Joining and Relating Tables in ArcGIS

In this Chapter you will learn

- What the difference is between a join and a relate
- How to join tables based on a common attribute field
- How to join data based on spatial location
- What the difference is between a join and a relate

1 Joining and relating tables

Consider the three tables shown in the top half of figure 1. Table 1 on the left-hand side is an attribute table that is associated with a polygon shapefile. Tables 2 and 3 are Microsoft Excel spreadsheets in the .xls format.

Assume you would like to create a map that shows the value for each of the five plots in the shapefile. To do this you need to **join** the excel spreadsheet with the value information to the shapefile that displays all of the plots.

Primary Key *Primary Key*

Owner	Plot
John Smith	1
Jane Doe	2
Fred Bloggs	3
Jane Doe	4
John Smith	5

Table 1: Shapefile Attributes

Plot	Value	Assessor
1	100,000	Jim
2	120,000	Jim
3	100,000	Jim
4	150,000	Shirley
5	9,0000	Shirley

Table 2: MS Excel (.xls format)

Assessor	Method
Jim	Market Value
Shirley	Cost Method

Table 3: MS Excel (.xls format)

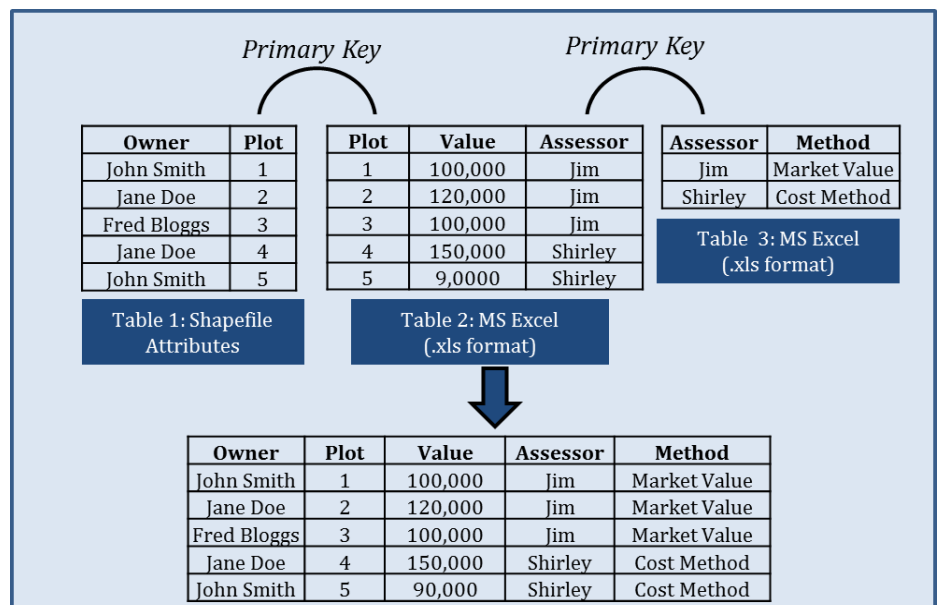| Owner	Plot	Value	Assessor	Method
John Smith	1	100,000	Jim	Market Value
Jane Doe	2	120,000	Jim	Market Value
Fred Bloggs	3	100,000	Jim	Market Value
Jane Doe	4	150,000	Shirley	Cost Method
John Smith	5	90,000	Shirley	Cost Method

Figure 1. Joining Tables. The table 1 on the top-left is the attribute table from a shapefile. Tables 2 and 3, which are both in MS Excel spreadsheets .xls format, can be joined using different primary keys.

The attribute field that is common between two tables is referred to as the **primary key**. In the example in figure 1 you would use the "Plot" attribute as the primary key to join table 2 to table 1 since this attribute appears in both the shapefile and the excel file that has contains the value data. You could join table 3 to table 2 using the "Assessor" attribute.

Joins work when there is a **one-to-one** or **many-to-one** relationship. Joining table 2 to table 1 in figure 1 is an example of a one-to-one relationship since each plot number appears only once in each table. The join between table 2 and 3 is a many-to-one since the same assessor appears many times in table 2, but only once in table 3.
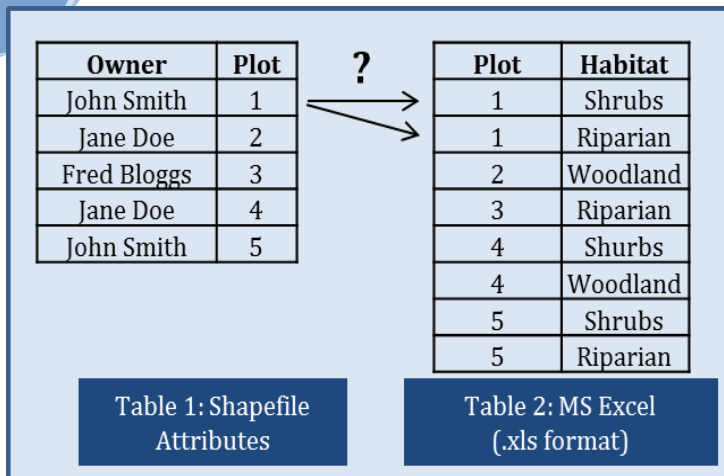
Owner	Plot		Plot	Habitat
John Smith	1	?	1	Shrubs
Jane Doe	2		1	Riparian
Fred Bloggs	3		2	Woodland
Jane Doe	4		3	Riparian
John Smith	5		4	Shurbs
			4	Woodland
			5	Shrubs
			5	Riparian

Table 1: Shapefile Attributes	Table 2: MS Excel (.xls format)

Figure 2. It is not possible to use a join when you have a one-to-many relationship

It is not possible to join table 2 to table 1 in figure.2 on the left. For example, you do not know whether Plot 1 in Table 1 should be joined to the first record with a shrubs habitat, or the second record that lists a riparian habitat for plot 1. This is an example of a **one-to-many relationship** where you have to use a **relate** instead of a join. Exercise 4 in this chapter will give you more information about relates. Note that the software will still allow you to do a join, however this is unwise as the software will join plot 1 to the first record with the shrubs habitat but completely ignore the second record that also applies to plot 1.


2.7 Setting up a simple join

Exercise 1: Setting up a simple join

1. Open ArcMap and add the Plots shapefile. Open the attribute table to view its attributes.

2. Add the Plot_Value spreadsheet. To do this, click on the "Add Data" button, click on the spreadsheet and click "Add". You will be presented with another dialog box asking you which sheet in this spreadsheet you would like to add. Choose "Sheet1$" and click "Add" again.

3. Right-click on the Plots layer > Joins and Relates > Join. Complete the Join Data dialog box as shown on the right.

4. Open the attribute table for the Plots layer. Notice the additional attributes, including the value of each assessor.
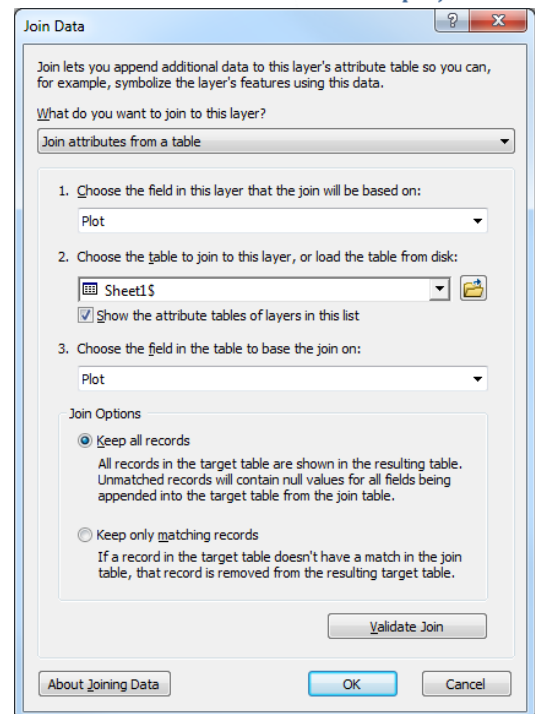
5. Right-click again on the Plots layer as shown above. By selecting "Remove Join(s)" you can see which joins exist, and remove them if you want.
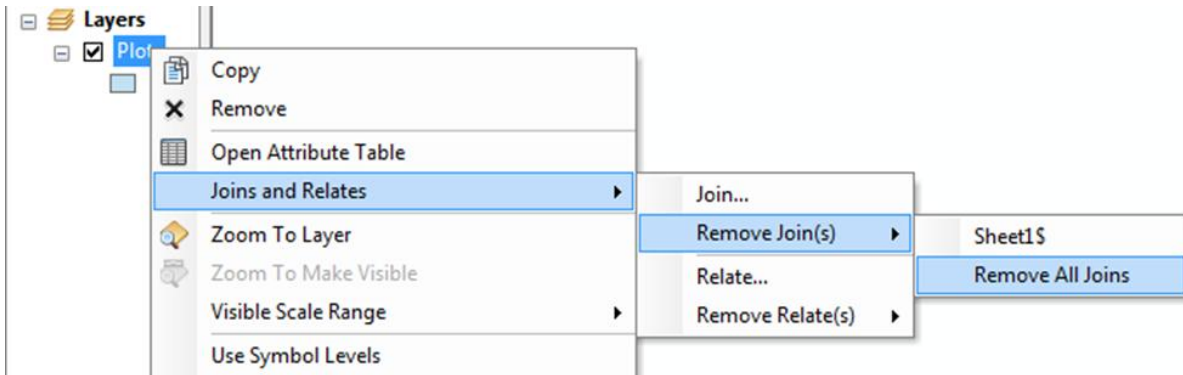

6. Note that when you save your map you are also saving any joins you have set up. For example, if you have a map document in which your parcels layer is joined to a table, then this join is available to you any time you use this map document. However, if you open a new map document and add in the parcels you will not automatically bring in the joined data with it. In that case you can set up the join, and then save the map document to preserve that join.

VIDEO

2.7 Joining and Exporting Data

Exercise 2: Joining a table to a shapefile and exporting the joined data

1. Start ArcMap and open a new map.

2. Add the Counties shapefile and the Pop_2008 Excel spreadsheet (use Sheet1$).

3. Open the attribute table for the Counties shapefile as well as for the excel spreadsheet that you will join to the shapefile. Which attribute is common between the tables and should be used as the primary key?

4. Right-click Counties and select Joins and Relates > Join.

5. Complete the Join Data dialog box as shown on the right.. By selecting "Keep only matching records" near the bottom of the dialog box we have a quick check to make sure the join worked: any county that does not have a matching record in the excel table will not be displayed and we would see a "hole" in Idaho.

6. Click OK. Which county was missing on the spreadsheet?
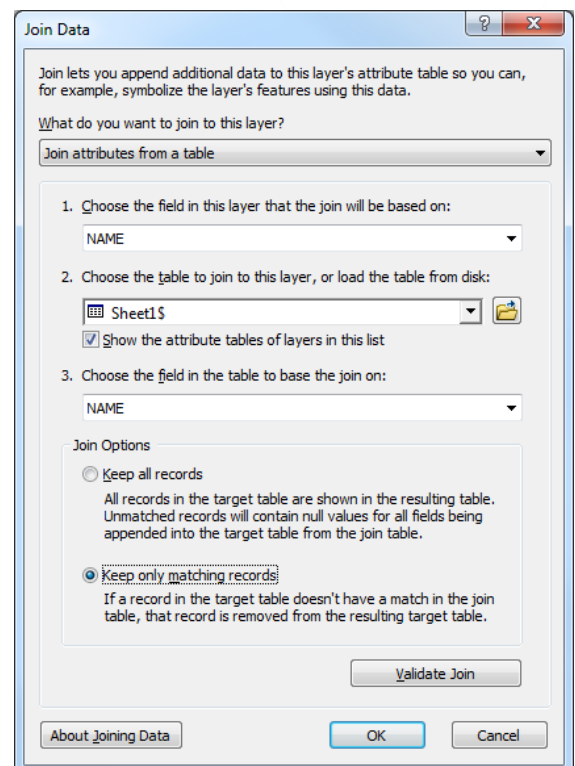
7. Right-click on the Counties layer and choose Data > Export data. Populate the Export Data dialog box as shown on the right. To choose the Output feature class click on the folder button and browse to the location where you want to save the new shapefile. Call the new shapefile "Counties_with_2008_Pop.shp".

8. Note the difference between a join that is set up, and then saved in a map document versus the shapefile we just exported. A saved join is "dynamic". When the data in the joined table changes, those changes will be reflected in your map. However, an exported joined table is static and does not automatically change when data in the spreadsheet is updated.
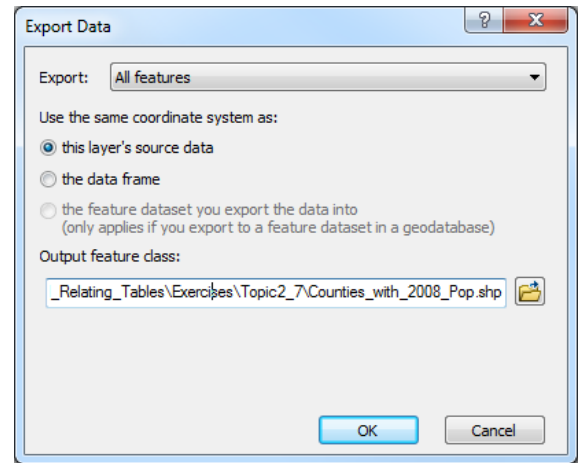
2.7 Why is my join not working?

Exercise 3: Most common reason why a join does not work

1. Open a new map document in ArcMap and add the Difficult_Plots shapefile. Also add the Plot_Value_Assessor spreadsheet (Sheet1$).

2. Join the excel table to the shapefile using Plot as the primary key. Having trouble selection the "Plot" field for the Excel table? How come only "Assessor" is listed as a possible primary key? To figure this out we need to look more closely at the Plot field in both the shapefile and the excel table.

3. Open the Layer Properties for Difficult_Plots and go to the Fields tab. Click on "Plot" and note the Data Type. Then open the properties for the Excel spreadsheet and note the data type. Screen shots for the Fields tab are shown below.

4. Note that "Plot" is a text field in the shapefile, but it is a "Double" in the excel table. Both need to be of the same data type for the join to work. Hence, it is not surprising ArcMap offered you "Assessor" as a potential joining candidate since it is also a text field.
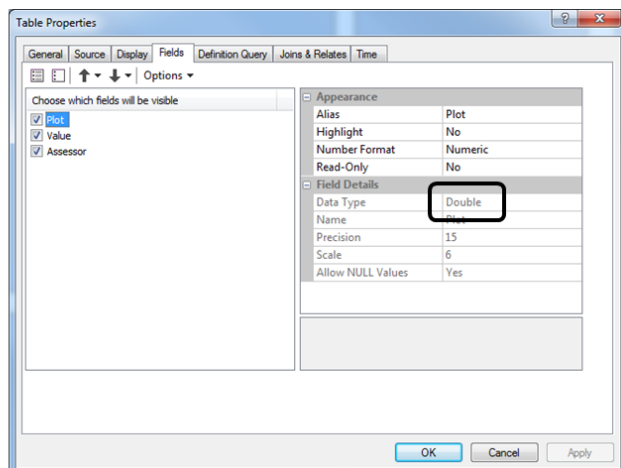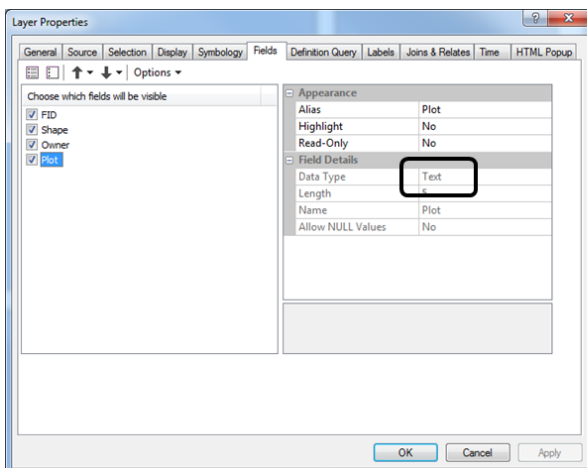
5. To make this join work we need to change the "Plot" field in the shapefile to a double, or by changing the Plot in the excel table to text. We will change the "Plot" attribute in the shapefile form text to a double. Unfortunately, you cannot change the data type of existing GIS data, but – as is usually the case – there is a workaround.

6. Open the attribute table for the Difficult_Plots shapefile. And follow the instructions below to add a new field called "PlotDouble" and populate those with the plot numbers in the double data type.

1. Click dropdown button

3. Name the field "PlotDouble"

4. Pick Type "Double". Set Precision to 5 and Scale to 0

2. Select "Add Field…"

6. Click OK

7. Right-click on "PlotDouble" and select "Field Calculator…"

8. Double-click on "Plot" to populate bottom window

9. Click OK

7. Right-click on Difficult_Plots to set up the join once again. This time use PlotDouble as the primary key for the shapefile. The dialog box for the join is shown on the right.

8. Open the attribute table for Difficult_Plots to ensure the attributes from the excel table have been added and the join was successful.

2.7 Joining GIS Linkage Data to your Parcels

Exercise 4: Join GIS Linkage data to a parcels layer

1. Open a new map document and add the Parcels shapefile and pcparc00 table from the Start folder.

2. Right-click on the Parcels layer and set up a join with pcparc00. Use the PARCEL_ID field from the Parcels shapefile and PM_PAR_14 from the pcparc00 table in the join.

3. Open the Parcels layer attribute table to see if the join was successful.

2.7 Setting up a Relate

Exercise 5: Working with Relates

1. Open a new Map Document in ArcMap and add the Plots shapefile as well as the Plot_Habitat (Sheet1$) Excel spreadsheet.

2. Open the Plot_Habitat attribute table and note that the <u>same plot number occurs multiple times</u>. For example, there are two records that refer to plot 1.

3. In this exercise you want to link the information about habitats to the Plots shapefile so you can look at them geographically. Open the Plots attribute table as well as the Plot_Habitat table and note that the Plot field has to be used as the primary key.

4. However, <u>there is a one-to-many relationship</u>: a single plot number in the Plots shapefile needs to be linked to multiple records with the same plot number in the Plot_Habitat table. Hence we must use a relate and not a join.

5. Right-click on the Plots shapefile and select Joins and Relates > Relate. Complete the Relate as shown on the right.

6. Use your identify tool to click on any of the plots. Note that by clicking the "+" in front of the identify results you are able to also view the related information as shown on the right.