

# Forests and Photosynthesis

Regina Sievert, Naida Lefthand and Julie Cajune  
Salish Kootenai College, Pablo, MT

## **Summary**

Students are introduced to the concept of photosynthesis through an investigation in which they test the effects of light on seedlings.

## **Grade level**

Fourth grade

## **Time required**

3 hours, plus a field trip

## **Materials**

Rulers

Science journals

[U.S. Greenness image movie](#)

[Satellite image of the Flathead Reservation](#) – see Resources

Seeds, soil and small pots

## **Goals**

By completing this lesson, students will

- 1) be introduced to the concept of photosynthesis,
- 2) gain experience in interpreting satellite images and
- 3) increase their skills in using inquiry to investigate a question.

## **Science standards addressed**

### *National Science Standards*

- Abilities necessary to do scientific inquiry
- Systems, order and organization
- Organisms and environments
- Changes in Earth and sky

### *American Indian Science Standards*

- Various forms of scientific and technological work currently engaged in by American Indian men and woman and in what ways their fields require the process of problem identification, design and solution

### **Teacher tips**

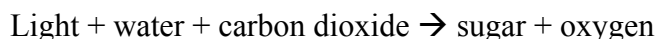
For the experiment, students should grow hearty plants, such as beans, that will grow straight and tall so that their height can be measured. Have students plant the seeds well in advance of the investigation, so the plants have time to sprout and establish with at least four inches of growth.

The U.S. greenness animation used in this lesson is a series of satellite images put together as a movie that shows the monthly amount of vegetation present in the U.S. Prior to watching the movie, there will be an excellent opportunity for students to apply their knowledge of photosynthesis to predict how the vegetation will change over the year. After watching the movie, students have an opportunity to develop hypotheses about why the amount of vegetation changes. More information about greenness images can be found in the Background section below.

The complexity of the experiment can be customized to the students' abilities and their experience with inquiry. Although the lesson is written as a guided inquiry designed by the class to investigate the effects of light on photosynthesis, it could also be driven by individual student questions about photosynthesis. For example, students could choose to investigate other effects relevant to photosynthesis, such as wavelengths of light, exposure (e.g., south vs. north), light duration, light intensity, temperature, or water.

### **Background information**

Plants require light, water, oxygen, carbon dioxide and nutrients in order to grow and be healthy. These items are used in the processes of photosynthesis and respiration. During photosynthesis, a plant harnesses the Sun's energy and combines it with carbon dioxide and water to make glucose (sugar). This sugar is used by the plant as energy to fuel its life processes. Oxygen is also produced during photosynthesis. A simple equation for photosynthesis is



This lesson asks students to hypothesize about the changes in color of *greenness images* of the United States. These images show the amount of growing vegetation present in an area at a given time; the more green the image, the more growing vegetation is present. The changes in vegetation are related to climate. Typically, greenness images taken during winter months show low amounts of growing vegetation, due to relatively little sunshine and low temperatures. The early spring months' images begin to increase in greenness, showing a progressive increase in vegetation as the forests and fields begin their new growth. Greenness peaks in the early summer images in the United States since adequate water, increased sunlight, and rising temperatures result in increased photosynthesis and more plant growth. High temperatures and less available water decrease plant growth in mid to late summer, and can be seen in the image, as green areas begin to turn reddish brown.

Greenness images are collected by satellites orbiting Earth. They are a valuable tool that are used in a number of ways, for example, in wildlife management to measure the amount of canopy, in forestry to measure regrowth of vegetation after logging, and in fire

management to estimate fuel load. More details about greenness images can be found on the *National Atlas* web site where the image is also found.

## **Procedure**

### *Engagement*

- 1) Each student pair should each have two well established healthy plants, at least four inches high, in separate pots, before beginning this investigation.
- 2) Show the students the satellite image of the Flathead Reservation. Ask student volunteers to point out landmarks that they recognize, such as Flathead Lake, the Mission Mountain Range, forests, agricultural fields and towns.
- 3) Point out several different forested areas, including areas that have been logged or burned. Ask students to predict what has happened in these areas. Facilitate a discussion on the importance of the reservation forests and their sustainable management by Tribal Forestry. Hang the photo in the classroom.
- 4) Take a tour of the tribal greenhouse with the botanist. Ask for a few tree seedlings to take back to the classroom. Assign students rotating responsibility to care for the trees.
- 5) Ask students what they noticed about the greenhouse facility. Ask them to identify what plants need to be healthy and grow. Make and post a list of student responses.

### *Exploration*

- 1) Through class discussion, design an experiment to investigate the effects of light and the absence of light on plant growth. Students should write their experiment description in their journals.
- 2) Discuss with students what types of data they should observe and record, and assist them in preparing their journals for recording data. Students should draw and record data about their seedlings before the experiment in their journals. They should also draw their predictions of what the light pot and dark pots will look like after five days.
- 3) Have students place their light and dark seedlings in the assigned locations, according to the class plan. Allow the seedlings to grow for five days, only disturbing the plants to water and turn them as needed.
- 4) After five days, students should observe, draw their plants and record data about them. Ask them to write a statement summarizing their results.

### *Explanation*

- 1) Allow students to report their experimental findings to the class and ask them to hypothesize about their results.
- 2) Facilitate a discussion with students about what humans need to grow and be healthy. Go back to the response “food” and ask students where plants get their food. Introduce the word photosynthesis and discuss its meaning and importance to plants. Develop the simplified equation for photosynthesis, writing it on the board while asking students to provide the necessary factors based on their knowledge of what plants need. Help students realize the importance of light in photosynthesis and for the plant’s growth and health.

- 3) Tell students about the greenness movie, how it is collected and what the greenness shows. Ask them to predict what the monthly progression of greenness will be. Show the movie to students and ask them to hypothesize about what causes the changes it shows.
- 4) Ask students to write their experimental conclusions in their journals.

#### *Elaboration*

- 1) Decide as a class about where to plant the tree seedlings. Make sure that students consider factors important for photosynthesis in choosing the planting sites. Have students contact (call or e mail) the tribal botanist to ask about what type of care the tree seedlings will need in order to survive.
- 2) Make signs to post next to the trees, indicating the date, the class, and the tree species. Plant the trees and assign students rotating responsibility to care for them. Students should also observe and record data about the trees' growth weekly.

#### *Evaluation*

- 1) Observe students and talk with them informally as they work on their experiments. Use a checklist to record each student's use of the process skills.
- 2) Examine student journals for evidence of proficiency in process skills, appropriate comparison of their light and dark seedlings, knowledge of content and ability to apply content to develop predictions, hypotheses and conclusions.

### **Vocabulary**

photosynthesis            hypothesis            prediction

### **Follow up activities**

- 1) Visit a forested area with a tribal forester who could talk with students about tribal forestry. Show students their location on the satellite image and/or map.
- 2) Visit some cultural trees, such as the scarred trees on Wild Horse Island, or the trees at Council Grove. Invite elders to talk about the cultural history of the trees.
- 3) Make a class graph of the tree seedlings' growth throughout the school year. Compare the growth of the seedlings, and hypothesize about the differences.

### **Resources**

National Atlas web site – Provides the greenness movie of U.S. vegetation growth along with an explanation of the image            [nationalatlas.gov/greenness.html](http://nationalatlas.gov/greenness.html)  
To get just the movie go to [nationalatlas.gov/green2.html](http://nationalatlas.gov/green2.html)

#### Satellite image of the Flathead Reservation

[http://yoda.cec.umt.edu/sid/bin/show\\_newjava.plx?image=flatheadres.sid&client=Native\\_Lands&section=Flathead%20Reservation&title=Native%20Lands](http://yoda.cec.umt.edu/sid/bin/show_newjava.plx?image=flatheadres.sid&client=Native_Lands&section=Flathead%20Reservation&title=Native%20Lands)