

Implementation of the Middle and Lower Cibolo Creek Watershed Protection Plan



Texas Water Resource Institute



The Texas Water Resource Institute provides science-based, community-supported solutions for the state's pressing water quantity and quality challenges through internal expertise and external collaborations



Our *Water Quality Improvement Program* works to restore many of the more than 400 impaired water bodies in Texas, while also proactively protecting unimpaired watersheds



Our *Water Resources Outreach and Training Program* targets both interested citizens and water professionals because understanding water issues today is critical

Water Quality

MANAGEMENT IN TEXAS

BARRIERS TO WATER MANAGEMENT AND MONITORING

- Data gaps
 - Texas is BIG, y'all
 - 90-95% privately owned
- Water Quality Impairments
 - Diverse use scenarios and climates
 - Management strategies rely on data and broad participation



Middle and Lower Cibolo Creek Watershed Protection Plan



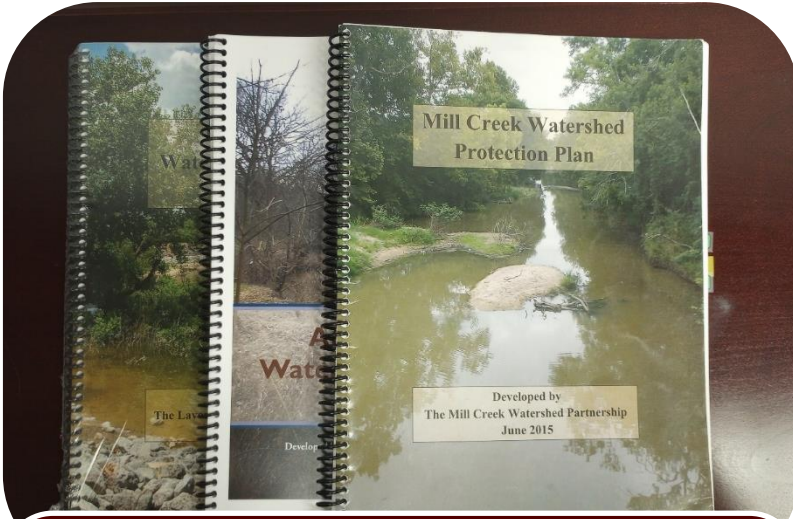
2004
Impairment Identified

Water quality sampling found *E. coli* bacteria and dissolved oxygen in the creek exceeding the recreational use standard



2017
WPP Initiated

TSSWCB, TCEQ and Texas A&M AgriLife Extension worked with a local steering committee to create the WPP

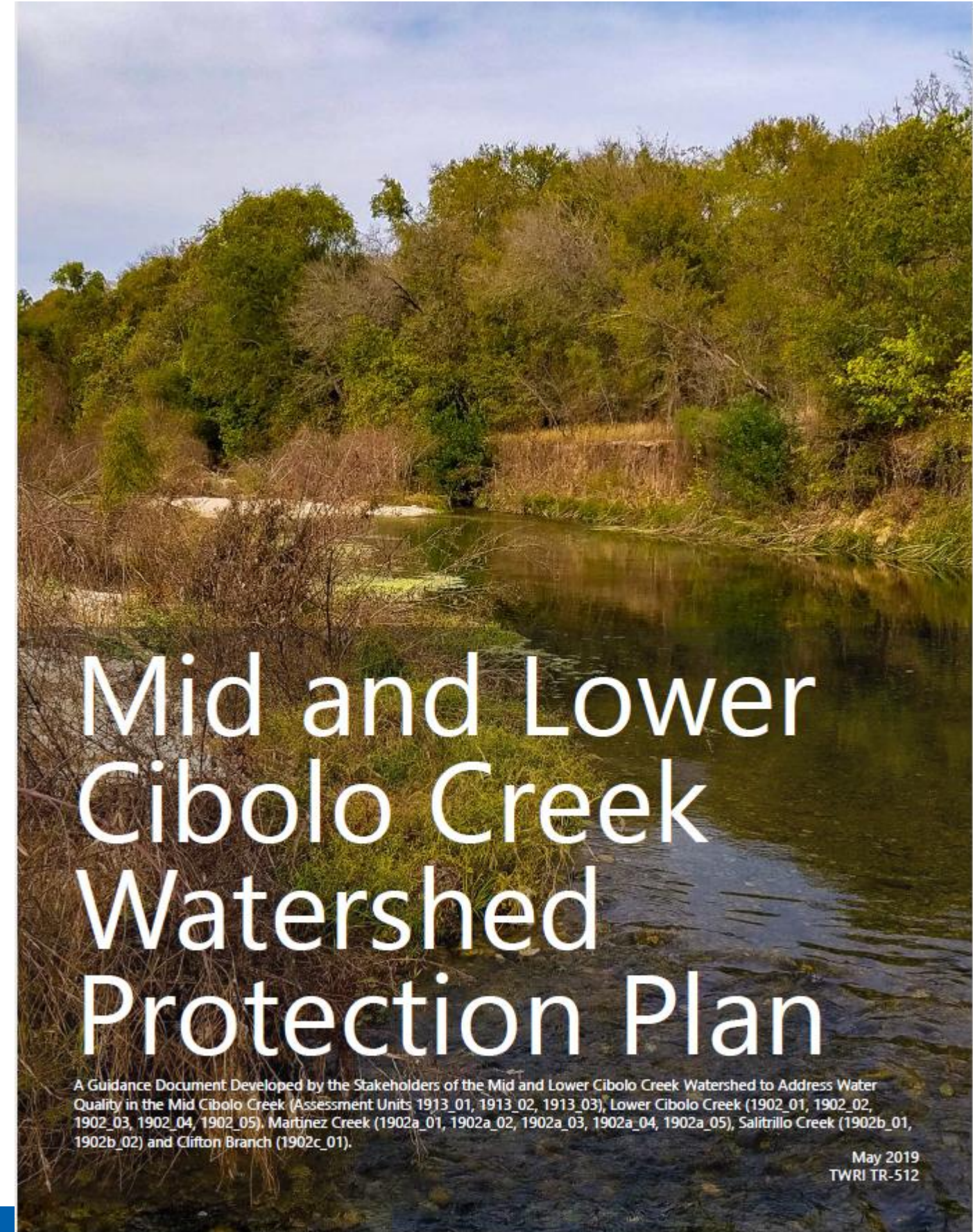


2019
WPP Accepted

WPP was accepted by the EPA as a watershed-based plan and became eligible for grant funding

Watershed Protection Plan

- Published in 2019
- Stakeholder Driven Strategy for Restoring Water Quality
- Strategies for Plan Implementation Include:
 1. Developing and Implementing Conservation Plans in Priority Areas
 2. Feral Hog Removal and Management
 3. Identify problematic OSSF's and work to bring systems into compliance
 4. Reduction of illicit Dumping and proper disposal of Animal Carcasses
 5. Urban Stormwater Planning and Management
 6. Installation of Urban Best Management Practices
 7. Implementation of Pest Waste Program
 8. Planning and Implementation of Wastewater Reuse
 9. Sanitary Sewer Overflow - Infrastructure maintenance and replacements



A Guidance Document Developed by the Stakeholders of the Mid and Lower Cibolo Creek Watershed to Address Water Quality in the Mid Cibolo Creek (Assessment Units 1913_01, 1913_02, 1913_03), Lower Cibolo Creek (1902_01, 1902_02, 1902_03, 1902_04, 1902_05), Martinez Creek (1902a_01, 1902a_02, 1902a_03, 1902a_04, 1902a_05), Salitrillo Creek (1902b_01, 1902b_02) and Clifton Branch (1902c_01).

May 2019
TWRI TR-512



The TWON program is for Texas residents who depend on household wells for their drinking water needs.



Protecting Texas waterways from bacterial contamination

Healthy Lawns Healthy Waters

The Healthy Lawns and Healthy Waters Program aims to improve and protect surface water quality by enhancing awareness and knowledge of best management practices for residential landscapes.



Provides science-based, watershed education to help citizens identify and take action to address local water quality impairments.

Active Engagement in Education and Outreach

Date	Program	Location
June 1 st , 2022	Lonestar Health Streams	Seguin
February 22 nd , 2023	Texas Watershed Stewards Program	Floresville
March 27 th , 2024	Lonestar Healthy Streams	Floresville
Spring 2025, 2025	Texas Well Owners Network	Floresville

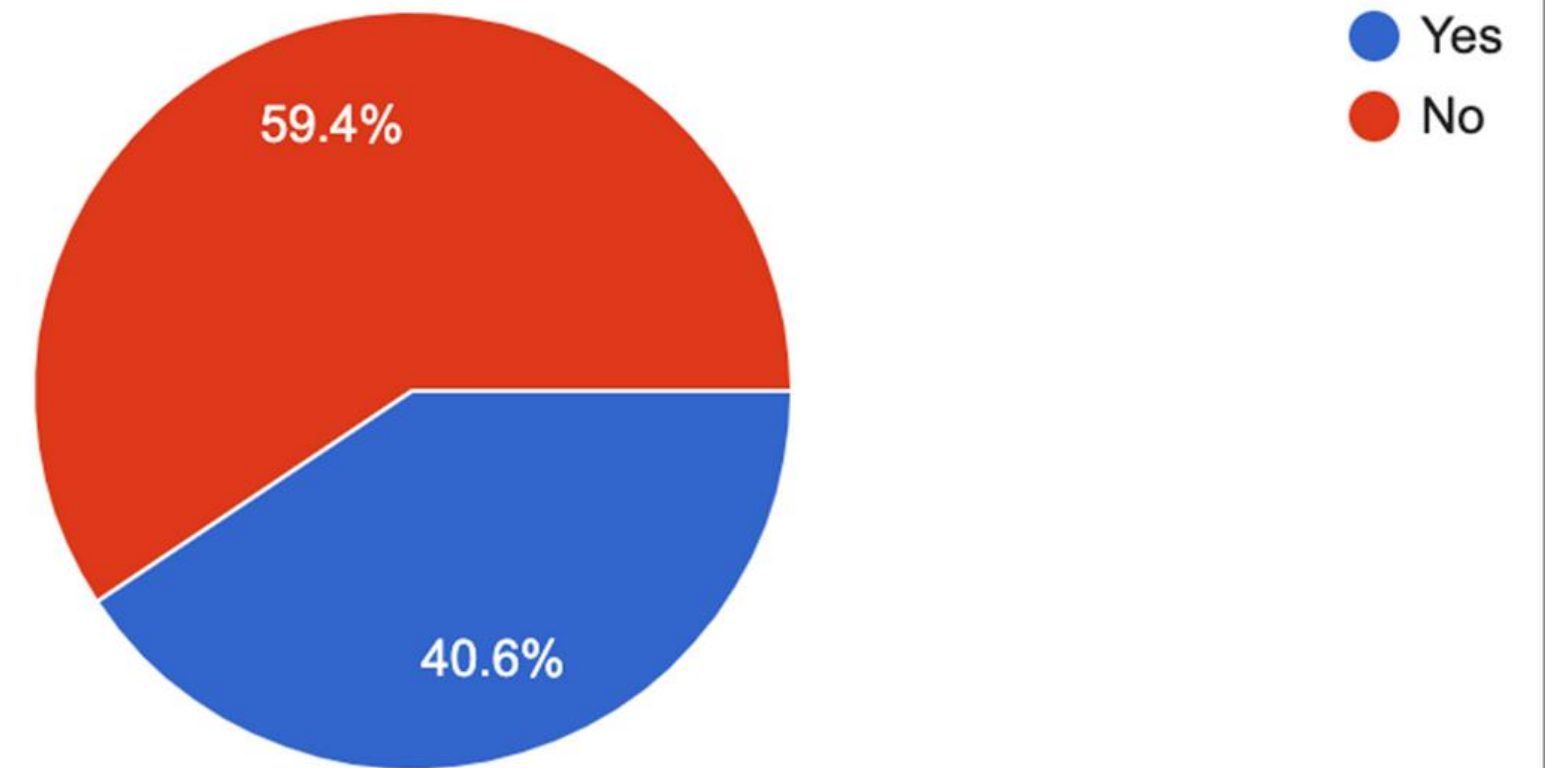


**Do water education
& outreach
programs have an
impact?**

**Are they reaching
the right
audiences?**

***POLL: ARE YOU PART OF
A WATERSHED?***

32 responses

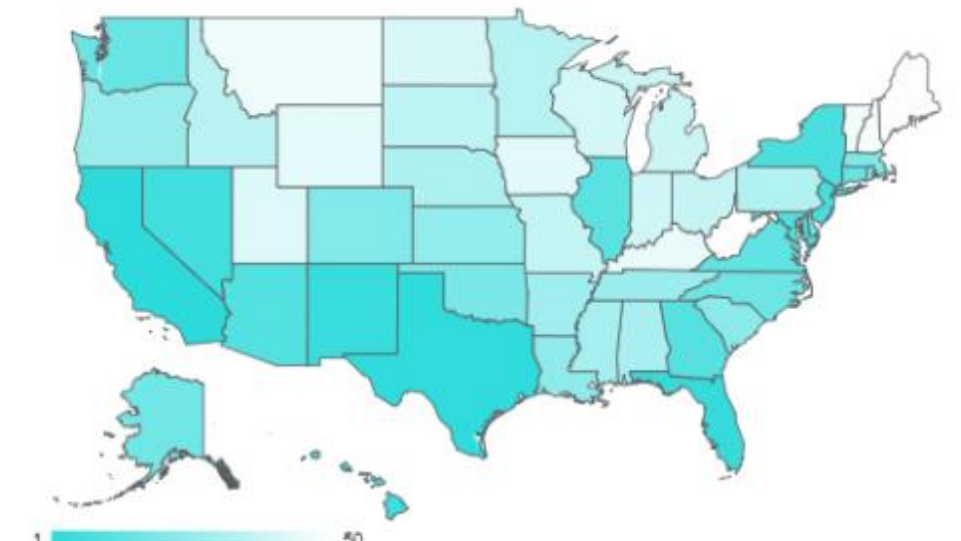


***THE NOT "MY" PROBLEM
PROBLEM***

FUTURE OF TEXAS

- Growth
- Diversification
- Water and land use shifts

NEED TO REACH NEW AUDIENCES - BUT HOW?



EMBED ON YOUR WEBSITE

Most & Least Diverse States in the U.S.

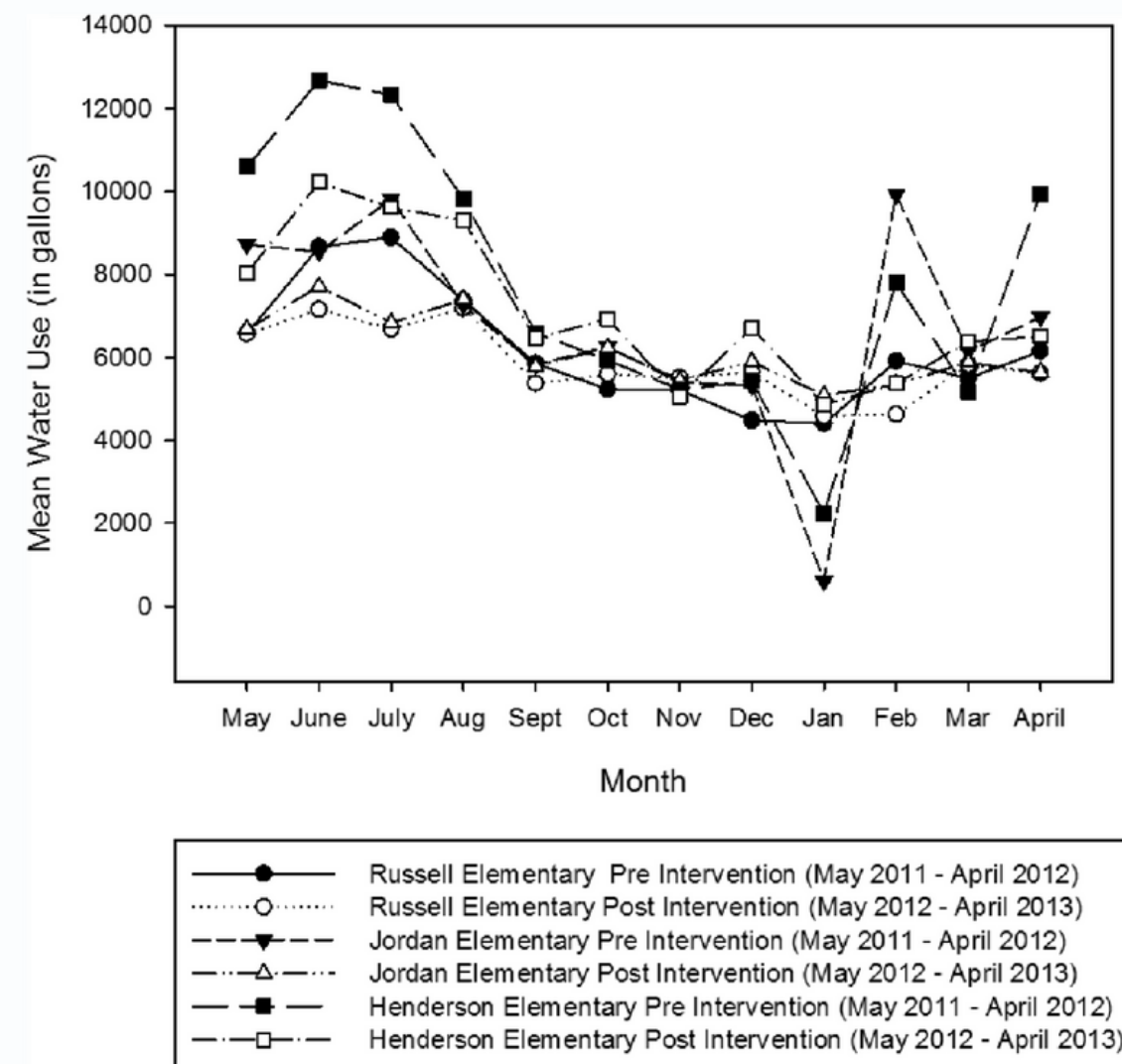
Overall Rank	State	Total Score	Socioeconomic Diversity Rank	Cultural Diversity Rank	Economic Diversity Rank	Household Diversity Rank
1	California	70.77	3	1	13	8
2	Texas	70.48	4	6	12	27
3	Florida	69.88	20	5	33	7
4	New Mexico	69.83	34	7	3	2
5	Hawaii	69.77	35	3	5	15
6	Nevada	69.72	26	2	32	1
7	New Jersey	69.71	12	4	42	39
8	New York	69.62	1	8	43	4

Source: WalletHub, "Most & Least Diverse States in America" (2024)

Adam McCann, WalletHub Financial Writer. Sep 17, 2024

WATER EDUCATION IN PUBLIC SCHOOLS

- Broad audiences represent changing populations
- “Intergenerational transfer” = wider community impact
- Recruitment and skill-building for future water workforce
- State standards



Effects of a water conservation education program on water use in single-family homes in Dallas, Texas

Victoria Faubion Serna

Published 1 December 2014

Environmental Science, Education

The **City of Dallas Environmental Education Initiative (EEI)** is a hands-on, inquiry-based, K-12 water conservation education program that teaches students concepts about water and specific water conservation behaviors.

The results showed that over a period of one calendar year the water use in the single-family homes within each school zone and throughout the entire research area in this study experienced a statistically significant decrease in water use of approximately 501 gallons per home per month (independent, t-test, $p > 0.001$).

Data from this research suggests that EEI is playing a role in decreasing the amount of water used for residential purposes.

Gold Standard PBL
Seven Essential Project
Design Elements



Pblworks.org

K-12 Teacher Education

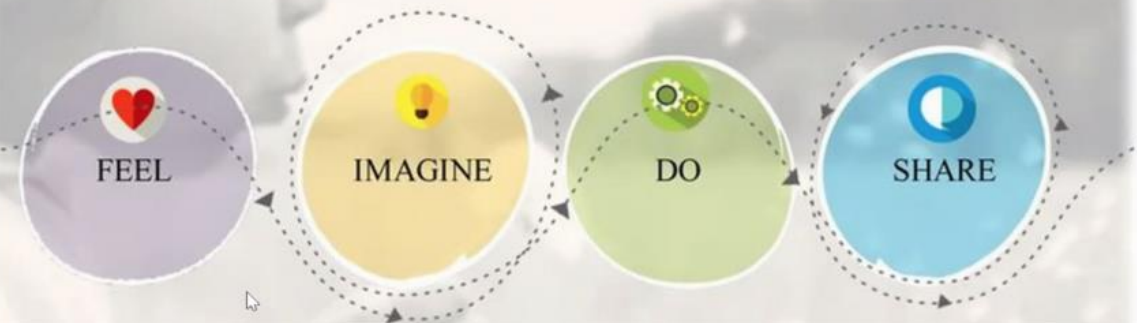
THROUGH A WATER LENS

Each teacher trained = 100–200 students/year

- Local examples
 - Hands-on
 - Action
- Personal connections
- Processes and Methods
- Careers

DESIGN for CHANGE

The DFC framework cultivates the I CAN mindset that allows students to believe they are not helpless, that change is possible and they can drive it. It develops the 21st century skills and creative confidence in people empowering them to use their creative agency to design innovative solutions



How to increase water education impacts?

CITIZEN SCIENCE

CASE STUDY: ACCESS WATER PROGRAM

PROFESSIONAL DEVELOPMENT WORKSHOPS FOR EDUCATORS

Empower educators with citizen science tools for water investigation

Meeting Community Needs:

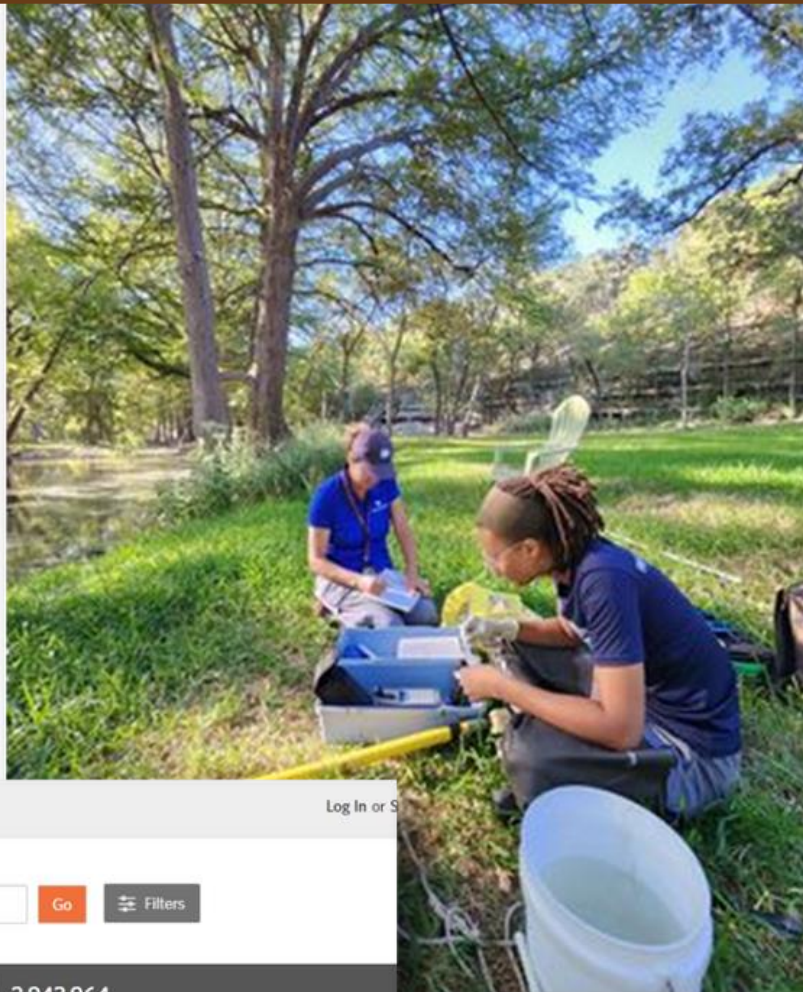
- Water Quality Education - Human Impacts
 - MS, HS, Undergraduate
 - Research and Career Prep
 - Geographic Information Systems (GIS)
 - Student-led, open-ended inquiry
- Diversifying student population
- Rapid development leading to increased water impacts

???

WHAT ELSE?



CITIZEN SCIENCE Learning by doing



iNaturalist Explore Community More Log In or Sign Up

Observations

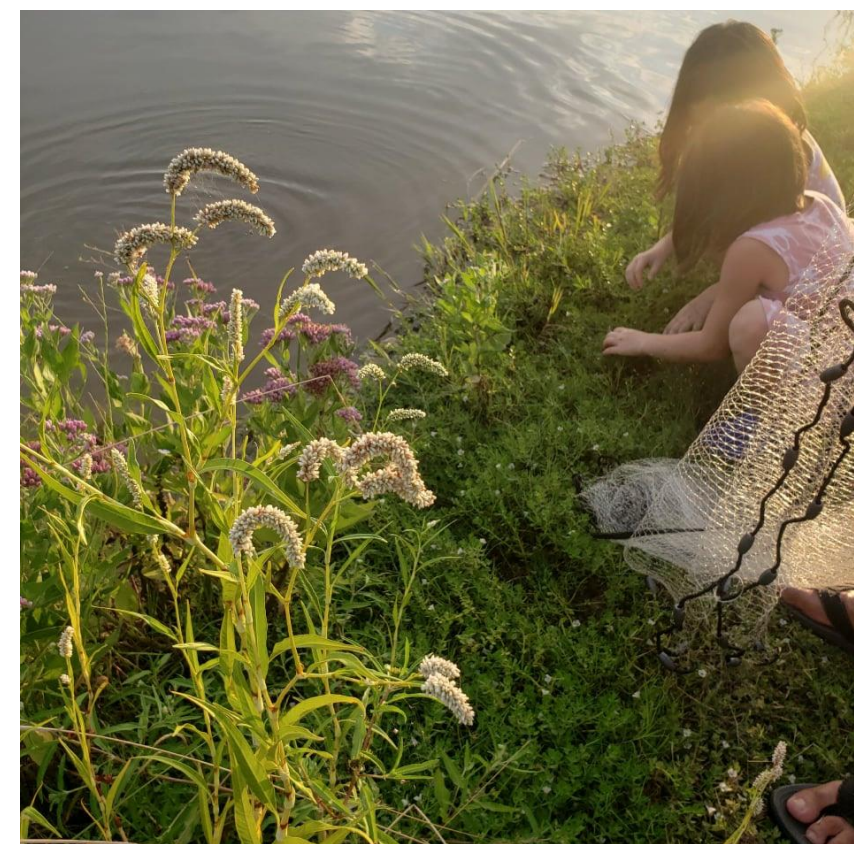
Species: Location: Go Filters

The World 171,519,174 OBSERVATIONS 461,236 SPECIES 344,296 IDENTIFIERS 2,943,964 OBSERVERS

Map Grid List Places of Interest

Common Moorhen (*Gallinula chloropus*) Parc-de-Montsouris... Today Research Grade 3 33m

- European Earwig (*Forficula auricularia*) Jessup, MD 20794... Today 1 33m
- Mallard (*Anas platyrhynchos*) Parc-de-Montsouris... Today 1 33m
- Wetland Giant Wolf Spider (*Tigrosa hellou*) Oxford Rd, Harriso... Today 1 33m
- Common Moorhen (*Gallinula chloropus*) Parc-de-Montsouris... Today 1 33m
- Eurasian Magpie (*Pica pica*) Today 1 33m

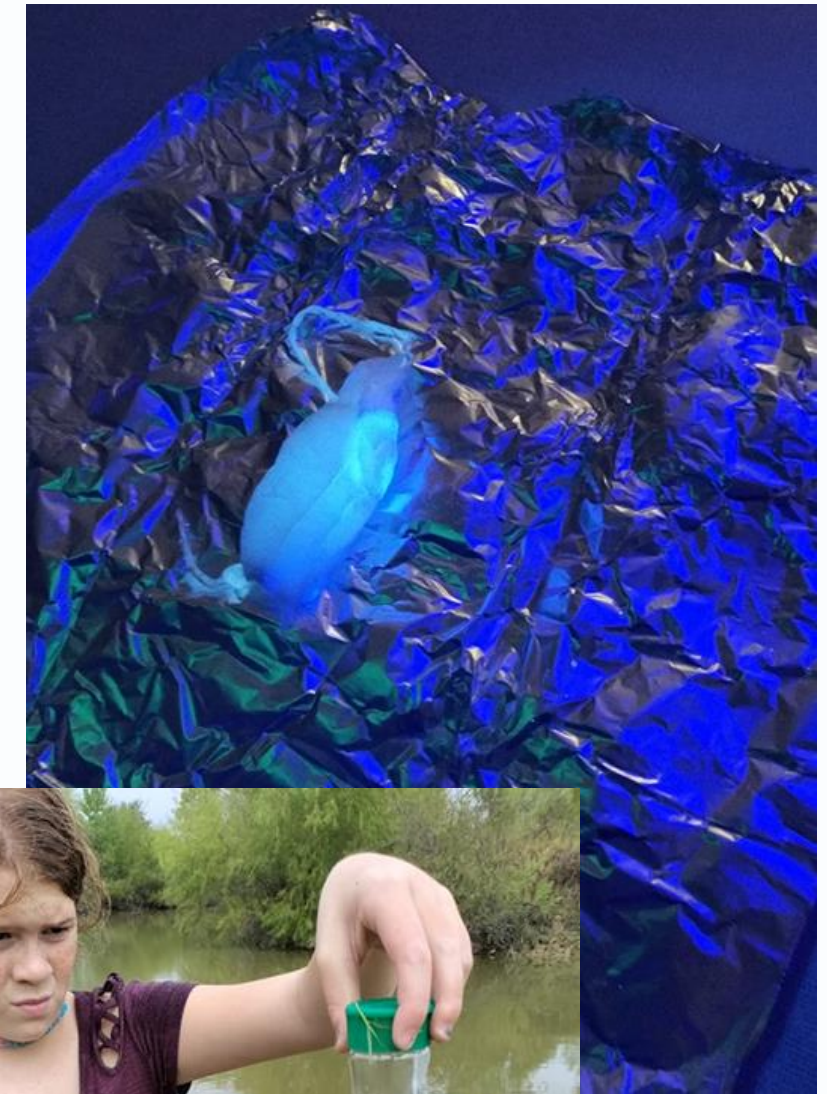


OB Monitoring ("Tamplng")

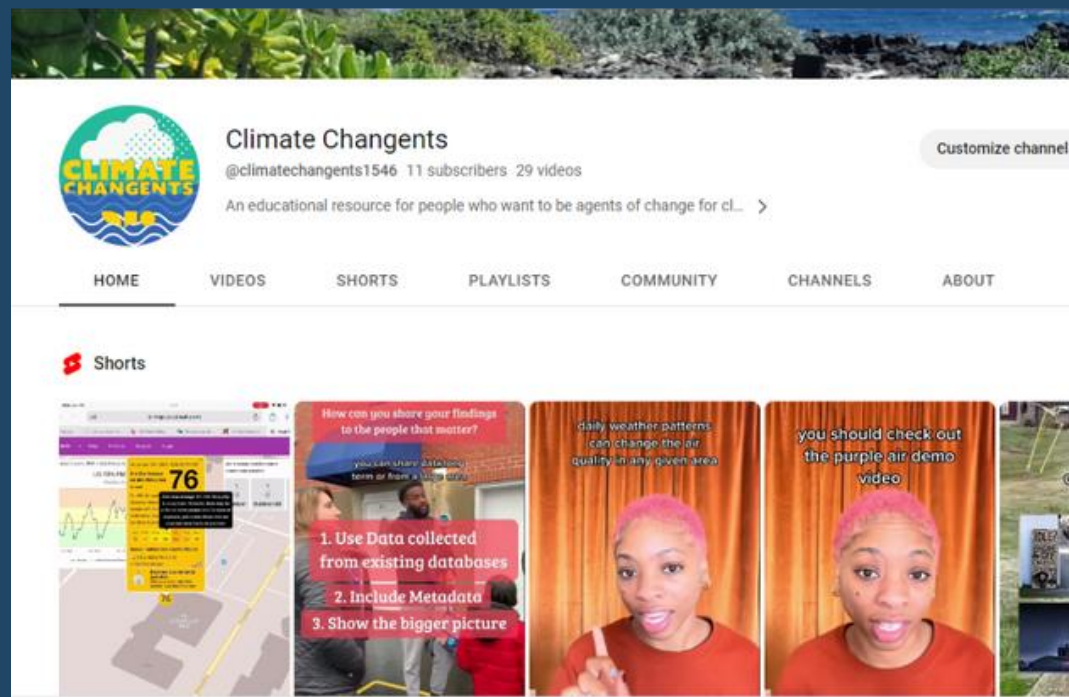
Optical Brighteners (OBs):

- Found in detergents and soaps, don't break down quickly
- Should be removed in wastewater treatment process
- Presence of OB's in waterways can alert to the presence of human sewage contamination as a proxy to bacterial sampling
- Fluoresce under a black light - glow **blue**
- Adsorb to COTTON

Perfect for classrooms?



VIDEO & SOCIAL MEDIA: EMPOWERING YOUTH AMBASSADORS



CLIMATE CHANGE AGENTS

climatechangents

climate_changents

@climatechangents154

FOLLOW US ON SOCIAL MEDIA!

CO-CREATED MATERIALS

TO MEET COMMUNITY

NEEDS:

- Interactive Online Community Hubs for transparency
- Local partnerships to learn local concerns
- Connection with existing programs
- Fill gaps

OB Tampling Citizen Science Hub

"Tampling" is an easy, fun, and affordable method for monitoring waterways for Optical Brighteners.

Optical brightener (OB) sampling using tampons is a low-cost method to detect the presence of human sewage contamination in stormwater infrastructure systems and natural waterways. "Tampling" (tampon + sampling) can serve as an early warning system for wastewater leaks by mobilizing community scientists to collect OB data on their own waterways.



What started out as a lab activity for students to conduct hands-on water quality monitoring without the expense and time of traditional kits has grown into a citizen science phenomenon. Now with an online public data collection system, standards-aligned curriculum, a growing number of success stories, plus a complete Tampling Citizen Science Field Guide and Online Community Hub, Tampling is making water quality monitoring more accessible than ever.

What are Optical Brighteners?

Optical Brighteners (OB) are found in many laundry detergents. Optical brighteners are not themselves harmful, but may indicate the presence of sewage leaks or failing septic systems upstream. Detecting the presence of OBs in waterways may help identify potential sources of E. coli in watersheds and provide an early warning system for human health concerns.



View Tampling data from Texas and around the world!

Data from the Tampling Survey will display on the Tampling Map below.

Number of Tamples Deployed: **52**

Results are symbolized as either Present (indicating that Optical Brighteners detected) or Absent (no Optical Brighteners).

Public Tampling Map for Hub



Want to contribute your own data to this map? Go Tampling in your community!



THE MEADOWS CENTER FOR WATER AND THE ENVIRONMENT

TEXAS STATE UNIVERSITY

TEXAS STREAM TEAM

Development of a Citizen Science *E. coli* and Optical Brightener Monitoring Prototype as a Pollution Screening Tool

Desiree A. Jackson and Sandra S. Arismendez, PhD
The Meadows Center for Water and the Environment, Texas State University

Presented at the *Water Quality Science Meeting 2021, Grand Rapids, MI*

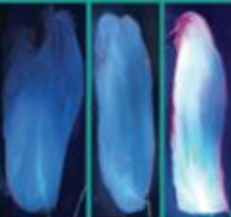
OBJECTIVES

- Monitor *E. coli* bacteria to identify potential sources of contamination
- Conduct optical brightener "tampling" monitoring as a pollution screening tool
- Develop a state-wide citizen science prototype to serve as a warning system for wastewater contamination.

KEY FINDINGS

Potential sources of *E. coli* bacteria to lower Cypress Creek include Mexican free-tailed bats and other wildlife, nonpoint source stormwater runoff, and failing or illicit discharges from on-site sewage facilities. Detection of optical brightener fluorescence at all sites and for all treatments may indicate wastewater contamination, although additional research and fluorometric analysis is needed.

RESULTS

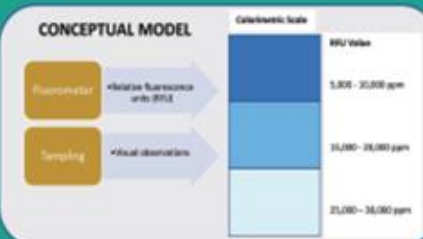


Optical brightener fluorescence was detected at all sites and treatments. Qualitatively, fluorescence was observed in low, medium, and high ranges. Organic matter such as algae, chlorophyll, and sediment fluorescence also interferes with "tampling" results. A protocol is currently being developed for fluorometric analysis of optical brighteners to quantify "tampling" fluorescence and to develop a uniform scale for more citizen scientists with interpretation of observed results.

BACKGROUND

Lower Cypress Creek is an urban stream in Central Texas exhibiting signs of water quality degradation and often exceeds the contact recreational use *E. coli* bacteria water quality standard (126 MPN/100 mL). This is a concern due to the role recreation plays on the local economy and the recreational activities associated with Cypress Creek. Mexican free-tailed bats reside under the bridge at Ranch Road 12 in Wimberley. Cattle access Cypress Creek as a drinking water source upstream of study area. Excrement from domestic pets and other wildlife including deer, raccoons, and waterfowl are also potential sources of bacteria in Cypress Creek. Sewered drain fields and malfunctioning septic systems are other potential sources of bacterial contamination. Commercial and residential developments in Wimberley have historically used septic systems for sewage disposal. Recently, a centralized collection system was installed and hook-ups to the system are beginning to take place.

CONCEPTUAL MODEL



Fluorescence → Coliforms count → MPN value

Fluorescence → 5,000 - 10,000 ppm

Tampling → Bacterial observations → 10,000 - 20,000 ppm

20,000 - 30,000 ppm

ACKNOWLEDGMENTS

We are thankful to Peter Way for his generosity in funding and providing access to private property along Cypress Creek. We are also grateful to the Wimberley Valley Watershed Association, City of Wimberley, The Meadows Center student research assistants, interns and staff for their support.

REFERENCES

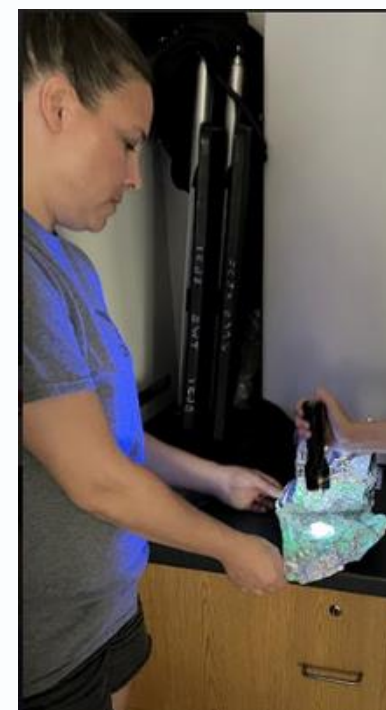
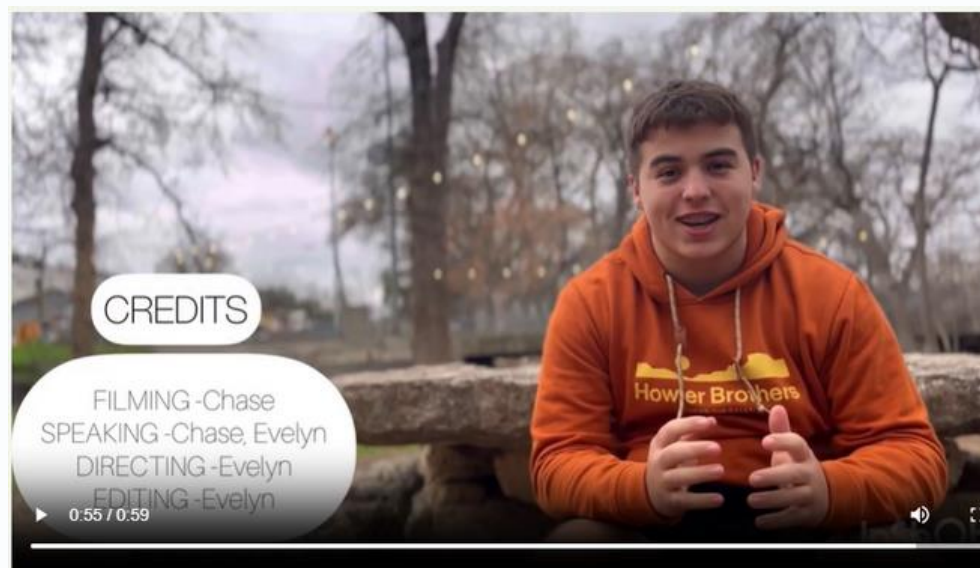
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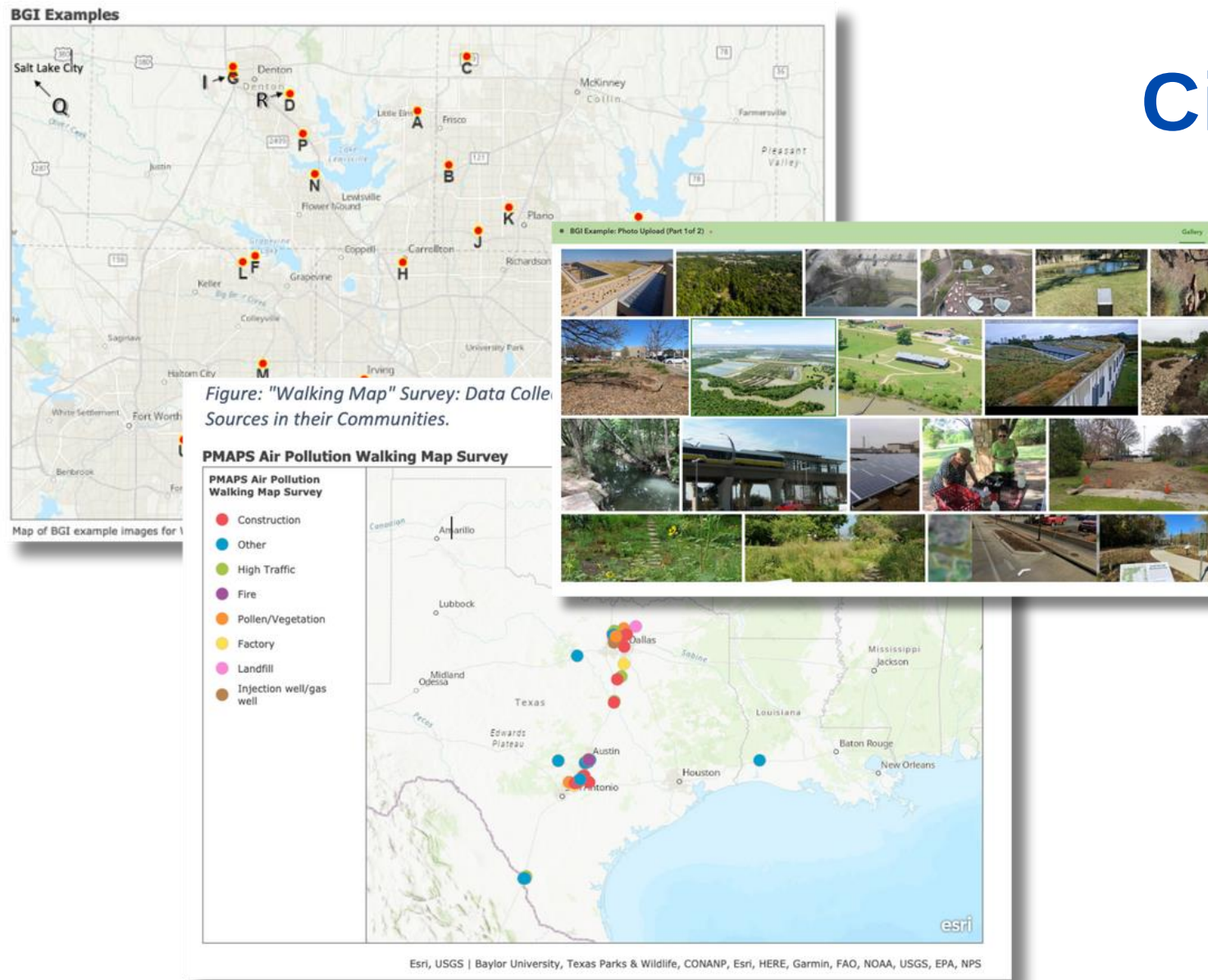
Arismendez, S., D. A. Jackson, C. L. Smith, A. R. Smith, J. R. Smith, J. R. Smith, J. R. Smith, and J. R. Smith. 2021. "Tampling" Prototype. Meadows Center for Water and the Environment, Texas State University, San Marcos, TX. 10 pp.

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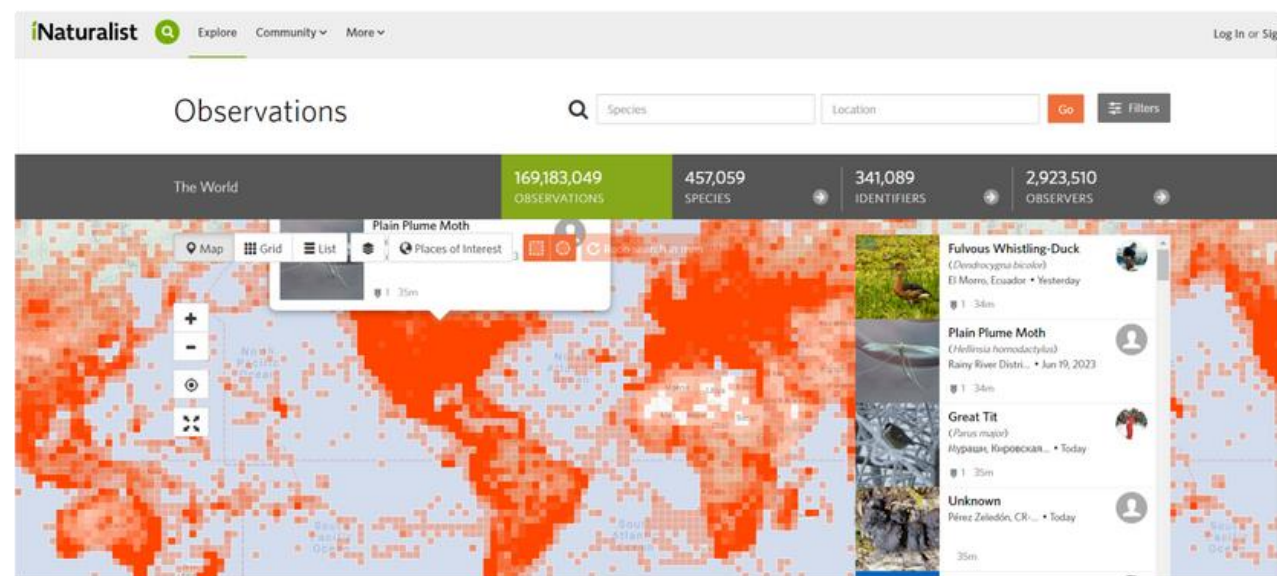
USING CITIZEN SCIENCE FOR DATA COLLECTION



Citizen Science:

- Multi-disciplinary tool for educating and collecting data
- Track engagement, impacts
 - Importance of geo-spatial data collection apps
 - **Today's Survey**
 - **Favorite Tool: ArcGIS Online**

- * **TIP: Use data that already exists, or is being collected for other purposes**
 - **iNaturalist, Texas Stream Team, SWQM, etc.**



• Citizen Science Evaluation Resources

- Citizen Science Assoc. (now AAPS)
- citizenscience.org/resources/research-evaluation/

Also helps with next step: Sharing findings



THANK YOU!

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TEXAS A&M
AGRILIFE


Texas Water
Resources Institute
make every drop count

TEXAS STATE
Soil & Water
CONSERVATION BOARD