

# Considerations for Adopting Mobile Digital Technologies to Enhance Outdoor Education

NAAEE Virtual Conference 2017

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[wikiwatershed.org](http://wikiwatershed.org)*



# Our Mission

STROUD™ WATER  
RESEARCH CENTER



Photo: Marissa Morton

To advance knowledge and stewardship of freshwater systems through global research, education, and watershed restoration

# LEED Facility

1800 ACRES EXPERIMENTAL  
WATERSHED



*Moorhead Environmental Complex, 2012*



# UPHAM WOODS

Upham Woods



Outdoor Learning Center

“These lands are to be used as an outdoor laboratory and camp for youth, such as 4-H clubs and other people cooperating with the University of Wisconsin in the advancement of conservation, of agriculture and rural culture.”

—Elizabeth and Caroline Upham, 1941

For more information, please contact Upham Woods at:  
608-254-6461 or uphamwoods@ces.uwex.edu  
http://fyi.uwex.edu/uphamwoods/



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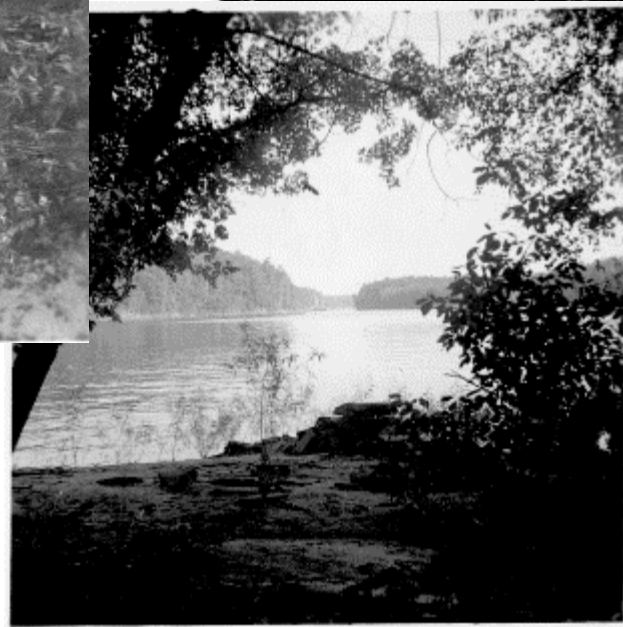




# Upham Woods



# Upham Woods



EDUCATION for  
PLANET EARTH

# Green Teacher

FALL 2016 | ISSUE 111 | \$7.95

## Tech it Outdoors?

PLUS

Technology that Enhances Outdoor Learning | Eco-Justice Education |  
An Urban Forest After-School Program | Education with a Humane Focus  
Learning through Role-Playing | An Intergenerational Empathy Game



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## Why do we tell stories?

To educate

To entertain

To share ideas

To remember

## What makes a scientific study?

Answer questions

Create a hypothesis

Collect data

Make observations

Make measurements

## What does it take to tell a scientific story?

Use the data and observations we collect to answer a question.

Teach others about our discovery by sharing the story of our study, our results, and photos or videos of the process

# “The exploration of nature should be a critical component of education.”

—David Sobel, 2015



# Changing Education

“In order to engage learners, educators must first be able to recognize and navigate in the learner’s own landscape.”

-Jan Visser, author of *Learners in a Changing Learning Landscape* (2008)

- **“Digital Natives”:**  
The generation of youth who have developed learning strategies shaped around the use of technology.  
(Prensky, 2006)



# Taking it Outdoors

- “Many educators believe that the most feasible learning activities of natural science is **outdoor inquiry**, which takes science investigation outside the classroom.” (Liu 2009)



# Place-Based Education

Place-based education provides a way to understand new concepts through making connections with relevant locations.

- “...this approach to education increases academic **achievement**, helps students develop **stronger ties** to their **community**, enhances students’ **appreciation for the natural world**, and creates a heightened commitment to serving as **active, contributing citizens**.” (Sobel 2004)
- “Place-based teaching includes all learners as they connect new **science-related ideas** to **community-based experiences**. We adopt the view that place-based learning can **connect** out-of-school learners to their communities.” (Zimmerman 2014)

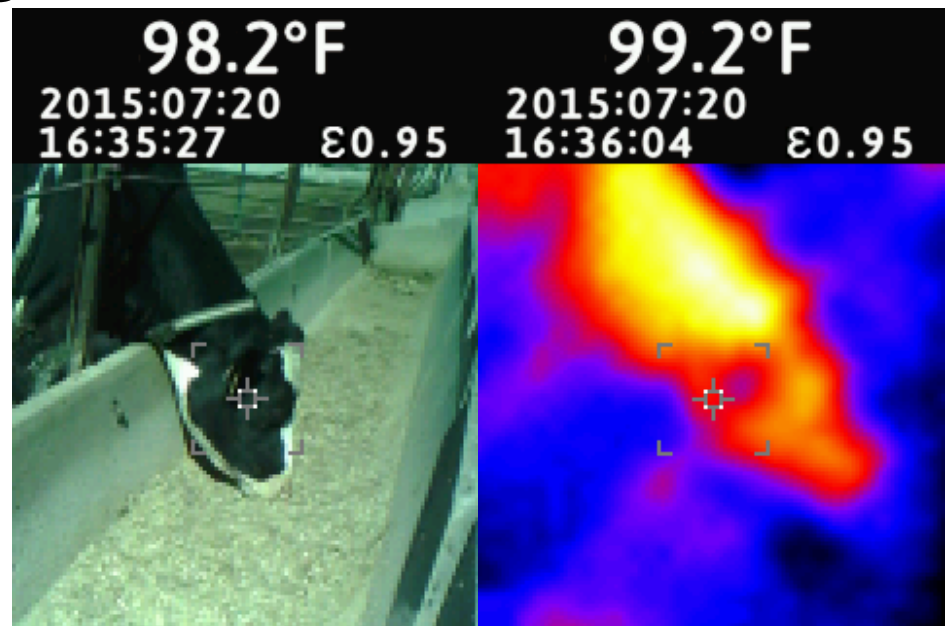
# Technology

- Liu studied the use of mobile technologies in an outdoor lab setting, with students using mobile computers to enhance their lesson, finding that 49% of students “felt that their opportunity to use a tablet PC throughout the learning activities was a **source of motivation.**” (2009)
- These students described their experience using the mobile technologies as more “personal,” “collaborative,” “hands-on,” and “interesting and interactive” than a typical class lecture. (2009)

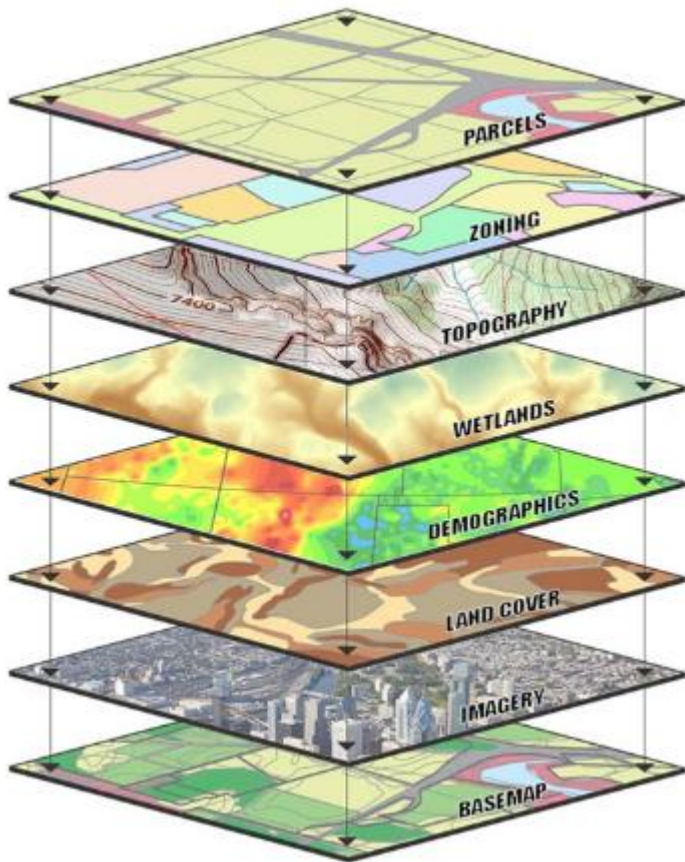


# Technology

- “Technology can support reflection and articulation of new knowledge if artifacts are captured for sharing.” (Zimmerman 2014)



# How can technology help us see?

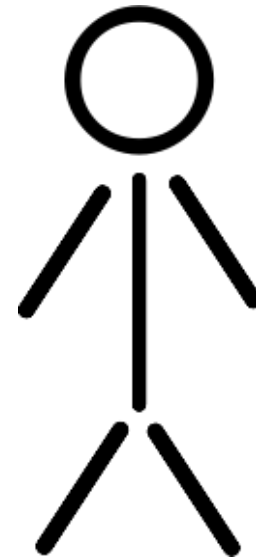


## GIS DATA LAYERS

Many different types of data can be integrated into a GIS and represented as a map layer.

Examples can include: streets, parcels, zoning, flood zones, client locations, competition, shopping centers, office parks, demographics, etc.

When these layers are drawn on top of one another, undetected spatial trends and relationships often emerge. This allows us to gain insight about relevant characteristics of a location.







Visible  
Light

What  
we can  
see



Radio

Infrared



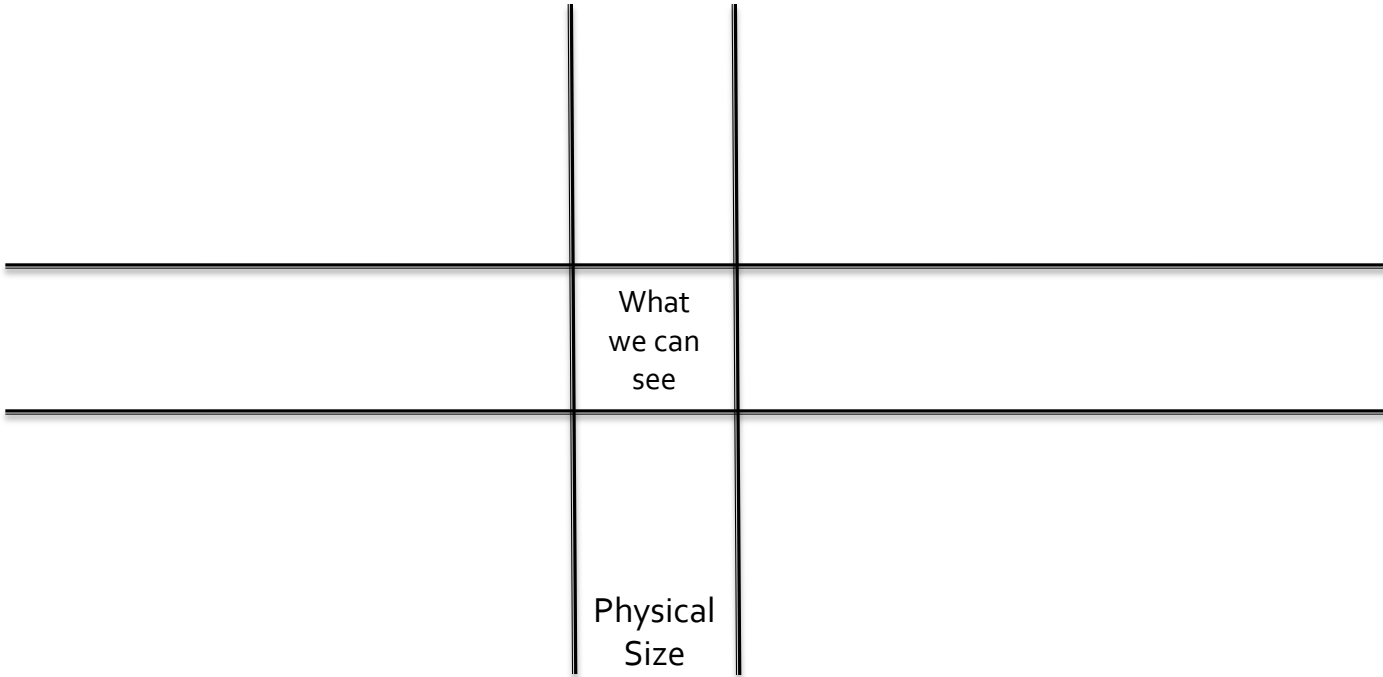
Visible  
Light

What  
we can  
see



Ultra Violet

X-Ray

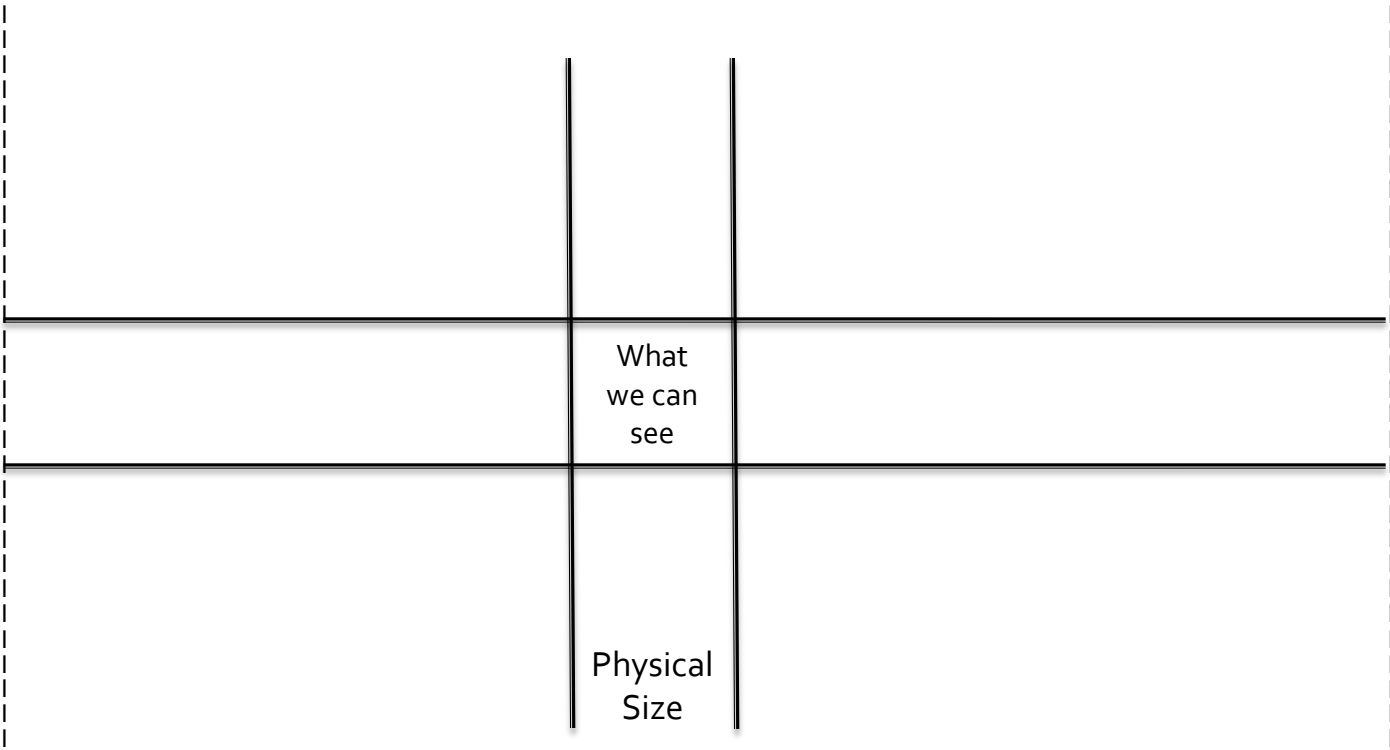


Sand particles



Landscape





Microns



Sand particles



Landscape



Galaxy





Radio		
Infrared		
Visible Light	What we can see	
Ultra Violet		
X-Ray	Physical Size	

Microns



Sand particles



Landscape



Galaxy



# What can technology see?

Technology helps us visualize attributes of space



Radio		
Infrared		
Visible Light	What we can see	
Ultra Violet		
X-Ray	Physical Size	

Microns



Sand particles



Landscape



Galaxy



# Career Scientists



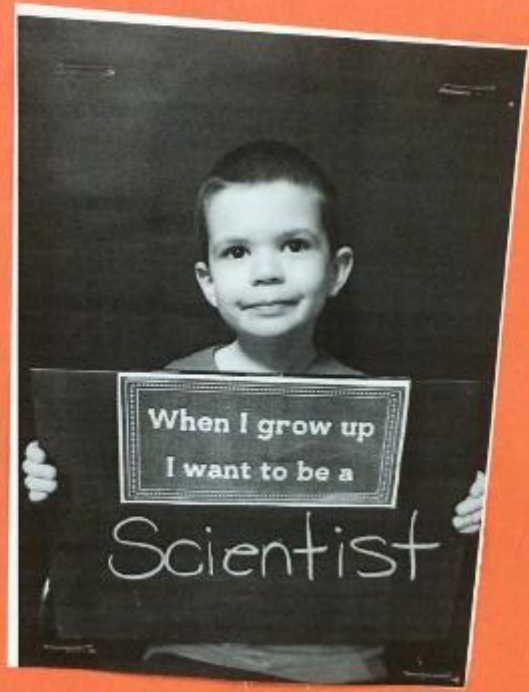
# We can all think scientifically about the world around us....





fire  
ghter

Soccer  
Player

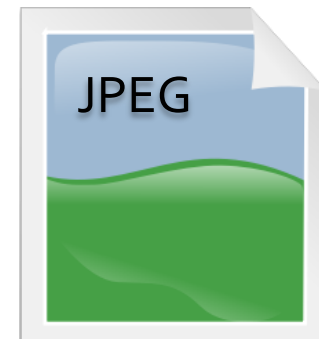
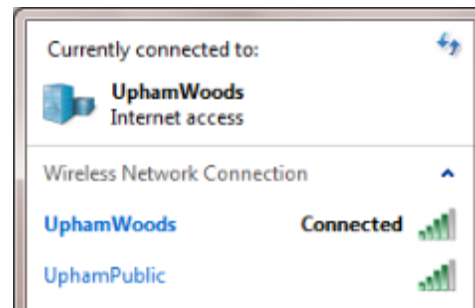


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# Design Considerations

- Memory
- Power
- Portability
- Off-line
- Dedicated device
- Platform neutral
- Digital artifact



# Digital Observation Technology Skills (DOTS) kits



# Navigator

- Provides direction to study sites
- Locates group geographically using a personal Global Positioning System
- Coordinates data collection with other team members



## Navigator

**Tools:** Garmin etrex 10 and map of Blackhawk Island

**Purpose:** A handheld GPS unit. Use this instrument to successfully navigate your team from waypoint to waypoint.

**Task:** Guide your group to each location as efficiently as possible using both the GPS and the map. All travel must be done on paths. At each point, record the latitude and longitude of the location.

### How-to:

1. Turn on the Garmin etrex 10 by holding down the button on the right side labeled 'light'.
2. Once on, use the toggle on the front to highlight the 'Where to?' square.
3. Select the 'Where to?' square by pressing **In** on the toggle.
4. Scroll through the waypoints and select the one your instructor tells you.
5. Once selected, toggle down to highlight 'GO' and click.
6. Your screen will now look like a map. To follow an easy-to-use compass instead, press the back button in the upper right. Toggle down and select 'Compass'. Keeping the compass level, line up the arrow and the line at the top. This screen tells you how far you are to your next point.
7. Using both the GPS and the map, guide your group to the correct location. Remember to stay on the trails.
8. Once you are at the correct location, identify its latitude and longitude. Do this by pressing the 'Back' button and selecting 'Map'. Press the toggle to the right and the information will appear on the top of the screen. Make sure to tell the Recorder these numbers.
9. Turn off the etrex when not in use.

### Helpful Hints:

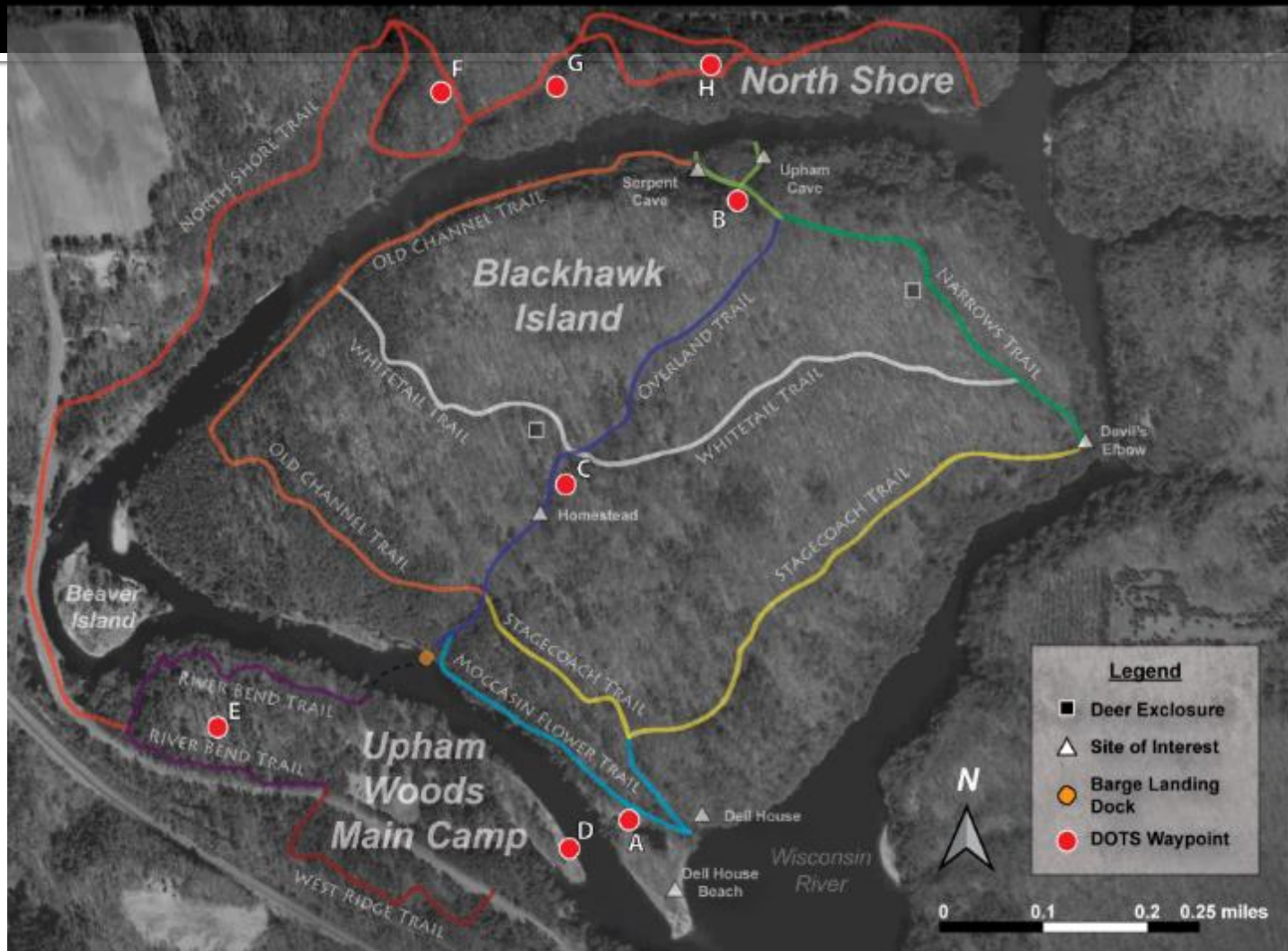
- Use both the Garmin and the map together.
- All waypoints will be on trails, so **DO NOT** leave the trails.
- If it is too dark to see the screen, press the 'light' button on the side.



<http://www.uwex.edu/ces/11/uphamwoods/>  
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# Navigator



# Media Specialist

- Captures photos and videos of the group
- Downloads stills from wildlife cameras
- Shares scientific story with others through images, movies, and writing



## Media Specialist

**Tools:** Garmin Virb, keys, and tablet to upload pictures

**Purpose:** A handheld camera designed to record images on the go. The media specialist is responsible for recording the team's experience through images and videos.

**Tasks:** At each viewpoint and while travelling, take pictures and record images that may help explain to viewers what the team is doing. Document things as you see fit.

**How-to:**

1. Turn on the Garmin Virb by holding down the button on the side labeled 'mode' until the green light appears.
2. To record an image, press the button labeled 'OK'.
3. To record a video, slide the bar forward in the direction of the red 'back'.
4. Turn the Garmin Virb off by holding down the 'mode' button until the green light turns off.
5. Remove the SD card from the trail camera at each location. Use the key that is the same color as the lock to unlock the camera.
6. Remove the iPad from its case.
7. Insert the card into the card reader.
8. Plug the card reader into the iPad.
9. The 'Photo' tap should open.
10. Select which images you would like to download onto the iPad and press 'import'.
11. Do not delete the images.
12. Return the SD card to the trail camera and relock the device.

**Helpful Hints:**

- Before recording images, ensure that there is an SD card in the Garmin Virb.
- Use the color coded keys to unlock the boxes accordingly.





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MOULTRIE



52°F



07/29/2014

02:49AM

MOULTRIECAM



# Meteorologist

- Collects atmospheric data
  - Temperature
  - Wind speed
  - Relative humidity
- Finds and explores microclimates



## Meteorologist

**Tool:** Kestrel 4000 Pocket Weather Tracker.

**Purpose:** A handheld weather station. Take this instrument with you to determine microclimates across Upham Woods and Blackhawk Island and note the differences.

**Task:** At each viewpoint, measure the wind, temperature, humidity, and altitude.

### How-to:

1. Turn on the Kestrel 4000 Pocket Weather Tracker by holding the red power button in the lower left.
2. The home screen should appear. Make note of the time of your observation.
3. Press the down arrow to begin seeing the data. They are as follows:
  - a. Wind - measured in miles per hour (mph). Make sure to cover the plastic cap from the anemometer so the wind can blow through it.
  - b. Temperature - given in Fahrenheit (°F).
  - c. Chill - Wind chill. This measures how cold it feels when the wind and the temperature are combined together. Measured in Fahrenheit (°F).
  - d. Humidity - the amount of moisture in the air. Measured in a percentage (%).
  - e. Heat Index - a combination of the air temperature and the humidity to describe how hot a person feels. Measured in Fahrenheit (°F).
  - f. Dew Point - the temperature at which the water in the air would be condensed and come down as rain. Measured in Fahrenheit (°F).
  - g. Wet bulb - wet bulb temperature. This refers to the lowest temperature that can be reached by evaporating water into the air. It will always be equal to or less than the air temperature. Measured in Fahrenheit (°F).
  - h. Bar - barometric pressure. This is the force exerted on you by the tiny particles in the air. Measured in inches of Mercury (inHg).
  - i. Altitude - the height of a location above sea level. Measured in feet (ft).
  - j. Dens Alt - density altitude. Pressure altitude corrected for non-standard temperature. Measured in feet (ft).
4. After all of the screens, the down arrow will lead you to User Screens 1, 2, and 3. This will show each measurement in order, using just a symbol. User Screen 1 has the three measurements that need to be recorded on it.
4. Remember to turn off the instrument by holding the power button.

### Helpful Hints:

- If at any point the screen shows the same name (for example "Wind"), but the maximum (Max) and average (Avg) readings, or a screen with a line that says "for data" at the bottom, that means one of the sideways arrows was pressed. Continue pressing one of the side arrows until the main screen reappears.
- If it is too dark to read the screen, press the button with a half-colored-in circle in the upper right. That will turn the screen light on. To turn the light off, press the same button again.
- To store data and revisit it later, press the camera button in the upper left. By pressing this button, every measurement will be stored and can be revisited at a later time.



Extension

<http://www.uwex.edu/ce/4000/UphamWoods>  
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# Meteorologist



# Thermal Investigator

- Uses atmospheric data to make predictions of surface temperatures
- Tests predictions to find the warmest and coldest objects in the study site

 **Thermal Investigator**

**Tool:** Kintex Infrared Thermometer

**Purpose:** A handheld IR thermometer designed to show the temperature of an object.


**Task:** At each waypoint, find the hottest living organism (not a tree/saple) and the coldest nonliving object.


**How-to:**


1. Turn on the Infrared Thermometer by pressing the center button labeled "ON/OFF".
2. Aim the thermometer at an object and hold down the button on the back.
3. A red light will appear on the object you are measuring.
4. Note the temperature that appears on the screen.
5. The thermometer will turn off automatically.


**Helpful Hints:**

- Pressing the button labeled "ON/OFF" will switch the reading from Celsius to Fahrenheit.
- DO NOT point the thermometer at anyone's face.



 <http://www.uwex.edu/ce/fieldtools.html>  
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# Thermal Investigator



# Thermal Imager

- Collaborates with Thermal Investigator to capture interesting thermal differences in the study site visually
- Shares interesting findings with team and facilitates additional inquiry



## Thermal Imager

**Tool:** Fluke Visual IR Thermometer

**Purpose:** A handheld IR thermometer designed to show the temperature of an object.

**Task:** At each waypoint, find the boundary of hot to cold using the thermal image screen and note what objects have the highest difference in temperature.

**How-to:**

1. Turn on the IR thermometer by holding down the menu button.
2. Turn the dial on the back of the thermometer to open up the lenses.
3. Be patient while the screen is loading. Once loaded, begin pointing the thermometer at various living and nonliving objects.
4. Note that the thermometer gives readings in Fahrenheit (°F), and the thermal imaging shows warm objects as red and cold objects as blue.
5. Keep the thermometer as still as possible while pointing at an object for about ten seconds.
6. Experiment with pressing the up and down arrows. This will change the view on the screen from a video to a true thermal image and back again.
7. To create an image, press the green button on the back of the thermometer. Make sure that there is an SD card in the thermometer to store the images.
8. To look back at past data, press the menu button and scroll up or down to find what you are looking for.
9. Turn off the thermometer by holding down the menu button.
10. Turn the dial on the back of the thermometer to cover the lenses when not in use.

**Helpful Hints:**

- Make sure you are close enough to an object to get an accurate reading. Generally about an arm's length is a good distance.



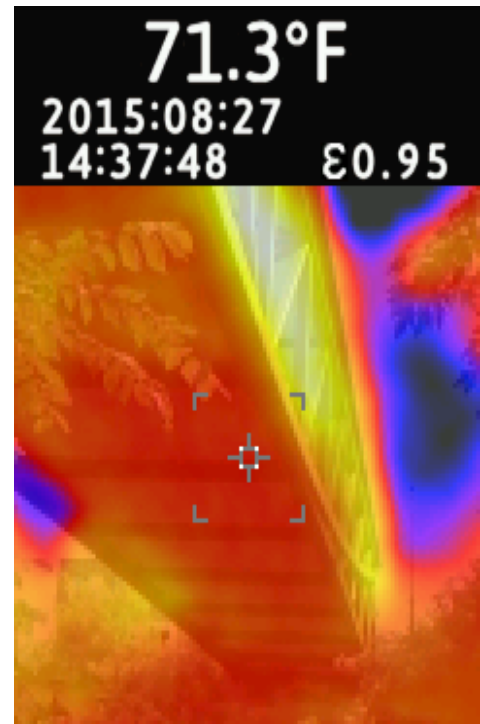
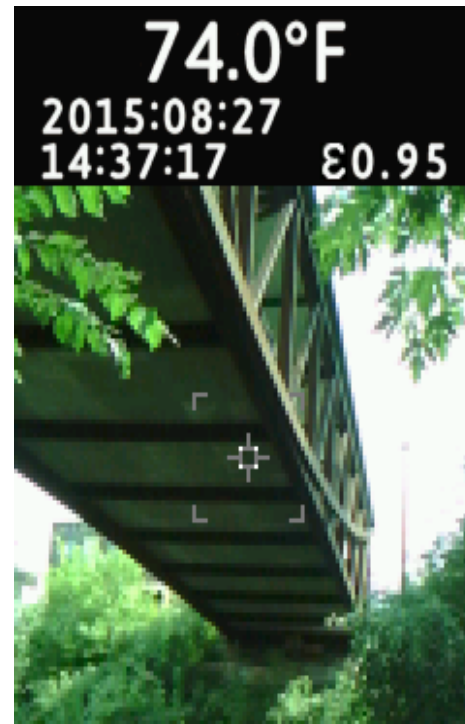
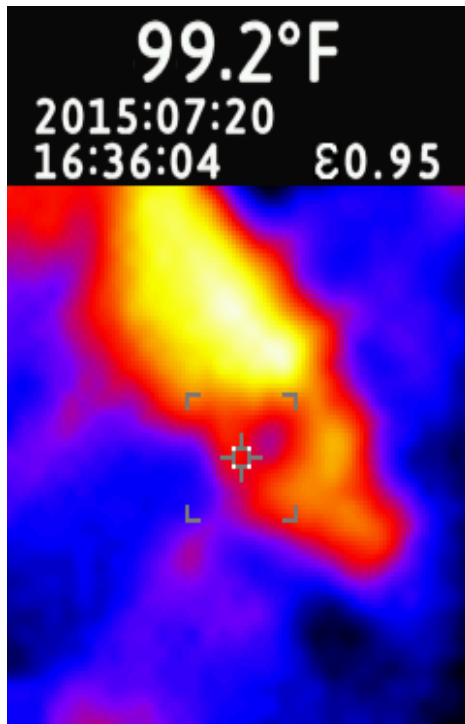
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(410) 750-6100



# Thermal Imager



# Thermal Imager



# Microbiologist

- Finds and photographs interesting microscopic patterns
- Shares findings with team members through Wi-Fi connection to iPad



## Microbiologist

**Tools:** Aven Mighty Scope and iPad.

**Purpose:** A handheld microscope that uses the tablet as a screen for the whole team to see at the same time.

**Tasks:** At each waypoint, find a living object that you have not seen at other waypoints and capture a unique adaptation that helps it survive in this microclimate.

**How-to:**

1. Turn on the microscope by sliding the switch to the 'on' position.
2. Turn on the tablet, in your team's bin.
3. Scroll to the 'Administrative' app and open it.
4. Open settings and click on the Wi-Fi.
5. When it appears, select the 'Wi-Fi' named microscope and a number.
6. If prompted for a password, enter 'uphamwoods'.
7. Go back to the main screen of the tablet.
8. Open the app on the tablet named Wi-Viewers.
9. Press the 'On' button on the lower left of the iPad.
10. Point the microscope toward an object and the image will appear on the tablet.
11. If the image is blurry, adjust the magnification by turning the yellow dial on the front of the microscope.
12. If it is too dark, adjust the light by turning the dial on the handle of the microscope.
13. To take a picture, either press the camera button on the front of the microscope or on the iPad.
14. When done, turn off the microscope and tablet.

**Helpful Hints:**

- You can freeze an image to study it more carefully by pressing the 'freeze' button on the iPad.
- You can record videos on the iPad as well.



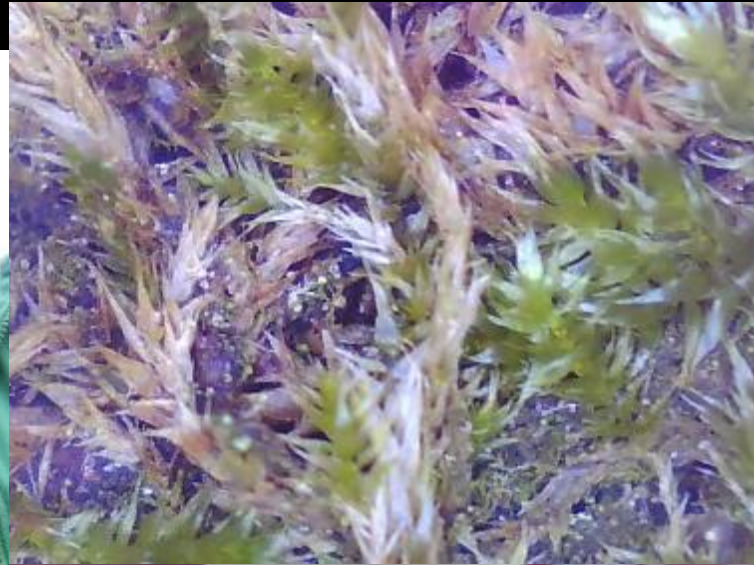


# Microbiologist



# Microbiologist







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# Research Results

Assessment Questions	Pre	Post	Difference	p value
I know about different types of technologies*	3.81	4.15	0.34	<0.001
I like to be outside	4.39	4.48	0.09	0.236
I like to use technology*	4.25	4.46	0.21	0.017
I know how to use different technologies*	3.76	4.11	0.35	<0.001
I like to use technology outside*	3.40	3.99	0.59	<0.001
I can use technology to learn	4.33	4.44	0.11	0.12
I care about nature	4.57	4.52	-0.04	0.53
I use technology at home	4.38	4.51	0.13	0.098
I can use technology to have fun*	4.35	4.54	0.20	0.024
I like to look at birds*	3.53	3.87	0.34	<0.001
I like to look at plants*	3.57	3.97	0.40	<0.001
I want to learn more about technology	4.15	4.29	0.15	0.123

Students were asked the above questions before and after the EARPOD lesson. Answers were collected on a five-point Likert scale (1=strongly disagree, 2=disagree, 3=neutral, 4=agree, 5=strongly agree). The average response was calculated with the total paired student responses (n=136). Differences in the average between pre and post assessment were then calculated. To test for significance, a paired t-test was calculated for each assessment question. \*Assessment questions that have significantly different post assessments scores when compared to pre assessments. This means that the measured change in response is due to the EARPOD lesson and not random error.

# EARPOD Conclusions and Take Home Messages

- Increase student's eagerness to use technology outside by showing them the capabilities of technology
- Improve student confidence in scientific observation skills by using technology
- Increase student awareness of technology tools available for learning
- Increase student knowledge of plant biology and science careers in an exciting way

# Teacher Reflections

***"The students spent more quality time observing leading to more purposeful writing."***

*Mary Roberts 5<sup>th</sup> grade teacher, Portage Elementary*

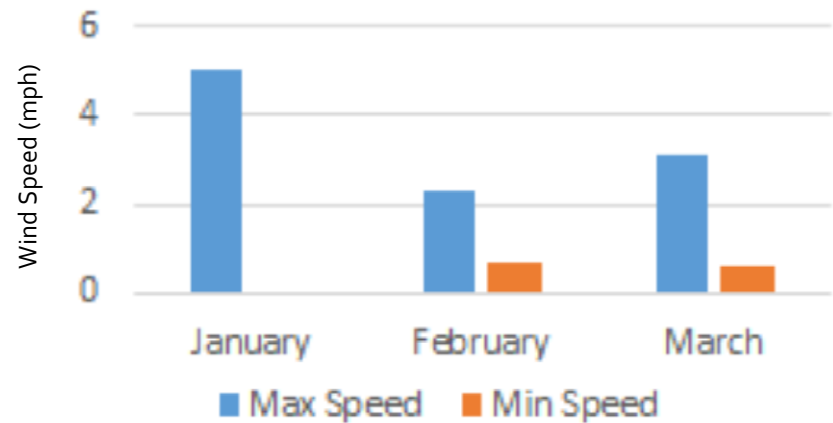
***"The students were able to see and make connections from educational readings to real life situations (Aha moments)."***

*Amy Luebke 5<sup>th</sup> Grade Teacher, Lake Delton Elementary*

***"Scientific thinking allowed them to have better understanding and processing due to practical data."***

*Mary Roberts 5<sup>th</sup> grade teacher, Portage Elementary*

Minimum and Maximum Wind Speeds per Month



***"Students understood negative and positive numbers much more completely due to thermometer work."***

*Amy Luebke 5<sup>th</sup> Grade Teacher, Lake Delton Elementary*

# *Software & Mobile Apps*

- Formatted for desktop, optimized for smaller computers and touchscreens, programmed for tablets & smartphones? (different programming considerations & languages)
- Need WiFi or cellular connection or not?
- Ability to store and share data?
- Designed as a learning resource?
- Enhance or distract from the outdoor education experience?



# Field Friendly Apps

- WiFi or cellular is not needed.
- Purposely designed and chosen to enhance learning experience.
- Data gathering - pics, video, sounds, learner collected scientific data,...
- Learning tools - identification, healthy data ranges, geospatial features & maps, access to scientific data,...

[Fieldfriendlyapps.org](http://Fieldfriendlyapps.org) by Joy Kacoroski, *“Mobile devices and apps can be an appropriate and effective way to connect children to the natural world. Apps provide additional tools to enhance a child’s learning, support efforts to appeal to different learning styles, and can create a multidisciplinary approach to learning. By using apps educators are able to provide a more in depth learning experience for a child so that they can create a greater understanding of the natural world processes.”*


# Mobile Apps

- Make your own: online templates to make simple apps (e.g. The Fossilator).
- Contract with a programmer for more complex apps (e.g. Water Quality).
- Review and select from available apps (e.g. Audubon Field Guides, Leaf Snap, StoryMe).

## The Fossilator

By Source Main LLC

Open iTunes to buy and download apps.



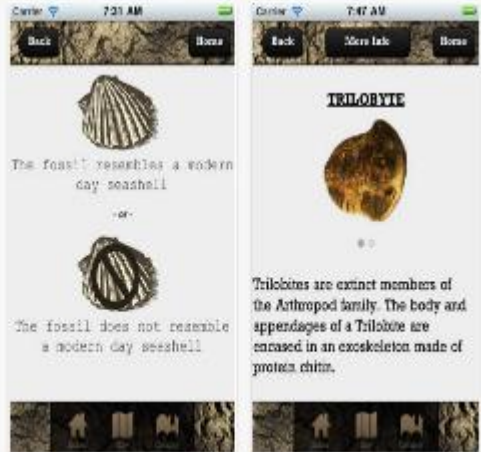
[View More by this Developer](#)

### Description

450 million years ago a good portion of the U.S. was submerged under a shallow ocean. Today many of our creeks, streams and quarries have exposed those layers of earth. Ever wonder what those little critters are that were trapped or buried in the sediment so many years ago?... Now the knowledge is a few clicks away.

[Source Main LLC Web Site](#) • [The Fossilator Support](#) • [... More](#)

### iPhone Screenshots



**View in iTunes**

**Free**

Category: Education  
Released: Jan 25, 2012  
Version: 1  
Size: 6.1 MB  
Languages: English, Spanish  
Seller: Michael Ball  
© 2012  
Rated 4+

Compatibility: Requires OS 4.0 or later. Compatible with iPhone, iPod, and iPod touch.

**Customer Ratings**

Current Version  
★★★★☆ 0 Ratings

# Water Quality mobile app


- Data collection tool and learning tool with digital field guide to basic macroinvertebrates, calculate macro PTI, chemical and physical stream data, site profile information, learning pop-ups, and export data.
- Available on Apple and Android tablets and smartphones.

**iTunes Preview** Overview Maps Video Charts

## WaterQuality

By Stroud Water Research Center

Open iTunes to buy and download apps.



**Description**  
The Water Quality app may be used for education or scientific research purposes.  
Users of all ages can learn about water quality parameters such as Dissolved Oxygen, T, colt, pH, Nutrients, Turbidity.  
[WaterQuality Support >](#) [...More](#)

**What's New in Version 1.7**  
Updated graphical assets.  
Fixed issue that made it impossible to submit a report on iPad.

[View in iTunes](#)

This app is designed for both iPhone and iPad.

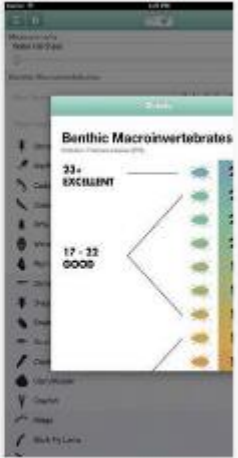

**\$4.99**  
Category: Education  
Updated: May 06, 2010  
Version: 1.7  
Size: 25.5 MB  
Language: English  
Seller: Stroud Water Research Center, Inc.  
© 2015 Northern Kentucky University  
Rated 4+

**Compatibility:** Requires iOS 6.0 or later. Compatible with iPhone, iPad, and iPod touch.

**Customer Ratings**  
We have not received enough ratings to display an average for the current version of this application.

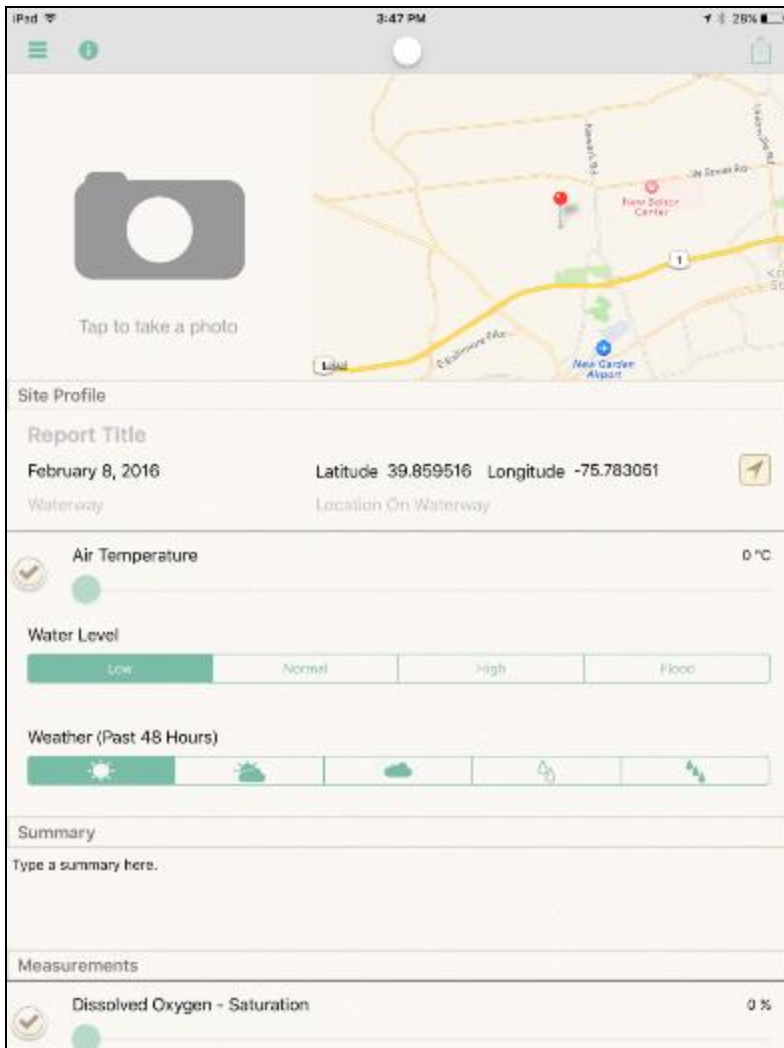
### Screenshots

iPhone iPad

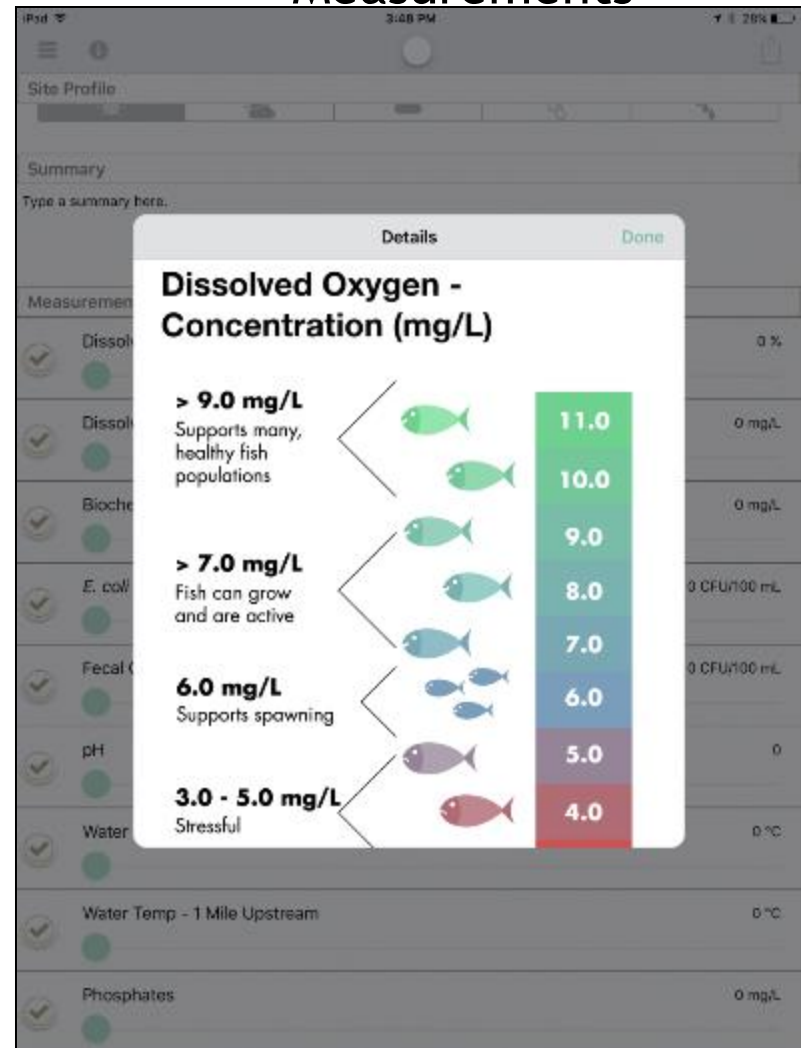


# Water Quality mobile app

## Site Profile

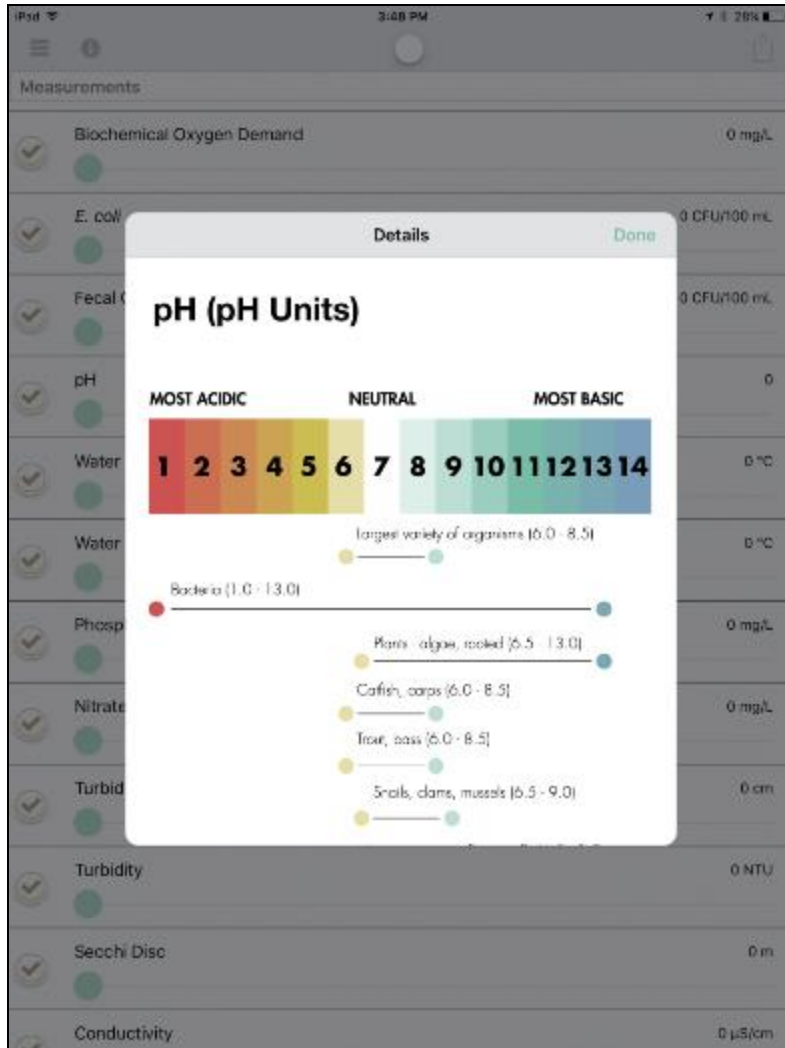


## Chemical and Physical Measurements

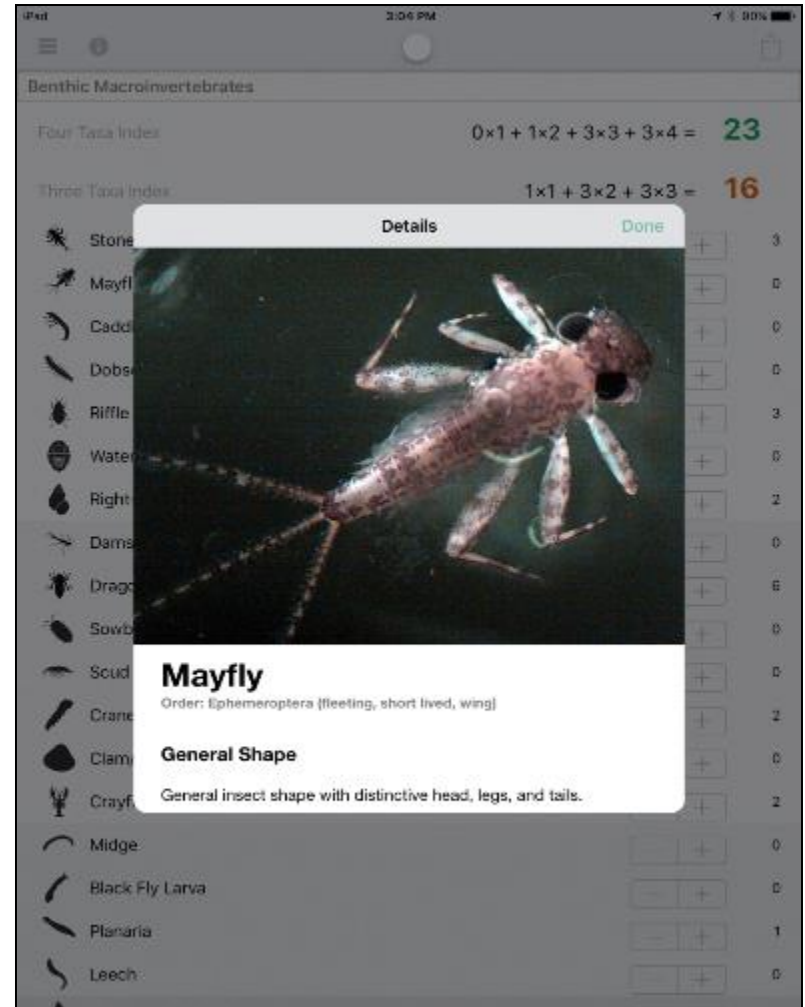


# Water Quality mobile app

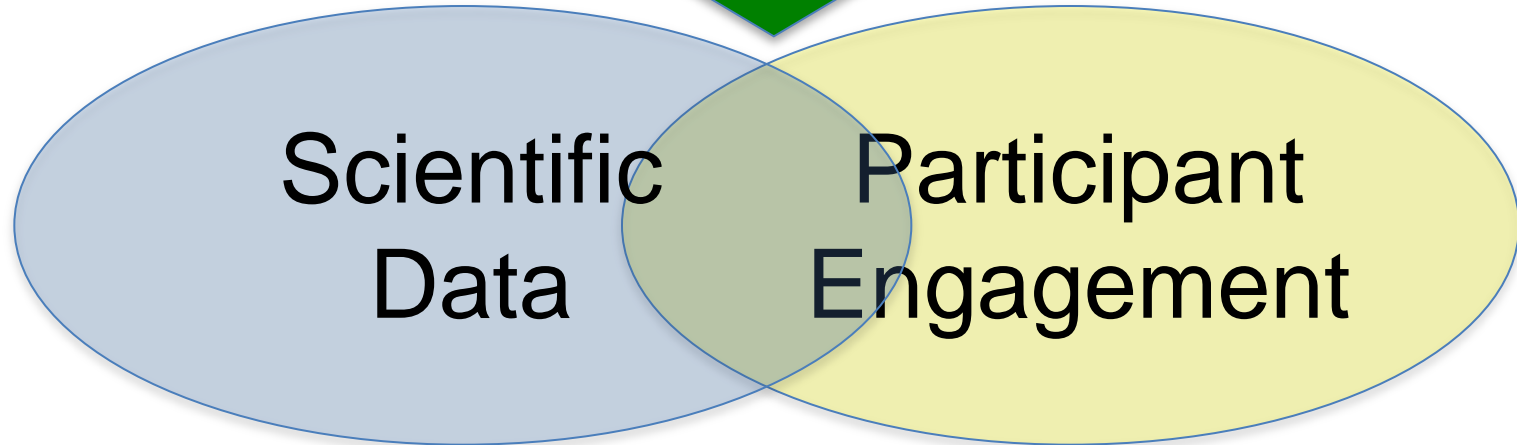
## Chemical and Physical Measurements



## Macroinvertebrate Digital Field Guide & PTI



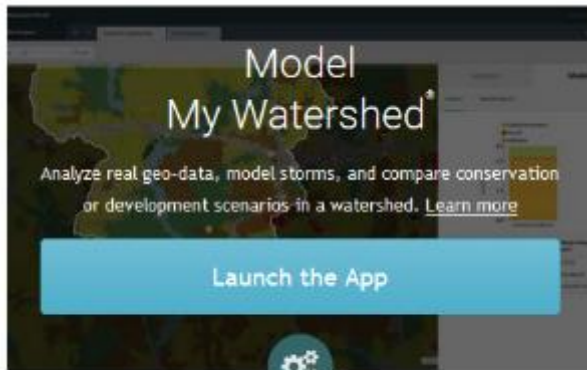
# Citizen Science



SCIENCE

# *Students as Citizen Scientists*

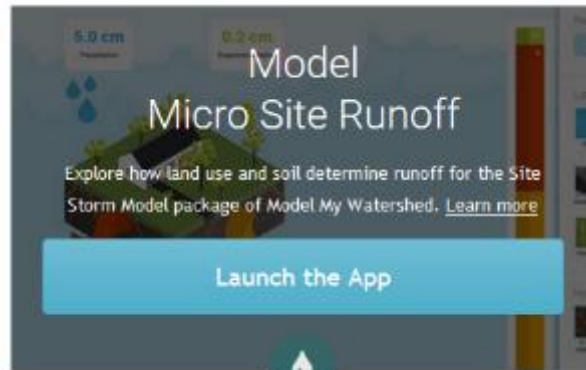

- The National Ecological Observatory Network (NEON)
- eBird
- GLOBE Program
- Digital Earth Watch Network and Picture Posts
- Kestral Watch
- Journey North
- Model My Watershed
- Leaf Pack Network
- Project Budburst
- Habitat Network
- iNaturalist
- Monarch Watch



### Model My Watershed<sup>®</sup>

Analyze real geo-data, model storms, and compare conservation or development scenarios in a watershed. [Learn more](#)


Launch the App



### Model Micro Site Runoff

Explore how land use and soil determine runoff for the Site Storm Model package of Model My Watershed. [Learn more](#)


Launch the App



### Leaf Pack Network<sup>®</sup>

Discover what aquatic insects can tell you about your stream's health by performing a simple leaf pack experiment.

Visit Leaf Pack Network



### EnviroDIY<sup>™</sup>

Join a community of do-it-yourself enthusiasts sharing open-source ideas for environmental science and monitoring.

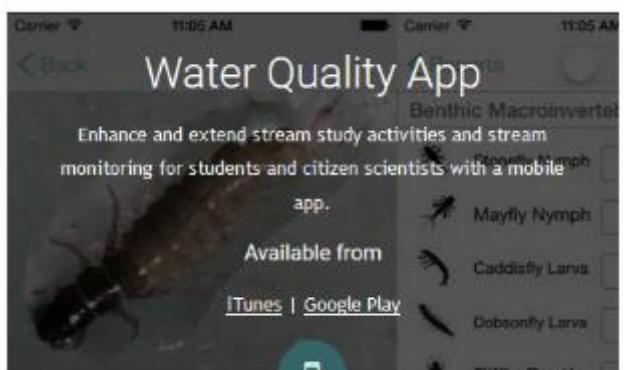
Visit EnviroDIY



### Monitor My Watershed<sup>®</sup>

See streaming data from NOAA, USGS, and more. Web app is currently limited to the Delaware River Basin. [Learn more](#)


View Real-Time Data



### Water Quality App


Enhance and extend stream study activities and stream monitoring for students and citizen scientists with a mobile app.

Available from [iTunes](#) | [Google Play](#)





# Pilot Curricula: Middle School and High School



## Innovative Technology in Science Inquiry

Username

Password

[Log In](#) [Log In with Schoology](#)

[Can't log in?](#) | [Sign Up](#)

## Innovative Technology in Science Inquiry

The Innovative Technology in Science Inquiry project engages students in STEM activities through the integrated use of technologies that include modeling, computational thinking, and real-time data acquisition. This comprehensive project will assist teachers in preparing diverse students for STEM careers by engaging them in exciting, inquiry-based science projects.

Elementary 3-4 Engineering	<h3>TES:MMW activities (2016 - 2017)</h3> <ul style="list-style-type: none"><li><a href="#">Part I: Exploring Watersheds (2016 - 2017)</a></li><li><a href="#">Part II: Conservation Practices in My Watershed (2016 - 2017)</a></li><li><a href="#">Part III: Tracking Water in My Schoolyard (2016 - 2017)</a></li><li><a href="#">Part IV: Managing Water (2016 - 2017)</a></li><li><a href="#">Part V: Modifying and Improving My Schoolyard (2016 - 2017)</a></li></ul>
Elementary 3-4 Life Science	
Elementary 3-4 Physical Science	
Elementary 5-6 Earth Science	
Elementary 5-6 Life Science	
Elementary 5-6 Physical Science	
Middle School Earth Science	

### Watershed (MS)

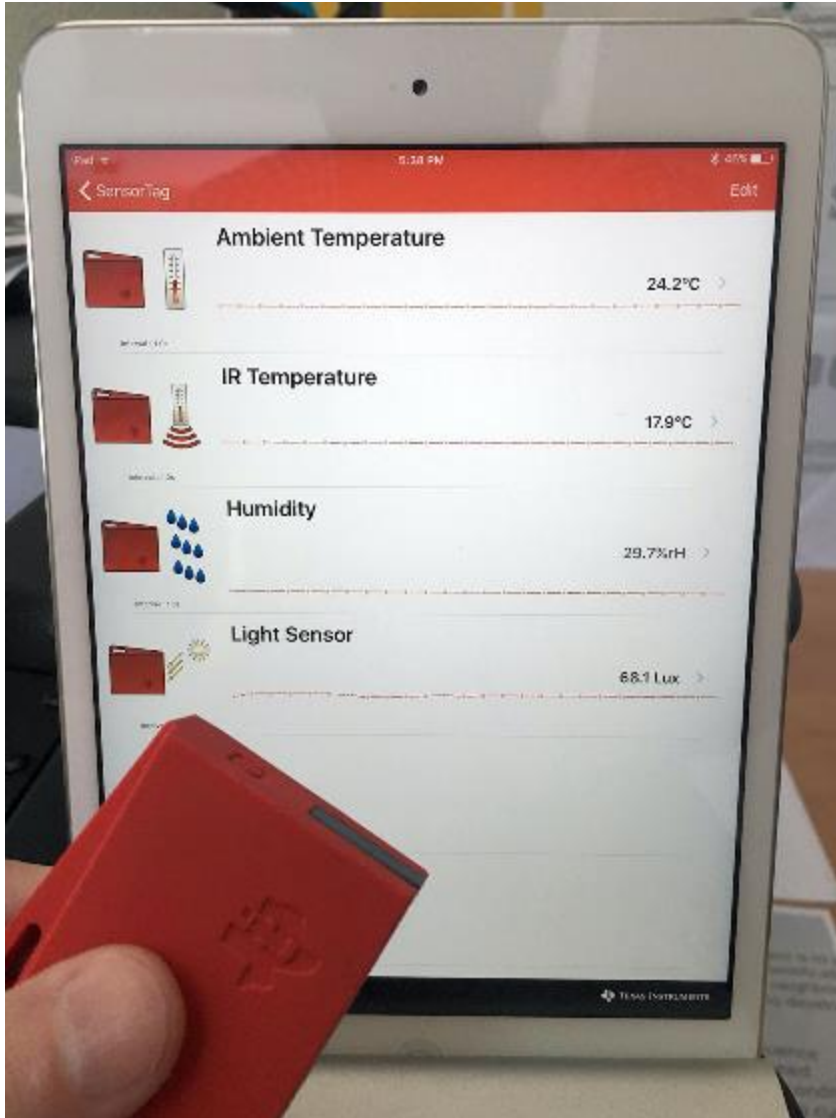
- [Optional Pre-Activity: Crumpled Paper Watershed](#)
- [Part I: What affects your watershed? \(2016 - 2017\)](#)
- [Part II: How healthy is your watershed? \(2016 - 2017\)](#)
- [Part III: How murky is your water? \(2016 - 2017\)](#)
- [Part IV: Can you filter your water?](#)

# Simulations: Micro Site Storm Model

- Animated model results from the USDA TR-55 runoff model for 24-hour rain storm over a hypothetical small unit of land with a single land cover class and hydrologic soil group.
- Students can vary land cover type, soil type and rainfall to obtain a typical water budget that petitions evapotranspiration, runoff, and infiltration.



# Sensors and Apps



- Light, temperature, humidity data collected with low-cost Blue Tooth environmental monitoring device (TI Sensor Tag).
- Students use mobile device to view sensor data then enter it in ITSI portal where the data can be viewed, graphed, and analyzed.

# Sensors

The screenshot shows the EnviroDIY website homepage. At the top left is the EnviroDIY logo, which includes a stylized tree and sun icon. To the right of the logo is a navigation menu with links for 'About', 'Mayfly', 'Community', 'Blog', 'Forums', 'Log In', and 'Register'. Below the navigation is a blue banner that says 'Presented by Stroud Water Research Center' and a 'Contact' link. The main content area is divided into several sections. On the left, there is a 'WELCOME TO ENVIRODIY™' section with a paragraph of text and a link to 'Find out how to get started'. Below that is a 'MAYFLY DATA LOGGER' section with links for 'Getting Started With Mayfly', 'Hardware', 'Board Features', 'Jumper Settings', and 'Starter Kit'. The central 'Latest Posts' section features three article thumbnails. The first is 'EnviroDIY Funded! Workshop Plans for 2017' with a 'NEWS' tag, showing three men working at a table. The second is 'EnviroDIY Mayfly logger stations deployed in PA, DE and MN!' with a 'NEWS / SHOWCASE' tag, showing a Mayfly logger station. The third is 'Comparison temperature dependency: LT500, Keller Nano Level' with a 'NEWS' tag, showing a line graph. On the right side, there are two 'RECENT FORUM TOPICS' and 'RECENT FORUM REPLIES' sections. The 'RECENT FORUM TOPICS' section lists 'Using PlatformIO with Mayfly by Sara Damiano' and 'Looking for a bare-bones 16 bit 0-5V dc'. The 'RECENT FORUM REPLIES' section lists 'ilicano on Arduino datalogger' and 'Shannon Hicks on Arduino datalogger'. At the bottom right is the Stroud Water Research Center logo.

**EnviroDIY**

About | Mayfly | Community | Blog | Forums | Log In | Register

Presented by Stroud Water Research Center | Contact

### WELCOME TO ENVIRODIY™

We're a community of enthusiasts sharing do-it-yourself ideas for environmental science and monitoring. This is the place to showcase gadgets, share ideas, ask and answer questions, and network with interest groups. [Find out how to get started](#)

### MAYFLY DATA LOGGER

- [Getting Started With Mayfly](#)
- [Hardware](#)
- [Board Features](#)
- [Jumper Settings](#)
- [Starter Kit](#)

### Latest Posts

**NEWS**

#### EnviroDIY Funded! Workshop Plans for 2017

Expanding EnviroDIY training with grants from William Penn Foundation and Environmental Protection Agency

**NEWS / SHOWCASE**

#### EnviroDIY Mayfly logger stations deployed in PA, DE and MN!

**NEWS**

#### Comparison temperature dependency: LT500, Keller Nano Level

### Never miss a post.

Sign up for a deliver weekly digest

#### RECENT FORUM TOPICS

- [Using PlatformIO with Mayfly by Sara Damiano](#)
- [Looking for a bare-bones 16 bit 0-5V dc](#)

#### RECENT FORUM REPLIES

- [ilicano on Arduino datalogger](#)
- [Shannon Hicks on Arduino datalogger](#)

**STROUD**  
WATER RESEARCH CENTER


# Model My Watershed

Model My Watershed: Site Storm Model

STROUP  
WikiWatershed skerlin +

McKeever Environmental - CURRENT CONDITIONS - NEW SCENARIO Compare

Precipitation 10.00 cm

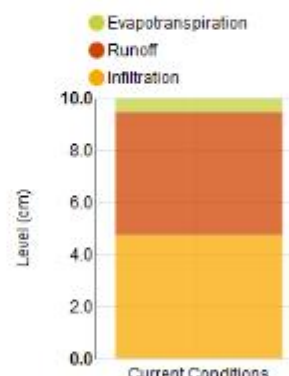


Analyze Model

RUNOFF WATER QUALITY

Results of a 24-hour hypothetical storm event as simulated by SLAMM and TR-55 model algorithms.

- Evapotranspiration
- Runoff
- Infiltration



Level (cm)

Current Conditions

Runoff Partition	Water Depth (cm)	Water Volume (m <sup>3</sup> )
Runoff	4.714	189,010.05
Evapotranspiration	0.532	21,336.70
Infiltration	4.754	190,588.92

Explore how land use and soil determine runoff with our

Map data ©2017 Google Imagery ©2017, OpenStreetMap, DigitalGlobe, U.S. Geological Survey, USDA Farm Service Agency, Leaflet Report a map error

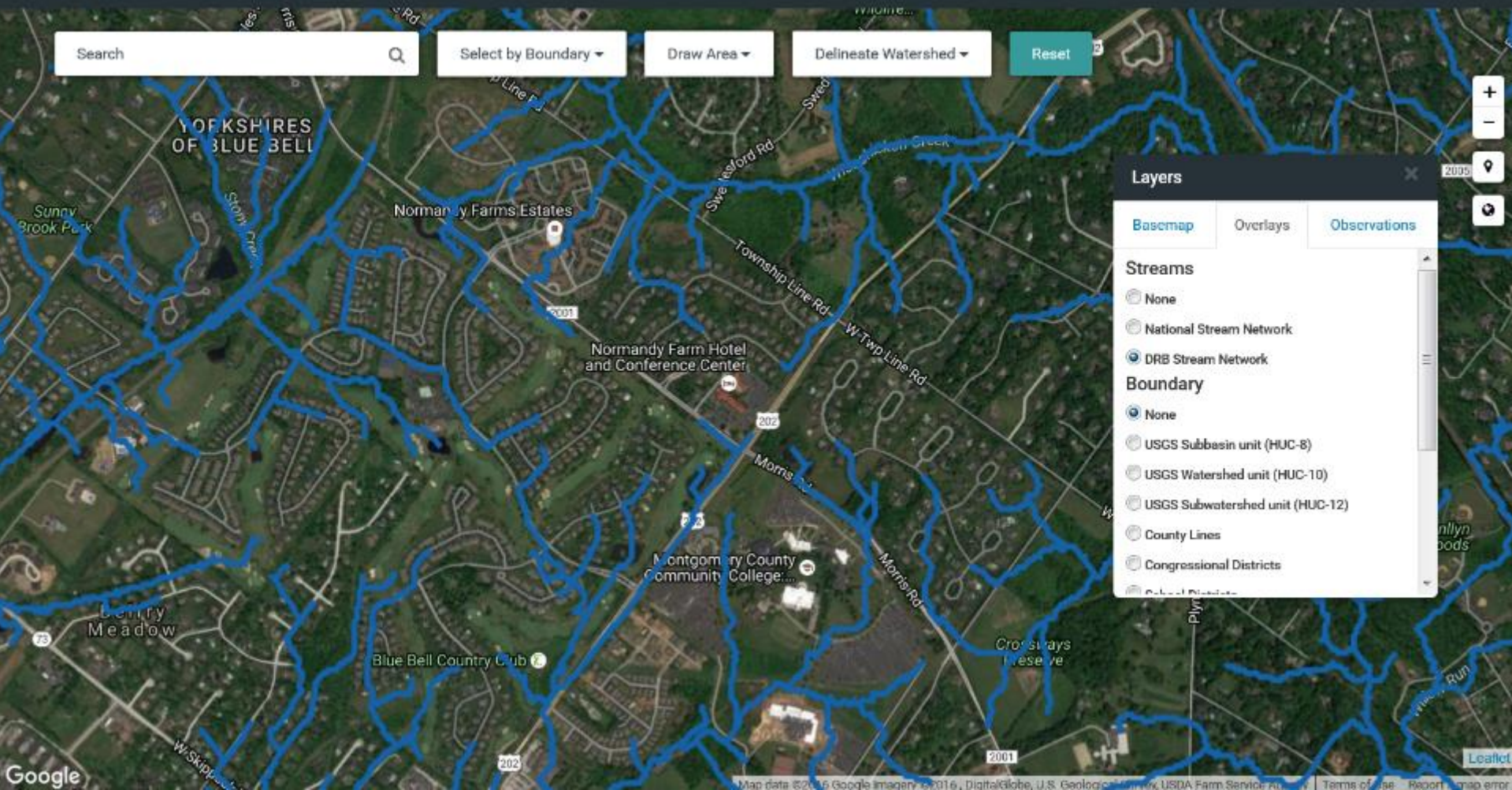
# Access to Scientific Data

- Model My Watershed users gather & analyze data and model changes in land cover and conservation practices
  - **Data:** USGS NHDplusV2 Stream Network, USGS National Land Cover data layer, USDA Hydrologic Soils data layer, USEPA National Climate Data, ESRI and Google terrain maps, county animal surveys, point source discharges, Stream Reach Assessment Tool water quality data, real-time USGS River Gauge Stations.
  - **Model My Watershed boundaries for analysis:** USGS Subbasin Units (HUC-8, 10, & 12), counties, congressional districts, school districts, PA municipalities, free draw a polygon to study, 1 square Km, or delineate a watershed from any point.

# Model My Watershed: Stream Network Overlay

Model My Watershed: Choose Area of Interest WikiWatershed skerlin

Search  Select by Boundary ▾ Draw Area ▾ Delineate Watershed ▾ Reset



**Layers**

- Basemap
- Overlays
- Observations

**Streams**

- None
- National Stream Network
- DRB Stream Network

**Boundary**

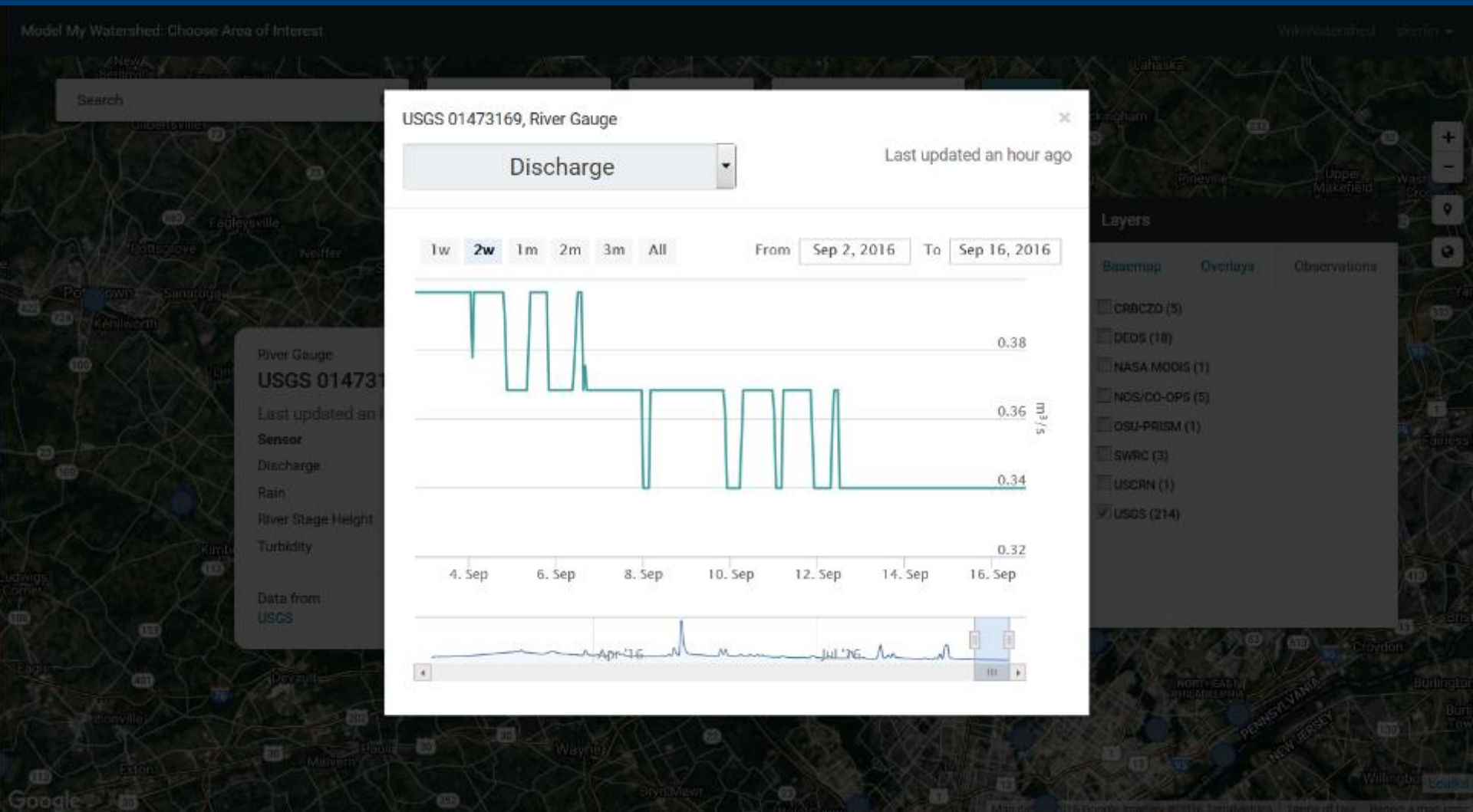
- None
- USGS Subbasin unit (HUC-8)
- USGS Watershed unit (HUC-10)
- USGS Subwatershed unit (HUC-12)
- County Lines
- Congressional Districts
- School Districts

Map data ©2016 Google Imagery ©2016, DigitalGlobe, U.S. Geological Survey, USDA Farm Service Agency, Terms of Use Report map error





# Observation Data - USGS



# Modeling Using Real Scientific Data

## Land Cover

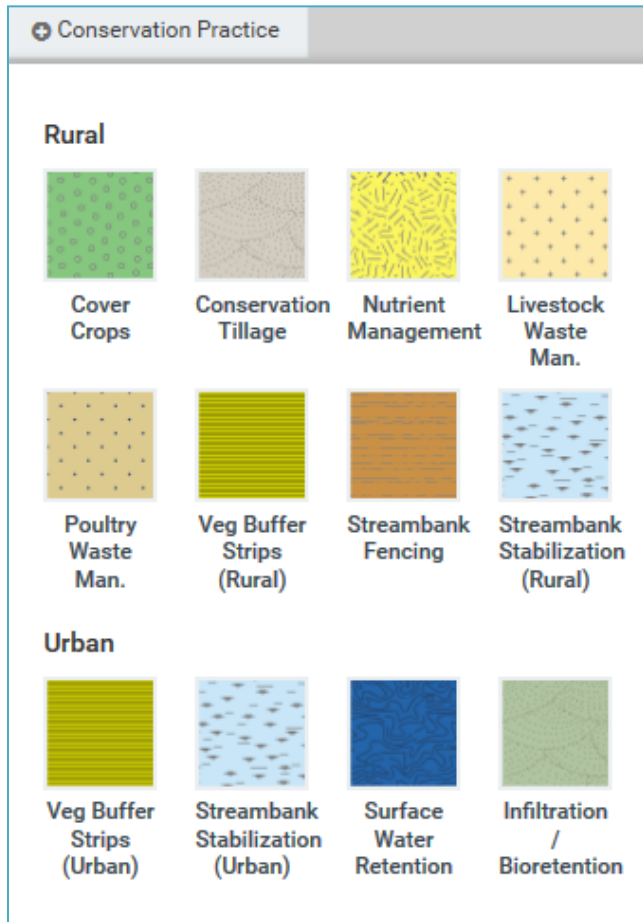


## Conservation Practices



- Design & model scenarios to improve their local watershed by changing land cover (land use) and proposing conservation practices (best management practices)
- **Site Storm Model** a 24 hr. storm event: hybrid of TR-55, SLAMM, FAO, & STEP-L professional models
- **Create scenarios** changing land cover and conservation practices

# Modeling Using Real Scientific Data



- Design & model scenarios to improve their local watershed by changing land cover (land use) and proposing conservation practices (best management practices)
  - **Watershed Multi-Year Model** using Mapshed, customized version of GWLF-E watershed simulation
  - **Create scenarios** of proposed conservation practices

# MMW: Land Cover Changes (+)

Model My Watershed: Site Storm Model

McKee Environmental | CURRENT CONDITIONS | DEVELOPMENT & FARMS | CONSERVATION PRACTICES & FOREST

Land Cover | Conservation Practice | Precipitation: 10.00 cm

11 Modifications

Analyze | **Model**

RUNOFF | WATER QUALITY

Results of a 24-hour hypothetical storm event as simulated by SLAMM and TR-55 model algorithms.

- Evapotranspiration
- Runoff
- Infiltration

Runoff Partition	Water Depth (cm)	Water Volume (m <sup>3</sup> )
Runoff	4.337	173,866.80
Evapotranspiration	0.513	20,554.96
Infiltration	5.151	206,513.92

Explore how land use and soil determine runoff with our

# MMW: Multi-year Model - Hydrology

Model My Watershed: Watershed Multi-Year Model



WikiWatershed sketlin

McKeever Multi-Year

CURRENT CONDITIONS

CONSERVATION PRACTICES

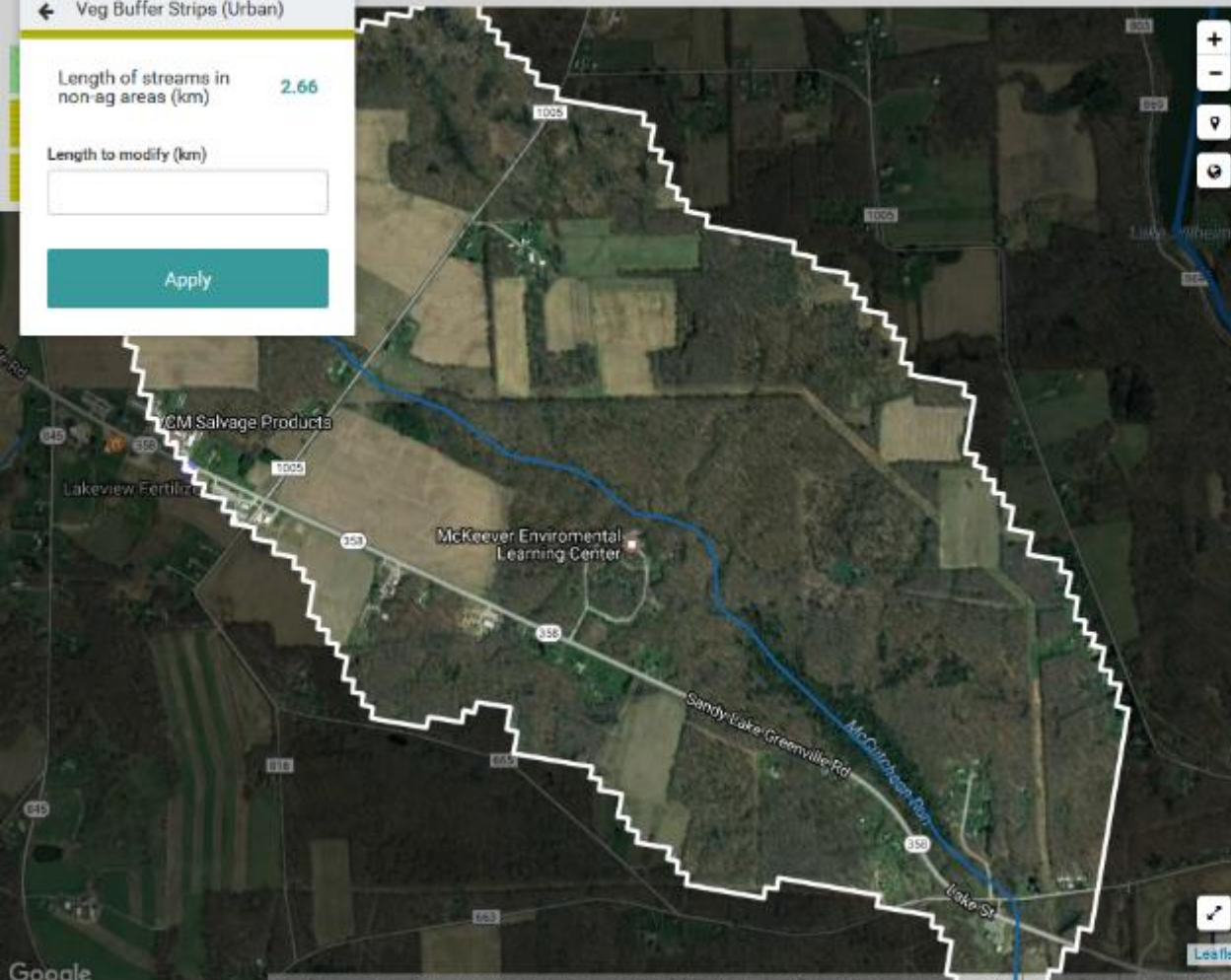
Conservation Practice

Veg Buffer Strips (Urban)

Length of streams in non-ag areas (km) **2.66**

Length to modify (km)

Apply



Analyze

Model

HYDROLOGY

WATER QUALITY

Average monthly water fluxes in centimeters from 30-years of daily water balance simulated by the GWLF-E (MapShed) model.

Precip



Month	Precip (cm)	ET (cm)	Surface Runoff (cm)	Subsurface Flow (cm)
Jan	5.41	0.25	0.96	3.07

# Take Home Ideas

- Carefully review and select technologies and apps to enhance outdoor education.
- Treat technology as any other educational resources.
- Students as citizen scientists using technology for access to data, sharing their data, and making sense of data.
- Use tech to engage 21st Century Learners.
- Use tech to extend learning beyond the classroom to outdoor learning and out of school learning.

# 2017 NAAEE Strand: Applying Research to Increase our Impact

## **2017 NAAEE, October 17-21, San Juan, Puerto Rico**

- *Cutting-edge research that is important and relevant to all environmental educators*
- *Linking research and practice: applying what we know to what we do*
- *Strategies for evaluating and improving environmental education programs*
- *Using research results to influence decision makers and demonstrate the value of EE*
- *Developing shared outcomes that allow us to better measure our collective impact*
- *Research and case studies about the benefits and challenges of learning and teaching in outdoor settings and in a culturally relevant context.*

This strand has always- and continues to- interrogate the question - What is the role that research plays in our practice as Environmental Educators? For 2017, we invite practitioners and researchers to submit proposals that advance meaningful discourse around science and the environment. To this end, we are seeking submissions that address how our field uses research findings to not just build our programs, but engage stakeholders, communities and citizens across the political spectrum.

We are also seeking proposals that include examples of programs that have undergone robust evaluation and/or empirical research studies that can promote best practices for practitioners as well as advance the community of scholarship contributing to the research-based tradition of our field. Proposals should advance the entire field of environmental education, not simply promote an individual successful program.

Go to <https://naaee.org/conference> to submit your proposal and volunteer to be a reviewer by April 10.

# Thank you!

Justin Hougham, Ph.D.  
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Upham Woods Outdoor  
Learning Center  
University of Wisconsin -  
Extension  
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[stroudcenter.org](http://stroudcenter.org)  
[wikiwatershed.org](http://wikiwatershed.org)

Go to <https://naaee.org/conference> to submit your EE research to practice presentation proposal and volunteer to be a reviewer.