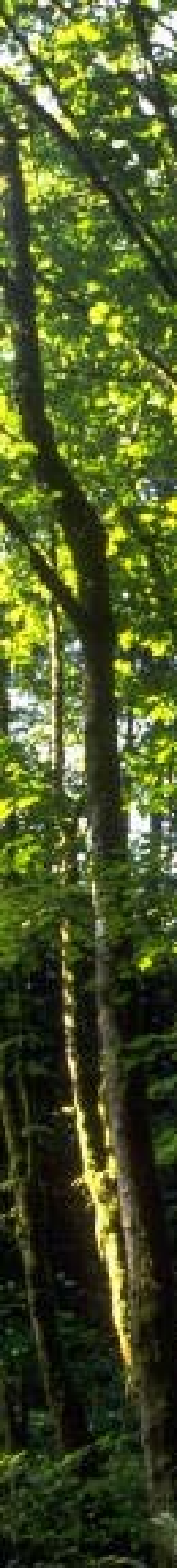


Rain Forest Teaching Curriculum

Table of Contents

Welcome to Rain Bird's Rain Forest Teaching Curriculum!

The Rain Bird Rain Forest Teaching Curriculum features "I can relate to that" science learning tools for teachers, students, and parents. The following is a list of answers to some frequently asked questions about the Rain Bird Rain Forest Teaching Curriculum:

What is it?

Rain Bird's Rain Forest Teaching Curriculum is an online educational tool for teachers to use and find specific lesson plans and related course work for kindergarteners through high school seniors. This content is also available online at www.rainbird.com.

What is its purpose?

To teach natural history, ecology, biology, physics, and chemistry through demonstrations, experiments, and classroom activities. Rain Bird and California State Polytechnic University, Pomona (Cal Poly Pomona) designed the program content, which focuses on endangered tropical rain forests in Latin America, South America, Africa, and Southeast Asia as the basis for teaching science through fun, hands-on things children already do and like—art projects, outdoor activities, and classroom demonstrations. The curriculum motivates kids to think about the part each of them plays—or the actions they can take—in preserving and protecting the environment.

Who should use it?

Teachers and parents. Teachers who are seeking a new, fun and engaging resource to teach children about science. Parents who are looking for friendly, but educational how-to's on "bringing science home." But most of all, it offers something for just about anyone and it's just plain fun for kids, no matter what their age.

Is the information easy to use?

Yes! The information is well organized and self-explanatory. The curriculum is arranged with grade-appropriate material (K-1, 1-2, 2-3, 3-4, 4-5, 6, 7, 8, and 9-12). As appropriate, each grade level contains projects that integrate science with art; data gathering, observation, and inference; analysis of physical matter; in-class demonstrations to be performed by teachers for students; and at-home projects that illustrate scientific principles in a manner both understandable and meaningful to school-age children.

Why the focus on rain forests?

Rain Bird has always supported and educated its consumers on the importance of the "Intelligent Use of Water." The curriculum ties into this philosophy because rain forests provide oxygen and consume carbon dioxide, playing a pivotal role in the climate control of our planet. This affects wind, rainfall, humidity, and temperature worldwide. Rain Bird is deeply concerned about the environment and has always promoted stewardship of Earth's resources, or which water is among the most precious. Some 30 million species of plants and animals—a majority of all things living on Earth—exist interdependently in tropical rain forests. In addition, rain forests are rich with plants vital in creating modern medicines.

What has the response to the curriculum been?

Thousands of online visitors each month learn about the important role tropical rain forests play in the world. And, because the information is being so well received, Rain Bird has expanded its commitment to university-level education through its partnership with California State Polytechnic University, Pomona. Jointly, they will unveil in 2002 three Rain Bird Learning Centers at Cal Poly Pomona's BioTrek Project, located on the Cal Poly campus.

About Rain Bird

Rain Bird Corporation, based in Glendora, California, USA, is the world's largest manufacturer of sprinkler and drip irrigation equipment. Founded in 1933, Rain Bird offers the industry's broadest range of irrigation products to golf courses, sports arenas, amusement parks, farms, and commercial and residential developers in more than 130 countries. For more information, visit Rain Bird's web site at www.rainbird.com.

This workbook is brought to you through a partnership between:

Rain Bird, Azusa, California

Science IMPACT, College of Science,
California State Polytechnic University, Pomona

The Rain Forest: An Introduction

What is a tropical rain forest?

A tropical rain forest is a forest that receives 4 to 8 meters of rain each year.

Where are tropical rain forests located?

Rain forests are located within a narrow region near the equator in Africa, South and Central America, and Asia.

Why are tropical rain forests important to our earth?

Rain forests play an important role in the climate control of our planet by having an affect on the wind, rainfall, humidity, and temperature. Within the rain forest, water, oxygen, and carbon are recycled. This natural recycling helps to reduce flooding, soil erosion, and air pollution.

The rain forests support over one half of the plant and animal life on Earth, even though they cover only 2% of the Earth's surface.

Approximately one fourth of the pharmaceuticals (medicines) we use come from plants of the tropical rain forests. According to the National Cancer Institute, 70% of the plants from which we make medicines and that are effective in the treatment of cancer can only be found in the rain forests.

What is happening to our rain forests?

27 million acres of the Earth's rain forests are destroyed each year due to man. The activities which threaten the rain forests are: agriculture, clearing and developing of land, beef cattle ranching, logging, and the building of dams and hydroelectric plants. This results in a loss of 100 acres of rain forest per minute and 80% of the rain forests in the world are now gone. The destruction of the world's rain forests at this rate causes 10,000 plant and animal species to become extinct each year.

Grades 6-8 Activities Overview

The tropical rain forest is a wonderful environment to learn not only about natural history, ecology, and biology, but also physics and chemistry. So much goes on in the rain forest and so many plants and animals live there (approximately 50% of the plant and animal life on the planet) that exclusive existence on the ground is impossible for the abundance of species. That is why the rain forest exhibits a layering of habitats, or canopy. There are many plants and animals, including insects, which never spend any part of their lives on the ground. These plants and animals have developed very specialized adaptations that allow them to compete successfully for all of the resources they require to thrive.

As we look at our planet, we can observe that the closer we move to the equator, the greater the abundance of life. The tropical rain forests, which exist in the narrow band around our Earth called the equator, are environments that require all plant and animal species to become very specialized in their strategies for acquiring food, water, reproduction opportunities, and all aspects of survival, because the competition for these resources is so great. This is very different from other areas of our planet, farther north and south from the equator, where the concentration of life is less dense. In those areas, it is more advantages to have very general adaptations and to be able to utilize many different strategies and resources. In other words, survival depends on being a generalist. Indeed, the rain forest can be a study in economics—supply and demand.

It is interesting to note that many of the species living in the tropical rain forest have yet to be discovered. In this portion of the Rain Bird Rain Forest Curriculum, we will be making our own discoveries, as we explore the sciences in the context of the highly specialized adaptations that all life forms exhibit in this fascinating environment. At each grade level, there are three activities for students and one in-class demonstration to be presented by the teacher.

Grade 7 Activities At a Glance

- Activity: Determining the Gas Released by Germinating Seeds
- Activity: Culturing and Studying Molds
- Activity: Making a Smoke Print of Leaves to Study External Morphology Characteristics
- Demonstration: The Colors in White Light

Grade 7 Activity: Determining the Gas Released by Germinating Seeds

We know that all living things share certain characteristics in common. Even plants and animals share certain common qualities, such as the gases they give off. Or do they? In this activity we will use limewater indicator to discover if germinating seeds give off the same gas we do when we breathe.

Materials (per group):

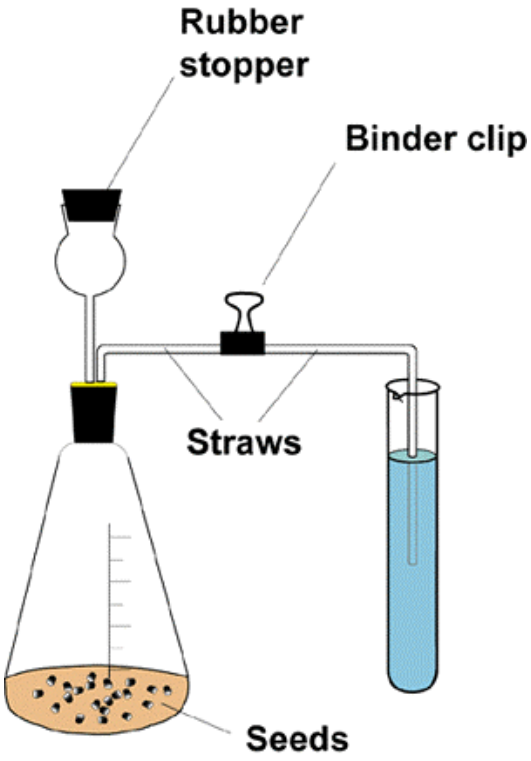
Radish seeds, lime water (see "Notes to the teacher" below for the recipe), paper toweling, 250 ml flask, rubber with 2 holes to fit flask (or substitute plumber's putty), test tube (glass or plastic), test tube rack or holder (inverted Styrofoam cup works well), binder clamp (the kind used to hold a stack of papers together), thistle funnel with stopper (or substitute apparatus explained below), 2 flexible drinking straws.

Procedure:

1. Soak some radish seeds for 30 minutes prior to lab (each group will need about 10).

2. Moisten some paper toweling (it should be wet but not so wet that water puddles in the bottom of the flask) and place it in the bottom of the flask (you may need to use a pencil to move it into place and flatten it out). Drop the seeds into the flask.

3. Place the rubber stopper on the flask. Place the thistle funnel in one hole and one of the flexible drinking straws in the other hole (use the end closest to the pleating of the straw to insert into the rubber stopper). Bend the straw so that the part exiting the stopper is horizontal to the tabletop and cut at a position 10 cm from the bend in the straw. Attach the other straw to the end you just cut and bend this straw down into the test tube (see diagram). Hint: Cut a couple of slits in the end of one straw so that the other straw slips on easily, then secure with a piece of tape. Blow through the 2 straw apparatus to make certain there are no obstructions.



4. Fill the test tube with limewater.

5. Clamp the straws at the point where you joined them.

6. Allow the seeds to germinate for a few days (at least 3 days).

7. Fill a second test tube with limewater and using a drinking straw, bubble your breath through it. It will turn cloudy indicating the presence of carbon dioxide.

8. After several days, remove the stopper from the thistle funnel and gently pour water down the funnel. Open the clamp. The water will displace the air and force it through the straws and into the limewater. Record the reaction.

Questions for Students:

1. What occurred when the gas from the flask containing the germinating seeds was forced into the limewater? Was this the same reaction that occurred when you bubbled your breath through the limewater?

2. What can you conclude about the gas given off by germinating seeds?

Notes to the Teacher:

The bubbling of human breath through the limewater indicator can be done as a demonstration in front of the entire class prior to setting up the activity, or by the students themselves. Limewater can be made by purchasing pickling lime at the market. Add 1 tablespoon of pickling lime to a quart of water. Use a glass quart jar for this. Secure the jar lid. Let this solution stand over night. The next day, decant (pour off) the clear liquid on the top, leaving the cloudy precipitate at the bottom. Store what you decant in another glass jar with a lid—this is your limewater. This clear solution becomes cloudy in the presence of carbon dioxide.

Grade 7 Activity: Culturing and Studying Molds

Molds play a very important role in the decomposition of organic materials. In the rain forest, which is teeming with life, dead plant and animal material would accumulate very quickly if it were not for animals that feed on dead organisms, bacteria that break down organic materials, and molds, which also break down organic materials. Molds have a variety of uses in our everyday lives as well, aside from being decomposers. They are important to the process of making bleu or Roquefort cheese and other food products, and probably the most famous of all uses, the antibiotic drug penicillin. In this activity you will culture several types of molds to examine.

Materials:

Mold cultures (see below), 4 or 5 potato slices, hand lens (or dissection microscope if available, but not necessary), dissecting needle or toothpick.

Procedure for Culturing Molds:

1. Obtain an orange with green mold on it, place in a jar and keep it in a dark, warm place for a few days.

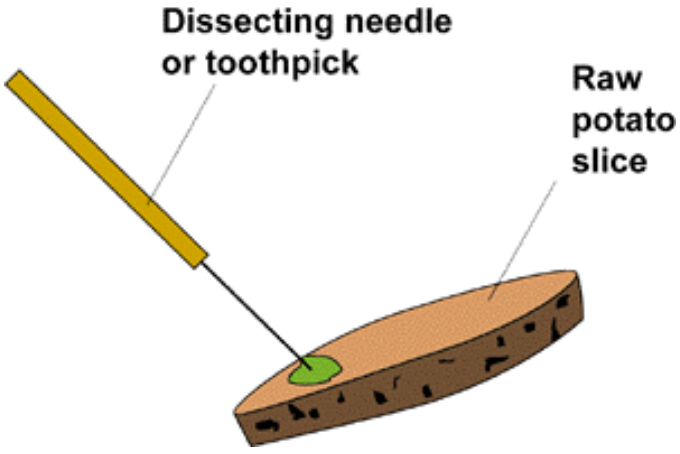
2. Place a piece of moist bread in a sandwich bag and keep it in a dark, warm place for a few days.

3. Take a piece of bleu or Roquefort cheese and put it in a jar in a dark, warm place for a few days.

4. Put a few dead flies in some stagnant water and keep them in a dark, warm place for a few days.

5. Leave a cup of coffee out for several days.

6. In each of the above cases, you should see mold growing. Transfer a little of each mold to a potato slice. Place the potato slices in a dark, warm place and after several days, each slice will have grown a pure culture of the respective molds.



Procedure for Examining Molds:

1. Using a hand lens or dissection microscope, examine each of the mold cultures.

2. Make sketches of what you see. Look for web-like structures (rhizomes) and stalks with ball-like structures (spore cases containing thousands of spores from which new molds can grow under the right conditions).

Questions for Students:

1. What primary purpose do molds serve?

2. If you go to your refrigerator and want to snack on some cheddar cheese, but you see some dark mold on it, will cutting off the dark mold you see ensure that all of the mold is gone? Why or why not?

3. What conditions are best for growing mold?

4. How does refrigeration help to keep our food free of mold?

5. Why do foods get moldy over time even in the refrigerator?

Notes to the Teacher:

It is probably best to do the culturing of the molds for the students. This will save time and ensure pure cultures. Be certain to show them the process, however.

Grade 7 Activity: Making a Smoke Print of Leaves to Study External Morphology Characteristics

In the rain forest an overwhelming number of plant species grow. The variety of adaptations and specialized characteristics is astounding. In this simple activity, one can gain a special appreciation for the characteristics of plant leaves by making smoke prints. Often what is revealed in a process like this helps us to discover subtle characteristics we might otherwise have overlooked.

Materials:

A variety of leaves from different plant and tree species, petroleum jelly, 2 smooth glass bottles with caps or corks, water, white paper, newspaper, candle.

Procedure:

1. Cover one side of the outside surface of a bottle with a layer of petroleum jelly, fill the bottle with cold water, and cap or cork it tightly.

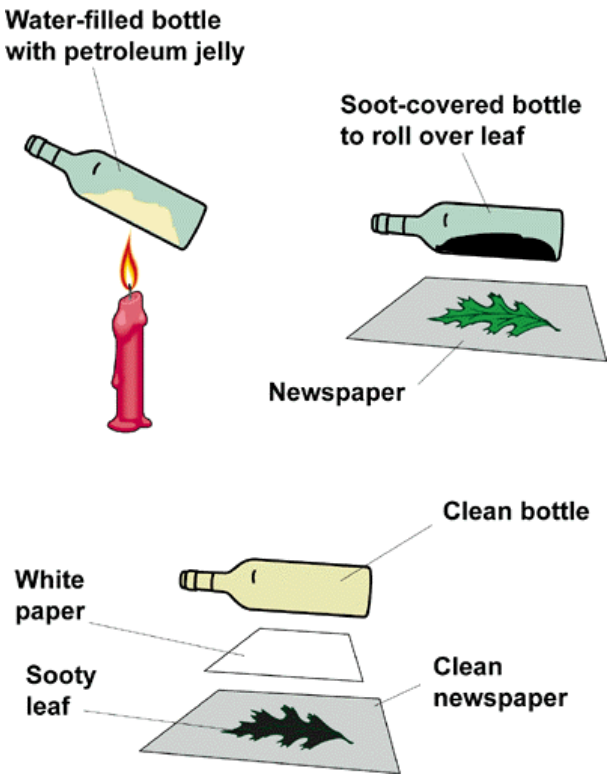
2. Hold the bottle over the candle flame, with the petroleum jelly side toward the flame, until it is covered evenly with soot.

3. Place a leaf, veins up, on a newspaper and roll the sooty bottle over the leaf.

4. Remove the sooty leaf from the newspaper and place it, again with veins up, on a clean newspaper, and place a piece of white paper over the leaf.

5. Roll a clean bottle over the paper that is over the sooty leaf. You now have a smoke print of the leaf.

6. Do this with several species of leaves.



Questions for Students:

1. Compare the characteristics of the leaves. Examine the edges and the veining as well as the thickness of the leaves.

2. Describe the plant survival advantages of the characteristics you have examined.

Notes to the Teacher:

You may want to soot the bottles for the students, depending on their level of maturity and sophistication working with flames. In any case, make certain that long sleeves are rolled up and long hair is tied back. This activity is excellent for integration with art.

Grade 7 Demonstration: The Colors in White Light

Light is a critical aspect of plant life in the rain forest. There is a constant fight for light, with the tallest trees receiving the most light and blocking light from smaller plants. In this demonstration, we will look at the spectral components of light and its interaction with plants.

Part 1—Separating the Colors in White Light

The goal of this demonstration is to demonstrate to students that white light can be separated into spectral colors. In addition, colored filters allow only certain colors of light through and colored objects reflect only certain colors of light.

Materials:

Overhead projector, paper or cardboard, holographic diffraction grating material (available from numerous scientific supply houses, e.g., Fisher Scientific, 1-800-955-1177), colored filters, colored objects, "neon" Post-It notes.

Procedure:

To protect the holographic diffraction grating material from fingerprints and scratches, mount it in cardboard with an opening about the size of the lens on your overhead projector. Mount the grating on the front of the lens, with the slits in the grating oriented vertically.

Place pieces of cardboard or paper on the stage of the overhead projector, with a 1-2 cm gap between them. Turn on the overhead. You should see a white line representing the gap between the paper or cardboard pieces. Turn the overhead so that this white line is off the screen, and you should see a bright spectrum of colors on the screen.

Place different colored filters along the gap between the paper or cardboard pieces and have students notice which colors pass through the various filters. Discuss the behavior of a colored filter as allowing the color of the filter to pass through and absorbing all other colors. Be aware of a common student

preconception that filters add the appropriate color to white light, rather than subtracting the other colors.

Remove all the filters and select a colored object. "Neon"-colored Post-It notes work very well because of their high reflectivity. Place the object on the screen, to the left of the display of colors. Start sliding the object into the display of colors and have students tell you when the appearance of the color of the object best matches the color on the screen at the location of the object. For example, an orange object will appear to match the orange part of the display, but will look very different from the screen in the blue part of the display. Discuss the colored appearance of objects as due to reflection of certain colors of light and absorption of other colors.

With this series of demonstrations, you can assist students deeply in their understanding of the concepts of selective transmission of colors (filters) and selective reflection of colors (objects).

Questions for Students:

1. What filters could be placed on top of each other to completely block any light from passing through?

2. Are there any pairs of different-colored filters that could be placed on top of each other such that some light still passes through?

3. Purple is a combination of red and blue. If a purple object were slid across the color display, how would its appearance change at various locations?

4. What would you see if a red object were placed on the screen in the display from a blue filter? How about a red filter?

Part 2—Light Reflected from Leaves

Materials:

Overhead projector, paper or cardboard, holographic diffraction grating material (available from numerous scientific supply houses), green leaves.

Procedure:

Using the apparatus set up in Part 1, slide a leaf into the color display on the screen and have students notice when it appears most similar to the display on the screen.

Questions for Students:

1. Why do leaves appear green?

2. Is green light important for the survival of plants? Would a plant grow well if it were grown in a room with only a light source covered with a green filter?

3. Suppose you were to grow a plant with one leaf wrapped in a green plastic filter, one in a red filter, and one in a blue filter. (The filters are perforated to allow the leaves to transpire.) How would the growth of the three wrapped leaves compare?