

GIS Lesson 6
MAPS WITH RASTER IMAGES III:
SATELLITE IMAGERY
TEACHER INFORMATION



Lesson Summary: During this lesson students use GIS to load and view true-color and enhanced satellite images of Alaska. Based on their knowledge of Alaskan geography and recent image interpretation experiences in RSG Lesson 1, they interpret features found in the satellite images.

Objectives: Students will learn how to load and display satellite imagery in AEJEE and will answer questions about what they see in the images.

Estimated Time: 30 minutes

Correlation to Alaska Standards:

Geography A-6 Use spatial (geographic) tools and technologies to analyze and develop explanations and solutions to geographic problems.

BACKGROUND FOR THE TEACHER

Images taken from satellites have been used by GIS and remote sensing researchers to make environmental observations from space for many years. There are many different satellites collecting many different kinds of data from all across the energy spectrum into wavelengths far beyond what the human eye can see.

Students tend to like the 'true color' images for their more familiar views of the earth, and of local community areas from space. Other kinds of enhanced images can be derived from satellite data and often provide important information, even though the color combinations take some getting used to. A common enhancement of satellite imagery is designed to approximate the appearance of CIR (Color Infrared) aerial photographs. (For a more thorough discussion of CIR, refer back to MapTEACH RSG Lesson 1.)

The Landsat image used in this lesson has been enhanced to highlight some of the diverse landscape features. In this statewide summertime image, areas covered by snow and ice are light blue, clear water is dark blue, vegetation is green, and bare rock, exposed soils and sand dunes are various shades of pink. Many areas that have been burned show up in tones of black and red.

Students will find that the larger the area covered by the image, the lower the resolution, and the larger the size of each pixel. These statewide images are actually made from many individual satellite images 'mosaiced' together so that the edge of each smaller image fits the next like pieces of a puzzle. Since individual satellite images are typically hundreds of megabytes in size, the whole image must be reprocessed to a lower resolution to create a manageable file size of a few megabytes.

It is tempting to want to use very high resolution satellite image data or digital air photos for a close-up view of an area of interest. These kinds of high resolution images can be very difficult or expensive to procure and cover only very small areas. The file sizes of these images are also extremely large. For our purposes, coarser-resolution data like the MODIS and Landsat imagery used in this lesson are still visually attractive choices for base maps and have the benefit of much smaller file sizes that function well with AEJEE.

MATERIALS

- Computers - one for each student is best or two students can share. The computers must meet the following specifications to run AEJEE:
 - Macintosh: MacOS 10.3 or above, 100 MB hard drive space, Internet connection; recommend G4 or faster processor and more than 64 MB RAM.
 - We recommend: Mac OS 10.4 or above, 500 MB hard drive space (400 MB for data).
- AEJEE software and MapTEACH GIS data can be downloaded from the MapTEACH website at <http://www.mapteach.org>, or provided by MapTEACH on a DVD by contacting:
 - De Anne Stevens - MapTEACH
 - Alaska Division of Geological & Geophysical Surveys
 - 3354 College Road
 - Fairbanks, AK 99709-3707
 - Tel: 907-451-5014
 - E-mail: deanne.stevens@alaska.gov
- Copies of student instructions for the lesson.

INSTRUCTIONAL PROCEDURES

Getting Ready

As always, try out the lesson on a classroom computer ahead of time.

Gear-up

Ask students if they have ever seen satellite images before. Have they ever used Google Earth? Google Earth uses satellite images as base map data for their maps. Do they think Google Earth uses GIS?

Explain to students that this lesson gives them an opportunity to use pictures taken from space to look at the Alaska landscape in GIS. You can whet their appetites by showing them some interesting images of Alaska from the USGS Landsat Image Gallery (see the link in the resources section below).

MORE EXPLORATIONS

Have students explore Landsat images of Alaska by searching through the USGS Landsat Image Gallery. They can also use Google Earth to view places all over the world, as well as their own home communities or other areas of interest in Alaska.

TEACHER RESOURCES

The Landsat Education Program (NASA)

<http://landsat.gsfc.nasa.gov/education/resources.html>

MORE RESOURCES FOR STUDENTS OR TEACHERS

USGS Landsat Image Gallery: An easy-to-browse array of images including such Earth features as volcanoes, floods, cities and more.

<http://landsat.usgs.gov/gallery.php>

Visible Earth: A catalog of NASA images and animations of our home planet

<http://visibleearth.nasa.gov/>

Google Earth: An online interactive map site that uses satellite imagery to bring geography alive. <http://earth.google.com/>

Remote Sensing Resources from the Remote Sensing & Geographic Information Facility: American Museum of Natural History (thorough and comprehensive account of resources) at http://cbc.rs-gis.amnh.org/remote_sensing/index.html . The **interactive tools** provided at the bottom right of the home page provide great ways to illustrate basic remote sensing concepts.

Name: _____

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STUDENT EXERCISE



Objectives: Students will learn how to load and display satellite imagery in AEJEE and will answer questions about what they see in the images.

Estimated Time: 30 minutes

In the last lesson you used shaded relief raster images as base layers to start building a map of your Project Community. We're going to take a break from the Project Community map right now to look at a different kind of raster layer, a satellite image. As you saw in class, satellite images can show many different kinds of features.

The satellite images we are going to use in this lesson are pretty low resolution in order to make data files that will work in AEJEE. We won't be able to see much detail, but we can still see plenty of features when we are zoomed out to large areas of Alaska.

During this lesson you will use a *MODIS satellite image* and a *Landsat satellite image* to look for features that stand out in the Alaskan landscape.

Explore 1: MODIS Satellite Image

1. **Open AEJEE** and make your window bigger **by clicking on the green button in the top left of the window.**
2. Navigate to the **Base_Data** folder and load the raster file **MODIS_Mosaic_true.jpg**. The "true" in the name is to indicate that the colors in the image are real-life colors.

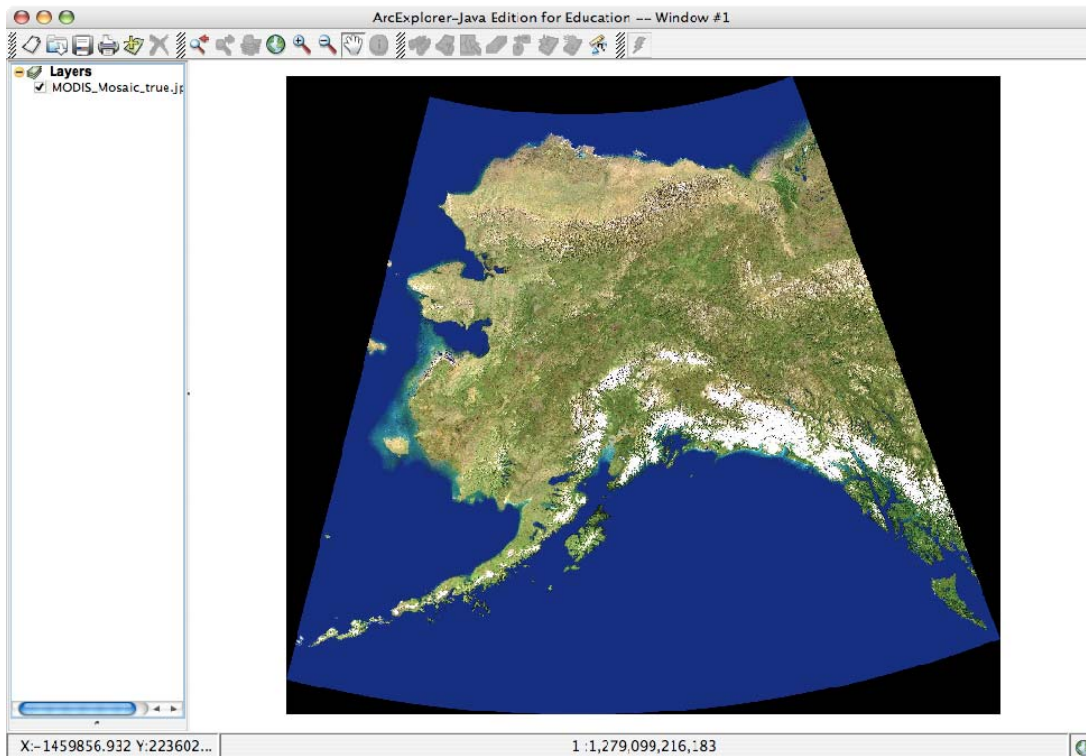
IF the map does NOT show all of Alaska, Clear the Projection

Remember when we were working with the statewide shaded relief image and we did not set a projection? This satellite data set is also very big and complicated, so we will not be setting a projection for it. It may be necessary to clear the projection. Remember: Normally, you would always set a projection!

(Note: Because you have not set a projection, you will not be able to use the measure tool or the "Zoom To Scale" function)

- **If** you need to clear the projection, start by **clicking on "Projection"** in the **Tools** menu.
- The **"Select Coordinate System" window** will appear: Click on the **"Clear"** button. Click **"OK."**

Your map should look something like this:



3. **Save** your map as **firstname_lastname_satellite** in the **student/MapTEACH_Work** folder.
4. **Zoom around** and look at what the MODIS image shows.

MODIS Image Interpretation

How is this satellite raster image different from the shaded relief rasters?

In general, what do you think the green areas are? _____

In general, what do you think the dark blue areas are? _____

In general, what do you think the light blue areas are? _____

In general, what do you think the white areas are? _____

What time of year do you think this satellite image was taken, and why?

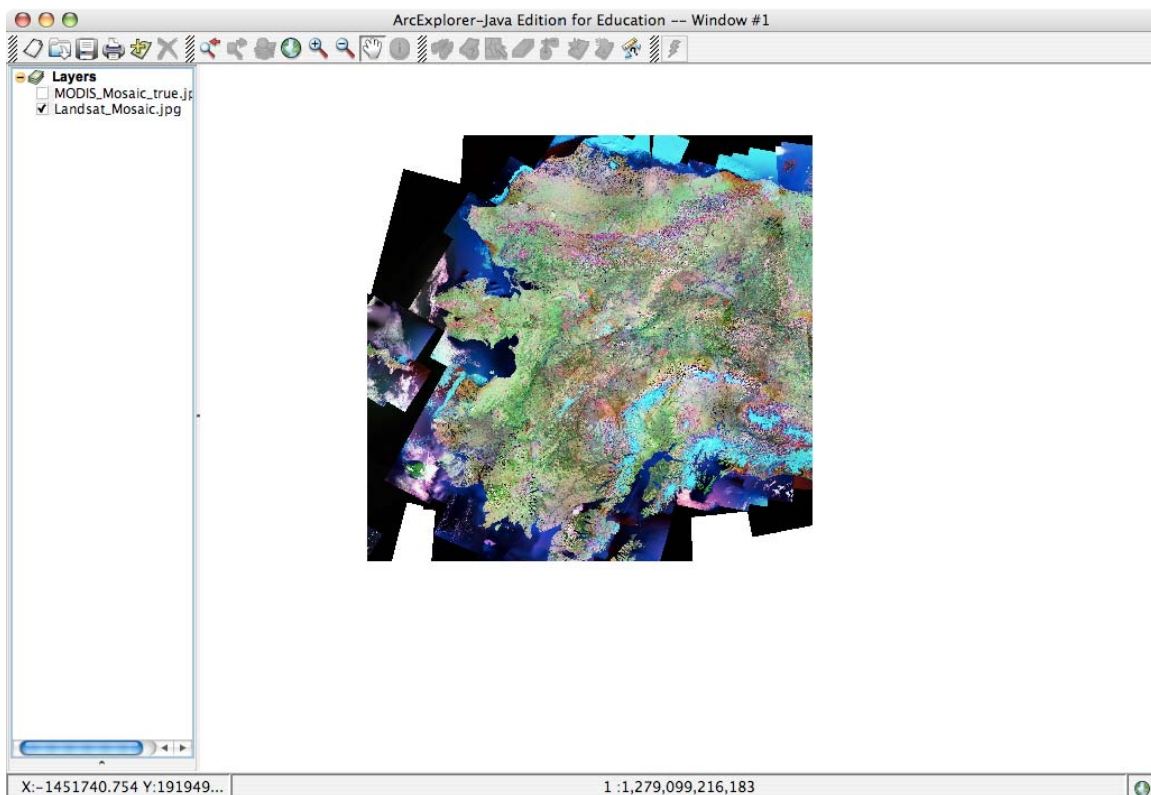
Do you think that this particular satellite image would be a good base map for a community planning project?

Why or why not? _____

Explore 2: Landsat Satellite Image

1. Load the raster file **Landsat_Mosaic.jpg** from the **Base_Data** folder. This image is from a different satellite. We do not have an image like this that covers the entire state, but we can still see a lot of interesting things.
2. Turn off the MODIS_Mosaic_true raster layer so you can see the Landsat_Mosaic image.

Your map should look something like this:



3. **Save** your map.
4. **Zoom around** and look at what the Landsat image shows.

Landsat Image Interpretation

How is this raster image different from the MODIS image?

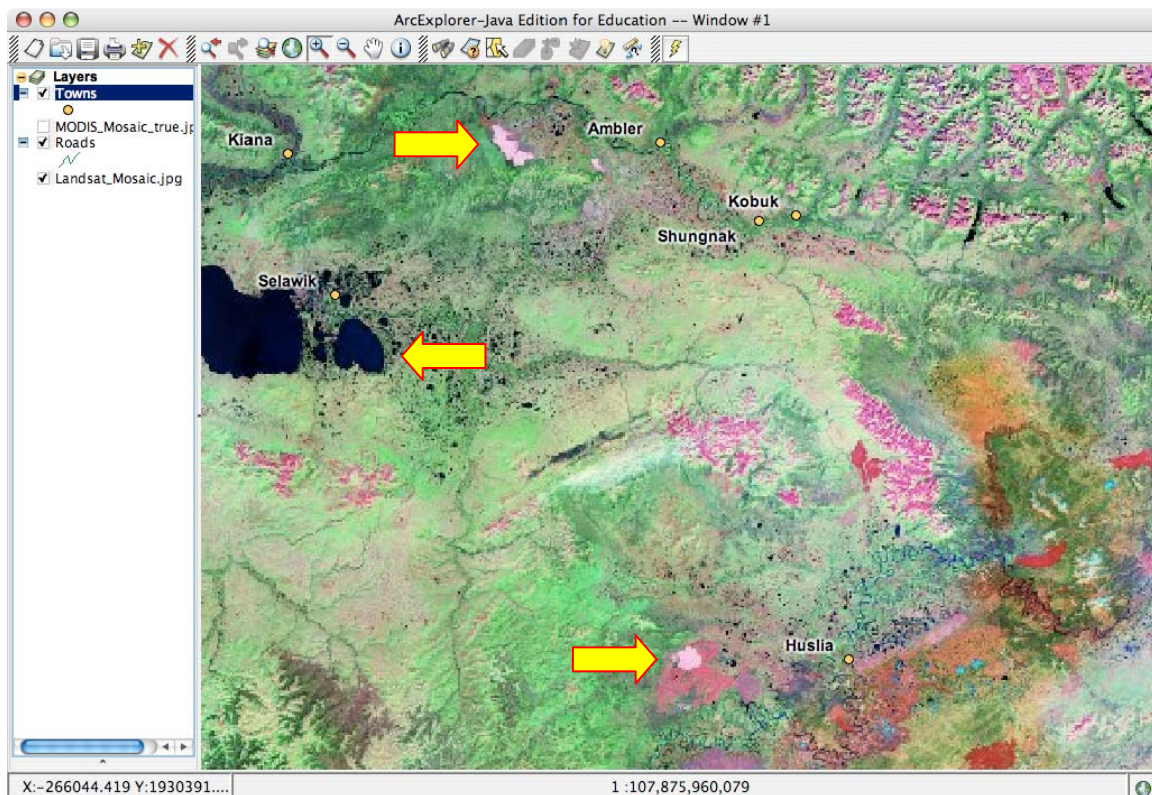
In general, what do you think the pink areas are? _____

In general, what do you think the light blue areas are? _____

In general, what do you think the dark blue areas are? _____

Add the **Towns** shapefile from the **Infrastructure** folder and label the towns with their names. Find the communities of Selawik, Huslia and Ambler and zoom in until you barely have all three in your map.

You should be zoomed in to the approximate extent shown here:



(The arrows on this map are pointing to places referred to in the next few questions)

Turn the MODIS_Mosaic_true layer on and off by checking and unchecking the box next to the layer name in the Table of Contents. This allows you to flicker between the two types of satellite image. Now, try to answer the following questions.

In the Landsat image, there is a light pink blob just west of Ambler and a light pink blob just west of Huslia. What do you think these could be?
(Hint: you may have seen one of these on an air photo in a PowerPoint presentation during a MapTEACH lesson; also, you might find these sorts of things in the Sahara Desert of Africa!)

What do these blobs look like in the MODIS image?

Turn off the MODIS image and use the Landsat image to look at the large lake that is just **southeast of Selawik**.

What color is the lake in the Landsat image? _____

Based on your previous interpretations of the colors in the Landsat image, what does this color indicate about the water?

What color is the lake in the MODIS image? _____

Based on your previous interpretations of the colors in the MODIS image, what does this color indicate about the water?

The Landsat image is from 1990, and the MODIS image is from 2001.

Based on your observations of the satellite imagery, what do you think might have happened to the lake between 1990 and 2001?

Do you think that a Landsat satellite image would be a good base map for a community planning project?

Why or why not? _____

Show your map to a teacher.

Teacher sign-off: _____