# Supporting Information

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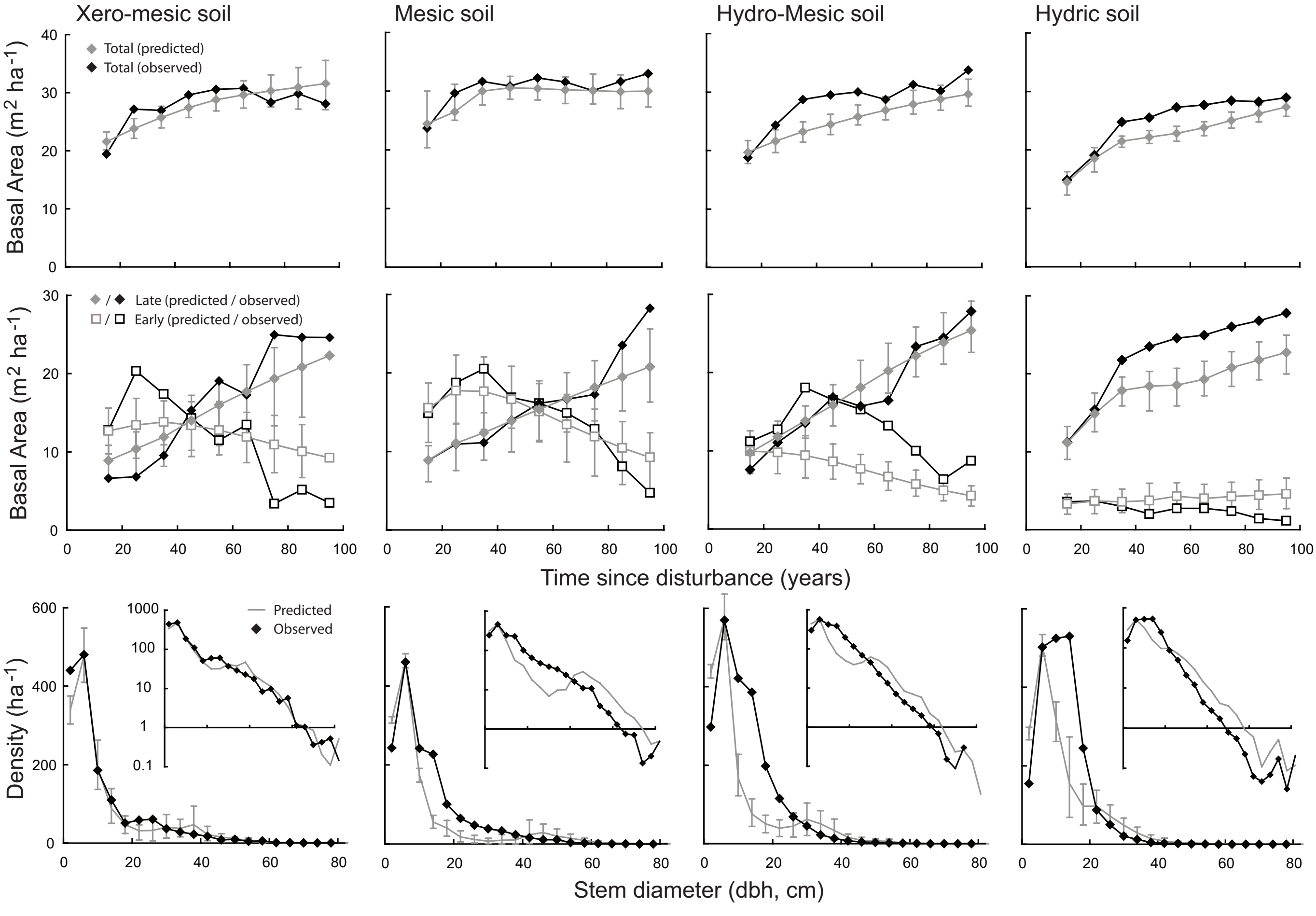


**Fig. S1.** Comparison of PPA model predictions with observations on four soil types in the US Lake states (Michigan, Minnesota, and Wisconsin). Model predictions are shown in gray, and observations are shown in black. (*Top*) Dynamics of stand basal area. (*Middle*) Dynamics of the basal area of early- and late-successional species [successional status was defined from observed correlations between species' basal area and stand age (*SI Appendix*, *Appendix 1*)]. (*Bottom*) Diameter distribution of 100-year-old stands (the insets show the same values on log scale). The PPA was parameterized from short-term (10- to 15-year) inventory data, initialized with data from young plots (average stand age, ≈15 years) then simulated for a subsequent 85-year period. To propagate parameter uncertainty, the model was simulated 50 times with parameter sets drawn randomly from their joint posterior distribution; the model predictions show the mean and the upper and lower 68% bounds from these 50 simulations. Note that the predicted and observed dynamics are averages over many stands from the region and, thus, may not apply to any single location.

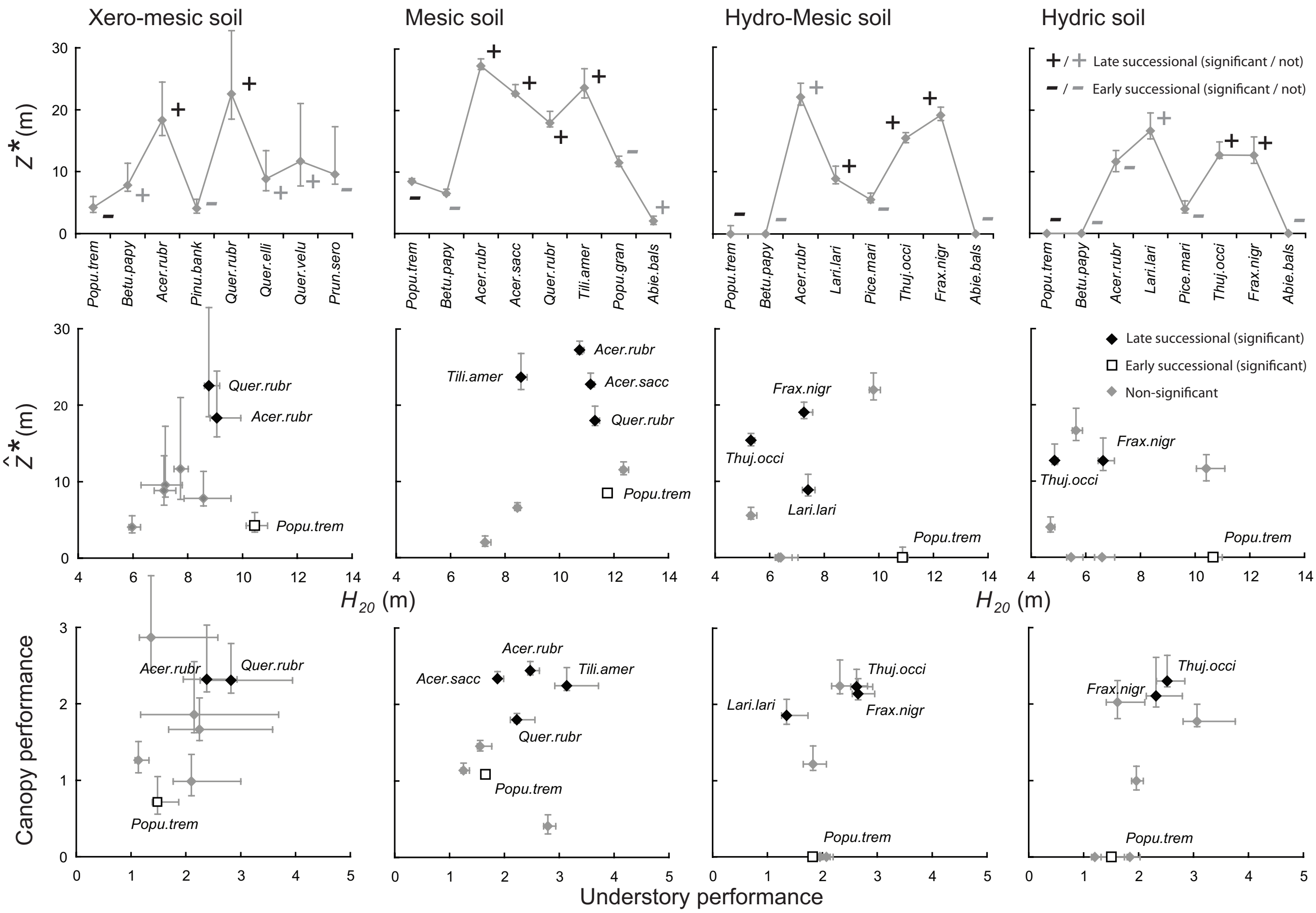


**Fig. S2.** Analytical decomposition of ecological succession on the four soil types. For the special case of the PPA used here, the late-successional dominant is predicted to be the species with the greatest value of $\hat{Z}^*$, the height of canopy closure in an equilibrium monoculture. $\hat{Z}^*$ (Eq. **1**) was calculated from PPA parameters estimated from short-term data on the growth, mortality, and allometry of individual trees. $H_{20}$ (height of a 20-year-old open-grown tree) is a metric for early-successional performance. Calculations of $\hat{Z}^*$ and $H_{20}$ include a propagation of parameter uncertainty (mean and 68% interval, shown). (*Top*) $\hat{Z}^*$ and observed successional status (defined from observed correlations between species' basal area and stand age; see *SI Appendix*, *Appendix 1*) for each species. Negative values of $\hat{Z}^*$ (which are plotted as zero) imply that a species cannot persist on a given soil. (*Middle*) $H_{20}$ vs. $\hat{Z}^*$ for the eight species. (*Bottom*) Decomposition of $\hat{Z}_j^*$ into components measuring performance in the understory $[(G_{D,j}/\mu_{D,j})^{\beta j}]$ and canopy $[\ln(2\pi\phi_j^2 F G_{L,j}^2 \mu_{L,j}^{-3})]$, with mean and 68% interval from error propagation. As with $\hat{Z}^*$, negative values of the canopy metric are plotted as zero. The $\hat{Z}^*$ metric also depends on the height allometry parameter $\alpha$ (not shown), which is lower for *Thuja occidentalis* on hydromesic and hydric soils compared with other species; thus, the $\hat{Z}^*$ of *Thuja* does not exceed that of *Acer rubrum*, even though *Thuja* has superior performance in both the understory and canopy. Species abbreviations refer to *Pinus banksiana*, *Acer rubrum*, *Betula papyrifera*, *Populus tremuloides*, *Prunus serotina*, *Quercus ellipsoidalis*, *Quercus rubra*, *Quercus velutina*, *Abies balsamea*, *Acer saccharum*, *Populus grandidentata*, *Tilia americana*, *Larix laricina*, *Picea mariana*, *Thuja occidentalis*, and *Fraxinus nigra*.

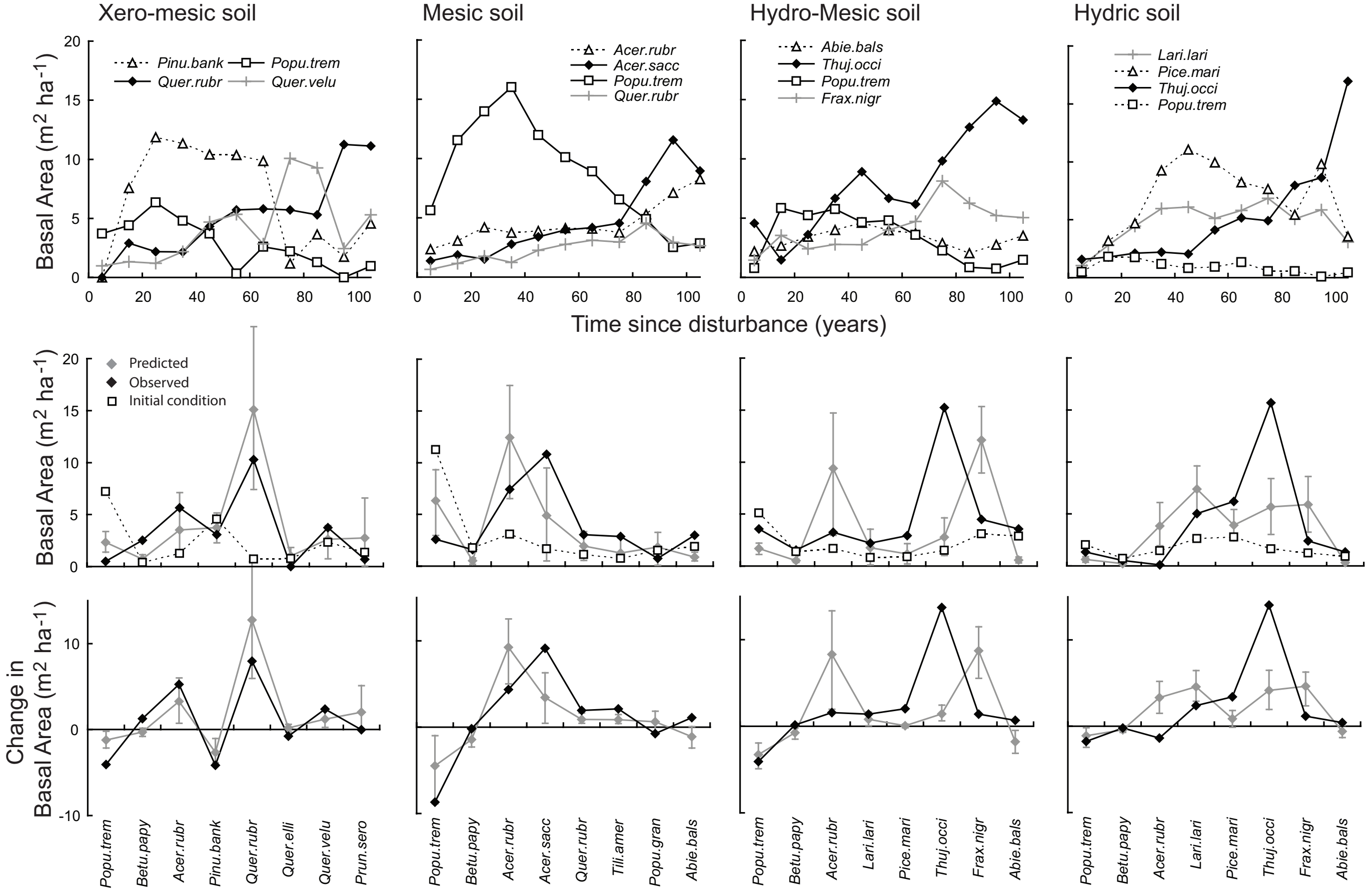


**Fig. S3.** Comparison of predicted and observed species-composition dynamics. (*Top*) Observed basal area of four selected species vs. stand age. (*Middle*) Basal area of each species in young stands (observed: average stand age ≈ 15 years) and old stands (observed and predicted: stand age = 100 years). (*Bottom*) Observed and predicted change in basal area between young and old stands. The mean and 68% interval from a propagation of parameter uncertainty are shown.

**Table S1. Data sources and sample sizes for the estimation of PPA model parameters on four different soil types in the US Lake states (Michigan, Minnesota, and Wisconsin)**

| Model component | Data source | Sample size (no. of trees) |
|---|---|---|
| Xeromesic soil | | |
| Growth | FIA pre-1999 | 2,645 |
| Mortality | FIA pre-1999 | 3,559 |
| Height allometry | FIA post-1999 | 8,203 |
| Crown allometry | FHM | 4,028 |
| Mesic soil | | |
| Growth | FIA pre-1999 | 41,133 |
| Mortality | FIA pre-1999 | 54,557 |
| Height allometry | FIA post-1999 | 103,044 |
| Crown allometry | FHM | 4,913 |
| Hydromesic soil | | |
| Growth | FIA pre-1999 | 17,143 |
| Mortality | FIA pre-1999 | 22,586 |
| Height allometry | FIA post-1999 | 36,657 |
| Crown allometry | FHM | 3,780 |
| Hydric soil | | |
| Growth | FIA pre-1999 | 11,801 |
| Mortality | FIA pre-1999 | 14,482 |
| Height allometry | FIA post-1999 | 36,657 |
| Crown allometry | FHM | 3,780 |

Because of the change in soil-classification system between the pre- and post-1999 Forest Inventory and Analysis (FIA) data (see *Data Sources* in SI Appendix), we could not separate hydromesic and hydric height data; therefore, the same data were used for height allometry on both hydromesic and hydric soils. The US Department of Agriculture Forest Health Monitoring (FHM) data, used to parameterize crown allometry, is a much smaller data set than the FIA, so the same FHM data were used for all four soils. The sample sizes shown are those used in the actual parameter estimation and, therefore, refer only to the most common eight species on each soil type.

**Table S2. The number of inventory plots available in the FIA data for each soil type *s* and age class *a*, *N*(*s*, *a*).**

| | Age class | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Soil | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Xeromesic | 29 | 128 | 189 | 191 | 279 | 171 | 234 | 131 | 156 | 72 | 78 |
| Mesic | 915 | 2,101 | 2,796 | 2,802 | 3,859 | 2,893 | 3,241 | 1,447 | 1,523 | 569 | 536 |
| Hydromesic | 73 | 195 | 406 | 303 | 390 | 244 | 176 | 168 | 78 | 81 | 32 |
| Hydric | 85 | 212 | 330 | 486 | 624 | 522 | 456 | 317 | 246 | 145 | 96 |

**Table S3. Parameter notation, definition, units, and details of MCMC proposal distributions**

| Model | Parameter | Meaning | Unit | Allowed range | Proposal distribution |
|---|---|---|---|---|---|
| Growth | $G_{L,j}$ | Trunk diameter growth rate, canopy tree | $cm{\cdot}yr^{-1}$ | 0.0010–2.0 | $\ln\{G'_{L,j}\} \sim N(\ln\{G_{L,j}\}, \sigma$ |
| | $G_{D,j}$ | Trunk diameter growth rate, understory tree | $cm{\cdot}yr^{-1}$ | | |
| | $\Omega_{G,j}$ | $G_{D,j}$ as fraction of $G_{L,j}$ | NA | 0–1 | $\Omega'_{G,j} \sim N(\Omega_{G,j}, \sigma)$ |
| | $\sigma_{GL,j}$, $\sigma_{GD,j}$ | SD for unexplained variation in diameter growth rate | cm | 0.01–2.0 | $\sigma'_{GL/GD,j} \sim N(\ln\{\sigma_{GL/GD,j}\}, \sigma)$ |
| Mortality | $\mu_{L,j}$ | Annual probability of mortality, canopy tree | $yr^{-1}$ | | |
| | $\mu_{D,j}$ | Annual probability of mortality, understory tree | $yr^{-1}$ | | |
| | $\rho_{L,j}$ | Expected lifespan, canopy tree ($=1/\mu_{L,j}$) | years | 5–500 | $\ln\{\rho'_{L,j}\} \sim N(\ln\{\rho_{L,j}\}, \sigma)$ |
| | $\rho_{D,j}$ | Expected lifespan, understory tree ($=1/\rho_{D,j}$) | years | | |
| | $\Omega_{\rho,j}$ | $\rho_{D,j}$ as a fraction of $\rho_{L,j}$ | NA | 0–1 | $\Omega'_{\rho,j} \sim N(\Omega_{\rho,j}, \sigma)$ |
| Height allometry | $\alpha_j$ | Allometry: height of a tree with dbh 1 cm | m | | |
| | $\alpha_j^{20}$ | Allometry: height of a tree with dbh 20 cm | m | 5.0–40.0 | $\ln\{\alpha_j^{20'}\} \sim N(\ln\{\alpha_j^{20}\}, \sigma)$ |
| | $\beta_j$ | Allometry: exponent for height vs. dbh | NA | 0.10–2.0 | $\beta'_j \sim N(\beta_j, \sigma)$ |
| | $\sigma_{height,j}$ | Coefficient for SD for unexplained variation in height | NA | 0.020–0.50 | $\ln\{\sigma'_{height,j}\} \sim N(\ln\{\sigma_{height,j}\}, \sigma)$ |
| Crown allometry | $\phi_j$ | Allometry: crown radius vs. dbh | $m{\cdot}cm^{-1}$ | 0.0020–0.40 | $\ln\{\phi'_j\} \sim N(\ln\{\phi_j\}, \sigma)$ |
| | $\sigma_{crown,j}$ | SD for unexplained variation in crown radius | m | 0.10–5.0 | $\ln\{\sigma'_{crown,j}\} \sim N(\ln\{\sigma_{crown,j}\}, \sigma)$ |
| Reproduction | $F$ | Fecundity: new recruits per unit crown area per year (shared across species) | $m^{-2}{\cdot}yr^{-1}$ | | |

The subscript $j$ refers to species. The fecundity parameter $F$ is shared by all species and was estimated separately from all other parameters. The parameters shown fall into three categories: those used in the implementation of the PPA; those needed for the reparameterizations; and those required to represent unexplained variation. The 10 parameters estimated for each species by the Markov chain Monte Carlo (MCMC) scheme are indicated by the fact that their allowable ranges and proposal distributions are given. The notation $N(x, \sigma)$ for the proposal distributions (far-right column) indicates a normal distribution with mean $x$ and variance $\sigma$. Values of $\sigma$ were tuned for each parameter during the MCMC burn-in period to achieve a Metropolis–Hastings acceptance rate of ≈0.25. NA, not applicable.

**Table S4. PPA model parameters for the U.S. Lake States**

| Species $j$ | Growth $G_{L,j}$ | Growth $\sigma_{GL,j}$ | Growth $G_{D,j}$ | Growth $\sigma_{GD,j}$ | Mortality $\mu_{L,j}$ | Mortality $\mu_{D,j}$ | Height $\alpha_j^{20}$ | Height $\beta_j$ | Height $\sigma_{height,j}$ | Crown $\phi_j$ | Crown $\sigma_{crown,j}$ | Fecundity $F$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Xeromesic soil | | | | | | | | | | | | |
| *Pinus banksiana* | 0.274 | 0.180 | 0.166 | 0.087 | 0.0255 | 0.0548 | 13.84 | 0.641 | 0.223 | 0.095 | 0.410 | |
| | (0.266,0.287) | (0.178,189) | (0.153,0.219) | (0.076,0.119) | (0.0218,0.0277) | (0.0359,0.0679) | (13.79,13.99) | (0.626,0.673) | (0.220,0.233) | (0.0.092,0.100) | (0.387,0.514) | |
| *Acer rubrum* | 0.309 | 0.176 | 0.097 | 0.059 | 0.0088 | 0.0199 | 16.89 | 0.541 | 0.181 | 0.121 | 0.977 | |
| | (0.299,366) | (0.162,196) | (0.087,0.127) | (0.050,0.082) | (0.0038,0.0110) | (0.0138,0.0266) | (16.80,17.02) | (0.522,0.572) | (0.178,0.189) | (0.110,0.112) | (0.0.966,1.017) | |
| *Betula papyrifera* | 0.166 | 0.117 | 0.089 | 0.064 | 0.0154 | 0.0628 | 16.20 | 0.362 | 0.185 | 0.118 | 0.638 | |
| | (0.158,190) | (0.114,132) | (0.081,0.114) | (0.056,0.077) | (0.0096,0.0190) | (0.0459,0.0727) | (16.06,16.72) | (0.329,0.420) | (0.175,0.198) | (0.117,0.122) | (0.617,0.674) | |
| *Populus tremuloides* | 0.359 | 0.179 | 0.168 | 0.082 | 0.0369 | 0.0726 | 16.88 | 0.467 | 0.173 | 0.098 | 0.497 | 0.0102* |
| | (0.345,0.379) | (0.169,194) | (0.148,0.264) | (0.071,0.159) | (0.0306,0.0393) | (0.0505,0.0831) | (16.82,17.06) | (0.455,0.517) | (0.169,0.183) | (0.0.098,0.099) | (0.487,0.516) | |
| *Prunus serotina* | 0.304 | 0.254 | 0.146 | 0.073 | 0.0043 | 0.0962 | 13.84 | 0.569 | 0.234 | 0.105 | 0.872 | |
| | (0.269,365) | (0.233,0.299) | (0.120,0.210) | (0.061,0.114) | (0.0021,0.0085) | (0.0243,0.1062) | (13.65,14.10) | (0.549,0.662) | (0.221,0.260) | (0.103,0.108) | (0.845,0.976) | |
| *Quercus ellipsoidalis* | 0.329 | 0.183 | 0.182 | 0.060 | 0.0205 | 0.0409 | 13.41 | 0.574 | 0.183 | 0.124 | 0.696 | |
| | (0.312,0.357) | (0.170,0.210) | (0.146,0.269) | (0.043,0.471) | (0.0145,0.0236) | (0.0233,0.0696) | (13.30,13.63) | (0.555,0.614) | (0.178,0.197) | (0.0.119,0.129) | (0.647,0.923) | |
| *Quercus rubra* | 0.316 | 0.174 | 0.183 | 0.077 | 0.0070 | 0.0235 | 15.66 | 0.507 | 0.198 | 0.106 | 0.898 | |
| | (0.310,0.351) | (0.167,0.199) | (0.165,0.224) | (0.071,0.105) | (0.0034,0.0092) | (0.0107,0.0354) | (15.55,15.90) | (0.484,0.543) | (0.195,0.211) | (0.105,0.108) | (0.887,0.985) | |
| *Quercus velutina* | 0.309 | 0.131 | 0.279 | 0.440 | 0.0135 | 0.0573 | 13.94 | 0.505 | 0.192 | 0.113 | 0.871 | |
| | (0.300,326) | (0.124,0.149) | (0.247,0.316) | (0.379,0.545) | (0.0046,0.0180) | (0.0241,0.1958) | (13.83,14.15) | (0.486,0.543) | (0.190,0.203) | (0.111,0.115) | (0.834,0.938) | |
| Mesic soil | | | | | | | | | | | | |
| *Abies balsamea* | 0.369 | 0.184 | 0.160 | 0.092 | 0.0368 | 0.0375 | 14.70 | 0.707 | 0.170 | 0.104 | 0.486 | |
| | (0.366,386) | (0.181,0.192) | (0.156,0.166) | (0.090,0.096) | (0.0355,0.0379) | (0.0359,0.0213) | (14.67,14.80) | (0.703,0.719) | (0.169,0.172) | (0.102,0.108) | (0.474,0.527) | |
| *Acer rubrum* | 0.340 | 0.214 | 0.150 | 0.087 | 0.0038 | 0.0206 | 17.54 | 0.455 | 0.166 | 0.121 | 0.979 | |
| | (0.337,0.347) | (0.212,0.223) | (0.147,0.157) | (0.085,0.091) | (0.0030,0.0044) | (0.0186,0.0213) | (17.53,17.59) | (0.451,0.461) | (0.165,0.169) | (0.120,0.124) | (0.966,1.021) | |
| *Acer saccharum* | 0.307 | 0.172 | 0.086 | 0.067 | 0.0034 | 0.0195 | 18.40 | 0.424 | 0.159 | 0.125 | 1.011 | |
| | (0.304,0.312) | (0.169,0.176) | (0.084,0.091) | (0.065,0.071) | (0.0028,0.0036) | (0.0175,0.0203) | (18.38,18.51) | (0.422,0.429) | (0.159,0.160) | (0.124,0.127) | (0.994,1.053) | |
| *Betula papyrifera* | 0.205 | 0.125 | 0.073 | 0.046 | 0.0190 | 0.0431 | 17.05 | 0.443 | 0.175 | 0.120 | 0.652 | 0.0071* |
| | (0.203,0.209) | (0.123,0.127) | (0.071,0.078) | (0.044,0.050) | (0.0174,0.0197) | (0.0361,0.0476) | (17.02,17.13) | (0.436,452) | (0.174,0.178) | (0.117,0.122) | (0.614,0.697) | |
| *Populus grandidentata* | 0.380 | 0.195 | 0.195 | 0.081 | 0.0179 | 0.0707 | 18.92 | 0.443 | 0.153 | 0.094 | 0.719 | |
| | (0.377,0.393) | (0.192,0.202) | (0.184,0.210) | (0.075,0.091) | (0.0165,0.0189) | (0.0560,0.0760) | (18.89,18.99) | (0.437,0.455) | (0.152,0.155) | (0.090,0.098) | (0.687,0.839) | |
| *Populus tremuloides* | 0.399 | 0.197 | 0.207 | 0.100 | 0.0274 | 0.0660 | 17.68 | 0.442 | 0.157 | 0.098 | 0.494 | |
| | (0.397,0.403) | (0.195,0.202) | (0.204,0.215) | (0.098,0.106) | (0.0266,0.0277) | (0.0624,0.0688) | (17.65,17.71) | (0.439,0.446) | (0.156,0.158) | (0.098,0.099) | (0.487,0.525) | |
| *Quercus rubra* | 0.391 | 0.209 | 0.179 | 0.073 | 0.0123 | 0.0303 | 17.20 | 0.447 | 0.185 | 0.106 | 0.912 | |
| | (0.388,0.401) | (0.207,0.215) | (0.173,193) | (0.068,0.080) | (0.0108,0.0130) | (0.0223,0.0335) | (17.15,17.29) | (0.442,0.460) | (0.183,0.187) | (0.109,0.105) | (0.884,0.973) | |
| *Tilia americana* | 0.288 | 0.182 | 0.133 | 0.088 | 0.0078 | 0.0159 | 16.83 | 0.543 | 0.187 | 0.103 | 0.830 | |
| | (0.285,0.299) | (0.179,0.189) | (0.126,0.146) | (0.083,0.097) | (0.0057,0.0084) | (0.0119,0.0177) | (16.79,16.91) | (0.536,0.556) | (0.185,0.189) | (0.100,0.107) | (0.804,0.955) | |
| Hydromesic soil | | | | | | | | | | | | |
| *Abies balsamea* | 0.298 | 0.169 | 0.126 | 0.075 | 0.0440 | 0.0449 | 14.79 | 0.707 | 0.173 | 0.103 | 0.492 | |
| | (0.295,0.318) | (0.165,0.176) | (0.124,0.134) | (0.074,0.078) | (0.0410,0.0455) | (0.0425,0.0461) | (14.71,14.95) | (0.694,0.740) | (0.170,0.178) | (0.102,0.106) | (0.474,0.538) | |
| *Larix laricina* | 0.228 | 0.158 | 0.075 | 0.049 | 0.0094 | 0.0415 | 15.36 | 0.493 | 0.182 | 0.107 | 0.362 | |
| | (0.223,0.228) | (0.155,0.165) | (0.068,0.089) | (0.045,0.061) | (0.0069,0.0107) | (0.0268,0.0461) | (15.31,15.58) | (0.487,0.523) | (0.180,0.187) | (0.105,0.111) | (0.338,0.446) | |
| *Picea mariana* | 0.174 | 0.113 | 0.059 | 0.042 | 0.0157 | 0.0219 | 15.25 | 0.603 | 0.158 | 0.108 | 0.407 | |
| | (0.171,0.180) | (0.111,0.119) | (0.056,0.066) | (0.041,0.046) | (0.0133,0.0164) | (0.0186,0.0257) | (15.21,15.34) | (0.595,0.612) | (0.157,0.161) | (0.101,0.118) | (0.382,0.604) | |
| *Thuja occidentalis* | 0.217 | 0.120 | 0.079 | 0.051 | 0.0044 | 0.0111 | 11.19 | 0.489 | 0.178 | 0.086 | 0.504 | 0.0071* |
| | (0.214,0.222) | (0.18,0.126) | (0.077,0.082) | (0.050,0.054) | (0.0032,0.0050) | (0.0089,0.0120) | (11.17,11.30) | (0.483,500) | (0.177,0.182) | (0.084,0.089) | (0.485,0.565) | |

| | Parameter | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Growth | | | | Mortality | | Height | | | Crown | | Fecundity |
| Species *j* | $G_{L,j}$ | $\sigma_{GL,j}$ | $G_{D,j}$ | $\sigma_{GD,j}$ | $\mu_{L,j}$ | $\mu_{D,j}$ | $\alpha_j^{20}$ | $\beta_j$ | $\sigma_{\mathrm{height},j}$ | $\phi_j$ | $\sigma_{\mathrm{crown},j}$ | $F$ |
| *Acer rubrum* | 0.327 | 0.258 | 0.152 | 0.087 | 0.0060 | 0.0245 | 16.36 | 0.459 | 0.185 | 0.121 | 0.987 | |
| | (0.321,0.344) | (0.250,0.271) | (0.145,0.167) | (0.082,0.095) | (0.0030,0.0073) | (0.0155,0.0280) | (16.31,16.71) | (0.451,0.484) | (0.182,0.189) | (0.120,0.123) | (0.963,1.032) | |
| *Betula papyrifera* | 0.160 | 0.097 | 0.153 | 0.204 | 0.0305 | 0.0370 | 15.41 | 0.475 | 0.173 | 0.119 | 0.636 | |
| | (0.156,0.169) | (0.092,0.101) | (0.150,0.163) | (0.191,0.231) | (0.0274,0.0326) | (0.0326,0.0444) | (15.34,15.61) | (0.464,0.504) | (0.171,0.181) | (0.117,0.122) | (0.618,0.700) | |
| *Fraxinus nigra* | 0.227 | 0.136 | 0.100 | 0.053 | 0.0071 | 0.0149 | 15.47 | 0.509 | 0.178 | 0.118 | 0.577 | |
| | (0.223,0.235) | (0.132,0.142) | (0.098,0.105) | (0.052,0.057) | (0.0058,0.0079) | (0.0126,0.0160) | (15.43,15.61) | (0.502,0.527) | (0.177,0.183) | (0.115,0.122) | (0.538,0.628) | |
| *Populus tremuloides* | 0.406 | 0.205 | 0.207 | 0.089 | 0.0439 | 0.0567 | 16.49 | 0.465 | 0.172 | 0.099 | 0.498 | |
| | (0.400,0.418) | (0.202,0.215) | (0.192,0.226) | (0.084,0.106) | (0.0410,0.0456) | (0.0453,0.0606) | (16.42,16.72) | (0.452,0.479) | (0.170,0.181) | (0.098,0.100) | (0.485,0.519) | |
| Hydric soil | | | | | | | | | | | | |
| *Abies balsamea* | 0.246 | 0.153 | 0.110 | 0.068 | 0.0453 | 0.0465 | 14.76 | 0.705 | 0.172 | 0.103 | 0.492 | |
| | (0.235,0.263) | (0.147,0.161) | (0.108,0.123) | (0.064,0.072) | (0.0411,0.0471) | (0.0416,0.0482) | (14.71,14.89) | (0.692,0.724) | (0.170,0.178) | (0.102,0.106) | (0.471,0.553) | |
| *Larix laricina* | 0.135 | 0.102 | 0.133 | 0.274 | 0.0085 | 0.0142 | 15.36 | 0.500 | 0.181 | 0.107 | 0.360 | |
| | (0.133,0.139) | (0.100,0.106) | (0.129,0.137) | (0.270,0.299) | (0.0070,0.0091) | (0.0102,0.0167) | (15.32,15.45) | (0.491,0.527) | (0.180,0.186) | (0.106,0.111) | (0.337,0.444) | |
| *Picea mariana* | 0.142 | 0.104 | 0.052 | 0.033 | 0.0154 | 0.0170 | 15.25 | 0.602 | 0.158 | 0.108 | 0.458 | |
| | (0.140,0.147) | (0.103,0.108) | (0.051,0.056) | (0.032,0.035) | (0.0148,0.0160) | (0.0155,0.0183) | (15.21,15.32) | (0.594,0.617) | (0.157,0.160) | (0.101,0.118) | (0.382,0.621) | |
| *Thuja occidentalis* | 0.181 | 0.105 | 0.065 | 0.047 | 0.0052 | 0.0104 | 11.18 | 0.488 | 0.179 | 0.086 | 0.519 | 0.0051* |
| | (0.178,0.187) | (0.103,0.108) | (0.063,0.070) | (0.045,0.049) | (0.0032,0.0057) | (0.0072,0.0117) | (11.18,11.23) | (0.484,0.500) | (0.178,0.181) | (0.084,0.089) | (0.487,0.570) | |
| *Acer rubrum* | 0.381 | 0.283 | 0.164 | 0.086 | 0.0128 | 0.0604 | 16.33 | 0.461 | 0.186 | 0.121 | 0.976 | |
| | (0.349,0.415) | (0.264,0.317) | (0.151,0.215) | (0.080,0.114) | (0.0086,0.0172) | (0.0345,0.0750) | (16.30,16.48) | (0.451,0.481) | (0.182,0.191) | (0.120,0.124) | (0.966,1.022) | |
| *Betula papyrifera* | 0.164 | 0.111 | 0.059 | 0.036 | 0.0324 | 0.0393 | 15.41 | 0.472 | 0.174 | 0.119 | 0.647 | |
| | (0.158,0.178) | (0.105,0.122) | (0.054,0.085) | (0.032,0.053) | (0.0272,0.0343) | (0.0333,0.0443) | (15.33,16.17) | (0.461,0.518) | (0.171,0.180) | (0.117,0.122) | (0.617,0.699) | |
| *Fraxinus nigra* | 0.189 | 0.124 | 0.106 | 0.050 | 0.0109 | 0.0204 | 15.47 | 0.509 | 0.179 | 0.118 | 0.567 | |
| | (0.184,0.213) | (0.120,0.135) | (0.101,0.114) | (0.047,0.060) | (0.0063,0.0125) | (0.0137,0.0233) | (15.43,15.57) | (0.501,0.532) | (0.178,0.184) | (0.116,0.129) | (0.531,0.663) | |
| *Populus tremuloides* | 0.395 | 0.212 | 0.147 | 0.049 | 0.0446 | 0.0609 | 16.49 | 0.465 | 0.174 | 0.099 | 0.492 | |
| | (0.381,0.417) | (0.196,0.237) | (0.136,0.165) | (0.038,0.068) | (0.0391,0.0478) | (0.0449,0.0796) | (16.41,16.64) | (0.453,0.484) | (0.170,0.185) | (0.098,0.100) | (0.485,0.516) | |

The table provides estimates for each parameter needed to implement the simple special case of the PPA model employed in the article. Parameter estimates are provided for the eight most common species, on each of four soil types in the U.S. Lake States (Michigan, Minnesota, and Wisconsin). Parameters are not provided for *Pinus resinosa*, which is common on xeromesic soil, both because in preliminary analyses we obtained unrealistic estimates for the average canopy lifespan of this species (>260 years), and because our field observations revealed that foresters actively favor this species by clearing space around individuals. For each parameter, the posterior mean is shown along with the 68% interval (in parentheses below the posterior mean). Species-specific parameters have a subscript *j*. Symbols and units are as follows: $G_{L,j}$, diameter at breast height (dbh) growth rate of a tree in the canopy (cm·yr$^{-1}$); $G_{D,j}$, dbh growth rate of a tree in the understory (cm·yr$^{-1}$); $\sigma_{GL,j}$ and $\sigma_{GD,j}$, magnitude of unexplained variation in $G_{L,j}$ and $G_{D,j}$, (standard deviation of a normal distribution, cm·yr$^{-1}$); $\mu_{L,j}$ and $\mu_{D,j}$, annual mortality rates of trees in the canopy and understory, respectively; $\alpha_j^{20}$, *height (m) of a tree with a dbh of 20 cm;* $\beta_j$, *exponent in height-dbh power law: height* $= \alpha_j \mathrm{dbh}^{\beta_j}$, where $\alpha_j \equiv \alpha_j^{20}/20^{\beta_j}$, dbh units are cm, height units are m; $\sigma_{\mathrm{height},j}$, proportionality constant for standard deviation of unexplained variation in height (see Appendix 2); $\phi_j$, ratio of crown radius to dbh (m·cm$^{-1}$); $\sigma_{\mathrm{crown},j}$, magnitude of unexplained variation in crown radius (standard deviation of normal distribution, m); *F*, fecundity (number of size-0 recruits produced per m$^2$ of sun-exposed crown area per year). (‡ A single value of *F* is assigned to all species on a given soil type. Note that, unlike all other parameters, *F* was chosen to reproduce a particular observation in 100-year old stands (see Appendix 2).

## Other Supporting Information Files

SI Appendix