

Supplementary File

Table S1. Summary data for mixed-conifer sample trees at Klamath National Forest (KNF), Tahoe National Forest (TNF), and Sequoia National Forest (SNF) sites. Abbreviations: DBH (diameter at breast height), BT (bark thickness), CR (crown ratio), BLC (height to base of live crown), GR (recent DBH growth rate). Species sampled: white fir (ABCO), red fir (ABMA), incense-cedar (CADE), lodgepole pine (PICO), Jeffrey pine (PIJE), sugar pine (PILA), western white pine (PIMO), and Douglas-fir (PSME).

Species	Statistics	DBH (cm)	Height (m)	BT (mm)	CR (%)	BLC (m)	GR (mm yr ⁻¹)
ABCO (n=132)	Mean	43.9	20.6	26.5	70	6.5	2.16
	s.d.	31.7	11.9	17.3	15	5.5	1.46
	Max.	161.4	59.2	83.5	95	25.9	6.82
	Min.	10.0	5.4	4.0	30	0.6	0.14
ABMA (n=138)	Mean	43.6	20.6	25.2	71	6.8	2.54
	s.d.	28.5	11.6	16.6	16	6.3	1.70
	Max.	134.8	51.2	100.0	93	29.0	8.76
	Min.	10.2	4.3	5.5	27	0.5	0.22
CADE (n=45)	Mean	47.0	17.3	37.9	71	5.3	1.90
	s.d.	30.1	9.1	28.8	13	4.2	1.34
	Max.	121.5	35.2	142.5	94	18.5	5.30
	Min.	12.0	4.8	6.5	40	0.8	0.12
PICO (n=29)	Mean	31.9	15.1	8.2	74	3.6	1.74
	s.d.	18.8	7.1	3.4	12	2.4	1.08
	Max.	74.8	28.8	16.5	91	11.7	4.18
	Min.	10.8	6.2	3.0	48	1.2	0.14
PIJE (n=30)	Mean	44.4	17.8	31.9	69	6.1	2.58
	s.d.	32.1	10.8	21.5	15	5.5	1.90
	Max.	131.9	44.8	94.0	94	22.7	7.62
	Min.	12.1	4.6	8.5	18	0.3	0.24
PILA (n=23)	Mean	67.9	29.0	39.2	55	13.9	1.92
	s.d.	40.2	13.6	19.2	13	8.2	0.96
	Max.	159.8	53.3	88.5	81	27.2	3.64
	Min.	10.5	5.9	8.5	33	1.8	0.24
PIMO (n=29)	Mean	52.1	21.4	18.0	71	6.6	1.42
	s.d.	32.6	12.3	8.6	19	7.0	0.62
	Max.	129.9	45.0	49.5	91	28.0	2.82
	Min.	10.5	4.6	5.5	15	0.6	0.28
PSME (n=30)	Mean	52.8	24.5	32.9	77	6.0	2.54
	s.d.	46.1	13.0	30.9	11	5.2	1.24

Max.	201.0	56.7	113.5	92	27.2	5.68
Min.	16.3	9.6	7.5	45	1.2	0.74

Table S2. Summary data for DBH and bark thickness (BT) in independent dataset collected in mixed-conifer stands at the Stanislaus-Tuolumne Experimental Forest (STEF) site. Species sampled: white fir (ABCO), incense-cedar (CADE), Jeffrey pine (PIJE), and sugar pine (PILA).

Species	Statistics	DBH (cm)	BT (mm)
ABCO (n=365)	Mean	31.6	22.2
	s.d.	26.8	18.3
	Max.	125.7	87.0
	Min.	5.0	2.0
CADE (n=221)	Mean	39.1	36.9
	s.d.	34.7	33.6
	Max.	151.4	145.0
	Min.	4.0	2.0
PIJE (n=51)	Mean	51.9	40.4
	s.d.	37.6	23.6
	Max.	156.7	81.0
	Min.	6.4	3.0
PILA (n=189)	Mean	79.5	53.6
	s.d.	43.2	24.9
	Max.	175.6	138.0
	Min.	5.8	1.0

Table S3. Bark thickness (BT) models for mixed-conifer forest type, fitted to data for Klamath, Tahoe, and Sequoia National Forests. Models including tree DBH (cm) were developed with and without measures for growth (GR; mm yr⁻¹) or vigor (crown ratio; CR). A second-order correction on the Akaike information criterion ranked model performance (best model AICc shown in bold). Models predict the square root of bark thickness (mm). Species sampled: white fir (ABCO), red fir (ABMA), incense-cedar (CADE), lodgepole pine (PICO), Jeffrey pine (PIJE), sugar pine (PILA), western white pine (PIMO), and Douglas-fir (PSME).

Data	Model fit	Parameters	Coefficients	s.e.	d.f.	t	Pr> t	RMSE
<i>Nonlinear Models</i>								
ABCO (n=132)	AICc= 219.815 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	1.002 0.869	0.056 0.028	130	17.83 31.05	< 0.0001 < 0.0001	6.28
ABCO (n=132)	AICc= 211.873 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.231 0.951 -0.078	0.101 0.037 0.024	129	12.19 25.87 -3.25	< 0.0001 < 0.0001 0.0015	6.05
ABMA (n=138)	AICc= 254.888 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	0.886 0.919	0.060 0.034	136	14.86 27.27	< 0.0001 < 0.0001	6.87
ABMA (n=138)	AICc= 237.544 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.214 1.042 -0.116	0.113 0.041 0.026	135	10.73 25.29 -4.51	< 0.0001 < 0.0001 < 0.0001	6.38
PIJE (n=30)	AICc= 44.774 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	1.048 0.892	0.098 0.047	28	10.66 19.20	< 0.0001 < 0.0001	6.32
PIJE (n=30)	AICc= 39.851 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.538 0.945 -0.106	0.242 0.045 0.037	27	6.36 20.84 -2.83	< 0.0001 < 0.0001 0.0087	5.67
PICO (n=29)	AICc= 7.282 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	1.027 0.603	0.104 0.057	27	9.92 10.61	< 0.0001 < 0.0001	1.49
PICO (n=29)	AICc= 1.899 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.192 0.562 0.261	0.125 0.053 0.093	26	9.56 10.62 2.81	< 0.0001 < 0.0001 0.0094	1.25
PILA (n=23)	AICc= 40.449 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	1.325 0.743	0.176 0.061	21	7.53 12.16	< 0.0001 < 0.0001	6.93
PILA (n=23)	AICc= 42.101 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.343 0.765 0.093	0.178 0.064 0.086	20	7.53 11.95 1.08	< 0.0001 < 0.0001 0.2920	6.67
PIMO (n=29)	AICc= 37.195 $\sqrt{BT} = a * \sqrt{DBH}^b$	<i>a</i> <i>b</i> ₁	1.299 0.609	0.156 0.059	27	8.30 10.24	< 0.0001 < 0.0001	4.24
PIMO (n=29)	AICc= 39.888 $\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	<i>a</i> <i>b</i> ₁ <i>b</i> ₂	1.301 0.609 0.006	0.161 0.061 0.053	26	8.06 10.05 0.11	< 0.0001 < 0.0001 0.9100	4.24
<i>Linear Models</i>								
PSME (n=30)	AICc= 56.634 $\sqrt{BT} = a * \sqrt{DBH}$	<i>a</i>	0.785	0.015	29	53.18	< 0.0001	7.16
PSME (n=30)	AICc= 56.370 $\sqrt{BT} = b_0 + b_1\sqrt{DBH} + b_2CR$	<i>b</i> ₀ <i>b</i> ₁ <i>b</i> ₂	-1.453 0.867 1.065	0.851 0.039 0.957	27	-1.71 22.12 1.11	0.0991 < 0.0001 0.2754	6.42
CADE (n=45)	AICc=111.319 $\sqrt{BT} = a * \sqrt{DBH}$	<i>a</i>	0.891	0.017	44	50.98	< 0.0001	12.08
CADE	AICc=112.356	<i>b</i> ₀	-0.517	0.368	42	-1.403	0.1680	11.55

(n=45)	$\sqrt{BT} = b_0 + b_1\sqrt{DBH} + b_2\sqrt{GR}$	b_1	1.031	0.076	13.619	< 0.0001
		b_2	-0.005	0.003	-1.417	0.1640

Table S4. Comparison of bark thickness (BT) models with DBH (cm) and models including DBH and DBH growth (GR; mm yr⁻¹) or vigor (crown ratio; CR) for Klamath, Tahoe, and Sequoia National Forests. AICc values were calculated using a second-order bias correction to correct for small sample size. Log Likelihood reflects the probability of the data given the model, while K represents the relative number of sample parameters for each model respectively. Species sampled: white fir (ABCO), red fir (ABMA), incense-cedar (CADE), lodgepole pine (PICO), Jeffrey pine (PIJE), sugar pine (PILA), western white pine (PIMO), and Douglas-fir (PSME).

Species	Model	AICc	ΔAIC	Log Likelihood	K
ABCO (n = 132)	$\sqrt{BT} = a * \sqrt{DBH}^b$	219.8	7.9	-106.8	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	211.9		-101.8	2
ABMA (n = 138)	$\sqrt{BT} = a * \sqrt{DBH}^b$	254.9	17.4	-124.4	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	237.5		-114.6	2
PIJE (n = 30)	$\sqrt{BT} = a * \sqrt{DBH}^b$	44.8	4.9	-18.9	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * \sqrt{GR}^{b_2}$	39.9		-15.1	2
PICO (n = 29)	$\sqrt{BT} = a * \sqrt{DBH}^b$	7.3	5.4	-0.2	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	1.9		3.9	2
PILA (n = 23)	$\sqrt{BT} = a * \sqrt{DBH}^b$	40.4	1.7	-16.6	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	42.1		-15.9	2
PIMO (n = 29)	$\sqrt{BT} = a * \sqrt{DBH}^b$	37.2	2.7	-15.1	1
	$\sqrt{BT} = (a * \sqrt{DBH}^{b_1}) * CR^{b_2}$	39.9		-15.1	2
PSME (n = 30)	$\sqrt{BT} = a * \sqrt{DBH}$	56.6	0.2	-23.1	1
	$\sqrt{BT} = b_0 + b_1\sqrt{DBH} + b_2CR$	56.4		-23.4	2
CADE (n = 45)	$\sqrt{BT} = a * \sqrt{DBH}$	111.3	1.1	-53.5	1
	$\sqrt{BT} = b_0 + b_1\sqrt{DBH} + b_2\sqrt{GR}$	112.4		-51.7	2