# HURRICANES

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**Document Contents:**

## Instructions for Using ArcExplorer GIS Software

1.  Start a new ArcExplorer project
    a.  Open or double-click on the name or icon of ArcExplorer (if you can't remember where it was installed, use the search option from the Windows Start button).
    b.  ArcExplorer will open with a new project. Like most Windows software, you can open an existing project, open a new project, and save or close a project from the menu bar on the file menu, which is located on the upper-left part of the screen. (You can get rid of the "Tip of the Day" message box that pops up if you wish.) Save the project with a name and in a location that you will remember.

2.  Add files to the ArcExplorer project
    a.  Single-click ⊕ button (fifth icon from the left on top row) to add files (called "themes" in ArcExplorer) to the project.
    b.  Navigate to the proper folder where the unzipped data files are located (this location will either be on a data CD or in a directory specified by your teacher). If you are in the correct location, you should see all the data files. Press the "CTRL" button to successively select the teguz.tif and all five of the .shp files at once.
    c.  Click "add theme" and the files will appear on the legend of your project. Click "close" to remove the dialog box.

3.  Select themes within the legend of the ArcExplorer project so that they can be seen
    a.  Click in the white box next to teguz.tif to show the base map.



This is a map of Tegucigalpa, Honduras. The elongated circle is the soccer stadium. This image was generated using lidar data and will serve as the base map for this Learning Experience.
    b.  Click in the white boxes next to the data files (river, debris_scar, dam, WL930m, and WL935m) when you are ready to activate each of them too.

4.  Activate the base map so you can change the size

    a.  Click on the name "TEGUZ.TIF" so you can see a raised box



    b.  Click on the name of each data file, one at a time, to activate each theme and change properties, such as color. For example, you will probably want to make the river blue instead of red.

5.  Drag and drop the theme by its name to change the order of the data files. The top one on the legend is the top one in the stack of maps.

6.  Change size of base map
    a.  Activate the base map (teguz.tif) by clicking the name.

b.  Single-click the yellow stack of paper  so that you can see the entire base map in your field of view. You can right-click on the map or choose Zoom Out or Zoom In then left-click to navigate around the map.
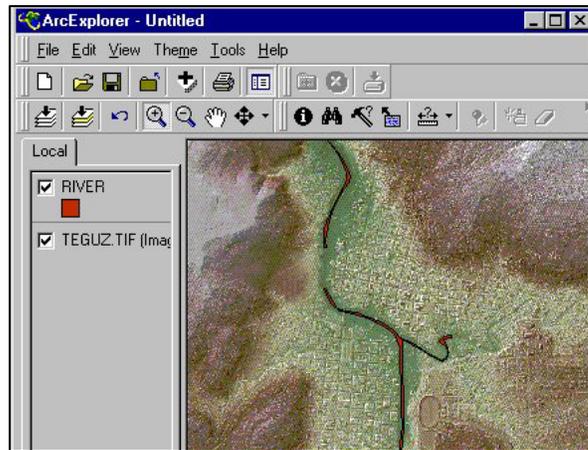


c.  Change colors of the data-file themes. Select and activate a data file.

d.  For example, you do not want the river to appear red or green. On the tool bar at the top of the ArcExplorer application, pull down theme, and click on "Theme Properties" or single-click on the  (edit theme icon).

e.  Select "Single Symbol," then single-click on both "Color" and "Outline color" to select desired color. Click "Apply" then "OK" to close the Theme Property box. The example below shows how to change the river color to blue.
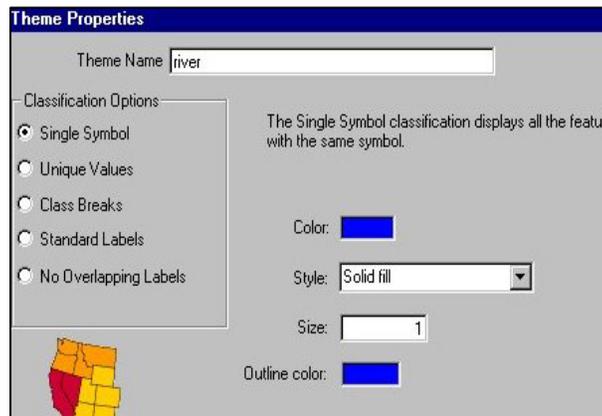


f.  Repeat step "e" for each theme. Change colors of themes accordingly:
    i.   Change river to light blue
    ii.  Change dam to brown
    iii. Change debris_scar to black
    iv.  Change WL930m to dark blue
    v.   Change WL935m to darker blue

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## Simulate El Berrinche Landslide and Flooding of Tegucigalpa

We are now going to simulate the landslide that occurred as a result of intense rainfall from Hurricane Mitch. To the west of the river, note the smooth part of the hill. This is where the landslide destroyed housing and vegetation as debris slid downhill toward the river. Landslide debris blocked the flow of the river, resulting in a dam and flooding of the city. We will simulate this catastrophe by successively activating themes.

1.  Deselect all themes in the ArcExplorer project.

2.  Select the base map (teguz.tif) by clicking in the white box to show the arrow (step 4 above).

3.  Select river. This shows water within the river banks under normal flow conditions. Note that the river flows to the north (up on the base map).

4.  Select debris_scar. This shows the area where the El Berrinche Landslide occurred.

5.  Select dam. This simulates how the landslide debris blocked the flow in the river.

6.  Select WL930m. This shows areas of the city that were flooded when the water level behind the dam rose to 930 meters.

7.  Select WL935m. This shows areas of the city that were flooded when the water level behind the dam rose to 935 meters.

8.  Navigate around the map to get a closer look at flooded buildings and streets.

    a.  Remember, you can always go back one step with the return arrow

    b.  Zoom in to magnify the map, or zoom out , if you get too close. Zoom in or out of the whole map with a single-click. Or zoom in to a specific area of interest by putting the tool anywhere on the map, then depressing the left mouse button and draging the cursor to the diagonal corner of your area of interest. Let go of the mouse button to see the new area in more detail.

    c.  You can move around the image using the pan tool.

    d.  The ruler lets you measure features on the map. You have to tell ArcExplorer what measurement units are used in the map. Do this by pulling down the "View" menu on the top tool bar, scroll to "Scale bar properties" and set map units to meters. Then pull down the down arrow next to the ruler tool and select meters. Now you can make measurements.

# Questions:

1. How fast will it take a laser pulse to reach the ground if the plane is flying at an altitude of 500 meters? Note: the speed of light is equal to 186,000 mi/sec. Note: First you need to put all variables in a consistent set of measurement units. **See the Speed of Light section in Lecture Supplements** for unit-conversion information.

2. Deselect all themes in the ArcExplorer project except for the image (teguz.tif). Zoom into the digital elevation model at the confluence of the two rivers adjacent to the large hill located near the southeastern edge of city. What is the spikelike spot in the river bed? (Note the airborne laser used in the UT lidar system will bounce off of objects in the air instead of penetrating them.)

3. Determine a way to measure the landslide scar area (using either ArcExplorer or graphing).

4. If you were in downtown Tegucigalpa directly across the river from the landslide and decided to jump into your car to avoid the rising floodwaters, in which direction would you want to drive?

5. Describe the potential effects of a hurricane if one were to hit your hometown.

**Extra Credit**

6. Go to the section on Hurricane Safety on page 11 in the **Lecture Supplements** file. Try to come up with the mathematical equations that explain how a car could be swept away by floodwaters that are only 2 feet deep.

## Example Output from ArcExplorer

Example of basemap (teguz.tif file). Items of interest have been labeled for clarity. Note the landslide that has occurred between the housing labels on the hill.
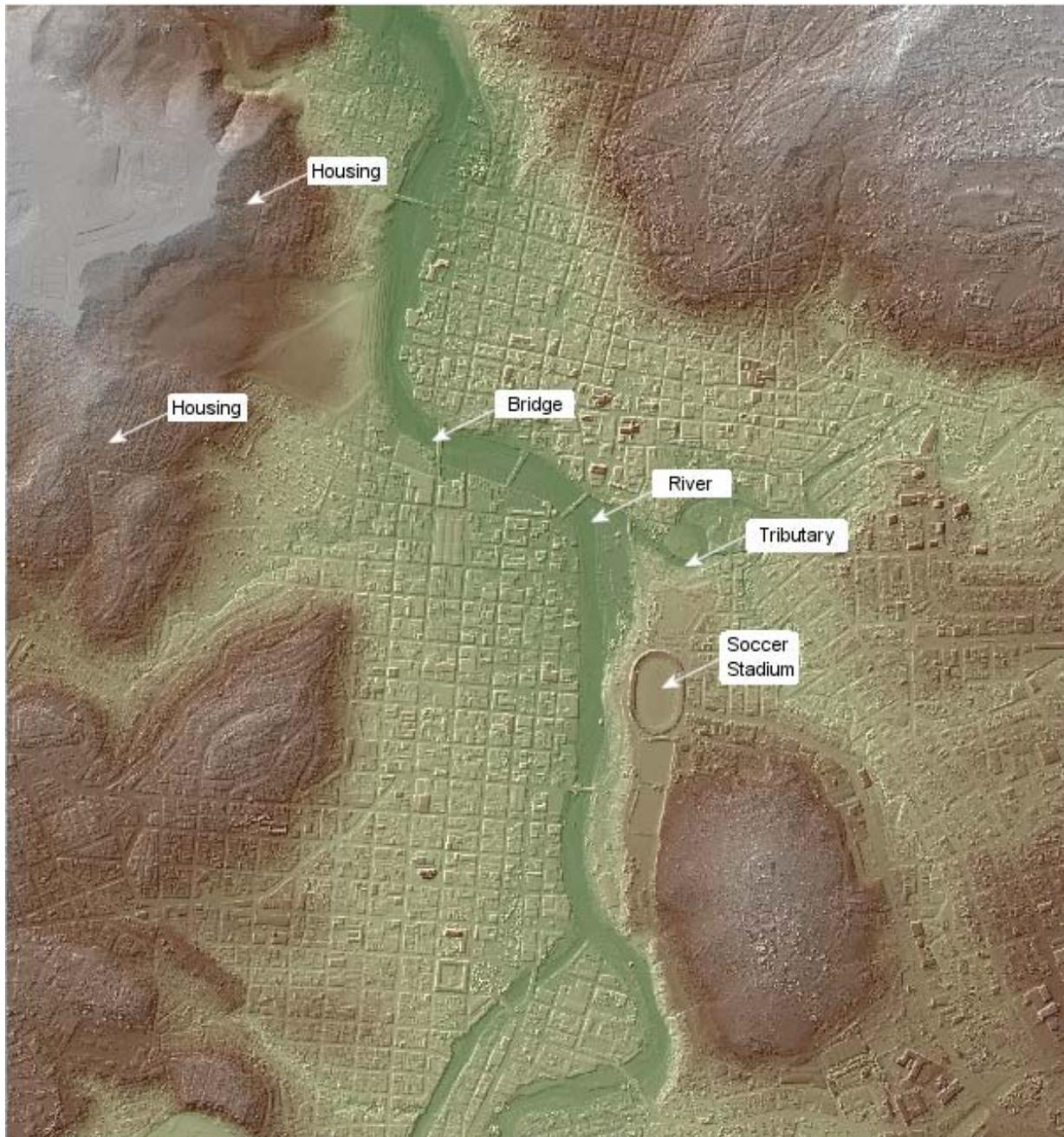
Examples of the basemap with several themes or shape files selected (dam2.shp, debris_scar.shp, and new_river.shp) follow.

The example below shows the extent of flooding in the city if the water were to rise to 930 m.
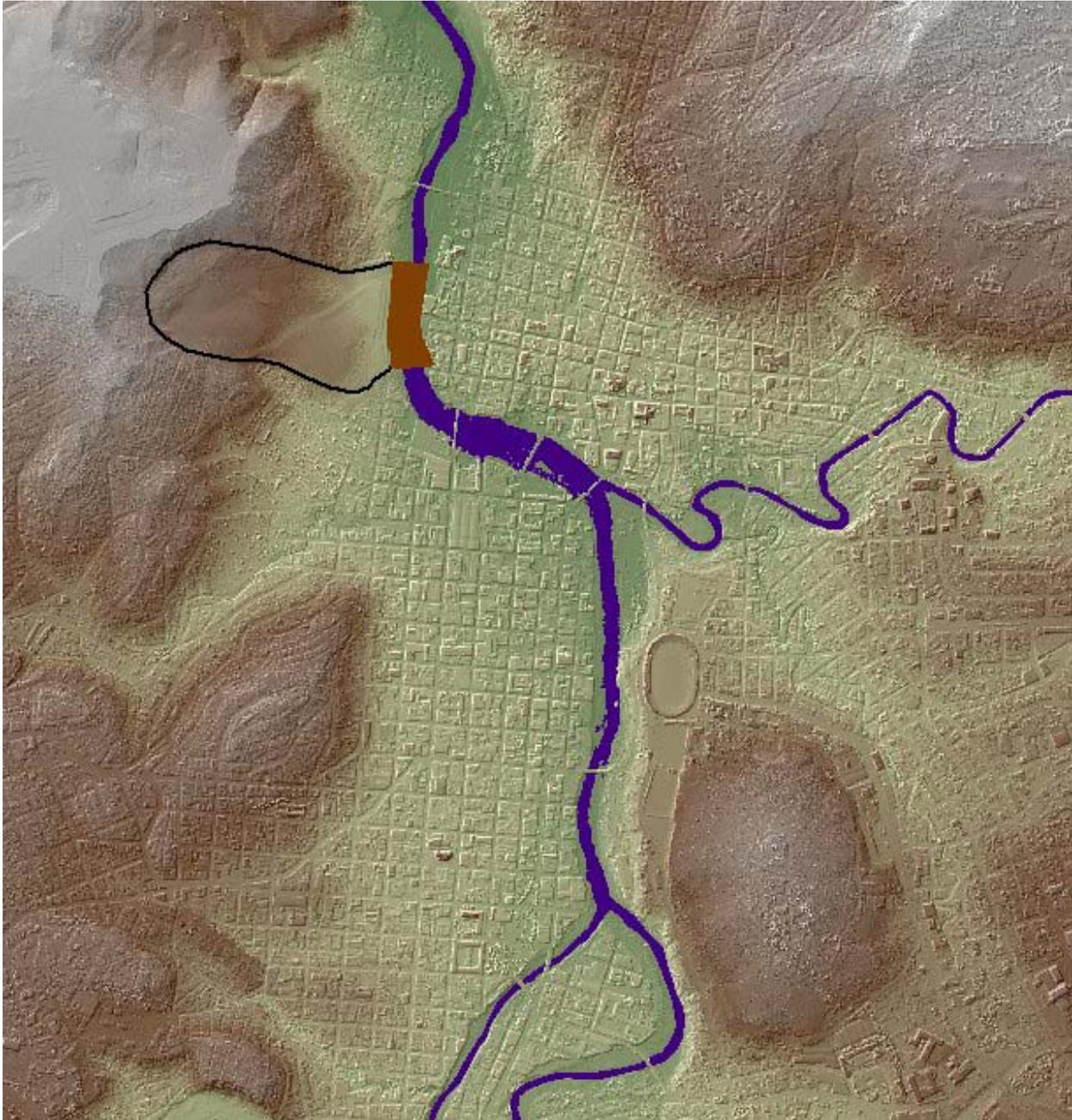
The example below shows the extent of flooding if the water were to rise to 935 m.