

Assignment #1: Selecting Features & Spatial Analysis

Preliminary Steps

I

- Review Gorr/Kurland, "GIS Tutorial I: Introduction"; "GIS Tutorial 4: Geodatabases"; "GIS Tutorial 5: Importing Spatial and Attribute Data" (pages 172-80); "GIS Tutorial 8: Spatial Data Processing" (pages 269-274); "GIS Tutorial 9: Spatial Analysis" (pages 303-7); and Ormsby et al., chap. 4 ("Exploring ArcCatalog").
- Peruse the following "How To" documents on the course web site: "How to Manage GIS Data Sets" and, where relevant, "ArcGIS Tips."
- If you are working on your own computer, make sure that your GIS folders are located under c:\TEMP, as described in "How to Manage GIS Data Sets."
- Use ArcCatalog, not Windows Explorer, to manage ArcGIS data files.
- The following exercises will use these data layers: Mdbg (which is the Miami-Dade Block Group), Mobile Homes, Colleges, Highways, and arail.
- Their common geographic coordinate system could be: Layers>Properties>Predefined>Projected Coordinate Systems>World>North American 1983 HARN (High Accuracy Reference Network). It could be more accurate to use a locally tailored projected system, such as: Layers>Properties>Coordinate System>Predefined>Projected Coordinate Systems>State Plane>NAD 1983>State Plane Florida _East_FIPS_0901). Or alternatively you could use an unprojected coordinate system: Layers>Properties>Predefined>Geographic Coordinate Systems>World>WGS 1984.
 - 5280 feet=1 mile, 1 mile=1.609344 kilometers.
- Note that, in ArcMap, Data>Export Data saves a map layer as a shapefile to ArcCatalog.
- The course web site document 'Selecting Features' pertains to the following exercises.

II

- ***Inspect mdbg, Lmobhome, Lcollege, and AHighway in ArcCatalog Preview, Table, and Metadata:***
 - In Metadata, inspect the 'Spatial Reference Information,' particularly the geographic coordinate system).
 - Perhaps an easier way to inspect a coordinate system: right-click a file> Properties> Shape (click gray box)>Field Properties>Spatial Reference. Make sure that the files you intend to map share the same, appropriate coordinate system.
- ***Define a coordinate system in ArcCatalog:***
 - Right-click each file>Properties>Fields. Click the gray area next to 'Shape', then, in the 'Field Properties' box below, click the ellipses to the right of 'Spatial Reference'. Then 'Select' or 'Import' a coordinate system.
 - Do so for mdbg as well.
 - Then for Lmobhome, Lcollege, and LHighway, import the coordinate system from mdbg.

- ***In ArcMap, avoid disrupted layer paths (see “ArcGIS Tips”) by ‘storing relative path names’:***
 - File> Map Properties>Data Source Options>click ‘store relative path names’ (see Gorr/Kurland, pages 37-38).

- ***In ArcMap, set the appropriate coordinate system on the data frame:***
 - Recheck the coordinate system: right-click Layers>Coordinate System, and inspect ‘Current coordinate system’.

- ***In ArcMap, check the displayed type of map units:***
 - Layers>Properties> General>Units>Map>Display. These correspond to the particular coordinate system, as you examined above.

- ***Measure Tool:***
 - Measure a distance between objects, confirming (on bottom-left portion of the display) that the measured number of units make sense.
 - Change the Display to miles.
 - Use the Measure tool to measure a distance, again confirming that the measured number of units makes sense.
 - If the measurements don’t make sense:
 - Check in ArcCatalog to see if the shapefile doesn’t have an associated .prj file.
 - If you have another, e.g., Miami-Dade map that measures correctly, import or select its projection (i.e. its .prj file) in ArcCatalog: right-click the shapefile in ArcCatalog’s tree>Properties>Shape>Spatial Reference>import or select the projection.
 - If you can’t find a projected coordinate system, try selecting or importing unprojected coordinates (e.g., WGS 1984) in ArcCatalog (as described above for projected coordinate system).

- ***In ArcMap, click ‘Add Data’:***
 - Add mdbg, Lmobhome, Lcollege, and Ahighway.

- ***Adjust each symbol’s shape, color, and size:***
 - Do so by clicking each symbol and selecting adjustments; or by right-clicking each color in the Table of Contents & selecting an appropriate color) and select a background color (Layers>Properties>Frame>Background, then select a color).

- ***Rename each layer:***
 - Do so by right-clicking a layer (Miami-Dade, Mobile Homes, Colleges, Highways), then Properties>General, and rename each layer.
 - Put the layers in this order: Highways, Colleges, Mobile Homes, Miami-Dade.
 - Make sure that the ‘Display’ tab is selected at the bottom of the Table of Contents.
 - Right-click each layer and move it upward or downward: what might doing so accomplish?
 - Explore layer labels: right-click the Mobile Homes layer, then check ‘Label Features.’ Uncheck and repeat for Colleges and Highways.

- **Group the layers:**
 - 'Grouping' layers can simplify the organization and analysis of map layers (see Gorr/Kurland, pages 48-51).
 - Right-click 'Layers' at the top of the table of contents.
 - Click New Group Layer. Then right-click New Group Layer and click Properties>General.
 - Name the new group layer 'Miami-Dade County'.
 - Click 'Group' tab in the Group Layer Properties window>Add. Navigate to ArcCatalog and add Lmohome (which is one way to add layers to the group)>OK.
 - In ArcMap, add the other layers to the group by clicking each one and moving it just under the group layer name.

- **In ArcMap, check that the Measurement tool on the Status Bar is set to display in miles: Layers>Properties>General>Units:**
 - Click the measurement tool & try measuring some distances. To turn it off, click the 'Select elements' tool on the Status Bar.
 - If measuring distances does not work properly, see the previous instructions on how to correct things.

- **Magnifier Window:**
 - Click Window>Magnifier.
 - Drag magnifier across map.
 - Right-click magnifier window's title bar>Properties>change Zoom percentage.
 - Drag magnifier across map, then close magnifier.

- **Overview Window:**
 - Click View>Zoom Data>Full Extent.
 - Zoom to a small area on the map.
 - Click Window>Overview.
 - Move cursor to center of the hatch pattern. Then click the hatch pattern and move it to another map area.
 - Close Layers Overview window.

- **Bookmark:**
 - Click View>Zoom Data>Full Extent.
 - Zoom to an area of the Miami-Dade map.
 - Click View>Bookmarks>Create.
 - Type a name for the specified area in Bookmark Name field>OK.
 - Click View>Zoom Data>Full Extent.
 - Click View>Bookmarks>your newly created bookmark.

Part A: Exploratory Selections

- **Selection Tab:**
 - Right-click Highways>Label features. Then zoom to layer.
 - Click 'Set Selectable Layers': inspect but don't change.
 - Right-click Highways. Open attribute table. Inspect. Close.

- **Identify Tool:**
 - Click 'Identify' tool. Select layer Highways at the top of the 'Identify' dialog box. Click a highway to identify. Then in the 'Identify' dialog

- box, right-click the highway and explore the options (e.g., flash, zoom). Close dialog box. Click 'Select elements' tool to turn off Identify tool.
- Click 'Select feature' tool (holding down 'Shift') to select three Highways or Highway segments. Open Highways attribute table>Show>Selected.
 - Right-click Highways. Selection>Zoom to selected features.
 - Open attribute table>right-click 'Length'>Sort Ascending>Sort Descending>Statistics. Close. Selection>Clear selected features.
 - Selection>Clear selected features.
 - Close table.
 - Right-click Highways. Open attribute table>click gray area on the left side (holding down 'Ctrl') to select three entries. Show>Selected (at bottom of table). Inspect map. Close table. On toolbar at top of ArcMap: Selection>Clear selected features.
- **Find Tool:**
 - Click 'Find' tool (binoculars icon) on status bar: set 'In' (i.e. active layer) to Highways and 'Search' (i.e. active field). Find one of the Highways or Highway segments: right-click entry in Find-tool dialogue box and specify 'identify', 'flash', 'zoom', and 'set bookmark'. Click Full Extent to return to full view. In table of contents, right-click Highways> Selection>Clear selected features.
 - **Select by Attribute:**
 - Selection>Select by Attribute (Layer: Highways; Method: Create a New Selection): select the Golden Glades Intersection. Open attribute table>Selected. Table of Contents>right-click layer>Selection>Zoom to selected features. Selection>Clear selected features. Close.
 - Highways Open attribute table: click entry to select Golden Glades Intersection. Selection>Clear selected features. Close.
 - **Select Feature Tool, Find Tool, & Bookmark - Review:**
 - Use Select Feature tool to select three Highways or Highway segments; right-click Highways. Open Attribute Table>Selected. Selection>Clear selected features. Close.
 - Use Find tool to select the Golden Glades Intersection, then use dialogue box to identify, flash, zoom, and set bookmark. View>Bookmarks>Golden Glades bookmark. Full Extent. Selection> Clear selected features. Close.
 - **Select by Attributes, Sort, Statistics:**
 - Make sure that Map Display is set to miles: Right-click Layers> Properties>Display and set to miles.
 - Select by Attribute (Layer: Highways; Method: Create a New Selection): select "ST_NAME">Get Unique Values>select Golden Glades Intersection. Open attribute table>Show>Selected. Table of Contents>open attribute table>Zoom to feature. Selection>Clear selected features. Close.
 - Select by Attribute: select "FID">Get Unique Values>select Highways if FID<5 or FID>105 and FID<125. Open attribute table >Show>Selected. Right-click column headed 'Length'>Sort

Ascending>Sort Descending>Statistics. Close. Selection>Clear Selected Features. Close.

- Select by Attribute: select "ST_NAME">Get Unique Values>select Golden Glades Intersection and Gratigny; Open attribute table>Show>Selected. Right-click column headed 'Length'>Sort Ascending>Sort Descending>Statistics. Close. Clear selected features.
- Select by Attribute: select "LENGTH" >Get Unique Values>select Highways if length<400. Open attribute table>Show>Selected. Selection>Clear selected features. Close.
- **Label Features, Zoom to Layer:**
 - Right-click Colleges>Open attribute table. Inspect. Close.
 - Right-click Colleges>Label features. Zoom to layer.
 - Selection>Set Selectable Layers>Colleges.
 - Select by Attribute: select FIU campuses. Open attribute table>Show>Selected. Selection>Clear selected features. Close.
- **Select by Location:**
 - Select by Location: select features from Highways that intersect with arail. Open attribute table>Show>Selected. Right-click column headed 'Length'>Sort Ascending>Sort Descending>Statistics. Selection>Clear selected features. Close.
 - Select by Attributes: College ('Name')>FIU.
 - Select by Location: select features from Highways that are within a distance of 2 miles from the FIU campuses. Open attribute table>Show>Selected. Selection>Clear selected features. Close.
 - Set Selectable Layers: College. Right-click College>zoom to layer.
 - Use Select Feature tool to select FIU-North (Biscayne Bay Campus). Selection>Zoom to selected feature. Full Extent tool. Selection>Clear selected features. Close.
 - Colleges: open attribute table. Click entry to select FIU-North. Selection>Zoom to Selected Features. Full Extent tool. Selection>Clear selected features. Close.
 - Use Find tool to select FIU-North, then use dialogue box to identify, flash, zoom, and set bookmark. View>Bookmark>FIU-North bookmark. Selection>Clear selected features. Close.
- **Interactive Selection, Export Data:**
 - Right-click Colleges>Label features. Zoom to layer.
 - Select by Attribute: College ('Name')>FIU.
 - Selection>Interactive Selection Method: remove from current selection campuses other than FIU-North (Biscayne Bay Campus). Selection tool (click FIU-South) (University Park Campus), or remove FIU-South in Select by Attribute dialog box. Selection>Clear selected features. Close.
 - Note: if Interaction tool doesn't work, check that Selections>Interaction Selection Method is set appropriately (e.g., if it's set to 'Select,' then you can't remove items.)

- If it still doesn't work, use the corresponding options in Select by Location.
 - Selection>Clear selected features.
 - Select by Attribute: select FIU campuses.
 - Selection>Interactive selection method: select from current selections.
 - Selection tool (click FIU-North, which will remove FIU-South). Right-click Colleges>Data>Export data ('FIU_North'>OK>Display as map layer).
 - Note: exporting the data saves it as a shapefile in ArcCatalog for later use. (See end of Assignment #1: 'Note: Create Layer from Selected Features'.)
 - Rename map layer 'FIU North'. Selection>Clear selected features.
- **Select by Location - Review:**
 - Open attribute table for Mobile Homes. Inspect. Close.
 - Selection>Set Selectable Layers>Mobile Homes.
 - Select by Location: select features from Mobile Homes that are within a distance of 3 miles from FIU-North (click Use selected feature); Selection>Zoom to selected features. Open attribute table for Mobile Homes>Show>Selected. Selection>Clear selected features. Close.
- **Buffer Spatial Analysis, Create Layer from Selected Features:**
 - Add 'Buffer Wizard': Tools>Customize>Toolbars>Commands: Categories - Tools>Commands: Buffer Wizard. Then click Buffer Wizard icon and drag to tool bar.
 - Alternatively: ArcToolBox>AnalysisTools>Proximity>Buffer (see Gorr/Kurland, pages 304-6).
 - Use Buffer Wizard to create a buffer for FIU-North, 3 miles radius (Features: FIU North>Next>At a specified distance: 3 miles. Buffer distance units are: miles>Next>Save output in a new layer: C:\...\buffer_FIUNorth_3miles.shp).
 - Table of Contents: right-click FIU-North buffer layer, then click Properties>General>Layer Name, and rename FIU North 3-miles buffer.
 - In Table of Contents change buffer to another color. Right-click buffer> Layer>Properties>General> Display>Transparent. Set to 30% transparent (or some other appropriate percentage). Right-click buffer layer>Zoom to layer.
 - Alternatively, change buffer to hollow color, then select an appropriate outline color and width.
 - Create a bookmark for the zoomed layer: View>Bookmark>FIU North 3miles buffer. Full Extent.
 - Use Identify tool to identify each mobile home park.
 - Select by Location: select mobile home parks that 'are contained by' FIU North 3 miles buffer.
 - Open attribute table for Mobile Homes>Show>Selected. Inspect. Close.
 - In table of contents for Mobile Homes, Selection>Create layer from selected features.
 - What's the advantage/disadvantage of 'Create layer from selected features' vs. 'Export data'?

- Right-click new layer. Layers>Properties>General>Layer name, and rename it 'Mobile Homes near FIU North'.
 - On the map, use the measurement tool to measure the distance from FIU-North to each mobile home park.
 - Save the map only if you wish (using 'save as' to do so). Recall that mhomes_fiu_north has been exported to and saved in ArcCatalog.
 - *Note: it's best to save a map via 'save as' in order to conserve its path names. Make sure that you've used File>Map Properties>Save relative path names.*
 - In sum, to buffer a feature selected from a larger set of features: (1) select the feature and either Data>Export>Save or 'Create Layer from Selected Features'; and (2) buffer the newly created selected feature.
- **Export Selected Features or All Features in View Extent:**
 - Data>Export Data>Selected features or All Features in View Extent
 - Right-click arail>Label features. Zoom to layer.
 - Then do either one of the following:
 - Table of Contents, right-click arail>Selection>Create Layer from selected features, and, to save in ArcCatalog, Data>Export data>Export: Selected features (and don't choose to display on map because it's already displayed).
 - Or, to directly save the layer as a shapefile in ArcCatalog: Data>Export Data>Export: All features in view extent>OK>Display as map layer).
 - Selection>Clear selected features.
- **Buffer via Select by Location:**
 - Select by Location>Colleges>that are within a distance of>1 mile >Highways.
 - Colleges's attribute table>Show>Selected. Inspect.
 - Selection>Clear selected features.
- **Definition Query/Query Builder:**
 - Selecting a feature in Definition Query/Query Builder removes the layer's other features from the map.
 - Open Colleges's attribute table>Inspect.
 - Right-click Colleges>Properties>Definition Query>Query Builder: "Name" = "Miami-Dade Community College">OK.
 - Inspect attribute table and the map: only MDCC's campuses are displayed on the map.
 - How to redisplay all of the campuses: clear the selection from Query Builder (i.e. so that it is blank)>OK.
 - Inspect the map. All of the campuses should be redisplayed.

Part B: Create a New Map that Eliminates Biscayne Bay & Minimally Populated Everglades & Coastal Areas

- **Eliminate Features from Map:**
 - Use either the Identify tool or Select Features tool to identify the FIDs for minimally populated areas (of Miami-Dade, i.e. mdbg).

- You could use Definition Query/Query Builder to exclude the FIDs of such areas. Here's a way that instead uses Select by Attributes and the "Switch Selection" option.
- Selection>Select by Attributes>Layer: Miami-Dade>Select if FID <> 1 (to exclude Biscayne Bay).
- Here's the easiest way to eliminate low-population areas: Selection>Select by attributes>Select if POP2000<(insert some 'low population' number).
 - Selection>Switch selection.
- Data>Export data (name as 'mdmap1')>OK>Display as map layer.
- Note: *In the next assignment we'll consider what to do with areas that have relatively low populations.*
- Recall that Definition Query/Query Builder would be a useful alternative way to eliminate the low and/or no-population areas.
- Below we will create sub-maps, but spillage of geographic features beyond the boundaries of the reduced map will remain a problem. In another assignment we will eliminate this problem via the 'Clip' procedure (ArcToolBox>Analysis Tools>Extract>Clip; see Gorr/Kurland, pages 275-78).

Part C: Create a Sub-Map – Selection Tool Method

- **Selection Tool Method** (see Ormsby et al., chap. 8):
 - Turn off all layers except mdmap1 (which you created above).
 - Inspect attribute table for mdmap1.
 - Selection>Set selectable layers>uncheck all layers except mdmap1.
 - Selection>Options, and reset options if desired.
 - Selection>Interactive selection method>Create new selection.
 - Perhaps use the Zoom-in tool (the '+ magnifying glass' icon) to enlarge the area of interest, then click Select Features tool>Select Features tool to select the area of interest.
 - Inspect the attribute table.
 - To delete selection: Selection>Clear selected features.
 - To save as map layer only: Right-click layer Selection>Create layer from selected features. Rename the layer.
 - To save as a shapefile in ArcCatalog: right click>Data>Export data>OK>Display as map layer.
 - Rename the new layer.
 - Before proceeding to next task:
 - Selection>Clear selected features.
 - Turn off Select Features tool (by clicking Select Element tool, right next to it).
- **Other Graphic Possibilities**
 - See 'Help: Selecting features using a graphic' (such as New Rectangle or New Circle).
 - Sketch Tool Method (see 'Help: Sketch Tool').

Part D: On Your Own - Create a Sub-Map via Query

- **Select by Attributes or Location:**
 - Use Select by Attributes or Select by Location to create a sub-map. Inspect its attribute table, export and display the new map layer, and rename the new layer.

Part E: On Your Own - Create a Sub-Map via Buffer

- **Buffer:**
 - Use Buffer Wizard (or ArcToolBox>AnalysisTools>Proximity>Buffer) to create a sub-map. Inspect its attribute table, export and display the new map layer, rename it.

Note: Selection>Create Layer from Selected Features

- Doing so creates a map layer but does not save the selected features as a shapefile in ArcCatalog (including use independent of the current map): what are the advantages/disadvantages of each (see Gorr/Kurland)?
- To save the created layer of selected features in ArcCatalog as a shapefile, do either of the following:
 - Create layer from selected features>Data>Export data>OK>Display as map layer (if desired).
 - Or skip the 'Create layer from selected features' command by immediately right-clicking the selected features and doing Data>Export Data>OK>display as a map layer (if desired).