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## CHAPTER 7

# Image mosaicking

Image mosaicking is the process of joining two or more independent images to form one single image. When you mosaic images, areas of overlap are stitched together. In the resulting output image, whichever theme was displayed on top is also the visible portion of the mosaicked image. Mosaic is flexible enough to be able to stitch together continuous or thematic data.

You'll find many practical uses for your mosaicked images using the ArcView Image Analysis extension.

In this chapter you'll learn:

- How Mosaic works.
- How to mosaic continuous images.
- How to mosaic thematic images.

## Mosaicking images

One of the functionalities of the ArcView Image Analysis extension is the ability to mosaic images. When you mosaic, you join multiple themes into one theme. You can mosaic either single or multiband continuous data, or thematic data.

### Mosaicking tip

Mosaic may also be used with just a single input image. There are at least two examples of when this might be useful.

If you have a floating point file such as the result from Vegetative Index (see Chapter 10, "Analyzing Images"), you can use Mosaic to convert it to an unsigned 8-bit image. Since Mosaic maps the original pixel values through the contrast table associated with each band, it produces an image with pixel values of 1-255 (excluding 0 for background) with the stretch already built-in.

Another example of when you might want to Mosaic a single image is when you want to produce a TIFF file with the stretch already built-in. This is useful when you are working with other software packages that cannot interpret the ArcView Image Analysis extension histogram stretch information.

## Mosaic properties and data preparation

One of the most important elements of the Mosaic functionality is that you must arrange your images in the view as you want the output theme to appear before you mosaic them. The ArcView Image Analysis extension mosaics images strictly based on their appearance in the view. Moreover, Mosaic only joins those themes that are checked for display, not active, in the view. This allows you to mosaic a large number of images without having to make each one active.

Additionally, in order to mosaic images they must contain the same number of bands. For example, you cannot mosaic a seven-band TM image with a six-band TM image. You can, however, use another ArcView Image Analysis extension tool that you already learned about, Subset, to subset bands from an existing image. In this way, you can mosaic images regardless of the number of bands they originally contain.

You can mosaic images that have different cell sizes or resolutions. In this case, the default mechanism is for the ArcView Image Analysis extension to consult the settings in the Image Analysis Properties dialog. The Cell Size is initially set to the maximum cell size. Therefore, if you mosaic two images: one with a 4-meter resolution and one with a 5-meter resolution, the output Mosaic theme has a 5-meter resolution. You can, however, set the Cell Size in the Image Analysis Properties dialog to whatever cell size you like. Then, the output Mosaic theme has the Cell Size you selected.

When you apply Mosaic, the images are processed with whatever stretch you may have applied using the Legend Editor. During processing, each image is fed through its own lookup table, and the output mosaicked image has the stretch built-in and should be viewed with no stretch. This allows you to adjust the stretch of each image independently to achieve the desired overall color balance.

**Note** For information on using the Legend Editor, see Chapter 5, "Enhancing image display."

#### How and why Mosaic uses nearest neighbor

Regardless of whether you use Mosaic to join continuous data or thematic data, the nearest neighbor resampling method is used to produce the output mosaicked image. The Mosaic process starts at the upper left-hand corner of the leftmost image as displayed in the view. The progression is from left to right and down ward, row by row, until the software reaches the bottom right pixel of the rightmost image. Mosaic considers only the pixels that make up the images; it does not include 0 values outside of the images' extent.

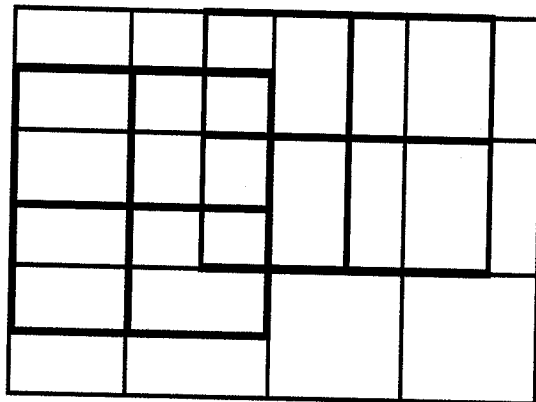
By using nearest neighbor, the mosaicked pixels will not be different from their original appearance. Pixel values are defined based on closest pixels. Other methods use averages to compute a pixel's value that can produce an edge effect, which results from 0 values being averaged with edge pixels from the mosaicked image.

You can also control how Mosaic functions by setting analysis properties. Of particular importance is the Cell Size. Because of the way images are displayed in the view, you may perceive some shifting of the images during the Mosaic function. This is due to the way the pixels of the two individual images line up in the view.

#### Understanding pixel shift

Because the images used in the Mosaic process do not always line up precisely in the view, the Mosaic function has to compensate for the pixel shift. In the following diagram, one image is represented in red. It is a simple representation of a 2 x 2-pixel image. The other image is represented in blue. It also is a simple representation of a 2 x 2-pixel image. Clearly, these two images have the same cell size, that is, the size of the pixels is the same. However, the top left corner of one image does not align with the other. This results in perceived pixel shift.

In the following diagram, a green image is superimposed over the two original images. This green image is the mosaicked image. You can see that, to compensate for the fact that the original images are not exactly aligned pixel-for-pixel, the mosaicked image relocates the upper left pixel. Due to this compensation, the mosaicked image appears to be shifted. The exact location of the mosaicked pixels, the green lines, may be controlled by using the Image Analysis Properties dialog.



*This illustrates that mosaic generates an output image covering the farthest extents of the input images.*

The default pixel location in the mosaicked image is determined by the leftmost and the topmost input images. This yields an upper left-hand coordinate from which the output pixels are laid out.

## Mosaic continuous data

Sometimes you may be working with multiple images that cover your project area. It may be difficult for you to manage many separate images. The ArcView Image Analysis extension allows you to mosaic the images so that you can treat them as one. To do so, you first need two (or more) images that are located in the same proximity and in the same coordinate system. In the following example, you can see how you can use the ArcView Image Analysis extension's functionality to process images in a streamlined workflow.


First, you add two images to the view that happen not to have the same resolution: Cir\_south\_4m.img has a 4-meter resolution; Cir\_north\_5m.img has a 5-meter resolution. You can then use the Legend Editor to make the two-color infrared images look similar. Then, you use the analysis properties to set the output mosaic's resolution before you mosaic the images.

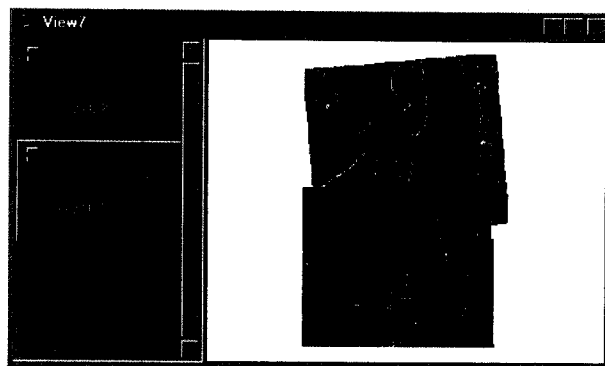
### Start ArcView GIS

#### Load the ArcView Image Analysis extension

1. From the file menu, choose Extensions.
2. Click in the check box labeled Image Analysis, then click OK. This loads the ArcView Image Analysis extension.

### Add two themes

1. Open a new view.
2. Click the Add Theme button .
3. Navigate to the avtutor directory and double click on the ia\_data directory.
4. Click on the Data Source Types drop-down list and select Image Analysis Data Source.
5. Hold the SHIFT key and click on Cir\_south\_4m.img and Cir\_north\_5m.img, and then click OK.
6. Click the check boxes of the Cir\_south\_4m.img and Cir\_north\_5m.img themes to draw them in the view.



*These two themes have different resolutions. You can set the analysis properties prior to mosaicking to select a resolution.*

### Apply a Gamma stretch

1. Open the Legend Editor for the Cir\_north\_4m.img theme, and click the Stretch drop-down list and choose Gamma.
2. In the Gamma number field, type the value "1.6," then click Apply. The theme redispays in the view.
3. In the view, double-click the title of the Cir\_south\_5m.img theme.
4. Note that the Cir\_south\_4m.img theme is listed in the Theme window.
5. Click the Stretch drop-down list and choose Gamma.
6. In the Gamma number field, type the value "1.6," then click Apply.
7. Close the Legend Editor.

### Choose the stacking order

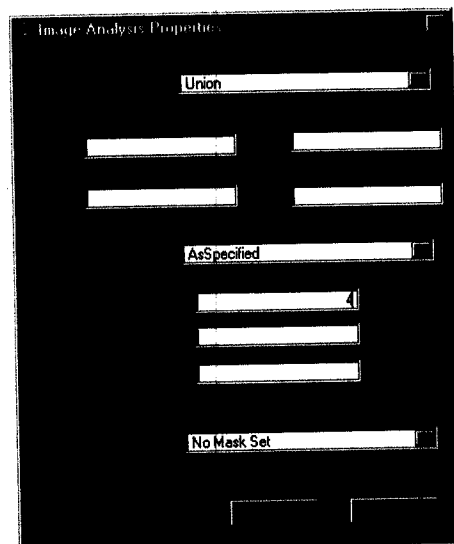
Currently, the Cir\_south\_4m.img theme is displayed on top of the Cir\_north\_5m.img theme. You can change the stacking order to see which you like better.

1. In the Table of Contents, click the title of Cir\_north\_5m.img and drag it to the top.
2. If you prefer the previous stacking arrangement, click the title of Cir\_south\_4m.img and drag it to the top of the Table of Contents. Otherwise, proceed to "Set the analysis properties."

### Set the analysis properties

Despite the fact that the two input themes have different resolutions, you can still obtain an output image with any resolution you choose. In this example, you are going to choose a 4-meter resolution.

1. Click the Image Analysis menu, then choose Properties.
2. Click the Analysis Cell Size drop-down list and choose AsSpecified.
3. Click in the Cell Size window and type "4". The output mosaic will have a 4-meter resolution.

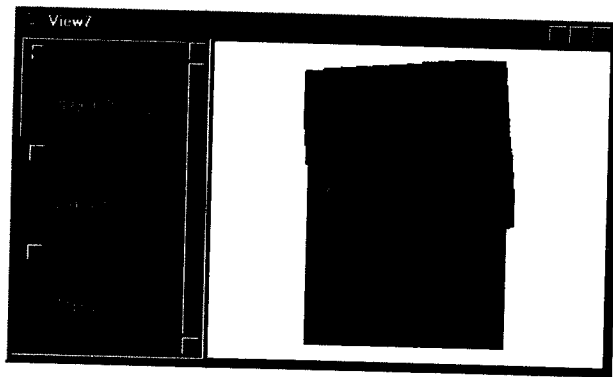


*You can use the analysis properties to set a cell size for the output theme.*

4. Click OK in the Image Analysis Properties dialog.

### Mosaic the Images


1. Click the Image Analysis menu and choose Mosaic. A progress bar displays at the bottom of the ArcView window as the ArcView Image Analysis extension mosaics the images.
2. When the process is complete, click the check box for the Mosaic theme to draw it in the view.
3. Click the check boxes of the two original themes so that they do not draw in the view.
4. Double-click the title of the Mosaic theme to access the Legend Editor.
5. Click the Stretch drop-down list and choose None, then click Apply.

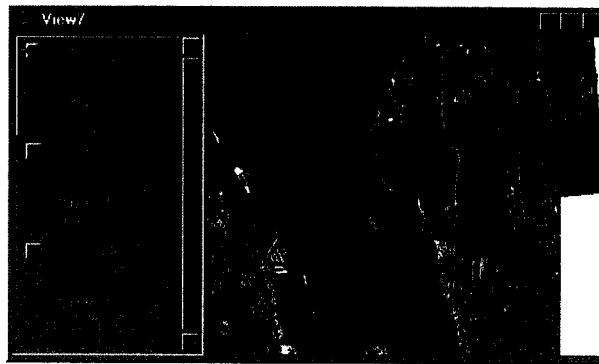


*The mosaic function has successfully joined the two themes into one.*

Mosaicked images already have the stretch built-in, so you probably want to view them with no additional stretch applied.


### Zoom into the joined area

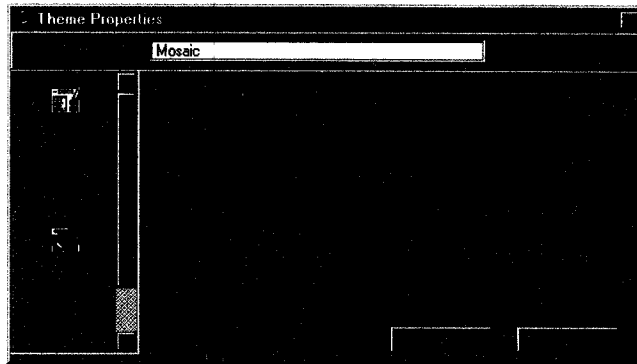
1. Click the Zoom In tool  located on the ArcView tool bar.
2. Click on an area where the two themes are joined. This area is indicated by the irregular edge of the Mosaic theme.



*This illustration shows you where the two images are joined.*

### Check the Theme Properties

1. Click on the title of the Mosaic theme to make it active.
2. Click the Theme menu, then choose Properties.
3. Click the Information icon  in the Theme Properties dialog. Note that the Cell Size value is 4.



*The Cell Size indicates the 4-meter resolution.*

4. Click Cancel to close the Theme Properties dialog.

As this example has shown, you can use a combination of tools to get the best possible results from mosaicking images. If you have two themes with different resolutions, you can easily use the analysis properties to select a resolution for the output file. Now, you can use other ArcView Image Analysis extension tools on your mosaicked image.



## Mosaic thematic data


As you saw in the previous example, you can mosaic continuous data themes into one theme. You can also mosaic thematic data, such as a land cover classification. If the legends associated with the thematic data themes are the same, you can mosaic them in the same way. Simply display them in the view, choose Mosaic from the Image Analysis menu, then check the Mosaic theme to display the joined themes.

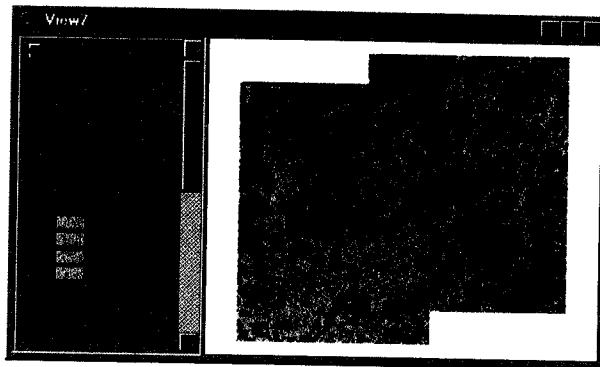
### Start ArcView GIS

#### Load the ArcView Image Analysis extension

1. From the file menu, choose Extensions.
2. Click in the check box labeled Image Analysis, then click OK. This loads the ArcView Image Analysis extension.

#### Add two themes of Olympia, Washington

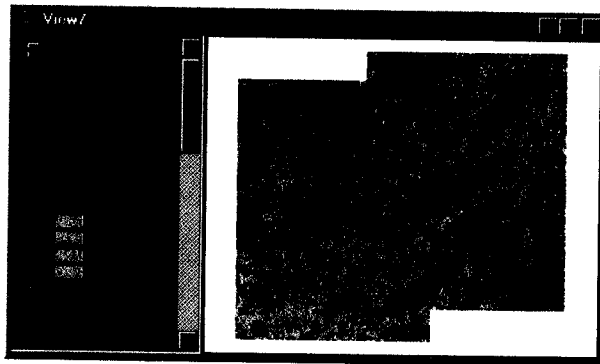
1. Open a new view.
2. Click the Add Theme button .
3. Navigate to the avtutor directory, and double click on the ia\_data directory.
4. Click on the Data Source Types drop-down list and select Image Analysis Data Source.
5. Hold the SHIFT key and click to select vegcovermap\_e.img and vegcovermap\_w.img, then click OK.
6. Click the check boxes of the vegcovermap\_e.img and vegcovermap\_w.img themes to draw them in the view.



*Two thematic themes displaying classes of vegetation are drawn in the view.*


### Mosaic the thematic images

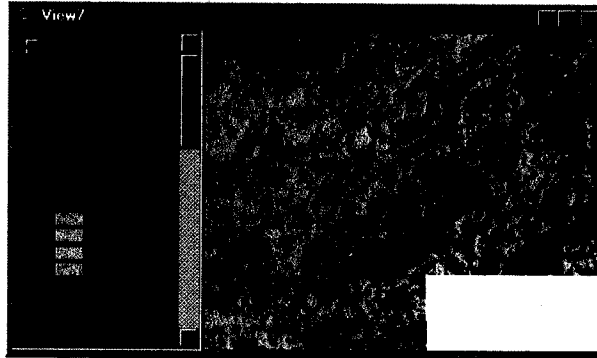
1. Make sure that the vegcovermap\_e.img theme is listed first in the Table of Contents. The ArcView Image Analysis extension mosaics images as they are displayed in the view.
2. Click the Image Analysis menu and choose Mosaic. A progress bar displays at the bottom of the ArcView window as the ArcView Image Analysis extension mosaics the images.
3. When the process is complete, click the check box for the Mosaic theme to draw it in the view.



*The mosaic function has successfully joined the two continuous data themes into one. Note that the classes remain the same.*

### Zoom in to a specific area

1. In the Table of Contents, click to deselect the two original themes, vegcovermap\_e.img and vegcovermap\_w.img, from display in the view. The Mosaic theme remains displayed in the view.
2. Click the Zoom In tool , and zoom in upon an area where the images have been mosaicked. This is an area where the extremes of the images do not cover the same area.



*The two themes were joined in this area. The classes have been mosaicked.*

After you mosaic, you might even choose to make a subset of your mosaicked image. As you have seen, the ArcView Image Analysis extension also has a convenient Subset function. You can even subset your mosaic during the process of creating it by using the Image Analysis Properties dialog. For example, you can set the Analysis Mask to a shapefile containing property boundaries.

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**Note** Sometimes continuous data is stored as thematic data with color tables that give the appearance of continuous imagery. This is often called pseudo color imagery. To mosaic this type of imagery see "Converting to RGB" in Chapter 3.

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## What next?

Now that you know about the data types that are compatible with the ArcView Image Analysis extension and how to integrate them into the ArcView GIS environment, you are ready to learn about other new tools and functionality available to you. One of the image analysis techniques you may want to apply to an image is feature extraction. With it, you can automatically digitize polygons that include areas with similar characteristics. You can then find similar areas throughout the image. The next chapter tells you how.