# Supplementary Material

Table A1: Parameter values

|  |  |
| --- | --- |
| **Parameter Description** | **Assigned value** **(alternate values)** |
| Economic parameters |
| *T* | Length of the planning horizon | 200 years |
| *Δt* | Time step | 10 years |
| *R* | Monetary discount rate | 0.025 |
| *β* | Discount factor | 1/(1+r)=0.80 |
| *rc* | Carbon discount rate | 0.01 |
| *ch* | Cost of logging trees/m3 | $22.20 |
| *pL* | Price of lumber/m3 | $160 |
| *PEng* | Price of HWP/m3 | $200 |
| *PPulp* | Price of chips in pulp/m3 | $145 |
| *PFuel* | Price of fuel/m3 | $155 |
| *chau* | Hauling cost/m3 | $6.77 |
| *charv* | Cost of logging trees/m3 | $22.20 |
| *Km* | Average round-trip distance | 150 km |
| *Sp* | Speed of trucks including loading | 50 km/hr |
| *Mill* | Sawmilling cost/m3 | $72 |
| *Emill* | Extra cost for HWP/m3 | $50 |
| *ppreng* | Proportion of residuals for HWP | 0.151 |
| *pprpulp* | Proportion of residuals for pulp | 0.697 |
| *pprfuel* | Proportion of residuals for fuel | 0.152 |
| Environmental parameters |
| *η* | Conversion of CO2 to carbon | 3.67 |
| *δ* | Decay rate of organic matter | 0.0718 |
| *δlum* | Decay rate of softwood | 0.0082 |
| *δpulp* | Decay rate of pulpwood | 0.0234 |
| *δfuel* | Decay rate of biomass for fuel | 0.700 |
| *δeng* | Decay rate of HWP | 0.008 |
| *esaw* | Carbon in raw material in sawnwood (tCO2/m3) | 0.0293 |
| *eeng* | Carbon in raw material in HWP (tCO2/m3) | 0.066 |
| *epulp* | Carbon in raw material in pulp (tCO2/m3) | 0.100 |
| *efuel* | Carbon in raw material in fuel (tCO2/m3) | 0.000 |
| *eharv* | Emissions from harvesting (tCO2/m3) | 0.01173 |
| *etruck* | Trucking emissions (tCO2/m3 per km) | 0.000078 |
| *savesub* | Emissions saved by product substitution | 0 (1) |
| *savefuel* | Emissions saved by fuel substitution | 0 (1.365) |
| *γ* | =1 if carbon outside ecosystem is counted, =0 otherwise | 0 (1) |
| Programming parameters |
| itermax | Upper bound for iterations  | 30,000 |
| Tol | Convergence tolerance | 1e-5 |

Source: van Kooten, Bogle, and de Vries (2015); van Kooten (2018)

Table A2: Functional forms

|  |  |  |
| --- | --- | --- |
| **Variable** | **Description** | **Functional form** |
| *Economic variables* |
| *lum* | Lumber as a proportion of volume (m3) | 0.00008+0.4658x̅ |
| *res* | Residues from commercial bole (m3) | 3.25115+0.5212x̅–0.000329x̅2 |
| *val* | Commercial value ($) | 0.001(plum-mill)×lum+ 0.001[(peng –emill)×ppreng+ppulp×pprpulp+pfuel×pprfuel ]×res] |
| *Logcost (x̅<250)* |  | 2.04 – 0.05x̅ |
| *Logcost (x̅≥250)* |  | 0.79 – 0.0001x̅ |
| *cost* |  | 0.001[((chau×km/sp)+charv )x̅+logcost] |
| *NetRev* | Net revenue ($) | Val – cost |
| *Environmental variables* |
| *clive* | Carbon in living biomass (m3) | 1.93536+0.41905x̅ – 0.0001739x̅2 |
| *cdead* | Carbon in dead biomass (m3) | 0.0055x̅ |
| *cdis* | Discounted carbon (tCO2) | 0.32η rc/(rc+δlum)×lum+[ppreng×rc/(rc+δeng ) +pprpulp×rc/(rc+δpulp)+pprfuel×rc/(rc+δfuel )]×res |
| *eprod* | Production emissions (tCO2) | esaw×lum+(eeng×ppreng+epulp×pprpulp+efuel×pprfuel )×res |
| *e* | Total emissions (tCO2) | (eharv+etruck×km)x̅+eprod |
| *saveharv* | Carbon stored in products, product & fuel substitution (tCO2) | cdis+savesub×(lum+ppreng×res)+savefuel×pprfuel×res |
| *cnoneco* | Carbon stored outside of the ecosystem (tCO2) | 0.001×pc×saveharv×(1–γ) |

Source: van Kooten et al. (2015); van Kooten (2018)



Figure S1: Map of Quesnel Timber Supply Area (TSA), British Columbia, Canada.

Source: Government of British Columbia. 2017. Retrieved from: <https://www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/timber-supply-review-and-allowable-annual-cut/allowable-annual-cut-timber-supply-areas/quesnel-tsa>.