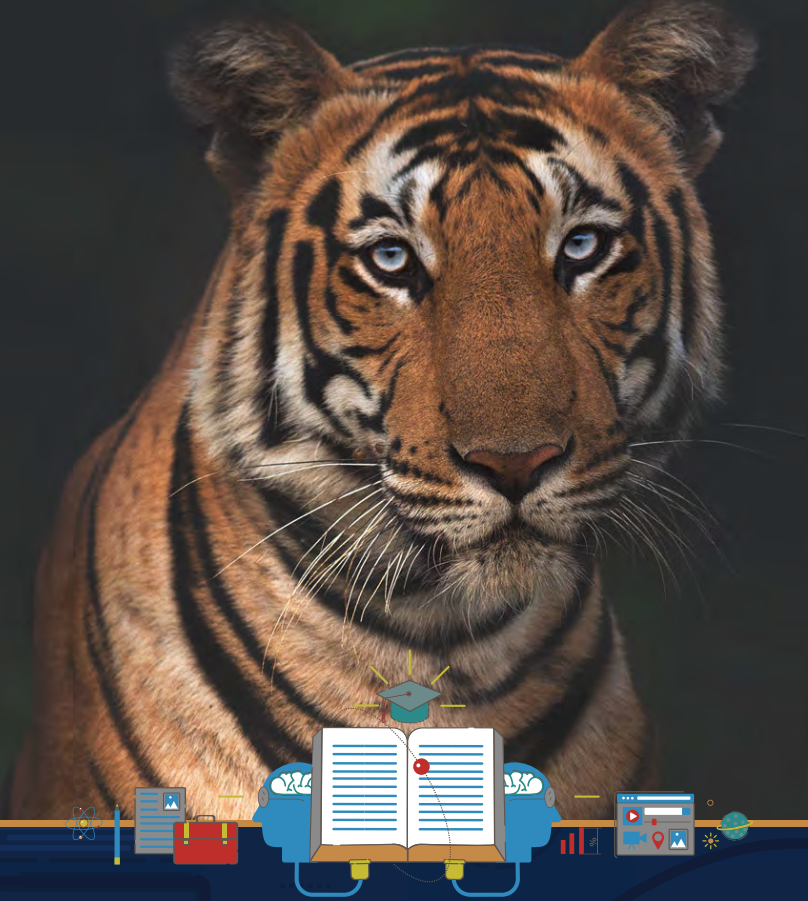


# TIGER QUEEN

A SCIENCE 3D ADVENTURE

GRADE 5



By MIKE HEITHAUS Ph.D

symbioeducation™



# KEY WORDS

Look for these words and see if you can figure out their meaning.

ATMOSPHERE

LUNAR MONTH

BIOSPHERE

NATURAL RESOURCES

COMMENSALISM

NOCTURNAL

COMPETITION

PARASITISM

CONSERVATION BIOLOGIST

POACHER

DEPOSITION

PRECIPITATION

ERODE

PREDATOR

EVAPORATION

SENSOR

GENETIC VARIATION

SOLITARY

GEOSPHERE

SYSTEM

HERBIVORE

TERRITORIAL

HYDROSPHERE

TRANSPIRATION

HOME RANGE

WATER CYCLE



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# CATS!

There are 24 species of cats found around the world. They range in size from the tiny rusty-spotted cat at around one kilogram (two pounds) to the massive tiger. The biggest tigers, found in Siberia, can grow to 300 kilograms (660 pounds)! Cats are found in just about every type of land habitat on the planet, except the tundra. Rainforests, deciduous forests, grasslands, and even deserts are all home to cats.

## Rusty-spotted cat



## Siberian tiger



## African lions

Most cats are secretive and solitary, but some are more social. For example, lions often live in prides in which several females work together to raise their young.

Most cats are relatively small, but a few are big. Big cats are the top predators in their ecosystems. Leopards, mountain lions, jaguars, lions and tigers are some of the most impressive predators on the planet. They are big. They are smart. They have sharp claws and teeth. They have excellent eyesight and hearing. They are stealthy. Even a huge tiger can sneak up on its prey to launch a surprise attack! As amazing as cats are, they are still in trouble. We are going to join a team in India working to study and save tigers. But first, we need to learn more about these incredible cats and meet a very special tigress named Kismet.



# KISMET

Deep in an untamed forest of India lives a queen. The Tiger Queen. Her name is Kismet. She is five years old. She lives in the Nilgiri Biosphere Reserve in southern India. Like all tigers, Kismet is **solitary**. She lives alone, except when she is mating or raising her young cubs. Kismet is also **territorial**. She lives in her own part of the forest away from other tigers. Kismet's mother, named Ghost, has her own territory, or **home range**, nearby. Male tigers usually defend a territory from intruders, like other males. Kismet's father, Euco, was the king of the reserve. He had a very large territory.



# TIGER LIFE

A close-up photograph of a tiger climbing a tree trunk. The tiger's body is covered in orange fur with black stripes. Its head is tilted upwards, and its paws are gripping the rough, textured bark of the tree. The background is a soft-focus green, suggesting a forest environment.

**Scientific name:** *Panthera tigris*

**Diet:** other animals

**Weight:** 240 to 660 pounds (110 to 300 kilograms)

**Size:** 6 to 9 feet (1.8 to 2.7 meters) including tail

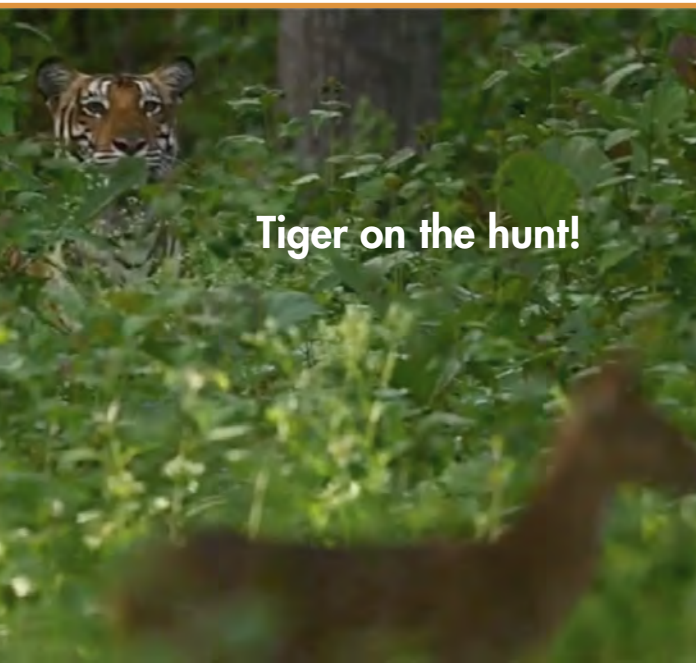
**Average lifespan:** 8 to 10 years

4

Tigers mark their territories by scratching trees or spraying their scent. This lets other tigers know where they have been.



Like all cats, tigers are **predators**. They eat other animals. Kismet and other tigers usually hunt medium-sized prey like deer and wild boar.



**Tiger on the hunt!**



**Spotted deer**



**Wild boar**

Sometimes tigers hunt larger prey. The Indian bison, called a gaur, also lives in Kismet's forest home. A gaur would be a huge meal for a tiger, but they can be dangerous. They have huge bodies and large horns that can injure or kill a tiger. Kismet was just a young tiger when her father, Euco, died trying to hunt a gaur.



**Gaur**

Gaurs are large mammals related to bison and cows. Tigers sometimes hunt them, but they can be dangerous.

## GROWING UP TIGER

Female tigers usually give birth to two or three cubs at a time. They find a sheltered place to give birth and nurse the cubs. Tiger cubs are born helpless. Their eyes open after about a week. For their first eight weeks they drink only their mother's milk. Young tigers follow their mother as she walks through her territory. As they grow, tiger cubs play with their siblings to develop skills they need to survive. Tigers usually stay with their mother for about two years. Once they are independent, they move on and establish their own home range.





Kismet grew up to be a very strong tiger. She learned how to successfully hunt and took over the territory of other tigers. She eventually became the most powerful tiger in the region. People who live near the forest gave her the nickname "Tiger Queen."

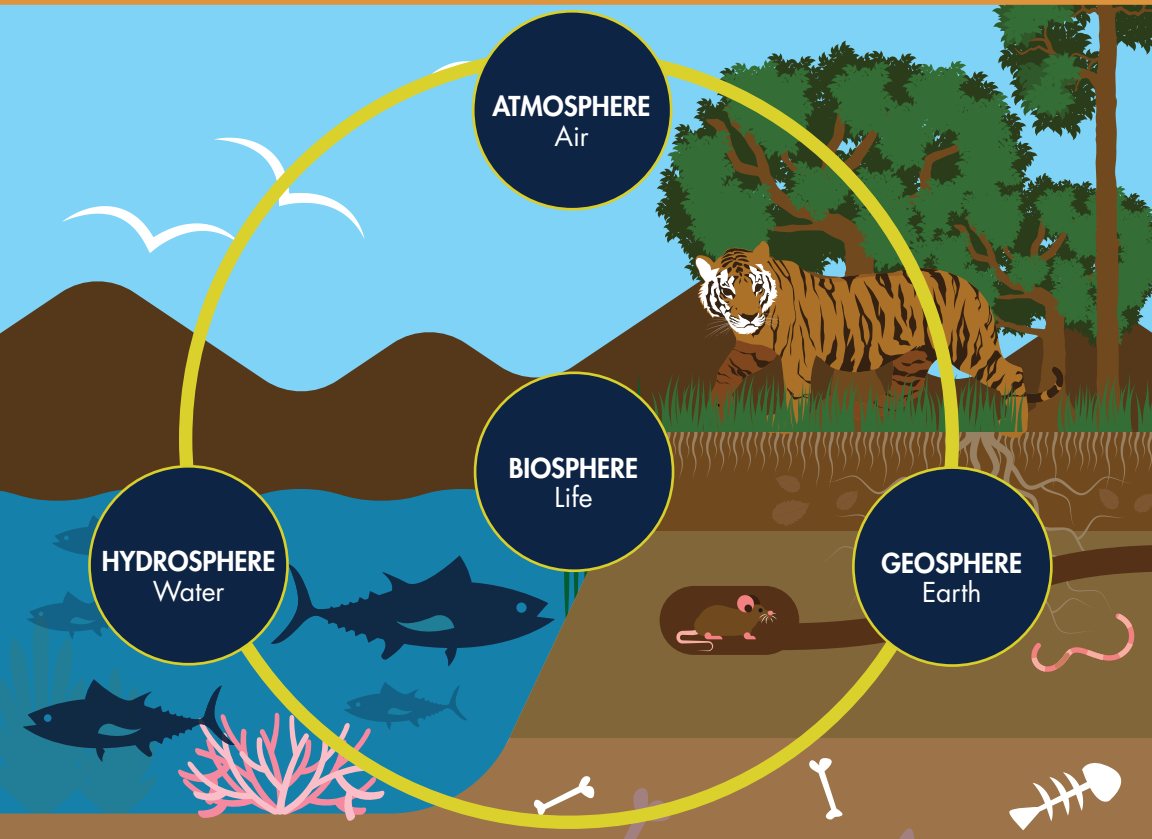
The first time Kismet became a mother, she gave birth to five cubs. She was a good mother. She allowed her cubs to stay with her much longer than most female tigers do. They grew and learned until they were strong enough to venture out to find their own territories. Kismet is still queen of her territory and is thriving in a world of constant change. But she and other tigers are not safe from some of the changes coming to their world. We are going on an investigation into Kismet's world to study tigers in South India. But first, we need to learn more about them and their ecosystems.





# FOUR SPHERES

Kismet's forest home is shaped by the four major **systems** on Earth. It is also shaped by how matter cycles through and among these systems.



## THE FOUR SPHERES OF EARTH

**Atmosphere** – air surrounding the Earth

**Hydrosphere** – all of the water on the planet including liquid water and ice on the surface, water vapor in the air as vapor, and water running underground

**Geosphere** – the materials from the core of the Earth to the solid material at the surface of the Earth

**Biosphere** – all of the life on Earth

**Matter** is anything that has mass and takes up space. It can be a solid, liquid, or gas. Matter changes form, but it is never destroyed! It keeps cycling from one sphere to another! Here is how matter cycles in Kismet's world.

Matter in air moves from the atmosphere into the biosphere (plants and animals).



Matter moves from the biosphere into the atmosphere when it is released from plants and animals through respiration.

Matter moves from the hydrosphere and geosphere into the biosphere (plants and animals).



Matter moves from one part of the biosphere to another when **herbivores** eat producers.



Matter moves from one part of the biosphere to another when predators eat prey.

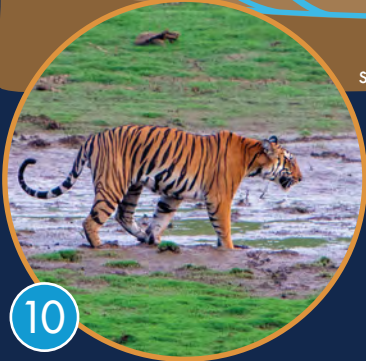
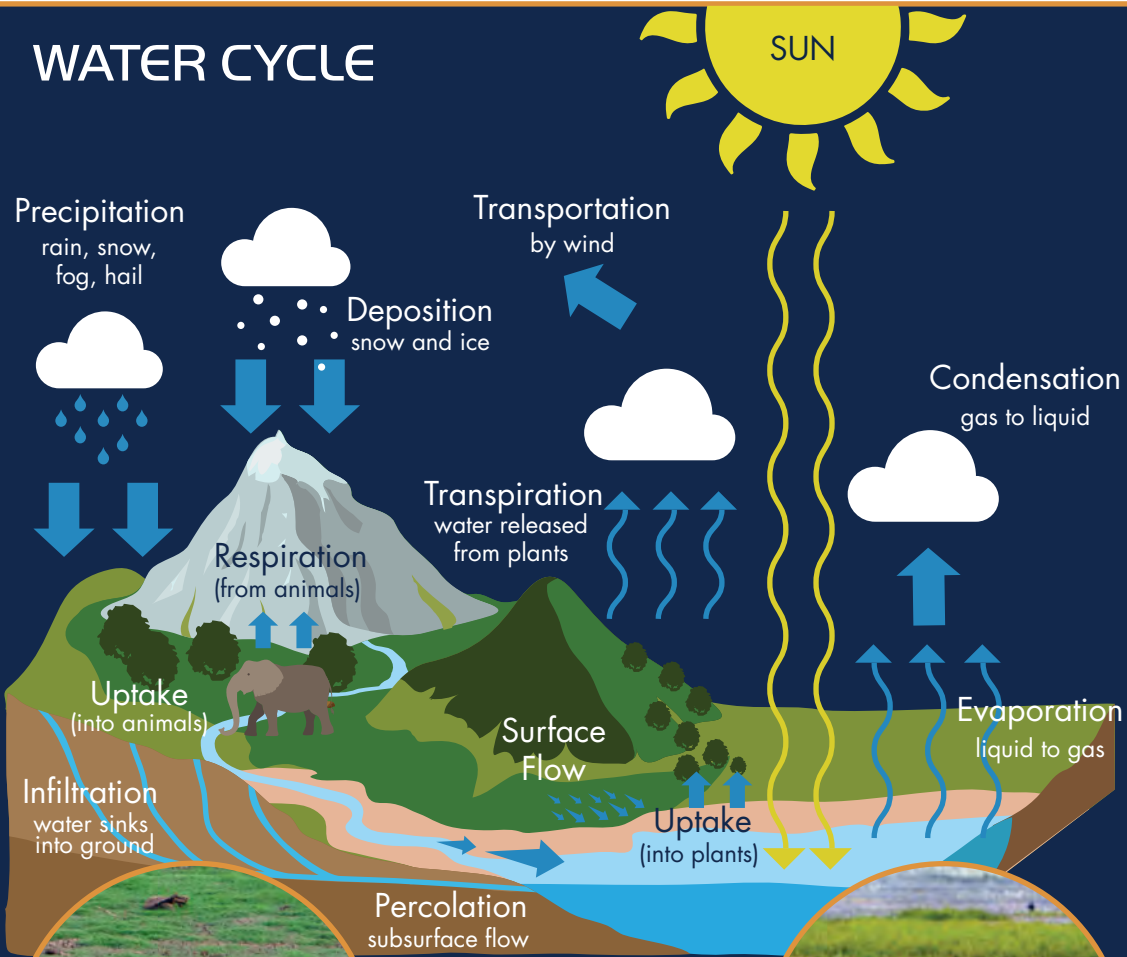


Matter moves from the biosphere into the geosphere when organisms die and decay and when they excrete waste.

# WATER, WATER, EVERYWHERE

Water is important to India's forests and every other ecosystem on Earth. The **water cycle** describes how water moves among the four spheres. It has been running for billions of years. The water that comes out of your sink was on the planet long before the dinosaurs existed! But it has moved huge distances and changed forms many times.

## WATER CYCLE



Kismet's home in the Nilgiri Biosphere Reserve is shaped by the water cycle. The seasonal rains allow plants to grow and rivers to run. As the water runs over the land and through rivers and streams it **erodes** dirt, carving a pathway through the landscape. Where the water slows, **deposition** of the sediment in the water can create islands or new land. Some of the water that plants take up from the geosphere through their roots is lost to the atmosphere through their leaves. This process is called **transpiration**. Water also moves from lakes, rivers, and oceans into the atmosphere when the sun warms the water through the process of **evaporation**. The water vapor can travel through the atmosphere and eventually condense into clouds and fall back to the ground as **precipitation**. In Kismet's forest, precipitation only comes in large amounts during part of the year. The seasonal changes in rainfall have dramatic effects on the tigers and other organisms that live there!



**What causes seasonal changes?  
It's about the sun and the Earth.**

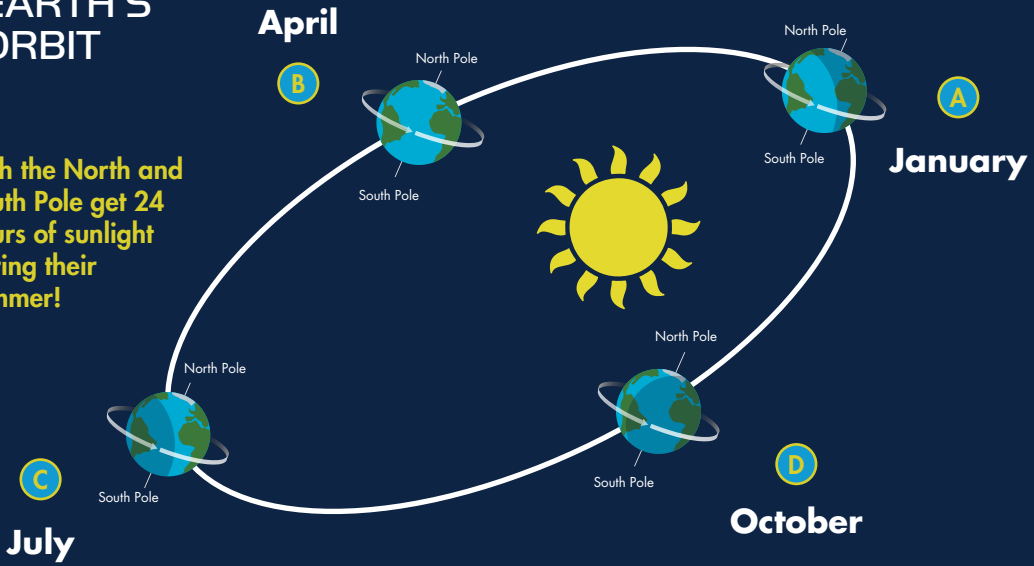


# THE SUN, STARS, AND SEASONS

Seasons are caused by a combination of Earth's orbit around the sun and the way Earth is tilted in space. Here's how it works:

## EARTH'S ORBIT

Both the North and South Pole get 24 hours of sunlight during their summer!



Winter



Spring



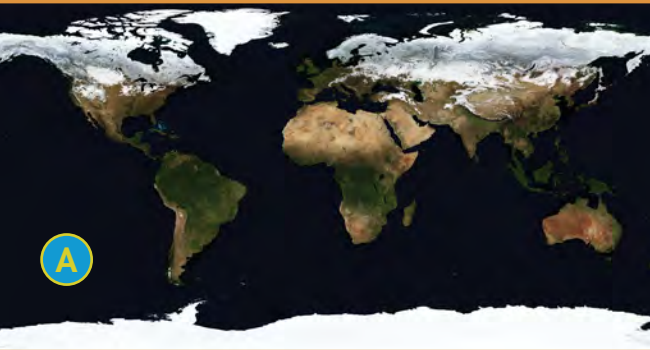
Summer



Autumn



The cycles of Earth's seasons can be seen from outer space. Do you notice the patterns for snow and ice on these satellite images? When and where are plants green and growing? When and where are plants drying out?



It's winter in the Northern Hemisphere and summer in the Southern Hemisphere.



It's spring in the Northern Hemisphere and autumn in the Southern Hemisphere.



It's summer in the Northern Hemisphere and winter in the Southern Hemisphere.



It's autumn in the Northern Hemisphere and spring in the Southern Hemisphere.

In the Nilgiri Biosphere Reserve, the seasons are critical to Kismet. In her part of India, the tilt of the Earth and the Earth's orbit around the sun bring changes in winds and rainfall. There are two main seasons: the dry season and the wet season. In the wet season, heavy rains fill the lakes and rivers, making it easy for animals to find water to drink. This rain allows plants to grow and turns the forest green with new leaves. With abundant water and energy from the sun, plants produce fruits. The fruit and new leaves are a great source of food for many animals. These animals reproduce during this time of plenty. That means there is also enough food for predators, like Kismet, to eat. The dense plant life also gives Kismet and other tigers the cover they need to sneak up on unsuspecting prey.



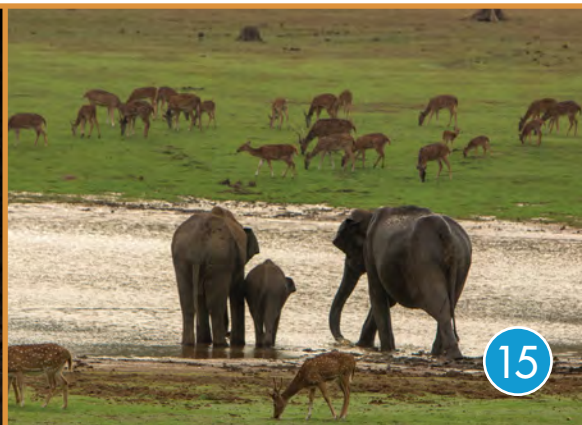
Unlike many cats, tigers love the water (above)! Tigers have even been known to swim for several kilometers to get across lakes. Dense foliage brought on by seasonal rains provides cover to tigers while they hunt (below).



In the dry season, life for the plants and animals becomes challenging. Hot temperatures and little water dries out plants, and most trees drop their leaves. The rivers and lakes begin to dry out too. Prey becomes harder to catch for tigers. Even though their orange fur and stripes provide **camouflage** against the dry vegetation, prey can see them coming. When it is difficult for tigers to catch small prey, they can look for bigger prey to make sure they get enough to eat. The biggest prey in the Nilgiri Biosphere Reserve is an elephant.



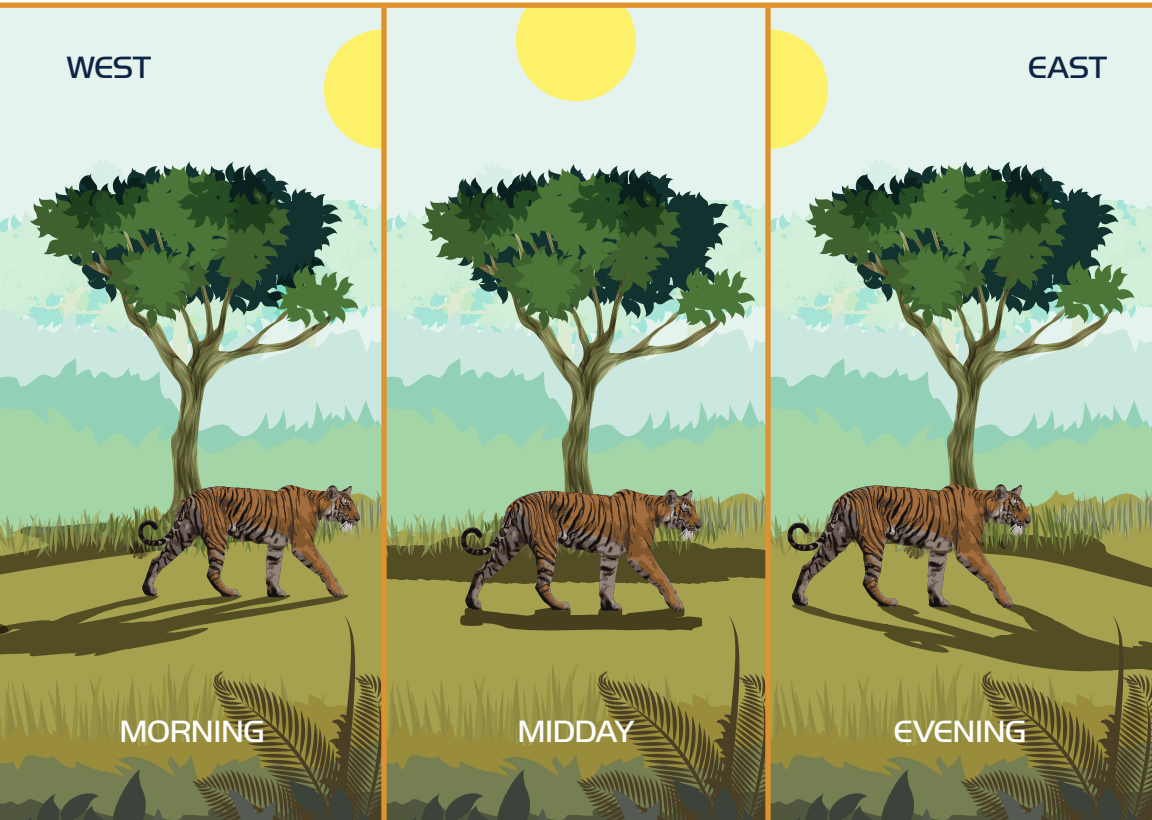
With fewer places to get a drink, elephants spend time near the drying lakes. Kismet knows where the elephants will be. Attacking an elephant is something that most tigers won't even consider. But Kismet figured out how to hunt young elephants. It is dangerous. The adult elephants vigorously protect their young and can trample a tiger or use their tusks to maul them. But for Kismet, the reward of a huge elephant meal is worth the risk!





# TIGER MOON... AND SUN

Another way to be successful when it is harder to sneak up on prey during the day is to use shadow and light. Tigers can stay in the shadows or hunt at night. In fact, many tigers like to hunt at night or at dawn and dusk. Although Kismet hunts during the day, she is also a skilled **nocturnal** hunter. Imagine Kismet, stalking through the forest at night. Cats have much better night vision than humans, so the moon provides more than enough light for her to see her prey. But not every night has a full moon. Not every night is even the same length! Throughout the day, shadows change locations. The orbit of the moon and the tilt and spin of the Earth affect the light and shadows that Kismet uses to hunt!



Look at how shadows change direction through the day. This is caused by the rotation of the Earth. In the morning, shadows fall towards the west. When the midday sun is overhead, shadows fall directly beneath objects. In the evening, shadows fall towards the east.

The transition from day to night is determined by the rotation of the Earth. The Earth spins in an eastward direction. As India turns to face the sun, the sun rises in the east. This causes shadows of trees and other objects to extend west early in the day. The shadows are long, providing Kismet with places to hide. As the Earth continues to spin, the shadows shift as the sun rises overhead. In the middle of the day, shadows are short because they are directly below objects. As the day begins to end, the shadows switch to the east side of objects and grow longer until the sun sets in the west. Then the forest and all of India spin away from the sun and into the shadow of the rest of the Earth, and it becomes night.

No matter the location, every day is not the same length. Why? Because of the tilt of the Earth and its orbit around the sun. During seasons when the Northern Hemisphere is tilted towards the sun, days are longer the farther north you are because these latitudes are in the sun longer. In the Southern Hemisphere, it is winter. Not only is it cooler, but days are shorter, and nights are longer because there is more time spent pointed away from the sun. As the Earth orbits the sun, the length of the day and night changes a little bit every day.

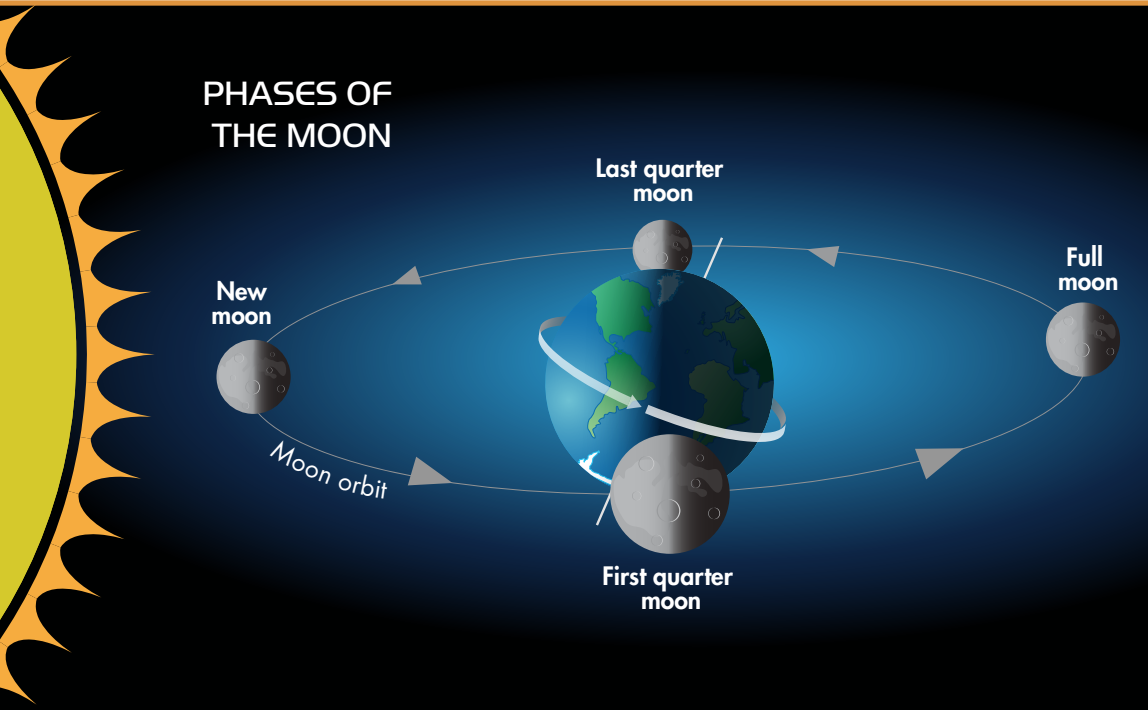
When it is nighttime, Kismet and other animals respond to the light of the moon. Every night does not have the same amount of moon visible in the sky. The moon may appear full, partial, or it may be completely dark (a phase called the new moon).



The moon appears to change its shape each night. These different shapes are called phases. The moon does not produce its own light. It reflects the light of the sun. The phase of the moon is determined by the positions of the sun, Earth, and moon.



The moon has its own month, which is how long it takes it to orbit the Earth. This **lunar month** lasts 29.5 days. That is how long it takes from one full moon to the next. Here is how it works:



The movement of the Earth affects what stars can be seen in the night sky. As the Earth moves around the sun, different parts of the universe become visible. It's like moving to different sides of your school. You will have a different view depending on what side you are on.

Every night, the stars look like they move across the sky. That is caused by the spin of the Earth on its axis. Can you make a model of this motion using balls?

# RELATIONSHIPS

There are many relationships within the Nilgiri Biosphere Reserve. Some occur within species. For example, Kismet protects her cubs to help them survive. Groups of langur monkeys help each other find enough food and stay safe from predators like tigers.

Some relationships occur between species. In India, the langur monkeys and the spotted deer work together to stay safe from predators. This relationship is called a **mutualism**. Both animals benefit. The monkeys have good eyesight. If they see a tiger from high up in the trees, they make a warning call. This call alerts all of the nearby monkeys and deer that a tiger is nearby. Spotted deer have a great sense of smell. If they smell a tiger that may be hiding in the bushes, they make a warning call that can be heard by other nearby deer and monkeys. The warning call system between the deer and the monkeys is a mutualism that helps both species survive.



Langur monkey



Spotted deer



Many species rely on the trees of the forest for shelter. The animals seeking shelter benefit from the trees but don't affect the trees. This relationship is called **commensalism**. One species benefits and the other is not affected.

Some of the most obvious relationships involve feeding, like herbivory. Herbivores, like gaur, elephants, and deer, feed on plants. These animals benefit from getting food, but do harm to the plants.



Asian  
elephant

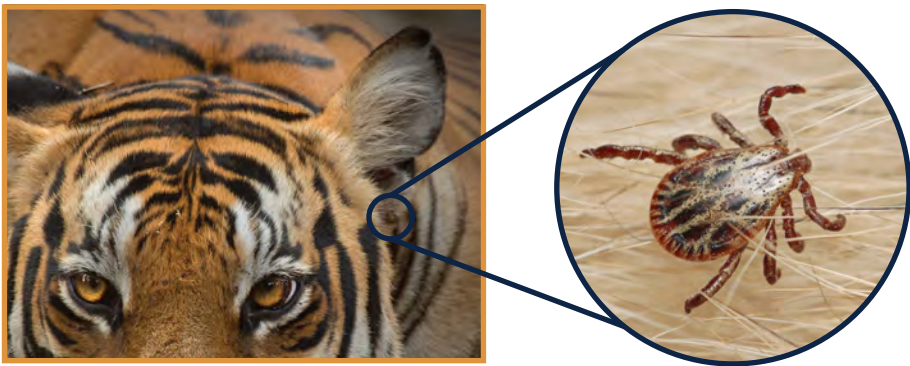


Gaur

In predation, predators eat prey. Predators benefit from this food, but the prey die. Sometimes prey can fight back. Indian porcupines can use their sharp quills to injure a daring tiger that gets too close.



**Parasitism** is a relationship in which one animal benefits and the other suffers but usually doesn't die. Ticks are small parasites that feed off the blood of their hosts, like tigers. When the tick feeds, the tiger loses some blood, but the tick doesn't kill the tiger.



In some interactions, both participants lose. Even a winner may have less food than it would have had without **competition**. Or, it may have to use energy to get the resources it wants. Plants compete for light, space, water and nutrients. Animals compete for many different resources. Kismet has to compete with other tigers for territory. She may have to compete for food with other predators like bears and leopards. Male tigers compete with other male tigers for mates.

# SAVING TIGERS

Populations of tigers are declining around the world. Several types of tigers have already disappeared forever. Right now there are more tigers in captivity in the United States than there are tigers living in the wild. People around the world are trying to save tigers. Different communities have different ways of trying to protect them. Governments have tried to protect areas that can allow wild tigers to survive. But in many places this has not been enough.

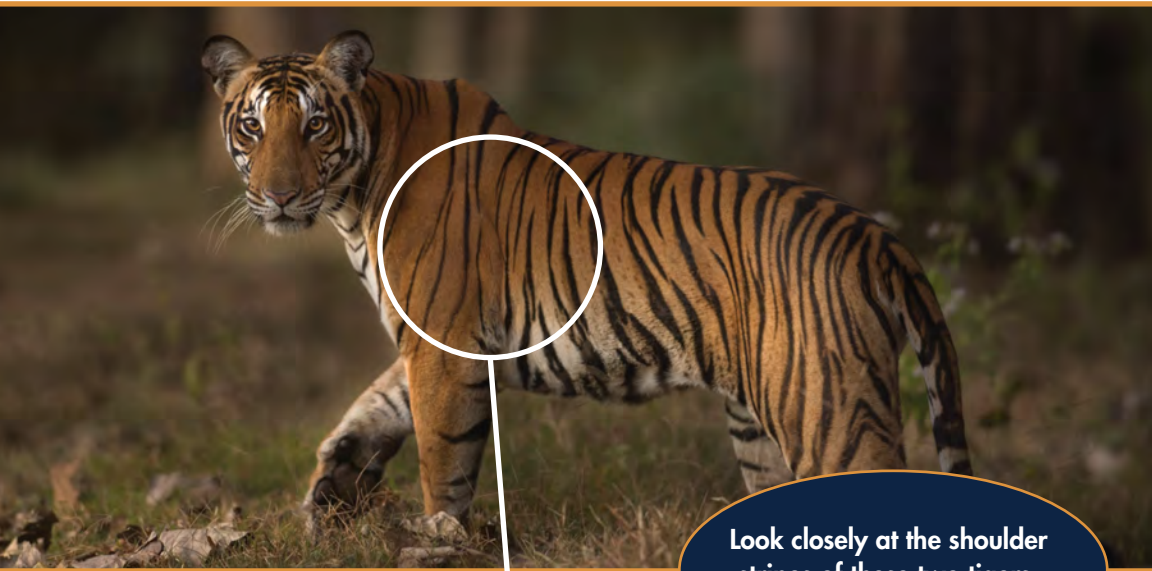
Tigers are big. In order to find enough prey to eat they need big areas to roam. Much of their natural habitat has been destroyed, so they are no longer found in places they used to live. Their forests have been cleared for towns, cities, and farms. In other places, their homes have been cleared to extract **natural resources** that people use. This may be the wood from trees or underground minerals that people dig up to use in products. Some people wrongly believe that tiger body parts are good for medicine. **Poachers** still hunt tigers even where they are protected. Finally, tigers can be dangerous to people, so in some places people try to kill them. It is very difficult to protect tigers from being killed illegally.

The best way to save wild tigers is to protect their habitats. It is also important to stop the illegal trade of tiger products, like their skins. Because wild populations are in such big trouble, zoos are trying to help. By working together, zoos breed tigers in captivity to ensure that there is enough **genetic variation** in the captive population. **Conservation biologists** hope that someday tigers may be able to be reintroduced to the wild in places where their habitats have been protected or restored. This strategy has helped other types of endangered animals. For example, the California condor had virtually disappeared from the wild. Breeding birds in captivity and releasing young animals in the wild has helped rebuild their populations!

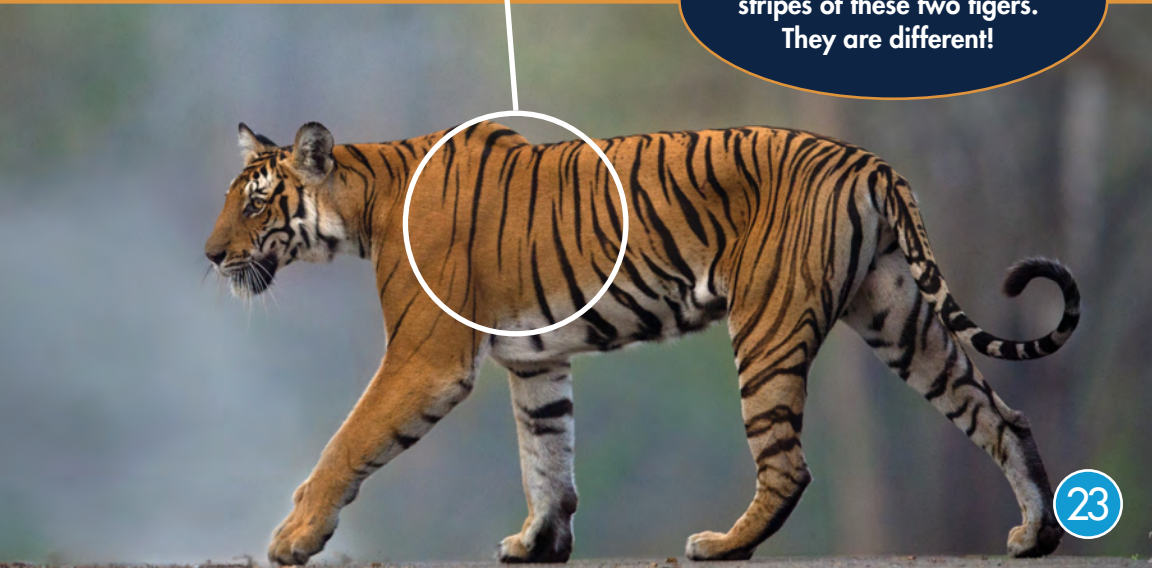


# SAME COLOR DIFFERENT STRIPES

Take a look at the image of Kismet and another tiger below. What similarities and differences can you see? All tigers have black stripes. The stripes help tigers blend into their environment. That makes it easier for them to sneak up on their prey. Did you know that each tiger's stripe pattern is different? It's like a person's unique fingerprint. The differences in stripes help scientists tell tigers apart and identify individuals.



Look closely at the shoulder stripes of these two tigers. They are different!



# STUDYING STRIPES

Saving tigers requires knowing more about them and their ecosystems. Scientists need to know how many tigers are in an area. They need to know how much prey is available. They need to know what factors affect the number of species in an area and how it changes with the seasons.

Tigers are very large animals, but spotting them in the wild is still very difficult. Scientists have found a way to study tigers without needing to see them! One method they use to study wild tigers is with “camera traps.” These cameras are set up in remote areas of the forest, and each one has a **sensor**. When the sensor detects movement, like a walking tiger, the camera takes a picture.



Each photo from the camera trap shows an image of the tiger's unique stripe pattern. Computer programs look at the photos and help identify individual tigers, so scientists know which animals are around. This helps them learn about entire tiger populations in an area.



Now it's time to join an investigation studying Kismet and the other tigers that call her forest home!





# GLOSSARY

## **ATMOSPHERE**

the air surrounding the Earth

## **BIOSPHERE**

all the life on Earth

## **COMMENSALISM**

an interaction in which one species benefits and the other is not affected

## **COMPETITION**

an interaction in which living things fight for limited resources

## **CONSERVATION BIOLOGIST**

a scientist who studies how to protect species

## **DEPOSITION**

the settling of soil or rocks in an area after being moved by wind or water

## **ERODE**

to be worn away gradually by wind or water

## **EVAPORATION**

the process of liquid turning into gas

## **GENETIC VARIATION**

the amount of genetic differences in a population

## **GEOSPHERE**

the materials from the Earth's core to the solid materials at the Earth's surface

## **HERBIVORE**

an animal that eats plants

## **HOME RANGE**

the area where an animal spends its time

## **HYDROSPHERE**

all of the water on Earth, including on its surface, in the air, and underground

## **LUNAR MONTH**

the amount of time measured between two new moons (about 29.5 days)

## **NATURAL RESOURCES**

materials or substances such as minerals, forests, water, and fertile land that occur in nature and can be used by people

## **NOCTURNAL**

active or occurring at night

## **PARASITISM**

an interaction in which an organism lives in or on another organism and harms the host organism it lives in or on

## **POACHER**

a person who hunts or catches animals illegally

## **PRECIPITATION**

rain, sleet, snow, or hail that falls to the ground

## **PREDATOR**

an animal that catches and eats other animals

## **SENSOR**

a device that measures or detects a physical property

## **SOLITARY**

living alone

## **SYSTEM**

a set of things working together

## **TERRITORIAL**

defending an area from other individuals

## **TRANSPIRATION**

the process of water being released into the atmosphere through plant leaves

## **WATER CYCLE**

the cycle by which water circulates between the oceans, the atmosphere and land





# PHOTO CREDITS

Abbreviation Key: SS = Shutterstock.com

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# SCIENCE 3D

Thanks for exploring with us! Our science adventures take us around the world to uncover secrets of the most amazing animals and places. Our mission and passion is to share these scientific discoveries with you. There are so many cool things to see out there, even in your own backyard, so get outside and explore!

## MIKE HEITHAUS PH.D.

Dr. Mike Heithaus is a scientist, explorer, author, educator, and television host. He is a professor of biology and Dean of the College of Arts, Sciences & Education at Florida International University. Mike and his students study sharks, whales, sea turtles, and other large marine animals around the world. They also work with people to help protect these species. Mike loves sharing his work with others. He has written text books and helped create programs for students in elementary, middle, and high school. He has been on television programs including on PBS, National Geographic, and Discovery Channel's Shark Week.



## PATRICK GREENE

As a wildlife filmmaker, Patrick has always had a passion for animals. He started to draw pictures of sharks and whales when he was just five years old. Later, he went to college to become a marine biologist and learned a lot about science. Then he got a job in television and learned how to make videos, too. Since then, he's gone all over the world studying and filming wild animals. He's made shows for National Geographic, PBS and ABC, and even won an Emmy Award. He loves making videos to teach students about science and about the many creatures that share our world.







# TIGER QUEEN

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