RECENT ADVANCEMENTS IN STAND DEVELOPMENT FORECASTING FOR NEW BRUNSWICK

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Outline

Brief History of Local Stand Management Models

Recent Model Improvements

Old vs New Yield Comparison





Stand Management Model Evolution

	1985-1995	1995-2015	2015+
NB	STAMAN Vanguard For. Man. Serv. Ltd.	STAMAN NB Dept. Nat. Res.	Open Stand Model [OSM-AD] <i>Acadian Variant</i> NB-ERD, UNB, U of Maine
NS	NS Growth & Yield Model NS Dept. Nat. Res.	NS Growth & Yield Model — NS Dept. Nat. Res.	→
Maine	FIBER NE For. Exp. Station, USDA For. Serv.	For. Veg. Simulator [FVS-NE] – – Northeast Variant USDA For. Serv. FIBER NE For. Exp. Station USDA For. Serv.	FVS-Online [FVS-AD] Acadian Variant USDA For. Serv., U of Maine, UNB, NS-DNR

Collaborative Initiatives Since 2012

OSM – Acadian Variant

- NB-ERD, UNB, U of Maine
 - C. Hennigar, A. Weiskittel
- DOS App plus API
- Most fine-tuning in NB

FVS Online – Acadian Variant

- U of Maine, UNB, USDA, NS-DNR
 - A. Weiskittel, J. Kershaw
- Web App; R desktop version
- Most fine-tuning in Maine



Both open source; both under development Different growth forecasts (currently) Open sharing of data and models b/w collaborators

What's New for New Brunswick?

- Open Stand Model (OSM) has replaced STAMAN to grow stands in NB
- Current OSM calibration is a blend of new models and STAMAN models
- Revised mortality and ingrowth models

Background mortality	 Hennigar (2016) for plantations, PCT, & clearcut; < 40 cm DBH & < 70 years old. Kershaw (2013) probabilistic survival model used for ME, PE, NS, and for NB Partial Cuts. STAMAN (2012) model for everything else.
Self-Thinning	 Hennigar (2013) specific-gravity based stand-level self-thinning relationships trained with NB stand survey data. A-line set equal to 85% of max relative density and 95% of max relative basal area
Ingrowth	 Aaron Weiskittel (2011) Acadian forest ingrowth (@ 1cm DBH) density, composition, and occurrence probability models. Adjustments made by Hennigar to avoid extrapolation issues and unrealistic behaviour.

New site productivity model for the Acadian Forest

- Hennigar et al. 2016. Development and evaluation of a biomass increment base index for site productivity. Can. J. For. Res.



- **Explicit prediction of tree height and height growth** during simulation
- New 'NB' tree height model (5-10% r² improvement) with tree competitive status, site, and management effects considered
- Local tree height model calibration is now possible if sufficient height observations are available
- New 'Acadian Forest' DBH growth model with region, competition, site, and management effects considered

Height	• Hennigar (2015) height model fit with NB data only (no adjustments for ME, NS, PEI)
DBH growth	Hennigar (2016) Acadian-wide model with regional random effects
Height growth	Deduced from DBH growth and height predictions

- STAMAN snag fall model ported to OSM
- New snag imputation capabilities for surveys with no snag tally

Snags	•	Snag fall rate based on STAMAN (2012) & adapted for OSM by Hennigar (2016) Snag inventory initialization model (Hennigar 2016) trained using recent NB FDS
Crown width, recession	•	Aaron Weiskittel (2011) using mostly Maine data
Grade	•	Walter Emrich (2015) Nor. H. Res. Inst. tolerant hardwood grade models

- Genetic gains are now considered during simulation
 - Applied to DBH and Height of planted species in OSM **before** simulation.
 - Applied to growth for planted species **during** simulation.
 - Caused earlier onset of stand competition

In STAMAN, genetic gain was applied to individual trees after simulation

Updated Log Volume Calculations

Switched from using Honer 1983 taper equations to Weiskittel and Li (2012) outside bark equations and bark thickness models.

Updated log minimum diameters and lengths, and % cull and product downgrade assumptions, to align volume calculations better with Crown scaling.



STAMAN vs PSP Growth (NB Co-op Plots)

Under predicted plot growth:

- Clearcut and planted stands by roughly 4 m³/ha/year
- PCT by roughly 1.8 m³/ha/year
- YIMO and partial cut by

< 0.5 m³/ha/year

Main issues

- Mortality too high for natural regeneration
- Growth too slow for all regenerating stands



OSM vs PSP Growth (NB Co-op Plots)

- Improvement over STAMAN for regenerating stands
- OSM is still slightly under predicting overall growth:
 - 0.60 0.67 m³/ha/yr
 - PCT relatively unbiased



Overall Yield Effects



Age or Years from Present

OSM vs PSP Growth (NB Co-op Plots)

Priority areas that need improvement



Stand Ratio of Poplar by Volume

Stand Basal Area (m^2 /ha > 3cm DBH)

Resource Supply Effects?

- OSM will certainly estimate more volume sooner compared to STAMAN; especially for regenerating stands.
- Though, catastrophic spruce budworm and climate change related disturbances were not factored into these yield estimates.
- Strategic forest planning model for Crown lands almost compete
 - Includes OSM yields and revised harvest operability rules
 - Planning to explore 'what-if' scenarios of spruce budworm outbreak scenarios on timber, carbon, and habitat supply