A towering cliff of ice hangs above Michele Koppes. She is in a kayak, paddling. Suddenly, she hears a loud crack. A huge piece of ice breaks away from the cliff. It splashes into the cold lake, creating waves. The waves rock the kayak, tossing it between jagged chunks of ice.

Koppes keeps paddling. After all, this is what she has come to see. Koppes is a glaciologist, a scientist who studies **glaciers.** Glaciers are huge masses of ice. They flow like rivers, but they move slowly.

Glaciers form in places where snow never completely melts. Instead, the snow builds up year after year. Over time, the layers of snow squash the lower layers into ice.

Yet a glacier is more than layers of ice. It's layers of ice that move. Koppes usually can't see the ice move, but she can hear it.

Bang! A thunderous noise stops Koppes. She and her companions have pulled their kayaks onto a rocky shore. They pause to listen.

Koppes knows this sound. It is the sound of moving ice. When ice gets to be about 40 meters (130 feet) thick, its great weight forces it to slide forward. Glaciers don't move quietly. They crack, rumble, and bang.

Ice and More Ice

Glaciers form on every continent except Australia. Small glaciers are no bigger than two football fields. The largest glaciers are the size of a continent. Altogether, glaciers cover ten percent of Earth's land area.

Some glaciers are sheets of ice. These ice caps cover large areas of land. For example, Greenland and Antarctica are almost fully covered in sheets of ice.

Others are mountain glaciers. They flow down rugged peaks and can stretch for 120 kilometers (75 miles).

Koppes and her team are standing at the foot of Tyndall Glacier in Chile. That's where the glacier flows into a lake. This part of a glacier is called the terminus. Here, huge pieces of ice can break off, or calve, into the water. One piece nearly hit Koppes's kayak.

Michele Koppes lowers herself into an ice cave in a glacier.

Getting Ready

Koppes and her team are studying how the glacier moves and changes. They plan to climb up the glacier and collect data along the way.

After stowing their kayaks, they check their gear. Koppes's backpack overflows with equipment. Some of the instruments are for measuring changes in the ice. Most of her gear is to keep her safe on the ice.

She zips up her warm coat. She puts on dark sunglasses. Sunlight reflecting off the ice can be blinding. Her eyes need protection.

Koppes clips herself into her climbing harness. A coil of rope rests across one shoulder. In her hand, she carries an ice axe. With a nod to her team, they begin the climb.

Chunks of ice break off into the water.

A climber crosses a dangerous crevasse.

On the Move

As the group heads out, Koppes thinks about the speed of this glacier. It grinds downhill about 700 meters (2,300 feet) each year. That's nothing compared to one glacier in Greenland. Every year, that glacier moves downhill about 15 kilometers (9 miles). It's the fastest glacier on Earth.

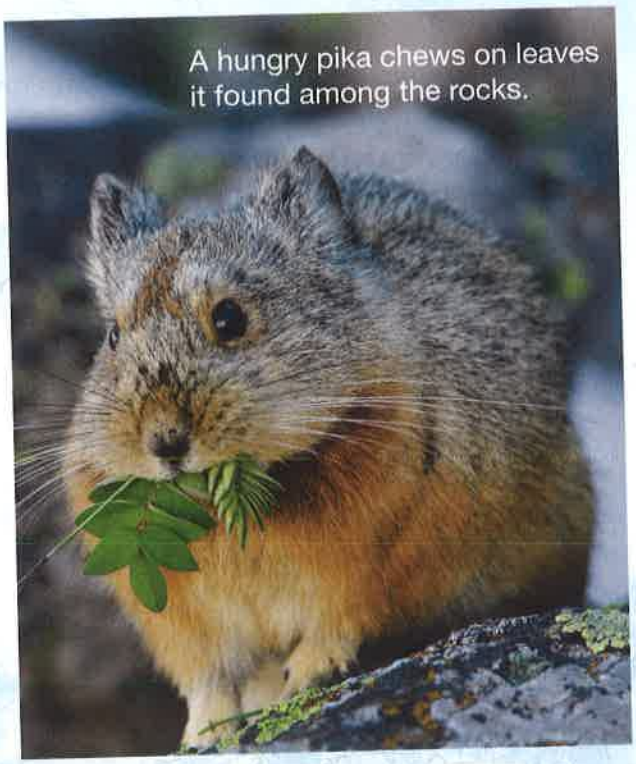
As a glacier flows, the bottom and sides drag more slowly than the middle. The different speeds tug at the ice. This can cause real trouble. It cracks the ice. Some cracks, called crevasses, can be deep and dangerous.

These cracks often become hidden under a thin crust of fallen snow. In many places, the snow is only a few centimeters thick. It can't support the weight of a person. For an explorer, a crevasse could be deadly.

Koppes saw this danger up close during another expedition. She and her team were in a helicopter, ready to hop out onto the ice.

Her partner leaned out of the helicopter and poked the snow with a pole. It seemed firm enough. So he jumped out. Bad idea! The snow gave way. Only the safety rope held by Koppes kept him from plunging to the bottom of a deep crevasse.

Koppes learned an important lesson about glacier safety that day. On today's hike, she and her team rope themselves together. If someone falls in a crevasse, the rest of the team can pull that person out.



A hungry pika chews on leaves it found among the rocks.

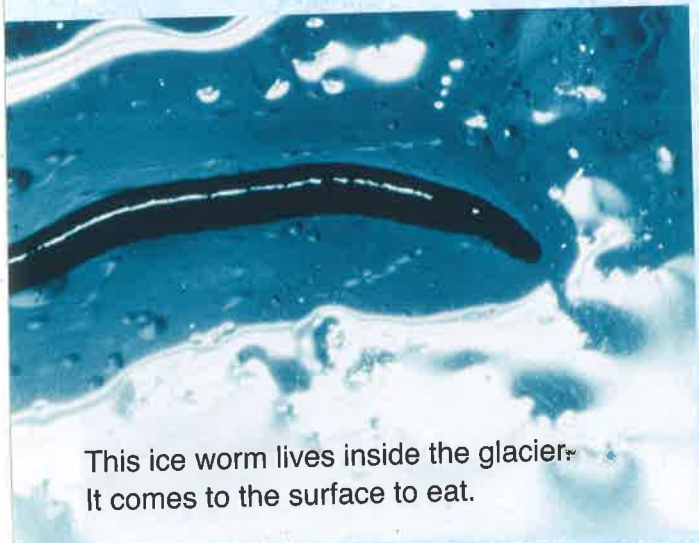
This seabird swims near a glacier.

Moving Mountains

Standing on the glacier, it's hard to feel how large and powerful it really is. After all, glaciers are the largest, most powerful moving objects on Earth.

As they move over time, they can do some extreme landscaping. They shape many of Earth's **landforms.**

Glaciers dig deep valleys. They carve troughs in the ground. They grind away mountains. They bulldoze sand and gravel into ridges called moraines.



This ice worm lives inside the glacier. It comes to the surface to eat.

Signs of Life

Glaciers change Earth's surface in other ways, too. In some parts of Greenland and Antarctica, the ice is over 4 kilometers (2.5 miles) thick. That's a lot of ice and a lot of weight. The ice is so heavy that it presses down on Earth's crust. Beneath the ice, parts of the land have been pushed below sea level.

Glaciers may look lifeless and icy. Yet they are the heart of a lively **ecosystem.** Many plants and animals live on or near glaciers.

Take pikas, for example. Pikas are small mammals. They have ears like a mouse. They are as large as a squirrel. Many only live in piles of broken rock on glaciers. They run in and out of the rocks. They search for food, guard their territory, and watch out for predators.

There are others animals that can only live on or near glaciers. One type of seabird only nests on rocks next to glaciers. It blends into the gray backdrop to stay safe from predators.

Koppes's favorite glacier critter is a worm. Ice worms are oddball animals that live inside glaciers. They squirm through the ice and come to the surface in the evening or early morning. Ice worms eat algae and bacteria that they find on the ice.

Shrinking Ice

Animals aren't the only ones who depend on glaciers. People do, too. Glaciers are like giant water towers. They store vast amounts of fresh water. During summer, temperatures rise. The ice begins to melt. The melting ice flows into rivers. People, plants, and animals need this water to live.

Water from glaciers in the Himalaya mountains, for example, pours into many rivers. More than 1.3 billion people in Asia depend on it. Imagine what might happen if this source of water disappeared.

That's just the problem. Many glaciers are shrinking. If glaciers melt too quickly, many problems follow. Lakes overflow and flood. Avalanches destroy towns. Icebergs threaten ships at sea. Water supplies dry up.

Koppes knows about this problem firsthand. This isn't the first time she has been to Tyndall Glacier. She made this trip several years ago, too. At that time, she took photographs. She measured the height of the glacier's surface. She checked the position of its terminus.

Today, it seems clear to her that there is less ice. When she studies her two sets of data, she will have proof. Tyndall Glacier is melting. It's getting smaller.

Melting Glaciers

In fact, almost every glacier on Earth is shrinking. This isn't the first time glaciers have melted. Earth's climate has warmed and cooled many times over millions of years. Scientists aren't sure exactly why. Each time it warms up, glaciers melt and shrink.

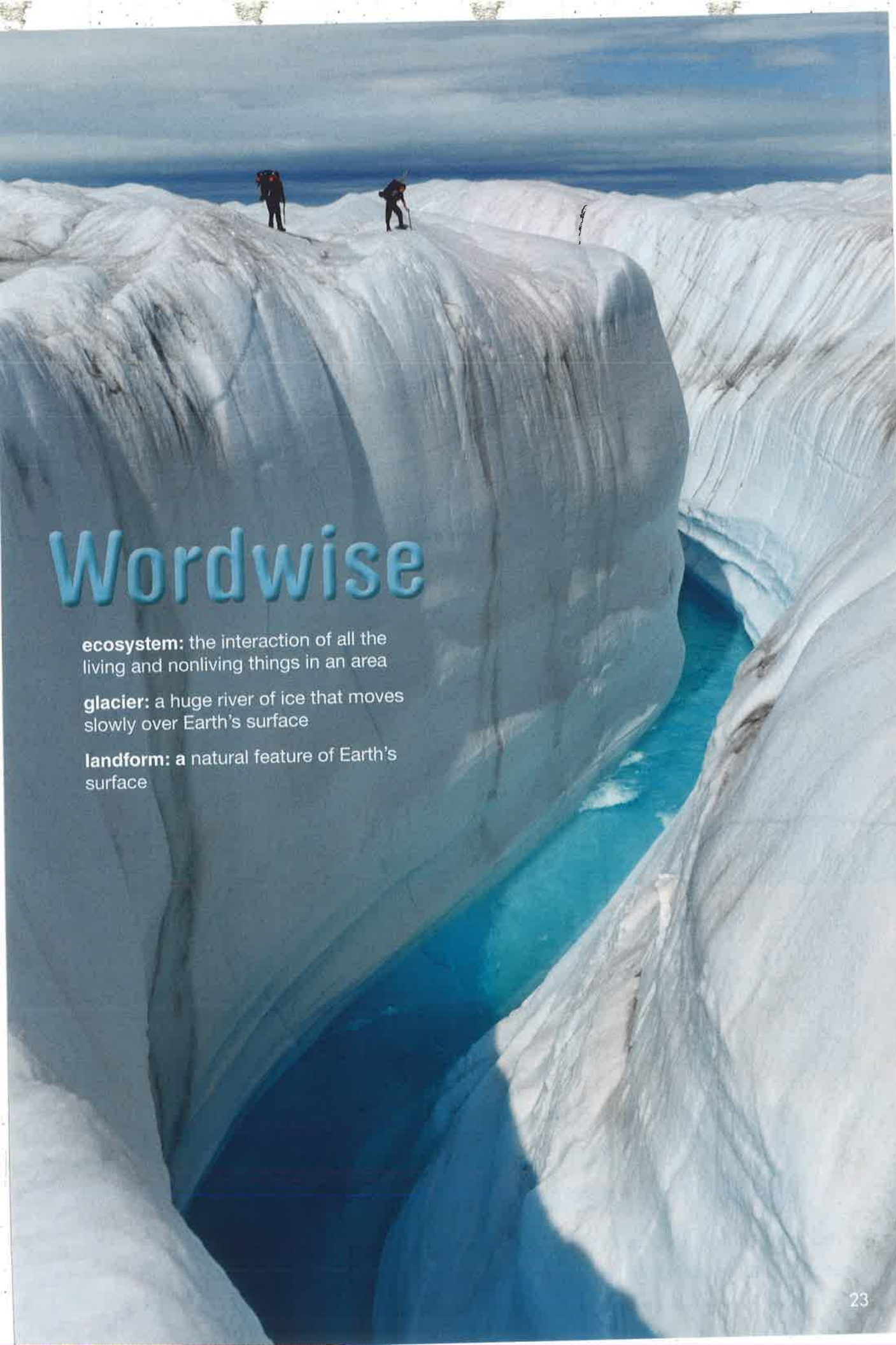
This time, though, Earth's atmosphere is warming faster than ever in modern history. Scientists say human activity is to blame.

Burning large amounts of coal, oil, and natural gas harms the environment. Over time, these activities release harmful gases into the atmosphere. Some of these gases, like carbon dioxide, trap Earth's heat. As Earth gets warmer, more glaciers melt. As more glaciers melt and do not return, fresh water supplies are put at risk.

After a full day of climbing, Koppes and her team reach the top of the glacier. She pauses a moment to take in the view. She can see far. An icy wind blasts her face. Beneath her, she hears the glacier groaning. She knows it is moving and changing.

The team will make camp here for the night. In the morning, they will make the long trip back down the glacier to study the data. They'll share what they know with other scientists.

A melting ice shelf forms at the foot of this glacier.



Wordwise

ecosystem: the interaction of all the living and nonliving things in an area

glacier: a huge river of ice that moves slowly over Earth's surface

landform: a natural feature of Earth's surface

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