Lesson: “Why don't the same trees grow everywhere?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey. It's Esther from the Mystery Science team. Let's try a quick brain exercise. You can even close your eyes if you want. I want you to imagine a tree. Take a moment to really picture your tree in all its parts. Like the trunk, that big middle part. Then imagine its branches and its leaves. And even though you don't usually see them, you know your tree has some roots. So, try to imagine those too. Okay. Got your tree? Great. You can open your eyes now. Of course, I can't see the tree you imagined, but here's what I picture. It's an oak tree, one of my favorite trees that grows where I live. Maybe your tree even looked something like this too. But then again, maybe your tree was more like this. Or wait. Maybe more like this. Or how about one of these? Even though trees have the same basic parts, you already know they don't all look alike. Instead, each kind of tree has a particular look. Like how this oak has a wide rounded shape at the top with a trunk below, or how this fir tree has a more triangular shape from top to bottom. When you're noticing the shape of these trees and how their parts are arranged, you're noticing their structures. And if we zoom in closer, you can spot even more differences in their structures. Just check out these leaves. Oak leaves have a wide flat structure with rounded edges. And fur leaves, well, you might be surprised that these are leaves. You may have heard them called needles, but needles are really a kind of leaf. They're much smaller with a skinnier, pointier

structure. While trees might have some of the same basic parts, like leaves or branches, those parts can have wildly different structures, and it's those structures that give different types of trees their unique looks. Like, check out this tree for instance. I've never seen a tree like this, but my friend Jay says they grow near where he lives. I'm curious if you've seen a tree like this before. Take a moment to look closely and see what you notice about its structures. What's similar to other trees you've seen? What's different?

EXPLORATION VIDEO 2

When I first look at this tree, the top half has some familiar looking parts, like these leaves. They're flat and sort of oval shaped with a shiny green color. And maybe you noticed that the leaves are attached to lots of slender branches, but then I get to the bottom half. What's going on there? It almost looks like this tree has upside down branches or maybe extra trunks. It's hard to tell just what these parts are. You probably know that different parts of a tree do different things. Leaves, for example, collect sunlight that the tree needs to grow, and roots take in water and nutrients. You can think of that as a part's job. This is also known as its function, and a part's structure helps it do that job so the tree can survive. So, let's look at those curvy parts of our mystery tree again. Maybe their structure can give us an idea about what they do. Based on their structure, what do you think these curvy parts do to help the tree survive?

ACTIVITY INTRODUCTION VIDEO

In order to uncover the secrets about how this strange looking tree's structures work, you first need to build your skills as a tree detective. We're going to set aside this tree mystery for now and instead begin a different investigation of some tree structures that may look a bit more

familiar to you. In today's activity, you will investigate how a tree's structures help it survive in a particular environment. Your challenge is to figure out what kind of tree most likely grows in the unique environment of Anchortown Forest. You can think of it kind of like a puzzle. Is it a tree that looks like this or like this? Or what about this? To figure this out, you'll look closely at the individual parts of trees, like branches and roots. You can think of them kind of like the pieces of your tree puzzle. You'll explore these different kinds of tree structures to see how they function differently in certain conditions. And since you don't have a bunch of roots and branches lying around your classroom to experiment with, you'll use different kinds of models to help you do this. After that, you'll learn more about what makes Anchortown Forest such a unique environment for trees to live in. In the end, you'll look back at all of the clues you gathered to put together your puzzle and figure out once and for all what kind of tree most likely grows in Anchortown Forest. We'll get you started step by step.

ACTIVITY STEP 1

In today's activity, you'll work with a partner. If you're working alone, that's okay too. When you're done with this step, click the arrow on the right to move on.

ACTIVITY STEP 2

Get these supplies. You'll get more supplies later.

ACTIVITY STEP 3

The first structures you're going to explore are roots. On your Roots Worksheet, there are drawings of six different trees and their roots underground. You'll also notice some numbers

beside each set of roots. These show you how deep they grow in the soil. Now your job is to look closely at all of the roots and find as many similarities and differences among them as you can. Write and circle what you notice on the pictures, like this, to help you make your observations.

ACTIVITY STEP 4

Look back at your observations and discuss what you noticed with your partner. What are the main differences you noticed among the roots? Do any have similarities?

ACTIVITY STEP 5

Now that you've seen what different types of roots look like, take a closer look at the types of ground they can grow in. All the roots you just observed lived in one of two different places. We'll call them Environment A and Environment B. As you know, a root's job is to absorb water and nutrients from the soil. In a moment, you'll watch a video and see what happens underground when it rains in these places. Then answer questions 1a and 1b on your Evidence worksheet.

ACTIVITY STEP 6

Now consider everything you've seen so far. Discuss with your partner. Based on your observations, which kinds of routes are most likely to help a tree survive in Environment A? What about Environment B?

ACTIVITY STEP 7

Now answer questions 2a and 2b on your worksheet. Circle all the roots you think would help a tree survive in Environment A. Then do the same thing for Environment B. Be sure to support your claims with evidence you gathered earlier.

ACTIVITY STEP 8

At this point, you have some idea about which roots help a tree survive in certain environments. This is an important piece of the Anchortown puzzle. Now let's look at another piece of the puzzle: branches. Branches also help a tree survive, but it might not be as obvious how they do that. Discuss with your partner. How do you think branches help a tree survive?

ACTIVITY STEP 9

I'm not sure how you answered, but one of the things we thought of is that branches support weight. Leaves, fruits, animals, you name it. Branches help hold that weight up for the tree.
But do all branches support weight in the same way? You're going to explore how different types of branches function when they have weight on them. This pipe cleaner will be your model for one type of branch. We'll call it Branch A. And this wooden stick will be your model for a different kind of branch. We'll call it Branch B. Now get these supplies.

ACTIVITY STEP 10

Work with your partner to set up your experiment. Partner 1, hold both of your branch models over the side of your desk like this. Adjust them so that both branches have the same amount

hanging off about this much. Partner 2, put a heavy book on top of the branches on the desk to hold them in place, like this. Check to make sure that the branches are the same length. Once you're done with that, you're ready to start experimenting.

ACTIVITY STEP 11

We're going to do the first test together. To start, let's try adding a little bit of weight to the tip of each of your models. Add one paper clip to the tip of each branch, like this. Try to put the paper clip right around here. Discuss with your partner. What do you notice about how each branch functions under a little weight? Then, answer question 3 on your Evidence worksheet.

ACTIVITY STEP 12

Now experiment by adding more weight to your models. What happens when you hang three paper clips from your branches? What about five? Or even more? As you experiment, observe closely and discuss what you notice with your partner. I'll set a timer for five minutes in case that's helpful. Alright. Time's up.

ACTIVITY STEP 13

During our experiments, we tried lots of different things. You probably did too. Here's what ours looked like when we added paper clips to each branch. Use your observations to answer question 4 on your Evidence worksheet.

ACTIVITY STEP 14

You experimented with adding a little weight and a medium amount of weight to your branches. We tried adding even more weight to our branches. Watch closely to see what happens. Discuss with your partner, then answer question 5 on your Evidence worksheet.

ACTIVITY STEP 15

Now take a moment to think deeper about the model and the evidence you've gathered. As you know, models are pretend versions of something real. So what might be pressing down on branches in real life? Discuss. What do you think the paper clips and the hand pressing on the branches represent in real life?

ACTIVITY STEP 16

We'll show you how two types of real tree branches function under different amounts of weight. Here's what these branches look like when a little bit of weight presses down on them. Here's what they look like with a medium amount of weight on them, like some snow. And here's what they look like. With a lot of weight on them, like after a blizzard, when a lot of heavy snow piles up. Now think back to your own experiments with your models. Discuss. Which model branch, A or B, functions like the real branches on the top of the screen? Which model functions like the real branches on the bottom?

ACTIVITY STEP 17

You've gathered your clues about how branches and roots function. That means you're almost ready to solve the Anchortown tree puzzle. But you're still missing one last important piece. For

the final piece of the puzzle, you're going to learn more about the unique environment of Anchortown Forest. This will help you figure out how all of these structures go together to help a tree survive in Anchortown forest. Now get your final supplies.

ACTIVITY STEP 18

This is the informational sign that's posted outside of Anchortown Forest. It has lots of details about the area's climate, soil, animals, and more. This information can give you clues about what kind of structures would help a tree survive in this place. Read through the Anchortown info sheet closely. Use your red colored pencil to underline any information that can help you figure out which kinds of roots trees need to survive in Anchortown Forest. Only focus on underlining clues about roots for now.

ACTIVITY STEP 19

Now that you've gathered all of your root clues, it's time to solve the first part of the puzzle. Which type of roots would help a tree survive in Anchortown forest? To help you make your claim, look back at all of the clues from your evidence sheet and the Anchortown info sheet. Discuss with your partner, then answer question 1 on your Solve the Puzzle worksheet. After that, draw what you think these roots look like on the Anchortown tree stump in the middle of the page. Your drawing doesn't need to look perfect.

ACTIVITY STEP 20

Read through the Anchortown info sheet again. This time, use your blue colored pencil to underline any information that can help you figure out which kind of branches trees need to survive in Anchortown Forest.

ACTIVITY STEP 21

Finish putting together your puzzle. Decide which branches would help a tree survive in Anchortown Forest. Look back at all of the clues from your Evidence sheet and the Anchortown info sheet to help you make your claim. Discuss with your partner. Then answer question 2 on your Solve the Puzzle worksheet and draw the correct kind of branches on the tree trunk. Your drawing doesn't need to look perfect.

WRAP-UP VIDEO 1

Anchortown Forest seems like a tough place for trees to grow, but as you discovered in the activity, certain structures can help them survive. Your data showed that Anchortown Forest is cold and snowy for much of the year. It's so cold that the soil deep underground stays frozen all the time, like Environment A. Since a lot of the ground is frozen, trees in Anchortown Forest need shallow roots that spread out wide to collect water. And all of those months of heavy snow can really pile up, putting extra weight on the branches. You saw that heavy weight can cause rigid branches to break. So, trees in Anchortown need flexible branches that can bend without breaking, like Branch A. Put the shallow roots and those flexible branches together and the trees in Anchortown Forest might look something like this. Maybe you've seen similar trees before. In fact, Anchortown Forest is inspired by a real place. As you can see on this map, it's a huge region that stretches across northern parts of Earth. The environment there is so unique that scientists have given this region a special name. It's called the boreal forest, or what's sometimes called the taiga. Just like Anchortown Forest, parts of the taiga have heavy snow for much of the year. If you go there, you might want to visit during the short summer season when

the snow has melted a little. Hiking around, you'd find real trees with the structures we investigated in the activity. They have shallow, wide spreading roots, and flexible branches. And now that you can finally see an entire tree, check out all its other parts. You might notice big things, like how tall the trunk is, or small things, like the shape of its leaves. What else can you notice about this tree? How would you describe its structures?

WRAP-UP VIDEO 2

Maybe you notice things like this tree's triangular shape, the bumpy texture of its bark, or its pointy needle-like leaves. And maybe you thought about how these different parts go together. For instance, the tree's roots connect to its trunk. And we can see some of the trunk structures like its bumpy bark. That's an outside or external structure. It's kind of like your skin. That's an external structure too. And you know that you have other structures inside your body, things like a heart and lungs. Those are internal structures. The inside of a tree's trunk looks totally different from your body. It might just seem like wood, but trees have internal structures too. They can be tricky to observe, so here's a model to help. It shows that there are layers inside the tree's trunk. Each layer has a different function. This layer here moves water from the roots up through the trunk to reach the branches and leaves. So trees in the taiga need shallow, wide spreading roots to collect water, and they need a trunk with internal structures to move that water. These structures and others are like pieces of a puzzle. They work together to make up a system, a group of things that affect each other and function as a whole. And systems are something you have in common with trees, even though we look so different from them inside and out. See if you can think of some systems your body has. What parts work together to help you survive?

WRAP-UP VIDEO 3

Maybe you thought about how your mouth, throat, and stomach work together as a system so you can digest food. Or how your heart and lungs are part of a system that moves blood and oxygen throughout your body. And your skeleton is actually a system of bones that holds you up and protects your insides. These systems do different things. But they're all important to helping you live, grow, and stay safe. And even though our bodies are so different from trees, in a way they're similar. To survive, a tree also needs multiple systems that do different jobs. To grow, for instance, it needs a system for collecting and transporting water. But what about something like staying safe? I mean, a tree could do a great job growing, but if its branches keep getting broken by heavy snow, it's not going to survive long. That's why flexible branches are helpful for trees in the taiga, and so is a triangular shape. That combination works together to spread out the weight of snow and help it slide off without breaking branches. Trees in the taiga need to stay safe under heavy snow, and trees in other environments need to stay safe too. But instead of snow, their environments might have different challenges, like really hot temperatures or strong rainstorms. Now do you remember our mystery tree? Earlier, we were trying to figure out how those curvy parts help it survive. So let's take a look at what its environment is like. That might give us some clues about what it needs to survive there. This sped up video shows an area similar to where our mystery tree grows. Watch what happens. Whoa. That's a lot of water. If you could visit for several days, you'd see that water flows into this area and goes out again every day again and again and again. And even when the water is gone, you'd find that the soil here is very soggy. Now that you have some evidence about what the environment is like, where the mystery tree grows, Let's be tree detectives again. What clues do you have about those curvy parts? How might this tree’s structures help it stay safe where it grows?

WRAP-UP VIDEO 4

Maybe you guessed that those curvy structures help keep the tree from getting swept away by the water. You're right. As evidence, you might have noticed that many of the structures curve all the way down into the ground. They help hold the tree in place and keep it upright and stable in the soggy soil. It's kind of like how people use cables to hold a tall tower steady. Or see how these stilts hold buildings safely out of the water? The mystery tree's curvy parts do a similar job. They provide strong support underwater to keep the tree's leafy branches safe and dry up above. The curvy parts of our mystery tree are actually a special type of root. They're part of a system that helps protect this tree. But there's more to the story here, and to uncover it, I have one more piece of evidence for you. This map shows where in the world trees similar to the mystery tree grow. They're the areas highlighted in green. Can you find some things those green areas have in common?

WRAP-UP VIDEO 5

Maybe you noticed that all the places highlighted in green are along coastlines. They're places where the land meets the ocean. During parts of each day, ocean water rises up and covers sections of the coast. That's what caused the water to appear in the video we saw. So not only is our mystery tree in danger of being swept away by water every day, but that water is coming from the ocean. You probably know that ocean water is very salty. People can't drink salt water, and it's not healthy for most plants either. They need freshwater to grow. But somehow, our mystery tree manages to survive in salty water that could kill it. That's because inside its roots, there's a material with a rubbery spongy structure that acts like a filter. This model shows how it blocks the salt from getting inside and lets the clean water pass through. Then other structures

transport that water to the rest of the tree. Our mystery tree is a mangrove tree. Its salt-blocking internal structures along with the roots' curvy external structures work together as a system to help it survive in a salty, soggy environment. Can you imagine if this tree tried to survive in the cold, snowy environment of the taiga? It probably wouldn't last long. And a tree from the taiga would probably find it hard to survive in a salty, soggy environment. Trees are rooted in one place, so they have structures that will work well for where they are. We can call those adaptations. Adaptations help living things survive in their environments. Just like people have adaptations for living on land and fish have adaptations for living in water, different kinds of trees have adaptations for the specific places they live. What works well in one environment can be very different from what works well in another environment. The oak trees where I live need to survive in an environment that goes from hot to cold and back again each year. But the environment where you live might be different. Maybe the trees near you need to collect and store water in a hot dry place. Or maybe they need to stay safe in strong winds. And if you travel someplace new, you might spot trees with a totally different look. See if you can figure out how each one's adaptations work together to help it survive in that particular place. Wherever you go, keep growing, stay safe, and stay curious.