FSTY 405 — Forest Growth and Yield

Final Exam, 3 December 2008

Name:

- Answer in the spaces provided after each question, writing down the intermediate steps. Use the reverse as scratch pad. Writing just the final numerical answer is *not* acceptable.

- Write legibly, and use ink, not pencil.

- Answer clearly and to the point. Nonsense will be penalized.

- Pages: 5. Questions: 6, worth 1 mark each.

- Time: 2.5 hours.

- Info (you may or may not need this):

  $a^x a^y = a^{x+y}$, $(a^x)^y = a^{xy}$, $y = a^x \Leftrightarrow x = \log_a y$,
  $\log_e x \equiv \ln x$, $e^x \equiv \exp(x)$,
  $\log_a xy = \log_a x + \log_a y$, $\log_a x^y = y \log_a x$.
  Area of circle of radius r: πr^2.

1. We have the following model:

$$V = 0.3BH - 4.2 \tag{1}$$
$$\Delta B = 3 - 0.02B - 0.04H \tag{2}$$
$$\Delta H = 1.7 - 0.03H \tag{3}$$

where V is volume (m³/ha), B is basal area (m²/ha), H is top height (m), and t is time (years). Increments are for 4-year periods.

A 40 year-old stand has $V = 75$, $B = 22$, $H = 12$. At age 44, a thinning removes 40% of the current basal area. Estimate the basal area at age 48.

2. These are types of growth models: spatial, whole stand, individual tree, distance-independent. These are models used in BC: STIM, FPS, Prognosis^{BC}, SORTIE, TADAM, DFSIM, TASS, Scube, TASSIE, FORCYTE, VDYP6, VDYP7, SYLVER, TIPSY, STANLEY, MGM, SDMD.

From these, fill in the correct model types in the following classification scheme, and give **one** example of each:

(a) .... Example:

(b) ....

     i. .... Example:

    ii. .... Example:

3. We have the following relationship between top height (H, metres) and age (A, years):
$$\ln H = a - b/\sqrt{A} \, ,$$

where $b = 11.5$, and a varies with site quality. The site index (base age 50) is 21. Estimate the top height at age 32.

4. What is:

(a) Ingrowth?

(b) Stochastic?

(c) Area potentially available (APA)?

(d) State vector, state variable?

(e) Eichhorn's rule?

5. Draw a System Dynamics (rate-level, Vensim) diagram for the model of question 1. Label the elements appropriately.

6. Explain how/why the (absolute or squared) mean size difference for competing trees could be smaller than that for trees that are further apart.