

Growth and yield of interior spruce: Filling in the blanks

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Many forest planning needs are well-served by simple yield tables. Either the traditional sort or generated by other growth models as in TIPSY. This is particularly true in British Columbia, where the emphasis has been on timber extraction from virgin forests, and where stand management after free-growing is rare. However, new demands are challenging growth forecasting tools worldwide, and perhaps also in British Columbia in the near future. Yield tables and traditional growth and yield models fail to address satisfactorily some issues that are becoming important. These issues include (a) Responses to a varying environment; (b) Ecosystem services such as carbon sequestering involve the whole life of a stand, final timber yield predictions are not sufficient; (c) Long-term data is often scarce; (d) Response to thinning and natural disturbances; and (e) Updating stand conditions with inventory information (adaptive management). The

additional needs can be accommodated using concepts from modern dynamical systems theory.

Scube is a dynamical stand-level growth model for interior spruce, a hybrid complex of white and Engelmann spruce. Interior spruce is the second most important commercial tree in British Columbia, after lodgepole pine. The model applies to even-aged spruce-dominated stands, planted or of natural origin, and was developed with data from the SBS biogeoclimatic zone that contains the bulk of the interior spruce. *Scube*'s priorities were to match the available field measurements, and to provide reasonable extrapolations for unobserved conditions. Suitable permanent sample plot data was rather sparse and heterogeneous (Figure 1). Reflecting the approaching transition to second-growth stands, older plots are of natural origin, while the younger ones are planted and have wider spacings. There are no thinnings. To fill in the observational gaps, the model structure was designed to be consistent with eco-physiological knowledge and experience with other species, while at the same time keeping low the number of parameters to be estimated. Recently, the equations were tested successfully on an extensive database from thinned and unthinned loblolly pine in the southeastern United States.

Figure 2 compares the available data and some growth projections from *Scube* and TIPSY. There is good agreement with the data and little difference between the models for stands of natural origin. Obviously, the predicted final yields for planted stands contain a great deal of uncertainty. Implications for timber supply calculations seem relatively small, at least in the short term. However, TIPSY deviates substantially from the observed early development in plantations. VDYP7, another commonly used growth model, works well for existing stands, but its bare-land projection option underestimates, tracking the lower edge of the data.

Scube has been implemented in a flexible and easy-to-use spreadsheet-based simulator. The software is Open Source and freely available on the Web. A similar model for aspen is nearing completion. It is intended to

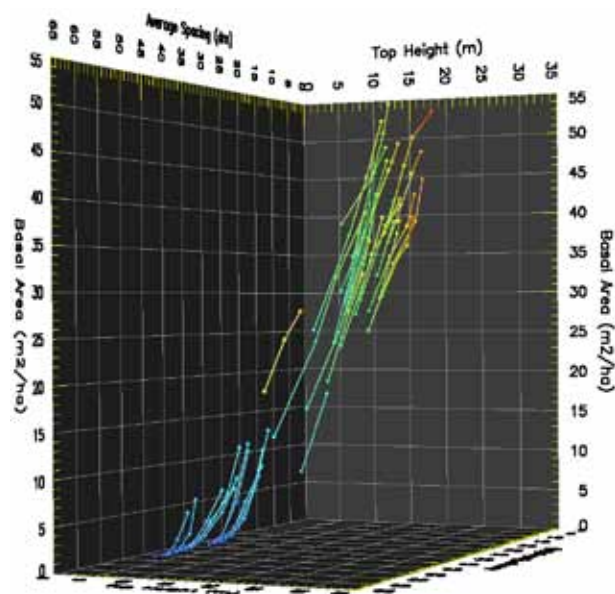


FIGURE 1. Permanent sample plot data for interior spruce in the SBS biogeoclimatic zone. Shading corresponds to age.

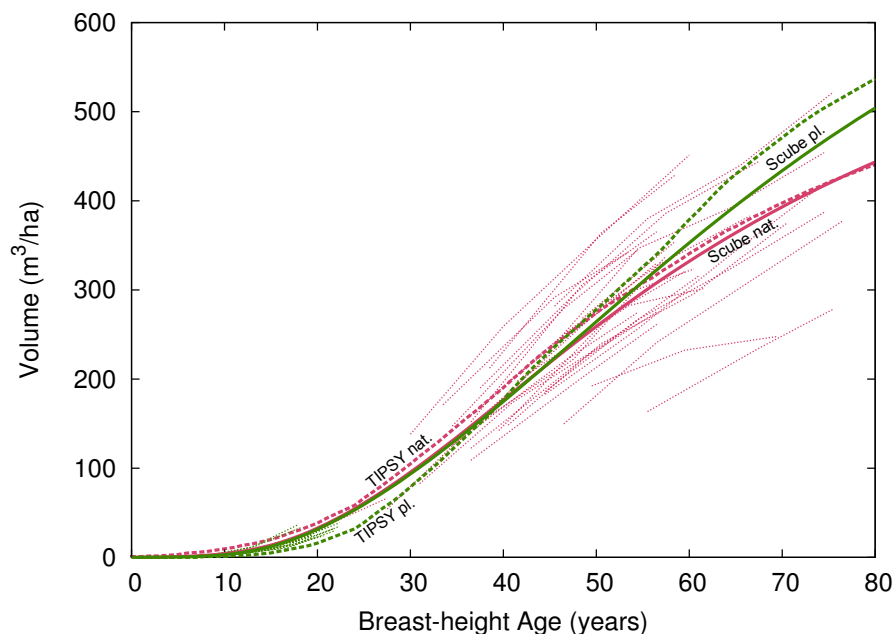


FIGURE 2. Data and examples of volume projections from Scube and TIPSY. Planted in green, natural in red. Predictions are for average site quality, planted pure spruce starting at 1000 trees/ha at breast height, and 80% spruce at 2500 trees/ha for natural. Reproduced with permission (Garcia 2011, p 277).

combine both models for investigating the dynamics of spruce-aspen mixed stands.

For further information visit the website “Scube, a Growth Model for Interior Spruce” at <http://forestgrowth.unbc.ca/scube> (Accessed December 2011).

Reference

García, O. 2011. A parsimonious dynamic stand model for interior spruce in British Columbia. *Forest Science* 57(4):265–280.

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