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

VIDEO TRANSCRIPT

EXPLORATION VIDEO 1

This is the explorer ship HMS Adventure about to set sail around the entire world. Onboard is a group of sailors. Their plan was to sail from the Hawaiian Islands—that's here on the map—and then circle all the way around the globe, returning back to Hawaii again in under three years. The very last thing they had to do before leaving on their journey was to build a figurehead for their ship. This is a figurehead. A figurehead is a large wooden decoration attached to the front of a ship. The crew of the HMS Adventure was excited to carve their figurehead from a special kind of tree found only in Hawaii, a tree the Hawaiians called the koa tree. The wood of the koa tree, seen on the inside when the tree has been sawed, is a beautiful shade of red. Again, as far as anyone knew, Hawaii was the only place in the world where koa trees could be found. And so, with the figurehead carved, off they went on their voyage around the world. They made it across the Pacific Ocean and almost all the way across the Indian Ocean. Everything was going so well—until one night, storms created huge 50-foot waves. The force of the waves snapped some of the wooden boards on the side of the ship. Once the storm ended and the seas calmed down, the crew of the ship saw the damage. Entire sections of wood had come off and were lost at sea. Water was leaking in. The sailors were terrified; they needed to act quickly. They needed wooden boards to patch up the leaks. Luckily for them, off in the distance an island was spotted. And, most importantly, there were trees on it. One person on board was especially excited. He

was Joseph. Joseph wasn't a sailor, he was the ship's scientist. As the ship's scientist, his job was to discover and collect as much as he can, especially about plants and animals that have never been seen before, and then bring his discoveries back to his home country of England. Joseph was excited because this island they were about to land on was a new island. No one had ever set foot on this island before. It was going to be an alien world and he would be the first to see it. And from the moment they landed, he started seeing all kinds of things he'd never seen before. There were animals he'd never seen before—like this, today called a panther chameleon. Or these: giant tortoises. Even the flowers and bushes were totally new. There was nothing quite like these in Hawaii. This island that these are on is known today as Reunion Island. You can find it here on the map, in the Indian Ocean about 1,000 miles off the coast of Africa. While Joseph collected samples, the sailors were busy looking around for the best wood to repair the ship with. They found a type of tree that was large with sturdy, solid wood. It was perfect. So they chopped the tree down. As soon as the tree fell, Joseph ran over toward its top end to get close to the branches. He wanted to get a look at the tree's leaves and flowers to see if it was something new. *Whoa*, he thought. These little flowers don't look new at all. They look so familiar. *Where have I seen these before?* he thought to himself, scratching his head. He pulled out his notebook and realized that these were the same flowers that he saw on the tree that they used to carve the figurehead from back in Hawaii. He walked back down to the tree's trunk where the sailors had cut the tree, and sure enough, when he looked, the wood was red. It was a koa tree. How could this be? Look how similar the trees are. Koa trees are only otherwise found in Hawaii, 10,000 miles away. That's almost half the world away from Reunion Island. That's the other side of the world. How could the same kind of tree be in both places? It's almost as if the trees had flown across the ocean. But we all know trees can't fly. How could koa trees have gotten on both of these islands half a world apart?

EXPLORATION VIDEO 2

The sailors were surprised to find koa trees on Reunion Island. Every other plant and animal on Reunion Island was different from those in Hawaii, so it must be that some koa trees traveled across the ocean. But how would koa trees get across such a long distance? Trees themselves are huge. The easiest way for any plant to get from one place to another would be for its seeds to have been moved. Seeds weigh very little, especially compared to an entire tree. Imagine if somehow the seeds of a koa tree got moved from Hawaii to Reunion. Once they landed on the island, they might have started to grow, and then there'd be koa trees on both Hawaii and Reunion Island. But how could the seeds have traveled halfway around the world? It sure wasn't the sailors who brought them. When they landed on Reunion Island, they found koa trees already growing there. Something else must have brought them. But what could it be? We need to go out and collect some clues. Let's look closely at the seeds of other trees and plants, like the trees and plants in your backyard. Maybe we'll find a clue that way. Take these yellow flowers: dandelions. You might have seen these in your yard before. If you've ever noticed, you can see how after they flower, each flower turns to this: a little fluffy white globe. Each piece of fluff has a seed on one end, right here. Watch what happens now as the wind blows. This video has been slowed down so you can see what happens to the dandelion seeds during a gust of wind. Here's another example: This is a maple tree, which you might also have in your neighborhood. See its seeds and what they do when the wind blows? And here's a fun example: This is a type of vine. You don't have this in your yard. It's found in the jungles of Asia. It grows this papery stuff around its seed. Here's the seed right here. Watch what these do as they fall from the top of the vine. So what do you think? Does seeing the dandelion, the maple, and the

vine seeds give you any ideas for how that koa tree might have gotten its seeds from Hawaii to Reunion Island?

EXPLORATION VIDEO 3

The dandelion, the vine, the maple seed—all of these seeds are carried by the wind. There's a reason for that too. It's actually good for each plant that this happens. Take dandelions, for example. This field is crowded with adult dandelions. They're everywhere. If the adult dandelions simply drop their seeds straight to the ground, there'd be no room for new dandelions to grow, so the seeds have to get away if they're going to grow and survive. We saw how each piece of fluff on the dandelion has a seed on one end. The seed doesn't weigh much, but it weighs enough that it wouldn't simply fly by itself. So each seed has its own little parachute made of fluff. By having this parachute, each seed can be carried by the wind to a new field where there's room for it to grow. The wind will carry dandelion seeds for miles. Trees have to deal with another problem. If any tree were to drop its seeds straight down, the seeds would land in the shade of the tree. At first, that might not seem so bad, but that is a deadly situation for a plant since all plants need sunlight in order to grow and survive. Maple seeds are bigger and heavier than dandelion seeds, and so a little fluffy parachute isn't enough to get them away from the shade of their parent tree. Instead, the maple tree seeds each come with a wing. This way they spin like helicopters, falling away from the shade of their parent. Without this wing, the maple seed would fall straight to the ground like a stone. The vine we saw earlier is also very tall, just like a maple tree. If its seeds fell straight down, they would also land in the shade and not get enough sunlight to survive. The vine seed comes with a wing. But unlike the maple, the wing works like a glider. So this vine uses gliders to send its seeds away. These will fly even with the lightest breeze. That's perfect for the jungles where this vine lives, where the

air is humid and still, and there's hardly any wind. If the wind works so well for the dandelion, the maple, and the vine, maybe it was the wind that blew the koa seeds all the way from Hawaii to Reunion Island. Maybe, but the wind only blows seeds so far. Dandelion seeds, which are some of the lightest seeds there are, blow a few miles at most. To get from Hawaii to Reunion Island, we're talking about thousands of miles, halfway around the world. So it seems really hard to believe that koa seeds would have been able to fly on the wind for thousands of miles. If it wasn't the wind that carried the seeds, what else could it have been? Well, not every plant uses the wind to spread its seeds. Look for some other clues, like this one: the palm tree. Let's get underneath it. Do you see its seeds? Here's one right here: They're coconuts. You think a coconut can blow away in the wind? No way. There's a good reason coconut palm trees grow near the ocean. Watch what happens to a coconut once it falls from the tree and lands on the beach.

EXPLORATION VIDEO 4

Coconuts are large seeds. They're about the size of a bowling ball. There's no way they'd blow in the wind. Instead, we saw in this video how, once they drop to the ground, a coconut gets picked up by ocean waves. On the water, a coconut floats like a little raft. Ocean currents carry the seed far away, usually until it lands on another island. So if you dumped a whole bunch of sand in the ocean and created a brand-new island with nothing on it, if you come back to your new island in a few years, you'd probably notice coconut palm trees growing on it. Each coconut washes up onshore and sprouts into a tree. So palm trees use the water, not the wind, to send their seeds away. There are other examples too. This plant, called the sea bean, is another. Sea beans are a type of bean, and they produce the largest bean pods in the world. Forget those green beans on your dinner plate. A single sea bean pod is bigger than your dinner plate. Each

pod has little sections that fall away individually, like this. And each of these sections is a container, or a wrapper. Inside of that is the seed. Like coconuts, these seeds float in water. And they'll float a long, long distance. Sea beans from South America have been found all the way on the shores of Australia. That's the other side of the world. So, floating on the water—could this be the solution to the mystery of how the koa trees traveled so far? Let's finally look at koa seeds and see what we can find. Notice the seeds are in a pod. It even looks a bit like the sea bean. Sending seeds by water so that they're carried by ocean currents—that works really well for coconuts and sea beans. But not that many plants spread their seeds by ocean current, and here's why: The ocean is salty. Salt water kills most plants unless the plant or seeds have special ways to deal with that. The part of the coconut that we eat, the white part, is the inside of the seed. But on the outside is a thick shell. That's the dark brown part of any coconut. And then surrounding that is an even thicker shell called the husk. If you've ever seen a coconut for sale at the grocery store, it almost never includes the husk. That part's been thrown away. So a coconut seed has all this protection from the salty water. That's why coconuts have no trouble with salty ocean water. And the sea bean, too, has both a thick shell and a protective wrapper around it. Koa seeds, they hardly have any protective shell at all. We've even done experiments, and we see that they die in salt water after just a few days. They won't grow or sprout once they've been soaked in salt water. But in order to make the trip from Hawaii to Reunion Island, koa seeds would have had to have floated in salty water for months. So, as tempting as it is to think maybe koa seeds traveled on ocean currents from Hawaii to Reunion Island, it seems impossible. So, we've seen that plants have ways of sending their seeds away in order to reach a good place for the seeds to find sunlight and grow. Some plants use the wind to carry their seeds, and others, like the coconut and sea bean, use the water to carry their seeds. So: wind and water. Are there other ways that plants move their seeds? There are. You probably

recognize these: They are cherries. Cherries are a tasty berry, a type of fruit. But think about when you bite into them. You have to be mindful of that stony thing in the center. That stony thing, that's not just there to annoy you—it's the seed of the cherry tree. Here in the background, you can see the cherries while they're still on the tree. A cherry seems like a very unlikely seed to get moved around much. It has no helicopter or wings to fly, and it would shrivel up in the ocean. But every seed has some way of being spread. Do you have any ideas how a cherry seed might get spread? Well, let's think about what happens with a cherry. As a food, it's tasty. And not just to human beings, but to raccoons, squirrels, and foxes too. Just like us, these animals have the pesky problem of enjoying the fruit part of the cherry, but not wanting to eat the stony part inside. The seed of the cherry tree. So you simply chew around it and then spit out the seed. So you see, now the seed has been spread. It's been sent away from the plant, so that it might get sunlight and a new place to grow. The animal has done the work for the plant, even if the animal doesn't realize it. So, animals are a third way that some plants spread their seed. There's wind, there's water, and there are animals. Whenever you see plants with fruits or berries, you can know that it's an animal that is doing the work of moving the seed away from the parent plant. Perhaps it was an animal, then, that ate koa seeds, and gradually made its way from one side of the globe to the other. A raccoon, maybe, or a fox, or a mouse, or a squirrel? But we must keep in mind that there's no land connection between Hawaii and Reunion. They're both islands with no path to follow. Which animal could have taken the seeds from one island to the other?

ACTIVITY VIDEO 1

In this activity, you're going to build paper versions of seeds that can fly. Then you'll see if you can get your seeds to fly away from their tree. Since you don't have a tree in your classroom,

someone will need to stand on a chair and be the Official Seed Dropper. This person is pretending to be a tree. Just like in the real world, you want your seed to land as far away from your tree as possible. Your goal is to escape this: the “Zone of Darkness,” the shady area directly under a tree. If your seed lands in the Zone of Darkness, it will struggle to grow. If your seed escapes the shady area and reaches the light, it will have a chance of growing into a big tree. Your teacher is going to put a piece of paper on the floor to represent the Zone of Darkness. Now you need to choose which kind of seed you want to make. There are three seeds to choose from. You could make a glider with wide wings. It glides like the vine seed you saw earlier. Here, I'll show you. Or, you could make a rotocopter, like this. Here, I'll show you a video of one flying in slow motion. Or, finally, you could make a spinner that looks like this. Here's the spinner in slow motion. So, pick which seed you want: the glider, the rotocopter, or the spinner. When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 2

Now that you've built your seed fliers, we're going to see whose seed wins. One person is going to stand on a chair, like this. They are the official Seed Dropper. Each of you will hand your seed to the Dropper and tell the Dropper how your seed should be attached to the branch. The clothespin is where the seed attaches to the branch. The Dropper will hold out their hand and squeeze the clothespin to release the seed. Good luck—I hope your seed doesn't land in the Zone of Darkness! When you're done with this step, press the arrow on the right.

ACTIVITY VIDEO 3

Now that you've made your choice, it's time to make a seed. Your teacher has set out three piles of directions and seed flyers, one for each seed. You'll need a pair of scissors and a pen or

pencil, and if you chose the rotocopter or the glider you also need a paperclip. When you're done with this step, press the arrow on the right.