FSTY 405: Silviculture II

Syllabus – Fall 2003

Course information

Calendar description

FSTY 405-3 Silviculture II. Factors influencing forest yields, traditional prediction methods, growth and yield simulations. Exploration of stand dynamics, quantitative implications of management treatments and environmental limitations to tree and stand growth.

Prerequisites: NREM 203-3, MATH 152-4, 342-3 and FSTY 305-4.

Approach and objectives

From the description above, the course deals with "quantitative silviculture", essentially forest growth modelling, or *growth and yield* (G&Y). It aims at developing a quantitative understanding of stand growth and development in response to silvicultural treatments and environmental factors, including a basic knowledge of G&Y prediction models and methods.

The approach involves an interweaving of several parallel themes:

- Tree physiological and ecological principles.
- Systems theory, dynamical systems and applied mathematics.
- Computer experimentation with simplified systems.
- Available G&Y models and methods.
- Practical issues of needs, application, and data collection.

Most students will become growth model users rather than developers. Therefore, we focus more in understanding the basis and limitations of the various techniques than in specialized methodologies for model building and estimation. Considering also the rapid advances in this field, we emphasize foundations and concepts over the mechanics of running current computer implementations.

Experience shows that it is quicker and more productive in the long run to introduce the appropriate mathematical tools as needed, than trying to circumvent them through obscure elementary arguments. Defining and explaining the mathematics when required means that, in principle, there would be few prerequisites, although obviously it is easier to recall previously acquired knowledge. As a byproduct, it is expected that the students will develop skills relevant to the application of mathematical modelling concepts and techniques to real-life problems and new situations.

Times and Locations

Lectures: Monday and Wednesday, 15:30 to 16:20, room 5-125.

Section C1, CRN 50349 lab: Tuesday, 8:00 to 10:50, room 5-154.

Section C2, CRN 50350 lab: Tuesday, 11:30 to 14:20, room 5-116.

Lectures start on 3rd September, labs 9th September.

Instructors, communications

Instructor

Oscar García, room 8-309, phone 960-5004.

Office hours: Wednesday, Friday, 16:30 to 18:30, or by appointment. Do NOT expect replies to email.

Guest lecturers TBA.

Teaching assistant

Adrian Batho, room 4-437, phone 960-5677, email `batha000@unbc.ca`.

Office hours: TBA.

Web site

`http://web.unbc.ca/~garcia/FSTY405/` will be used for assignments, notes, announcements, etc. Students are expected to check the site at least once a week.

Readings and materials

Textbook (required reading)

VANCLAY, J. K. "Modelling Forest Growth and Yield — Applications to Mixed Tropical Forests", CAB International, 1994. Somewhat expensive, but currently there are no other good alternatives. Not at all restricted to tropical forests, despite its title; covers well the growth modelling literature, although with more emphasis on mixed species and/or uneven-aged stands than usual. Copies on reserve in the library.

Reqired/supplementary reading

The following two texts cover growth & yield modelling, along somewhat more traditional lines (on reserve at the library):

CLUTTER, J. L., FORTSON, J. C., PIENAAR, L. V., BRISTER, G. H. and BAILEY, R. L. "Timber Management: A Quantitative Approach", Wiley, New York, 1983. Chapters 2, 3 and 4 (required reading).

DAVIS, L. S. and JOHNSON, K. N. "Forest Management", 3rd ed., McGraw-Hill, 1987. Chapters 3, 4 and 5.

BC MOF. "Guidelines for developing stand density management regimes". 1999 (`www.for.gov.bc.ca/hfp/pubs/stand_density_mgt`). Required reading, on reserve.

DI LUCCA, C. M. "TASS/SYLVER/TIPSY: Systems for predicting the impact of silvicultural practices on yield, lumber value, economic return and other benefits". In: Colin R. Bamsey (Ed.) Stand Density Management

Conference: Using the Planning Tools. Clear Lake Ltd., Edmonton, AB. 1999. `http://www.for.gov.bc.ca/hre/gymodels/GY-Model/sdm.htm`). Should read this.

SPURR, S. H. "Forest Inventory", Ronald, 1952. Old, but still worth reading.

OLIVER, C. D. and LARSON, B. C. "Forest stand dynamics", Update Edition, Wiley, 1996. Not growth modelling, but good treatment of fundamental ideas and principles of tree and stand development.

ASSMANN, E. "The principles of forest yield study", Pergamon Press, 1970. A classic, with much historical background and review of Central European work, in English. Unfortunately out of print.

FRANC, A., GOURLET-FLEURY, S. and PICARD, N. "Une Introduction à la Modélisation des Forêts Hétérogènes", ENGREF, 2000. A recent advanced monograph (in French).

Various articles and reports available on the internet, sites indicated below.

Software

Besides MS Excel, the following software, all available free, may be used in the labs and/or for assignments (at least gnuplot, Vensim and the MOF models will):

Gnuplot. A flexible and easy to use plotting program. `www.gnuplot.info`. There is a good brief tutorial at `http://www.duke.edu/~hpgavin/gnuplot.html`.

Vensim. System Dynamics simulation package, free version available (Vensim PLE). `www.vensim.com/freedownload.html`

Simile. Another one, only discrete time but with multiple-instances feature. `http://simulistics.com/`. See online tutorials. A third (commercial) one, Stella, is available in the UNBC network.

BC MOF growth and yield packages VDYP, SiteTools, Tipsy, MGM, Prognosis BC, and tutorial "Introduction to Growth & Yield CBT": `http://www.for.gov.bc.ca/hre/software/download.htm`

APLSE. Free interpreter for the APL computer language. ftp://watserv1.uwaterloo.ca/languages/apl/apl-plus/index.html (also get *plusdemo* for a tutorial and documentation)

Some students might find useful a symbolic algebra package, not just for this course. Derive (www.derive.com) is relatively easy to use (a version is built-in in the TI-89 and TI-92 calculators). Other alternatives might have a steeper learning curve: Maxima (free, at http://maxima.sourceforge.net/), Maple (www.maplesoft.com, network licenses at UNBC), muPad (www.sciface.com), or Mathematica (www.wolfram.com).

URLs

The MOF and MSRM growth and yield websites contain much useful material and pointers: http://www.for.gov.bc.ca/hre/gymodels/, http://srmwww.gov.bc.ca/car/resinv/g&y/index.html. Students should be thoroughly familiar with their contents.

UNBC Growth & Yield Chair website: www.unbc.ca/forestry/forestgrowth

Forest Productivity Council: http://www.for.gov.bc.ca/hre/fpc/

MSRM Terrestrial Information Branch: http://srmwww.gov.bc.ca/tib/

(Pacific Northwest) Growth Model Users Group: www.growthmodel.org/

Western Mensurationists: www.westernforestry.org/wmens/

Forest Biometry, Modelling and Information Sciences (e-journal): www.fbmis.info

AME modelling tutorials: http://helios.bto.ed.ac.uk/ierm/ame/tutorial/main.htm

IUFRO: http://iufro.boku.ac.at/iufro/iufronet/d4list.htm

John T. Finn's Systems Ecology Notes: http://bandersnatch.fnr.umass.edu/pub/mod577/sysnotes.html

Ecological modelling server: http://dino.wiz.uni-kassel.de/ecobas.html

Systems links: www.uni-klu.ac.at/users/gossimit/links/bookmksd.htm, http://pespmc1.vub.ac.be/CYBSYSLI.html, http://sysdyn.mit.edu/road-maps/rm-toc.html.

O. García's downloadable articles (see reference [8] for a suggested reading sequence on growth modelling): `http://web.unbc.ca/~garcia/publ/publs.htm`

Grading, etc.

Exams:
Midterm - 22nd October
Final - December.

Lab exercises, quizzes:	20%
Assignments/projects:	15%
Midterm:	30%
Final (cumulative):	35%

Attendance and class participation may be taken into account for borderline decisions.

Questions about grading should be brought to the attention of the instructor or TA in writing within one week. After that time there will be no reconsideration.

Academic honesty: Refer to the Academic Offenses section of the UNBC Undergraduate Calendar.

Tentative course outline

(Pages for required readings from the textbook in parenthesis)

- Introduction (p. 1–5. MOF: *Guidelines for developing stand density management regimes.*)
- Overview (p. 5–13. Clutter et al, Ch.4)
- Site quality (p. 134–155. Clutter et al., Ch.2)
- Yield tables/functions (p. 14–18)
- Distance-dependent models (p. 58–68. Di Lucca. Clutter et al, Ch.3)
- Distance-independent and size class models (p. 68–78, 156–191, 34–56)

- Whole stand models (p. 18–33)
- Regeneration and recruitment (p. 192–203)
- Data, estimation, “validation” (p. 79–102, 204–241)
- Review and discussion (p. 223–251)