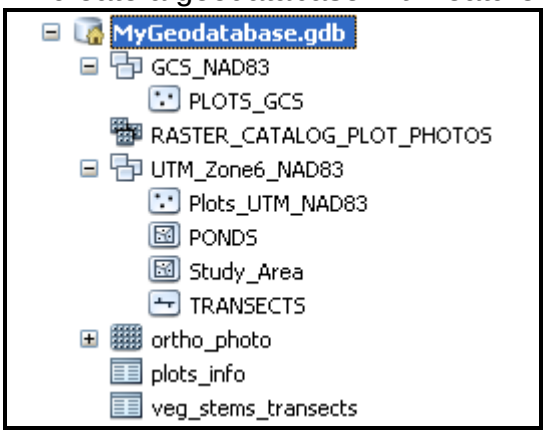
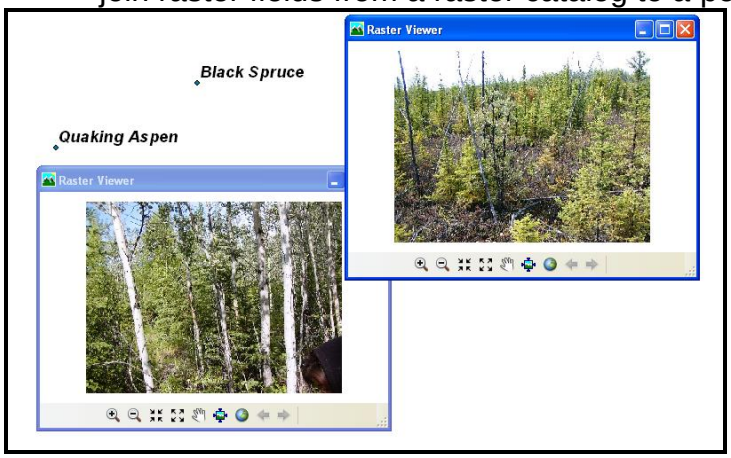
Lab#8: Working With Geodatabases

In this lab, you will learn how to:

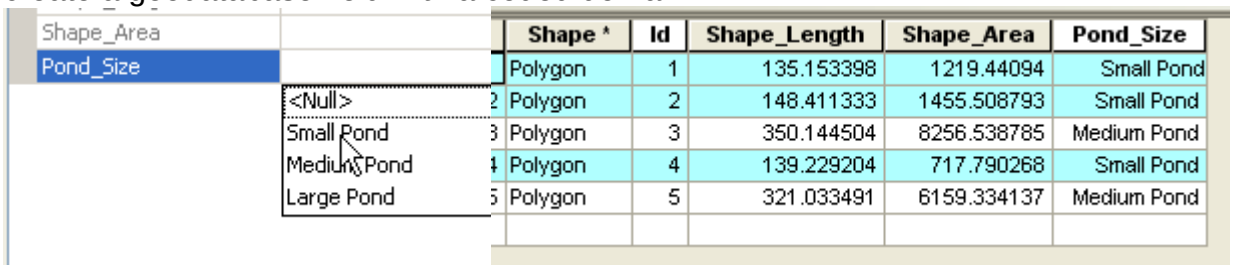
- create a geodatabase with feature datasets, tables, raster datasets, and raster catalogs



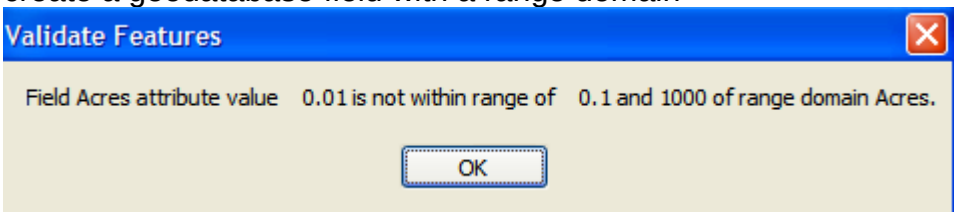
- join raster fields from a raster catalog to a point attribute table



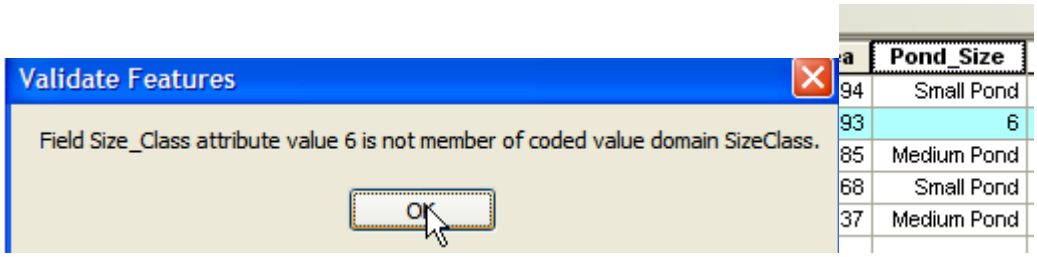
- create a geodatabase field with a coded domain



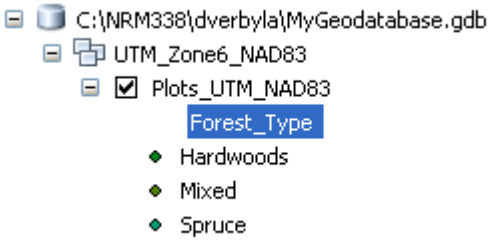
- create a geodatabase field with a range domain



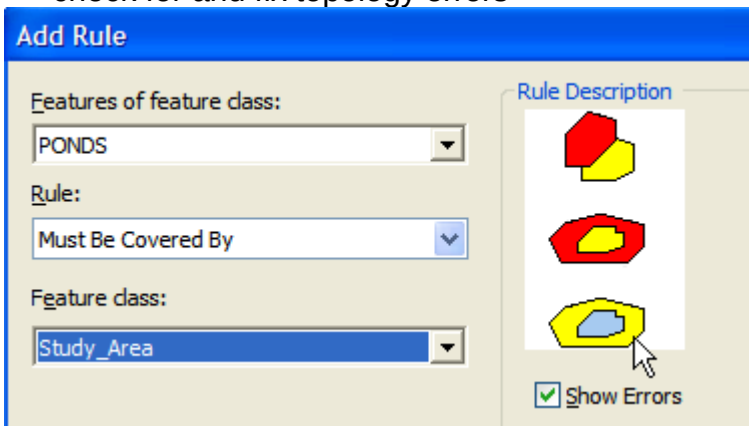
- use domains to check for attribute validation



- define feature class subtypes



- check for and fix topology errors

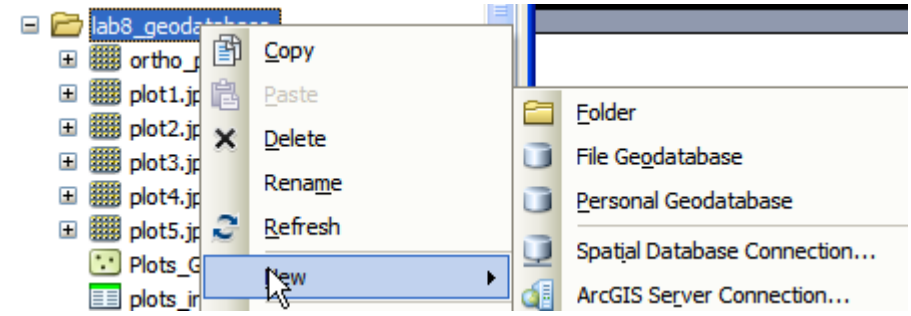


Geodatabases

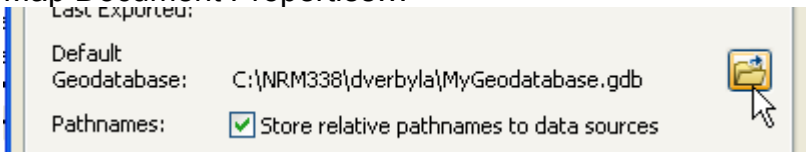
The geodatabase has many advantages over shapefiles. One is that tables can support raster fields. Another is that you can create domains to restrict integer values or check range of floating point or integer values in a table. Topology or spatial relationship rules among GIS layers can also be validated.

Step 1) Import shapefiles from last week's lab into a geodatabase.

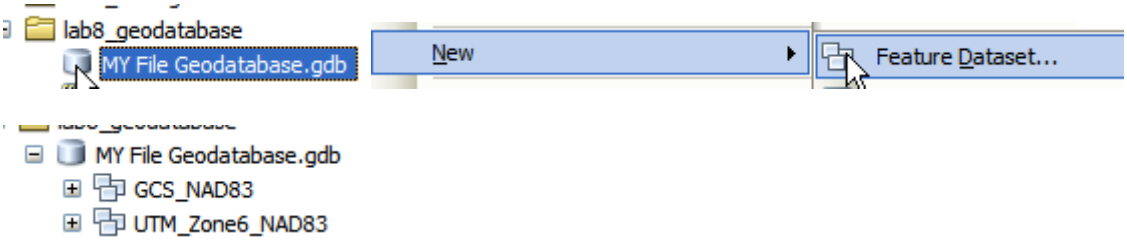
Use *your arcmap catalog window* to create a **new *File Geodatabase***:



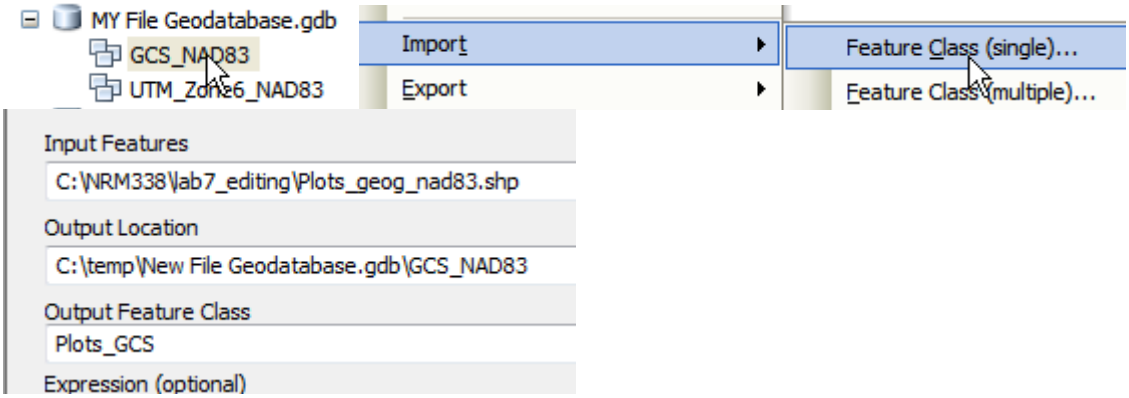
Then specify that this will be your default Arcmap geodatabase…File Menu… Map Document Properties…

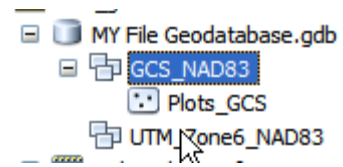


A feature dataset is a container for layers that have the same coordinate system. Create a feature dataset for ***GCS_NAD83*** data and another for ***UTM_Zone6_NAD83*** data inside your geodatabase:

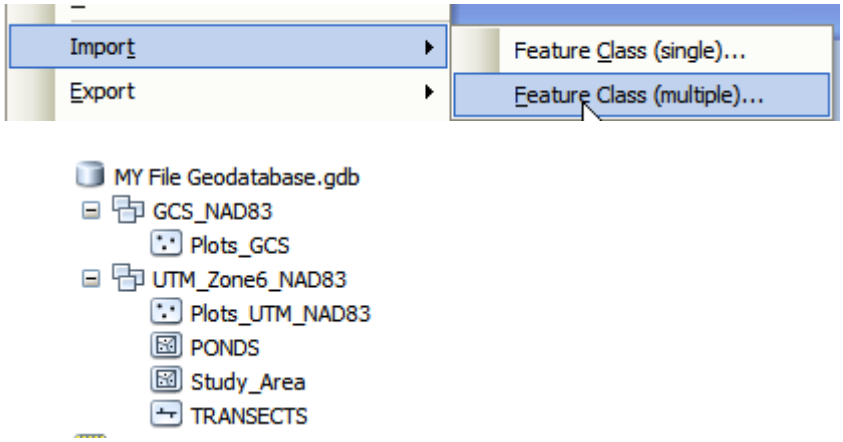


Then import your plots point shapefile into the GCS feature dataset:

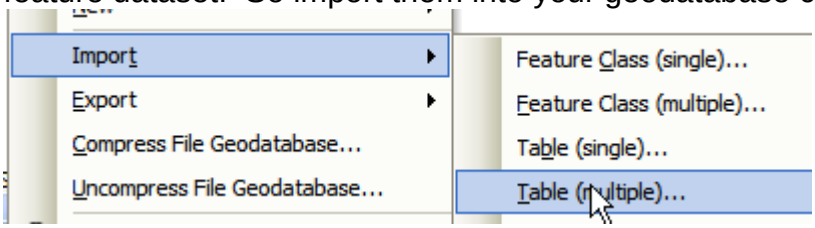


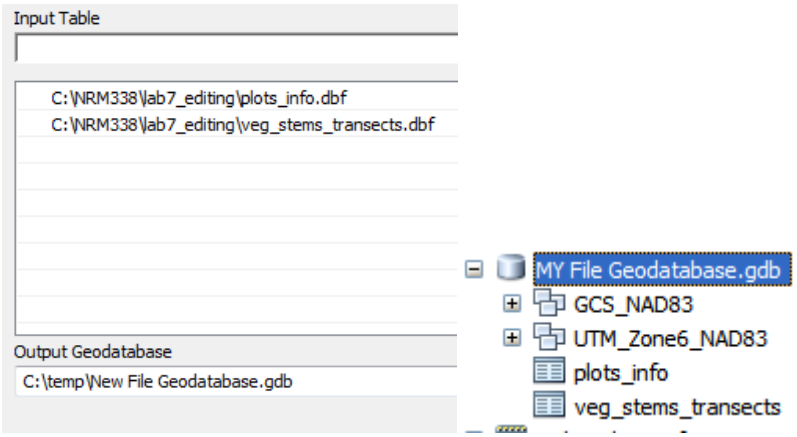


Then import the other layers that are in the UTM coordinate system into that feature dataset:

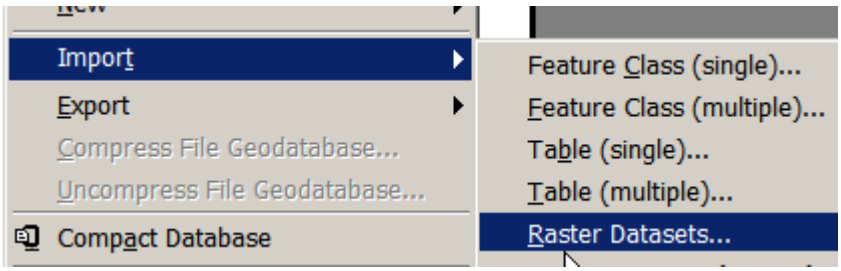


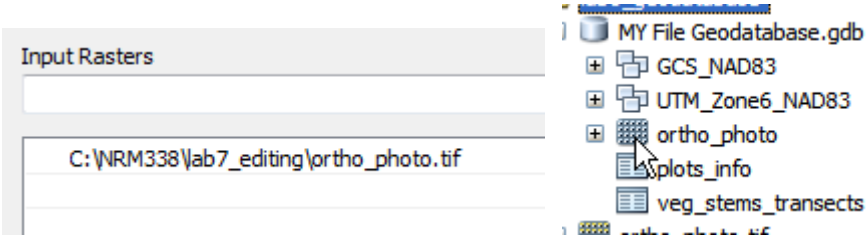
Since stand alone tables do not have a coordinate system, they cannot be imported into a feature dataset. So import them into your geodatabase container:



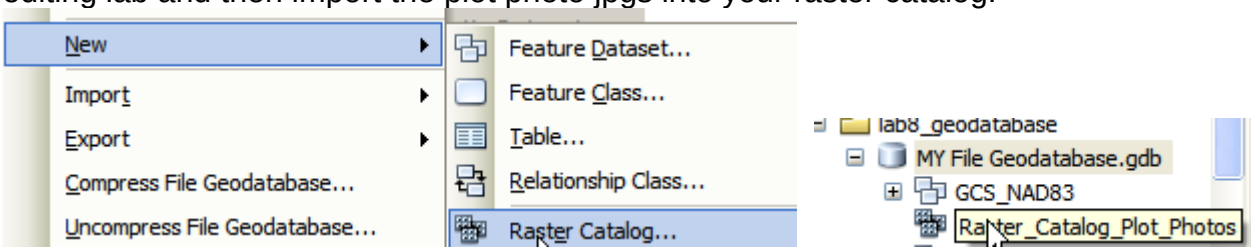


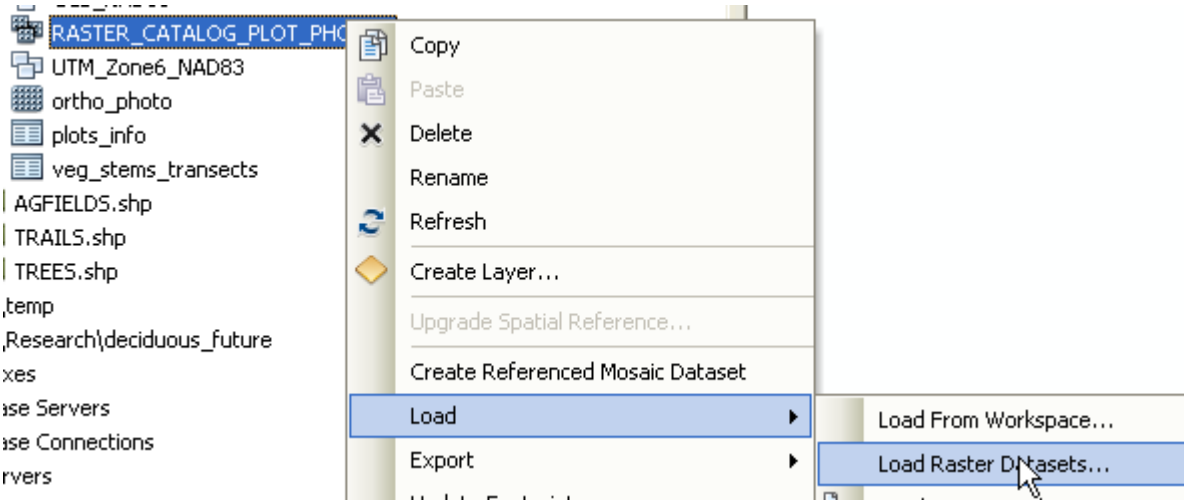
Since Rasters are not features, they cannot be stored in a Feature Dataset. So import your ortho photo into your geodatabase container as a Raster Dataset.

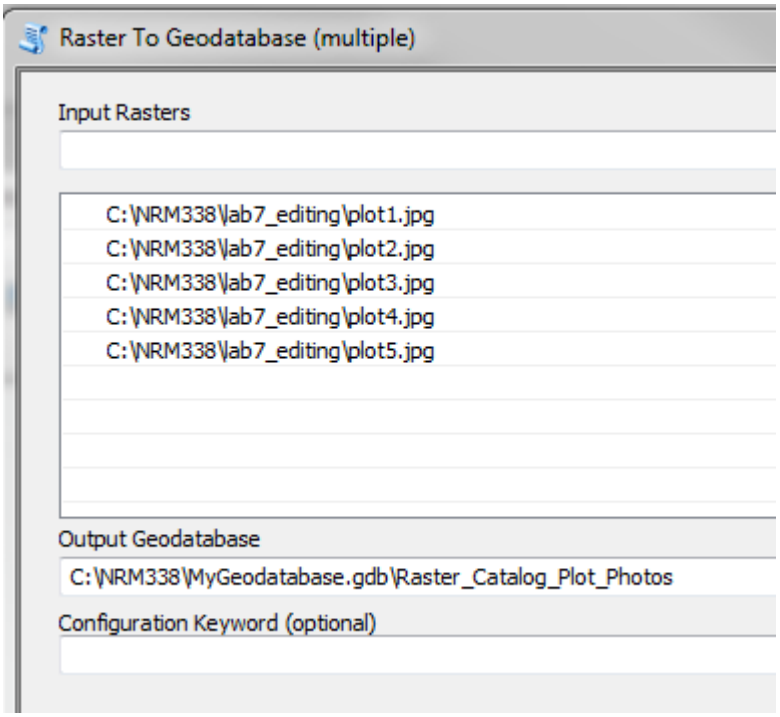




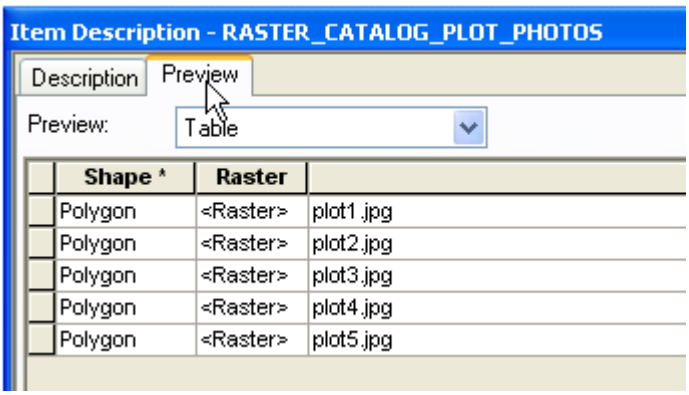
A raster catalog is a collection of raster datasets defined in a table format in which each record represents an individual raster dataset in the catalog. A raster catalog can be large and contain thousands of images. Create a raster catalog for your photos from last week's editing lab and then import the plot photo jpgs into your raster catalog.



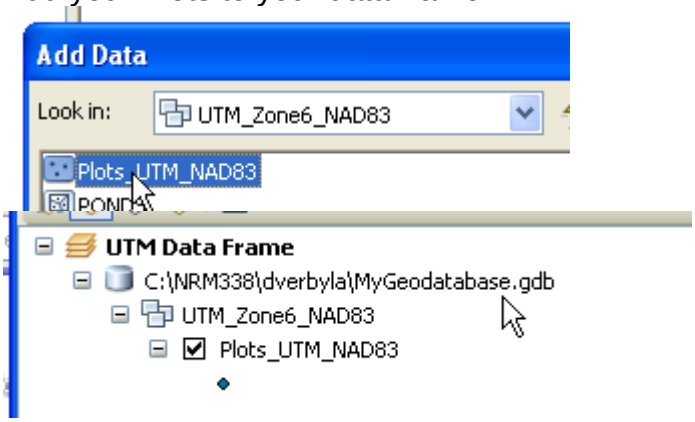




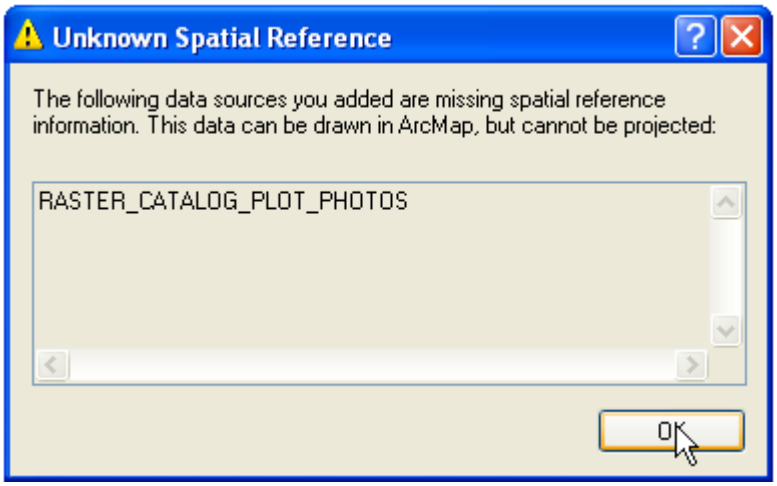
The Raster Catalog is a table where each photo is a row in the table.



Add your Plots to your data frame.



Then add your raster catalog of photos



and add a field named ***Plot_ID*** to the raster catalog table. Calculate the correct Plot_ID for each record.

Raster	Name	PLOT_ID
<Raster>	plot1.jpg	1
<Raster>	plot2.jpg	2
<Raster>	plot3.jpg	3
<Raster>	plot4.jpg	4
<Raster>	plot5.jpg	5

Then temporarily join your raster catalog table to your point attribute table using the ***Add Join*** tool. (The Join Field tool permanently joins tables, but does not join raster fields).
Note there is a key field in each table to use in your joining…

RASTER_CATALOG_PLOT_PHOTOS

Shape *	Raster	Name	PLOT_ID
Polygon	<Raster>	plot1.jpg	1
Polygon	<Raster>	plot2.jpg	2
Polygon	<Raster>	plot3.jpg	3
Polygon	<Raster>	plot4.jpg	4
Polygon	<Raster>	plot5.jpg	5

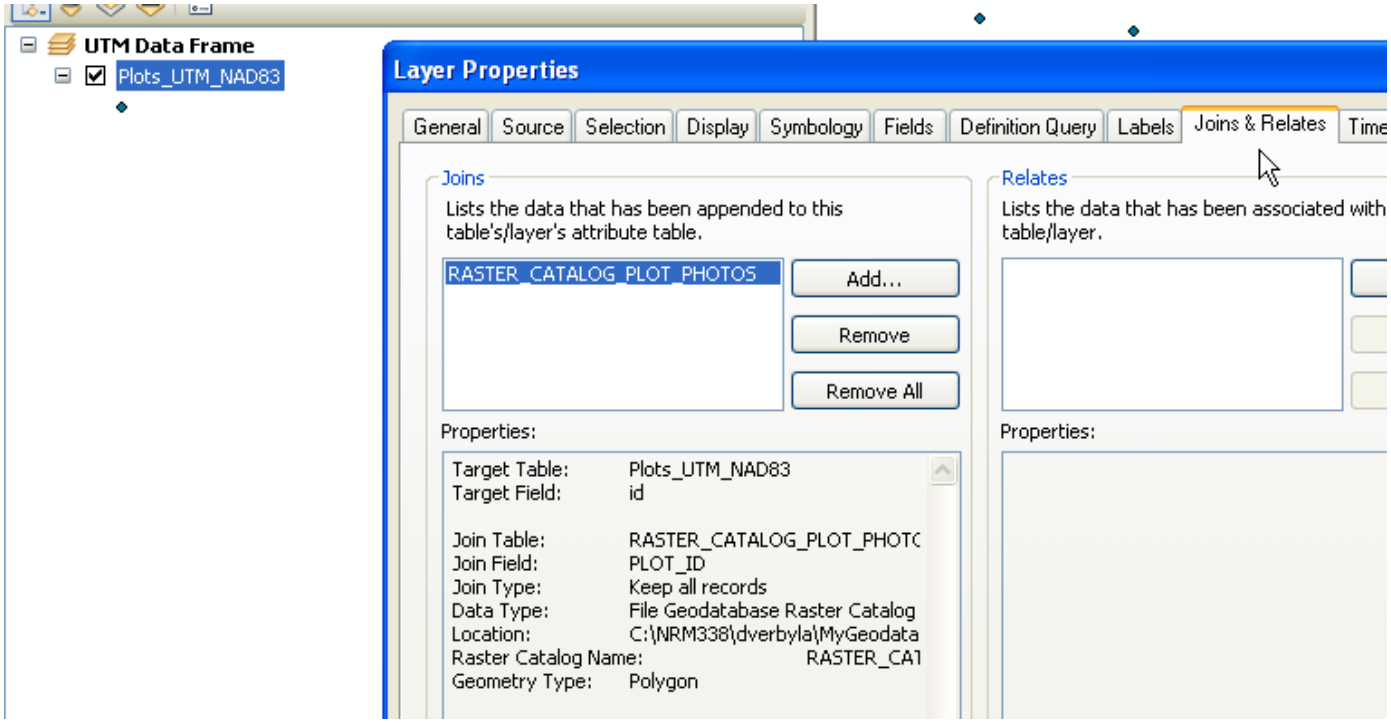
0 (0 out of 5 Selected)

RASTER_CATALOG_PLOT_PHOTOS

Plots_UTM_NAD83

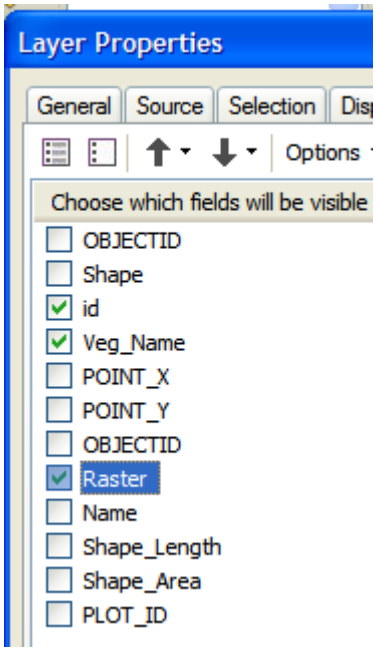
Shape *	id	Veg_Name	POINT_X	POINT_Y
Point	1	Quaking Aspen	438772.356676	7180087.79992
Point	2	Birch-White Spruce	438135.296519	7179020.14529
Point	3	Alder-Birch	437976.616906	7180356.94401
Point	4	Paper Birch	437824.737924	7180369.52535
Point	5	Black Spruce	439058.300174	7180218.34118

Look at your point layer properties…



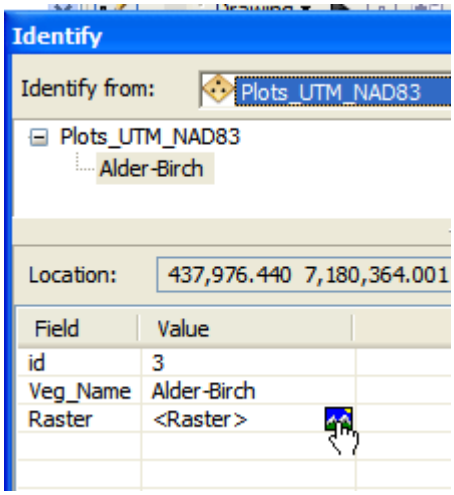
Temporary joins are listed in the layer properties Join and Relates tab

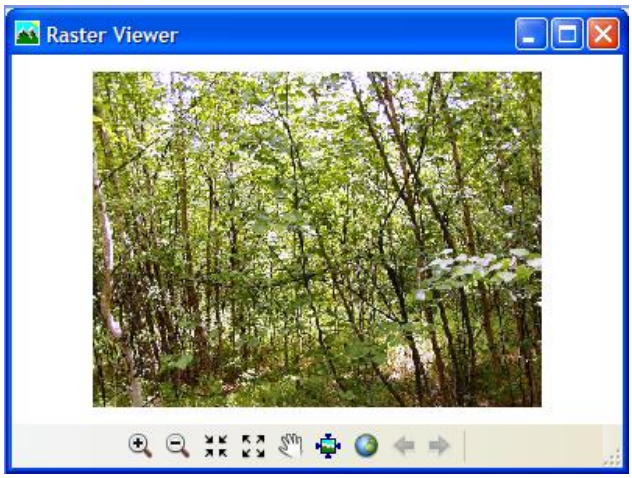
And the fields from the raster catalog are now available with your points.



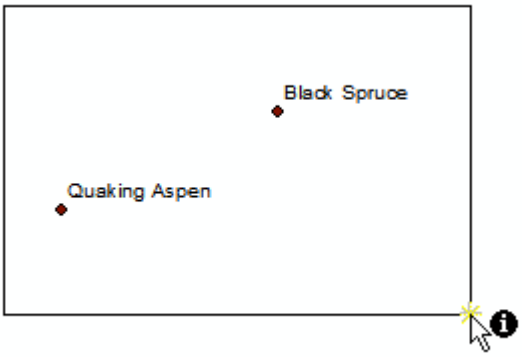
Use the identify tool 

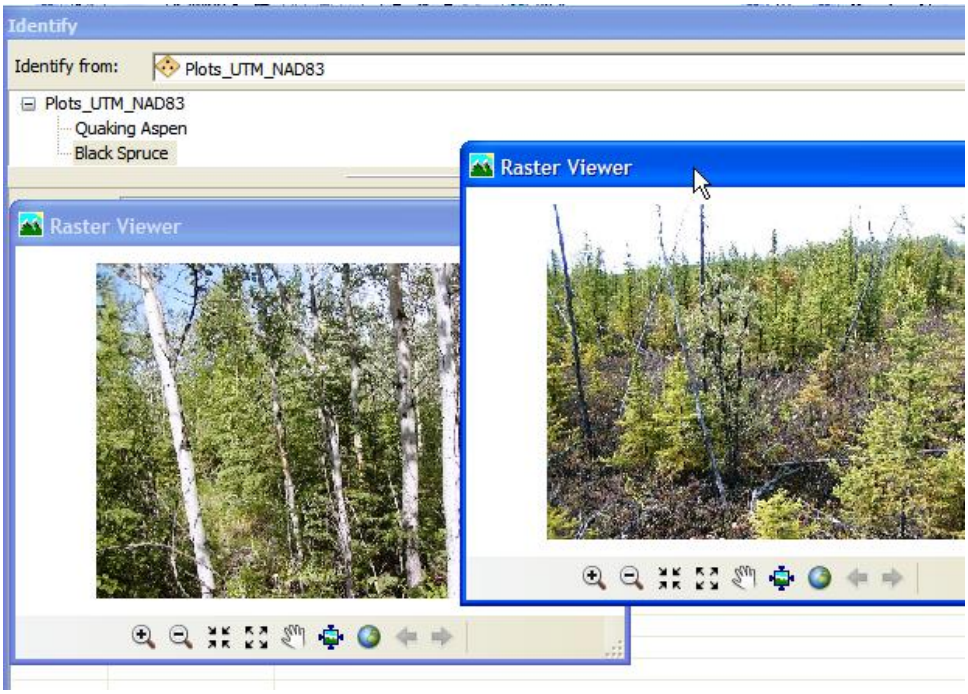
to display the fields from your point attribute table.





You can see more than one photo by using the identify tool to select more than one plot location:

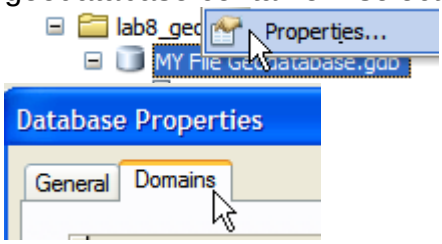

Black Spruce
Quaking Aspen


Identify
Identify from:
Plots_UTM_NAD83
Plots_UTM_NAD83
Quaking Aspen
Black Spruce
Raster Viewer
Raster Viewer

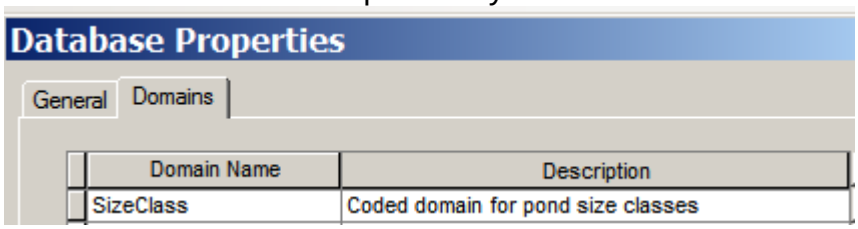
Attribute Domains

Another advantage of geodatabases is the ability to establish coded domains and range domains to minimize errors in attribute values. A coded domain restricts attribute values to a user-specified number of attributes and each attribute value has a label to display in the table. For example, we want ponds coded as 1=small, 2=medium, 3= large. the values of 0 or 4 would not be possible to have in the table.

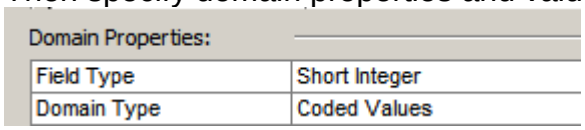
Step 1) Create a coded domain. Each ***domain is stored in the geodatabase*** and can be applied to many feature datasets. In your Catalog window, right mouse click on your file geodatabase container...*select properties*.

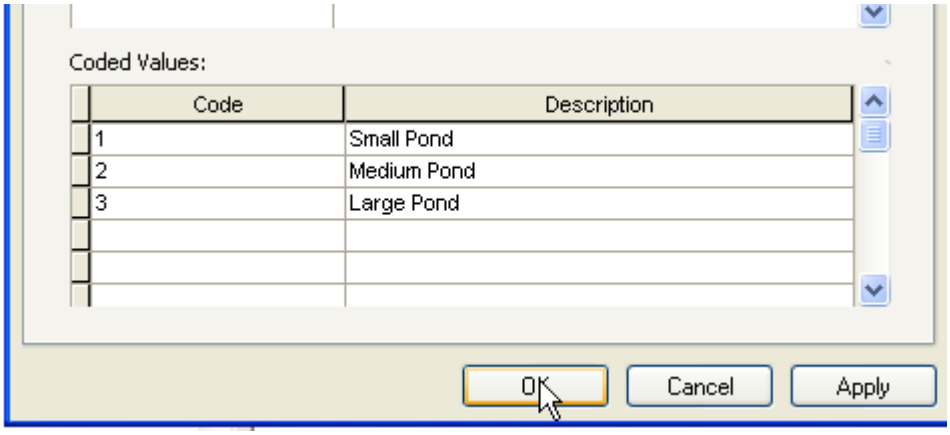


Enter a name and description for your domain:

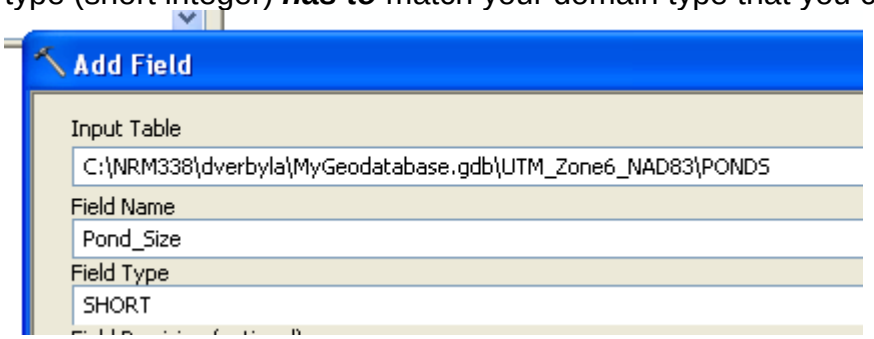


Then specify domain properties and values:

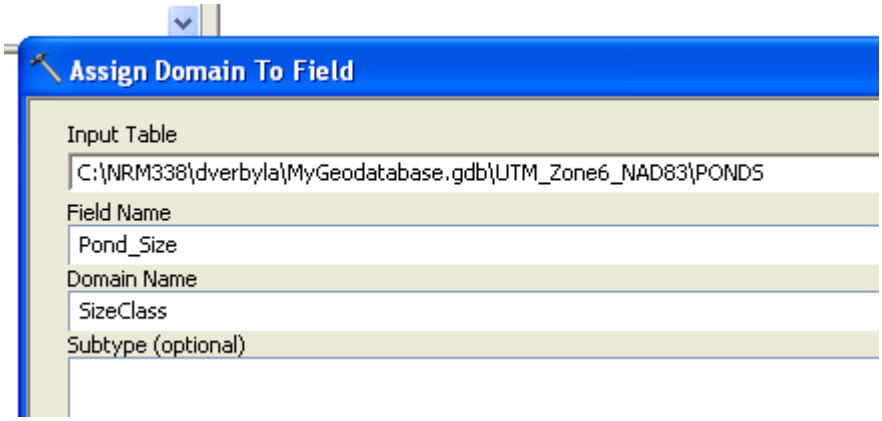




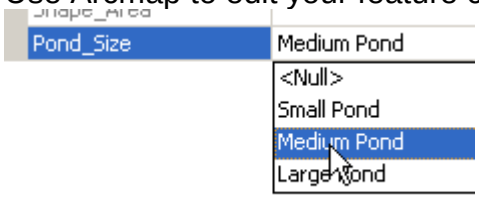
Step 2) Assign the domain to the table you want to edit. First use you the ***Add Field*** geoporcessing tool create a short integer field in your ponds feature class. Note that the field type (short integer) ***has to*** match your domain type that you created in your geodatabase!



Then use the Assign Domain to Field geoprocessing tool to assingn your geodatabase coded domain to your Pond_Size field.



Use Arcmap to edit your feature class and assign an arbitrary size class to each pond.



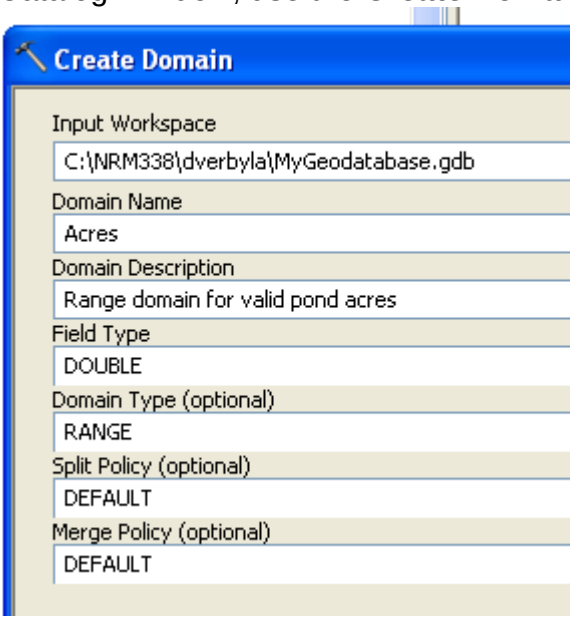
PONDS

Shape *	Id	Shape_Length	Shape_Area	Pond_Size
Polygon	1	135.153398	1219.44094	Small Pond
Polygon	2	148.411333	1455.508793	Small Pond
Polygon	3	350.144504	8256.538785	Medium Pond
Polygon	4	139.229204	717.790268	Small Pond
Polygon	5	321.033491	6159.334137	Medium Pond

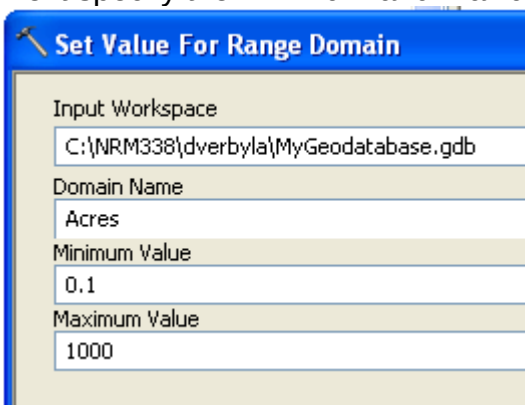
Range Domains

A range domain specifies a range of acceptable values and also specifies whether a missing value <null> is allowed. In this example, we will restrict the acceptable value for pond area in acres to range from 0.1 to 1000 acres.

Step 1) Create a Range Domain. Create another domain in your geodatabase container for Acres and specify the limit to be between 0.1 and 1000 acres. This time instead of using the Catalog Window, use the ***Create Domain*** geoprocessing tool…

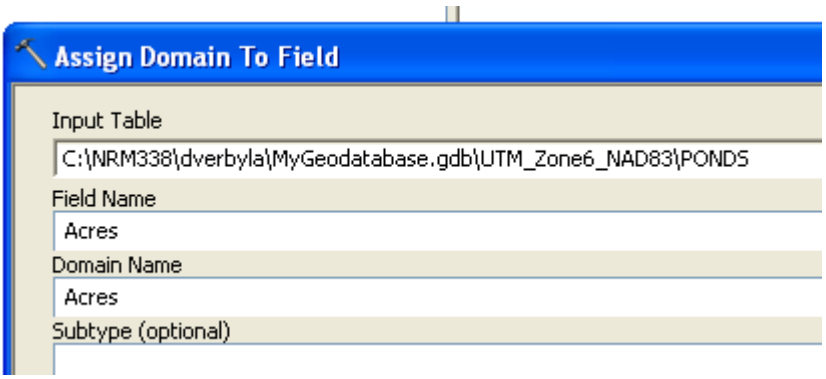


Next specify the minimum and maxiumum allowable values for your range domain:

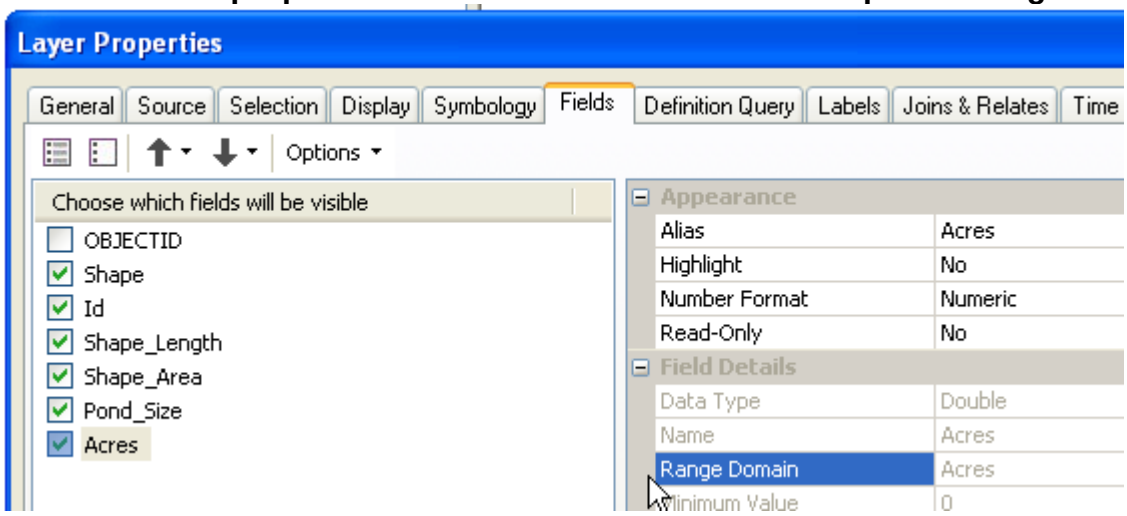


Step 2) Assign the Range Domain to a Field. Create a field named Acres in your Ponds feature class and assign your range domain to this field.

Size_Class	Acres
Small Pond	0.30132
Small Pond	0.35966
Medium Pond	2.04022
Small Pond	0.17736
Medium Pond	1.52199

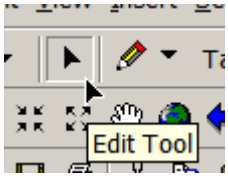


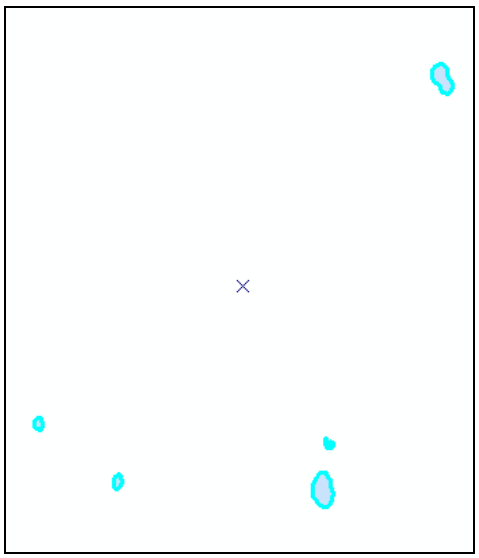
Check the field properties to see that this field has a companion range domain.



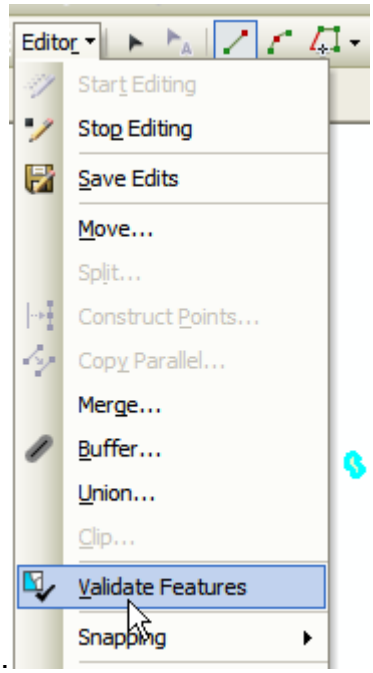
Step 4) Are all pond polygons are within their attribute domains.

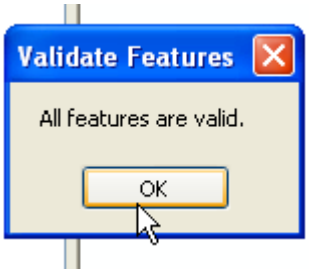
Start editing. Select all your ponds using your edit tool.





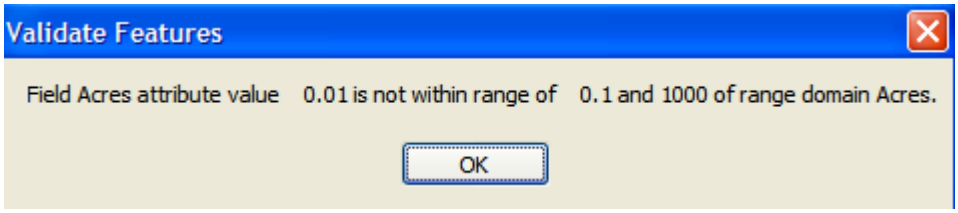
From the Editor menu….





Change a pond's acres to a value of 0.01 and then validate your features.

Size_Class	Small Pond
Acres	0.01

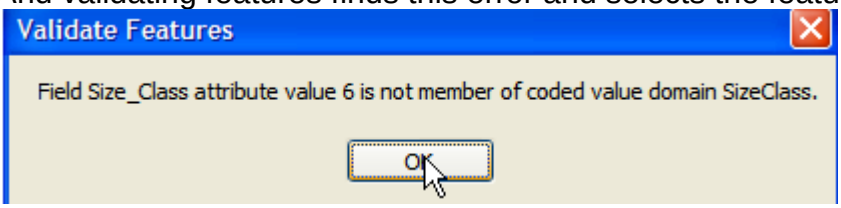


The feature with the error is selected automatically by the validation tool.

Select a record from your ponds attribute table and use the field calculator to give it a size class of 6. Notice that this is not in the coded domain.

Size_Class
Small Pond
Small Pond
6
Small Pond
Medium Pond

And validating features finds this error and selects the feature with an invalid size class code.



Feature Subtypes

Subtypes are features grouped based on a coded domain attribute value. For example, you might have hydrology subtypes 1=streams 2=rivers 3=ponds 4=lakes or a subclass named RoadClass as 1=local streets, 2=secondary streets 3=highways. Subtypes are used to assign different properties such as field default values, attribute domains, relationship rules to each different subtype. As an example, you will create a subtype representing *deciduous*, *coniferous*, and *mixed* forest stands for the plot locations. First, add a short integer field named ***Forest_Type*** to your Plots attribute table:

Plots_UTM_NAD83

Shape *	id	Veg_Name	Forest_Type
Point	1	Quaking Aspen	<Null>
Point	2	Birch-White Spruce	<Null>
Point	3	Alder-Birch	<Null>
Point	4	Paper Birch	<Null>
Point	5	Black Spruce	<Null>

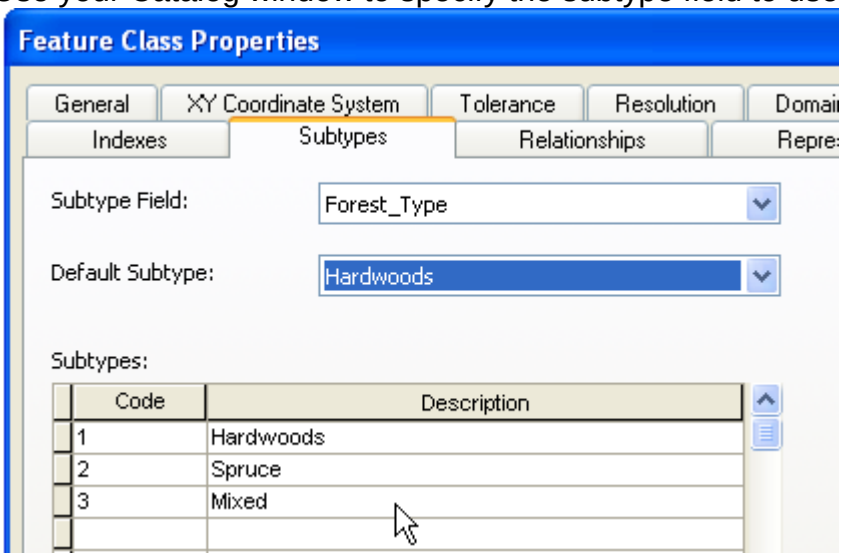
And create a coded domain and assign the forest type to your plots.

Coded Values:

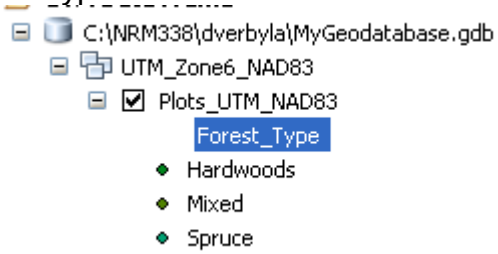
Code	
1	Deciduous
2	Coniferous
3	Mixed

id	Veg_Name	Forest_Type
1	Quaking Aspen	Deciduous
2	Birch-White Spruce	Mixed
3	Alder-Birch	Deciduous
4	Paper Birch	Deciduous
5	Black Spruce	Coniferous

Use your Catalog window to specify the subtype field to use with your plot points:



When you add the feature class to your arcmap data frame, points will be symbolized by subtype:



Each subtype can be assigned a different domain.
Next create a three coded domains in your geodatabase for the three forest types:

Deciduous	Coded domain for hardwoods
Coniferous	Coded domain for conifers
Mixed	Coded domain for mixed

Coded Values:

Code	
1	Aspen
2	Birch
3	Balsam Poplar

Coded Values:

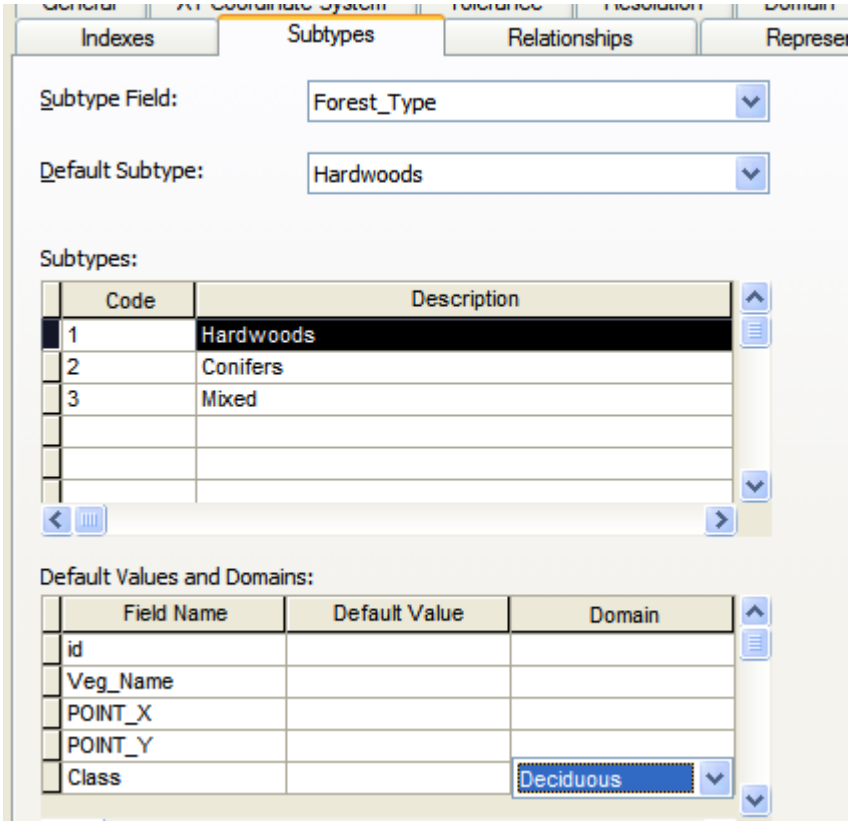
Code	Description
1	White Spruce
2	Black Spruce
3	Lodgepole Pine Plantation

Coded Values:

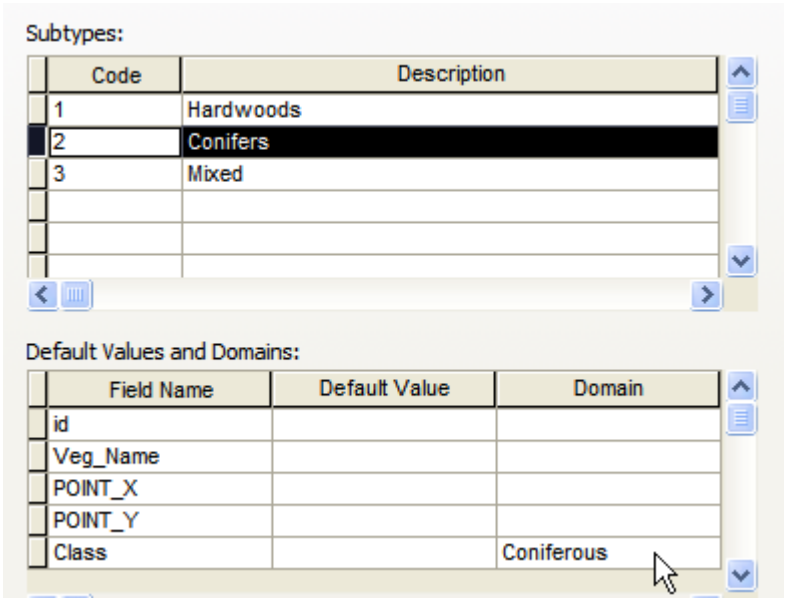
Code	Description
1	Aspen-White Spruce
2	Birch-Black Spruce
3	Aspen-Birch-White Spruce

Add a short integer field named Class to your Plots attribute table.

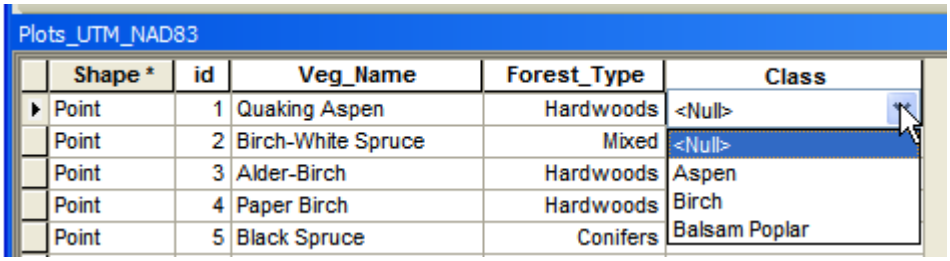
Next use the Catalog Window apply the appropriate coded domain to your subtype field in your Plots attribute table:

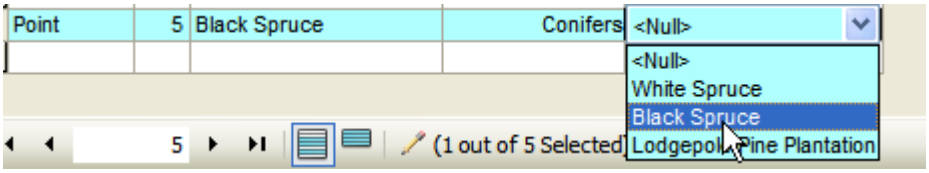


If the subtype is Hardwoods, use the Deciduous coded domain for the class field.
If the subtype is Conifers, use the Coniferous coded domain for the class field.
If the subtype is Mixed, use the Mixed coded domain for the class field.



Then use Arcmap to assign the correct Class values for each plot:





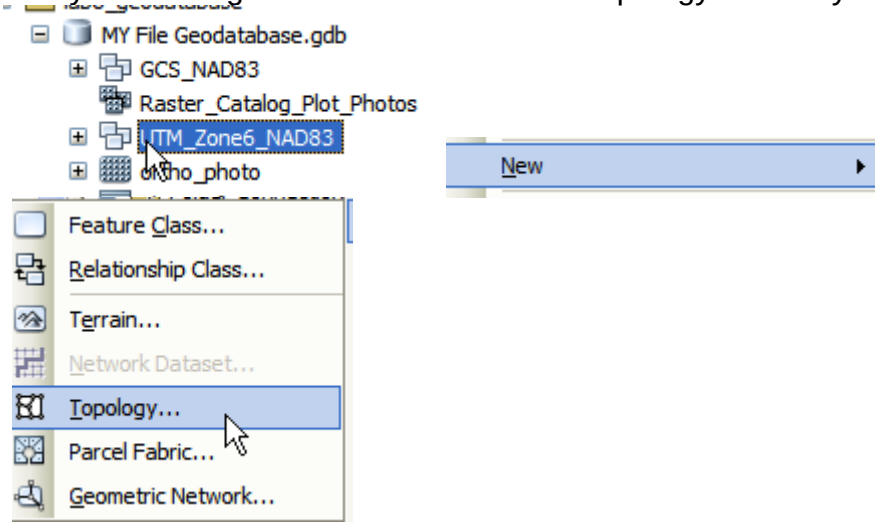
Topology Rules

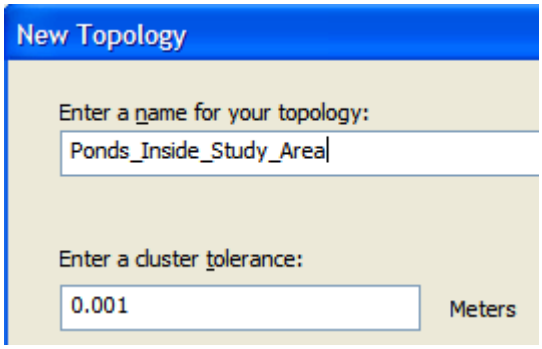
Topology rules are spatial rules about relationships among features and feature classes. For example, soil polygons must not overlap, shorelines and ponds must share boundaries, county polygons must be covered by state polygons, fish locations must be on stream lines, moose home range polygons must not be inside lake polygons, etc. Since topology can involve more than one GIS layer (feature class), it is ***stored at the Feature Dataset level*** in your geodatabase.

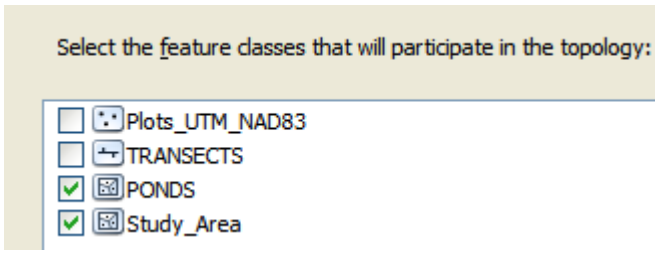
In this lab, you will create two topology rules:

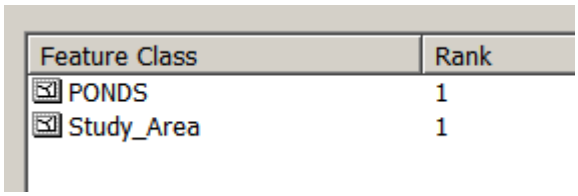
1) Pond polygons must be completely inside the study area polygon
2) All plot locations must be on it's transect line.

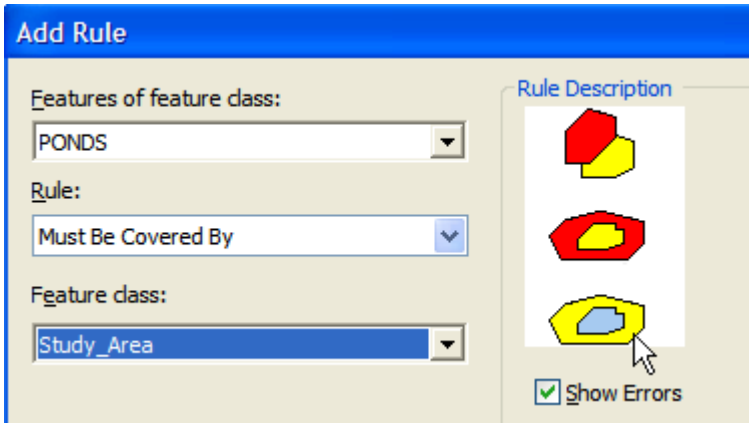
Use your catalog window to create these topology rules in your UTM feature dataset:

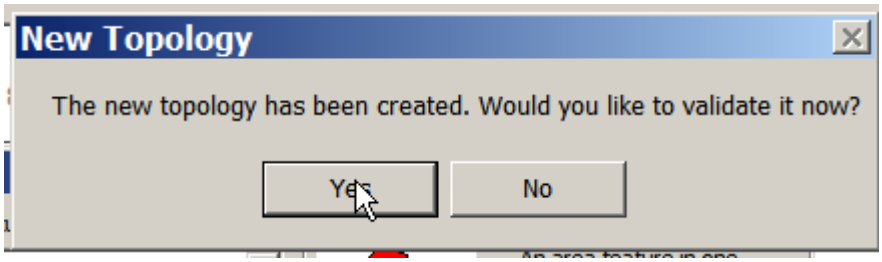






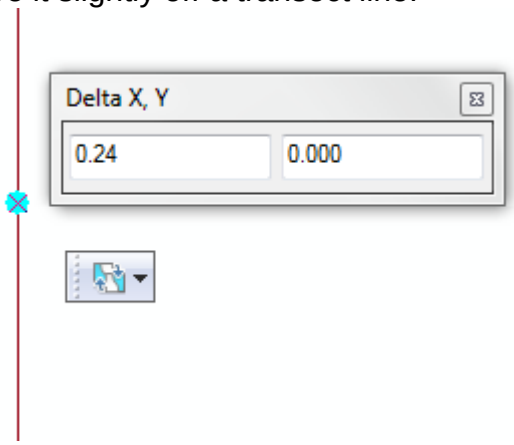




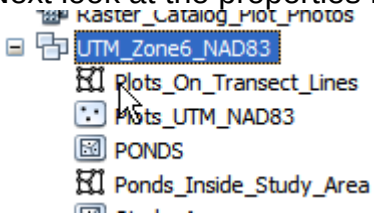


And the topology rule is validated for the two GIS layers.

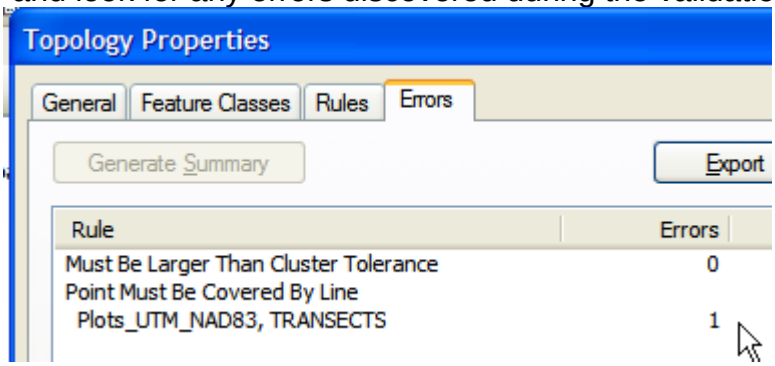
Repeat the process with a rule that plots must be on transect lines…but first edit a point and move it slightly off a transect line:



Next look at the properties for each topology rule:

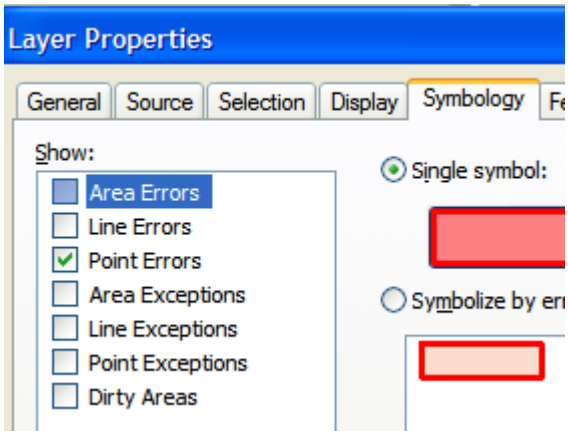


and look for any errors discovered during the validation process

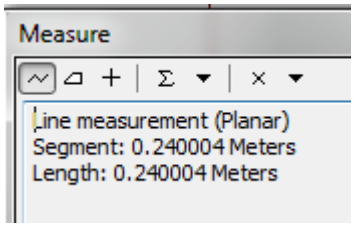


Add this topology rule in Arcmap to see where the error is:

Modify the symbology for your topology rule, showing only point errors:

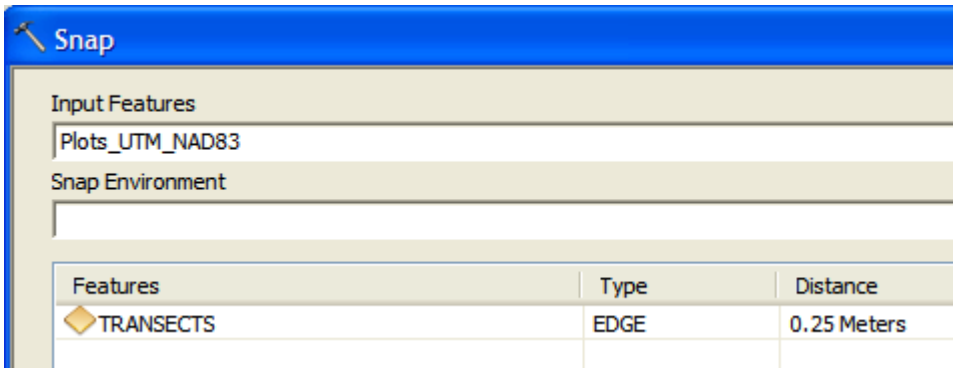


Use the measure tool to determine distance…

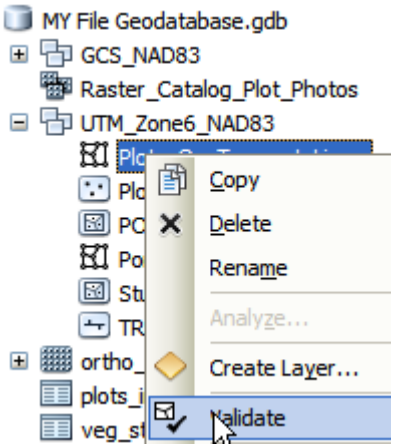


Notice the plot location is off by about 24 cm.

Fix this by snapping the plot locations to transect lines if they are within 25 cm of a line. Use the geoprocessing tool Snap to do this..

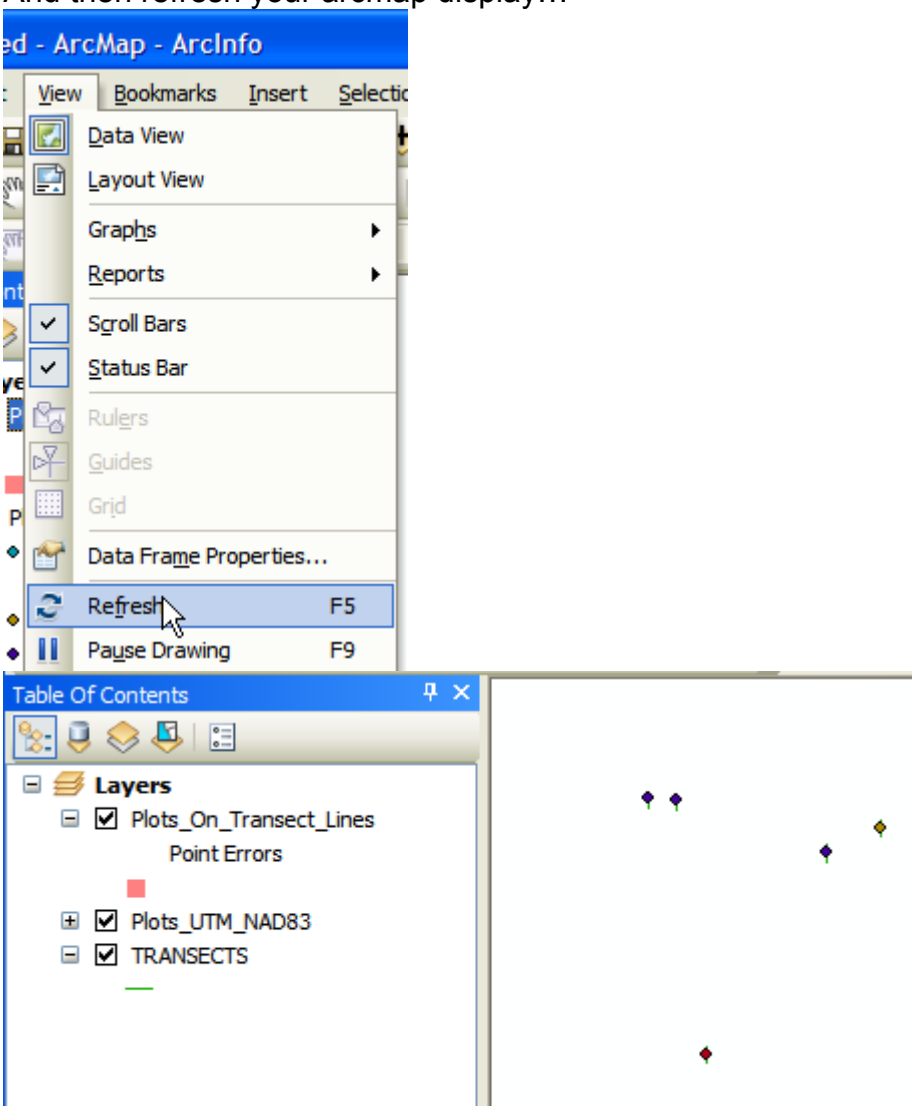


Notice that although the error has been fixed, the topology rule is displaying the results from a prior validation.

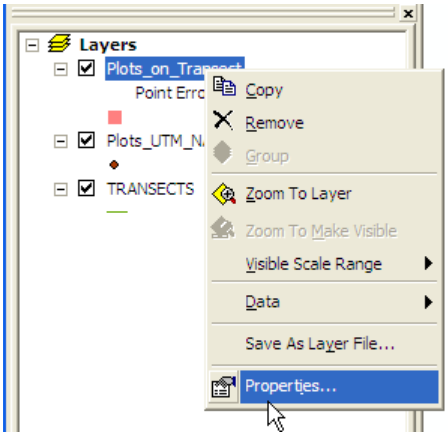


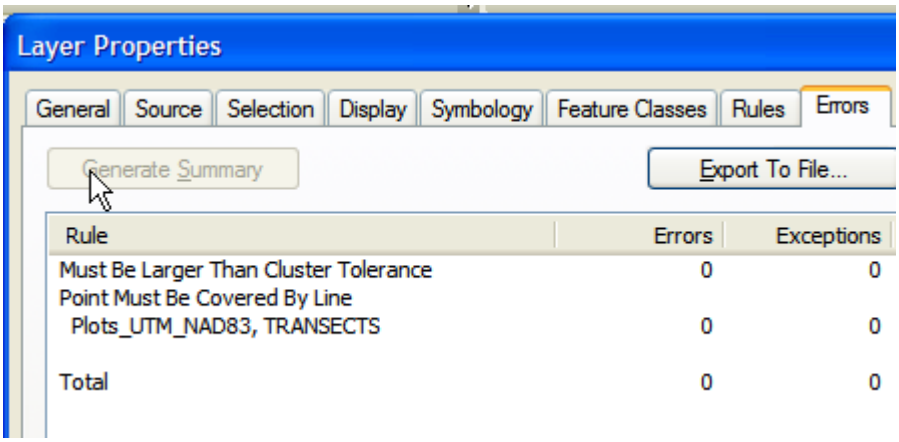
In you catalog window, validate your topology rule.

And then refresh your arcmap display…



Notice that no point errors are displayed, and you can generate a summary validation report under the layer properties for your topology rule layer…


Layers
Plots_on_Transect
Point Errc
Plots_UTM_N
TRANSECTS
Copy
Remove
Group
Zoom To Layer
Zoom To Make Visible
Visible Scale Range
Data
Save As Layer File...
Properties...


Layer Properties
General
Source
Selection
Display
Symbology
Feature Classes
Rules
Errors
Generate Summary
Export To File...
Rule
Errors
Exceptions
Must Be Larger Than Cluster Tolerance
0
0
Point Must Be Covered By Line
Plots_UTM_NAD83, TRANSECTS
0
0
Total
0
0