



Cities and Seasons

Lesson Plan

Overview

In this lesson, students will explore how satellite images show seasonal changes in seven cities in North and South America. Through a sequence of images, students can learn about the "green-up" and "brown-down" of the seasons and continue to think about the way seasons change over time and in various regions of the Earth. Students will study a data table to make inferences about seasonal changes at various locations based on color changes in vegetation. Students will learn about seasonal differences in North and South America.

Suggested Lesson Sequence	Please see the Seasonal Changes module description.
Lesson Level	Extended
Science Connections	<ul style="list-style-type: none"> Students will explore the green-up/brown-down cycle of plant growth and death. Students will make connections between vegetation ground cover (as observed from space) with the changing seasons in various cities.
Mathematics Connections	<ul style="list-style-type: none"> Students learn to read and interpret a data table containing color data of the Earth's surface.
Technology Connections	<ul style="list-style-type: none"> Students will use satellite imagery to observe the impact of seasonal change on the vegetation of the Earth's surface.
Lesson Assessment Tools	<ul style="list-style-type: none"> Assessment and Standards Table (Word) Assessment Activity Description (below) Authentic Assessment (below)

Materials

Computer (projection device recommended)

[Seasons of the Cities](#) imagery (Powerpoint)

[Seasonal Cities Data Table \(PDF\)](#)

[Seasonal Cities Questions \(Word\)](#)

[Global Greenup Movie](#) narrated by Pixel the Satellite (optional; [Quicktime Player](#) required to view movie)

I. Assessing Prior Knowledge

Students should be familiar with the concept of vegetation "green-up" and "brown down" from the [Global Green-up](#) lesson. Begin a discussion with your students about the reasons plants change color through time. Use this discussion as a way to explore the connection between plant life and the seasons. Students may note that not all plants (e.g. evergreens) change their colors seasonally. This is an excellent observation. Many plants, however, do have a distinct cycle of changing colors and perhaps even losing their leaves under dry and/or cold conditions.

II. Contextual Preparation

Using a computer (projection device recommended), students may view the [Seasons of the Cities](#) sequence of images to observe the "green-up" and "brown-down" of vegetation at various cities in North and South America. On each image, students will see small letters that indicate cities and regions in North and South America. From north to south, these locations include: Hudson Bay, Canada, Duluth, Minnesota, Mexico City, Mexico, San Jose, Costa Rica, Bogota, Colombia, Brasilia, Brazil, and Tierra del Fuego, Argentina. What is notable about these cities is that they are selected to provide a useful north-south cross sectional view of North and South America.

Students should view the series of images several times, making general inferences about the ways that seasons might be changing in each of the cities on the maps. It is helpful for students to select one city and keep their eye on how its surroundings change color over the course of the year. Students should make the connection between the color of ground cover and seasons (greens = spring/summer; browns = late fall/winter/early spring; white = winter). Students may note that some cities change color more than others throughout the year.

You may wish to take some time to discuss these cities and/or the countries in which they occur with your students to provide additional context for your students. In addition, you may wish to show your students the [Global Greenup movie](#), narrated by Pixel the Satellite. The movie transcript is provided below for your use.

"1. Ahhhh...the four seasons: salt, pepper, cinnamon, and nutmeg. 2. Oh, those aren't 4 seasons, they're 4 seasonings! 3. Can you tell me what the four seasons are? (Pixel looks like he's listening to the kids...waits for a moment) 4. That's right...spring, summer, fall, and winter! 5. I have a great job, orbiting the Earth all year round, because I get to see how the Earth changes as the seasons change. 6. Did you know that I can see



changes in the seasons from all the way up here in space? 7. In this lesson, you'll get to see a whole years' worth of Earth pictures taken by one of my satellite friends, and you'll use these pictures to track the changes in the globe's colors through time. 8. What could those color changes mean? 9. Your teacher will help you get started with that—in the mean time, I'm off to see some glaciers in Alaska! 10. See you sooooooon!!!!"



III. Student Activities

1. After engaging students in this initial discussion, teachers should then show the [Seasonal Cities Data Table](#) on a color computer screen and distribute copies of the [Seasonal Cities Questions](#). The table contains a summary of "color data" for each of the seven cities listed earlier. Each cell in the table contains the approximate color of the Earth at that particular location on one of 18 dates throughout the year. This table is similar to the work that students completed in the [Global Green-up](#) lesson as they examined similar images and selected a crayon that best represented the color of a location at a particular time.
2. Either individually, in small groups, or in large group discussion, students should answer the [Seasonal Cities Questions](#) that complement the [Seasonal Cities Data Table](#). The questions are designed to help students make connections between geography and seasonal changes, and set the stage for more detailed study of the impact of seasons on animal migrations.

Questions for Class Discussion:

1. What do the different colors represent?

(green = lush vegetation; light green = sparse vegetation; light/dark brown = no vegetation; black = no sunlight available for satellite photo to be taken; white = snow)

2. Which locations seem to have the most variation in ground cover (most different colors)? What are the positions of these locations on the Earth?

Hudson Bay, Canada and Duluth, Minnesota: these are the northernmost locations; Tierra del Fuego, Argentina: this is the southernmost location.

3. Which cities seem to have the least amount of color variation? Where are these cities located on the Earth?

San Jose, Costa Rica and Bogota, Columbia: both located near equator

4. When does it appear to be summer in each of the cities?

Hudson Bay: June 1 - August 11

Duluth: June 1 - Sept. 21

San Jose: Dec. 1 - March 1

Bogota: Nov. 1 - Feb. 1

5. Compare Hudson Bay and Tierra del Fuego. What do you notice about the seasons in each of these cities as you compare them to each other?

Winter (colder season) in Hudson Bay appears to be Nov. 1 - April 1 and summer (warmer season) is June 1 - Aug. 11. Winter in Tierra del Fuego is April 1 - Aug. 11 and summer is Nov. 21 - March 22.

6. Which cities have the longest summers? Where are these cities found?

San Jose and Bogota: these cities are located near the equator.

7. Which locations have the longest winters? Where are they found?

Hudson Bay: the northernmost location.

Tierra del Fuego: the southernmost location.

8. What season is it in Tierra del Fuego when the color is black? Tierra del Fuego is black because it was too dark during this season for the satellite to take a picture. What colors might you expect to see on the ground in place of the black color if you were to visit Tierra del Fuego during this season?

Winter; you would expect to see white or brown. (Note: Please refer to the lesson called [Lights, Camera, Action!](#) to have your students learn more about how darkness affects camera imagery.)

9. If you were an animal that stayed in one location all year long, near which cities would you probably need to eat differently in the summer compared to the winter? Where do you think you may be able to eat the same sorts of foods year round? Where would you need to build up a layer of fur or fat to stay warm in the winter?

The cities located in the tropics (San Jose and Bogota) are most likely to be places where animals could eat the same sorts of foods throughout the year. Near the locations of Hudson Bay and Tierra del Fuego, the climate would be more variable because of the cold winters and shorter growing seasons. Many animals develop an extra layer of fur or fat in order to stay warm in the cold winter climate. Also, many animals such as squirrels and birds store food such as nuts and acorns to eat in the wintertime, when plants are dormant and insects are not available to eat.

10. How might scientists use satellite images of seasonal changes to study migrations of animals?

(Answers may vary.) Scientists could examine how animal movements are related to different amounts of green plant material over the course of a year.

IV. Assessment

Students should also be able to explain how the seasons, and the color (cover) of the land, change over time. In particular, they should be able to discuss how seasonal changes in North America compare to those in South America. They should recognize that seasonal changes tend to be more apparent the farther one gets from the equator. They should also begin thinking about the connections between seasonal change and animal migration, a topic that is addressed in several lessons throughout the module called [Migrations del Mundo](#).

Lesson Extension for Authentic Assessment

- Throughout this lesson, children have explored the effects of seasonal variation on the color of the Earth's surface. In order to examine the *cause* of these changes, children should explore how the Earth tilts on its axis over the course of a year. Using a globe and a flashlight (to depict the sun), show students that from late March- late September the northern hemisphere faces the sun, while during other periods the southern hemisphere faces the sun. Have students identify the geographic locations depicted in this lesson on the globe, and turn out all lights in the classroom except for the flashlight. Using the [Seasonal Cities Data Table](#), have students match up the tilt angles with the colors they would expect to see on the ground. It will become particularly apparent how Tierra del Fuego can remain black over the course of a day in the Southern Hemisphere winter.
- Using the Internet, have students study the various geographic locations depicted in this lesson and write a story about the people, plants, and/or animals of that area. Special topics may include how the people, plants, and animals adjust to changes in the climate throughout the year, and how the culture of the people reflect these seasonal changes. You may also be able to find a school or teacher in one of these locations on the Internet and establish a pen-pal relationship between your classes to last throughout the school year.