Lesson: “How can we protect Earth's environments?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther, from the Mystery Science Team. One of my favorite things to do in the summer is visit a lake near where I live. On a clear day, the sky and water are both so blue. But check out the water in this lake. This is a picture taken from space of Lake Erie, a huge lake in the Midwest of the United States. The picture was taken in September, 2017. See those electric green swirls in the water? Beautiful, right? But here's what it looks like up close. Not so nice. But what it looks like is nothing compared to how it smells. Local said that the smell of Lake Erie during this time reminded them of old garbage or rotten eggs. Patches of this smelly green stuff covered huge sections of Lake Erie from summer until winter. Then the next summer, it came back again. And Lake Erie isn't the only place having this problem. Take a look at what happened to Lake Okeechobee in Florida, Lake Champlain in Vermont, the Ramapo River in New Jersey, and the Ballona Wetlands in Los Angeles. Even ponds and lakes in Central Park, New York City. And it's not just the US either. Bodies of water all over the world are having the same problem. So what's going on here? What could be causing this weird, smelly muck in the water in all these places? I wonder if you have any ideas.

EXPLORATION VIDEO 2

To understand the smelly green muck, it helps to zoom in really close, closer, even closer. If you looked at muck like the stuff on Lake Erie under a microscope, you'd see millions of different tiny living things in the water. We often call these different kinds of things by one name, algae. When there's too much of this stuff in a body of water, it takes over, this is called an algae bloom. But many underwater animals eat algae, like small fish, tadpoles, and turtles, just to name a few. You may even know that lots of underwater animals depend on oxygen produced by algae to breathe. So lots of algae in the water means lots of food and oxygen for those creatures, right? That's true, algae are a natural and important part of lakes and oceans, and when they grow and stay healthy, creatures that depend on them stay healthy too. But something different is happening with these algae blooms, check this out. This is what a beach in Thailand looked like after a huge algae bloom, and this was found on the shores of Sarasota, Florida after an algae bloom there. Dead wildlife washed up in big numbers. It seems like even though a little algae in the water is good for underwater life, like fish, a lot of algae is bad, why do you think that is?

EXPLORATION VIDEO 3

Think of it this way, what's the healthiest food you could serve at a school cafeteria? Like how about a nice leafy green salad? Usually it's a good thing if a cafeteria offers salad. Eating those leafy greens can help you grow and stay healthy. But imagine if you showed up to lunch one day and the entire cafeteria is full of salad, salad here, salad there, salad everywhere. You're swimming through a cafeteria-sized pool of salad. You try to get your lunch, but it's hard to find anything but salad. It's hard to move, even hard to breathe. A cafeteria full of salad isn't exactly the same as a lake taken over by an algae bloom, but a similar thing is happening here. While

having some algae can be helpful, in a harmful algae bloom, there's so much algae that it crowds out other living things in the water, making it hard for them to eat, move or even breathe. And sometimes some kinds of algae also produce chemicals that, in high amounts, make the algae itself unhealthy to eat or touch. In 2014, people in the city of Toledo even had to stop using water from their sinks and showers because their drinking water had become filled with way too much harmful algae from nearby Lake Erie. They had to rely only on bottled water shipped in from other places. Even creatures that don't directly touch harmful algae can still be hurt. Most seabirds don't live in water, but they eat things like fish that do. If those fish become filled with harmful chemicals, a seabird might get sick or die. When harmful algae blooms take over, it can lead to this. This is an area where all the plants and animals that usually live there have either left or died. It's called a dead zone. Now, algae blooms aren't a new thing. They've occurred naturally for millions and millions of years. But in some places they seem to be getting worse. Big algae blooms used to happen on Lake Erie occasionally, but now they happen every year. Blooms off the coast of California now sometimes extend as far north as Canada. What could be causing algae in these places to grow more now than it did before? Any ideas?

EXPLORATION VIDEO 4

Scientists are still studying exactly what conditions lead to harmful algae blooms, but they've noticed that what helps algae grow in water is similar to what helps many plants grow on land. For example, many algae blooms go away in wintertime and come back in summer. Like many plants, algae thrive in warmth and sunlight. More warm sunny days means more algae. And take a look at this. This is a lawn grown without fertilizer and this is a lawn grown with fertilizer. Fertilizer contains nutrients that help plants grow. Now take a look at this. This water has a small amount of fertilizer in it and this water has a large amount of fertilizer in it. Those same fertilizer

nutrients also help algae grow. Back at Lake Erie, scientists monitoring the lake have noticed that the water here is changing over time. One big change, the water has more fertilizer nutrients in it now than it once did. Those nutrients are helping algae blooms in Lake Erie grow. But why the change? Where did the extra nutrients come from? There are many different possible sources. Some nutrients occur naturally in lakes and oceans. Many gardeners use fertilizers to make their lawns and flowers grow. And think about who else wants to help their plants grow big and healthy? Farmers. Farmers often use lots of fertilizer too, but there's another source of those nutrients that might surprise you. Waste from humans and pets is full of nutrients that help algae grow. But could fertilizer on a lawn or farm or dog poop in a park really be the source of the nutrients in a big body of water like Lake Erie? How could those nutrients get from a neighborhood on land to the middle of a lake? I wonder what you think.

EXPLORATION VIDEO 5

Imagine you spread a bunch of fertilizer on a lawn, then water it. Some of that fertilizer will be soaked up by the grass, right? But the rest of it might soak deep into the ground, or wash off into a storm drain, we call this runoff. That runoff might then wash into streams, rivers and eventually big bodies of water like lakes and oceans. Water can end up far away from where it first came from, carrying nutrients along with it. And as more fertilizer nutrients enter the water, more algae grows. So to recap, harmful algae blooms are more likely to happen in places with more warm sunny days and more plant fertilizer and waste running off into the water. What can we do about these problems? Imagine you live in a lakeside town that's having problems with harmful algae blooms, how could the town fix this problem?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to play a game called Bloom Busters. The Laketown lakes are in trouble. More and more algae have been growing in the lakes and the residents of Laketown don't know how to fix it. If this continues, the wildlife and people that live around the lakes could get really sick. That's where you come in. You and your teammates will have your own map of Laketown and you'll need to reduce the amount of algae in all three lakes before it's too late. It's not gonna be easy, though. At the end of each round, more algae will grow. Things will probably get worse before they get better. But by working together, you and your teammates can reduce the algae in the lakes back to a healthy level again. Are you up to the challenge of saving Laketown? We'll show you how to get started, step by step.

ACTIVITY STEP 1

You'll play the game in a group of three. Decide who will be player 1, player 2, and player 3. Make sure you have enough space to lay out all of the materials for the game.

ACTIVITY STEP 2

Get your supplies. Each person will need a pair of scissors. Each group will need all of these things.

ACTIVITY STEP 3a

This is your map of Laketown. Each lake has some gray shaded boxes in it. These boxes represent the healthy amount of algae in each lake. This is what Laketown should look like, but right now, there's too much algae in the lakes. Add six squares of algae to each of your three

lakes, like this. One square equals one patch of algae. When you're ready, click the arrow to move on.

ACTIVITY STEP 3b

To win the game, your team needs to work together to get rid of all this extra algae and get all three lakes back to just the shaded boxes. But you'll have to watch out because more algae will grow during the game. If any one lake fully fills up with algae, like this, your team loses the game. Now let's learn how to reduce the algae in your lakes.

ACTIVITY STEP 4a

One way to reduce algae in your lakes is to prevent it from growing in the first place. Find the two Prevent It Project sheets and cut along the dotted lines, like this. Then fold them in half on the solid line, like this.

ACTIVITY STEP 4b

Prevent It Projects are your most powerful defense against the algae. Take a minute for all three teammates to read the four Prevent It Projects. Don't worry about the symbols just yet. We'll see what those mean soon. I'll set a timer for two minutes in case it's helpful. Okay, time's up. Go on to the next step.

ACTIVITY STEP 5

To complete a Prevent It Project, your team needs to gather a certain amount of Progress cards. When you complete a project, you get rid of some algae in the lakes right away. You also reduce the amount of algae that will be added into your lakes at the end of each round. The more cards

it takes to complete a project, the better the reward is. Place the four Prevent It Projects above your map with this side face up.

ACTIVITY STEP 6a

Another way to reduce algae is with a Quick Fix card. These cards will let you remove a little bit of algae right away. This can be helpful, but Quick Fixes can have consequences. When you use a Quick Fix card, you'll have to roll the dice, literally. Whatever number you roll will decide what kind of consequence your quick fix will have. Sometimes nothing will happen. Other times there may be a negative effect.

ACTIVITY STEP 6b

Cut along the dotted line on your Consequences sheet. Put your Consequences sheet and dice to the side for now.

ACTIVITY STEP 7

All the cards that can help you reduce algae in your lakes, Progress cards and Quick Fix cards, are in the Progress Deck. Place the deck face down on the Progress Deck space like this.

ACTIVITY STEP 8

Now find your End-of-Round Algae Growth Tracker. This tells you how much algae to add to each lake at the end of every round. Player 3, you have an important job. You are in charge of the Algae Tracker. Go ahead and write your name on the Algae Tracker. Then attach a paper clip here. Since the algae growth is so bad in Lake Town right now, you're going to start the game with the paperclip pointing at, "Add 3 algae to each lake."

ACTIVITY STEP 9

You're almost ready to start playing. All players take two cards from the deck and put them face up in front of you. These are your starting cards. From now on, when you take a card at the beginning of your turn, you'll only take one card. Now you're all set. But before you and your team play on your own, we're going to walk you through an example round first.

ACTIVITY STEP 10

Let's see an example round of the game. After this, you'll get a chance to play it yourself. Player one goes first. They take one card from the Progress deck. They get to spread the word Progress card. Next player one gets to play one card from their hand if they want. They talk to their teammates and decide to put the Progress card towards this project. Now their team only needs two more Progress cards before they get these rewards. Now it's player two's turn. They take one card from the deck and decide to play a Quick Fix from their hand. The card says to remove two algae from two lakes. After they do that, they have to roll the dice to see if they get a consequence. They roll a one and look at their Consequences sheet. That's the Dirty Lake consequence. Oh no. That means they have to add more algae. They put the Quick Fix card they just played in the discard pile. Player two's turn is over. Now it's player three's turn. They take one card from the deck. Then they talk to their team and decide to play a wild Progress Card which works for any Prevent It Project. They decide to put it towards this project. Now they only need one Progress card to complete it. Player three's turn is over. Okay, now that this example round is over, go to the next step.

ACTIVITY STEP 11

Now you try. Starting with Player 1, everyone in your team take one turn. After Player 3 takes their turn, pause your game. Once everyone is ready to move on, click the arrow.

ACTIVITY STEP 12

After everyone takes a turn, it's the end of the round. Now it's the algae's turn to grow. Player 3, look at the Algae Tracker and see where the paperclip is pointing. Add that amount of algae to each of the three lakes. Checking the tracker and adding algae to your lakes at the end of every round is very important. Try your best not to forget. Once you're ready, click the arrow to go on.

ACTIVITY STEP 13

Let's see one last thing before you finish playing your game. Once you play enough Progress cards to complete a Prevent It Project, your team gets the reward. Follow the instructions on your Prevent It Project to remove algae from a lake and lower your Algae Tracker. Flip your Prevent It Project over and stack your used Progress cards like this. The project is now complete. Click the arrow to move on.

ACTIVITY STEP 14

Now play the rest of the game. Remember, it's your team versus the algae so make sure you're talking and working together. If your team loses, it's okay. Talk about what you could do differently next time. If you need a reminder of how to play, check out the rule sheet. Good luck and have fun. When you finish playing the game, click the arrow to discuss.

ACTIVITY STEP 15

Discuss. What was your team's strategy?

ACTIVITY STEP 16

Discuss. What worked well for your team, what didn't work well for your team?

WRAP-UP VIDEO 1

The decisions your team made to save Lake Town are the same tough choices people have to make in communities around the world. Maybe your team decided to take action right away with quick fixes. Many communities make this choice too. A town harmed by a dangerous algae bloom has a problem now. It needs solutions now too. Some people are hopeful that brand new technologies could help us get rid of harmful algae. Scientists are experimenting with many different ideas to treat harmful algae blooms, everything from adding chemicals to the water to adding special kinds of clay. But these solutions are still being tested. Some people are concerned that these new tools might not work well enough, or that they may have unintended consequences. Many communities impacted by harmful algae blooms are starting to think about how to prevent these algae blooms from happening in the first place. Did you try any Prevent It Projects during the game? What were the advantages, or pros? What were the disadvantages, or cons?

WRAP-UP VIDEO 2

To address harmful algae long term, quick fixes won't be enough. We're gonna have to find ways to prevent harmful algae blooms from happening in the first place. We know water with

more nutrients in it grows more algae, so what if we could keep things like plant fertilizer and pet waste from running into lakes and oceans. During the game, maybe you noticed that your team did better when your teammates worked together against the harmful algae. The same is true in real life. Around Lake Erie, for example, governments, businesses, families, and scientists are working together to figure out the best way to reduce fertilizer nutrients in the lake. Governments in both Canada and the U.S. have signed an agreement to reduce nutrients in Lake Erie by passing laws and funding programs. Some farmers around Lake Erie have taken extra steps to reduce their fertilizer runoff by using less fertilizer or planting extra plants to filter fertilizer out of the water. Community groups have taken on projects, too, like this one in the city of Cleveland that makes sure only rain goes into local storm drains, so runoff to lake stays cleaner. During the game, it took time for your team to complete Prevent It Projects and it took even more time before you could remove algae each round instead of adding new algae. The same is true for lakes in real life. It can take years of change for algae-clogged waters to become healthy and balanced again. But harmful algae blooms don't go away on their own. When nothing changes, they get worse, sometimes much worse. Any step a person takes to keep nutrients out of the water now means a little less algae later. And when more and more people make changes together, over time, their impact grows bigger and bigger and harmful algae blooms get smaller and smaller. You can help get rid of harmful algae blooms in real life too, no matter where you live. Harmful algae blooms occur in bodies of water around the world, from here in Lake Erie to here in Florida, to here on the coast of China and here in Lake Windermere in England. And remember, whether you live near a body of water or not, runoff travels. Algae blooms in the Gulf of Mexico are made worse by nutrient-rich water pouring into streams and rivers over a thousand miles away. The choices your community makes, like how much fertilizer your local park uses, how clean you keep the storm drains on the street near

your school, or even whether you pick up after your pets, those small things make a real difference to the health of living things near and far. Earth is home, home for us, manatees in Florida, grasses in Cape Cod, seals in Siberia, dogs in Texas, weeds in Lake Windermere, birds on Lake Erie, and so many more. What can you do to help keep all these living things healthy? What small steps can you take now to help your community that could have big effects in the future? Take care of our home and stay curious.