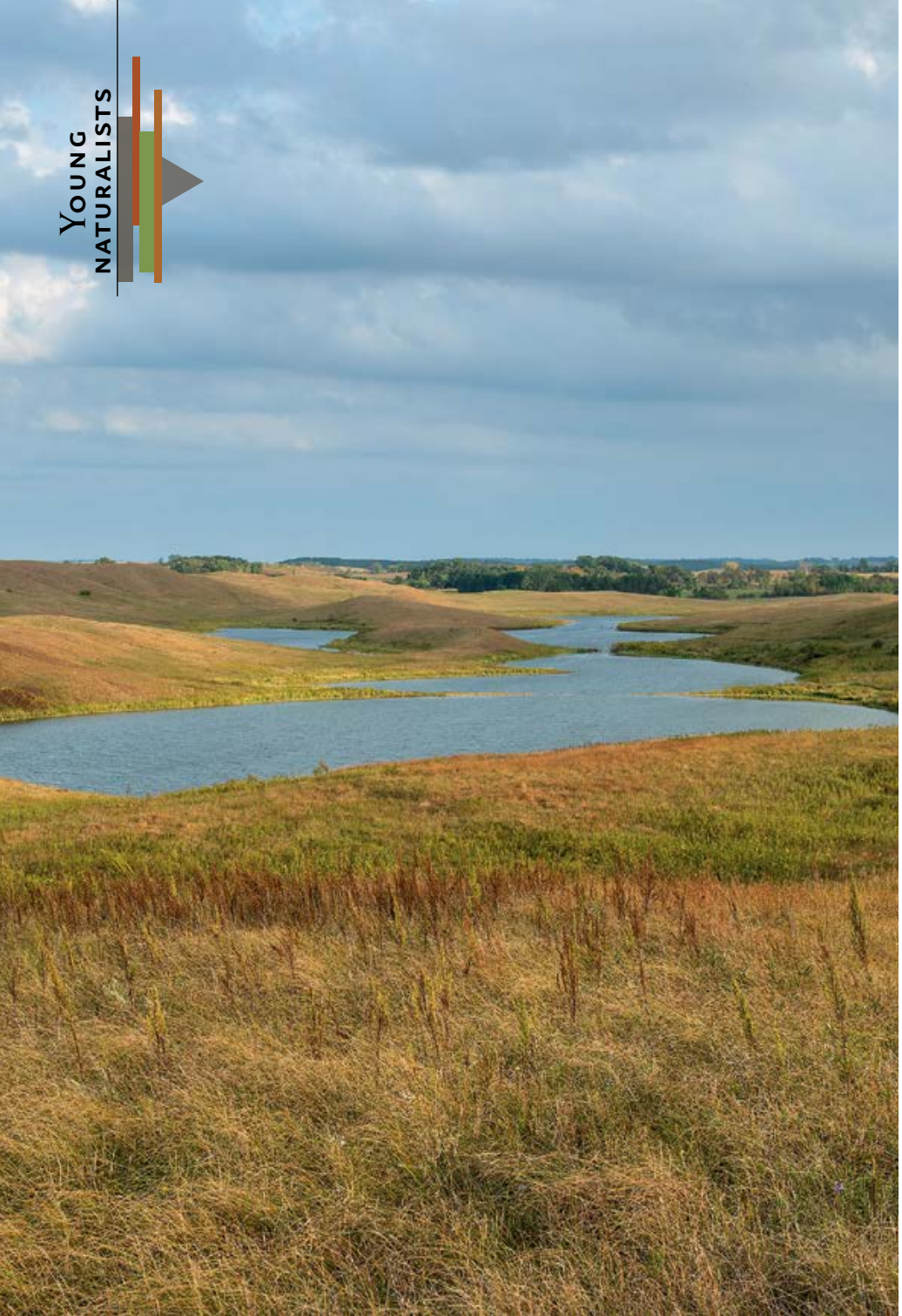


Young Naturalists

by Mary Hoff

Photography by Gary Alan Nelson

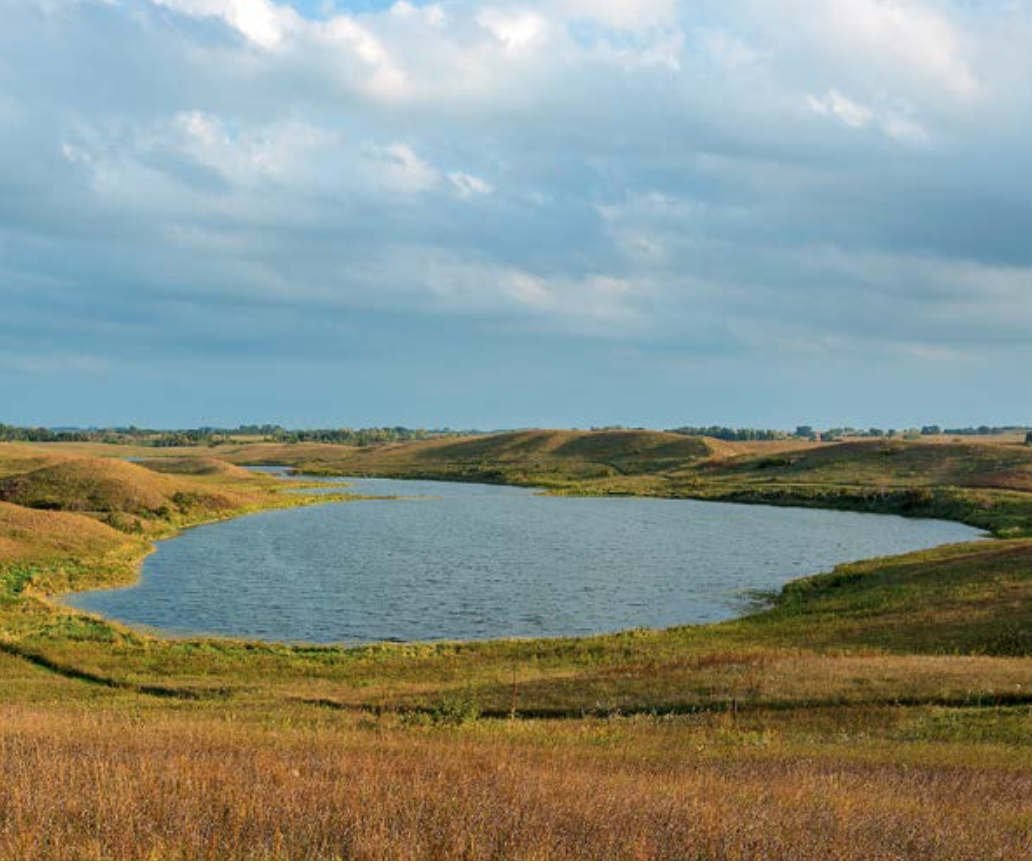
The Glacier Did It

Moving and melting ice shaped many of Minnesota's land features.

Shut your eyes. Imagine that it's a sunny summer day 14,000 years ago. What do you see? In most of Minnesota, the scene looks a lot like winter.

All around you stretches a glacier—a vast sheet of ice a mile thick. It seems to be frozen in time and place. But in reality, it is on the move. Inch by inch, the ice is flowing across what we now know as Minnesota, pushed down from the north as snow piles up and turns to ice in huge amounts during this cold period in the Earth's history. Far beneath, where ice meets land, some amazing things are happening. Rocks and boulders are being dragged along as though they were bits of sand. Gravel and sand are being plowed and scraped as if by a giant bulldozer. Rivers and streams flow through openings in the ice, tumbling pebbles and sand together as though they were in a giant rock-polishing machine.

Now fast-forward to today. You'll see things have changed. The ice has melted. Left in its place, like cups and plates and food after a party, are remnants of the glacier's activity: gravel piles, massive rocks, water-filled basins, and more. In fact, there's a good chance that some of these features are around you! Let's take a look at a few reminders of our state's Ice Age.

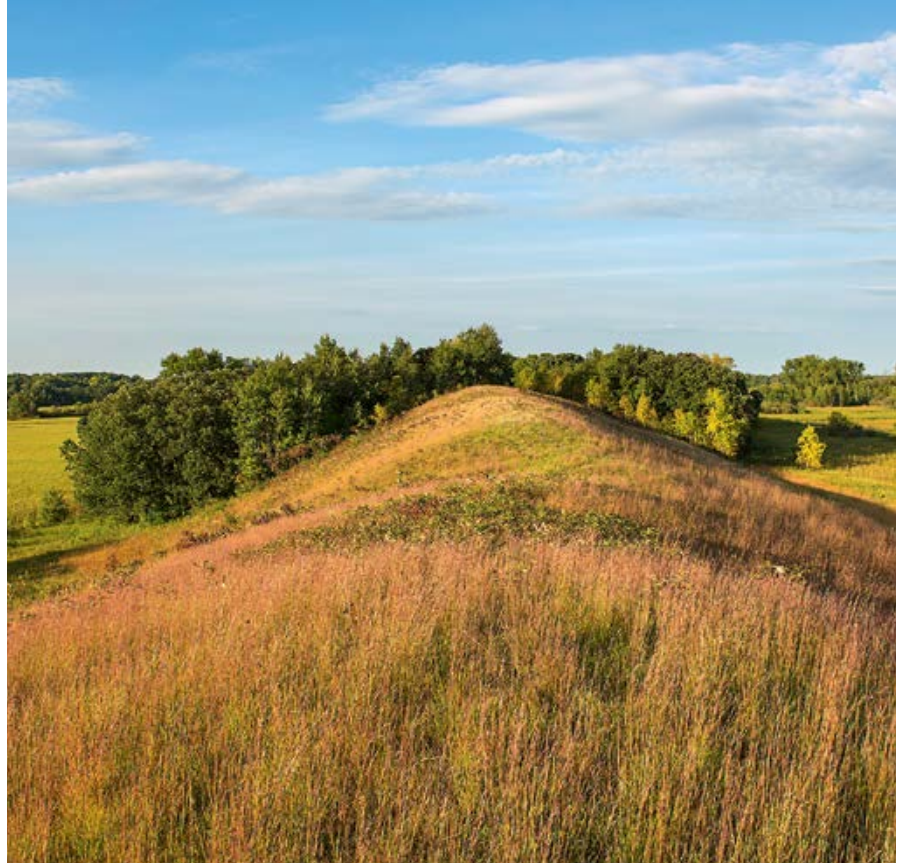


Kettle Lake

If Minnesota is the "land of 10,000 lakes," at one time it was probably the land of thousands of chunks of ice. As glaciers moved across the land, they carried massive amounts of clay, sand, and gravel with them and left them behind—the geological equivalent of tracking dirt into the kitchen on your shoes, only big time. In some places this material, known as *till,* buried large chunks of ice broken off from the glacier. When the chunks of ice melted, the till settled, leaving depressions in the landscape. These pits then filled with water, creating many of the lakes we see around us today.

Lakes formed in this way are known as kettle or ice-block lakes. Most of Minnesota's 11,842 lakes are kettle lakes.

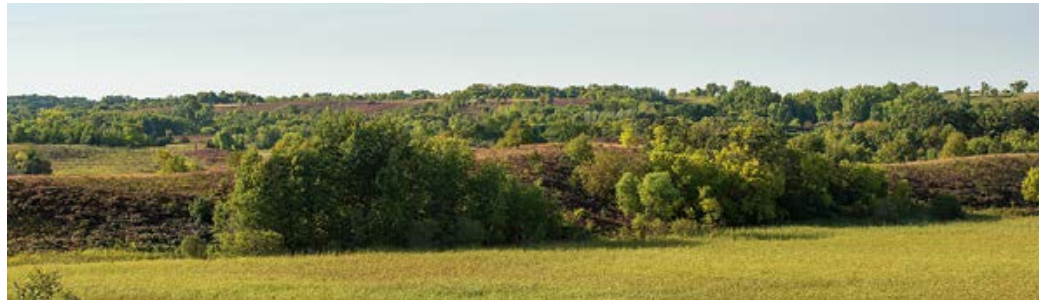
If you'd like to try this yourself, put three ice cubes into an empty pie pan and then fill the pan with sand to cover the cubes. Let it sit overnight. What do you see in the morning?



Esker

Just as rivers that run through our state today carry rocks, gravel, and sand with them, so did rivers within the glacial ice that once covered Minnesota. When the glaciers melted, they left behind snake-shaped ridges of these rocky and sandy materials that trace the path of the former rivers. Known as *eskers,* these curved hills tell us where waterways once ran beneath the ice.

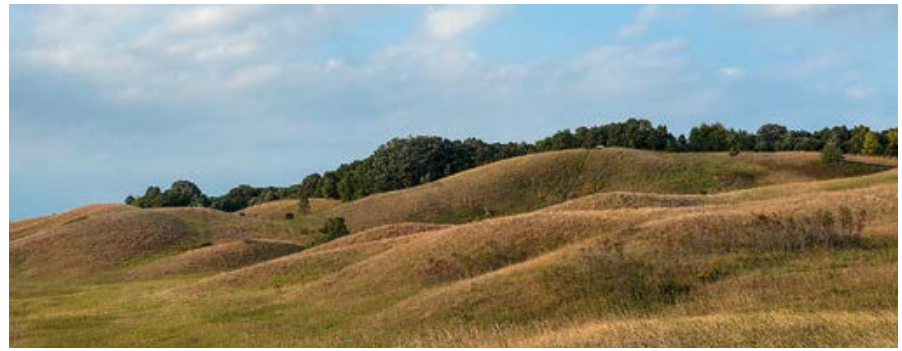
Eskers come in many sizes. Lake Johanna esker in Pope County in west-central Minnesota is 70 feet high in places. Some eskers can be more than a mile long.

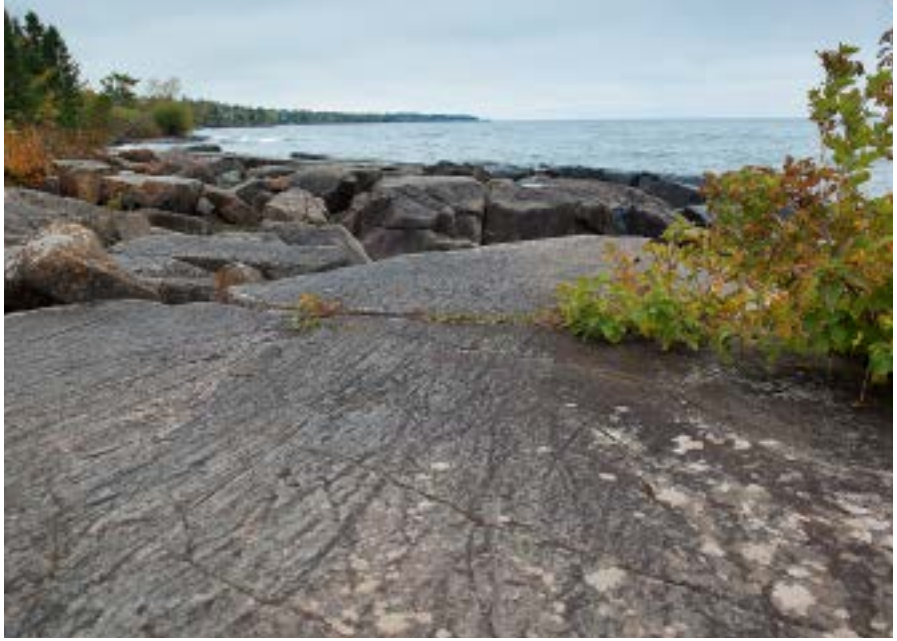


Moraine

When a glacier adds ice at its back end as fast as the ice is melting at its front end, the front end stays in one place while the glacier continues to flow. The sand, pebbles, and rocks moved to the front of the glacier by this flow pile up there like groceries at the end of a conveyor belt, forming a ridge known as a *terminal moraine*. The location of a terminal moraine tells us how far a glacier advanced. Other piles of sand, pebbles, and rocks left along the way as the glacier moves are known as *ground moraines*.

In Minnesota, moraines run along the north shore of Lake Superior, form a horseshoe shape in the middle of the state, and mark the farthest reach of glaciers in southwestern and southeastern Minnesota. Their names, such as Itasca moraine, Alexandria moraine, and St. Croix moraine, tell you a little bit about where they are located.





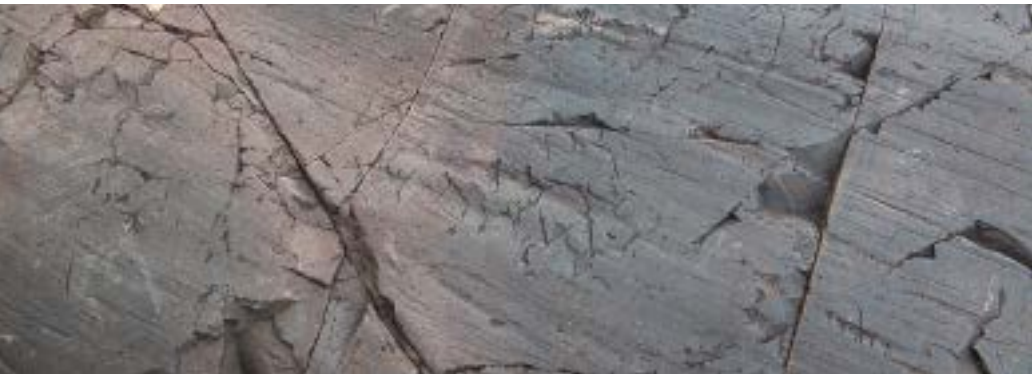
Striation

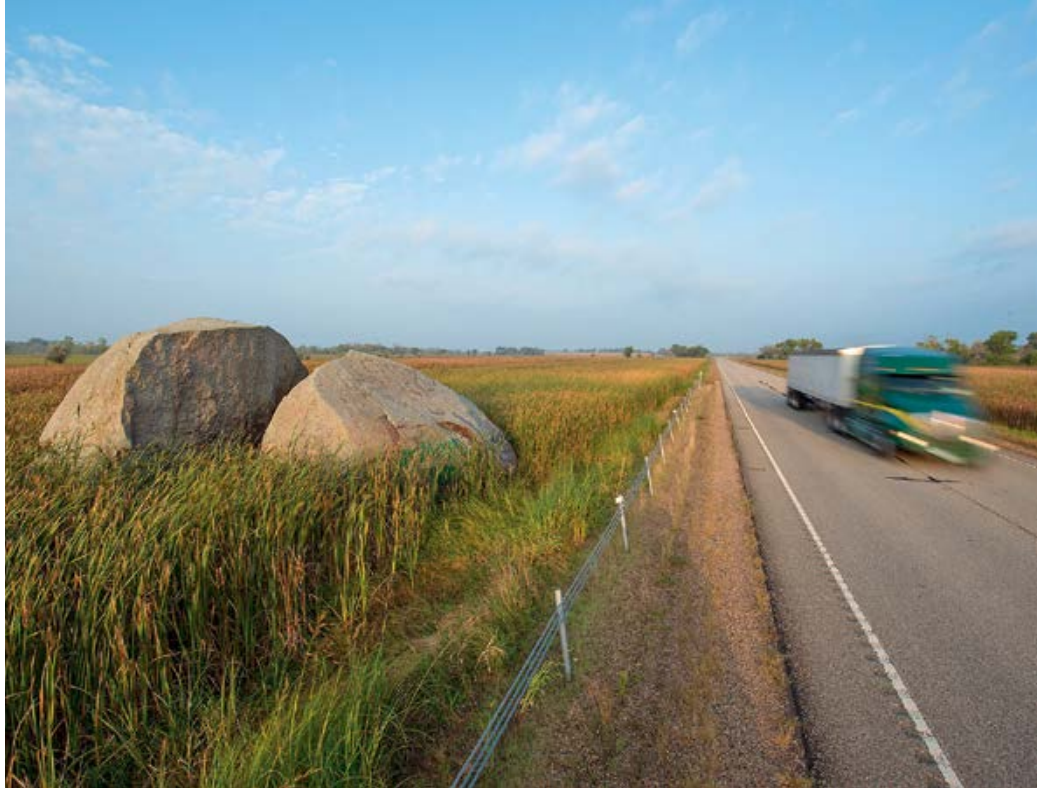
Hiking along the shore of Lake Superior, you come upon a big rock that has long scratches in it, as though someone or something dragged sharp objects across it.

Well, that's exactly what happened! And the "something" is a glacier.

Have you ever noticed that when you rub two things together, they get warmer? That happens in nature, too. As glaciers move across the land, the part that's rubbing against the land melts due to the friction. When it refreezes, rocks can end up frozen into it like the sand in a piece of coarse sandpaper. As the ice sheet creeps forward the rocks scrape the bedrock, leaving the gouges, known as *striations,* that we see today.

Sometimes rocks with glacial striations have a super-smooth background surface. That happens when the glacier also picks up tiny particles of sand, which polish rather than scratch the rock surface.





Erratic

This broken boulder on the side of State Highway 7 between Odessa and Appleton probably weighs more than 100 tons. This kind of rock was not formed anywhere near here. Where did it come from, and how did it end up in western Minnesota?

The answer, as you might have guessed, is glaciers. Cycles of freezing and thawing in glacial times helped break large chunks of rock away from rock formations in what we now know as Canada. As glaciers crept down from the north, they carried these chunks and eventually dropped them—much as you might pick up pebbles on a hike and leave them somewhere else. Only these rocks, known as *erratics,* can be big—some as big as a garage.

Some geologists have used glacial erratics in the same way detectives use objects left at a crime scene—to figure out what happened before they arrived. Because different kinds of bedrock are found in different places, the type of rock in an erratic provides a clue as to where it came from. By studying erratics and matching them to the rock that underlies parts of Canada, scientists can figure out where a glacier began and the direction in which it traveled.

Glacial Lake

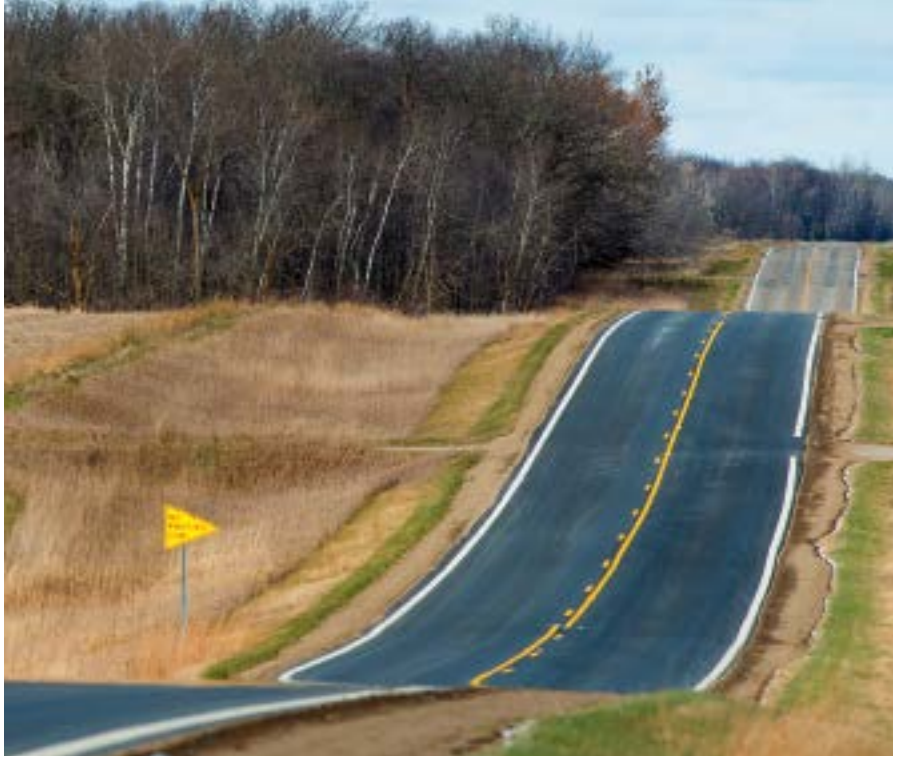
The biggest footprint that the glaciers left in Minnesota can be seen in the northwestern part of the state. It's the flattened terrain left behind by Glacial Lake Agassiz, an enormous lake formed by water flowing from the melting glaciers.

Lake Agassiz once covered more than 120,000 square miles in what is now Minnesota, North Dakota, Ontario, Manitoba, and Saskatchewan. That's bigger than any lake on Earth today—bigger than all of the North American Great Lakes put together!

When Lake Agassiz drained, it left behind many clues to its existence. Ridges of sand stretching across parts of northwestern Minnesota mark where its beaches once were. The flat, rich soils of the Red River Valley were once the lake bed beneath Lake Agassiz's waves. So were the peatlands of Big Bog State Park and the Red Lakes—Upper and Lower—that are now among Minnesota's largest bodies of water.

Teachers resources

Find a Teachers Guide and other resources for this and other Young Naturalists stories at *mndnr.gov/young_naturalists*.



Drumlin

Some piles of glacial till stretch for long distances across the landscape. But in other places, glaciers sculpted till into distinctive mounds as they moved across the land.

Some mounds, known as *drumlins,* are shaped like giant water droplets—wide at the "upstream" end and tapering to a point at the other, as though pointing in the direction the glacier is traveling. This road in Otter Tail County in western Minnesota goes up and over drumlins, giving it a roller-coaster-like look (and feel!).

Fascinating Clues

Some parts of Minnesota—notably the southeast—escaped at least the most recent glaciers, so these areas have few if any clues pointing to the former action of ice. But most of our landscape is filled with fascinating features that the glaciers left behind during their prehistoric visit to this area. As you travel around the state, or even around your neighborhood, keep your eyes open. Those hills, ridges, and mounds have many stories to tell—if you take the time to listen.