Scott, Erica Akemi Goto, 2022. Assessing risk management policy's equity implications based on FEMA disaster aid in the Gulf of Mexico region. Society for Risk Analysis Annual Meeting (Conference Proceedings)

-Goto, Erica, Natalie Herbert, Gabrielle Wong-Parodi, Simone Domingue, Lisa Maillard, Alex Basaraba, Maria Lemos, 2023. “Practitioners' Perception of Self and Collective Efficacy (Adaptive Capacity) to Extreme Weather Events” (manuscript in preparation)

-Wong-Parodi, G., Herbert, N., … and Lemos, M.C.. “Effectiveness of web-based engagement in scaling up use and effects of co-produced tools” (in prep)

-Maillard, L., … and Lemos, M.C. “Comparing competing drivers of scaling up usable knowledge from theory, including legitimacy, credibility, usefulness, and fit” (in prep)

-Herbert, N., Harrison, T., Jorns, J., … and Wong-Parodi, G. “Recruiting in compounding crises: Results from two studies in frontline U.S. populations” (in prep)

-Wong-Parodi, G., Domingue, S., Harrison, T., Herbert, N., Maillard, L., and Lemos, M.C. “Leveraging the humanity of randomized controlled trials for actionability” (in prep)

-Lemos, M.C., …“Scaling up actionable climate knowledge” (in prep)

-Jagannathan, K., Maillard, L., … and Lemos M.C. “Pathways to adaptation” (in prep)

Ongoing efforts capitalizing on collected data include papers that may explore:

-Collected available adaptive capacity indicators from literature; and,

-Climate or hazard plans of participant communities, using the database our team developed.

UNANTICIPATED ACCOMPLISHMENTS (ALL YEARS): Unanticipated accomplishments are listed below, reflecting what was completed but not described in the project’s proposal. These are separated by focus area: recruitment & engagement, VA tool, climate, and research.

Recruitment & engagement:

-On the community side, we did not anticipate that some communities would bring non-profit, county, or other frequent collaborators into the assessment process. This created an opportunity to strengthen connections not only between departments but also with community-based organizations that are important in supporting and implementing resilience actions.

-The holistic stormwater system framing and consideration of equity in the assessment and development of adaptation actions were stronger and more robust than initially anticipated due to the investment in that portion of the training and insertion of social vulnerability considerations into the on-line assessment tool.

VA Tool

-Feedback from Great Lakes cities on the online tools created by Headwaters Economics for an earlier “proof of concept” phase of the VA tool (i.e., SARP) helped refine the VAtool for use in the Gulf Region. For example, when commenting on the VA template, SARP community participants were receptive to the idea of receiving multiple smaller documents such as an Executive Summary or one-page briefs dedicated to socioeconomic information and climate information specifically, as they noted that these might be easier to “shop around.” In response, a feature was added to Neighborhoods at Risk that allows users to download a brief socioeconomic profile that complements the climate profiles created for this project.

-SARP community participants also expressed that they liked having a geovisualization tool that allowed them to overlap certain layers, but most said that it did not necessarily teach them anything about their community that they weren’t already aware of. In response, the opening view of the Neighborhoods at Risk tool was redesigned to show the community's top three socioeconomic vulnerabilities, highlight neighborhoods where those characteristics are greater than the community median, and display the count of residents (overall and broken out by vulnerability metric) within the highlighted neighborhoods.

Climate:

-A challenge for the team was how to balance the need for educational materials related to climate change and impacts with the location-specific quantifiable data needed for inclusion in the VA tool. The team decided on creating a separate, stand-alone report, Climate of the Gulf Coast States, which describes climate processes, impacts, tools, observations, and projections. This enabled participants who were not as knowledgeable about climate and climate impacts to delve deeper in the subject without obscuring relevant data necessary for the VA tool process. The climate report was posted on the SCIPP website so that it is accessible to a wide audience.

Research:

-Our team has devised novel ways of learning and developing knowledge in spite of and because of constraints from the COVID-19 pandemic. Our team developed a research product (in prep) exploring the barriers for recruiting during compounding crises. The challenges our team faced in designing and deploying a field experiment in the

midst of compounding crises shaped a perspective (in prep) considering how RCT research must reckon with humanity, including hurricanes and a pandemic, and how working with people instead of willing these “threats” to research studies can provide key lessons for addressing rooted problems in sustainability research and adaptation. Our out-of-the-box thinking for research led to the development of a participant observation protocol, which spurred a consideration of the ways equity fits in co-produced research (in prep, to be submitted to a Special Issue of Community Science on equity in co-production). Weekly remote meetings also fostered crucial literature contributions, which we are pursuing in a perspective that synthesizes research on “scaling up” climate adaptation (in prep).

-Crucially, collaboration over the years also led to the pursuit of new opportunities to further our work together. Team discussions in 2020 onward reckoned with how to better address justice, equity, diversity, and inclusion (JEDI) issues in communities, leading to a collaborative proposal between GLISA and SCIPP to improve the FloodWise tool. Members of the adaptive capacity (AC) team also leveraged project knowledge to apply for additional funding to validate Headwater Economics Rural Capacity Index.

2. Outputs

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

When the form is completed, you may click "Mark as Complete" at the bottom of the page to save your work and return to the dashboard.

** denotes required fields*

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2. OUTPUTS

Outputs are tangible or measurable deliverables, products, data, or publications produced during the project period.

2.1. Please indicate the number of students (K-12, undergraduate, or graduate), postdoctoral scholars, citizen scientists, or other trainees involved in the project. *

Please enter 0 if none were involved.

K-12 students	0
Undergraduate students	0
Graduate students	14
Postdoctoral scholars	4
Citizen Scientists	0
Other Trainees	5

2.1a. Other Trainees *

Please describe who are the "other trainees" involved in your project.

Other trainees refers to early career scientists who have been in their positions fewer than five years after competing their most recent degree.

2.2. Has your project generated any data and/or information products? *

Generation of data includes transformations of existing data sets and generation of data from existing resources (e.g., maps and images). Information products include publications, models, software, code, curricula, and digital resources.

(Check all that apply.)

Responses Selected:

Data
Information Products

2.3. Briefly describe how you fulfilled the approved Data Management Plan and, if applicable, any changes from the approved plan. *

As described in the project's Data Management Plan, we acquired socioeconomic data from the latest release U.S. Census Bureau's American Community Survey for Neighborhood at Risk (NaR). We acquired publicly available climate data and conducted climate analysis, collected online pre- and post-surveys, and recorded the audio and transcribed key informant interviews. In order to minimize risks, the research team agreed to not publicly identify participating communities by not publishing their NaR profiles or climate profiles on SCIPP and GLISA websites and to de-identify personal information and community names in the survey, participant observation, and interviews. This decision was made because a number of communities expressed desire to not have their participation publicly advertised.

For the climate analysis, the climate group drew on raw data from several publicly-available sources. Gridded precipitation and temperature datasets were obtained from NOAA's Physical Sciences Laboratory, along with city-level 1981-2010 climate normals through NOAA's National Centers for Environmental Information (NCEI). Dynamically downscaled data from the North American CORDEX project were enlisted to analyze possible futures for the region's climate by the late-21st century (2071-2100) under the RCP8.5 emissions scenario. The University of California at San Diego's LOCA climate data were used alongside the NA-CORDEX data to illustrate some high-level differences in the outputs of statistically and dynamically downscaled climate model projects. Ocean temperature analysis used observational data from NOAA's National Data Buoy Center. These datasets have been transformed into several maps and charts in the regional climate summary document. For example, the gridded precipitation dataset has been used to create maps of average annual rainfall amount and frequency across the Gulf Coast states, and charts of average seasonal temperature variability have been created using the city-level 1981-2010 climate normals. Other datasets for constructing figures were also identified and transformed, such as the use of a USGS gridded elevation dataset to create a map of the Gulf Coast states' altitude variation and landmarks.

For the natural hazards analysis, the climate group drew upon existing publicly-available datasets:
- Hurricane Tracks via NOAA's Office for Coastal Management;
- Tornado Tracks via NOAA's Storm Prediction Center;
- Palmer Drought Severity Index (PDSI) data via NOAA's Physical Sciences Laboratory;
- Storm Events Database (for floods and flash floods) via NOAA's National Centers for Environmental Information;
- Wildfire data from the National Wildfire Coordinating Group;
- Sea Level Trends via NOAA's Inundation Dashboard; and
- Hurricane Storm Surge data via SCIPP's SURGEDAT portal and the First Street Foundation.

For the survey questionnaire data, we deployed Qualtrics as described in the Data Management Plan.

Questionnaires and procedures were approved by IRBs at the University of Michigan, Stanford University, and the University of Oklahoma. IRB approval included review of our informed consent procedures, which, as described, does not preclude our project from data sharing after pursuing data de-identification procedures. As described in the Data Management Plan, this data is hosted on password protected servers for Stanford University and the University of Michigan.

Additionally to what was proposed in the Data Management Plan, we acquired SHELDUS dataset from the Center for Emergency Management and Homeland Security at Arizona State University. The data is a paid dataset that provides spatial data of hazard events and losses for the entire United States. Another dataset that we collected, that was not included in the Data Management Plan, is Participant Observation. During the web-assisted and in-person engagements, with consent of participants, we observed the engagements and took notes. We removed community and personal identifiers from this dataset. A third dataset includes the recruitment database, which includes outcomes of our 500+ phone call records made to recruit participants. All de-identified data sets will be deposited in the Gulf of Mexico Research Initiative data management system (GRIIDC). This includes surveys results, interview transcripts, participants observation notes. The research team collected all data in accordance with their home institution's IRB and asked all participants for their consent to participate in the research study.

If your project has generated data, please download the Excel worksheet entitled GRP Data Management Reporting. Use the "Data Report" tab in the worksheet to create an inventory of data sets that you produced and to verify deposit in a curation facility. Upon completion, please upload the worksheet to your task list. If you need guidance on how to complete the Data Report, please e-mail gulfgrants@nas.edu. A member of GRP's data management staff will reach out to you.

If your project has produced publications, websites or data portals, GIS applications, models or simulations, software packages or digital tools, code, curricula, or other interactive media, please download the Excel worksheet entitled GRP Information Management Reporting. Use the "Information Products Report" tab in the worksheet to create an inventory of these products and to verify deposit in a curation facility. Upon completion, please upload the worksheet to your task list. If you need guidance on how to complete the Information Products Report, please e-mail gulfgrants@nas.edu. A member of GRP's data management staff will reach out to you.

2.4. Aside from data and information products, what other tangible or measurable deliverables or products (e.g., workshops, trainings, and outreach events) were produced during the project period? *

Upon completion of this form, you may upload supplemental material that represent the tangible or measurable deliverables or products to complement this narrative report.

Other deliverables are separated by recruitment/engagement or presentations. Examples of these are available upon request.

Recruitment & Engagement:
-One outreach blog
-Two outreach flyers (widely distributed)
-Six recruitment webinars (175 participants total)
-One recruitment presentation (15 participants total)
-Three internal 'train the trainer' sessions for graduate students and early career professionals
-11 recorded training videos for the FWC tool
-54 community dossiers (i.e., Key Facts and Issues, Size and Geography,Population Demographics, Government, Adaptive Capacity, Social Vulnerability, Flood Risk, Current Events) to prepare the internal team for each workshop
-32 community workshops (16 in-person, 16 webinar)
-50 communities trained in FWC, including more than 200 individual practitioners
-50 customized vulnerability assessment reports (not for public distribution)
-One list of relevant resources
-One glossary of relevant terms
-10 newsletters send to FWC community participants

Presentations:
-Harrison, T., and Maillard, L. "FloodWise Communities: Scaling up vulnerability assessments & aligning adaptive capacity", Alabama Association of Floodplain Managers Annual Meeting, October 5, 2021
-Herbert, N., Harrison, T., and Wong-Parodi, G. "Initiating new science policy partnerships while handling competing crises: Evaluating the results of recruitment for climate change research among U.S. Gulf Coast communities, 2020-2021." American Geophysical Union Annual Meeting, December 14, 2021
-Harrison, T., and Petersen, A. "Best Practices for Building and Scaling up Equity Core Competencies of Local Practitioners Planning for Sea-Level Rise Impacts." American Geophysical Union Annual Meeting, December 17, 2021
-Harrison, T., "Merging Research and Practice: The FloodWise Communities Experience", The 19th Annual Bayou Preservation Association Symposium: The Cost of Doing Nothing - Opting for Resilience, September 29, 2022
-Harrison T., Goto, E., and Jorns, J. "Merging Research and Practice: The FloodWise Communities Experience",

Poster Presentation, 5th National Adaptation Forum, October 25, 2022

-Kalafatis, Scott; Goto, Erica. Assessing risk management policy's equity implications based on FEMA disaster aid in the Gulf of Mexico region: session presentation during the SRA Annual Meeting, Tampa, Florida (December 4-8, 2022)

-Herbert, N., Wong-Parodi, G., and Lemos, M. C. “Scaling-up local adaptation: Results from an initial survey of local practitioners managing climate risks in the U.S. Gulf Coast, 2020-2022”, Society for Risk Analysis Annual Meeting, December 5, 2022

-Domingue, Simone. Driving Equitable Climate Mitigation and Adaptation, 47th Annual Natural Hazards Research and Applications Workshop. (Presentation and panel discussion on FloodWise, co-production and equity, 2022)

-Harrison, T., “Resilience and Climate Planning: The FloodWise Communities Project”, Mississippi-Alabama Sea Grant Consortium Gulf Coast Climate & Resilience Community of Practice Annual Meeting, May 16, 2023

3. Data Management

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

When the form is completed, you may click "Mark as Complete" at the bottom of the page to save your work and return to the dashboard.

** denotes required fields*

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3. DATA MANAGEMENT

In this section, please provide a response to each question to complement the **Data Report** in the GRP Data Reporting Excel worksheet.

3.1 If you listed multiple data sets in the data reporting table, please briefly describe how these data sets relate to one another. *

"Neighborhood at Risk", "Climate of the Gulf Coast States Report," and "Weather and Climate Profiles" were used during the engagements. Each community that participated in FloodWise Communities was provided with a customized social vulnerability and climate profile. "City Planning Documents Database" was developed to better understand small- and mid-sized jurisdictions in the region and also served to support the engagements with relevant information about the participant communities. Before the engagements, participants answered "pre-test survey," during the engagement "Participant Observations" were collected, and "post-test survey" was collected after the engagement. Interviews ("Interview Tool/Engagement") were conducted in a voluntary manner after a post-test survey was answered by participants.

3.2. Please provide a list of additional documentation to describe the data listed in the reporting table (e.g., code books, lab manuals, workflow procedures). Enter none if you did not produce any additional documentation to describe the data. *

-Interview guide: contains semi-structured interview questions to be asked after completion of post-survey with individual participants
-Interview matrix: connects the questions from the interview guide with research questions and variables
-Participant observation protocol: details guidelines and process for observers on the project's engagement team to collect data during the workshops
-Survey data: pre- and post-test questionnaires
-Recruitment script: standardized verbiage and information used to reach out to potential project participants
-Recruitment logic: diagram demonstrating the standardized order and minimum number of recruitment touches per community
-Recruitment spreadsheet: a database of 500+ phone calls conducted with outcomes collected during study recruitment
-Recruitment application spreadsheet: spreadsheet tracking contact and other information submitted in each application
-List of communities: List of all communities that applied organized by state and treatment, with notes indicating attrition.
-Treatment map: map visualizing all applicants, which are color coded by their randomly assigned treatment.
-Dossier Template: standardized template of community-level data and information that was researched, collated, and summarized for workshop facilitators' review prior to workshops.

3.3. Beyond depositing data and metadata in a repository, what other activities have you undertaken or will undertake to ensure that others (e.g., researchers, decision makers, and the public) can easily discover project data? What other activities have you undertaken to ensure that others can access and re-use these data in the future? *

Beyond depositing data and metadata in a repository, the data is being used in a series of draft manuscripts that will soon be submitted for publication. In each paper, we reference that the data is available publicly. We will continue to be available to respond to requests for data.

3.4. Are any data products you produced sensitive, confidential, and/or proprietary? *

Yes

3.4a (yes). Were these sensitive, confidential, and/or proprietary data products described in the data management plan of the approved project plan? *

No

3.4b (no). For the sensitive, confidential, and /or proprietary data products that were not described in the data management plan of the approved project plan, please describe why they must remain confidential. Please note if (and when) you plan to make these data publicly available in the future or if they must remain confidential indefinitely. *

Participant names are not included in any project data shared publicly, as identifiers are used in their place for survey and participant observation data. Our team chose to also remove individual community names from datasheets, as participants in communities could be identified by community name and role in the dataset. We do not plan to make these identifiers available in the future, and they should remain confidential indefinitely.

3.4c (no). Please describe any other changes to your plan for managing restricted access to and re-use of confidential data since the approval of the project plan that are not captured in Question 3.4b (no). Briefly describe the new plans and procedures. If there are no other changes that are not captured in Question 3.4b (no), please state that in the text box.*

No changes.

4. Information Products

Before the form is completed, you may click "Save & Continue Editing" at the bottom of the page at any time to save your work or "Next" to move onto the next page of this form.

When the form is completed, you may click "Mark as Complete" at the bottom of the page to save your work and return to the dashboard.

** denotes required fields*

4. INFORMATION PRODUCTS

In this section, please provide a response to each question to complement the **Information Products Report** in the **GRP Information Products Management** Excel worksheet.

4.1. Please select the type(s) of information products that your project produced. *

Responses Selected:

1. Scholarly publications, reports or monographs, workshop summaries, or conference proceedings
2. Websites or data portals
6. Software packages or digital tools, or other interactive media

Scholarly publications, reports or monographs, workshop summaries, or conference proceedings *

Please provide a list of citations for project publication, reports and monographs, workshop summaries, and conference proceedings.

-Wimhurst, Joshua “Jay”, Kimberly Channell, Omar Gates, and Mark Shafer, 2021. Climate of the Gulf Coast States: An Examination of Climate Change’s Effects Across the Region. Southern Climate Impacts Planning Program, 78 pp. https://www.southernclimate.org/wp-content/uploads/Gulf_Coast_Climate.pdf

-Domingue, Simone, Erica Akemi Goto, Lisa Maillard, Teal Harrison, Alex Basaraba. 2023. “Unpacking Practitioner Perceptions of ‘Community’: Lessons from Participant Observation of Climate Vulnerability Assessment Workshops in the Gulf Coast Region. Community Science (manuscript in preparation).

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-Goto, Erica, Natalie Herbert, Gabrielle Wong-Parodi, Simone Domingue, Lisa Maillard, Alex Basaraba, Maria Lemos, 2023. “Practitioners' Perception of Self and Collective Efficacy (Adaptive Capacity) to Extreme Weather Events” (manuscript in preparation)

-Wong-Parodi, G., Herbert, N., … and Lemos, M.C.. “Effectiveness of web-based engagement in scaling up use and effects of co-produced tools” (in prep)

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-Lemos, M.C., …“Scaling up actionable climate knowledge” (in prep)

-Jagannathan, K., Maillard, L., … and Lemos M.C. “Pathways to adaptation” (in prep)

Websites or data portals *

Please provide a list of project websites and data portals (including the website URL).

-Neighborhoods at Risk: https://nar.headwaterseconomics.org/

-FWC Program website: https://floodwisecommunities.org/

-Project page on GLISA's website: https://glisa.umich.edu/project/making-gulf-communities-more-resilient/

How long beyond the grant period will you maintain the project website/data portal and its contents? Please describe plans to archive the website/data portal and its contents after regular maintenance concludes.*

GLISA will maintain the project website and associated webpages and portals in collaboration with Headwaters Economics as long as GLISA maintains its core federal funding from the National Oceanic and Atmospheric Administration (NOAA). If funding ends, GLISA will work with the University of Michigan and Headwaters Economics IT services to archive all content indefinitely.

Curricula for education and training, GIS applications, Models or simulations, Software packages or digital tools, or other interactive media, and Other *

If you produced any additional documentation to describe information products, please provide a list of this documentation (e.g., model or simulation documentation, software manuals, source code annotation).

-FWC tool (login required): https://app.floodwisecommunities.org/login

4.2. Beyond depositing information products in a repository, what other activities have you undertaken or will undertake to ensure that others (e.g., researchers, decision makers, and the public) can easily discover and access the listed information products? *

Beyond depositing information products in a repository, the data is being used in a series of draft manuscripts that will soon be submitted for publication. Many of these papers are intended to be published Open Access, and will be available on GLISA's website. In each paper, we reference that the data is available publicly. We will continue to be available to respond to requests for information. GLISA and SCIPP plan to continue to publish new information products in their websites as they are completed if they can be shared publicly.

4.3. Are any of the information products you produced confidential, proprietary, or subject to special license agreements? *

Yes

4.3a (yes). Were these information products that are confidential, proprietary, or subject to special license agreements described in the data management plan of the approved project plan? *

No

4.3b (no). For those information products that are confidential, proprietary, or subject to special license agreements and not described in the data management plan of the approved project plan, please describe why they must remain confidential. Please note if (and when) you plan to make these data publicly available in the future or if they must remain confidential indefinitely. *

Climate change is still politically sensitive in many parts of the study region. Consequently, some participating communities expressed desire to not have their participation publicly advertised, as it could lead to adverse effects including harassment of participants or termination of employment. Publishing the location-specific climate profiles and NAR profiles would reveal the identities of participating locations; therefore those are not made publicly available (see section 2.3 for additional information).

4.3c (no). Please describe any other changes to your plan for managing information products that are confidential, proprietary, or subject to special license agreements since the approval of the project plan that are not captured in Question 4.3b (no). Briefly describe the new plans and procedures. If there are no other changes that are not captured in Question 4.3b (no), please state that in the text box.*

No changes.

5. Project Outcomes

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** denotes required fields*

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5. PROJECT OUTCOMES

Outcomes refer to the **impact(s), consequence(s), result(s), or effect(s)** that occur from carrying out the activities or outputs of the project. Outcomes may be environmental, behavioral, health-related, or programmatic. Example outcomes include, but are not limited to: increased learning, knowledge, skills, and motivation; policy changes; actions taken by a group as a result of information generated by your project.

5.1. Please describe the outcomes achieved during your project and how they were assessed. For this question, we are interested in learning about the immediate short-term outcomes that have already occurred during or as a result of your project. Do not include long-term outcomes you foresee your work contributing to beyond the end of the project. *

The project brought together researchers and practitioners in an effective and collaborative manner, all in the midst of a global pandemic. The project team learned a lot about how best to work together from the very beginning of the engagement process and how to balance the needs of the research study (e.g., adequate number of participants, randomized assignment of treatment) with the practical aspects of engaging with communities (e.g., importance of building on trusted networks and relationships, balancing project needs with competing priorities). Part of this ability to communicate and make decisions well can be explained by the role of a highly collaborative management approach (led by an especially strong project manager) that kept all the pieces moving together and forward under challenging circumstances.

Practically and academically, the project brought together two experiment-driven ways of identifying adaptation solutions to meet the challenge of increasing risk to stormwater infrastructure that are actionable and scalable. The first treats 'society as experiment' and relies on trial and error to embrace learning in and by practicing within the very complex, and at times messy and chaotic nature of experimental work that involves actual decision-makers with highly demanding professional lives. The second, randomized controlled trials, relies on systematic assessment in highly structured environments. With FloodWise Communities, our study was at the intersection of these two approaches in that we conducted an RCT in an action-context that allowed us to reveal both practical, actionable outcomes that is part of the research process, while deepening our understanding of why and for whom interventions are actionable and scalable.

Hence, conducting the FloodWise RCT within the action-context of stormwater management decision-making and where decisions are consequential had implications not only for improving the design of research but for the actionability of the knowledge created. For example, during the course of the study, the FloodWise research team had to balance the tension between the needs of a rigorous RCT design versus what was needed by FloodWise participant teams to ensure that the knowledge produced was actionable, such as whether to answer clarifying questions or "going off script" without compromising the design of the RCT in the three treatment groups.

In terms of the experiment's scholarly results, the project team is still analyzing data to compare the impact of remote versus in-person engagement on our variables of interest (e.g., fit, interplay, credibility and legitimacy) and potential impact on adaptive capacity (see list of articles in preparation in section 4.1). But by carefully reconciling our academic and practical goals, the project, as designed, had immediate practical outcomes to the communities involved, in that each community completed their assessment as planned and produced a comprehensive community-level report. How these reports are going to be used and how they will ultimately affect the capacity of

these communities to make decisions might not be assessable at the point of project completion. At this point, we hope to be able to trace such use in the future and remain committed to exploring different ways to evaluate mid- and longer-term outcomes.

So far, we are aware of these community actions:
-Using the data provided to support the development of a climate action plan;
-Combining the results of the assessment with public health to support public health work with vulnerability;
-Using the assessment process to draft a formal 117 page vulnerability assessment report for their city;
-Applying their qualitative assessment findings to inform a federally funded project to identify and design several multi-beneficial and nature-based stormwater projects; and,
-Using the assessment and process in “real time decision making” during their workshop, including finalizing project locations based on social vulnerability mapping & sensitivity analyses and incorporating social vulnerability data into an in-progress grant application.

5.2. We're interested in hearing not just the results of your project but what are their implications for or contributions to:

- **offshore energy system safety,**
- **environmental protection and stewardship, and/or**
- **health and community resilience**

Please describe what you consider to be the most remarkable accomplishment or finding of your project. What can others learn from your accomplishment and finding? How do you see it fitting in with your greater field of study or community of practice? *

As described above, we believe that the most remarkable and innovative aspect of our project has been the ability to combine a state of the art research approach (RCTs) with very practical and actionable outcomes. The design of our study, despite the challenges we faced, is poised to yield not research results but also increase the actionability of the knowledge produced. Since we were conducting research within an action-context, we allowed ourselves the freedom for creativity and flexibility in terms of meeting the rigors of an RCT while at the same time acknowledging the needs of participant teams. This allowed for continued collaboration with participant teams when they might otherwise have decided to no longer engage in the research project, and perhaps even garnered greater support for taking the adaptation actions identified through the project. As another example, throughout the project, outside stressors including severe weather events such as Hurricane Ian occurred. This made it challenging for our participant teams to continue participating; the research team responded with sensitivity for example in the lead up and in the aftermath of Hurricane Ian by not following-up on post-survey completion in Florida. Sensitivity of this nature may allow for continued collaboration, support for action, and perhaps renewed engagement as communities recognize the importance of adaptation planning for their stormwater infrastructure given recently experienced threats. While the COVID-19 pandemic made it difficult to implement in-person and web-assisted treatments, we were flexible with respect to the timing of these engagements to allow for further collaboration and participation. Moreover, during the course of the pandemic, more people used remote technology in their work, which may have increased participant teams' facility with the technologies we were testing in our study.

Overall, as participants engaged with the FloodWise tool, every participant team left with better knowledge of the vulnerability of their stormwater system, and perhaps better appreciation for justice, equity, diversity, and inclusion issues and community risk. Ultimately, this research has the potential to critically to:
-Inform new methodologies that meld robust scientific results and direct impact on decision making' thus approaches and methods from this project can be applied to any area of study as a means to foster both knowledge and action.

-Better understanding of drivers and challenges of actionability and scaling up is relevant for all fields of research trying to influence social change.

6. Communication

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** denotes required fields*

Note to Grantees: In Section 6, we seek input from you to help us evaluate the Gulf Research Program's funding strategy. This section will not be made available to the public.

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6. Information to Inform GRP Evaluations

6.1. Sharing the difficulties you encountered helps us learn from your experience. Describe any challenges you encountered in your project and how you addressed or overcame them. Challenges are inherent to conducting any complex project. These may include (but are not limited to): unexpected staffing changes, changes in the community you are working in, appearance of a new technology or dataset in the field you are working in, challenges accessing a field site, policy or regulatory changes that affect the issue you are addressing, low recruitment rates, delays in setting up services, or other problems in implementing and conducting your project. *

Global pandemic and severe weather events: The project took place over disruptive events, namely the COVID-19 pandemic, severe weather events, and major hurricanes. The research team worked with communities' timelines and did our best to put their priorities first when making decisions about the experiment and data collection. For example, to accommodate COVID restrictions, the project team changed the order of the planned interventions by carrying out the webinar engagement before the in-person treatment. Meanwhile the team kept communication constant with the participants to learn what could be done to accommodate new challenges posed by the pandemic. The pandemic also significantly interfered with our ability to avoid the hurricane season because it pushed the timeline of the project closer to the start of the season. Subsequently, towards the end of the in-person experimental phase of the study, Florida was impacted by Hurricanes Ian and Nicole. In the aftermath of these storms, the research team elected to suspend data collection for most Florida participants. In making these choices, our team held many internal discussions about the tradeoffs between our need to collect data to inform outcomes and the ethics of pushing communities to keep their commitment in the midst of severe disaster. We also considered that despite the risks for the experiment, these decisions paved the way for building longer-term relationships with the participating cities for further evaluation and collaboration in other co-productive processes in the future.

Participant availability and capacity: In addition to historical events, the RCT was subject to a dynamic work context. In many of the engagement processes the research team members actively observed the many capacity challenges practitioners faced because of their work needs and unanticipated events that prevented them from participating in the project as planned. We also observed that community team members were "wearing many hats" as they "put out fires" in their places of work. Thus scheduling engagements that worked for all participants was very challenging. The core objective of this experiment was to assess tradeoffs in engagement styles to look at transaction costs. But the availability and capacity of our team made a difference too. Our research team members planned for changing contexts and contingencies by making themselves readily available, having backup team members ready in case of emergencies, and being able to schedule and reschedule engagements. This flexibility was necessary for completing the number of engagements we hosted over a relatively short project timeframe.

Engagement and data collection challenges: Overall, the research process went smoothly, including facilitation of engagements and data collection. However, there were sometimes challenges faced by the research team. For

example, in one small town during an engagement, a stormwater professional made a sexist joke that was jarring to the research team which was composed of mostly women facilitators. The atmosphere in this engagement was already tense because another stormwater professional frankly stated at the beginning of the engagement that they did not want to be present, questioning whether the engagement would be a waste of their time. In this instance, different power dynamics are at play, including gender stereotypes and community concerns about research extraction. The research team had to refrain from getting upset or anxious in order to calmly keep the engagement going. Because the research team facilitators were able to regain composure and adeptly move through the rest of the engagement, data collection was not interrupted or compromised. Additionally, shortly after this rocky start, practitioners were moving through the engagement with interest, and by the end of the engagement, they expressed how the workshop exceeded their expectations and that they were glad they had participated.

6.2. We like to hear about what you learned from your work and how you feel it affects future work or the work of others. Think back on your project strategies, methods, and activities, what worked and what did not? Is there anything you would do differently in the future? If so, tell us what and why. *

Overall the outcomes of the project exceeded our expectations, including, and perhaps because, our responses to the double challenge of the COVID-19 pandemic and a severe hurricane season (see description of specific action below). As mentioned above, in our view, the most significant thing we learned was how to aspire and carry out fundamental research that yields immediate impact on the ground. Our approach of designing a RCT that involved not only active engagement with actual decision-makers but also a concrete outcome (stormwater VA) that can be generalized to other decision contexts. It also suggests that such an approach can be a viable form of understanding drivers and constraints to creating, accelerating, and scaling up actionable knowledge. We are also grateful for the opportunity of learning together how overcoming challenges can represent an opportunity to affect change. Although there were aspects of the project that did not work as planned, we believe that overall, and despite all the unusual challenges, the project worked better than we hoped. Perhaps one thing we would do differently is to start working on publications earlier in the project since it would have been nice to have results published already.

6.3. What are the next steps for this work, either for you and your project team or other researchers? Has this project led to other opportunities to work in this area? *

The project team has been continuously engaged in finding new ways to continue working together. We continue to meet regularly and have recently written one proposal for NOAA focusing on developing a new package for FWC co-produced with frontline communities in the Gulf and Great Lakes regions. This proposal is a direct response to our realization that we need to complement Neighborhoods at Risk with another specific tool directly addressing JEDI dimensions of stormwater management. We proposed to work with a couple of frontline communities in each region leveraging resources from SCIPP and GLISA and continuing our collaboration with Adaptation International. In addition, we have submitted a Letter of Intent to NSF in preparation for writing a proposal to hold a workshop next year bringing together scholars, practitioners and boundary organizations to brainstorm the potential creation of a center for accelerating and scaling up actionable knowledge to inform equitable and just adaptation in different sectors and regions of the US. Both proposals are a direct result of the FWC and our desire to continue to work together. Finally, within GLISA we are working to further diffuse FWC in the Great Lakes region both through our small grants program and as part of our portfolio of tools.

6.4. Have you developed new collaborations or partnerships (formal or informal) as a result of this work? If yes, please describe the new collaborations or partnerships. *

While we did not not develop completely new partnerships, we have broadened collaboration between GLISA, SCIPP, Headwater Economics, Stanford University and Adaptation International to other projects. Hence researchers from these organizations who did not formally participate in the FWC project worked together in new collaborations, have and are working on new proposals (for NSF and NOAA) and have collaborated in publications despite not being funded through this project. We believe that one of the the potential most enduring impacts of this project is the team's commitment to replicate our model (together and with potentially other partners) of carrying out projects that combine rigorous fundamental research and short-term impact on the systems we seek to understand. In this model, we are able to both generalize approaches to other contexts and accelerate scaling up of knowledge on the ground through the use and diffusion of decision support tools such as FWC.

The project team has also developed relationships with the individual communities that participated in the project, some of whom have already reached out with interest in continuing the new partnership. For example, two FWC communities wrote letters of support for our NOAA proposal (see above), expressing an interest in participating if funded.

6.5. What, if any, positive changes in policy or practice do you foresee as a result of your work? *

As mentioned throughout this report, in effect ,the cities, parishes and counties involved in the project have been able to assess the vulnerability of their stormwater systems. They have also received customized climate and risk information. The assessment and data can trigger action related to prevention, response and adaptation to future climate impact that is projected to become more frequent and severe. In addition, the FWC assessment can contribute to future climate, hazards and risk planning, better understanding of neighborhood level vulnerability to flooding, storms and sea level rise, allow for comparison and collaboration between jurisdictions and serve as data for grants and disaster relief funding. The diversity of the participant teams can also support better integration with other city level policies and initiatives such as risk management, disaster response and long term climate change policies. Finally, we should not underestimate the potential impact of continuously keeping the conversation and dialogue among practitioners focusing on climate impact and response, especially focusing on JEDI dimensions. We believe that FWC can increase awareness among practitioners about specific and generic vulnerabilities, including physical exposure, socioeconomic sensitivity and the intersectionality of vulnerability at the individual and community levels across gender, race and class. We believe FWC can also contribute in that aspect, especially in enhancing awareness among practitioners that stormwater management goes beyond maintaining and retrofitting infrastructure to making sure those most affected and exposed to harm should be taken into consideration in any planning if we want a future that is just and sustainable.

6.6. If you could make one recommendation to the Gulf Research Program for how best to build on the work you conducted in this project, what would it be? *

At the risk of sounding self-serving, we believe that investing in impact evaluation after the project is concluded and funding scaling up of positive results would be the most valuable action. One perennial challenge of engaged research (and mostly all research) is the lack of following up to document what works, what does not work, and how to accelerate and scale up positive results both in terms of process (e.g., engaged research) and outcomes (diffuse the use of tools like FWC to other communities in Gulf region). Our project team is interested to continue engaging with participating communities at least twice annually for several years to find out if and how the assessment and data have been used.

7. Communication and Dissemination

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** denotes required fields*

Note to Grantees: In Section 7, we ask you to help us communicate the importance, progress, and accomplishments of your work. Information provided in this section will be used by the Gulf Research Program to highlight its funded projects in print and electronic informational and promotional materials. The intended audience for the information provided in this section is different and should be thought of as a general audience. When you return to the dashboard, you may upload images that represent and illustrate the work of your project.

7.1. Please describe the most exciting or surprising thing you have learned while working on this project in a way that is understandable by a general audience. *

The most exciting thing we have learned is how to design research projects that both yield robust scientific results and directly benefit participants in 'real' decision contexts. Often the main objective of research projects is to increase our understanding of important processes such as why and why not scientific knowledge can help us to solve critical problems affecting society. Often it takes a long time for the impact of these research projects to become clear. In this research we sought to accelerate potential benefits to participants by implementing the project in 'real' decision-making context. We used a well established research method – randomized control trials (RCTs) that allows for rigorous comparison between different ways to do the same thing to better understand the factors that influence how city workers planning and responding to climate change impact (e.g., storms, hurricanes and sea-level rise) could use climate and socioeconomic data to better prevent and adapt to these impacts. We designed an experiment in which city workers used a decision support tool, Floodwise Communities (FWC), to assess the vulnerability and capacity of their stormwater systems to the increasing threats posed by climate change impact. By carefully collecting data before and after city workers used FWC we were able to answer our research questions while at the same time providing each participating city with a completed assessment of their stormwater system's vulnerabilities and customized data profiles. Although it may be too early to tell, our hope is that these assessments will have an impact on the way these cities respond to disasters and plan for the future.

7.2. Do you have any stories that capture the impact of this project? (optional)

If so, please share one or two. Examples of what we are interested in include stories of people/communities that the project has helped; lives that have changed; work that led to policy change, such as legislation or regulation; and research breakthroughs.

Immediate community-level impacts from completing stormwater VAs include:
-Using the data provided to support the development of a climate action plan;
-Combining the results of the assessment with public health to support public health work with vulnerability;
-Using the assessment process to draft a formal 117 page vulnerability assessment report for their city;
-Applying their qualitative assessment findings to inform a federally funded project to identify and design several multi-beneficial and nature-based stormwater projects; and,
-Using the assessment and process in “real time decision making” during their workshop, including finalizing project locations based on social vulnerability mapping and sensitivity analyses and incorporating social vulnerability data into an in-progress grant application.

Other short-term impacts noted during post-interviews with individual practitioner participants include:
-Several practitioners commented that the engagements helped to deepen relationships with other people in their workplace or organization, or connected them to others working on stormwater-related issues.
-One community mentioned that through the engagement they learned about a mobile home park and a low-income/elderly community that are in different locations but are both vulnerable to flooding due to management of a particular weir.
-Several practitioners noted that they intend to use the Neighborhoods at Risk Tool and the results of the VA for upcoming grant applications or present results to other stakeholders.
-Several participants highlighted the benefit of collaboration (e.g., collaborating with participants from other departments, having participants in the same room) during the process of conducting the Vulnerability Assessment.
-One participant mentioned how participating in the FloodWise Communities enhanced the knowledge about the community and its risk.
One participant mentioned how the engagement clarified important definitions, such as vulnerability, exposure, and resilience.
-One participant mentioned how s/he intent to combine the results of the Vulnerability Assessment with other assessments, e.g., vulnerability in the context of public health
-One participant mentioned how their community is planning to use the information from Neighborhood at Risk and Climate Profile for other assessments

-One participant mentioned the value of learning about the social and economic characteristics of communities in the hazard prone areas.

7.3. Have any communications, outreach, or dissemination activities occurred in relation to your project?*

Please describe:

- Any press releases issued (other than that issued by the National Academies of Sciences, Engineering, and Medicine) about the project.
- Any media coverage or news stories about the project.
- Any social media accounts, websites, listservs, or other communication vehicles used to communicate information about this project. Please include relevant web addresses if available.

-News: “Free program helps Gulf Coast communities assess climate risk”, Yale Climate Connections, February 16th, 2023 https://yaleclimateconnections.org/2023/02/free-program-helps-gulf-coast-communities-assess-climate-risk/?utm_source=Weekly%20News%20from%20Yale%20Climate%20Connections&utm_campaign=1d93dd6477-EMAIL_CAMPAIGN_2023_02_16_06_29&utm_medium=email&utm_term=0_-1d93dd6477-%5BLIST_EMAIL_ID%5D

-Blog: “How to Support stormwater management and resilience in the Gulf South”, National League of Cities: CitiesSpeak, March 1, 2021, https://www.nlc.org/article/2021/03/01/how-to-support-stormwater-management-and-resilience-in-the-gulf-south/

-Website: “FloodWise Communities”, The FloodWise Communities Project, November 20, 2020, www.floodwisecommunities.org