Lesson: “How could a fish feed a forest?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther from the Mystery Science team. Have you ever wondered where the food you eat comes from? Sometimes it can be surprising. Like, check out this big guy. This fierce-looking fish is a salmon. I've been eating salmon since I was a kid, but I never really thought about how this food comes from this fish. When salmon like this are young, they spend time in the ocean. That's where they chow down on things like even smaller fish and these tiny creatures called krill. That's how a little salmon like this becomes an adult salmon like this. All that food they eat is made of matter. That's a word you may know well. Matter is anything that takes up space and has weight. By taking in matter from food, animals can build their bodies and get bigger. But watch closely because that matter is about to move. That's the unique thing about salmon. They spend part of their lives in the salty ocean, but they also travel to spend part of their lives in rivers and streams that flow through forests. That makes them part of both ecosystems: in the ocean and in the forest. Woah. It's mealtime. Soon, the matter from that salmon will be part of this hungry bear. That bear lives here in a forest in the southeastern part of the US state of Alaska. That's miles and miles away from those fish and krill in the Pacific Ocean. But thanks to salmon, they're connected. Let's take a closer look at the forest ecosystem. This Alaskan forest includes a huge variety of living things, from massive brown bears, majestic bald eagles, and towering trees to slimy banana slugs, delicate mushrooms, and billions of microscopic bacteria.

You already saw one way that bears and salmon interact in this ecosystem. Can you think of some ways these other living things might interact with salmon too?

EXPLORATION VIDEO 2

You already know that brown bears eat salmon, and maybe you guessed that eagles eat salmon too. They'll even take their meals to go, carrying salmon often to the forest. Eagles and bears can be messy eaters, so there are often salmon scraps left over. Plus, they make other kinds of leftover waste. Yep. That's bear poop. Fortunately, that leftover waste doesn't just pile up. If it did, the forest would be covered by bear poop, dead leaves, and other waste. Instead, that waste becomes food for living things like slugs, microscopic bacteria, and fungi like these mushrooms. You might know a name for these living things. They're decomposers. Decomposers take in matter from dead stuff and leftover waste. In the process, they break that matter down and release some of it back into the environment. From bears to bacteria, all these living things take in matter that once came from salmon. In parts of this Alaskan forest, scientists discovered that matter from salmon was even in the trees. That sounds pretty weird. Obviously, a spruce tree can't eat a salmon the way a bear does. Trees have a totally different way of getting matter. If you've seen our lesson on how trees get bigger, you may recall that trees get most of their matter from the air around them. Through their leaves, they take in an invisible gas. Then they use matter from the gas to build their roots, trunks, and leaves. That's pretty amazing. But if trees get most of their matter from gas in the air, how could matter that was part of a salmon become matter that's part of a spruce tree? How could salmon from a stream even get close to a tree? I wonder if you have any guesses.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to figure out the mystery of how matter from the salmon is ending up in the trees of the forest. In order to solve this mystery, we're first going to explore matter in this ecosystem before the salmon arrive from the ocean. You'll build a model to represent this forest ecosystem. There's matter everywhere in this forest. Matter makes up all the living parts, like the trees, the bears, and the mushrooms. But the non-living parts of the environment, like the air and parts of the soil, are also made of matter. Today, you're going to keep track of some of this matter. You'll use beans to represent that matter. Not only is there matter here, but it's on the move. But where will it go? To track where the matter moves, you'll use this Matter Journal. You'll follow the matter's journey through the forest by moving your matter pieces and drawing arrows on your model to show the path the matter takes. Your challenge is to use this model to solve the mystery of how salmon gets to the trees. We'll show you how to get 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.

ACTIVITY STEP 2

Get your supplies.

ACTIVITY STEP 3

First, let's make your Matter Journal. You're going to fold it in half along the thick black line first. Line up the corners, press down, and then use your fingernail to make a good crease. Then fold it in half again along the thin black line. Your journal should look like this when you're done.

ACTIVITY STEP 4

Now, lay out your Forest Ecosystem pages. Make sure they look like this with the tree on the left and the bear on the right. Then place one sticker towards the top like this and another towards the bottom like this so that the pages stay connected.

ACTIVITY STEP 5

You're going to use your beans as a model for matter. You know that matter is everywhere, but first, let's focus on the matter in the environment, the soil, the water in that soil, and the gases in the air. That's where the matter in this activity will start its journey. To show how these parts of the environment are made of matter, you're going to add matter pieces. Go ahead and work with your partner to add matter pieces to represent the matter of the soil and the gases in the air.

ACTIVITY STEP 6

Here's what our model looks like. We added some beans here to represent the matter of the soil and also any water that might be in that soil. We also added matter pieces here to represent the gases in the air. Your model might look slightly different, and that's okay. Everything in the

environment is made of matter. Go to the next step to start following matter on its journey through this ecosystem.

ACTIVITY STEP 7

Now it's time to read about where the matter travels through this forest ecosystem. On the front of your journal, read the part labeled “Trees” aloud with your partner. Pay close attention to any clues about where matter travels. Use your pencil to underline any clues that you find.

ACTIVITY STEP 8

Now, you wanna show where the matter travels on this journey by using your forest model. So first, look back at the clues you underlined and talk with your partner about where you should move your matter pieces. Then, once you've decided where they should go, move your matter pieces.

ACTIVITY STEP 9

Here's what our model looks like. We read about how trees, like spruce trees, absorb water through their roots. So we moved some of our matter like this to represent that water. We also read that gases from the air enter plants through openings in their leaves, so we moved some matter pieces like this. So that you and your partner can remember the path that the matter travels, you'll use your markers to add arrows to your model. For example, we added some arrows here to remember that matter from the air moved into the tree's leaves. You don't need to draw an arrow for every piece that you moved, just a few to show the general path. Go ahead and add some arrows to your model now.

ACTIVITY STEP 10

Here's what our model looks like after we added arrows. We drew a few arrows here to remember that matter moved from the soil into the trees. And like I already said, we added a couple of arrows here too, to remember that matter from the air moved into the tree's leaves. You might have drawn more arrows, and that's okay. Go to the next step to start discussing this matter journey.

ACTIVITY STEP 11

Discuss this question as a class, then record your answer to question one in your Matter Journal.

ACTIVITY STEP 12

Now let's read about where matter travels next. Open your journal and read the “Bears” paragraph aloud with your partner. As you read, look for clues that tell you where the matter travels. Underline those clues with your pencil.

ACTIVITY STEP 13

Now that you've read about what happens to matter next, you want to show that on your model. So first, look back at the clues you underlined and talk with your partner about where you should move your matter pieces. If the reading mentioned parts of the ecosystem that you don't see in your model, you might want to draw those additional parts. Once you've decided where they

should go, move the matter pieces, then use your marker to add arrows to show the path that the matter took as it traveled.

ACTIVITY STEP 14a

Discuss this question as a class, then record your answer for question two in your Matter Journal.

ACTIVITY STEP 14b

Here's what our model looked like. We read that bears can eat part of spruce trees, so we moved some of the matter pieces into the bear. We also read that some of the matter will become bear poop, so we drew that here and moved some of our matter pieces to the bear waste. We also drew some arrows to help us remember the path that the matter took. Your model might look a little different from ours, and that's okay. Go to the next step to continue following the path of this matter.

ACTIVITY STEP 15

Let's continue on our matter journey. Read the “Mushrooms” paragraph aloud with your partner. As you read, look for clues that tell you where the matter travels. Underline those clues with your pencil.

ACTIVITY STEP 16

Now that you've read about what happens to matter next, you want to show that on your model. Talk with your partner about the clues you underlined. If the reading mentioned parts of the ecosystem that you don't see in your model, we suggest that you draw those additional parts.

After you've added any drawings, talk with your partner about where you should move your matter pieces. Once you've decided where they should go, move the pieces, then use your marker to draw arrows to show the path.

ACTIVITY STEP 17a

Discuss this question, then record your answer for question three in your Matter Journal.

ACTIVITY STEP 17b

Here's what our model looked like. We read that mushrooms live in this forest ecosystem and can grow on top of bear poop. So we drew a mushroom right here on top of the bear waste. We also read that the mushrooms break down that waste into tiny parts that eventually become the matter in the air and in the soil. So we moved our matter pieces like this. We also drew some arrows to help us remember the path the matter took. Your model might look a little different from ours, and that's okay. Go to the next step when you're ready to move on.

ACTIVITY STEP 18

Your ecosystem model is almost complete. Discuss this question as a class. Can the matter get back to the trees? How? Look at your ecosystem model. It can help you figure out the answer.

ACTIVITY STEP 19

Now that you've discussed how the matter could get back to the tree, let's show it on our ecosystem model. Work with your partner to move the matter pieces back to the tree. Make sure

you also add arrows to your model. Those arrows should show the path of matter traveling back to the tree.

ACTIVITY STEP 20

Your ecosystem model is complete. Go ahead and put all your matter pieces back into the cup. Now imagine that salmon have traveled from the ocean and arrived in this forest. Does your forest ecosystem model give you any new ideas about how the matter in a salmon could become matter in a tree? Discuss with your partner. After you've discussed, go ahead and write your answer to question four on the back of your Matter Journal. You can look back at the clues in the Matter Journal and use your ecosystem model to help you figure it out.

WRAP-UP VIDEO 1

In the activity, you used objects like beans to represent the matter that makes up a forest. Then you created a model to track where and how that matter moves. In our model, we noticed something interesting. See how all these arrows sort of make a big circle or loop? Depending on the arrows you added, your model may have two loops. Ours has arrows up here through the air and arrows down here through the soil. Maybe you discovered something similar. If you start at an arrow, like here, where matter from the air moves to the tree, then follow the direction that moves through the ecosystem, you can end back where you started and go around again. When a process happens again and again like this with a set of steps that repeats, you can call that a cycle. The arrows in your model show matter moving, so it's a matter cycle. Maybe this cycle gave you some new ideas about how matter from a salmon could get to a tree. Let's start with the bear. Instead of eating parts of the tree, the bear could eat the salmon instead. You probably know what happens next. The bear takes in matter from the salmon and uses some of

it to build its body, but it also releases some matter as waste. Yep. Bear poop. The matter in the bear poop gets broken down by decomposers, like the mushroom. Some of that broken-down matter becomes part of the soil, and some becomes part of the air. From your model, you may have an idea where the matter can go next. The tree can take it in. That means matter that starts here as part of the salmon's body can move through the ecosystem and become part of the spruce tree. You did it. You solved the salmon mystery. You found a way to get matter from a salmon to a tree. It's the matter cycle that makes it possible, and there's more that you can uncover about the matter cycle. Like, remember those two loops in our model? Matter is cycling through the air up here, and it's cycling through the soil down here. Let's focus on the matter in the air first. You may recall that trees get most of their matter from gas in the air. That gas is called carbon dioxide. See that carbon part of the name? Carbon is really important to the matter that trees are made of. A tree uses carbon from the gas to build their roots, trunks, and leaves. Take a look at the forest model. Where do you think the carbon that's part of this tree could move next?

WRAP-UP VIDEO 2

This spruce tree might look tasty to a hungry bear. When the bear eats, it takes in carbon that's part of the tree's leaves and twigs. Carbon moves from the tree to the bear and gets used in its body, But that carbon isn't done moving yet. Some ends up in the bear's poop. Sound familiar? Now you're back to the mushroom, the decomposer in your model. As decomposers break down matter from living things, they release some carbon back into the environment as carbon dioxide gas. From the air, that carbon dioxide can be taken in by plants like the spruce tree. And from the tree, some of that carbon could move through the forest again, like these arrows in the model show. So carbon is cycling here. A carbon cycle is part of the larger matter cycle in this

forest. But while most of the matter trees are made of comes from carbon dioxide, there is some other matter they need as well. That's where these arrows come in that go through the soil. You already know that trees take in water from the soil. They also take in something called micronutrients. Micro means really tiny, and nutrients are something that living things need to stay healthy and grow. Micronutrients are kind of like the vitamins some people take for their health. Through its roots, a tree takes in micronutrients from the soil and uses them to build their roots, trunks, and leaves. But those micronutrients aren't done moving. They can move to the bear that eats the tree's leaves and to the bear's waste, which gets broken down by decomposers. Some get released into the soil, where they're taken in by plants again. So micronutrients are cycling too. Salmon play a special role in the way matter cycles. During their time in the Pacific Ocean, salmon take in a lot of matter. Then, they move that matter over miles and miles, all the way back to the rivers and streams of the forest. That matter provides many animals with the food they need. It also creates more dead stuff and leftover waste for decomposers. And when decomposers break that matter down, it adds more micronutrients to the soil, which can help trees grow bigger, faster, sort of like adding fertilizer to a garden. That's how salmon help to feed this forest. Scientists can trace some matter in trees all the way back to the salmon's time in the ocean. You see, an ocean ecosystem has a matter cycle too, just like a forest and just like every ecosystem on Earth. Anywhere you go, there's matter cycling around you. There's matter in the non-living parts of the ecosystem, like air, water, and parts of the soil. That matter cycles to the living things in the ecosystems, like plants, animals, and decomposers. You are part of the matter cycle too. The matter in salmon can become the matter in you. And when you breathe out, that's carbon dioxide gas. Just think, that matter could be taken in by a plant, then eaten by an animal. Who knows where it will end up? With each breath, you're sending matter off on an epic journey through the matter cycle. Have fun, and stay curious.