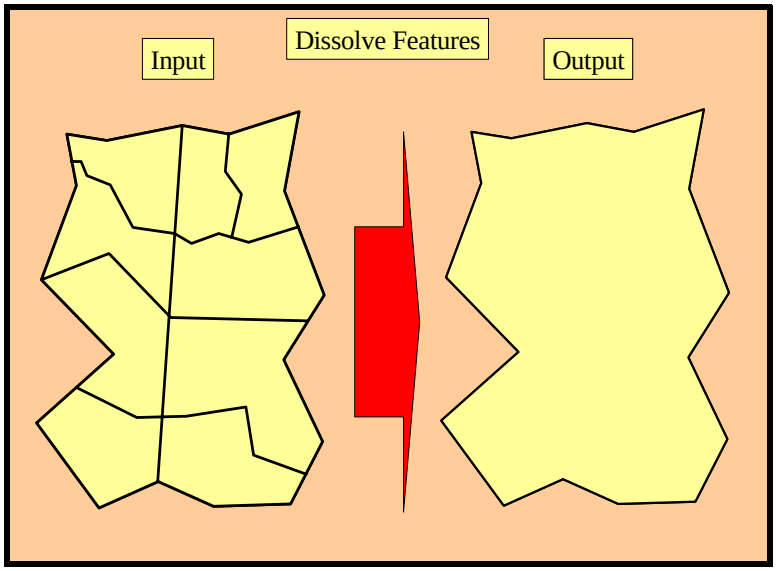
Chapter 17 Creating a New Suit from Old Cloth: Manipulating Vector Mode Cartographic Data

Imagine for a moment that digital cartographic databases were a perfect analog of the paper map. Once you digitized a database from information on a paper map you would be unable to change its scale, or projection. Moreover, you could not alter the line weights you specified at the time of digitization. Even worse, you could not combine the file with others or use just a subset of it. I think you get the point. If you were unable to perform operations such as these, and many more like them, there would be little benefit to converting our maps from paper to digital.

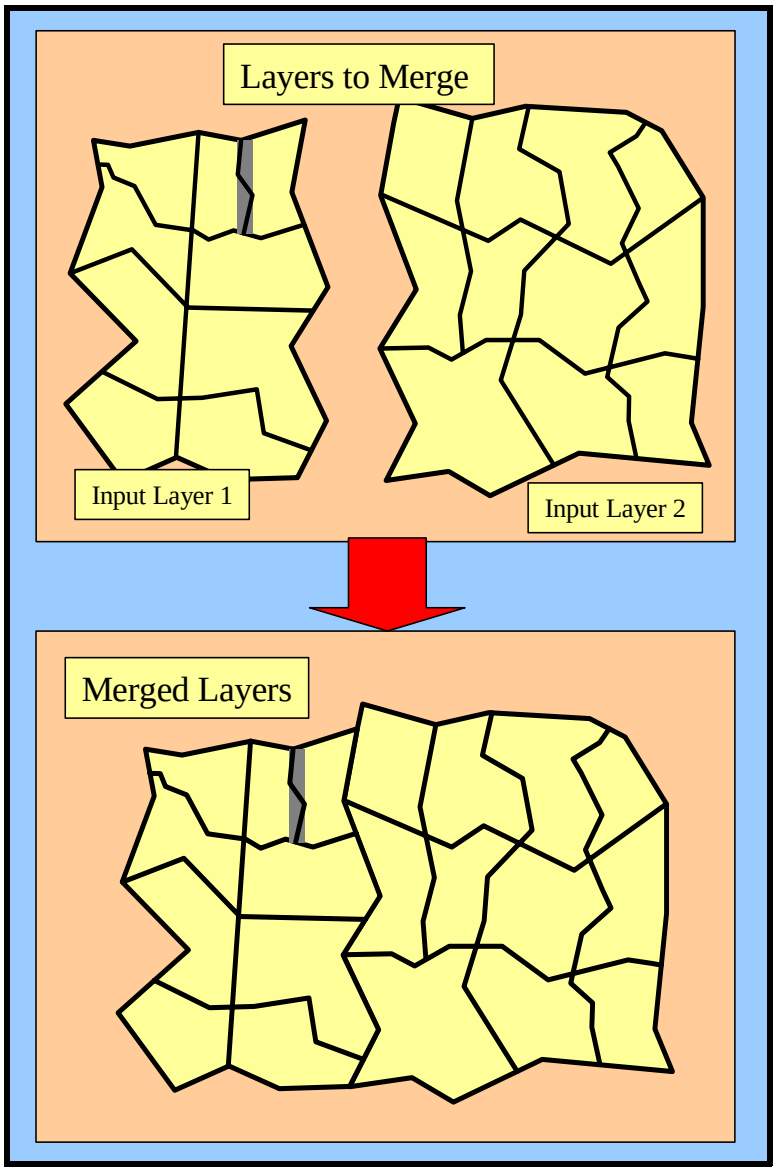
The objective of this chapter is to introduce to some of the more common manipulations that greatly increases the utility of cartographic datasets. By the way, you already know how to perform several such manipulations. For instance, by now you can probably change the projection or coordinate system of a cartographic dataset with your eyes closed. Certainly, you can perform operations like zooming in and out, which change the scale of the map as it appears on your monitor or on the paper when you print it.

Here you will learn about the following operations that you can use to modify cartographic datasets:

1. Dissolve. You use this operation merge line or area features that have the same value for an attribute. For instance imagine that you have a feature class, coverage, or shapefile depicting the outlines of US Census block groups for Gloucester County, New Jersey. As part of a mapping project, maybe the Atlas of Gloucester County, you need to make a series of thematic maps depicting place to place variation in census block group statistics. For example, you need to make maps of population density, education, income and other attributes. Although you have the block group cartographic dataset, you lack a cartographic database for the outline of the county. Of course, standard cartographic practice requires the cartographer to draw higher level boundaries [the county] with a heavier line weight than lower level boundaries [the block groups]. The dissolve operation, which you access from Arc Map with the Arc Toolbox, enables you to extract all interior boundaries from the block group layer leaving behind the county outline, that you can use, along with the block group layer from which extracted it, to compose a cartographically correct map.

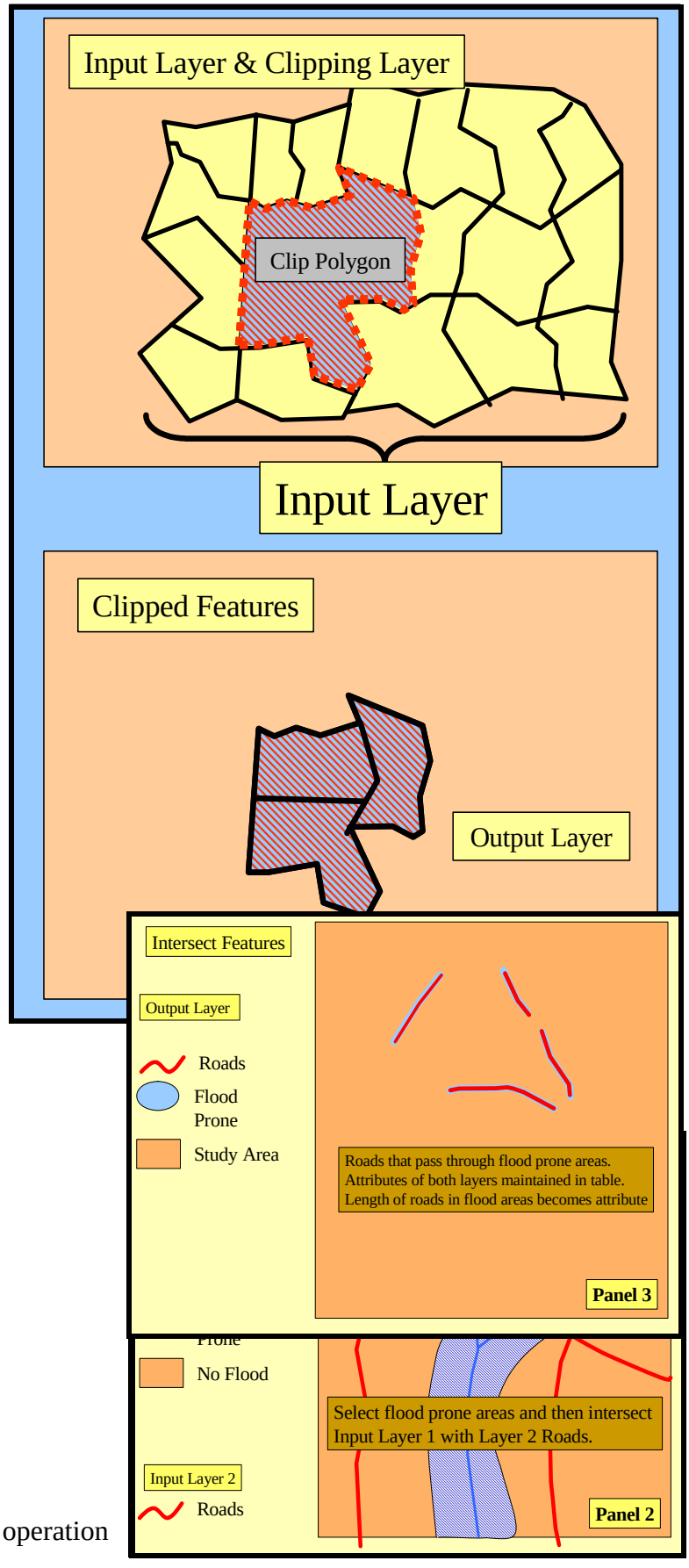


2. Append or Merge. This operation enables you to combine two or more adjacent cartographic databases into a single database. The layers you merge must contain the same feature type, lines or polygons for instance. Imagine that you are carrying out a study of employment patterns in Gloucester County, New Jersey in which you are working with data at the census tract level. The study is going very well and you decide to expand its scope to include Camden County, which is adjacent to Gloucester. Although you could work with each county separately, you decide that the analysis will go more smoothly working with a single data set that comprises both of the counties. The GIS operation that enables you to accomplish this is append, which enables you to create a single cartographic dataset from two or more datasets.



3. Clip. Suppose that you have a cartographic database for a large area, such as Gloucester County, New Jersey, but wish to make maps for only a portion of the county. One thing you could do is use the zoom function to zoom into the area of interest. This approach is acceptable in some instances, but has several disadvantages. First, the zoomed in area must be in the form of a rectangle, which might or might not suit your needs. Additionally, if you wish to make thematic maps, the class intervals you see on the zoomed in map will reflect the entire attribute data set, not just the values visible within the zoom window.

   In clipping you will work with two layers: one to be clipped and one to to do the clipping. In the illustration the Input Layer is the layer to be clipped. The layer to do the clipping acts like a cookie cutter and slices out a portion of the clipped layer. In the illustration the "cookie cutter" has cut the Clipped Features from the Input Layer. The output layer consists of all features in the input layer that fall within the edges of the cookie cutter. You can now proceed to make maps of the smaller area.



4. Intersecting Layers. The layer this operation

produces contains only those features that fall within all of the overlay polygons. In Panel 1 of the illustration, I have depicted two layers. Input Layer 1 categorizes the study area by flood proneness. Input Layer 2 describes the road network of the area. An emergency planner is interested in determining how much of the road network lies in flood prone areas. To create the output layer that provides the answer to this query, in Panel 2 the analyst first used the select by attributes operation to select the flood prone attribute and then performed the intersection of Layer 1 and Layer 2. Panel 3 shows the result of the intersection operation.

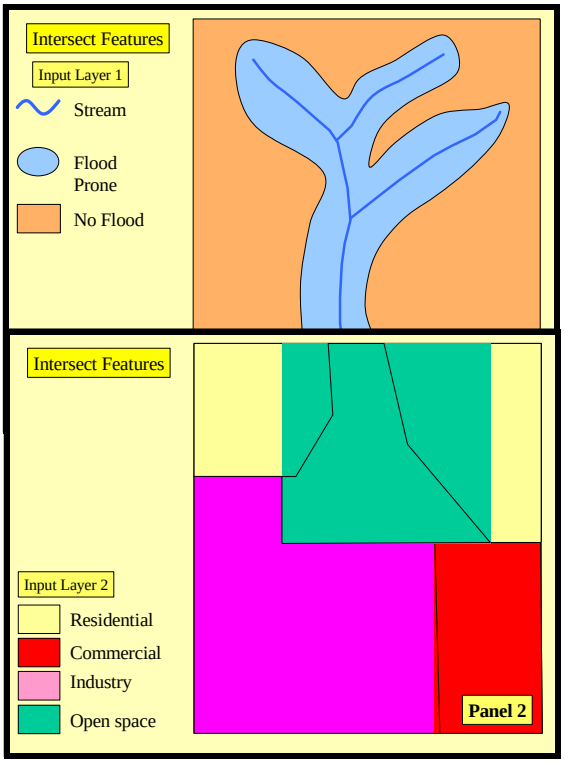
If the analyst had not selected any features, then the output layer would depict the road network as it passes through both flood prone and non flood prone areas. Because the analyst first selected the flood prone areas, the intersection operation focused only on the joint occurrence of flood and road.

In the case of the intersection operation, the resulting attribute table contains the attributes of both input layers. In the case of geodatabase features classes the length field, if it exists, is calculated. In the case of shapefiles, the length field is carried over from the input layer. If you save the result as a shapefile, then you will have to recalculate the length field before you can determine how many miles of roads in your study area are in flood prone areas. We will learn how to do this later.

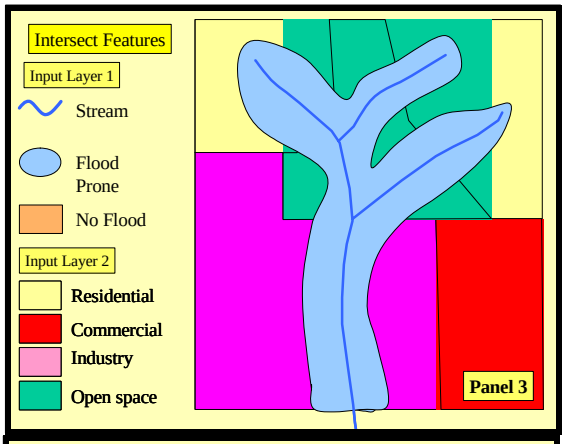
In raster mode logical analysis you frequently perform logical AND operations. You can think of intersection as the vector mode equivalent of the raster calculator's logical AND operation: the output layer produced by the operation contains only those features that are spatially coterminous in both input layers.

You can also intersect two polygon layers. In Panel 1 of the illustration you can see Input Layer 1 which depicts streams, flood prone areas and non flood prone areas.

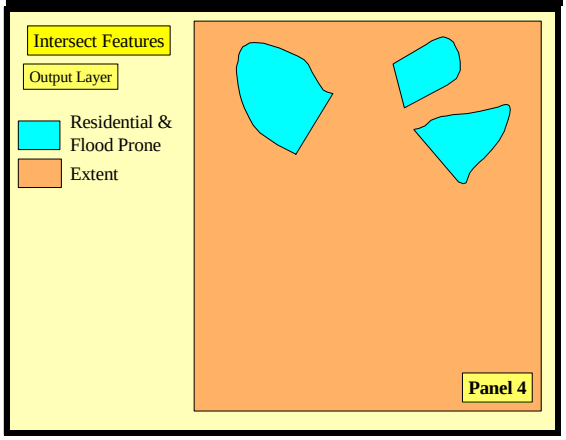
In Panel 2, you can see Input Layer 2, a polygon layer depicting the land use pattern of the study area. The analyst is interested in determining how much residential land falls within the flood prone areas.



Panel 3 shows Input Layer 1 and Input Layer 2 overlain. To perform the intersection analysis, the analyst begins by making two attribute selections: from the flood prone layer [Layer 1] she selects the flood prone attribute; whereas from the land use layer [Layer 2] she selects residential land use. Next she performs the overlay.

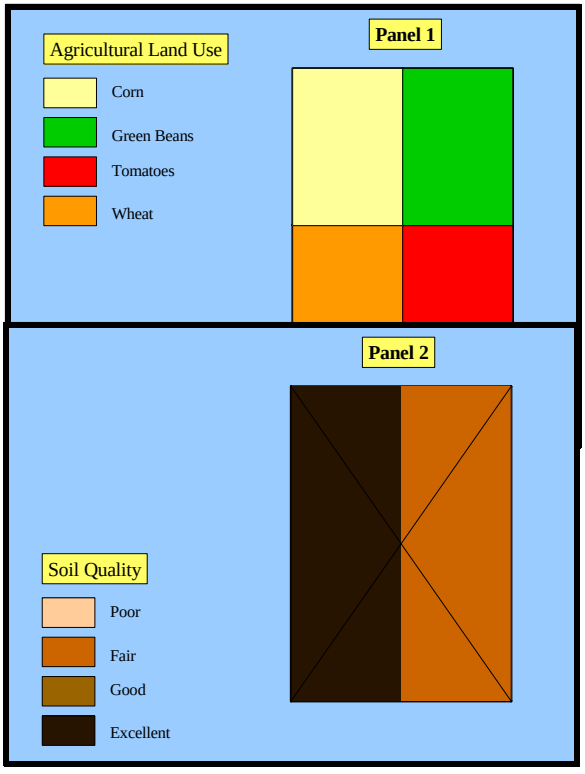


In Panel 4 you can see the result of the intersection. Those places that are both flood prone and residential in land use were selected. The resulting polygons contain attributes from both input layers. As in the previous example depicting the intersection of a polygon layer and a line layer, this operation, in which the analyst intersects two polygon layers, is analogous to a logical AND operation: only those portions of features that exist in both input layers exist in the output layer.

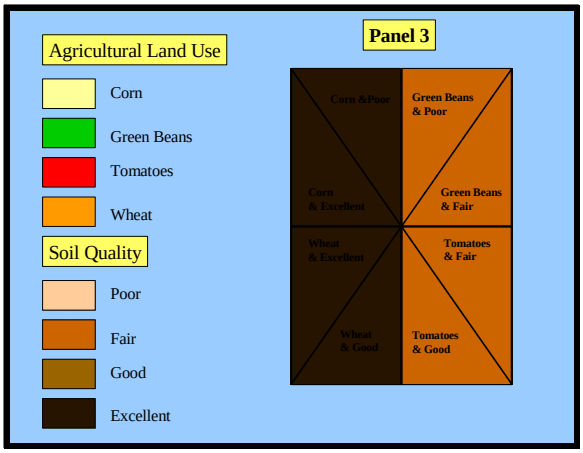


5. Union. If intersect is analogous to a logical AND operation, you can think of union as similar to logical OR. In this case the output layer includes all features from both input layers whether or not the features overlap. However, when two polygons do overlap, the operation creates new polygons that possess boundaries of both layers. The output layer also contains attributes of both input layers. Imagine that you are an agricultural agent and that you are interested in performing an analysis that involves cropping patterns and soil quality. You have two GIS layers with which to work. Panel 1, Agricultural Land Use, depicts place to place variation in cropping patterns.

   Panel 2, Soil Quality, is a soils map that depicts the quality of soil rated for agricultural suitability.



Panel 3 shows the result of the union of the layers in Panel 1 and Panel 2. In this image the polygons from the two input layers are combined as are their attributes. This layer combines polygons that overlap and creates new polygons that contain attributes from both input layers.



Using Arc Toolbox from within ArcMap. To use ArcMap to perform the operations just introduced, you will use the Arc Toolbox as accessed from Arc Map / Arc Info. Although we will introduce only the operations that implement the concepts introduced here, you will learn the basic approach for using the toolbox. This knowledge will serve you as you learn additional operations of which there are very many.

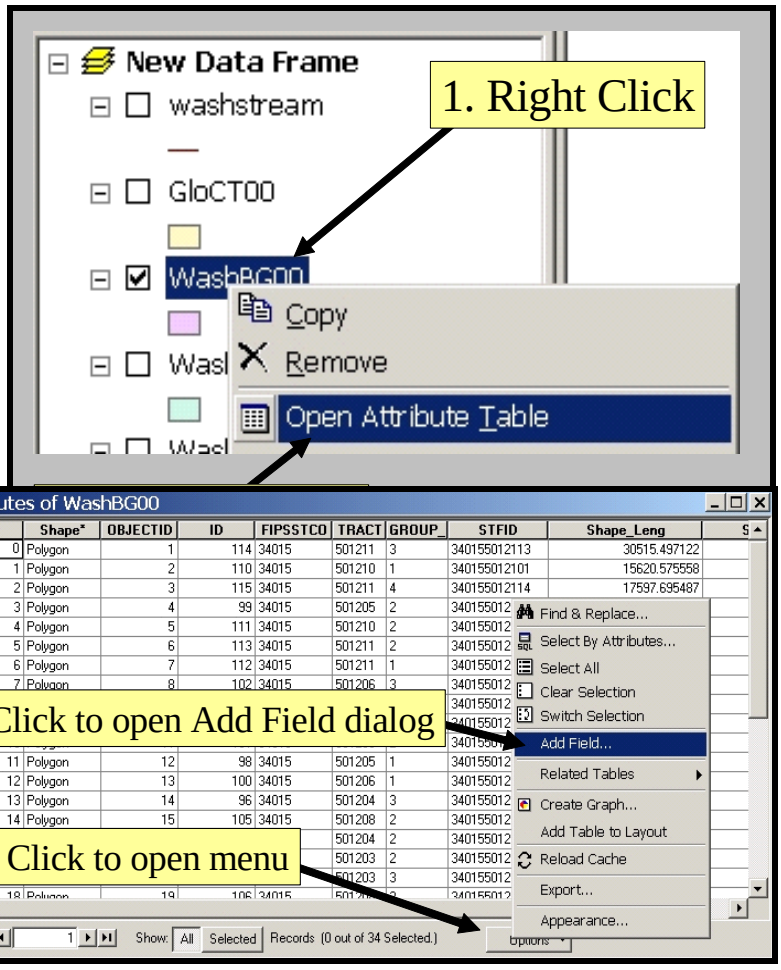
If you would like to work along with the examples I present in the text, you must first copy the folder Chap_17 from the open area to your H: drive. You might want to copy the folder to the local hard drive [C:] so that processing will take place quickly. Next, run ArcMap and connect to the Chap_17 folder. Open the map document Ch_17 to add all of the datasets to the table of contents. You will find all of the datasets required to follow through the examples outlined here.

Dissolve. This operation enables you to merge line or area features that have the same value for an attribute. Here I will take you through an example in which you will merge all census block group boundaries for Washington Township, New Jersey [plus a little of Camden County] to create a single polygon outline of the entire area. Because there is no attribute in the file that has the same values for each of the census block groups, you have to create one. Next, you will use the Arc Toolbox Dissolve operation to dissolve all interior boundaries.

To create the attribute field:

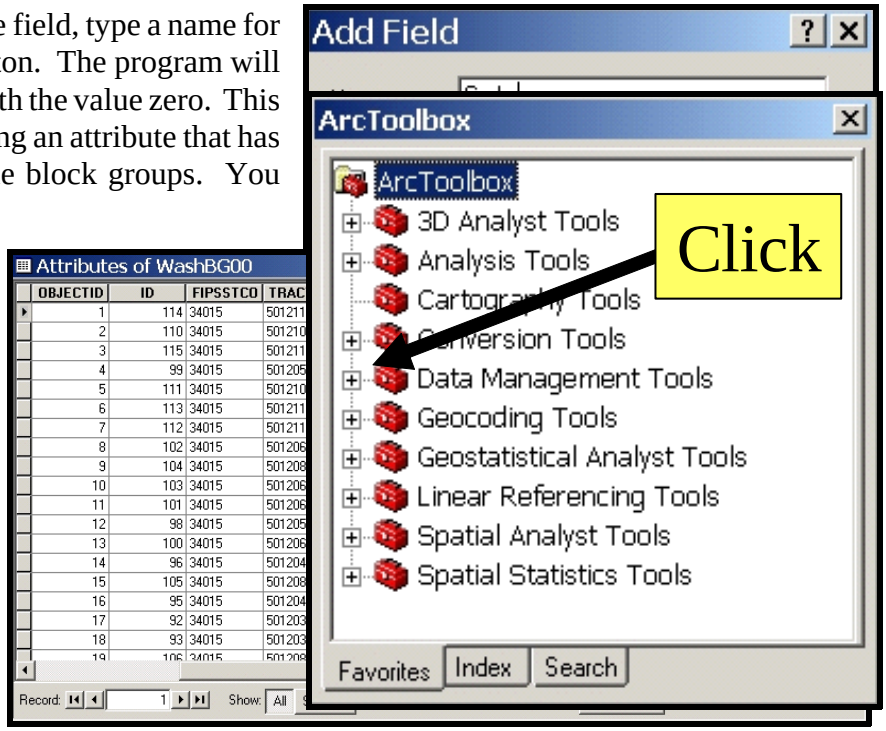
1. Right click on the layer for which you wish to dissolve boundaries to open the popup menu and then

select Open Attribute Table from the menu. In the illustration I have right clicked on the shapefile, WashBG00. The program will open the attribute table.



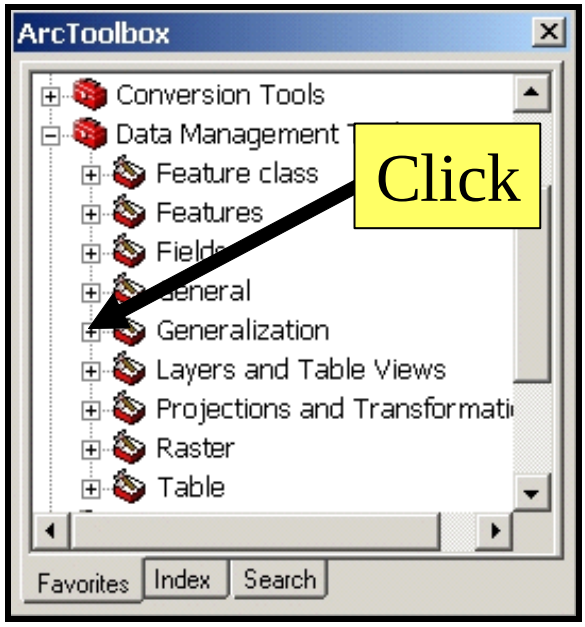
2. Click the Options button located near the bottom of the table to open the popup menu.
3. Select Add Field from the menu. The program will open the Add Field dialog.

4. In the dialog click on the Name field, type a name for the field and click the OK button. The program will add the field and populate it with the value zero. This accomplishes the end of creating an attribute that has the same value for each of the block groups. You will now use Arc Toolbox to dissolve all of the Census block group boundaries, leaving only the outline of the entire area.

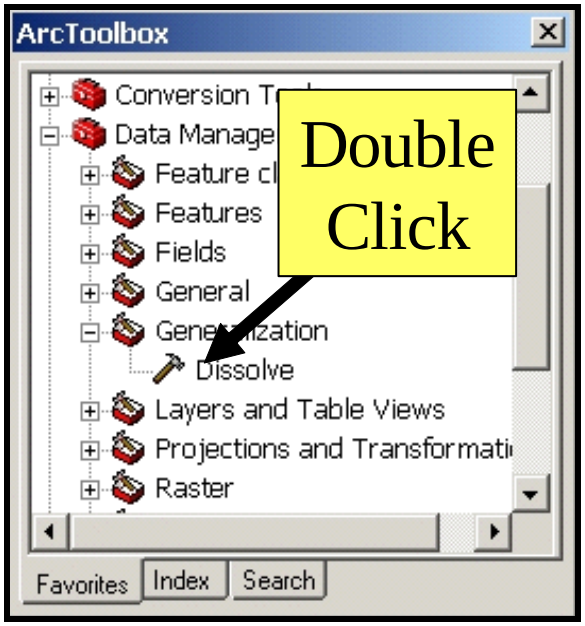


The illustration depicts the table

after adding the Code field and populating it with zero values. You are now ready to open Arc Toolbox. To do this, click on Window in the Main Menu and select Arc Toolbox from the drop down menu. You can also click on the Arc Toolbox icon located on the Standard toolbar. The program will open the toolbox program. Move the Arc Toolbox window around be clicking its title bar and dragging it. You can locate the toolbox anywhere within the Arc Map window. Note that it has a tendency to dock itself if you move it near the edge of any window. If you want to avoid this, hold the Control key as you drag the window. Note that if you have not maximized the Arc Map window, you can place the Toolbox on the desktop outside the program window.



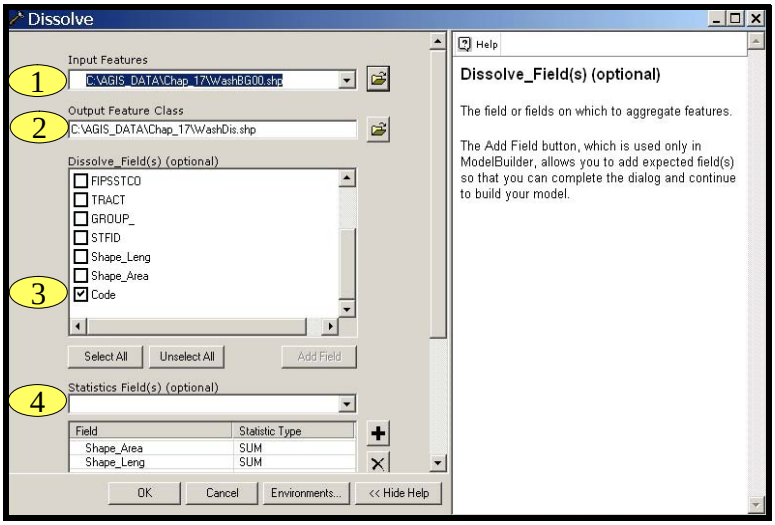
To perform the dissolve, you need to navigate to the Dissolve tool. To do this, open the Data Management Tools box by clicking on the plus sign to its left. You can also double click the box. The program will open the toolbox.



In the Data Management Toolbox, open the Generalization tool shelf by clicking the plus sign to its left side

Within the Generalization tool shelf you will see a number of tools [if you are using Arc Map Arc View, you will see only the Dissolve tool]. You want to use Dissolve tool, so double click it to open the dialog.

Dissolve Dialog. Fill in the dialog as follows:



1. Input Features. Use the Input Features field to specify the location and name of the file on which you wish to perform th dissolve. You can either type the information, use the arrow to the right side of the field, or use the browse button to navigate to the file.

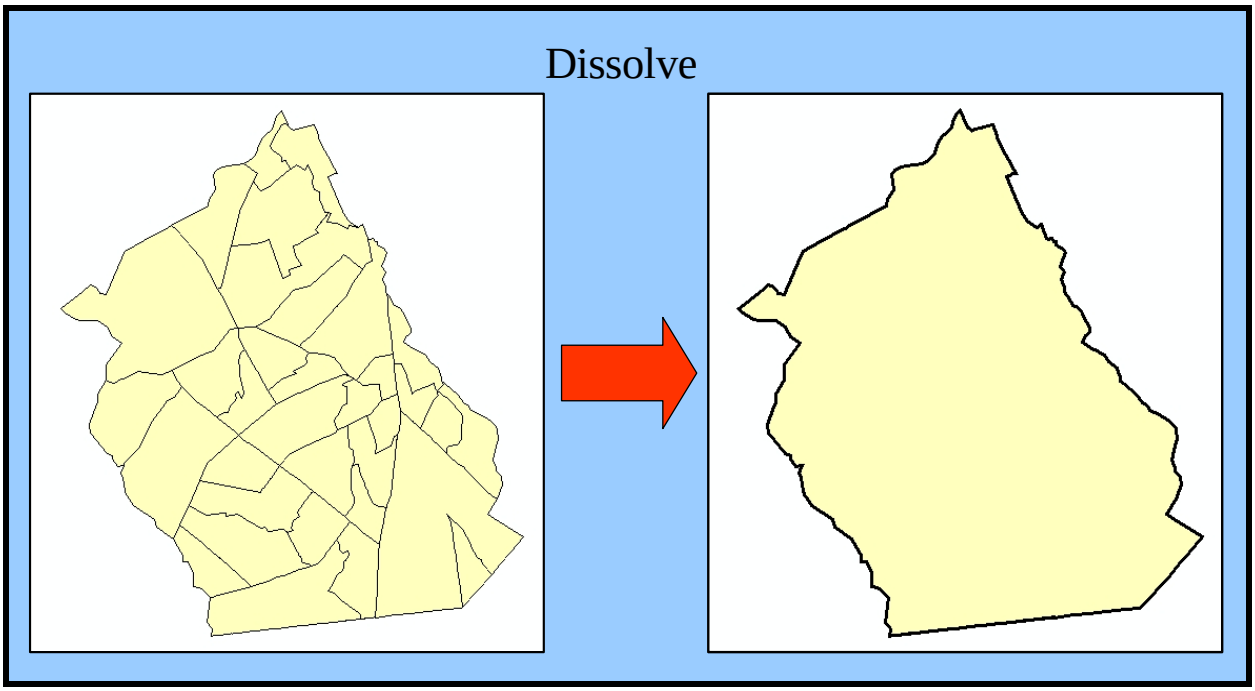
2. Output Feature Class. You can accept the default or click in the field and type a name for the new file. Alternatively, you can use the browse button to navigate to the location where you want to store the file and give it a name.

3. Dissolve Field. Scroll to the dissolve field and click in the box to select it. In this case, use the attribute [code] you just created for the precise purpose of performing the dissolve. By default, the attribute that you selected for the dissolve field will be included in the output layer.

4. Statistics Field(s). The next field, Statistics, gives you the option of including in the new file additional fields that exist in the attribute table of the input layer. For each field you wish to include you must specify the statistics type you want to calculate. To include a field from the existing table, click the arrow to the right side of the Statistics Field and click to select the field name. Next, in the Statistics Type field, for each field you have decided to include in the attribute table of the new file, click and pick the statistic type. In the illustration, I have selected the Shape_Area and Shape_Leng fields and have specified that the statistic calculated should be the sum. Be careful, as you can do silly things with this. One of the statistics I have asked the computer to calculate makes sense, but the other is nonsense in this case. There is no need to calculate statistics unless you plan to use the data in the future. Click the OK button to create the new layer.

The program will display a progress box and enter the new layer in the table of contents.

In the illustration, the input layer of census block group boundaries is on the left side. To the right is the



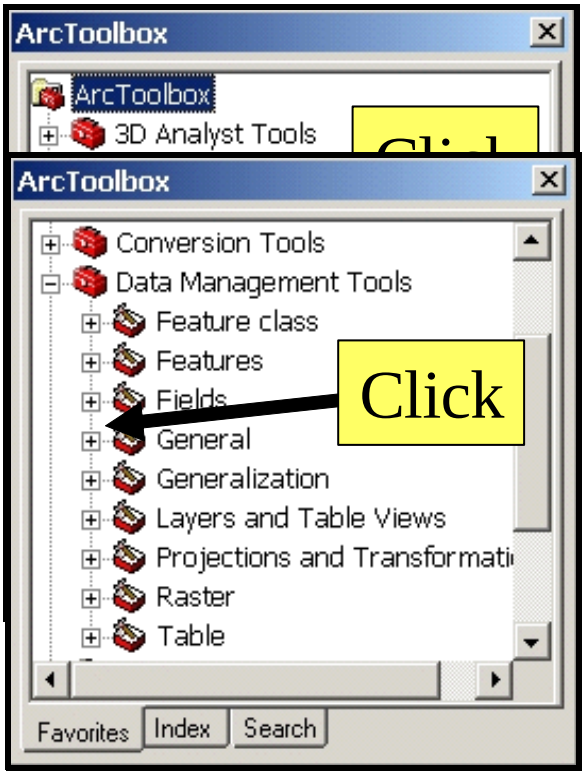
output layer created by dissolving on an attribute, code, that has the value zero for each of the polygons in the input layer.

Append or Merge. The append operation serves to combine multiple adjacent layers into a single layer. The layers, coverages or feature classes that you want to append must share the same coordinate system and all of the features must be of the same type. That is, all of the features must be points, or all must be lines, or all must be areas.

With this operation one of the layers serves as the "target." This is an existing layer to which the program will append the input feature layer or layers. One implication of this is that the existing layer to which you will append will be altered. If you still have a need for this layer, then use Arc Catalog to make a copy of it and use the copy as the target. As you will see, you can also make a copy from within Arc Toolbox.

To begin the append operation, open the Arc Toolbox program and expand the Data Management Toolbox by clicking the plus sign to its left. The program will open the toolbox and display the tool shelves within it.

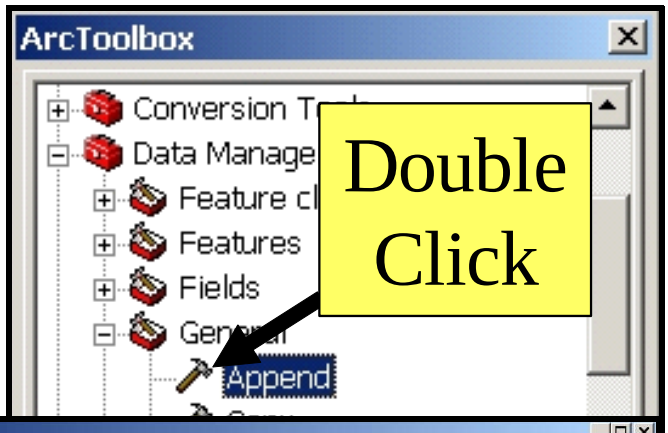
To continue navigating to the append tool, click the plus sign to the left of the General tool shelf. The program will

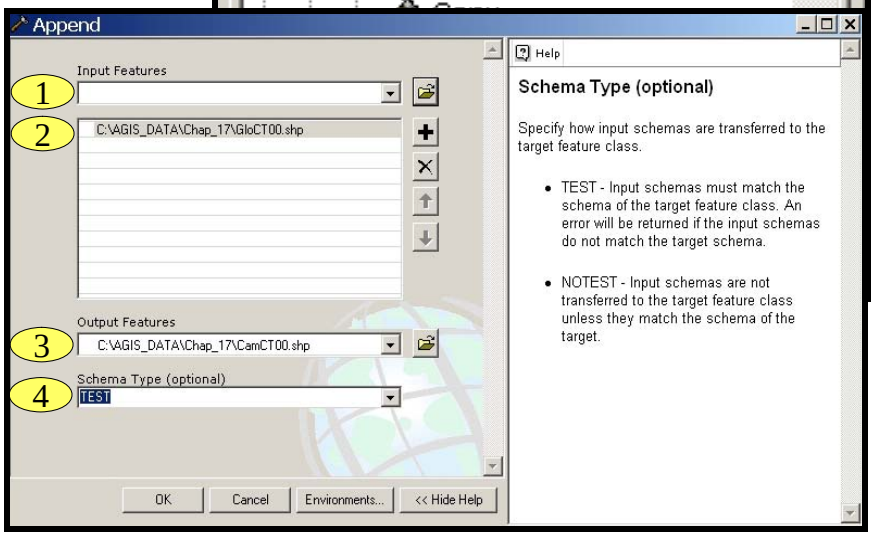


open the tool shelf.

As soon as you open the General tool shelf, you will see the tools contained within. In the illustration, you can see that one of the tools is Append. Notice that there is also a Copy tool. If you do not wish to alter the layer you are using as the target, then use the copy tool to make a copy of the features to which you want to append other layers and use the copy as the target.

To begin the append operation, double click on the append tool to open the append dialog.





Append Dialog. To complete the dialog carry out the following steps:

1. Specify the Input Features.

This is the layer or layers that you want to append to the target. Use the browse button located to the right side of the field to navigate to the location of the file or files you wish to use as inputs. Remember, that all layers must contain the same types of features and that all must use the same coordinate system. You can also click the arrow to the right side of the field and then click to pick layers from the listing of files in the currently active data frame of the table of contents.

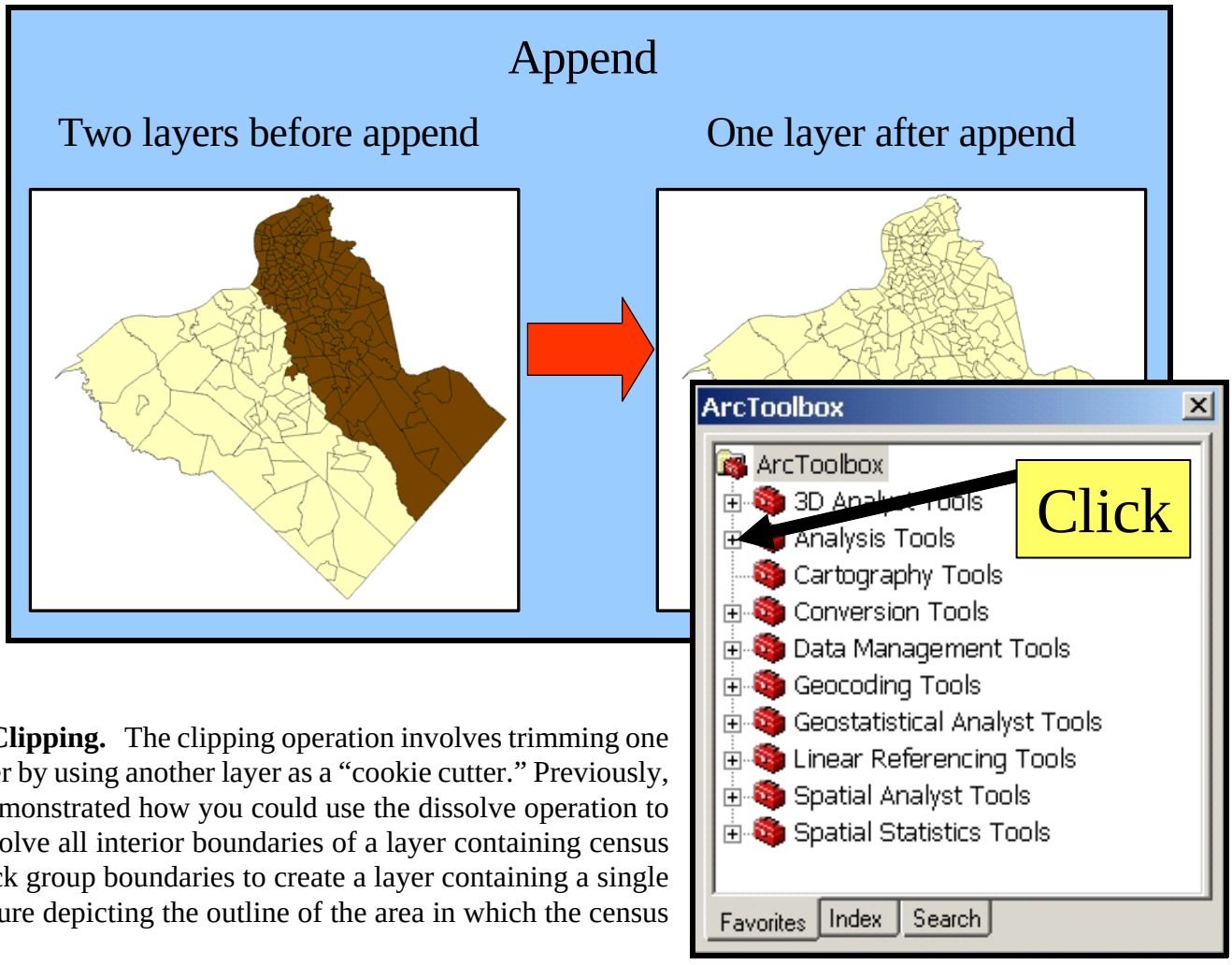
2. In the illustration, this item lists the input features you have added to the dialog. If you want to remove a layer, click on it and then click on the X button located to the right side of the window.

3. Output Features. Type the location and name of the layer, use the browse button to navigate to the location of the layer to which you wish to append or select a layer from the drop down list. This is the target layer.

4. Schema Type. For this field you select TEST or NOTEST. If you select TEST, then the fields in the input layers must match the name and order of those in the target or the program will generate an error message. If you select NOTEST, then the fields in the input layer are not transferred to the target unless they match those of the target [see Help message].

To complete the append operation, click OK.

In the illustration, in the panel on the left you can see that prior to the append operation there were two datasets, one for Gloucester County New Jersey [yellow] and one for Camden county New Jersey [brown]. After the append operation, the two layers have become one.

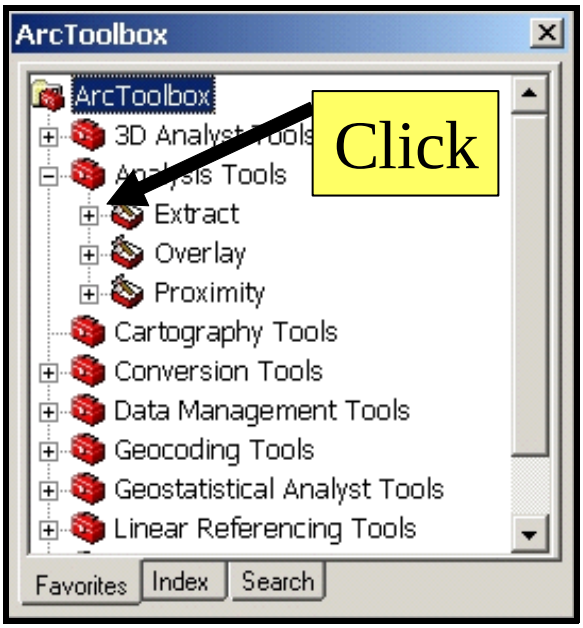


Clipping. The clipping operation involves trimming one layer by using another layer as a "cookie cutter." Previously, I demonstrated how you could use the dissolve operation to dissolve all interior boundaries of a layer containing census block group boundaries to create a layer containing a single feature depicting the outline of the area in which the census

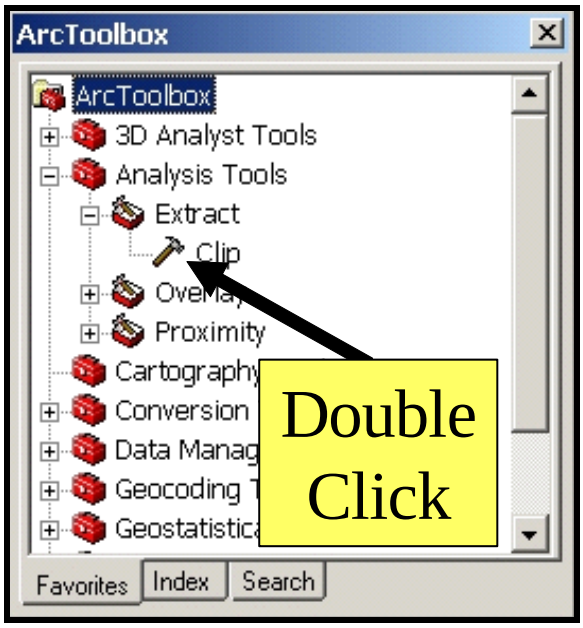
block groups are located. I suggested that you could use that single layer to create cartographically correct thematic maps in which you draw boundaries of higher level units with heavier lines and boundaries of lower level area with lighter lines. You could also use that single polygon as a cookie cutter to trim a larger layer so that it fits just inside the cookie cutter polygon.

To begin the clip operation, open the Arc Toolbox. In the Toolbox click the plus sign to the left of the Analysis Tools toolbox. The program open the contents of the toolbox.

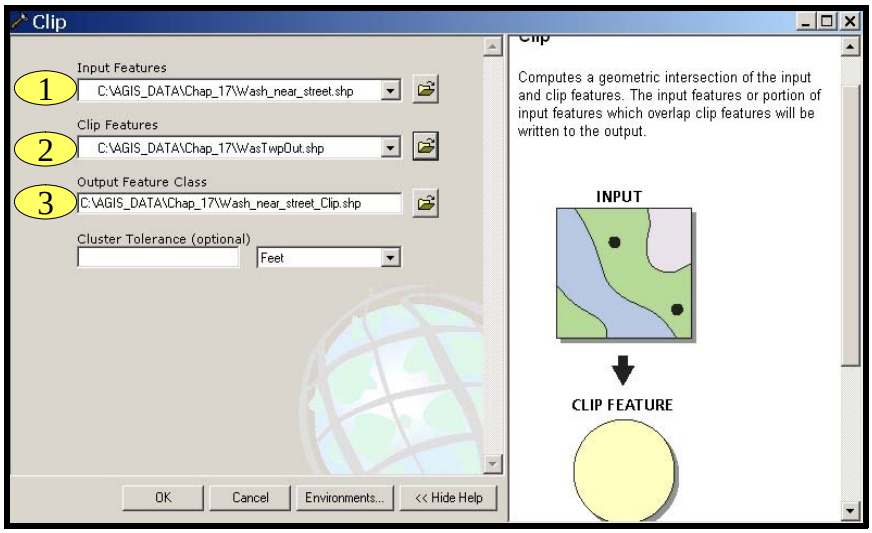
In the Analysis Tools you can see three tool shelves: Extract, Overlay and Proximity. Click the plus sign to expand the Extract shelf.



In the Extract shelf you will find the Clip tool [note that in the Arc Info version of the software there are additional tools not shown here]. Double click the tool to open the clip dialog box.



Clip Dialog. To clip a layer complete these steps:

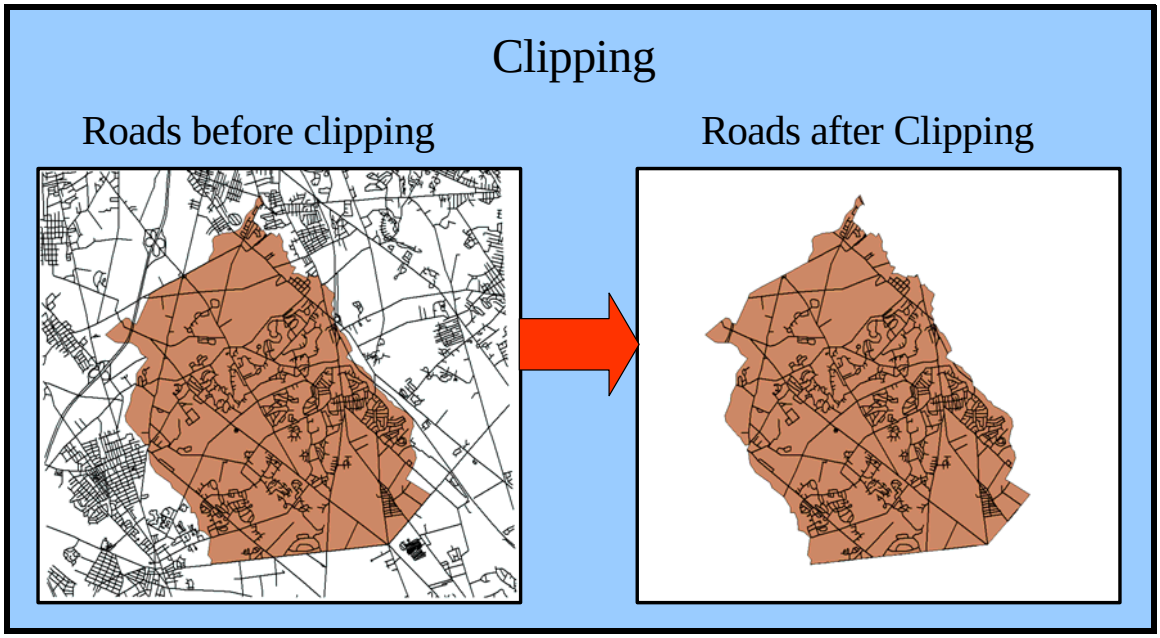


1. In the Input Features field enter the name and location of the layer that contains the features you want to clip with the cookie cutter layer. In the illustration, the layer I am going to clip contains data on the street network in the area around Washington Township, New Jersey. This is the layer that you are going to clip so that if will fit within a cookie cutter polygon.

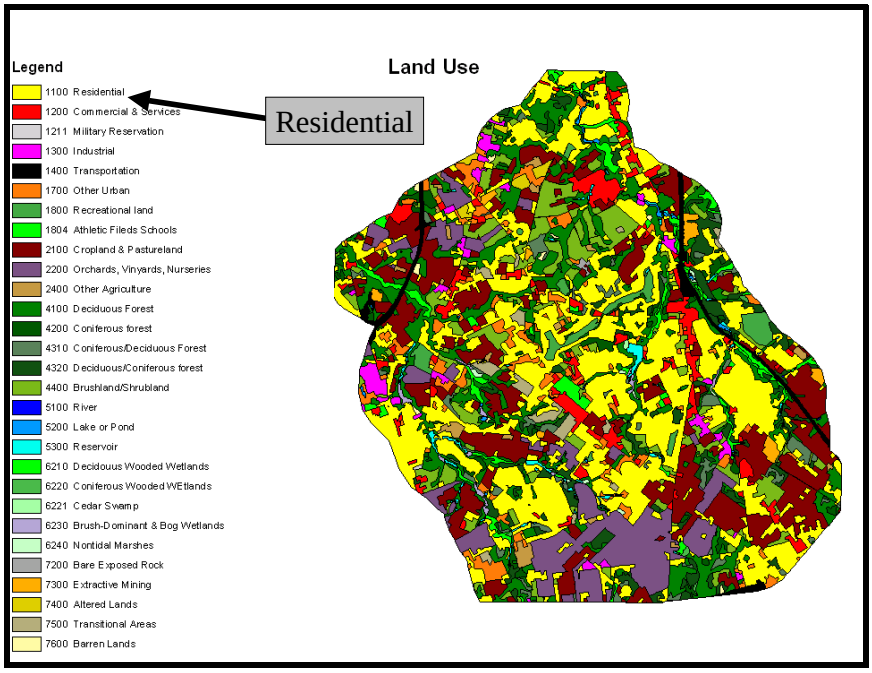
2. Clip Features. In the second field select the layer that you want to use as a cookie cutter. This must be a polygon layer. Although in many cases it might consist of a single polygon, this is not a requirement, but if, for instance, you used the census block group layer as the clipping polygon, then each block group polygon would act as its own cookie cutter. Generally, this is not the result you seek.

3. Output Feature Class. In the third field click the browse button and specify the location where you want to save the clipped layer and give it a name. To complete the operation, click the OK button.

In the illustration, on the panel to the left, I have displayed a layer containing the road network in the vicinity of Washington Township, New Jersey. This layer is the input to the clip operation. The clip layer is WasTwpOut.shp, which is the layer I created in the dissolve operation described earlier. The output layer depicted in the right hand panel is Wash_Near_Street_Clip.shp, which consists of the streets from the input layer that fall within the border of the clip layer.



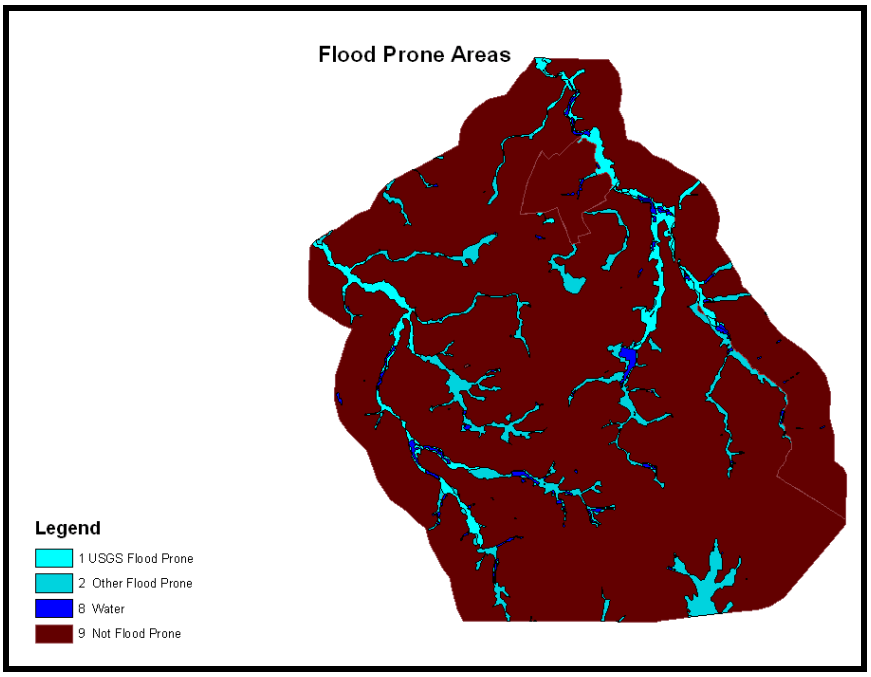
Intersection. Remember that the concept behind intersection is similar to that of the logical AND operation you learned about in the spatial analysis portion of the introductory course. When you intersect two layers the output layer contains only those features that fall within the spatial extent of both of the overlay input layers. The output layer contains attribute data and overlaid polygons from both input layers.



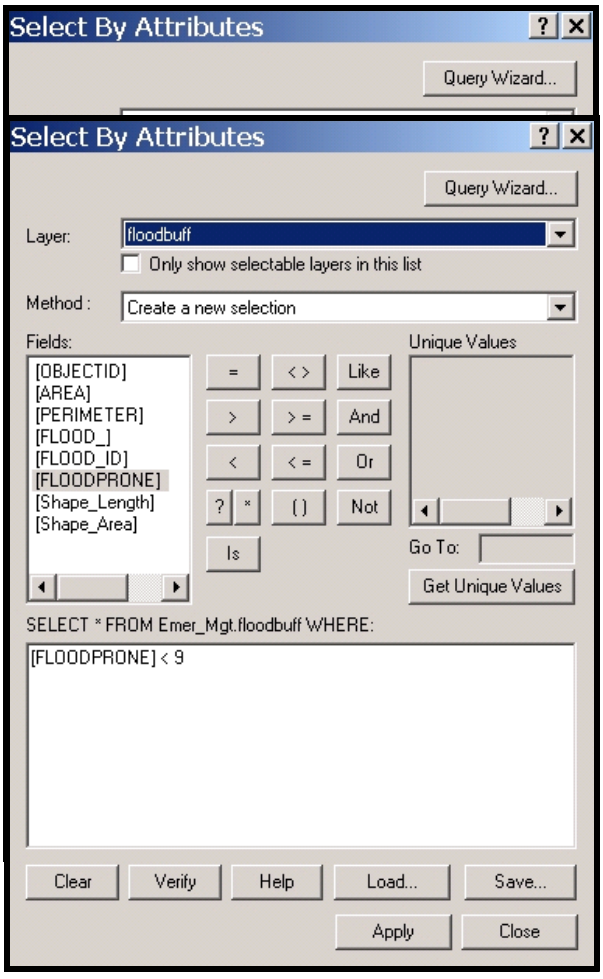
To get an idea of how this works, imagine that you are an emergency management planner and wish to identify residential areas of Washington township that are likely to flood. You have two layers that can help. The first layer depicts place to place variation in land use in the township and its vicinity.

Because the planner is interested only in residential areas, prior to doing the intersection, he must use select by attribute to select residential uses [land use code = 1100]. To do this click selection in the Main menu and then click Select by Attributes in the drop down menu. Doing the selection limits the intersection to selected features.

The second layer depicts water and flood prone areas for the same region. The planner is only interested in areas that are water or some kind of flood prone. Prior to performing the intersection operation, the planner must use the select by attributes operation to select polygons with those attributes, which in this case means selecting all polygons with a flood prone code of less than nine.



To make the selection from the layer depicting land uses, click Selection in the Main Menu and then click Select by Attributes from the drop down menu. In the Select by Attributes dialog use the Layer field to set the layer to landusebuff. Make sure that the Method field is set to Create a new selection. Other choices in the Method field include: Add to current selection, Remove from current selection, and Select from current selection. In the Fields window double click to select the "LAND_USE" attribute and then click the equal sign button. Click the Get Unique Values button to display all land use codes. In the Unique Values window double click on the value 1100, which is the code for residential land uses. After you have completed this, the SELECT FROM window at the bottom of the dialog should look just like the one in the illustration. To make the selection click the Apply button. The program will select all features in the landusebuff layer that have the values 1100 for the "LAND_USE" attribute.

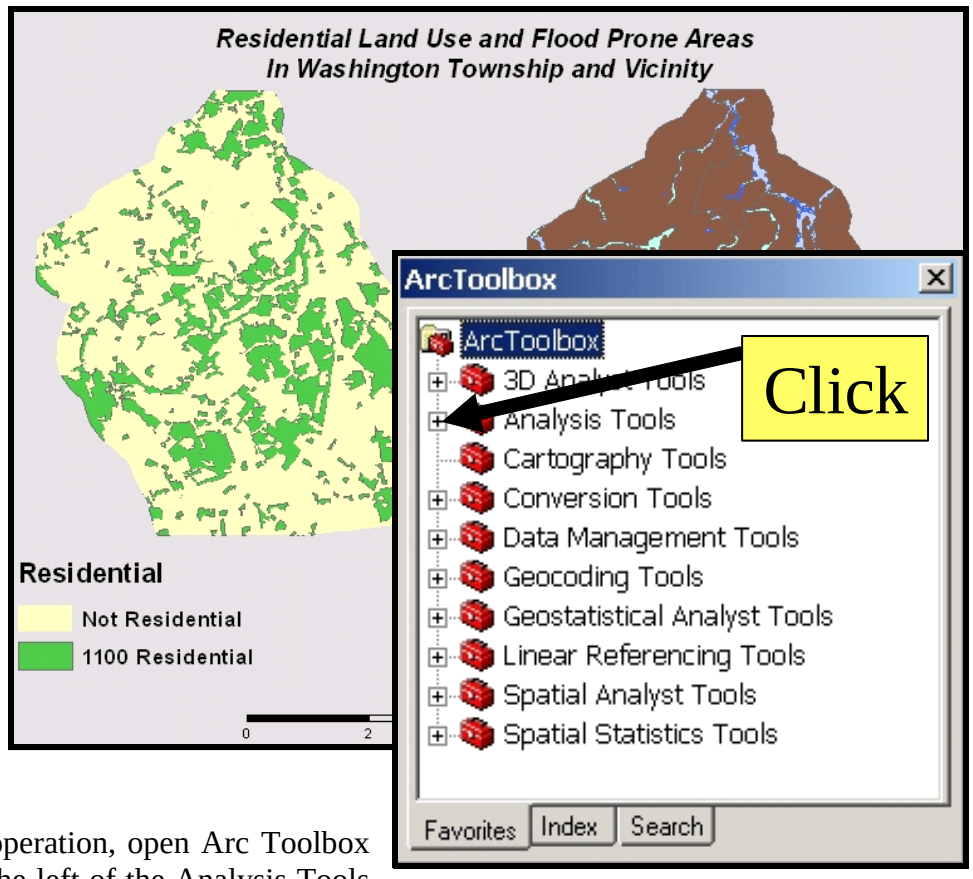


Notice that the full range of relational and logical operators is available in this dialog. Be a little carful using the logical operators, as the logic can get quite tricky quite quickly!

While you are still in the Select by Attributes dialog you can perform the selection operation on the layer that depicts flood proneness. Use the Layer field to change the

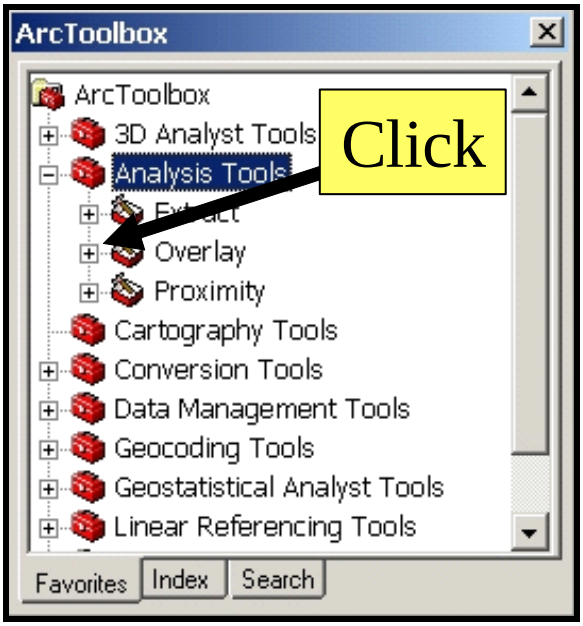
layer to floodbuff. To create the selection statement double click on "FLOODPRONE" in the Fields window, then click the less than sign [<]. Click the Get Unique Values button to display the data values in the layer and then double click 9 [which will now be displayed] in the Unique values window. Your selection statement should look like the one I have entered in the illustration. To make the selection, click the Apply button. The program selects all polygons in the floodbuff layer that have a code values of less than nine. In short, you have selected all features that are any kind of flood prone or water. The only unselected features are in areas that are not flood prone. You are now ready to perform the intersection.

The illustration depicts the two input layers. In the map on the left you can see the residential areas in green. The map on the right shows flood prone and water areas in blue and non flood prone areas in brown. Our analysis will create a layer in which those the only land use areas remaining will be residential areas that are in flood prone areas and the only areas remaining from the flood prone layer will be those that are flood prone and in a residential area.

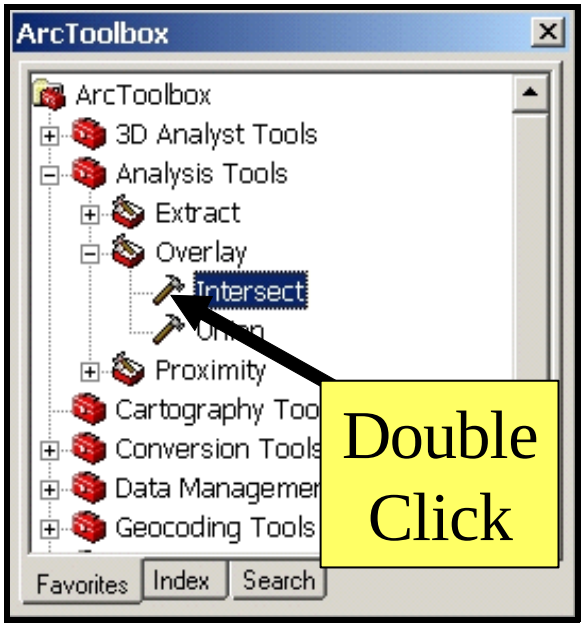


To begin the intersection operation, open Arc Toolbox and click on the plus sign to the left of the Analysis Tools toolbox. The program will open the toolbox.

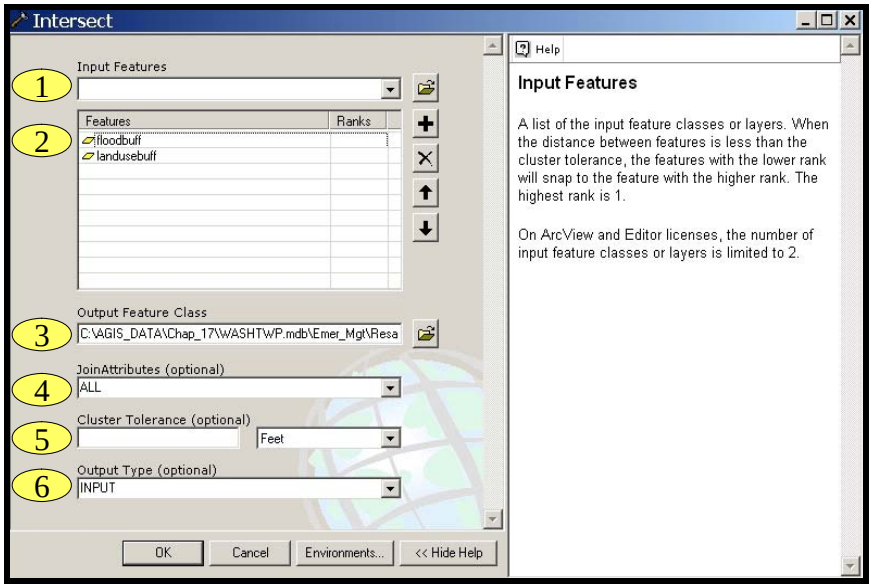
From the items within the Analysis Toolbox click the plus sign to the left of the Overlay tool shelf. The program will open the shelf and show the tools inside.



Within the Overlay tool shelf you can see the Intersect and Union tools. Double click the Intersect tool to open the dialog you will use in making specifications for the intersection operation.



Intersection Dialog. To complete the intersection operation, proceed as follows:



1. Input Features. As the name suggests, this is where you load the layers on which you wish to perform the operation. If you click the arrow to the right side of the field, the program will open a drop down list depicting all of the vector layers currently in the table of contents of the active data frame. To select a layer from the drop down list, click it. After you click a layer, the program lists it in the Features sub-window. Another way to input features is to use the browse button to navigate to the location and name of the layers you want to intersect and add those layers to the Features list. Note that if, as is the case in the example presented here, you wish to intersect a subset of the features in the input layers, this approach will not work. Remember, to intersect a subset of features, you must perform a selection to identify which features you wish to intersect. In the example presented here we have selected residential uses from the land use layer and water and flood prone areas from the flood prone layer. If you access those layers by using the browse button to navigate to them, it is as if you are loading then anew. The feature selections you performed do not apply. If you perform the intersect operation in this way, all features in both layers are intersected, which is fine if that is you intention.

2. Features. In this window the program lists the layers you have selected for intersection. To remove a layer from the list, click it and then click the X button to the right of the window. The Ranks field allows you to assign a snapping priority to the layers. Features in lower ranks snap to features in higher ranks when the distance separating features is less than the Cluster Tolerance [Item 4]. Note that with Arc Info you can intersect more than two layers at a time. If you are working with the Arc View version of the software, then you are limited to two layers per intersection.

3. Output Feature Class. Type or navigate to a location and then either accept the default name for the new layer or provide whatever name you like.

4. Join Attributes. Use this field to control which attributes in the input features the program will transfer

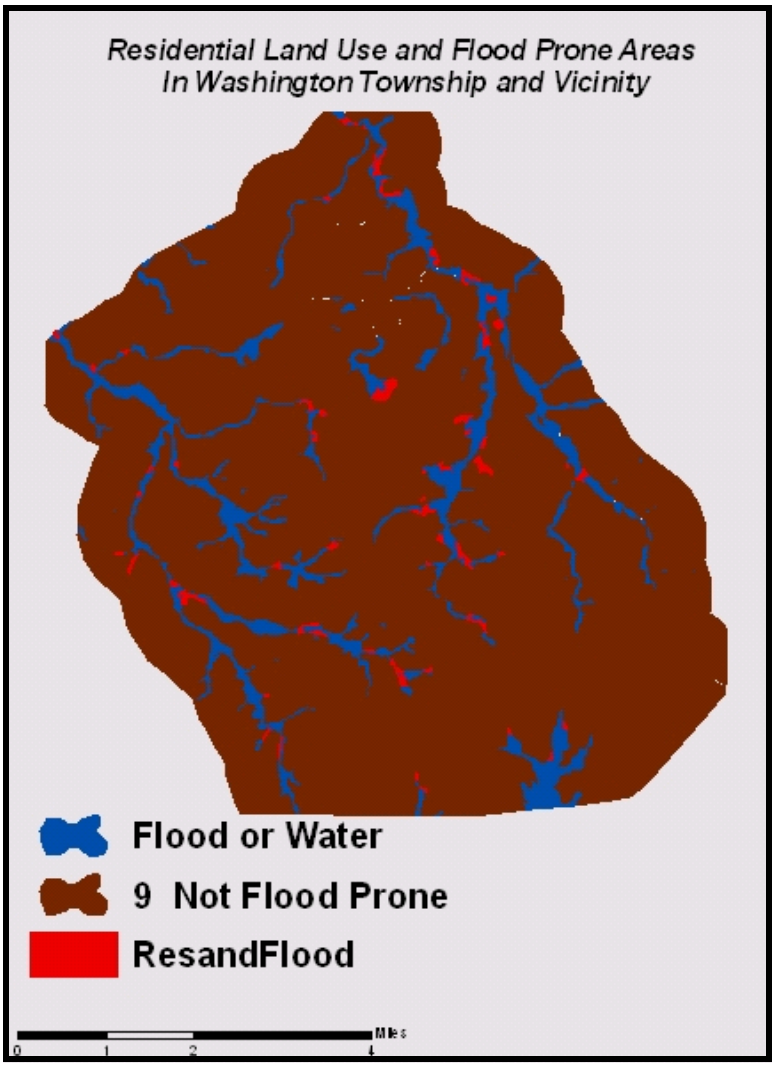
to the output Feature Class. The choices are

1. ALL. The program transfers all features in all input layers to the output feature class. This is the default value.
2. NO_FID. The program transfers all features in all input layers to the output feature class except for the FID [feature identification field].
3. ONLY_FID. The program transfers only the FID field to the output layer.

5. Cluster Tolerance. You can use this to set the distance at which features are considered to be coincident. The default is that the program calculates a minimum value in the units of the coordinate system of the input layers.

6. Output Type. You can use this field to specify the geometry of the features produced in the output feature class[1]. The choices are:

1. INPUT. The features in the output layer will be the same as the lowest level present in the input layers. For instance, if all input layers contain polygons, then the output layer will contain polygons. If the input layers contain polygon and line features, then the output layer will consist of line features.
2. LINE. This option forces the program to create a layer in which the output features consist of line intersections. You can not specify this option if one of the input layers contains point features.
3. POINT. The output layer contains point features that intersect with features in the input layers.



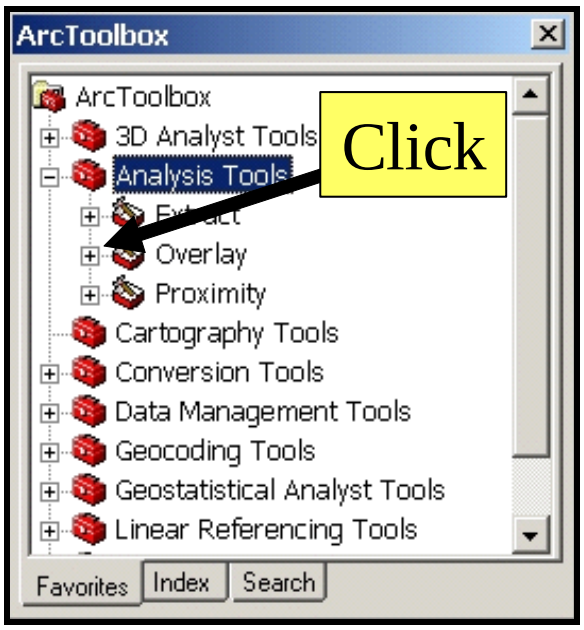
Intersection Output. The map depicts the areas that are both flood prone and residential. I have displayed the output layer on a layer that depicts the areas of the Washington Township vicinity that are either not flood prone or are water or flood prone. The map can give you a sense of the locations of these places where you definitely do not want to live.

[1] For a more detailed discussion of this topic, read the help file associated with the intersection operation.

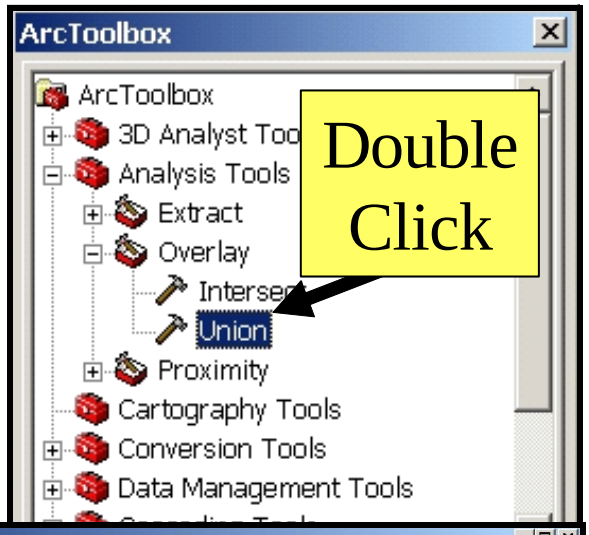
Union. As you know, union is somewhat like the OR operation you learned to use in the spatial analysis portion of the introductory course. In this case the overlay operation results in an output layer in which all polygons in either of the input layers are included in the output layer irrespective of whether or not the polygons overlap. The attribute table associated with the output layer has the attributes of both input layers. In the case of polygons in the input layers that have boundaries that cross, the program forms new polygons. Suppose, for example, that you are performing the union operation on a land use layer and a flood prone layer. If a polygon that has the land use residential is crossed by the boundary between areas that are flood prone and areas that are not flood prone, then in the output layer the land use polygon will be divided into two portions. The portion that falls into the flood prone region will have attributes indicating that the polygon is residential in land use and is flood prone. The portion that falls outside the flood prone region will have attributes that indicate that its land use is residential and that it is not flood prone. In the example presented here I will demonstrate the union of the land use and flood prone layers from Washington Township.

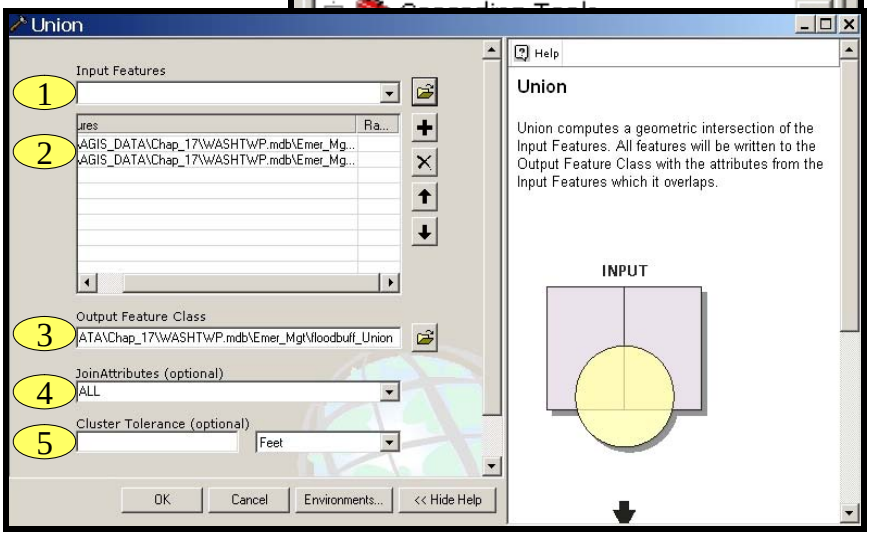
To begin the union operation, open Arc Toolbox and click on the plus sign to the left of the Analysis Tools toolbox. The program will open the toolbox.

From the items within the Analysis Toolbox click the plus sign to the left of the Overlay tool shelf. The program will open the shelf and show the tools inside.



Within the Overlay tool shelf you can see the Intersect and Union tools. Double click the Union tool to open the dialog you will use in making specifications for the union operation.





Union Dialog. To complete the union operation, proceed as follows:

1. Input Features. As the name suggests, this is where you load the layers on which you wish to perform the operation. If you click the arrow to the right side of the field, the program will open a drop down list depicting all of the vector layers currently in the table of contents of

the active data frame. To select a layer from the drop down list, click it. After you click a layer, the program lists it in the Features sub-window. Another way to input features is to use the browse button to navigate to the location and name of the layers you want to intersect and add those layers to the Features list.

2. Features. In this window the program lists the layers you have selected for union. To remove a layer from the list, click it and then click the X button to the right of the window. The Rank field allows you to assign a snapping priority to the layers. Features in lower ranks snap to features in higher ranks when the distance separating features is less than the Cluster Tolerance [Item 4]. Note that with Arc Info you can intersect more than two layers at a time. If you are working with the Arc View version of the software, then you are limited to two layers per intersection. In the case of the union operation, all input features must be polygons.

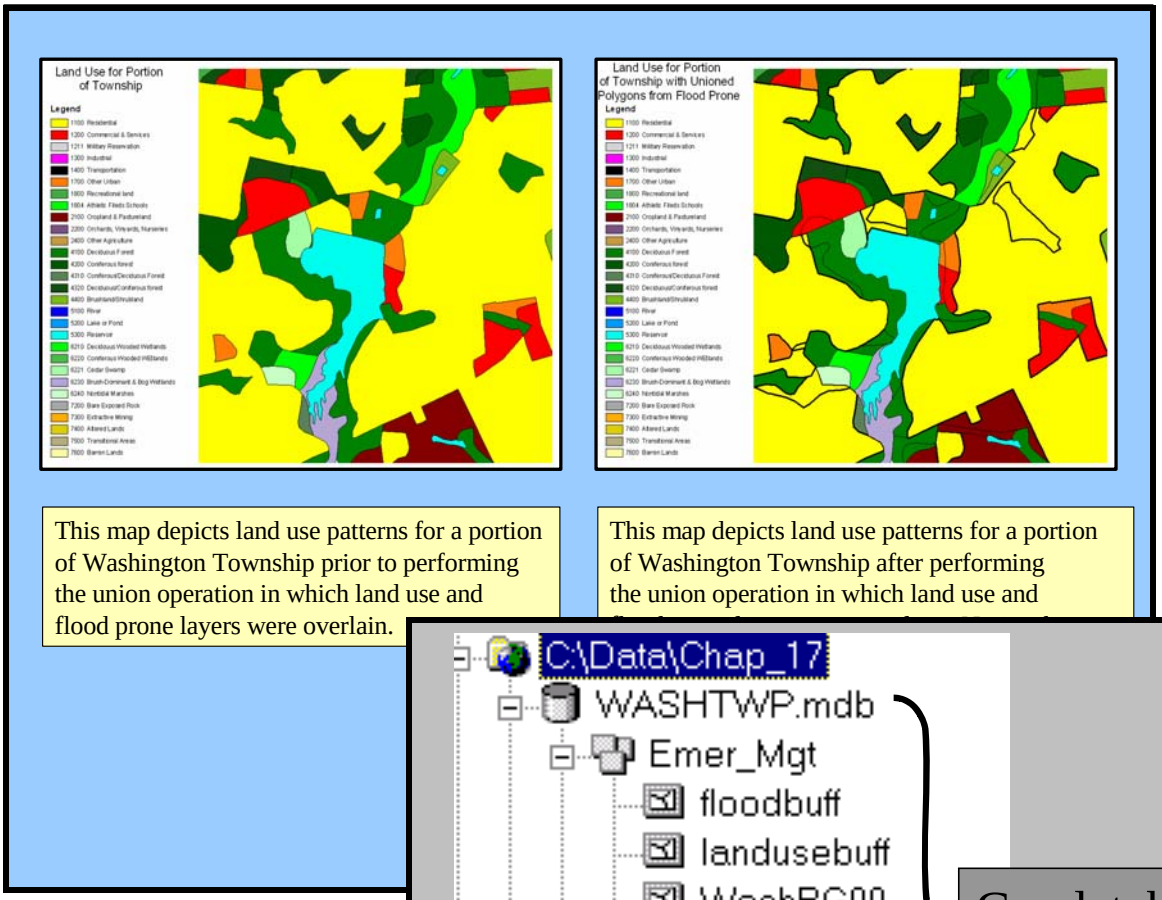
3. Output Feature Class. Type or navigate to a location and then either accept the default name for the new layer or provide whatever name you like. Remember, if you are saving the new layer as a shapefile, then area and perimeter values for polygons altered in either of these values will be incorrect. If you are saving the new layer as a geodatabase feature class, then these values will be recalculated correctly.

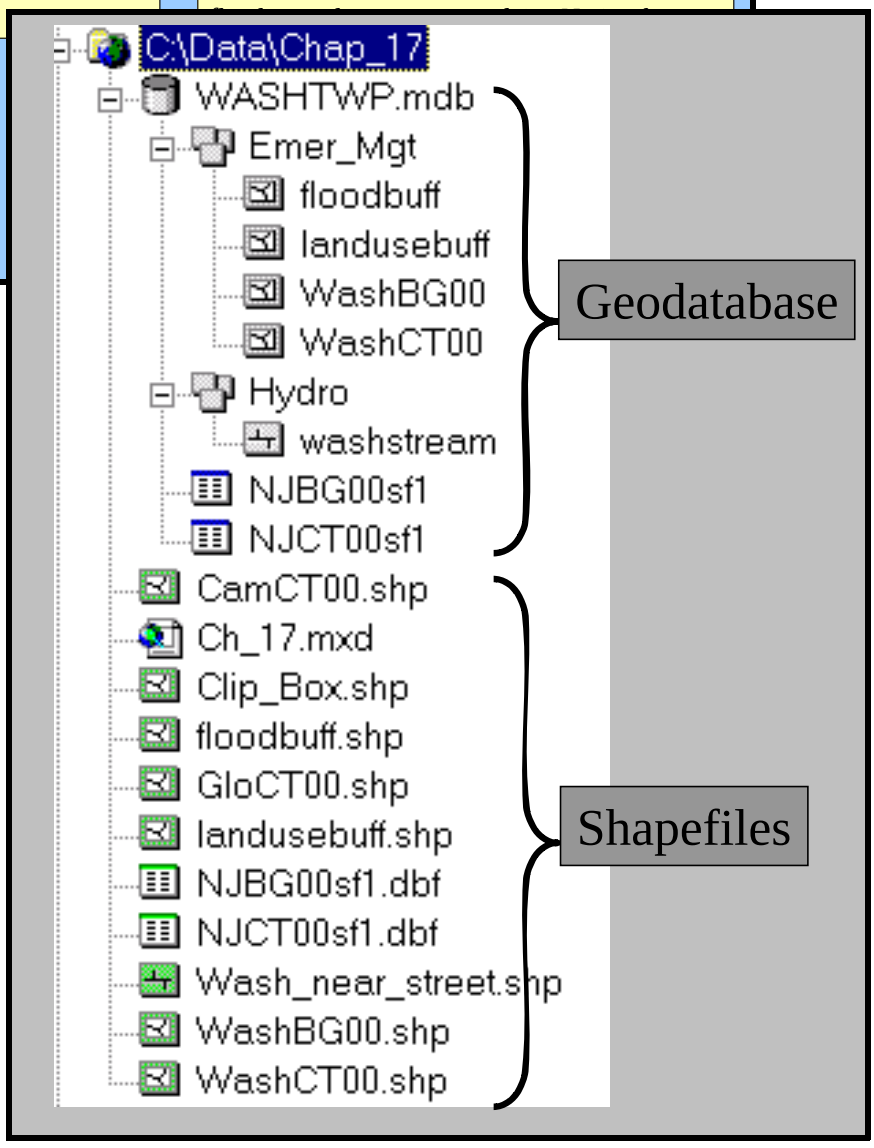
4. Join Attributes. Use this field to control which attributes in the input features the program will transfer to the output Feature Class. The choices are

1. ALL. The program transfers all features in all input layers to the output feature class. This is the default value.
2. NO_FID. The program transfers all features in all input layers to the output feature class except for the FID [feature identification field].
3. ONLY_FID. The program transfers only the FID field to the output layer.

5. Cluster Tolerance. You can use this to set the distance at which features are considered to be coincident. The default is that the program calculates a minimum value in the units of the coordinate system of the input layers.

Union Output. The map on the left side of the illustration on the next page shows a portion of the land use layer prior to the union operation. The map to the right shows a portion of the land use layer after union with the flood prone layer. Notice that some of the land use polygons have been cut into smaller pieces in the case that a flood prone layer boundary crosses a land use layer boundary.





Workshop: For this workshop you will work with the Chap_17 database, which you can find in the open area. I suggest that you first copy the database to your H: drive and then move it to the local hard drive [C:] where you can carry out all calculations with greater speed and no fear of running out of disk space.

The illustration depicts the contents of the database with which you will be working for this exercise. The following tables outline the steps you will take in completing the workshop.

File	CamCT00.shp
Task 1	Add a new field and populate the field with 0. The population part should be automatic.
Task 2	Use the dissolve operation to dissolve all interior boundaries. The dissolve field will be the one you just created
Product	Shapefile of outline of Camden County. You will use this later

File	GloCT00.shp
Task 1	Add a new field and populate the field with 0. The population part should be automatic.
Task 2	Use the dissolve operation to dissolve all interior boundaries. The dissolve field will be the one you just created
Product	Shapefile of outline of Gloucester County. You will use this later

Files	CamCT00.shp and GloCT00.shp
Task 1	Use the append operation to combine the two files. To begin this process make a copy of one of the files [either CamCT00. Shp or GloCT00.shp. Rename the copy CamGloCT00.shp. Use this file as the target in the append operation.
Task 2	Join the new file CamGloCT00.shp with the attribute table NJCT00sf1.dbf

Task 3	Make a choropleth or dot map of one or more attributes in the dBase table. Use the county outline files you created previously to draw a heavier border for each of the counties.
Product	Well designed layout using appropriate classes, symbols, and titling information.

Files	WashCT00.shp and Wash_near_street.shp
Task 1	Add a new field to WashCT00.shp and populate the field with 0. The population part should be automatic.
Task 2	Use the dissolve operation to dissolve all interior boundaries. The dissolve field will be the one you just created
Task 3	Use the dissolved file depicting the borders of the township as a clipping layer. Use the clip operation to cookie cut the Wash_near_street.shp file so that you have a new street layer that depicts the streets of the township. Call this layer Washstreet.shp
Product	Create a street map of the township. Use the dissolved layer as a frame for the streets. The map should be in layout form and properly titled and symbolized.

Files	landusebuff.shp and floodbuff.shp
Task 1	With landusebuff.shp as the target file, use the Select by attribute operation to select all residential land uses [land_use = 1100]
Task 2	With floodbuff.shp as the target file, use the Select by attribute operation to select all areas that are water or flood prone. [floodprone < 9 will do this]
Task 3	Use Arc Toolbox to intersect the two layers for the selected values only.
Product	Create a map that shows the residential areas that are flood prone. For this map provide a base map that enables easy identification of areas to avoid. You could use a street layer for instance.

The End