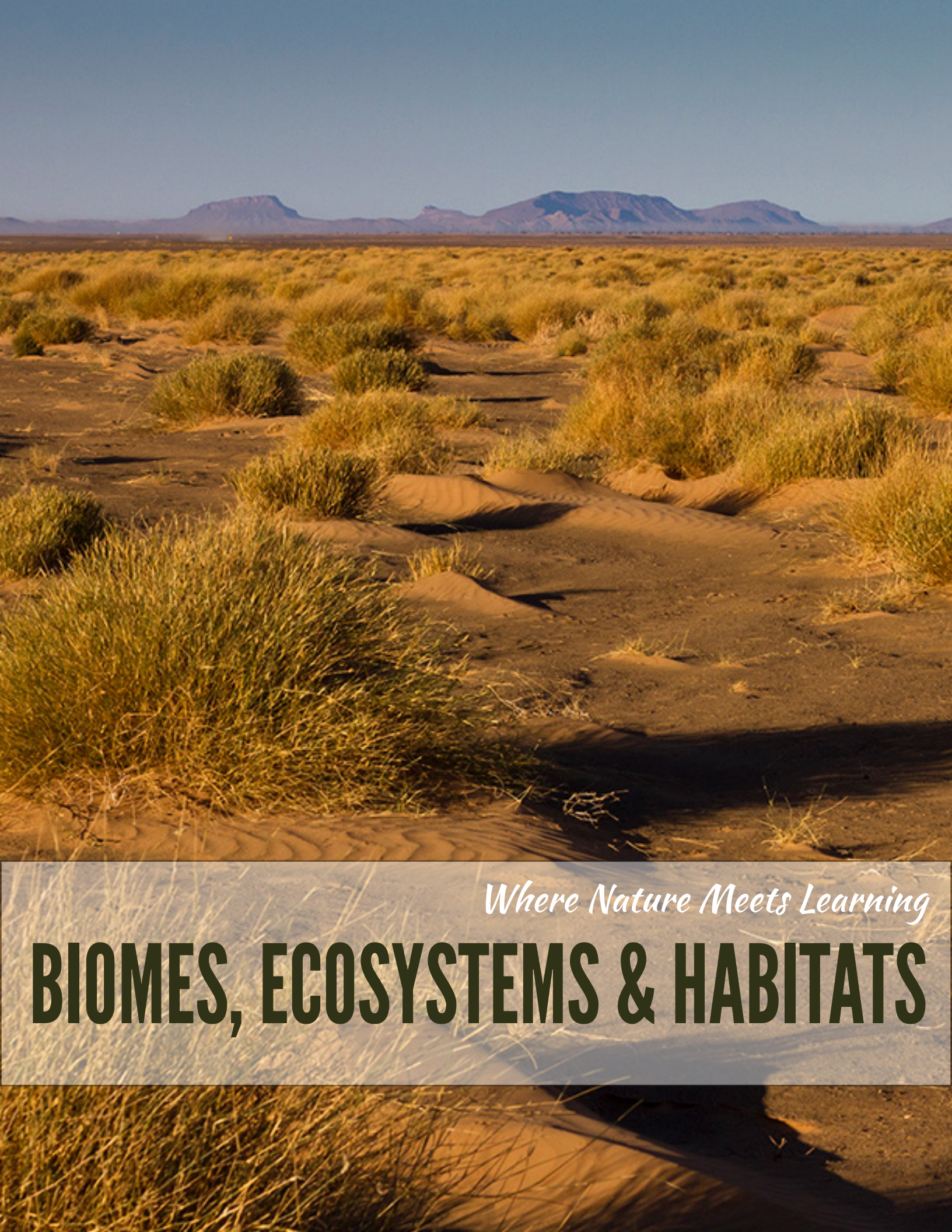

Where Nature Meets Learning

BIOMES, ECOSYSTEMS & HABITATS

Unit 1:
Biomes, Ecosystems & Habitats

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Unit 1:
Biomes, Ecosystems & Habitats

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UNIT 1

BIOMES, ECOSYSTEMS & HABITATS

"*Nature is not a place to visit. It is home.*" - Gary Snyder

One hot and humid morning in the Neotropics, a pair of Harpy Eagles is perched high among the branches of a Kapok tree. As far as their keen eyes can see, the forest below extends in a blanket of greens, browns, reds and yellows. While the male preens his long tail feathers—which act like a rudder when he flies, helping him steer through the dense vegetation—the female slowly spreads her wings to catch the rays of the sun. Suddenly, they spot movement below. They lift the ruff of feathers around their faces, called a facial disk, which helps direct sound to their ears. This allows them to use their hearing as well as their eyesight to hunt beneath the forest canopy, where little sunlight penetrates. The eagles are both alert now, and tense with anticipation as they watch a three-toed sloth slowly climbing a tree to warm itself in the morning sun. Without hesitation the male lifts from his perch, wings beating the air, talons outstretched...

Biomes

What is a biome?

Have you ever wondered why **harpy eagles** don't live in the cold Arctic tundra, when other birds of prey, like **peregrine falcons** and **gyrfalcons**, thrive in that part of the world? Or why **polar bears** don't roam the forests of China, eating bamboo shoots side by side with **giant pandas**? Why don't we find aquatic **green anacondas** slithering through the deserts of Arizona, when many other types of snakes, such as the **diamondback rattlesnake**, are a common sight? Why do certain animals live in certain places and not others? Let's find out!

First, imagine you live in the lowland **Neotropical** areas of Panama, a country in Central America. Panama is known for its hot, humid tropical climate. Here the sun is strong and you would sweat a lot. Imagine what it would be like, then, if you were to take a trip to Antarctica where temperatures can reach -51°C and the ground is permanently covered in snow and ice. What things would you bring? Would you wear different clothing than you do normally?

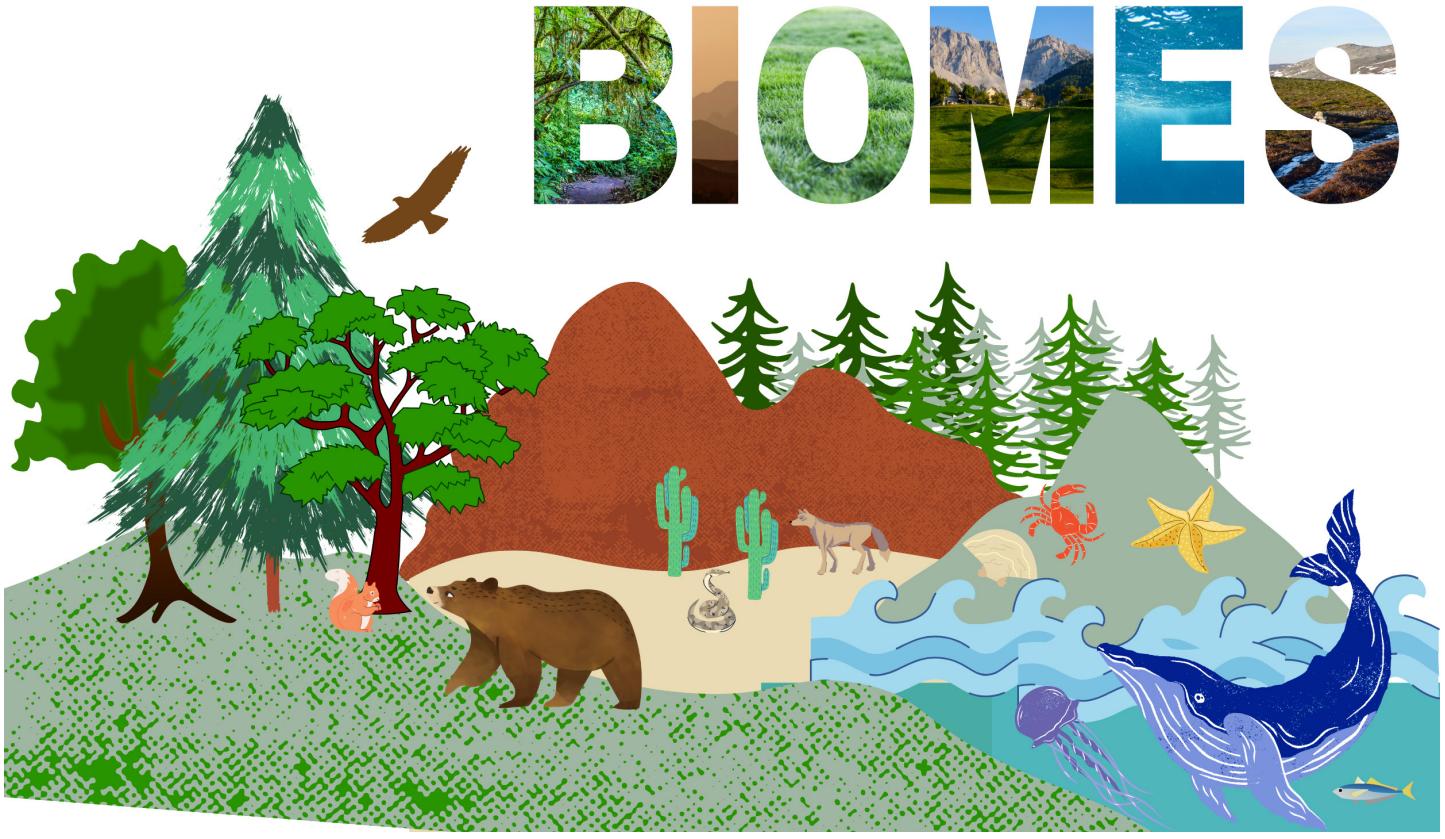
Humans, of course, are able to put on warmer clothes or seek shelter inside a house, but I bet you've never seen a bird in a raincoat or a giraffe with snow boots! Plants and animals don't naturally live outside of the biomes for which they are adapted. But what exactly is a biome?

A **BIOME** is a large area characterized by its vegetation, soil, climate, and wildlife. It consists of a unique group of plants and animals living together in a particular area that has certain environmental conditions. The main **abiotic** factors that influence a biome are temperature, precipitation and elevation.

Some animals, like **coyotes**, that can be found from Alaska to Panama, have adapted to live in a few different biomes. While other animals, like the polar bear (which has blubber over 10 cm thick to help it stay warm) is olnly found in the cold Arctic tundra. Polar bears, anacondas, and harpy eagles, like all organisms, are adapted to survive, thrive, and interact with the specific living and non-living components of their environment.

If this sounds a bit confusing, it might help if you think of biomes as rooms in a home. Each one is separate but connected. Sometimes there is a clear division between them, other times there is a gradual flow from one into the other.

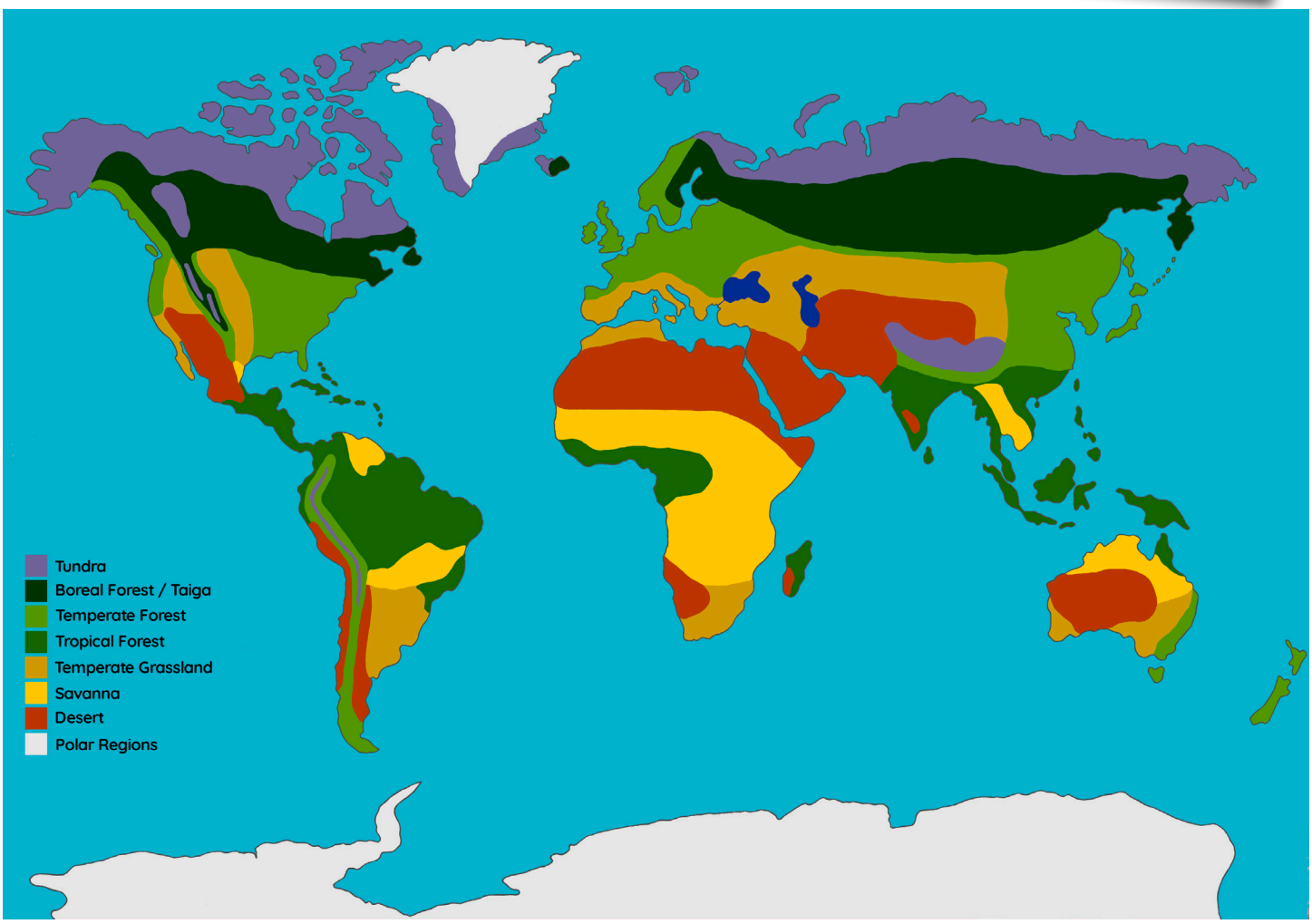
Just like rooms in a home, you can often tell them apart just by knowing a little bit about



each one. If you walked into a brand new house, and someone asked you to find the kitchen, would you be able to do it? What things would you look for? Even if you entered the home of someone from a very different culture than your own, chances are you would be able to find the kitchen, or the area where food is prepared, or stored, and sometimes eaten. It is this way with biomes. Once you learn to recognize their main characteristics, you will have no trouble identifying them.

Though biomes are also dynamic and can be altered by changes in climate, human activities, or other events, today there are 5 main biomes found on planet Earth: **aquatic**, **forest**, **grassland**, **desert,** and **tundra**. However, more detailed observations have led scientists to divide these biomes into other distinct groupings such as freshwater, saltwater, savanna, chaparral, temperate rainforests, and more! Read on to learn about the fascinating and unique biomes that make up our world.

But first... take a look at the map below. Can you find where you live on this map? Can you identify the biome in which you live?



Aquatic Biome

Water is the lifeblood of planet Earth, covering 71% of its surface. It can be found just about everywhere, from vast oceans whose depths are yet to be fully discovered by man, to roaring rivers that rush across the land; and from a seasonal pool where frogs lay their eggs, to underground reservoirs that support deep rooted trees and humans alike. Even in the driest places on Earth, trace amounts of water sustain life. Of all the water on Earth, a whopping 97% is salt water, and only 3% is freshwater. Of this valuable fresh water, a majority is found in frozen icebergs and glaciers. Only a mere 1% of all water on our planet is available for human consumption. Water is without a doubt, one of Earth's most important natural resources.

Freshwater Biome

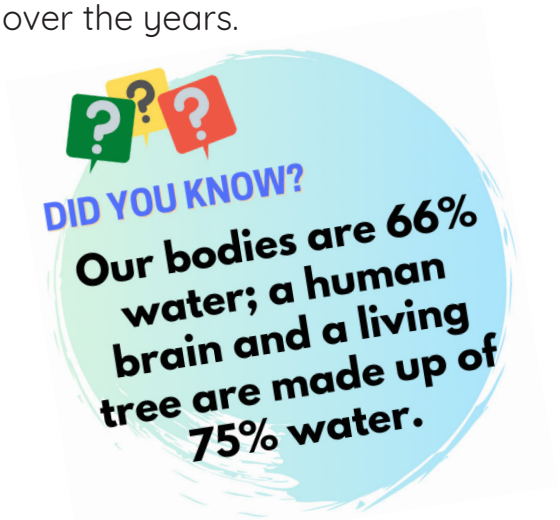
Freshwater, which is the water we drink, has very low concentrations of dissolved salts. Most lakes, ponds, rivers, streams, and some wetlands are composed of freshwater.

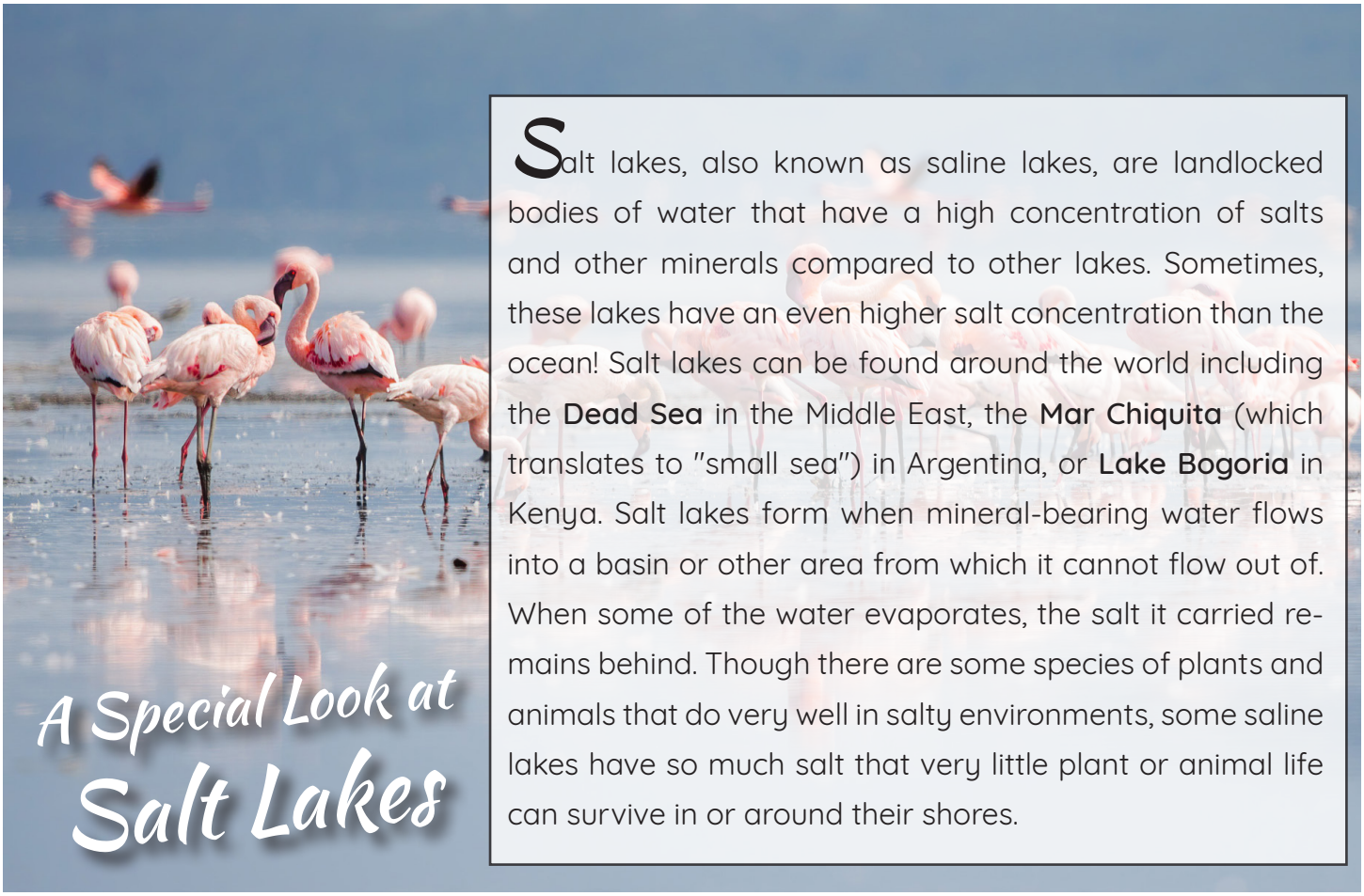
Lakes and ponds are bodies of relatively still water surrounded by land. They can vary in size, shape, elevation, temperature, and depth. The deepest lake on Earth is **Lake Baikal** in Russia. It is over one kilometer (1,620 meters) deep at its deepest point! Lake Baikal contains almost one fifth of the entire planet's unfrozen freshwater. Its "sister lake," **Lake Khövsgöl**, is located in northern Mongolia. This lake is considered one of the most pristine in the world and is one of only 17 ancient lakes on Earth. During the coldest periods of the year, Lake Khövsgöl freezes enough to hold the weight of several cars. In fact, in the winter some people use the lake as a highway!

Take a moment to think about different vegeation you might have seen growing in and around still water. Was it tall or short? Were the stems thin or thick? What were the leaves like? As you can image, plants that grow in freshwater biomes must be adapted to a wet environment. However, depending on where they are growing, they also need to

be adapted to warm or cold temperatures, **alkaline** or **acidic** environments, or **stagnant** or flowing water. Many aquatic plants and algae grow close to the surface of the water or along its shores to capture sunlight.

When thinking of lakes, surfing probably isn't the first thing that comes to mind. This is because many lakes tend to have relatively still, flat waters. However, some of the world's larger lakes can actually be very turbulent at times, especially in inclement weather. The **Great Lakes** in North America are one of Earth's largest freshwater systems. Here, high winds can cause waves to form. When the weather is just right, the waves are high and constant enough to attract local surfers. When the waves become too powerful, they can actually be extremely dangerous. Sadly, hundreds of ships have sunk on the Great Lakes over the years.





A Special Look at Salt Lakes

Salt lakes, also known as saline lakes, are landlocked bodies of water that have a high concentration of salts and other minerals compared to other lakes. Sometimes, these lakes have an even higher salt concentration than the ocean! Salt lakes can be found around the world including the **Dead Sea** in the Middle East, the **Mar Chiquita** (which translates to "small sea") in Argentina, or **Lake Bogoria** in Kenya. Salt lakes form when mineral-bearing water flows into a basin or other area from which it cannot flow out of. When some of the water evaporates, the salt it carried remains behind. Though there are some species of plants and animals that do very well in salty environments, some saline lakes have so much salt that very little plant or animal life can survive in or around their shores.

Rivers and streams are bodies of moving freshwater that often originate high in mountains from melting snow, precipitation, or groundwater. These flowing waters carve paths and channels as they move across the land before emptying into oceans, lakes, other rivers, or before drying up. As you can probabaly tell, not all rivers are alike.

Some rivers and streams are seasonal, meaning they only flow at certain times of the year. When not full with water, their dry beds are still visible and provide important habitat to terrestrial organisms. Once the rains start again, these dry beds often fill up quickly.

Subterranean rivers are those bodies of fresh water that flow underground. Perhaps one of the most well-known of these is the Puerto-Princesa Subterranean River, located in the Philippines. Surrounded by pristine forest, this river is over 8 km long and flows directly into the sea.

If you can believe it, even glaciers have their very own streams, called **subglacial streams**. Water flowing over the top of a glacier descends through channels eventually flowing under the ice sheet. Extreme pressure from the glacier itself maintains high water volume in these streams. This pressure can even cause the water to flow uphill, an unusual natural phenomenon.

The **Amazon River** in South America, at about 6,500 km long, begins in the Andes Mountains and flows into the Atlantic Ocean. The **Nile River**, located in northeastern Africa, is over 6,600 km long and flows into the Mediterreanean Sea. These are among the longest rivers in the world.

The normal cycle of most rivers includes periods of flooding and drying, therefore the animals and plants that live in and along these bodies of water must be adapted to survive in these changing conditions. Some plants have strong stems and roots that hold tight to rocks, while others have flexible stems that bend in the current.

The wildlife found in freshwater biomes varies from region to region but can include insects, snails, clams, crustaceans, fish, turtles, frogs, snakes, and ducks. These animals are suited to living in water of low salinity and most would not survive in the ocean, or other water bodies with high salt content.

Rivers, of course, have been and continue to be very important for humans as well. Many cities are built along rivers. For centuries, these flowing water bodies have provided drinking water, recreation, and places to forage or hunt for food. They even act as watery highways that allow for easy travel by boat, and for goods to be imported and exported.

Marine Biome

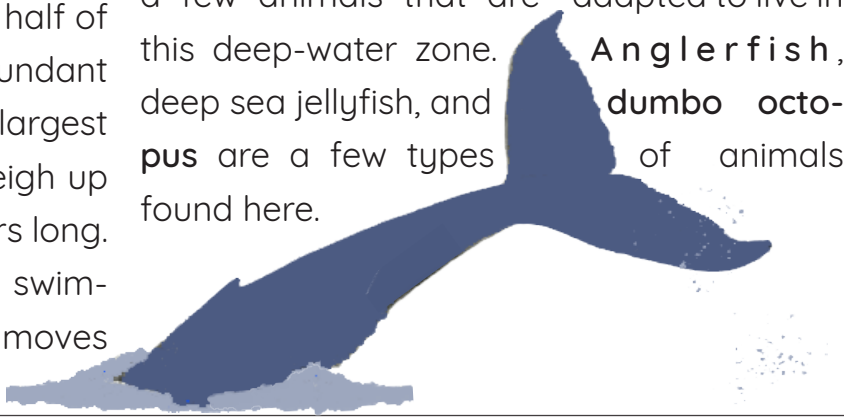
The **marine** biome is Earth's largest biome. It covers over 70% of the planet, and contains the world's oceans, seas, gulfs and bays. Marine environments are salty with about one cup of salt for every gallon of water. The marine biome is divided into four zones. However, it is important to keep in mind that these zones are not perfectly separated. There is some overlap and many marine creatures can move in between the zones with ease.

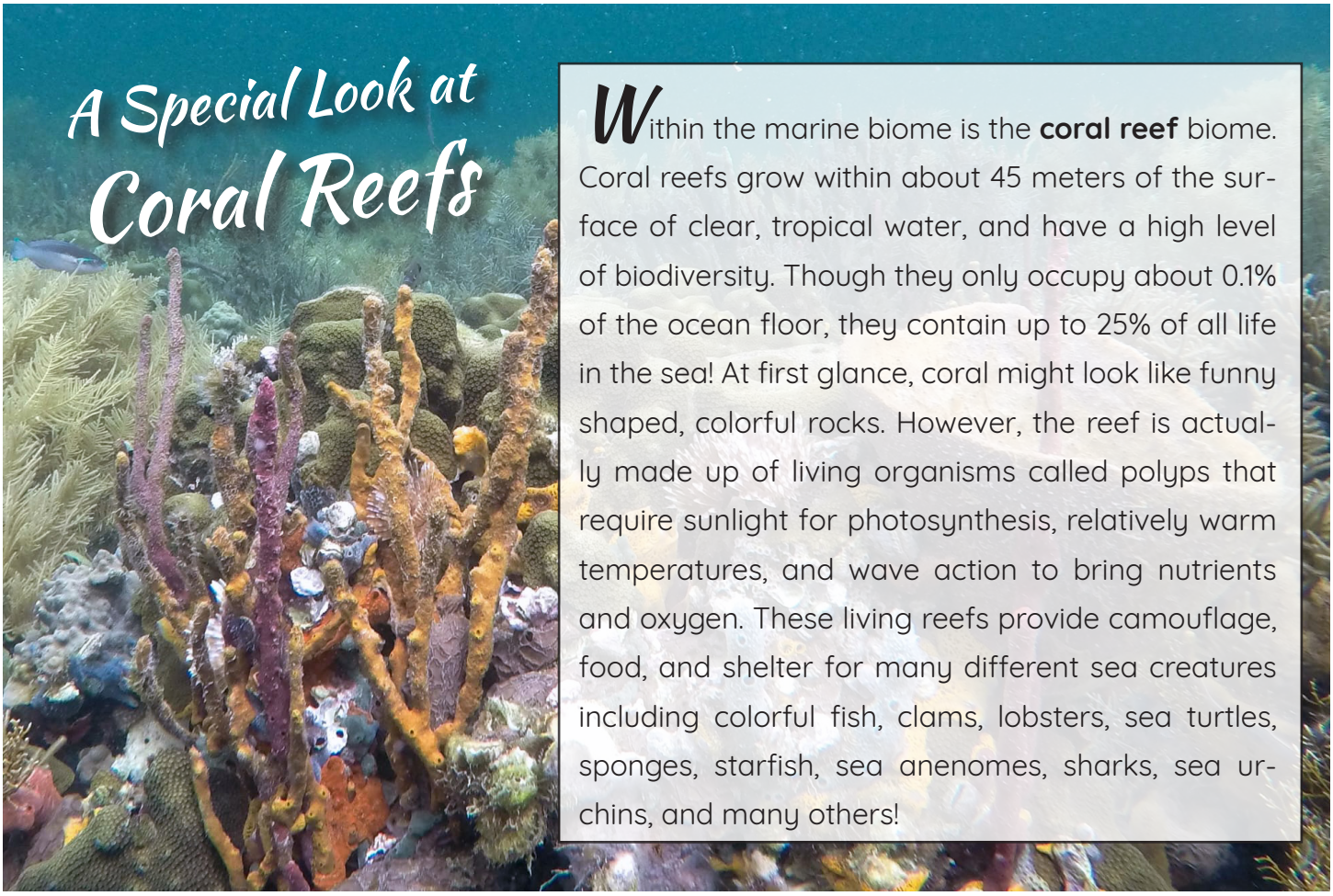
The **intertidal zone** is where the ocean meets the land. Plants and animals in this zone must be able to withstand the water's force as waves push and pull against the sand and rocks. At high tide, plants and animals may become submerged underwater. During low tide, these same organisms are exposed to the air. Plants in this zone are hearty. Some even produce mucus to help reduce water loss. Seagrass and seaweed make up most of the vegetation in this zone.

Waters found further from land are considered open ocean. This is the **pelagic zone.** Surface seaweed and phytoplankton (microscopic marine algae that produce half of the planet's oxygen) are the most abundant flora. Here we can find the world's largest animal, the **blue whale**, which can weigh up to 170,000kg and grow to be 30 meters long. Keeping it company is the fastest swimmer in the world—the **sailfish**—which moves through the ocean at over 100 km/h.

The **benthic zone** lies beneath the pelagic zone and contains most areas of the sea floor except those of the very deepest point. As you can probably imagine, little sunlight reaches this zone and temperatures are low. Animals that live here are adapted to survive in near darkness and deep-water pressure conditions. These animals, collectively referred to as 'benthos,' include microorganisms such as bacteria and fungi, and an abundance of invertebrates such as anemones, sea stars, urchins, worms, bivalves, crabs, and sponges.

The deep sea, or **abyssal zone,** is found at depths greater than 3,000 meters from the surface. If that doesn't sound so deep, wait until you hear about the Mariana Trench. It is the deepest oceanic trench and at nearly 11,000m deep, it is deeper than Mt. Everest is tall! The abyssal zone is cold, about 3°C, dark (no sunlight reaches here), and has a high level of dissolved oxygen, high pressure, and a low concentration of nutrients. Despite these extreme conditions, there are a few animals that are adapted to live in this deep-water zone. **Anglerfish**, deep sea jellyfish, and **dumbo octopus** are a few types of animals found here.





A Special Look at Coral Reefs

Within the marine biome is the **coral reef** biome. Coral reefs grow within about 45 meters of the surface of clear, tropical water, and have a high level of biodiversity. Though they only occupy about 0.1% of the ocean floor, they contain up to 25% of all life in the sea! At first glance, coral might look like funny shaped, colorful rocks. However, the reef is actually made up of living organisms called polyps that require sunlight for photosynthesis, relatively warm temperatures, and wave action to bring nutrients and oxygen. These living reefs provide camouflage, food, and shelter for many different sea creatures including colorful fish, clams, lobsters, sea turtles, sponges, starfish, sea anenomes, sharks, sea urchins, and many others!

Compare & Contrast

You have now learned a little bit about Earth's aquatic biomes and how important they are for sustaining all life on this planet. You also learned about different characteristics of freshwater and saltwater biomes. How do they vary? How are they similar? Take a look at the words in the left hand column of the chart. Using what you learned, think about some descriptive terms you can put into each column to describe each biome. Can any terms apply to more than one biome? How about all three?

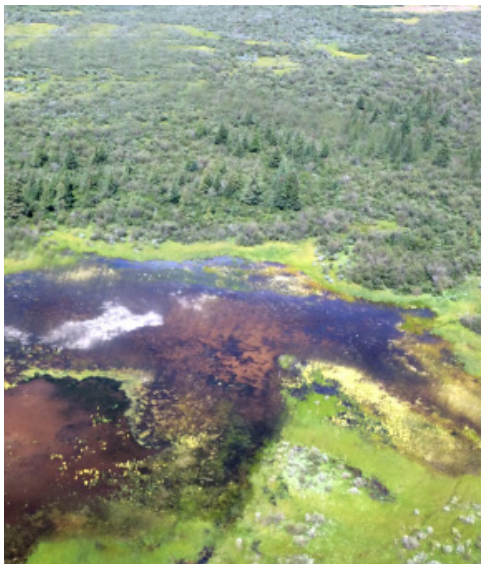
	Oceans	Lakes	Rivers
Animal types/ adaptations			
Plant types/ adaptations			
Benefits to humans			
Size and elevation			
Movement (i.e. waves)			

Forest Biome

Forests blanket just over 30% of our planet's landmass. They cover more than 4 billion hectares combined across all continents except Antarctica. Of all the terrestrial biomes, forests contain the highest level of **biodiversity** of plant and animal life. Forests also contribute to the health of the planet. Trees continually provide us with clean air to breathe by absorbing carbon dioxide in our environment and producing oxygen through photosynthesis.

Taiga (Boreal Forest)

The largest land biome is the **taiga**, also known as boreal forest. This region forms a strip across the Northern Hemisphere south of the Arctic and encompasses forested mountain slopes. Here, winters are long and cold, with temperatures ranging between -5 and 5°C, but can drop to below -20°C. Summers are short and wet, with temperatures reaching up to 18°C. In general the taiga receives between 20-75 cm of annual precipitation, mainly as snow.



Glacial ice-sheets once covered the taiga. As they receded, some plants and animals moved further north, where many are still found today. Trees found in boreal forests include both evergreen and decidiuous species. Spruces, pines, larches, and birch (a broadleaf), are all adapted to survive in the thin, nutrient poor, acidic soil. Lakes and soggy bogs, known as muskegs, cover much of the ground in this zone, a result of poor drainage due to **permafrost** and bedrock.

Evergreen trees keep their leaves year round which helps to conserve energy. The dark green color of the plants

helps them absorb more light energy while their narrow needle leaves with a thick waxy covering prevent moisture loss. The leaves' pointed tips help keep excess rain and snow from buiding up and causing damage to the tree. Fires are uncommon in the taiga, but are an important component to the health of the forests. When a fire passes through it burns away dead and sick trees, making room for new growth.

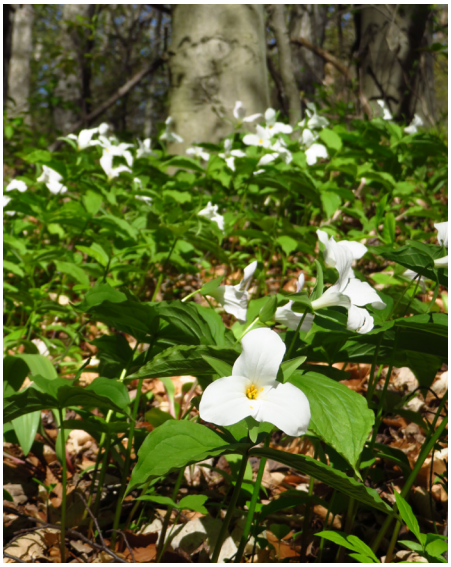
The **deciduous** plants here adapt through four distinct seasons. The broad-leaf plants capture more sunlight, but lose their leaves and become dormant in the winter to protect them against the cold. New leaves will grow each spring.

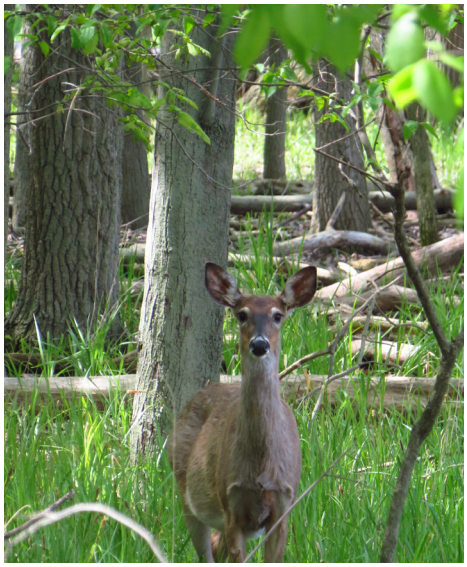
Shrubs, wildflowers, berries, and lichens can all be found in boreal forests. Conditions vary in different parts of the taiga worldwide, and that influences the specific vegetation found within the regions.

Mammals are abundant throughout the taiga. Moose, caribou, elk, deer, bear, lynx, hares, wolverine, weasels, tigers, boars, and many rodents call these boreal forests home. Birds, such as jays, woodpeckers, owls, grouse, finches and many others are found in the taiga. A majority of the Neotropical migrant songbirds, particularly warblers, nest in the boreal forest in the summer months and migrate to Central and South America in the winter.

Insects are abundant and have adapted to the extreme change in seasons throughout the year. Even amphibians, such as the **boreal chorus frog**, have unique **adaptations** to withstand below zero conditions and are able to thrive in boreal forests.

In temperate regions around the world, we can find mixed deciduous and evergreen forests. Deciduous trees lose their leaves and grow new ones each year. Evergreens keep their foliage year-round. What are the advtantages and disadvantages of each? What factors might influence why a tree has evolved to lose its leaves or not?





Temperate Forests

Temperate Forests, our planet's second largest biome, grow throughout the temperate zone—the region between the tropics and Earth's polar regions. These forests receive between 150-500 cm of precipitation a year. The plants and animals that live here must adapt to seasonal changes in temperature and moisture.

Huge, long-lived coniferous trees dominate this region. These towering trees can block sunlight from reaching the forest floor, so tree seedlings must be able to germinate in shadier areas. However, natural, sun-touched clearings do occur that provide easier growing conditions for young trees.

The majority of the world's temperate forests can be found in the northern hemisphere, covering parts of North America, Europe and Asia. While conditions in the southern hemisphere aren't ideal for the formation of temperate forests, some can be found in Australia, New Zealand, South Africa and along the southern coast of Chile. Temperate forests cover large areas of many different continents around the world, so we can expect to find a great number of different types of plants, animals and other organisms that call these forests home.

In Asia, **Siberan tigers**, leopards, **sika deer**, sable, flying foxes, **red pandas**, **Asiatic black bears,** and **giant pandas** inhabit this biome. In Europe, we find otters, lynx, rabbits, hedgehogs, squirrels, minks, deer, eagles, and songbirds. In North America, we can find raccoons, porcupines, beavers, deer, skunks, squirrels, bats and bears, as well as a multitude of birds including owls, jays, crows, woodpeckers, hawks, and songbirds. Temperate forests of Australia are home to many unique animals including **koalas**, **Tasmanian devils**, wombats, **platypus**, and snakes.

Just as there is a huge variety of life within the temperate forest biome, there is also a large amount of variation within this biome itself. Temperate rainforests, moist broad-leaf and coniferous forests, woodland and pine forests, interior coniferous forests, and mountain oak-pine forests are just a few of the different forests that fall under the term temperate forest.

A Special Look at Cork Forests

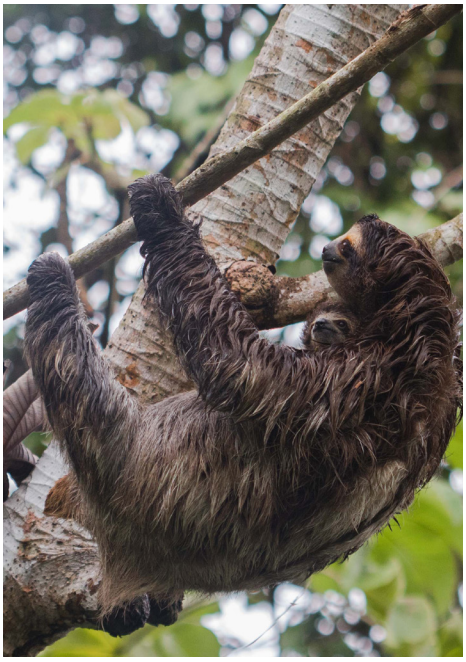
Cork Oak grows in groves and forests in southwestern Europe and northwestern Africa. **Cork forests** are a major **community** found in the Mediterranean woodlands region. The pleasant Mediterranean climate allows this ancient species to thrive. Cork Oak dates back to the Tertiary period, over 2.6 million year ago. Cork oak is the primary source of cork for wine bottle stoppers, cork flooring and other uses. Cork is a natural, sustainable, and renewable resource. Harvesting cork involves only removing the bark, not the entire tree. As the bark regrows, it absorbs and stores five times more carbon from the atmosphere through photosynthesis. Cork forests are very biodiverse, and provide homes for many threatened animal and plant species endemic to the region, such as the **Iberian Lynx, Barbary Macaque**, and **Spanish Imperial Eagle**.

Brain BUSTER

Forests around the world are highly biodiverse and provide homes to a great variety of animals. Take a look at the animals below. Identify which ones are found in forests and think about what special adaptations they have for survival.

Tiger	Humpback Whale	Koala	Chameleon
Toucan	Gorilla	Anteater	Lemur
Polar Bear	Giraffe	Camel	Monkey
Boa Constrictor	Porcupine	Woodpecker	Octopus
Deer	Wolf	Snow Leopard	Giant Panda
Greater Roadrunner	Bald Eagle	Jaguar	Musk Ox
Elephant	Penguin	Gila Monster	Hare





Tropical Forests

Tropical forests, of course, are found in the tropics, a region that spans about 30 degrees latitude on either side of the equator between the Tropic of Cancer to the north and the Tropic of Capricorn to the south. The tropics are warm and wet year-round. The temperature normally ranges between 20-30°C. The humidity varies from 77-88%. Rainfall ranges from 150 to over 1,000 cm annually, with the majority of the rainfall ocurring during the rainy season.

You might be surprised to learn that there are many different types of forests in the tropics, such as humid lowland rainforest, semi-evergreen forests, montane tropical forests, and cloud forests. Despite the relatively heavy rainfall in this region, even tropical dry forests grow here. Tropical dry forests are composed mainly of deciduous trees that lose their leaves in the dry season. This helps them to survive during times when water is less abundant.

Of course, of all the tropical forest types, perhaps the one that most captures our imagination is the tropical rainforest, and for good reason. Found on the continents of Central and South America, Africa, Australia, and Asia, tropical rainforests cover approximately 6-7% of the total landmass, but hold nearly half of all the species on Earth.

Seen from above, a rainforest looks like a massive, colorful quilt of greens, yellows, browns and reds. Standing among its towering trees, one can't help but be in awe. Palms that "walk," trees that "bleed," water-filled vines, meat-eating plants, leaves that close when you touch then, and flowers that smell like rotting meat are just a few of the fascinating plant life that grows in rainforests around the world. **Epiphytes** (plants that grow on the branches and trunks of other plants) found here include lichens, mosses, ferns, cacti, orchids, and bromeliads.

Most rainforest trees have shallow roots. Their roots don't grow deep into the ground but rather remain near the surface from where they can efficiently uptake nutrients. Some roots even grow above the ground itself. These prop roots can get extremely big, growing taller than a full grown person! Since their roots do not penetrate deep into the ground, trees often fall in heavy rain or wind storms. These fallen trees become habitat for many animals. However, they decompose quickly, helping to return much-needed nutrients to the soil. Rainforest trees tend to have large leaves and grow tall in order to obtain some sunlight in the dense forests. Rainforest plants have adaptations such as drip tips, waxy leaves, and spines to help them survive and avoid predation.

Tropical forests are bustling with life. Colorful birds, noisy monkeys, sleek cats, slithering snakes, and a wide variety of insects, lizards and frogs call this biome home. Tapirs, capybara, anteaters, sloths, tarsiers, orangutans, caimans, basilisk lizards, toucans, hornbills, cotingas, bird of paradise, and **harpy eagles** are all some of the incredible animals found in these forests.

The **Amazon** rainforest is the world's largest rainforest, covering a large part of South America. It is home to one tenth of all life on Earth. The vastness of this forest is crucial in maintaining global weather and rainfall patterns, producing oxygen, and absorbing carbon dioxide. Furthermore, over 30 million people live in the Amazon rainforest.

DID YOU KNOW?

Rainforests are the world's oldest living ecosystems. They have been known on Earth for more than 70 million years.

A Special Look at Cloud Forests

Within the tropics, higher elevation forests are enshrouded in dense fog and cloud. Rain falls almost daily in these wet montane forests. At above 500 m, the moisture in the cool air creates ideal conditions for epiphytes, bromeliads, orchids, and moss. The incredible amount of foliage found here supports great biodiversity. Hummingbirds and tanagers are common in the cloud forests of Central and South America, while several species of birds of paradise call the cloud forests of Indonesia home. **Spectacled Bears** forage for juicy epiphytes in the Andes, and other unique mammals, such as the recently discovered **Olinguito**, endemic to Ecuador, and agile gibbons of Indonesia, are also found in these forests. Only 1% of the global woodlands are cloud forests.

Tundra Biome

The tundra is the coldest terrestrial biome. It covers approximately one fifth of Earth's surface, spanning the Arctic and sub-Arctic regions. Though the tundra biome does not have extremely high biodiversity, it remains a very important place for the organisms that call it home. It is also very important for humans. Trapped within the tundra's permafrost is soil-bound carbon. As long as the carbon remains trapped, less carbon dioxide enters our atmosphere, helping to keep the air we breathe clean.

As you can probably imagine, life on the tundra can be hard for plants, animals and humans alike. If you were to visit the tundra, one thing you might notice right away is that very few or no trees grow here. That is because this biome offers a very short growing season (the time when trees and other plants receive enough precipitation, favorable temperatures and light to grow). Even though trees are lacking, many other plants do survive here. The tundra is carpeted with colorful, short shrubs, lichens, mosses, and grasses.

Without the cover of trees, animals have had to adapt different ways in which to hide well in the tundra. Before reading further, can you guess what adaptations they might use? If you said "camouflage" you are right. But, here's where things get tricky. In the winter the ground is covered in white snow. After the snow melts in spring, the brown rocks and weeds become visible. What is an animal to do? Many arctic species completely change their appearance from summer to winter. **Arctic fox**, **Arctic hare** and ptarmigans change from mottled browns and grays during the summer months

to completely white in the winter, allowing them to blend in perfectly with their habitat no matter the season. Some species, such as the **snowy owl**, do not change their plumage from season to season. However, males are nearly pure white while females have black speckling all over their white feathers. This speckling helps the female blend in with the ground vegetation during the short summer months. Young snowy owls are heavily covered in dark markings to avoid being detected by predators during their vulnerable first year. Other animal adaptations include having thick fur and compact bodies for keeping warm. Some tundra birds have feathers all over their feet and toes, an adaptation for standing on snow for extended periods of time.

Across the globe, we can find three different types of tundra: Arctic, alpine and Antarctic.

Arctic Tundra

The Arctic tundra is found within the Arctic Circle. Parts of Russia, Canada, the United States (Alaska), Greenland, Finland, Sweden and Norway are home to this important biome. Precipitation averages only 15-25 cm a year. Winters here are long and cold with temperatures reaching -34°C. During the very short summer, which only lasts 50-60 days, it can get as warm as 12°C. In order to combat the wind and cold, plants in the arctic are short and cluster together. They are also adapted to the permafrost soil and low light intensity. Animals such as caribou, **Arctic fox**, **Arctic wolf** and **musk ox**, hares, **snowy owl** and ptarmigans can be found here.

Alpine Tundra

The Alpine biome is found above tree line or at snow level, usually above 3,000 m elevation, on mountain slopes. This biome is characterized by high winds, cold temperatures, much snow, intense sunlight with high ultraviolet light, thin air (decreased carbon dioxide and oxygen), and poor soil. The summer is short with average temperatures between 4-15°C. The winter is long and the temperature is usually below zero Celsius. Annual precipitation is about 300 mm a year and comes mostly in the form of snow.

Alpine plants tend to be small, ground-hugging vegetation that can tolerate sandy soil and dry conditions. Many of the plants grow and reproduce slowly, giving them a dwarfed stature. The oldest known living organism is the **Great Basin bristlecone pine**, found only in the alpine regions of the Sierra Nevada Mountains of California. This species of tree has a lifespan of over 5,000 years!

Typical alpine plants include grasses, sedges and low woody shrubs. These plants have adaptations to live in the conditions of the region, and are wind resistant. They have well-developed root systems that allow them to anchor well to the ground and increase uptake of nutrients. Despite the diffi-

culties plants face in this environment, alpine regions have many **endemic** plants, plants only found in this region. This is because the plants found here are specifically adapted to these unique conditions. Since alpine regions are found all over the world, the animal life within this biome is variable and includes mammals such as wild goats and sheep, **Himalayan tahr**, yak, rabbits and hares, marmots, chinchillas, pikas, and birds including keas, buntings, finches and grouse. Even a few species of amphibians, such as the **Alpine Salamander** in the European Alps, are found.

Antarctic Tundra

While Arctic and alpine tundra are the most common types of tundra found on Earth, tundra does exist in the extreme latitudes of the Southern Hemisphere as well. While most of Antarctica is covered in ice and snow and no vegetation grows there—making it cold desert rather than tundra—some of the Sub-Antarctic Islands, as well as part of the Antarctic Peninsula are composed of rocky landscapes that support vegetation. South Georgia, South Sandwich Islands and the Kerguelen Islands are characterized by tundra. Flora found in Antarctic tundra is primarily lichens, mosses, liverworts and algae. Land mammals are lacking, but sea birds such as albatross and penguins, and sea mammals including seals are found in the Antarctic tundra.

Brain BUSTER

You have now learned a little bit about the adaptations some animals have to survive in the tundra. Can you match the animal on the right to its specific adaptation on the left? Note, some animals have more than one adaptation, but for this activity, try to match each adaptation to only one ainmal.

Adaptation

Compact body

Feathered Feet

Turn white in winter

Thick fur

Hibernate

Migrate

Desert Biome

Deserts cover about one fifth of the Earth's surface, and are found on every continent. They are characterized by very low precipitation, less than 50 cm of rainfall a year. They are surprisingly diverse in size, elevation, and temperature. Deserts can be hot or cold. They can tower above us from high elevations or be found below sea level. Some were formed millions of years ago, while others have been around for mere decades. New deserts might be forming even as you read this. Even though at first glance deserts may appear to be dry and lifeless, they are actually filled with a surprising amount of incredible flora and fauna, all adapted to live in the extreme, arid environment deserts offer.

Have you ever been to a desert? Maybe you live in one! If you have never visited a desert, take a moment to picture one. Would it be hot or cold? What would the animals eat? Where would they sleep? Many people, when they think of a desert, often imagine a dry and lifeless place or see the classic depiction of an animal skull on a sandy floor, while a lone vulture perches on a single cactus. Though you will never see a Harpy Eagle in the desert, this biome has some amazing plants and animals all its own.

Desert plants—cacti, shrubs, succulents, and grasses—all have special adaptations to cope with this extreme environment. Seeds can remain **dormant** for long periods of time while they wait for the moisture they need to grow. Roots are adapted to seek out water and store it. Hairs and spines help create shade to reduce evapo-transpiration. Many desert plants have small, waxy leaves which also aid in conserving water. Silvery or glossy surfaces on leaves help reflect radiant energy from the sun's rays.

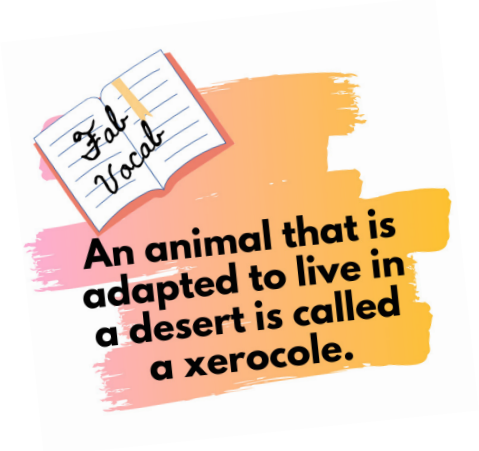
Animals also have unique adaptations for living in deserts. **Fennec foxes** have huge ears to help dissipate heat and are crepuscular, meaning they are most active at dawn and dusk when the temperatures are cooler. **Addax antelope** and some gazelles can go for months without drinking water.

Certain toads and frogs hibernate beneath the soil and wait until the first hard rains to emerge, mate, and lay their eggs before going underground again. Then it is a race against time and the elements. The eggs they lay must hatch, turn to tadpoles and then into frogs or toads before the pond or puddle they live in dries up. This can happen in a matter of a few short weeks.

Many animals that live in the desert are nocturnal, and rest in the shade during the day or at least during the hottest parts of the day.

Some desert animals are able to detect the presence of water by picking up the scent of associated plants and minerals. Snakes, deer, rodents, and lizards are all perfectly adapted to live in this habitat, and are just a few more examples of the animals found in deserts around the world.

Depending on the authority you ask, biomes are sub-classified in different ways. For example, sometimes deserts are divided into subtropical, rain shadow, interior and polar deserts. Other authorities classify them as hot and dry, semi-arid, and coastal. But no matter which way you prefer to look at it, each different type of classification represents the biome as a whole.



Hot, Dry Deserts

Hot, dry deserts, like the **Sahara Desert** in Africa and the **Thar Desert** in India, are very hot in the summer and remain warm for the rest of the year. Despite being very hot during the day, temperatures can drop significantly at night, sometimes to below 0°C. There is little precipitation and the evaporation rate may exceed the rainfall rate, resulting in a minuscule amount of rain reaching the ground. The soil in these deserts, as you can probably imagine, is rocky and sandy and soaks up any rainwater that touches its surface very quickly.

Cold Deserts

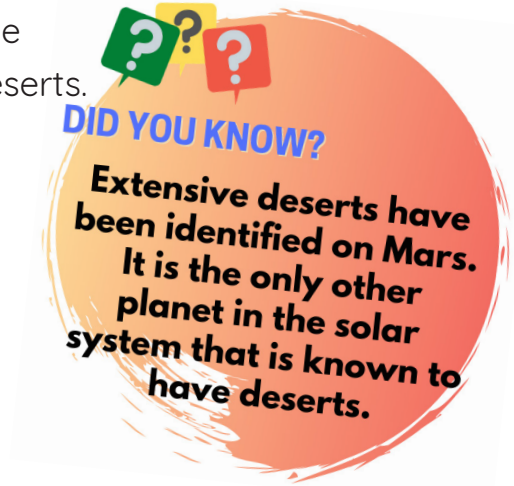
The cold deserts tend to have short, moist, cool summers and long, very cold winters. Like other deserts, they receive relatively little precipitation in the form of rain or snowfall, and are considered very dry. The arid conditions are caused by the dryness in the air. Vast regions of Greenland and Antarctica are covered by cold desert, which are essentially ice fields. The **Antarctic Desert**, which covers 14.2 million square kilometers, is the largest desert on Earth.

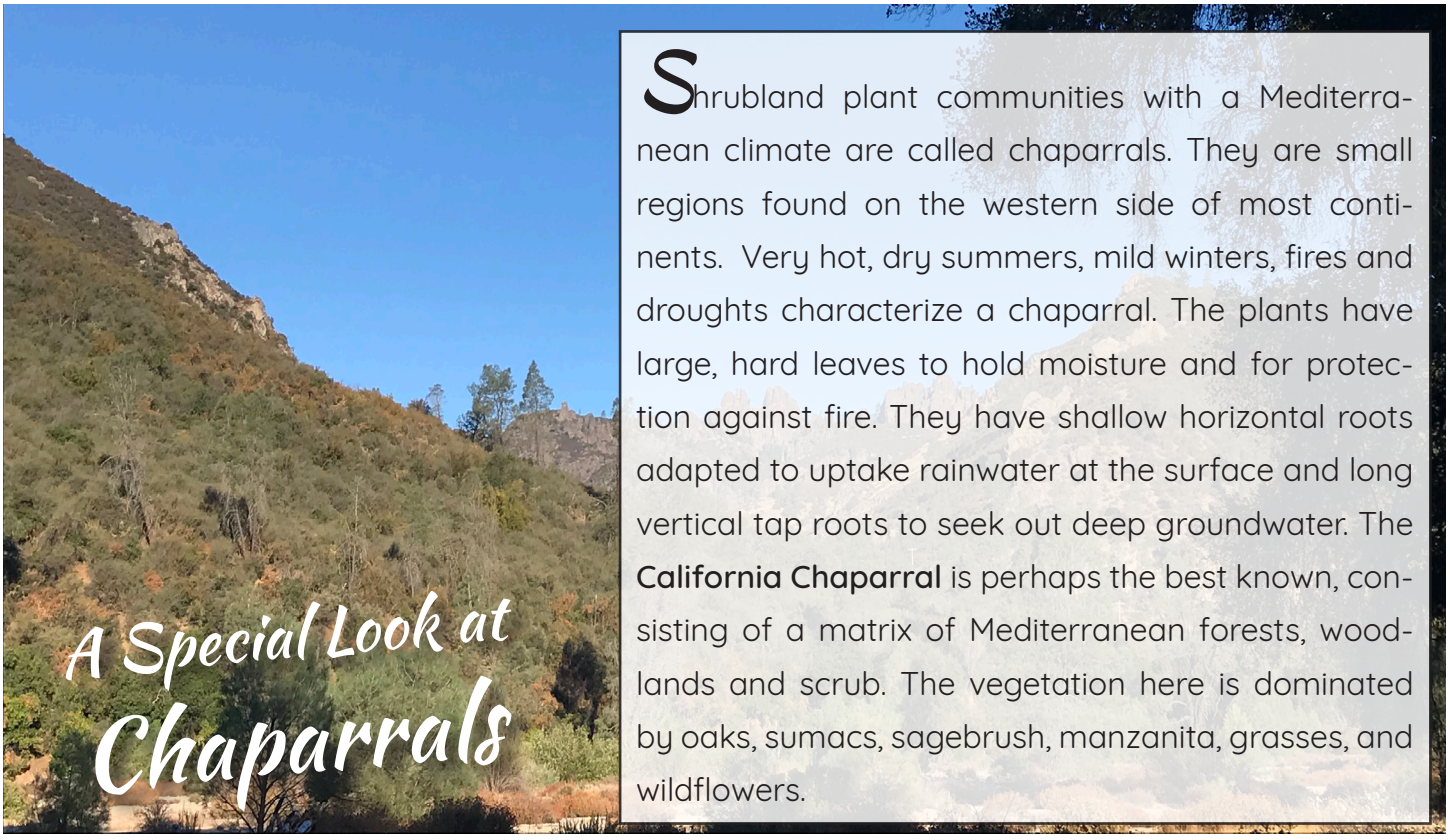
Coastal Deserts

A coastal desert has a cool winter and a warm summer. Normally occurring on the western edges of continental land masses, they are bound by oceans to the west and mountain ranges to the east. They are influenced by cold ocean currents and wind crossing the water to land, occasionally causing fog and dew, the main forms of precipitation. Coastal deserts are found in Namibia, Chile, Baja California, western Australia and a few other areas where these conditions exist. The driest desert in the world is a coastal desert. It is the **Atacama Desert** in Chile. This desert only receives an average of 15 mm of rain per year, although there are parts that receive much less - only a millimeter or two per year.

Semi-arid Deserts

Semi-arid deserts are characterized by slightly cooler temperatures than hot and dry deserts. They have warm summers and cool winters which is when it tends to rain. The Eurasian Steppe, the **Sahel**, the western United States, and the Australian outback are considered semi-arid deserts. Temperatures can vary greatly, but they are typically less extreme than hot deserts.





A Special Look at Chaparrals

Shrubland plant communities with a Mediterranean climate are called chaparrals. They are small regions found on the western side of most continents. Very hot, dry summers, mild winters, fires and droughts characterize a chaparral. The plants have large, hard leaves to hold moisture and for protection against fire. They have shallow horizontal roots adapted to uptake rainwater at the surface and long vertical tap roots to seek out deep groundwater. The **California Chaparral** is perhaps the best known, consisting of a matrix of Mediterranean forests, woodlands and scrub. The vegetation here is dominated by oaks, sumacs, sagebrush, manzanita, grasses, and wildflowers.

Grassland Biome

Grasslands expand over the continents of North and South America, Europe, Africa, and Asia. They are typically found between desert and forest, in both temperate and tropical regions. Dominated by grasses, they are typically semi-arid with limited rainfall. Soil conditions are not sufficient to promote tree growth. Trees that do grow in grasslands are sparsely distributed. They are maintained by low precipitation averaging 50-90 cm per year, natural and controlled fires, and grazing animals that help keep everything in balance.

Temperate Grasslands

The North American prairies, Eurasian steppes, South African veldts, and South American pampas are all part of the temperate grassland biome. Grasses and wildflowers dominate these regions of rich soil, hot summers, and cold winters. Temperature changes can be extreme, varying from below zero to over 37°C.

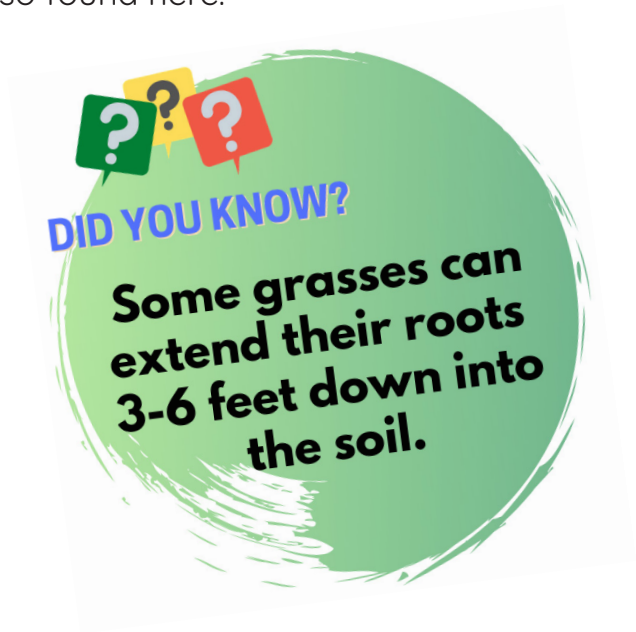
Fires are common in these ecosystems, so grasses have underground stems and buds to prevent fire damage. Also, their growth points are close to the ground so the plant is not killed when grazed by animals. Small animals tend to burrow and thus adapt well to fires by sheltering underground to avoid the flames.

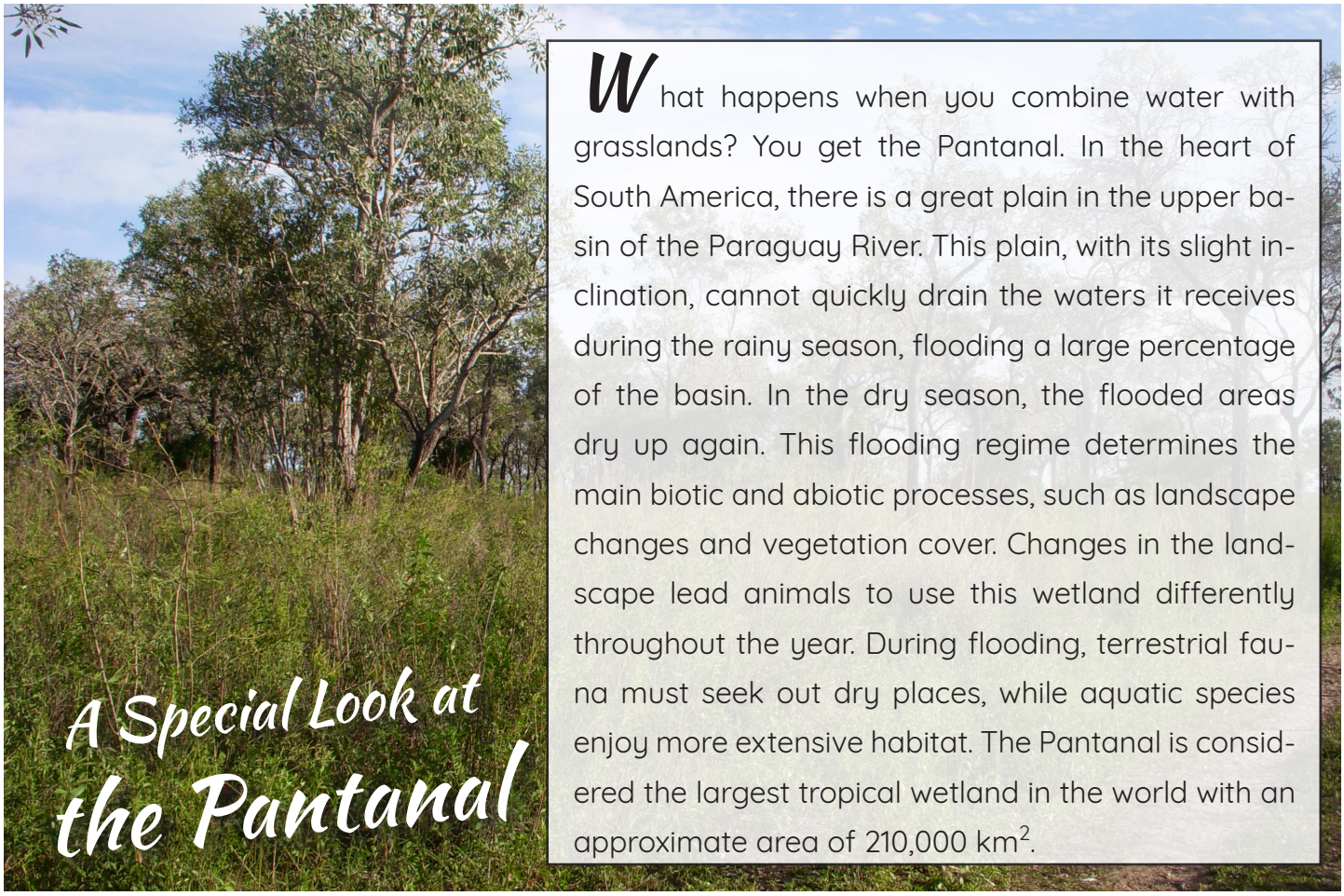
Common temperate grassland animals include prairie dogs, badgers, bison, **pronghorn**, antelopes, rabbits, flycatchers, raptors, and butterflies.

Savannas

Grasslands in a warm or tropical climate that have scattered trees are called savannas. These tropical grasslands typically have slightly higher annual rainfall of 76-100 cm, and an average temperature of 20-30°C. Lightning-generated fires are common. Climate changes, soil conditions, animal behavior, and agriculture practices can create savannas.

Two of the most famous savannas include the **Serengeti** of Africa and the **Brazilian Cerrado,** both well-known for the wildlife found there. Savanna wildlife include large mammals such as elephants, giraffes, buffalo, anteaters, jackals, **lions**, **cheetahs,** and **jaguars**. Long-legged birds such as ostriches, storks, cranes, bustards, seriemas, and **secretarybirds** are all at home walking through the tall grass. Open area birds such as vultures, eagles, blackbirds, and seedeaters are also found here.





A Special Look at the Pantanal

What happens when you combine water with grasslands? You get the Pantanal. In the heart of South America, there is a great plain in the upper basin of the Paraguay River. This plain, with its slight inclination, cannot quickly drain the waters it receives during the rainy season, flooding a large percentage of the basin. In the dry season, the flooded areas dry up again. This flooding regime determines the main biotic and abiotic processes, such as landscape changes and vegetation cover. Changes in the landscape lead animals to use this wetland differently throughout the year. During flooding, terrestrial fauna must seek out dry places, while aquatic species enjoy more extensive habitat. The Pantanal is considered the largest tropical wetland in the world with an approximate area of 210,000 km^2.

A CLOSER LOOK

Biomes at a Glance

	Elevation	Temperature	Precipitation	Soil Type	Plants	Animals
Forest	Sea level to alpine treeline, over 4,500 m / 15,000 ft	Highs: 30°C/86°F Lows: -30°C/-22°F	From 40 to over 200 cm per year can be in form of rain or snow	Acidic and low in nutrients (taiga & tropical); fertile (temperate)	Variable with adaptations to different precipitation, light level and temperature	Highly biodiverse Adapted to seasonal changes
Desert	Highest: 2,226m (7,300 ft) Lowest: -86m -282 ft	Highs: 38°C/100°F Lows: -4°C/25°F	Less than 50 cm high rates of evaporation	Course, sandy and rocky	Drought resistant; small, waxy leaves; spines and hairs	Often lack sweat glands; many nocturnal; live underground; large ears
Tundra	Arctic & Antarctic Tundra: sea level & low elevations Alpine tundra: over 4,500 m / 15,000 ft	Highs: 15°C/59°F Lows: avg. -34°C/-29°F to as low as -50°C/-58°F	15-25 cm per year	Poor soil characterized by *permafrost* subsoil that does not drain; alpine soils drain well	Shallow roots Grow low to the ground Wind resistant Adapted to low light and cold temperatures	Thick fur; Many turn white in winter; Feet covered in fur or feathers
Grassland	Sea level to above treeline, over 4,500 m / 15,000 ft	Highs: 37°C/98°F Lows: 0°C/32°F	50-100 cm per year	Nutrient rich; well-drained	Wind resistant; low rainfall and thick grasses inhibit the growth of trees and shrubs	Flat, broad teeth and digestive systems to eat grasses; birds nest on ground
Aquatic	Below sea level to high elevation lakes, over 5,000 m / 16,400 ft	Average ocean temperature 4°C/39°F Freshwater variable, below freezing to over 50°C/122°F	Extremely variable	Extremely variable	Adapated to tidal changes, flooding/ drought	Gills to breathe; toe webbing, flippers to swim; eyes & ears placed high on head

Ecosystems

What is an Ecosystem?

You have just learned all about biomes. Can you define a biome in your own words? Just a reminder, biomes are networks of many ecosystems spread over a large geographical area, characterized by their vegetation, soil, climate, and wildlife. The boundaries of biomes are not rigidly formed, and many flow into one another through areas called transition zones or **ecotones**.

An **ecosystem** is the complete interactions of the living (biotic) and non-living (abiotic) components of a specific area. An ecosystem can be as large as the Serengeti Plain or as small as a backyard pond. Take a coral reef for example. This complex, colorful structure houses tropical fish, elaborate anemones, and other plant and animal life within crystal clear waters, where rays of sunshine penetrate. How everything (the fish, anemones, coral, vegetation, water and sunlight) interacts with each other forms a coral reef ecosystem.

Most regions of the world and the countries found there support many different ecosystems all at once.

Where Waters and Land Collide

So far, we have talked about freshwater and saltwater as being very separate systems. Most often they are. However, there are times when vast flowing rivers mingle with the sea. Where freshwater and salt water combine, estuaries of **brackish** (slightly salty) waters are formed. High ocean tides push saltwater into the estuary, while large quantities of freshwater enter from the mouths of rivers. These environments are some of the most biologically productive on Earth. Here, organisms have to withstand varying concentrations of salinity, temperature, and water exposure, as well as soil with extremely low or no oxygen. The largest estuary in the world is the **St. Lawrence River.** This river flows from the **Great Lakes** in North America into the Atlantic Ocean. The smallest estuary in the world is the **Adzhalyk Estuary** in the Ukraine, which also connects with the Atlantic Ocean. Sea birds, shellfish, fish, reptiles, raccoons, and other animals can all be found in estuaries.

Wonderful Wetlands

Swamps, vernal pools, bogs, and marshes are all considered **wetlands**. Wetlands can be found on every continent except Antarctica. They are defined as lands where the soil is sometimes or always covered with water or where water is at or near the surface of the soil. This abundant saturation of water creates a unique environment for animals and plants specially adapted to these wet conditions. However, all wetlands are not alike. Their make-up varies due to soil type, water type, vegetation, climate and other factors.

There are two main types of wetlands. **Coastal wetlands** consist mainly of brackish water. These wetlands are affected by salinity levels and by the rising and ebbing tide which can affect water flow and distribution. Many special plants, like mangroves which are found in the tropics, have adapted to the high levels of salt in their environment. **Inland wetlands** are located mainly on edges of rivers or streams or can be found in isolated depressions surrounded by dry land.

Wetlands worldwide provide habitat for a great diversity of animals including herons and ducks, beavers, turtles, fish, insects, and crustaceans, as well as a multitude of plants. Migrating birds often use wetlands as a place to rest and feed during their long journeys across the globe.

Wetlands play a major role in improving water quality. They filter sediments, pollutants and nutrients from the water, maintaining the health of the ecosystem for the plants and animals that live there. Don't forget to thank a wetland for helping to keep our water clean. Wetlands also hold excess water in the environment. If you have ever cleaned up spilled water with a sponge, you have an idea of how a wetland works. By storing water, wetlands can help prevent flooding and reduce erosion. Some of our food staples such as wild rice, fish, and shrimp are all produced in wetlands. In addition, many medicines are derived from plants found here.

Furthermore, writers, painters, photographers, and anyone who enjoys the sights and sounds of nature are continually inspired and awed by the beauty of these watery sanctuaries.

A Special Look at Mangroves

Mangrove forests are found mainly in tropical and sub-tropical coastal regions. Mangrove trees have adapted to manage the high levels of salt in their environment. Some types of mangroves store the salt in their leaves so that when the leaves fall, the salt falls with them. Other types have developed salt-secreting glands. They can excrete so much salt with these glands that it is sometimes visible on their leaves! Their roots, which look to be a tangled maze, help stabilize the soil. They also help these trees "breathe." Special roots grow above the mud.which have tiny openings that allow air to enter and reach the roots growing beneath the ground.

Where Earth meets Sky

Over the course of history, there have been significant changes to the surface of the Earth. The tectonic plates found on the Earth's crust are ever moving, and constantly changing the world around us. As these plates move, ever so slowly, they stretch, rub and clash with each other. Major collisions over time have created the Earth's great mountain ranges.

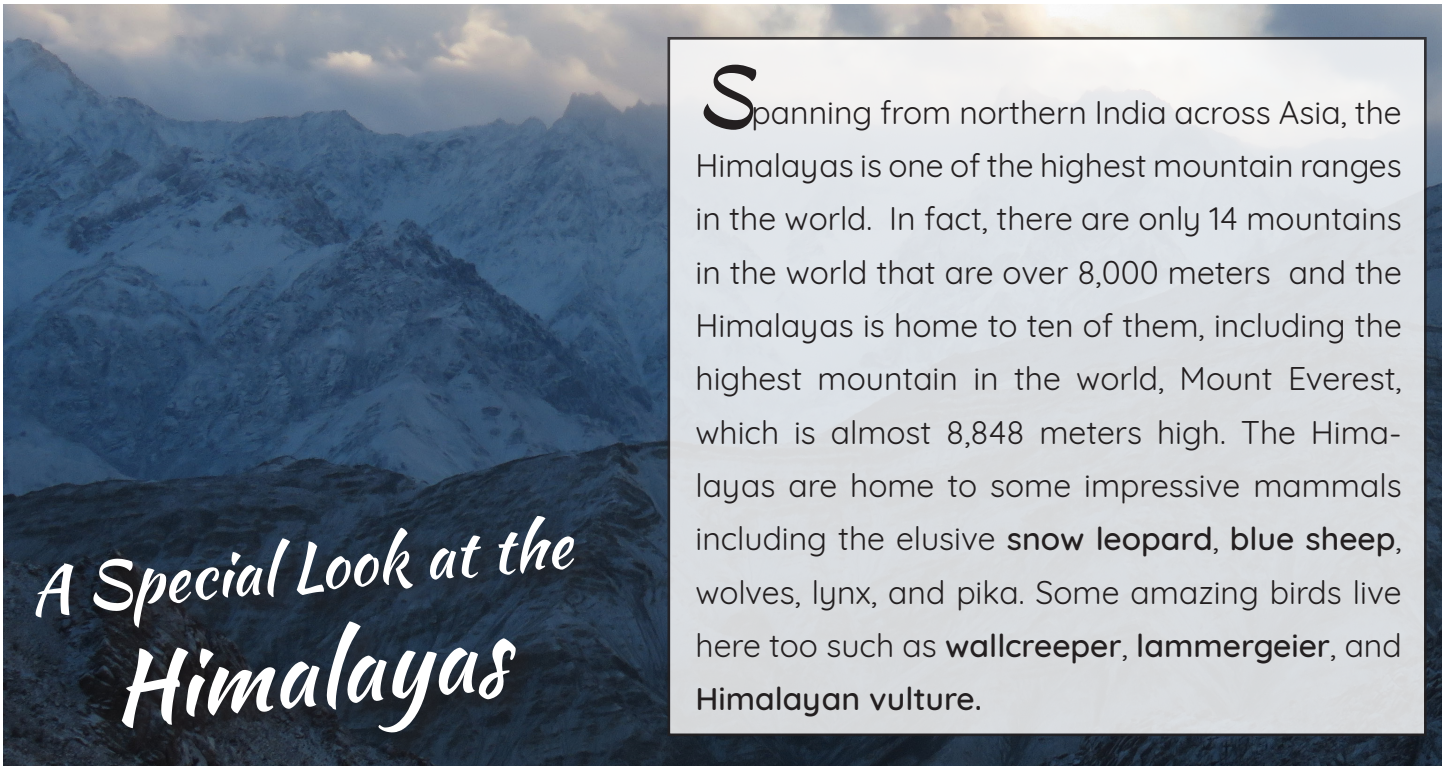
A mountain is an elevated area of land that rises abruptly from its surroundings. To be considered a mountain, it must rise at least 300 meters above the bordering land. Many mountains together form ranges that extend for great distances. Mountains are found on land and in the oceans and seas, often peaking above the surface to form islands. Many mountains are of volcanic origin. Some remain active as volcanoes, while others lack volcanic activity. Different types of mountains include volcanic, fold, fault-block, dome and plateau mountains, all defined by the way they have been formed and their distinctive appearances. Furthermore, weathering and erosion continue to shape mountains long after they form.

There are several major mountain ranges on Earth. In Asia, the **Himalayas** contain the tallest mountains in the world, including **Mount Everest**, **K2**, **Lhotse**, and **Annapurna**. In South America, the **Andean Mountain Range** stretches from northern Colombia

and Venezuela to the southern tip of Argentina, making the Andes the longest continental mountain range in the world at 7,000 km in length. It contains deep Inter-Andean valleys and high-elevation plateaus. **Aconcagua** in Argentina, at 6,961 m is the highest mountain outside of Asia. **Chimborazo** in Ecuador, which peaks at 6,263 m, is the farthest point from the center of the Earth, due to the equatorial bulge caused by the earth's rotation. Other major mountain ranges include the **Atlas Mountains** of northwestern Africa, the **Alps** in Europe, and the **Rocky Mountains** in North America.

From a distance, mountains can look uniform or simple. The highest mountains on Earth, even in the tropics, are snow-capped, with frigid temperatures and extreme conditions. Mountain ranges even create their own climate, blocking wind and rain, promoting specific cloud formations, and affecting adjacent ecosystems significantly. At a closer look, mountains are home to many different ecosystems, and even different biomes! Alpine tundra is specifically found on mountains, hosting ecosystems specialized for high elevation. We find boreal forest, cloud forest, paramo and many other ecosystems on mountains. They hold great biodiversity.

Many animals and plants are specifically adapted to live at high elevations, and won't be found anywhere else. They must adapt to strong winds, extreme temperatures and changing seasonal conditions. Surprisingly, many of the Earth's tiniest birds—hummingbirds—are at home in the highlands of the Americas. They feed specifically on plants found in the region. To deal with low tem-

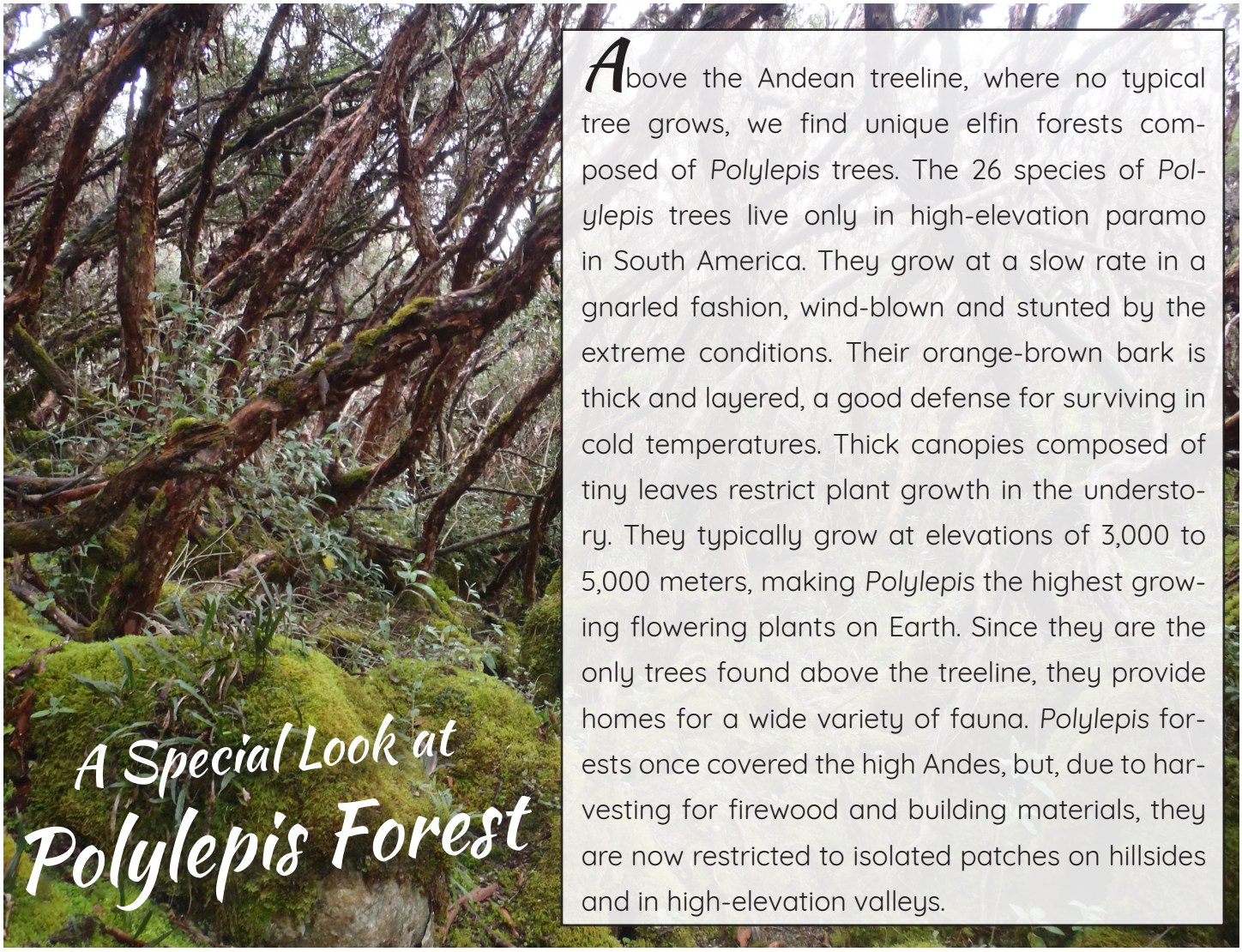


A Special Look at the Himalayas

Spanning from northern India across Asia, the Himalayas is one of the highest mountain ranges in the world. In fact, there are only 14 mountains in the world that are over 8,000 meters and the Himalayas is home to ten of them, including the highest mountain in the world, Mount Everest, which is almost 8,848 meters high. The Himalayas are home to some impressive mammals including the elusive **snow leopard**, **blue sheep**, wolves, lynx, and pika. Some amazing birds live here too such as **wallcreeper**, **lammergeier**, and **Himalayan vulture.**

peratures at night, hummingbirds enter into a state of torpor, in which they drop their heart rate to survive the cold conditions. They also tend to be bigger and fly slower than other hummingbirds found at lower elevations.

On rocky mountain slopes we also find many species of ungulates—goats, sheep, antelope, and deer—that are quite comfortable moving around the rocky landscape with their hoofed feet. Pikas and rodents nestle perfectly among the rocks, and predators such as mountain lions and **snow leopards** use superb camouflage to hunt large prey on these high rocky slopes.



A Special Look at Polylepis Forest

Above the Andean treeline, where no typical tree grows, we find unique elfin forests composed of *Polylepis* trees. The 26 species of *Polylepis* trees live only in high-elevation paramo in South America. They grow at a slow rate in a gnarled fashion, wind-blown and stunted by the extreme conditions. Their orange-brown bark is thick and layered, a good defense for surviving in cold temperatures. Thick canopies composed of tiny leaves restrict plant growth in the understory. They typically grow at elevations of 3,000 to 5,000 meters, making *Polylepis* the highest growing flowering plants on Earth. Since they are the only trees found above the treeline, they provide homes for a wide variety of fauna. *Polylepis* forests once covered the high Andes, but, due to harvesting for firewood and building materials, they are now restricted to isolated patches on hillsides and in high-elevation valleys.

Habitats

From humans to hippos, from butterflies to buffalo, from cactus to coyotes, every living thing needs a place to live, food for energy, a source of water, and enough shelter and space. The order and arrangement of these elements is called a habitat. Many animals share habitats with each other, and with many species of plants. Habitat size can range from hundreds of acres to a small patch of grass. Animals that migrate may utilize many different types of habitats on route to their final destination. Even large cities contain habitats for plants and animals. What animals and plants are living just outside your door?

Wild Places

A habitat is the home or environment of an animal, plant or organism. For example, **harpy eagles** can find everything they need in their abundantly diverse tropical rainforest territories. Harpy Eagles require large tracts of mature lowland rainforest to provide them with space to move. They need other harpy eagles to breed with. They need tall, emergent trees in which to build their nests and to roost or rest. They require a varied diet, and mainly hunt **arboreal** animals such as monkeys and sloths.

A harpy eagle, by nature, must share its habitat with many different types of animals, many of which it hunts to survive. This raptor's rainforest habitat also has plenty of rivers, streams, and rain that provide an abundance of water. Their large size and strong wings enables them to hunt larger prey found in the canopy. The harpy eagle would not easily survive

in a different habitat, such as the open plains of Africa or deserts of the arid southwestern United States. These regions lack enough large trees for nesting, perching and shelter, and very little arboreal prey. Animals may use a habitat year-round, others, such as migratory species, may use habitats seasonally.

Microhabitats are those habitats that provide something different than the surrounding ecosystem. They may have unique characteristics, and plants and animals that live there. A microhabitat can be a fallen log, the soil beneath a rock, or a seasonal pond. If we take a closer look at this same forest where the harpy eagle lives, we might find a small puddle that formed during the rainy season. This puddle could provide a seasonal, microhabitat for a frog. Here small insects will lay their eggs as will frogs. When the tadpoles hatch, they feed on insect larvae to survive.

Wild Neighbors

When we think of an animal (or plant) in its habitat, we probably most often imagine it living within a lush forest, an arid desert, near a roaring river, or other natural landscape. While this is true for many of the wild things we share this planet with, others have adapted to living side by side with humans in even the most urban environments.

In the middle of some cities around the world, relatively small patches of forests, wetlands and other wildlife habitats remain. Here, surrounded by highrises and highways, nature can be surprisingly abundant. Just a few examples of these include **Central Park**, in New York City, **Lake Alarobia** in Madagascar, **Metropolitan Natural Park** in Panama City, and **Nairobi National Park** in Kenya where lions and giraffes still roam.

Still, many other animals have learned to make their homes in the heart of major cities. Perhaps the best example of this is the **rock pigeon**. These feral birds populate just about every city in the world. They nest on buildling ledges, feed on food scraps, and roost and rest on rooftops. The abundance of these birds has actually attracted some raptors, such as the **peregrine falcon**, to cities around the world. Peregrine falcons are specialized in hunting birds, and pigeons make a terrific meal. Because peregrine falcons naturally nest on cliffs they have adapted to nesting on building ledges or bridges in cities. Cave swallows, coyotes, geckos, spiders and many other organisms have found a way to survive in cities. If you live in a major city, or if you visit one, try to spend some time looking for wildlife. You might be surprised at what you find!

Many people who live in cities work hard to attract wildlife to their own backyards or neighborhoods by providing them with the space, shelter, food and water sources they need to survive. Bird feeders and bird baths can attract a host of bird species year-round. Specially designed boxes provide important nesting habitat for owls, swallows, ducks, and kestrels, and important roosting habitat for bats. Planting flowers and fruiting trees or bushes can bring butterflies, birds, and bees to the city. A pile of logs or branches, tall grasses and leaf piles provide habitat for spiders, crickets, lizards, and small mammals.

Niches

Whether pollinator, producer, predator or prey, every single organism on the planet has an important job to do in the ecosystem in which it lives. The job, or role that an animal, plant or organism plays in its environment is called an **ecological niche**. How an organism is adapted to its environment and how it relates with the living and nonliving elements of its environment defines its niche, or role, in an ecosystem.

Take a moment to think about your favorite wild animal. Is it a wolf? A snake? Maybe you are fond of aardvarks, spiders, jellyfish, or dolphins. What about wolverines? Or meadowlarks or ladybugs? No matter which animal comes to mind, we guarantee that it, like all living things, has an important job to do in nature. Every living thing is a key component of the ecosystem in which it naturally lives and all play a role in keeping nature in balance.

Organisms such as bees, bats, butterflies, moths, and hummingbirds help **pollinate** flowers. They move from flower to flower to feed on their nectar. As they do so, flower pollen clings to their feet, feathers or faces. When they move on to the next flower, they are unwittingly transferring pollen.

Some fruit-eating birds, squirrels, agoutis, and other animals help disperse and plant seeds so new trees grow. Birds do this by swallowing fruits and seeds. When the seeds pass through their digestive system, they are still viable and often germinate.

This helps trees and other vegetation grow in areas away from their "mother trees." Squirrels and agoutis, on the other hand, dig holes in the ground where they store nuts and seeds that they can dig up later to eat. But sometimes they forget where those seeds are buried! When that happens, the seeds have time to germinate and grow into trees.

Woodpeckers, too, are important for the health of trees. They find and eat potentially harmful insects that could do great damage to the leaves or bark of trees.

Lions, eagles, wolves, and leopards are all top predators. They help control prey populations and maintain equilibrium in the ecosystems in which they live. Even though they are all predators and there will be overlap in some of the prey they hunt, depending on the size, habitat and adaptations of each predaator, each will hunt slightly different animals. This avoids direct and total competition, allowing for many different predators to share habitats.

If you have ever been to the beach, a lakeshore, a wetland or other river, you might have noticed a few different types of shorebirds feeding in the same area or very close to one another. It might seem like they are all competing for the same food. However a closer look might reveal that the different species also have beaks of different lengths, meaning some are foraging for food closer to the surface, while others are probing for worms, mollusks, or crabs further beneath the sand or mud.

When we talk about niches, it is also important to remember the second part of what a **niche** is. It is not only how an animal interacts with other living things, but also the needs it has in its own environment such as where it raises its young, how it finds food, and how it escapes predators. Some animals have very specialized niches, for examples some birds that nest only in certain types of trees or that specialize in eating one type of prey.

It is important to include both parts of this definition when talking about ecological niches. You might be surprised to learn that fly larvae and fungi perform a similar role in the environment. Both of them act as **decomposers**, breaking down animal matter, which helps nutrients return to the soil. But, they don't fill the exact same niche and they don't compete with one another for survival. Think about what a fly needs to survive, where it lives, and how it finds food, compared to the needs of fungus.

How are they similar?
How are they different?

We are going to be learning much more about the special niches many different animals have in the next chapter.

Read and reflect...

Wow! Give yourself a pat on the back! You just learned a lot about biomes, ecosystems, habitats, and just some of the plants, animals and other organisms that call these places home. And don't forget, you, too, live in a biome, an ecosystem and a habitat!

In this unit, we delved into some of Earth's major biomes, ecosystems and habitats. But we only touched the surface of all the fascinating plants, animals, and other organisms we share this planet with. Whether studying the makeup of an entire biome, finding similarities between vultures and ants, or seeking to understand a mushroom's niche, there is still so much for us to learn about this planet we call home.

While we hope this unit helped answer some questions you might have had about our wonderful and fascinating natural world, we also hope it left you with a curiosity to learn more.

If so, we invite you to make a list of questions you would like the answers to in a journal or other place you can easily access your questions and make notes. Now, work on your own, with family members, friends, or your teacher to discover the answers to some of these questions. Using scientific resources, talking with an expert, and making your own observations are just some of the ways you can go about this.

Finally, take a moment to think about the quote at the beginning of this unit. *"Nature is not a place to visit. It is home."* What does this quote mean to you? Does it mean something different now that you have learned a little more about our natural world?

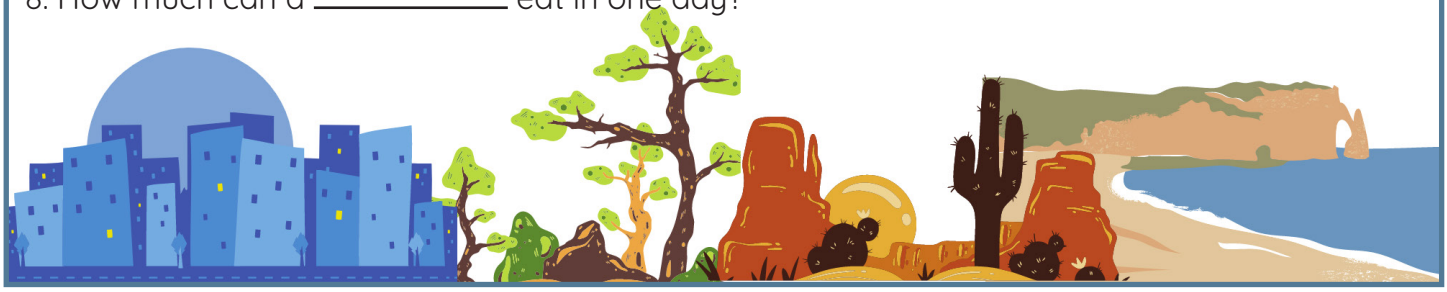
Can you give an example, using something you just learned, to illustrate what this quote might mean? Is the author speaking metaphorically? Is he being literal? What if you think of the quote from a tiger's perspective? Or a flower's? Does nature mean something different to non-humans than to humans? Why or why not? Should it?

explorer's corner

my backyard

Next time you are outside, take a moment to stop, look and listen. What questions might you have about the natural world in your backyard, neighborhood or town? What types of habitats are found near your home? What niche might a particular animal have? Here are some sample questions to get you started. Be sure to fill in the blanks with animals or plants near you, or come up with your very own questions.

1. Where do _____ nest?
2. Why aren't there _____ in my neighborhood?
3. Where do _____ find water?
4. Why do some animals bury _____?
5. Why do some animals use _____ to survive, while others don't?
6. What is the tallest/smallest _____ in my neighborhood ?
7. Where do _____ go at night?
8. How much can a _____ eat in one day?



Before you go, be sure to review the definitions of biomes, ecosystems, habitats, and niches.

BIOME

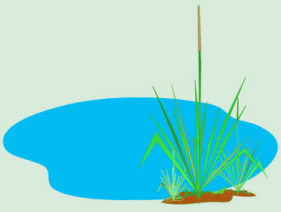
A large area characterized by its vegetation, soil, climate, and wildlife.

ECOSYSTEM

The interaction of living organisms and non-living elements in a particular area.

HABITAT

A natural home or environment of an animal, plant or other organism.



NICHE

The role that an animal, plant, or other organism plays in its environment.

Abiotic - non-living components of an ecosystem such as temperature or ocean currents

Acidic - having a pH o 6.9 or less

Adaptation - a change in structure, function or behavior of an organism which improves its chances of survival in a specific environment or condition

Alkaline - having a pH of 7 or higher

Arboreal - relating to an animal that spends most or all of its time in tree.

Biodiversity - each and every living thing on Earth, or within a specific biome, ecosystem, habitat, or other region

Biome - a large area characterized by its vegetation, soil, climate and wildlife

Brackish - a mix of saltwater and freshwater

Community - a group of different species that live together and interact in the same habitat or environment

Deciduous - a tree or shrub that loses its leaves and regrows new ones every year

Decomposer - an organism that helps break down organic matter and return associated nutrients back to the soil

Dormant - when the normal physical functions of an organism are temporarily slowed or stopped

Ecosystem - the interaction between living and non-living elements in a particular area

Ecotone - an area where one biological community meets another

Endemic - an organism native and restricted to a specific geographical place

Epiphyte - a plant that grows on the surface of other plants

.

Evergreen - trees or shrubs that keep their leaves all year round

Habitat - a natural home or environment of an animal, plant or other organism

Neotropical - pertaining to the tropical regions of the Americas, including southern Mexico, Central and South America, and the Caribbean

Niche - the role that an animal, plant or organism plays in its environment

Organism - an individual form of life composed of a single cell or a complex of cells in which organelles or organs work together to carry out the various processes of life. An organism is capable of growing, metabolizing nutrients and (normally) reproducing

Population - the number of organisms of the same species that occupy a particular area

Permafrost - ground that is completely frozen and remains so all year round, for several years (at least 2) in a row

Pollinate - to transfer pollen from the male part of the flower (anther) to the female part (stigma)

Stagnant - a body of water in which the water doesn't move or flow

Subterranean - underground

Sustainability - meeting the needs of the present without compromising those of future generations. Refers to natural resources as well as social and economic resources

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