Partnering for Action

Community monitoring of harvested rainwater in underserved, rural and urban Arizona communities

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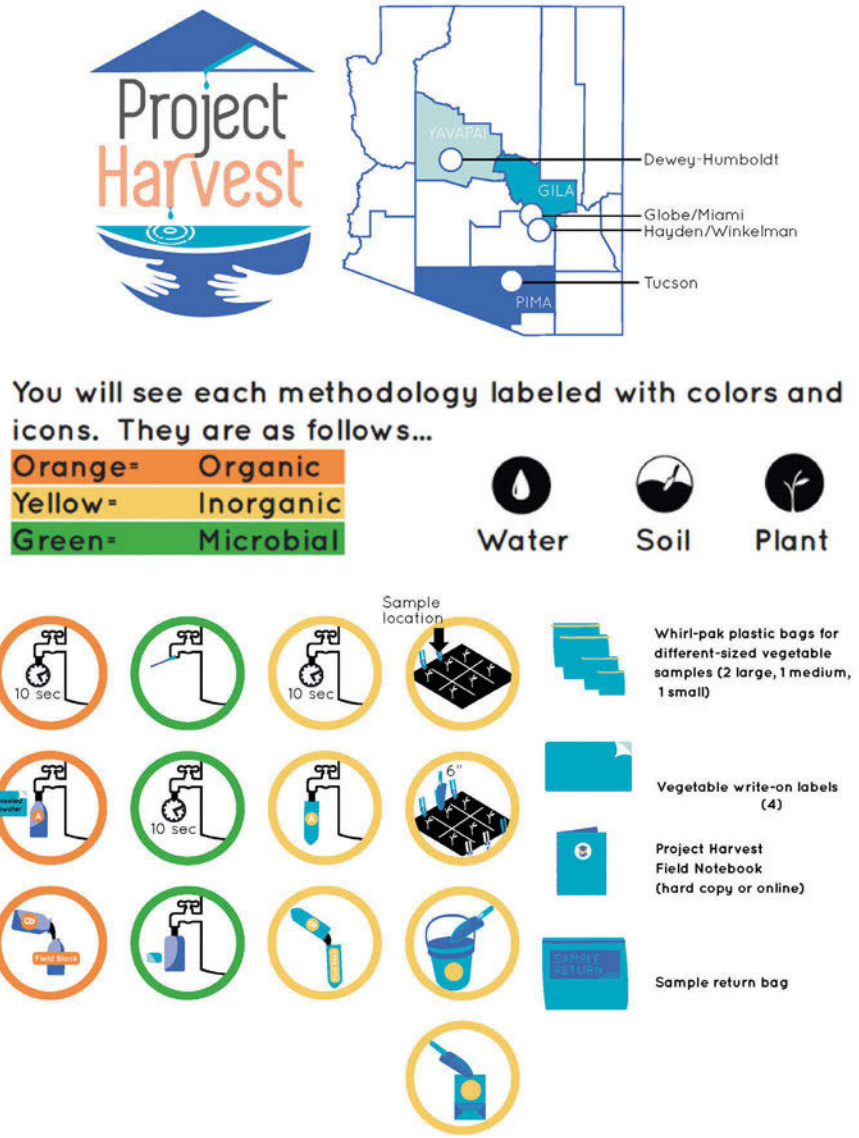

Figure 1. Project Harvest logo, map of participating communities and selected components of the instructional manual.

Climate change and increasing population are placing pressure on drinking water supplies and residents want to be part of the solution. In Arizona, both urban and rural community members are conserving water by using rainwater harvesting systems as a way to cope with predicted drought. Water conservation practices like this are important and can help to meet water supply demands. Communities seeking to adopt these practices want information on the quality of harvested rainwater and guidance on how to use it.

The University of Arizona's Project Harvest (PH), in partnership with the

Steps in Research	Project Harvest Community Role and Activity
Choose or define question(s) for study	• Questions are derived from a community needs assessment and local water provider
Gather information and resources	• Informal gatherings were used to identify interested community members • Promotoras have been identified and trained
Develop explanations	• At trainings and home visits, participants were asked to develop their hypotheses and rationale regarding the quality of their harvested water
Design data collection methodologies	• Residents built their own water harvesting systems • Residents are deciding what vegetable to grow and sample
Collect samples, record data	• Community participants are collecting samples for 3 years
Analyze samples	• Participants are using DIY tools
Analyze data	• Participants are receiving laboratory analytical reports yearly and encouraged to collaborate in data analysis
Interpret data/draw conclusions	• Participants will be given the results at community gatherings, where further interpretation and conclusions are developed together
Dissemination/Translate results into action	• Participants will be encouraged to share data with others • Results will be disseminated broadly • Participants will have the data to make informed decisions
Discuss results, new questions	• Results and new research ideas will be discussed in detail with participants

Table 1. Community participation in the scientific research process.

Sonora Environmental Research Institute, Inc., is a co-created citizen science project investigating the quality (inorganic, organic or microbiological contaminants) of harvested rainwater, as well as the quality of the soil and plants irrigated with it. Using educational materials delivered by peers, PH aims to co-produce environmental quality data in a form that will be directly relevant to the participants' lives, increase community involvement in environmental decision-making, and improve environmental health education in underserved rural and urban communities (Figure 1). From a community perspective, PH serves to answer commonly asked questions. What is the quality of my harvested rainwater? What could impact the quality of it? Is it safe to irrigate my food garden with harvested rainwater? Arizona communities are not only driven by water quantity challenges in the arid/semi-arid southwest, but also water quality challenges.

When you design a co-created citizen science project, the research question needs to come from the community.

With PH, we are also applying community-based participatory research principles to ensure that knowledge generation is combined with action. Although this approach to research is coming from a public health perspective, water resource practitioners (including landowners, consultants, community leaders and government personnel) can apply this approach to improve decision-making, and stimulate policy changes.

Projects where community members are involved in most or all research steps are less commonly undertaken on a large scale and potentially more difficult to administer in comparison to collaborative or contributory projects. However, the community benefits are undeniably greater when local stakeholders are directly involved. For example, PH participants are analyzing water and soil samples via do-it-yourself (DIY) methodologies, identifying additional contaminants to measure based on their local environmental history, and fostering engagement and education through a local health worker, or *promotora* (Table 1).

How could Arizona's environmental history potentially impact harvested rainwater quality?

These days, it is hard to find a residential area not neighboring a hazardous waste site or potential source of environmental pollution. According to a 2013 U.S. General Accounting Office report, one in four Americans live within three miles of at least one hazardous waste site. These sites, totaling more than 355,000, are typically located in minority, low-income communities. In the Southwest, we have one-third of the world's largest copper deposits. Community members neighboring active and legacy mining activities have and continue to express concerns about their environmental quality. In addition to potential metal-rich dust deposition, there are concerns related to pesticide drift and biological contamination (i.e. pathogens).

Why does PH use DIY and traditional laboratory (lab) methods?

PH is an environmental monitoring and learning research project. In addition to harvested rainwater quality, PH tests whether environmental monitoring protocols and timing of results affects a participant's self-confidence and sense of control (known as self-efficacy) for learning and doing science, as well as one's understanding of the scientific process. PH participants have been randomly

Figure 2. Project Harvest promotora Lisa Ochoa conducting a do-it-yourself experiment, Hayden/Winkelman, AZ.
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Figure 3. Project Harvest promotora Miriam Jones teaching a participant in Globe/Miami, AZ.

assigned to one of two sampling groups. Participants in the lab group collect rainwater, soil and/or plant samples throughout the year to be analyzed at University of Arizona laboratories. The DIY group is provided materials on how to collect rainwater and soil samples, perform contaminant analyses for arsenic and microbial contamination and interpret results at home (Figure 2). The DIY participants submit their results, rather than samples, to university researchers. Surveys, focus groups, and interviews are being used to evaluate learning and self-efficacy outcomes. Both the harvested rainwater results and the learning outcomes of PH are equally valuable.

What is peer education and a *promotora?*

Peer education is where the educators share similar social backgrounds or life experiences with those they are teaching. In Latina/o/x and Hispanic communities, the community health worker, known as a *promotora*, is generally a trained female with leadership qualities. They partner with organizations to assist in achieving common goals.

In PH, we have seven *promotoras* who have completed over 40 hours of training. They recruit families through their own local networks, local festivals, and/or farmer's markets and go door-to-door training PH participants. The *promotoras* are the PH "glue" connecting the university researchers to participating families. This design is based on the PH director's previous work showing that citizen science coupled with peer education can lead to

Figure 4. Project Harvest and Sonora Environmental Research Institute, Inc. (SERI) promotoras (left to right) Imelda Cortez and Palmira Henriquez with SERI Project Manager/Project Harvest team member Flor Sandoval, Tucson, AZ.
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Figure 5. Project Harvest and SERI promotoras (left to right) Aviva O'Neil and Armida Boneo, Tucson, AZ.
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Figure 6. Project Harvest director and assistant professor Mónica Ramírez-Andreotta instructing a participant on sample collection procedures.
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significant increases in self-efficacy among minorities, particularly Latinas/os/xs and Hispanics. A *promotora* (Figures 3 -5) can be a knowledge broker, interpreter, and translator of information between the targeted population and organizations outside of the targeted community. Because they are indigenous to the community, they can effectively reach, teach, and share information with their peers. These individuals can be considered gatekeepers for hard-to-reach populations and are critical for environmental health education efforts, as the community will listen to them.

As outlined by May et al. (2003), knowledge mediators bridge communities in two ways: horizontally, by facilitating social networks within the community; and vertically, by connecting targeted residents with researchers or critical services from outside the community. These "bridging acts" are critical for environmental health education efforts, as they connect ethnically diverse community groups with environmental health information. These groups can then make informed choices to reduce health risks, improve quality of life, and protect the environment.

Figure 7. Trainee collecting a harvested rainwater sample from one of the five 1,500 gallon cisterns Project Harvest installed as part of their community building efforts in Arizona.
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Project Harvest is informing community members and scientists about the potential chemicals and microorganisms from neighboring sources of atmospheric and land pollution. Ultimately, PH hopes to guide local and state environmental policy, as well as non-governmental programs and interventions. In this sense, PH is responsive, practical, and applied while following the robust principles of the scientific method. Although it is challenging to include community partners in shaping research questions and interpreting the findings, it is imperative that they are given the platform and opportunity to do so. Environmental health issues are messy and require capacity building at the local level, culturally sensitive strategies and a trained population of scientists from all communities, especially those underserved, to inform decision-making and develop lasting solutions (Figure 7). All of this can be accomplished through a citizen science approach to research. ■

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