Table S1. Biomass price per ton.

Species	Bid Price in total (CAD)	Volume (M^3)	Wood Density(ton/m^3)	Price (per/Ton of Biomass)
Pr	$25,205,523.87	395,838.28	0.57	$116.84
Mh	$4,684,690.75	60,907.09	0.55	$134.94
Pw	$2,003,674.20	52,986.06	0.40	$94.54
Or	$1,081,306.00	17,503.46	0.70	$88.25

Table S2. VCS program fee list [84].

Cost Details	US_Dollar	CAD_Dollar
Account opening fee	$500.00	$692.00
Account maintenance fee	$10,000.00	$13,840.00
Pipeline listing request fee	$1,000.00	$1,384.00
Project registration request review fee	$2,500.00	$3,460.00
VCU issuance levy	$47,106.18	$65,194.95
Validation/verification body annual fee	$100,000.00	$138,400.00
Gap analysis fee	to be determined	to be determined
In total	$161,106.18	$222,970.95

Table S3. Species parameters in 3-PG model.

parameters	description	red pine	sugar maple	white pine	red oak
pFS2	Foliage:stem partitioning ratio - D = 2 cm	0.401171222	0.511065	0.096683015	0.3128153
pFS20	Foliage:stem partitioning ratio - D = 20 cm	0.718539984	0.2226362	0.179875917	0.2061026
aWS	Constant in the stem mass v. diam. relationship	0.008077857	0.04874298	0.328369614	0.02961269
nWS	Power in the stem mass v. diam. relationship	3.239867747	2.885765	2.025551812	2.933496
pRx	Maximum fraction of NPP to roots	0.64057461	0.2824392	0.802336028	0.5234468
pRn	Minimum fraction of NPP to roots	0.583602456	0.1445269	0.299998741	0.3948174
gammaF1	Maximum litterfall rate	0.03189035	0.03162548	0.034557521	0.03073229
gammaF0	Litterfall rate at t = 0	0.001446568	0.001274389	0.002028975	0.000999307
tgammaF	Age at which litterfall rate has median value	77.19920922	44.97505	13.26683085	44.3985
gammaR	Average monthly root turnover rate	0.032142186	0.01007257	0.019183888	0.01357631
leafgrow	If deciduous, leaves are produced at end of this month	0	4.76017539	0	4

leaffall	If deciduous, leaves all fall at start of this month	0	11	0	11
Tmin	Minimum temperature for growth	-29.96575462	-30.74562607	-16.71080212	-9.084438
Topt	Optimum temperature for growth	12.66330209	21.85634278	29.33101916	22.73599
Tmax	Maximum temperature for growth	31.37751101	37.16315285	32.2338974	31.31155
kF	Days production lost per frost day	2.073539429	1	2.440740131	0.2833382
SWconst	Moisture ratio deficit for fq = 0.5	0.79	0.556	0.79	0.79
SWpower	Power of moisture ratio deficit				
fCalpha700	Assimilation enhancement factor at 700 ppm	1.808443336	1.09132	1.724045404	1.892967
fCg700	Canopy conductance enhancement factor at 700 ppm	0.767964485	0.8823162	0.304902493	0.7035984
m0	Value of m when FR = 0	0.001116885	0.001	0.01615003	0.0145686
fN0	Value of fNutr when FR = 0	0.704745325	0.98547867	0.539559573	0.425422
fNn	Power of (1-FR) in fNutr	1.870400747	1.87301546	0.558076238	0.490533
MaxAge	Maximum stand age used in age modifier	392.9786284	299.748444	248.311827	308.8946
nAge	Power of relative age in function for fAge	4	4	4	4
rAge	Relative age to give fAge = 0.5	0.55	0.95559566	0.956907578	0.95
gammaN1	Mortality rate for large t	0.003293742	0.198393	0.134909323	0.1939148
gammaN0	Seedling mortality rate (t = 0)	0.006784615	0.01195904	0.027284612	6.81194E-05
tgammaN	Age at which mortality rate has median value	53.88407613	37.96661	21.74922485	59.0543
ngammaN	Shape of mortality response	0.110870378	1.221333	1.46149783	0.5768297
wSx1000	Max. stem mass per tree - 1000 trees/hectare	485	580	410	560
thinPower	Power in self-thinning rule	1.028022284	1.287685429	1.202877432	1.242594
mF	Fraction mean single-tree foliage biomass lost per dead tree	0.221879416	0.09960352	0.034690669	0.3575642
mR	Fraction mean single-tree root biomass lost per dead tree	0.2	0.0320374	0.2	0.2
mS	Fraction mean single-tree stem biomass lost per dead tree	0.558814289	0.5555434	0.590548095	0.08444142

SLA0	Specific leaf area at age 0	16.20929666	27.89011	26.8412051	14.0319
SLA1	Specific leaf area for mature leaves	21.15734442	11.45268	23.23164069	15.77845
tSLA	Age at which specific leaf area = (SLA0+SLA1)/2	36.49738976	40.59216	9.481088822	7.869642
k	Extinction coefficient for absorption of PAR by canopy	0.606344209	0.41220769	0.850594816	0.3379362
fullCanAge	Age at canopy closure	10.03162547	15.3419344	17.13383595	32.32855
MaxIntcptn	Maximum proportion of rainfall evaporated from canopy	0.145424168	0.22781709	0.360162838	0.08722418
LAImaxIntcptn	LAI for maximum rainfall interception	1.259386024	3	2.196143512	4.833775
cVPD	LAI for 50% reduction of VPD in canopy	5	5	5	5
alphaCx	Canopy quantum efficiency	0.066889235	0.04157227	0.040792603	0.05287352
Y	Ratio NPP/GPP	0.482893422	0.46186524	0.480678879	0.4755294
MinCond	Minimum canopy conductance	0.013253385	0.00001	0.00592428	0.01778883
MaxCond	Maximum canopy conductance	0.012329367	0.02052064	0.021223141	0.003392984
LAIgcx	LAI for maximum canopy conductance	3.275729246	3.33	3.292320476	3.099621
CoeffCond	Defines stomatal response to VPD	0.019083251	0.0455384	0.059353704	0.01252035
BLcond	Canopy boundary layer conductance	0.283897496	0.2	0.243680911	0.2499149
RGcGw	The ratio of diffusivities of CO2 and water vapour in air	0.66	0.66	0.66	0.66
D13CTissueDif	d13C difference of modelled tissue and new photosynthate	2	2	2	2
aFracDiffu	Fractionation against 13C in diffusion	4.4	4.4	4.4	4.4
bFracRubi	Enzymatic fractionation by Rubisco	27	27	27	27
fracBB0	Branch and bark fraction at age 0	0.27	0.75	0.75	0.75
fracBB1	Branch and bark fraction for mature stands	0.1518	0.15	0.15	0.15
tBB	Age at which fracBB = (fracBB0+fracBB1)/2	2	2	2	2
rhoMin	Minimum basic density - for young trees	0.284121986	0.55	0.331227306	0.4808171
rhoMax	Maximum basic density - for older trees	0.643606366	0.554138711	0.507179677	0.547633

tRho	Age at which rho = (rhoMin+rhoMax)/2	63.84190702	1	149.9696618	76.2321
crownshape	Crown shape (1=cone, 2=ellipsoid, 3=half-ellipsoid, 4=rectangular)	1	2	1	3
aH	Constant in the stem height relationship	4.528062242	4.6	0.006149669	2.2724829
nHB	Power of DBH in the stem height relationship	0.287781415	0.6	1.022862629	0.7367869
nHC	Power of competition in the stem height relationship	0.032522694	0.04	0.04831385	0.082321041
aV	Constant in the stem volume relationship	0.00010974	0.000052	1.4852579	0.001
nVB	Power of DBH in the stem volume relationship	3.10676	2.16	6.577328	1.68
nVH	Power of height in the stem volume relationshi	0.3667	0.5	-15.9983	1.62
nVBH	Power of DBH^2 x height in the stem volume relationship	0.001	0.001	0.001	0.001
aK	Constant in the crown diameter relationship	1.1134	0.88	1.91587	0.31
nKB	Power of DBH in the crown diameter relationship	0.59935	0.6	0.815111	1.01
nKH	Power of height in the crown diameter relationship	0.6	0.001	0.001	0.001
nKC	Power of competition in the crown diameter relationship	0.0964	0.001	-0.00704	-0.111
nKrh	Power of relative height in the crown diameter relationship	0.3743	0.001	0.631472	0.001
aHL	Constant in the LCL relationship	0.006	18.42	52.03412	23.41
nHLB	Power of DBH in the LCL relationship	17.01	19.35	0.001	19.45
nHLL	Power of LAI in the LCL relationship	0.0001	0.001	0.001	0.001
nHLC	Power of competition in the LCL relationship	2.7646	0.001	-0.27291	-0.03
nHLrh	Power of relative height in the LCL relationship	9.14434	0.001	28.71732	0.001
Qa	Intercept of net v. solar radiation relationship	-90	-90	-90	-90
Qb	Slope of net v. solar radiation relationship	0.8	0.8	0.8	0.8
gDM_mol	Molecular weight of dry matter	24	24	24	24
molPAR_MJ	Conversion of solar radiation to PAR	2.3	2.3	2.3	2.3

This is a table shows the final model parameters, description and values.

Table S4. Scenario1-Business as usual. The first two columns of this table show the area of four tree species growing in each soil type. The third column shows the timber biomass obtained by logging each tree species in different soil types. The last column shows the remaining biomass of the site by 2045 after logging is completed.

Business as usual			
Pr	Area/ ha	Timber_biomass/ ton	Remaining_biomass/ ton
sand	2,214.2	293,921.8	1,544,360.2
sandy loam	1,160.3	119,342.8	642,209.7
clay	2.8	382.6	1,725.4
mountain	0.6	69.1	317.5
no data	81.9	8,556.8	48,244.3
in total	3,459.8	422,273.1	2,236,857.1
income		$49,338,389.0	
Mh			
sand	1,395.68	126,599.0	1,145,012.2
sandy loam	971.5	79,900.3	666,399.8
clay	67.0	4,094.4	39,430.9
mountain	30.3	2,172.3	17,575.2
no data	145.1	12,458.1	107,769.1
in total	2,609.6	225,224.1	1,976,187.2
income		$30,391,740.1	
Or			
sand	651.5	36,206.4	325,058.5
sandy loam	456.2	29,126.3	255,384.5
clay	16.4	766.6	7,108.6
mountain	1.9	75.3	728.1
no data	0	0	0
in total	1,126.1	66,174.5	588,279.7
income		$5,839,897.8	
Pw			
sand	661.5	28,819.4	174,922.7
sandy loam	651.7	33,133.9	186,249.1
clay	100.2	5,230.4	25,951.8
mountain	6.9	202.3	1,082.9
no data	65.4	3,082.3	17,968.7
in total	1,485.7	70,468.3	406,175.2
income		$6,662,073.1	
Sum	8,681.1	$92,232,099.9	5207499.2

The following three tables present the timber harvest volume, remaining biomass, and potential income for each soil type under the "Business as Usual", "Maximize timber value", and "Carbon Certification" forest management scenarios.

Table S5. Scenario2-maximize timber value.

Maximize timber value

Pr	Area/ ha	Timber_biomass/ ton	Remaining_biomass/ ton
sand	2,214.2	700,484.3	836,657.6
sandy loam	1,160.3	310,112.3	406,060.8
clay	2.8	902.4	707.2
mountain	0.6	175.1	142.6
no data	81.9	23,590	29,645.7
in total	3,459.8	1,035,264.1	1,273,213.9
income		$120,960,257.4	
Mh		max	
sand	1,395.7	511,635.7	576,507.8
sandy loam	971.5	339,509.9	274,556.7
clay	67.0	17,406.6	20,474.5
mountain	30.3	7,682.1	9,250.7
no data	145.1	51,795.3	48,942.1
in total	2,609.6	928,029.6	929,731.8
income		$125,228,314.2	
Or		max	
sand	651.5	141,918.5	153,310.6
sandy loam	456.2	100,646.9	147,076.8
clay	16.4	2,918.9	3,870.6
mountain	1.92	283.4	404.2
no data	0	0	0
in total	1,126.1	245,767.7	304,662.2
income		$21,688,999.5	
Pw		max	
sand	661.5	71,389.1	98,795
sandy loam	651.7	75,346.7	114,334.1
clay	100.2	12,985.9	13,266.5
mountain	6.9	487.1	588.4
no data	65.4	7,300.3	10,603.4
in total	1,485.7	167,509.1	237,587.4
income		$15,836,310.3	
Sum	8,681.1	$283,713,881.5	2745195.3

Table S6. Scenario3-introduce carbon certification.

Carbon Certification			
Pr	Area/ ha	Timber_biomass/ ton	Remaining_biomass/ ton
sand	2,214.2	293,921.8	1,544,360.2
sandy loam	1,160.3	119,342.8	642,209.7
clay	2.8	382.6	1,725.4
mountain	0.6	69.1	317.5
no data	81.9	8,556.8	48,244.3
in total	3,459.8	422,273.1	2,236,857.1
income		$49,338,389.0	

Mh		carbon	
sand	1,395.7	0	1,392,604.3
sandy loam	971.5	0	809,519.8
clay	67.0	0	49,305.3
mountain	30.3	0	22,008.6
no data	145.1	0	130,987.2
in total	2,609.6	0	2,404,425.2
income		$0.00	
Or		carbon	
sand	651.5	54,310.9	308,130.8
sandy loam	456.2	43,690.5	241,766.9
clay	16.4	1,149.9	6,750.2
mountain	1.9	112.9	692.9
no data	0	0	0
in total	1,126.1	99,264.2	557,340.8
income		$8,760,065.7	
Pw		carbon	
sand	661.5	28,819.4	174,922.7
sandy loam	651.7	33,133.9	186,249.1
clay	100.2	5,230.4	25,951.8
mountain	6.9	202.3	1,082.9
no data	65.4	3,082.3	17,968.7
in total	1,485.7	70,468.3	406,175.2
income		$6,662,073.1	
Sum	8,681.1	$61,840,359.9	5635737.2

Figure S1. Red pine model parameters sensitivity analysis.

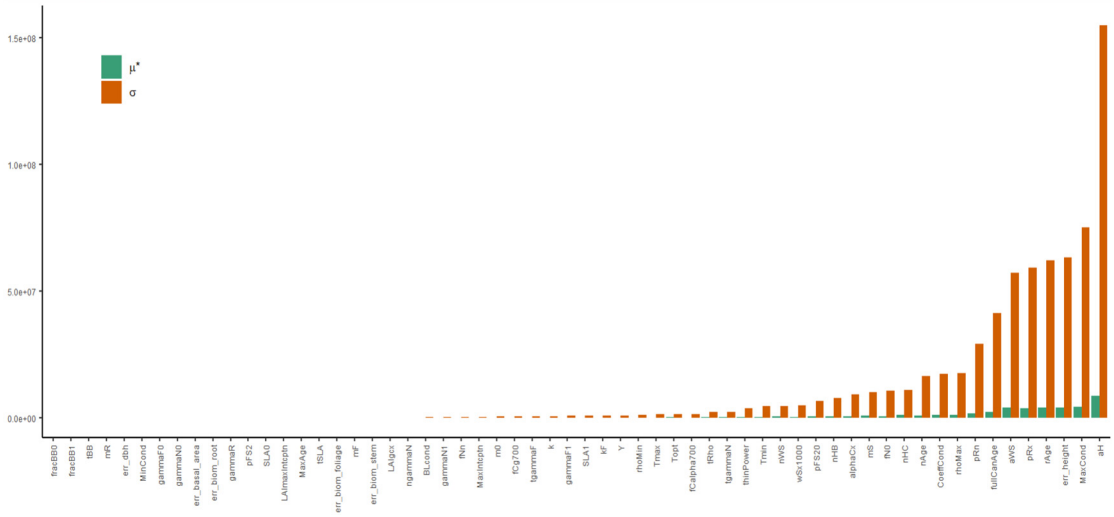


Figure S2. White pine model parameters sensitivity analysis.

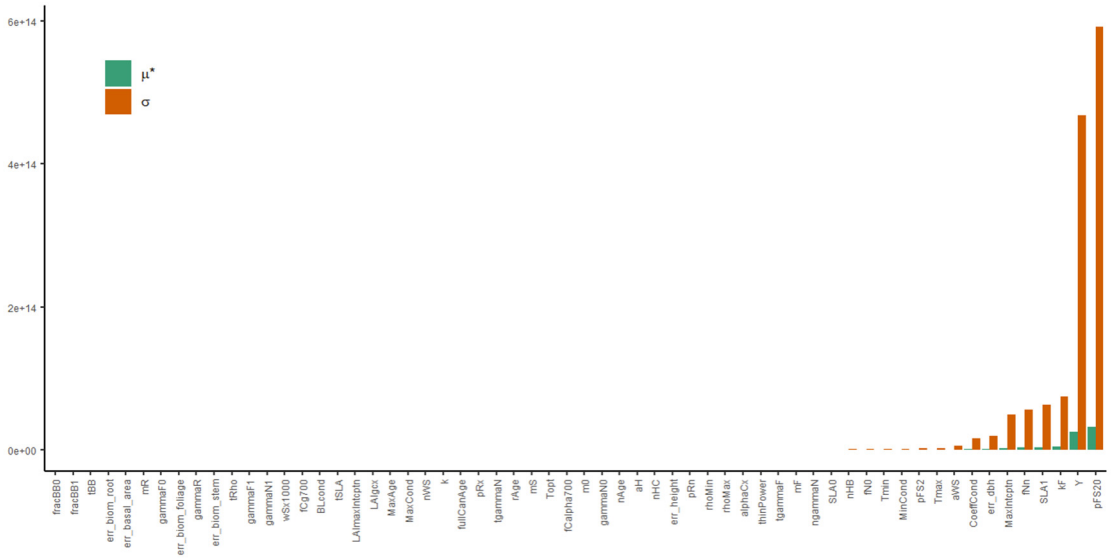


Figure S3. Sugar maple model parameters sensitivity analysis.

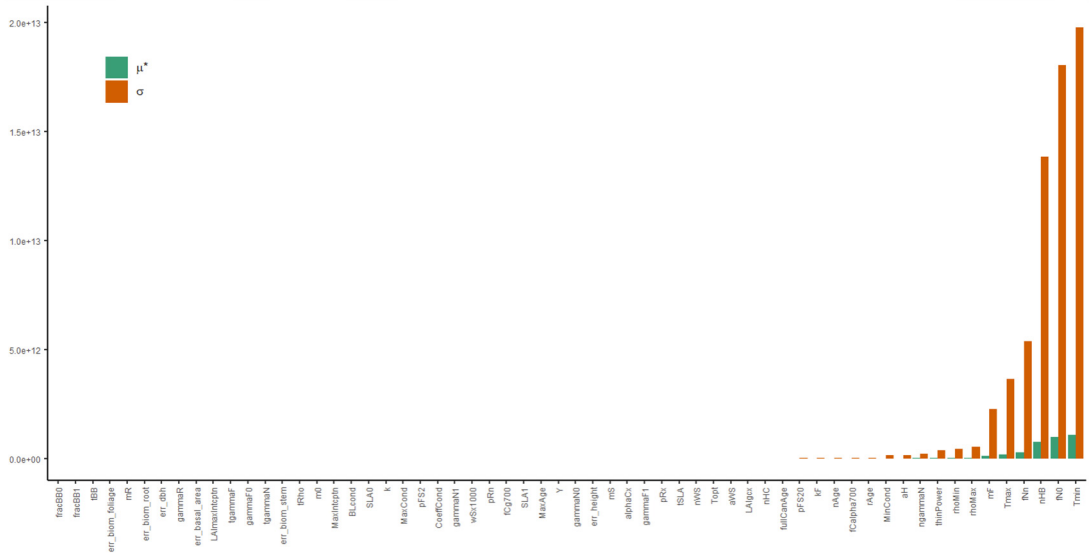
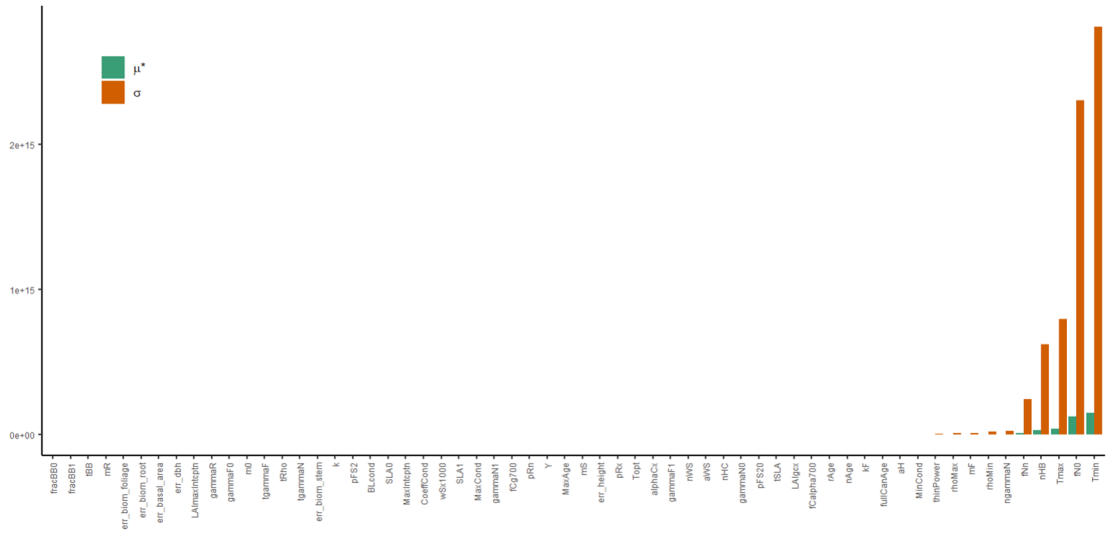


Figure S4. Red oak model parameters sensitivity analysis.



μ*
σ
2e+15
1e+15
0e+00
fracBB0
fracBB1
tBB
mR
err_biom_foliage
err_biom_root
err_basal_area
err_dbh
LAImaxIntcptn
gammaR
gammaF0
m0
tgammaF
tRho
tgammaN
err_biom_stem
k
pFS2
BLcond
SLA0
MaxIntcptn
CoeffCond
wSx1000
SLA1
MaxCond
gammaN1
fCg700
pRn
Y
MaxAge
mS
err_height
pRx
Topt
alphaCx
gammaF1
nWS
aWS
nHC
gammaN0
pFS20
tSLA
LAIgcx
fCalpha700
rAge
nAge
kF
fullCanAge
aH
MinCond
thinPower
rhoMax
mF
rhoMin
ngammaN
fNn
nHB
Tmax
fN0
Tmin