Temperate Rainforest Ecosystems

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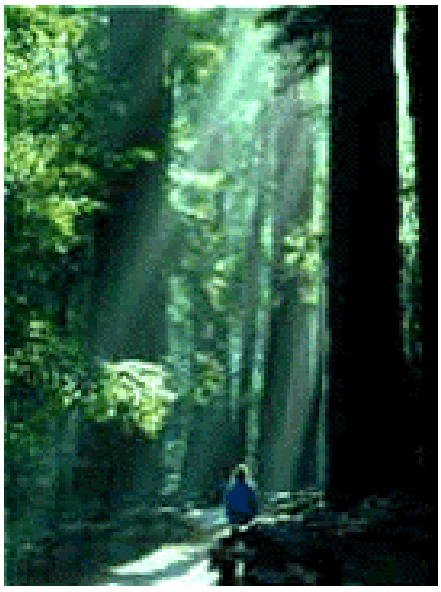
Focus Questions

What is a temperate rainforest?

How does a temperate rainforest compare to a tropical Rainforest?

When people hear the word ”rainforest” they most likely think of the lush jungle plants, colorful birds, high humidity, and heavy rainfall of tropical rainforests. These forests are found in Southeast Asia, Africa, South America, and Central America in countries such as Panama. But there is another kind of rainforest, called the temperate rainforest that exists right in the United States along the coastline of the Pacific Northwest and in Canada, and Alaska. Temperate rainforests are formed in the Pacific Northwest because the coastal mountain ranges in Washington, Oregon, and Northern California trap the air masses full of moisture that rise from the Pacific Ocean. As this moisture condenses into rain it creates lush rainforests with trees like the Coastal Redwood in California that grow to enormous sizes and a **biomass** that exceeds that of the tropical rainforests.



National Park Service photo

Walking through the giant redwood trees, while sunlight streams on to the forest floor.

What is a temperate rainforest?

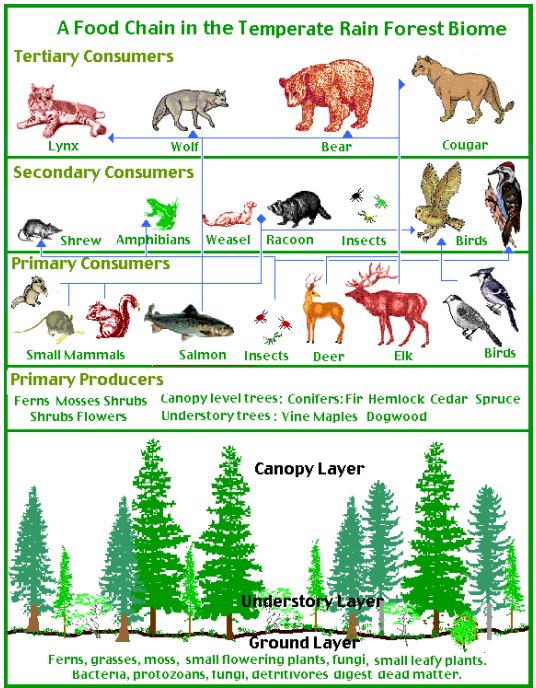
Temperate rainforests receive from 1,500 to 5,000 millimeters (60 to 200 inches) of rain a year. In California, the rainfall is closer to the lower end of the range and there is even a concern about drought in the summer months. The climate is mild (temperate) because the same mountains that block the ocean moisture help protect the rainforest from extremes in the weather. There are two seasons in the

temperate rainforest; one long, wet season where the temperatures rarely drop to freezing and one short dry season when the temperatures rarely exceed 80. Even in the dry season the climate is cool and cloud-covered with fog providing the necessary moisture to nourish the rainforest. Fog provides about 175-3,000 millimeters (7-12 inches) of rain each summer. Temperate rainforests cover only 75 million acres of earth.

Two-thirds of all temperate rainforests are in the Pacific Northwest. The trees grow to enormous sizes since the winters are mild and the rain is abundant. Many **epiphytes** are found in the temperate rainforests. Epiphytes are plants that grow on other plants. The maple trees have more epiphytes than any other tree and researchers cannot yet explain why. The maples here are covered with club mosses. Other trees have ferns, lichen, and mosses hanging from their branches. There is a fine mist in the air. The forest is always damp with water dripping from the tree branches and sunlight filtering through the canopy onto the forest floor.

What is the structure of the temperate rainforest?

Like the tropical rainforest, the temperate rainforest is divided into layers. The topmost layer is called the **canopy,** which is dominated by tall evergreen **conifers** (trees that produce cones with seeds). Because of the heavy rain and mild temperatures, these conifers enjoy maximum year-round growth and reach record heights and girth. Coastal redwood giants in California have reached heights of over 300 feet (the height of a 30 story building!). There are four additional conifers that grow in the rainforest. The next tallest is the Douglas Fir (up to 280 feet), followed by the Sitka Spruce (230 feet), the Western Red Cedar (200 feet), and the Western Hemlock (130 feet). Some of these trees may be up to 500 to 1000 years old and the trunk can be more than 100 feet around!



Courtesy of Dr. Elizabeth Anne Viau

Beneath the canopy is the **understory**. In this layer are found small shade-loving trees, such as the dogwood with its' beautiful pink and white flowers, and vine maples. Ferns, salal, and berry shrubs grow in the filtered sunlight beneath the small trees.

On the **forest floor**, the lowest layer, there is a thick covering of low-growing lichens, mosses, small plants (such as oxalis), wildflowers, and grasses. The ground is covered with conifer needles, leaves, branches, twigs, and fallen dead trees. Mosses and algae cover the rocks, tree trunks, and branches. Everything feels rich and moist and is very green on the forest floor. This shady, rich environment allows many varieties of mushrooms, toadstools, and other fungi to thrive. The soil here is especially full of nutrients because there is much dead **organic** material on the ground being broken down by **decomposers** such as bacteria and insects. Because the temperatures are cool, the material is broken down and recycled much more slowly than in the tropical rain forest. Scientists have measured more biomass (living things) in each square yard of this forest than anywhere else on Earth.

When a huge tree (usually a Sitka Spruce) dies and falls onto the forest floor, small seedlings often take root on the horizontal trunk and it becomes a **nurse log** nurturing the tiny plants. They are called nurse logs, because young trees grow on the top mossy surface of the fallen trees. These fallen logs make a moist, soggy habitat for mosses, ferns, lichens, and new tree seedlings. Colonnades (trees standing in a row) may form after the nurse log has completely disintegrated. Trees can also be found standing on “stilts” because they first sprouted on stumps of dead trees and as they grew over time, the stumps decayed leaving the tree standing only on the roots.

Most of the animals in the temperate rainforest live on or near the forest floor. Here, the understory and canopy provide protection from the wind and rain and most of the food is found there. Cones drop from the trees with nutrient rich seeds, which are eaten by birds and small animals such as voles (mouse-like creatures) and chipmunks. Insects live in the mossy floor and tree bark. Birds and amphibians feed on the insects. Many amphibians live in the streams and ponds and salmon are important consumers. Deer feed on the grass and leaves of the understory. The top consumers of the food chain in the temperate rainforest include black bears and cougars.

How does a temperate rainforest compare to a tropical rainforest?

Mainly because of the differences in temperature and rainfall, the temperate and tropical rainforests are very different places. The trees, the plants, the structure of the forest, the animals that live there, and even the type of soil are so different that if you stood in the middle of

each forest, you would have no trouble telling which forest you were in just by looking around and observing!

In a lush **tropical rainforest** you would see that the types of trees and plants are very different than in the temperate rainforest. There would be many varieties (over 1,100 species of plants in some tropical rainforests!) of leafy trees and plants, mainly palms, bamboo, and tree ferns. Branches touch and leaves seem to fill every space in the canopy. Vines, such as the Strangler Fig, hang down from the trees. Insects are everywhere and there are colorful fruits, and birds such as parrots. Most of the animals live in the canopy far above the forest floor and you would also see a greater variety of animals and birds. You may see monkeys, jaguars, bats, and large poisonous snakes. The forest would be teeming with the movement and sounds of life. The temperature would always be warm, never cool in the tropical rainforest.

Standing in a **temperate rainforest**, the temperature may be warm in the summer, but most of the time it would be cool and wet. There would be giant redwood trees mixed with only 3 or 4 other species of tall conifer trees. In the understory are leafy, delicate trees and shrubs such as dogwoods and maples. The forest floor is a thick layer of mosses and other low-growing plants with nurse logs nurturing young plants. This where most of the animals of this forest live because the soil is rich, there is lots of food, and the tall trees provide protection from the sun, wind, and rain above. You may see a bear or cougar, birds such as owls or woodpeckers, raccoons and chipmunks, or a grazing deer or elk. Never a poisonous snake! This forest is quiet and peaceful with sunlight filtering down in beautiful beams from the canopy above.

Teachers can use the information below to lead an activity using a Venn diagram.

Temperate Rainforest	Temperate AND Tropical Rainforest	Tropical Rainforest
One long, wet winter/spring season with a dry, foggy summer	Both wet and dry times of the year	Two wet seasons, 2 dry seasons
5-16 feet of rain a year	Lots of rain!	6-30 feet of rain a year
Cool temperatures most of the year		Warm temperatures most of the year

Located on the western edge of North and South America		Located in a 3,000 mile wide belt near the equator
Mostly conifer trees, some broadleaf trees	Huge amounts of plants	Mostly broadleaf evergreens like palms, bamboo and tree ferns
Largest biomass of any biome	Huge amounts of animals	Largest biodiversity of any biome
3 layers of the forest	Canopies, understories, and forest floors	4 layers of the forest Emergent layer
Most of the animals live on the forest floor		Most of the animals live in the canopy
Jungle-like appearance with epiphytes, ferns, and mosses	Jungle-like appearance	Jungle-like appearance with palms, tree ferns, and vines
No poisonous snakes		Poisonous snakes and other creatures
Large predators are bears and cougars	Has a food chain with predators and consumers	Large predators are jaguars and large snakes
Soil is rich		Soil is poor
Faster recovery from destruction	Vulnerable to destruction	Slower recovery from destruction

Vocabulary – Temperate Rainforest

Biomass *n.* The total amount of living things in a region such as a rainforest.

Canopy *n.* The layer of rainforest made up of the tops of the tallest trees: Coastal Redwood, Douglas Fir, Sitka Spruce, Western Red Cedar, and Western Hemlock.

Conifers *n.* Cone-bearing evergreen trees with needles.

Decomposers *n.* Microscopic fungi and bacteria that feed directly on dead matter breaking it down.

Epiphytes *n.* Plants that live on other plants instead of in the soil.

Forest Floor *n*. Also called the Ground Layer, this is the lowest layer of the rainforest and has a thick layer of low-growing plants. It is dark and moist with rich soil. Most animal life exists here.

Nurse log *n.* A dead tree that falls in the forest and provides nutrients for tree seedlings and other plants to grow.

Organic *adj.* Coming from living material such as plants.

Understory *n.* The middle layer of rainforest containing broadleaf trees and shrubs.

Related Web Sites

Redwood National and State Parks, California

http://redwoodnationalandstateparksca.arp.myareaguide.com

This site contains information about the Redwood National and State Parks. You can view and print maps to the redwood state parks along the California coast. Another section provides information about the redwoods. A photo gallery provides images of the forest. Other information about traveling and visiting the redwood forest is also offered.

Redwood National and State Parks

http://www.nps.gov/redw

This is the home page for the Redwood National and State parks, part of the National Parks Service web site. A general description is provided about the redwood parks. By clicking on the "In Depth" button, detailed information is provided. Maps, Frequently Asked Questions, information about the trees, a photo gallery, and on-line games about the redwoods for kids is available.

What's It Like Where You Live?

http://mbgnet.mobot.org/sets/rforest/index.htm

Discusses and compares the difference between the tropical and temperate rainforests. Offers several pictures and links to other biomes and ecosystems. A detailed section on rainforest plants is offered with descriptions, pictures and illustrations.

The Temperate Rainforest

http://www.scsc.k12.ar.us/2001Outwest/PacificNaturalHistory/Projects/LachowskyR/Default.htm

This page provides a great description of the location, climate, trees, and animals that make up a temperate rainforest. A glossary of terms is provided as well as a comparison of tropical and temperate rainforests. Links are also provided to other related rainforest sites.

Temperate Forest Foundation

http://www.forestinfo.org

This site is designed to provide information regarding the temperate forests. A teacher's resource section provides access to photos, posters, videos, field trips, and links to other related sites.

The Temperate Rainforest Canopy of the Pacific Northwest

http://academic.evergreen.edu/n/nadkarnn/TRFwebsite/TRFhome.htm

This interactive site allows you to explore and learn about the creatures in the forest canopy. Another section provides 3 activities for children: tree and bark rubbings, canopy poetry, and "Ask Dr. Canopy!" where questions about the forest canopy can be submitted. Suggestions for being more environmentally aware are presented. A link to various teacher resources regarding the temperate rainforests is also available.

American Rainforest Web Adventure

http://www.teachervision.fen.com/tv/curriculum/weeklywebadventures/american_rainforest/t_home.html

This rich site contains resources for students and teachers. The American Rainforest Main Page contains online activities for students, which educate and test the student's knowledge of the temperate rainforest. The teacher section outlines several lessons and activities

that can be used in the classroom. Links to related web sites are also presented. The Web Adventures Main Page provides links to several interactive web-based learning activities, including the American Rainforest. These activities are aimed at grades 5 and 6 and include curriculum connections to math, language arts, and science.

Olympic Mammals

http://www.nps.gov/olym/edmam.htm
Describes with some photos, the animals that inhabit the Olympic National Park.

World Builders - Rainforests

http://curriculum.calstatela.edu/courses/builders/lessons/less/biomes/rainforest/rainintro.html
This site provides a good explanation of tropical and temperate rainforests. Excellent information and diagrams are also provided for the food webs for each type of rainforest.

Exploring the Temperate Rainforest Canopy Curriculum

http://academic.evergreen.edu/n/nadkarnn/TRFwebsite/curriculum.html
A six-activity curriculum for grades 4th-12th that includes interactive, hands-on, student-centered lesson plans. These activities include:
• a canopy hydrology field experiment,
• a tardigrade microscope lab and international database where students can submit their samples,
• two interactive, cooperative learning activities on canopy structure and ecology,
• two activities that engage the students in creative expression and presentation.

Lists over 100 links to rainforest information.

http://www.kidskonnect.com/Rainforest/RainforestHome.html

Free Stock Photos

http://www.freestockphotos.com

This site contains many images that are free to use in your publications and also includes links to other public domain photography web sites.

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Free Lesson Plans, WebQuests, Worksheets
http://www.edhelper.com
(Rainforest info only deals with tropical rainforests – temperate rainforests not discussed.)

BIOME: Rainforests – An AskERIC Lesson Plan
http://askeric.org/Virtual/Lessons/Science/Ecology/ECLO24.html
(Nothing on temperate rainforest)

Rainforest Teaching Theme – Lesson Plans, Worksheets
http://www.bestteachersites.com/themes/science/rain/
(Tropical rainforest ONLY)

Wealth of the Rainforest – Pharmacy to the World
http://www.rain-tree.com
(Great site, BUT only addresses the Amazon rainforest)

Geology of Redwood National Park
http://www2.nature.nps.gov/grd/parks/redw/index.htm
(This site covers geology of the redwood parks, but does not discuss temperate rainforest)

Bay Area Field Trips

Coyote Point Museum For Environmental Education
1651 Coyote Point Drive
San Mateo, CA 94401
(650) 342-7755
www.coyoteptmuseum.org
Classes on Bats, nocturnal animals, and the Redwood forest as well as “Deep Into the Forest” (formerly “Temperate rainforest”) and multiple additional courses. Fees. Please call.

Bay Area Science Alliance (BASA)

http://www.basa.info/cs/basa/print/docs/basa/about.html
The Bay Area Science Alliance (BASA) is a non-profit partnership of education and business leaders committed to fostering science education and literacy throughout the Bay Area. BASA provides access to resources for teachers, parents, providers and the general public; encouraging participation in fun and educational activities related to the environment and science. BASA members collaborate to enhance science understanding and K-12 educational practices, in both formal and informal science instructional experiences. 99 links to Bay Area science resources.

Additional Resources

Into the Forest – Nature's Food Chain Game

Ampersand Press
(800) 624-4263
www.ampersandpress.com
This unique card game has beautiful color cards listing what each animal eats and what it is eaten by. The game works just like the natural food relationships in the forest helping students discover the world of food chains in nature. The animals are all from the temperate rainforest. There is a well-designed mini-poster included.

Biomes Atlases: Temperate Forest

By John Woodward, 2003
Heinemann Educational Books - Library Division
ISBN: 1844211568
Each book in this series provides readers with a deeper understanding of the world's biological communities, with each title focusing on a particular biome. The books contain an introduction to the Earth's principal biomes with enough depth for project work.

The Tree in the Ancient Forest

By Carol Reed-Jones, Illustrations by Christopher Canyon, 1995
ISBN: 1883220319
DAWN Publications
DawnPub@oro.net
The remarkable web of plants and animals living around a single old fir tree takes on a life of its own in this stunningly illustrated story, written in a poetic verse style. Complete with a guide to the forest creatures and their relationships.

America's Rainforest (video)

Connecticut Valley Biological Supply Science Catalog – 2003
(800) 628-7748
Beautiful cinematography portrays the temperate rainforest of the Pacific Northwest as an endangered biosphere. Documents the 300 years of unsound commercial timbering practices that have led to this delicate and complex ecosystem coming to a crossroads.

Life in the Temperate Rainforest (#655)
Milliken Primary Science Resource/Activity Guides

Colorful books provide transparencies and activities that encourage scientific thinking such as predicting, inferring, classifying, measuring, etc. Grades 2-3.

NASCO EcoQuest Biodiversity Temperate Rainforest Kit

Nasco Science Catalog No. 522 - 2003
(800) 558-9595
www.eNasco.com
Students can explore and model the rainforest using a multidisciplinary approach. Includes Flex-Tank stacks and domes, soil, spores for mosses and ferns, and seeds for 6 tree species for growing rainforest plants. Also has 3 temperate rainforest books, a video on ancient trees, a poster, teacher guide, and student activity sheets.

Virtual Field Trip

Contact: Ken Freeman
E-mail: ken.freeman@cincyzoo.org
(513) 475-6130
www.cincyzoo.org
Radiant Rainforests - Students will learn about the remarkable biodiversity of two rainforest types; tropical and temperate. Focusing on the tropical rainforests of South America and the temperate

rainforest of the Pacific Northwest, students will learn about the similarities and differences of these two rainforests in terms of climate, flora, and fauna.