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## The World's Biomes

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### The World's Biomes

A *biome* is a large region where a distinct variety of plants and animals live together. Each biome has its own particular *climate*, or the average weather in an area. This poster shows some of the world's major land **biomes**. Explore the color-coded map, *right*, and images to learn what makes these **biomes** so unique.

[\(See picture, "Map: Biomes."\)](#)

#### Temperate Forest

This biome has four seasons: winter, spring, summer and fall. By winter, the biome's *deciduous* trees have shed their leaves, which grow back in the spring. In the fall, the leaves' green pigment, or *chlorophyll*, breaks down to reveal reds and yellows. Many birds and mammals live here.



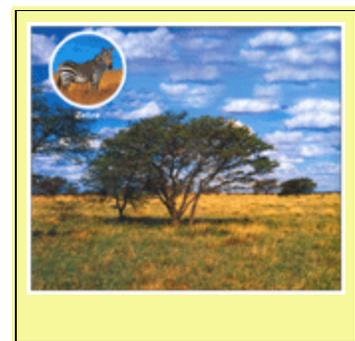
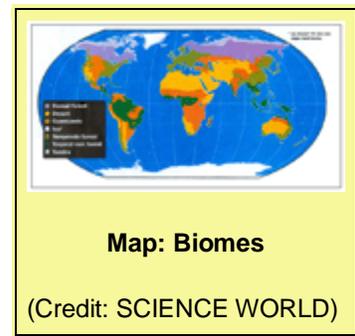
**Temperate Forest Biome  
and Great Horned Owls**

(Credit: Gunter Marx  
Photography/Corbis; Owls:  
Lynn M. Stone/Nature  
Picture Library)

[\(See picture, "Temperate  
Forest Biome and Great Horned Owls."\)](#)

#### Grasslands

These open, flat areas are covered with grasses and few trees. Tropical grasslands, called savannas, are warm all year, with a wet and a dry season. Zebras, elephants, and rhinos roam the savannas. Temperate grasslands, like the Great Plains, have hot summers and cold winters.



[\(See picture, "Grasslands Biome and Zebra."\)](#)

### Tropical Rain Forest

Found near Earth's *equator* (imaginary line around Earth's middle), this biome gets lots of sunshine and more than 2.5 meters (8 feet) of rain a year. This warm biome supports the world's greatest diversity of plants and animals, including frogs, monkeys, and birds.

### Grasslands Biome and Zebra

(Credit: Charles O'Rear/Corbis; Zebra: Stan Osonlinski/Corbis)

[\(See picture, "Tropical Rain Forest Biome and Red-Eyed-Tree Frog."\)](#)

### Tundra



### Tropical Rain Forest Biome and Red-Eyed Tree Frog

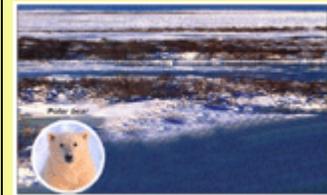
(Credit: Frans Lanting/Minden Pictures; Frog: Premaphotos/Animals Animals)

In this biome, temperatures can dip below freezing (0°C, or 32°F) for 10 months a year. It's so cold that a layer of earth below the soil stays frozen all year. This *permafrost* keeps out deep-rooted trees. Most residents use the tundra as a summer home. An unusual year-round dweller: the polar bear.

[\(See picture, "Tundra Biome and Polar Bear."\)](#)

### Desert

This biome receives less than 25 cm (10 in.) of precipitation a year. Hot deserts, like those in Australia, stay toasty all year, while cold deserts, such as Mongolia's Gobi Desert, can be chilly. To survive, reptiles and mammals, such as the red kangaroo, have adapted to little water and intense sunshine.



### Tundra Biome and Polar Bear

(Credit: Jeremy Woodhouse/Photodisc/Getty Images; Polar Bear: John Conrad/Corbis)

[\(See picture, "Desert Biome and Red Kangaroo."\)](#)

### Boreal Forest



### Desert Biome and Red Kangaroo

(Credit: Ted Mead/WWI/Peter Arnold; Kangaroo: Frans)

Lanting/Minden Pictures)

This belt of *coniferous*, or cone-bearing, trees stretches across northern Asia, Europe, and North America. Winters are long and snowy, while summers are short and cool. Many birds, such as the common redpoll, migrate north to breed in the boreal forest during its brief summer.

[\(See picture, "Boreal Forest Biome and Common Redpoll."\)](#)

• Sources: Berkeley Natural History Museum; NASA-Supported Classroom of the Future. A Supplement of *Science World*.

## Biome Survival: Part I

Each biome has a unique climate. So each biome's plants and animals have developed a variety of *adaptations*, or traits that help them survive in their environment. Study the chart below to learn about each biome and how certain plants and animals are adapted to live there.

**Biome: Temperate Forest:** This *temperate* biome is located between the polar regions and the tropics. The forest has four seasons: a cold winter, warm summer, and two in-between seasons--spring and fall. By winter, the forest's deciduous trees have lost their leaves, which re-grow in the spring.

**Animal Adaptations:** Gray squirrels and chipmunks gather nuts and store them underground. This ensures that they'll have food during the chilly winter when food is scarce.

**Plant Adaptations:** Some plants fill their stems with a sugary solution, which keeps water in the stem from freezing during the winter.

**Biome: Grasslands:** These open, flat areas are covered with grasses and few trees. There are two main types: Tropical grasslands, called savannas, are warm all year, with a wet and a dry season. Temperate grasslands have hot summers and cold winters.

**Animal Adaptations:** During the dry season, elephants use their strength to tear open the trunks of baobab trees, which store water in their trunks. Then, the animals drink up.

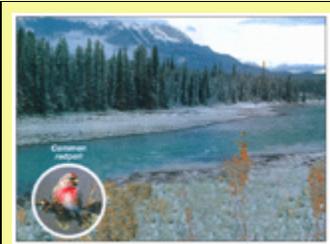
**Plant Adaptations:** During the savannas' dry season, many grasses shed their leaves to reduce *transpiration*, or the loss of water vapor through pores in the leaves.

**Biome: Tropical Rain Forest:** Found near Earth's *equator* (imaginary line around Earth's middle), tropical rain forests get lots of sunshine and plenty of rain--more than 2.5 meters (8 feet) a year. The rain forest supports the world's greatest diversity of plants and animals.

**Animal Adaptations:** The toucan's long bill helps it reach fruit on branches that are too fragile to support the weight of some birds that are competing for similar resources.

**Plant Adaptations:** Many trees sport leaves with pointed "drip tips" that let water droplets from plentiful rainfall roll off easily.

**Biome: Tundra:** Spanning the Arctic Circle, the tundra is the coldest and snowiest biome. Temperatures can dip below freezing (0°C, or 32°F) for 10 months a year. During this biome's short summer, the sun stays overhead 24 hours a day melting the snow for a brief period.



**Boreal Forest Biome and Common Redpoll**

(Credit: Carr Clifton/Minden Pictures; Bird: Jim Zipp/Photo Researchers, Inc.)

**Animal Adaptations:** The arctic hare and arctic fox sport white coats. This form of *camouflage* helps them blend in with the snow so they are nearly invisible to predators.

**Plant Adaptations:** The arctic willow has shallow roots so it can survive in the soil atop the *permafrost*. This layer of frozen earth beneath the soil makes it impossible for deep-rooted trees and plants to take hold.

**Biome: Desert:** This biome receives less than 25 cm (10 in.) of precipitation a year. With no moisture-rich clouds to block sunrays, daytime sun can be intense. Hot deserts, such as those in Australia, stay toasty all year, while cold deserts, such as Mongolia's Gobi desert, can be chilly much of the year.

**Animal Adaptations:** The thorny devil lizard has a body covered with tiny spines. At night, dew forms on the lizard's back. The spines channel the water to its mouth.

**Plant Adaptations:** The barrel cactus has a pleated shape that lets it expand like an accordion. That way, it can store more rain water in its tissues.

**Biome: Boreal Forest:** This belt of *coniferous*, or cone-bearing, trees stretches across the northern portion of North America, Europe, and Asia. Winters are long and snowy, while summers are short. Temperatures can stay below freezing (0°C, or 32°F) for six months a year.

**Animal Adaptations:** Some animals, such as black bears, *hibernate*, or sleep through the cold winter. During this time they fast, relying on stored fat for energy.

**Plant Adaptations:** Conifers, such as pine and spruce, have a conical shape that lets the heavy snow easily slide off their branches.

## Biome Survival: Part II

Study the chart (*Biome Survival: Part I*) describing the world's **biomes** and adaptations that help plants and animals thrive in their habitats. Then, read the questions below and circle the correct answer.

1. In which **biomes** do plants have adaptations to store scarce water?

- a. tropical rain forest and tundra
- b. desert and tropical rain forest
- c. desert and grasslands
- d. tropical rain forest and temperate forest

2. What adaptation allows the toucan to obtain hard-to-reach food?

- a. It has claws to break off tree branches.
- b. Its long bill lets it nab fruit on thin branches.
- c. A sharp tooth on its beak helps it pierce fruit.
- d. Flat teeth help the toucan grind up leafy snacks.

3. Trees CAN'T grow in the Arctic because

- a. the ground is too soggy.
- b. trees can't compete with the arctic shrubs for nutrients.
- c. trees' deep roots can't penetrate the permafrost.
- d. grazing animals prevent trees from growing.

4. Which of the following is the most likely reason why brightly colored animals don't live in the tundra?

- a. With so much white snow, the animals would stand out as easy targets for predators.
- b. Bright colors would absorb too much sunlight.
- c. The animals would blend in and get lost.
- d. Bright colors could startle other tundra animals.

5. Which adaptation helps rain water roll off the rain-forest trees?

- a. Lightweight leaves
- b. Thick bark
- c. Broad leaves
- d. Drip tips on leaves

6. Why is having spines advantageous for the thorny devil lizard?

- a. The sharp spines are good for nabbing prey.
- b. The spines channel water to the lizard's mouth.
- c. Lizards need spines for locomotion.
- d. The lizard can store water in its spines.

7. Where would you most likely find a tropical rain forest?

- a. near Earth's equator
- b. in the Arctic
- c. at the North Pole
- d. in Mongolia

8. Deserts receive less than \_\_\_ centimeters of precipitation a year.

- a. 10
- b. 25
- c. 50
- d. 100

9. Why do conifer trees have a conical shape?

- a. Any other shape would block sunlight from the forest floor.
- b. A cone shape lets more trees crowd together.
- c. The shape lets snow slide off the branches.
- d. The pointy top helps the tree withstand high winds.

10. By winter, deciduous trees

- a. have grown new leaves.
- b. have lost their leaves.
- c. have died.
- d. have colorful leaves.

## Treetop Resort

Every year up to 3 billion birds--more than 300 different species--migrate to the boreal forest to *breed*, or reproduce. Study the map below showing the spring migration routes of four species of birds. Then, use complete sentences to answer the questions that follow.

[\(See picture, "Map: Spring Migration Routes of Birds."\)](#)

1. Which bird begins its northward journey from the Dominican Republic?
2. How many U.S. states does the whooping crane fly through before reaching the boreal forest?
3. Which birds' migration routes are located entirely west of the Mississippi River?
4. If you were on a boat in the Atlantic Ocean in late spring, which bird might you spot in the sky?



**Take It Further:** Research to find some other birds that migrate to the boreal forest. Then, choose one and sketch its approximate migratory route on this map. For help, visit: [www.boreafforest.org/world/birds.htm](http://www.boreafforest.org/world/birds.htm)

## What's the Weather?

To get a snapshot of a biome's climate, scientists create *climographs*, or graphs that show the area's average precipitation and temperature for every month of the year.

Below is a data table showing the average monthly rainfall and temperature for a particular biome. Use the data to create climographs. Then, answer the questions to figure out which biome these data represent.

Climate Data

Month	Average Rainfall (Millimeters)	Average Temperature (Celsius)
January	249	27.5
February	231	27.5
March	262	27.5
April	221	27.5
May	170	27.5
June	84	27.5
July	58	28
August	38	28.5
September	46	28.5
October	107	28.5
November	142	28.5
December	203	28

• Source: The Met Office

Graph It!

Using the data table (*above*), make two line graphs: one showing the average temperature for each month, and the other showing the average rainfall for each month. Label the x- and y-axes.

### Sort It Out

1. Review your two graphs. In which month does this biome receive the most rainfall? How much?
2. Using the data table, calculate the average yearly rainfall. **Hint:** Add up the monthly rainfall amounts, and divide that total by 12.
3. Which biome--rain forest, desert, or tundra--would you expect to have the highest rainfall throughout the year?
4. Using the data table, calculate the difference between the average temperature in July and the average temperature in January.
5. Which biome--rain forest, desert, or tundra--best fits with the data and your climographs?

## Carbon Cleanup

When you flip on the television, you are using electricity. Much electricity comes from power plants, where fuels--such as oil--are burned to create electricity.

The downside: Burning *fossil fuels* produces carbon dioxide. This *greenhouse gas* can trap heat in the atmosphere, leading to an overall warming of the planet. But trees can help to remove some of this gas. These green giants take in carbon dioxide from the air to carry out *photosynthesis*. In this process, plants capture energy from sunlight to turn carbon dioxide and water into food.

How many trees would it take to absorb the carbon dioxide that's produced when you use everyday appliances? Use the equation below to find out. Then, fill in the table and answer the questions that follow.

### Equation

- a. Each mature tree can remove roughly 11 kilograms (kg) of carbon dioxide a year.
- b. Use this equation to calculate the number of trees needed to absorb the carbon dioxide released each year from the use of certain appliances: (kilograms of carbon dioxide released) divided by (11 kilograms of carbon dioxide absorbed per tree) = number of trees. **Hint: Round up your answer.**

Home appliance	Average carbon dioxide released each year per household (Kg)	Number of trees needed to absorb the released carbon dioxide
Television	62	—
Home computer	119	—
Refrigerator	562	—

• **Source: U.S. Department of Energy**

1. Which household appliances require more than 40 trees to offset the carbon dioxide that is produced from powering each?
2. The use of which home appliance would cause the most carbon dioxide to be produced? How much?
3. Suppose a household used all of the appliances on the data table. What is the total amount of carbon dioxide produced in one year from using the appliances? How many trees would it take to absorb that amount?

## Worldly Words

The front and back of this poster are filled with vocabulary words. Use them to solve the clues below and complete the crossword puzzle. Then, unscramble the letters in the parentheses to spell out the bonus words.

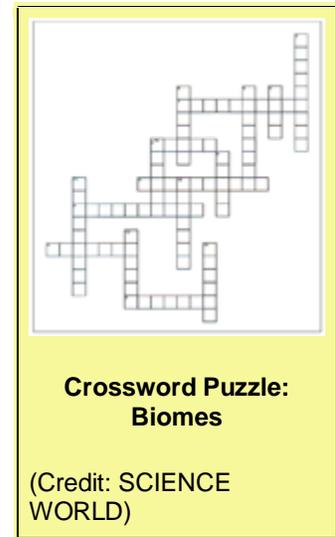
[\(See picture, "Crossword Puzzle: Biomes."\)](#)

### Across

1. Trait that helps a plant or animal survive in its environment: \_ \_ \_ \_ \_  
\_ \_ \_ ( \_ ) \_
2. A large region where plants and animals live together in a particular climate: \_ \_ \_ \_ \_
3. A layer of frozen earth that is situated beneath the soil: \_ \_ ( \_ ) \_ \_ \_  
\_ \_ \_ \_ \_
4. The arctic hare's white coat is a form of \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ , keeping it hidden from predators.
5. Imaginary line around Earth's middle: \_ \_ \_ \_ \_ \_ \_ \_
6. The average weather in an area: \_ \_ ( \_ ) \_ \_ \_ \_

### Down

7. Black bears ( \_ ) \_ \_ \_ \_ \_ \_ \_ \_ , or sleep through the winter.
8. Photosynthesis is the process that turns \_ \_ \_ \_ \_ ( \_ ) dioxide and water into food.
9. \_ \_ \_ \_ ( \_ ) \_ \_ \_ are tropical grasslands.
10. This biome supports many coniferous trees: \_ \_ \_ \_ \_ forest.
11. By winter, ( \_ ) \_ \_ \_ \_ \_ \_ \_ \_ trees have shed their leaves.



12. Many birds \_\_\_\_\_ ( ) \_\_\_\_\_ to the boreal forest to breed.

13. The tundra spans the \_\_\_\_\_ Circle.

14. The temperate forest has four seasons: ( ) \_\_\_\_\_, spring, summer, and fall.

**Bonus:** The boreal forest is named after "Boreas," or Greek god of the a. \_\_\_\_\_ b. \_\_\_\_\_.

## Resources

We want to thank Colby Loucks, senior conservation specialist at the **World Wildlife Fund (WWF)** for help in reviewing this poster. For more about his research and about WWF, visit:

[www.worldwildlife.org/science/staff/colby\\_l.cfm](http://www.worldwildlife.org/science/staff/colby_l.cfm)

This NASA site has well-organized information on land **biomes**. The site also includes two "missions," which challenge students to investigate the climate and plant life of different **biomes**. Visit: <http://earthobservatory.nasa.gov/LaboratoryBiome/>

On this Web site, students perform Internet research and use comparison-contrast diagrams to understand what makes various **biomes** unique:

[www.manatee.k12.fl.us/sites/elementary/palmasola/5thbiomecov.htm](http://www.manatee.k12.fl.us/sites/elementary/palmasola/5thbiomecov.htm)

Use climographs to learn more about the climate of selected **biomes**. Check out:

[www.cotf.edu/ete/modules/msese/earthsysflr/biomes.html](http://www.cotf.edu/ete/modules/msese/earthsysflr/biomes.html)

Take an online tour of some of Africa's **biomes**, including savannas, rain forests, and desert regions. You'll discover the ecology and culture that makes each place distinct, at:

[www.pbs.org/twnet/africa/explore/index\\_flash.html](http://www.pbs.org/twnet/africa/explore/index_flash.html)

Did you know that a giraffe's tongue can be as long as 53 centimeters (21 inches)? Discover other fun facts about the animals living in the African savannas, at:

<http://nationalzoo.si.edu/Animals/AfricanSavanna/afsavfact.cfm>

Interested in aquatic **biomes**? Check out this Missouri Botanical Garden site, which includes descriptions of both freshwater and marine **biomes**: <http://mbgnet.mobot.org/sets/>

To learn more about the world's desert **biomes** and what it takes to survive in these dry regions, go to: [www.livingdesert.org/deserts/default.asp](http://www.livingdesert.org/deserts/default.asp)

This educational site explores five **biomes**, and includes subdivisions within each biome. For instance, there are four distinct regions within the desert biome: [www.worldbiomes.com/](http://www.worldbiomes.com/)

This site from World Wildlife Fund (WWF) includes the common and scientific names for plants and animals found in the boreal forest: [www.wwf.ca/satellite/wwfkids/Boreal/Default.asp](http://www.wwf.ca/satellite/wwfkids/Boreal/Default.asp)

Take a virtual tour of life in the boreal forest by clicking on photos with accompanying text at this Natural Resources Defense Council site: [www.nrdc.org/land/forests/boreal/page1.asp](http://www.nrdc.org/land/forests/boreal/page1.asp)

## Answers

**Biome Survival: Part II**

1. c
2. b
3. c
4. a
5. d
6. b
7. a
8. b
9. c
10. b

### Treetop Resort

1. The Cape May warbler begins its northward journey from the Dominican Republic.
2. The whooping crane flies through six U.S. states before reaching the boreal forest.
3. The migration routes of the Pacific loon and the whooping crane are located entirely west of the Mississippi River.

4. You might spot a Hudsonian godwit in the sky.

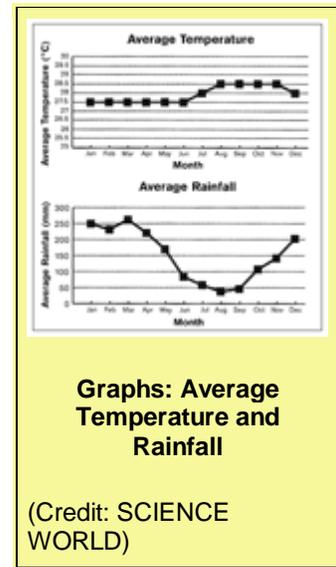
### What's the Weather?

#### Graph It!

[\(See picture, "Graphs: Average Temperature and Rainfall."\)](#)

#### Sort It Out

1. March; 262 millimeters
2. 151 millimeters
3. Rain forests have the highest rainfall throughout the year. The rain forest can receive up to 2.5 meters of rain a year.
4. 0.5°C
5. Rain forest



### Carbon Cleanup

Home appliance	Average carbon dioxide released each year per household (Kg)	Number of trees needed to absorb the released carbon dioxide
Television	62	6
Home computer	119	11
Refrigerator	562	51
Central air-conditioning	1,256	114

1. refrigerator, central air-conditioning
2. central air-conditioning, 1,256 kg
3. 1,999 kg, approximately 182 trees

### **Worldly Words**

1. Adaptation
2. Biome
3. Permafrost
4. Camouflage
5. Equator
6. Climate
7. Hibernate
8. Carbon
9. Savannas
10. Boreal
11. Deciduous
12. Migrate
13. Arctic
14. Winter

- Bonus:** a. North  
b. Wind