Assignment 4 – Overcoming Limitations

Introduction

Sometimes models of forest vegetation are described as simulating three basic system properties: birth, growth and death. In other words, models for trees need to simulate increment, mortality and regeneration. Unfortunately, the MTU CFI design does not include measurements of any trees less than 5 in. DBH. These are the trees that most recently regenerated in your stand!

In this assignment you will explore the consequences of imputing missing data manually versus just ignoring the problem.

Instructions

TIP: First, before you do anything else, create a new folder in your `H:` *drive for this assignment. Then, duplicate your three FVS files from the last assignment, and put them in the new folder.*

Part One: impute missing trees

You need to estimate, by species, the trees/acre in the 2 and 4 in. DBH classes that were present in Section 30 at the time of the inventory in 2002. Then, you need to create a second "stand" which uses the treelist from the original stand, but with "pseudo" trees added to the treelist file to represent these trees. You need to add some trees to each plot within the stand!

Here are suggested steps:

1. Look at a stand table for your stand. Estimate the number of trees/acre in the 2 and 4 in. classes using the "add trendline" feature in Excel to find a quadratic regression line.

2. Start with a blank spreadsheet in Excel. Create columns for:

   plot_no tree_no fvs_spp dbh count

   Find the 12 unique plot numbers in your original tree data. Then, create pseudo trees for each plot and each of the 2 and 4 in. diameter classes. This means at least 24 "pseudo" trees.

   Adjust the tree count so that the trees per acre by species match what you decided they should be in steps 1 and 2. **Be careful here.** Say you need to add 35 tpa in the 2" class. Recall that a single tree in a single plot contributes 5/12=0.4167 tpa to the stand total. Thus, you would need to add 35/0.4167=84 trees to your inventory. There are 12 plots, so you need to add 84/12=7 trees with dbh 2" to each plot.

Note that you don't need to add 7 lines per plot to your excel spreadsheet. You can add one line, for one tree, with count=7. You should probably split the trees you add into more than one species to make future simulations more realistic. For this assignment, however, start with making them all sugar maple to save some time.

3. Save your spreadsheet as a .csv file, and process your pseudo data with Format4FVS to create a new .fvs tree data file.

4. Duplicate your original .fvs file and merge your pseudo trees on to this file. Since they are both text files, you can do this in notepad. Ask me how.

5. Modify your .slf file so that the new file exists as a second "stand".

At this point, you should have four files – one .loc, one .slf and **two** .fvs files. The two .fvs files correspond with the original CFI data and the data with the "pseudo" trees added.

Part Two: evaluate the consequences

Use FVS to simulate the development of your stand for 100 years, in 10-year cycles. Do this twice, once with the original .fvs file, and the second time with the new .fvs file including the imputed number of trees in the two smallest DBH classes.

Examine the sensitivity of the model in terms of change in stand structure over time and compare cumulative volume removal under "conventional" uneven-aged management. Use a residual BA of 70 ft^2/ac, q=1.3, a 22 in. maximum diameter and a 10 year cutting cycle.

1. Generate three line plots each with diameter class on the X axis: i) trees per acre; ii) basal area per acre; and, iii) cumulative volume removal. Plot two lines, one for the case where trees in the small DBH classes were imputed, and one for the case where the missing data were ignored.

2. Construct a table similar to this, but with appropriate units, formatting, etc. noted:

	Initial 2002 Conditions		Ending 2102 Conditions	
	Original data	Small classes imputed	Original data	Small classes imputed
Trees per acre				
Basal area per acre				
Volume per acre				
Cumulative removal				

3. In a short paragraph, summarize your conclusions. How "good" was your imputation? How much did your efforts increase the accuracy of simulations? What are the consequences of ignoring versus imputing small trees missed in the routine inventory? Do you believe you've properly captured the three basic system properties in your simulation now? Is there anything else missing?

Your memo should be no longer than one double-sided page!

Due Date

You have two weeks for this assignment. It's due at the beginning of lab on **Monday March 15**, 2010. Yes, that's the first day back after spring break.