

UNBC, College of Science and Management
FSTY 405: Forest Growth and Yield

Syllabus – Fall 2008

Course information

Calendar description

FSTY 405-3 Forest Growth and Yield. 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

The course deals with ‘*growth and yield* (G&Y), forest growth modelling, or ‘quantitative silviculture’. 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: Tuesday and Thursday, 1:30pm to 2:20pm, room 5-157.

Laboratory: Monday, 11:30am to 2:20pm, room 5-154.

Lectures start on September 2, labs September 8.

Instructor, communications

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

Office hours: Monday, Friday, 16:30 to 18:30, or by appointment.

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. Out of print, but currently there

are no other good alternatives. Not 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.

Full text in PDF format available to FSTY-405 students, courtesy of Dr. Vanclay. To download follow the instructions in the course web site.

Required/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 (<http://www.for.gov.bc.ca/hfp/publications/00083/>). Required reading, on reserve.

DI LUCCA, C. M. "TASS/SYLVYER/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.

GURTIS, R. O., and MARSHAL, D. D. "Permanent-plot procedures for silvicultural and yield research". USDA Forest Service, Gen. Tech. Rep. PNW-GTR-634. 2005. 86 p. (<http://treearch.fs.fed.us/pubs/9425>). Everything about PSP's.

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

Software

Besides MS Excel (or OpenOffice.org Calc), the following software, all available for free, may be used in the labs and/or for assignments (at least gnuplot,

Vensim and the MOF models will). Some is available on the Student Terminal System.

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

NetLogo. An individual-based (aka multi-agent) modelling system: <http://ccl.northwestern.edu/netlogo/>

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

URLs

The MOF and MSRM growth and yield websites contain much useful material and pointers:

www.for.gov.bc.ca/hre/gymodels/,
<http://srmwww.gov.bc.ca/car/resinv/g&y/>,
www.for.gov.bc.ca/hfp/silviculture.

Students should be thoroughly familiar with their contents.

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

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/

Southern Mensurationists:
www.mensurationists.com

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

IUFRO Division 4:

<http://www.iufro.org/science/divisions/division-4/>

Ecological modelling server:

<http://dino.wiz.uni-kassel.de/ecobas.html>

Systems links:

<http://www.uni-klu.ac.at/gossimit/linklist.php>,

<http://pespmc1.vub.ac.be/CYBSYSLI.html>,

<http://sysdyn.clexchange.org/road-maps>.

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: One Midterm in October, Final in 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 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 Vanclay's book 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)