WATERS

Watershed Awareness using (Free) Technology and Environmental Research for Sustainability

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WATERS

The WATERS project increases student interest in STEM careers while building environmental awareness about watersheds.

FOCUS AREA
Data Science Education, Engineering & Science Connections, STEM Models & Simulations, Tools for Inquiry

SUBJECT
Earth & Space Science

GRADE
Middle School

Importance

Across the country, every minute of every day, water glasses are filled from a tap, toilets are flushed, laundry is washed, and bathtubs are filled almost without a thought as to how the water got there, where it goes when it leaves, or who helps to assure that our water is safe. As the need for clean water increases with a growing population, so does the need for increased participation in water careers. Students from all backgrounds should learn about their local watersheds as well as the wide variety of available water careers.

The Watershed Awareness using Technology and Environmental Research for Sustainability (WATERS) project is developing and researching a student-centered, universally accessible curriculum for teaching water concepts and water career awareness. The project is applying principles from Universal Design for Learning (UDL) to create a powerful, scalable approach to water learning open to all students. By providing flexibility in information presentation and student responses, reducing barriers in instruction, and offering appropriate supports and challenges, the WATERS project is paving a path to increased access to proven curricula and approaches that hold the potential to greatly increase awareness of and engagement with water concepts and career pathways in learners nationwide.

https://concord.org/our-work/research-projects/waters/

Origins

*Give students access to **real** data and **real** tools in **real** places so they can make **real** decisions about their environment.*

Students will:

- *learn about watershed science*
- *explore their local watershed*
- *evaluate local watershed conditions*
- *design and test solutions to current watershed challenges*
- *engage in watershed activities/groups/causes in their neighborhood*

Water SCIENCE

Supporting Collaborative Inquiry, Engineering, and Career Exploration with Water

Middle school students from southern Arizona, central California, southeastern Pennsylvania, and eastern Massachusetts completed hands-on science at streams, and engineering activities while designing and testing water filters, received guidance and instruction from undergraduate student mentors, and learned about careers in environmental and water conservation while investigating their community's local water resources.

Grant No. DRL-1433761

Teaching Environmental Sustainability: MMW

*Give students access to **real** data and **real** tools in **real** places so they can make **real** decisions about their environment.*

Promoted geospatial literacy and systems thinking by providing students and teachers with access to scientifically valid and easy-to-use watershed tools to accurately examine their own neighborhoods, to define local environmental problems or challenges, and to develop solutions to improve their environment.

Grant No. DRL-1417722

Innovative Technology Experiences for Students and Teachers (ITEST)

Funding for the ITEST program is provided by revenue from the **H-1B visa program**, which permits overseas workers to fill vacant U.S. engineering, science or mathematics positions.

The ITEST program seeks to enrich the formal and informal learning experiences of PreK-12 students by supporting projects that:

ITEST Project STUDIO: Build Our World

Increase awareness

of STEM and ICT careers

Motivate students

to pursue the education necessary to participate in those careers

Provide students with technology-rich experiences

that develop their knowledge of related content and skills (including critical thinking skills) needed for entering the STEM workforce

WATERS STEM Careers

- ***High School Diploma / Certification***
- Associate Degree
- Bachelor's Degree or Higher

GOVERMENT & REGULATORY

- Erosion & sediment control technicians
- Conservation district officers
- ***Fish & boat commission officers***
- Extension agents
- State foresters
- Fisheries biologists
- Wildlife biologists
- Research scientists

AGRICULTURE & FARMING

- ***Farmers***
- Agricultural technicians
- Irrigation engineers
- Livestock production managers
- Biologists
- Agronomist
- Drought operations managers
- ***Firefighters***
- Soil scientist and engineers

WATER PROCESSING

- Engineers
- ***Drinking & wasterwater facility certified operators***
- Microbiologists
- Chemists
- GIS technicians
- Electrical engineers
- Programmable logic control (PLC) programmers
- Electrician
- Plumber

DEFENSE & MILITARY

- Army & Navy & Air Force–Corps of Engineers
- ***Coast Guard–marine debris specialist***
- Meteorologists
- Structural & environmental engineers
- ***Drinking & wastewater operators***
- ***Water transportation specialists***
- Hydro technicians (cleaning & operating equipment)

DESIGN & SUPPORT

- CAD technicians
- GIS analysts
- Mathematicians
- Statisticans
- Data analysts
- Computer programmers
- Graphic designers
- Landscape architects
- Electrical engineers & designers

STORMWATER MANAGEMENT

- Land use planners
- Engineers
- Landscape architects
- Wetland scientists
- Hydrologists
- Geologists
- ***Green infrastructural technicians & landscapers***
- Horticologists
- Surveyors
- GIS technicians

Figure 1. Water STEM Careers based on required levels of education

Career Videos

The Concord Consortium

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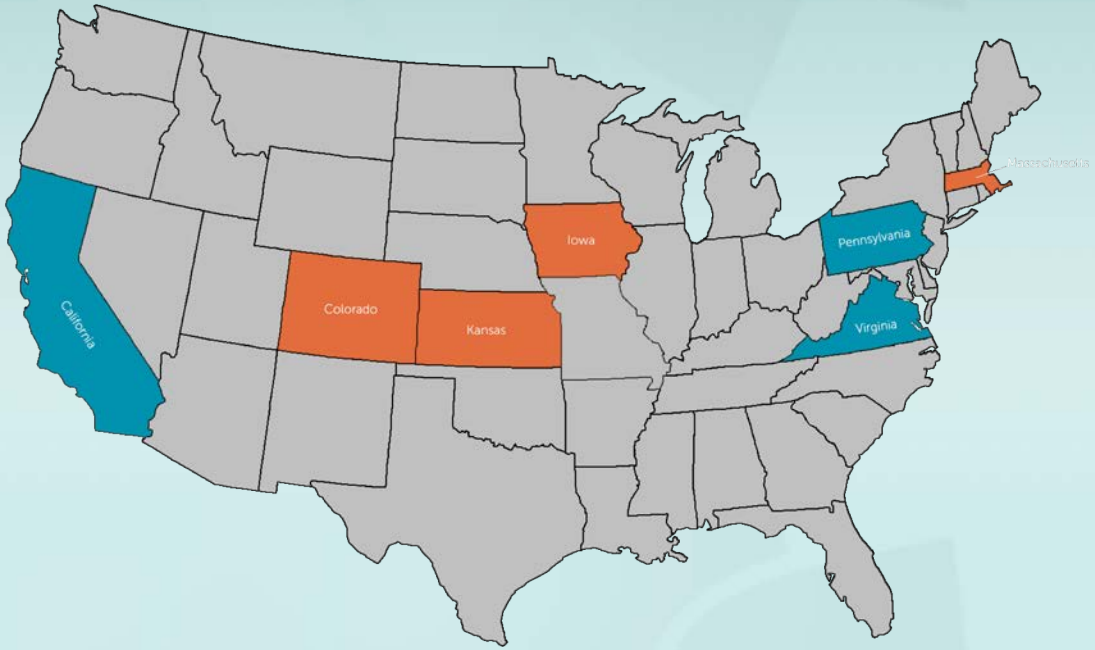
Career Videos

Ikey Sealy, Student Intern, Philadelphia Wastewater

Participants

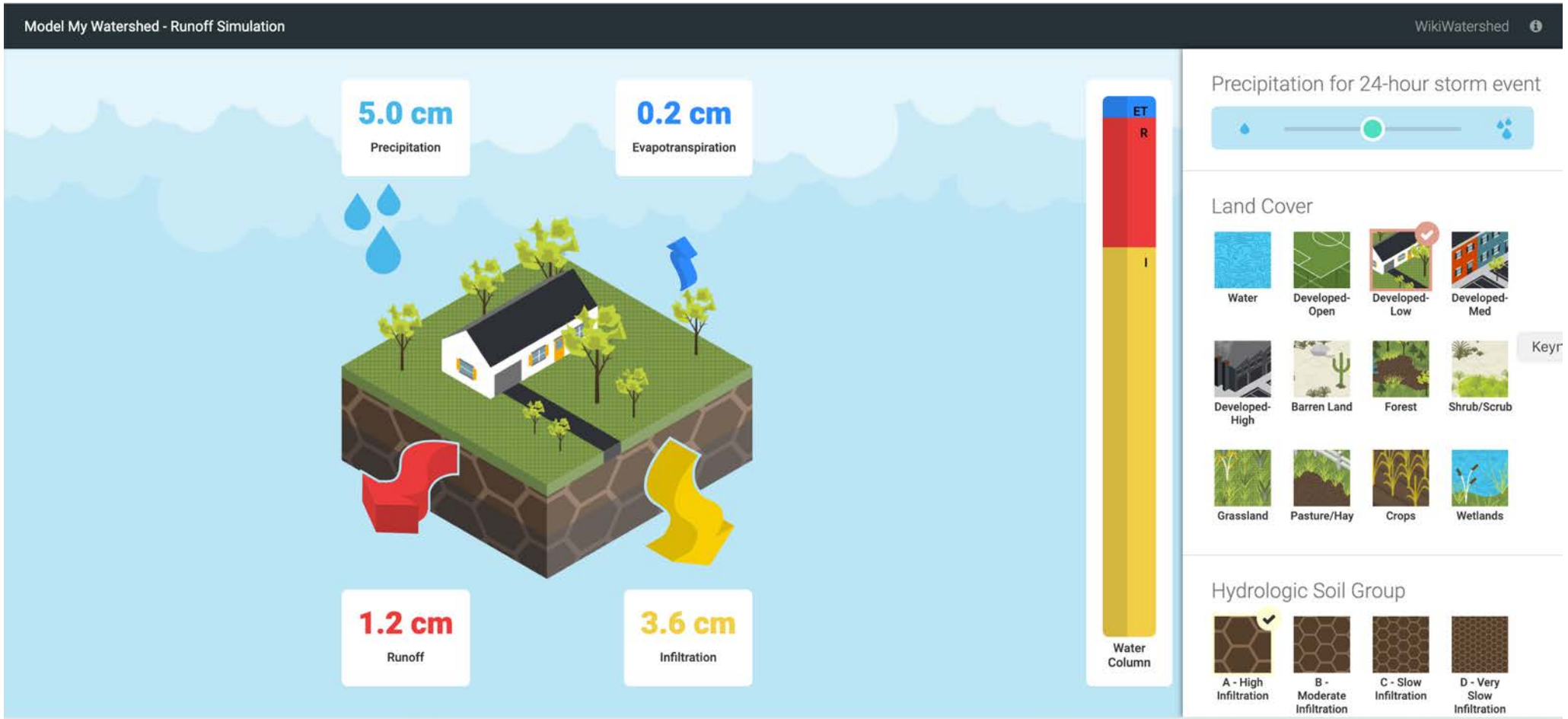
Past/Present Participating States

Past Research states:
CA, CO, IA, KS, MA,
MO, PA, and VA



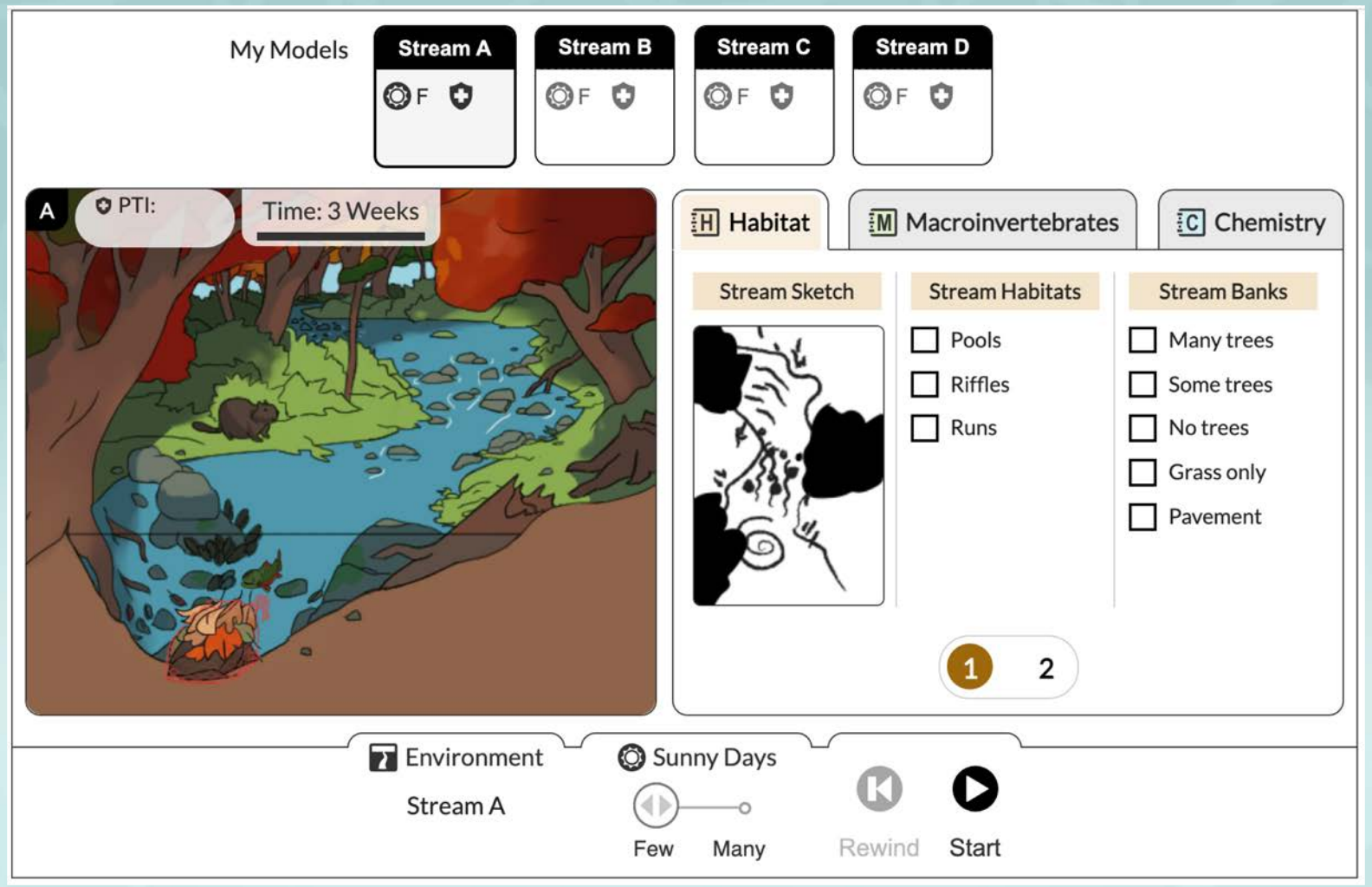
WATERS Research states (in blue):
CA, PA, and VA and now possibly OR.

Tools, Models and Resources



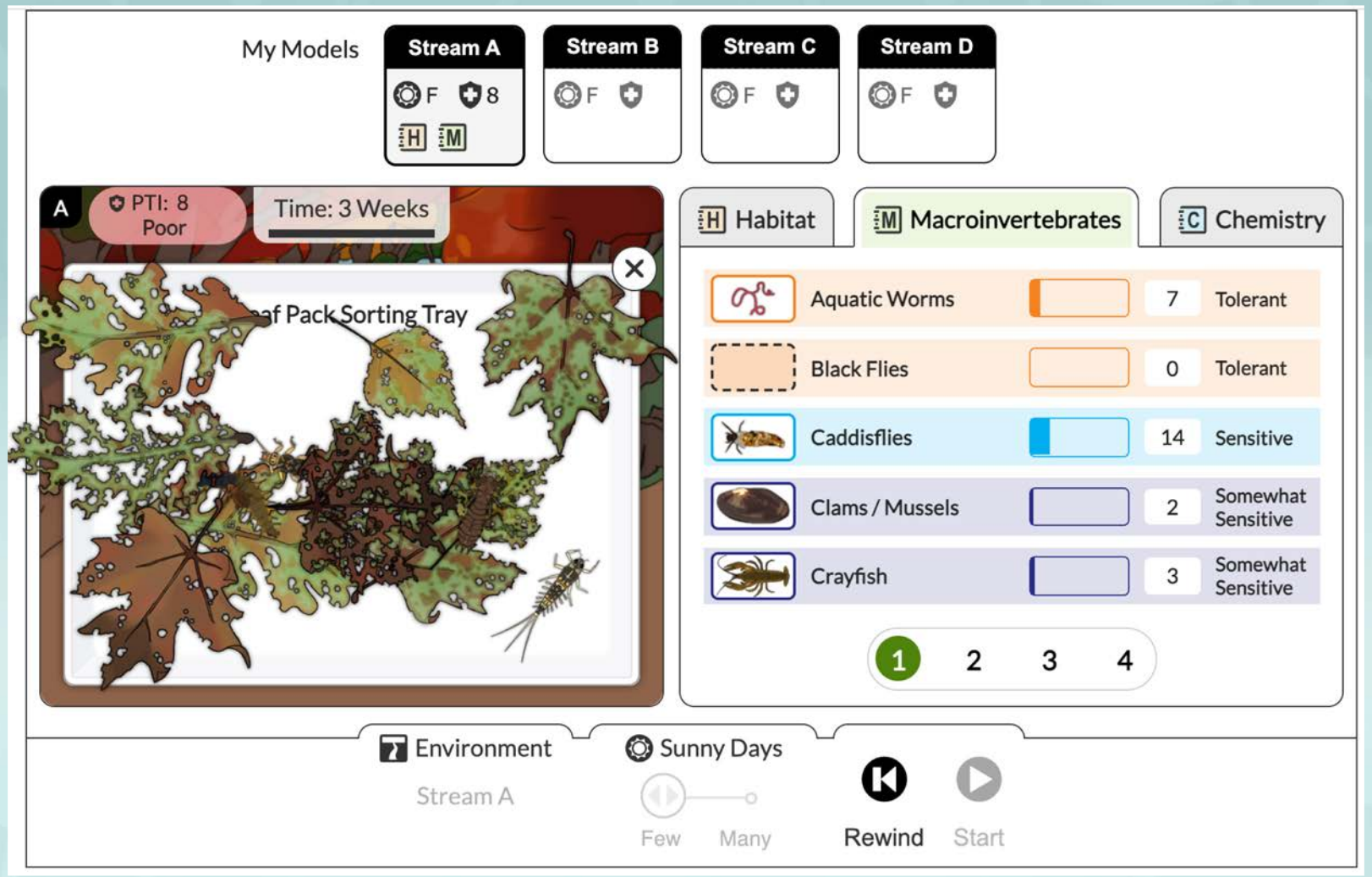
The **Runoff Simulation** animates results from applying the TR-55 runoff model developed by the US Department of Agriculture for a single 24-hour rain storm over a hypothetical small unit of land with a single land cover class and a single hydrologic soil group. Students can vary cover type, soil type and rainfall to obtain a typical water budget that petitions evapotranspiration, runoff, and infiltration.

https://runoff.modelmywatershed.org/



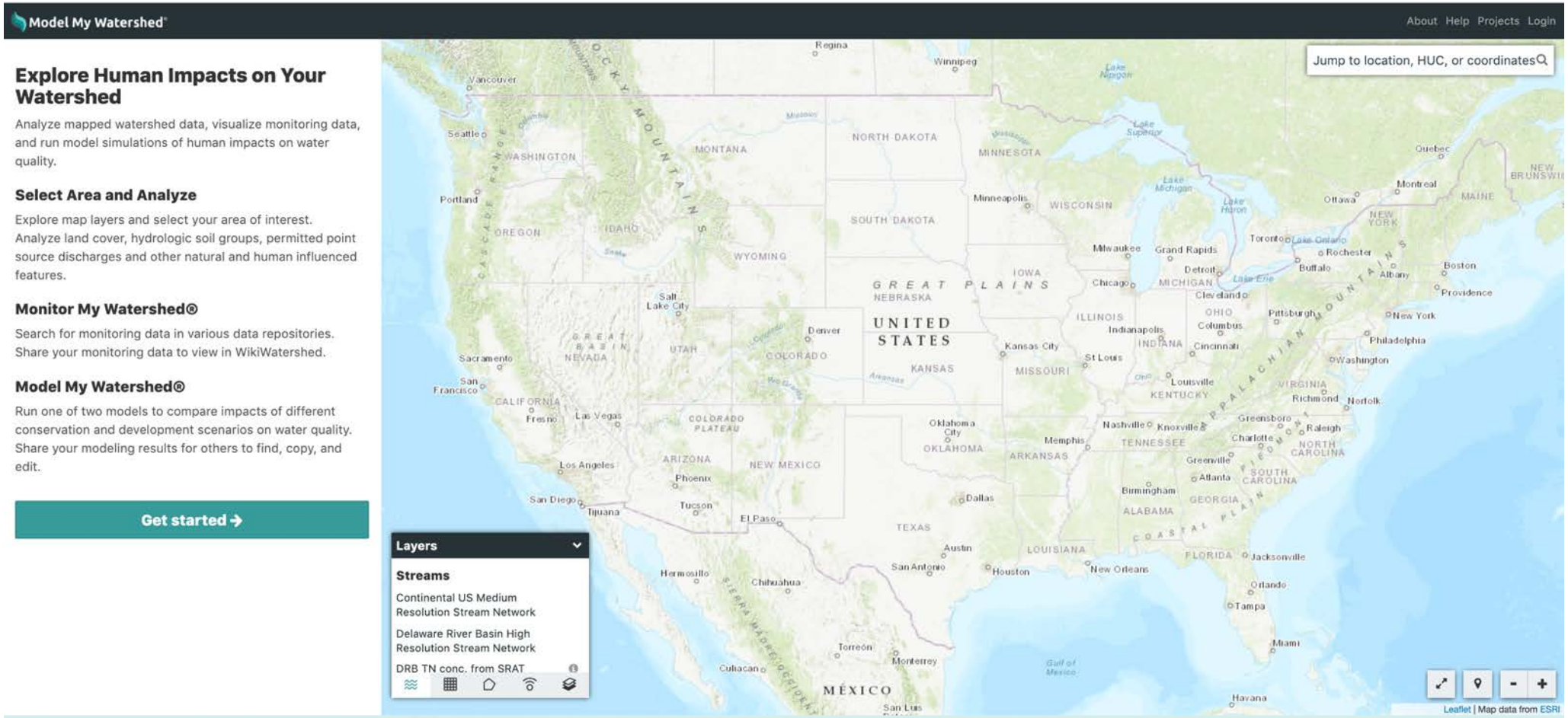
Leaf Pack Simulation

https://leaf-pack.concord.org/

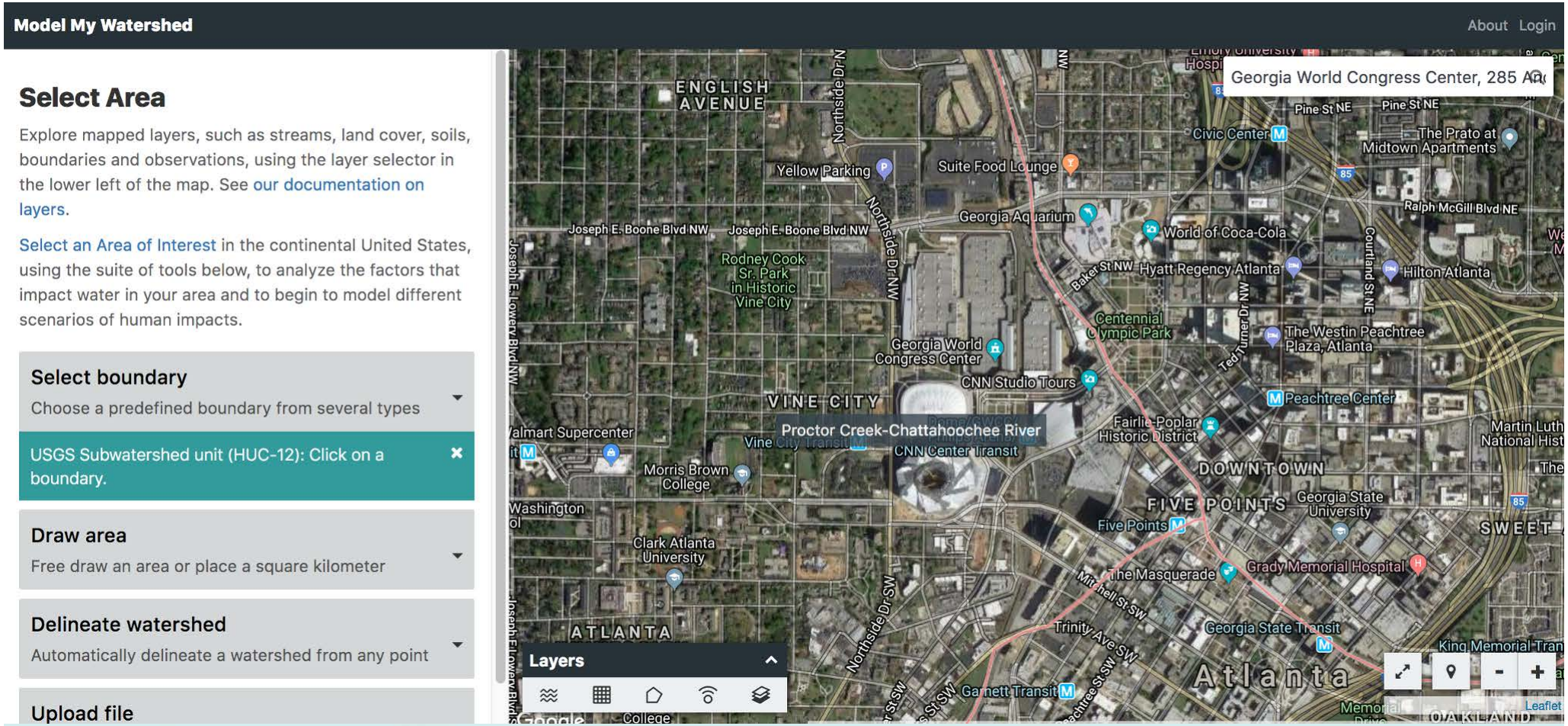


Sorting Macroinvertebrates

https://leaf-pack.concord.org/

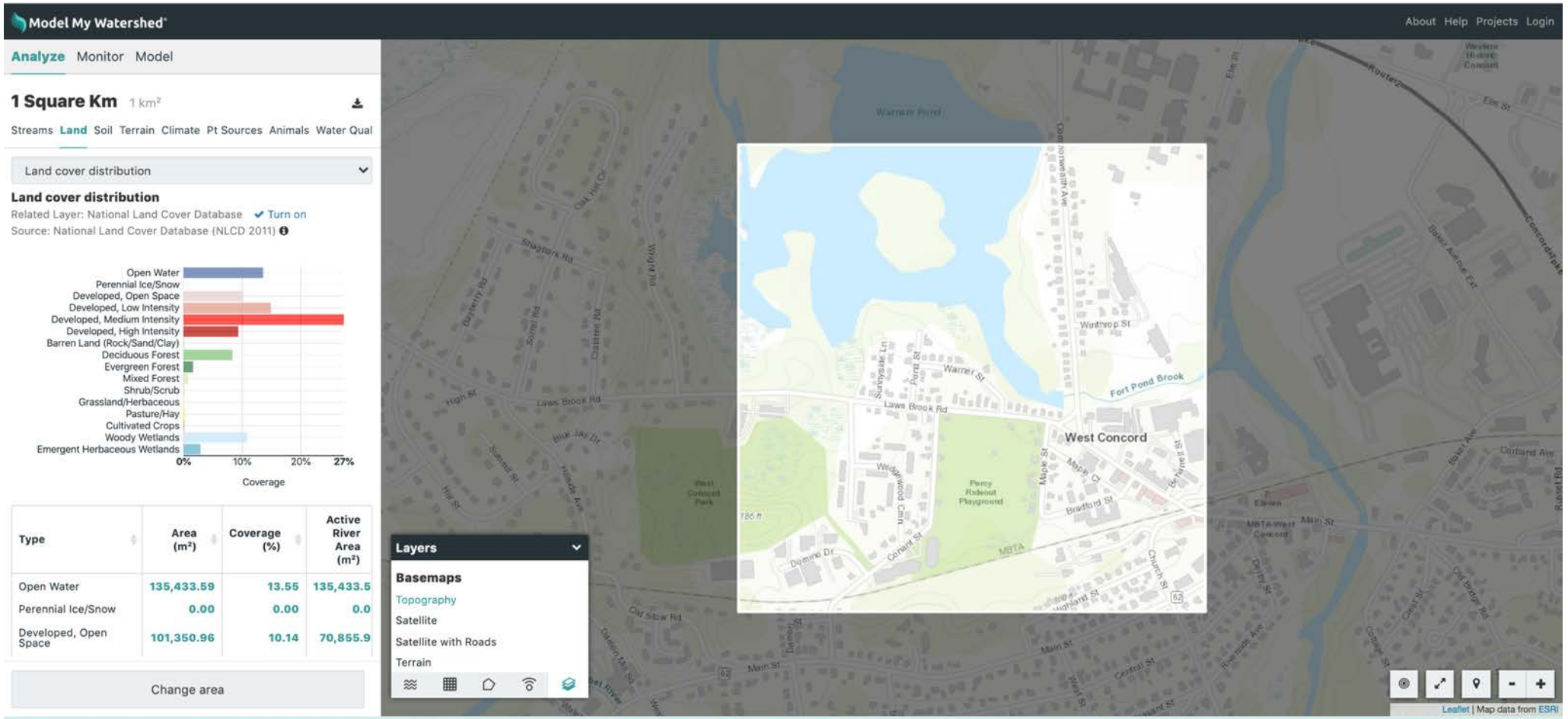


The **Model My Watershed (MMW) Site Storm Model** simulates storm runoff and water quality by applying the TR-55 and STEP-L water quality models for a single 24-hour rainstorm over a selected land area within the continental United States. The results are calculated based on actual land cover data (from the USGS National Land Cover Database 2011) and actual soil data (from USDA Gridded Soil Survey Geographic Database) for selected land cover. https://modelmywatershed.org/



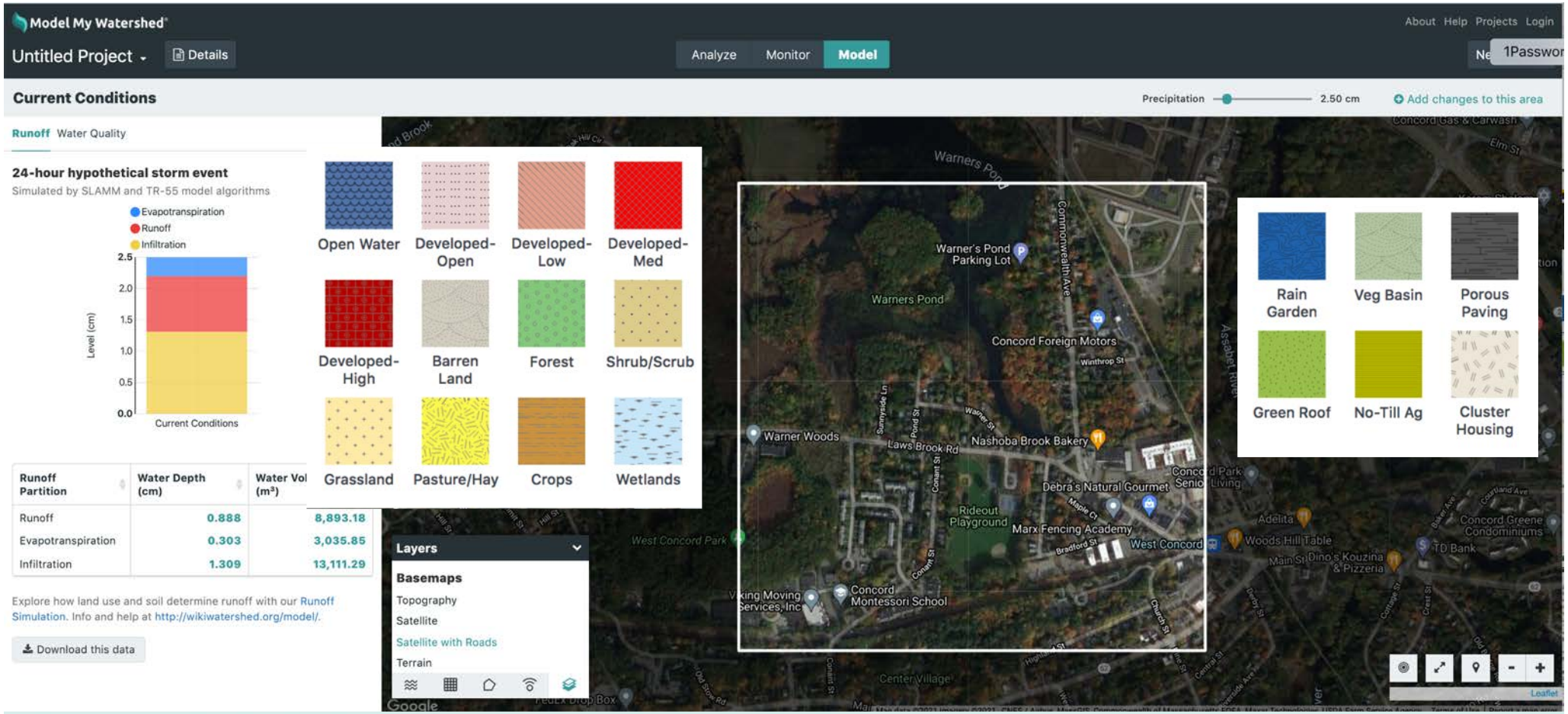
Users can define an area in many ways. You can select USGS HUC units or you can use the “Draw Area” tool to draw a precise area of any size or a 1 km box to change into geospatial analysis mode.

https://modelmywatershed.org/



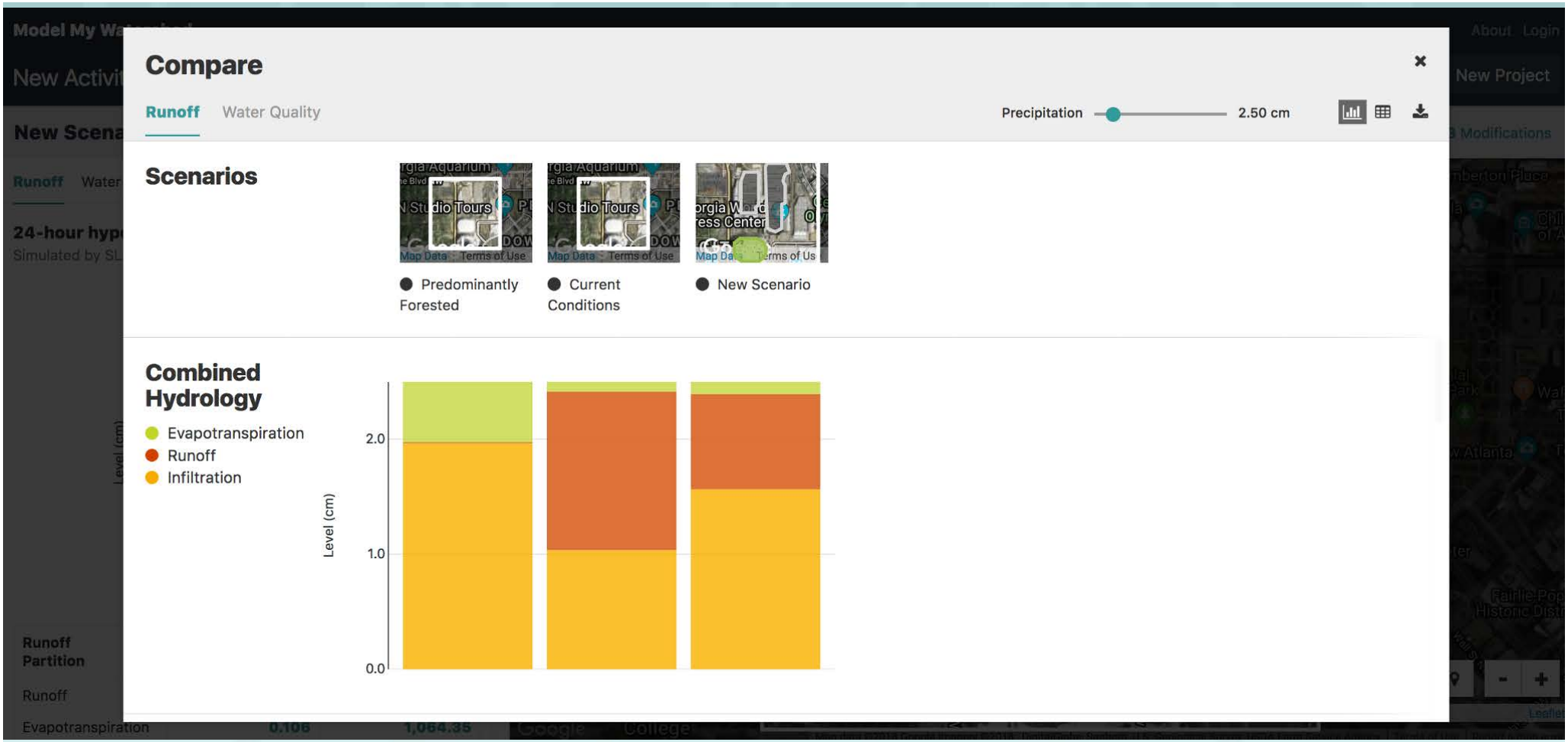
Calculations and analysis are done on the fly for each area based on nationally available data and are not pre-computed estimate or "canned" numbers. These are **real values** based on the most recently available national land cover and soil type datasets.

https://modelmywatershed.org/

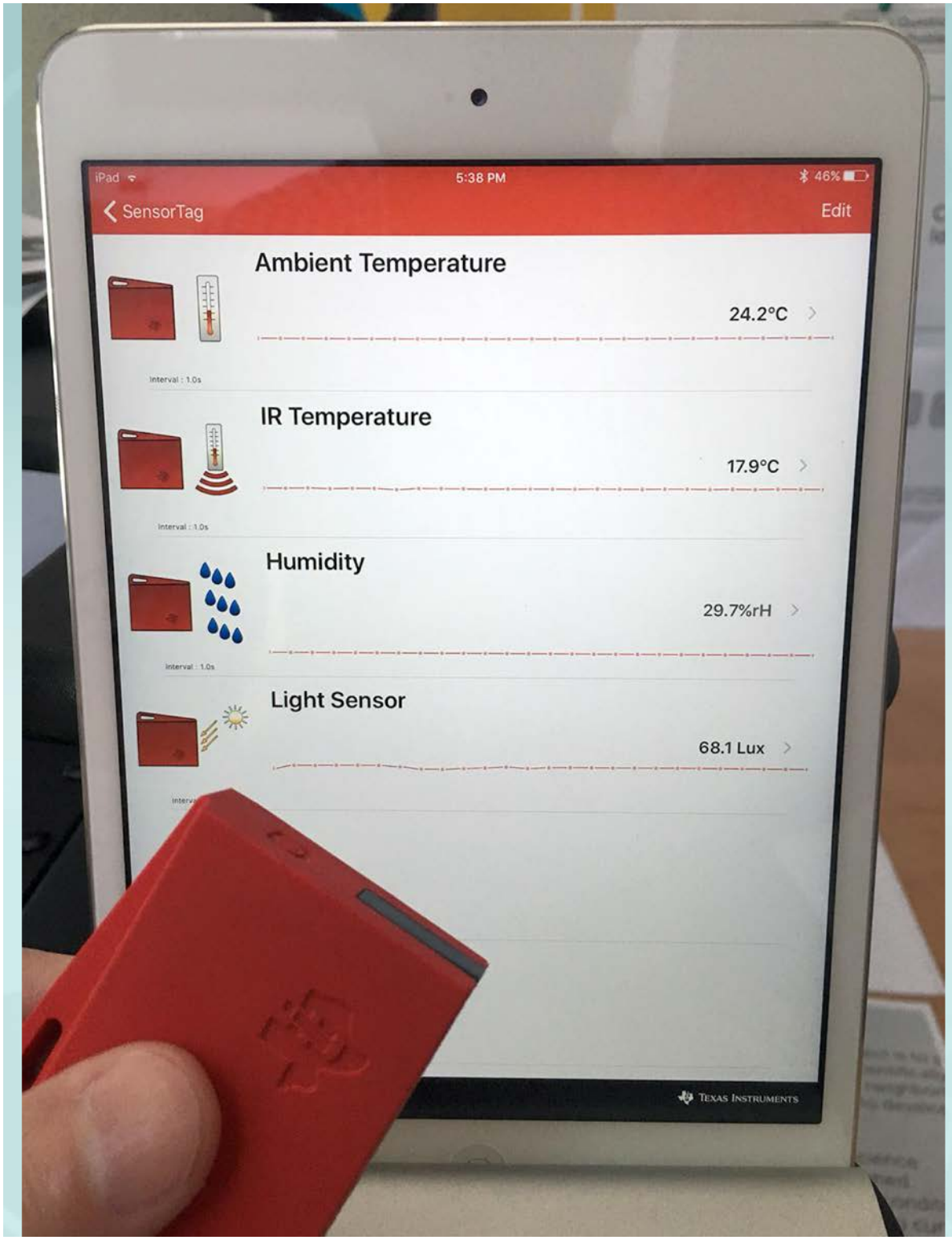


Students can make changes by adding **conservation practices**, (adding green roofs, rain gardens, and porous paving) to reduce impact. Students can change **land cover** (planting trees or reducing development) to impact their watershed.

https://modelmywatershed.org/

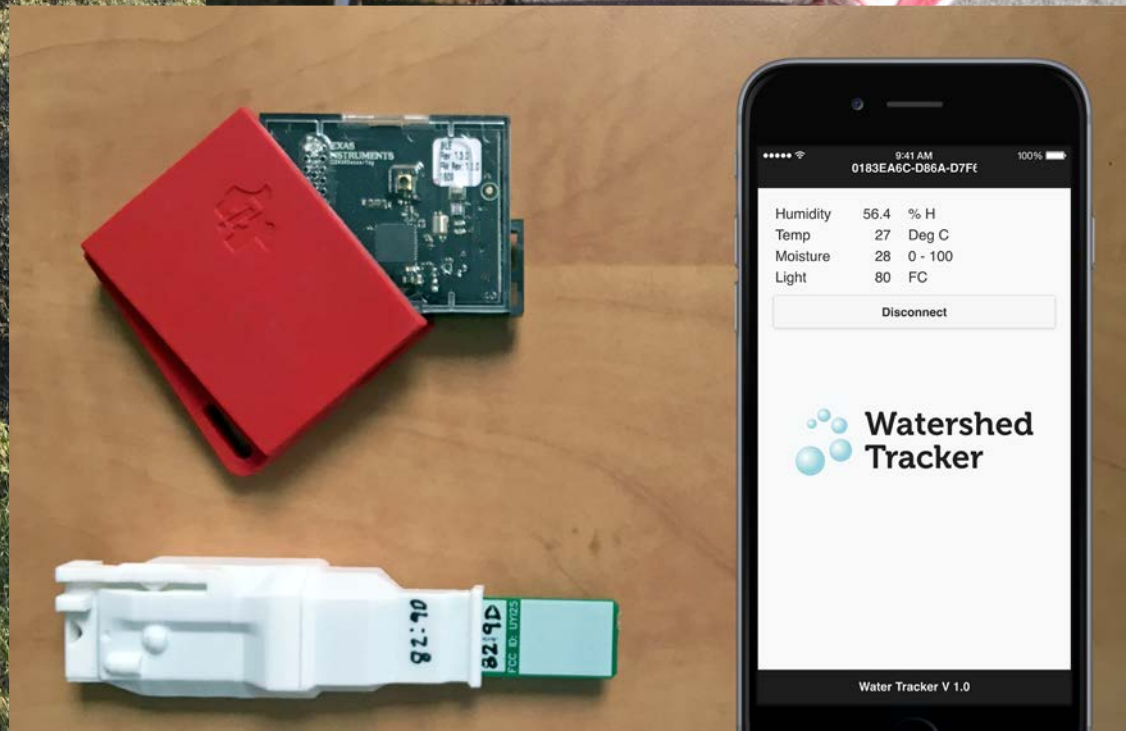


Compare Scenarios



Students collect light, temperature, humidity data using a low-cost Blue Tooth (BT) environmental monitoring device. Students use their mobile device to view their sensor data so they can enter it in the Innovative Technology in Science Inquiry portal where the data can be viewed, graphed, and analyzed.

https://www.ti.com/tool/TIDC-CC2650STK-SENSORTAG


9:41 AM
100%
0183EA6C-D86A-D7F
Humidity 56.4 % H
Temp 27 Deg C
Moisture 28 0 - 100
Light 80 FC
Disconnect
Watershed Tracker
Water Tracker V 1.0

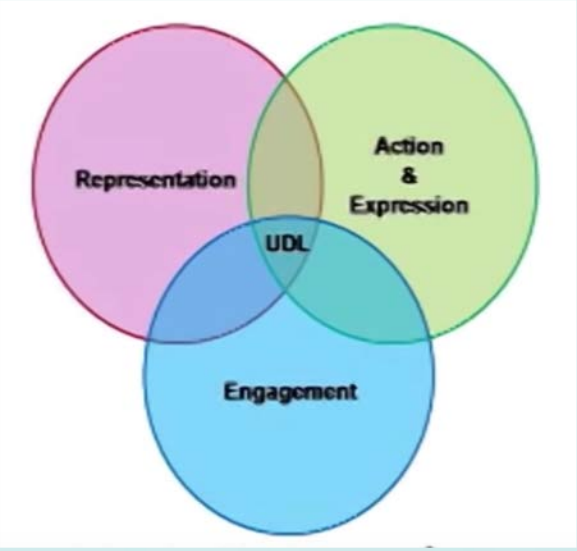
Monitor Your World

Download in App Store (any mobile device)

Research Study

UDL at a Glance

See how the UDL framework guides the design of instructional goals, assessments, methods, and materials that can be customized and adjusted to meet individual needs.



https://youtu.be/bDvKnY0g6e4

cast.org

Universal Design for Learning (UDL) is a research-based set of principles to guide the design of learning environments that are accessible and effective for all. Now endorsed by federal policy and that of many states and districts, UDL informs all of our work in educational research and design, professional learning, workforce development, and publishing.

cast.org

Glossary

The Concord Consortium | Activity: O2021 - Lesson 1: Discover Your Local Watershed | Anonymous

1 2 3 4 5 6 7 8

What Have You Learned?

Today you explored what a watershed is and how human activities affect water quality in watersheds everywhere!

You also explored how **human choices affect the natural resources** that not only meet the needs of the present (us!), but must someday meet the needs of the future (the generations to come after us!). You will learn more about this important approach to **using resources wisely**, or sustainability, in future lessons.

Take a moment to think about everything you learned today and answer the following questions.

The watershed is affected by human activity.
Image by DUOTONE from Pixabay

Question #14

Where does water flow in a watershed?

Please type your answer here.

Term: watershed

The mountains direct the rain water downhill to a river.

What do you think "watershed" means?

Write the definition in your own words here.

Submit | I don't know yet

Term: watershed

A system defined by the area of land over which all water drains downhill through a series of streams and rivers to a common outlet (river, lake, bay or ocean).

The mountains direct the rain water downhill to a river.

My Definition:
Where water runs off.

Term: watershed

A system defined by the area of land over which all water drains downhill through a series of streams and rivers to a common outlet (river, lake, bay or ocean).

The slope of the mountain directs the rain water into the lake.

My Definition:
Where water runs off.

Ten Research WATERS Lessons

Lesson 1: Discover Your Local Watershed
Lesson 2: Stream Study: What Do Stream Organisms Tell Us?
Lesson 3: Stream Study: What Does the Chemistry Tell Us?
Lesson 4: The Water We Drink
Lesson 5: Runoff Simulation

Lesson 6: Exploring My Schoolyard
Lesson 7: Investigating My Schoolyard
Lesson 8: Modeling Improvements to My Schoolyard
Lesson 9: Road Map to Action!
Lesson 10: Communicating My Action Plan!

Non-research activities - https://learn.concord.org/waters

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