Lab 12: Cartographic Modeling

Note: This lab is to be done the last two weeks of the semester.
It is due the Wednesday, December 16, 2009 at 11:59 p.m., on FR3131 or FR5131 WebVista.

This lab is different from previous labs in that there will be relatively few detailed instructions. During this lab you will have an opportunity to use what you have learned to solve a small problem using spatial data analysis. This miniature example represents the sort of project done daily by many spatial data analysis professionals. We will give you a brief description of the problem, an inventory of data layers, and a desired product or outcome. You will need to put together the spatial and tabular data required to solve the problem.

Our goal is the identification of areas suitable for a park development. We will be working with data from the Marine on St. Croix area. Your job is to identify areas suitable for a 100 hectares (ha) park. The basic criteria are:

1) Build only on private land in Minnesota

2) Slope less than or equal to 3 degrees

3) The entire area needs to be within 200 m of a road

4) Must be more than 100m from Lakes, streams, or rivers features

5) No building on any wetlands

6) Individual polygons for final areas must be larger than 100 hectares (apply this last)

You need to identify areas, which meet all these criteria (AND combinations), so your analysis will include a number of overlays of spatial data to identify suitable sites.

You are provided with the following data layers. All data should be in the \Lab12 subdirectory. All layers are in NAD83, UTM zone 15 coordinates, meters, and elevations in meters. Remember, there 10,000 square meters in each hectare.

MARON_STX	A DEM grid of the study area
MAR_BD	A polygon shapefile of major municipal regions from a USGS digital line graph. Ownership codes are in the item MODN_ID. Codes 1,7, and 8 are Wisconsin, **3 is private land in Chisago County**, **9 private land in Washington County**, and 2, 4, 5, 6, 10, and 11 either public land or

within the borders of Marine on St. Croix.

MAR_HYD	A polygon shapefile, hydrologic features, from a USGS digital line graph. Lakes, rivers, and ponds are represented as polygons
MAR_WET	A polygon shapefile of wetlands with item "attribute", giving USFWS wetlands type (remember, a value for Attribute of OUT contains no data – don't use these areas; see the previous DEM/wetlands lab for detailed description).
MAR_RD	A line shapefile identifying road locations in the study area.

You need to combine these data, using the appropriate buffer, overlay and tables commands in ArcMap to identify the areas that meet the above-listed restrictions. Think of creating a series of binary masks to do this, which you will then overlay. You should use the tools you have learned over the semester to complete this task. DO A FLOWCHART FIRST, IT WILL REALLY HELP.

You'll use a few commands repeatedly.

After selecting Records you may either deleting the ones you don't need or separately saving just the records you want to retain; for example, select the layer, right click, Data→Export Data.

A common clean up operation is Dissolve. Toolbox → Data Management Tools → Generalization → Dissolve. This operation is often done after each step in long sequences of spatial operations as it removes unnecessary interior lines/data. You may Dissolve each layer before creating a common or unique field and Union but it is only **required** (necessary) for the Property Layer.

Once you have prepared a layer (before overlay) you may need to assign a common code for an attribute (create a new attribute named good4wetslope or some similar name, and all those polygons that satisfy the criteria would get a 1, all those that fail at least one criteria, would get a 0). This common code or unique field will help you track this layer's data through later operations.

The next command you will probably use repeatedly is the Union command; Toolbox → Analysis Tools → Overlay → Union. You use this command to combine two polygon layers. We used this command in Lab 9 and Lab 11. You may sometimes use intersect instead of union (Refer to past Labs or ask for help)

NOTE: Before your final step (measuring the polygons to determine those greater than 100 hectares, you MUST use Toolbox →Data Management Tools → Features → Multipart to Single Part. This command will ungroup the polygons allowing the correct number and size to be displayed.

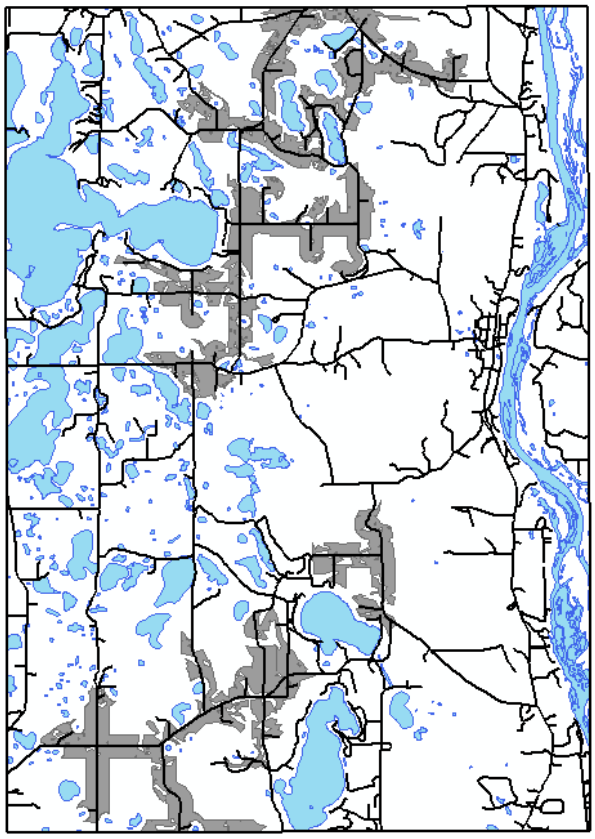
While you can convert all the layers to grids and do this as a raster exercise, for nearly everyone it will be easier to do this mainly with vector data. You will want to create a slope file, recode it based on our slope criteria, and convert this to a vector shapefile. Load MARON_STX up (it is a GRID, you can load it directly), calculate the slope with the surface functions, reclassify the slope into 0 and 1 based on whether they are over or <= 3° (See the Raster Lab 10), select the result, and in the Spatial Analyst --- Convert --- Raster to Features (shapefile) named slpcls.

To Turn In: (via .pdf on WebVista)

At a minimum, you should turn in the following:

1) A flow diagram indicating the analytical functions you applied and the intermediate layers produced; *(hand-sketched is o.k., but only if you write legibly and scan it as a .pdf)*. I suggest you use Paraben's Flowcharter that is on the Lab computers.

2) A final map, which identifies the suitable locations, along with the road, and lakes. You should include the title, legend, scale bar, north arrow, your name, etc., i.e., the whole nine yards. You will be graded not only on accuracy, but on map aesthetics, e.g., are the various features identifiable, does the map unambiguously provide the desired information, and are the fonts, title, and legend, etc., appropriate and provide the information we seek? You may also turn in intermediate analyses, if you think they help clarify the analysis and to ensure you'll get maximum credit, but again, the maps should be complete and well done.



3) Three additional maps. 1st Map: wetlands binary class, hydrography binary class, and roads, 2nd Map: road buffer binary class and roads, and 3rd Map: private in Minnesota, slope binary class, and roads. Include legends, titles, etc. for each of these maps. ***See the following page for examples of these views for these maps.***

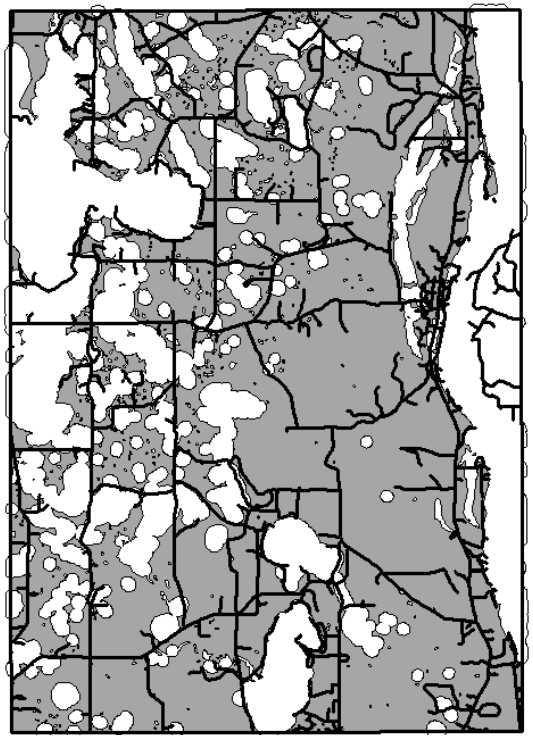
4) The **final data layer**. This is a shapefile of you final answer, the suitable areas for a park. DO NOT submit the Map file (MXD) file or any other shapefiles. Remember a shapefile is a family of files that all have the same first name. Using the WebVista Lab12 assignment page, Attach all the pieces of the shapefile; i.e. .shx, shp, sbx. dbf, ect.

The view portion of your final suitable area map should look like the adjacent figure. Pay most attention to the location and extent of the light gray areas on this map, they meet all the criteria. It is quite easy to miss-code a variable, and your areas will not match those below. Roads (dark lines) and hydrography (dark areas) are also included, to help you determine if your final areas are correct.

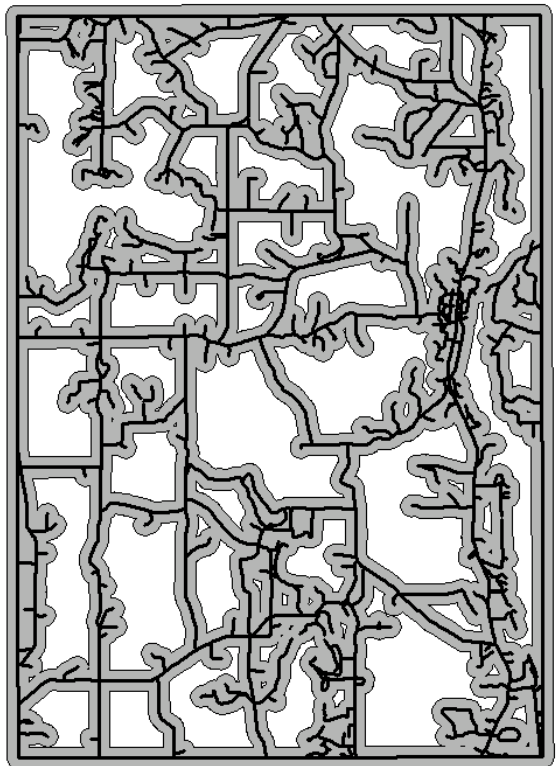
This lab is due the last week of class, Wednesday, 12/10/08 at 11:59 p.m., on the class WebVista site. This lab will be worth 30 points, and there will be no late labs accepted.

Examples for the three additional required maps. The views you include in the layouts should contain data that look something like the figures below.

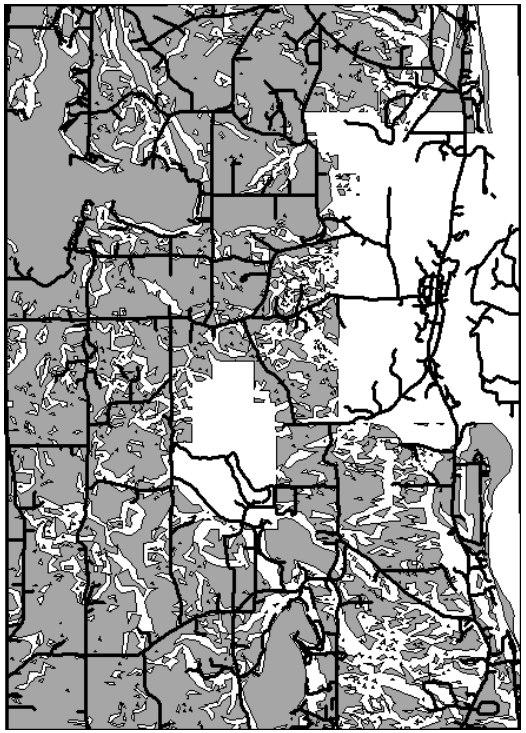
1st additional map data: non-wetlands and hydrography- buffers criteria, plus roads.



2nd additional map: roads and road buffer.



3rd additional map: private in Minnesota, slope binary class, and roads.



EXTRA CREDIT – On a Separate attached page, answer the following question. (1 point)

Each year several students submit feedback sheets that suggesting that they could save steps in this exercise if they use Intersection rather than Union.

> *This is true; some use of Intersection could help save steps. However, I choose to suggest students create binary indicators, Union files, then create a composite binary indicator and dissolve, instead of Intersection. Often it helps to understand the detailed steps when learning a complex process, however there is not an approved method to complete the final lab.*

Question: Of the main four (4) Union steps in this exercise which one could you NOT do with Intersection? Briefly Explain why.