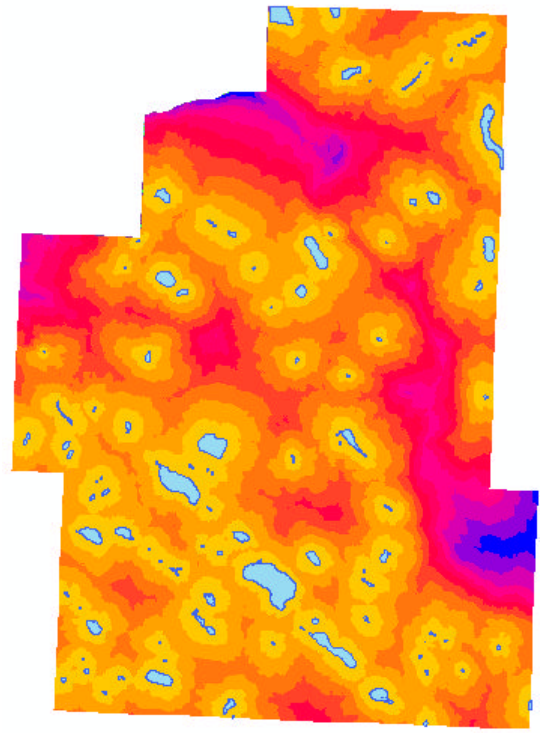
Pond Distance and Habitat for use in Wildlife Modeling



These instructions enable you to aggregate layers within a study area, calculate new fields, and create new data out of existing data, for use in further habitat analyses. In this example, Alberta Vegetation Index (AVI) coverages are available to extract habitat, landuse, soil moisture, and pond information from. A DEM is also used to incorporate slope into the habitat model. In Part 1, you use ArcGIS 8.x to perform the following:

- Calculate new fields by selecting values according to habitat classification criteria
- Use the geoprocessing wizard and XTools to dissolve/explode
- Convert to raster, derive slope, and calculate new grids

You need to have the **XTools** and **Spatial Analyst** extensions installed for use with ArcGIS. In Part 2, you will use ArcView 3.2 with the **Nearest Features** extension to do the distance analysis.

ORIGINAL DATA

Avi_all6twp.shp	shapefile of merged AVI data within the study area
Boundary.shp	shapefile of the study area boundary
DEM	raster grid of a digital elevation model

CREATED DATA

All_ponds.shp	shapefile of pond data selected from the AVI data
Habitat	raster grid of wood frog habitat rankings
Land_soil	raster grid of landuse/soil moisture rankings
Slope	raster grid of slope derived from the DEM
Slope10c	reclassified grid of 10 slope class rankings
Cost_hab	raster grid created by combining habitat criteria layers
CostDistance	raster grid created from the cost weighted surface function

PART 1

Start ARCMAP:

1. Choose START → PROGRAMS → ARCGIS → ARCMAP
2. Start using a new empty map document
3. Click the ADD DATA button and add **Avi_all6twp.shp**, **Boundary.shp** and **DEM**

Enable the required extensions:

Whenever adding an extension to ArcMap, you must first enable it and then display the toolbar.

4. Choose TOOLS → EXTENSIONS
5. Click a check beside XTOOLS and SPATIAL ANALYST to enable them
6. Click CLOSE
7. Right click on an empty spot of any visible toolbar
8. Make sure there is a check beside XTOOLS and SPATIAL ANALYST to make them visible
9. Save the map document

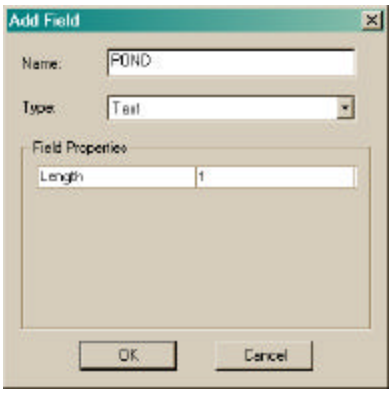
Select and create the ponds:

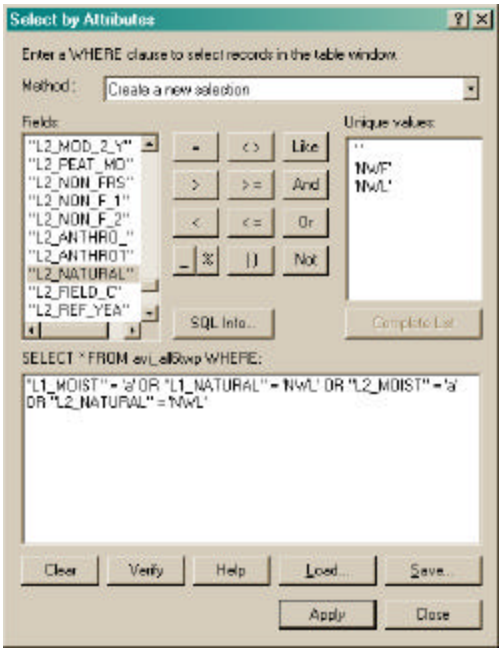
The first step is calculating a field with a value that indicates which features are ponds as defined by your criteria.

10. In the table of contents, right click on **avi_all6twp.shp**
11. Choose OPEN ATTRIBUTE TABLE
12. Click on the OPTIONS button
13. Choose ADD FIELD
14. Name the field **POND**, of type **TEXT**, with length **1**
15. Click OK
16. Click on the OPTIONS button
17. Choose SELECT BY ATTRIBUTES
18. Create a new selection with the following SQL expression:

```
"L1_MOIST" = 'a' OR
"L1_NATURAL" = 'NWL' OR
"L2_MOIST" = 'a' OR
"L2_NATURAL" = 'NWL'
```

19. Click APPLY
20. Right click on the POND field heading
21. Choose CALCULATE VALUES
22. Click YES to the warning
23. Type **"y"** in the expression box
24. Click OK

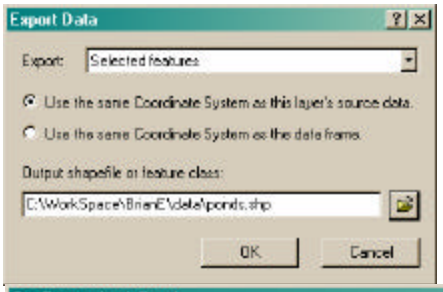




25. CLOSE the Select By Attributes dialog box

The second step is to export those selected features into their own layer.

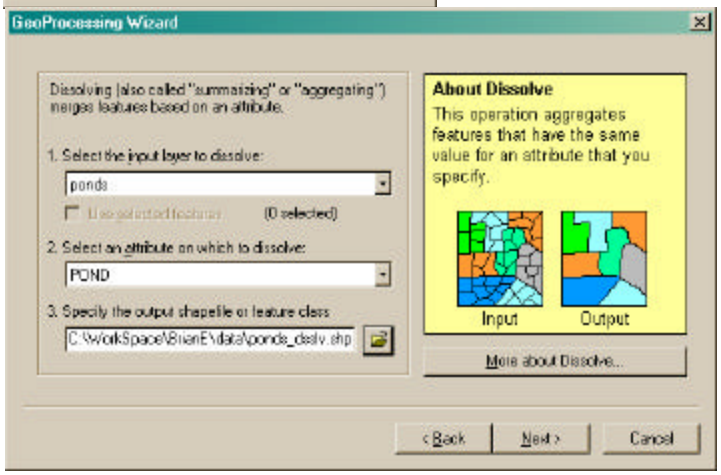
26. In the table of contents, right click on **avi_all6twp.shp**
27. Choose DATA → EXPORT DATA



28. Specify an output name (e.g. **ponds.shp**) to save the selected features to
29. Click OK and then YES to add the new layer

The third step is to dissolve the ponds that are split because they lie on the border between township map sheets.

30. Choose TOOLS → GEOPROCESSING WIZARD



31. Select "Dissolve features based on an attribute" and click NEXT
32. Select **avi_all6twp** as the input layer, **POND** as the attribute, and specify **ponds_dsslv.shp** as the output name (*Keep the check in the "Use selected features" check box!*)
33. Click NEXT
34. Click FINISH

The fourth and final step is to explode the resulting multi-part shape into single-part shapes for each pond.

35. Choose XTOOLS → FEATURE CONVERSIONS → CONVERT MULTIPART SHAPES TO SINGLE PARTS
36. Select **ponds_dsslv** as the layer to convert and specify **all_ponds.shp** as the output
37. Click OK

*This last pond layer appears similar to the previous dissolved layer, but when you use the selection tool (from the TOOLS toolbar) to interactively select one pond – all ponds are highlighted in **ponds_dsslv** and only the single pond is highlighted in **all_ponds**.*

38. Choose XTOOLS → CALCULATE AREA, PERIMETER, LENGTH
39. Select **all_ponds** as the layer to measure
40. Click the SPECIFY button and then click OK to accept the layers original coordinate system
41. Click OK

If you open the attribute table, you will see area and perimeter values calculated for each pond according to the default units set in XTools.

Select and calculate the habitat and landuse/soil moisture fields:

To create habitat criteria layers for use in further modeling, you will first need to apply selection and classification labeling to each polygon record in the ***avi_all6twp.shp*** *layer and calculate new field values.*

42. Close all tables and other dialog windows that may be open
43. Click on the CLEAR SELECTED FEATURES button in the TOOLS toolbar
44. Turn all other layers off except for **avi_all6twp.shp**
45. In the table of contents, right click on **avi_all6twp.shp**
46. Click OPEN ATTRIBUTE TABLE
47. Click OPTIONS → ADD FIELD
48. Name the field **Habitat**, of type **SHORT INTEGER**, with precision **2**
49. Click OK
50. Click on the OPTIONS button
51. Choose SELECT BY ATTRIBUTES

Create new selections with each of the following SQL expressions in the table below and calculate the corresponding habitat ranking value.

52. Enter **<the SQL expression>**
53. Click APPLY
54. Right click on the **HABITAT** field heading
55. Choose CALCULATE VALUES
56. Click YES to the warning
57. Type **<the value>** in the expression box
58. Click OK
59. Repeat the previous 7 steps for each entry in the table

Also, add a new field for ***Land_soil*** *and apply selection/calculation.*

Example Habitat Table (substitute your criteria here):

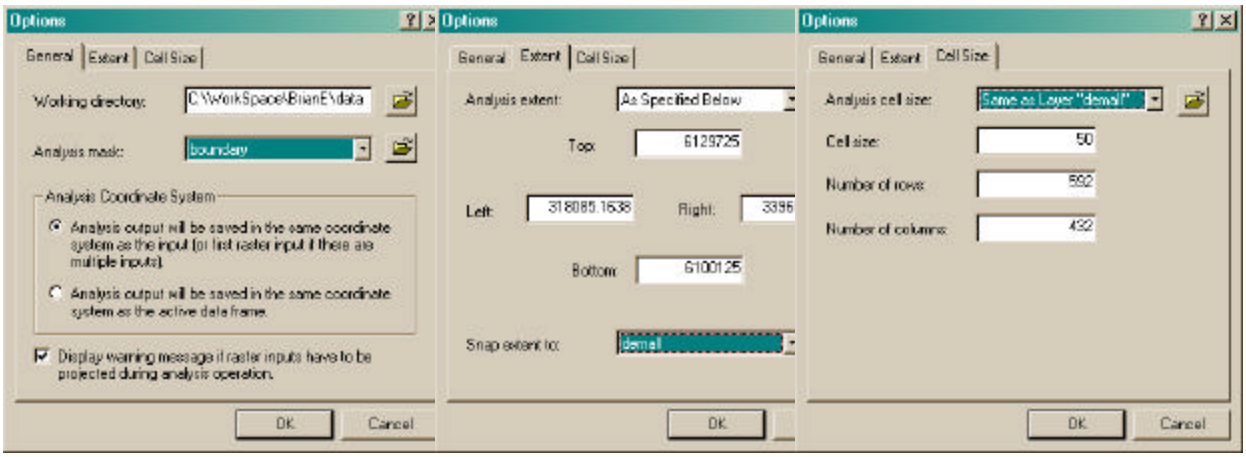
<the SQL expression>	**<the value>**
"L1_SP1" = 'Aw'	1
"L1_SP1" = 'Pj'	7
"L1_SP1" = 'Sw'	7
"L1_SP1" = 'Sb'	5
"L1_NATURAL" = 'NMS'	9
"L1_NATURAL" = 'NWR'	10
"L1_ANTHRO1" = 'AIG'	10
"L1_ANTHRO1" = 'AIH'	10
"L1_NON_FRS" LIKE 'S%'	1
"L1_NON_FRS" = 'BR' OR "L1_NON_FRS" = 'HF' OR "L1_NON_FRS" = 'HG'	2
etc…	etc…

*Note: These are purely made up for demonstration purposes only. Use criteria that you have gleaned from the scientific literature. Also, see "****Building an SQL expression****" in ArcGIS Desktop Help for more information on making selections.*

Create habitat rasters:

Working with raster data requires the Spatial Analyst extension. When using this extension it is important to set the analysis OPTIONS the way you need them to be. In this example, the study area boundary.shp file is used a mask, and the extent is snapped to the DEM grid and cell size. This ensures that the output is only processed within the boundary mask, and the output grid cells are in the same size and spatial position as the DEM cells.

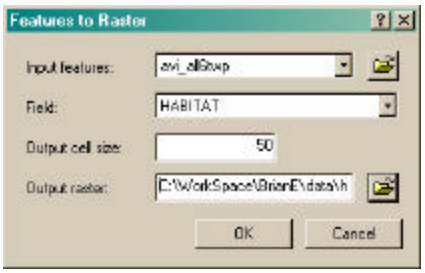
Set the Analysis Options:



60. Choose SPATIAL ANALYST → OPTIONS
61. In the GENERAL tab, set Working directory and specify **boundary** as the analysis mask
62. In the EXTENT tab, set the Analysis extent to **boundary** and Snap extent to **DEM**
63. In the CELL SIZE tab, set the Analysis cell size to **DEM**
64. Click OK

Convert features to raster:

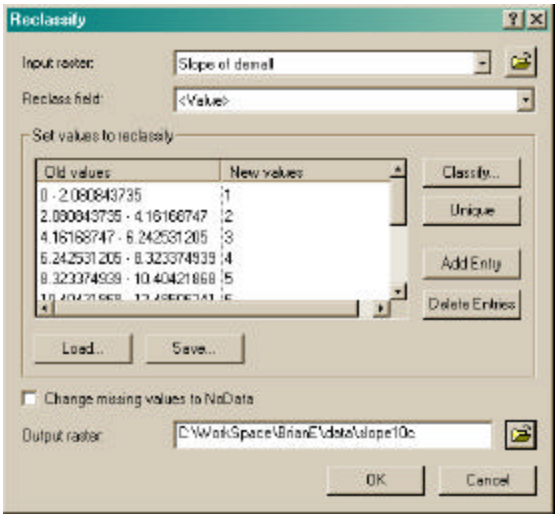
The classified AVI data must be converted to raster grids so that they can be combined using Spatial Analyst's RASTER CALCULATOR and COST WEIGHTED functions.



65. Choose SPATIAL ANALYST → CONVERT → FEATURES TO RASTER
66. Select **avi_all6twp** as the input layer
67. Select **HABITAT** as the field to convert on
68. Specify **habitat** as the output raster name
69. Click OK
70. Repeat for the **land_soil** attribute field

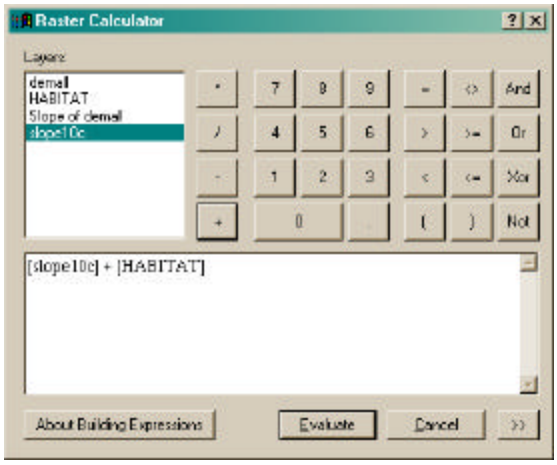
Derive raster surfaces:

The first part here is to create a slope class grid by deriving slope from the DEM and then create a permanent grid by reclassifying into ranked values.



71. Choose SPATIAL ANALYST → SURFACE ANALYSIS → SLOPE
72. Use **DEM** as the input raster
73. Select the desired parameters or leave at defaults
74. Click OK
75. Choose SPATIAL ANALYST → RECLASSIFY
76. Click the CLASSIFY button and set the method and parameters as desired; e.g. **Equal Interval**, **10** classes
77. Specify and output raster name; e.g. **slope10c**
78. Click OK

The second part is to combine the habitat criteria into a cost surface.

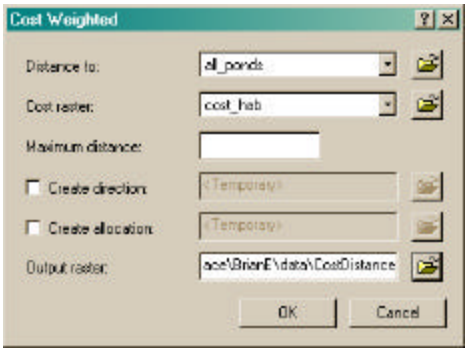


79. Choose SPATIAL ANALYST → RASTER CALCULATOR
80. Type the expression to combine the raster layers into your habitat cost surface

Make sure that your rankings are appropriate for each raster (lower values indicate better potential habitat in the habitat, land_soil, and slope10c rasters and higher values indicate worse potential habitat).

81. Click EVALUATE
82. In the table of contents, right click on **Calculation**
83. Choose MAKE PERMANENT
84. SAVE as a new name; e.g. **Cost _hab**
85. In the table of contents, rename the layer name to **cost_hab**

Cost weighted distance:



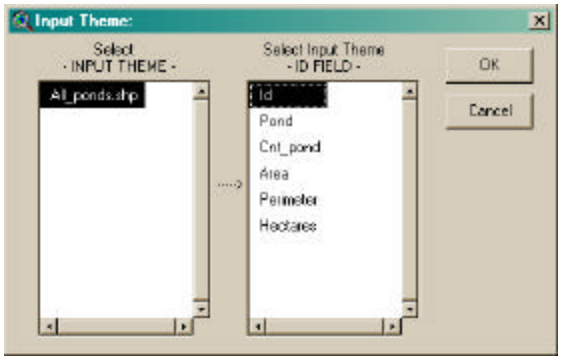
*Refer to "**Cost Weighted Distance mapping**" and related topics in ArcGIS Desktop Help for more information on this function.*

86. Choose SPATIAL ANALYST → DISTANCE → COST WEIGHTED
87. Select **all_ponds** for Distance to
88. Select **cost_hab** as the cost raster
89. Specify and output raster name; e.g. **CostDistance**
90. Click OK
91. SYMBOLIZE this output and create a map layout

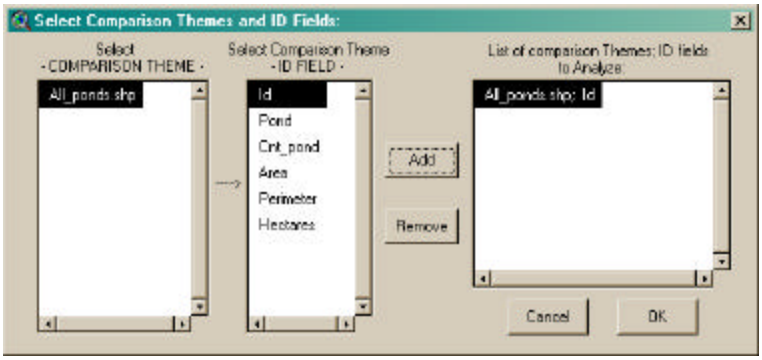
PART 2

Nearest features in ArcView 3.x:

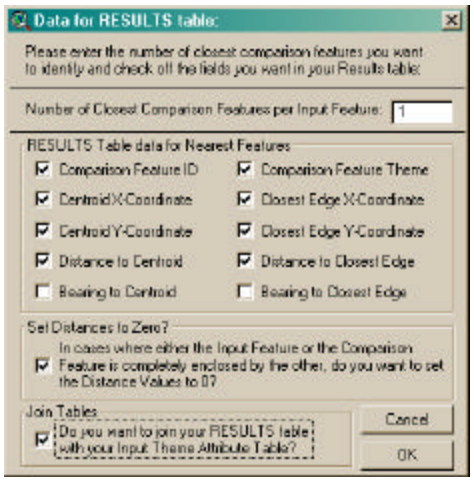
1. Choose START MENU → PROGRAMS → ESRI → ARCVIEW GIS
2. Create a new project with a new view
3. Add **all_ponds.shp** to the view now



4. Choose FILE → EXTENSIONS
5. Click a check beside **Nearest Features v3.5**
6. Click OK
7. In the View Toolbar, click on the NEAREST FEATURES button 
8. In the INPUT THEME dialog box, select **all_ponds.shp** as the input theme and **ID** as the ID field
9. Click OK



10. In the SELECT COMPARISON THEME AND ID FIELDS dialog box, select **all_ponds.shp** as the comparison theme, and **ID** as the ID field
11. Click the ADD button and then click OK



12. In the DATA FOR RESULTS TABLE dialog box, enter the number of closest comparison features, select the desired results, etc.
13. Click OK
14. In the CONNECTING LINES dialog box, click on the nearness number, choose line connection, select line color, and click ADD TO LIST for each set of connecting lines you want
15. Check "Save connecting lines in a shapefile?"
16. Click OK
17. Specify the output names