GIS IN ECOLOGY:
ANALYZING VECTOR DATA

Biological Sciences GIS University of Alberta

Department of Biological Sciences

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UNIVERSITY OF ALBERTA

Contents

This is an applied course on how to use the software. It reinforces working with map documents and layers. It focuses on overlaying, buffering, and other simple analyses involving vector data, with an introduction to geoprocessing using ArcToolbox and ModelBuilder.

For additional suggested reading on GIS theory, fundamentals, and software:
http://www.esri.com
and the "Tutorials & Online References" links at:
http://www.biology.ualberta.ca/facilities/gis/index.php?Page=338

References:

Crosier, Scott, Bob Booth, Kathy Dalton, Andy Mitchell, and Kristin Clark. 2004. **Getting Started with ArcGIS**. Environmental Systems Research Institute, Inc. Redlands, CA.

Harlow, Melanie, Rhonda Pfaff, Michael Minami, Alan Hatakeyama, Andy Mitchell, Bob Booth, Bruce Payne, Cory Eicher, Eleanor Blades, Ian Sims, Jonathan Bailey, Pat Brennan, Sandy Stevens, and Simon Woo. 2004. **Using ArcMap**. Environmental Systems Research Institute, Inc. Redlands, CA.

McCoy, Jill. 2004. **Geoprocessing in ArcGIS**. Environmental Systems Research Institute, Inc. Redlands, CA.

Vienneau, Aleta, Jonathan Bailey, Melanie Harlow, John Banning, and Simon Woo. 2004. **Using ArcCatalog**. Environmental Systems Research Institute, Inc. Redlands, CA.

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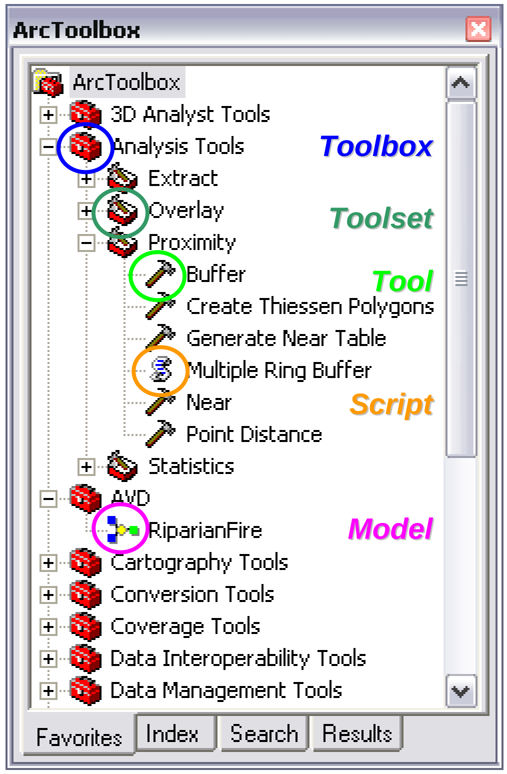
GIS IN ECOLOGY:
ANALYZING VECTOR DATA

Introduction



In this short course you will get familiar with ESRI's ArcGIS software and its basic functions for spatial analyses on data stored in the **vector data model**. Recall that vector data represents features as points (x, y coordinates), lines (sets of coordinates), and polygons (sets of coordinates defining boundaries that enclose areas), and focuses on modeling discrete features with precise shapes and boundaries. Example file types include vector coverages, shapefiles, CAD, etc.

Tools and Functionality for Vector Data

The focus of this short course is on simple vector analyses, such as overlaying and buffering, and also includes instructions on adding x, y coordinate data to a map. **ArcToolbox** contains the majority of the geoprocessing functionality for these analyses.

Geoprocessing – One of the basic functions of any GIS is to manipulate geographic information to create new information by applying an operation to existing data. Layers are often combined to generalize, isolate, and determine relationships among features. If you want to process spatial data based on the geography of the features in the layers, then use the geoprocessing tools in ArcToolbox to:

- Dissolve
- Append
- Clip
- Intersect
- Union
- Buffer
- Add XY Data
- and many others

Each ***tool*** is organized in a container called a ***toolset*** within a broader ***toolbox*** category. You may use the tools individually, or combine them in **ModelBuilder** to create a ***model*** that runs the sequence of geoprocessing tools in your workflow. The ModelBuilder application helps you to streamline your workflow and automate repetitive tasks by stringing processes together. You may then run the model with a single click, set parameters, iterate, and even export and modify as a ***script*** , to adapt your model for flexible applications.

Consult the **ArcGIS Desktop Help** for details on these and many other geoprocessing tools.

Course Data Sources

Free spatial data that can be used for GIS analysis in ecological applications have been obtained from the GeoGratis website http://geogratis.cgdi.gc.ca/frames.html and Alberta SRD http://www.srd.alberta.ca/UpdatesFireAlerts/WildfireStatus/HistoricalWildfireInformation/SpatialWildfireData.aspx. The following provides a brief metadata summary of each geographic layer in the course dataset that has been made available to you in the \\BIOLABS\BIO_PRINT\COURSES\GIS-100 directory.

The 1:250,000 scale data have been previously processed to file geodatabase feature classes that conform to the NAD 1983 UTM Zone 11 spatial referencing (i.e. map units are in meters) for NTS map sheet 083J (Whitecourt) in central Alberta. Unspecified file formats are file geodatabase feature classes or tables.

Name	File Format	Description	Feature	Data Model
soil_cmp soil_layer soil_mapunit soil_name		CANSIS soil attribute tables *(Refer to **CANSIS Data Model for Detailed Soil Surveys.mhtml** in the _documentation folder.)*	N/A	Table
random_sites	.xls	random_sites locations	N/A	Table
points		Towns and other human point features	Point	Vector
access		Roads and other human linear features	Line	Vector
streams		Small rivers and streams	Line	Vector
boundary		Study area boundary	Polygon	Vector
firehistory		Historic spatial wildfires in study area	Polygon	Vector
forestry		CLI forestry capability	Polygon	Vector
soils		CANSIS soil database	Polygon	Vector
waterbodies		Lakes and major rivers	Polygon	Vector
waterfowl		CLI waterfowl productivity	Polygon	Vector

Instructions for Copying the Course Dataset

1. Double click on the COURSES shared directory icon on the Desktop
2. Open the “**GIS-100**” folder by double clicking on it
3. Click on the FOLDERS icon along the top menu bar
4. On the left side of the window, click and drag the scroll bar to see “My Computer”
5. Expand “**My Computer**” by clicking on the “**+**”
6. Expand “**Local Disk (C:)**” by clicking on the “**+**”
7. Click and drag (copy and paste) the “**2_AVD**” folder from the right side of the exploring window to the **C:\WorkSpace** directory on the left side
8. Once all the files have copied over, close the exploring window

Tasks

Creating point data, joining data by attribute or spatial location, tabular calculations, buffering, overlaying, ModelBuilder.

Getting Started

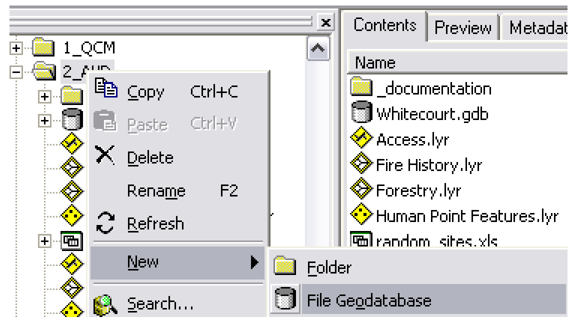
1. Point to START MENU >>> PROGRAMS and open ARCCATALOG 

2. Navigate to the **C:\WorkSpace\2_AVD** directory and click the "**+**" to expand it
3. Peruse the Whitecourt.gdb to get familiar with the files used in the following exercises

Creating a new empty file geodatabase:

This will be used to contain output files you generate.

4. In the catalog tree, right-click on the 2_AVD folder and select NEW >>> FILE GEODATABASE
5. Rename the new gdb to **Work.gdb**



Adding data from ArcCatalog:

6. Open ArcMap by clicking on the LAUNCH ARCMAP button
7. Start with a new empty map
8. Resize and reposition the windows so that ArcMap can be viewed simultaneously beneath ArcCatalog
9. Select the **Whitecourt.gdb\soils** features from ArcCatalog then click and drag to the "Layers" data frame in ArcMap
10. Select the following layers from ArcCatalog then click and drag to the "Layers" data frame in ArcMap: **Study Boundary.lyr**, **Waterbodies.lyr**, **Streams.lyr**, and **Towns.lyr** (hold the CTRL key for multiple selections)
11. In ArcCatalog, click VIEW >>> REFRESH (or press the F5 key) – *to release selections*
12. Minimize ArcCatalog
13. In ArcMap, rename the data frame to "**Soil Sites**"
14. Choose FILE >>> MAP PROPERTIES >>> DATA SOURCE OPTIONS to "Store relative path names"
15. SAVE the map document as **Whitecourt_*date*.mxd**

Adding XY Data, Joining Data, and Calculating Attributes

In this application, some of the many GIS functions available in ArcMap are demonstrated to answer the question: **What are the soil attributes at each random point location?** Often, field data collection results in a table of locations (i.e. from GPS units) that have ecological attributes associated with them. For example, telemetry locations and vegetation plot sites can easily be integrated with other GIS layers to map point features of interest. This XY data may be stored in GIS-ready tables (text, dBase, or INFO), an MS Access database, or an MS Excel spreadsheet that has been explicitly formatted. The following instructions show how to spatially display random sites and spatially join them with digital soil attribute data. However, the soil features are incomplete in that they must be joined to additional attribute tables to obtain important information on soil values. The steps involve:

TIP: Using Excel for Tables

1. ArcGIS 9.3.1 can only read Excel version 2003 or earlier (**no** .xlsx files)
2. Only one worksheet can be imported at a time
3. Column headings (field names) must be present
4. No skipped rows anywhere
5. Do not use spaces or non-alphanumeric characters in column headings
6. Be aware that date/time values are subject to import errors (a work around is to split the date/time parts in to separate columns)

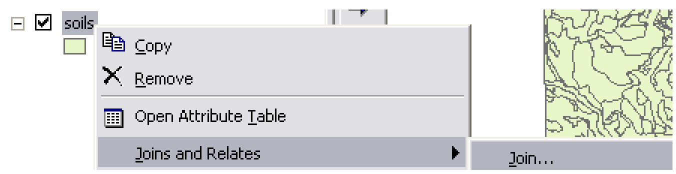
- Joining attributes from a table
- Adding XY data
- Joining data from another layer based on spatial location

The available data includes random point locations and a CANSIS soil survey. (See **CANSIS Data Model for Detailed Soil Surveys.mhtml** for soil relationship information.) Note: You will notice after completing this task that the soils data are incomplete – i.e. several polygons are unclassified. This demonstrates the point that not all data are equal and that you must check your data for errors/omissions prior to use in analysis!

Joining attributes from a table:

The soils coverage has additional attribute tables that must be joined. Use "MAPUNIT" as the field to base the join to attributes from the soil_cmp.dbf table, and then "SOILTYPE" to join attributes from the soil_name.dbf table.

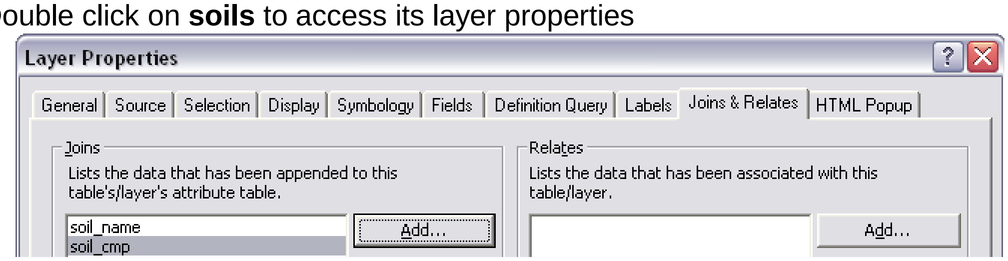
1. Turn off and collapse all but the soils layer
2. Right click on **soils** and choose JOINS AND RELATES >>> JOIN
3. In the JOIN DATA wizard at step 1: Choose "**MAPUNIT**"
4. At step 2: Click the BROWSE button and navigate to **C:\WorkSpace\2_AVD\Whitecourt.gdb** and select the **soil_cmp** table



5. At step 3: Choose "**MAPUNIT**"
6. Click OK
7. Click YES to Create Index

*Repeat a second join on **soils** using "**SOILTYPE**" to join attributes with **soil_name**. Another way to set an attribute join is in Layer Properties.*

8. Double click on **soils** to access its layer properties



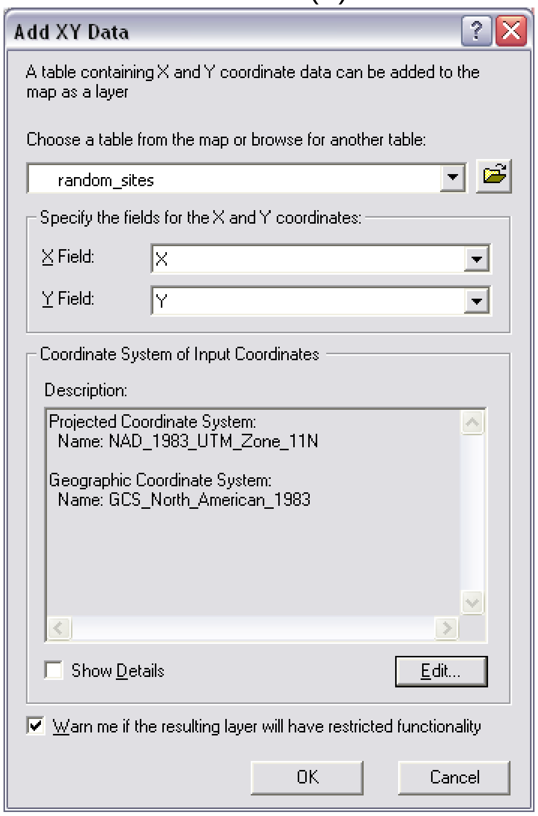
9. In the JOINS & RELATES tab, click on the ADD button
10. At step 1: Choose "**soil_cmp:SOILTYPE**"
11. At step 2: BROWSE for **soil_name**
12. At step 3: Choose "**SOILTYPE**"
13. Click OK

Making the attribute join permanent:

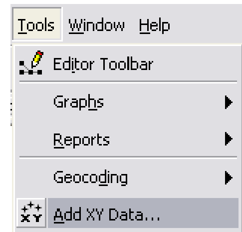
14. Right click on **soils** and choose DATA >>> EXPORT DATA to save to a new feature
15. Specify a new name; e.g. **C:\WorkSpace\2_AVD\Work.gdb\SoilData**
16. Click YES to add the new layer to the map document
17. In the SYMBOLOGY tab, show **SoilData** categorically by "**ORDER_**"
18. Click OK to apply the symbology and dismiss the Layer Properties dialog
19. Open the **soils** and **SoilData** attribute tables to inspect them simultaneously

*In the **soils** joined table, the field headings are prefixed by each table name. The permanently joined tables in **SoilData** do not have this naming.*

20. Remove all joins by right clicking on soils and choosing JOINS AND RELATES >>> JOIN >>> REMOVE JOIN(S) >>> REMOVE ALL JOINS



Adding XY data:



21. Choose TOOLS >>> ADD XY DATA
22. Browse for the **random_sites.xls** file
23. Double click to open it and select the **random_sites** table
24. Click ADD
25. Select the appropriate **X** and **Y** fields – *automatically done by ArcMap if the fields are labeled as X and Y or Longitude and Latitude*
26. Click the EDIT button to set the Spatial Reference
27. Click the SELECT button
28. Navigate to select the predefined projected **NAD_1983_UTM_Zone_11** as the coordinate system – *as indicated in the metadata!*
29. Click OK

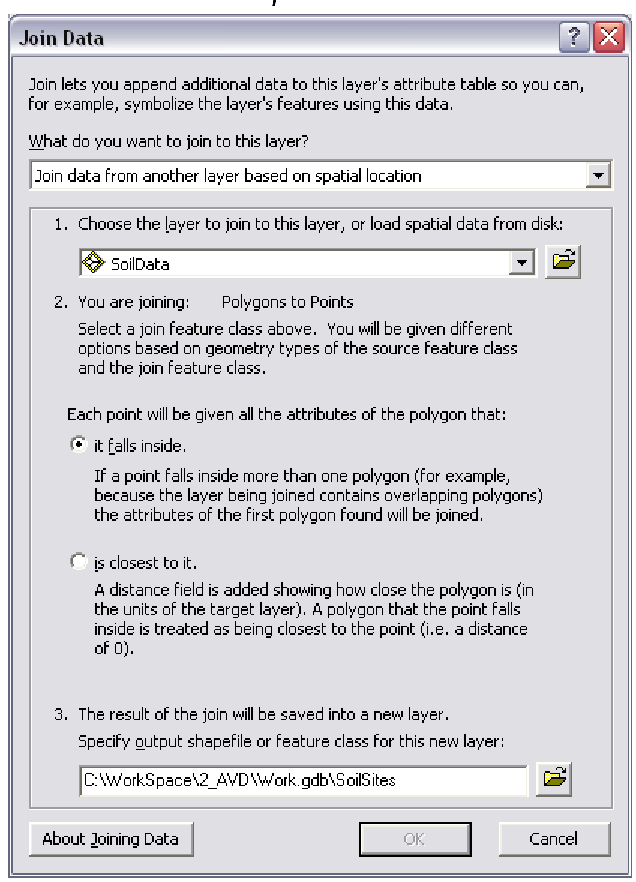
Read more about XY data in ArcGIS Desktop HELP. Save this event as new spatial data…

30. In the table of contents, right-click on the **random_sites Event** name
31. Select DATA >>> EXPORT DATA
32. Provide a new name for the feature class; e.g. **\Work.gdb\Sites**
33. Click OK

Joining data from another layer based on spatial location:

*A spatial join is used to extract the values from the **SoilData** layer that coincide with the random **Sites** locations.*

34. Right click on **Sites** and choose JOINS AND RELATES >>> JOIN
35. Choose to 'Join data from another layer based on spatial location' and set the following:
36. Step 1: Select **soils** as the join layer
37. Step 2: Select 'it falls inside'
38. Step 3: Type in an output file name; e.g. **\Work.gdb\SoilSites**
39. Click OK



40. Click YES to add the new point layer to your map document
41. Open the attribute table to view each location's soil attribute values

*The **SoilSites** layer represents the spatial coincidence of the random points with the soils attributes.*

42. SAVE your map document

Spatial joins have much power depending on the order (e.g. polygons to points, points to polygons, etc.), and by choice:

POLYGONS TO POINTS:

- 'it falls inside' – this method assigns the attributes of the polygon to the point
- 'is closest to it' – this method assigns a distance value in a new *DISTANCE* field

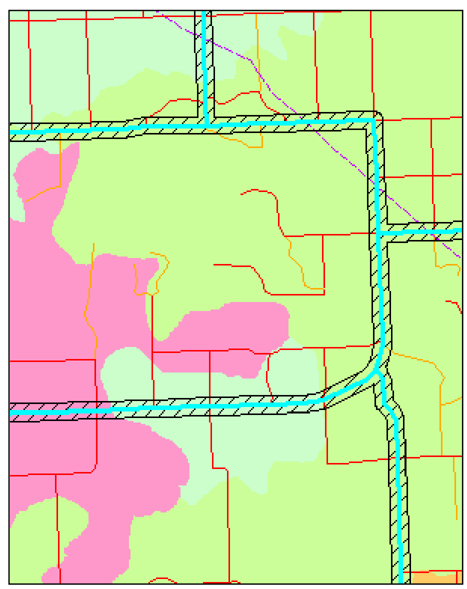
POINTS TO POLYGONS:

- 'Each polygon will be given a summary of the numeric attributes of the points that fall inside it..." – this method assigns a count value to a new *COUNT* field
- 'Each polygon will be given all the attributes of the point that is closest to its boundary..." – this method assigns a distance value in a new *DISTANCE* field

You can also join points to lines, lines to points, lines to polygons, and polygons to lines!

Remember a spatial join is what you use to intersect points with other layers, get counts, or automatically calculate nearest distance measures between features.

Common Geoprocessing and Summarizing



The following instructions show how ArcToolbox's geoprocessing tools can be used to answer the question: **How much waterfowl habitat is within 250 meters of major roads?** The steps involve:

- Selecting by attributes for major roads
- Buffering
- Clipping
- Calculating area
- Summarizing area by habitat class

The available data includes a CLI classification on land capability for waterfowl and an access layer including roads. This new analysis will be performed in a new data frame.

1. Choose INSERT >>> DATA FRAME
2. Rename this new data frame: "**Waterfowl Area**"
3. Add the following data by dragging and dropping from ArcCatalog to ArcMap:
   - **Access.lyr**
   - **Waterfowl.lyr**
4. Refresh and minimize ArcCatalog
5. In ArcMap, click the SHOW/HIDE ARCTOOLBOX button and dock it where you prefer
6. Take a moment to examine the ArcToolbox window by clicking on the tabs (FAVORITES, INDEX, SEARCH, RESULTS)

*Keep in mind that there are many ways to utilize ArcToolbox: first you will learn how easy it is to interact with your data in ArcMap using the tools one at a time. Remember to click the **Show Help** button to view instructions and tips on how to use the tools.*

Selecting by attributes for major roads:

7. Choose DATA MANAGEMENT TOOLS >>> LAYERS AND TABLE VIEWS >>> SELECT LAYER BY ATTRIBUTES
8. Set **Access** as the layer
9. Click the appropriate buttons to enter the expression:

   `"FIR_ROADNO" <> ' '`

Recall what you learned in the "Querying and Creating Maps" course.

10. Click APPLY then CLOSE to dismiss the selection dialog window

Buffering:

11. In ArcToolbox, navigate to ANALYSIS TOOLS >>> PROXIMITY >>> BUFFER
12. Double click on the BUFFER tool to open it *(alternatively, right click and choose OPEN)*
13. Click on the SHOW HELP button – *to see helpful information at the right side as you click on each of the parameters on the left side*
14. Reposition the Buffer window so you can see it and the table of contents simultaneously
15. Click and drag **Access** from the table of contents in ArcMap to the Input Features text box of the Buffer window
16. Specify **C:\WorkSpace\2_AVD\Work.gdb\RoadBuffer250** as the Output
17. Enter **250** for the linear distance and select **Meters** for the unit
18. Select **ALL** as the Dissolve Type
19. Click OK
20. Close the log dialog window when completed
21. CLEAR SELECTED FEATURES
22. Zoom in to examine the new **RoadBuffer250** polygon layer

Clipping:

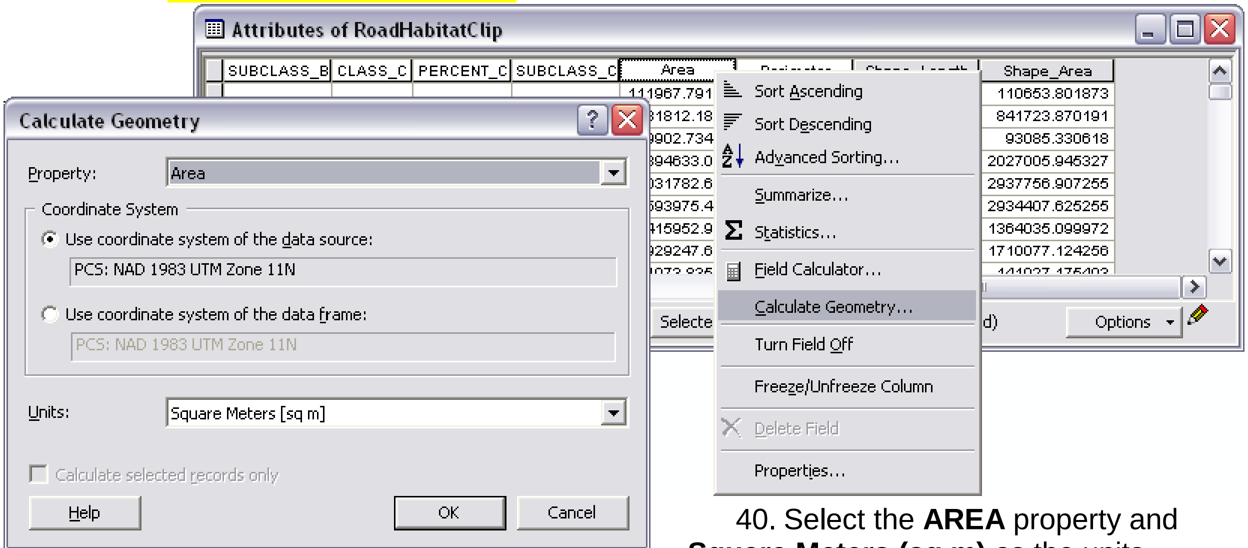
23. In ArcToolbox, navigate to ANALYSIS TOOLS >>> EXTRACT >>> CLIP
24. Double click on the CLIP tool – *read the descriptive text that is displayed in the help panel to learn more about this tool*
25. Drag **Waterfowl** to the Input Features layer
26. Drag **RoadBuffer250** as the Clip features layer
27. Specify **C:\WorkSpace\2_AVD\Work.gdb\RoadHabitatClip** as the output
28. Click OK
29. Close the log dialog window when completed
30. Zoom in to examine the new **RoadHabitatClip** layer

Calculating area:

An attribute table can be treated just like a database table: fields can be added, deleted, and calculated to yield new information about the associated geographic features. In this example, you will update the area field to reflect the actual area of each polygon within the buffers you processed above in preparation for summarizing the data below.

31. SAVE your map document
32. Choose VIEW >>> TOOLBARS >>> EDITOR to add it
33. Choose EDITOR >>> START EDITING
34. Select the **\Work.gdb** to edit data from
35. In the Editor Toolbar, set **RoadHabitatClip** as the Target Layer
36. In the table of contents, right-click on **RoadHabitatClip**
37. Click on OPEN ATTRIBUTE TABLE

38. Right click on the heading of the “**AREA**” field
39. Click CALCULATE GEOMETRY

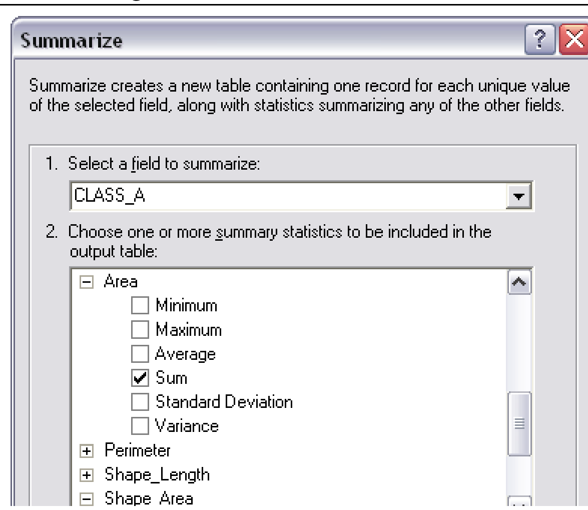


40. Select the **AREA** property and **Square Meters (sq m)** as the units
41. Click OK
42. Choose EDITOR >>> STOP EDITING
43. Click YES to save edits

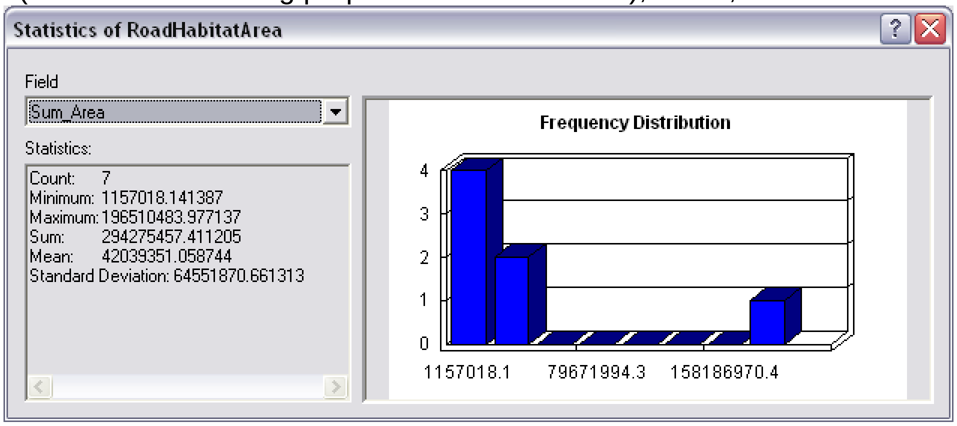
IMPORTANT NOTE: Notice that the AREA field now has the exact same values as the SHAPE_AREA field that is automatically generated for geodatabase feature classes. You may want a previous area to persist in future overlay outputs, so calculating your own distinctive field will help with future proportion calculations, for example. However, when working with shapefiles, the automatic geometry fields are not added/calculated, and you must always calculate the geometry into a new or existing field.

Summarizing area by habitat class:

44. In the attribute table of **RoadHabitatClip**, right-click on the “**CLASS_A**” heading
45. Choose SUMMARIZE from the menu
46. Select to summarize **CLASS_A** by **Area – Sum** (expand and click a check beside Sum)
47. Save to the Work.gdb and specify a name for the output table; e.g. **RoadHabitatArea**
48. Click OK
49. Click YES to add the table to the map document
50. In the table of contents’ SOURCE tab, open the **RoadHabitatArea** table to view the info



51. Optionally, right-click the Sum_Area heading and click STATISTICS to view Min, Max, Sum (useful for calculating proportions in a new field), Mean, Std Dev



Can you find the Summary Statistics tool in ArcToolbox?

Geoprocessing with the ModelBuilder

The following instructions show how ArcToolbox's ModelBuilder can be used to answer: **What is the area of burned riparian forest species for each year?** The steps involve:

- Setting up a model with ArcToolbox's ModelBuilder
- Buffering water features
- Unioning and dissolving the riparian buffer
- Clipping forestry by riparian area
- Intersecting riparian forestry with fire history
- Adding a field, calculating area, and summarizing multiple fields
- Running the model

The available data includes streams, water bodies, a CLI classification on land capability for forestry, and fire history layer of polygons indicating the year of burn. This new analysis will be performed in a new data frame

1. Choose INSERT >>> DATA FRAME
2. Rename this new data frame: "**Riparian Fire**"
3. Add the following data from the WORK folder by dragging and dropping from ArcCatalog to ArcMap: **firehistory**.shp, **forestry**.shp, **streams**.shp, **waterbodies**.shp
4. Refresh ArcCatalog and minimize
5. In ArcMap, modify the layer drawing order
6. SAVE your map document

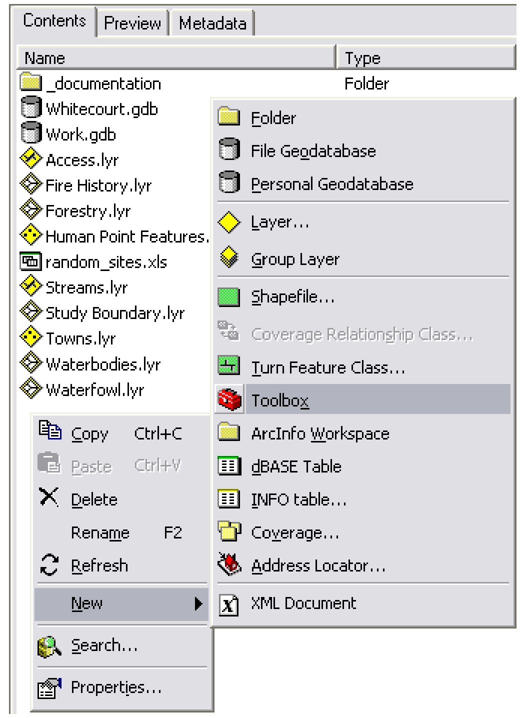
Setting up a model with ArcToolbox's ModelBuilder:

To create a model in ModelBuilder, ideally you may create your own custom toolbox in ArcToolbox. There are several ways to do this, but a suggestion is to create a new toolbox in your working directory using ArcCatalog, and then add the toolbox to ArcToolbox to work with in ArcCatalog or ArcMap.

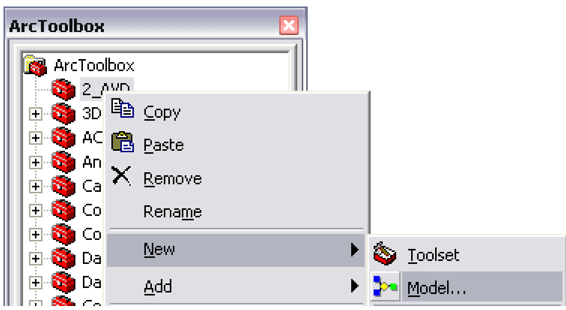
7. In ArcCatalog, navigate to the **\2_AVD** folder
8. Right click on the **\2_AVD** folder and choose NEW >>> TOOLBOX
9. Rename Toolbox to "**AVD**"

10. While ArcMap can be viewed simultaneously beneath ArcCatalog, click and drag the **AVD** toolbox from ArcCatalog to the ArcToolbox window in ArcMap

An alternative way to add a toolbox is to right click on ArcToolbox and choose ADD TOOLBOX. Navigate to the directory containing the newly created AVD toolbox and click OPEN. You may also create a new toolbox in this manner, but you do not have immediate control on where it will be saved.



11. CLOSE ArcCatalog
12. In ArcMap, right click on the **AVD** toolbox in the ArcToolbox window
13. Choose NEW >>> MODEL

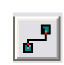


The ModelBuilder interface is immediately displayed.

14. Choose MODEL >>> MODEL PROPERTIES
15. Specify a Name (no spaces) and Label; i.e. **RiparianFire**
16. Check to 'Store relative path names'
17. Briefly, examine the ModelBuilder window
18. Click OK and then click the SAVE button
19. Choose HELP >>> ARCGIS DESKTOP HELP
20. Read through '**An overview of ModelBuilder**' and explore some of the links
21. Minimize the help file when finished – *you will want to refer to it as you work*

Buffering water features:

The first step in your model building is to buffer the two types of water features.

22. In ArcToolbox, navigate to ANALYSIS TOOLS >>> PROXIMITY >>> BUFFER
23. Drag and drop the BUFFER tool to the Model window
24. Drag and drop the **streams** layer from the table of contents to the Model window
25. Click on the ADD CONNECTION button 
26. Click and drag to connect Streams to the BUFFER tool element
27. Double click the BUFFER tool element
    - Specify the output as **\WORK\streams_Buffer.shp**
    - Set the Distance linear unit to **500 meters**
    - Dissolve **ALL** and leave all else at their defaults
    - Click OK
28. REPEAT for the **waterbodies** layer
29. Click on the AUTO LAYOUT and FULL EXTENT and ZOOM OUT buttons to organize the model elements

You could run the model at this point, but to see just how powerful and timesaving ModelBuilder is, continue with building your model until all processes have been set up.

Unioning and dissolving the riparian buffer:

Combine the water buffers into one contiguous polygon to create the riparian area. Union and dissolve are just the tools for the job. Remember to look at the HELP for each tool to understand how they work.

30. In ArcToolbox, navigate to ANALYSIS TOOLS >>> OVERLAY >>> UNION
31. Drag and drop the UNION tool to the Model window
32. Click on the ADD CONNECTION button
33. Click and drag a connection from one buffer output layer to the UNION tool element
34. Repeat for the other buffer output layer
35. Double click on the UNION tool element to open it
    - Optionally, change output name and any other parameters *(if needed)*
    - Click OK
36. In ArcToolbox, navigate to DATA MANAGEMENT TOOLS >>> GENERALIZATION >>> DISSOLVE
37. Drag and drop the UNION tool to the Model window
38. Click on the ADD CONNECTION button
39. Click and drag a connection from the UNION output layer to the DISSOLVE tool element
40. Double click on the DISSOLVE tool element to open it
    - Do NOT check any Dissolve_Field(s) – *this automatically works on the shape*
    - Change the Output Feature Class to **\WORK\Riparian.shp**
    - Click OK
41. Click on the AUTO LAYOUT and FULL EXTENT and ZOOM OUT buttons to organize the model elements

Clipping forestry by riparian buffer:

42. In ArcToolbox, navigate to ANALYSIS TOOLS >>> EXTRACT >>> CLIP
43. Drag and drop the **forestry** layer from the table of contents to the Model window
44. Click on the ADD CONNECTION button
45. Click and drag two connections in the following order:
    a. the **forestry** input layer
    b. the **Riparian** output layer
46. Double click on the CLIP tool element to open it
    - Change output name **\WORK\RiparianForestry.shp**
    - Click OK

Intersecting riparian forestry with fire history:

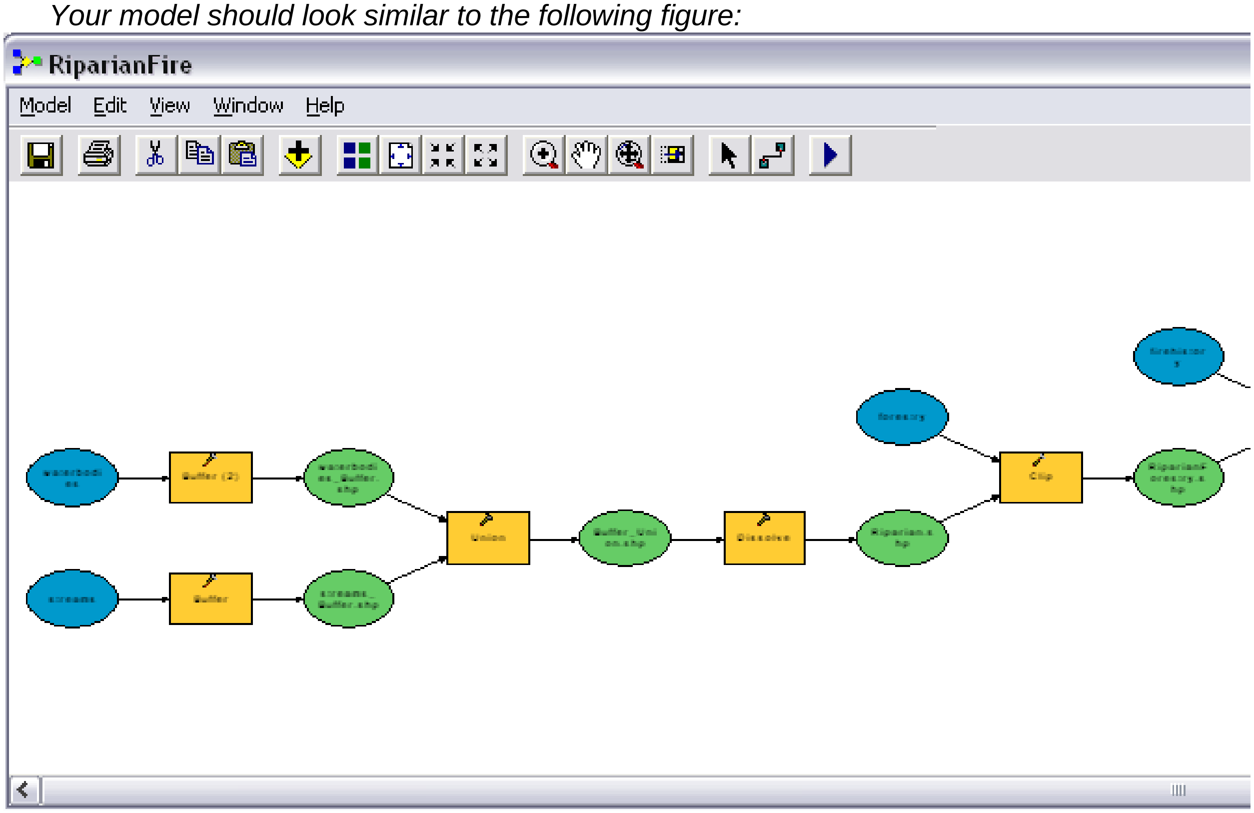
47. In ArcToolbox, navigate to ANALYSIS TOOLS >>> OVERLAY >>> INTERSECT
48. Drag and drop the INTERSECT tool to the Model window
49. Drag and drop the **Fire History** layer from the table of contents to the Model window
50. Click on the ADD CONNECTION button
51. Click and drag two connections in the following order:
    a. the **Fire History** input layer
    b. the **RiparianForestry** CLIP output
52. Double click on the INTERSECT tool element to open it
    - Change the output name to **\WORK\RiparianFireSpecies.shp**
    - Click OK

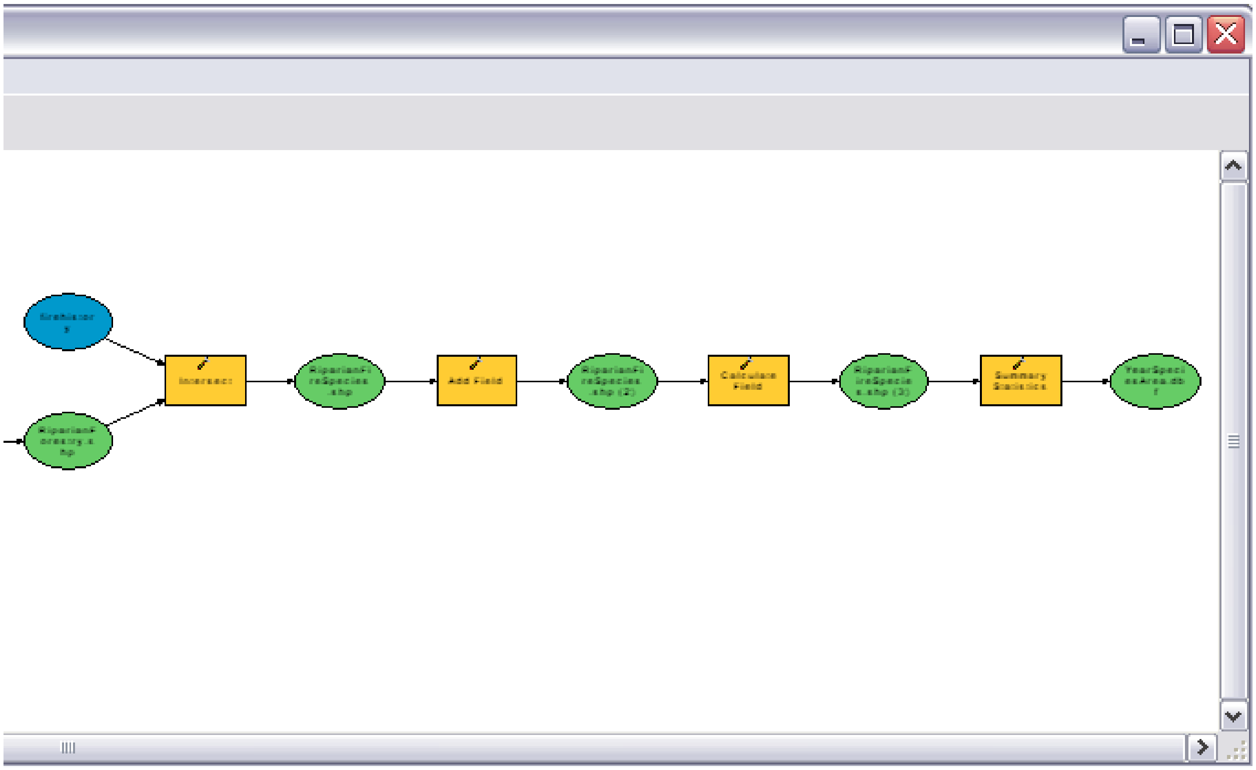
Adding, calculating, and summarizing fields:

53. Use the SEARCH and/or INDEX tabs in ArcToolbox to ***locate*** the tool you want
54. Locate, drag, and drop the ADD FIELD tool to the Model window
55. Connect the INTERSECT output to the ADD FIELD tool
56. Double click on the ADD FIELD tool element to open it
    - Specify the new Field Name as **I_AREA**
    - Specify the Field Type as DOUBLE
    - Click OK
57. Repeat the locate, drag, and drop for the CALCULATE FIELD tool
58. Connect the ADD FIELD output element to this tool
59. Double click CALCULATE FIELD to open it
    - Specify the new Field Name as **I_AREA**
    - Specify the Expression as **`!shape.area!`**
    - Select the Expression Type as PYTHON
    - Click OK
60. Repeat the locate, drag, and drop for the SUMMARY STATISTICS tool
61. Connect the CALCULATE FIELD output to this tool
62. Double click SUMMARY STATISTICS to open it
    - Specify the output table as **\WORK\ YearSpeciesArea.dbf**
    - Select **I_AREA – SUM** for the Statistics Field(s)
    - Select **BURNYEAR** and **SPECIES_A1** for the Case Field(s)
    - Click OK

Running the model:

Your model should look similar to the following figure:





You could continue building the model to include more geoprocessing you may need to perform. However, stop here and see how your model runs. Hopefully you have set all the connections and parameters appropriately. If not, simply double click on each element to open, examine, and modify as necessary.

63. Click on the SAVE button (*perhaps this is a good time to SAVE the map document, too*)
64. Choose MODEL >>> VALIDATE ENTIRE MODEL – *all model elements should be color*
65. Choose MODEL >>> RUN ENTIRE MODEL – *or click on the RUN button* 
66. After waiting for the processes to complete, examine the log window then close
67. In the ModelBuilder window, right click on the final output **YearSpeciesArea.dbf** and choose ADD TO DISPLAY

You may examine the intermediate layers by adding them to ArcMap or preview them in ArcCatalog. If you are satisfied with the final output then you may opt to delete all intermediate data.

68. Make any modifications to the model; e.g. UNcheck 'Intermediate' for the **Riparian.shp** and **RiparianFireSpecies.shp** outputs
69. Choose MODEL >>> DELETE INTERMEDIATE DATA
70. Click SAVE and close the ModelBuilder window

Note: For future reference, know that you can set the ARCTOOLBOX >>> ENVIRONMENT working directory and other options.