

# Tamplimg: A Bright Future for Community Science and Urban Water Quality

Presented by:

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# What is Community Citizen Science (CCS)?

*a.k.a. Participatory Science, Volunteer Monitoring, Crowdsourcing, and many more...*



The participation of students, amateurs, or volunteers (any non-professional scientist) in the process of scientific research.



## Recent Growth

Technological advancements (smartphones)  
Enhanced data collection,  
Educational and societal impacts



## Groups and Resources

Citizen Science Association, SciStarter, iNaturalist,  
Master Volunteers, Texas Stream Team

Image Source: <https://fritsahlefeldt.net/>



# Benefits of CCS



## Data Collection

- Eyes on the ground
- Data gaps
- Accessibility (off limits)
- Machine learning (AI)



## Education and Outreach

- Broaden engagement
- Project-based Learning
- Virtual options
- Curricular materials



## Impacts

- Community input & support
- Learning gains
- Funding opportunities
- Sustainability goals

- Volunteers from all over the US have been collecting data for decades on lakes, streams, and coastlines
- Water monitoring is one of the most prevalent types of CCS program worldwide

## Citizen and Community Science Volunteer Water Quality Monitoring



Photo credit: From Texas Stream Team website  
(<https://www.meadowscenter.txstate.edu/Service/TexasStreamTeam.html>) and from: [www.WFAA.com](http://www.WFAA.com)

[ACCESS](#)  
[Workshops](#)  
[Website](#)



## Texas ACCESS Water Classroom Toolkits

Curriculum & Teacher Guide

Urban Water Quality and Citizen & Community Science




This toolkit is designed to help connect teachers and students across the state with water education resources, through interactive citizen science experiences in their own communities.

TEXAS STATE  
**Soil & Water**  
CONSERVATION BOARD

  
**Texas Water  
Resources Institute**  
*make every drop count*

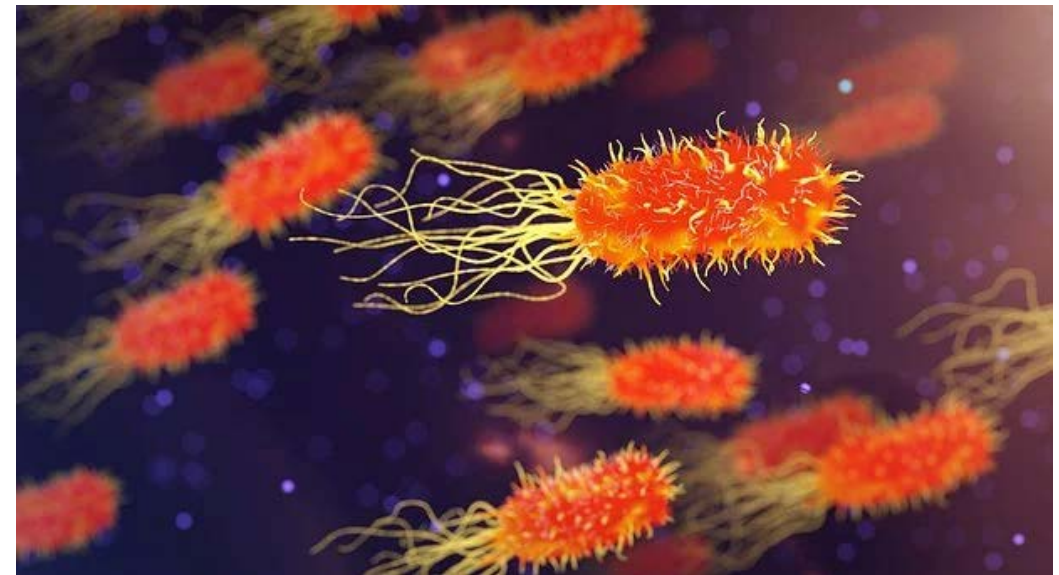
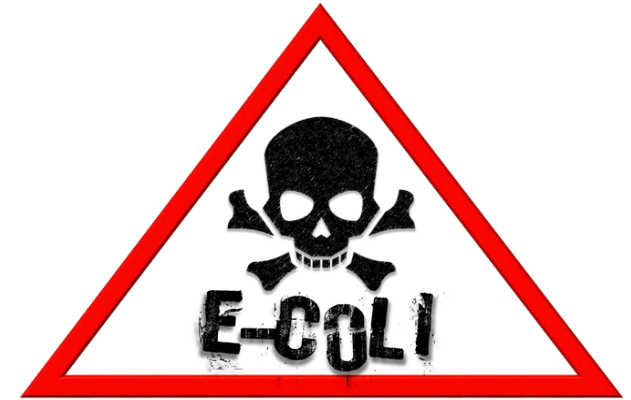
TEXAS A&M  
**AGRI**LIFE  
EXTENSION

  
Texas A&M Engineering  
Experiment Station



# Bacteria in our Water - what do you think?

- What is the major concern with bacteria in waterways?
- What are some of the main sources of bacteria in waterways?
- Do you think there are waterways with bacterial concerns near you?



# How can CCS help?

## How do we test for bacteria?

- Laboratory
- Time consuming
- Training required
- Costly



## What are the main sources of bacteria?

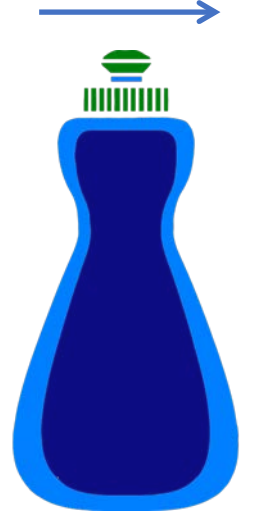
- Traditional testing doesn't tell you if the source is animal or human
- Rural/Urban interface = changing land use and behavior

Current CCS Involvement (TST)



# Optical Brighteners (OBs)

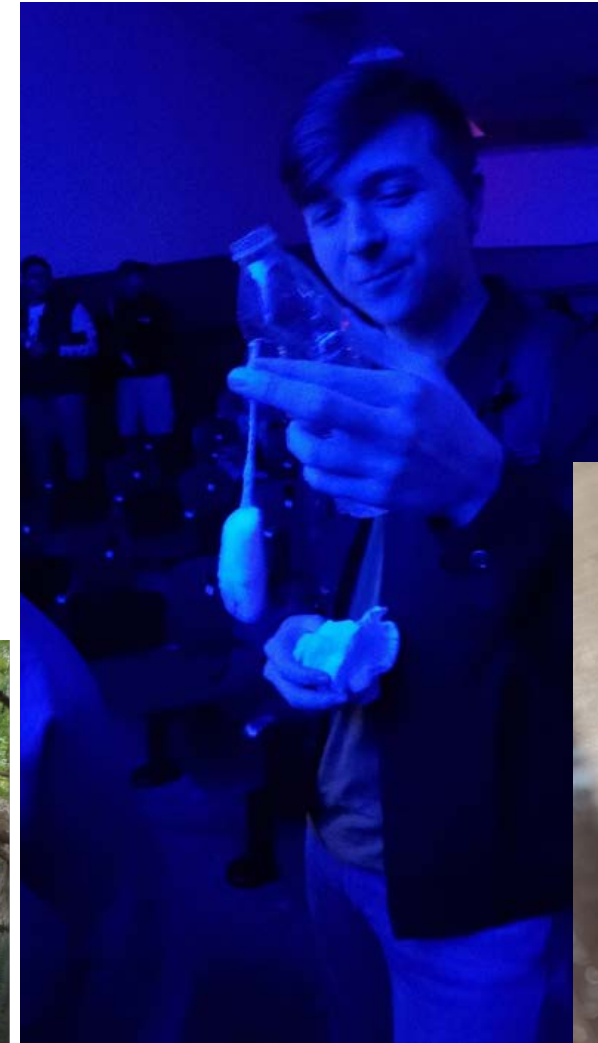
- Found in detergents and soaps, don't break down quickly
- Should be removed in treatment process
- Presence of OB's in waterways can alert to the presence of **human sewage contamination** as a proxy to bacterial sampling
- Fluoresce under a black light – glow blue
- Adsorb to **COTTON**



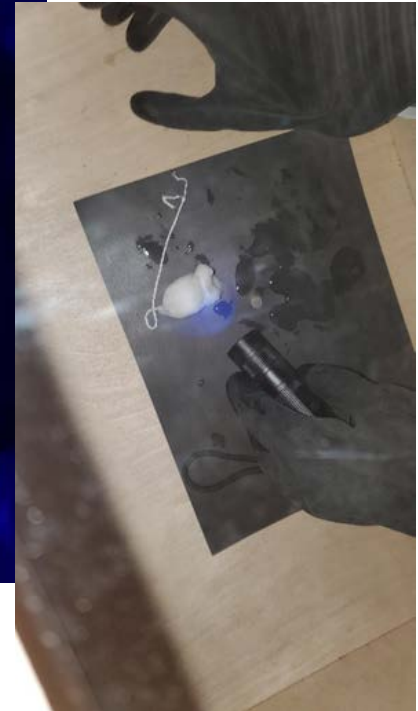
CCS  
Volunteer  
Procedure



# "Tamplng"



→  
Student  
proudly  
displaying his  
Tample





Research conducted by the Texas Stream Team and Meadows Center for Water and the Environment in conjunction with Dr. Albus using “Tamplng” method



**THE MEADOWS CENTER  
FOR WATER AND THE ENVIRONMENT**  
Texas state university

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**TEXAS STREAM TEAM**

**TEXAS STATE UNIVERSITY**  
The rising STAR of Texas

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

Destree A. Jackson and Sandra S. Arismendez, PhD

The Meadows Center for Water and the Environment, Texas State University

*Presented at the Joint Aquatic Sciences Meeting 2021, Grand Rapids, MI*

## OBJECTIVES

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

## 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 economic 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, Texas across Cypress Creek as a drinking water source upstream of study area. Excretion from domestic pets and other wildlife including deer, racoons, and waste are also potential sources of bacteria to Cypress Creek.

Natural drain fields and malfunctioning septic systems are other potential sources of bacterial contamination. Commercial and residential developments in Wimberley have historically used on-site septic systems for sewage disposal. Recently, a centralized collection system was installed and hook ups to the system are beginning to take place.

### What is *E. coli* Bacteria?

*Escherichia coli* bacteria originate in the digestive tract of endothermic organisms and are found in the feces of warm-blooded animals. It is used by state and federal agencies as bioindicator indicators of potential pathogen contamination and as a water quality standard for the contact recreational use.

### What are Optical Brighteners (OB)?

OBs are chemical compounds or dyes added to laundry detergents, cleaning agents, textiles, synthetic fibers, and many kinds of paper including toilet paper. They absorb ultraviolet light and fluoresce under ultraviolet light. They are used as an indicator of wastewater contamination from illicit discharges in storm drains and failing septic systems. Where local contamination is known to occur, optical brighteners can assist in pollution screening and source identification.

## METHODS

**Project Duration:** June 2021 to present

**Sighting Frequency:** Eight sites, twice a week/weekly bi-monthly

**Data types:** Water-quality field parameters and observations  
*E. coli* bacteria colony counts  
"Tapping" presence/absence

**Sampling methods:** Texas Stream Team and Abus 2021

**Field parameters:** water temperature, dissolved oxygen, pH, and specific conductivity

**Field observations:** flow severity, algae cover, water clarity, water surface, water condition, water odor, days since last significant precipitation, and rainfall accumulation.

***E. coli* bacteria:** Colisure Enzygnal

Optical brightener tapping consisted in placing individual portions of sterile organic cotton tampons in recycled water bottles placed in the centroid of stream flow and attached to a tree branch or kumbe ball with monofilament line. Four deployment/retrieval treatments were applied: 3-days, 4-day, 1-week, and 2 weeks. Upon retrieval, samples were transported to the lab in a dark container for evaluation under UV light.

## 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.

- Forty-eight sampling events occurred, and 355 *E. coli* samples were collected between June 2021 and April 2022. Eighteen samples were lost due to errors in plating or malfunctioning equipment.
- The highest *E. coli* geometric mean was at Onaca Creek (Site B1058) and the lowest was at the most upstream site (B1053).
- The two sites upstream of the RR12 bridge had geometric means below (<126 MPN/100 ml) the water quality standard while all the remaining sites downstream of RR12 had geometric means above (>126 MPN/100 ml) the water quality standard.
- Monthly geometric means for all sites show seasonal fluctuations with higher values coinciding with high rainfall and lower values when rainfall was lower, and bats were absent.

- Sites were grouped into upstream, midstream and downstream. Midstream sites generally exhibited higher *E. coli* bacteria concentrations at the beginning of the study, but a shift to higher bacteria values was observed at the downstream sites after high rainfall events in October-November.
- Rainfall measurements from the U.S.G.- gauge on the Blanco River at Fischer Store Road were compiled for three days leading up to a measuring event and reported as rainfall accumulation (in).
- A correlation analysis between *E. coli* concentration and rainfall yielded strong correlations ( $r^2 > 0.50$ ) at all sites except at the spring and Onaca Stream. The strong correlation between *E. coli* bacteria and rainfall yields results from nonpoint source pollution during rainfall events.

## 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, phytoplankton, and sediment fluorescence can interfere with "tapping" results. A protocol is currently being developed for fluorometric analysis of optical brighteners to quantify "tapping" fluorescence and to develop a colorimetric scale to assist citizen scientists with interpretation of observed results.

## NEXT STEPS

- Continue sampling eight sites bi-monthly
- Collect field parameters, observations, and *E. coli* bacteria colony counts
- Quantify fluorescence using a handheld fluorometer and initiate "tapping" monitoring to establish a relationship for colorimetric scale
- Investigate methods to discern bacteria sources including:
  - development of a mixing model;
  - conducting dye studies to identify failing septic systems,
  - track bat colony presence/absence
- Utilize sub-watershed for field reconnaissance to identify failing septic systems.
- As of May 2022, the City of Wimberley reported 71 completed sewer connections, 17 pending connections, and approximately 15 locations with extensions or plans to connect.

## CONCEPTUAL MODEL

## 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.

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# Case Study: Cypress Creek and Optical Brighteners

## OBJECTIVES

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## BACKGROUND

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# Case Study: Cypress Creek and Optical Brighteners

## RESULTS

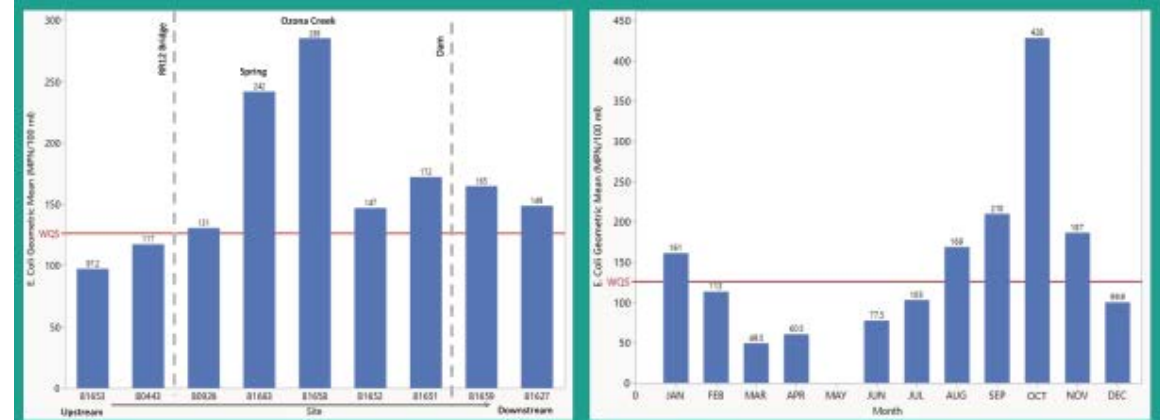


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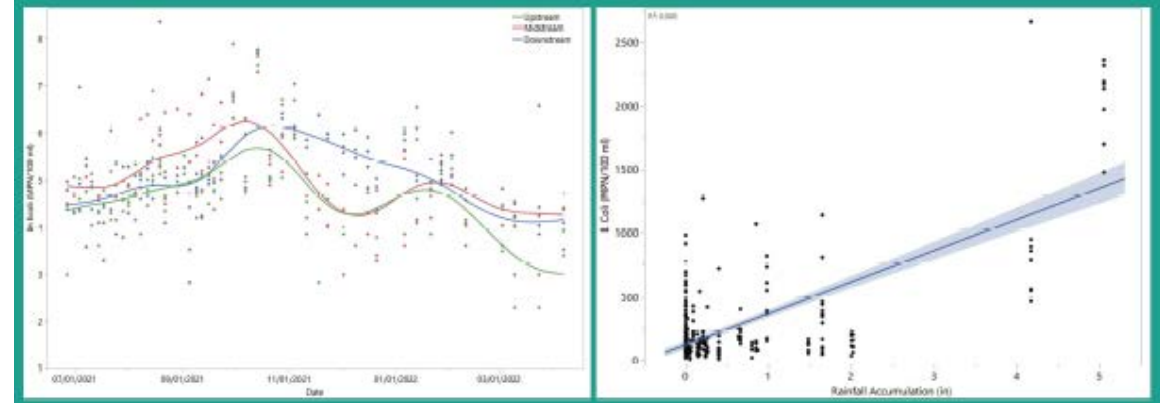
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# Curriculum (TEKS): **Optical Brightener** Sampling (*aka Tamplng*)

## Module 3: Water Quality CCS - Optical Brighteners (OBs)

Grade Level/Course: 7<sup>th</sup> Grade Science, Aquatic Science, AP Environmental Science

Purpose: The purpose of this module is for students to understand how the presences of optical brighteners in a water sample can be an indicator of pollution that was caused by human activity.

Student Learning Objective:

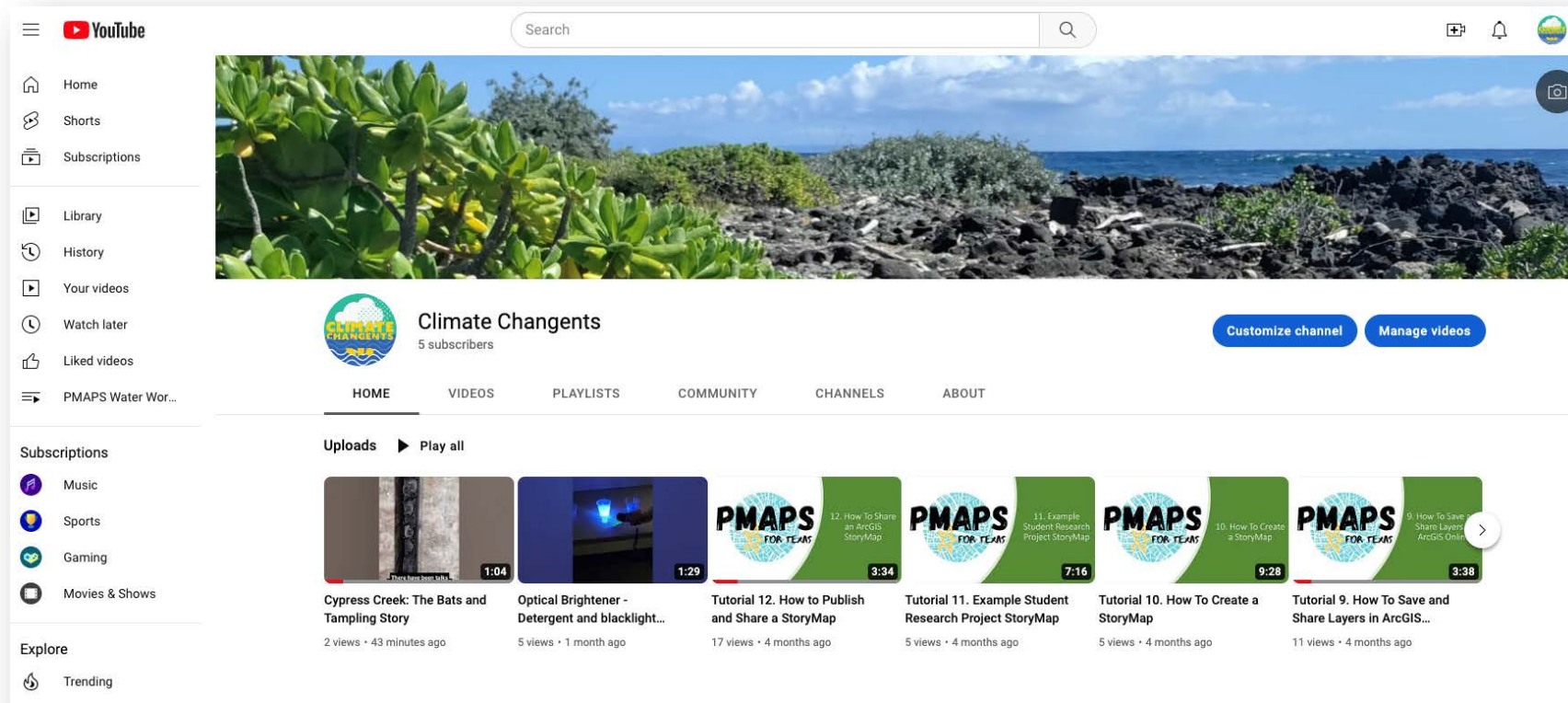
- Students will define Optical Brighteners (OBs) and identify sources of OBs in surface water
- Students will determine how OBs found in a water source can indicate the presence of contaminants due to human activity.
- Students will discuss a case study using OB monitoring on a Texas waterway and apply their findings to their own research





# Online Engagement through Videos and Social Media

- [https://www.youtube.com/watch?v=As\\_5qiBcupU](https://www.youtube.com/watch?v=As_5qiBcupU)







# Climate Change Agents Project

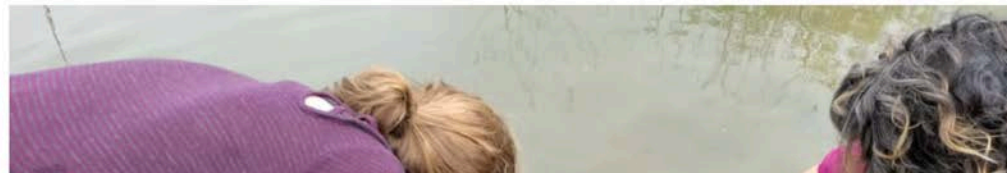
Home Page for "Tamplng" and "AQ Walking Map" Citizen Science Projects, with Educational Resources, Videos and Online Materials

Climate Changents Team  
March 14, 2022

**For the latest videos and project updates, follow us on social media!**

Calling all Climate Change Agents ages 13-18! Are you hoping to make a difference in your community? Do you have big ideas for environmental change?

**Register today for the National Geographic Slingshot Challenge!** A brand new contest where a 1-minute video is your chance to share your ideas with a global audience and win up to \$10,000!



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CCS  
Story Map



*Q: We found a positive! Now what??*

## **ACCESS Water Community Hub**

Data sharing and community engagement platform

- CCS engagement and education
- Student-led community research projects
- Water quality data collection

*Sponsored by grants from National Geographic Society and Texas State Soil and Water Conservation Board*



Please fill out this short survey to help us make this tool more useful for stakeholders and stormwater managers!

TEXAS A&M AGRILIFE

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————→ **CCS Fact Sheet (*Albus, Bowling 2022*)**

**AgriLife Learn - free download here:**



**<https://agrilifelearn.tamu.edu/s/product/citizen-and-community-science-inclusive-research-for-a-sustainable-future/01t4x000007U3TqAAK>**