Intro to ArcGIS II: GIS Analysis
Workshop Outline
Maribeth Price--Instructor

Day 1: Vector analysis

Lesson 1: Spatial queries
- Select By Location
- Selecting on both location and attributes
- Ways to use selections

Lesson 2: Spatial Joins
- What is a spatial join?
- Cardinality
- Feature geometries
- Coordinate systems
- Setting up spatial joins

Lesson 3: Map Overlay
- About Geoprocessing
- Overlay functions
- Dissolving
- Environment Settings

Lesson 4. Modelbuilder
- About Model Builder
- Toolboxes
- Creating models
- Running models
- Inputs and Outputs
- Model Parameters

Day 1 Project: Siting a landfill

Day 2: Raster analysis

Lesson 5. Raster basics
- Raster storage model
- Discrete/continuous rasters
- Integer and floating point rasters
- Raster formats
- Raster tables and areas

Lesson 6. Map Algebra
- Raster analysis options
- Converting layers
- Reclassifying rasters
- Boolean analysis
- The Raster Calculator

Lesson 7. Distance and Surface tools
- Distance functions
- Raster buffers
- Topographic functions

Lesson 8. Neighborhood tools
- Neighborhood functions
- Raster conversions
- Zonal Functions
- Density functions
- Interpolation functions

Day 2 Project: Siting a landfill with weighted overlay

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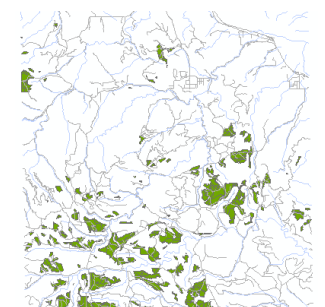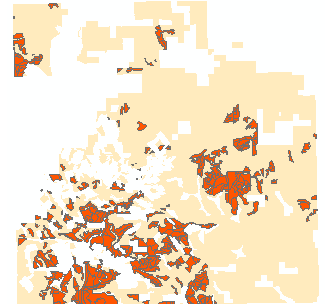### Maribeth Price--Instructor

Day 1 Project

Imagine that the Black Hills National Forest (BHNF) is looking for a place to construct a landfill site for use by the Forest Service. There are some criteria they want to apply to find a suitable location.

- It must be on BHNF land, not private land.

- It should currently have a low density of vegetation, to avoid extensive logging of the site.

- It should be on a geological unit with a low infiltration rate, to protect groundwater.

- It should be within 500 meters of an existing road, to limit road construction costs.

- It should be at least 250 meters from a stream, to protect the surface water.

- The site must be at least 25 acres in size.

You will use the data in the Sturgis83 geodatabase to find potential locations for this landfill.

1. Create a new file geodatabase in the BlackHills folder to contain your analysis results. Save all feature classes to this geodatabase.

2. Determine the areas that are BHNF land. The vegetation layer has an OWNER field indicating whether a polygon national forest (NFS) or private (PVT) land. Select the NFS polygons and create a layer from them.

3. Next, you need to combine information about the geology and the NFS vegetation. Intersect these two layers.

4. Query the intersected layers to find the polygons with open tree density (DENSITY96 is 0 or A) and the geology infiltration rate (INFIL) is Low. Save the selection as a layer. There are three conditions and the order matters, so do it in two steps, or use parentheses if doing a single attribute query. Check your selection to make sure it is right (orange areas) before going on.

5. Buffer the roads to a distance of 500 meters. Be sure to use the dissolve option! Use the buffers to clip, to find the target areas close to the roads.

6. Buffer the streams to a distance of 250 meters. Use erase to remove the areas close to the streams.

7. Your final target areas should look like this. Next we need to eliminate the areas less than 25 acres, but first we have to get rid of the arbitrary boundaries between the polygons. Dissolve the target areas using the Owner field (all have the same value). Make sure that you UNCHECK the box to create multipart features—each separate polygon should be a different feature.

8. Create an ACRES field and use Calculate Geometry to determine the size of each site. Select those greater than 25 acres. These are your final target sites. You should have about 44.

9. Create a simple map layout to present your analysis results.

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Day 2 Project

You will now refine the results of your landfill siting project using some raster criteria.
- The site must have a low slope.
- The population density should be as low as possible.
- The closer to the road, the better.
- The further from the stream, the better.

Study Figure 11.8 in your book. We will do a weighted overlay analysis to score each of our sites in terms of the above criteria, using N = 4 for the number of rank levels. Your maps will be very similar to the figure, except that we will replace the infiltration condition (already taken care of in day 1) with a population density condition.

Set the environment settings. The landfill geodatabase should be your working and scratch space, the extent should be the vegetation raster (original one), and the cell size should be 30 meters.

Create each of the following rasters:
> Slope
> Distance to roads
> Distance to streams
> Population density (use the Kernel Density tool with the blockpop layer and POP2000 as the population field, a search radius of 5000 meters, and units of square kilometers.) Try a geometrical interval classification with 10 classes to display it.

Create four reclassified rasters, one for each condition in the table below. Each one should contain values from 1 to 4 based on the rankings shown below.

Slope (degrees)	Distance to roads (m)	Distance to streams (m)	Pop density (people/km^2)
0-5 = 4	0-200 = 4	0-200 = 1	0- 0.5 = 4
5-10 = 3	200-400 = 3	200-400 = 2	0.5-1 = 3
10-20 = 2	400-600 = 2	400-600 = 3	1-2 = 2
>20 = 1	>600 = 1	>600 = 4	>2 = 1
Weight = 0.3	Weight = 0.1	Weight = 0.4	Weight = 0.2

Use the raster calculator to create the final raster with your Landfill suitability index. Each condition should be enclose in parentheses to execute correctly: (raster1 * 0.2) + (raster2 * 0.01) + …

Use the Extract By Mask tool to clip the suitability raster to the polygons from Day 1 to complete your analysis.

Display your sites using a green to red ramp, with green being high suitability and red as low (use Invert on the symbology tab, if needed).

Does this map help you narrow down your choice for potential sites?