W 1239

WHEN RAIN DRAINS THE TERRAIN

WATERSHED IN A BOX AND WATERSHED PUZZLE

Andrea Ludwig, Associate Professor and Extension Specialist, Department of Biosystems Engineering and Soil Science



Real. Life. Solutions.™

UTEXTENSION
INSTITUTE OF AGRICULTURE
THE UNIVERSITY OF TENNESSEE

WHEN RAIN DRAINS THE TERRAIN

Watershed in a Box and Watershed Puzzle

Skill Level
Beginner (4th and 5th grade) or Intermediate (6th – 8th)

Learner Outcomes
The learner will be able to:

- Describe the role of watersheds in the water cycle
- Use new terminology
- Create a watershed model and identify landform features and water cycle components.

Educational Standard(s) Supported

GEO.ESS2 12

Success Indicator
Learners will be successful if they can:
- Identify features in their watershed model and use new terminology.

Life Skill(s)

Observing, Identifying and Building Relationships, Communication

Tags: 4-H Science

Time Needed: 30-45 minutes

Materials List

Aluminum baking pans (9.5 in x 12 in)

Blue washable markers (thick-line, various shades if possible)

White copy paper

Spray bottle

Cardstock (lamination optional)

Scissors

Copies of Student Handout

Printed puzzles

Author(s)

Andrea Ludwig, Associate Professor and Extension Specialist, Department of Biosystems Engineering and Soil Science

Reviewed by

Lynne Middleton, Extension Specialist, 4-H & Youth Development

Introduction to Content

If you stacked up all the rain that falls in a year in a Tennessee schoolyard, it would add up to about 50 inches – that's over four feet! Where does all that water go? Much of it soaks into the ground and eventually becomes groundwater. The water that doesn't soak in flows across the surface of the land and becomes runoff. That runoff then collects and drains into creeks, streams, wetlands, and rivers that eventually make their way to the ocean.

With so much rain falling, it is no surprise that there are over 60,000 miles of rivers and streams in Tennessee. If all those waterbodies were lined up end to end, that's long enough to go around the earth about two and a half times! The web of waterways that drain the land are an important part of the water cycle.

Terms and Concepts

The land that drains to a waterbody forms that waterbody's ***watershed***. The size of a waterbody is proportional to the size of the watershed. For example, the creek that runs through the schoolyard or in the backyard has a smaller watershed than the river into which that creek flows. Many small creek watersheds make up the larger river watershed. Watersheds fit together like puzzle pieces along ridges. The ridges that form the boundaries between one watershed and another are called the watershed ***divide***.



Water flows downhill by gravity, but the flowpath isn't a straight line because the earth's surface isn't smooth. The ***relief*** or ***topography*** of an area affects the way water flows across the earth. Water coming off a hill of mountain combines into small channels called headwaters. Those headwaters flow into each other to create larger creeks and streams. Each channel finds the path of least resistance flowing downhill. Those creeks and streams flow together to form rivers. When one waterbody flows into another waterbody, it is called a ***confluence***.

Setting the Stage

This activity is meant to take the concept of a watershed, which can be hard to understand because of the large scale, and make it tangible by building a model right there at the student's desk. First, revisit the components of the water cycle. Ask students:

1. What happens when it rains? In terms of the water cycle, what happens to precipitation? What are the possible transformations or storages of that water?
2. What is the closest creek or river to the school? Is there one that flows in the schoolyard? Where does that water come from?

Talk about the local topography of the schoolyard or surrounding lands. Is it relatively flat? Where is the closest hilltop or mountain? How does it affect the flow of rainwater runoff?

Experience – Build a Mountain Watershed Model

Preparation: Each student will need an aluminum baking pan, a sheet of white copy paper, and thick-line blue washable markers. If possible, obtain a variety of blue colors such as turquoise, cobalt blue, dark blue, etc. The baking pan is used to contain the water. If the number of baking pans is limited, then students can each create their models and then take turns at aluminum pan stations. Dump water from pan between each use.

Strategies to Increase Student Engagement

- Tip – Get outside! Go to the schoolyard creek and talk about where the water comes from. Talk about how much water is in the creek and how it would be different in different seasons or right after a rain
- Tip – Get techy! Use the StreamStats web browser application to delineate the watershed of the local creek or river: https://streamstats.usgs.gov/ss/
- Tip – More technology! Use the River Runner web browser application to show students how water that hits the schoolyard makes its way into local creeks and rivers and eventually to the ocean.
    - https://river-runner-global.samlearner.com/

Notes

Using a variety of color markers in the blue to green range will create a more colorful and interesting model as the different colors move through the paper during the "rainstorm."

Fill a spray bottle with water which will create the "rainstorm." It is recommended that the instructor uses spray bottle to maintain control of how much water and where the water is applied.

Have a trash can available to take wet paper. Access to a sink or other area to drain water would be useful.

Decide if the landform feature labels (see worksheet) will be re-used or not. The features labels may cut directly from the student worksheet and used once, or labels can be pre-cut and laminated for multiple uses. If multiple use labels are desired, print the label box on cardstock, laminate, and cut along the lines to create individual labels. Provide a set with each aluminum pan station.

Activity:

Lead the activity from the front of the room by demonstrating these steps in making the landscape:

1. Take the white copy paper in your hands. Explain this is the land. Crumple it up into a ball, not too tight.
2. Pull apart the crumpled ball so that it comes back to a square shape but still maintains some waves and folds. Describe the major folds and creases that remain as ridgelines and hilltops.
3. Take the thick-point blue markers and glide over the folds and creases so that the folds are colored but there are also white spots between folds.
4. Put paper in the aluminum baking pan. Squish paper together slightly if it was flattened during marking.

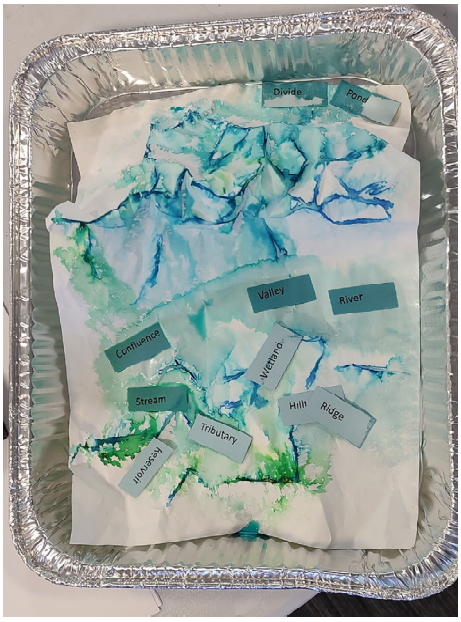


Explain that they have all now made their own unique mountain landscapes, and that a rainstorm is approaching. Ask students what they think will happen in the model when the rain begins. Go around the room and "rain" on the landscapes with the spray bottle. Spray enough water such that the marker runs down the paper and forms channels but stop spraying before the paper gets so wet it flattens out under the weight of the water.

Refer students to the handout with the features labels and glossary of terms. Students either cut out the single-use labels or use provided laminated multi-use labels to label the features they see in their model.



Share



Go around the room and ask students to share their Mountain Watershed Model with the class. Ask them to describe their landscape using the landform terminology and then describe what happened when the rainstorm came and what water features were created.

Process

After all students have shared their models, talk about the similarities and differences. Did all models look the same? Why not? When the models were made (the crumpling up of the paper), each student crumpled up the paper in a unique way and unfolded in a unique way, each having different forces acting on the paper or "land." These unique forces created unique topographies that affected the way the water flowed during the rainstorm.

Ask students how many watersheds they had in their model. There is no one correct answer. There will be many small watersheds created by small changes in topography inside or nested inside of the large watersheds created by the major divides.

Revisit the schoolyard or local landscape. Have humans affected the topography of the land? How has this changed the way water moves? How is this accounted for? If possible, go out and find drainage features (like gutter downspouts, drains, pipes, and channels) and create a map of water flow through the schoolyard.

Generalize

Now that students have created a mountain watershed model, students can understand that no matter where you are on the landscape, you are in a watershed. Tennessee has ten major river basins all containing small creek watersheds. Watersheds and river basins fit together along ridges like puzzle pieces making up the landscape. Use the Tennessee Watershed Puzzle handouts in class. Cut along the watershed boundaries to create ten puzzle pieces. The other handout can be used as a puzzle board to help students assemble the puzzle. For more advanced students, the board may not be necessary.

Apply – Investigate Local Watersheds

Trace a Drop

Introduce the class to the concept of a topographic map, a two-dimensional representation of the three-dimensional landscape. Discuss contour lines and water features on the map. If possible, take students out into the schoolyard to see different topographic features. Stand in a parking area or playground and ask students to imagine what happens to a raindrop that falls in that spot. Where does it go? Contrast pavement versus turfgrass. In the parking lot, find drainage features like the curb, drains, and pipes. Follow the drop as far as possible, to the closest creek.

Find Your Tennessee Watershed Address

Just as we have a physical mailing address for our home, our home also lies in watersheds of creeks and rivers, so we also have a watershed address. Use the map application to search for a location (e.g. the school address) and find the watershed address for that location. The analogy of a city, state address is like a creek, river watershed address (the creek watershed lies within the river watershed).

Map application: https://tiny.utk.edu/watershedsmap

Challenge students to find their Tennessee Watershed Address for their home.

References

Tennessee Watersheds from the Tennessee Department of Environment and Conservation - https://www.tn.gov/environment/program-areas/wr-water-resources/watershed-stewardship/tennessee-watersheds.html

Watersheds of Tennessee and the Surrounding Area – https://tiny.utk.edu/watershedaddress

Project Wet - https://www.projectwet.org/programs/watershed-stewardship

The authors would like to thank the following colleagues for their thoughtful review of this document: Audrey Fulton, Julie Berbiglia, and John Taylor.

Supplemental Information

Educational Standards Met

GEO.ESS2 12) Obtain, evaluate, and communicate information about man-made and natural threats (e.g., mining, pollution, erosion, runoff, floods, and earthquakes) to Tennessee watersheds

TIPPS
Life Skills

Head – Thinking, Managing

Heart – Caring

Hands – Working

Student Worksheet

Find these features in the mountain watershed model. Cut along lines to create labels and place them on the model where you see these features.

River	**Creek**	**Pond**
Valley	**Reservoir**	**Confluence**
Tributary	**Ridge**	**Divide**
Hilltop	**Wetland**	**Headwaters**

Definitions of Terms

Confluence – flowing together at one point

Creek – a natural stream of water normally smaller than and tributary to a river

Drainage Divide – the physical boundary that separates watersheds

Headwaters – the source of a stream

Hilltop – the highest part of a hill

Pond – a body of water usually smaller than a lake

Reservoir – an artificial lake where water is collected

Ridge – a range of hills or mountains

River – a natural stream of water of considerable volume

Tributary – a stream feeding into a larger stream or lake

Valley – an elongated depression on the earth's surface between ridges

Wetland – land areas that are covered with shallow water



UTIA.TENNESSEE.EDU

Real. Life. Solutions.™

W 1239 5/24 24-0111 Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.A