

Exercise 3

Joining and Relating Tables



Introduction

In this exercise you will learn how to apply tabular and spatial joins and relate tables.

Upon completion of the exercise, the student will be able to:

- Perform a table join and a spatial join.
- Join attributes from multiple tables of interest.
- Execute a relate between two tables.
- Test the validity of a relate procedure.



Contents

Part 1: Spatial Join	3
A. Perform a Spatial Join	3
B. Perform another Spatial Join	4
Part 2: Table Join	6
A. Join tables	6
B. Set Symbology.....	6
C. Apply Labels	7
D. Build a Definition Query	8
Part 3: Relating Tables	10
A. Execute a Relate	10
Part 4: Testing the Relate	11
A. Select attributes to relate	11
B. Perform and examine the relate.....	12
C. Perform a Relate with side-by-side tables	13

Part 1: Spatial Join

In ArcGIS Pro, joining attributes involves appending attributes from one layer into the attributes of another layer. ArcGIS Pro provides two methods for joining attributes: a table join and a spatial join. A spatial join tests the spatial relationship shared between the two layers whose attributes you want to join. Depending upon the feature types involved, some of the spatial relationships that can be tested are:

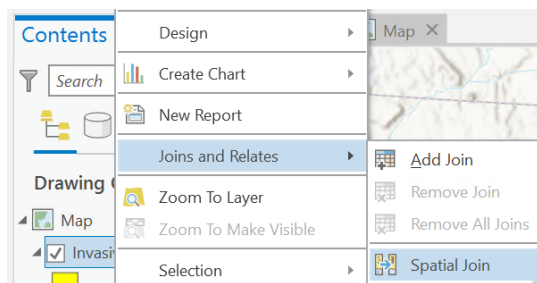
- Join attributes of the nearest feature (e.g., points nearest to lines).
- Join attributes of the overlapping feature (e.g., polygons overlapping polygons).
- Join attributes of the intersecting feature (e.g., points inside polygons).

In this part you will conduct two spatial joins. First, you will join the attributes from the ranger districts layer to the invasive species layer you worked with in the previous exercise. The output of the join is a new layer whose attributes contain both ranger district and invasive species information. Next you will join the ecological response unit (ERU) layer attributes to the output of the previous spatial join.

A. Perform a Spatial Join

We want to join the ranger district attributes to the invasive species layer based on the two layers' spatial location to each other.

1. Open the **Tables.aprx** file in ArcGIS Pro if it isn't already.
2. In the Contents pane, right-click the **Invasive_PL** layer then move your cursor to **Joins and Relates** and click **Spatial Join**.



3. In the Spatial Join window set the following parameters:
 - i. Join Features: **RangerDistrict**
 - ii. Join Operation: **Join one to many**

The Join Operation parameter specifies how joins between the target features and join features will be handled in the output feature class if multiple join features are found that have the same spatial relationship with a single target feature.

Join one to one—If multiple join features are found that have the same spatial relationship with a single target feature, the attributes from the multiple join features will be aggregated using a merge rule which is set in the Fields section.

Join one to many—If multiple join features are found that have the same spatial relationship with a single target feature, the output feature class will contain multiple copies (records) of the target feature.

Note: In the Fields section you can choose which fields will be included in the output.

- iii. Leave the other fields as default.
- iv. Click **OK**.
4. Once the tool is finished, a new layer named **Invasive_PL_SpatialJoin** is added to the Contents pane. Take a look at its attribute table!

You might notice some records in the table have multiple copies. This is because the Join Operation was set as **Join one to many**.

B. Perform another Spatial Join

Next you will perform a second spatial join that appends the ERU layer attributes to the output of the previous spatial join.

1. In the Contents pane, right-click the **Invasive_PL_SpatialJoin** layer then move your cursor to Joins and Relates and click **Spatial Join**.
2. In the Spatial Join window set the following parameters:
 - i. Join Features: **ERU**
 - ii. Output Feature Class: **Invasive_PL_SpatialJoin_2**
 - iii. Join Operation: **Join one to many**
 - iv. Leave the other fields as default and click **OK**.
3. Examine the attribute table of the **Invasive_PL_SpatialJoin_2** layer. This table can now be queried and used for analysis and reporting.

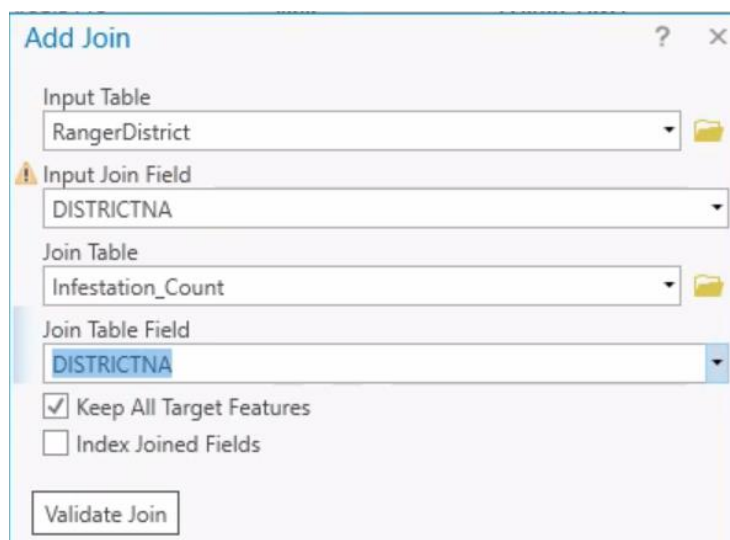
Part 2: Table Join

A table join is based on matching values in key fields stored in separate tables. A key field holds unique data which identifies that record from all the other records in the table. A table join does not create a new feature class like the spatial join does.

Suppose you are tasked with analyzing and reporting invasive species infestations in the Carson and Santa Fe National Forests. You have a summary table breaking down the distribution of invasive species infestations by ranger district. You will join the summary table to the attribute table of the RangerDistrict layer with the goal of creating a map illustrating the number of infestations in each district.

A. Join tables

1. In the Contents pane, right-click the **RangerDistrict** layer then move your cursor to Joins and Relates and click **Add Join**.
2. In the Add Join window set the following parameters:
 - i. Input Join Field: **DISTRICTNA**
 - ii. Join Table: **Infestation_Count**
 - iii. Joint Table Field: **DISTRICTNA**

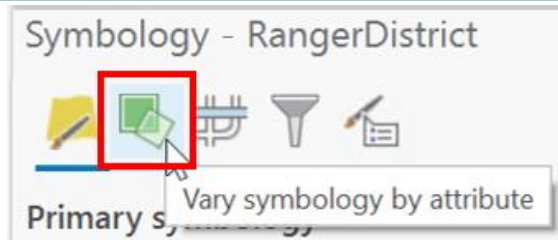


- iv. Click **OK**. Three fields have been added to the RangerDistrict table including the Infestation Count field which has total number of infestations in each district.

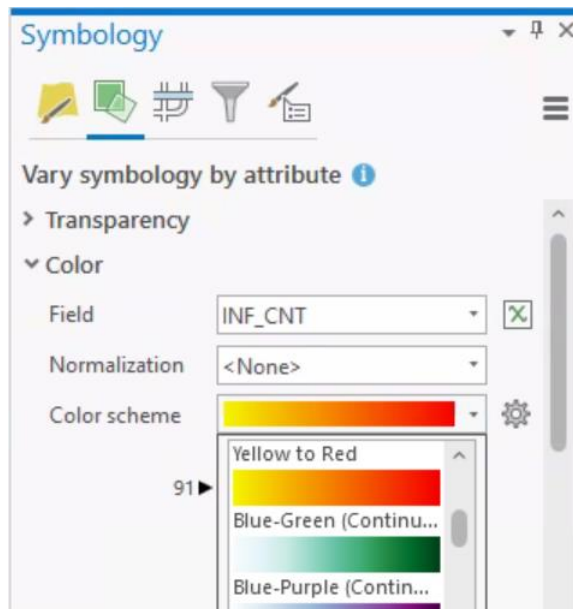
B. Set Symbolology

With infestation count joined to the RangerDistrict layer's attribute table, we can now symbolize those districts according to their total number of infestations.

1. In the Contents pane, right-click the **RangerDistrict** layer then click **Symbolology**.
2. In the Symbolology pane, click the **Vary symbolology by attribute** button.



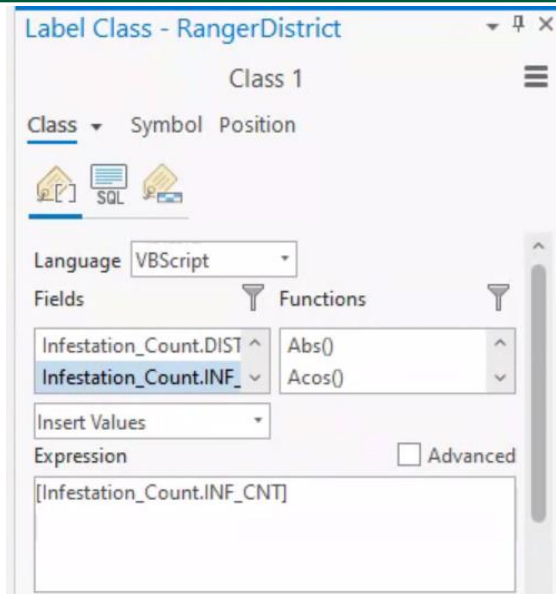
- i. Expand the **Color** section.
- ii. Set the **Field** to **INF_CNT**.
- iii. In the Color scheme menu click the box next to **Show names** then click the **Yellow to Red** color scheme.



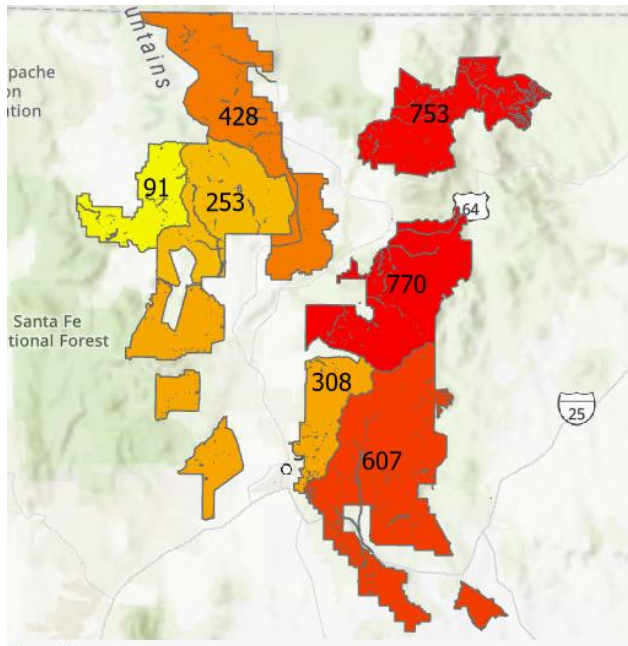
C. Apply Labels

We will label the map with the number of infestations in each district.

1. In the Contents pane, right-click the **RangerDistrict** layer then click **Labeling Properties...**
 - i. In the Label Class pane set the Language to VBScript.
 - ii. Delete all the text in the **Expression** field.
 - iii. In the Fields menu scroll down to **[Infestation_Count.INF_CNT]** and double-click on it to add it to the Expression field.
 - iv. Click **Apply**.



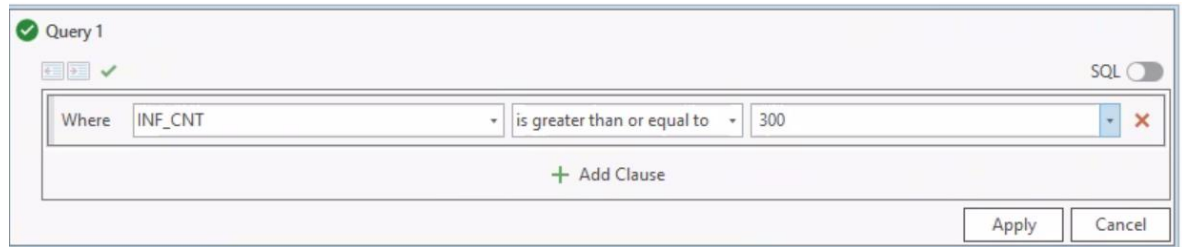
2. In the Contents pane, right-click the **RangerDistrict** field then click **Label** to make the labels appear in the map.
3. Turn off every layer except **RangerDistrict** and **Invasive_PL**.



D. Build a Definition Query

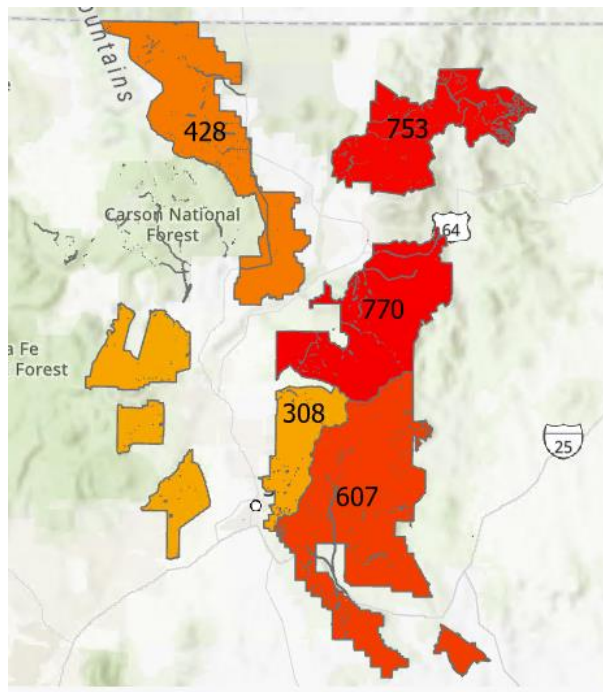
Suppose you only want to display districts that have at least 300 infestations. You can use a Definition Query to filter out districts that have less than 300 infestations.

1. In the Contents pane, right-click the **RangerDistrict** layer then click **Properties**.
 - i. In the Layer Properties window click **Definition Query** then click **New definition query**.
 - ii. Use the menus to create this query: Where **INF_CNT** is **greater than or equal to 300**.

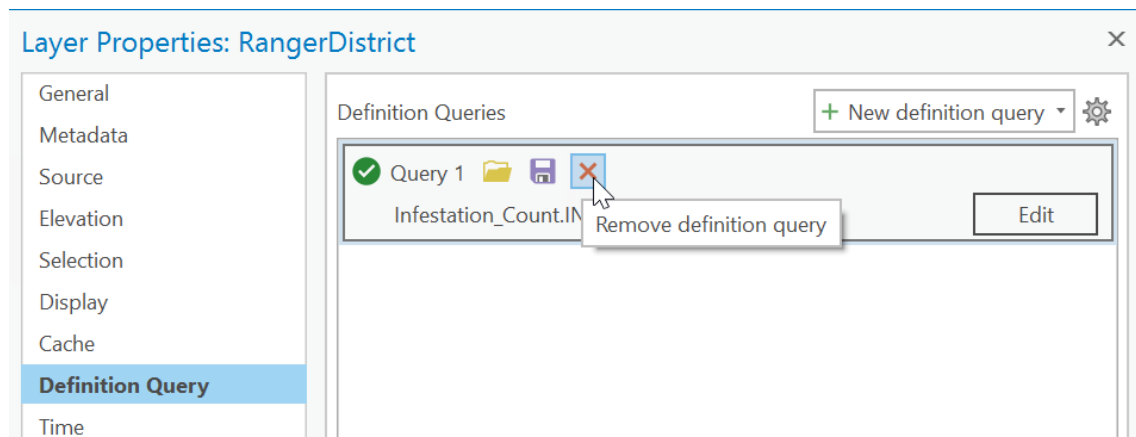


- iii. Click **Apply**.
- iv. Click **OK**.

Notice the two districts that have less than 300 infestations aren't displayed. A Definition Query only functions in the map document. The layer's total number of features and records, (7) has not changed.



- 2. Open the RangerDistrict **Layer Properties** window again and remove the Definition Query.



Part 3: Relating Tables

When tables are related, you can select records in one table in to see matching records in the related table.

A. Execute a Relate

Let's relate the **Invasive_PL** table to the **RangerDistrict** table. Like the Join command, the Relate command requires that you specify the key field names shared between the two tables to be related. We will use the district name fields to relate the tables. Unlike the Join command, executing a Relate does not append associated records into a single table. After you create a Relate, when you select records in one table the related records are automatically selected in the other table.

1. In the Contents pane, right-click the **Invasive_PL** layer, move the cursor over **Joins and Relates**, then click **Add Relate**.
2. In the Add Relate window set the following parameters:
 - i. Input Relate Field: **District Name**
 - ii. Relate Table: **RangerDistrict**
 - iii. Output Relate Field: **RangerDistrict.DISTRICTNA**
 - iv. Relate Name: **District Name**
 - v. Cardinality: One to many

Because a map document could have multiple tables with multiple relations between them, it is a good idea to give the relationship an identifiable name.

The screenshot shows the 'Add Relate' dialog box with the following fields and values:

- Layer Name or Table View: Invasive_PL
- Input Relate Field: District Name
- Relate Table: RangerDistrict
- Output Relate Field: RANGERDIST
- Relate Name: District Name
- Cardinality: One to many

Note: You can also use an Excel spreadsheet in a relate!

- vi. Click **OK**.

A Relate called “District Name” has been established between the two tables. The Relate is saved with the project file. Let’s use the Relate to answer questions about the data.

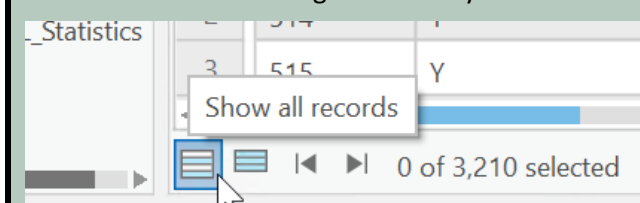
Part 4: Testing the Relate

We will test the relationship by first determining the infestation areas intersecting a certain ecological response unit.

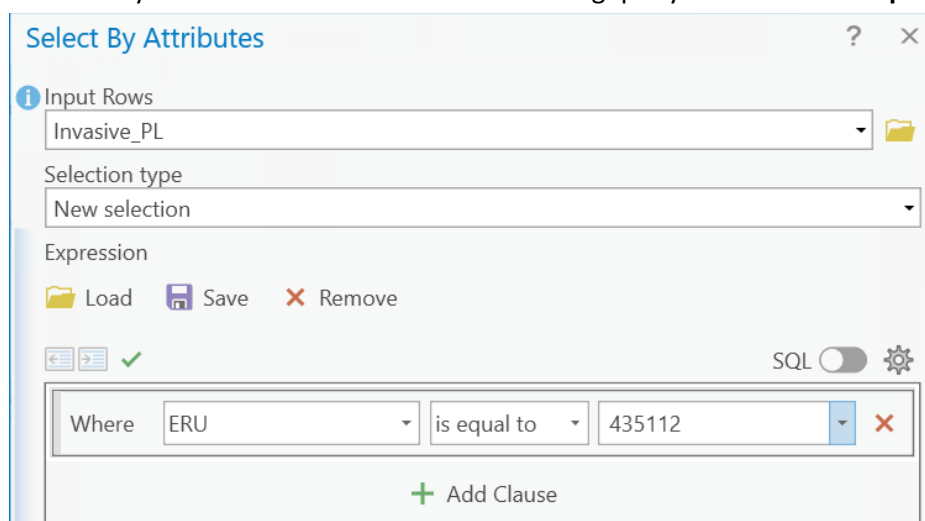
A. Select attributes to relate

1. Open the **Invasive_PL** table.

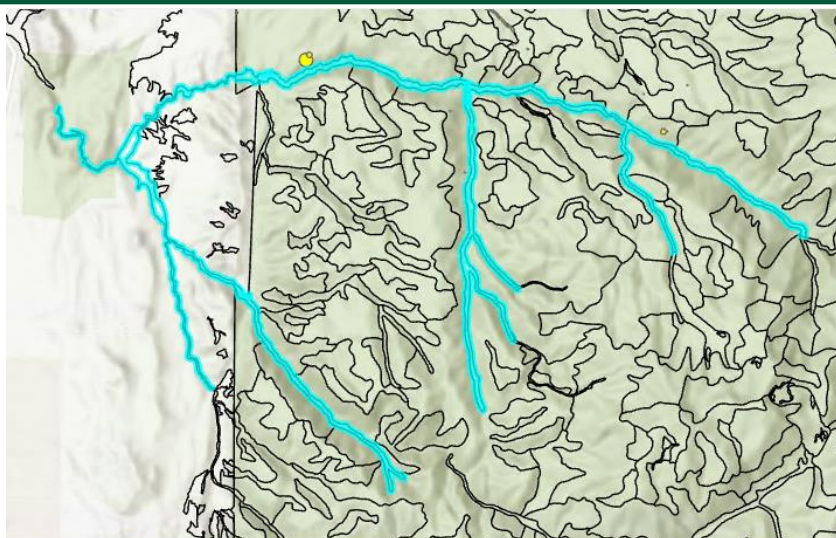
If no records are showing make sure you are **showing all records**—not just selected records.



2. At the top of the table, click **Select By Attributes**.
3. In the Select By Attributes window build the following query: Where **ERU** is equal to **435112**.



- i. Click **OK**. The 23 infestation areas within the ERU highlighted below are now selected.



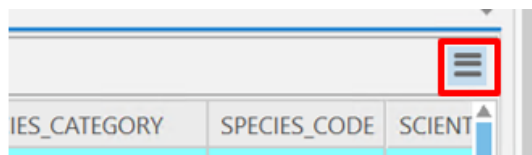
B. Perform and examine the relate

We will use the selected records to execute the “District Name” relate. This will cause the related RangerDistrict table to open with the associated records selected.

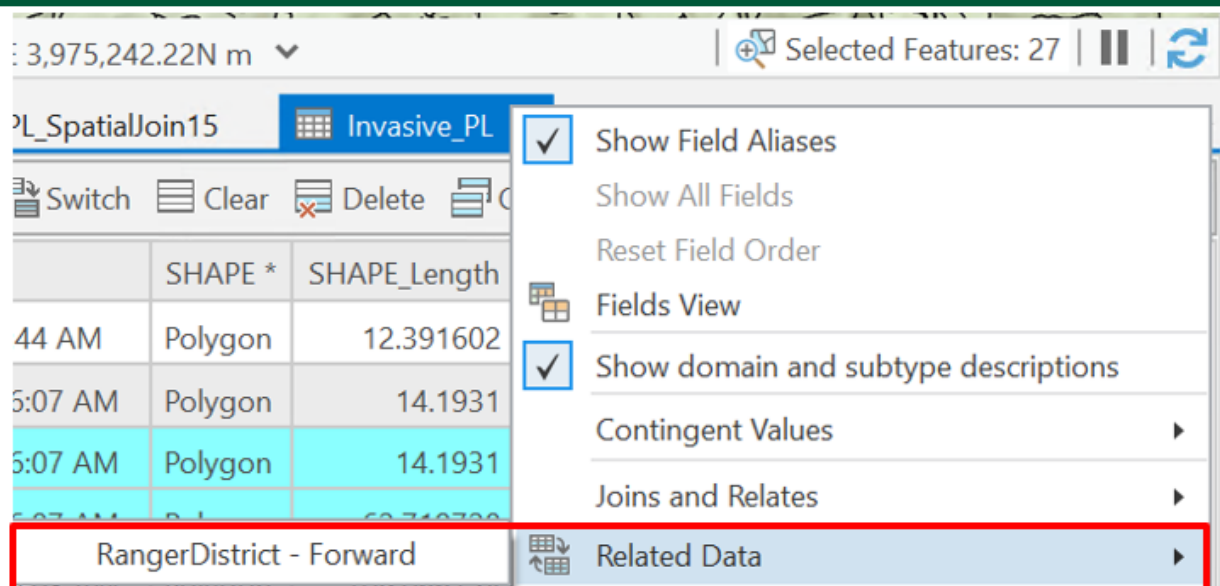
1. In the **Invasive_PL** table place your cursor on the **District Name** field to open a pop-up window with information on the relate that you created for that field.

Area	ERU	District Name	Label
31117	4	District Name (District) Type: Text (255) Default: <Null> Read-Only: No Nullable: Yes Indexed: No Required: No Relate: District Name Related table: RangerDistrict_Infestation_Count Foreign key: RangerDistrict.DISTRICTNA Cardinality: One to many	
97884	4		
24793	4		
04743	4		
73467	4		
54056	4		
03715	4		
35769	4		

2. Click the Table Options button.

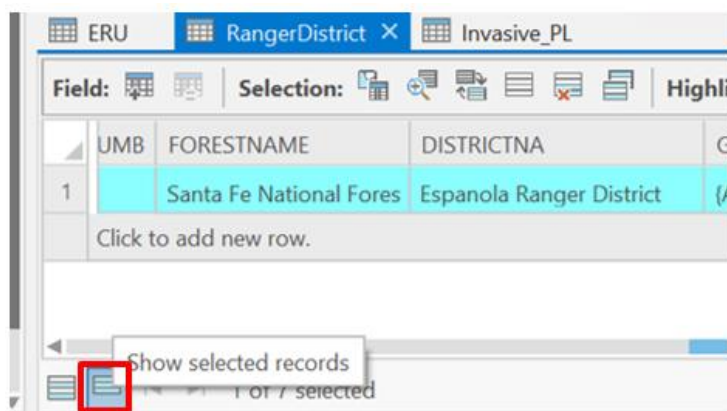


- i. Place your cursor over the Related Data menu then click **RangerDistrict – Forward**.



The RangerDistrict table opens and only the **Espanola Ranger District** is selected. This means all the selected Invasive_PL features are contained by this district.

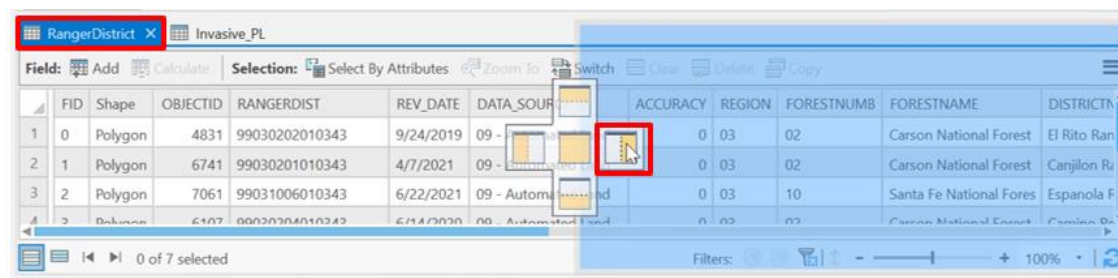
3. At the bottom of the table, click the **Show selected records** button if it's not already active.



4. Click **Clear Selection**.

C. Perform a Relate with side-by-side tables

1. Click and drag the blue tab of the **RangerDistrict** table until a cross appears then place your cursor over the box on the right side of the cross.

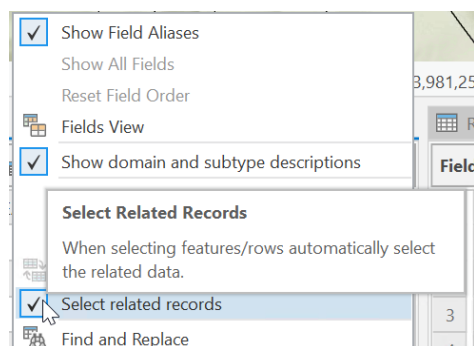


The RangerDistrict table is now docked on the right side of the Invasive_PL table.

Field	OBJECTID *	CURRENT_MEASUREMENT	INFESTATION_ID	PROJECT_C
1	510	Y	031005IS00004_EBT2...	<Null>
2	514	Y	030207_CJAR4_6	<Null>
3	515	Y	030207_CJAR4_3	<Null>
4	757	Y	030206_CJAR4_20	<Null>

Field	FID	Shape	OBJECTID	RANGERDIST	REV_DATE	DATA_SOURCE
1	0	Polygon	4831	99030202010343	9/24/2019	09 - Automi
2	1	Polygon	6741	99030201010343	4/7/2021	09 - Automi
3	2	Polygon	7061	99031006010343	6/22/2021	09 - Automi
4	3	Polygon	6107	99030204010343	6/14/2020	09 - Automi

- Click the menu button on the upper right side of the Invasive_PL table then click **Select Related Records**.



- Clear any selections in the Invasive_PL table.
- Select a few records in the Invasive_PL table then examine the related record(s) selected in the RangerDistrict table.

From this exercise you have learned the two methods for associating multiple tables: Join and Relate. This exercise had you learn the process involved in building and executing a Relate. Use a Relate over a Join when you want to keep attribute information separated to their respective tables. In addition, a Relate is not limited by cardinality (i.e., how separate table records relate to each other). For example, with a Join you must determine if the records to associate share a one-to-one, one-to-many, many-to-one, or many-to-many cardinality. A Join is only correct for a one-to-one or many-to-one cardinality.

A more advanced method to relate tables that is beyond the scope of this course is to create a relationship class. A relationship class is an object in a geodatabase that stores attributes about a relationship between two feature classes, between a feature class and a nonspatial table, or between two nonspatial tables. Both participants in a relationship class must be stored in the same geodatabase. Some relationships specify that a given feature, row, or table is not only related to another feature but that creating, editing, or deleting one will have a specified effect on the other.

Congratulations on finishing this exercise!