

Exploring outdoors is fun! Especially when you have a great guide like Dr. Watt R. Shedd.

Join Brooke and her classmates' adventures by completing the hands-on activities in each chapter of this book. Look closely at a stream or creek in your neighborhood, and you can become a stream doctor too.

Parents and teachers can guide young readers, or Brooke's story can be read independently.

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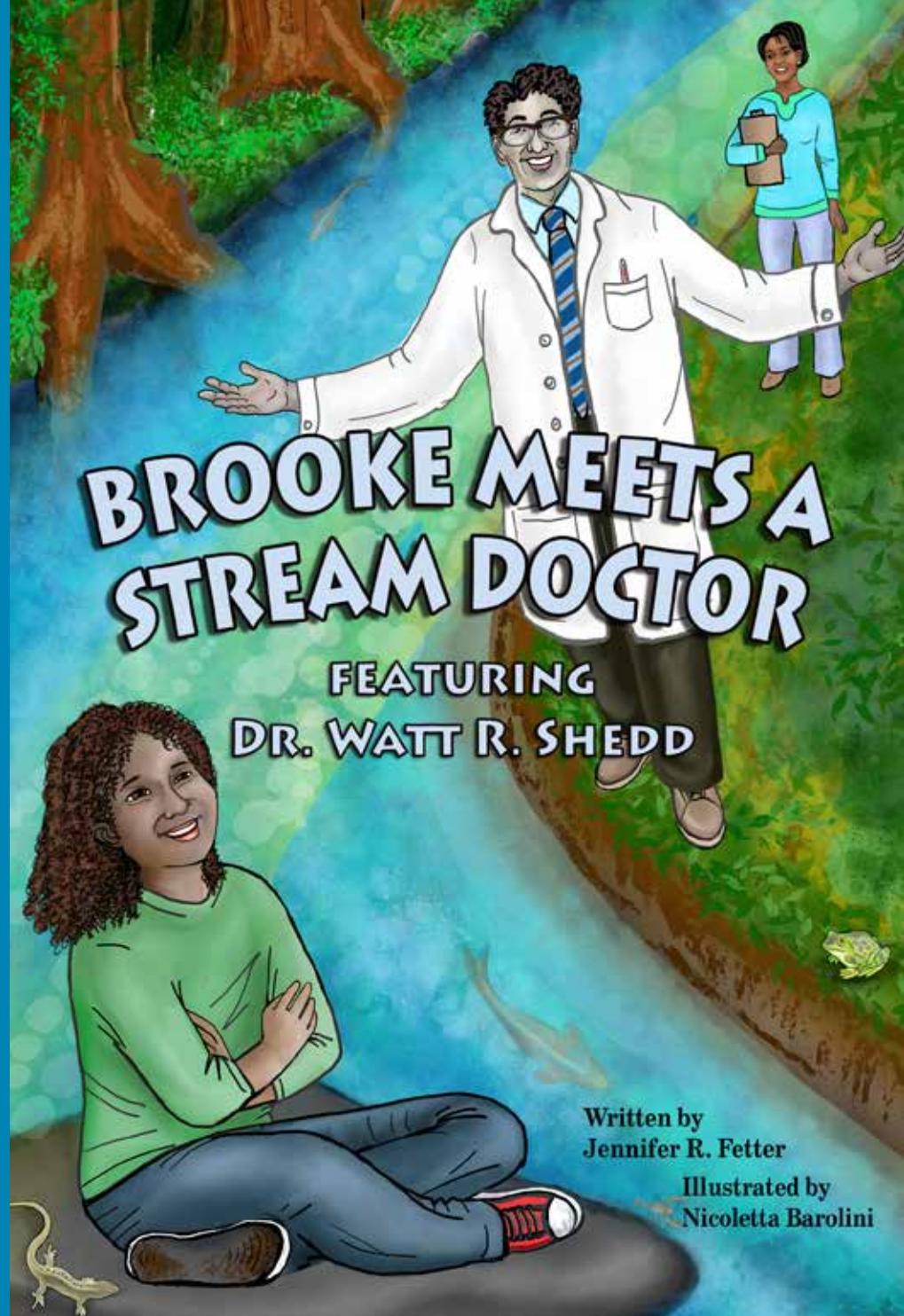
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**PennState Extension**

Jennifer R. Fetter

Brooke Meets A Stream Doctor



**FEATURING  
DR. WATT R. SHEDD**

**Written by  
Jennifer R. Fetter**

**Illustrated by  
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Many thanks to all the reviewers who helped bring this book to life, especially Maya and Ethan, who were the first students to meet Dr. Watt R. Shedd.

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## CHAPTER I

## Brooke's Bridge

A strip of long grass, overgrown hedges, and shaggy trees line the back of the complex where Brooke lives. She's heard the adults complain that it looks like a mess, but Brooke loves the way the shadows fall between the branches creating a mystery of what lies beyond. Sometimes, she'll spy the cooler kids in the grade above her hanging around there in the afternoon, and she'll wander over and try to fit in. Sometimes, they'll even say hi, but mostly they ignore her.

Today, Brooke is doing her best to keep up as her "not quite friends" skip between the trees. They are on a trail that has been formed from their sneakers marching through on so many trips before this one. She can hear them whispering and giggling ahead. Then everyone takes off running, and their laughs get louder.

It's not the first time they've run ahead and left her behind on purpose.

*It's fine, she thinks. I've seen plenty of cool things to explore here before, and I'll do the same now.*

She knows that she has lots of time to look around before she has to be home for dinner. Off to the right, something catches her eye. It's big and white and flat. *Maybe a wooden board?*

She can't tell what it is from where she is standing, so she decides to head off the trail and get closer. She swats branches and tall plants in her way like a swashbuckler as she creates her own path to the mystery object. *Hmm, it's an old screen door.*

Brooke wishes it were a magical door to an extraordinary world, but it's really just a broken metal door that someone dumped out there in the trees instead of taking it to the trash where it belongs. Brooke steps onto the door. It bounces a little. She shifts her feet from side to side, letting the door wobble beneath her, and notices water flowing beneath it.

It turns out that maybe the old metal door really is a magical door to an extraordinary world. Brooke smiles and decides this is going to be her next adventure. She's going to follow the flow and jumps off the bridge.

*Splat!*

Her sneakers sink into the wet mud.

*Uh-oh.*

She'll have to explain that when she gets home.



At first, she starts walking uphill. The ground is less wet there and easier to walk on, but the water is flowing in the opposite direction.

Brooke turns around and backtracks to the door-bridge to begin her journey again. This time, downhill. The little trickle of water wiggling through the mud starts to grow as she moves through the trees. She can't wait to see where it leads. She is moving so fast that she barely notices all the treasures she is passing along the way. She stomps over some animal tracks in the mud. She swats an unusual bug off her arm when it lands there to rest. She startles a singing bird in a nifty-looking tree. It quickly flies off as she races by.

Brooke suddenly emerges from the trees into a field of grass. The flowing water is now deeper and moving faster than she is. She stops to look around. She could have sworn she heard a bird singing a moment ago. *What happened to it?* She can't hear any birds singing here.

The water is deeper than before and flowing faster. Brooke examines the area and thinks that if she sits on the edge of the stream, it's probably deep enough for her to dangle her feet. As she sits down, she looks at her muddy shoes.

She scoots forward and stands in the water, shuffling her feet around to wash off the mud.

At first, it's working, but then the water starts turning the color of chocolate milk. Now her socks are wet and dirty too.

The cocoa-colored water starts flowing away from her, down the stream, as she climbs back up out of the water. Clumps of dirt fall away from the steep sides of the stream as she struggles to pull herself up. More chocolate milk water flows away.

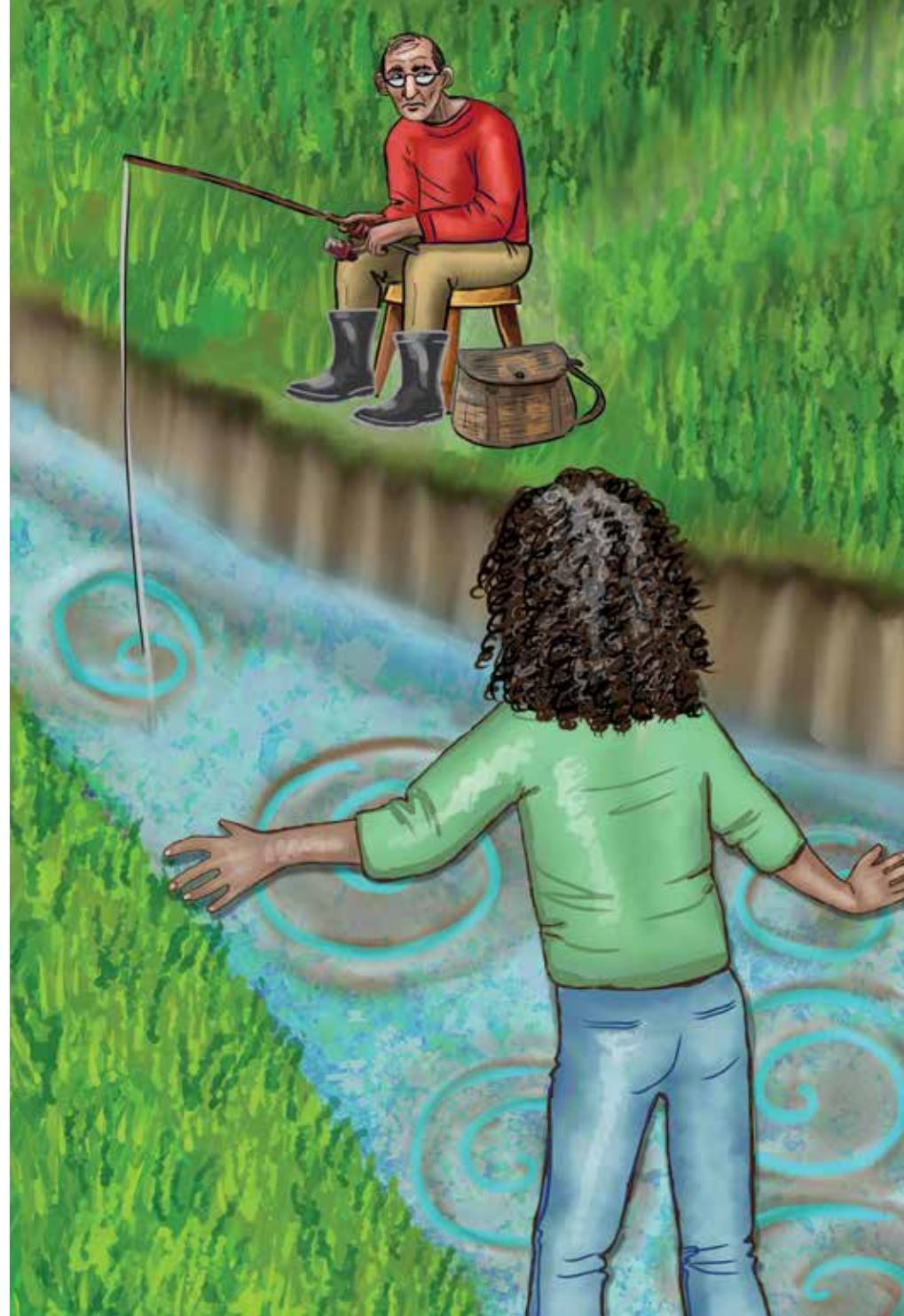
“Hey! What’s going on up there?”

Brooke freezes, then slowly turns to see an older man sitting on a stool not far from her. She recognizes him as a neighbor on her street. He’s holding a fishing rod and looks very upset.

“I’ve been trying to catch a fish here all day with no luck,” he grumbles. “Now you show up and make the water all muddy. Thanks for nothing!”

Brooke is stunned at first and then scared. She’s heard the older kids tell lots of stories about this man they call “Mr. Crankypants.” She’s not sticking around to find out if the stories are true.

She turns and runs back up the hill and into the trees. She doesn’t stop running as she passes the nifty tree, the startled bird, the unusual bug, and the muddy tracks. She runs past the door-bridge, out of the trees, and onto her street.



Brooke runs all the way home. Just outside her door, she remembers her muddy shoes and socks. She pops them off and hides them behind a bush.

She hurries up the stairs and into her safe space, under the blanket on her bed.



## CHAPTER 2

## Dr. Watt R. Shedd at Your Service

Brooke is relieved that her shoes are dry by the following morning and she's able to sneak them back into the house without anyone noticing. For the next few weeks, she keeps thinking of her exciting adventure in the woods. In fact, she daydreams about it often. She's hoping she can go back and revisit her stream soon, as long as Mr. Crankypants isn't there. She really wants to cross that magical door-bridge and discover what lives in the water and . . . *Oops!* She's daydreaming again. She needs to hurry up and get to school, or she'll be late.

As Brooke sits at her desk in class, she notices a man she's never seen before talking with her teacher at the front of the room. He's wearing a long white coat, and he looks a lot like a doctor.

*Oh, gosh, I hope he's not here to see me.*

The other students look just as worried as Brooke is about why a doctor is in their class. The room quiets down a lot quicker than usual.



Ms. Shepherd stops her talk with the mysterious guest and turns to speak to the class.

“Good morning, everyone!” she sings with enthusiasm. “I see you have noticed there is someone special here with us today. For the next few weeks, we will be working on a new project. Our class will go outside to explore a stream near the edge of the school grounds.”

Brooke sits straight up with her ears perked. *Did she say outside? To a stream? This project is going to be great!*

“To guide us, I have invited my friend here.” Ms. Shepherd points to the man in the white coat. He smiles so big you can see all his teeth.

“Hi, there! I’m Dr. Shedd, Dr. Watt R. Shedd, to be exact.” His booming voice sends everyone back in their desk chairs a little.

“Are you really a doctor?” Tyrell asks from the back row.

Dr. Shedd smiles and nods his head. “Indeed, I am, but not the kind you are imagining. I am not a medical doctor, the kind who works in hospitals and such. I’m the kind of doctor who does research and teaches.”

The students all look a little confused.

“In my job, I work with water, especially water in streams. I study things that might pollute

the water and then look for ways to help keep our streams healthy. Does that make sense?”

There’s silence at first, then Shandra blurts out, “So you’re a stream doctor?”

There’s some giggling at the idea of a stream needing a doctor, but Dr. Watt R. Shedd looks pretty pleased with that title. “Yes, I guess that’s exactly what I am.”

A stream doctor. Brooke likes the sound of that. *Maybe someday I can be a stream doctor too. I wonder what kinds of diseases and problems streams can have. And how do you know if they’re sick? And what kind of medicine do you give them?* She has so many questions for Dr. Shedd.

Ms. Shepherd starts making her way around the classroom with art supplies. She hands out blank papers, coloring pencils, and crayons.

Dr. Shedd asks everyone to draw a picture of a perfect stream. “Make it the healthiest stream you can imagine.”

A few hands pop up at once. “What makes a stream healthy or unhealthy?”

Dr. Shedd waves his hand in the air as if he’s swatting away some invisible flies. “Before I answer that question, I want you to show me what you think the answer is by finishing

your drawings. Then I will show you all about healthy and unhealthy streams when we go outside to visit your school’s stream.”

Brooke has no problem coming up with what she thinks is the perfect stream ever—her stream. She has no problem remembering what was beyond her door-bridge. She draws the grassy field, the deep stream banks, and the chocolate-like swirls, but she doesn’t draw the grumpy fisherman. She’s certain that Dr. Shedd will love her drawing and agree it’s a wonderfully healthy stream.

## IT'S YOUR TURN.

With some coloring pencils or crayons, draw a picture of how you imagine a healthy stream would look. You can draw it here in your book or on a separate piece of paper.

## CHAPTER 3

# Time for a Walk

Brooke scrunches up her face as she tucks her drawing away into a folder that Ms. Shepherd gave to her and her fellow students. She won't get a chance to show off her perfect stream today. Instead, they are lining up at the classroom door to go outside.

A short walk across the school playground and through the grass field, where they sometimes play kickball, leads them onto a little trail not much different from the one Brooke has hiked at home. With Dr. Shedd in front and Ms. Shepherd behind, the class follows along the trail and down a hill. At the bottom, they stop and turn their eyes to where Dr. Shedd has started pointing.

“Here we are,” he exclaims. “Here is the stream we are going to explore.” His arm stretches out over the heads of the whole class as he traces the nearby stream to where it fades into the distance. “What do you all think? Is this a healthy stream?”

There isn't much of a response from the class. Even Brooke isn't sure how to answer. *This*

*stream doesn't look anything like my stream.*

She sighs and nods her head. It does have some things in common, but she never realized before now that streams don't all look the same.

Dr. Shedd seems prepared for silence as an answer. “Let's think about this the same way your doctor tries to figure out if you're healthy when you visit. What are some things the doctor does when you are at an appointment?”

“My doctor takes my temperature every time I'm there,” says Meera.

“Very good,” Dr. Shedd quickly responds. “Can we take a stream's temperature?”

The group nods their heads a little, guessing that Dr. Shedd was looking for a yes.

“What tool do we need to take a temperature?” he asks.

Most of the class quickly shouts the correct answer: “A thermometer!”

Dr. Shedd and Ms. Shepherd are both pleased with that response.

“Who brought a thermometer with them today?” Dr. Shedd laughs at his own joke and then reaches into his pocket. “I have a thermometer with me, but we don't need one right now. Instead, I thought we could see how the water feels when we touch it.”

Dr. Shedd has all of the students place their hands in the water.

There's *splish-splashing* of fingers, then calls of "Brrr! That's cold."

"Does everyone agree? Does it feel cold?" Dr. Shedd sticks his thermometer in the water too. "It's 59 degrees Fahrenheit, but the weather-caster said it would be 75 degrees today. Very interesting. The water is cooler than the air. Let's make a note of that."

Ms. Shepherd smiles and hands Dr. Shedd a clipboard she's been carrying. On it, the students can see a white paper.

"Just like your doctor, I'm going to write down all the things we discover about this stream," he says. "That will help us decide later if the stream is healthy or not."

Knowing the temperature of the stream is not enough to decide whether it's healthy. The class will have a lot of work to do before they get their answer.

Ms. Shepherd speaks up. "Class, we will return to the stream often and collect more information about it. We will have more guests to help us too. At the end of the project, you will be able to figure out if the stream is healthy or not."



Brooke smiles to herself. *We're all going to be stream doctors.*

They march back to the classroom. Today's visit to the stream was just a short one. Ms. Shepherd hands out clipboards like the one she gave Dr. Shedd earlier. "Take a minute to fill in your name on your Stream Health Chart," she instructs. "Then you can also write an answer about the water temperature."

The students notice that the chart doesn't ask for the temperature from the thermometer. Instead, they have to record if the water felt warmer or colder than the air.

The end-of-day bell rings and Ms. Shepherd collects all of the clipboards. On her way out the door, Brooke asks if she can have an extra copy of the Stream Health Chart. Ms. Shepherd and Dr. Watt R. Shedd both look surprised by this request.

Without waiting to be asked, Brooke quickly offers, "I want to find out if my stream at home is healthy too."

"Sure thing. Here you go. We will be very interested to hear what you learn."

Brooke grabs the clipboard, says a quick "Thanks," and runs out the door.

When she gets home, Brooke wastes no time.

She hurries into the trees, past the door-bridge, along the trickling water until she emerges back in her field. Brooke hurries to plunge her hand into the water.

*Hmm. It's warmish. Maybe not warm, but definitely not cold. It feels almost exactly the same as the air.*

She jots down "same" on her Stream Health Chart and walks slowly back home as she wonders why her stream feels so different than the one at school.

## IT'S YOUR TURN.

Is there a stream you would like to explore? Ask an adult for help choosing a place that is safe to visit. Once you find a stream, plan a visit with them so you can feel the temperature of the water on your fingers. Record your discovery on your own Stream Health Chart.

## MY STREAM HEALTH CHART



### Question

#### **WATER TEMPERATURE:**

Is your stream warmer or colder than the air?

### Answer

## CHAPTER 4

## That's Not Dirt

Ms. Shepherd announces that it's day two of the Stream Health project, and the students are eager to get out of the classroom. After lunch, they are happy to see Dr. Shedd and a new stranger. A tall woman in overalls with muddy knees smiles as the class fills their desks. The name Sandy is stitched in red on the pocket of her overalls.

Ms. Shepherd quiets the class and then gestures to Dr. Shedd to start. "Hello again, everyone. I'm happy to be back with you and introduce you to my excellent friend, Mrs. Loam." Dr. Shedd asks the students if they can guess Mrs. Loam's job.

Travis quickly shouts, "Whatever it is, it must be a dirty job."

Mrs. Loam looks at the boy and winks. "What makes you say that?" she inquires with a smile.

"You're covered in dirt!" the whole class calls out.

"What? This?" She rubs her hands on the brown spots on her overalls and shakes her

head and giggles. "That's not dirt. That's soil and it is very important. We need soil for growing plants, for many animals to live in, and for much more. I am a soil scientist. My job includes helping to protect our soil."

Lilli jokingly calls out, "She's a dirt doctor."

Mrs. Loam laughs and says, "Remember it's soil, not dirt. Besides, I'm not an actual doctor the way Dr. Shedd is, but I do study it."

With that, Ms. Shepherd asks the class to line up at the door so they can go outside to their stream. As they walk through the field where they sometimes play kickball, Mrs. Loam stops them, asking a question. "What's beneath our feet right now?"

The students are quick to answer, "Grass!"

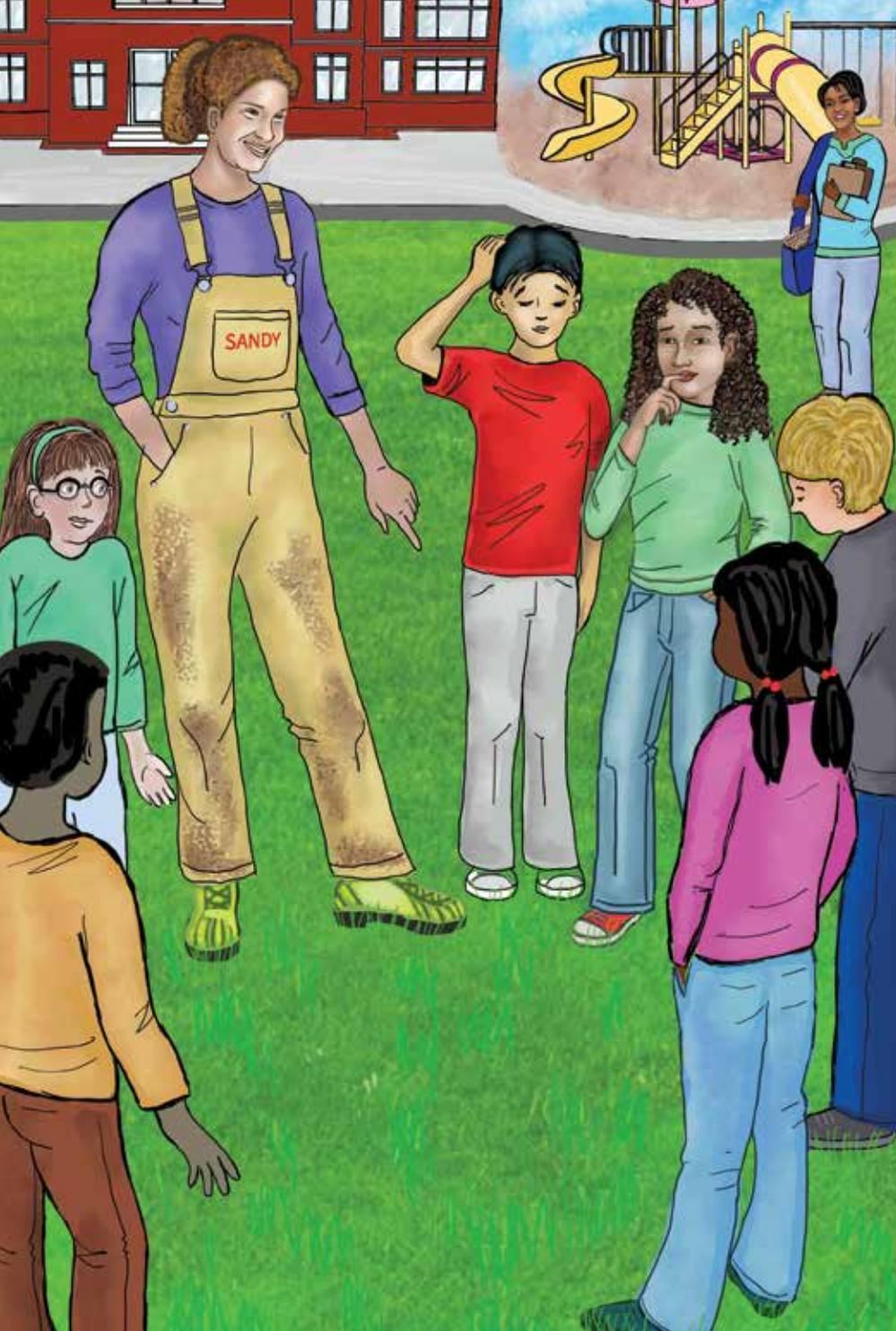
But she doesn't seem satisfied. "And what's beneath the grass?"

Now they get it. The students respond again, "Ooh, it's soil."

Mrs. Loam nods, and they begin walking again.

When they get to the edge of the stream, they stop. Ms. Shepherd hands out their clipboards.

"What is question number two on our Stream Health Chart?" Mrs. Loam looks around for a response. "The chart asks us if the water is clear," she answers herself.



*It seems like an odd question. Isn't water always clear?* The students all nod their heads to answer yes.

“Can you think of a time when you saw water in a stream that wasn't clear?” Mrs. Loam asks.

Brooke's hand goes straight up. “There's a stream near my home that has water that kind of looks like chocolate milk.”

She sees some of her friends nodding. “Yeah, I've seen brown water in streams before too,” Jackson says.

Mrs. Loam teaches them that the chocolate milk-like streams are not a good thing. “When it rains really hard, soil can get washed away from fields and the edges of the stream, especially when there are no plants to help cover and protect the soil. That soil belongs on the land and not in the water.”

She explains that the sunlight can't pass through the water when it's cloudy and full of mud. And plants and animals that live in streams need sunlight to survive. Since the water looks clear here in the stream at the school, Mrs. Loam tells the class that it is a good sign of a healthy stream.

The next question on their Stream Health Chart asks, “What is on the bottom of the stream?”

Mrs. Loam shows them some pictures she brought with her of different streams. One is rocky, with little pebbles and big stones of different colors covering the bottom. Another also has rocks, but it's hard to tell what color they are because they're all coated with brown mud. The last picture has no rocks, just a smooth coat of brown mud. The students look at their stream and agree it resembles picture number two the most. There are rocks, but there is also mud coating them.

“Those rocks are essential in the bottom of most streams,” Mrs. Loam tells them. “The little spaces between the rocks are home to some of the most wonderful living things.”

Ms. Shepherd tells them they will learn more about that in a future visit to the stream.

“After big rainstorms, brown and muddy water usually starts to clear again. That's because the little bits of the soil settle to the bottom of the stream.” Mrs. Loam explains, “The soil fills in the spaces between the rocks, starts to cover the rocks, and then hides the rocks completely.” Seeing lots of rocks on the bottom of a stream is a sign of a healthy stream. Seeing lots of mud is a sign of an unhealthy stream.”

The class takes notes on their charts, and then Ms. Shepherd collects their clipboards as they head back to the classroom.

At the end of the day, Brooke grabs her extra Stream Health Chart and runs home to continue her neighborhood stream health checkup. She stands at the stream edge and looks down. The water looks mostly clear, she notes. But the stream bottom is all mud. She doesn't see any rocks at all. And she remembers how her sneakers sunk into the mud and created a chocolate milk-like mess. She fills in her chart and walks back home. *Hmm. What does that mean for my stream?*

## IT'S YOUR TURN.

Take your Stream Health Chart and visit your stream. Take some time to decide whether the water is clear or some other color. What does the bottom of the stream look like? Can you see rocks or mud? Be sure to record your answers on your chart.

## MY STREAM HEALTH CHART



### Questions

#### **WATER CLARITY:**

Is the water in your stream clear?  
Does it have a color? What color?

#### **STREAM BOTTOM:**

What is on the bottom of your stream?  
Do you see rocks, mud, or both?

### Answers

## CHAPTER 5

# The Very Important Creatures

Another week passes before Brooke and her classmates see Dr. Shedd again. When he walks into their classroom, he's wearing rubber boots that go all the way up his legs. They make a funny flapping noise as he crosses the hard classroom floor. A young man follows behind him, also flapping in big rubber boots.

"Hello, students!" bellows Dr. Shedd. "I'm so excited to see you again and return to the stream." He introduces his friend, "Say hello to Mr. Podd."

The class sings, "Hello, Mr. Podd!"

The man blushes a little under a bushy mustache. "You can call me Arturo."

"Arturo is an environmental field technician and looks for the tiny living things that live in streams," says Ms. Shepherd. Brooke remembers Mrs. Loam telling them they would learn more about the creatures that live in the spaces between and under rocks in the stream.

"Before we go out to the stream today, I am

going to teach you a big, fancy word," Arturo announces. He starts writing on the board in the front of the room. The letters seem to never stop, but eventually, they do. As he steps away, the word **MACROINVERTEBRATES** appears before them.

"Does anyone want to try to say this word out loud for us?" Arturo asks.

A few students attempt with hilarious tries, so he helps them out. "Let's take it in pieces."

Arturo circles the first five letters. "MACRO," he says it like mack row. "This is like the word micro, and it has to do with size." He explains that things that are macro are big, in this case, big enough for us to see easily. Then he underlines most of the end of the word. "VERTEBRATES." He says it like vur ta brates. "These are animals that have a backbone, like you and me, and cats and dogs, frogs and fish, and more," Arturo tells them. "But that is not what we are talking about today. Notice the IN that sits just before vertebrates in this word?"

He looks around the class to make sure everyone is following along. "IN-vertebrates are the opposite. They have no backbone and include lots of bugs and things like worms, clams, crayfish, snails, and more."

Ms. Shepherd tells the class to change into the shoes she asked them to bring with them to school today. She had told them to bring a pair of rain boots or an old pair of sneakers that are okay for getting wet and dirty. Once they are ready, everyone walks outside in a line. There is a lot of boot flapping noise as they make their way across the playground.

When they arrive at the stream, Arturo asks the class to wait at the stream's edge while he climbs in to show what they will be doing today. He gently steps into the water in his boots, careful not to slip on the rocks. He walks out to an area where the water is bubbling and trickling over some rocks.

"We are going to be looking for macroinvertebrates, bugs, here in your stream today," Arturo tells them. He shows them how they will find a rock in the water that is as big as or bigger than their hands. Arturo picks one that is about the size of a dinner plate. He gently lifts it out of the water and turns it over. "Most of these bugs hide on the bottom sides of the rocks or in the spaces between the rocks." He waits patiently as the water drips away from the rock. His eyes light up. He returns to the stream edge to show the students what he found. The students can see lots of wriggling and wiggling going on in the little puddles left on the rock. Dr. Shedd

goes out in the stream and grabs a second rock so more of the students can see.

Arturo tells them, "Most of these bugs are young and have not become adults yet."

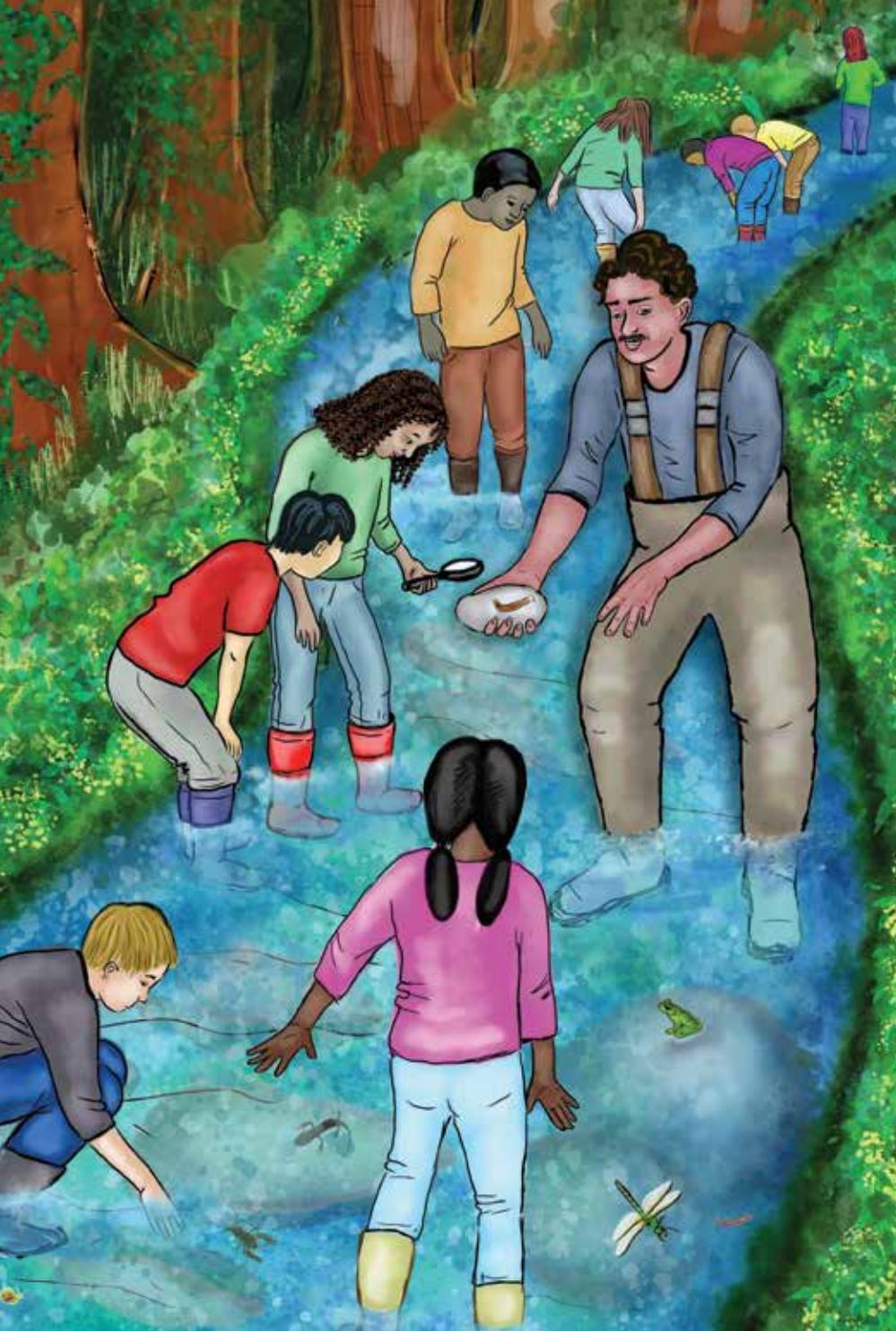
Ms. Shepherd reminded the class of the time when they raised caterpillars until they became butterflies.

"Yes," exclaims Arturo. "It's very much like that. Someday these bugs will transition into adults too. And many of them will look very different than they do now."

Ms. Shepherd hands out a few magnifying glasses so the students can look closer. Brooke is quick to grab one of those magnifiers. *I don't remember seeing any bugs in my stream, but maybe I wasn't looking close enough*, she thinks.

Dr. Shedd invites the students to carefully walk into the stream and find their rocks to explore. "One important rule is that we put the rocks back in the place we found them when we finish exploring. We don't want to take away anyone's home," he explains before waving the students on in their search.

The students agree to respect the stream creatures and then eagerly begin looking for their rocks. There is much excitement, laughter, squeals of delight, and even a few shrieks from the students who don't like bugs very much.



Everyone is finding lots of bugs. Ms. Shepherd asks the students to share their discoveries with each other.

Brooke calls Arturo over to her rock. “What is this thing?” she asks. A large, long-tailed, many-legged bug sits flat against the bottom of her rock. Specifically, it has two long-pointy tails, two antennae, and six legs. It has shades of yellow and brown colors on it. As they examine it, it starts to do little bug push-ups in the puddle on Brooke’s rock.

Arturo is excited. “That is called a stonefly and is a nymph, which is a young version of the insect. Someday it will grow wings and fly away. But for now, it lives underwater. Those little push-ups are how it gets oxygen from the water, using its gills.”

He announces to the whole class, “Stoneflies cannot tolerate very polluted water. They are sensitive bugs. So, finding this stonefly here is a good sign about the health of this stream.”

Brooke beams with pride. She’s happy she was the one to find the stonefly.

Back on the land next to the stream, the students sort through pictures of other bugs they might have found and circle their names on their Stream Health Charts.

Arturo tells them he spent many years

studying bugs before becoming very good at knowing all their names. “What is important today is that we decide if we found lots of different kinds of bugs or a lot of the same kind of bug. Did we find a variety?”

The students all agree that they found many macroinvertebrates while they were exploring. They saw six different types of bugs when they counted them up, but there were many more possible types on their list.

The class flapped their boots back to the classroom, changed into their school shoes, and packed their things to head home for the day. Once again, Brooke asks to take her extra Stream Health Chart home. She also asks to borrow a magnifying glass.

Once home, Brooke heads out to her stream. A bug flies past her, and she remembers the one she swatted off her arm the day she first discovered her stream. *Ooh, I wonder if that bug started its life in my stream?*

She has difficulty finding rocks to flip over in her muddy-bottom stream, but she finds a few. There are not very many bugs either. She finds a small group of little silver bugs that look like tiny shrimp. Her chart tells her they are called scuds. She also finds a snail and a crayfish. She marks them down on her chart and walks home.

## IT'S YOUR TURN.

Take your Stream Health Chart and visit your stream. Find some rocks to flip over and explore. Do you see any macroinvertebrates (bugs) on your rocks? Make some notes on the back of this page about how many bugs and how many different kinds of bugs you discover. Don't forget to carefully put your rocks and bugs back where they came from.



**Tip:** For a picture guide like the one in Brooke's classroom, ask an adult to help you search online for “macroinvertebrate identification.”

## MY STREAM HEALTH CHART



### Questions

#### MACROINVERTEBRATES:

How many bugs did you find?

How many different bugs did you find?

### Answers

## CHAPTER 6

# Everyone, Say “Trees”

It's the fourth day of the Stream Health project, and the students are happy to have another day of outdoor learning. Dr. Shedd, Ms. Shepherd, and another guest wait in the front of the room, just like in previous days. Today's guest is a tall man in a tan shirt with badges, like a police officer, but not entirely.

Dr. Shedd introduces him. “This is our local state forester, Horton Culture. He is really into trees and other plants and will help us explore the plants around our stream today.”

Mr. Culture is soft-spoken, and the students must lean in to hear him when he speaks. “Hello, students. I am glad to meet you. I know plants are not as exciting as the bugs you got to see on your last visit to the stream, but I hope you will enjoy the things we will see today.”

Ms. Shepherd lines up the class at the door, hands out their clipboards, and off they go.

As they pass through the field where they sometimes play kickball, Mr. Culture asks the class, “What is under your feet right now?”

The students quickly remember the correct answer to this question, and all shout, "SOIL!"

Mr. Culture looks shocked and confused. "That is not the answer I was expecting," he says. "I meant the stuff on top of the soil."

"Grass?" Kenzo says cautiously.

"Yes, I was thinking of the grass."

Ms. Shepherd explains how Mrs. Loam had asked them the same question a few days earlier and taught the students about the importance of soil.

Mr. Culture smiles and continues. "There is a lot of grass around here. That is one of the plants that we find near your stream."

As the class returns to the stream's edge, Mr. Culture asks them what other types of plants they see.

The class begins to call out answers: "Trees!"

"Bushes!"

"Weeds!"

"Flowers!"

"Vines!"

They come up with quite a variety of answers.

On their Stream Health Charts, Mr. Culture asks them to circle the answer that best de-

scribes the plants around their stream. Their choices are "mostly trees and shrubs," "mostly flowers and tall grasses," "mostly mowed or lawn grasses," or "mostly bare soil."

The students agree that the answer is "mostly trees and shrubs," even though there is some bare soil on the trail where they are standing, and the mowed grass is not too far away in the field where they sometimes play kickball.

"Now, let's look at the edges of the stream itself. What kind of plants do you see growing on the banks?" Mr. Culture asks.

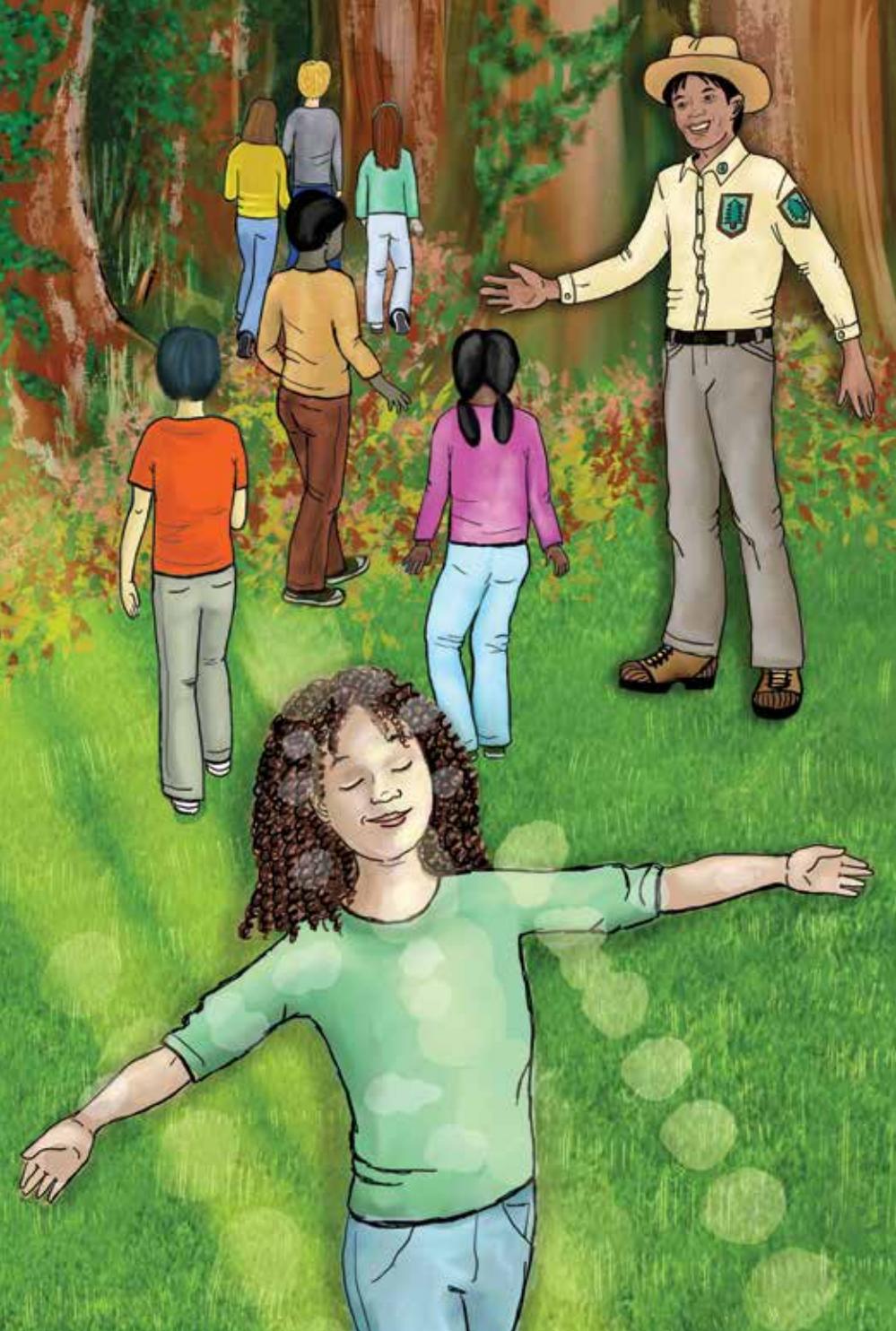
Ella says, "My dad works in a bank!"

Ms. Shepherd explains, "Yes, there are two different definitions of the word bank. Mr. Culture is talking about the kind of bank that is the land that makes up the sides of the stream. What kind of plants do you see there?"

There is some murmuring but not a lot of answers. Mr. Culture looks to the students for their responses.

Brooke speaks up. "There are not a lot of plants on the stream banks. Just a few little tufts of grass here and there."

Mr. Culture nods. "Let's circle an answer on our Stream Health Charts. What would you choose?"



They all circle “mostly bare soil.”

“What did Mrs. Loam tell us would happen to the soil that is not covered and protected by plants?” Dr. Shedd asks.

Maya raises her hand and reminds everyone that the bare soil would wash away in heavy rains and make the stream muddy.

Mr. Culture is impressed! “Yes,” he says. “Plants play a critical role by helping to hold the soil in place, on the land, where it belongs. This stream could use more plants on its banks to make it healthier.” He explains that some plants are better than others for making a stream healthy. “Trees and shrubs help to keep the soil in place, but they also make it shady and keep the water cool for the animals living in and around the stream.”

The students tell Mr. Culture about how they took the stream’s temperature, which was colder than the air. They look up together and see many leafy trees overhead, helping to shade the stream from the bright sun.

Mr. Culture also tells them how the leaves fall from the trees into the stream.

Brooke looks concerned. “Doesn’t that pollute the stream?” she asks. She is thinking about her stream at home and how clean and neat it looks. The grasses are trimmed short along the

edges, and the leaves fall in the forest instead of in the field where her stream is.

“Actually, those fallen leaves are an important food for the bugs in the stream, and the bugs are an important food for the fish in the stream. So, the trees are feeding the wildlife in the stream,” Mr. Culture explains. “But that was an excellent question, young lady.”

Brooke seems disappointed by the answer, even though she just got paid a compliment.

Mr. Culture bends down to the stream edge and grabs a clump of leaves stuck together behind a rock in the water. He gently peels the layers of leaves apart, and the students discover more bugs living among the leaves.

“Macroinvertebrates!” William shouts.

Mr. Culture is shocked again. “Wow! You are right. Those are macroinvertebrates.”

On the way back to their classroom, Mr. Culture asks the students to pay attention to how they feel as they walk out from under the trees and back into the field, where they sometimes play kickball. He asks them to share their feelings as they take their seats at their desks.

“I liked it better under the trees,” says Riley. “It was hot in the field, and I was sweating while we walked back.”

The rest of the class nodded their heads in agreement. Mr. Culture tells them to make sure they thank a tree for the lovely cool shade they provide.

Before they leave to go home, Ms. Shepherd asks them to gather together for a class photo so they can remember their Stream Health project later.

“Everyone, say ‘trees!’” Mr. Culture shouts as the picture is snapped.

At home, Brooke stands out in the field by the side of her stream. She still has trouble agreeing that the mowed grass isn’t perfect for her stream. She circles “mostly mowed or lawn grasses.” Then she looks at her stream banks. They are part mowed grass and part bare soil. She circles “mostly mowed or lawn grasses” there too. *I wonder if my stream is healthy after all.* She strolls back home, deep in thought.

## IT'S YOUR TURN.

Take your Stream Health Chart and visit your stream. What kind of plants are growing in the area around your stream? What kind of plants are growing on your stream banks? Circle your answers on your chart.

## MY STREAM HEALTH CHART



### Questions

#### PLANTS:

Which of these best describes the plants around your stream?

Which of these best describes the plants on your stream's banks?

### Answers

*(circle one)*

mostly trees  
and shrubs

mostly flowers and  
tall grasses

mostly mowed or  
lawn grasses

mostly bare soil

*(circle one)*

mostly trees  
and shrubs

mostly flowers and  
tall grasses

mostly mowed or  
lawn grasses

mostly bare soil

**Unhealthy?**

**Healthy?**

## CHAPTER 7

# Feathers, Paws, and Claws

There are not one but two guests in the front of Brooke's classroom today. A man and a woman, both short with round faces and light-colored hair. They seem much older than Dr. Shedd and Ms. Shepherd.

"Hello again, class," says Dr. Shedd. "I hope you are excited to head back to the stream today. Today will be our last visit where we collect health information about our stream."

"Nooo!" the class moans in unison.

"Don't worry, I am sure we can come up with more reasons to visit the stream in the future," Ms. Shepherd says with a wink.

"Today, we have some very special guests with us." Dr. Shedd introduces the old man and woman. "Please welcome Mr. and Dr. Ivor."

"I'm the Mr., she's the doctor," the man says as he points to the woman next to him. "You can call us Herb and Karen, though."

"Thank you for letting us join you today. I am a

wildlife biologist. I used to teach at the university, but now I am retired." Karen points back at the man and says, "My husband, Herb, is also retired. He used to work as an auto mechanic."

The students are puzzled about how an auto mechanic will help them with their stream.

Karen continues. "Today, we are going to explore all of the animals that might be living in the area around your stream."

The students gather their clipboards and go outside to the stream. As they walk through the playground, Herb pulls out a pair of binoculars and starts scanning the sky.

"Did I mention that my husband is a very excellent bird-watcher?" Karen asks. "It's been his favorite hobby for a very long time."

The students are noisy, talking among each other with their outside voices and enjoying their last Stream Health walk. Any wildlife that might have been around before they arrived probably scurried away to a safe place as the loud class approached. Ms. Shepherd quiets the class.

Herb points up into the trees. "Look, students, do you see that little black and white bird on the branch? That's a Carolina Chickadee."

As they all look up, the tiny bird loudly calls, "Chickadee-dee-dee." It sounds as if it is saying

its own name. Then it flitters away, higher up into the tree where the students can't see it.

Karen takes over. "A stream can be an essential part of the habitat of many different animals. It can supply water to drink, of course, but it might also be full of food like fish, bugs, and plants. It can also be a shelter. But many animals need more than just the stream to be a proper habitat. They need large trees for shelter, fruits and nuts for food, and much more." She points to the acorns on the ground around them.

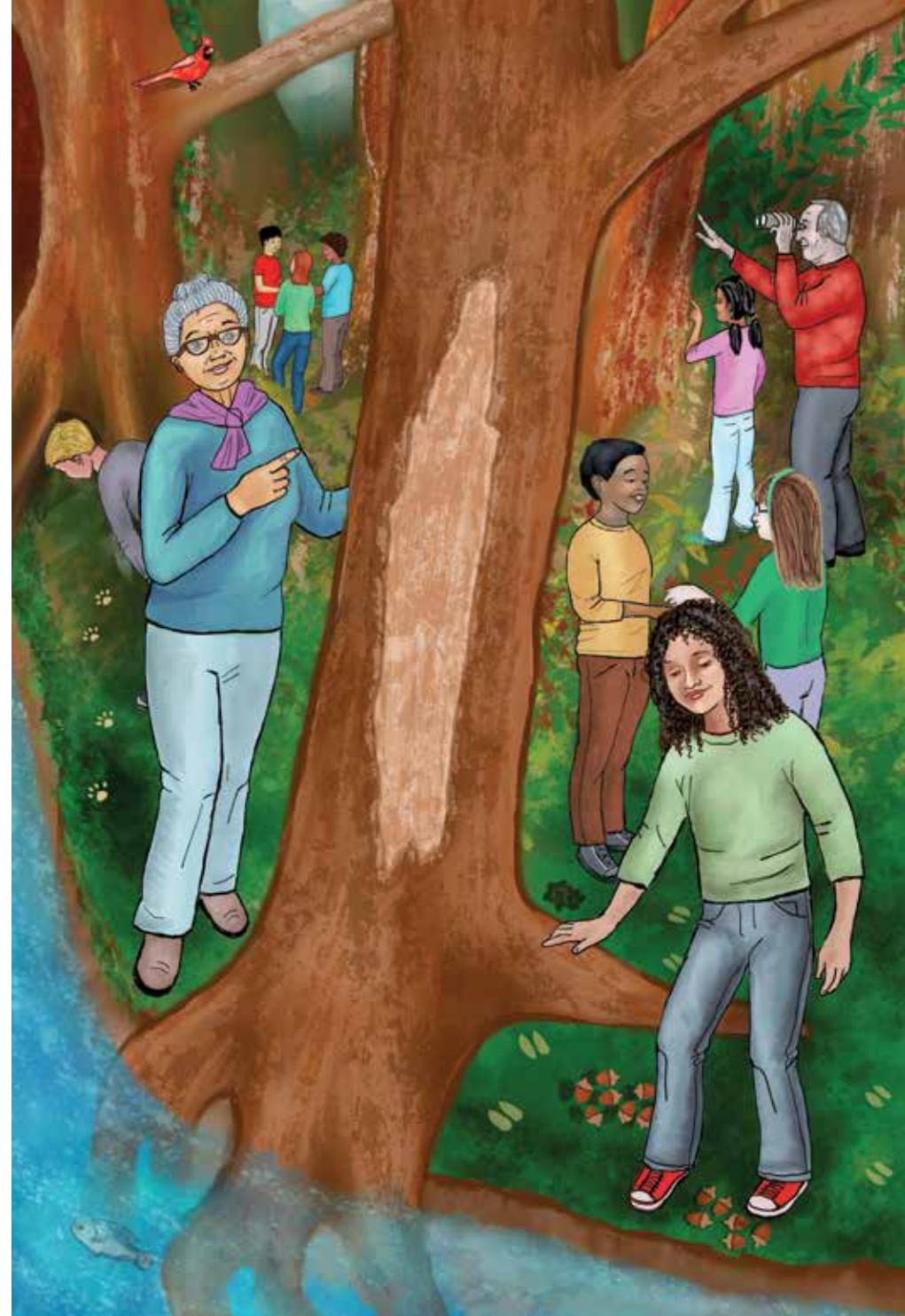
"We are going to look for signs of wildlife today. We got lucky seeing that chickadee. Herb has great skills, but most animals won't be brave enough to show themselves while we are here. What do you think we could look for instead? What would be a sign that wildlife lives here?" Karen asks.

The students seem unsure. Karen gives them some hints. "What kinds of things might an animal leave behind after a visit here?"

Ethan speaks up. "Their footprints?"

"Very good," says Karen. "One thing we can look for is the tracks of different animals, especially in the mud around the stream."

The group comes up with a list of other things they might find. It includes fur and feathers,



nests or holes in trees, piles of nutshells, and even animal poop, which Karen tells them is called “scat” in science.

Brooke and her classmates go on a scavenger hunt, looking for the different signs of wildlife. In addition to the things they listed, they also find a tree with the bark scraped off. Karen tells them this is where a male deer, or buck, rubbed its antlers on the tree. Luke even finds a snake-skin while exploring.

Herb continues to explore the treetops with his binoculars. He points out a woodpecker going in and out of a hole in a tree and some other birds. At one point, he even names a bird just by its song. They never did see it. The students gather together and record their discoveries on their Stream Health Charts.

As they walk back to the classroom, Karen helps them understand what their wildlife signs mean for the stream. “This stream is definitely the home for quite a variety of wildlife. This is an excellent thing.”

Dr. Shedd gives a big thumbs-up. “It’s nice we can share the stream and the outdoors at your school with many other living things. In many places, we have changed so much about the outdoors that wildlife has had to leave to find new places to live. When I visit next, we will review all the data we collected about our stream and make

a final decision about the stream’s health.”

The students all go home for the day.

It’s hot out in the field while Brooke stands beside her stream. She has trouble finding any signs of wildlife. She does see one big, gray feather and some scat in a little pile that looks like the chocolate-covered raisins her uncle is always eating. She will have a hard time not laughing the next time she sees him eat those. She also hears some birdsongs, but they are far away. She turns to try to see where they are coming from and finds herself looking back up the hill at the woods that she will have to pass through to get back home. *Hmm. Why are the birds there but not here?* Brooke notices many more signs of wildlife as she walks home through the trees away from the stream.

## IT'S YOUR TURN.

Take your Stream Health Chart and visit your stream. What signs of wildlife or actual wildlife do you see? Record your discoveries on your chart.

## MY STREAM HEALTH CHART



### Question

#### **WILDLIFE:**

Did you see any wildlife near your stream? What kinds? Did you discover any signs of wildlife near your stream? What did you find?

### Answer

Unhealthy?

Healthy?

## CHAPTER 8

# What Does It All Mean?

As promised, Dr. Shedd has returned to Brooke's class to help them use their data to decide whether their stream is healthy or not. Ms. Shepherd hands out everyone's clipboards with their Stream Health Charts. She also shares a copy on the screen in the front of the room using her computer. Step-by-step, they explore each day's investigations.

**Water temperature:** The stream had cold water compared to the air.

**Water clarity:** The water was clear.

**Stream bottom:** There were rocks but also some mud.

**Macroinvertebrates:** They found lots of bugs but not a lot of different types of bugs.

**Plants:** Mostly trees and shrubs surround the stream. The stream banks are mostly bare soil.

**Wildlife:** There were signs of many types of animals, including deer, birds (chickadees, woodpeckers), snakes, and more.

“Which of these things do you think might be something we should be concerned about as stream doctors?” Dr. Shedd asks the class. “Cold water is good for some important fish, but others like warm water. It's important for it not to be too hot, though. In this case, our cold water is a good sign of stream health.”

Okay, the students think, that's not a problem. What about water clarity? The water was clear and not muddy. They already know that is a good sign of stream health.

Maya raises her hand, and Dr. Shedd calls on her. “The mud covering many of the rocks on the stream bottom is a problem. It is taking away homes from bugs.”

“That is true,” he responds. “Let's put an X in the ‘unhealthy’ box to the right of the Stream Bottom section on our health charts. What else should we be concerned about?”



“There aren’t as many different kinds of bugs as there should be,” José says.

Again, Dr. Shedd agrees and instructs the class to put an X in the “unhealthy” box to the right of the Macroinvertebrates section.

“And there is bare soil instead of plants on the stream banks,” Marisa adds.

The students all put an X in the “unhealthy” box to the right of the Plants section before Dr. Shedd even gets to instruct them.

“Is it bad news for this stream?” he asks. “Should we panic? Let’s mark the healthy things. Put an X in the ‘healthy’ box to the right of any section with signs of a healthy stream.”

The students mark the “healthy” boxes for temperature, clarity, total number of bugs, type of plants around the stream, and signs of wildlife. The students talk about it and decide that the stream has more healthy qualities than unhealthy ones but could use a little help to make it healthier.

While the rest of the class gets ready to go to recess, Brooke pulls out her Stream Health Chart from her stream at home. She looks at each line and marks the “healthy” or “unhealthy” box next to each section. Her water is warm, so Brooke decides to label it unhealthy. Her water

is clear (as long as she isn't walking in it), so she marks it healthy. But her stream bottom is mud, so that's another unhealthy mark. Brooke is getting nervous. Her perfect stream seems to be in trouble. She barely found any bugs and mostly all the same kind of bug. She has mowed grass instead of wildflowers or trees and shrubs. And there was almost no wildlife. All of these are unhealthy signs. She groans and heads outside but is in no mood to play today.

## IT'S YOUR TURN.

Take a look at your Stream Health Chart. If you haven't already, record all of your data from the different sections onto the complete chart on the back of this page. Mark the "healthy" or "unhealthy" box for each section. Is your stream more healthy or more unhealthy?

# STREAM HEALTH CHART

by Dr. Watt R. Shedd, Stream Doctor



**MY STREAM**  
HEALTH CHART

MY NAME: \_\_\_\_\_

Mark an **X** under **HEALTHY** or **UNHEALTHY**  
after answering each question.

Question	Answer	Unhealthy?	Healthy?
<b>WATER TEMPERATURE:</b> Is your stream warmer or colder than the air?			
<b>WATER CLARITY:</b> Is the water in your stream clear?  Does it have a color? What color?			
<b>STREAM BOTTOM:</b> What is on the bottom of your stream?  Do you see rocks, mud, or both?			
<b>MACROINVERTEBRATES:</b> How many bugs did you find?  How many different kinds of bugs did you find?			
<b>PLANTS:</b> Which of these best describes the plants around your stream?	(check one) <input type="radio"/> mostly trees and shrubs <input type="radio"/> mostly flowers and tall grasses <input type="radio"/> mostly mowed or lawn grasses <input type="radio"/> mostly bare soil		
Which of these best describes the plants on your stream's banks?	(check one) <input type="radio"/> mostly trees and shrubs <input type="radio"/> mostly flowers and tall grasses <input type="radio"/> mostly mowed or lawn grasses <input type="radio"/> mostly bare soil		
<b>WILDLIFE:</b> Did you see any wildlife near your stream? What kinds?			
Did you discover any signs of wildlife near your stream? What did you find?			



## CHAPTER 9

# A Sick Day for a Stream

After recess, the students file back into their seats, but Brooke is not moving at her usual happy pace.

Dr. Shedd says, “One of my jobs as a stream doctor is to help people come up with ways to make their streams healthier when in need. Even though the stream here at the school is mostly healthy, we can still talk about things to help keep it healthy and maybe make it a little better.” He seems excited about sharing this part of his work. “Let me give you some ideas of activities you could do as a class, and maybe Ms. Shepherd will let you all choose one to do together.”

As he talks, he makes a list on the board in the front of the room.

1. Add more plants to the stream banks.
2. Plant more trees on the school grounds.
3. Put up bird boxes.

4. Create signs to teach other people about the stream.
5. Have litter cleanups on school property.
6. Give a presentation to the school's neighbors about stream health.
7. Plant a meadow in the field where you sometimes play kickball.
8. Lead younger students on a stream health study of their own.

“I am sure you can come up with some ideas too,” Dr. Shedd assures them.

There is only a little time left in the school day, so Ms. Shepherd has everyone get out the stream drawings they created the first time Dr. Shedd visited. They take turns in pairs telling each other how they would change their drawings to make their streams healthier. Ms. Shepherd also instructs them that tonight, for homework, they need to tell at least one adult about what they learned during their Stream Health investigation. All the students look happy with their assignment, except one.

Ms. Shepherd pulls Brooke aside to find out

why she looks unhappy. Brooke is still dragging her feet and feeling blue. She doesn't say a word when Ms. Shepherd asks her what's wrong. Instead, she holds up the Stream Health Chart and drawing of her “not-so-perfect” stream.

Dr. Shedd comes over to join their conversation. “Tell me about your stream at home, Brooke. What could we do to make you happier about it?”

“I want it to be perfect,” Brooke says. “But it turns out it is unhealthy.”

Together, they go down the Stream Health Chart and look at the drawing. “I see some trees in the background of your picture. What could you change about that to help your stream?”

Brooke thinks for a bit, and just as a smile comes across her face, the end-of-day bell rings. She runs out the door before answering Dr. Shedd.

As Brooke sprints up her street, she puts the finishing touches on a plan she has been concocting in her mind. Even though the other neighborhood kids will think she is cuckoo, she plans to knock on Mr. Crankypants's door. She has to tell one adult about what she learned, and Brooke is sure he will want to hear what she has to say. She walks to his door, hesitates

for a second, takes a deep breath, and knocks. A few seconds later, she looks Mr. Crankypants in the eyes and starts talking.

After a few minutes of babbling and what seems like only one big breath she took for the entire story, Brooke finally stops.

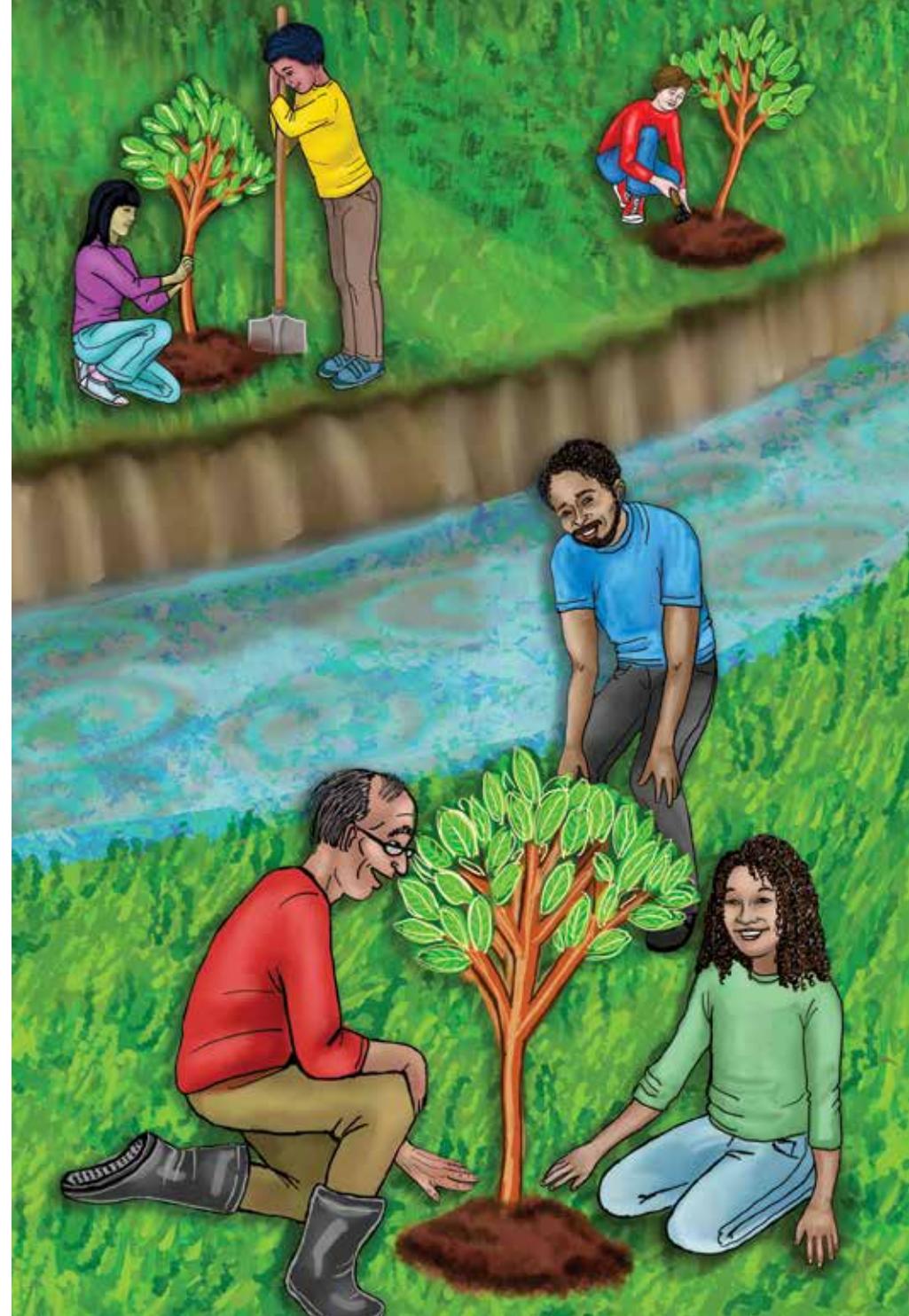
Mr. Crankypants looks a little overwhelmed. “You are that little girl who was playing in the stream while I was fishing, right? Do your parents know you are here?”

That’s a good point, Brooke thinks. “Um, no. I came straight from school. I probably should have gotten permission first,” she says.

He smiles and walks with her to her door, where she introduces her uncle to . . . *oh no, I can’t call him Mr. Crankypants out loud.* She only has to panic for a few seconds because Mr. Crankypants speaks up for himself.

“Hi, I’m Rod,” he says. “Rod Caster, I live a few doors down. Your niece was telling me about her school project. I was interested in her story but also concerned about her being at my door without another adult.”

Brooke, her uncle, and Rod, as he told her to call him, talk about the stream and her school project. Brooke shares her plan to help make her stream more perfect, which would also help



Rod not be so cranky about never catching any fish. Together, they discuss finding a way to plant more trees around the stream.

Brooke and her uncle continue meeting with Rod over the next few weeks. Ms. Shepherd even helps Brooke get Dr. Shedd to join the conversations back in Brooke's neighborhood. Winter was approaching, so they could not plant trees right away, but they could work on a plan to have all of Brooke's classmates and the neighbors on her street come together in spring to plant 100 trees along the stream. The community agrees to help take care of the trees and keep them growing strong after the planting.

*I can barely wait for spring to arrive because I'm going to make sure that my stream becomes a healthy one.*

### About the Author

Jennifer R. Fetter spent plenty of time getting into troublesome adventures in the woods near her childhood home before growing up to be an educator, biologist, and now children's book author. She is passionate about helping people of all ages enjoy science and the natural world in a way that is meaningful to them. Jennifer also serves as a stream doctor in her work with Penn State Extension.

### About the Illustrator

As a scientific illustrator, educator, and nature-loving mom, Nicoletta Barolini is super passionate about helping kids and grown-ups connect with science and the beauty of the outdoors.

