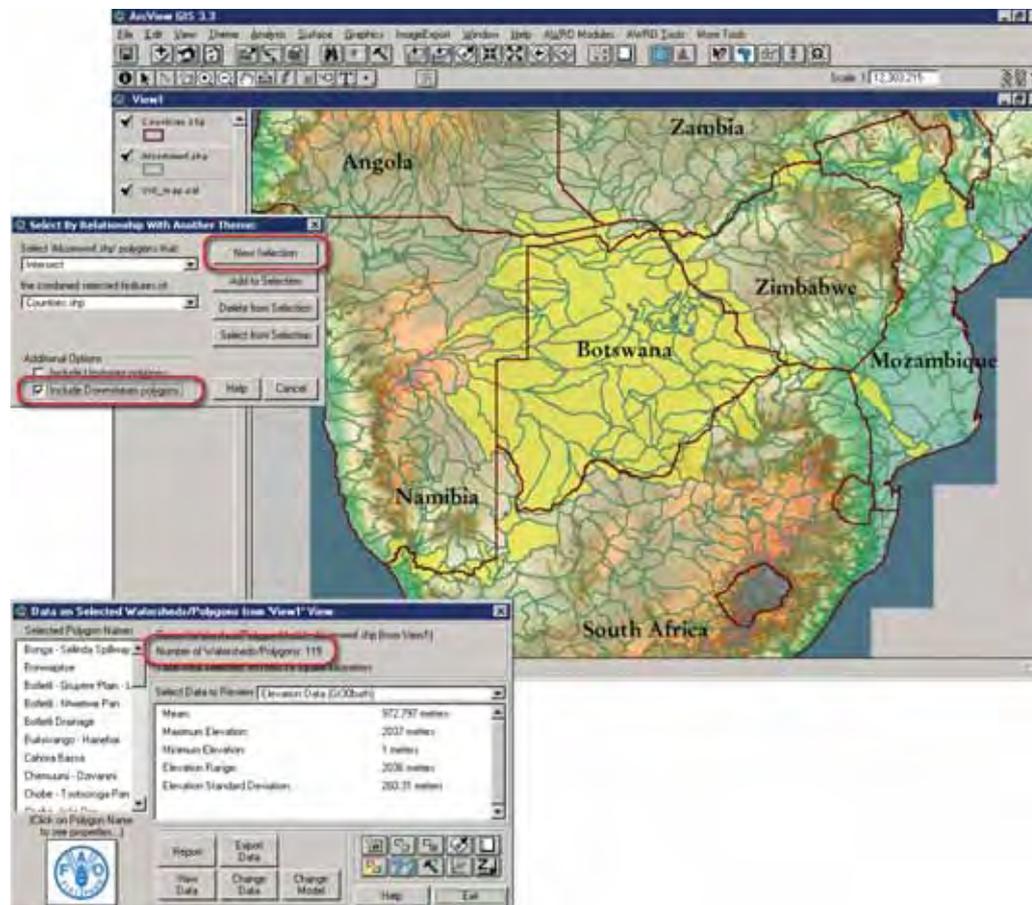In a similar manner they could have identified those areas which drain out of the Republic of Botswana, and where they go, by checking the "Include Downstream Polygons" option (Figure 1.67c).

FIGURE 1.67C
Areas which drain out of the Republic of Botswana

Given that the analysis process is a function of the "current" selection state of the watershed theme, a user can conduct iterative queries based on containment or other spatial relationships with numerous themes in a view.

Watershed Statistics Viewer

This tool offers users a wide variety of statistics describing the current set of selected watersheds. The Watershed Statistics Viewer will generate statistics for all the currently selected datasets. These datasets may include such things as: population densities, mean annual air temperatures, precipitation, and potential evapotranspiration. In Figure 1.68, the "Selection Criteria" tool was used to select all the watersheds that drain into Lake Tanganyika. To do this:

1. Click on the "Add Basemap Image to View" tool [icon] to load one of the image backgrounds (e.g. "Vrtl_map.sid") from the image database component folder. This background image is not necessary for proper functioning of this tool, but it makes it easier to locate your area of interest in the view.

2. Open the Watershed viewer by clicking on the **WS** icon. This will also make sure that the default watershed model is added to the view.

3. Select the ArcView zoom button [🔍] to zoom to the Lake Tanganyika region.

4. Click on the "Select Upstream and Downstream Watersheds" icon [⬚] and Select "All Upstream Watersheds" from the selection criteria.

5. Mouse click anywhere in lake Tanganyika.

The Watershed Statistics Viewer then generates a set of statistics for the entire selected area for all the datasets that are currently associated with this watershed model. In this example, the Watershed Viewer is showing the cumulative elevation statistics for the 37 watersheds in the Lake Tanganyika drainage basin (Figure 1.68).

FIGURE 1.68
Attribute data of watersheds
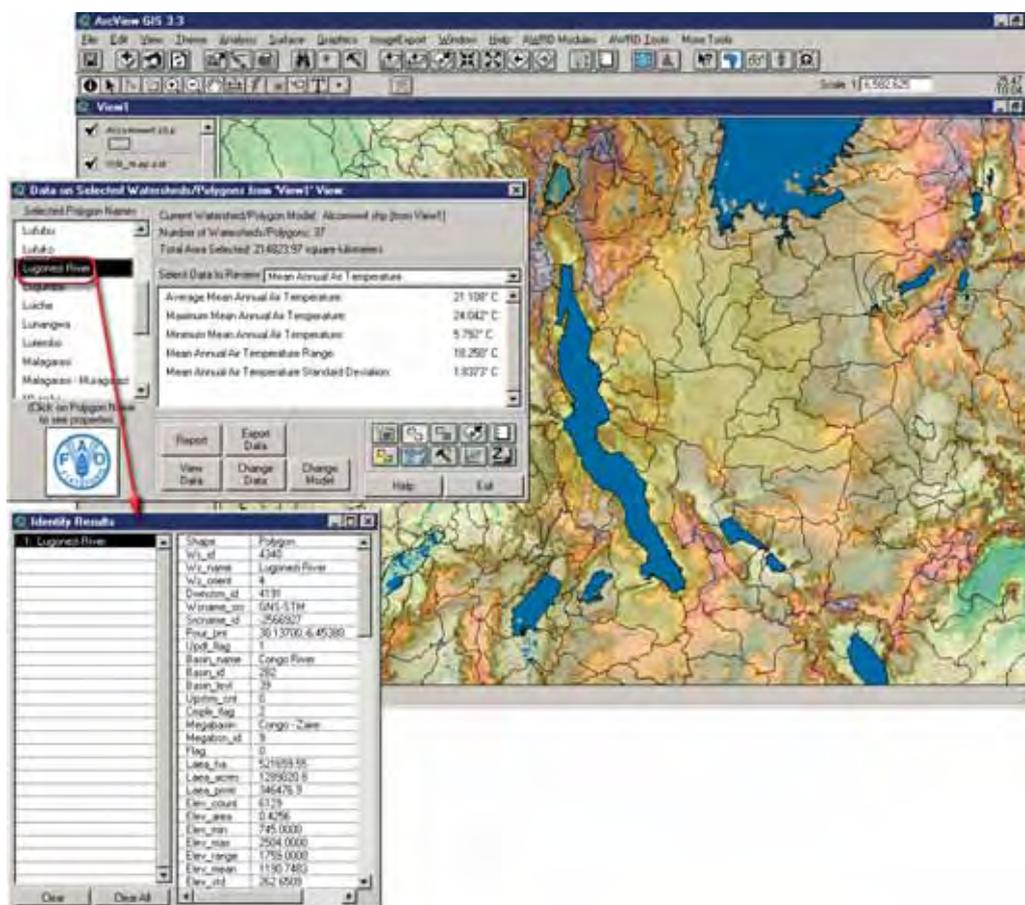
The Watersheds Module presents a variety of data as well as a number of tools to examine, analyse and visualize the data. At the top centre of the "Watersheds Viewer" is basic information about the current selection, including the current watershed model, the current view, the number of watersheds selected, and the total land area selected. The Watersheds Module may also be resized by stretching on one of the corners so that all the data may be viewed at once.

Statistics on any Watershed: on the left side of the Watersheds Viewer is a list of all the currently selected watersheds. The attribute data associated with any of these watersheds can be reviewed by simply clicking on the name of the watershed of interest as shown in Figure 1.68.

   If the user selects the 'Mean Annual Air Temperature Data' rather than 'Elevation Data (Gt30bath)' as shown above, then the results would show the monthly and annual

mean air temperatures for the Lake Tanganyika drainage basin.

Also, if the user has access to the ESRI ArcView Spatial Analyst extension, then the AWRD will also provide the ability to generate statistical datasets from the users' own data. Users can also customize this module to generate summary statistics based on any other additional non-categorical raster datasets by "registering" that raster dataset with the Watershed Model Maintenance Tools. Summary statistics can be generated for any "registered" polygonal data layer, and users are not limited to examining WS models alone with this module.

Statistics on the combined set of individual watersheds: can also be derived. In the following example two watersheds were selected at random to illustrate the use of this tool:

1. Click on the "Add Basemap Image to View" tool to load one of the image backgrounds (e.g. "Vrtl_map.sid") from the image database component folder. This background image is not necessary for proper functioning of this tool, but it makes it easier to locate your area of interest in the view.

2. Open the Watershed viewer by clicking on the **WS** icon. This will also make sure that the default watershed model is added to the view.

3. Select the ArcView zoom button to zoom to the Lake Tanganyika region.

4. Click on the "Select watershed feature" icon, hold down the "Shift" key and then mouse click on the Ifume and Lugonezi River watersheds (this selection will highlight these watersheds in yellow, and the "Shift" key allows you to select multiple watersheds.). The statistics generated for these two watersheds are illustrated in Figure 1.69.

FIGURE 1.69
Statistics on the combined set of selected watersheds
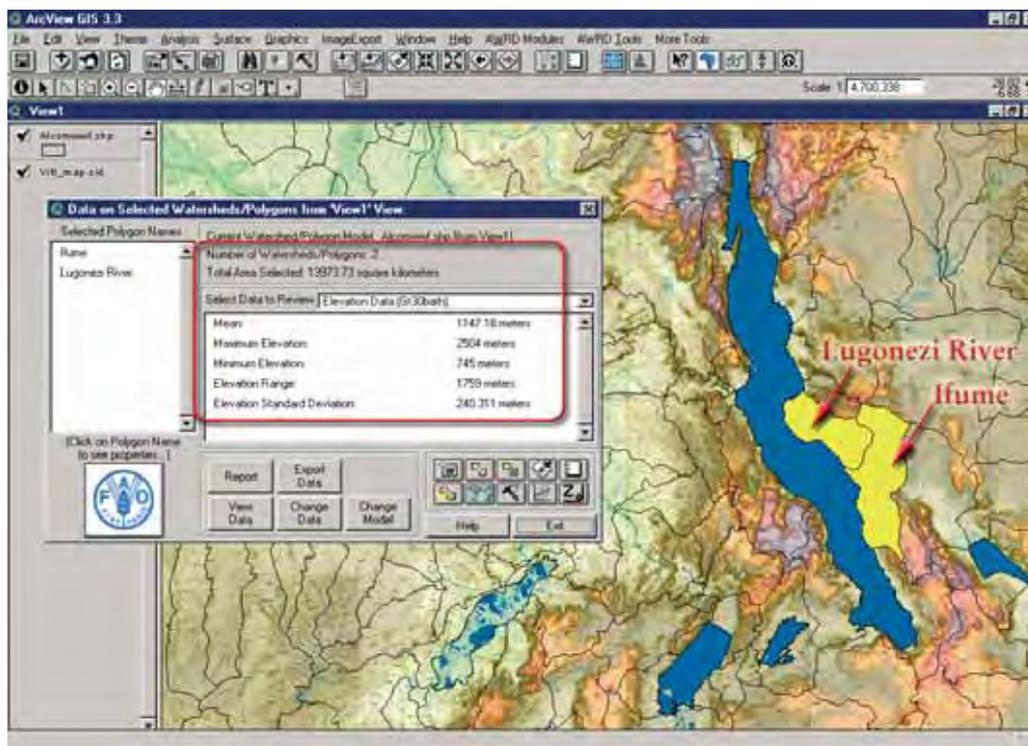
The Mean Elevation value of the combined set of watersheds, shown in the Watershed Statistic Viewer above, is derived from the data of Mean Elevation and Watershed Size of these two selected watersheds. Basically, the Watershed Module weights each watershed based the size of that watershed when computing the various statistics, so that, for example, if two watersheds were selected and if one watershed was twice the size of the other, then the larger watershed would be weighted twice as heavily as the smaller one. In this example, if Watershed A had a mean elevation of 100 m and was 100 square kilometres in size, and if Watershed B had a mean elevation of 200 m and was 50 square kilometres in size, then the mean elevation for the combined areas of Watersheds A and B would be calculated as follows:

$$\text{Mean Elevation} = \frac{(A\_Elev * A\_size) + (B\_Elev * B\_size)}{(A\_size + B\_size)} = \frac{(100 * 100) + (200 * 50)}{(100 + 50)} = 13$$

where:

A_elev = Watershed A Mean Elevation

A_size = Watershed A Size

B_elev = Watershed B Mean Elevation

B_size = Watershed B Size