Guidelines for Analysis

The main activity this semester is to provide a canopy cover and quality ranking for tree cover in the St. Anthony Park Neighborhood in St. Paul.

You will develop and combine the data in your area, and perform an analysis. You will write an individual report for your study sub-area. The format and content of the report is covered in the "Instructions for Individual Reports" handout on the class website server. You must include complete metadata for data layers, but this does not have to be printed, only turned in on the CD with your digital layers.

Tree canopy in cities provide many benefits, including a reduction in stormwater runoff, reduced noise, decreased cooling costs, increased property values, and a stronger sense of community. The City of St. Paul is interested in a pilot project to develop a street tree inventory, to better focus efforts on developing and managing a health tree canopy. The City is particularly concerned about the St. Anthony Park (SAP) neighborhood because the emerald ash borer (EAB), an exotic pest, has been found in the southern part of the SAP. The EAB is effectively 100% lethal for green ash (Fraxinus pennsylvanica) , one of the most common street trees in St. Paul, and the Twin Cities.

Your task this semester will be to develop the base data layers needed to estimate the threat of the EAB to St. Anthony Park, and to identify areas where tree canopy cover is most needed and best planted.

You will produce two related products this semester:
1) data layers and maps of green ash density, both absolute (trees per acre), and relative (proportion of the canopy area comprised of green ash), and
2) a suitability ranking for land for increased canopy cover, based on data you develop and criteria give.

You will develop two primary data layers:
A) a tree canopy data layer, which will identify individual trees where possible, and clusters of trees where individuals cannot be distinguished. This polygon digital data layer will have at least attributes for a) major form (values conifer or broadleaved), b) is_ash (values of yes or no), and c) size, as small (< 6 feet tall), medium (6 to 25 feet tall), and large (over 25 feet tall).

These data layers will be developed through a combination of digitization from high-resolution aerial photographs, GPS coordinate digitizing, and field attribute data collection. You will attempt to visit all trees in your assigned study area, and determine if it is an ash.

You will create the first product from this trees data layer for your study area, calculating green ash density (total number of trees in your area divided by the area), and a raster moving window (average density over an acre). You will create the second product/map by applying a set of criteria for ranking suitability.

Current tree canopy is valued based on density (area per unit area) and diversity, and the desirability for planting is where there are few trees, few different tree species (low diversity), a

high proportion of impervious surface, and a large number of plantable sites (grass or soil at least 100 square feet in area). You will rank areas by value for planting, with a score of 0 being needs little intervention, and 100 meaning high interventions.

You will do this ranking twice, once with the canopy as it exists now, and with the canopy after removing all the green ash trees.

Lands are desirable for planting when

- Current canopy area coverage is low
- Current tree density (numbers per acre) is low
- The area is not a building, and is far from a pervious surface (large parking lots or other expanses of impervious surfaces
- There is low tree species or functional group diversity (e.g., conifers vs. hardwoods)
- There is high impervious surface proportion
- There is a well-distributed set of areas area suitable for planting (grass or soil polygons at least 100 square feet).
- The area is not in a precluded use (e.g., baseball or soccer fields, golf fairways.
- The area is steeply sloped.

These are deliberately vague, as is often the case in real life. You will have to convert these to a points/scoring system for the analysis. You need to come up with a ranking for parcels. The interpretation of these criteria may require discussions with the client (the instructor).

Data Development

You'll note from the requirements above that you will need to develop/modify at least the following data layers for your working area (methods for collection in *italics*):

1) A ground-level surface/landcover (polygon) data layer that contains the following categories, with a minimum mapping unit of 100 square feet.
   - Current impermeable surface by type, including roads, sidewalks, walkways, paved or cement patios or other impervious surface walkways; roads and alleys should be distinguished from parking lots, and from sidewalks/patios/walkways by attribute values.
   - Greenspace and type;
     - Grass and/or herbaceous (non-woody plants in lawns, fields, and gardens)
     - shrubs, either landscaping or unmanaged

The layer should have an attribute table with a short integer variable named suf_type, coded for each of these types, with the following numbering convention:

1 – impervious surface, roads
2 – impervious surface, parking lots
3 – other impervious surface (sidewalks, walkways, patios, alleys, etc.)
4 – compacted soil
10 – grass/herbaceous
11 – shrubs
12 – uncompacted bare soil (raised beds, unwalked on areas without concrete or surface

vegetation, e.g., under trees)

You will create this data layer primarily from interpretation of LEAF-OFF aerial photographs, for example the USGS aerial photographs collected in 2006 and 2008 among the class data sets. You will use field visits and GPS to update the coordinate values you digitize, and to collect and verify the attributes you assign.

2) A Buildings data layer, including type (house, garage, commercial, other) and roof type (flat or pitched);

Use an unsigned integer integer variable in this layer named bld_type, with the following coding:

1 – house
2 – garage
3 – commercial
4 – other

Choose your own variable name and coding for roof type, and you may add other attributes if you feel they might be useful.

You will create this primarily from the airphotos you use above , field visit for attributes. This data layer should be topologically consistent with the previous data layer.

2) Tree location (point) data layer with attributes (small, tree less than 6 feet tall, medium-6 to 25 feet, and large, greater than 25 feet all). You must also include two attributes, tree type (needle-leaved or broad-leaved), and taxa (is green ash, or other; if you can identify to some higher level for the others, e.g., oak, maple, or species, then do so).

Create a short integer for size named tree_sz, coded as:

1 – small
2 – medium
3 – large

and another named tree_type

1 – needle-leaved
2 – broad-leaved

and a third for taxa:

1 – green ash
2 – other

if you wish to split the other taxa, define a numbering convention, e.g., 3 – sugar maple, 4 – silver maple, 5 – maple species, 6 – white oak, etc.

This layer will be created from interpretation of the leaf-on aerial photographs provided, Citipic2000.img, and GPS updates, with field visits for attributes.

Source Data

Source data will be provided early in the semester, on a class data server, and on CDs if requested. Instructions for access will be provided during the second week of class.

You should purchase a USB drive to save your data, and periodically save it to another secure location, e.g., home computer, burn a CD, or other backup.

Helpful Hints For GIS Data Development

During this course you will develop several data layers, and adapt provided data layers, to

include in spatial analyses. There are a few things you can do to minimize wasted effort and time, and minimize the impact of the inevitable disasters which will most certainly befall you during the course of this projects. Remember to:

Read the materials on topological digitizing and editing, and practice these on a "throw away" data set. Using them from the start will save much editing.

Develop a naming system which makes sense, and stick with it. Something like typ_vr, where the *typ* is the data layer or type, and *vr* is version or some descriptive append, e.g. hyd_2c would be the hydrology layer, version 2, cleaned.

Save often, and backup to independent locations. Do yourself a favor and take time create subdirectories, e.g., one for land use, one for elevation, etc., and copy your data to them. Make sure you periodically (every week or so) make a backup copy to netfiles, and on your home computer, and on labeled and dated CDs.

Save old versions of data layers. You may discover a problem with your data due to some action, e.g., and overlay or an edit. If you have kept old versions (aided by the naming system, and by your frequent saves), you won't have to start from scratch.

Develop a "check" coverage which is a composite of the study area boundaries, roads, and perhaps other features, then check each new coverage developed against this coverage for consistancy immediately as it is produced. This check coverage will allow you to quickly catch errors or blunders in data development. Most coverages have boundaries related to the road, hydrography, and/or edge features of your study area. If this is so, as soon as any new coverage is developed and registered, make sure it is reasonably well developed and registered by displaying the check coverage on top of it.