

FIA–FSP Forest Science Corner

TASS III: The new growth and yield prediction model

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The new generation of TASS will provide forest managers with realistic yield predictions of future forests in support of Sustainable Forest Management (SFM).

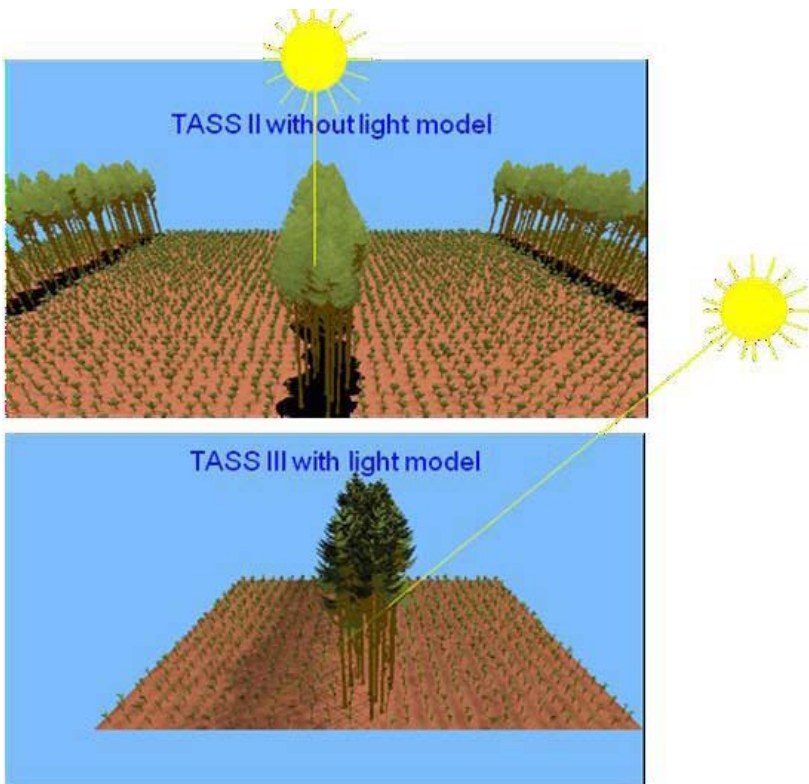


Figure 1. Contrasting crown and solar dynamics in TASS II without light modelling above, and TASS III with light modelling below. In the first case the sunlight is stationary and vertical, and in the second case the sunlight fluctuates according to the time of day.

Version III of the Tree and Stand Simulator (TASS) has been designed to provide forest practitioners with projected yield models on complex stand structures in uneven-aged and mixed-species stands (multi-cohort and spatially heterogeneous). This decision-support tool allows the user to model alternative silvicultural treatments such as variable retention and partial-cutting scenarios. TASS III also has the ability to assess light penetration and light sensitivity levels in these various harvesting scenarios, which users can see in 3-D and at different intervals throughout time.

From the first two versions that were engineered in 1968 and 1975 by **Dr. Ken Mitchell** (MOFR Research Scientist Emeritus), TASS has evolved into an increasingly flexible program. Practitioners currently access TASS II-generated data through the Table Interpolation Program for Stand Yields (TIPSY). With TASS III, users will be able to run TIPSY not only for simple stand structures, but to also directly generate yield predictions based on alternative silviculture systems and complex stand dynamics that are more realistic to today's forest management practices.

The much anticipated release of the operational version of TASS III is expected in the spring of 2010. The three most significant features that have changed in TASS are the following:

- Modelling of complex, multi-cohort stands (i.e., multi-storied, multi-species, and/or multi-aged stands) through innovative modelling of canopy light penetration and its effect on crown dynamics (Figure 1)
- Direct public distribution of TASS in a new Windows-based graphical user interface (GUI)
- Integrated tree- and stand-visualization capabilities

TASS III also has the ability to assess wood quality in second-growth stands for some species, including Douglas-fir, coastal western hemlock, and lodgepole pine, and does so using information that has been collected from the most recent wood quality studies in BC. This feature gives the user the ability to assess wood-quality differences based on various silviculture practices. One of the main changes to wood quality between old-growth and second-growth stands is the increased proportion of juvenile or crown-formed wood. For example, when compared to mature wood, the juvenile wood of Douglas-fir is characterized by lower relative density, shorter tracheids, larger microfibril angle, lower strength, lower percentage of latewood, lower transverse shrinkage, lower cellulose content, and higher lignin content (Barrett and Kellogg 1984, 1986).

TASS III allows the user to predict multiple scenarios for a range of stand establishment options and

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silvicultural treatments (temporal and spatial) in tabular and visual formats with significantly more flexibility than ever before.

TASS III development by the Stand Development Modelling Group (SDMG) within the Research

Branch of the BC Ministry of Forests and Range, is being led by **Jim Goudie**. Team members **Mario Di Lucca, Catherine Bealle Statland, Roberta Parish, Ken Polsson, Shelley Grout, George Harper, Peter Fielder, and Dave Simpson** from the MFR Research Branch, as well as consultants **Ian Cameron and Steve Stearns-Smith**, have been working together on several research projects, some of them funded by the Forest Science Program (FSP), to test the new applications in TASS III.

Modelling the impacts of silvicultural treatments on the wood quality of Interior spruce

Wood-quality research has usually been a high priority for the Forest Science Program (FSP). Most foresters know that stand density substantially impacts important wood quality and log-fibre characteristics. Previous work on coastal Douglas-fir (Mitchell and Polsson 1993), lodgepole pine (Middleton et al. 1995; Mansfield et al. 2007, 2009), and coastal western hemlock (Goudie 2003) indicate that crown structure influences wood quality (density, strength and stiffness, and tracheid characteristics). In general, wide spacings lead to large branches, large knots, and low wood quality, which is all associated with rapid growth of the juvenile core.

For Interior spruce, the silviculture treatment regimes that will generate the best wood at the lowest cost are unknown. Because Interior spruce (Sx) accounts for roughly 20% of the total volume harvested in British Columbia each year, it is important to provide forest managers with a tool that gives realistic projections on wood quality to help them make decisions on silviculture. Using TASS III, the SDMG will be working with a group of stakeholders and agencies to test the effects that silviculture treatments will have on the wood quality of spruce in the Central and Northern Interior of BC. It is expected that reports and papers from this 4-year study will be ready for publication in the spring of 2011.

For more details on the project describe above as well as other projects and for more information on TASS III, please visit: www.for.gov.bc.ca/hre/Stand-DevMod/index.htm and www.for.gov.bc.ca/hre/gymodels 

References

- Barrett, J.D. and R.M. Kellogg. 1984. Strength and stiffness of second-growth Douglas-fir dimension lumber. Forintek Canada Corp., Vancouver, BC Tech. Rep.
- Barrett, J.D. and R.M. Kellogg. 1986. Lumber from second-growth managed forests. Proc. A Technical and Forest Products. F.P.R.S., S.A.F., Bellingham, WA.
- Di Lucca, C.M., J.W. Goudie, and S.C. Stearns-Smith. 2004. Variable retention yield adjustment factors for TIPSYS. BC Min. For. Res. Prog. Ext. Note 69, Victoria, BC. www.for.gov.bc.ca/hfd/pubs/Docs/En/En69.htm
- Di Lucca, C.M., J.W. Goudie, and S.C. Stearns-Smith. 2009. TASS III: A new generation growth and yield prediction model for complex stands in British Columbia. BC Min. For. Res. Prog., XIII World Forestry Congress, Buenos Aires, Argentina.
- Goudie, J.W. 2004. Modeling the impact of silvicultural activities on the wood characteristics of coastal western hemlock in British Columbia. In *Fourth Workshop on the connection between silviculture and wood quality through modeling approaches and simulation software*. Harrison Hot Springs, British Columbia Canada. Gerard Nepveu (editor). Equipe de Recherches sur la Qualite' des Bois, INRA, Nancy, France. pp. 528-536.
- Goudie, J.W., C.M. Di Lucca, W. Klenner, I.R. Cameron, R. Parish, and K.R. Polsson. 2005. Application of simulation models to design and analysis of silvicultural systems in British Columbia. In *Workshop on balancing ecosystem values: Innovative experiments for sustainable forestry*, Portland, Oregon. Charles Petersen and Douglas Maguire (editors). USDA Forest Service, General Technical Report PNW-GTR-635. Portland, Oregon, pp. 175-186. www.fs.fed.us/pnw/publications/gtr635/GTR635c.pdf
- Mansfield, S.D., R. Parish, C.M. Di Lucca, J.W. Goudie, K-Y. Kang, and P. Ott. 2009. Revisiting the transition zone between juvenile and mature wood in lodgepole pine: A comparison of fibre length, microfibril angle, and relative wood density. *Holzforschung* 63(4):449-456. www.reference-global.com/doi/abs/10.1515/HF.2009.069
- Mansfield, S.D., R. Parish, J.W. Goudie, K-Y. Kang, and P. Ott. 2007. The effects of crown ratio on the transition from juvenile to mature wood production in lodgepole pine in western Canada. *Canadian Journal Forest Research* 37:1450-1459. <http://article.pubs.nrc-cnrc.gc.ca/RPAS/rpv?hm=Hlnit&calyLang=eng&journal=cjfr&volume=37&afpf=x06-299.pdf>
- Mitchell, K.J. 1969. Simulation of the growth of even-aged stands of white spruce. Yale University Press, Yale Univ. School of Forestry Bull. No 75, New Haven, CT.
- Mitchell, K.J. 1975. Dynamics and simulated yield of Douglas-fir. *For. Sci. Monogr.* 17.
- Mitchell, K. J. 1988. SYLVER: Modelling the impact of silviculture on yield, lumber value, and economic return. *For. Chron.* 64(2):127-131.
- Mitchell, K. J., R. Kellogg, and K. Polsson. 1989. SYLVER: The link between silvicultural practices and financial return. *Can. For. Ind.*:38-42.
- Pojar, J., K. Klinka, and D.V. Meidinger. 1987. Biogeoclimatic ecosystem classification in British Columbia. *Forest Ecology and Management.* 22:119-154.