Lesson: “Where do flash floods happen?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hey, it's Esther from the Mystery Science team! And today I've got a mystery to show you that has to do with water. Look at this huge, powerful river. Now what if I told you that just a few minutes earlier, that river wasn't even there? See just a trickle of a stream? A few flowers waving in the breeze? But if you listen carefully, you might hear a rumble in the distance. And if you look really closely near those trees in the background, you'll see something moving down the riverbed. That's water, a big river of water filled with mud and sticks. The river is getting bigger and louder now. These two dogs have come to check out what all the racket is. A few seconds later, the river starts to overflow, washing over the flowers on the bank. By the time the dogs come back to check on what's going on, the entire area has transformed into a roaring river. And even they realize that it's time to head out to find someplace safer and drier. What's happening here is something called a flash flood. A flood is when water overflows into areas that are usually dry. Unlike some floods, which happen over days or even months, flash floods happen really fast. Usually in six hours or less. In a flash flood, water flows together at high speeds, creating a rushing river that can quickly fill an area. Even though it might seem like this flood appeared out of nowhere, it's actually not the first time a flash flood has happened in this place. In this area, Santa Clara Pueblo land in New Mexico, people have learned to expect flash

floods to happen every year, and sometimes more than once. Some places get flash floods over and over again in the same spot. But why would flash floods happen so many times in the same area? Can you think of reasons why one place might flood more than other places?

EXPLORATION VIDEO 2

I don't know how you answered, but the first thing I think of is rain. Since the result of a flash flood is too much water, it would make sense that the cause of a flash flood would be too much rain—but it's not that simple. Take a look. This is Seattle, a city in Washington state. Seattle is famous for its foggy, rainy weather. The area usually gets about 152 rainy days every year. That's way more rainy days than most places in the US, so you'd think that Seattle would get a lot of flash floods, right? But that's not the case. The Seattle area has had exactly one recorded flash flood in the last 70 years. Even though it rains in Seattle often, most of the rainstorms are small. Places that get a lot of light rain aren't that likely to get flash floods. There's just not enough water in one place at one time to create a fast-moving wave. On the other hand, places that get big rainstorms are likely to get flash floods, even if those big storms don't happen very often. But not all big rainstorms lead to flash floods. To understand how rain becomes a flood, we have to look at the ground. But the ground under your feet can be really different in different places. For example, I live in an area where there are lots of natural spaces and farmland. So I see mostly plants, soil, and mud on the ground, with a few big paved roads here and there. Take a minute to think about what the ground is like in your area. When you go outside and look down, what do you see?

EXPLORATION VIDEO 3

Different kinds of ground do different things when rain falls. If you live in a place with lots of natural spaces like I do, when rain falls on the ground, it usually hits plants and soil. But different places have different kinds of soil. Some soil, like the soil in this container, is gritty and grainy and hard to pack together. Scientists call this "sandy soil." Very sandy soils are like sand on the beach. Take a look at what happens when water falls on sandy soil. The water disappears almost immediately. It soaks into the soil, trickling down into spaces between the grains of sand. Sandy soil is absorbent, which means that it soaks up water like a sponge. But what if the ground is made of a different kind of soil? This container is filled with clay soil. Soils with a lot of clay are a lot like the clay that you might use for an art project. They're mucky and sticky and clump together really easily. Watch what happens when water falls on the clay soil. The water just stays on the surface. Clay doesn't absorb water quickly. The water will have to sit there for a long, long time before it soaks into the clay. And in some places, the ground doesn't absorb water at all. If you live in a rocky area, you might have noticed water bouncing off rocks during a rainstorm or rolling down the sides of rocky cliffs. And if you live in a city, maybe you've seen puddles on the street or sidewalk after a big rain. In cities, the ground is usually covered in hard, human-made surfaces we call "pavement." Rocks and pavement have something in common. They're usually waterproof. Rain that falls on rock and pavement usually just stays there on the surface. If enough water collects in one spot, that can create a puddle. If even more water collects, it might create a flood. Still, a big puddle is different from the rushing river of water that we saw in that flash flood earlier. What might make water move like that? Can you think of anything that could turn an overflowing puddle into a fast-moving river?

EXPLORATION VIDEO 4

Think about the last time you saw water moving from one place to another. You may have noticed that it was flowing downwards. Water flows from high places to low places. Rainwater's no different. When rain falls, any water that the ground doesn't absorb flows downhill and collects in low spots. In some places, the water may not flow very far. Think about the puddles forming on a parking lot, for example. Parking lots are usually pretty flat. So rain water might just roll a few feet downhill, toward a tiny dip in the pavement. But imagine what happens when it rains on the top of a tall, steep mountain. The rainwater slides down the sides of the mountain, gathering speed as it goes. The steeper the mountain, the faster the water moves. If enough water flows together on one slope, by the time it reaches the bottom, it can become a fast-moving river of water—a flash flood. Okay, so now that you've learned what causes a flash flood, I have a challenge for you. The U.S. state of Texas has dealt with flash floods for a long time. One strip of land in Texas in particular has experienced more flash floods than most other places in the entire United States. Over the years, this one part of Texas has become so famous for flooding, that locals gave it a nickname: Flash Flood Alley. So here's your challenge. I challenge you to find Flash Flood Alley. How could you figure out which part of Texas gets the most flash floods? What kind of place would you look for?

EXPLORATION VIDEO 5

I'm guessing you probably thought about some of the things that we've been talking about—how the weather and the ground in an area can make a place more likely to flood. If the place: one, is in a lower area next to a steep slope, like a mountain or a cliff; two, has ground that can't

absorb water, like clay soil or pavement; and three, gets big rainstorms—then you know that place is super likely to get flash floods. Seems simple enough, right? Well, yes, but Texas is really big. It takes 13 hours to drive from the top of the state to the bottom of it. Imagine how long it would take you to travel to the bottom of every mountain and every hill to see how much water the ground could soak up. Luckily, we don't have to do that. That is why we have maps. A map is a model of a place that shows information people have gathered about that place over time. You've seen some maps of Texas already. Different kinds of maps show different kinds of information in different ways. This is a road map of Texas. It uses dots to mark cities and lines to show roads and borders. This map would be perfect if you were trying to plan a road trip from Houston to El Paso to visit family, or if you wanted to see how many big cities are in between Dallas and San Antonio. But let's take a look at another map of Texas that shows us something different. This map uses symbols, tiny pictures that represent things, to map which parts of Texas have certain resources, like cattle or oil. And some maps use colors to mark different areas. On this map, the color green shows where Texas has forest. So even if you're miles and miles away from Texas, a map with the right information might be all you need to help you find Flash Flood Alley. Imagine you're starting with a totally blank map of Texas. What information would you want to add to the map to help you find Flash Flood Alley?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to explore the state of Texas and find Flash Flood Alley, the place that gets lots of flash floods—more than anywhere else in Texas. You don't have time to explore all of Texas, but with a map of Texas, you can explore the state without actually going there. On your map, you'll see five numbers, each in a different location on the map. Flash Flood Alley is in one of these five places, but which one? It's up to you to figure that out. As you

explore Texas, you'll get clues that tell you where flash floods are likely to happen. You'll use your Flash Flood Finder to keep track of all these clues. At the end, you'll put all the clues together to figure out the exact location of Flash Flood Alley. Are you ready? We'll show you how to get started, step by step.

ACTIVITY STEP 1

Find a partner. Explorers often work in teams. You and your partner will explore Texas together, share ideas, and work together to figure things out. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies. If you don't have crayons with these exact colors, that's okay. You can use other colors if you need to.

ACTIVITY STEP 3

Cut the Flash Flood Finder worksheet in half on the dotted line. Now each of you has their own Flash Flood Finder.

ACTIVITY STEP 4

Take a look at your map of Texas. It shows you land and water and one more thing: the key to the map. Find the key on your map. A map’s key is a lot like the key to a secret code. It tells what the marks on the map mean. Find the waves on the key and the waves on the map. On the map, those waves mean water. Color the area around the waves blue on the key and blue

on the map. You're coloring in the water of the Gulf of Mexico. That's the lowest area on the map. Water always runs downhill, off the land and into the Gulf of Mexico.

ACTIVITY STEP 5

Find the numbers on the map that mark places where Flash Flood Alley you might be. If you find reasons that flash floods are likely at one of these places, you'll mark them on your Flash Flood Finder. We'll show you how in the next steps.

ACTIVITY STEP 6a

Here's the first clue to help you find Flash Flood Alley. Notice the parts of the map are different shades of gray: dark gray, medium gray, and light gray. Look at the map's key to see what those shades of gray mean. Discuss with your partner.

ACTIVITY STEP 6b

The key shows the answer. Darkest gray is the highest land. That's where all the tall mountains and flat-topped mountains are. Medium gray is lower. That's where there are hills and low flat-topped mountains. Light gray is where the land is lowest.

ACTIVITY STEP 7

Your map shows you where the land is higher and lower, but it doesn't show you what that land really looks like. These pictures show you what you'd see if you traveled to the highest land, the lower land, and the lowest land on your map. Think about what would happen in each place if there was a rainstorm. Discuss.

ACTIVITY STEP 8

When it rains in a high place like a hill or a mountain, water can flow downhill to flood lower land nearby. On your map, notice where two shades of gray meet. In these areas, a lower place is next to a higher place. Because water runs downhill, flash floods are likely in that lower place. On your map, find where two shades of gray meet. Look for numbers nearby. Those numbers show where Flash Flood Alley might be.

ACTIVITY STEP 9

You will use your Flash Flood Finder to keep track of what makes flash floods likely in different places. Look at the Flash Flood Finder's key. The triangle means that a lower place is near a higher place. Draw a triangle in the box by each number that is in a lower place near a higher place, like this. Number 3 is in a lower place near a higher place. This will remind you that a flash flood is more likely near number 3. Now mark the other two places yourself. Some numbers won't get a triangle. You're marking only the numbers that have a lower place near a higher place.

ACTIVITY STEP 10

Your map has another clue that can help you find Flash Flood Alley. Some of the places you just marked have an extra reason that flash floods might happen there. Where high land ends in a cliff or a steep rocky slope, rainwater runs off the ground and flows downhill fast. On your map's key, find the line that marks where there are cliffs and rocky slopes. Draw an arrow on the key to show water flowing down the cliff, like this. Then find all the cliffs on your map. Work with your

partner to draw arrows like these showing where rain water would flow. Remember, water flows from a higher place to a lower place.

ACTIVITY STEP 11

Flash floods are more likely at the bottom of cliffs and rocky slopes because rain water rushes down them. On your map, look for numbers that are at the bottom of a cliff or rocky slope. On your Flash Flood Finder, put an arrow pointing down by those numbers.

ACTIVITY STEP 12

Here's another clue. Soil with a lot of clay in it doesn't soak up water. If the ground doesn't soak up rain, it's more likely to cause a flood. Your map shows where the soil has lots of clay. On your map's key, find the shape beside the words “Clay soil.” Use your yellow crayon to color in the shape. Then find all the areas on your map that have the word “clay” and color those areas yellow. There are four places total to color on the map.

ACTIVITY STEP 13

Places with lots of clay soil are likely to flood because the water doesn't soak into the ground. On your Flash Flood Finder's key, color the square beside “Clay soil” yellow. On your map, look for numbers near areas with clay soil. On your Flash Flood Finder, draw a yellow square by those numbers.

ACTIVITY STEP 14

Paved roads, sidewalks, and parking lots don't soak up water. The more pavement there is in a place, the less water soaks into the ground. All that water can cause a flood, so finding places with lots of pavement gives you another clue that will help you find Flash Flood Alley. On your map's key, find the symbol for “city.” A black dot marks the city's location. The circle around the dot shows the pavement around the city. Color the circle red. Your map shows five Texas cities with the most pavement. On your map, make a red circle about the size of the one in the key around each of the cities.

ACTIVITY STEP 15

Flash floods are more likely when pavement keeps water from soaking into the ground. On your Flash Flood Finder’s key, color the circle beside “pavement” red. On your map, look for numbers near areas with lots of pavement. On your Flash Flood Finder, draw a red circle by those numbers.

ACTIVITY STEP 16

Here's your last clue: a big rainstorm that drops lots of water can cause a flash flood. Big rainstorms are common in some parts of Texas, but not in others. On the map, find the four places marked with an X. Each X marks where there was a giant rainstorm, so big that it set a record for the amount of rain it dropped. Draw a blue cloud over the X in the key and the Xs on the map.

ACTIVITY STEP 17

On your Flash Flood Finder's key, color the cloud beside giant rainstorm blue. On your map, look for numbers near the rainstorms. On your Flash Flood Finder, draw a blue cloud by those numbers.

ACTIVITY STEP 18

Now, take a look at your map and your Flash Flood Finder. Discuss.

ACTIVITY STEP 19

Here's what our Flash Flood Finder looks like. Look at your map and discuss with your partner.

WRAP-UP VIDEO

In today's activity, you explored a map to figure out where Texas's famous Flash Flood Alley is located. Let's see where your search took you. First, you looked for low places next to high places. Texas has many different kinds of high places, from tall mountains to flat-topped mountains to rocky cliffs. Maybe you noticed that the cliffs and the rocky slopes in the center of Texas are also right next to one of the lowest areas in Texas, these low plains in the east. Next, you looked for places where the ground couldn't absorb water, like areas with clay soil or big paved cities. Several big cities, including San Antonio and Austin, are located at the base of those central rocky slopes, and that area also has a lot of clay soil. Maybe by then you were a little suspicious—could this be Flash Flood Alley? Lastly, you mapped some of Texas's biggest rainstorms. Two of those rainstorms dumped a lot of water right over those same slopes. After

you looked at all the information on your map together, only one area had all of the things that we know make a place likely to flood. Only one area had all the perfect conditions for flash flooding. Number 4 on your map is Flash Flood Alley. In real life, it's actually even bigger than the area around the number 4. This whole area is Flash Flood Alley. When heavy rain falls on the top of those rocky cliffs and slopes, it runs downhill to the lowlands below, gathering speed as it goes. When the water reaches the bottom, the clay soil and paved cities in the area can't absorb the water. So the water just continues flowing, turning into a bigger and bigger river. And there you go, that's why it's called Flash Flood Alley. But even though there's only one place called Flash Flood Alley, maybe you found other areas in Texas that were also likely to get flash floods. Like, take a look at this area. The area around the city of Houston also has clay soil, is in a low part of the state, and gets big rainstorms. Plus, Houston itself is a huge city with lots of pavement—and it turns out, Houston does have a lot of flash floods. While Flash Flood Alley gets the most flash floods in Texas, that doesn't mean that other places don't flood. Conditions that lead to flash floods show up in many different places. So what can we do about this? If we know where and why flash floods happen, is there anything we can do to stop them? Mapping where flash floods are likely to happen can help us avoid flash floods. We can use what we know about where floods happen to make sure that we build new buildings and roads in places that flood. And for places where people already live and work, knowing where flash floods are likely to happen gives us time to prepare. If we know ahead of time, we can take steps to keep people in high-flood-risk areas safe long before the next flash floods happen. Still, actually stopping flash floods is a bit harder to do. As much as humans might love to have power over the weather, so far, no one's invented a way to control the rain. But some scientists and engineers are looking to the ground to try to find ways we might reduce the danger of floods. Check this out. This truck is dumping water onto a parking lot, but even though the ground is

covered in pavement, the water isn't making a puddle—it just seems to disappear. This is a special kind of pavement designed to let water absorb into the ground. Though the surface of the pavement is hard, it has lots of tiny holes in it that allow water to wash through it to a collection area below. The water can then soak into the soil beneath the pavement slowly without causing a flash flood. Some cities and Flash Flood Alley are exploring using these special pavements to make their city safer from floods. So we might not be able to stop flash floods completely, but by learning about the kinds of places that do and don't get flash floods naturally, we may discover ways to keep our communities safe from flash floods without needing to stop them. The more we can work with the natural forces around us, the less we have to work against them. Do flash floods happen where you live? If not, what kind of severe weather happens in your area? Think about how people in your communities prepare for those events and help keep each other safe. Take care, and stay curious.