

Organizing Principles: An Introduction to GIS

Exercise 5: Leveraging the *What* of Geographic Data

*** Files needed for exercise: *ID_counties.shp*; *id_pop_co_2009acs.dbf*; *count_id_mcdonalds.dbf*; and *ID_mcdonalds.shp*

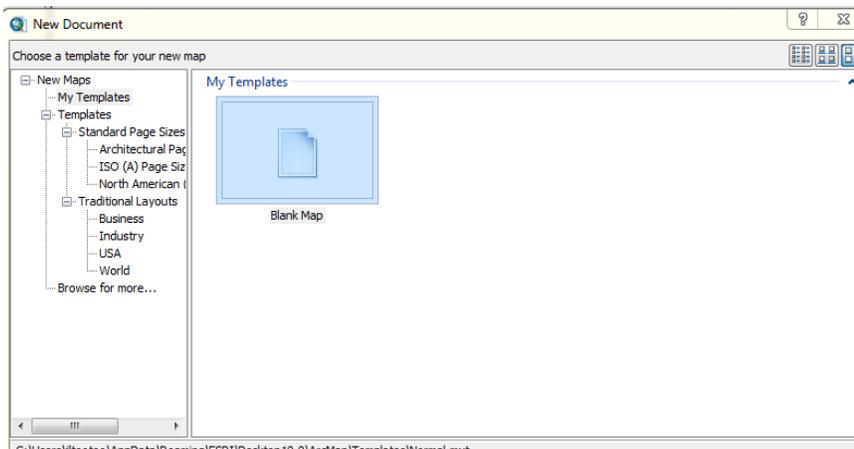
Exercise 5.1 Table Join

Goals: In this exercise you will join an Idaho County shapefile table to a .dbf table containing county population data from the 2009 US Census American Community Survey (ACS) and export the combined table to a new .shp file for display.

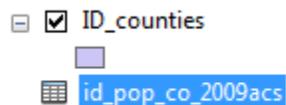
Skills: After completing this exercise, you will understand basic table joins in ArcMap.

Setting up your project for this exercise:

1. Open ArcMap. Choose to start a new **Blank Map**.

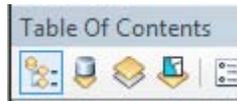


2. Click the **Add Data** button .
3. If you have not already connected to your folder, click on the **Connect to Folder** button .
4. Browse to your folder and connect to it. We now have a permanent connection to that folder.
5. Double click on the *Exercise_05_data* folder to open it.
6. Add the *ID_counties.shp* and the *id_pop_co_2009acs.dbf* files to your project. You can select both by holding down the *Shift* key. They will appear in your Table of Contents (TOC):



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- Take a look at the tabs in your TOC. How does what you see in your TOC change as you toggle between the tabs: **List by Drawing Order**, **List by Source**, or **List by Visibility**? We will talk about the **List by Selection** tab later. Return to the **List by Source** tab .

Take a look at your tables to confirm your join field:

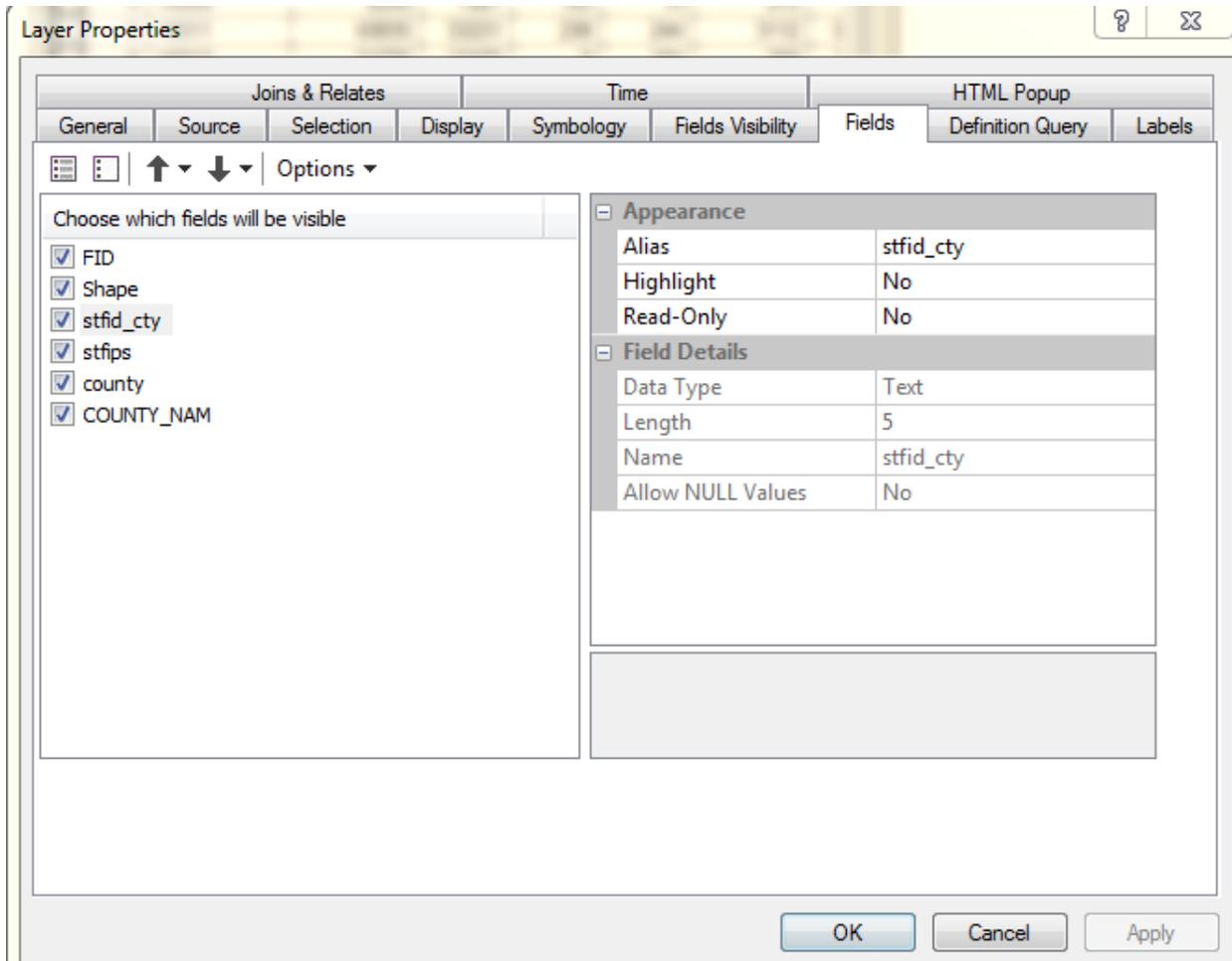
- You will append data to the county shapefile *ID_counties.shp* attribute table – *this is the target table*.
- Take a look at the fields in your county shapefile attribute table. To view the attribute table, right click on the shapefile in the Table of Contents and select **Open Attribute Table**.
- This table is associated to your county shapefile with attribute names (attribute fields) as columns and rows as records of individual counties. At the bottom of the table the number of records is shown.
- The first join will be based on the **stfid_cty** attribute field; this field represents the county name. Is this field unique to each county?

FID	Shape *	stfid_cty	stfips	county	COUNTY_NAME
0	Polygon	16001	16	001	ADA
1	Polygon	16003	16	003	ADAMS
2	Polygon	16005	16	005	BANNOCK
3	Polygon	16007	16	007	BEAR LAKE
4	Polygon	16009	16	009	BENEWAH
5	Polygon	16011	16	011	BINGHAM
6	Polygon	16013	16	013	BLAINE
7	Polygon	16015	16	015	BOISE
8	Polygon	16017	16	017	BONNER
9	Polygon	16019	16	019	BONNEVILLE
10	Polygon	16021	16	021	BOUNDARY
11	Polygon	16023	16	023	BUTTE
12	Polygon	16025	16	025	CAMAS
13	Polygon	16027	16	027	CANYON
14	Polygon	16029	16	029	CARIBOU
15	Polygon	16031	16	031	CASSIA
16	Polygon	16033	16	033	CLARK
17	Polygon	16035	16	035	CLEARWATER
18	Polygon	16037	16	037	CUSTER
19	Polygon	16039	16	039	ELMORE
20	Polygon	16041	16	041	FRANKLIN
21	Polygon	16043	16	043	FREMONT
22	Polygon	16045	16	045	GEM
23	Polygon	16047	16	047	GOODING
24	Polygon	16049	16	049	IDAHO
25	Polygon	16051	16	051	JEFFERSON
26	Polygon	16053	16	053	JEROME
27	Polygon	16055	16	055	KOOTENAI
28	Polygon	16057	16	057	LATAH
29	Polygon	16059	16	059	LEMHI
30	Polygon	16061	16	061	LEWIS
31	Polygon	16063	16	063	LINCOLN
32	Polygon	16065	16	065	MADISON
33	Polygon	16067	16	067	MINDOKA
34	Polygon	16069	16	069	NEZ PERCE
35	Polygon	16071	16	071	ONEIDA
36	Polygon	16073	16	073	OWYHEE
37	Polygon	16075	16	075	PAYETTE
38	Polygon	16077	16	077	POWER
39	Polygon	16079	16	079	SHOSHONE
40	Polygon	16081	16	081	TETON
41	Polygon	16083	16	083	TWIN FALLS
42	Polygon	16085	16	085	VALLEY
43	Polygon	16087	16	087	WASHINGTON

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- Once you have confirmed this field is in fact unique and does represent county name, you should also determine what type of data field it is. To find this information right click on the shapefile in your TOC and select **Properties**. This will open the layer properties. Select the **Fields** tab and click the **stfid_cty** field. What type of field is it?



Note: This field represents a five-digit Federal Information Processing Standard (FIPS) code (which uniquely identifies counties and county equivalents in the United States, certain U.S. possessions, and certain freely associated states. The first two digits are the FIPS state code and the last three are the county code within the state or possession.

- Now that you have that sorted, take a look at the table you will append to the county shapefile (*id_pop_co_2009acs.dbf*) - this is the **join** table. Open this table and examine it, the common

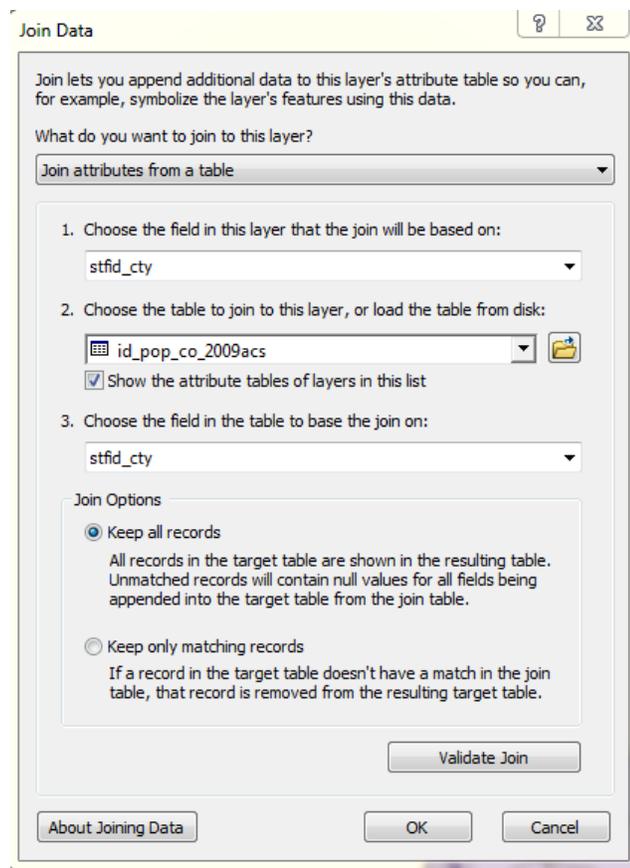
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field that you will use to join this table to your shapefile is: **stfid_cty**. Confirm that it is the same data type as the field in the county shapefile.

Join your tables:

1. In examining your two tables you may have noticed that there are the same number of records in both your target and join tables, this means that your join is a *one to one join*.
2. You have confirmed that the field you are basing your join on, is a *common field* to both the target table (*ID_counties.shp* "**stfid_cty**"), and the join table (*id_pop_co_2009acs.dbf* "**stfid_cty**"). The two fields have the same name in each table (this may not always be the case), are of the same data type, so you are ready to join.
3. Right click on the *ID_counties.shp* (this shapefile contains your target) in the table of contents; select the **Joins and Relates** tab, choose **Join**. This will open the join dialogue.



4. You are immediately confronted with a question: **What do you want to join to this layer?** In the drop down box, select **Join attributes from a table**.

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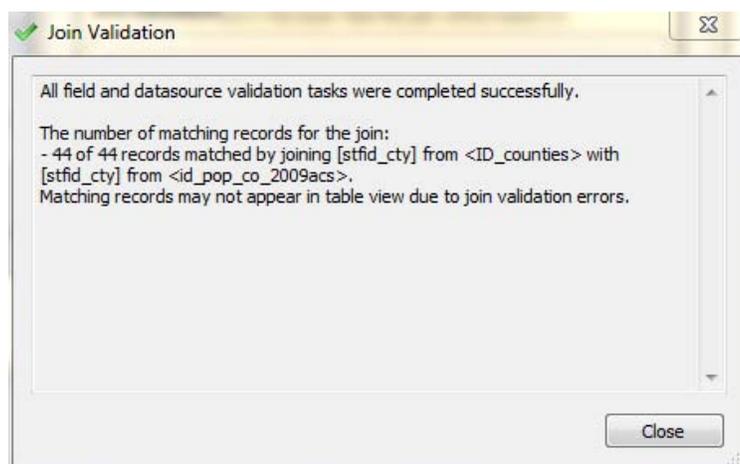
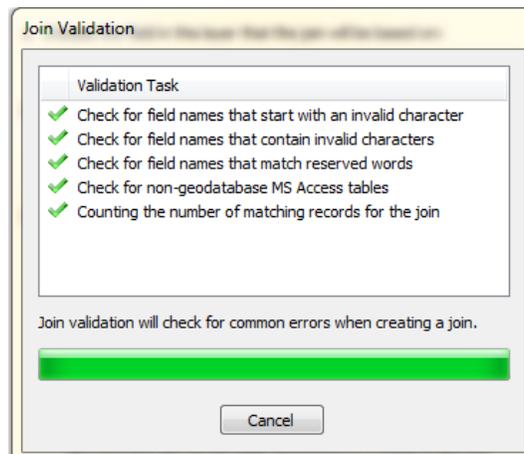
5. Next you will choose the join field present in your target table that the join will be based on: **stfid_cty**.
6. Select the *id_pop_co2009acs* table as the table to join to your target.
7. Finally choose the field in the join table to base the join on: **stfid_cty**.
8. Before you click okay, take a look at some of the help: **About Joining Data**, and the

Contextual Question Mark

9. Click **Validate Join**.



This will check for some common issues that can foul a table join.



If you see the message above, it is a positive sign.

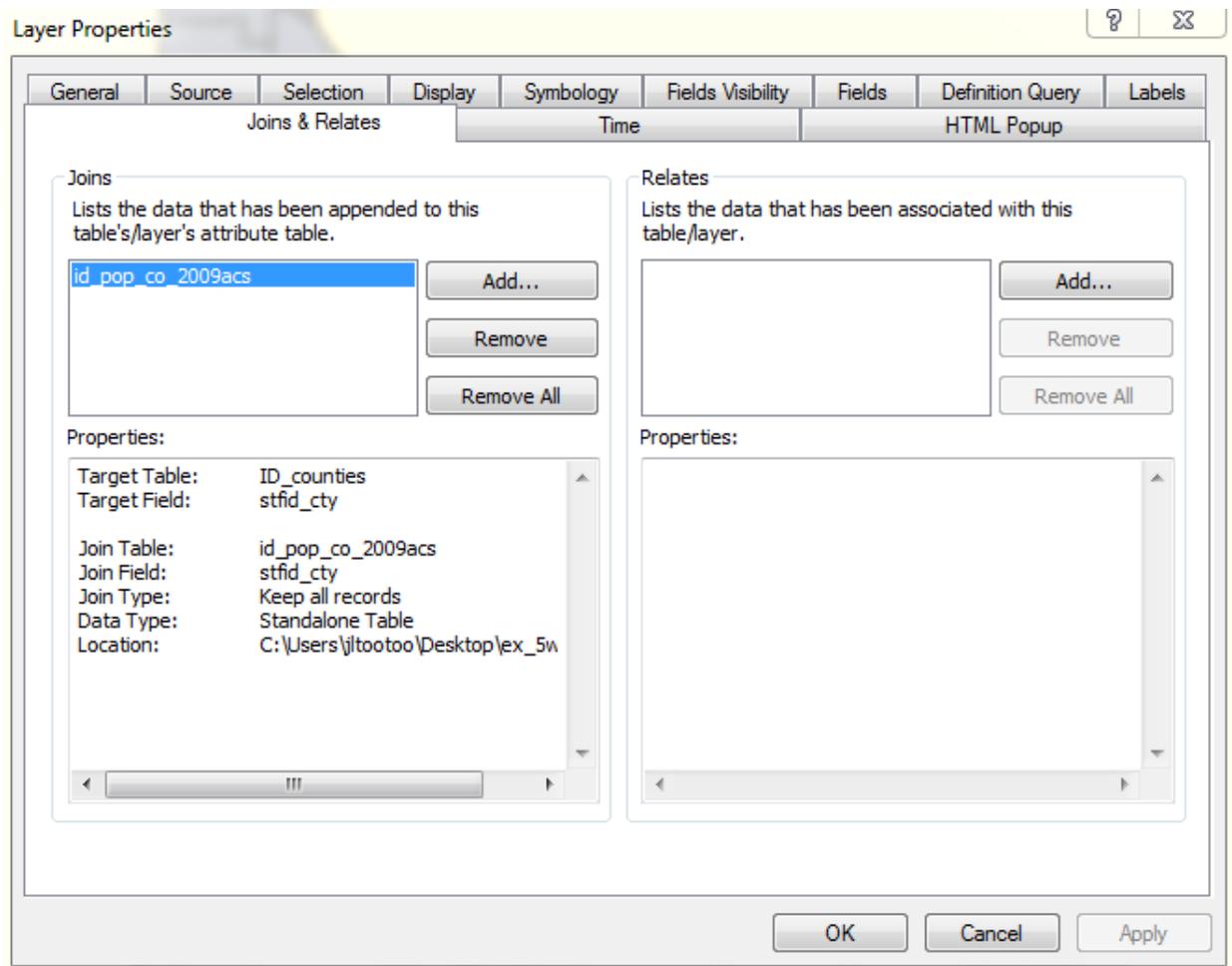
10. Click **OK**.

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Take a look at the result of your join

1. Right click on your target (*ID_counties.shp*) in the TOC and open the attribute table.
 - a. Does the table look different?
 - b. Do you see any records with NULL values in your table? If so this could be an indication that something went afoul with your join.
2. Close your table. Open the layer **Properties** by right clicking on the *UT_counties.shp* in your TOC, then choose the **Joins & Relates** tab.



This is the place to take a look at all of the information related to your join(s).

3. After you take a look at the join information click on the **Fields** tab. All fields from both tables (target/join) should be present in the join table.

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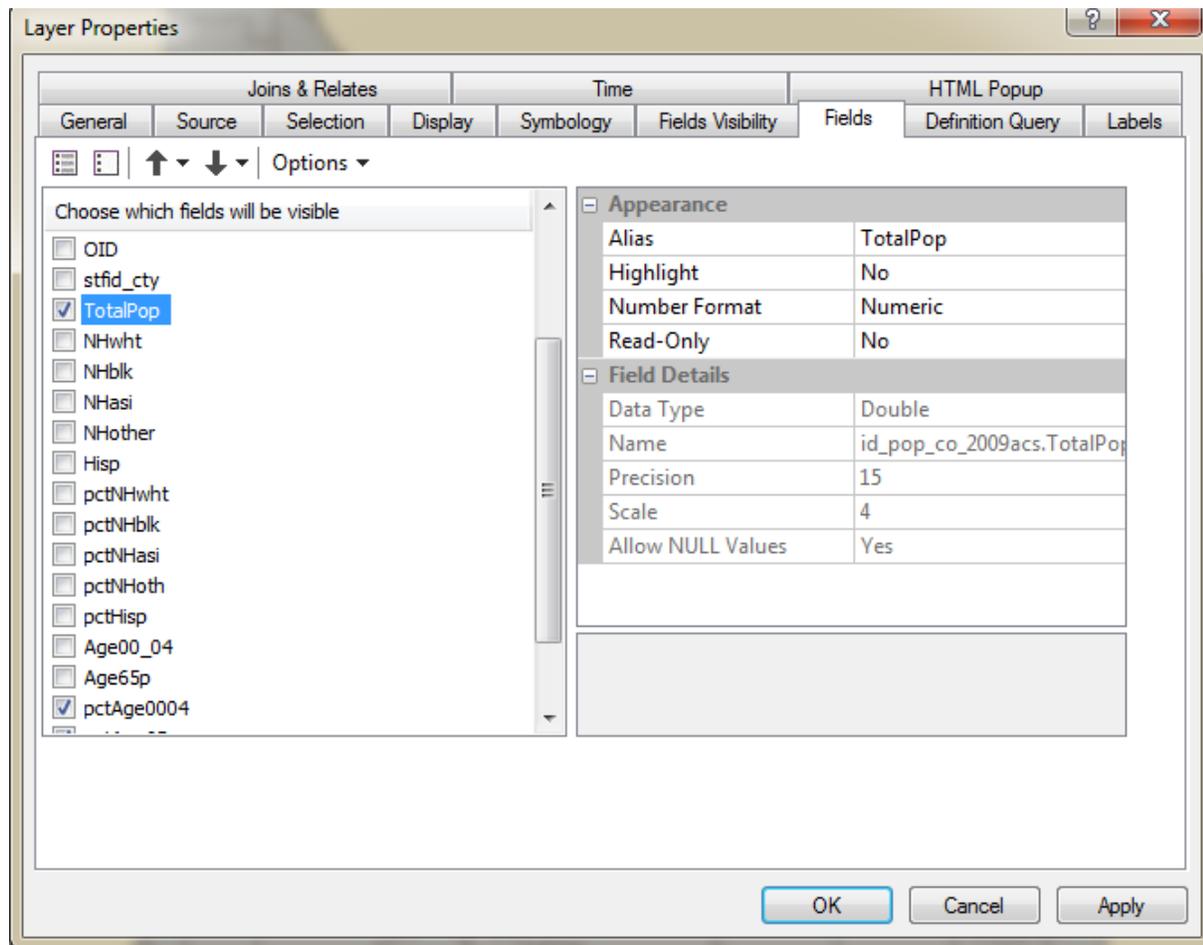
4. A successful attribute join is very useful. You can select, display and or calculate fields based on the appended data in the target table.
5. It is important to remember that in a join the data are dynamically linked: what does this mean?
 - a. Nothing is written on disk - the join exists in your project only.
 - b. Edits to the underlying tables will appear in appended fields.
 - c. Fields in your target table can be edited, but the data in the appended fields cannot be directly edited.
6. You will now export your joined data (target + join) to a new feature as a shapefile. The table associated with this feature will include all of the data from the two original tables, and will be written - so you will need to name and save it.
7. Open the layer **Properties** by right clicking on the *UT_counties.shp* in your TOC and choose the **Fields** tab. Before you export your joined data you can select the fields that you want to

be present in your new feature class. Click **Turn all fields off**  and choose the following five fields by checking the boxes:

- a. stfid_cty
- b. COUNTY_NAM
- c. TotalPop
- d. pctAge0004 (percentage population age 0-4)
- e. pctAge65p (percentage population age 65 and over)

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- Click *Apply*, and take a look at your table. The five fields you selected should be the only fields you see in the table.

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Table

ID_counties

stfid_cty	COUNTY_NAM	TotalPop	pctAge0004	pctAge65p
16087	WASHINGTON	10011	6.19	18.9
16085	VALLEY	8667	5.58	14.68
16083	TWIN FALLS	72578	7.89	14.34
16081	TETON	8422	9.53	5.49
16079	SHOSHONE	12794	4.79	18.7
16077	POWER	7689	8.41	11.08
16075	PAYETTE	22534	7.58	13.84
16073	OWYHEE	10995	7.71	13.21
16071	ONEIDA	4148	6.7	16.25
16069	NEZ PERCE	38691	5.74	17.76
16067	MINIDOKA	18800	8.85	14.29
16065	MADISON	37120	10	5.74
16063	LINCOLN	4533	9.84	12.05
16061	LEWIS	3645	5.29	22.52
16059	LEMHI	7818	5.53	19.39
16057	LATAH	37511	5.41	9.9
16055	KOOTENAI	133461	6.47	13.78
16053	JEROME	20142	9.97	11.23
16051	JEFFERSON	22892	10.41	9.19
16049	IDAHO	15286	5.42	18.97
16047	GOODING	14320	8.44	15.46
16045	GEM	16355	6.62	17.35
16043	FREMONT	12537	9.16	12.27
16041	FRANKLIN	12272	9.52	12.16
16039	ELMORE	28791	8.8	8.43
16037	CUSTER	4129	6.32	16.66
16035	CLEARWATER	8192	3.87	20.74
16033	CLARK	984	9.25	15.96
16031	CASSIA	21154	9.85	13.52
16029	CARIBOU	6888	7.78	15.11
16027	CANYON	176820	9.7	10.31
16025	CAMAS	1040	5.1	9.23
16023	BUTTE	2769	3.94	17.77
16021	BOUNDARY	10748	6.22	14.3
16019	BONNEVILLE	96238	9.82	10.65
16017	BONNER	40878	5.32	14.75
16015	BOISE	7467	3.55	11.88
16013	BLAINE	21775	6.92	9.99
16011	BINGHAM	43635	9.74	10.86
16009	BENEWAH	9246	6.11	16.65
16007	BEAR LAKE	5859	6.54	16.81
16005	BANNOCK	80428	8.89	10.63
16003	ADAMS	3520	4.32	16.45
16001	ADA	368791	7.64	9.72

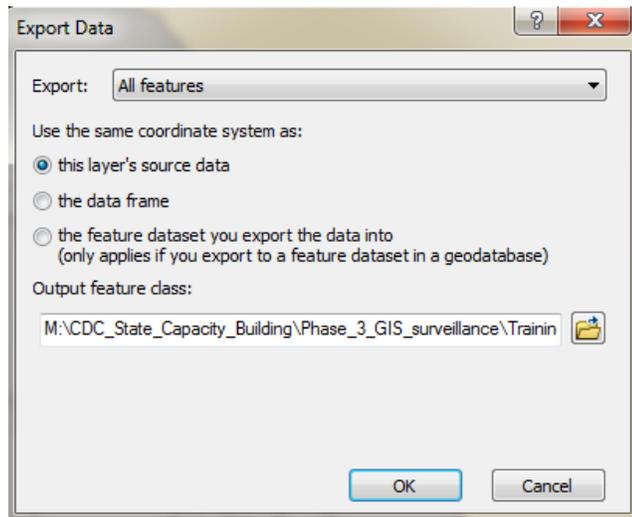
1 (0 out of 44 Selected)

ID_counties

- Close your table and right click on **UT_counties.shp** in your TOC one last time. Choose **Data > Export Data** to open the export data option.

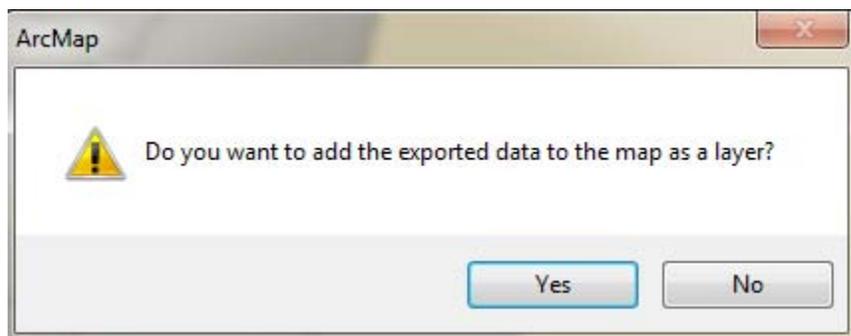
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10. You are exporting **All features**, and want to use the same coordinate system as **this layer's source data**; click the folder browse button to name the file *ID_CO_POP_join* and save it in your data folder.

Before clicking on Save make sure you save as type: shapefile.



11. Add the exported data as a layer and take a look at the attribute table. Only the fields you selected should have come though in the resultant shapefile. Leave your project open, or save it; you will use it in the next exercise.

Exercise 5.2 Selections

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Goals: In this exercise you will join an Idaho county shapefile table to a .dbf table containing county summary information on McDonald's restaurants by county and export the combined table to a new .shp file for display. Along the way you will become familiarized with some of the attribute selection settings and tools in ArcMap.

Skills: After completing this exercise, you will have some experience working with attribute settings and selections in ArcMap.

Setting up your project for this exercise:

1. You will use the same project from exercise 5.1.
2. Click the **Add Data** button .
3. Browse to your folder and double click on the Exercise_05_data folder to open it.
4. Add the *ID_mcdonalds.shp* to your project - these are the point locations for McDonald's restaurants in Idaho.
5. Add the *count_ID_mcdonalds.dbf* table to your project. This table represents a summary count of the number of McDonalds in each county.
6. Join the *count_id_mcdonalds* table to your *ID_CO_Pop_join* Shapefile, paying attention to the following:
 - a. What is your common field?
 - b. How many records are in your target table (*ID_CO_Pop_join*) and your join table?
How will this affect your join result?
 - c. Validate the join; how many records of the 44 matched?
7. Take a look at your table. You should have 26 records with <Null> values. There are no records of McDonald's restaurants for these counties in your join table (remember there were fewer than 44 records in this table). If your McDonald's table was your target table, how would the resultant table look?

Working with selections

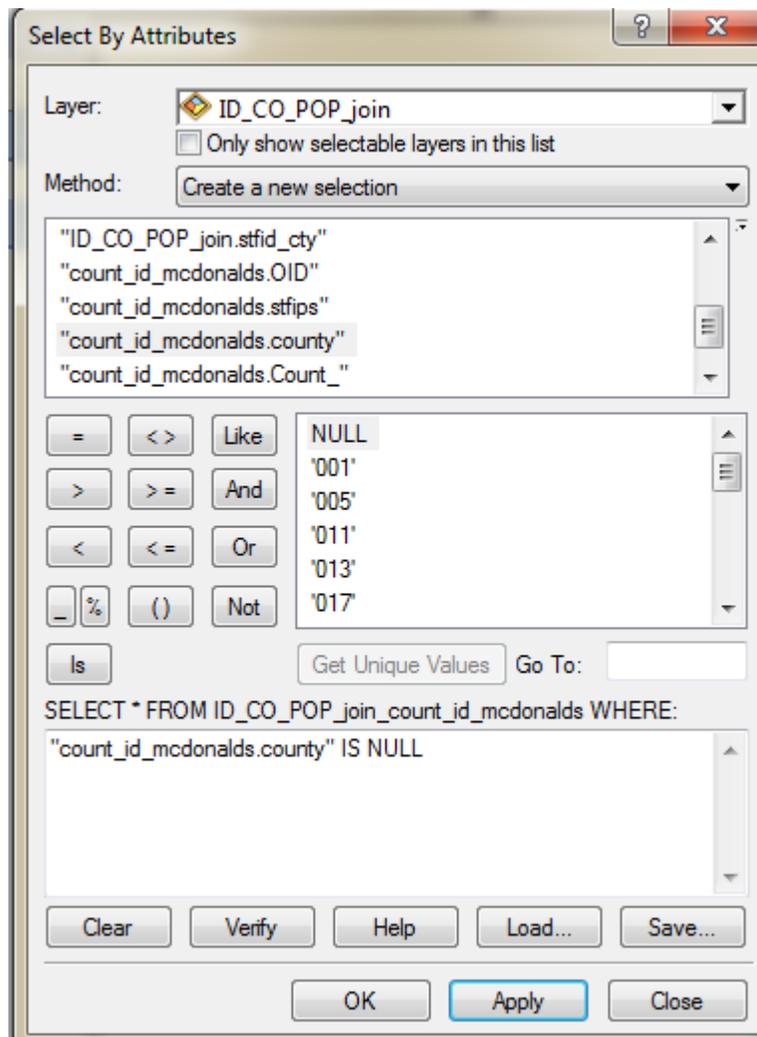
1. Left click on the **Selection** tab in the Menu Bar. You can control the options for your selections in this menu and you can build your attribute selections. You are now going to make a selection based on your join.



2. Choose **Select by Attributes**.

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3. In the dropdown select the *ID_CO_POP_join* shapefile as your layer and select **Create a new selection** as your method. Build the following statement by double clicking the field the "count_id_mcdonalds.county" field name, clicking the IS button, then typing NULL:

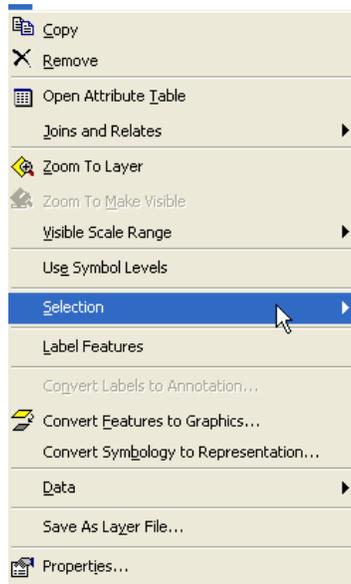
"count_id_mcdonalds.county" IS NULL

This query will select those counties that had no corresponding record in your join table. Click **OK** to close the dialogue.

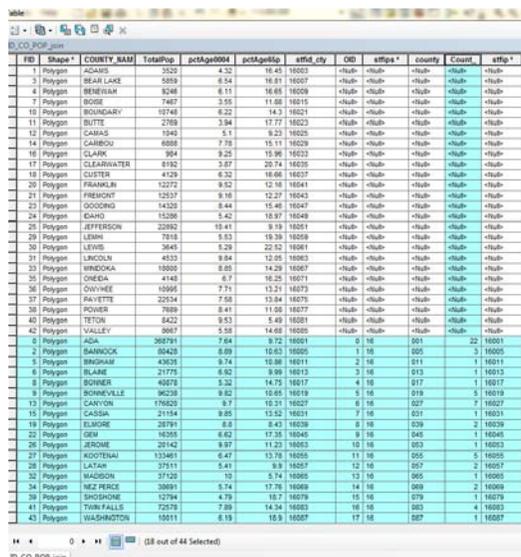
4. Right click on your *ID_CO_POP_join* shapefile in the TOC and choose **Selection**.

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5. Choose **Zoom to Selected Features**. This will allow you to zoom to the selected features on your map; in this case the extent will not change. In this menu you can also:
 - a. Clear selected features;
 - b. Copy selected;
 - c. Switch selection and;
 - d. Create a layer from selected features.
6. Switch your selection to select only those counties that contain McDonald's restaurants.
7. Open your attribute table; you are now going to take a look at some descriptive statistics for your selected records. Right click on the "count_" field and select **Statistics**.



FID	Shape*	COUNTY_NAME	TotalPop.	pctAge0004	pctAge65+	stfcd_city	OID	stfpa_*	county	Count	stfp*
1	Polygon	ADAMS	3520	4.52	16.45	16003	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
3	Polygon	BEAR LAKE	6919	5.54	16.61	16007	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
4	Polygon	BENEFICIAL	9246	6.11	16.65	16029	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
7	Polygon	BOISE	7467	3.55	11.88	16019	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
10	Polygon	BOUNDARY	10748	6.22	14.21	16021	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
11	Polygon	BUTTE	2769	3.94	17.77	16023	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
12	Polygon	CAMAS	1942	5.1	9.23	16025	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
14	Polygon	CARBOZ	6688	7.78	15.11	16029	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
16	Polygon	CLATSOP	394	9.25	15.98	16033	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
17	Polygon	CLEARWATER	8192	3.87	20.74	16035	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
18	Polygon	CUSTER	4129	6.52	16.68	16037	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
20	Polygon	FRANKLIN	12272	9.52	12.18	16041	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
21	Polygon	FREMONT	12837	9.16	12.27	16043	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
23	Polygon	GOODING	14330	6.44	15.48	16047	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
24	Polygon	HAHA	15286	5.42	18.97	16049	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
25	Polygon	JEFFERSON	22982	10.41	9.19	16051	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
29	Polygon	LENA	7818	5.53	19.38	16059	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
30	Polygon	LEWIS	3645	6.29	22.52	16061	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
31	Polygon	LINCOLN	4533	9.84	12.65	16063	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
33	Polygon	MINIDOKA	10000	6.85	14.29	16067	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
35	Polygon	ONEIDA	4148	6.7	16.25	16071	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
36	Polygon	OVYSEE	10965	7.75	13.21	16073	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
37	Polygon	RAVETTE	20534	7.58	13.84	16075	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
38	Polygon	POWER	7689	6.41	11.68	16077	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
40	Polygon	TETON	8422	9.53	8.49	16081	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
42	Polygon	VALLEY	8667	5.58	14.68	16085	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*	<stfpa_*
0	Polygon	AGA	268791	7.64	9.72	16001	8	16	001	22	16001
2	Polygon	BANNOCK	84428	8.89	10.63	16005	1	16	005	3	16005
5	Polygon	BINGHAM	43638	9.74	10.68	16011	2	16	011	1	16011
6	Polygon	BLaine	21776	6.92	9.96	16013	3	16	013	1	16013
8	Polygon	BONNER	46878	5.32	14.75	16017	4	16	017	1	16017
9	Polygon	BONNEVILLE	96238	9.52	10.65	16019	5	16	019	5	16019
13	Polygon	CADWON	178620	9.7	10.31	16027	6	16	027	7	16027
15	Polygon	CASSIA	21154	9.95	13.52	16031	7	16	031	1	16031
19	Polygon	ELMORE	28791	8.8	8.43	16039	8	16	039	2	16039
22	Polygon	GEM	16585	6.62	17.35	16045	9	16	045	1	16045
26	Polygon	JEROME	20142	6.97	11.23	16053	10	16	053	1	16053
27	Polygon	KOOTENAI	133461	6.47	13.78	16055	11	16	055	5	16055
28	Polygon	LATAH	37611	5.41	9.9	16057	12	16	057	2	16057
32	Polygon	MADISON	37120	10	5.74	16065	13	16	065	1	16065
34	Polygon	NEZ PERCE	30891	9.74	17.78	16069	14	16	069	2	16069
38	Polygon	SHOSHONE	12374	4.78	10.7	16079	15	16	079	1	16079
41	Polygon	TWIN FALLS	22979	7.89	14.34	16083	16	16	083	4	16083
43	Polygon	WASHINGTON	15011	6.19	16.9	16087	17	16	087	1	16087

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8. Here you can get summary statistics for any meaningful attributes within your selection.

