Exercise 5 – Working with Related Tables

Session Objectives: At the conclusion of this session, you will be able to:

- ❑ Create a relational geodatabase
- ❑ View, query and analyze related tables in ArcMap 10
- ❑ Add data to related tables in the field using ArcPad 10
- ❑ Use ArcTools to create a random sample of points

Material Created By: Eric Kelchlin (January 2008)

Revision: January 2012

Software: ArcGIS 10 SP 3, ArcPad 10 SP 3

Data Path: D:\CSP301Exercise5

Databases: Bombayhook.gdb, Exercise5.gdb, Inventory.gdb

MXD: Inventory.mxd

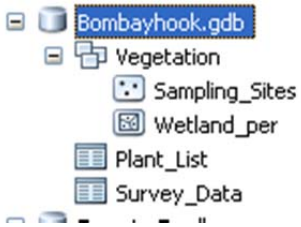
SECTION 1 – Creating a Relational Database

Creating relational databases is all about relating tables and feature classes together using a common field for the purpose of viewing or extracting data across multiple datasets. This design strategy creates a stair-stepped hierarchical data structure, which is in stark contrast to the "flat" mega-tables that scroll-on forever.

In this section, a 15-year long wetland monitoring dataset from Bombay Hook National Wildlife Refuge will be used to illustrate how to create a relational database and view, query, and analyze the data in related tables. The dataset contains location information on sample sites (n=221), saltmarsh vegetation species and percent cover values that are expressed as Daubenmire cover class mid-points.

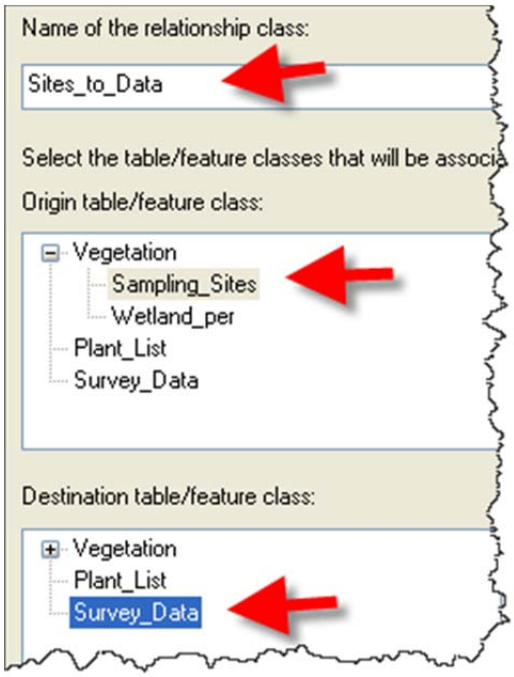
All data are located in the **D:\CSP7301\Exercise5** folder, unless otherwise stated.

1. Open ArcCatalog and explore the data sets in the Bombayhook.gdb.

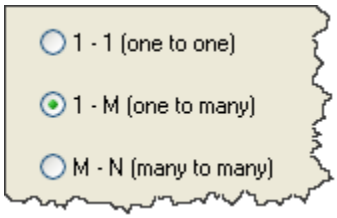


2. Our goal is to create relationship classes that will join the **Sampling_Sites** feature class to the **Survey_Data** table, and the **Plant_List** table to the **Survey_Data** table.

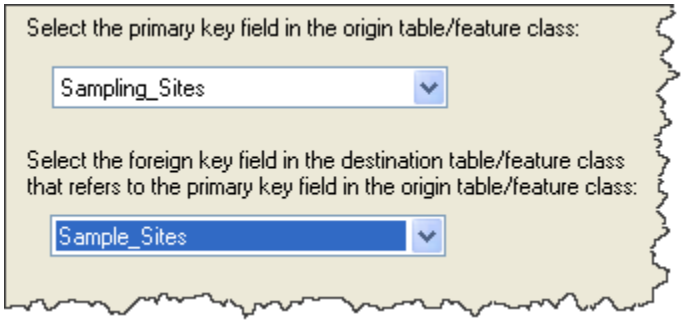
   - Right-click on the **Vegetation** feature dataset and select **New > Relationship Class**.
   - Name the relationship class **Sites_to_Data** and select **Sampling_Sites** for the Origin and **Survey_Data** for the Destination. Click **Next**.
   - Keep the default Simple (peer to peer) relationship. Click **Next** twice, keeping the defaults on the next screen as well.



- Select the **one to many** relationship. Click **Next** twice, keeping the defaults on the next screen.



- Select the Sampling_Sites field as the primary and foreign key. This will link the features together. Click **Next** and **Finish**.

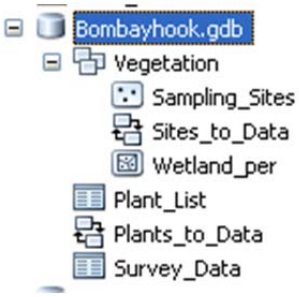


- Create the second relationship class, linking the **Plant_List** table with **Survey_Data**. Right-click on the "Can" this time to create the new relationship class; where you create the relationship depends on the location of the tables in the geodatabase.

- Name this relationship **Plants_to_Data**. This will be a one to many relationship (1:M) as well.

- What origin and foreign keys will you use? The Origin key should be a unique value (i.e., the "1") for each record, and the Destination key needs to be the same data type and values…just more than 1 (i.e., the "M").

3. Close ArcCatalog when done.



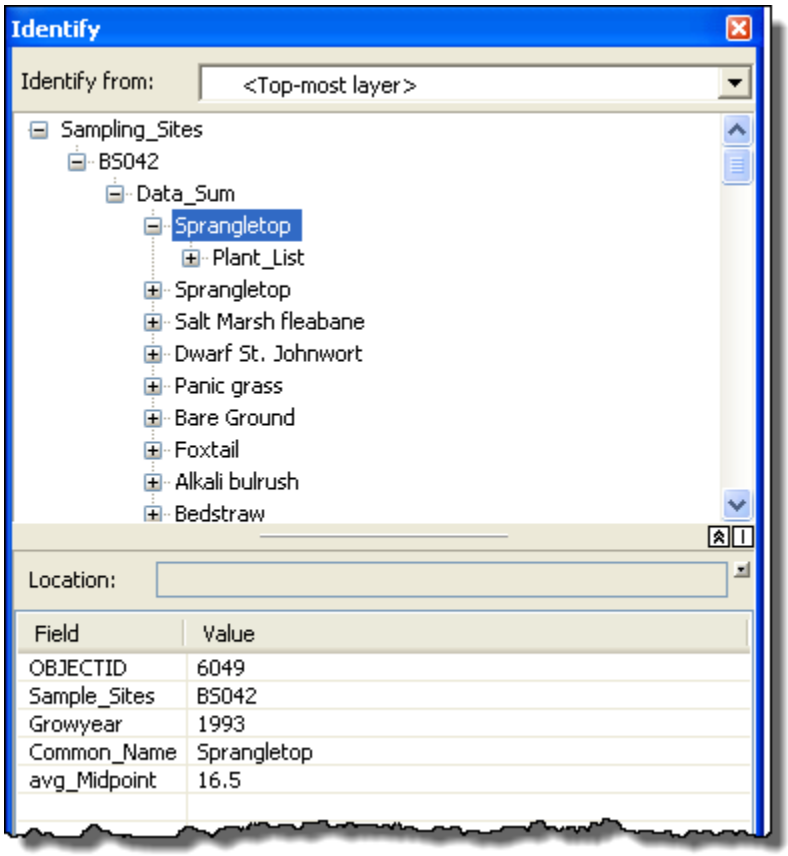
SECTION 2 - Working with Related Tables in ArcMap

TASK 1 - Viewing Related Tables

1. Open a new blank map in ArcMap and **Add** the **Sampling_Sites** feature class. The tables remain in the geodatabase, but the data are accessible because of the defined relationships.

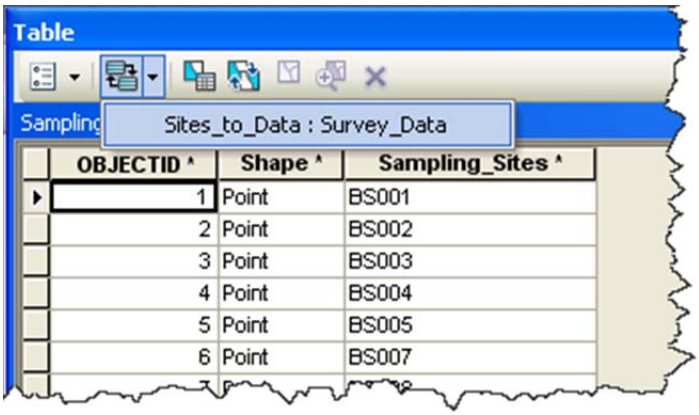
2. You can view the related tables by using the identity tool to see the data specific to each sampling site, or through the attribute table to see all the records.

   - Click on the identity tool on the Tools toolbar. Select any sampling site. Notice that the data are structured in multiple levels. Each level has its own attribute table that can be explored by clicking the plus symbol.



   - Close the Identify dialog and open the **Sampling_Sites** attribute table.

- Click the Related Tables button and select the **Sites_to_Data** relationship class on the list. Notice the new tab at the bottom of the table; you now have multiple tables opened-up at the same time.



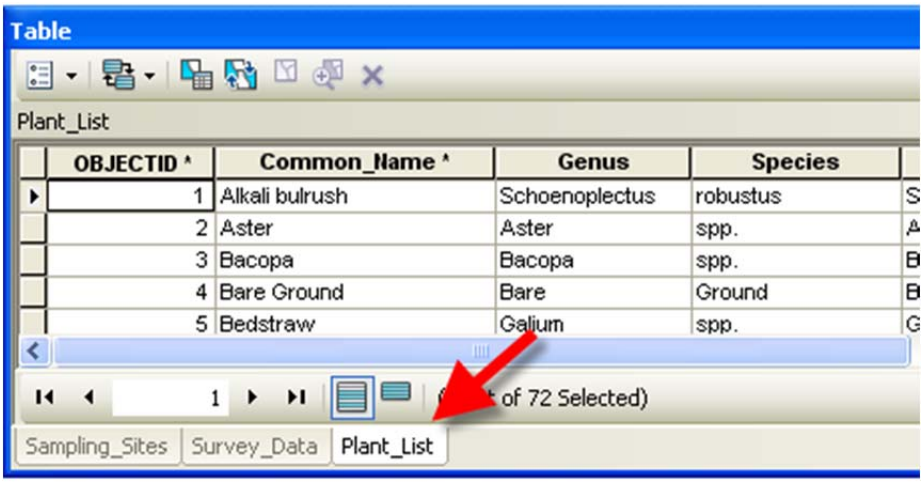
- Click the Show all records button to view the data. ArcMap defaults to show the selected records only, so get into the habit of clicking the button as soon as you open a related table.

- Click on the button again and select the **Plants_to_Data** relationship class on the list. Show all the records . The process of opening related tables must be done in logical tiered steps. In this example the logical order is to go from sample sites to sample data and then sample data to the plant species data.

TASK 2 - Analyzing Data from Related Tables

Analyzing data from related tables requires a bottom-up approach. To illustrate this fact we will calculate an average percent cover estimate for Graminioid plants (e.g. grasses) in 1992.

1. Notice that you have 3 tables open at the same time and you can switch between each one by simply selecting the table on tabs.



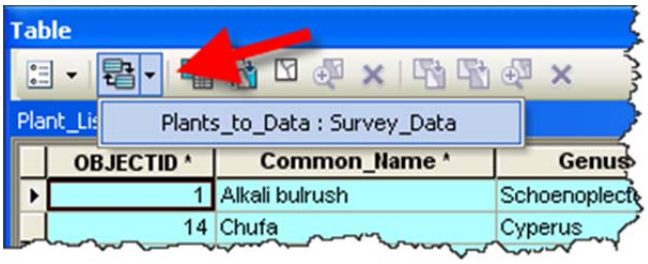
2. Perform an attribute query to select only **Graminoid** records from the **Plant_List** table.

   - Make sure you have the **Plant_List** table open. Click the Select by Attribute button and run the following query:

     "Growth_Habit" = 'Graminoid'

   - Click the view only the selected records button at the bottom of the table.

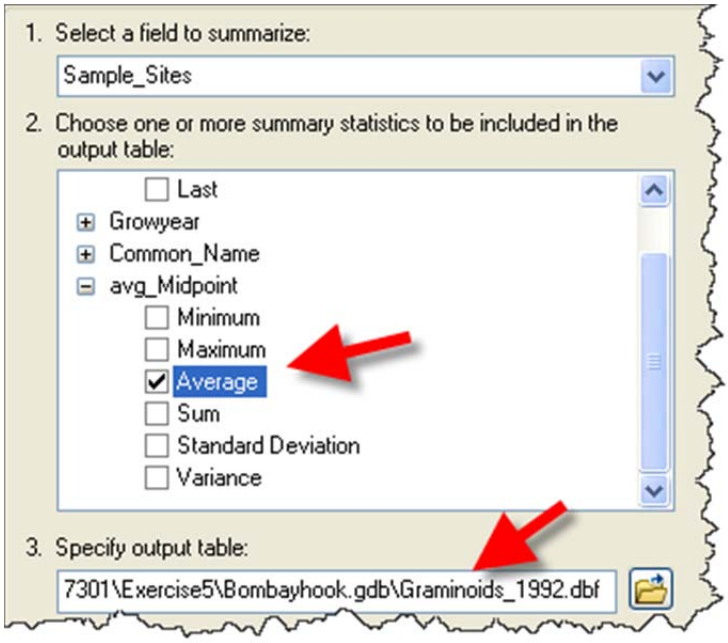
   - To apply the result of the query up to the **Survey_Data** table, simply click the related tables button and select the **Plants_to_Data** relationship.



3. Next, perform a select by attribute query on the **Survey_Data** table to isolate only the records in 1992. You should have 2175 records selected.

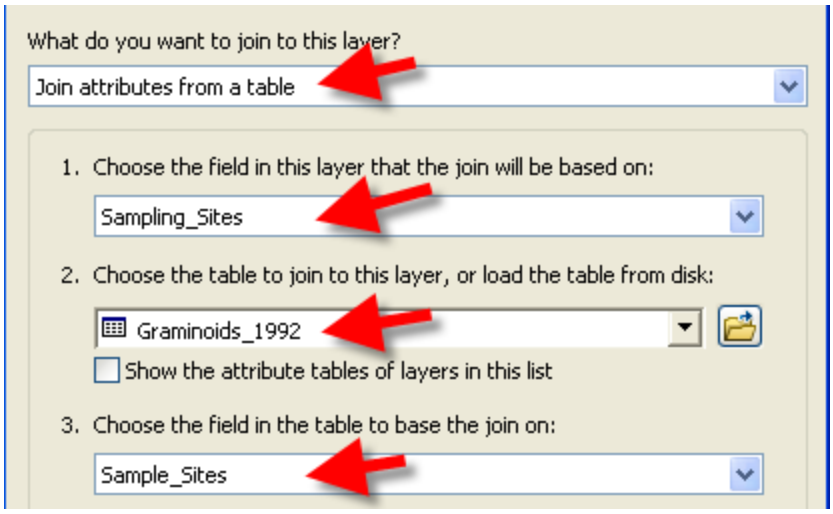
4. Now all you need to do is calculate an average mid-point value by sample sites. To do this, right-click on **Sample_Sites** field and select **Summarize**.

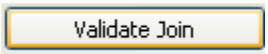
   - Scroll down the list of fields and check the Average box under the **avg_Midpoint** field. Name the table **Graminoids_1992** and save in the Bombayhook.gdb. Click **OK** and add the data to the map.



TASK 3 – Graphically Display the Data

1. Right-click on the **Sampling_Sites** table and join it to the **Graminoids_1992** table as shown below.



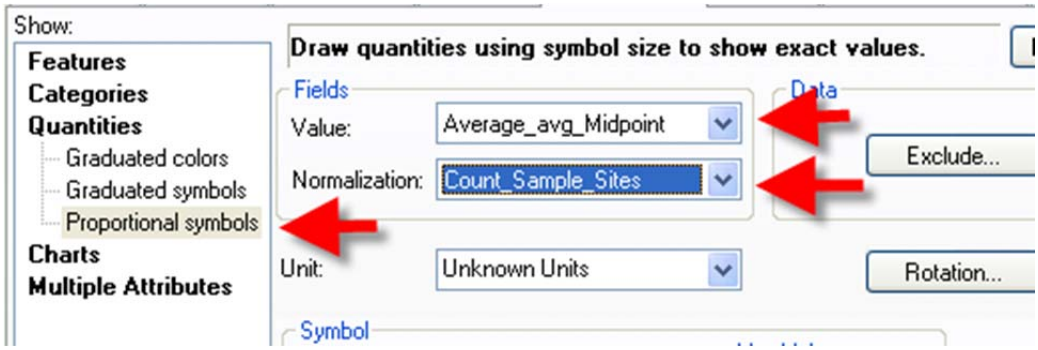
- Click on the Validate Join button  to make sure the join will work properly. Often a join will fail because field headers contain invalid characters such as a period "**.**" or a reserved word such as "**Percent**". So it's a good habit always validate you joins.

- Click **OK** to complete the join.

2. Finally, let's symbolize each sample point based on the average Midpoint value to quickly to visualize trends in Graminoid plant species.

- List your data by drawing order in your Table of Contents.

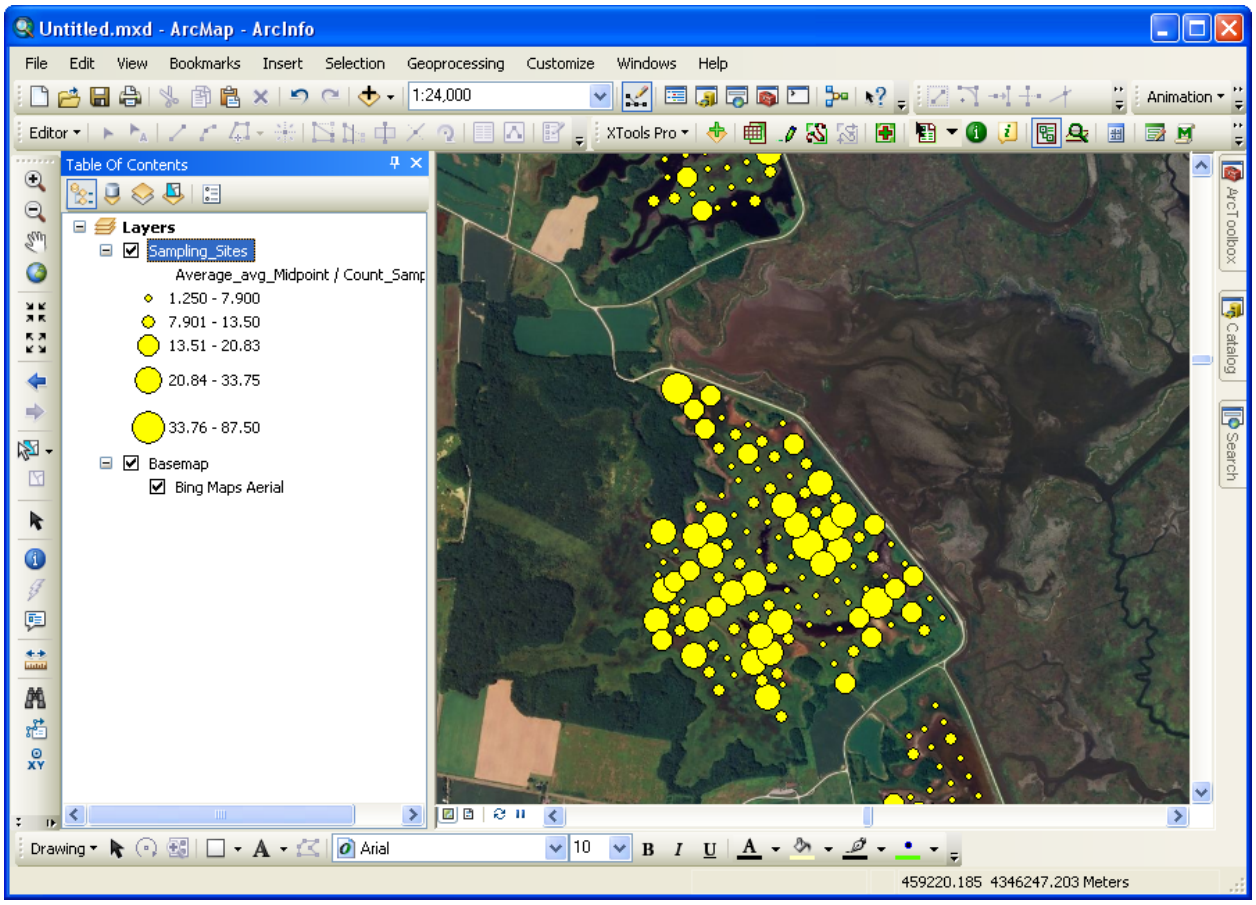
- Right-click on the **Sampling_Sites** feature class and select Properties > Symbology tab. Change the symbol type to **Proportional Symbols** and use the values as shown on the next page. Click **OK**.



- This symbology will give you a rough idea where Graminoids are more prevalent in the impoundments.

- Change the Symbology to the **Graduated symbols** this time. Can you see more of a pattern now?

- Add a Bing base map to help with your interpretation.



SECTION 3 – Small Mammal Trapping Project

In this section we use a small mammal trapping project to illustrate the value of designing a geodatabase for field use. We have a nearly complete geodatabase, with feature datasets, feature classes, domains and tables. The only thing you need to do is create the relationship classes and add some data.

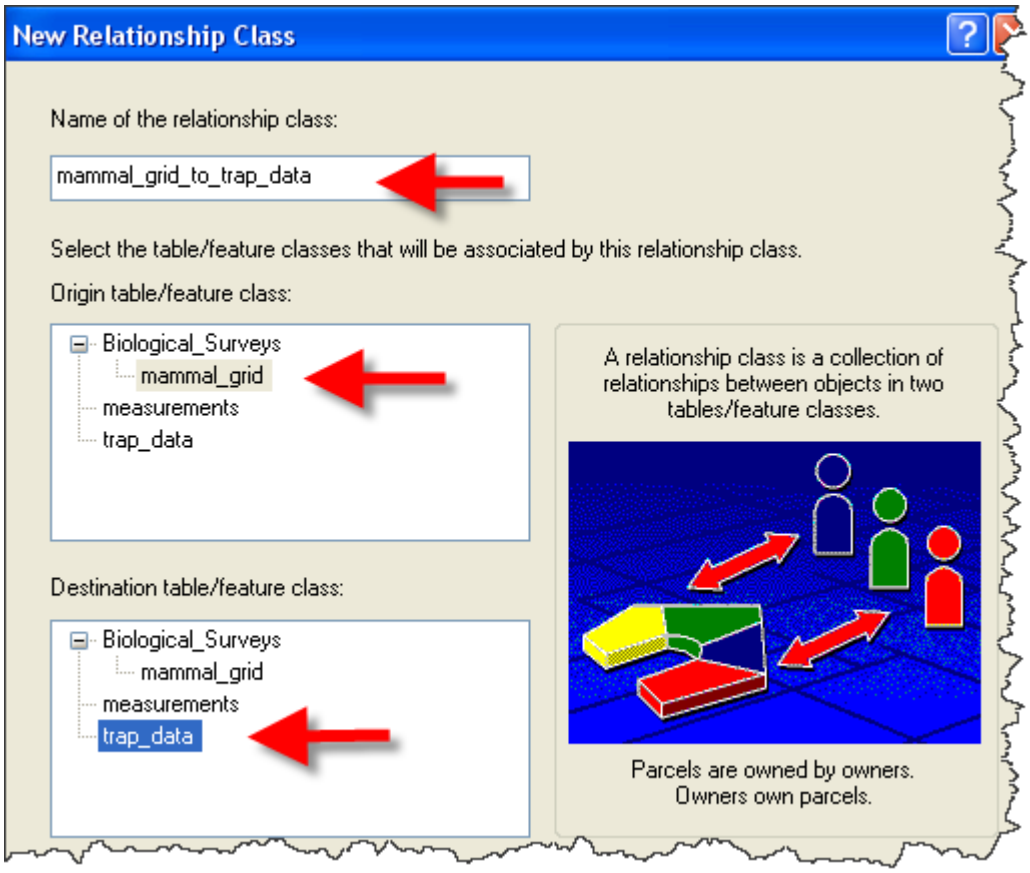
TASK 1: Create Relationship Classes

1. Open ArcCatalog and navigate to the **Exercise5.gdb**. Explore the data sets.

2. Right click on the **Biological_Surveys** feature dataset and create a new relationship class.

   - Name the relationship class **mammal_grid_to_trap_data**.

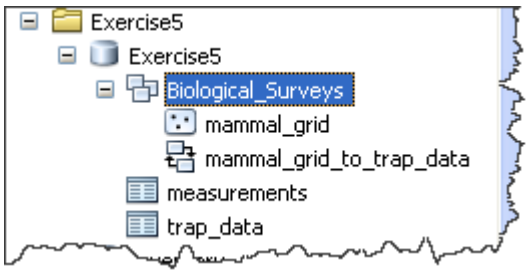
   - Select **mammal_grid** for the Origin feature class and **trap_data** as the Destination table.



   - Make this relationship a **1-M (one to many)**.

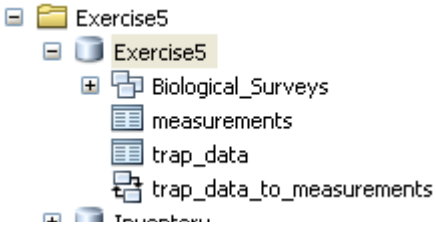
   - Select the **Trap_ID** field for the <u>primary</u> and <u>foreign key</u> fields.

- You should see the new relationship class in your geodatabase when done.



3. Next, create a one-to-one (1:1) relationship joining the **trap_data** table to the **measurements** table. Unlike the 1:M relationship, where multiple trap checks can be recorded per trap site, a one-to-one relationship requires that no duplicates records occur. You can only have one trap individual associated with one measurement record. This will require the use of a unique primary key for the trap_data table and a unique foreign key for the measurements table.

   - Right-click on the "can" and create a new relationship class.
   - Name the relationship class **trap_data_to_measurements**. Assign the **trap_data** table as the Origin, and the **measurement** table as the Destination.
   - Make sure the relationship is **1-1 (one to one)**.
   - Select the **Date** field as the <u>primary</u> and <u>foreign key</u> field.
   - Click **Finish** on the summary dialog. You should see the new relationship class in your geodatabase.



STOP HERE!

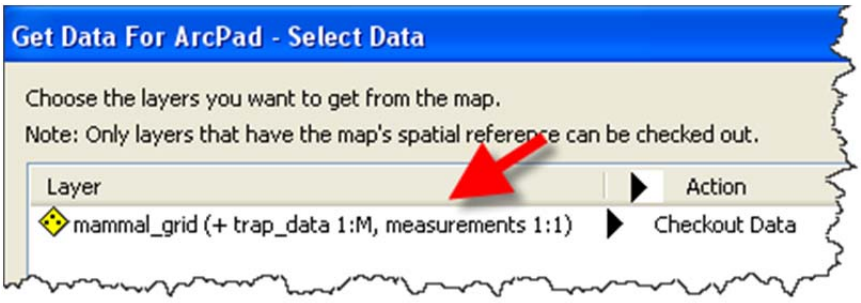
TASK 2: Check Out and Edit the Table in ArcPad

1. Close ArcCatalog and Open ArcMap. Add the **Biological_Surveys** feature dataset to the table of contents.

2. Add labels to the grid points by right-clicking on the layer and selecting Label Features.

3. Zoom into the extent of the trap grids and save your map document in the **Exercise5** folder. Name it **Small_Mammal.mxd.**

4. Check Out the data to ArcPad. Notice how the relationship tables automatically tags along with the **mammal_grid** feature class.



5. Save the ArcPad project in the **Exercise5** folder.

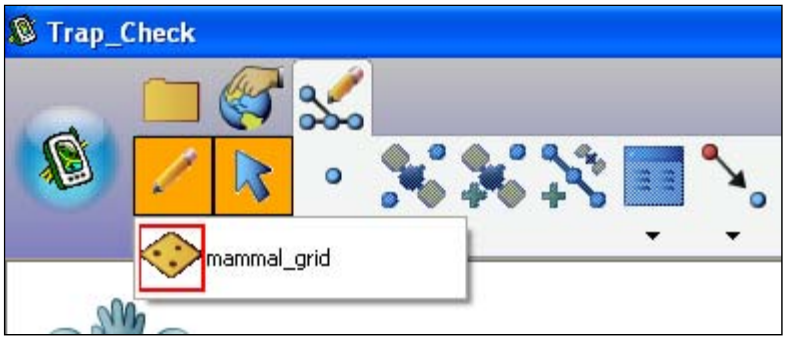
6. Save your map document, close ArcMap and open ArcPad on your PC. Normally you would copy your ArcPad project folder over to your Trimble unit, but for testing purposes, using ArcPad on your PC is a time saver.

7. Select

and browse to the location of your ArcPad Map document (.apo).

8. Start an editing session by clicking on the Drawing Toolbar and then select the Start/Stop Editing Tool . Click the **mammal_grid** layer to enable editing.

9. Next, click the Select Arrow Tool and <u>double click</u> on any of the trap sites.

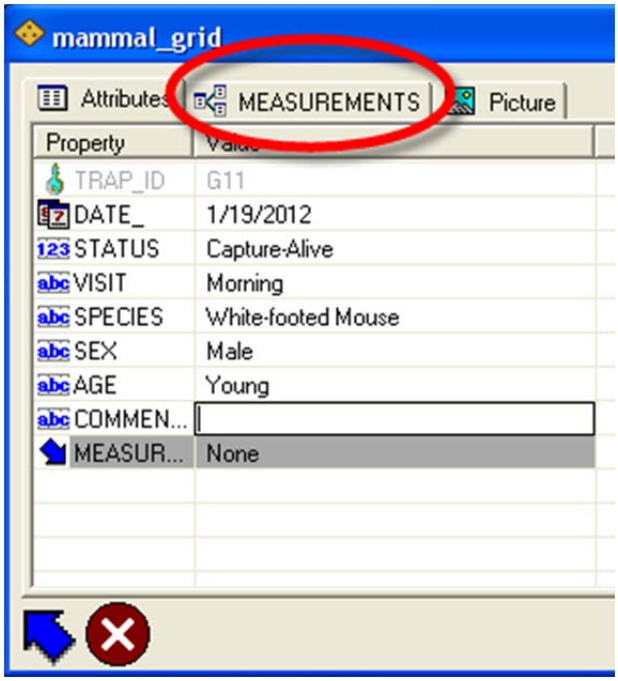


10. Select the **TRAP_DATA** Tab and select the **Add Record** icon at the bottom of your screen dialog.

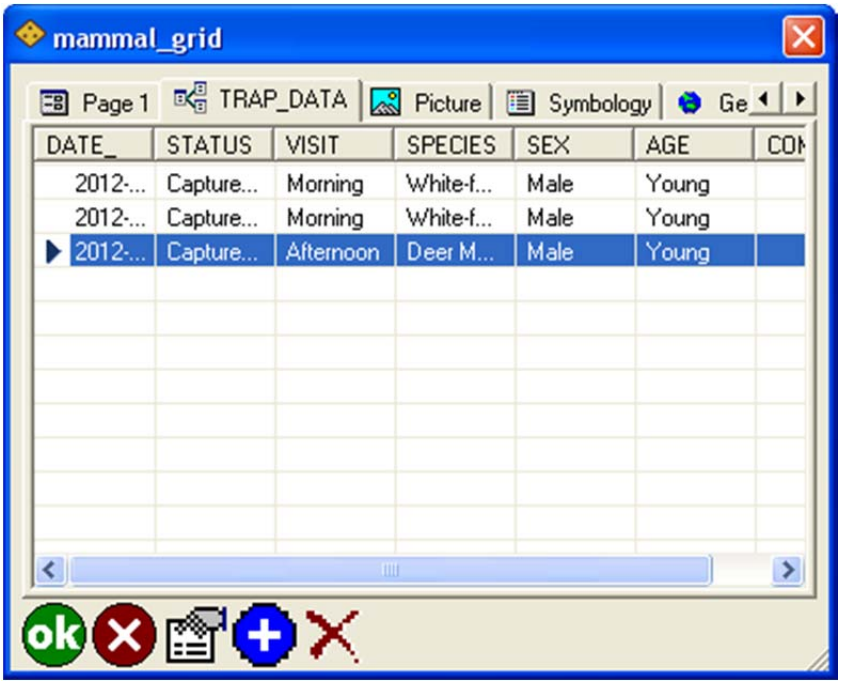
11. Populate the data form. Notice that you can assign domains to table fields as well as feature class fields.

    - Click on the Measurements tab and select to add numeric data for the captured mammal. Notice how the date field (the destination key) is already filled out for you.

    - Click Arrow at the bottom of the form to accept the record.



12. Add a few records to both tables.



13. When done, tap to accept the edits.

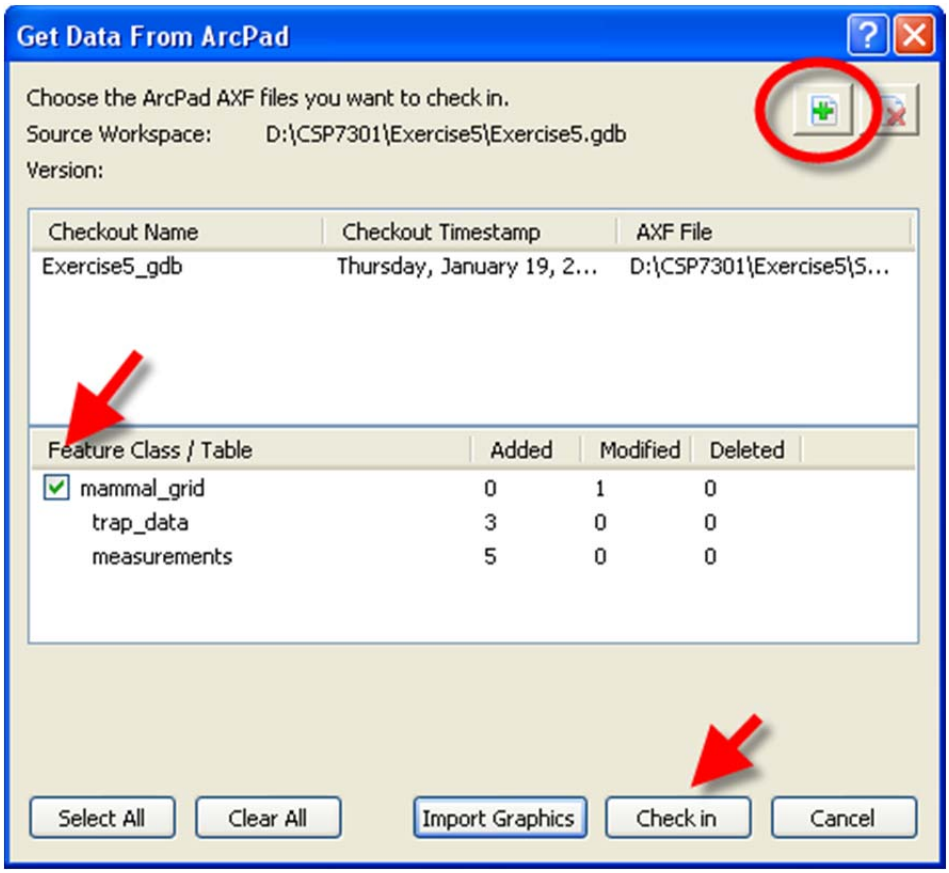
14. Stop editing and close ArcPad.

15. Do not check-in your edits; let's just move on to save some time.

TASK 3: Check In Edits from ArcPad

1. Re-open the **Small_Mammal.mxd** you saved earlier.

   - Start an editing session and check in the data.



   - Open the related tables to view your data. Stop editing and save your edits.

STOP HERE!

SECTION 4 – Invasive Weed Survey Project

For this project we have the geodatabase structure partially build with a single feature dataset, feature class and a several domains. You need to create a table and a relationship class before we go out into the field to conduct the weed survey.

Read the GPS Project Summary below and remove the form on the next page. You'll need the form to complete the Inventory geodatabase.

GPS Project Summary

Title: Pelican Island NWR Complex Invasive Weed Survey

Requested by: Maury Eastwick, Biological Science Technician

Problem Statement:
Pelican Island NWR Complex would like to conduct an invasive weed survey to evaluate its management practices (spraying, mowing and burning). Unfortunately, time and resources are limited due to the continuing resolution and budget constraints. So, Maury requested that a roving band of gypsy GPS students visit the refuge to perform the survey for free. The course leader agreed to volunteer the class, but only on a small scale effort. The survey will be conducted on a single 10 acre parcel using a random sampling approach.

Objectives:
1. Survey fields on campus for invasive weeds using a random sampling methodology.
2. Visually estimate percent cover within a 5 meter radius at each survey point

Existing Data: Exercise5\Inventory.gdb

Methodology:
1. Using the form on the next page, modify the Invasive.gdb to include a new feature class, table with domains and a 1:M relationship feature class.
2. Create 10 random points in the 10 acre parcel using ArcTools.
3. Navigate to the points and collect the data using ArcPad 10.
4. Check in the field data and update the geodatabase.

Deliverables:
1. A completed geodatabase with weed survey field data in a related table.
2. A graphical display of the weed data.

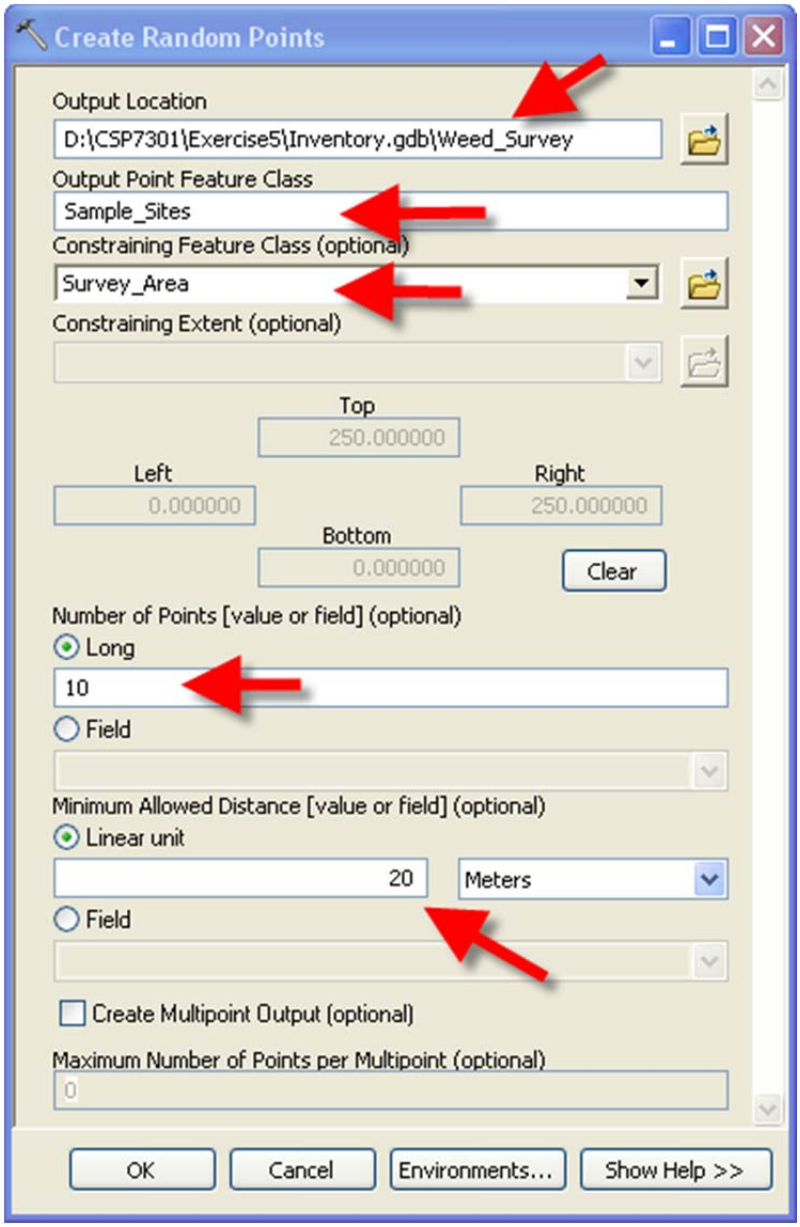
Invasive Weeds Survey Project

Feature Class or Table Name	Data Type	Field Name	Field Type	Text Length	Domain Name	Default Value
Sample_Sites	Point	**Sample_ID**	Short Int			
Weed_Data	Table	GPS_Date	Date			
		Technician	Text	35		"Your last name"
		Species	Text	35	Species	
		Pcover	Long Int			
		Stage	Text	35	Stage	Post-seed
		Treatment	Text	35	Treatment	Mowed
		Sample_ID	Short Int			

TASK 1: Create a Random Sample of Points

1. Open the **Inventory.mxd** and use the Search Window to find a random points tool.

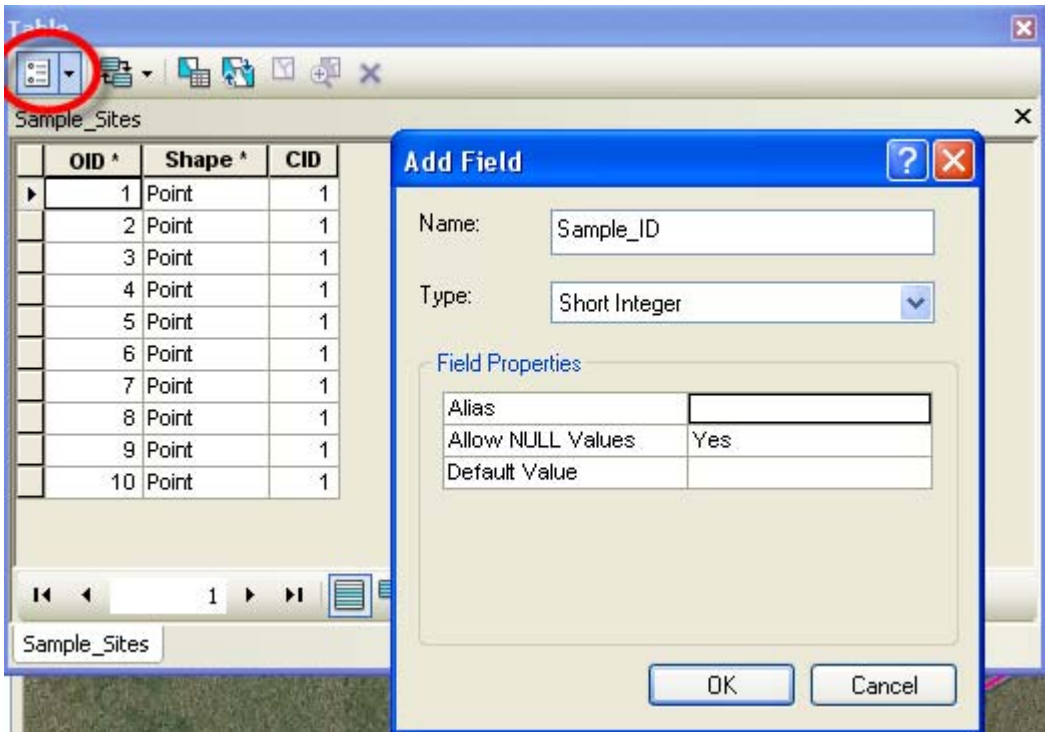
2. Select the **Create Random Points Tool** and fill-in the fields as shown below. Make sure to set the **Output Location** to the Weed_Survey feature dataset.



TASK 2: Create a Unique Origin Key

1. Open the **Sample_Sites** attributes table.

2. Click the **Table Options** button and add a new Short Integer field. Name the field **Sample_ID**.



3. Right-click on the **Sample_ID** column and select **Field Calculator**. Click **Yes** to perform the calculation outside of an editing session.

4. Double-click on the **OID** field name to add it to the script. Click **OK**.

5. Delete the **CID** field by right-clicking on the column header and selecting **Delete Field**.

6. Label the points using the new **Sample_ID** field. Note: You will need to change the field in the **Properties > Label** Tab to **Sample_ID** before you can turn on the labels.

7. Save the MXD and Close ArcMap

8. Open ArcCatalog.

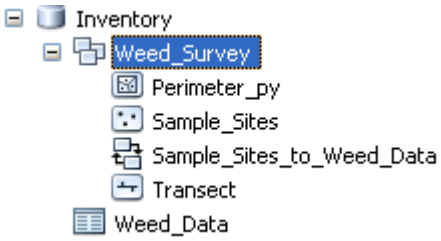
TASK 3: Create the Table and Relationship Class

1. Create the **Weed_Data** table in the **Inventory.gdb** following the table structure outlined on the data form. Just right-click on the "can" and select **New > Table**. The domains are already in the "can", so just assign them as you create each field.

2. Create a simple one-to-many relationship feature class linking the **Sample_Sites** feature class (the Origin) to the **Weed_Data** table (the Destination).

   - Name the relationship feature class **SampleSites_to_Weed_Data**, as listed on the data form.

   - Use the **Sample_ID** fields as the Origin and Destination keys.



TASK 4: Check Out and Collect Field Data

1. Launch ArcMap and open the **Inventory.mxd**.

2. Change the symbology so the layers are visible in the field. Save your map document.

3. Check out the **Survey_Area** and **Sample_Sites** feature classes. Save the ArcPad Project in the **Exercise5** folder.

4. Copy the ArcPad project folder over to your Trimble unit. Open the ArcPad map document to make sure all is well before we head-out into the field.

5. Leave your MXD open.

6. Copy over the Plant_Pics folder and paste on your Mobile unit to help you identify the plants in the field.

TASK 5: Check In the Field Edits and Analyze the Data

1. Copy the project folder from your Trimble unit and replace the folder on your PC.

2. Re-open the **Inventory.mxd** you saved earlier.

3. Start an editing session and check in your field edits.

4. View the related **Weed_Data** table to make sure everything came over.

5. Query the most dominant plant species you surveyed and create a map similar to what we did in SECTION 3.