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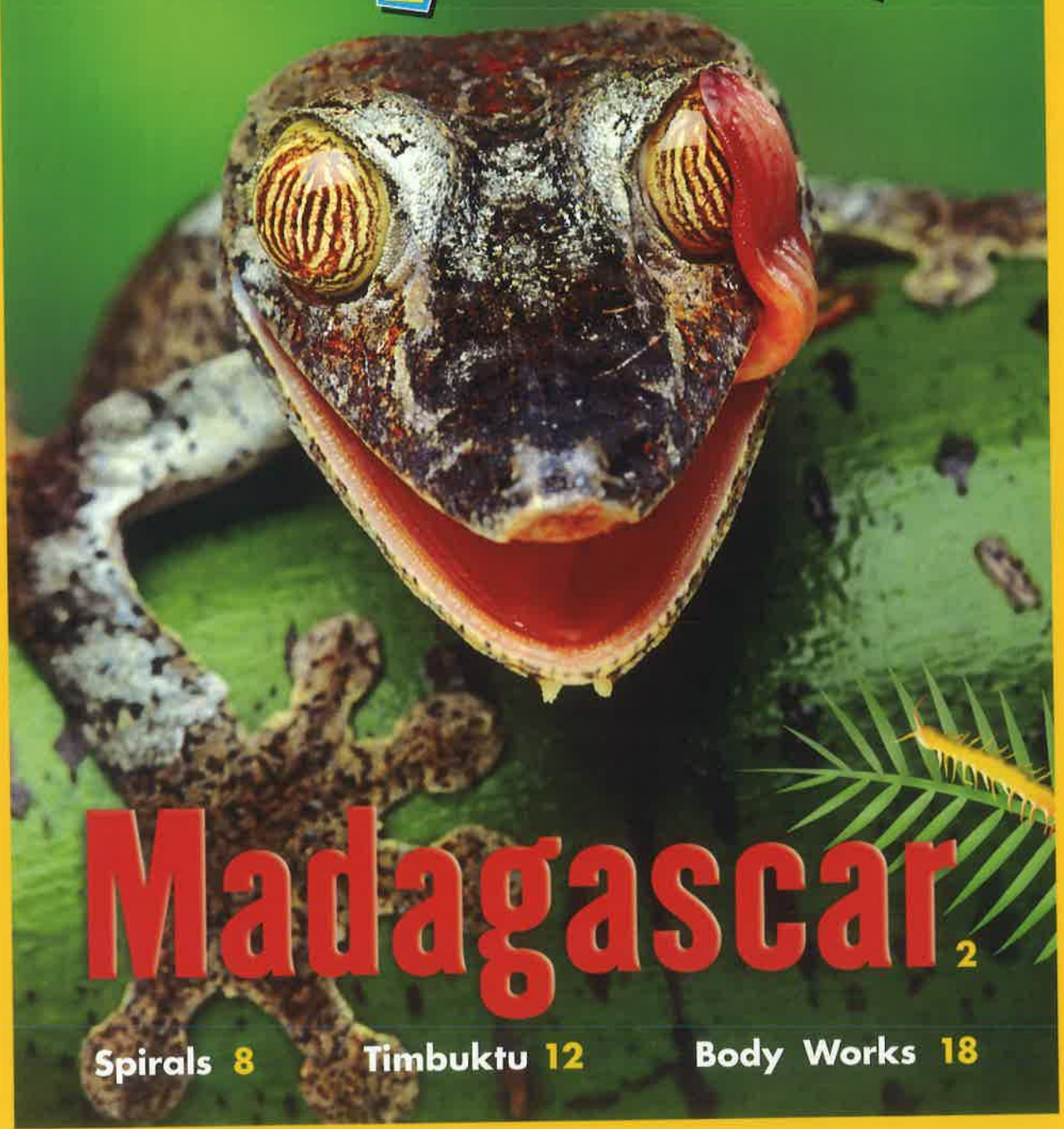
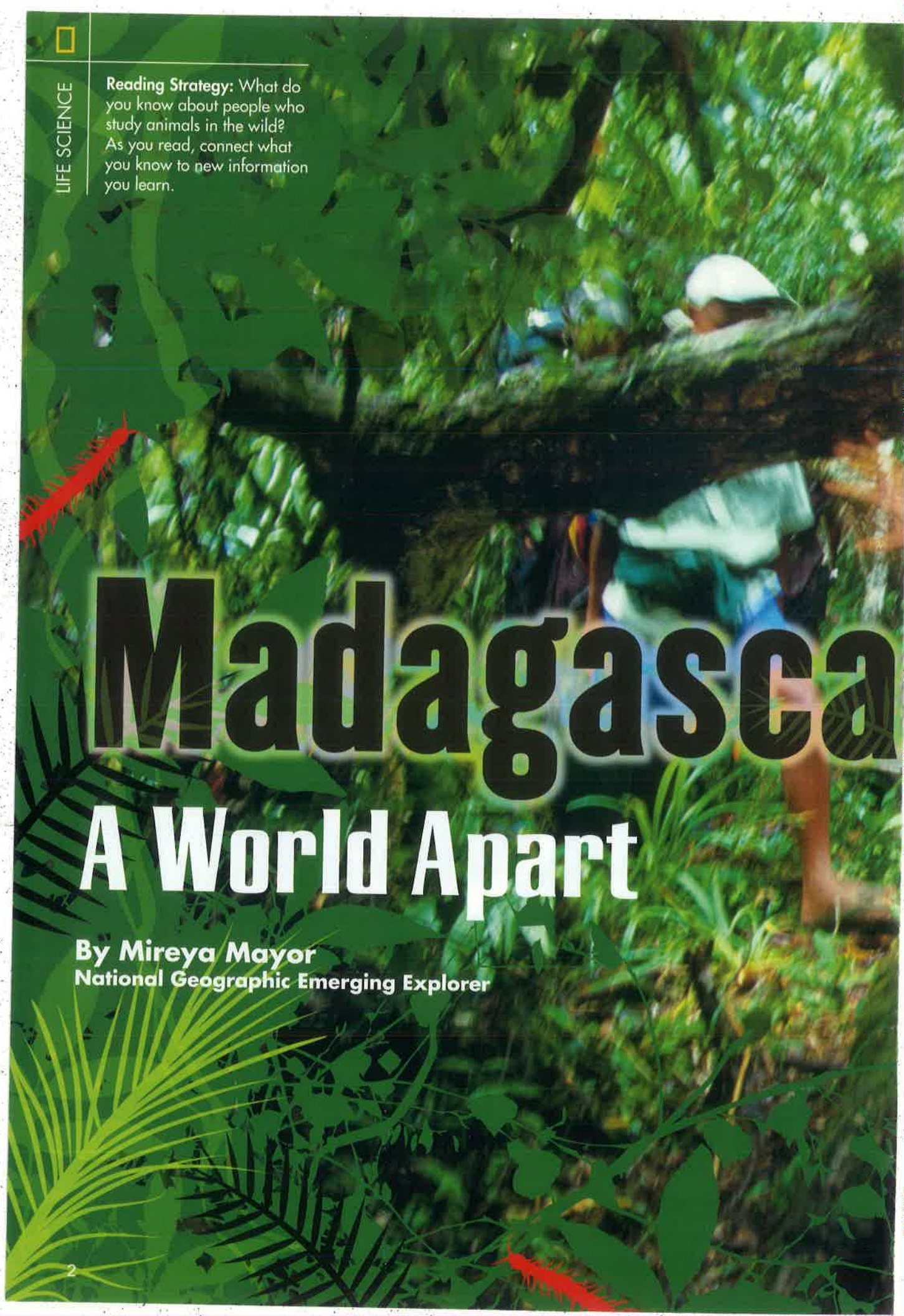
NATIONAL GEOGRAPHIC Explorer!



Madagascar 2

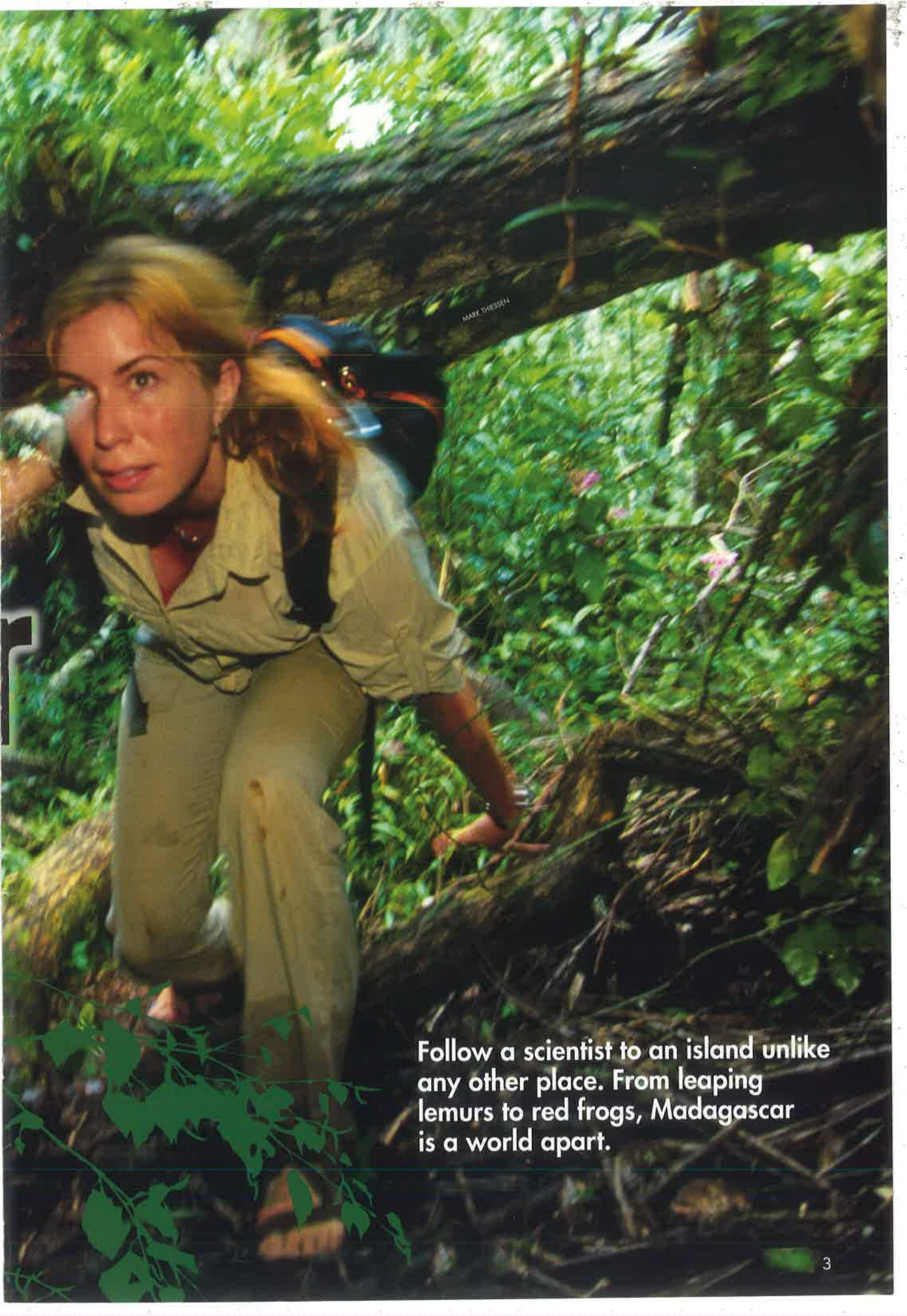
Reading Strategy: What do you know about people who study animals in the wild? As you read, connect what you know to new information you learn.



Madagasca

A World Apart

By Mireya Mayor
National Geographic Emerging Explorer



Follow a scientist to an island unlike any other place. From leaping lemurs to red frogs, Madagascar is a world apart.

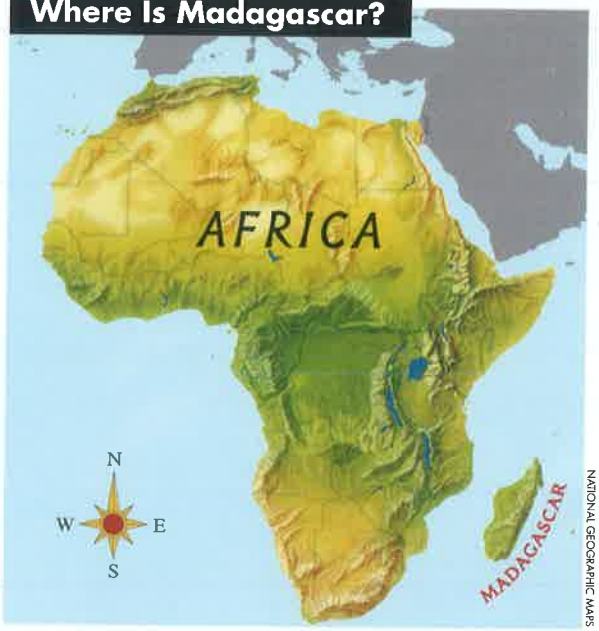
Here's how my job description reads: *Must like adventure. Must be patient. Must not mind mud. Must not scare easily. Must get close to predators. And finally, must love lemurs.*

Does that sound like a crazy job? It is. But I love it. I've slogged through dark, wet rain forests. I've hiked across dry **savannas.** I've sunk into muddy swamps. Each place I visit challenges me in a different way.

What makes it worthwhile is the chance to study unusual animals. Madagascar drifted from the African continent 165 million years ago. It became an island in the Indian Ocean.

Over millions of years, the animals on the island developed special features to adapt to their habitat. More than three-fourths of the animals of Madagascar are **endemic.** That means they are found nowhere else on Earth.

Where Is Madagascar?



NATIONAL GEOGRAPHIC MAPS

Lovable Lemurs. *These are sifakas, a type of lemur. Their name sounds like the noise they make.*

Must Be Patient

Sometimes it takes more than walking to find animals. It can take waiting—lots of waiting. Patience is key to my job.

That's especially true for studying Madagascar's chameleons. Finding these lizards can take a long time. They sit perfectly still for hours. Their colors blend in with the rain forest, so they're really hard to spot.

To study chameleons, I stare into the trees, waiting for a sign of movement. When I spot a chameleon, I scramble up the tree to catch it.

Luckily, Madagascar's chameleons move pretty slowly. That means I can actually catch and study them. When I do catch one, I love to look at its eyes. Each eye moves on its own. It's funny to watch a chameleon watch me with one eye while the other eye looks for food.

Massive Moth. *This comet moth is named for its tail, which can grow up to 20 centimeters (8 inches) long.*

Handle With Care! *A tomato frog makes a sticky material that can make animals sick.*

Must Not Mind Mud

Climbing a tree to chase a chameleon is one of the easier things I do. My job also involves sloshing across swamps and mucking through mud. I don't mind getting down and dirty, though. There are some really cool things buried under all that mud!

One of the coolest is the tomato frog. It lives only in one small part of the island. I find the frogs near swamps, ponds, and other wet places. These plump **amphibians** spend their days buried in mud. They come out at night to hunt insects. Hunting is a risky time because larger animals could attack the frogs.

The frogs get their name from the way they react to danger. I've seen this firsthand. I sometimes pick up tomato frogs. That makes the frogs think they're in danger. So they puff up their orange and red bodies. Then they really do look like tomatoes!

The bright color warns predators the frog isn't safe to eat. That's because it makes a sticky material that makes animals sick. I handle the frogs carefully. Of course, I'd never eat one!

Colorful Chameleon. *This panther chameleon is one of Madagascar's many lizard species.*

Must Not Scare Easily

So far, I've talked about some animals that I've found. At times, though, animals find me. That happened one day after a walk in the woods.

After the walk, I saw my pants were dirty. I scrubbed them clean and set them aside to dry. When I put them back on, something didn't feel right. I jumped out of the pants, and about 50 cockroaches skittered out!

They were hissing cockroaches. These were seriously big bugs. Each was as long as my ring finger. From their name, you can guess that these not-so-cuddly critters hiss. And they were *loud.*

Hissing cockroaches usually live inside rotting logs. I guess they decided my pants would make a good home. That taught me to shake my clothes before I put them on!

Of course, the cockroaches seem tiny compared to the island's giant jumping rats. They're about the size of rabbits. They can leap a meter (three feet) into the air, like tiny kangaroos. I try to avoid these animals.

Must Get Close to Predators

I can handle roaches; I can ignore rats. Some days, though, I come face-to-face with Madagascar's top predator. It's the fossa.

One look at this animal, and you know it was built to hunt. Picture a short, stocky mountain lion. A fossa has powerful jaws filled with needle-sharp teeth. Like a cat, it has long claws on both its front and back feet.

One of the coolest things about a fossa is that its feet are reversed. Its biggest toe is on the outside of its foot. That helps a fossa grip a tree better when climbing up.

A fossa may look fierce, but I know it isn't really a threat to me. It's fairly small, about 12 kilograms (26 pounds). Still, getting close to one feels creepy. The fossa eats any small animal it can find. Unfortunately, the fossa's first choice of food is my favorite animal.

Must Love Lemurs

I enjoy my final job requirement: must love lemurs. The lovable, furry, wide-eyed lemur is my favorite animal. Not just on Madagascar, but on Earth.

Of all the animals on Madagascar, lemurs are probably the most well-known. About 90 species of lemur live all over the island. Large lemurs, such as indris, are about the size of medium-sized dogs. Teeny, tiny mouse lemurs could sit in your palm.

To study lemurs up close, I need to catch them. That means more climbing. Lemurs spend most of their time in trees high above the ground. They are fantastic acrobats.

Capturing them is tricky. When I need to study a lemur, I shoot a dart at it. The dart carries medicine that puts the animal to sleep. Usually, the lemur falls gently from the tree into my net on the ground.

Not always. Some lemurs fall asleep right where they are. Then I have to climb the tree to get them.

On one trip, a friend and I spotted a tiny lemur. We trapped it so that we could take a closer look. It turned out to be a totally new species of mouse lemur! It is one of the smallest lemurs ever found.

We brought the mini **mammal** down to the ground so we could learn more about it. We measured it and took lots of photos. By the time we finished, it was night. It was too dark to climb the tree to put the lemur back. So I had to sleep with the lemur in my tent. It spent the night running around and jumping on my head. Needless to say, I didn't get a lot of sleep that night.

Night Crawler. *This nocturnal lemur is called an aye-aye. It finds insects to eat by tapping on tree bark with its long middle finger.*

The Joys of My Job

By now, you've seen that I have a pretty strange job. It can be tough. Still, I love it. That's because Madagascar is a living, breathing laboratory.

I never know exactly what a day will bring. Will I stumble across a new animal, never seen before? Will I spend an afternoon learning about lemurs? No amount of giant bugs, leaping rodents, or piles of mud can keep me away from my next discovery.

Wordwise

amphibian: animal that begins life in water but later moves onto land

endemic: found in only one place

mammal: animal that feeds milk to its young

savanna: flat, grassy plain with few or no trees

Fossa

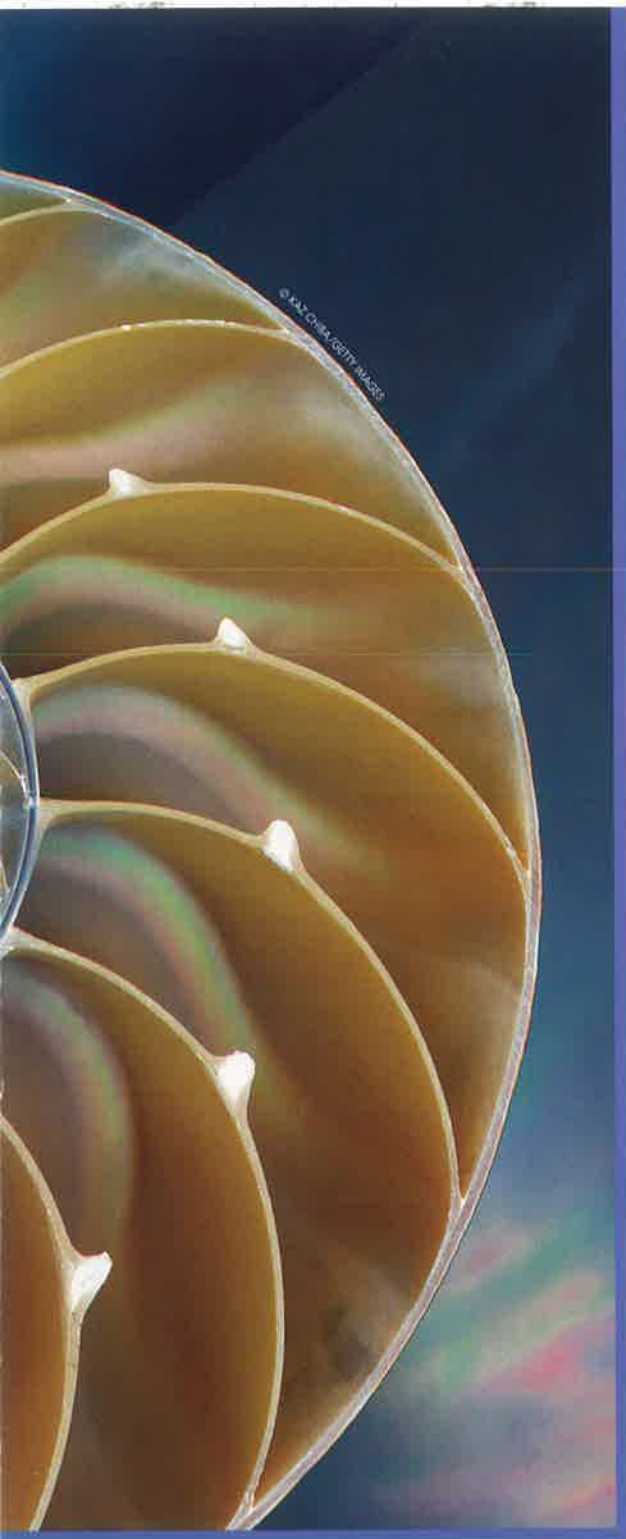
Aye-aye

Reading Strategy: If you come across something you don't understand, stop to figure it out. You might reread a part, read more slowly, or read on.

Nautilus shell

NATURE'S SP

What do a deep-sea creature and a ram's horn have in common? It has to do with their shape. They are examples of nature's spirals.



RALS

By Wendy Lichtman

A spiral is a curved shape that winds around a point. Spirals occur all the time in nature. When certain galaxies swirl through space, they form spirals. When hurricanes rage over the ocean, they also form a spiral. The horn of a ram, the seeds of a sunflower, and the nautilus shell all twist and turn in a spiral. Look around, and you'll see spirals again and again.

Shaped for Survival

As you explore, keep this question in mind: Why do so many living things have a spiral shape? The answer may be easier than you think. The spiral shape may help some animals and plants survive.

Imagine a bighorn sheep, up in the high desert. Chin down, the ram charges full force in a battle for a mate. Brown horns curl back over its ears, then curve down and up past its cheeks. These spiraled horns become powerful weapons when the ram has to butt heads with another bighorn ram.

Twisting and Turning

The spiral shape occurs in sea creatures, too. Look at the shell to the left. The nautilus needs a hard shell to protect its soft body. So the animal lets out a material through its skin. This material forms a hard shell.

As the nautilus grows, it builds a new chamber. Then, it moves in. Each new chamber is the same shape as the last. It's just bigger and slightly rotated. The shell grows into a spiral of protection!

Bighorn sheep

Spiraling Seeds and Leaves

Your next stop on the search for spirals is the prairie. There, you can see how spirals help some plants grow, too. Look closely at the head of a sunflower. (See the photo below.) It is covered with seeds that may produce new sunflowers. The seeds grow in two spirals, one curving to the right and the other to the left.

Did you notice how many seeds there are? Each seed is the same size, but there is no crowding in the center. Even at the edges, no space is wasted. Why two spirals? Nature is just being efficient. It's the best way to pack the most seeds on the flower head.

For another example of nature's spirals, head closer to home. Check out some houseplants. When you look down on the plant, you may see that the leaves grow in a spiral that winds around the stem.

Look at one of the lower leaves. It takes many turns of the spiral before another leaf grows directly above it. This lets sunlight reach both the top and bottom leaves. Thanks to the spiral, each little leaf gets its share of sunlight!

A Number Puzzle

Wherever spirals occur in nature, they often follow a special number pattern. No one knows how this happens. It is a mystery, but the pattern is there if you know how to look.

In the 1200s, a mathematician named Fibonacci wrote a book about numbers. In the book, he described a sequence of numbers. A sequence is a series of numbers in a certain order. It was later discovered that the numbers in that sequence relate to spirals in nature.

Here is how the Fibonacci sequence begins: 0, 1, 1, 2, 3, 5, 8, 13, 21… The order may seem confusing, but not if you know the secret. *Shhhh.* Here it is. Say these number problems out loud: 0+1=1, 1+1=2, 1+2=3, 2+3=5, 3+5=8,… Do you see how it works?

Start with the numbers 0 and 1. Add them together to get the next number—another 1. Keep adding the last two numbers to get the next number in the sequence. Here's the really cool part: In math, three dots mean you can always add another number. The sequence can go on and on. It never ends!

AMY WHITE & AL PETTEWAY/NATIONAL GEOGRAPHIC STOCK

Sunny Spirals. *Look closely at this sunflower's seeds. Can you find the two spiral patterns?*

From Numbers to Spirals

What does a number pattern have to do with a spiral? For the answer, look at the diagram at the bottom of this page.

Each square has sides that are equal to a number in the Fibonacci sequence (1x1, 2x2, 3x3, 5x5, 8x8…). The first square repeats. If you draw a curved line connecting the opposite corners of all the squares, you'll see it! Nature's stunning shape: the spiral.

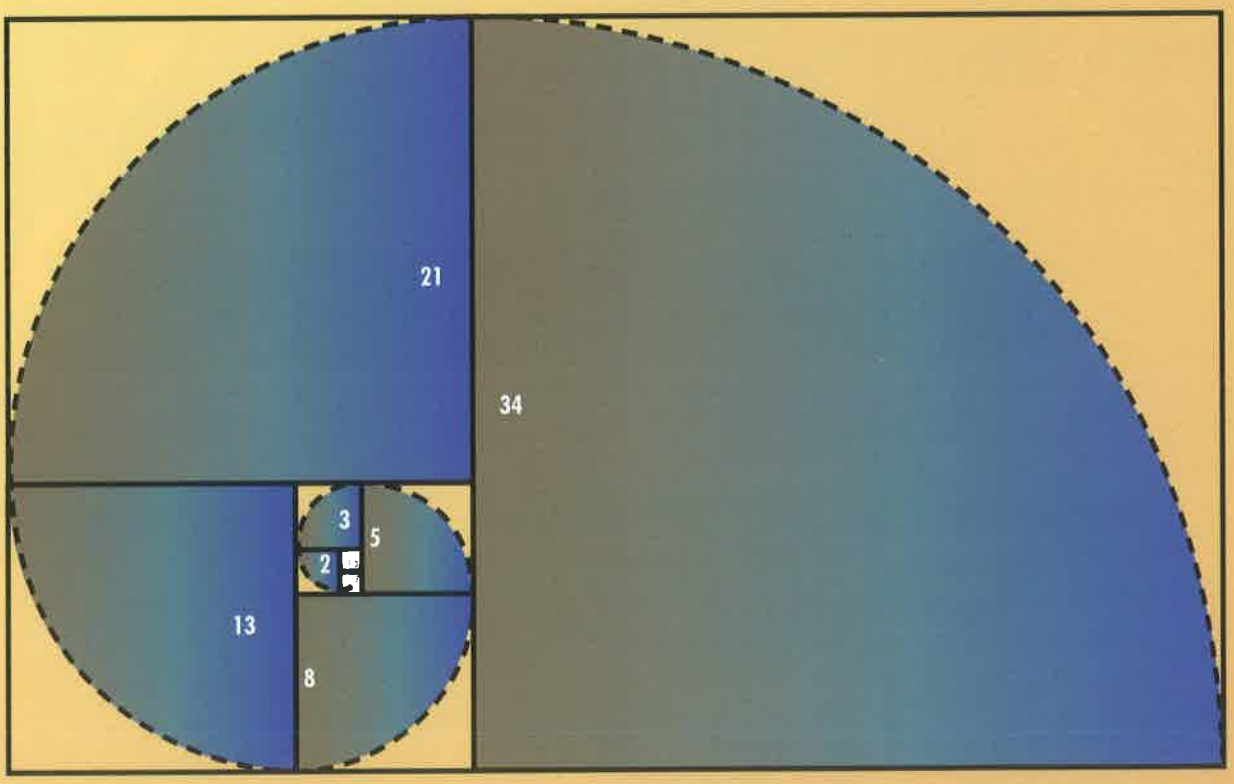
Nature brought us the spiral. Fibonacci's math discovery helped explain it. You don't need math to find spirals in nature. Just take a good look.

See how young ferns unfurl their tender fronds. Follow the pattern between the sections of a pinecone. Watch bathwater spiral down a drain. And, for a spiral that's out of this world, look through a telescope. In the direction of the Big Dipper, you'll see a pinwheel galaxy!

Those are just a few of the places to look for nature's twists and turns. Like the Fibonacci sequence, examples of spirals in nature seem never-ending.

ESA/NASA

Spirals in Space. *Gaze through a telescope to see spiral-shaped galaxies in outer space.*

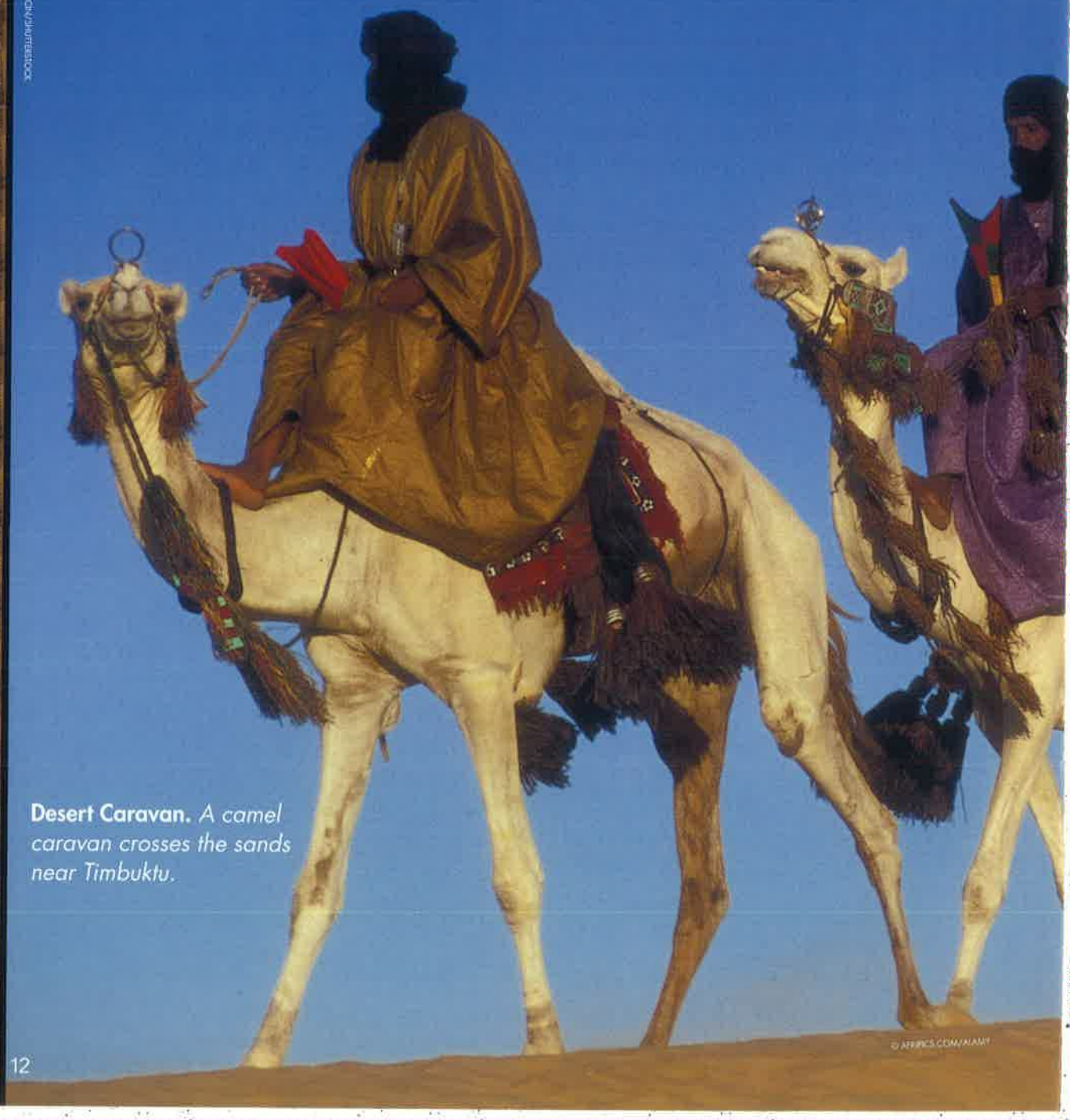


From Squares to Spiral. *The number in each square shows the length of its sides. Connecting the corners of the squares, from smallest to largest, creates a spiral.*

SOCIAL STUDIES

Reading Strategy: As you read this story, ask yourself questions to make sure you understand what you are reading. Then look for the answers to your questions.

Tim



ERIKZ MAGNUSSON/SHUTTERSTOCK

Desert Caravan. *A camel caravan crosses the sands near Timbuktu.*

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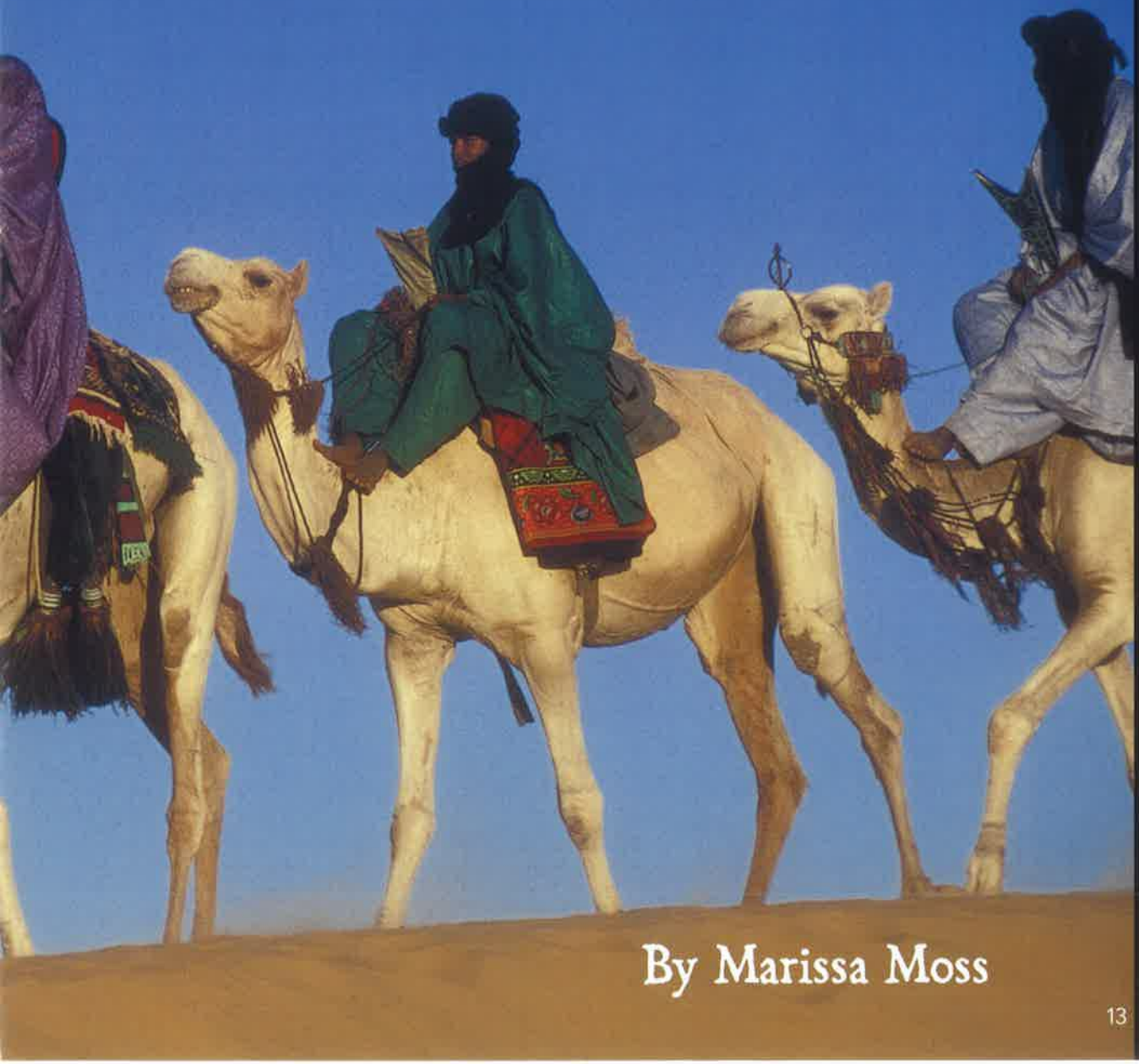
Tales From Timbuktu

Timbuktu is in a race against time. Long ago, it built its fortune on gold and salt. Today, the city is trying to rescue an even greater treasure from its past.



By Marissa Moss

Some say Timbuktu is the end of the world. It is not. It lies in the heart of the country of Mali, a place in Africa with a long history, rich with tales. The vast sands of the Sahara spread to its north. The nourishing waters of the Niger River flow to the south.

Once upon a time, Timbuktu was Mali's most golden city. Step into Timbuktu's marketplace today and feel the hot sun. The sand under your feet is gritty. Look around at the low, clay-colored buildings. Some have spires jutting into the sun-bleached sky.

Women in brightly colored skirts walk by. You pass baskets filled with white rice and millet. You see red tomatoes and tan peanuts, rubber sandals and plastic buckets. A fire burns orange in a clay oven, where a woman bakes fresh bread.

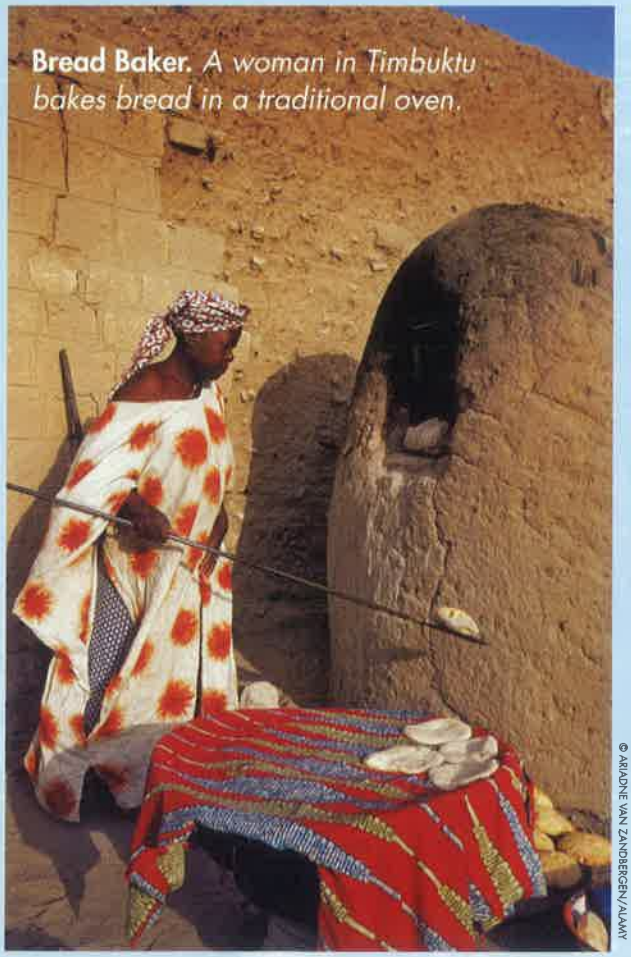
Bringing the Past to Life

In one part of the market, a very old man prepares to tell a story. You sit in front of him. He squats and pours you a cup of tea. He is a *griot,* or a traditional storyteller.

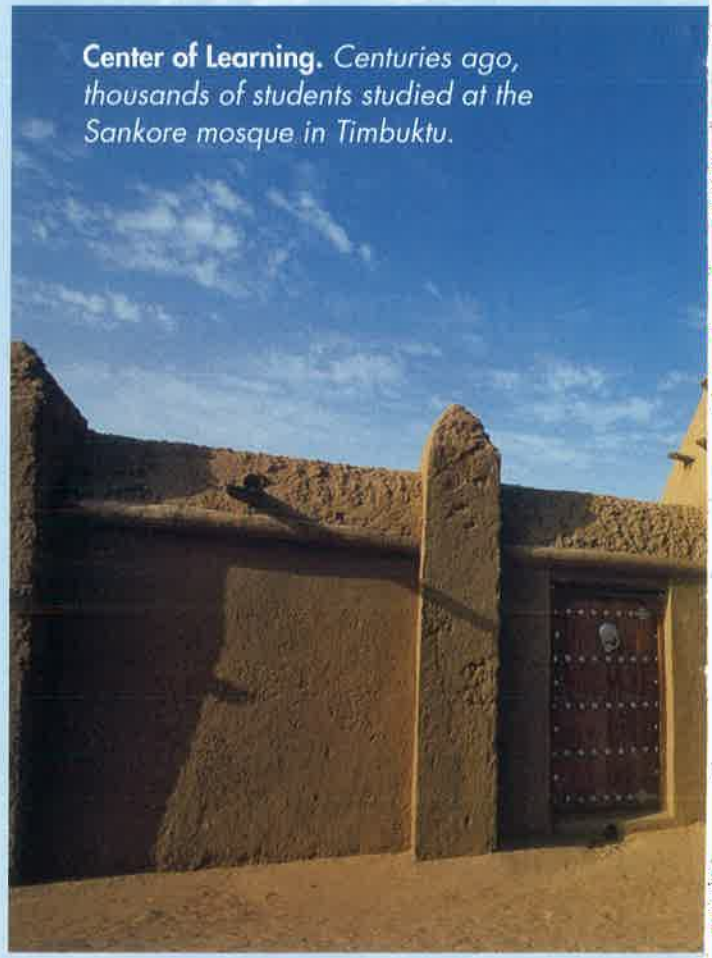
If you lived in Mali, this is one way you would learn about your country. Griots chant about kings and magicians. They sing about wars and journeys from the past. History has been shared this same way for generations.

This griot has told the story of Timbuktu's famous past a thousand times. Listen as he takes you back 700 years ago, to the 14th century. He begins the way he always does....

"Long, long ago, when Mali was a powerful kingdom, there was a great king named Mansa Musa. He made Timbuktu into the City of Gold. Walk around Timbuktu today, and you can still see the enormous **mosque** that the king built. The gold from the past is gone. Yet another treasure remains."



Bread Baker. *A woman in Timbuktu bakes bread in a traditional oven.*



Center of Learning. *Centuries ago, thousands of students studied at the Sankore mosque in Timbuktu.*

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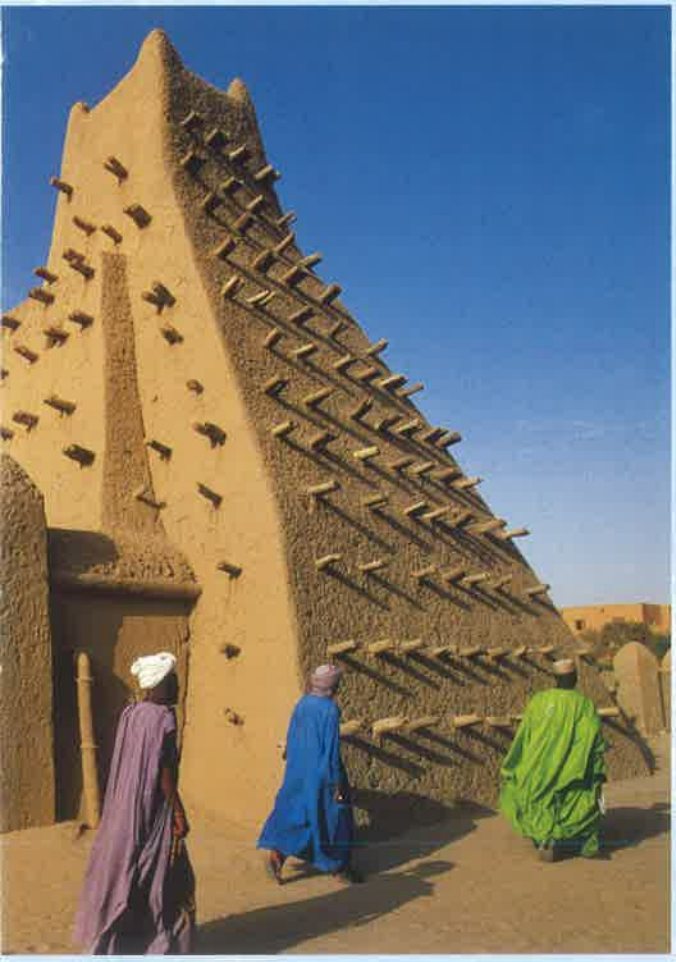
Golden King. *A map of Africa made in Spain in the 1300s shows Mansa Musa.*



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Gold and Salt

Gold and salt helped make Timbuktu rich. Miners dug gold out of mines in the southern part of the Mali Empire. Workers collected salt in the northern desert. They dug 23-kilogram (50-pound) blocks of salt up from under the sand.

It's easy to understand why gold was so valuable. But salt? Here's why: People wanted salt because it made food taste better. They also used salt to preserve food, making it last a long time without rotting. Back then, salt was hard to find in other parts of the world. People in Mali even used salt as money. It once was worth as much as gold!

Traders took gold and salt and other goods from Mali to sell in other places. They brought back spices, silk, and more.

Timbuktu, where the desert met the river, was in the perfect place to become Mali's biggest trading center. It was the crossroads for traders traveling trade routes north to Europe and Egypt or south to the Atlantic Ocean.

Traders rowed up and down the Niger River. They crossed the desert in caravans of camels. From all the goods they sold, the king collected taxes, or money. So the kingdom became very rich.

© ARIANNE VAN ZANDBERGEN/AFRICS.COM

Traveling to Timbuktu. *This artwork shows explorers going to Timbuktu in the 1800s.*

Golden Journey

The griot continues the story. "Mansa Musa was a wise and religious man. He made a **pilgrimage** to Mecca, a holy city. He traveled with thousands of followers and a treasure-load of gold. He went with his first wife and 500 of her servants.

"A line of 100 camels stretched as far as the eye could see. Each camel carried 140 kilograms of gold. Five hundred slaves, each carrying a heavy staff of gold, followed the camels. Thousands of ordinary people walked behind the slaves. It looked like an entire city winding through the desert."

A New Treasure

"The journey took Mansa Musa a year. Everywhere he went, the king gave away his gold. When he reached Mecca, the gold was gone. That didn't matter to Mansa Musa. Now his name was golden. When people heard about Timbuktu, they didn't think of mud huts. They imagined a city shining like gold.

"Mansa Musa gave away his gold. But he brought back a different treasure: knowledge. The camels carried books about medicine, math, law, and more. Scholars returned with the king. So did an architect, or building designer. They helped turn Timbuktu into a city of mosques, libraries, and schools. It had been a center of trade. Now it was a center of learning, **culture,** and religion, too. Timbuktu truly was a golden city," the griot says.

Recovering the Past

It has been hundreds of years since Mansa Musa ruled. Mali fell on hard times. Trade routes moved from the desert to the ocean. Other tribes and countries wanted to run Mali. Some started battles and caused great damage.

In 1960, Mali finally became an independent country. No other country controls it. Today, it's one of the poorest nations. Yet it still has a priceless treasure: books from its golden past.

Many of the ancient books are wrapped in leather. Some are written on paper; others on tree bark or gazelle skin. Many are handwritten in flowing **Arabic** letters. Their pages are filled with ideas about stars and math, history and religion, and more. The books let us understand Timbuktu's brilliant past. Some are about making peace. Those ideas, from centuries ago, may help us today.

But these books are in danger. Over hundreds of years, families have tried to protect them. Yet sand, weather, even termites have damaged the books. Some crumble in private libraries and kitchen cupboards. Some lie buried underground or hidden in caves. Others are in the leather trunks of traveling **nomads.**

Scientists are working hard to save the books. They are carefully preserving them. They are using scanners and special cameras to store the books on computer, creating a digital library. Soon scholars everywhere will be able to log onto the Internet and learn from Timbuktu's great past.

Take-Away Treasure

Before you leave, the griot shares an old Mali saying with you: "To succeed you need three things—the brazier, time, and friends."

The brazier is a stove to heat water for tea. Time is what you need to brew the tea. Friends are what you need to drink it. If you have friends and tea, can good stories be far behind?

Today, the griot told you a famous story from Mali's golden past. Ancient books and modern computers also are helping Mali share its stories with the world. As you sip the last drops of tea, ask yourself: What stories will *you* bring home from Timbuktu?

Wordwise

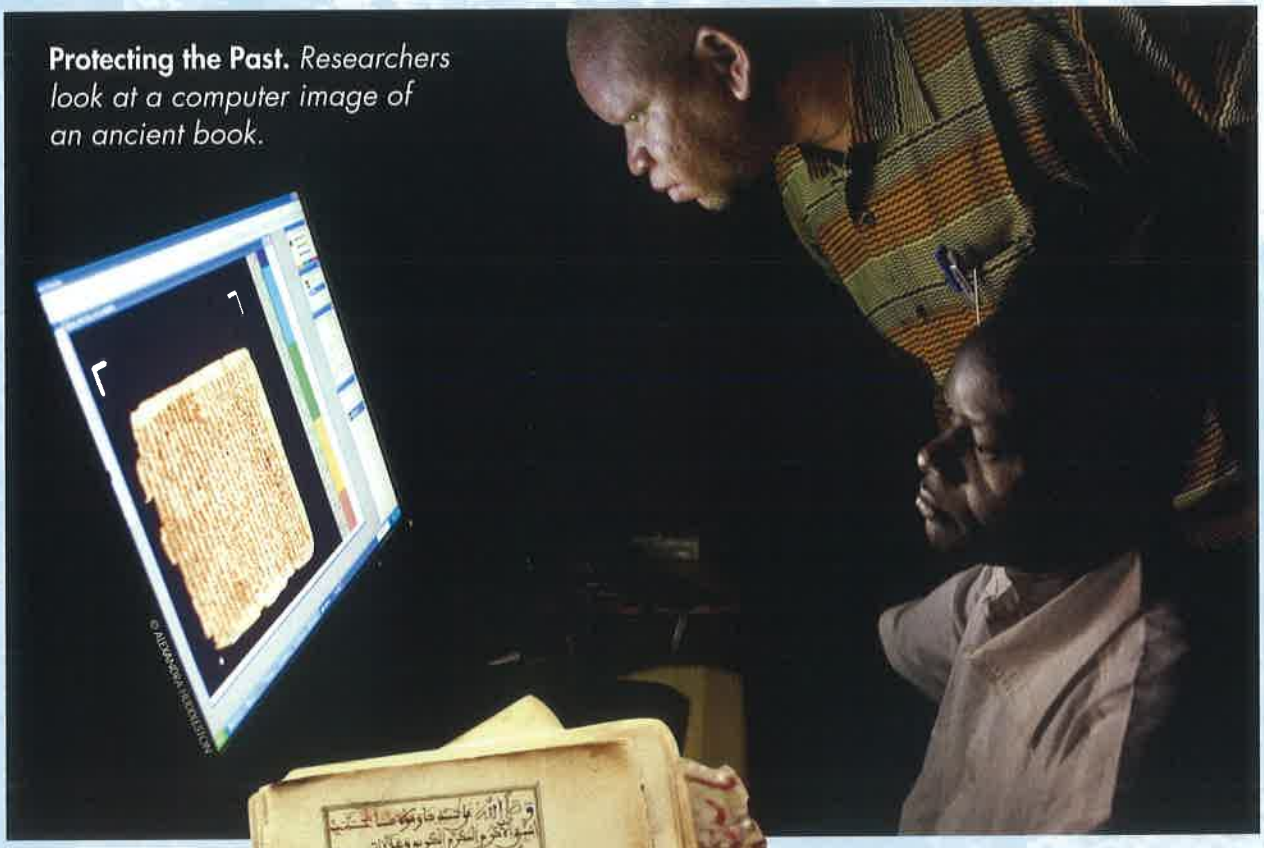
Arabic: language spoken in the Middle East and North Africa

culture: group of people's way of life, ideas, customs, and traditions

mosque: building used by Muslims for worship

nomad: person who does not live in one place all the time

pilgrimage: journey to worship at a sacred place



Protecting the Past. *Researchers look at a computer image of an ancient book.*

© WOLFGANG KAEHLER/ALAMY

Priceless Treasure. *Scientists are racing to save precious books like this.*