FSTY 405 — Silviculture II

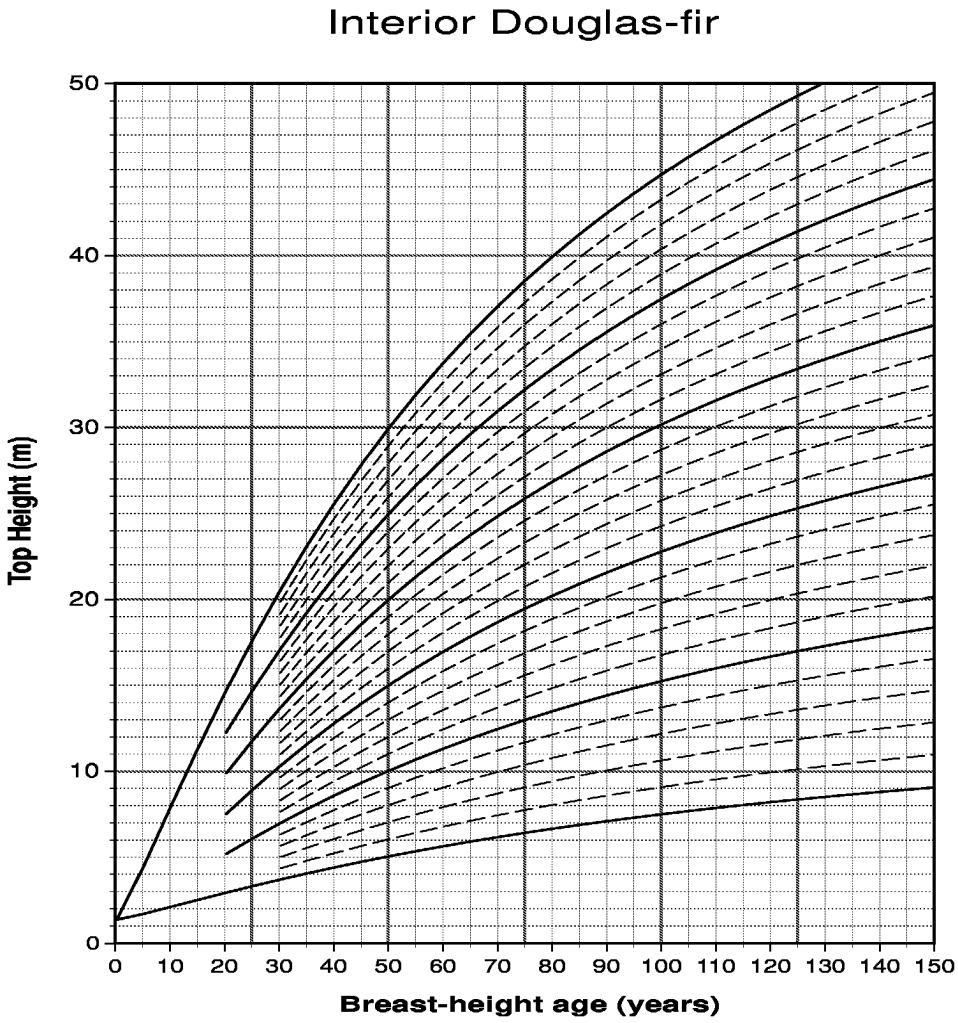
Final Exam, 6th December 2002

Name:

Student number:

- Ensure that your name and student number are correctly entered above.
- Answer in the spaces provided after each question, writing down clearly the intermediate steps. Use the reverse as scratch pad.
- Write clearly, and use ink, not pencil.
- Pages: 6. Questions: 8 out of 9, worth 3 marks each. Cross-out clearly the number of the question that you want excluded. Otherwise, I will drop the one with the highest marks. Total 24 marks.
- In non-math questions, answer clearly and to the point. Writing nonsense causes marks to be taken off.
- Info: $\ln xy = \ln x + \ln y$, $\ln x^y = y \ln x$, $y = \ln x \Leftrightarrow x = \mathrm{e}^y$, $\mathrm{e}^{x+y} = \mathrm{e}^x \mathrm{e}^y$. Circle area $= \pi r^2$.

1. With the following graph



Site Index	5	6	7	8	9	10	11	12-13	14-15	16-18	19-22	23-28	≥29
Years to bh	24	21	18	16	15	14	13	12	11	10	9	8	7

(a) Label the continuous curves with the corresponding site index on the right edge of the graph. Index age is 50 years (breast-height).

(b) Estimate the site index for a stand of 24 metres at breast-height age 60:

(c) Predict the top height at 100 years **total age** for site 16:

Round to the closest integer. Mark the relevant points on the graph.

2. What is Area Potentially Available (APA)? Explain how it is defined, and what is its use.

3. We have the following model:

$$\begin{aligned} \Delta B &= (0.1N - 0.9B)/H \\ \Delta N &= -0.02N \\ \Delta H &= 0.04(50 - H) \end{aligned}$$

where B is basal area (m^2/ha), N is stems per hectare, and H is top height (m). Increments are for 5-year periods. A 40 years-old stand has $B = 22$, $N = 800$, and $H = 12$. At age 45 there is a mechanical thinning removing 50% of both basal area and number of stems. Estimate the basal area at age 50.

4. Indicate two models used in BC in each of the following categories:

   (a) Distance independent:

   (b) Whole-stand:

   (c) Yield table:

5. Draw a System Dynamics (rate-level, Vensim) diagram for the model of question 3. Label the elements appropriately.

6. We have the following relationship between top height (H, metres) and age (A, years):

$$\ln H = a - b/\sqrt{A}\ ,$$

   where $b = 10.22$, and a varies with site quality. A 32 years-old stand has a top height of 14 m. Estimate the site index (base age 50).

7. Explain Pressler's law, also known as the pipe model theory.

8. Is site index useful in uneven-aged stand management? Why/how? Mention two possible alternatives.

9. For ages up to 120 years, the VDYP volume equation is

$$V = b_0 + b_1 H + b_2 HA + b_3 H^2 C + b_4 AC \ , \tag{1}$$

where V is total volume (m^3/ha), H is top height (m), A is breast-height age (years), and C is canopy closure (%). The regression parameters for lodgepole pine are:

i:	0	1	2	3	4
b_i:	79.0	-10.5	0.0628	0.0235	-0.0830

Goudie's site index model, for site index 19 simplifies to:

$$H = 34.93 - 4613/(A^{1.285} + 137.2)$$

(the coefficients, except for 1.285, vary with site).

For site index 19 and 90% canopy closure, what is the MAI at 80 years breast-height?