

**Genre** Explanatory Text

**Essential Questions**

What impact do we have on the environment? How do we help the environment? How do we hurt it?

# WHY IS THE WORLD GREEN?

*by Susan Martins Miller*

# NATURE'S LABORATORY

Trees, grass and plants all over the world make the earth green. But why are some ecosystems so green? And what do plants need in order to stay green and survive?

When scientists study questions like these, they use a laboratory. In a laboratory scientists can observe and take notes. By observing in a laboratory, scientists can understand more about how and why events occur. Most laboratories are indoors, where scientists can control the environment. However, sometimes scientists cannot find answers to their questions inside a laboratory. Instead, they have to go outside. In one study, scientists researched an entire lake in Venezuela, a South American country. They traveled to Lake Guri to answer the question, “Why is the world green?”



Why did scientists want to use a lake as a laboratory? That part of Venezuela was once covered with flora and was full of life. Now the plant life is dying, and many places are barren and brown. Scientists wanted to find out why these places turned from green to brown. If they could understand what caused the plants to die, then they would also learn what the plants needed to survive.

Knowing what plants need to live will answer their question, “Why is the world green?”

# MAKING A LAKE

At one time, the Caroní River wound its way through a beautiful green forest. Lake Guri did not even exist. Not many people lived in this area, and Venezuela needed power so leaders thought the nation should use the river to make electricity. They decided to build a dam and named it the Guri Dam. The dam obstructed the flow of the river and created a huge lake, which they named Lake Guri. Lake Guri is a massive body of water that is almost as big as the state of Connecticut!

After the dam was built, the river water rose. The valleys flooded and became the lake's bottom. Only the hilltops stayed above the water, and they became small islands. Hundreds of islands were scattered all over Lake Guri.

The habitats of many living things were now underwater. Before the dam was built, animals could ramble freely over the land to hunt for food, but when the water began to rise, some animals ran or flew away while other animals drowned. Many animals starved when they were cut off from their natural food supply. The animals that did survive the flood could not get from one island to another.

What began as one huge ecosystem now became hundreds of very small ecosystems.





*Scientists wondered if top predators, such as this jaguar, were linked to the dying plants.*

Some scientists were immediately interested in the changes that would take place as a result of the Guri Dam. What would all this flooding do to the ecosystem? Soon, they watched as the plants began to die on many of the islands. They also noticed that many of the top predators, such as pumas and jaguars, were nowhere to be found. Could these changes be connected?

Scientists were baffled by these strange mysteries. Maybe Lake Guri could help answer their questions. They formed a hypothesis. If the top predators disappeared and the plants died, then it might be the top predators that keep the ecosystem healthy. To see if their hypothesis was true, scientists would first need to understand the roles that top predators and plants play in a healthy ecosystem. Then they could discern if these roles had changed at Lake Guri after the flood.

# DO WE NEED THOSE BIG CATS?

Before the dam was built, there was a healthy ecosystem along the Caroní River. Big cats such as jaguars and pumas lived in the hills and the valleys. Harpy eagles flew overhead. Anacondas slithered along the forest floor. These animals were the top predators. As carnivores, they fed on small animals like howler monkeys, iguanas, and leaf-cutter ants. Many of these small animals were herbivores, which meant they ate the green plants all around them. All the parts of the ecosystem were in place. The balance in the food web meant that every living thing had enough to eat.

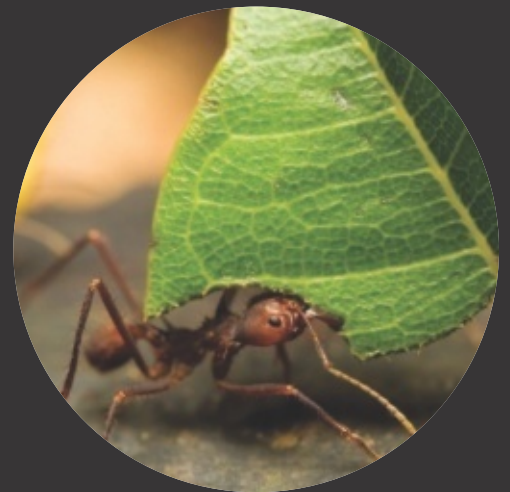
When the floods came, some of the top predators disappeared. Would something happen to the food web now?

An international team of scientists went from island to island. What they found was puzzling. Some of the islands were green and healthy, but others were not. The scientists looked closer and saw that the big islands in Lake Guri were full of healthy, green plants. The small islands, though, were full of dead trees. All plants need sunlight, air, and nutrients to live and grow. They could still get all of these things on the small islands, so why were some plants dying while others were healthy?

The scientists wondered what made the plants on the small islands different from the plants they found on the big islands. They took a closer look at what other things they found on the two different kinds of islands. What the scientists found taught them a lot about why the world is green.

The scientists looked at islands of different sizes. They found that the smaller islands were all in trouble for the same reason: they did not have top predators. There were no jaguars and pumas. The bigger, greener islands were alike in one important way. They did have these top predators. The islands with the top predators were still full of green plants. But the scientists did not know what the animals at the top of the food web had to do with the plants at the very bottom. The scientists kept observing the islands to find an answer.

*The arrows point to the consumers.*





*Howler monkeys use a special cry to protect their territory. Without predators, the monkeys became almost completely silent.*



*Millions of leaf-cutter ants destroyed the landscape by cutting many of the plants.*

## TOO MANY MONKEYS

Then the scientists saw that the top predators and the plants had something in common—herbivores. They knew that when the food chain near the Caroní River was healthy, herbivores ate plants, and predators ate herbivores. Before the dam flooded the Caroní River, howler monkeys, iguanas, and leaf-cutter ants ate the plants that grew around them. These herbivores and omnivores were the prey of top predators. By eating herbivores, the top predators controlled how many herbivores lived in the ecosystem.

Now that the small islands had lost their top predators, the herbivores and omnivores no longer had animals hunting and eating them. As a result, the number of plant consumers grew rapidly. On one island, scientists found 10 times as many iguanas as there used to be. On another island, they found 50 times as many howler monkeys. On yet another island, they found 100 times more leaf-cutter ants! The population of these animals and insects was growing out of control.

The herbivores and omnivores ate the forest faster than it could grow back on these tiny islands. The thick, green blanket of forest began to disappear. Saplings did not have a chance to grow before being eaten. Soon food became scarce, and the only plants left on the smaller islands were either poisonous or too tough to eat.

## DELICATE BALANCE

Leaf-cutter ants contribute to a healthy ecosystem by putting organic material into the soil. By digging, they also help water soak into the ground. Both of these contributions would help new plants grow—if the ants were not also eating new growth.

Just a few years after the flood, many of Lake Guri's islands had almost no plant life. The scientists thought that most of the plant species would soon die off. Without plants, the howler monkeys, leaf-cutter ants, and other herbivores would have nothing to eat. They would also disappear from the island. The flood had disrupted the food chain. The connections among the living things were broken. Surviving became hard. Life was sometimes even impossible in this ruined ecosystem.

The scientists learned that, in a way, plant life is protected by top predators. Since the big cats of Lake Guri hunted and consumed howler monkeys and other herbivores, they controlled how many herbivores lived on the islands. On the islands without predators, the plants died. They just had too many herbivores eating them. The plants on the larger islands lived because the number of herbivores was controlled. Top predators play an important role in keeping an ecosystem in balance. Without them, every other living thing in the food chain is affected, all the way down to the plants.





# PREDATOR PROBLEMS CLOSE TO HOME

Lake Guri in Venezuela is not the only place in the world where losing top predators changed the ecosystem. It happened in North America too.

Yellowstone National Park is in the western part of the United States. Between 1883 and 1917, hunters killed large numbers of wolves. By the 1970s all of the wolves in Yellowstone Park had been killed or had disappeared. The bison, moose, and elk that lived in the park did not have any predators. Soon there were too many of these herbivores.

Years later, scientists noticed the disappearance of aspen trees, and they began looking for reasons why. They decided that changing weather was not the cause. Neither were forest fires. So then scientists studied the trees themselves. They started by counting the growth rings from one hundred aspen trees. Each ring represented one year, and they found that the aspen trees were at least seventy years old. The scientists calculated that the aspens had stopped growing in the park in the 1920s and 1930s.

The scientists assessed the history of Yellowstone. They recalled that the park's wolf population had been greatly reduced around that time. Without the wolves, the herbivores had eaten the aspens and willow trees without fear.

*When wolves could no longer be found in Yellowstone, the ecosystem became unbalanced.*





Meanwhile, the Lamar River inside the park had become wider. The soil on the banks was washing downstream because the plants on the banks had disappeared. Without those trees, many species of birds had nowhere to build their nests. Beavers could not find any plant materials, so they couldn't build dams.

The animals that depended on the plant life began to disappear too. Scientists concluded that the wolf, the top predator, controlled the numbers of elk, bison, and moose. Without this control, the animals had destroyed the plants and trees.

In 1995, scientists brought wolves back to Yellowstone. Once the top predators returned, the aspens and willows started growing back. Birds and beavers slowly returned to the park. The balance of the ecosystem was being restored.

### **COULD THE WORLD BE A COLOR OTHER THAN GREEN?**

The scientists at Lake Guri and Yellowstone National Park think so. They have learned that changing ecosystems can actually change the color of the world.

Both of these ecosystems lost an important link in the food chain—the top predators.

The other living things were affected by this loss. Important plant species disappeared. After careful study and observation, scientists have learned that top predators play a crucial part in keeping the world green.

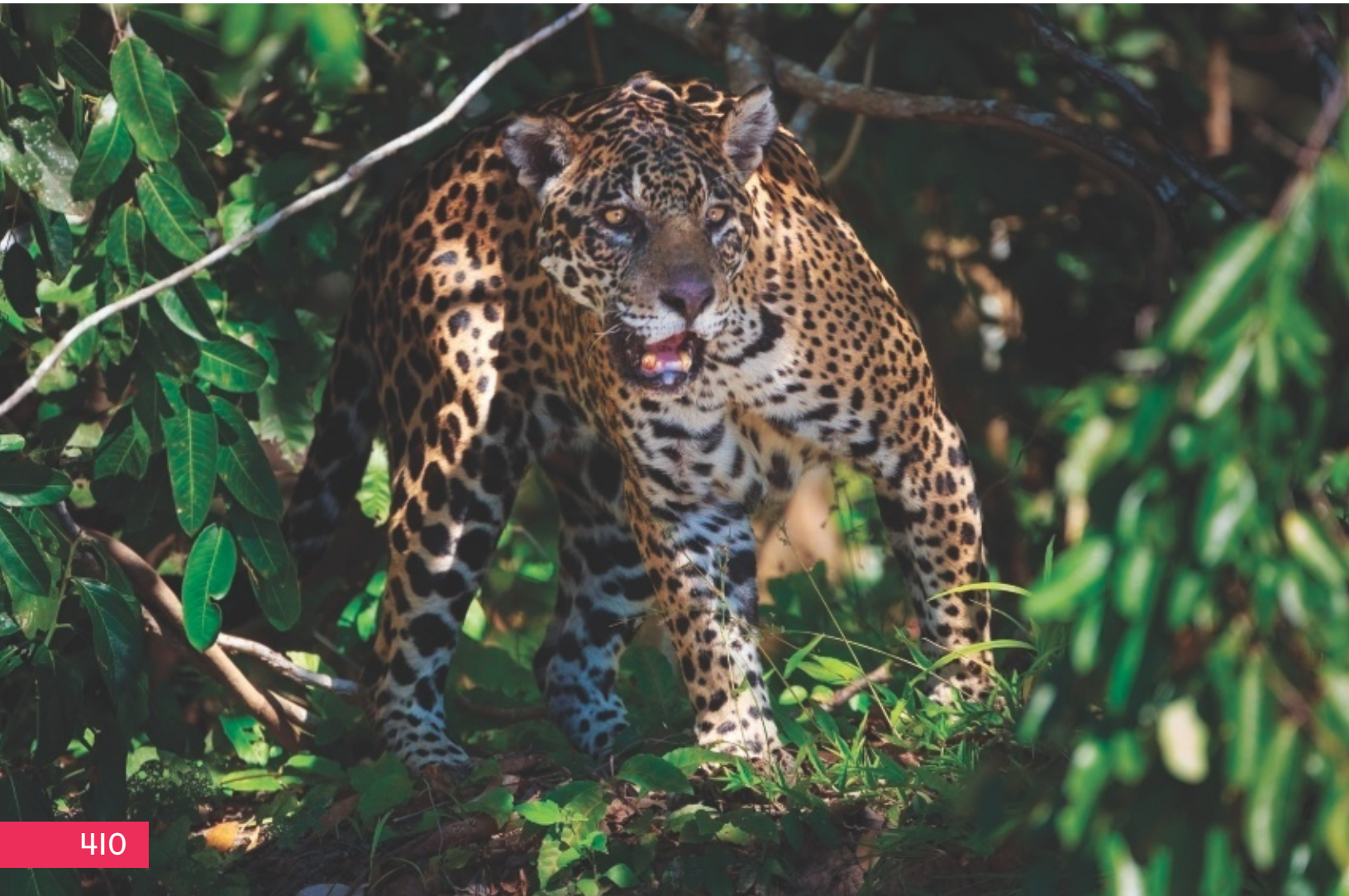
You will answer the comprehension questions on these pages as a class.

### Did You Know?

Dams have advantages and disadvantages. They can provide water for clean electricity, irrigation, and water sports. However, they are also expensive to build and can upset the balance in an ecosystem.

## Text Connections

1. Why did Venezuela build the Guri Dam?
2. When many plants died on the smaller islands the dam created, scientists wanted to figure out why. What was their hypothesis?
3. How are top predators related to plants in an ecosystem?
4. In national forests such as Yellowstone and Yosemite, plants and animals are protected. How do national forests help keep the ecosystem in balance?
5. Think about the food chains in your area. Which animals are at the top? Which animals are at the bottom?



## Write

Write about your place in a food web. What plants or animals do you eat?

## Look Closer

### Keys to Comprehension

1. What happened when the Guri Dam was built? How did the creation of islands affect animals living there? Use specific details from the text to support your answer.
2. Why were plants dying on the smaller islands? How did top predators keep some islands green?

### Writer's Craft

3. How does the author use cause and effect to structure this selection? How does "Midnight Forests" also use cause and effect?

### Concept Development

4. By how much did the numbers of herbivores grow on the smaller islands after the top predators disappeared? Use specific information from the selection to support your answer.
5. How did the reduction of wolves in Yellowstone lead to ecological imbalance? Based on "John Muir," how does this support John Muir's stance on the environment?



Read this Science Connection. You will answer the questions as a class.

### Text Feature

Authors sometimes **boldface** important terms in informational texts.

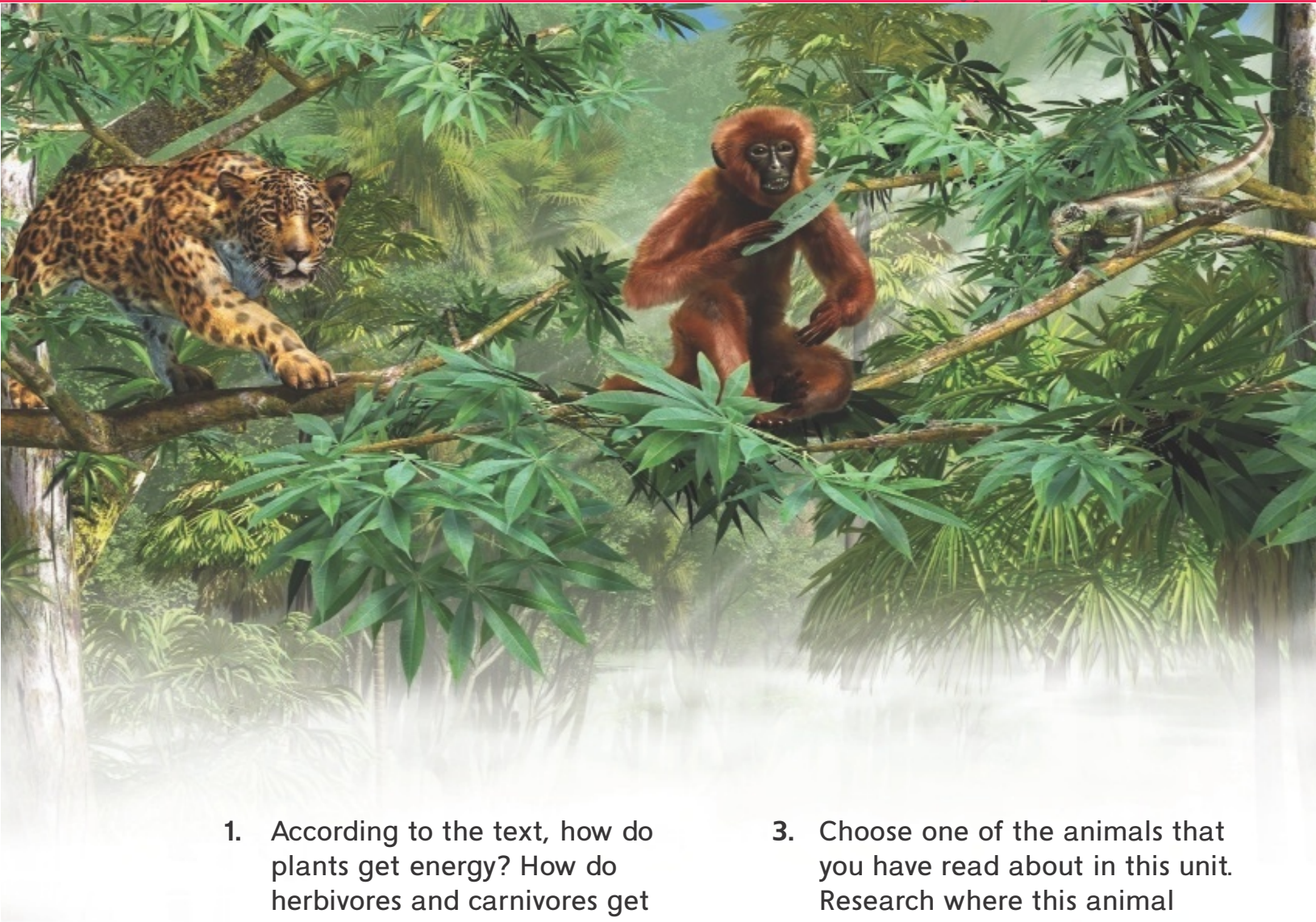
## Untangling the Web

When the ecosystem of Lake Guri was fractured, it had far-reaching effects on the flora and fauna of the region. Many of the islands in the area became barren. After investigating, scientists learned that the loss of top predators disrupted the delicate balance of these ecosystems.

Top predators get their name by being at the top level of the food web. With the exception of other top predators, almost nothing hunts them. Plant life is at the bottom level of the food web. Plants convert sunlight into a form of energy that animals can eat. Plant eaters, or **herbivores**, are a step above plants in the food web. They get energy from the sun secondhand. **Omnivores** eat both plants and animals. **Carnivores** only consume meat and therefore receive sun energy by eating herbivores, omnivores, or other carnivores.

The food web also has recyclers at the very bottom that are called **decomposers**. Some decomposers are visible, like fungi, but others are microscopic bacteria. This “clean-up crew” devours dead animals and plants and returns valuable nutrients to the environment. When top predators die, either from natural causes or through an attack from another top predator, decomposers recycle the energy from their carcasses. Plants use this energy to grow and provide food for herbivores. The transfer of energy continues when top predators prey on herbivores.

If the top of the food web disappears, even the bottom of the web will suffer. When the top predators disappear, decomposers lose a valuable source of nutrients. Without these nutrients in the soil, plants may grow weak and die. Likewise, if the plants die, there will be no food for herbivores, which will starve. If the herbivores starve, there will be no food for the carnivores. The ecosystem is interconnected at every level.



1. According to the text, how do plants get energy? How do herbivores and carnivores get energy from the sun?
2. Carnivores only eat meat. What would happen to carnivores if plant life disappeared from the food web? How would this impact the entire food web?
3. Choose one of the animals that you have read about in this unit. Research where this animal fits into a food web, and then develop a diagram that tracks the movement of energy throughout the web.



## Go Digital

Search for information about food webs in various habitats, such as the desert, ocean, tundra, or taiga.