Can hybrid poplar save industrial forestry in Canada’s boreal forest?: A financial analysis and policy considerations

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Overview

- Introduction: *A perfect storm?*
- Methods
- Results
- Policy considerations
- Conclusions

Introduction: *A perfect storm?*

- increasing competition among land uses and users
- forest fibre production is rapidly evolving from timber foraging to a system of agricultural cropping (Sedjo 1999)
- boreal forest does not represent a high value fibre resource

Introduction: *weathering the storm*

- one potential solution would be to intensify forest management
- it could address all three problems

1. offset timber lost to other uses
2. follows global trends towards plantations
3. increase the value of the forest resource

Introduction: *weathering the storm*

- financial considerations often spoil otherwise good ideas
- intensive management of *native species* in Boreal regions results in negative soil expectation values (Rodrigues et al. 1998)
- 21st century will be the “era of tree domestication”, and “poplar will lead the way” (Bradshaw and Strauss 2001)

Introduction: *weathering the storm*

- of Canada's 67.8 million hectares of agricultural lands, 21 million hectares are marginal lands considered usable for hybrid poplar (Tardif 1994)
- few firms establishing hybrid poplar plantations
- is the reason financial and/or policy?
- the answer: *a bit of both*

Methods: *data*

- Prairie Farm Rehabilitation Administration (PFRA), a division of Agriculture and Agri-Food Canada, has been conducting research on hybrid poplars for over 25 years
- PFRA data is used to estimate a yield curve for hybrid poplar in the western Canadian boreal regions

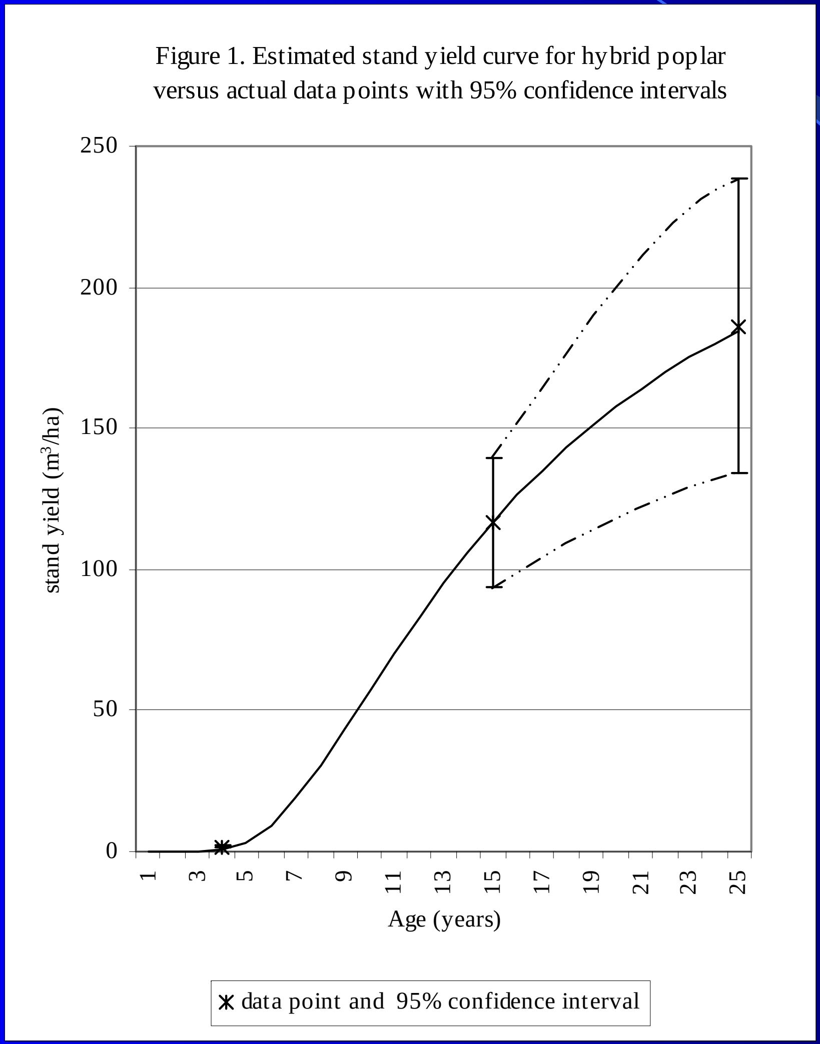
Methods: *yield curve estimation*

- evaluated three different functional forms

1. Chapman-Richards Growth Function
2. Lundkvist-Korf Growth Function
3. McDill-Amateis Growth Function

- Lundkvist-Korf growth function provides estimates closest to the empirical data

Methods: *Lundkvist-Korf growth function*



Methods: *Stand-Level Optimal Economic Rotation Model*

The optimal economic rotation (OER) is the stand age where the marginal return from allowing the stand to grow another year equals the opportunity cost of the capital that would be generated from harvesting the current crop and regenerating the site, thereby maximizing the value of the forest land (e.g., Pearse 1990)

Methods: *the model*

$$\max_t SEV = \frac{Pv_n(t) - Ce^{rt}}{e^{rt} - 1}$$

- SEV represents the value of the land *to the landowner*

$$\max_t NPV = \frac{Pv_n(t) - \left(\sum_{t=0}^{T} S_t^{PV} + \sum_{t=0}^{T} R_t^{PV} \right) e^{rt}}{e^{rt} - 1}$$

- NPV represents the financial viability *to the forestry firm*

Results: *sensitivity analysis*

Table 3. Sensitivity analysis.

Scenarios	SEV ($/ha)	NPV ($/ha)	Benefit/Cost Ratio	Real IRR (%)	OER (years)
Base case	1 681	-87	0.98	3.6	19
1	2 733	961	1.22	5.1	18
2	664	-1 100	0.73	1.7	20
3	n/a	-529	0.89	2.9	19
4	n/a	355	1.09	4.3	19
5	1 080	-683	0.85	2.8	20
6	2 314	542	1.15	4.7	18
7	564	-700	0.79	n/a	18
8	4 490	1 529	1.24	n/a	20
9	3 548	1 017	1.25	5.1	20
10	768	-998	0.74	2.1	24

Specifications:

Base case:

a. Net stumpage value = $28.69/m^3$ (WRI 2000)
b. Total Present Value of Silviculture costs = $1 231/ha (Thomas and Kaiser 2003)
c. Land rent = $62/ha (Thomas and Kaiser 2003)
d. Real interest rate = 3.7% (Buongiorno and Gilless 2003)
e. Yield parameters: A = 275, n = 1.5 and k = 49.7
NOTE: real IRR is solved for NPV = 0 with all other variables held constant

Alternative scenarios:

Scenario 1: Base case except 25% increase in net stumpage value (from $28.69/m^3$ to $35.86/m^3$)
Scenario 2: Base case except 25% decrease in net stumpage value (from $28.69/m^3$ to $21.52/m^3$)
Scenario 3: Base case except 25% increase in land rent (from $62/ha to $77.50/ha)
Scenario 4: Base case except 25% decrease in land rent (from $62/ha to $46.50/ha)
Scenario 5: Base case except 25% increase in total present value of silviculture costs (from $1,231/ha to $1,539/ha)
Scenario 6: Base case except 25% decrease in total present value of silviculture costs (from $1,231/ha to $923/ha)
Scenario 7: Base case except 1.5 percentage point increase in real interest rate (from 3.7% to 5.2%)
Scenario 8: Base case except 1.5 percentage point decrease in real interest rate (from 3.7% to 2.2%)
Scenario 9: Base case except 27% increase in gross stand volume at year 20 (from 158m^3/ha to 200m^3/ha)
Scenario 10: Base case except 24% decrease in gross stand volume at year 20 (from 158m^3/ha to 120m^3/ha)

Results: *take home message*

- intensive management of hybrid poplar *could be* financially viable in western Canadian boreal regions
- will depend heavily on the policies that governments use to encourage or discourage such plantation forestry

Policy consideration #1: *allowing hybrid poplar on public land*

- over 2.4 million hectares of crown land is currently managed for agriculture as cattle grazing pasture (SRD 2003)
- this land could be rented to forestry firms for less than private landowners charge
- government can charge double the grazing rent and forestry firms will still realize a real IRR of approximately 5%

Policy consideration #2: *increasing growth rates*

- large knowledge gap regarding the growth potential of hybrid poplar in Canada's boreal forest
- geneticist Barb Thomas believes that simply selecting clones for western Canadian conditions could eventually increase MAI to 12 m3/ha/year (real IRR of 6.2%)

Policy consideration #3: *future stumpage values*

- at $26.85/tonne of carbon dioxide (Point Carbon 2005), the real IRR would increase from 3.6% to 4.7%
- at 10m3/ha/year and a carbon dioxide price of $25/tonne, the apparent land availability for poplar plantations would be 310 000 hectares in Western Canada and 20 000 hectares in Eastern Canada (McKenney *et al*. 2004)
- fire and pest resistance: e.g., mountain pine beetle

Policy consideration #4: *the ACE*

- allowable cut effect (ACE) is an immediate increase in annual allowable cut (AAC) attributable to expected future increases in yield (Schweitzer *et al*. 1972)
- private land could be contractually coupled with public land to activate the ACE
- firm could increase its AAC in existing timber from public lands because of increased productivity shown in poplar stands

Conclusions

- can hybrid poplar save Canada's boreal forest industry?
- to do so, it must increase competitiveness while appeasing environmental concerns
- appears to be financially viable given different policy reforms
- approximately 60% of the current pulpwood and strand-board producing land base could be protected while maintaining current output

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