

You can now use the aligned image and the shapefile together in your image analysis. You'll see in Chapter 6, "Image rectification," how you can use the Align tool to rectify a raw image to another image that already has a map coordinate system.

Close the view

You can now close the view and go on to the next exercise, or you can end your ArcView GIS session. To end your ArcView GIS session, click the File menu and choose Exit. Click No when asked to save changes.


Exercise 4: Finding areas of change

The ArcView Image Analysis extension allows you to see changes over time. You can perform this type of analysis on either continuous data using Image Difference, or thematic data using Thematic Change. In this exercise, you'll learn how to use Image Difference and Thematic Change. Image Difference is useful for analyzing images of the same area to identify land cover features that may have changed over time. Image Difference performs a subtraction of one theme from another. This change is highlighted in green and red masks depicting increasing and decreasing values.

Find changed areas

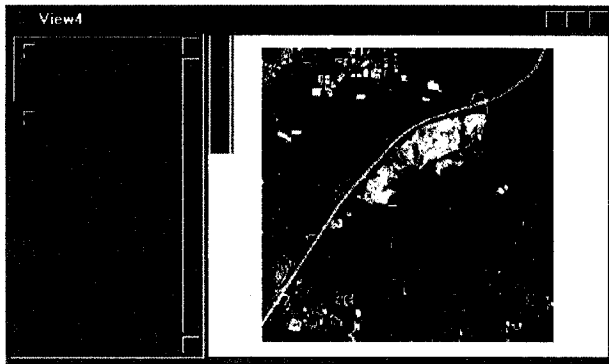
In the following example, you are going to work with two continuous data images of the north metropolitan Atlanta, Georgia, area—one from 1987 and one from 1992. Continuous data images are those obtained from remote sensors like Landsat and SPOT®. This kind of data measures reflectance characteristics of the Earth's surface, analogous to exposed film capturing an image. You will use Image Difference to identify areas that have been cleared of vegetation for the purpose of constructing a large regional shopping mall.

Add and draw the images of Atlanta

1. If necessary, start ArcView GIS and load the ArcView Image Analysis extension.
2. Open a new view.
3. Click the Add Theme button .
4. Navigate to the avtutor directory. Double click on the ia_data directory.
5. Click the Data Source Types drop-down list and choose Image Analysis Data Source.
6. Press the SHIFT key and click on atl_spotp_87.img and atl_spotp_92.img. Click OK.

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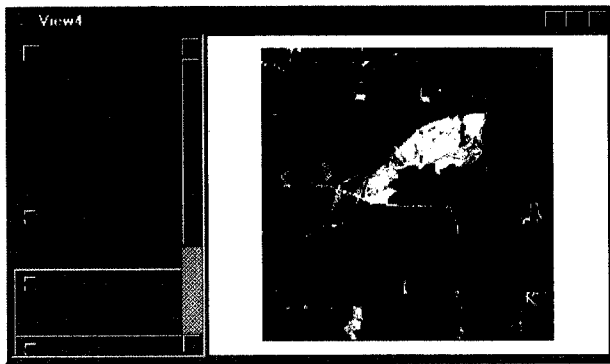
7. Click the check box for both the Atl_spotp_87.img theme and the Atl_spotp_92.img theme to draw them in the view.



With images drawn in the view and active, you can calculate the difference between them.

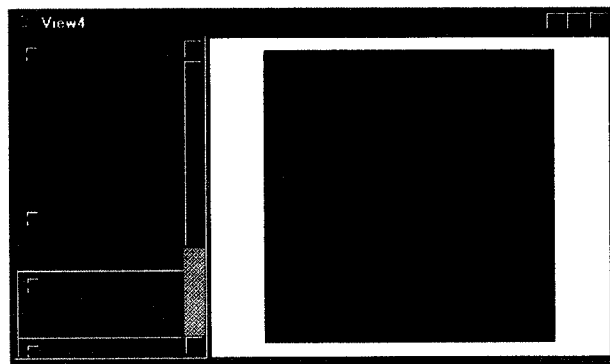
Compute the difference due to development

1. Make both themes active in the view by holding down the SHIFT key while clicking on the inactive theme.
2. Click the Image Analysis menu and choose Image Difference.
3. In the Image Difference dialog, click the Before Theme drop-down list and select Atl_spotp_87.img.
4. Click the After Theme drop-down list and select Atl_spotp_92.img.
5. Click the As Percent radio button.
6. Type "15" in the Increases more than text box.
7. Type "15" in the Decreases more than text box. Click OK in the Image Difference dialog. Two new themes, one called Difference, the other called Highlight Difference, are added to your view.
8. In the Table of Contents, click the check box of the Difference theme to draw it.



Difference shows the results of the subtraction of the Before Theme from the After Theme.

9. In the Table of Contents, click the check box of the Highlight Difference theme to draw it.



Highlight Difference shows change in the red and green areas.

Image Difference calculates the difference in pixel values. With the 15 percent parameter you set, Image Difference finds areas that are at least 15 percent increased than before (designating clearing) and highlights them in green. Image Difference also finds areas that are at least 15 percent decreased than before (designating an area that has increased vegetation, or an area that was once dry, but is now wet) and highlights them in red.

Close the view

You can now close the view and go on to the next exercise, or you can end your ArcView GIS session. To end your ArcView GIS session, click the File menu and choose Exit. Click No when asked to save changes.


IN LAYOUT PRINT VIEW - LABEL ACCORDINGLY

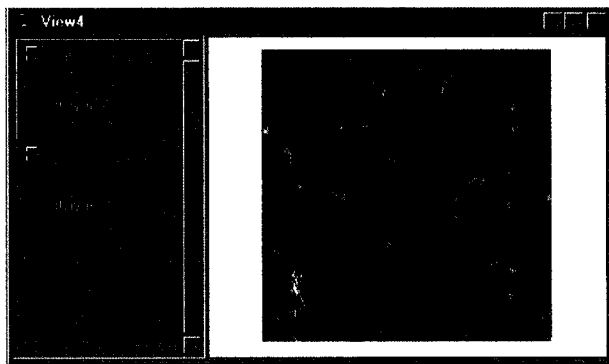
Using the Thematic Change and Summarize Areas

The ArcView Image Analysis extension provides the Thematic Change to make comparisons between thematic data images. Thematic Change creates a theme that shows all possible combinations of change and how an area's land cover class changed over time. Thematic Change is similar to Image Difference in that it computes changes between the same area at different points in time. However, Thematic Change can only be used with thematic data (data that is classified into distinct categories). An example of thematic data is a vegetation class map.

The next example uses two images of an area near Hagan Landing, South Carolina. The images were taken in 1987 and 1989, before and after hurricane Hugo. Suppose you are the forest manager for a paper company that owns a parcel of land in the hurricane's path. With the ArcView Image Analysis extension, you can see exactly how much of your forested land has been destroyed by the storm.

Add and draw the images of an area damaged by hurricane Hugo

1. If necessary, start ArcView GIS and load the ArcView Image Analysis extension.
2. Open a new view and click the Add Theme button .
3. Navigate to the avtutor directory. Double click on the ia_data directory.
4. Click the Data Source Types drop-down list and choose Image Analysis Data Source.
5. Hold the SHIFT key and click on both tm_oct87.img and tm_oct89.img to select them. Click OK.
6. Click the check boxes of both themes to draw them in the view.



This view shows an area damaged by Hurricane Hugo.

Create three classes of land cover

Before you calculate Thematic Change, you must first categorize the Before and After Themes. Categorize is an option available from the Image Analysis pull-down menu. You'll use the thematic themes created from those categorizations to complete the Thematic Change calculation.

1. Click the title Tm_oct87.img to make the theme active.
2. From the Image Analysis menu, choose Categorize.
3. In the Desired number of classes text box, type "3" to classify the data into water, forest, and bare soil. Click OK. The categorization process will take a moment to complete.

The ArcView Image Analysis extension uses unsupervised classification for categorizing a continuous image into useful thematic classes. (For more information on image classification, see Chapter 9, "Image categorization.") This approach is particularly useful when you are unfamiliar with the data that makes up your image. You simply designate the number of classes you would like the data divided into. The ArcView Image Analysis extension then performs a calculation assigning pixels to classes depending on their values. From an unsupervised categorization, you may be better able to quantify areas of different land cover in your image. You can then assign the classes names like forest, water, and bare soil.

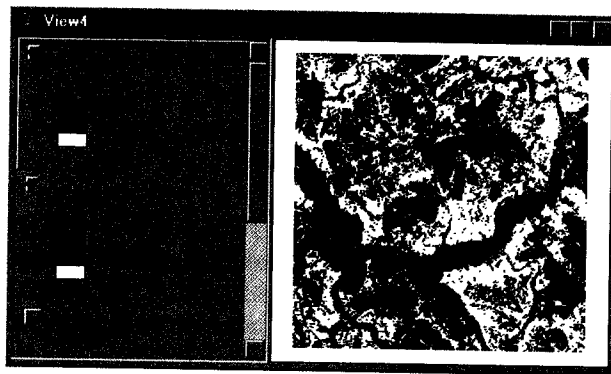
4. Click the check box to draw the theme Categorization of Tm_oct87.img in the view.
5. Click the check box of Tm_oct87.img so the original theme is not drawn in the view. This makes the remaining themes draw faster in the view.

Give the classes names and assign colors to represent them

1. Double click on the title of the Categorization of Tm_oct87.img theme to access the Legend Editor.
2. Double click the Symbol next to the Value 1 to access the Color Palette. Move the Color Palette so it does not cover the Legend Editor.
3. Click the color blue for Value 1 and change the Label field to "Water".
4. Click the color green for Value 2 and change the Label field to "Forest".
5. Change the Label field of Value 3 to "Bare Soil". Click Apply.
6. Close the Color Palette and the Legend Editor.

Categorize and name the areas in the post-hurricane image

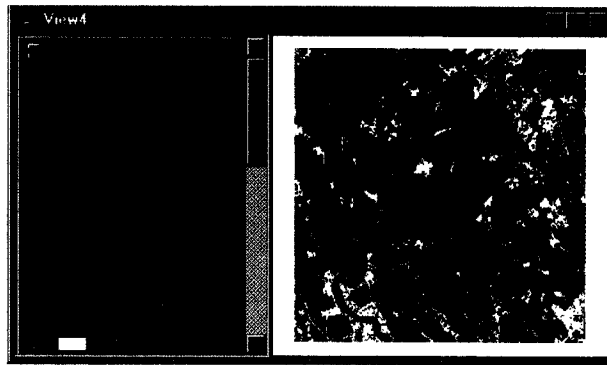
1. Follow the steps provided for the theme Tm_oct87.img to categorize the classes of the Tm_oct89.img theme. When you are done, draw the new Categorization of Tm_oct89.img theme in the view.
2. Click the check box of the Tm_oct89.img theme so that it does not draw in the view.



This illustration shows how Categorize was used to create classes of data corresponding to land cover (Water, Forest, and Bare Soil).

Use Thematic Change to see how land cover changed because of Hugo


1. Make both the Categorization of Tm_oct87.img theme and the Categorization of Tm_oct89.img theme active in the view by holding the SHIFT key and clicking the inactive theme.
2. From the Image Analysis menu, choose Thematic Change.
3. Confirm that the Before Theme drop-down list shows Categorization of Tm_oct87.img and the After Theme drop-down list shows Categorization of Tm_oct89.img. Click OK in the Thematic Change dialog.
4. Click the check box of the Thematic Change theme to draw it in the view.
5. Double click the title of the Thematic Change theme to access the Legend Editor.
6. Double click the Symbol for "was: Forest, is: Bare Soil" to access the Color Palette.
7. Click the color red in the Color Palette, then click Apply in the Legend Editor. Now you can easily see the areas destroyed by the hurricane.
8. Close the Color Palette and the Legend Editor.



The amount of area that was Forest and is now Bare Soil is shown in red.

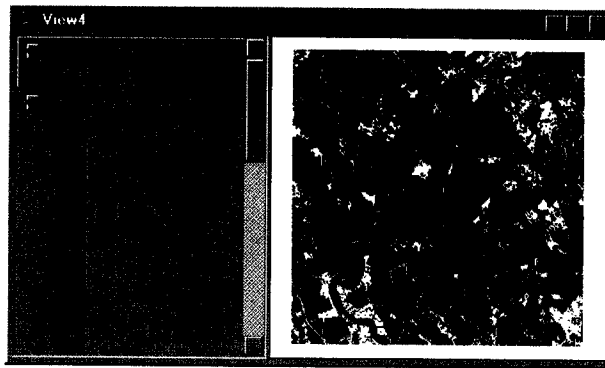
Add a feature theme that shows the property boundary

Using Thematic Change, the overall damage caused by the hurricane is clear. Next, you will want to see how much damage actually occurred on the paper company's land.

1. Click the Add Theme button .
2. Navigate to the avtutor directory. Double click on the ia_data directory.
3. Click the Data Source Types drop-down list and choose Feature Data Source.
4. Double click on property.shp to add it as a theme, and click the check box to draw the theme in the view.

Make the property transparent

1. Double click on the title of the Property.shp theme to access the Legend Editor.
2. Double click on the Symbol to access the Fill Palette.
3. Click on the transparent box located in the upper left-hand corner of the Fill Palette (the empty square).
4. Click the Outline drop-down list and choose 3.
5. In the Legend Editor, click Apply to see the outline of the land boundary.
6. Close the Fill Palette and the Legend Editor.



You can use Summarize Areas within the boundaries of the shapefile.

Get numeric data about the damage

1. Make the Thematic Change and Property.shp themes active in the view by holding the SHIFT key and clicking the inactive theme.
2. From the Image Analysis menu, choose Summarize Areas.
3. Click the Zone Theme drop-down list to choose Property.shp.
4. Click the Zone Attribute drop-down list to choose Property.
5. Click the Class Theme drop-down list to choose Thematic Change. Click OK in the Summarize Areas dialog. A Summarize Areas Results dialog opens.

Summarize Areas Results

1

Acres

Class Name	Count	%	Acres
was: Water, is: Unclassified	0	0.00%	0
was: Water, is: Water	3772	7.81%	838.873437
was: Water, is: Forest	393	0.81%	87.401183
was: Water, is: Bare Soil	16	0.03%	3.558316
was: Forest, is: Unclassified	0	0.00%	0
was: Forest, is: Water	890	1.84%	197.931431
was: Forest, is: Forest	22307	46.19%	4960.962288
was: Forest, is: Bare Soil	14817	30.75%	3317.119604
was: Bare Soil, is: Unclassified	0	0.00%	0
was: Bare Soil, is: Water	219	0.45%	48.704476
was: Bare Soil, is: Forest	2219	4.60%	493.494209
was: Bare Soil, is: Bare Soil	2657	5.50%	590.90316

You can see that approximately 3,517 acres of forested area within the property boundary were lost due to hurricane Hugo.

Exer

- When you are finished looking at the values, click Close in the Summarize Areas Results dialog.

As this example shows, you can use the ArcView Image Analysis extension to evaluate areas of your image within certain regions such as the property boundary of the paper company's land.

IN LAYOUT - CREATE A PRINT - LABEL

Close the view

You can now close the view and go on to the next exercise, or you can end your ArcView GIS session. To end your ArcView GIS session, click the File menu and choose Exit. Click No when asked to save changes.


Exercise 5: Mosaicking images

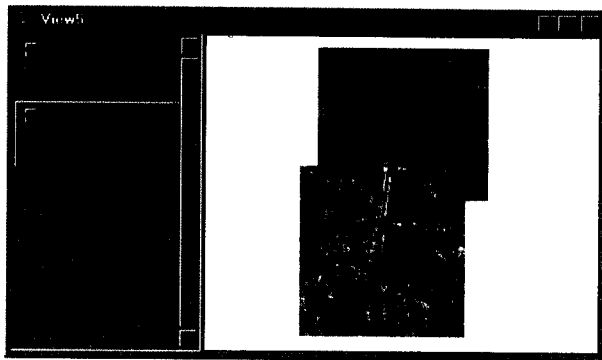
The ArcView Image Analysis extension allows you to mosaic multiple images. When you mosaic images, you join them together to form one single image that covers the entire area. To mosaic images, simply display them in the view, ensure that they have the same number of bands, then select Mosaic.

In the following exercise, you are going to mosaic two airphotos with the same resolution.

Note You can also Mosaic images with different resolutions. See Chapter 7, "Image mosaicking", for additional information.


Add and draw the images

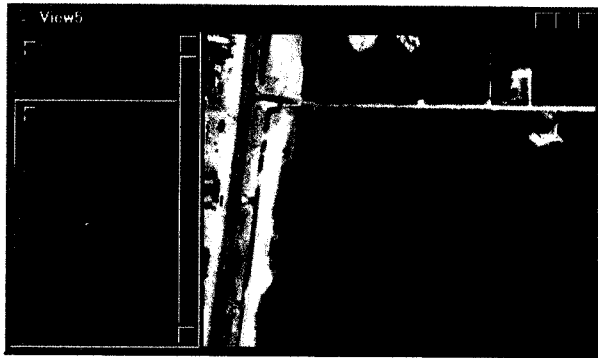
- If necessary, start ArcView GIS and load the ArcView Image Analysis extension.
- Open a new view.
- Click the Add Theme button .
- Navigate to the avtutor directory. Double click on the ia_data directory.
- Click the Data Source Types drop-down list and choose Image Analysis Data Source. *V:\ESRI\AV-GIS30\AVTUTOR\IA-DATA*
- Press the SHIFT key and click on airphoto1.img and airphoto2.img. Click OK.
- Click the check box for both the Airphoto2.img and Airphoto1.img themes to draw them in the view.
- Click the Airphoto1.img theme and drag it so that it is at the top of the Table of Contents.




The two airphotos display in the view. The Mosaic tool joins them as they appear in the view: whichever is on top is also on top in the mosaicked image.

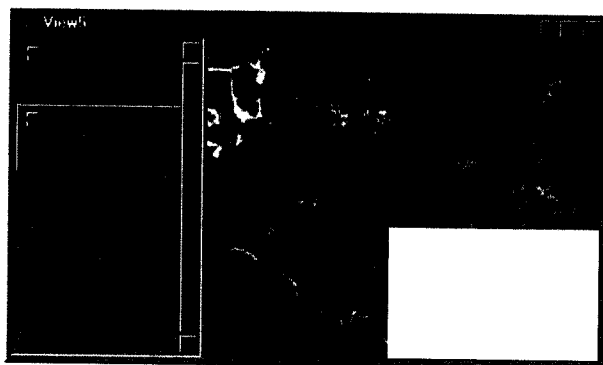
Zoom in to see image details

1. Click the Zoom to Image Resolution button .



The two images are displayed in the view at a 1:1 resolution. You can now use the Pan tool to see how the images overlap.

2. Click the Pan tool , then maneuver the images in the view.

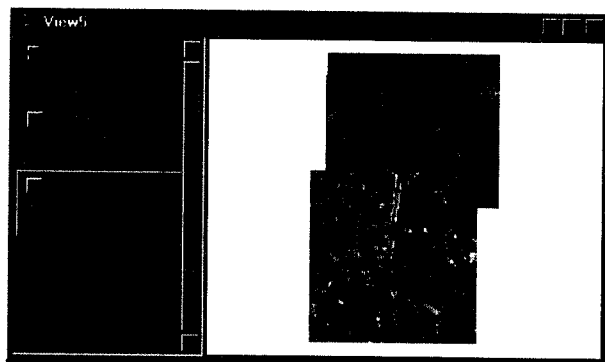


This illustration shows where the two images overlap.

3. Click the Zoom to Full Extent button  so that both images display in their entirety in the view.

Use Mosaic to join the images

1. From the Image Analysis menu, select Mosaic. A status bar displays at the bottom of the window as the ArcView Image Analysis extension mosaics the images.
2. When the process is complete, click the check box of the Mosaic theme to draw it in the view.
3. Click the check box of the Airphoto1.img and Airphoto2.img themes so that they do not draw in the view.



The Mosaic function joins the two images as they appear in the view. In this case, Airphoto1.img is mosaicked over Airphoto2.img.

IN LAYOUT, LABEL & PRINT VIEW

Close the view and exit ArcView GIS

You can now close the view. To end your ArcView GIS session, click the file menu and chose Exit. Click No when asked to save changes.

What next?

From here, you can continue to read this book to get more detailed information on the way the ArcView Image Analysis extension components work and the type of information you can get from each of them. You can also use this book as a reference as you complete your own work with the ArcView Image Analysis extension. If you have questions while you work, the on-line help also provides information.