Project Harvest: A Co-Created Citizen Science Rainwater Harvesting Program in Rural and Urban Arizona Communities

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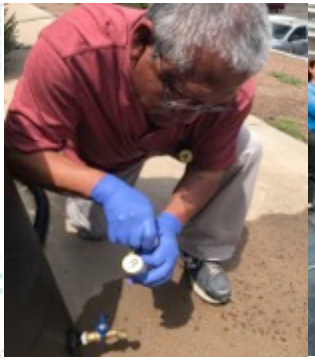
UNIVERSITY OF ARIZONA RESEARCH TEAM

From left to right, top to bottom: Francisco Montijo, Shana Sandhaus, Leona Davis, Sanlyn Buxner, Alara Bovill, AJ Moses, Leif Abrell, Flor Sandoval, Monica Ramirez-Andreotta, Jesus Solis-Leon, Dorsey Kaufmann, and Victoria Obergh. Missing team members: Jean McLain, Aminata Kilungo, Rob Root, and Norma Villagomez-Marquez



Project Harvest

Project Team - Las Promotoras

Theresa Foley
Tucson

Imelda Cortez
Tucson

Margaret Dewey
Dewey-Humboldt

Lisa Ochoa
Hayden/ Winkelman

Aviva O'Neil
Tucson

Palmira Henriquez
Tucson

Miriam Jones
Globe/Miami

Soils can be a sink for pollutants and may pose a threat to public health

Gardens are hubs for public health intervention and environmental health literacy efforts

37M households participated in food gardening at home, 3 million at a community garden

- **76% of the households grew vegetables**

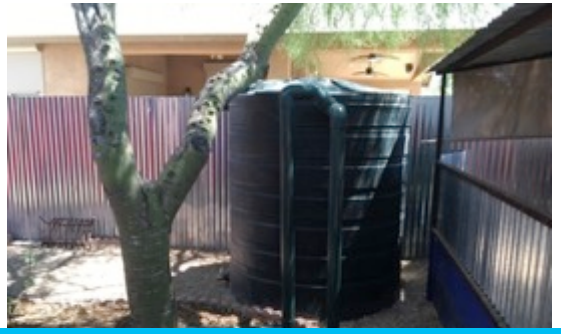
Gardens are a public health solution to:

- Increasing access to wholesome foods
- Improving community building efforts
- Creating green space
- Reducing the cost of foods

Project Harvest

Photo credits: Max Liboiron and Dorsey Kaufmann

Conserving water + reducing heat island effect through rainwater harvesting



What is the quality of my harvested rainwater?

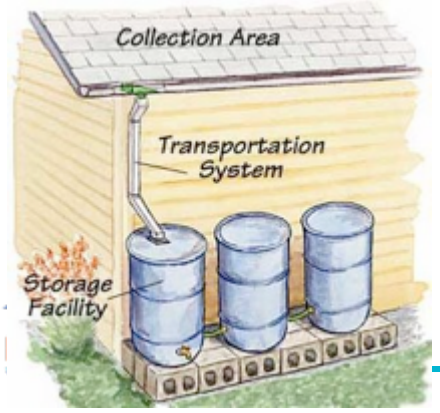


Image Credits: Flor Sandoval and Ann Marie Wolf, Sonora Environmental Research Institute

Public Participation/ Citizen Science

Intentional collaborations where the public engages research to generate new science-based knowledge

Peer Education

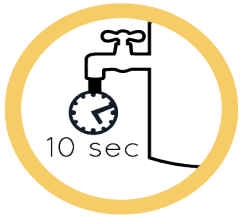
People who share similar social backgrounds or life experiences are sharing information with peers

Information Design

Presenting information that fosters efficient and effective understanding; to help participants make informed decisions

Shirk, J. L., H. L. Ballard, C. C. Wilderman, T. Phillips, A. Wiggins, ،R. Jordan, E. McCallie, M. Minarchek, B. V. Lewenstein, M. E. Krasny, and R. Bonney. 2012. Public participation in scientific research: a framework for deliberate design. Ecology and Society 17(2): 29.
Hunter JB, de Zapien JG, Papenfuss M, Fernandez ML, Meister J, Giuliano AR. The Impact of a Promotora on Increasing Routine Chronic Disease Prevention among Women Aged 40 and Older at the U.S.-Mexico Border. Health Education & Behavior. 2004; 31, 18S-28S.

Research questions



Are there pollutants in harvested rainwater?

If so, do these pollutants get trapped in soils?

Do plants accumulate these pollutants?

If so, could pollutants in homegrown food affect health?

Research Questions

Environmental health literacy is

1) Knowledge and awareness of environmental exposures,
2) Skills and self-efficacy to protect health,
3) Community action to protect collective health.

Adapted from: Gray, K. M. From Content Knowledge to Community Change: A Review of Representations of Environmental Health Literacy. *International Journal of Environmental Research and Public Health* **2018**, 15, 466, doi:10.3390/ijerph15030466.

How does participation in Project Harvest affect a participant's environmental health literacy?

How does the method of data sharing affect a affect a participant's environmental health literacy?

How does environmental monitoring method (LAB vs. DIY) affect a participant's environmental health literacy?

Project Harvest Communities

Dewey-Humboldt

- Iron King Mine & Humboldt Smelter Superfund Site
- 4 million m^3 mine tailings

Globe-Miami

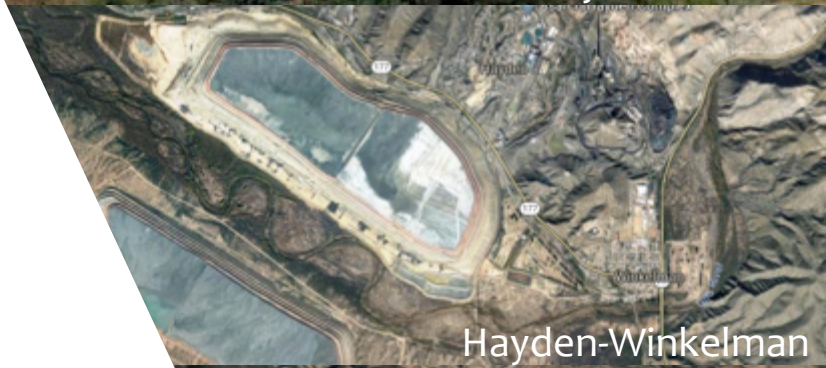
- Copper Smelter
- Rod Mill
- Open Pit Mine

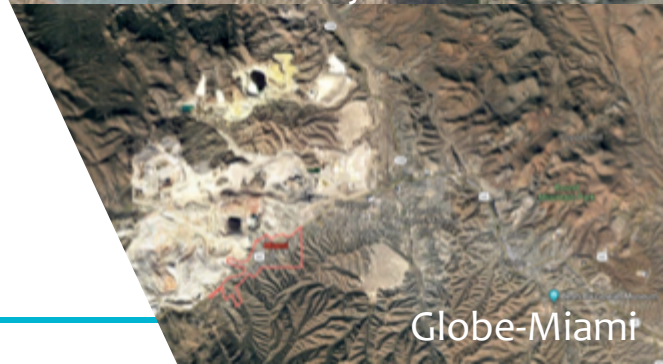
Hayden-Winkelman

- ASARCO Hayden Plant Superfund Alternative Site with smelter, concentrator, Kennecott smelter & tailings

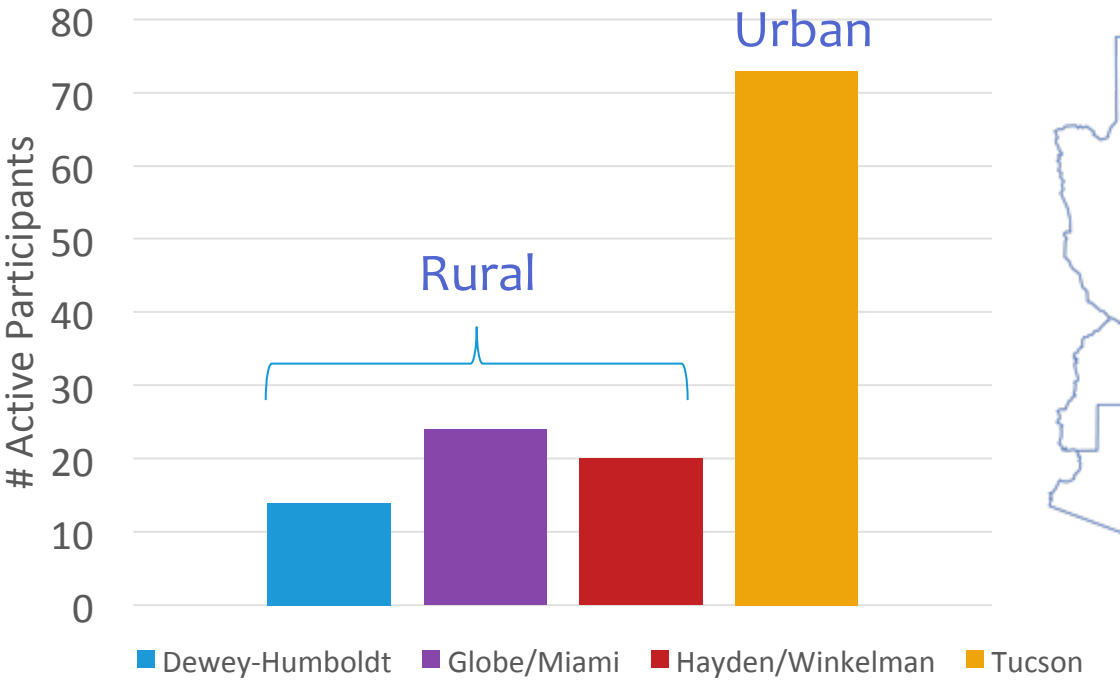
Tucson

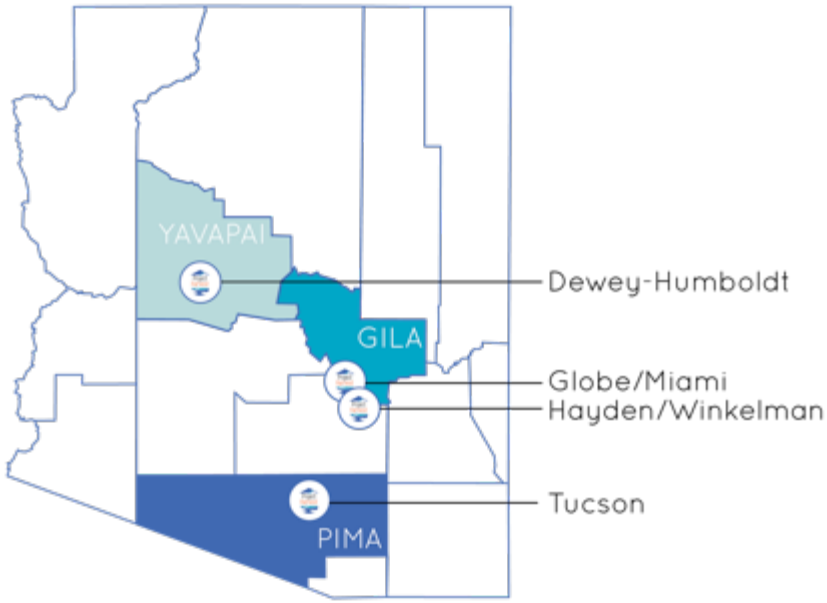
- TIAA Superfund Site
- Other Toxic Release Inventory Sites





Project Harvest is active in four Arizona communities

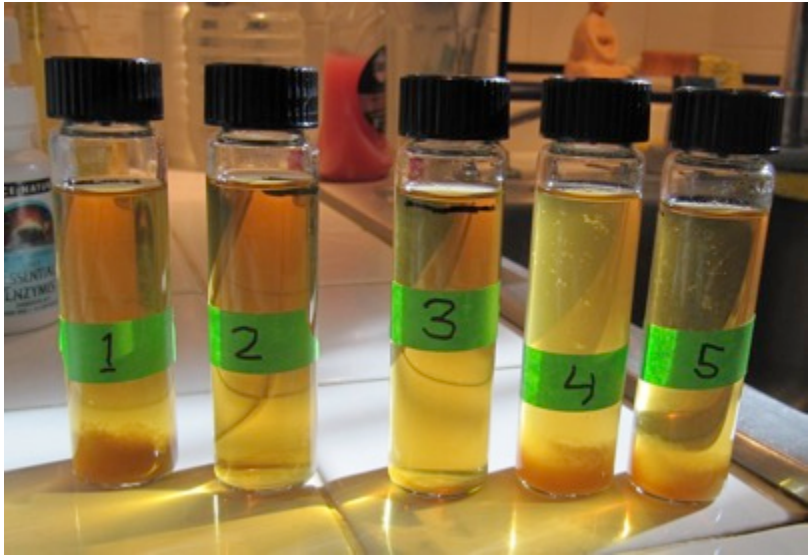


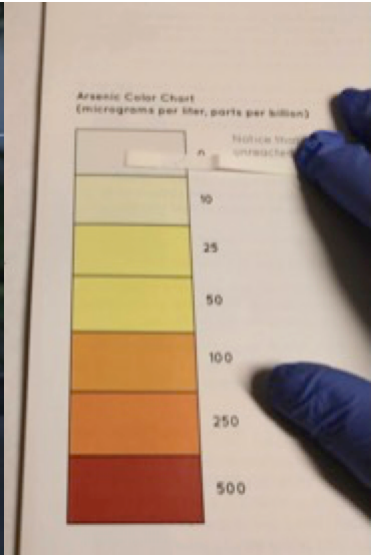



Project Harvest
DIY
GUÍA
LOBO
PRIDE


Project Harvest
LAB
GUIDE

Participant Methods - DIY





Participant Methods - Lab

Harvested Rainwater Samples are collected four times a year.

	First Winter rain	Last Winter rain	First monsoon rain	Last monsoon rain	First Winter rain	Last Winter rain	First monsoon rain	Last monsoon rain
	Irrigated:				Irrigated:			
	Non-Irrigated:				Non-Irrigated:			
	Irrigated:				Irrigated:			
	Non-Irrigated:				Non-Irrigated:			

Based on community location, a literature review, and analyses of existing national datasets, the contaminants below were selected.

Microbial	Inorganic	Organic
Total coliform*	Arsenic*	Atrazine
E.coli*	Aluminum	2,4-D (2,4-Dichlorophenoxyacetic acid)
All contaminants listed were tested for LAB samples ***Contaminants for DIY tests**	Barium	Carbaryl
	Beryllium	Chlorpyrifos
	Cadmium	Nonylphenol
	Chromium	Pentachlorophenol (PCP)
	Copper	PFOA (Perfluorooctanoic acid)
	Lead	PFOS (Perfluorooctanesulfonic acid)
	Manganese	Prometon
	Nickel	Simazine

How do you use your rainwater?

Standards/advisories used to frame and interpret rainwater results.

Assumption - Harvested rainwater is NOT for human consumption at this time.

Agricultural Irrigation Standard

Livestock and Poultry Standard

Surface Water - Partial Body Standard

Surface Water - Full Body Standard

Non-potable Indoor Use of Harvested Rainwater Guideline

Lifetime Health Advisory

World Health Organization Drinking Water Quality Guideline

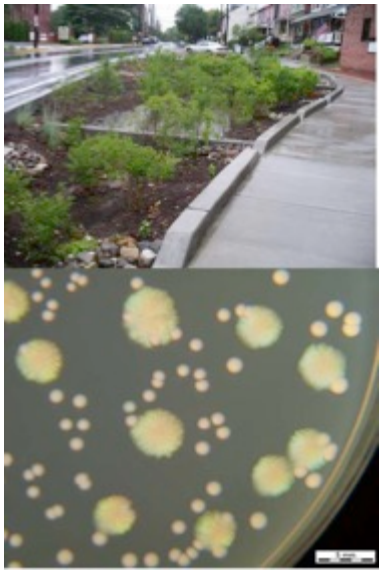
Project Harvest

Different standards/advisories were selected based on:

- How Project Harvest participants **currently** use their harvested rainwater
- Promotora recommendations and preferences
- Availability of useful standards or advisories

What contaminants could be in harvested rainwater?

Sources of microbial contamination



Coliform Bacteria

- Generally harmless, common to digestive tracts
- Naturally occurring in the environment, but may be from a fecal source

E.coli

- A fecal coliform, can be both non-pathogenic and pathogenic
- *E.coli* generally from fecal matter, but can also be naturally occurring in the environment

Turbidity (Relative clarity of a liquid)

- Can be influenced by particulates such as clay, silt, algae, and microscopic organisms

Image source: https://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2018/10/Bacteria-Management-Report_final.pdf

What contaminants could be in harvested rainwater?

Dust - Natural and human-made from resource extraction

- Mining

What contaminants could be in harvested rainwater?

Exhaust from:

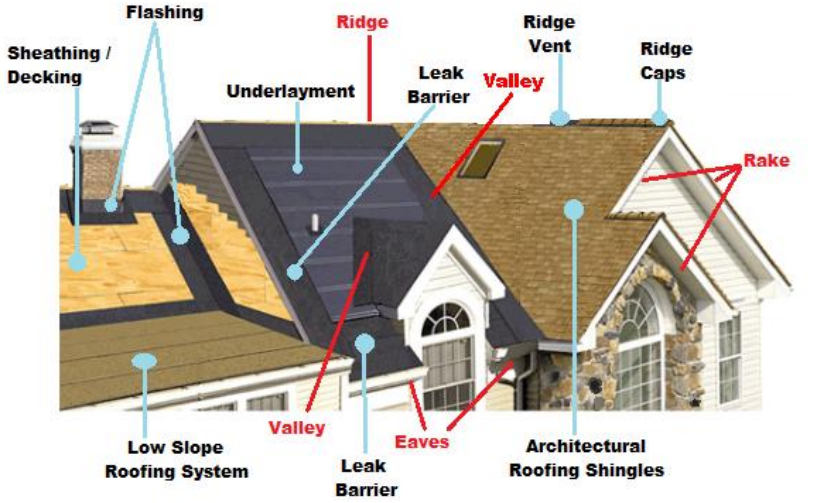
- Automobiles
- Power plants
- Airplanes

What contaminants could be in harvested rainwater?

Organic Compounds from:

- Application of Pesticides/herbicides
- Pesticides/herbicide drift

What contaminants could be in harvested rainwater?



Roofing Materials

- Sealants
- Cement
- Paint Coatings

What contaminants could be in harvested rainwater?

Water Harvesting Systems

- Cistern
- Sealants
- Plumbing

CIENTÍFICO CIUDADNO DE PROJECT HARVEST

SE OTORGA EL PRESENTE CERTIFICADO ORGULLOSAMENTA A:

Usted!

Por tomar con exito muestras ambientales y completar el primer año 2017-2018 de Project Harvest

Mónica Ramírez-Andreotta, Project Harvest Director

College of Agriculture & Life Sciences
Soil, Water and Environmental Science

Integrated Environmental Science & Health Risk Laboratory

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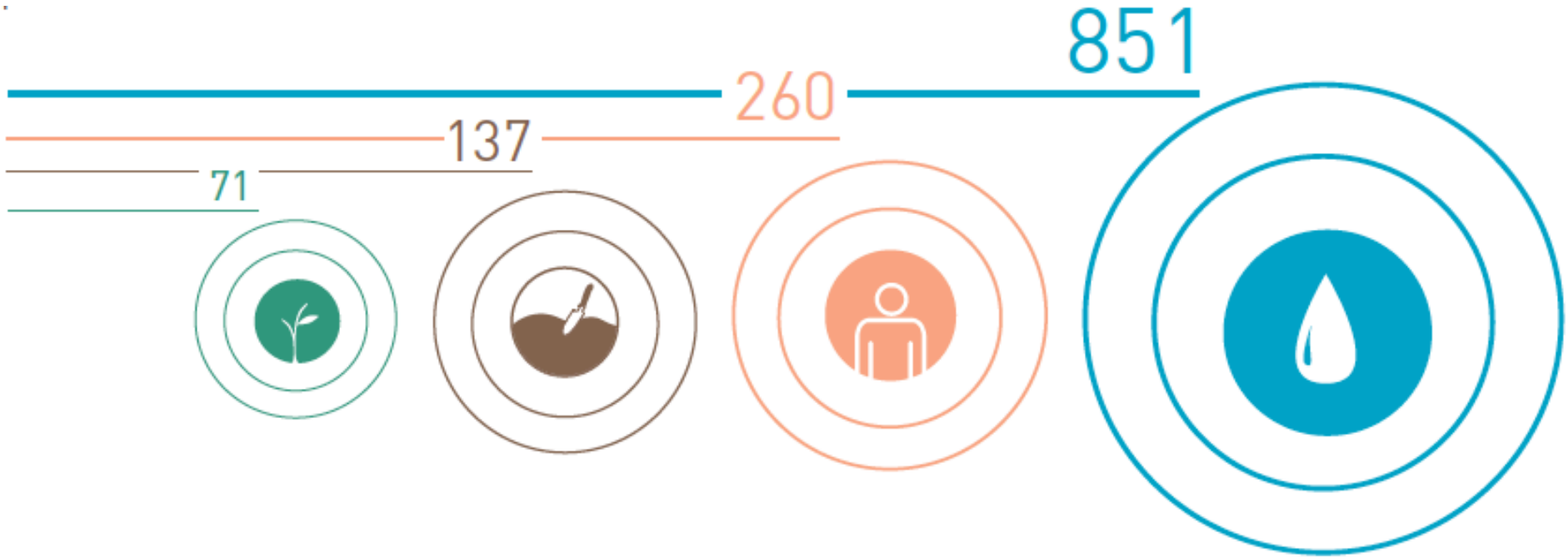
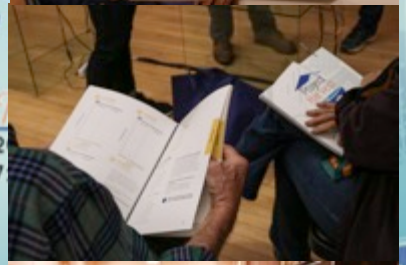
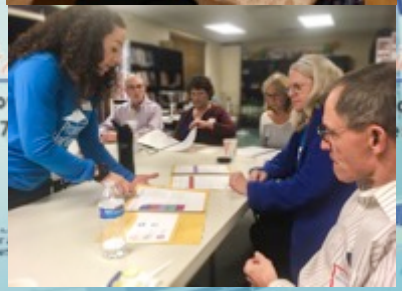
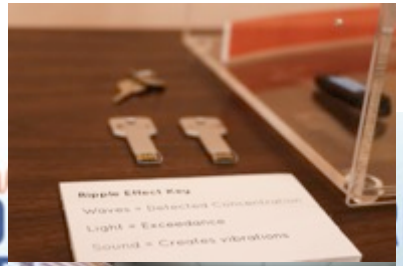
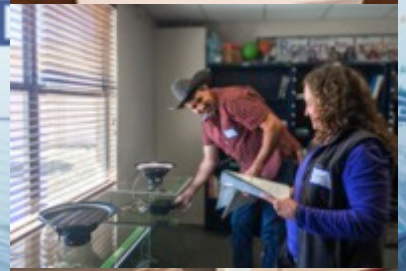
We have successfully completed the 1st year (2017-2018) of sampling!
We would like to give a special thanks to all **163** of the Arizona Project Harvest participants for their efforts, motivation and patience throughout this research project.



Play Project Harvest video and NPR story

Sevigny, M. November 14, 2018. Local NPR station KNAU. *In Arizona Mining Town, Gardeners and Scientists Team Up to Check for Contamination*. *http://www.knau.org/post/arizona-mining-town-gardeners-and-scientists-team-check-contamination*

"Arizona Science", in association with "Science Friday" on the local NPR station KUAZ. *Episode 154: Training to Test Rainwater.*

https://radio.azpm.org/p/radio-azscience/2018/11/1/140257-episode-154-training-to-test-rainwater/

Thank you very much!

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https://ramirez-andreotta.faculty.arizona.edu/
https://gardenroots.arizona.edu/

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