



# Patchwork of the Planet

## Lesson Plan

### Overview

Students will learn how satellite images can be joined to make a picture mosaic. Such mosaics help scientists examine particular Earth features (e.g., mountain ranges, rivers, plains, oceans, coastlines, continents) that are themselves too large to appear in a single scene or field of view. Students will use actual satellite images to make satellite mosaics of various regions of the United States. Students will then use a camera to photograph portions of a globe in the classroom, and combine these photographs to re-create the globe as a flat mosaic.

Suggested Lesson Sequence	Please see the <a href="#">Global Visions</a> and <a href="#">Maps and More</a> module descriptions.
Lesson Level	<a href="#">Intermediate/Extended</a>
Science Connections	<ul style="list-style-type: none"> <li>Students will view and identify large-scale features of the Earth from satellite images as they work on combining individual <b>scenes</b> to make a <b>mosaic</b> of an area.</li> <li>Students will learn that a globe of the Earth (a <b>spherical, three dimensional</b> object) can be represented as a <b>flat</b> object by piecing together their own photos.</li> </ul>
Math Connections	<ul style="list-style-type: none"> <li>Students will develop <b>spatial awareness</b> as they view features of the Earth from an overhead <b>perspective</b>.</li> <li>Students learn that a flat map of the Earth requires that parts of the map are <b>stretched</b>, or that the map will have <b>gaps</b> in it.</li> </ul>
Technology Connections	<ul style="list-style-type: none"> <li>Students will analyze satellite images and discuss the processes whereby individual scenes are joined in order to examine Earth features that are too big to appear in one satellite <b>field of view</b>.</li> <li>Students will learn that satellite images often show different colors or <b>brightness</b> because they are taken at different times.</li> <li>Students will use a camera to take photos, which</li> </ul>

	will later be combined to create a <b>mosaic</b> .
Lesson Assessment Tools	<ul style="list-style-type: none"> <li>· <a href="#">Assessment and Standards Table (Word)</a></li> <li>· <a href="#">Assessment Activity Description (below)</a></li> <li>· <a href="#">Authentic Assessment (below)</a></li> </ul>

## Materials

Powerpoint Reader ([Windows](#) / [Mac](#))

Selected America Patchwork Activity Sheets ([Powerpoint](#)), printed for each student

Patchwork of the Planet Assessment Slide Show ([Powerpoint](#))

Digital or film camera

Scissors for each student

Clear tape

Globe

Computer and projection device (recommended)

*About the slideshow:* This slideshow is not meant for students to read through on their own. It is intended to be viewed together, to outline and illustrate a discussion of the lesson's themes, led by the teacher. You might have a different student read each slide's text.

## Vocabulary

- **Mosaic:** a picture or design made from joining smaller pictures together
- **Patchwork:** forming a quilt or other large cloth out of smaller pieces of cloth

## Procedure

This lesson has two parts that will each likely take a full class period.

### I. Assessing Prior Knowledge

Begin this lesson by beginning a discussion of puzzles with your class. Ask students to describe their favorite types of puzzles. You may also ask: has anyone ever done a puzzle without knowing what it will look like? People often times take small bits of things, arrange them together like a puzzle, and then fasten them to one another to make something larger such as a piece of artwork, a quilt, a large image, or a map. When many small pieces are put together, we can often times start to see new things in the "bigger picture" that were not possible to see when looking at the individual smaller pieces. Ask students if they have experience making any sort of large mosaic out of smaller things—perhaps you can relate back to a previous art project in class. Introduce the vocabulary words by way of this discussion.

## II. Contextual Preparation

Continue the class discussion by telling students that they will become Earth artists in this lesson—that is, they will piece together pieces of images that a) have been taken by satellites, and b) have been made by themselves, to make a “patchwork planet Earth.” Ask students to discuss how they might learn more about the Earth by seeing a larger part of it. Encourage students to think about how we might be able to study large mountain ranges, lakes, oceans, continents, and maybe even the entire planet if we are able to see large areas at once.

## III. Student Activities

### Part I: Patchwork of America

1. The [America Patchwork Activity Sheet](#) has a series of puzzles designed for students to piece together various regions of the United States. Because coastal areas provide nice lines for joining images, four coastal regions of the U.S. have been provided for you to use with your students in creating image puzzle mosaics. These puzzles include:

- The Puget Sound region of Washington (4 pieces),
- The Lake Michigan region (8 pieces),
- The Central Atlantic Coast states (10 pieces), and
- Florida (13 pieces).

In addition to these satellite image puzzles, this activity sheet also contains a cartoon for students to cut out and piece together as practice, before attempting the satellite image mosaics.

You may wish to print the practice cartoon and just one of the image mosaics to begin with. The Puget Sound area, because it contains only 4 images, would be a good place to start.

2. Distribute the cartoon image puzzle. Have students cut out the puzzle pieces and arrange them to make a smiling star. Students may tape together the star once they have arranged it, or they may leave the paper loose.
3. You may wish to display the cartoon star “answer” on a computer screen after some students have worked on their mosaics for a few minutes. This will assist students in finishing their work.
4. Now, distribute the page containing the Puget Sound satellite images. Students will

- repeat the above procedure to make their satellite mosaic. Again, after some time, you may wish to project the "answer" for the students so that they may compare their work.
5. After finishing the Puget Sound satellite mosaic, pause to ask students what they see in the completed image. You might lead students in a discussion about how natural Earth features (rivers, snow-capped mountain ranges, plains, forests, etc.) might be discernable in satellite imagery, and how they might be used to make various conclusions about pictures taken from satellites. Compare the mosaic to a map of the Puget Sound region of the U.S., if one is available. Mention that this image can be updated regularly, as satellites whiz overhead.
  6. Share with students the fact that each of the puzzle pieces is an actual scene taken by a satellite called Landsat. As background information: Landsat can image the entire Earth in 16 days, but many times the ground is covered by clouds. So, side-by-side images of the Earth can look different from one another, depending on seasonal condition (the health of plants on the ground, the angle of the sun, the time of the day), or satellite condition (the brightness settings of the camera), or the image display itself (often the colors of images are displayed differently).
  7. At your discretion, distribute another Earth image puzzle to the class. Tell students that they will now travel to a different part of America to do some more patchwork! Feel free to repeat the procedure with all image puzzles, as time and interest allow.

## Part II: Patchwork of the Planet

1. In order to more fully develop the notion of a satellite mosaic, place a globe on a table in the classroom. Use a digital camera (preferable) or film camera to take a series of close-up images of the globe. As you take photos, keep the distance between the camera and the globe approximately the same. Start by focusing the camera (i.e. "satellite") on the equator and spinning the globe about its axis so that a series of slightly overlapping images can be taken. Use a zoom setting on the camera so that only a part of the globe is visible in each image. The more small images that are used, then the less distortion will occur at the edge of each image. The camera could be set up so as to be able to capture part of the globe, but not the entire globe.
2. Once the globe has been spun the complete 360 degrees for photos along the equator, you may wish to continue taking photos of the rest of the planet. After completing your photographs, download (or develop, if using film) the images and print them.
3. Now, have your students make a mosaic of the equator images by joining them so as to model an entire satellite path as it orbited the Earth. These photographs can be taped together flat and used to show how the spherical, three-dimensional Earth can be mapped on flat paper. To model the equator as a circle, simply curl the strip of images back upon itself and join them together using tape.
4. In your comparison between the images and the globe, compare the relative sizes of the features. The images will probably be at a different scale than the globe. This will be an excellent time to discuss the concept of scale. Often times, images and maps are

made at a scale that is different than that of the original object (in this case, a globe).

5. If you gathered more images of the globe, away from the equator, then continue to join these images together as a class. The class will discover that as a full sphere is modeled, it becomes impossible to join all of the places together as a flat map. Ask students if they could join the images together if they were made of a stretchy material such as rubber. Students should make the important connection that if they could stretch some images, they would be able to join the entire Earth together as a flat map. That is exactly how flat maps are formed! Roads, coastlines, borders, and other features are "stretched" to join up with one another. As one moves farther and farther from the equator, the more stretching is required to make a flat map! This stretching is why landmasses near the poles, such as Antarctica and Greenland, often appear much larger on a map than on a globe. If areas are not stretched, then gaps will appear in the flat map.

Now, begin a summative class discussion, using the following questions as a guide:

1. What is an image mosaic?

*An image mosaic is a large image made up of individual smaller images joined together at common points.*

2. How does one join scenes together in order to get a larger perspective of a particular region of the Earth?

*Take photos of individual scenes. Look for natural features on the photos to assist in making a mosaic.*

4. Why might a scientist choose to combine individual scenes that have been captured by a single satellite?

*Scientists can study landscapes, mountain ridges, valleys, lakes, oceans, and other natural features over a large area.*

5. Would it be possible to combine a series of scenes if they were taken from two different satellites? What might be some of the issues that would impact the effort to do so?

*It would be possible; however, the satellites may take pictures from different perspectives, heights, or angles due to different locations in orbit.*

6. What if two or three different scenes were captured using different zoom lenses? Would it be possible to combine them? Why or why not?

*This would be difficult because the images would be scaled up or down and features would*

*be different sizes in different scenes.*

#### **IV. Assessment**

Show students the [Patchwork of the Planet Assessment Slide Show](#). In this slide show, students will be presented with various questions that can be answered orally or in writing, on a blank piece of paper. Students can demonstrate their knowledge of the associated concepts of mosaics and maps through their answers to these questions.

#### **Lesson Extensions for Authentic Assessment**

1. Take students to the playground, allowing them to select a part of the ground to photograph using a sequence of images. Students can then make their own image mosaics of familiar places.
2. Repeat the above extension, completing the same series of steps on the same plot of ground only using a different zoom setting on the camera. Preferably, students could zoom the lens even further, therefore requiring more photos to fully represent the entire region. Parallels could then be drawn between the first set of photos and the second set of photos. For example, if the camera was zoomed 2x, would it therefore require twice as many photographs to entirely cover the plot? Or four times as many photographs?