

Silviculture Research

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Dave has been with the research group in Smithers since 1989. He has extensive experience in the forests of the former Prince Rupert Region and is now becoming more familiar with the broader NIFR. Currently, he is very interested in how silviculturists should adapt their practices in the light of projected climate change. One of the biggest projects he has worked on is the Date Creek silvicultural systems study, a study that integrates silviculture with forest ecology to provide silvicultural solutions for biodiversity issues. His other research interests include: linking tree population dynamics to ecosystem processes, canopy-understory interactions, neighbourhood dynamics, and simulation modeling. Dave is a lead developer of the complex stand dynamics simulator SORTIE-ND. He was Professional Forester of the Year in 2006 in British Columbia and is co-author of a new book titled "A critique of silviculture: managing for complexity".



Stand Modelling

Dave is leading research and development of the SORTIE-ND ecological modelling program, which has been designed to predict stand dynamics based upon the growth of individual trees. Of particular interest is the application to BC's sub-boreal forests: SORTIE-ND has potential for modelling the growth and yield of complex stands affected by mountain pine beetle. Collaborators on this project include UBC, Institute of Ecosystem Studies in Millbrook, New York, and Bulkley Valley Centre for Natural Resources Research and Management (BV Center).

During the second year of evaluating and validating SORTIE-ND for predicting timber supply, Dave and his collaborators assessed the model's logic and conceptual structure. Sensitivity analyses were conducted to determine the extent to which various parameters and starting conditions influence the model's outcomes. As well, two crown allometry studies have identified crown behaviours to improve the predictive ability of SORTIE-ND, and expand its scope to additional stand types. One study with UBC examined the influence of stand density in dense pine stands of the Cariboo, while the second study with BV Center explored crown shyness and the space between crowns near Smithers. Both studies will improve understanding of crown and stand dynamics.

In application, SORTIE-ND is a tool for predicting mid-term timber supply in stands left with complex structure after a mountain pine beetle infestation. A long-term objective for the project

is developing SORTIE-ND for use in planning silvicultural treatments. Notably, SORTIE-ND would provide information on a treatment's implications for timber supply.

Publication

Rasmus Astrup, K. David Coates and Erin Hall. 2008. Finding the appropriate level of complexity for a simulation model: An example with a forest growth model. *Forest Ecology and Management*. 256: 1659-1665. (available on SharePoint)

Understory growth Dynamics in Long-term Research Trial following MPB

A research trial initiated in 1962 in lodgepole pine stands is now providing insights into how young trees respond after the overstory is killed by MPB. The plots near Houston and Burns Lake were originally established to investigate the performance of spruce trees planted and seeded in partially-cut pine stands. Several years ago, most of the residual overstory trees became infested with MPB.

Dave has collaborated with staff from the BV Center to compile and analyze measurements of trees taken between 1963 and 2003 to determine how the pine overstory affected understory spruce growth and survival. New measurements of the plots made in 2007 and 2009 will reveal how the spruce responded to the loss of overhead canopy.

The project provides new information on interior tree growth, by tracking a 40-year history of understory trees in partially-cut stands, as well as the release of advanced regeneration after the overstory is disturbed by MPB. The findings are particularly relevant to questions concerning mid-term timber supply following the MPB epidemic. Information on the project is posted on the BV Centre website and described in a journal article in preparation.

Implications for Silviculture after MPB

Understory trees are not normally accounted for in forest inventories. Little is known about the abundance of seedlings and saplings left surviving under MPB-affected stands. In response to this knowledge gap, Dave partnered with a number of agencies, pooling data resources collected over the years from various research plots to assemble descriptions of understory tree growth in three TSAs. Data sources included provincial and federal government programs, universities, the forest industry and forest consultants, and the Canadian Forest Service provided financial support.

This year, information was extrapolated from previously-measured plot data about secondary stand structure in pine-leading stands of the Cariboo-Chilcotin. This information summarized the abundance and health of live trees—analyzed by tree species and biogeoclimatic subzone—for the Quesnel, Williams Lake and 100 Mile House TSAs.

The data generated by the project have been compiled in a database available to resource managers. The database provides information to support decisions concerning harvesting strategies following MPB infestation, but the application extends beyond industry: secondary forest structure influences a range of habitat values that are important to recreational users and First Nations.

Extension & Consultation Activities

- In New York, Dave reported on a study done in collaboration with the Cary Institute of Ecosystem Studies which modelled competitive effects and responses above and below ground occurring among nine tree species.
- Dave has co-authored, with professors at Oregon State University and University of Quebec, a book entitled *A Critique of Silviculture: Managing Complexity*, published by Island Press in late 2008. The book brings together new ideas and findings in ecology and complexity science to set the foundation for a fresh approach to silviculture, one that manages forests as complex adaptive systems. Those involved with forestry, silviculture, forest ecology or managing forest ecosystems are the book's intended audience.
- Dave Coates is adjunct professor at UBC's Faculty of Forestry, Forest Sciences Department, and is a committee member for three of its graduate students.
- Dave has given upwards of 30 presentations since April 2007 on a variety of topics. The major themes have been secondary structure in MPB-damaged forests, natural regeneration dynamics in MPB-damaged forests, and incorporating complexity theory into silviculture. Audiences of these talks include Senior Forest Service management, Forest Districts, forest companies, seminar series at UBC, UNBC, the University of Washington and the Bulkley Valley Research Centre, the northern, southern and coastal silvicultural committees, the North American Forest Ecology Workshop, the Western Silvicultural Contractors Association, The Canadian Weed Science Society, Bulkley Valley Research Centre Conferences, the Alberta Growth and Yield Association, and others.

Published work since April 2007

Puettmann, K., Coates, K.D., Messier, C. 2009. *A Critique of Silviculture: Managing for Complexity*. Island Press, Washington DC. (link available on SharePoint)

Coates, K.D., Canham, C.D., LePage, P.T. 2009. Above- versus below-ground competitive effects and responses of a guild of temperate tree species. *Journal of Ecology*, 97:118–130. (available on SharePoint)

Astrup, R., Coates, K.D., Hall, E. 2008. Recruitment limitation in forests: Lessons from an unprecedented mountain pine beetle epidemic. *Forest Ecology and Management*, 256:1743-1750. (available on SharePoint)

Stadt, K.J., Huston, C., Coates, K.D., Feng, Z., Dale, M.R.T., Lieffers, V.J. 2007. Evaluation of competition and light estimation indices for predicting diameter growth in mature boreal mixed forests. *Annals of Forest Science*, 64:477-490. (available on SharePoint)