Tampling:
A Bright Future for Community Science and Urban Water Quality

Presented by:

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Image Source: https://fritsahlefeldt.net/

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

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

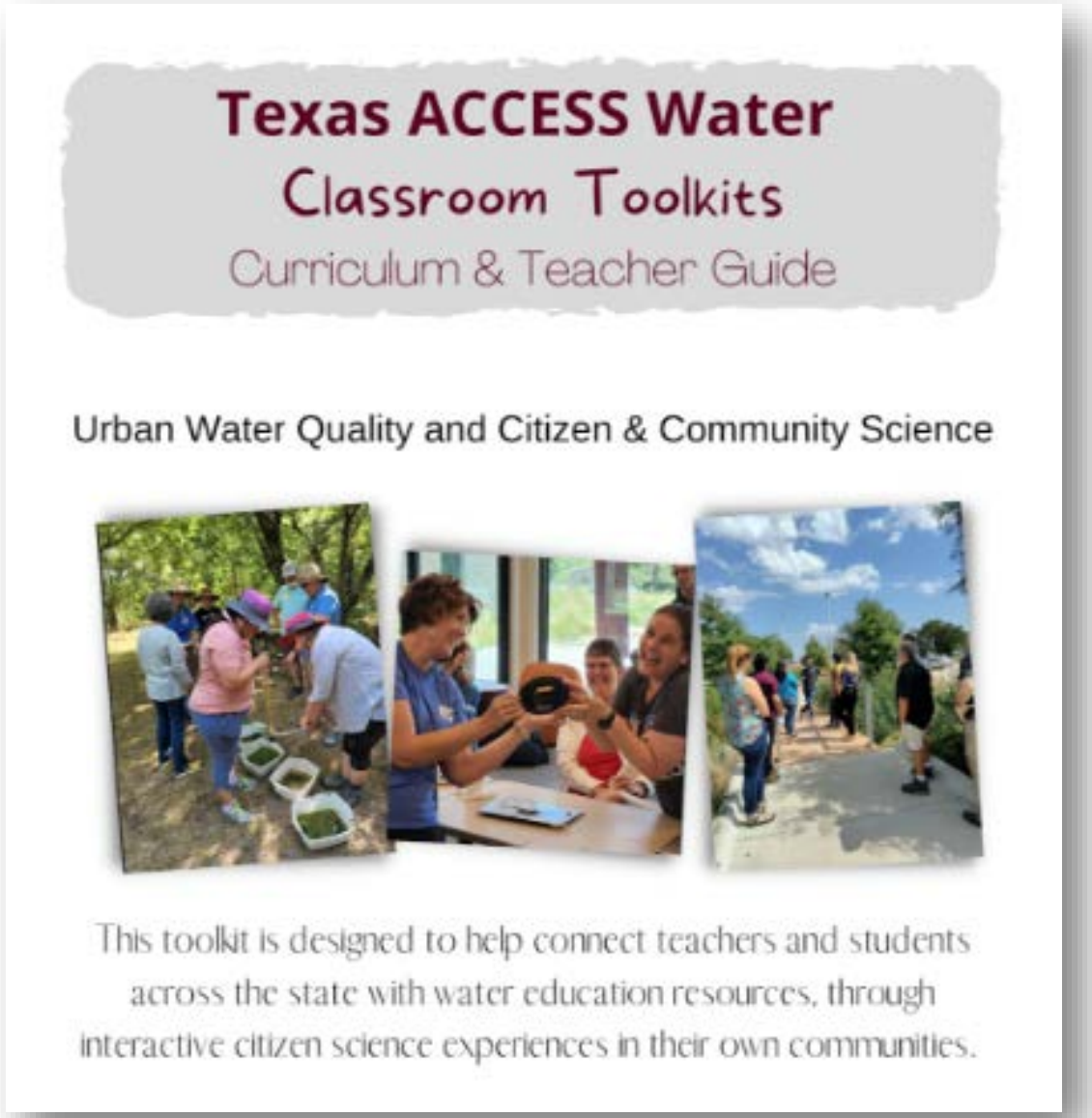
Citizen and Community Science

Volunteer Water Quality Monitoring

Texas Stream Team
Caring for Our Waters

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

[ACCESS Workshops Website]



TEXAS STATE Soil & Water CONSERVATION BOARD

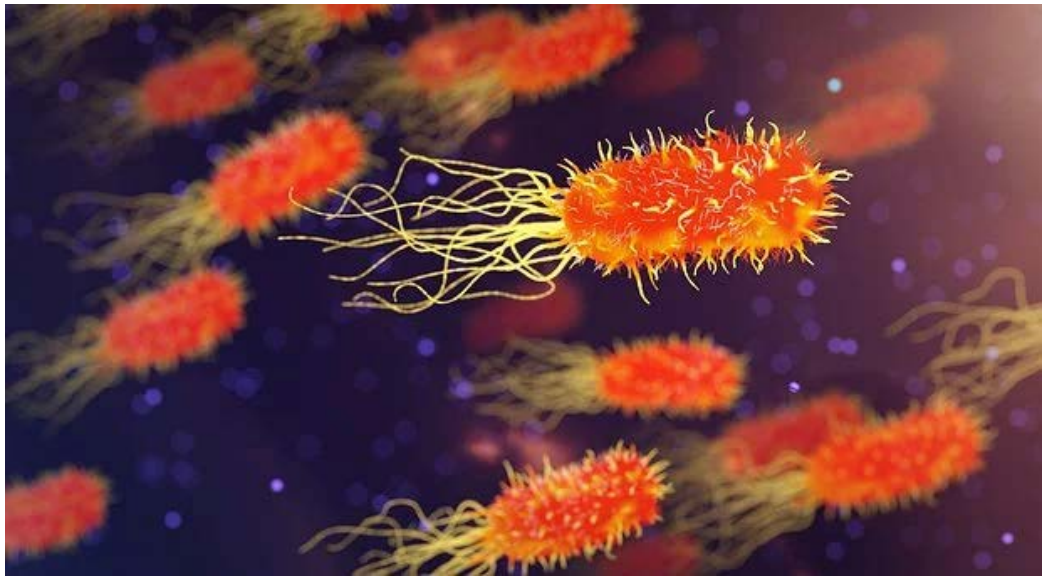
Texas Water Resources Institute
make every drop count

TEXAS A&M AGRILIFE EXTENSION

TEES
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)

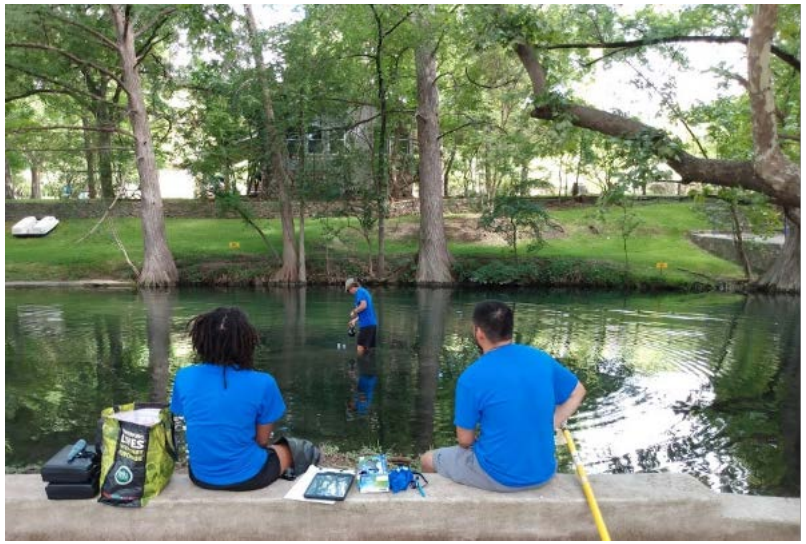
Optical Brighteners (OBs)

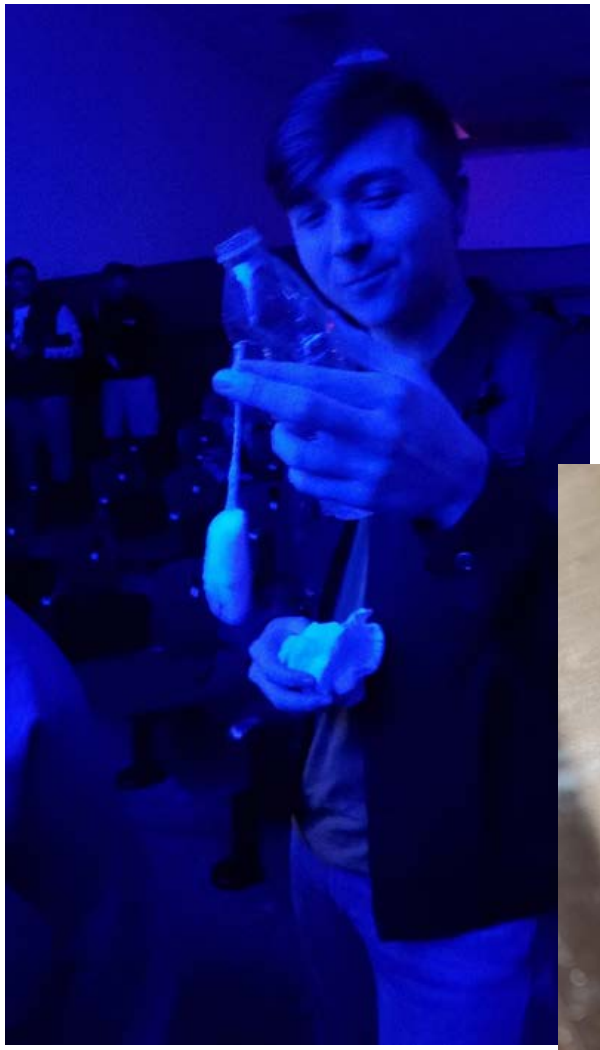
- Found in detergents and soaps, don't break down quickly
- Should be removed in treatment process
- Presence of OB's in waterways can alert to the presence of **human sewage contamination** as a proxy to bacterial sampling
- Fluoresce under a black light – glow blue
- Adsorb to **COTTON**

CCS Volunteer Procedure

Texas A&M AgriLife

"Tampling"





Student proudly displaying his Tample

https://www.meadowscenter.txstate.edu/Leadership/TexasStreamTeam/Waterways-Newsletter/September-2021/Lower-Cypress-Creek-Pilot-Project?mc_cid=046ec66e4b&mc_eid=523f42722e

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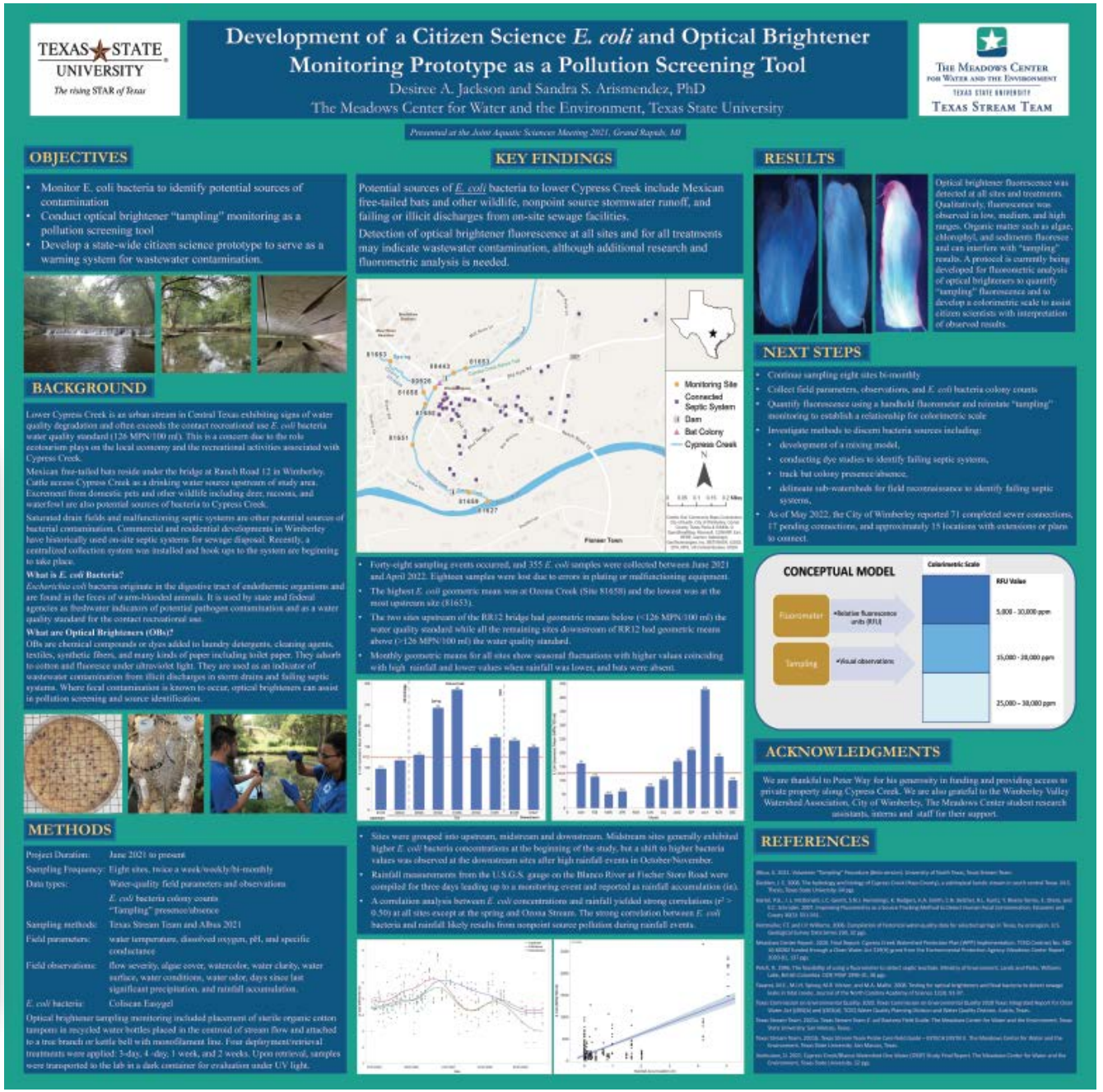
Case Study: Cypress Creek
BATS and Optical Brighteners

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



Case Study: Cypress Creek and Optical Brighteners

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.



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 ecotourism 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, racoons, and waterfowl are also potential sources of bacteria to Cypress Creek.

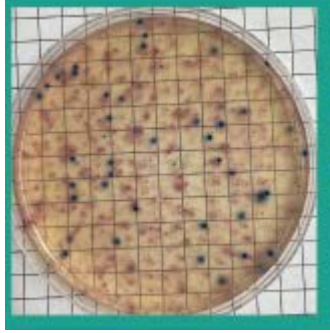
Saturated drain fields and malfunctioning septic systems are other potential sources of bacterial contamination. Commercial and residential developments in Wimberley have historically used on-site septic systems for sewage disposal. Recently, a centralized collection system was installed and hook ups 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 freshwater indicators of potential pathogen contamination and as a water quality standard for the contact recreational use.

What are Optical Brighteners (OBs)?

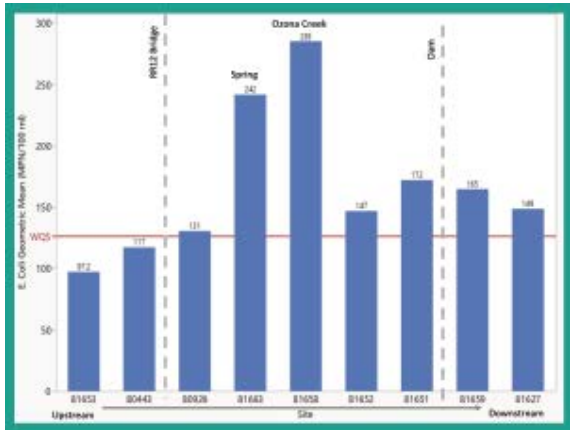
OBs are chemical compounds or dyes added to laundry detergents, cleaning agents, textiles, synthetic fibers, and many kinds of paper including toilet paper. They adsorb to cotton and fluoresce under ultraviolet light. They are used as an indicator of wastewater contamination from illicit discharges in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

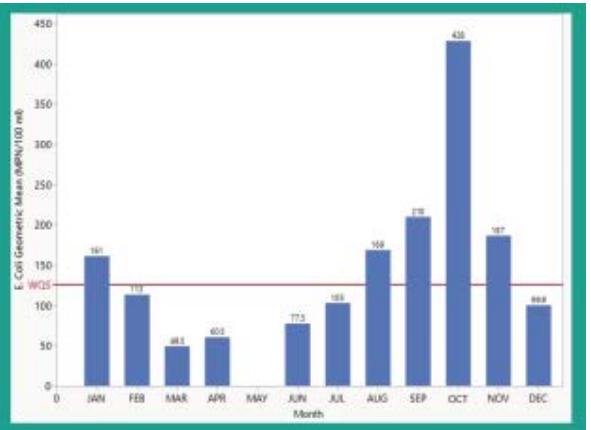


Case Study: Cypress Creek and Optical Brighteners

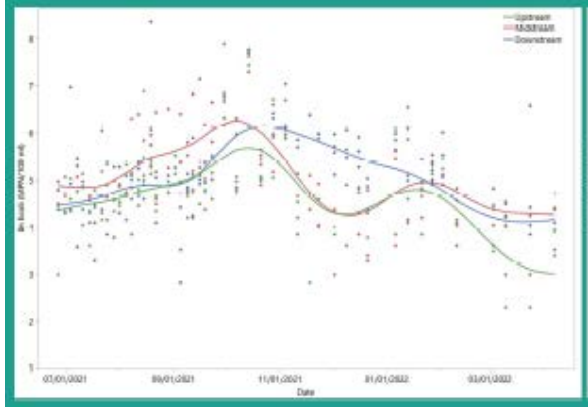
RESULTS

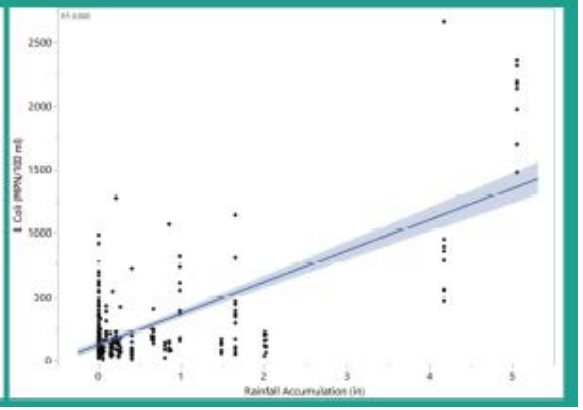
Optical brightener fluorescence was detected at all sites and treatments. Qualitatively, fluorescence was observed in low, medium, and high ranges. Organic matter such as algae, chlorophyl, and sediments fluoresce and can interfere with "tampling" results. A protocol is currently being developed for fluorometric analysis of optical brighteners to quantify "tampling" fluorescence and to develop a colorimetric scale to assist citizen scientists with interpretation of observed results.





- 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.S. gauge on the Blanco River at Fischer Store Road were compiled for three days leading up to a monitoring event and reported as rainfall accumulation (in).
- A correlation analysis between *E. coli* concentrations and rainfall yielded strong correlations ($r^2 > 0.50$) at all sites except at the spring and Ozona Stream. The strong correlation between *E. coli* bacteria and rainfall likely results from nonpoint source pollution during rainfall events.





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.

Curriculum (TEKS): Optical Brightener Sampling *(aka Tampling)*

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

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

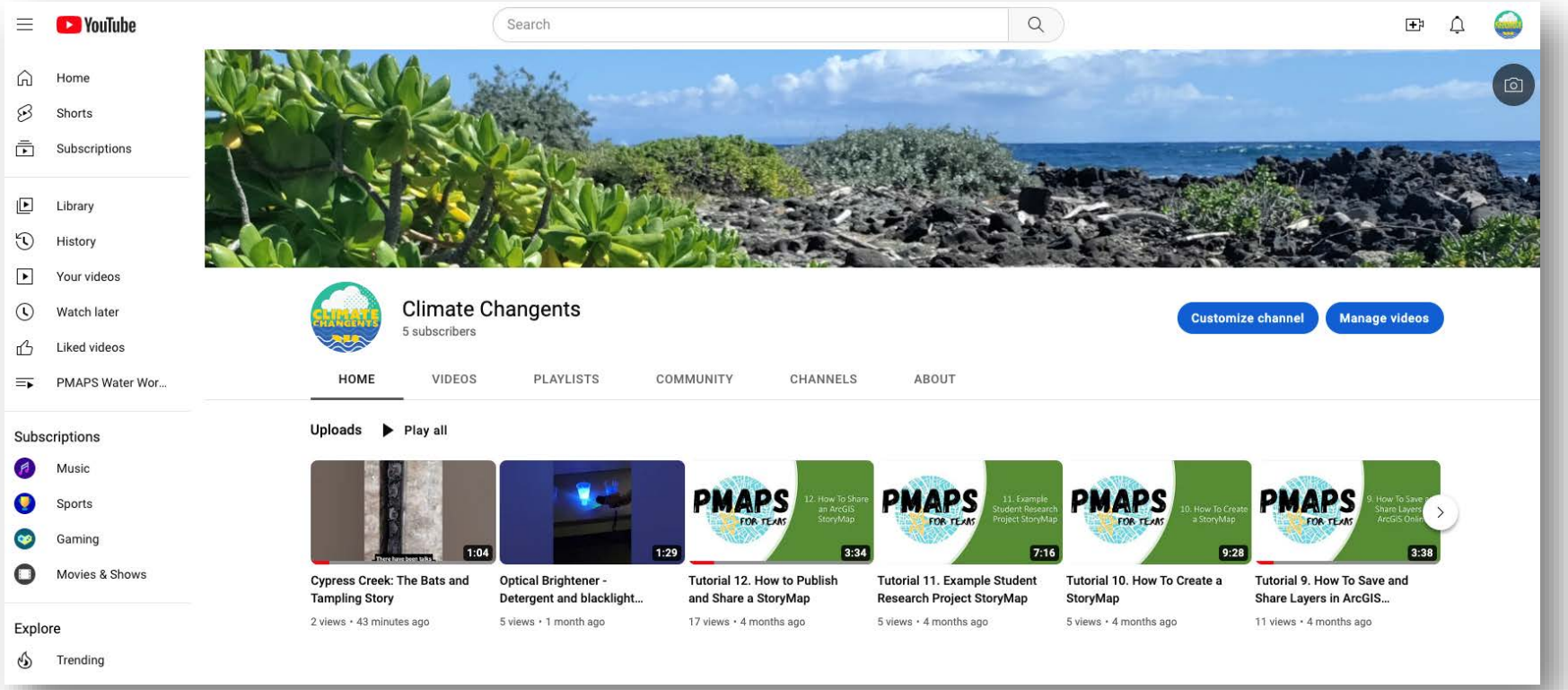
Purpose: The purpose of this module is for students to understand how the presences of optical brighteners in a water sample can be an indicator of pollution that was caused by human activity.

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



Climate Change Agents Project

Home Page for "Tampling" 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!

Scan for real-time updates:

Follow the Climate Changents Team for more air quality information!

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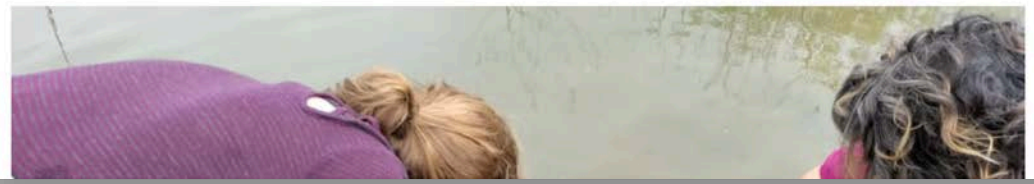
Calling all Climate Change Agents ages 13-18! Are you hoping to make a difference in your community? Do you have big ideas for environmental change?

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!



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