Lesson: “How did a tree travel halfway around the world?”

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

Hi, it's Jay from the Mystery Science Team. This is a koa tree, a kind of tree that grows on the Hawaiian islands. Koas are impressive to look at. Left undisturbed, koas can grow really tall. They're the tallest native trees in Hawaii. Forests filled with koa trees provide homes to many other native Hawaiian plants and animals like these butterflies and these colorful birds called Hawaii honeycreepers. And koa trees are colorful on the inside, too. Their wood is a beautiful deep red. For thousands of years, Hawaiians have built all kinds of things out of koa wood, from canoes to bowls to ukuleles. Goods made from koa wood are sold around the world. But these days, koas are becoming rare. There are fewer and fewer koas in Hawaii. And for a long time, people thought that this was the only place koa trees naturally grew. But then a team of scientists made a startling discovery. What they discovered had to do with the kind of tree that grows here on an island called Réunion. Réunion is halfway across the world from Hawaii but look at this tree growing on Réunion and compare it to a koa tree growing in Hawaii. These two trees have the same fluffy flowers. They have the same kind of leaves, and inside, the same dark red wood. After a lot of careful testing, the team confirmed that these trees don't just look the same, they are the same kind of tree. How is this possible? Remember before this discovery, people thought that the koa only grew in Hawaii – nowhere else in the entire world.

How could the same kind of tree show up in two places thousands of miles apart and nowhere else? I wonder if you have any ideas?

EXPLORATION VIDEO 2

Even though trees like these have been growing on Réunion for thousands of years, scientists think koa have been growing in Hawaii for even longer. So it would make sense if somehow those trees growing on Réunion originally came from Hawaii. Maybe humans took a koa tree from Hawaii to Réunion. That would make sense, right? Humans move all kinds of things. But how could a person get a koa tree from Hawaii to Réunion? I mean, look at this koa tree. It's huge and heavy, not easy to carry. But this tree wasn't always huge and heavy. Like many trees and other plants, each koa tree starts out as a seed. When that seed is in the right conditions, it can start to sprout into a tiny seedling and eventually grow into a tree. That big tree grows seeds of its own. Those seeds drop to the ground where they hopefully sprout and grow into more trees. So all the koa trees in Hawaii and all those matching trees on Réunion started out as the same kind of seed. Seeds are a lot easier for a person to take from place to place than a whole tree. But here's the tricky thing. Scientists think that these trees have been growing on Réunion since long before any human ever set foot there. So it can't have been people that brought koa seeds there. So how else could it have happened? How could a koa seed travel all the way from Hawaii to Réunion?

EXPLORATION VIDEO 3

To see how a seed might travel all that way, let's look closely at some other kinds of seeds. Take these dandelions. Maybe you've noticed that after they flower, dandelions start to look like these, little fluffy white globes. Each piece of fluff has a seed on the end, right here. Here's an

example of a bigger plant. This is a maple tree. Its seeds grow inside this papery, funny-shaped outer covering. The seeds themselves are inside this bump at the end here. What does the shape of these flat, papery parts at the end remind you of? Dragonfly wings, maybe bunny ears? And here's one more. This vine called the Javan cucumber, grows some really wild-looking seed coverings. Check it out. It almost looked like the seed is inside a clear envelope. An envelope shaped kind of like a boomerang. Now let's take a closer look at some koa seeds. This is what koa seeds look like on their own and these are what the koa seeds grow inside. Each kind of plant grows its own unique parts in its own unique shape. We call this a plant's structure. Each of the plants we've looked at grows really different structures around their seeds, but all of these seed structures will eventually do the same thing. Drop from the plant they're growing on, travel through the air, and land on the ground. How will the structure around the seeds change how they travel through the air?

ACTIVITY INTRODUCTION VIDEO

In today's activity, you and a partner are going to work together to observe how three different types of seeds move through the air: a maple seed, a rain tree seed, and a koa seed. These three seeds have very different outer structures so they're all shaped differently. Your challenge is to discover how a seed structure affects how it travels through the air. Now we don't have time to travel the world to collect all these seeds today. Instead, you're going to make your own model seeds out of paper. A model is a pretend version of something. Scientists use them to study things that might be hard to get their hands on. The model seed structures you'll make won't look exactly the same as they do in real life but they'll still move like real seed structures do. After you make your seeds, you'll act like a tree and drop them from your branches and observe how their structure affects how they fall. We'll show you how to get started step by step.

ACTIVITY STEP 1

For this activity, you'll work with a partner. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Get your supplies. Each person needs one maple printout, one rain tree printout, one koa printout, a pair of scissors, and one paperclip.

ACTIVITY STEP 3

First, you're going to make your maple model. Write your name on the back so that you can keep track of it when you test it later. Then find dot A in the bottom left corner, and fold it up to meet dot B so that it covers the gray triangle like this.

ACTIVITY STEP 4

Now fold the triangle up so that it covers the picture of the seed. Then slide your paperclip on the bottom like this. When you're done with this step, the maple seed will be on the inside of your seed structure.

ACTIVITY STEP 5

Now, cut along the dotted line like this. Stop cutting when you reach the stop sign. When you're done with this step, your maple model should have two flaps like this.

ACTIVITY STEP 6

Your maple model is almost finished. Fold flap number one toward you on the line like this. Then fold flap number two on the line in the opposite direction like this. Push your folded flaps up gently with your fingers so that they stick sideways like this. Now your maple model is ready.

ACTIVITY STEP 7

Now you are going to pretend to be a maple tree. When your teacher tells you to, stand up next to your desk. You'll need enough space to stretch your arms or branches out. Root your feet to the ground. Stand up tall. Stretch your branches up as high as you can like a huge tree in the forest. When you're ready, go to the next step, and we'll do our first drop test together.

ACTIVITY STEP 8

Let's do the first drop test together. Hold your maple model from the side with two fingers like this. Reach up with your tree branch arm and hold your model as high as you can. Now, open your two fingers to drop it from your branch. Observe how your model moves as it falls to the ground. Then, pick it up and test it again. It's important to test your model a few times to see if anything changes. As you do this, talk with your partner about what you notice. I'll set a timer for three minutes in case that's helpful. Okay, time's up. Click the arrow on the right to go on to the next step.

ACTIVITY STEP 9

Discuss: how did your maple model move as it fell to the ground? Did it fall quickly or slowly? Did it fall close to the tree or far away?

ACTIVITY STEP 10

Now it's time for you to make and test a different model seed structure: the rain tree. Write your name on the back. Then, find the two dotted lines on your printout. There's one at each end. Cut along those dotted lines and stop at the stop sign. When you're done, you'll have two slits.

ACTIVITY STEP 11

Hold the two ends of your printout and make a “U” with them like this, then slide the slit at one end into the slit at the other end like this. You should have something that looks like this when you're done. You finished making your rain tree model. Click the arrow on the right and we'll do the first test drop together.

ACTIVITY STEP 12

It's time to pretend to be a tree again. Stand up and make sure you have enough space to spread out your branches. Hold your rain tree model with two fingers so that the ends are pointing sideways like this. Then stretch your branches as high above your head as you can and drop your model. As it falls, observe how it moves. Repeat this a few more times. I'll set a timer for 30 seconds in case that's helpful. Okay, time's up. Click the arrow on the right to move on to the next step.

ACTIVITY STEP 13

Now you have two model seed structures that you can test. Work with your partner to drop both of your models and compare how they fall. As you do this, pay attention to what is the same and

what is different about your two models. I'll set a timer for three minutes in case that's helpful. Okay, time's up. Click the arrow on the right to go on to the next step.

ACTIVITY STEP 14

Go ahead and take a seat. Once you're there, discuss. What did you notice about how your two models fell? Did your two models fall in the same way or in different ways?

EXPLORATION VIDEO 4

When you dropped your rain tree seed model, maybe you noticed it didn't just fall straight down. It tumbled sideways, whirling away from its tree. Watch what happens when some real seeds with different outer structures fall to the ground. Structures with flat sides, bends or curves can catch the air and move away. Maybe you noticed that your maple model didn't move very far sideways. Our maple model twirled as it fell, sort of like a helicopter, but it mostly fell pretty straight downward. But watch what happens when seeds fall off a real maple. These maple seeds twirl like a helicopter, just like your model. But these seeds have something else helping them move that your model didn't: A strong wind. That wind caught these structures as they fell and carried them away. The maple seed's structure causes it to twirl like a helicopter as it falls. That twirling helps the seeds float lightly and slowly to the ground, making it easier for a strong breeze to sweep them away as they fall. But what about koa seeds? How does their outer structure change how they move through the air? Let's make a model to find out.

ACTIVITY STEP 15

Now, it's time to make your koa model. Write your name on the back. Then, fold it in half along the black line like this. Try to line up the edges, but it's okay if it's not perfect. Run your fingernail along the fold to make a really strong crease, like this.

ACTIVITY STEP 16

It's time to be a tree one last time. Stand up and hold your koa model with two fingers at one end like this. And stretch your branches as high above your head as you can. Drop your model and observe how it falls. Then repeat this process a few more times. I'll set a timer for three minutes in case that's helpful. Okay, time's up. Click the arrow on the right to go to the next step.

ACTIVITY STEP 17

Go ahead and take a seat, then discuss. What did you notice about how your koa model fell? Did it fall in the same way as your other models? Did it fall in a different way than your other models?

ACTIVITY STEP 18

Based on everything you observed and discovered in your drop tests, discuss: what do you think caused each of your models to fall differently?

WRAP-UP VIDEO 1

The structures around seeds change how those seeds move through the air. Because each model has a different shape, each one fell in a different way. Twirling, coasting sideways or flip-flopping to the ground. Real seed structures come in different shapes too, and those shapes make them fall in different ways. Check out what the Javan cucumber seed does as it falls. It's like a glider, but the structures around these seeds don't just look cool as they coast through the air, they actually give the seeds a better chance at surviving and growing into adult plants. Take this field of dandelions, for example. One dandelion contains hundreds of tiny seeds. If each dandelion in this field drops hundreds of seeds straight down, there'd be no room for new dandelions to grow. So the seeds have to spread out to survive. Each dandelion seed has its own little parachute of fluff. When a gust of air blows on the dandelion, each tiny fluff parachute carries its seeds far away. When seeds spread out, we say the seeds disperse. When they spread out using the wind, we call that wind dispersal. So if wind dispersal works so well, maybe it was the wind that blew the koa seeds from Hawaii to Réunion. Think about what happened when you dropped your model koa seed. What do you think? Could the wind carry a koa seed halfway across the world? Why or why not?

WRAP-UP VIDEO 2

Look at the structure around these koa seeds. They look smooth, and long, and flat. When we tested our koa seed model, its flat sides did help it tumble and flip-flop as it fell to the ground, but it didn't travel that much. It didn't always drop straight down like a stone, but it still usually landed pretty close. The wind might carry the seed structure a small distance, but could it carry it halfway across the world? Based on our tests, we thought maybe not. In real life, the wind

does help koa seeds disperse a little, but scientists don't think the wind alone could carry a koa seed all the way across the ocean. So if koa seeds didn't get from Hawaii to Réunion on the wind, what else could carry them there? Maybe you thought of seeds traveling by water. Hawaii and Réunion are both surrounded by the ocean after all, but saltwater can kill most seeds. So seeds that spread out using water usually have a hard, thick outer structure that protects them, like this thick shell. Koa seeds? No thick shell. But check this out. These seeds don't have a hard shell either, but they have something else surrounding them. A juicy fruit. These are cherries. Cherries are tasty, and not just to humans. When you bite into a cherry, you have to be mindful of that hard thing in the center. That thing? It's the seed of a cherry tree. A cherry seed has no special structure to fly. When it falls from a cherry tree, it drops down to the ground like a stone and it has no hard shell to protect it from water either. So cherry seeds are not wind dispersed and they're not water dispersed either. So how are cherry seeds dispersed? I wonder if you have any ideas.

WRAP-UP VIDEO 3

Think about what an animal like this squirrel would do if she found a tasty cherry. Maybe she'd pick it up in her paws and carry it to a safe place to snack on it. Maybe she'd spit the hard seed out on the ground once she ate the fruit. Maybe she'd even swallow the seed by accident and carry it around in her belly wherever she went next. Animals are another way seeds disperse. When animals eat plant seeds, they can end up carrying those seeds long distances. The structure around koa seeds does help them disperse in the wind, but that same structure also makes these seeds an ideal animal snack. The outer structure is thin and easy to crack into and inside, koa seeds themselves are small and round, easy for small wildlife near a koa tree to gobble up. Okay, great. So we figured it out. A squirrel ate a koa seed in Hawaii and then got in

a hot air balloon and floated all the way to Réunion Island? Wait a minute, that can't be what happened. If an animal dispersed the koa seed, it would have to be some kind of animal that can travel across the ocean to the other side of the world. But what kind of animal can do that? Any ideas?

WRAP-UP VIDEO 4

Not many animals can make a journey thousands of miles across the ocean, but these birds can. Scientists now think that this is how koa seeds first got from Hawaii to Réunion. A bird swallowed a koa seed here in Hawaii. That bird took off with the koa seed in its belly. It flew and flew across the ocean until it finally landed here on Réunion. Koa seeds can't fly that far on their own, but because they are so small and snackable, koa seeds don't need tiny papery wings to fly. They can borrow the wings of expert flyers, birds. So next time you spot a seed, whether it's attached to a tree, fallen to the ground or lodged in the middle of a juicy fruit, take a close look at the structure around it. How would this thing move as it falls? What clues does it give you about how these seeds disperse? Huge plants like koa trees may seem like they've never changed or moved, but sometimes what we see is just one part of a long and epic plant journey. Keep exploring and stay curious.