GREAT SMOKY MOUNTAINS INSTITUTE AT TREMONT

STREAM ECOLOGY

GRADE LEVEL
4th-8th

TIME FRAME
3 hours

MATERIALS
- Bug boxes/ ice cube tray
- Tweezers
- Yellow stream net
- Dissolved oxygen kit and instruction cards
- Turbidity tube
- pH kit instruction kit
- Thermometers
- Macro invertebrate ID guides
- Strainers
- String/yarn

LOCATIONS
- Girl Scout Island
- Upper ford
- Lower Ford
- Lagoons

CROSS-CUTTING CONCEPTS
Cause and Effect and Patterns
Observed patterns in stream and prompt questions about relationships and causes underlying them.

Structure and Function
Investigate how unique adaptations like shape of an organism help and animal to thrive.

IDEAL SEASONS
Fall/Spring

INVITE
EXPLORE
WONDER
CREATE
REFLECT
SHARE

LESSON SUMMARY
Students will investigate the stream and identify how abiotic and biotic factors can be used to investigate stream health.

Guiding Question: How can we investigate the stream to determine the health of the ecosystem?

KEY LESSON CHARACTERISTICS

WHAT LEARNERS DO	SKILLS & KNOWLEDGE	SOCIAL & EMOTIONAL ABILITIES
Make predictions	Principles of ecology	**Responsible Decision Making** Make choices to safely navigate the stream for themselves and their team
Collect data	How to identify organisms	**Relationship skills** Work with peers to investigate the stream
Analyze data	Indicators for clean water	**Social Awareness** Develop empathy for animals who live in the stream and people who relay on the water
Argue from evidence	How water flows though environments	
Compare environments		

LESSON FLOW

- ABIOTIC VS BIOTIC
- WEB OF LIFE
- RIVER MAPPING
- ABIOTIC TESTING
- STREAM SEARCH
- INSECT INVESTIGATION
- CREATE A RIVER

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Stream Ecology

ABIOTIC VS BIOTIC — *5 MINUTES*

1. Students need to pick up an object to fit in the palm of their hand. then form two unique groups of abiotic/ biotic things

Instruct each student to pick up an object from the ground.
"This item must be little enough to fit in your pocket but keep it in your hand."
Have students categorize into like groups,
"get together with others who have similar objects"

2. Students will discuss how they found those two groups.

Students will likely start organizing by shapes or colors encourage them to think where the objects came from.

- *What did your object have in common with others in your group*
- *Was there more than one characteristic your groups had?*
- *How did we divide the groups?*

3. Define Abiotic and Biotic

- **Abiotic**-*something found in nature that was never alive or never will be alive*
- **Biotic** - *something found in nature that is alive or was once alive*

"How do Abiotic and Biotic things interact with each other?" Can Biotic things live without Abiotic things?

WEB OF LIFE — *5 MINUTES*

1.Students will set all their objects down on the ground, and try to find something that is not connected to something else in the group.

Set your objects on the ground, make a path showing what you found to something else it is connected too. like the tree to the soil, or rock to soil. (can use string, or draw lines in the dirt.)

- *Think about these resources is there something that is not dependent on something else?*
- *Can we find anything in the forest or the stream that isn't needed by anything else?*

Today we are going to investigate what the ecology of the stream and discover how living and non living things interact to survive in this environment.

CHECK-IN

Do "biotic vs. abiotic" quiz (Get down on the ground and pick up some duff) "is this biotic or abiotic?." (Scrape some dirt underneath the duff) "is this biotic or abiotic?." (Dig into the ground down to soil) "is this biotic or abiotic?."

BIO BREAK

During this activity students are sitting and it is a good opportunity for bathrooms at the office. or changing into their water shoes.

EXTENSION

To further understanding how are these objects connected
Have students put abiotic/biotic objects on the ground and create a spider web of how objects are connected to each other

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STREAM ECOLOGY

STREAM MAPPING *25 MINUTES*

1. Tell students that you'd like each of them to find a quiet spot along the banks of the stream (not too close to the water's edge) to sit and draw a map of a section of the stream. Their map should be of the stream directly in front of them, about 20-40' wide, not as far as they can see. Get out a whiteboard and draw an example as you explain.

We're going to map the way the water moves and in which directions, as well as any other features you feel, are having an impact on the stream and its movement like boulders, fallen trees, etc.

2.Gather everyone back in a circle.

Pair Share: Compare your map to another person's. What things do you see that are similar and different between your two maps?

- *What are some of the different areas of the stream that you noticed?*
- *What physical features make these areas different?*
- *Why are these different areas of the stream important?*

Introduce terms pool, riffle, and run or allow them to come up with their own distinctions for the different areas of the stream and keep track of them on a group whiteboard.

We know there are physically different areas of the stream, but could abiotic factors and the life we find be different in these places as well?

CO-TEACHING OPPORTUNITY

Co-Teachers can lead this activity! or can assist be modeling mapping with their students.

ABIOTIC INVESTIGATION *30-40 MINUTES*

1. Divide students into teams to collect stream data

Each group should collect data and record them on the whiteboard. encourage students to explore different parts of the stream and record the location of their test in their journal.

Temperature-hold the thermometer in the water for 40 seconds and write down results.-

Ph-add 3 drops of solution into container shake it and determine color on the ph scale. Write down results, dump solution into waster bottle

Dissolved oxygen- collect water, have student break tip in the container and determine the oxygen in the water.

Turbidity- Fill turbidity tube with water and look until you can see the white and black hourglasses to determine water clarity.

- *How do these abiotic factors influence life in the stream?*
- *Did any of your results surprise you?*
- *Did different areas of the stream give us different results why or why not?*
- *How does the flow of the river effect dissolved oxygen?*

How do you think the abiotic factors influence the biotic community how can we find evidence of that?

CO-TEACHING OPPORTUNITY

Utilize co- teachers as leaders in rotation to collect data

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STREAM ECOLOGY

MODEL BY EXAMPLE

To help make sure students can find macroinvertebrates it is important to model good search techniques like looking under rocks and waiting to see if organisms move

STREAM SEARCH *45-60 MINUTES*

Students will explore the stream searching for aquatic organsims.

1.Tell students another way we can determine the health of the stream is by investigating the biotic factors of the stream.

To find organisms in the stream you are going to need to change into your water shoes. Look under rocks, and logs for small things called macroinvertebrates found in the stream.

Rules and Safety

- Do not throw rocks or sticks.
- All things moved in the stream must be returned where you found them that is somethings habitat.
- If a rock is to big to pick up leave it and find a smaller rock.

Kick nets

Kick nets- are a tool you can use to find some of the macroinvertebrates that burrow deep into the ground. the best way to find them is to work as a group of three angle the net to the ground at a 45 degree angle and one person will kick sediment up towards the kick net

Sifters

Sometimes macroinvertebrates can be found by sifting through the sediment. To find macros gather sediment in sifter and in the water mix until you see if any bugs stay in the strainer.

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- *What does the biotic search tell us about the stream?*
- *Do any of the invertebrates we found look similar?*
- *Where in the stream did we find the most life? (riffle, pool, run,)*
- *How did organisms differ in the different areas you found them?*
- *Do you think you may find any of these organisms in streams by your house?*

All of these unique organisms have special adaptations to survive in the stream and we are going to get a better look at them on a microscope to see how they help them survive.

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STREAM ECOLOGY

MICROSCOPE USE

Check to make sure other classes are not going on that need to use the microscope or coordinate a time for both groups to meet. you may need to move the microscope to the cove room and project.

ARGUING FROM EVIDENCE

Students will be making a case for what critter they think they are seeing and why. They might not always agree, but this is a great opportunity to allow students to argue and discuss based on evidence. Encourage students to challenge thoughts or add supporting information. Just reiterate that this is a respectful discussion.

CLEAN UP!

Release your Macros! Macroinvertbrates need to be returned to the stream as soon as you finish with your class they will not be able to survive in the water for hours so make sure to take them back to their homes.

INSECT INVESTIGATION *30-45 MINUTES*

1.Bring the macroinvertebrates (macros) caught during the stream search to the microscope and hand out macro invertebrate keys to the students.

When I place a macro under the microscope use your key and take a minute to discuss with a person next to you what you think it is. Then I will call on those with hands raised to tell the group what they think it is. When sharing, you should frame your thought as "I think it is a __ because..." to provide evidence and support your thought.

2.After observing the macros, have a discussion about the macros and what they can tell us about the stream.

- *What are some similarities we saw between the macros?*
- *What are some differences?*
- *Which macros would be more sensitive to things like pollution or murky water? Why?*
- *What can the presence of more sensitive macros tell us about the stream?*
- *What do you think you would find in a stream by your house?*

CREATE A RIVER *20 MINUTES*

1.Have each student take out their journal and draw a river and two natural objects and two humans objects.

"Take out your journal and make your paper horizontal and draw a river running straight though the paper. on your drawing include 2 natural and 2 human made objects. When students finish their drawings connect the drawings on the ground. Take a river walk and find something interesting you noticed along the river."

- *What do you notice along the river?*
- *How do you think the water quality changes along the river?*
- *What organisms do you think you may find in the river?*
- *How would this compare to a river back at home?*

BRING IT HOME

- What could you learn from studying a stream in your neighborhood?
- Why does the water quality change in different environments?
- What could you do to improve water quality back at home?

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STREAM ECOLOGY

ADDITIONAL ACTIVITIES

CREATE A CRITTER

1.Have students think about adaptations of the organisms found in the river.

2.Have students create a critter in their journal that can survive in a unique environment. thinking about how special adaptations can help animals survive in unique environments.

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- *What adaptations did you notice that help organisms survive in the river?*
- *What environments did the organisms live in?*

SOLO SIT

1.Have students sit along the river and reflect on questions in their journal

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- *Imagine you are a _____. (stonefly, mayfly, etc.) What is your day like?*
- *You are a drop of water. Tell a story about your journey down the stream.*
- *Imagine you are the river constantly flowing downstream how have you changed over time?*

BOAT RACES

1.In pairs or groups, students construct a boat out of natural materials and give it a name. Let students know that they will be racing their boats and may wish to test the currents and materials prior to racing. That way, they'll have evidence to support their ideas for building materials and where to release the boat.

2. Student groups release their boats one at a time from anywhere along the starting line. Record the times of each boat on a whiteboard.

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- *Did you notice any patterns in our boats' paths?*
- *Did any boat's path surprise you?*
- *What can our boats paths tell us about erosion?*

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STREAM ECOLOGY

Stream Ecology Field Card

Abiotic vs Biotic

1. Have students pick up a natural object from the forest floor.

pick up a natural object from the forest floor. it should be small enough to fit in the palm of your hand.

- *What did your object have in common with others in your group*
- *Was there more than one characteristic your groups had?*
- *How did we divide the groups?*

Define Abiotic and Biotic

""How do abiotic and biotic things interact with each other? Can biotic things live without abiotic things?"

Web of life

Set your objects on the ground, make a path showing what you found to something else it is connected too. like tree to soil, or rock to soil. (can use string, or draw lines in the dirt.)

- Think about these resources is their something that is not dependent on something else?
- Can we find anything in the forest or the stream that isn't needed by anything else.

How do you think ecology differs from land to water.

Stream mapping

1.Find a spot along the river to sit at least 10 feet away from someone else and you will be mapping what you see.

- *Compare your map to another person's.*
- *What things do you see that are similar and different between your two maps?*
- *What are some of the different areas of the stream that you noticed?*
- *Why are these different areas of the stream important?*

2.Introduce terms; pool,riffle, run, what do you think these mean?

We know there are physically different areas of the stream, but could abiotic factors and the life we find be different in these places as well?

Abiotic Investigation

1. Students and teachers will collect data in the stream for temperture, ph, dissolved oxygen and turbidty.

Divide students into 4 groups to rotate and collect data on temperture, do, ph, and turbidty

- *How do these abiotic factors influence life in the stream?*
- *Did any of your results surprise you?*
- *How does the flow of the river effect dissolved oxygen?*

Stream Search

1.Send students into the stream to find Macroinvertbrates.

In order to find organisms in the stream you are going to need to change into your water shoes. and look under rocks, and logs for small things called macroinvertbrates found in the stream.

Rules and safety

- No Throwing rocks
- Return rocks and logs where you found them.

- *Do any of the invertebrates we found look similar? where in the stream did we find the most life? (riffle, pool, run,)*
- *How did organisms differ in the different areas you found them?*

Insect Investigation

1.Bring macroinvertebrates to science room or cove room to look at them under the microscope. Giving students the opportunity to argue from evidence and combat ideas not people.

- *What are Similarities or differences in your macroinvertbrates?*
- *Which macros would be more sensitive to things like pollution or murky water? Why?*
- *What can the presence of more sensitive macros tell us about the stream?*
- *What do you think you would find in a stream by your house?*

Create a river

1.Have each student take out their journal and draw a river and two natural objects and two humans objects.

2.Line up journals to create 1 long river on the ground.

- *What do you notice along the river?*
- *How do you think the water quality changes along the river?*
- *What organisms do you think you may find in the river?*
- *How would this compare to a river back at home?*

Stream Ecology

4th - 5th	6th - 8th	9th - 12th
• 3-LS4-3 Construct an argument with evidence that in a particular habitat some organisms can survive well, less well, or not at all. • 3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.*	• MS-LS2-2.Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. • MS-LS2-4.Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.	**Tennessee State Standards for High School** • ESS3 Human Activty Research and evaluate the effectiveness of public lands(state parks,national parks,wildlife refuges, wilderness areas) in sustain biodiversity • EVSCls2 using mathematical models support arguments regarding the effects of biotic and abiotic factors on carrying capacity for populations within a ecosystem.

ADDITIONAL INFORMATION

Tremont watershed information

The Middle Prong of Little River drains the watershed between Miry Ridge and Defeat Ridge, both of which descend from the crest of the Smokies. The Middle Prong is formed by the confluence of Lynn Camp Prong and Thunderhead Prong at the former logging town of Tremont, where it has cut a deep gorge. From here, the river continues northward, absorbing Spruce Flats Branch and several smaller streams before steadying in a relatively flat area known as Walker Valley.
Tremont is in Tennessee river watershed, as water flows into The Middle Prong and eventually into the Tennessee river it flows until it eventually empties at Fort Loudoun lake in Knox County.

- According to the EPA the Middle Prong is classified as a unpolluted stream.
- Certain stream organisms are used as bio indicators such as salamanders, mayflies, stoneflies, water pennies, caddisflies, & fish.