SUPPLEMENTARY DATA

S3. Supplementary table and figures giving details of model comparison, correlation between coefficients and model validation.

Table S1. Model comparison for the sub-model of spatial heterogeneity for the case when MIZ = 8.0 m and effect of obstacle is not considered. The underlined sub-models No. 2 and No. 10, which share the same structure of modelling the potential of tree root provision (*p*), were ultimately selected as sub-models, respectively. Only combination cases that gave a meaningful fit are listed.

	Structure of the sub-model of spatial heterogeneity						Fit				
No.	Production efficiency (*E*, Eq. 1)		Potential of tree root provision (*p*, Eq. 2)				Nsc/Nc	Evaluation indicator			
	Type of function	Ref.	β	*Broadleaves*	λ_s	φ_s		AIC	BIC	R^2	RMSE
1	Power	Eq.8	= 0	*with P. abies*	$\in [0, +\infty]$	$= \lambda_s$	4 / 4	375.35	381.44	0.43	360.67
2	Power	Eq.8	= 0	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	4 / 4	375.07	381.16	0.44	358.66
3	Power	Eq.8	= 0	*with A. alba*	$\in [0, +\infty]$	= 1	3 / 4	375.64	381.74	0.43	362.82
4	Power	Eq.8	= 0	*with A. alba*	= 1	$\in [0, +\infty]$	4 / 4	375.30	381.39	0.44	360.33
5	Power	Eq.8	$\in [0, +\infty]$	*with A. alba*	= 1	$\in [0, +\infty]$	2 / 5	375.20	382.52	0.48	345.55
6	Power	Eq.8	$\in [0, +\infty]$	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	2 / 5	376.29	383.60	0.46	353.15
7	Power	Eq.8	= 1	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	3 / 4	374.38	380.48	0.46	353.79
8	Power	Eq.8	= 1	*with A. alba*	$\in [0, +\infty]$	= 1	3 / 4	374.85	380.94	0.45	357.10
9	Logistic	Eq. 4	= 0	*with P. abies*	$\in [0, +\infty]$	$= \lambda_s$	4 / 4	383.95	390.04	0.20	428.38
10	Logistic	Eq. 4	= 0	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	4 / 4	383.95	390.05	0.20	428.42
11	Logistic	Eq. 4	= 0	*with A. alba*	$\in [0, +\infty]$	= 1	3 / 4	383.87	389.96	0.20	427.71
12	Logistic	Eq. 4	= 0	*with A. alba*	= 1	$\in [0, +\infty]$	3 / 4	383.23	389.32	0.22	422.26
13	Logistic	Eq. 4	$\in [0, +\infty]$	*with A. alba*	= 1	$\in [0, +\infty]$	2 / 5	385.22	392.54	0.22	422.21
14	Logistic	Eq. 4	$\in [0, +\infty]$	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	3 / 5	385.95	393.27	0.20	428.42
15	Logistic	Eq. 4	= 1	*with A. alba*	$\in [0, +\infty]$	$= \lambda_s$	3 / 4	385.86	391.95	0.14	445.06
16	Logistic	Eq. 4	= 1	*with A. alba*	$\in [0, +\infty]$	= 1	3 / 4	385.46	391.55	0.15	441.53

Note: N_{sc} / N_c – Number of significant coefficient / number of total coefficient. See the table of Table Abbreviations and symbols for the meaning of the others.

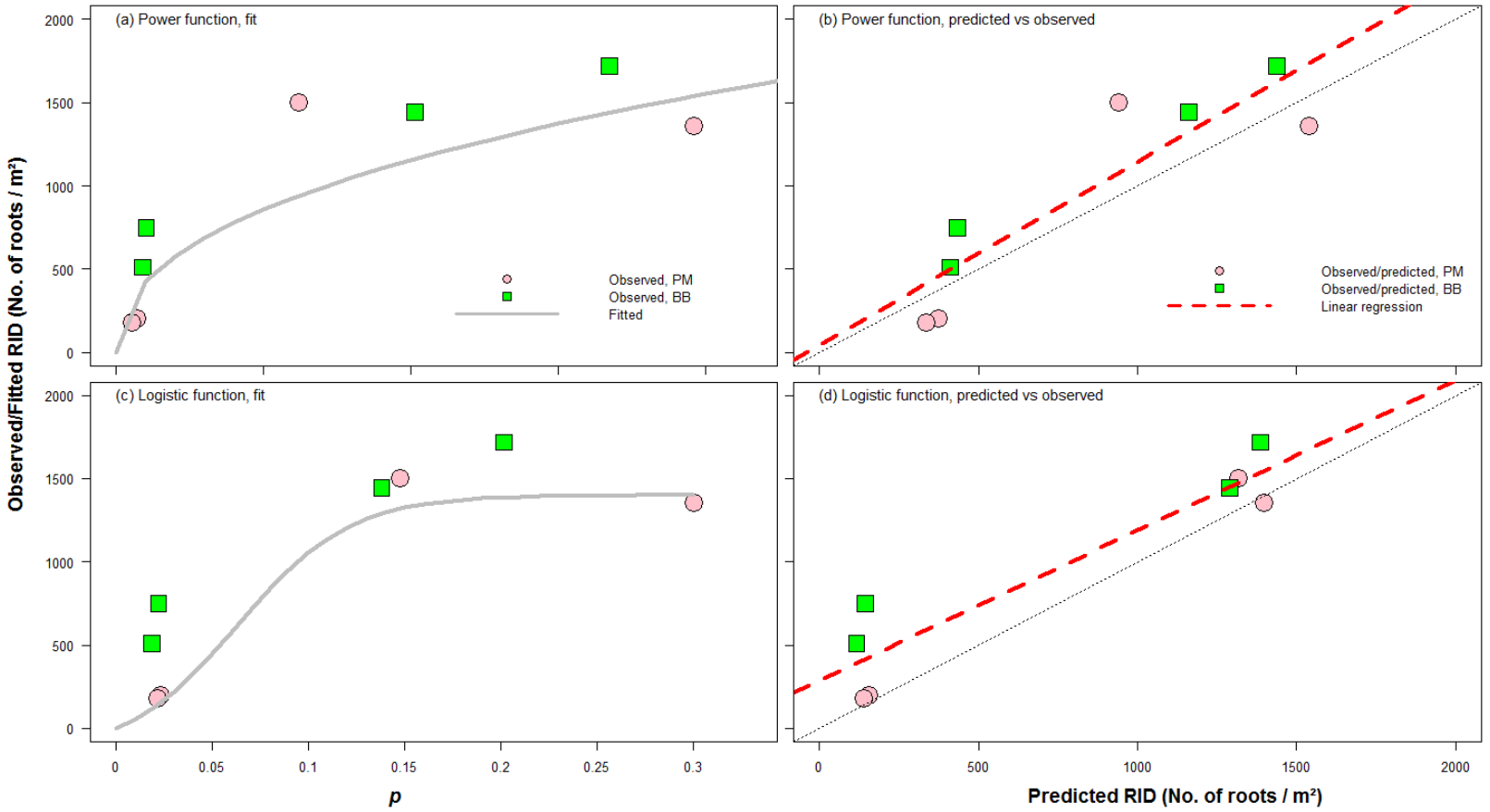

Figure S1. Validation of the ultimately selected sub-models of spatial heterogeneity using not-fitted root data. In (b) and (d), smooth spline is replaced by linear regression due to low number of points. p – potential of tree root provision. Note that the metric p differs according to the modelling approaches because of the parameter values of λ_s and α (see Table 2).

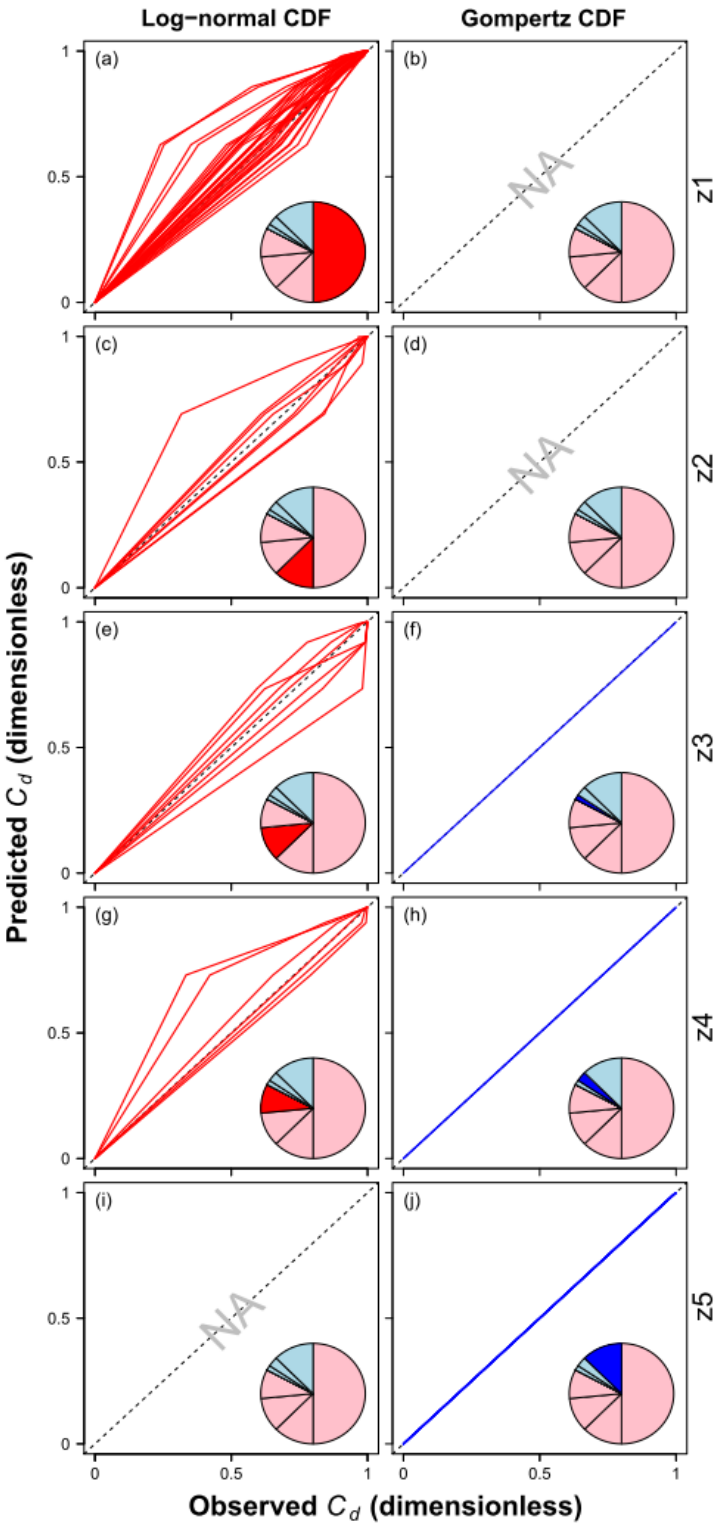

Figure S2. Validation of the ultimately selected sub-models of diameter spectrum using not-fitted root data. Rows of plots: *z1* to *z5* denote the five soil layers from]0.0, 0.2] m to]0.8, 1.0] m; columns of plots: left for log-normal CDF and right for Gompertz CDF. In each plot, the pie chart (right on the bottom) shows the proportion of cases in the dabase for model validation of all the soil layers. Colours: pink - C_d at 1 mm < 0.990 (it turns to red when the case is referred to in the plot using log-normal CDF); light blue - C_d at 1 mm ≥0.990 (it turns to deep blue when the case is referred to in the plot using Gompert CDF). For example, the pie chart in (a) shows that up to 50% cases of diameter spectrum at the soil depth of]0.0, 0.2] m amongst all the cases of diameter spectrum should be modelled by log-normal CDF. NAs in (b), (d) a, (i) denote that no available data fall in these cases.

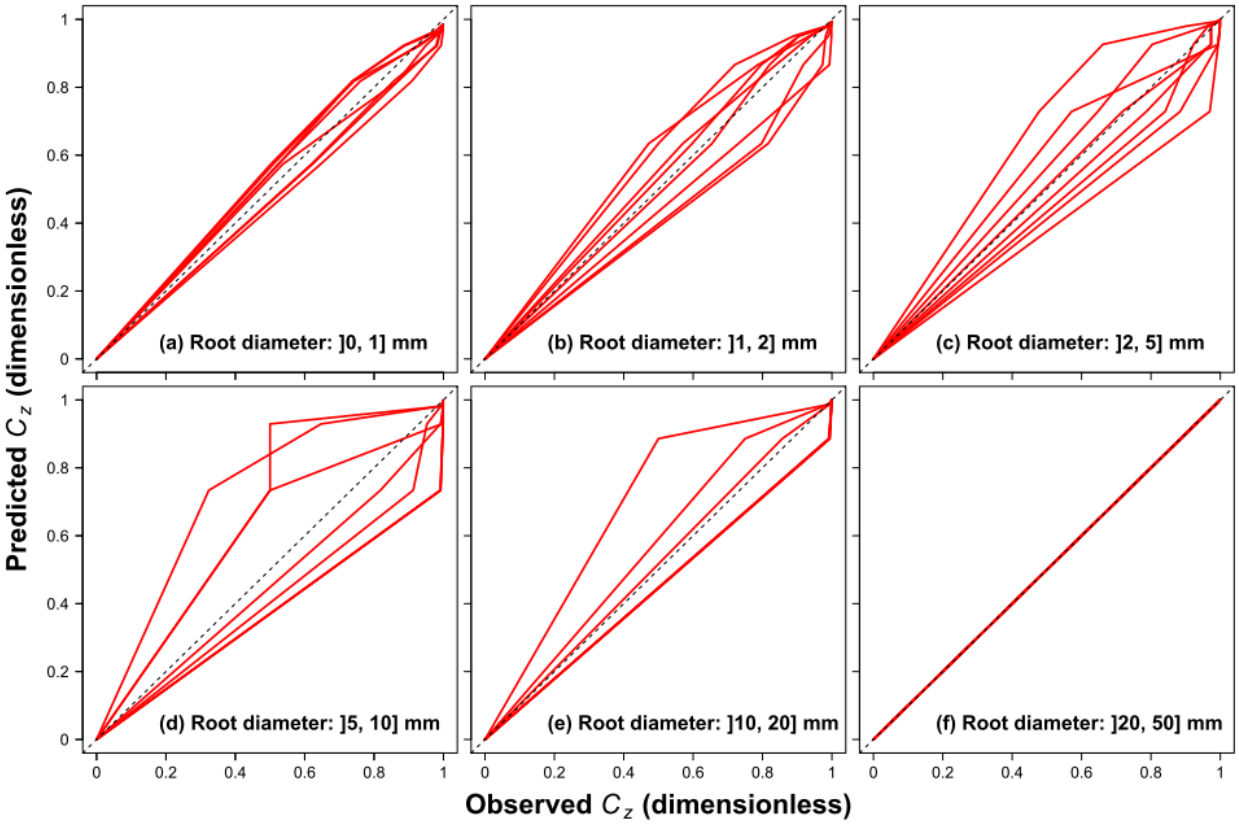

Figure S3 Validation of the sub-model of vertical profile using non-fitted field observed data. Each red curves denote one root vertical profile

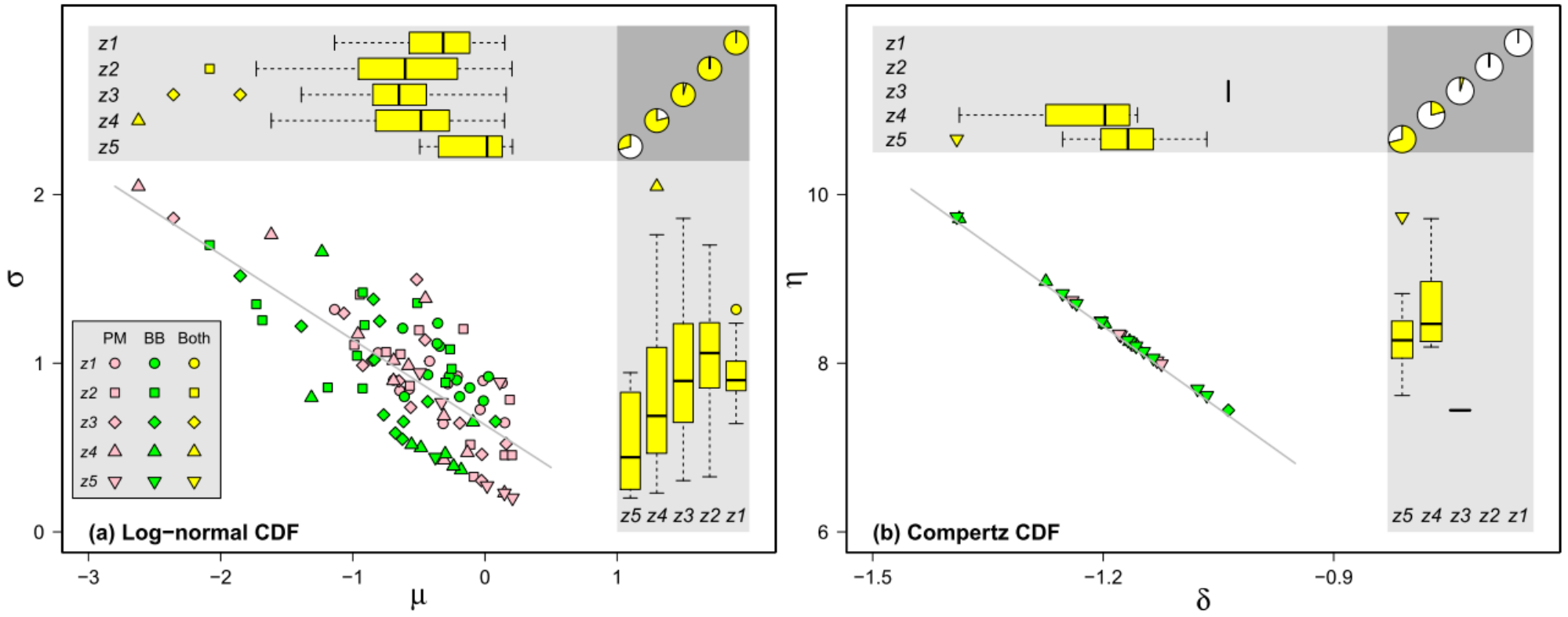

Figure S4. Variation of the parameters of the Log-normal CDF (a, used when C_d at a root diameter of 1 mm < 0.990) and Gompertz CDF (b, used when C_d at 1 mm ≥0.990) for the sub-model of diameter spectrum. In each of pie charts (right on the top) in (a), yellowand white colours denote C_d at 1 mm was < 0.990 and ≥0.990, respectively; this is converse in (b). *z1* to *z5* denote the five soil layers from]0.0, 0.2] m to]0.8, 1.0] m. Grey lines represent linear regressions; the equation in (a): $\sigma = -0.50\mu + 0.63$ ($R^2 = 0.56$); the equation in (b): $\eta = -6.50\delta + 0.68$ ($R^2 = 0.99$).