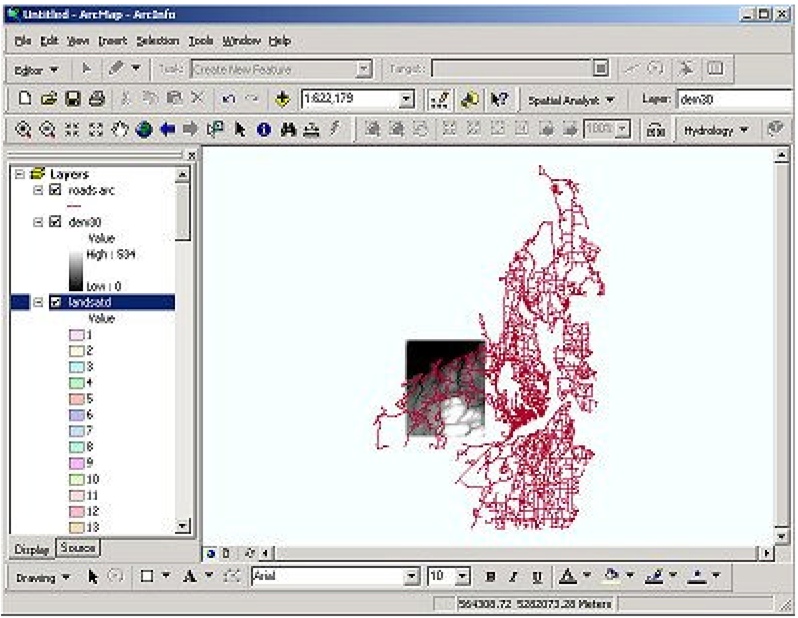
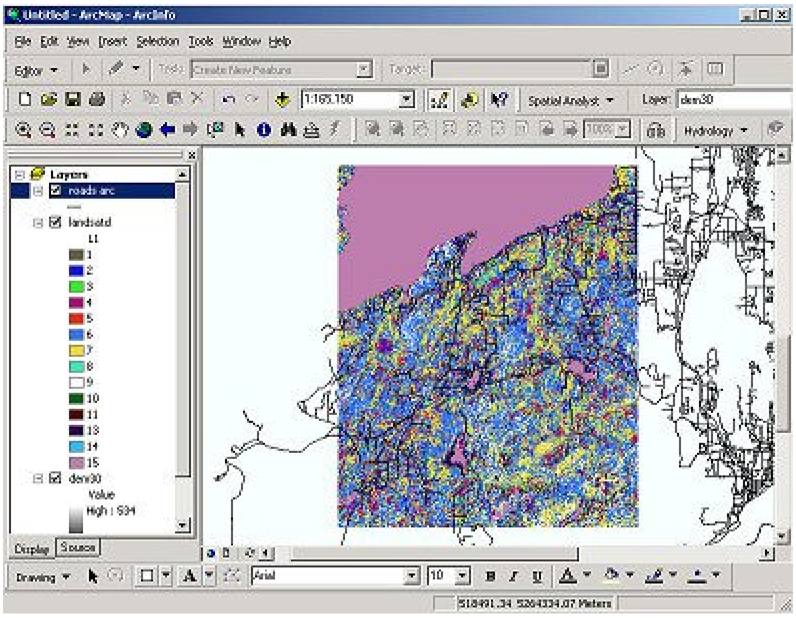
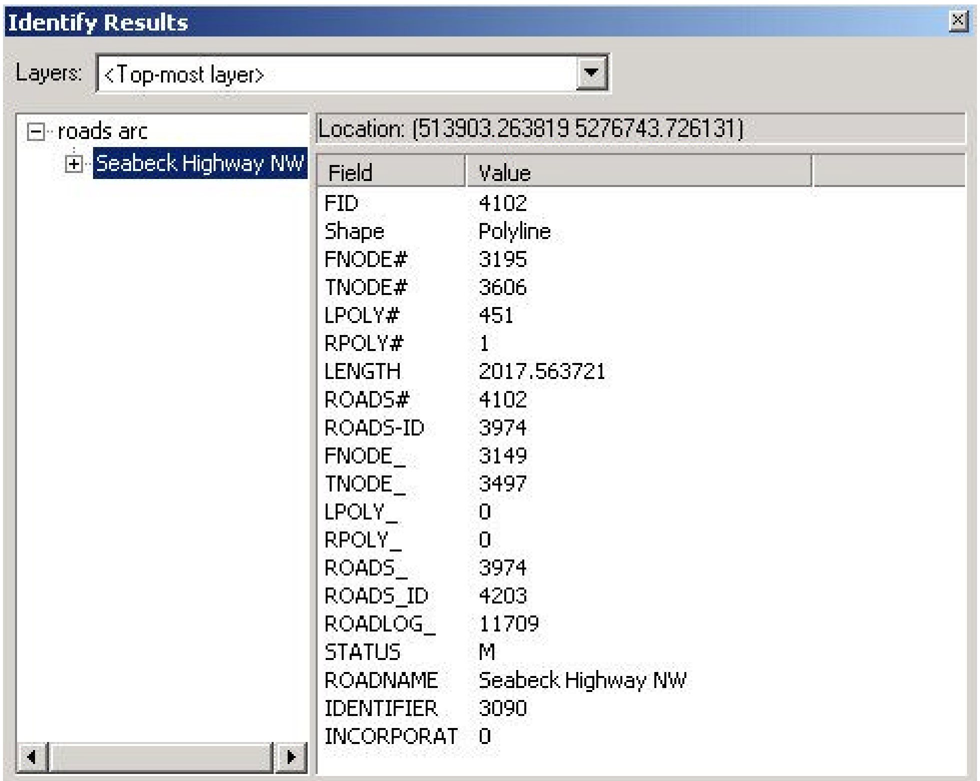
1. In this exercise we'll look at two common tasks: Selecting spatial objects and /or "zones" and recording some descriptive or summary statistics about that selection. Open an ArcMAP document and load the ROADS ARC (the roads as arc or line feature type), DEM30, and the raster grid landsatcl (general landcover classified from landsat image data).



2. Zoom to the spatial extent of the DEM30 data and select a continous Stretched color ramp for that dataset, then change the value field to display for the landsatcl dataset to "L1" and select a color scheme. Draw the landsatcl on top of the DEM30



3. Let's work with the ROADS ARC first (i.e. turn off the landsatcl and DEM themes). In an earlier exercise we illustrated that you can select features using the SELECTION > Select by Attribute, or Select by location options. These two methods built queries of the data using a dialog box. First let's look at what we know about ROADS ARC. Use the IDENTIFY  button to select a single road and look at the available attributes.



Identify Results

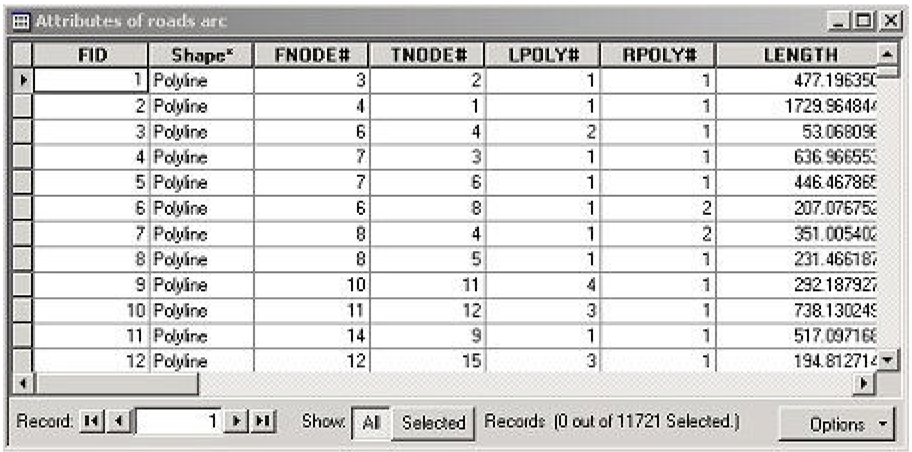
Layers: <Top-most layer>

roads arc
Seabeck Highway NW

Location: (513903.263819 5276743.726131)

Field	Value
FID	4102
Shape	Polyline
FNODE#	3195
TNODE#	3606
LPOLY#	451
RPOLY#	1
LENGTH	2017.563721
ROADS#	4102
ROADS-ID	3974
FNODE_	3149
TNODE_	3497
LPOLY_	0
RPOLY_	0
ROADS_	3974
ROADS_ID	4203
ROADLOG_	11709
STATUS	M
ROADNAME	Seabeck Highway NW
IDENTIFIER	3090
INCORPORAT	0

4. We could also RIGHT CLICK on the ROADS ARC theme name on the left-hand side and select the OPEN ATTRIBUTE TABLE.

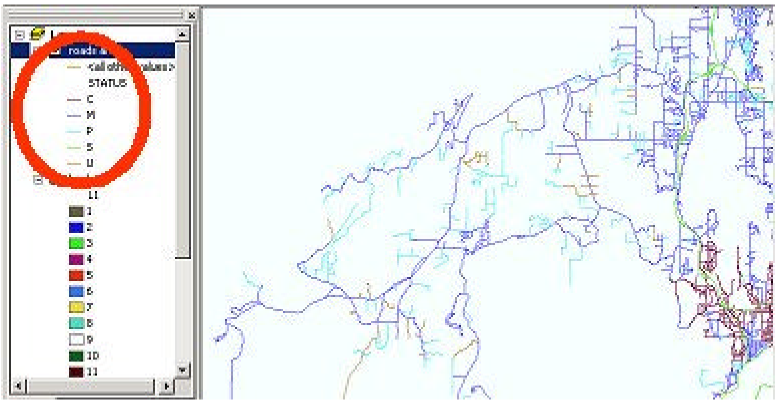


Attributes of roads arc

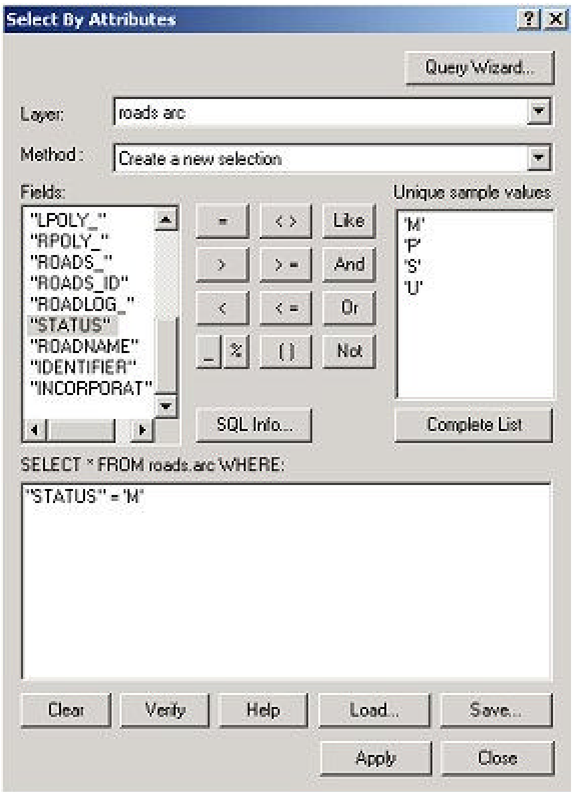
FID	Shape*	FNODE#	TNODE#	LPOLY#	RPOLY#	LENGTH
1	Polyline	3	2	1	1	477.19635
2	Polyline	4	1	1	1	1729.96484
3	Polyline	6	4	2	1	53.06809
4	Polyline	7	3	1	1	636.96655
5	Polyline	7	6	1	1	446.46786
6	Polyline	6	8	1	2	207.07675
7	Polyline	8	4	1	2	351.00540
8	Polyline	8	5	1	1	231.46618
9	Polyline	10	11	4	1	292.18792
10	Polyline	11	12	3	1	738.13024
11	Polyline	14	9	1	1	517.09716
12	Polyline	12	15	3	1	194.81271

Record: 1 Show: All Selected Records (0 out of 11721 Selected.) Options

5. Note that one of the attributes is STATUS. Use a unique symbology for the attribute Status.

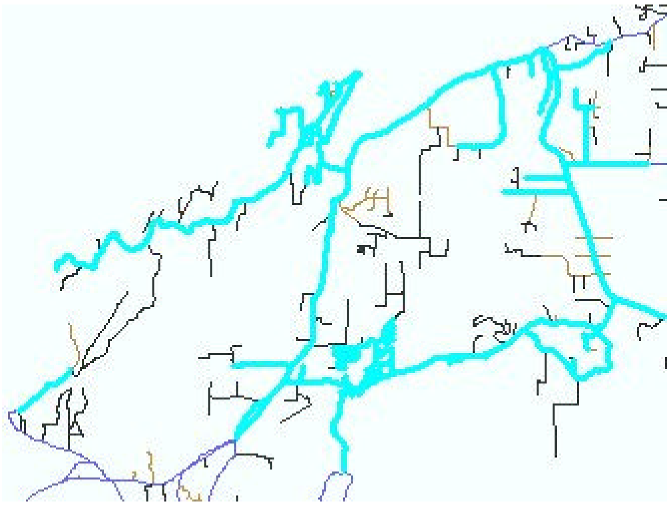


6. Use the SELECTION > Select by Attribute dialog and make a select set of roads that have a STATUS value equal to "M".



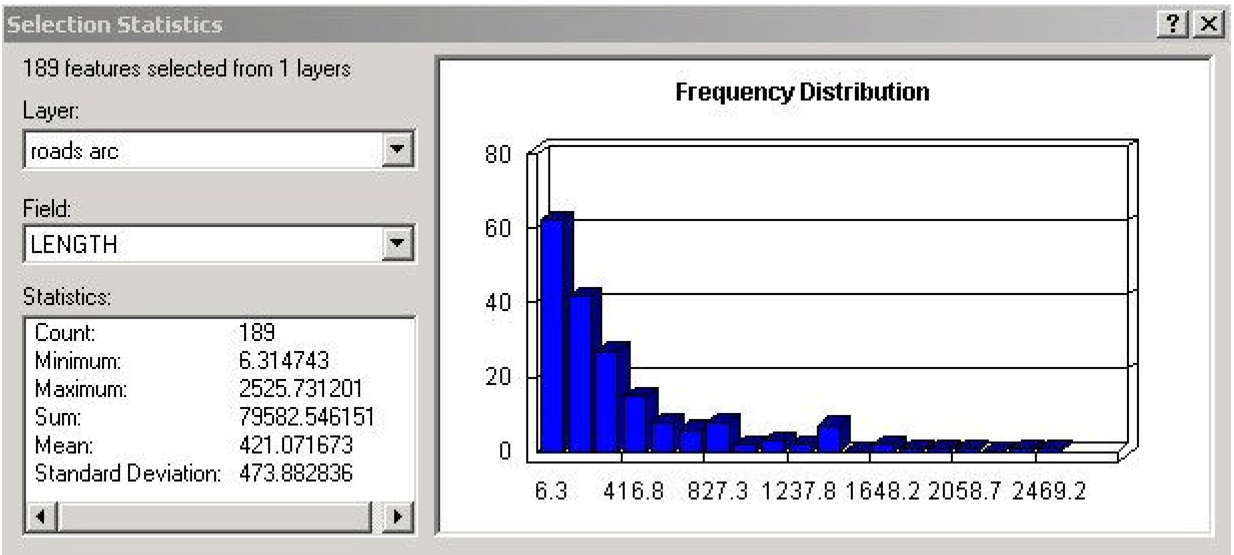
7. Now "set" the SELECTION > Interactive Selection method > Select from current selection.

Your selection tool  is now set to "reduce the select set" to only those objects that you "point to" (ie. not the universe of roads, but only those that are in the current selection). Using the selection tool, Drag a box over a small area of the screen (like the Big Beef Creek area. This step should remind you of the lecture concerning - add select, un-select, reduce-select, and null-select. Now your select set are those in your small area that have the "M" Status value. Can you do this in the reverse order?

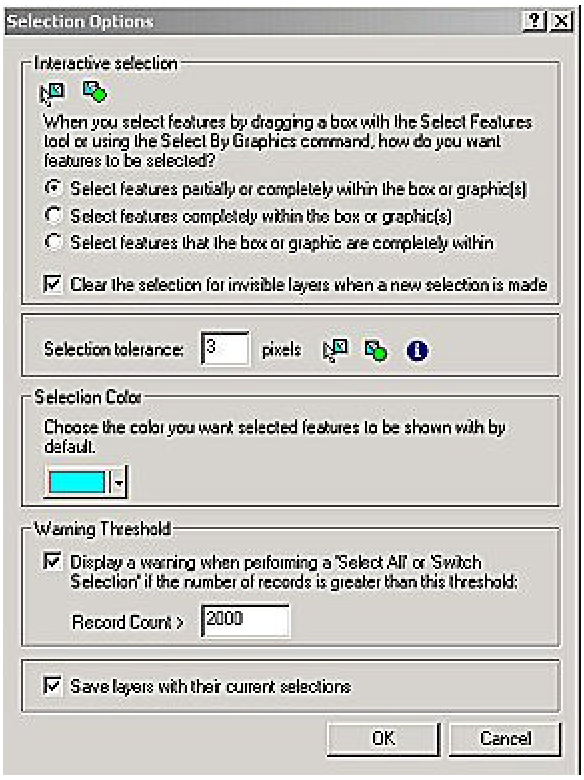


8. Now use the SELECTION > STATISTICS function 

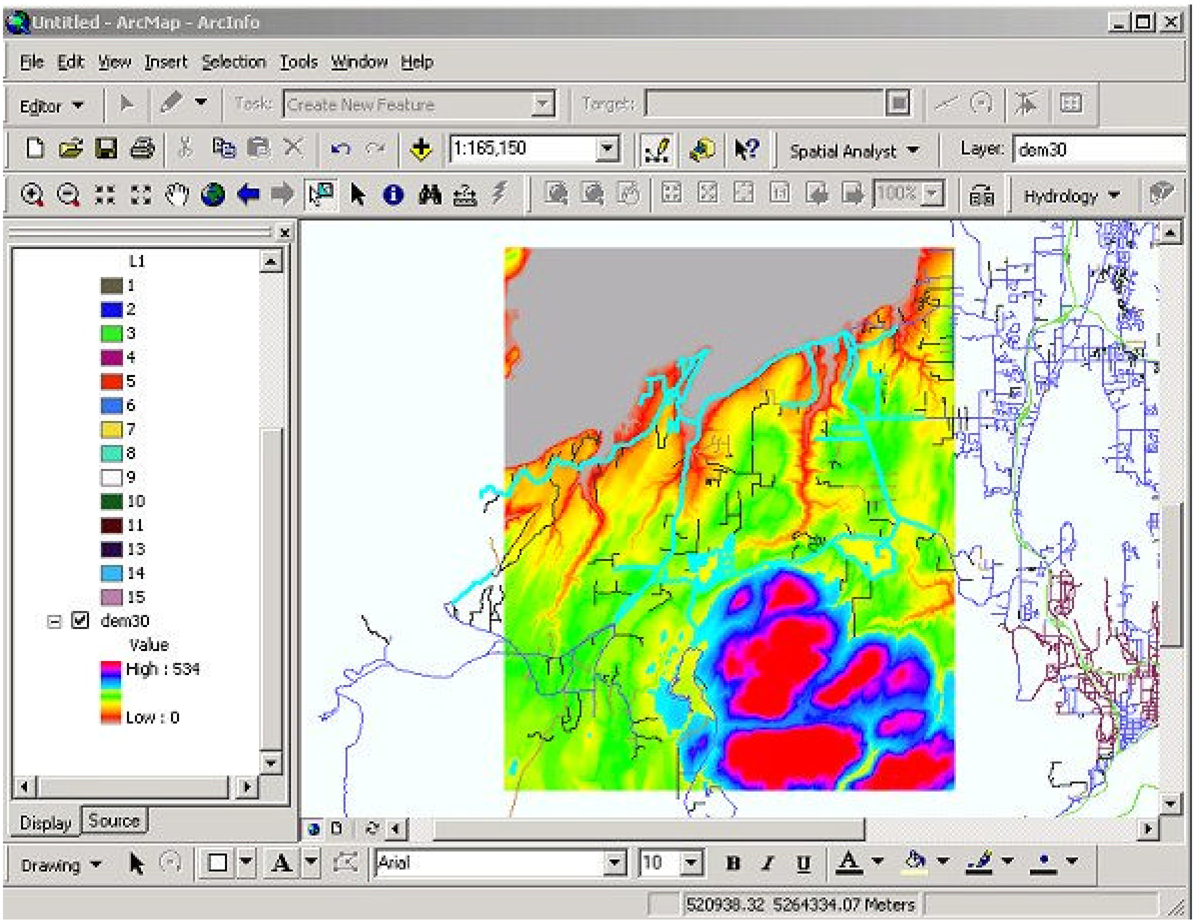
Set this tool dialog to use the layer ROADS ARC, the Field LENGTH.



9. The SELECTION > OPTION dialog allows you to set many of the methods which will help you make the type of selection you'll want for other applications. Take a moment to think through your options.

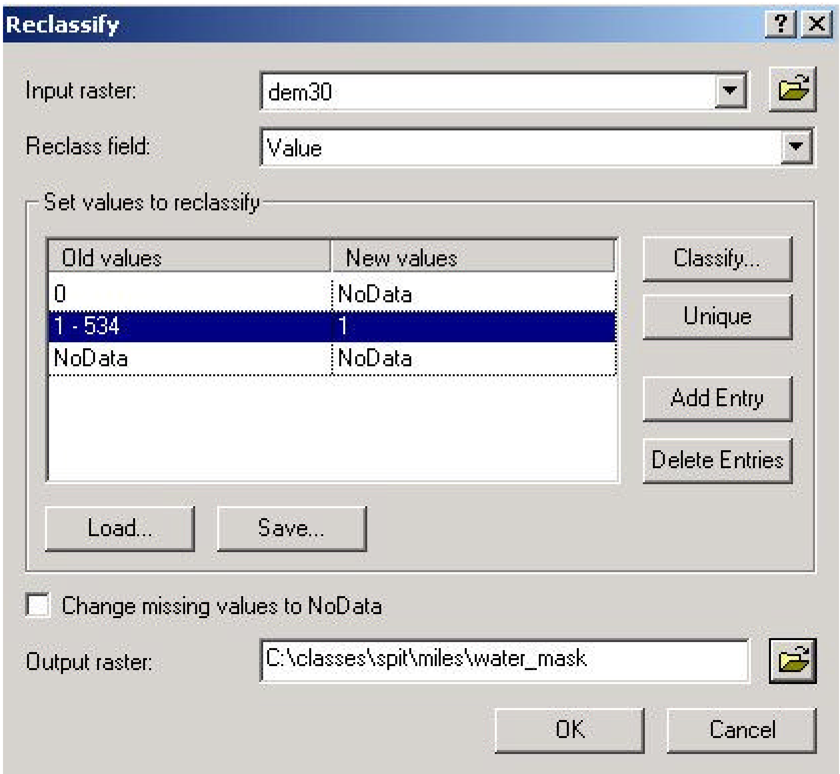


9. Here is what I did over BIG BEEF CREEK. Reproduce something close to this: Roads where Status = "M" within the spatial extent of the Big Beef Creek DEM30 dataset.

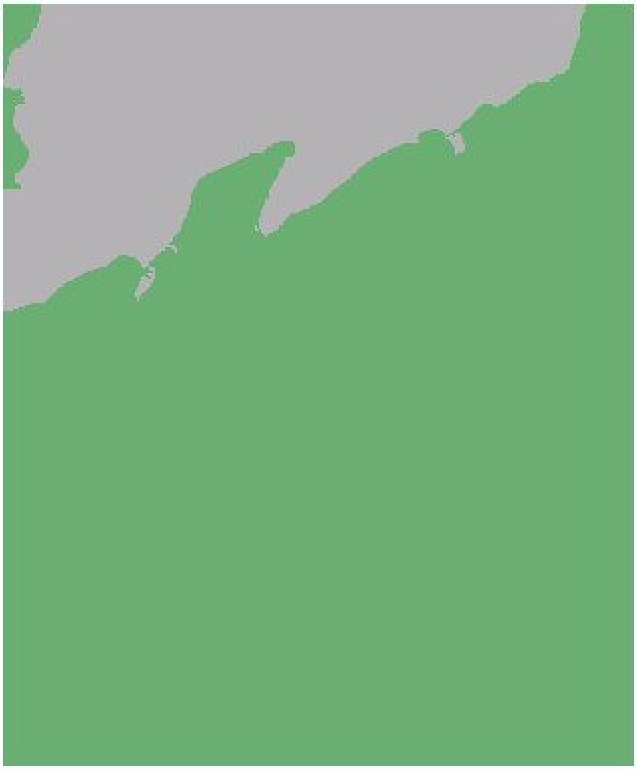


1. The select set will remain "in affect" even if the theme is not displayed. Turn-off the ROADS ARC.

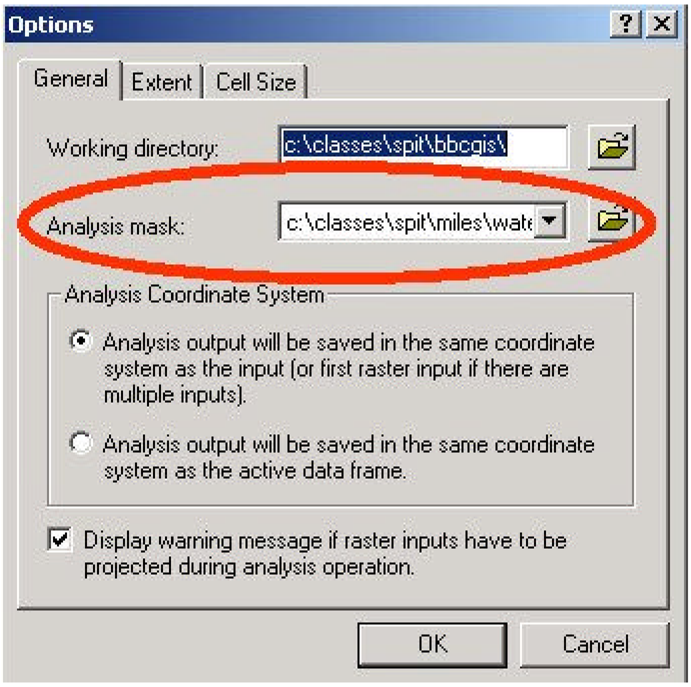
2. We'll go about the next task using an "Anaylsis MASK" on a raster grid. First let's make the MASK. We want to make a raster grid that has positive values in the locations where we want the future analysis to take place and "NoData" (not zero) in the "masked out" location. Use the SPATIAL ANALYST > RECLASSIFY option. Edit the value "old" and "New" values to make "0" reclass to a value of "NoData", 1 - 534 to "1", and all other nodata go to nodata. Send the output to a workspace you'll remember and name it water_mask.



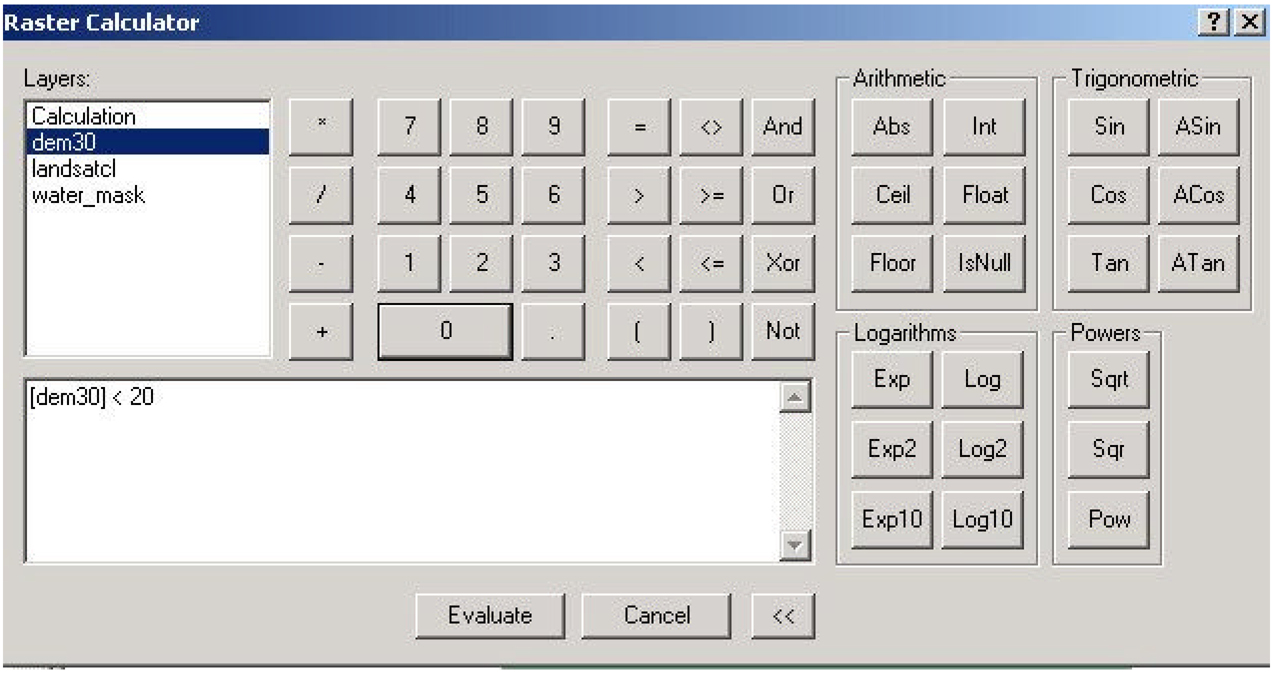
2. The resulting MASK will look like this.



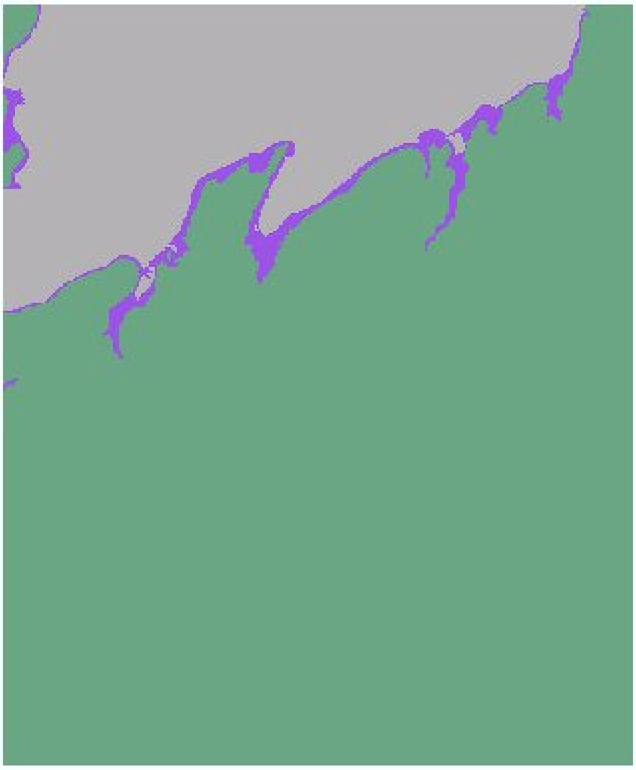
4. Now use the SPATIAL ANALYST > OPTIONS selection and the GENERAL tab to set the ANALYSIS MASK to the new water_mask



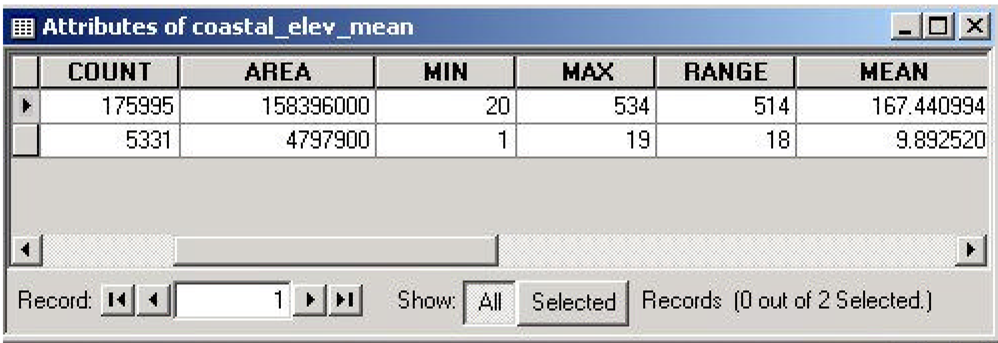
3. Use the SPATIAL ANALYST > RASTER CALCULATOR option from the "Spatial Analyst toolbar" and make a raster calcuation for when the DEM30 < 20 equation test true.



4. If the MASK worked we should have a zone of grid cells which in the DEM30 dataset had cell values less than 20, but because the analysis environment had a MASK set - which allowed the raster calculations (or any other raster analysis function) to operate only on those cells with positive values in the MASK grid (and in our case that ment only cells with an evaltion of 1m or greater - the raster calcuation expression tested true for cells greater then or equal to 1m and less then 20m. Clearly there was an easier way to do this. But didn't we learn a lot?

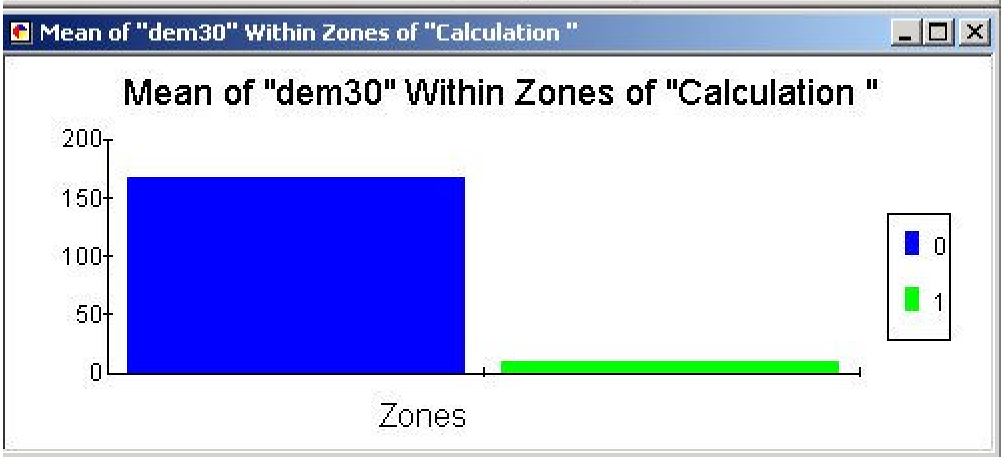


5. Now let's findout what the MEAN elevation is in the coastal zone we've just defined. Use the SPATIAL ANALYST > ZONAL STATISTICS option to open the Zonal Statistics dialog. Zone dateset will be new grid we calculated (mine is named CALCULATION). The FIELD in that attribute table for that grid that defines which zone each cell belongs to is named VALUE (1 = in the coastal zone, 0 = upland zone). The grid which contains the values which we wish to summarize is DEM30. The Statistic we want is the MEAN, and then we provide a location on the harddrive for the output table (note that the default is a *.dbf file, I'll name mine coastal_elev_mean)


Attributes of coastal_elev_mean

COUNT	AREA	MIN	MAX	RANGE	MEAN
175995	158396000	20	534	514	167.440994
5331	4797900	1	19	18	9.892520

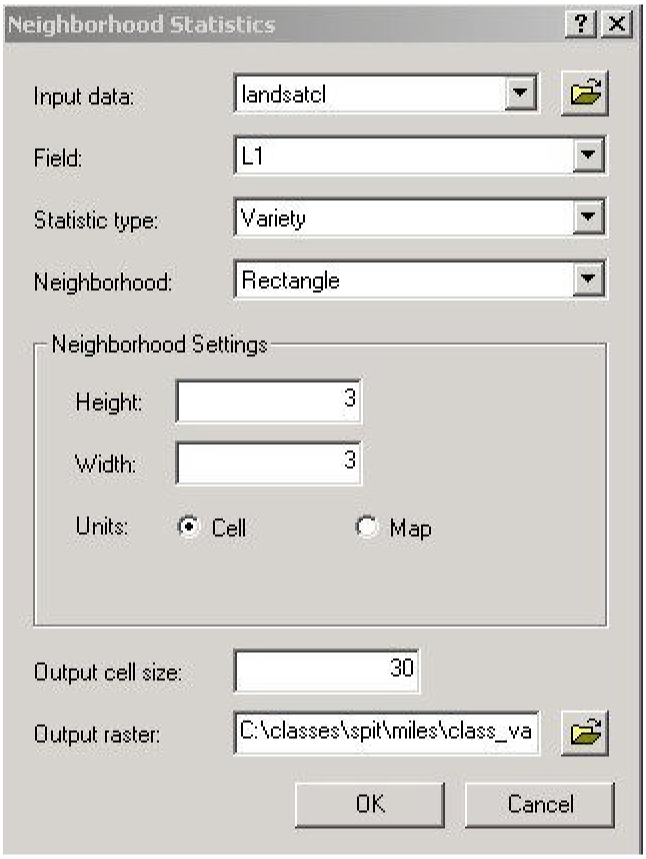
Record: 1 Show: All Selected Records (0 out of 2 Selected.)



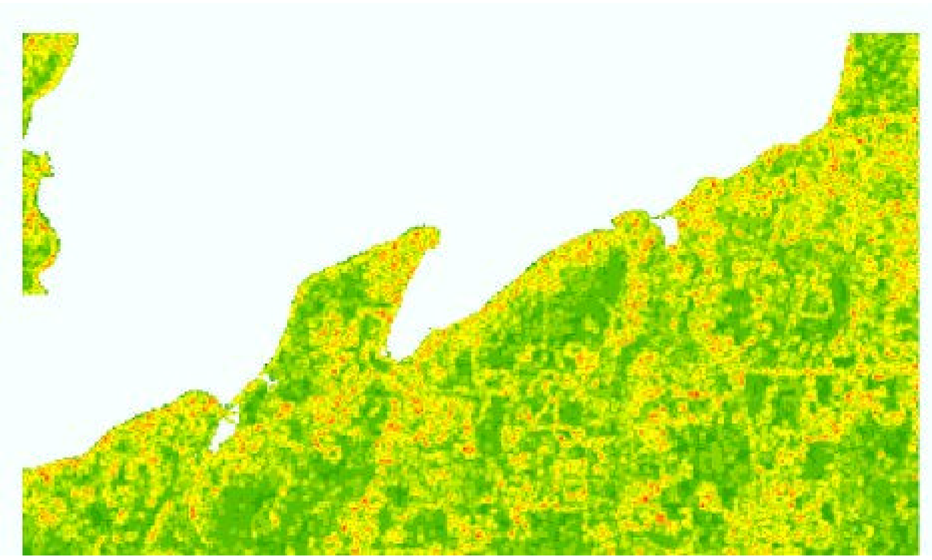
6. As you can see, the MEAN elevation in my coastal zone is 9.89m. This is calculated from a total of 5331 cells which have a combined area of 4,797.9 hectacres. It is interesting to note that the majority of the cells had a value of 5m. If you refresh your ArcCatalog you'll see that the table has been written to you workspace.

7. By zooming in on the coastal region and using the option in the symbology for the "Calculation" grid values that equal "1" to have "No Color" I can display the Landsatcl (classified landcover) in the coastal zone. It looks like there is a great deal of "LOCAL" variety. I wonder if the coastal zone is more heterogenious then the uplands. To find out we'll first calculate a "FOCAL VARIETY 3X3" analysis on all of the landsatcl dataset - That's a "Neighborhood function" in ArcMAP. SPATIAL ANALYST > NEIGHBORHOOD.

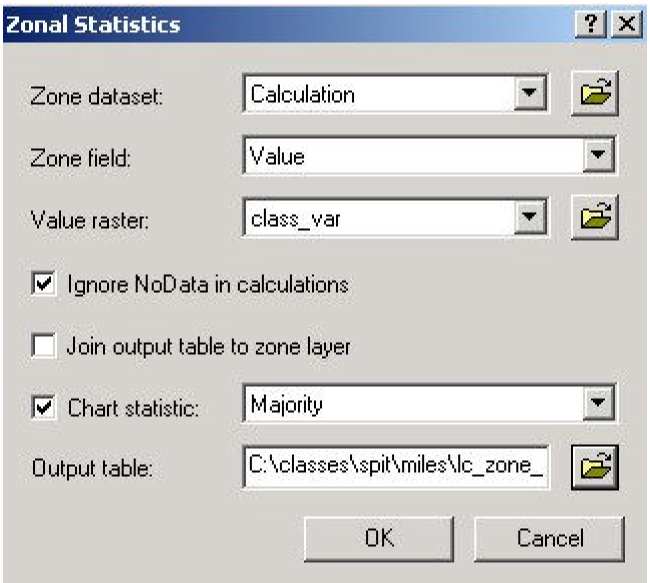
The input data is landsatcl, the field from that grid's attribute table is "L1", the statistic is "variety" the neighborhood I'll define is a 3x3 rectangle of cells, the default cellsize is fine and I'll output the results to my workspace named "class_var".



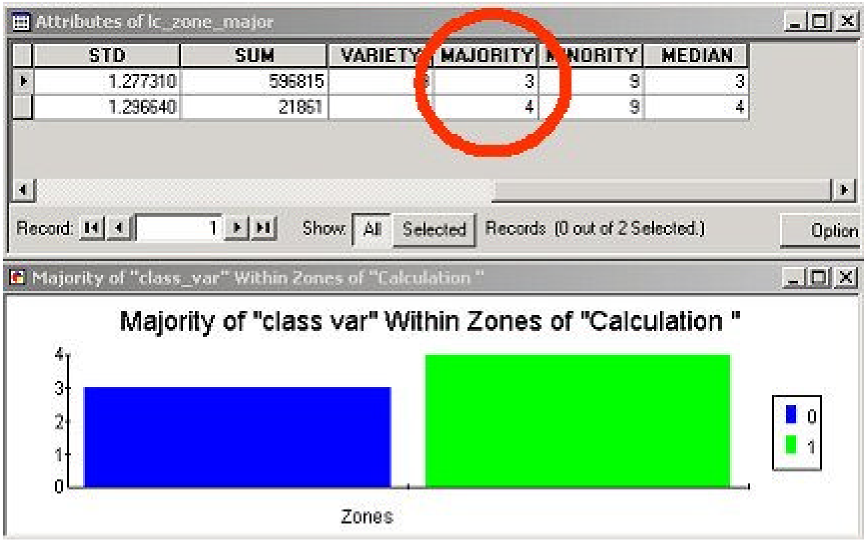
8. This is descrete data (values of 1, 2, ...9) - you see the neighborhood has is made up of 9 cells (the center plus 8 neighbors) so if all the cells have different landcover values the center cell will have a value of 9. If they are all the same then the value will be 1. Change the symbology to unique values and pick a color ramp



9. Do again the zonal statistics function again. This time ask for the "MAJORITY" value in the coastal and upland zones (where "1" in the grid name Calculation = coastal, and "2" = upland). The value raster grid we wish to summarize in this way is the grid I'm named "class_var" (the result of the neighborhood variety function). I'll output my table with the name "lc_zone_majority"



10. It looks like the Upland has a lower variety (3), while the Coastal Zone is higher (4). Makes sense.



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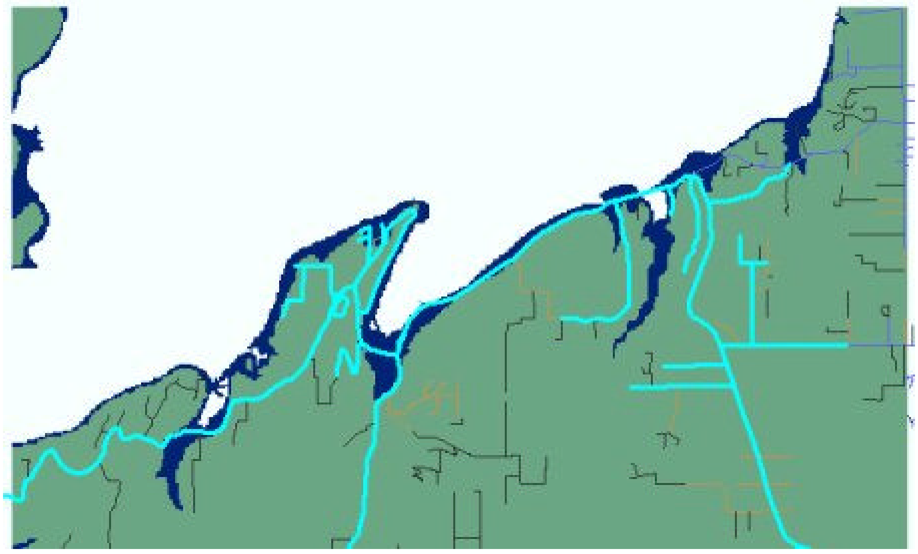
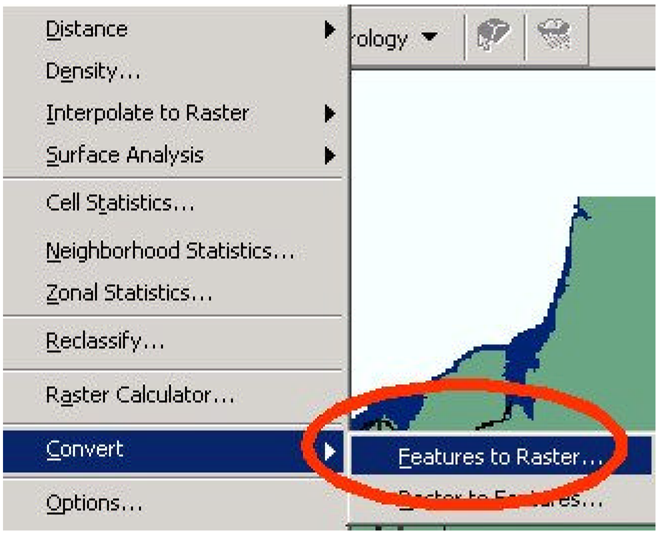
1. You remember those roads that we selected which were of type "M" , but also over the general area of the Big Beef Creek DEM30 dataset? Make your display illustrate the two zones we've defined (coastal and upland - ie. the "Calculation" raster dataset) and turn the ROADS ARC theme back on. The selected set should still be in affect.



2. Let's use the SPATIAL ANALYST to convert the selected ROADS ARC vectors to the raster format.

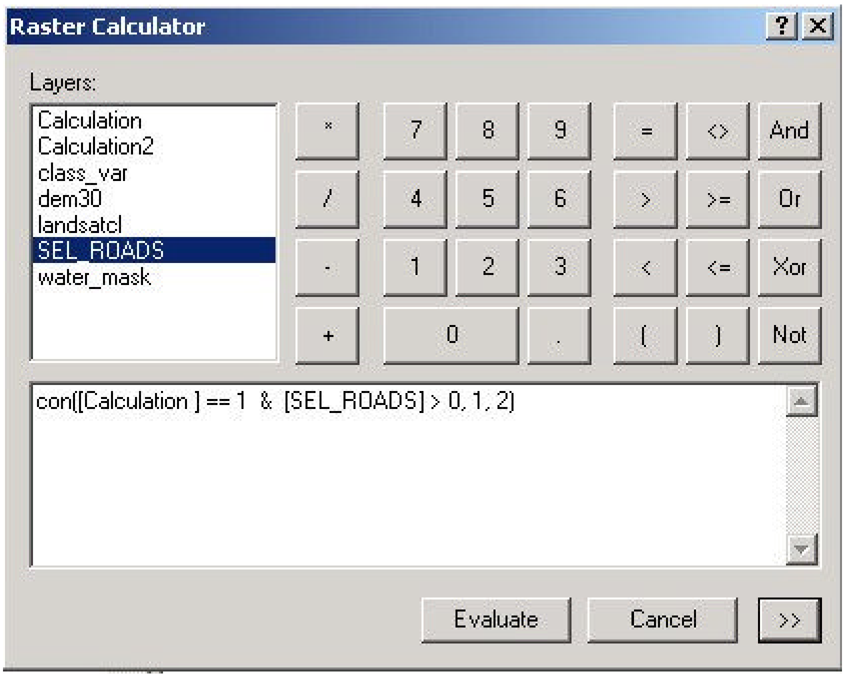


3. In the dialog box make your Input features "ROADS ARC", the field in the attribute table of ROADS ARC that I'll use to identify each road is ROADS-ID, I'll change the cell size to 30, and output the results to a grid name "sel_road".

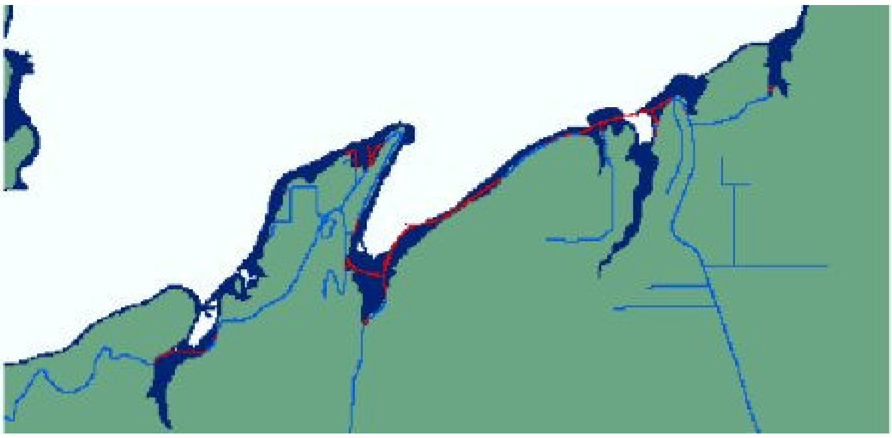
4. No let's use the RASTER CALCULATOR and a "CON" statement (a conditional statement). This is a command that follows the logic of "new calculation" = con(conditional state is true, then do this, if not do this). In our case the syntax is:

con([Calculation] == 1 & [SEL_ROADS] > 0, 1, 2)

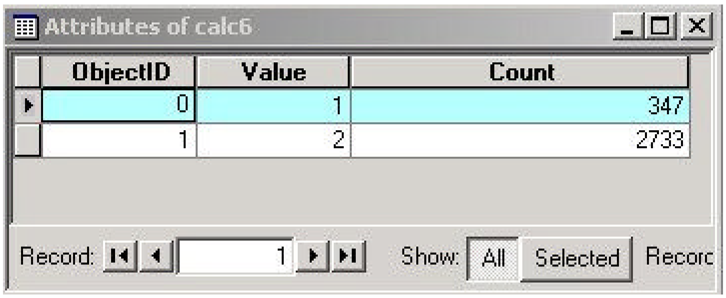
Which says: if the conditon is true where the value of a cell in CALCULATION grid is equal to "1" and in the SEL_ROADS grid is also greater then "0", the make the output cell have a value of "1" , if that condition isn't true have a value of "2".



5. Make you display make sense.



6. So how many cells meet the condition and have a value of "1"? Right Click on the resulting calculations > OPEN Attribute Table, and look at the "COUNT" in the attribute table. The answer for me is 347 30m cells. So, I have roughly 10,410 meters of roads in of type "M" in the coastal zone of the BBC digital elevation model dataset.



ObjectID	Value	Count
0	1	347
1	2	2733

This was a lot of "stuff". However, it introduced a number of useful functions. It's time to go home.