

SUPPLEMENTARY INFORMATION

Combined analyses of phenotype, genotype and climate implicate local adaptation as a driver of diversity in *Eucalyptus microcarpa* (Grey box).

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SUPPLEMENTARY METHODS

Leaf trait variation between canopy points within an individual tree

We assessed the effect of sampling from a single canopy point by collecting a second set of 10 leaves from a different side of the canopy for 32 trees across families and replicates. Differences in leaf area, length, weight and thickness between canopy points within an individual tree were assessed by a two-sample t-test in R v 3.2.1 ('t.test' function; [1]), using individual leaf data (10 leaves / position). To account for multiple testing, a Bonferroni correction was applied to p -values on a trait-by-trait basis. The amount of variance within trees, between canopy points, and between trees was also assessed via a mixed model using the R package 'lme4' v 1.1-12 [2]. Using individual leaf data, a model including tree and position within tree as random effects was implemented.

Little difference was found in leaf trait measurements between canopy points with only three comparisons across all four traits and 32 trees tested significantly different after correction for multiple testing (Table S2). Similarly, variance between individual trees was 3.9 – 6.6 times greater than variance between canopy points within a tree (Table S3), suggesting that most of the variation in traits occurs between rather than within trees.

Comparing Q_{ST} to an empirical F_{ST} distribution

Where large numbers of neutral loci are available, an empirical neutral F_{ST} distribution may be calculated to avoid limitations associated with estimating a distribution of F_{ST} values from a single mean value [3]. An empirical distribution of neutral F_{ST} values was created for the sampled region of *Eucalyptus microcarpa* (Grey box) in this study using existing sequencing data for 418 'neutral' SNPs for 157 samples from the seven original provenance populations [4]. 'Neutral' SNPs were defined as those not significant in four genomic outlier analyses and annotated as synonymous or intergenic only based on *E. grandis* v1.1 annotations within 5,000 bp of the SNP [5]. For Bendigo, the original provenance population could not be located so a large natural stand near the original provenance location was sampled as a representative site. Per locus, unweighted F_{ST} estimates were calculated using the 'MakeDiploidFSTMat' function in the R package 'OutFLANK' v 0.1 [6]. F_{ST} estimates weighted for sample size can produce estimates with slight negative values. This unweighted method was chosen to ensure only positive F_{ST} estimates, making results comparable to Q_{ST} and χ^2 distributions which cannot have

negative values. Trait Q_{ST} values were considered significantly greater than neutral F_{ST} if the lower bound of the Q_{ST} SE was greater than the upper 5% bound of empirical F_{ST} values, i.e. $Q_{ST} > F_{ST}$, even when considering error. As empirical distributions may be influenced by sampling bias in the SNPs included, results were also compared to a theoretical χ^2 distribution (see main article).

Q_{ST} estimates for tree height, leaf area, leaf length and leaf weight exceeded neutral F_{ST} , suggesting these traits are potentially under divergent selection (Figure S1). Based on 418 ‘neutral’ SNPs from the original provenance populations, mean neutral F_{ST} was 0.033, with an upper 5% bound of 0.069 (Figure S1). For tree height, leaf area, leaf length and leaf weight, Q_{ST} was greater than the empirical 5% neutral F_{ST} cut-off, even when accounting for one SE.

References

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3. Whitlock MC. Evolutionary inferences from Q_{ST} . *Mol. Ecol.* **2008**, *17*, 1885–1896.
4. Jordan R, Hoffmann AA, Dillon SK, Prober SM. Evidence of genomic adaptation to climate in *Eucalyptus microcarpa*: Implications for adaptive potential to projected climate change. *Mol. Ecol.* **2017**, *26*, 6002–6020.
5. Myburg AA, Grattapaglia D, Tuskan GA, Hellsten U, Hayes RD, Grimwood J, et al. The genome of *Eucalyptus grandis*. *Nature* **2014**, *510*, 356–362.
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Table S1. Definitions for climate variables used in climate association analysis of quantitative traits and putatively adaptive SNPs in *Eucalyptus microcarpa* (Grey box). All data are environment (gridded) layers with 0.01 degree (~1 km) resolution.

Climate variable	Variable Definition ¹
<u>Aridity (ratio)</u>	
Mean annual aridity index	Monthly ratio precipitation to potential evaporation (pan, free-water surface)
Maximum month aridity index	Monthly ratio precipitation to potential evaporation (pan, free-water surface)
<u>Precipitation (mm)</u>	
Annual Precipitation (Bio12)	Sum of all 12 monthly precipitation estimates. Centered on 1990
Average winter (Jun, Jul, Aug) precipitation	Based on 109 years of data
Average summer (Dec, Jan, Feb) precipitation	Based on 109 years of data
Precipitation of Driest Period (Bio14)	The precipitation of the driest period. Centered on 1990
Precipitation of Wettest Period (Bio13)	The precipitation of the wettest period. Centered on 1990
<u>Temperature (°C)</u>	
Annual Mean Temperature (Bio01)	Mean weekly mean temperatures (weekly mean = mean of the weekly max. and min. temperatures over the year). Centered on 1990.
Max month absolute mean max temperature	The monthly mean absolute maximum temperature derived from the hottest day of each month over 50-years (1955 to 2005) of 5km gridded daily climate.
Max Temperature of Warmest Period (Bio05)	Highest weekly maximum temperature in all weeks of the year. Centered on 1990

¹ From Atlas of Living Australia spatial data (<http://spatial.ala.org.au/>)

Table S2 Results of two sample t-tests assessing differences in leaf trait measurements between two different canopy points within a single tree (10 leaves per canopy point) for *Eucalyptus microcarpa* (Grey box). Footnotes on next page.

Tree ID	Provenance	Rep	Area			Length			Weight			Thickness			
			t	df	p	t	df	p	t	df	p	t	df	p	
1-II-r2-c5	Deniliquin	II	1.892	9.7	0.089	1.910	14.9	0.076	1.537	9.8	0.156	-0.201	13.9	0.843	
1-II-r6-c3	Deniliquin	II	-1.650	16.9	0.117	0.259	16.8	0.799	-0.194	17.3	0.848	3.398	13.2	0.005	*
1-III-r8-c7	Deniliquin	III	0.792	17.5	0.439	0.551	14.6	0.590	0.342	17.1	0.736	-0.721	14.4	0.483	
1-IV-r4-c6	Deniliquin	IV	1.438	18.0	0.167	3.459	17.7	0.003	1.421	18.0	0.172	1.083	18.0	0.293	
1-IV-r6-c4	Deniliquin	IV	-1.477	15.3	0.160	-1.189	15.9	0.252	-1.681	14.6	0.114	1.299	15.6	0.213	
4-II-r6-c3	Forbes	II	0.410	17.2	0.687	2.206	16.6	0.042	1.043	17.9	0.311	2.296	17.5	0.034	*
4-II-r8-c8	Forbes	II	0.006	15.3	0.995	-1.891	16.3	0.077	-0.323	12.9	0.752	-2.559	15.4	0.021	*
4-II-r9-c5	Forbes	II	1.965	16.7	0.066	1.125	18.0	0.275	1.175	17.4	0.256	-3.421	15.0	0.004	*
4-IV-r5-c2	Forbes	IV	-0.265	13.9	0.795	-0.899	13.0	0.385	0.207	15.8	0.839	-5.173	12.3	0.000	#
4-IV-r8-c4	Forbes	IV	-0.428	17.2	0.674	-2.087	18.0	0.051	-1.850	18.0	0.081	0.606	16.4	0.553	
5-II-r3-c3	Wagga	II	1.332	17.9	0.200	2.623	18.0	0.017	0.210	17.5	0.836	-3.130	16.9	0.006	*
5-II-r6-c9	Wagga	II	-2.039	17.9	0.056	-4.245	17.3	0.001	-2.327	17.7	0.032	-0.957	18.0	0.351	*
5-III-r6-c6	Wagga	III	-0.952	13.7	0.358	-0.030	12.2	0.977	-0.162	18.0	0.873	3.524	16.6	0.003	*
5-IV-r10-c6	Wagga	IV	0.078	18.0	0.939	0.616	17.5	0.546	0.293	17.4	0.773	0.742	17.3	0.468	
5-IV-r10-c8	Wagga	IV	-2.141	14.6	0.050	-0.755	17.4	0.460	-1.721	15.5	0.105	2.119	16.0	0.050	
6-II-r3-c2	Bendigo	II	2.622	15.0	0.019	3.621	14.7	0.003	0.061	16.2	0.952	-0.476	14.3	0.641	
6-II-r8-c5	Bendigo	II	0.859	15.8	0.403	0.581	17.3	0.569	1.710	15.7	0.107	1.286	17.8	0.215	
6-III-r2-c6	Bendigo	III	-0.368	15.5	0.718	-1.255	16.3	0.227	-0.610	16.1	0.550	1.013	16.3	0.326	
6-III-r9-c2	Bendigo	III	-1.541	14.7	0.145	-1.646	17.3	0.118	-1.483	12.4	0.163	-1.289	16.3	0.215	
6-IV-r5-c1	Bendigo	IV	-1.545	17.0	0.141	-2.122	17.1	0.049	-1.925	17.9	0.070	-0.482	16.2	0.636	
6-IV-r8-c2	Bendigo	IV	-2.279	15.0	0.038	-1.001	17.1	0.331	-2.407	16.0	0.028	-0.331	17.7	0.745	
7-II-r7-c8	Avoca	II	2.934	13.6	0.011	3.242	17.1	0.005	2.898	16.2	0.010	0.560	18.0	0.582	
7-IV-r5-c5	Avoca	IV	1.239	16.2	0.233	1.890	17.0	0.076	0.542	17.3	0.595	0.000	15.6	1.000	
7-IV-r7-c5	Avoca	IV	-3.401	18.0	0.003	-0.212	14.8	0.835	-4.025	17.9	0.001	-1.826	15.3	0.087	

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Table S2 Continued from previous page

Tree ID	Provenance	Rep	Area			Length			Weight			Thickness		
			t	df	<i>p</i>	t	df	<i>p</i>	t	df	<i>p</i>	t	df	<i>p</i>
10-II-r1-c10	West Wyalong	II	0.105	18.0	0.917	0.429	14.8	0.674	0.125	17.7	0.902	-0.079	12.6	0.938
10-II-r10-c5	West Wyalong	II	1.104	16.1	0.286	3.053	17.9	0.007 *	1.336	16.6	0.200	-0.120	17.1	0.906
10-III-r6-c8	West Wyalong	III	-0.138	14.8	0.892	0.748	15.3	0.466	-0.395	14.4	0.699	-0.224	16.7	0.825
10-IV-r4-c9	West Wyalong	IV	1.377	10.3	0.198	2.845	13.4	0.013 *	1.715	10.6	0.115	0.489	13.1	0.633
10-IV-r7-c5	West Wyalong	IV	-0.180	15.3	0.859	-1.590	14.3	0.134	-1.138	14.6	0.273	-3.851	14.4	0.002 *
11-II-r1-c5	Benalla	II	0.046	17.6	0.964	2.948	12.3	0.012 *	-0.268	17.3	0.792	2.495	17.8	0.023 *
11-III-r11-c3	Benalla	III	-1.281	14.3	0.221	0.502	17.0	0.622	-1.172	14.0	0.261	0.147	17.7	0.885
11-III-r8-c2	Benalla	III	0.266	16.3	0.794	-0.175	17.6	0.863	0.301	16.6	0.767	-0.133	17.7	0.896

* $p < 0.05$, # $p < 0.0016$ (Bonferroni correction by trait; 0.05/32)

Table S3 Mixed model estimates of variance between trees (Tree) and between two canopy points within a tree (Position) for leaf trait measurements in 32 *Eucalyptus microcarpa* (Grey box) trees, including fold difference between variance estimates. Residual = residual model variance.

Model component	Variance			
	Area	Length	Weight	Thickness
Position (within tree canopy)	1.27700	0.44070	0.00087	0.00018
Tree	6.05000	1.74020	0.00573	0.00086
Residual	11.09200	2.15300	0.01182	0.00060
Variance _{Tree} / Variance _{Position}	4.7	3.9	6.6	4.8

Table S4 Mixed models for calculating narrow-sense heritability (h^2) and Q_{ST} in nine quantitative traits measured in *Eucalyptus microcarpa* (Grey box). Fixed terms are stated in normal text. Random terms given in *italics*.

Trait	Mixed model ¹
<u>Growth traits</u>	
Diameter at Breast Height (DBH)	DBH ~ Rep + Edge + Stem + (<i>I Prov</i>) + (<i>I Family</i>)
Height	Height ~ Rep + Edge + Stem + (<i>I Prov</i>) + (<i>I Family</i>)
Size ratio	SizeRatio ~ Rep + Stem + (<i>I Prov</i>) + (<i>I Family</i>)
<u>Leaf traits</u>	
Leaf area	Area ~ 1 + (<i>I Prov</i>) + (<i>I Family</i>)
Leaf length	Length ~ Rep + (<i>I Prov</i>) + (<i>I Family</i>)
Leaf weight	Weight ~ 1 + (<i>I Prov</i>) + (<i>I Family</i>)
Leaf thickness	Thickness ~ Rep + Edge + (<i>I Prov</i>) + (<i>I Family</i>)
Specific leaf area (SLA)	SLA ~ Edge + (<i>I Prov</i>) + (<i>I Family</i>)
Leaf density	Density ~ Rep + (<i>I Prov</i>) + (<i>I Family</i>)

¹ Model syntax as per R package ‘lme4’

Table S5 Trait correlations (a) and contributions (b) to trait principal component (PC) axes in *Eucalyptus microcarpa* (Grey box). PC axes are from a principal component analysis (PCA) of provenance level Best Linear Unbiased Estimate (BLUEs) trait data. Values in bold represent (a) highest correlation per trait and (b) two highest contributing traits to the PC axis. Note, first line for both the growth and leaf PCA indicate the percentage variance explained by the principal component axes (in *italics*).

PC axis	a) Correlation			b) Contribution (%)		
	1	2	3	1	2	3
<u>Growth trait PCA</u>						
<i>% variance</i>	<i>79.31</i>	<i>19.07</i>				
DBH	0.91	-0.40		34.51	28.08	
Height	0.98	-0.13		40.18	2.84	
Size ratio	0.78	0.63		25.30	69.08	
<u>Leaf trait PCA</u>						
<i>% variance</i>	<i>58.63</i>	<i>30.30</i>	<i>8.99</i>			
Area	0.97	-0.01	0.24	26.58	0.00	10.58
Length	0.85	0.44	-0.06	20.43	10.75	0.60
Weight	0.85	-0.27	0.44	20.71	4.02	36.48
Thickness	-0.75	0.51	0.41	16.10	14.44	31.26
SLA	0.73	0.59	-0.31	15.23	18.83	18.24
Density	0.18	-0.97	-0.12	0.96	51.96	2.83

Table S6 Climate associations for individual leaf and growth traits in *Eucalyptus microcarpa* (Grey box), calculated (a) without and (b) with adjustment for spatial population structure (latitude and longitude). Note p = significance of environmental component in the linear model and is not adjusted for multiple testing. See Table S1 for climate variable definitions. Footnotes on page 12.

Trait	Environment	a) Trait ~ Environment				b) Trait ~ Lat. + Long. + Env.			
		Adj. r^2	direction	F _{env [1,5]}	p_{env}	Adj. r^2	direction	F _{env [1,3]}	p_{env}
DBH									
	Mean annual aridity index	0.32	+	3.8	0.108	-0.03	+	0.4	0.594
	Max. month aridity index	0.43	+	5.6	0.065	0.09	+	0.8	0.446
	Annual precipitation	-0.12	+	0.3	0.582	-0.11	+	0.1	0.769
	Summer precipitation	-0.01	-	0.9	0.382	-0.14	+	0.0	0.927
	Winter precipitation	0.24	+	2.9	0.149	-0.09	+	0.1	0.726
	Driest period precipitation	-0.16	-	0.2	0.680	-0.11	+	0.1	0.787
	Wettest period precipitation	0.38	+	4.7	0.083	0.23	+	1.4	0.316
	Annual mean temperature	0.08	-	1.5	0.275	-0.10	-	0.1	0.742
	Max. abs. mean max. temp.	0.17	-	2.2	0.195	-0.05	-	0.3	0.640
	Warmest period max. temp.	0.13	-	1.9	0.226	-0.01	-	0.4	0.575
Height									
	Mean annual aridity (ratio)	0.08	+	1.5	0.270	-0.43	+	0.5	0.519
	Max. month aridity (ratio)	0.11	+	1.8	0.242	-0.27	+	1.0	0.399
	Annual precipitation	-0.06	+	0.7	0.454	-0.58	+	0.2	0.690
	Summer precipitation	-0.19	-	0.0	0.890	-0.63	+	0.1	0.778
	Winter precipitation	0.06	+	1.4	0.297	-0.53	+	0.3	0.619
	Driest period precipitation	-0.18	+	0.1	0.800	-0.52	+	0.3	0.607
	Wettest period precipitation	0.40	+	5.1	0.074	0.03	+	2.2	0.235

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Table S6 Continued from previous page

Trait	Environment	a) Trait ~ Environment				b) Trait ~ Lat. + Long. + Env.			
		Adj. r^2	direction	F _{env [1,5]}	p_{env}	Adj. r^2	direction	F _{env [1,3]}	p_{env}
Height (continued)									
	Annual mean temperature	-0.15	-	0.2	0.665	-0.59	-	0.2	0.701
	Max. abs. mean max. temp.	0.01	-	1.0	0.353	-0.51	-	0.3	0.600
	Warmest period max. temp.	-0.11	-	0.4	0.556	-0.37	-	0.7	0.472
Size ratio									
	Mean annual aridity index	-0.19	-	0.0	0.844	-0.51	+	0.2	0.687
	Max. month aridity index	-0.19	-	0.0	0.845	-0.36	+	0.5	0.516
	Annual precipitation	-0.16	+	0.2	0.685	-0.60	+	0.0	0.890
	Summer precipitation	-0.09	+	0.5	0.501	-0.60	-	0.0	0.911
	Winter precipitation	-0.19	-	0.1	0.812	-0.59	+	0.0	0.853
	Driest period precipitation	0.06	+	1.4	0.297	-0.56	+	0.1	0.770
	Wettest period precipitation	-0.11	+	0.4	0.552	-0.33	+	0.6	0.487
	Annual mean temperature	-0.04	+	0.7	0.427	-0.53	-	0.2	0.721
	Max. abs. mean max. temp.	-0.20	-	0.0	0.969	-0.43	-	0.4	0.587
	Warmest period max. temp.	-0.05	+	0.7	0.443	-0.54	-	0.1	0.737
Leaf area									
	Mean annual aridity index	-0.07	+	0.6	0.470	0.74	-	1.6	0.290
	Max. month aridity index	0.00	+	1.0	0.363	0.73	-	1.4	0.323
	Annual precipitation	-0.18	+	0.1	0.774	0.77	-	2.2	0.233
	Summer precipitation	-0.07	-	0.6	0.470	0.72	-	1.2	0.347
	Winter precipitation	-0.02	+	0.9	0.384	0.74	-	1.5	0.305
	Driest period precipitation	-0.20	+	0.0	0.977	0.69	-	0.8	0.428
	Wettest period precipitation	0.07	+	1.5	0.279	0.64	-	0.3	0.625

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Table S6 Continued from previous page

Trait	Environment	a) Trait ~ Environment				b) Trait ~ Lat. + Long. + Env.			
		Adj. r^2	direction	$F_{env [1,5]}$	p_{env}	Adj. r^2	direction	$F_{env [1,3]}$	p_{env}
Leaf area (continued)									
	Annual mean temperature	-0.20	-	0.0	0.946	0.84	+	4.2	0.132
	Max. abs. mean max. temp.	-0.19	-	0.0	0.880	0.81	+	3.3	0.165
	Warmest period max. temp.	-0.19	-	0.0	0.864	0.69	+	0.9	0.412
Leaf length									
	Mean annual aridity index	-0.16	-	0.2	0.701	0.83	-	4.0	0.139
	Max. month aridity index	-0.17	-	0.1	0.757	0.80	-	3.2	0.172
	Annual precipitation	-0.19	+	0.1	0.812	0.87	-	6.4	0.085
	Summer precipitation	-0.17	+	0.1	0.753	0.81	-	3.3	0.168
	Winter precipitation	-0.19	-	0.0	0.882	0.83	-	4.0	0.140
	Driest period precipitation	0.08	+	1.5	0.276	0.70	-	1.1	0.371
	Wettest period precipitation	-0.15	+	0.2	0.651	0.71	-	1.2	0.361
	Annual mean temperature	0.20	+	2.5	0.173	0.88	+	7.5	0.072
	Max. abs. mean max. temp.	-0.06	+	0.6	0.457	0.84	+	4.8	0.117
	Warmest period max. temp.	0.16	+	2.1	0.205	0.79	+	2.7	0.201
Leaf weight									
	Mean annual aridity index	0.20	+	2.5	0.175	0.87	-	0.8	0.449
	Max. month aridity index	0.33	+	4.0	0.103	0.86	-	0.5	0.550
	Annual precipitation	-0.16	+	0.2	0.682	0.89	-	1.5	0.313
	Summer precipitation	0.10	-	1.6	0.257	0.88	-	1.2	0.352
	Winter precipitation	0.23	+	2.8	0.153	0.88	-	1.0	0.399
	Driest period precipitation	-0.17	-	0.1	0.753	0.85	-	0.3	0.624
	Wettest period precipitation	0.20	+	2.5	0.172	0.84	-	0.1	0.813

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Table S6 Continued from previous page

Trait	Environment	a) Trait ~ Environment				b) Trait ~ Lat. + Long. + Env.			
		Adj. r^2	direction	F _{env [1,5]}	p_{env}	Adj. r^2	direction	F _{env [1,3]}	p_{env}
Leaf weight (continued)									
	Annual mean temperature	-0.06	-	0.6	0.461	0.89	+	1.5	0.308
	Max. abs. mean max. temp.	-0.05	-	0.7	0.429	0.88	+	0.9	0.405
	Warmest period max. temp.	-0.04	-	0.8	0.420	0.86	+	0.5	0.527
Leaf thickness									
	Mean annual aridity index	0.18	-	2.3	0.191	0.14	-	0.6	0.499
	Max. month aridity index	0.11	-	1.7	0.245	0.05	-	0.3	0.647
	Annual precipitation	0.22	-	2.7	0.160	0.20	-	0.8	0.427
	Summer precipitation	-0.18	-	0.1	0.776	0.45	-	2.6	0.204
	Winter precipitation	0.35	-	4.2	0.096	0.26	-	1.2	0.358
	Driest period precipitation	-0.08	-	0.6	0.490	0.34	-	1.7	0.285
	Wettest period precipitation	0.35	-	4.2	0.095	0.15	-	0.6	0.487
	Annual mean temperature	-0.17	+	0.1	0.756	0.05	+	0.2	0.653
	Max. abs. mean max. temp.	-0.03	+	0.8	0.409	0.02	+	0.2	0.717
	Warmest period max. temp.	-0.14	+	0.3	0.632	0.24	+	1.1	0.375
SLA									
	Mean annual aridity index	-0.03	-	0.8	0.402	0.40	-	1.9	0.260
	Max. month aridity index	-0.05	-	0.7	0.429	0.43	-	2.1	0.240
	Annual precipitation	-0.20	-	0.0	0.914	0.38	-	1.8	0.275
	Summer precipitation	-0.15	+	0.2	0.670	0.23	-	0.8	0.431
	Winter precipitation	-0.12	-	0.4	0.565	0.33	-	1.4	0.322

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Table S6 Continued from previous page

Trait	Environment	a) Trait ~ Environment				b) Trait ~ Lat. + Long. + Env.			
		Adj. r^2	direction	F _{env [1,5]}	p_{env}	Adj. r^2	direction	F _{env [1,3]}	p_{env}
SLA (continued)									
	Driest period precipitation	-0.05	+	0.7	0.430	0.33	-	1.4	0.326
	Wettest period precipitation	-0.20	+	0.0	0.979	0.17	-	0.6	0.511
	Annual mean temperature	0.32	+	3.8	0.108	0.64	+	5.1	0.109
	Max. abs. mean max. temp.	0.23	+	2.8	0.157	0.66	+	5.7	0.096
	Warmest period max. temp.	0.22	+	2.7	0.159	0.26	+	1.0	0.395
Leaf density									
	Mean annual aridity index	0.72	+	16.8	0.009	0.59	+	6.1	0.089
	Max. month aridity index	0.60	+	9.9	0.025	0.42	+	3.5	0.156
	Annual precipitation	0.27	+	3.2	0.132	0.65	+	7.6	0.070
	Summer precipitation	-0.20	-	0.0	0.928	0.84	+	20.4	0.020
	Winter precipitation	0.76	+	20.5	0.006	0.72	+	10.4	0.049
	Driest period precipitation	-0.20	+	0.0	0.965	0.87	+	27.1	0.014
	Wettest period precipitation	0.39	+	4.8	0.081	0.37	+	2.9	0.184
	Annual mean temperature	0.36	-	4.4	0.090	0.55	-	5.5	0.102
	Max. abs. mean max. temp.	0.69	-	14.5	0.013	0.51	-	4.6	0.121
	Warmest period max. temp.	0.42	-	5.3	0.070	0.62	-	6.9	0.079

DBH = Diameter at breast height; SLA = Specific Leaf Area

Adj. r^2 = adjusted r^2 of linear model; Lat. = Latitude; Long. = Longitude; Env. = Environment; Abs. = absolute

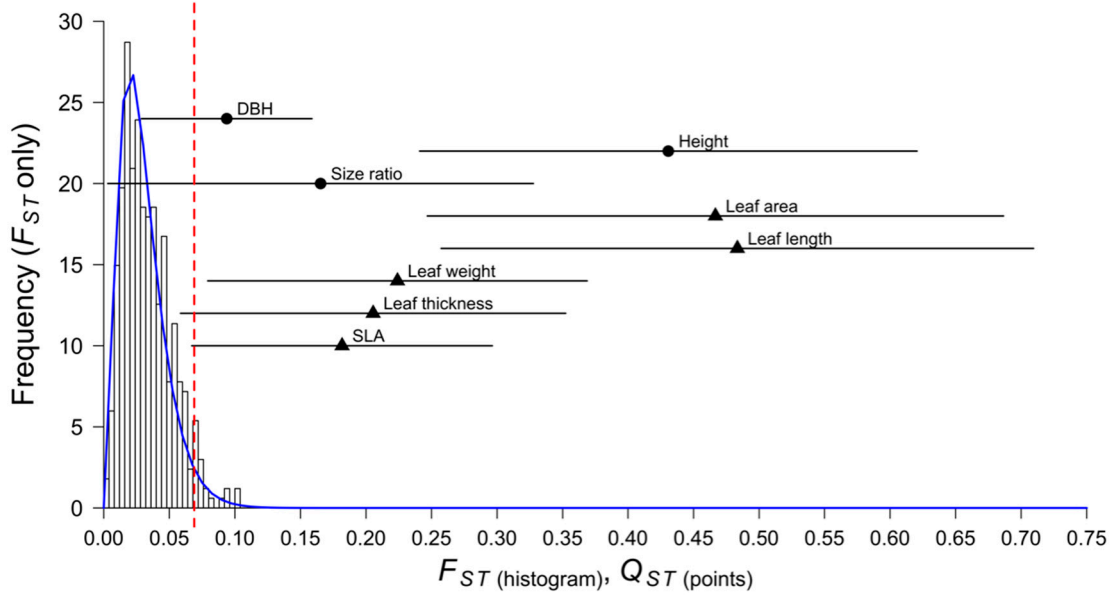


Figure S1 Empirical per locus ‘neutral’ F_{ST} distribution (bar plot) for *Eucalyptus microcarpa* (Grey box) and Q_{ST} estimates (points; circles = growth traits, triangles = leaf traits, lines = one standard error). F_{ST} calculated from 418 ‘neutral’ SNPs using 157 samples from the seven original natural provenance populations. Dashed red line = 5% upper limit of per locus F_{ST} estimates (empirical 95% cut-off). Blue line = χ^2 distribution based on 3.3 degrees of freedom (mean F_{ST} ‘neutral’ SNPs = 0.033). Leaf density not plotted ($Q_{ST} = 1 \pm 0$ (SE)).

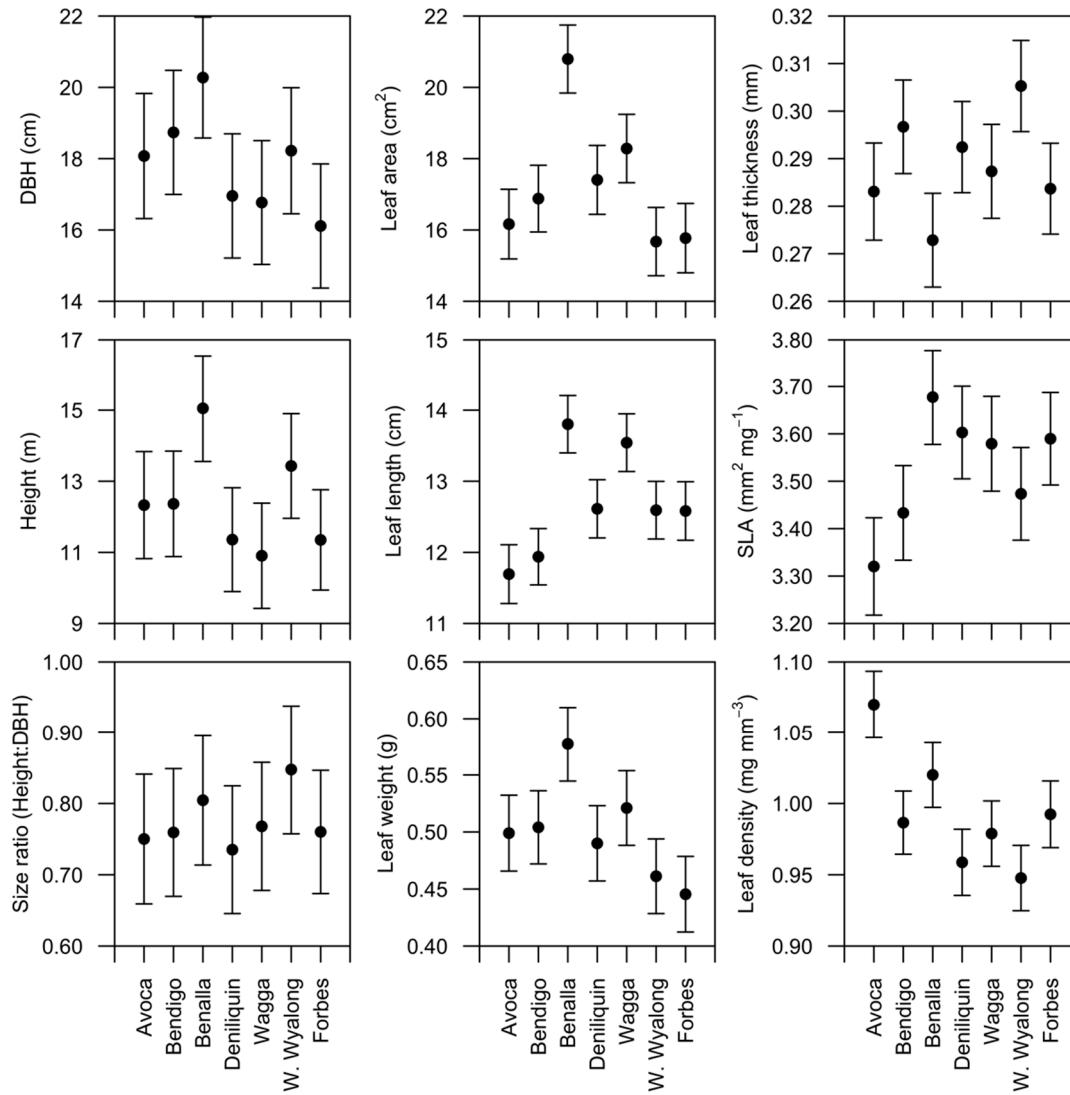


Figure S2 Provenance level, Best Linear Unbiased Estimates (BLUEs) for nine quantitative traits measured in *Eucalyptus microcarpa* (Grey box). Provenances ordered from south (left) to north (right). Error bars = 95% confidence interval. Note different scales on y-axes.