FSTY-405 — Lab 2

TADAM, again

Name: . . . .

Objectives

Understand dynamic model components, usage, applications. Use of TADAM's Excel add-in.

Complete the required info. Return for marking.

The add-in

In the first lab we used a Palm OS simulator for the TADAM model. Now we will try an implementation running in Excel. Remember, *model* $\neq$ *implementation*. We shall use the Interior-spruce version.

Download the Excel add-in from `http://forestgrowth.unbc.ca/tadam`. The add-in is already installed on the lab computers, so you only need to extract *TadamSDemo.xls* somewhere into your H: disk.

We will be creating a table similar to that in *TadamSDemo.xls*. Open a new Excel sheet. Click on f_x and scroll down the catagories. Under *TadamS* you will see the functions listed below. Explore *TadamSDemo.xls* to see how they work. These constitute sort of a do-it-yourself modelling kit.

Growth

Recall that TADAM's state variables are top height, trees per hectare, and basal area. Growth is relative to top height, and height and age are connected by the site index model.

`tdsGrowTPH`, `tdsGrowBA`: The *global transition functions*. They project trees per hectare and basal area between two heights. Internally, the local transition functions (rates) are integrated with a 4th-order Runge-Kutta method, using equal-sized height steps of one metre or less (you will learn about all this later).

`tdsHeight`: This function estimates top height from age and site index. *Age* is age from planting. The "time gain" is a horizontal shift of the curves, useful for modelling unusual establishment or past weather conditions; normally left at 0.

`tdsAge`: Inverse of the previous one; estimates age from top height and site index.

Site utility functions

`tdsSite`: Estimates site index from height and age.

`tdsGain`: Calculates the time gain, given age, height and site.

Thinnings

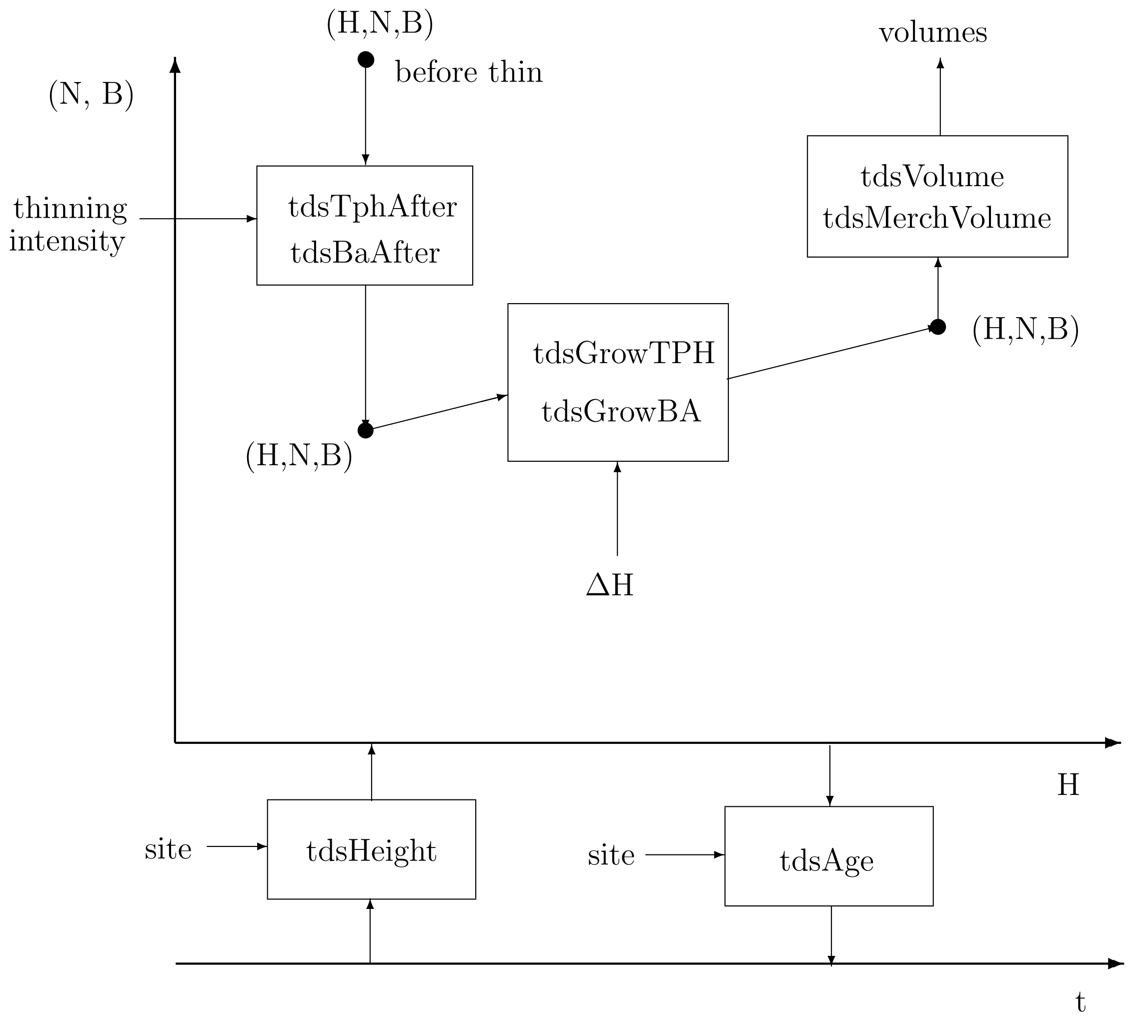
`tdsBAAfter`: Estimates the basal area from the trees per hectare after a "typical" thinning.

`tdsTPHAfter`: Estimates the trees per hectare from the basal area after a "typical" thinning.

Outputs

`tdsVolume`: Total volume, estimated from the current state variables.

`tdsMerchVolume`: Merchantable volume, above a given dbh merchantability limit. It also excludes tops and stumps, so that the value for a zero limit is smaller than that given by `tdsVolume`.



Simulations

You may keep *TadamSDemo* open, for pointers.

Chose a site index of $15 + x.y$, where xy are the last two digits of your student number. Enter it in a spreadsheet cell.

Site index:...............

Set up columns for age, height, trees per hectare, basal area, total volume, merchantable volume. Use a merchantability limit of 27.5 cm, fairly high in order to simulate the effect of piece size on value. Start with a stand of 1200 tph, and breast height (1.3 m). Complete the initial table row:

Age	Height	TPH	BA
......	......	......	......

Hint: When setting up formulas, try to use cell references instead of actual numbers (e.g., site index, initial density); that way it is easier to make changes later. Remember to use dollar signs for absolute cell references when necessary (e.g., `$B$6`).

Project for ages 10, 20, 30, ..., 200 years.

Calculate the total volume MAI for each age (add a column for it). The maximum is at age ...., and it is .... m^3/ha-yr.

Let us do some simple economic analysis. Assume a net harvesting revenue of \$30/m^3 of merchantable volume. To make values at various ages comparable, we *discount* them to age 0. Assuming a discount rate of 4%, we do this by dividing a value for age t by 1.04^t. We consider also an establishment cost (age 0) of \$150/ha, plus 10 cents for each seedling that survives to breast height.

Add a column with the net present value (NPV), that is, the discounted revenues minus costs for each age. According to this, the optimum economic rotation is ....years, with an NPV of \$............/ha.

We are ignoring any contribution from future harvests which, if positive, would bring the optimal rotation slightly forward (it would pay to vacate the land earlier).

Try changing the initial trees per hectare. The most profitable initial density is aprox.............tph, with an NPV of \$............/ ha.

Go back to the initial 1200 tph. Perform a thinning at age 30, removing half of the trees. Hints: insert a row for the situation after thinning; check the cell references for the displaced row.

How much could you pay for the thinning and still make a profit? \$............/ha.
Hint: the direct contribution of the thinning to the NPV is its net revenue (negative in this instance) divided by 1.04^{30}. Balance this plus the maximum harvest NPV against the unthinned NPV.

If you run out of time, stop here and take the rest as homework. Otherwise, continue.

Perform a thinning at top height 22 m, removing half of the standing basal area. Hint: insert rows for before and after thinning, and use the `tdsAge` function. Check for changed cell references!

Now, for the row with the maximum NPV:

Age	Height	TPH	BA	
......	......	......	......	(no marks)

Try graphing trends over time. Explore the spreadsheet and experiment until you have a good understanding of what is going on.