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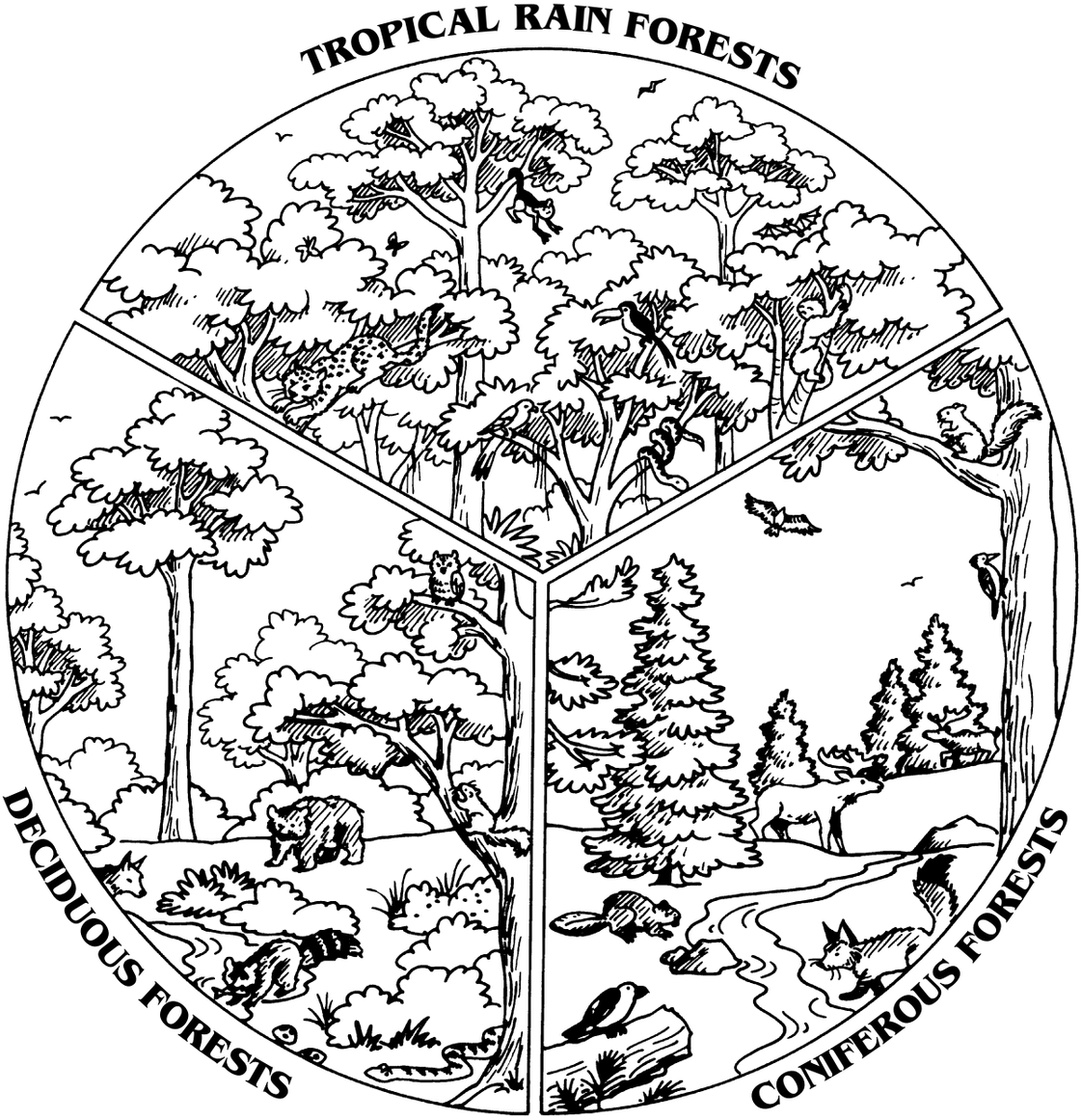
FORESTS

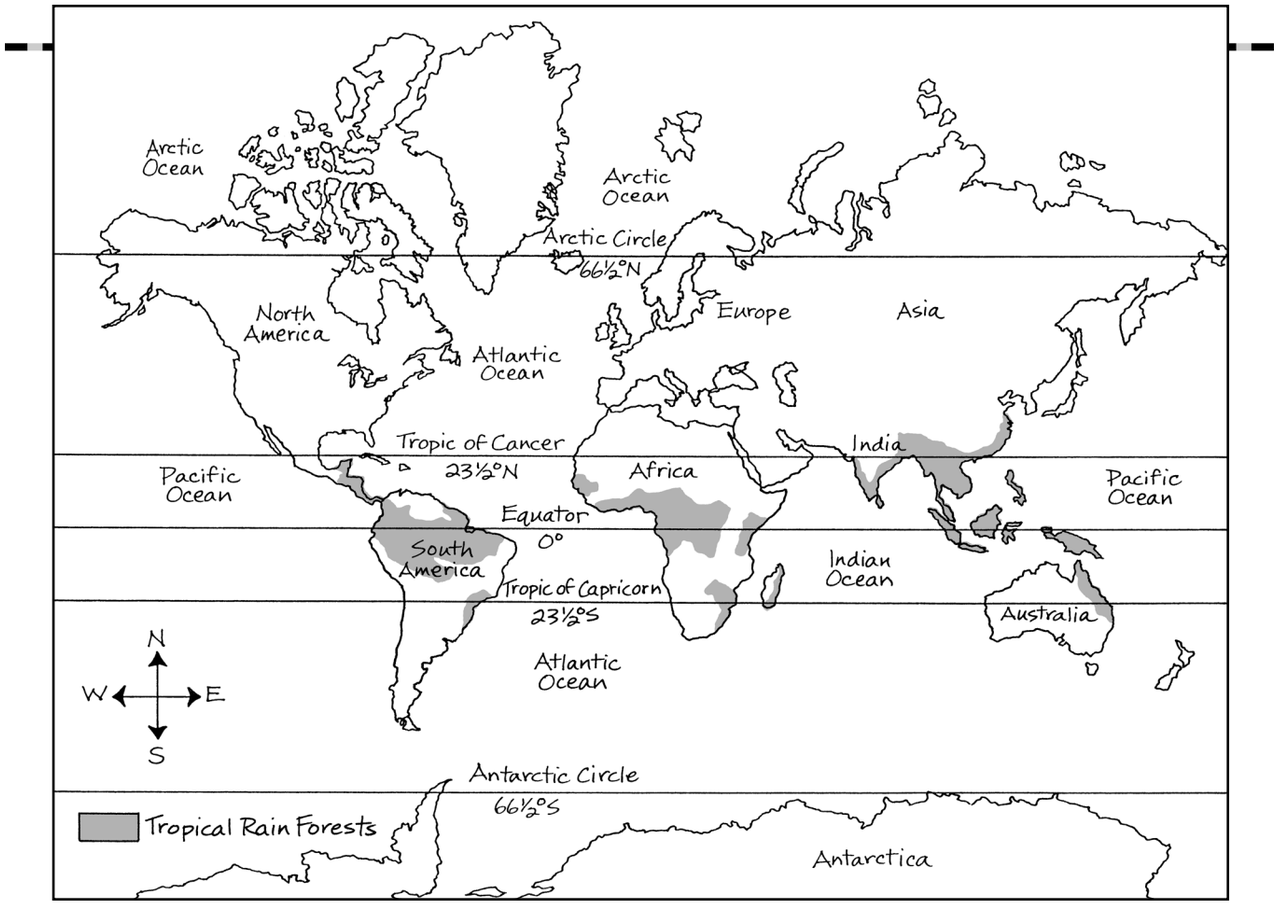


A **forest** is a terrestrial biome in which trees are the main plant. Although there are exceptions, trees generally are larger than other plants. **Trees** are plants with a **trunk,** which is the main supportive **stem** (part of a plant that supports leaves and flowers) of plants. Trees have woody roots, trunks, and limbs that provide a supportive structure, somewhat like a skeleton, that allows them to grow quite large. The climate, the type of soil, and the **topography** (description of the size, the shape, and the elevation of a region of land) of the region determine the type of trees that make up a forest.

Over 30 percent of Earth's **terrestrial** (land) surface is covered by forests. The three basic types of forests presented in this section are tropical rain forests, deciduous forests, and coniferous forests.

TROPICAL RAIN FORESTS

Rain forests are forests that have a constant warm temperature and receive more than 80 inches (200 cm) of **precipitation** (water that falls from the atmosphere in the form of rain, hail, snow, or sleet) each year in the form of rain. While rain forests are found on different parts of Earth, including the low **elevations** (height above sea level) of mountains, most are found in two regions called the **tropics,** which form a band around the center of Earth. The **northern tropics** region lies between the **equator** (an imaginary line around the center of Earth) and the Tropic of Cancer in the **Northern Hemisphere** (region of Earth that is north of the equator). The **Tropic of Cancer** is located at Latitude 23°N. **Latitude** is an imaginary line



that gives the location of a place north (N) or south (S) of the earth's equator and is expressed in degrees. The **southern tropic**s region lies between the equator and the **Tropic of Capricorn** (at 23½°S) in the **Southern Hemisphere** (region of Earth south of the equator).

The rain forests inside and bordering this band that receive more than 80 inches (200 cm) of rain each year are called **tropical rain forests,** and these are the rain forests that will be explored in this book.

The trees and plants of a tropical rain forest are **evergreens** (plants that do not lose all their leaves during the year). Evergreens do lose a few leaves at a time, but new ones are growing as old leaves are shed. In comparison, **deciduous** trees and plants lose all their leaves during part of the year. Huge numbers of animals live in rain forests, including insects, worms, fish, snakes, lizards, birds, and mammals, such as jaguars, monkeys, and bats. The different rain forests of the world support different kinds of animals.

In this section, you'll identify the locations of rain forests and you'll find out how Earth's rotation affects the temperatures of the tropical areas. **Rotation** is the turning of an object about an **axis** (imaginary line through the center of an object about which the object turns). You'll also discover what soil is and why the soil of such a lush area is lacking in **nutrients** (nourishing materials needed for life). You'll also investigate the **seasons** (divisions of the year defined by the position of Earth as it moves about the Sun, weather, and rainfall), climate, and **organisms** (living things) in rain forests.

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Rain Forest Humidity

All forests in the tropics are **tropical forests,** but they are not all rain forests. But, most rain forests are in the tropics. For a forest to be a rain forest, it must receive more than 80 inches (200 cm) of rain each year. Most tropical rain forests receive about 200 inches (500 cm) of rain every year, and a few get more than 400 inches (1,000 cm).

While the rainfall in most tropical rain forests is evenly spaced throughout the year, the tropical areas of India, Myanmar (formerly known as Burma), and Southeast Asia along the northern Indian Ocean coasts experience a cycle of seasonal changes related to rain called **wet seasons** and **dry seasons.** Wet seasons are times of abundant rain, and dry seasons are times when there is a lack of rain. Tropical rain forests in these areas are called **monsoon rain forests** (areas that experience pronounced wet and dry seasons). Unlike most tropical rain forests, which are evergreen forests, many plants in monsoon rain forests are deciduous, which means they lose all their leaves during part of the year. The leaves are lost during the dry season.

The consistently high temperatures and abundant rainfall in rain forests result in another characteristic of this type of forest—high humidity. **Humidity** is the measure of the amount of water **vapor** (gaseous state of a substance, such as water, that is normally in a liquid state) in the air. The air in a rain forest is like a sponge; it holds lots of water vapor. While rainfall is a major contributor to humidity, transpiration also affects humidity. **Transpiration** is the **evaporation** (change from a liquid to a gas) of water from a plant's **stomata** (tiny surface openings that are especially abundant on the undersides of **leaves,** the main food-producing part of a plant).

FUN TIME!

Purpose

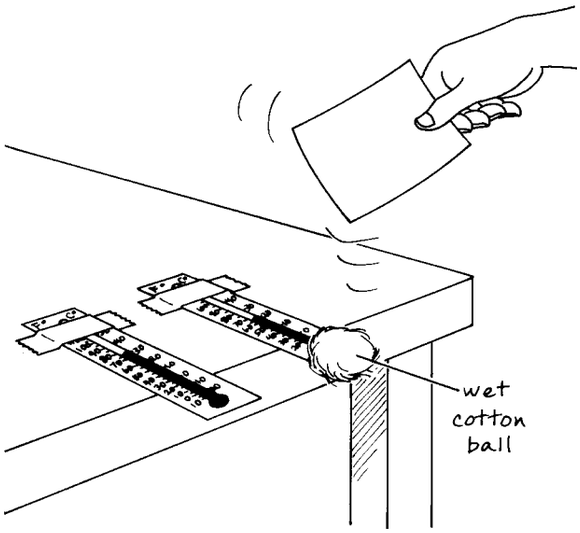
To measure relative humidity.

Materials

- cotton ball
- tap water
- 2 outdoor thermometers that measure in Celsius degrees
- transparent tape
- index card (handheld battery-operated fan can be used)

Procedure

1. Wet the cotton ball with water and wrap it around the bulb of one of the thermometers. This is your wet-bulb thermometer. Leave the second thermometer uncovered. This is your dry-bulb thermometer.
2. Lay the two thermometers on a table with their bulbs extended over the table edge. Tape the other ends of the thermometers to the table.
3. Use the index card to fan the air near the bulbs of the two thermometers. Do not hit the bulbs with the card. *Note: If a battery-operated fan is used, hold it so that the blades*



of the fan are about 4 inches (10 cm) from the thermometer bulbs.

4. Continue to fan the bulbs until the temperature on the wet-bulb thermometer stops decreasing. Then record the Celsius temperatures from both thermometers.

5. Use the following example and the relative humidity table to determine the relative humidity from your temperature readings.

Example:

What is the relative humidity if the dry-bulb reading is 16°C and the wet-bulb reading is 13°C?

- Subtract the wet-bulb temperature from the dry-bulb temperature:

  16°C – 13°C = 3°C

- Find the dry-bulb temperature (16°), in the column on the left side of the Relative Humidity in Air table. Now find the difference between the two thermometer readings (3°) in the horizontal row at the top of the table. Where the column and the row meet is the number for the relative humidity. For this example, the number is 71; thus the relative humidity is 71 percent.

Relative Humidity in Air

Difference between Dry-Bulb and Wet-Bulb Temperatures (C°)

Dry-Bulb Temperature (C°)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0	81	64	46	29	13											
2	84	68	52	37	22	7										
4	85	71	57	43	29	16										
6	86	73	60	48	35	24	11									
8	87	75	63	51	40	29	19	8								
10	88	77	66	55	44	34	24	15	6							
12	89	78	68	58	48	39	29	21	12							
14	90	79	70	60	51	42	34	26	18	10						
16	90	81	71	63	54	46	38	30	23	15	8					
18	91	82	73	65	57	49	41	34	27	20	14	7				
20	91	83	74	66	59	51	44	37	31	24	18	12	6			
22	92	83	76	68	61	54	47	40	34	28	22	17	11	6		
24	92	84	77	69	62	56	49	43	37	31	26	20	15	10	5	
26	92	85	78	71	64	58	51	46	40	34	29	24	19	14	10	5

Results

You made a wet-bulb and dry-bulb thermometer and used them to measure relative humidity.

Why?

Relative humidity is the amount of water vapor in the air compared to the total amount of vapor that the air could hold at that temperature, expressed as a percentage. An instrument, like the one you made in this experiment, which contains a wet-bulb and a

dry-bulb thermometer and is used to measure relative humidity, is called a **psychrometer.**

When the relative humidity reaches 100 percent, the air is **saturated,** meaning it cannot hold any more water vapor. If air with 100 percent humidity cools, some of the water vapor in the air will **condense** (change from a gas to a liquid). If the air is next to the ground, the extra moisture will condense as dew. **Dew** is water from water vapor in the air that condenses on cool surfaces. Above the ground, the extra moisture will condense into **cloud droplets** (tiny drops of water with diameters between 0.00004 to 0.002 inches [0.0001 and 0.005 cm] that form clouds). **Clouds** are visible masses of water droplets that float in the air, usually high above the earth. **Fog** is a cloud that is close to the ground. Raindrops can form in clouds by **accretion,** which is the merging of water drops that bump into one another. When the drops get large enough they fall. Raindrops also form if tiny ice **crystals** (solid materials whose particles are arranged in a repeating pattern) and water drops are mixed together in a cloud. The water sticks to the ice and the ice crystals grow large and become heavy enough to fall. As they fall they melt and hit the ground as rain.

MORE FUN WITH HUMIDITY!

Animals, as well as plants, add water to the air. See how the breath of animals increases air humidity. Do this by placing the end of a drinking straw inside the opening of a quart-size resealable plastic bag. Seal the bag as much as possible around the straw. Exhale through the straw five or more times, then quickly pull the straw out of the bag and completely seal the bag. Observe how cloudy the inside of the bag becomes. If the bag is not cloudy, repeat the procedure of blowing through the straw then removing the straw and closing the bag. Rub the outside of the bag with your fingers. The

cloudiness will disappear and tiny drops of water will form. Rubbing the bag causes the tiny invisible drops of water clouding the bag to combine into larger visible drops. If the drops of water are not visible, open the bag and feel the inside with your fingers.

BOOK LIST

Allaby, Michael. *How the Weather Works.* Pleasantville, New York: Reader's Digest, 1995. Information and experiments that let you discover more about the weather, including humidity.

Christian, Spencer. *Can It Really Rain Frogs?* New York: Wiley, 1997. Information and experiments about humidity and other weather events.

VanCleave, Janice. *Weather.* New York: Wiley, 1995. Experiments about humidity and other weather-related topics. Each chapter contains ideas that can be turned into award-winning science fair projects.