Supplementary Table S1. Shapiro–Wilk normality test results for model residuals by site.

Site	n	p-value
Andong	6	0.391
Boseong	6	0.377
Byeongcheon	7	0.212
Topyeong	7	0.594
Yeongdong	7	0.020
Total	33	0.285

Supplementary Table S2. Result of leave-one-out cross-validation

Site	n	RMSE	MAE	MAPE	MPE
Byeongcheon	7	0.18	0.16	3.84	-0.54
Andong	6	0.60	0.49	10.30	-2.97
Boseong	6	0.41	0.39	13.00	-3.47
Topyeong	7	0.11	0.10	2.38	0.53
Yeongdong	7	0.28	0.20	7.60	2.58
Total	33	0.30	0.24	6.24	-0.33

Supplementary Table S3. Result of AIC/BIC between Power-log regression and Polynomial regression

Organ	Model	AIC	BIC
Stem	Power-log	-35.85	-31.36
	Polynomial	-34.63	-28.65
Branch	Power-log	1.13	5.62
	Polynomial	2.85	8.83
Leaf	Power-log	-9.06	-4.57
	Polynomial	-7.07	-1.09
Root	Power-log	-9.21	-4.72
	Polynomial	-7.26	-1.27
Whole tree	Power-log	-39.66	-35.17
	Polynomial	-38.53	-32.54

Supplementary Table S4. Parameter estimates and standard errors (SE) of the site-specific allometric equations.

Site	Term	Estimate	SE	t-value	p-value
Byeongcheon	Intercept	-0.69	0.28	-2.43	0.06
	Slope	2.22	0.25	8.84	>0.01
Andong	Intercept	-0.93	0.67	-1.40	0.24
	Slope	2.43	0.56	4.35	0.01
Boseong	Intercept	0.07	0.24	0.27	0.80
	Slope	1.54	0.25	6.25	>0.01
Topyeong	Intercept	-1.01	0.11	-9.47	>0.01
	Slope	2.52	0.09	27.84	>0.01
Yeongdong	Intercept	-0.49	0.15	-3.31	0.02
	Slope	2.03	0.12	16.55	>0.01

Supplementary Table S5. ANCOVA results evaluating slope differences (log(DBH) × Site) among sampling sites

Source	DF	Sum Sq	F value	p-value
log(DBH)	1	6.28	471.51	<0.001
Site	5	0.03	0.47	0.75
log(DBH) × Site	5	0.15	2.87	0.05
Residuals	54	0.31		

Supplementary Table S6. Standard errors (SE) of parameter estimate and correction factors (CF) for the log-transformed allometric models.

Site	n	SE	CF
Byeongcheon	7	0.16	1.01
Andong	6	0.42	1.09
Boseong	6	0.22	1.02
Topyeong	7	0.03	1.00
Yeongdong	7	0.11	1.01
Total	33	1.11	1.85

Supplementary Table S7. Uncertainty of wood density, biomass expansion factor, and root ratio by site.

Site	Wood density	Biomass expansion factor	Root ratio
Byeongcheon	16.02	66.09	8.01
Andong	50.76	30.87	15.60
Boseong	34.77	51.79	13.49
Topyeong	11.35	21.71	4.05
Yeongdong	38.85	31.52	10.84
Total	12.51	17.87	4.95

Supplementary Table S8. Comparison of net primary productivity (NPP) of willow species (*Salix* spp.) measured in various countries.

Reference	Country	NPP of Stands (ton C ha^{-1} $year^{-1}$)	Scientific name
Verlinden, et al. (2013).[41]	Belgium	5.6	*Salix* spp.
Nakatsubo et al. (2023) [42]	Norway (Svalbard)	4.5	*Salix polaris*
Arevalo et al. (2011) [43]	Canada	6.1	*Salix viminalis*
Fischer et al. (2015) [44]	Europe	8.2	*Salix dasyclados*

Supplementary Table S9. Uncertainty-propagated Net Primary Productivity (NPP) by site (95% expanded uncertainty)

Site	n	Mean growth	SD of growth	Density	NPP	SE of growth	Rel. unc. NPP	SE of NPP	U95 NPP	NPP lower (95%)	NPP upper (95%)
Byeongcheon	7	12.32	6.91	750	9.24	2.61	0.21	1.96	3.92	5.32	13.16
Andong	6	17.19	12.56	700	5.66	5.13	0.30	3.59	7.18	4.86	19.21
Boseong	6	7.77	6.54	250	0.91	2.67	0.34	0.67	1.34	0.61	3.28
Topyeong	7	15.83	10.57	550	4.09	3.99	0.25	2.20	4.39	4.31	13.10
Yeongdong	7	19.82	21.04	250	2.33	7.95	0.40	1.99	3.98	0.98	8.93

Mean growth: Mean annual aboveground biomass increment per tree ($kg \cdot tree^{-1} \cdot yr^{-1}$)
SD growth : Standard deviation of annual growth ($kg \cdot tree^{-1} \cdot yr^{-1}$)
Density: Tree density per hectare ($trees \cdot ha^{-1}$)

NPP: Estimated net primary productivity ($ton \cdot ha^{-1} \cdot yr^{-1}$)

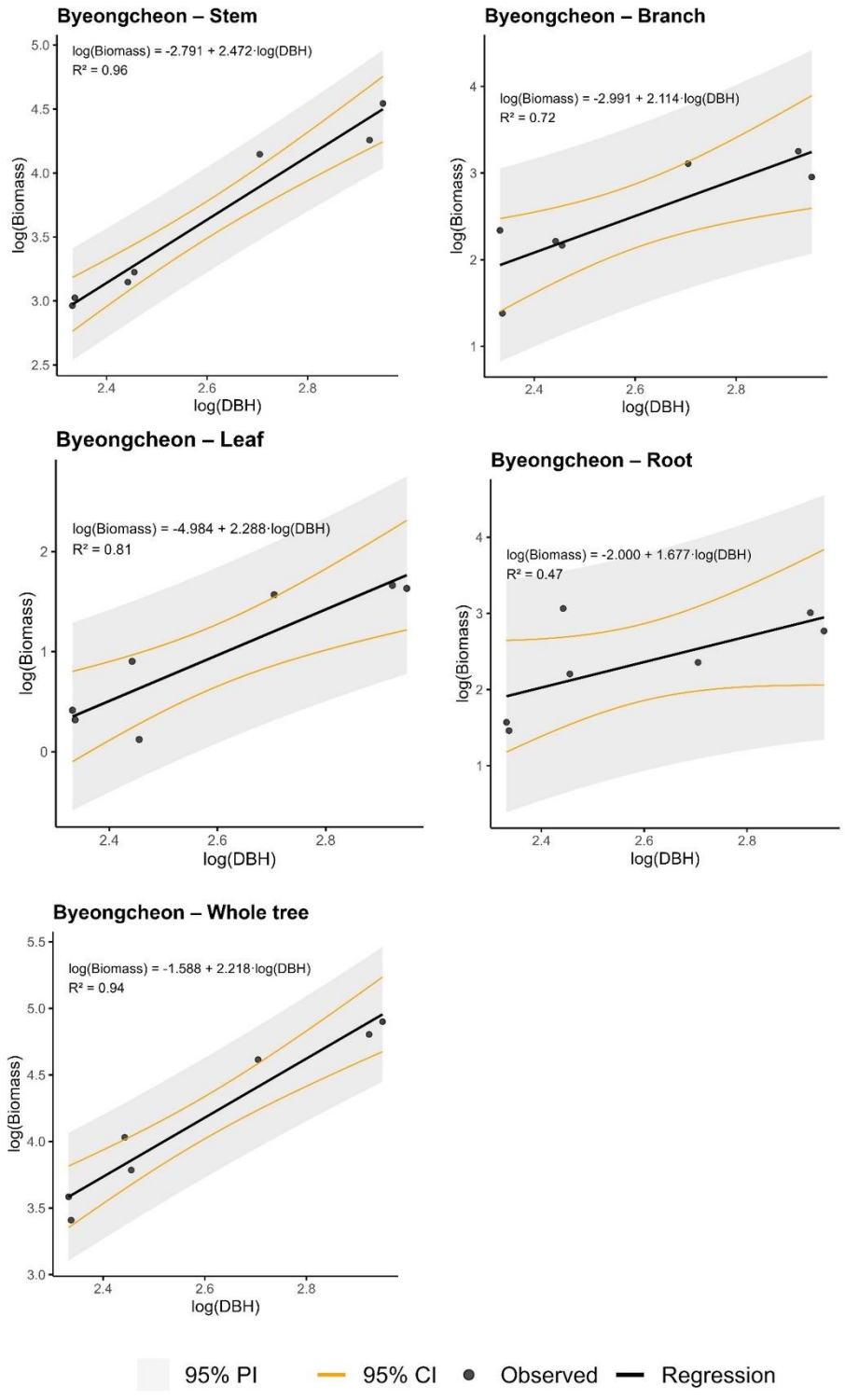
SE growth: Standard error of mean annual growth ($kg \cdot tree^{-1} \cdot yr^{-1}$)

Rel. unc. NPP: Relative uncertainty of NPP
(propagated uncertainty expressed as a proportion or percentage)

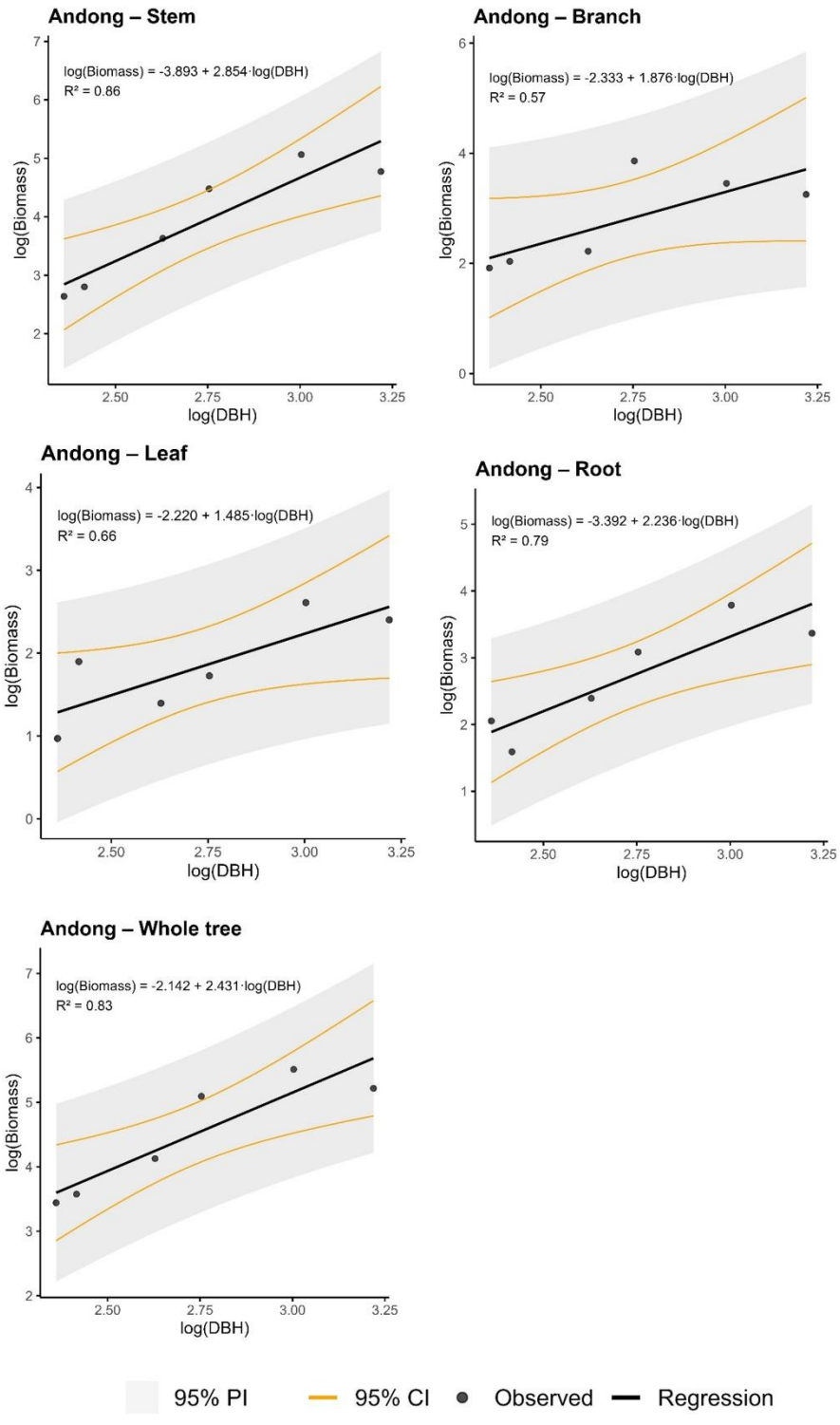
SE NPP: Standard error of estimated NPP ($ton\ ha^{-1} \cdot yr^{-1}$)

U95 NPP: Expanded uncertainty at 95% confidence (U95) ($ton\ ha^{-1} \cdot yr^{-1}$)

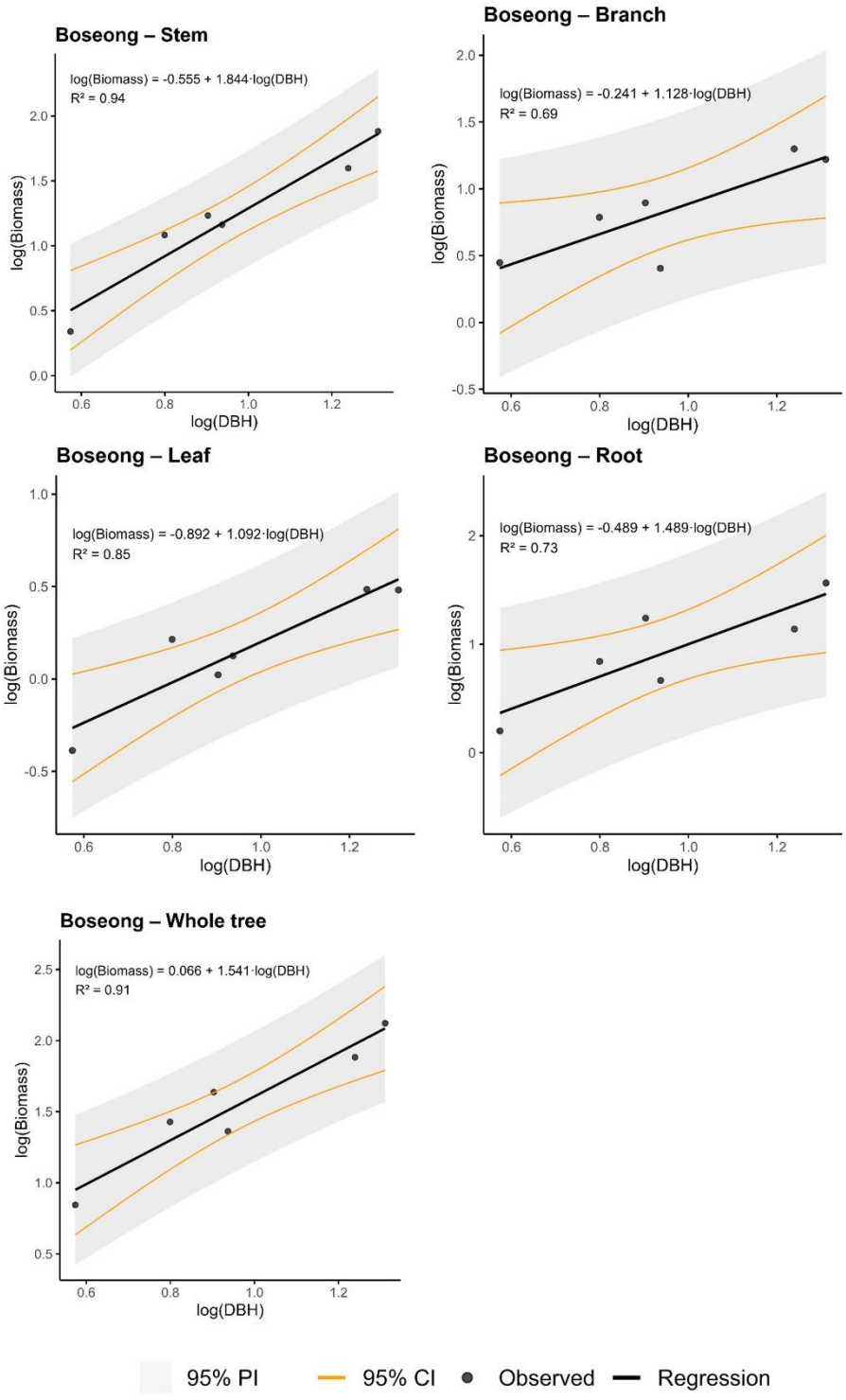
NPP lower/upper (95%): Lower/Upper 95% confidence limit of NPP



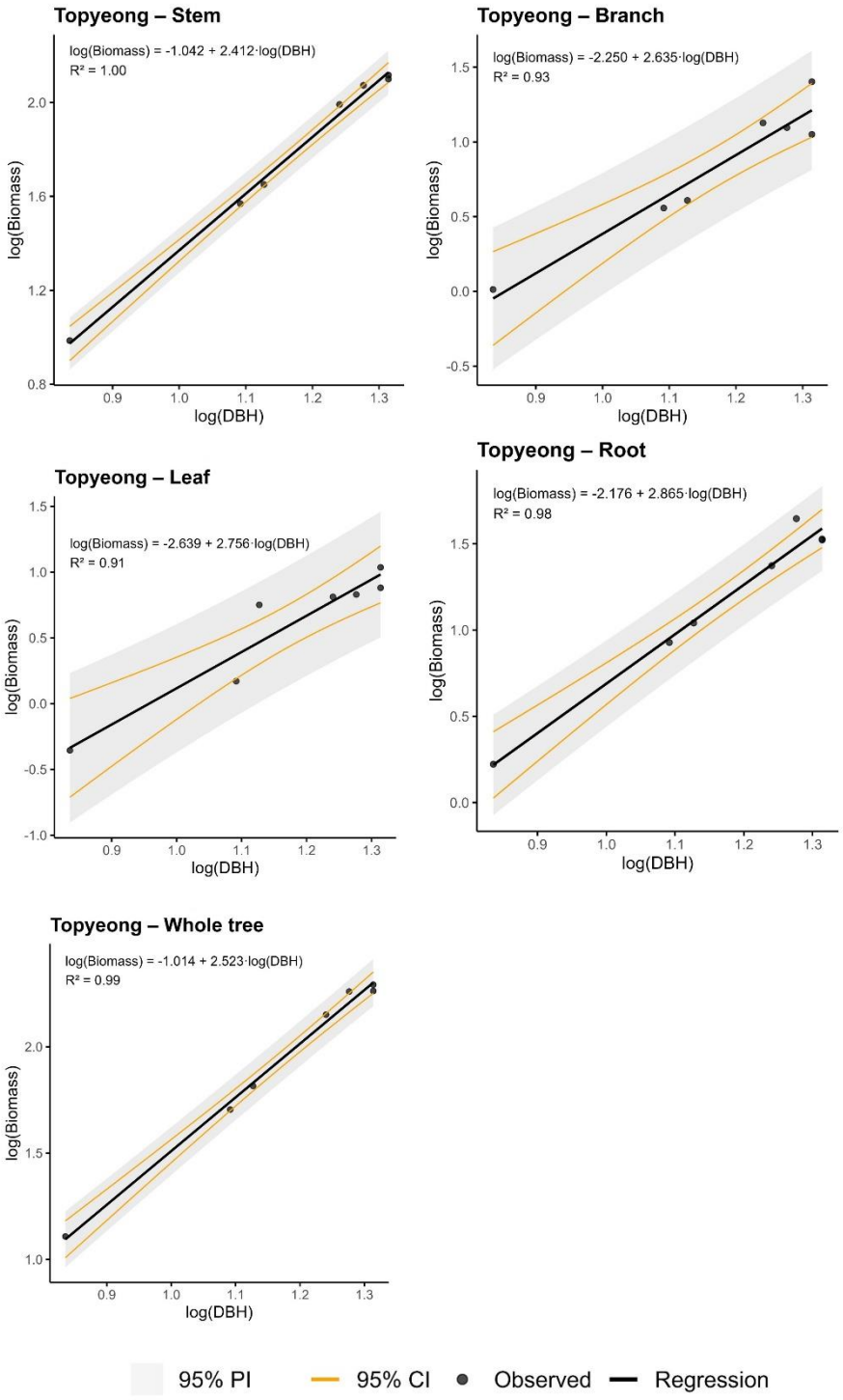
Supplementary Figure S1a. Allometric relationships between diameter at breast height (DBH) and dry biomass of stems, branches, leaves, roots, and whole trees of *S. chaenomeloides* from Byungcheon Stream. Each regression equation was obtained from seven samples obtained from each organ and from the whole-tree.



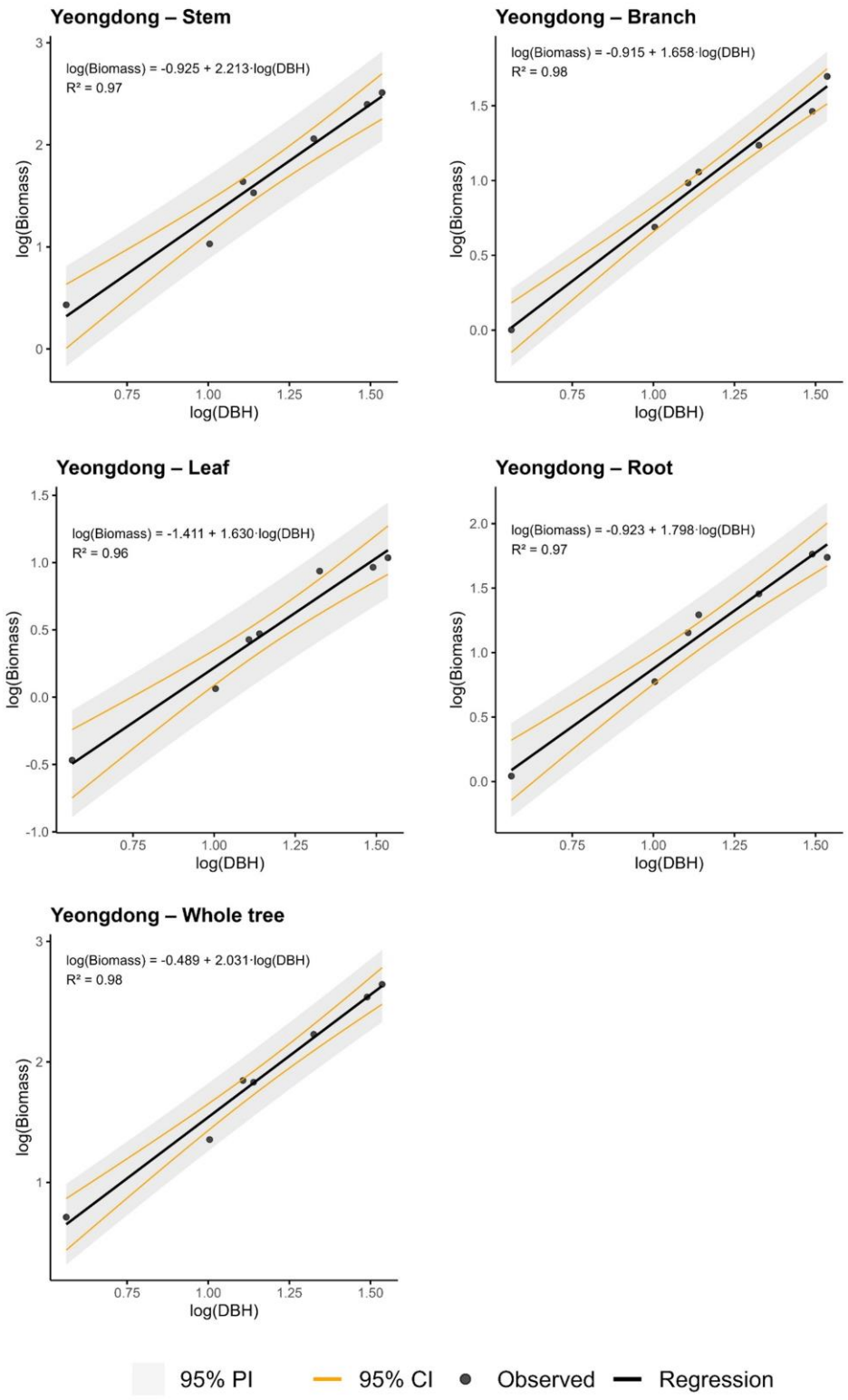
Supplementary Figure S1b. Allometric relationships between diameter at breast height (DBH) and dry biomass of stems, branches, leaves, roots, and whole trees of *S. chaenomeloides* from the Andong reach of Nakdong River. Each regression equation was obtained from six samples obtained from each organ and from the whole tree.



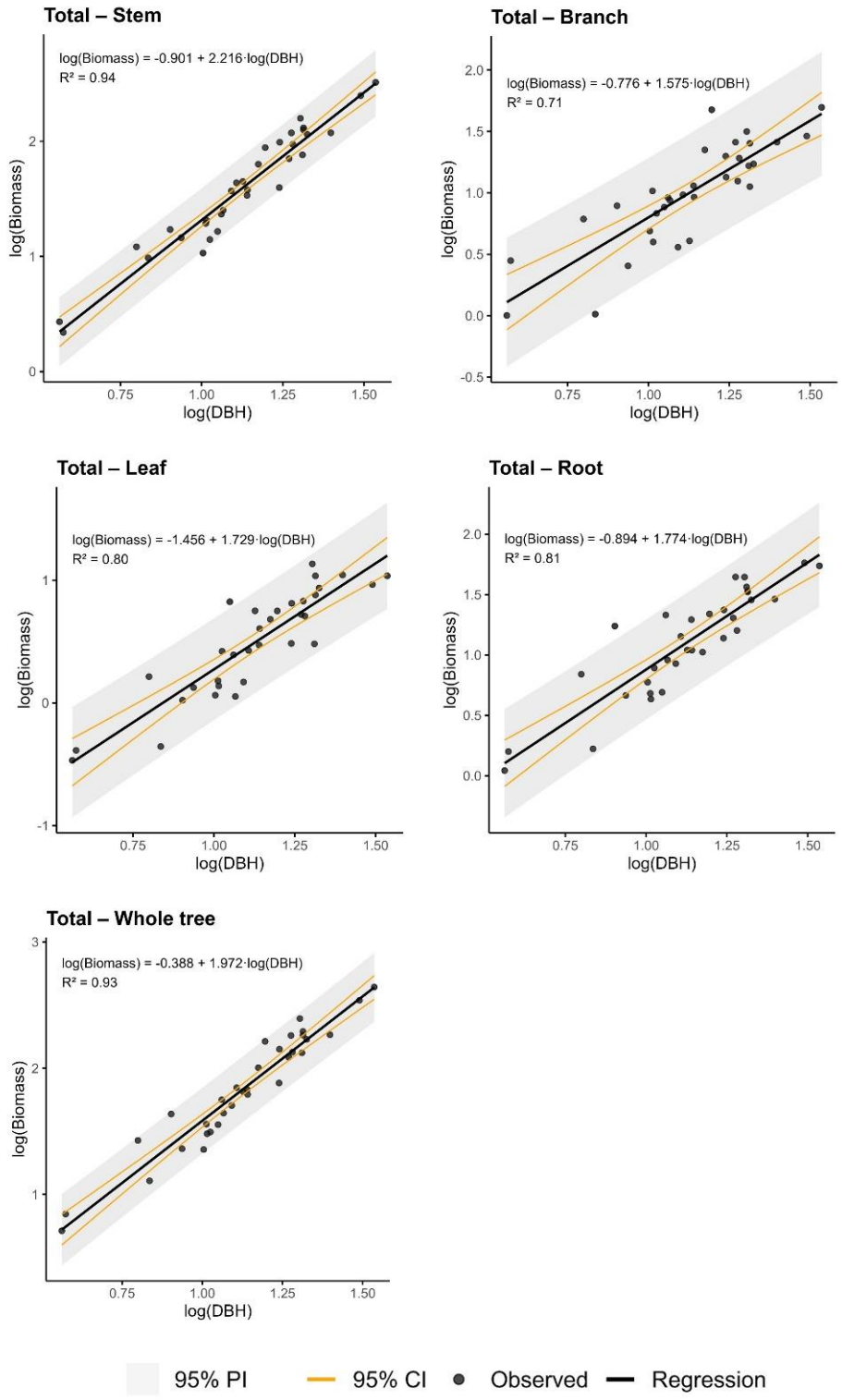
Supplementary Figure S1c. Allometric relationships between diameter at breast height (DBH) and dry biomass of stems, branches, leaves, roots, and whole trees of *S. chaenomeloides* from Boseong River (BS). Red dotted lines represent regression models. Each regression equation was obtained from six samples obtained from each organ and from the whole tree.



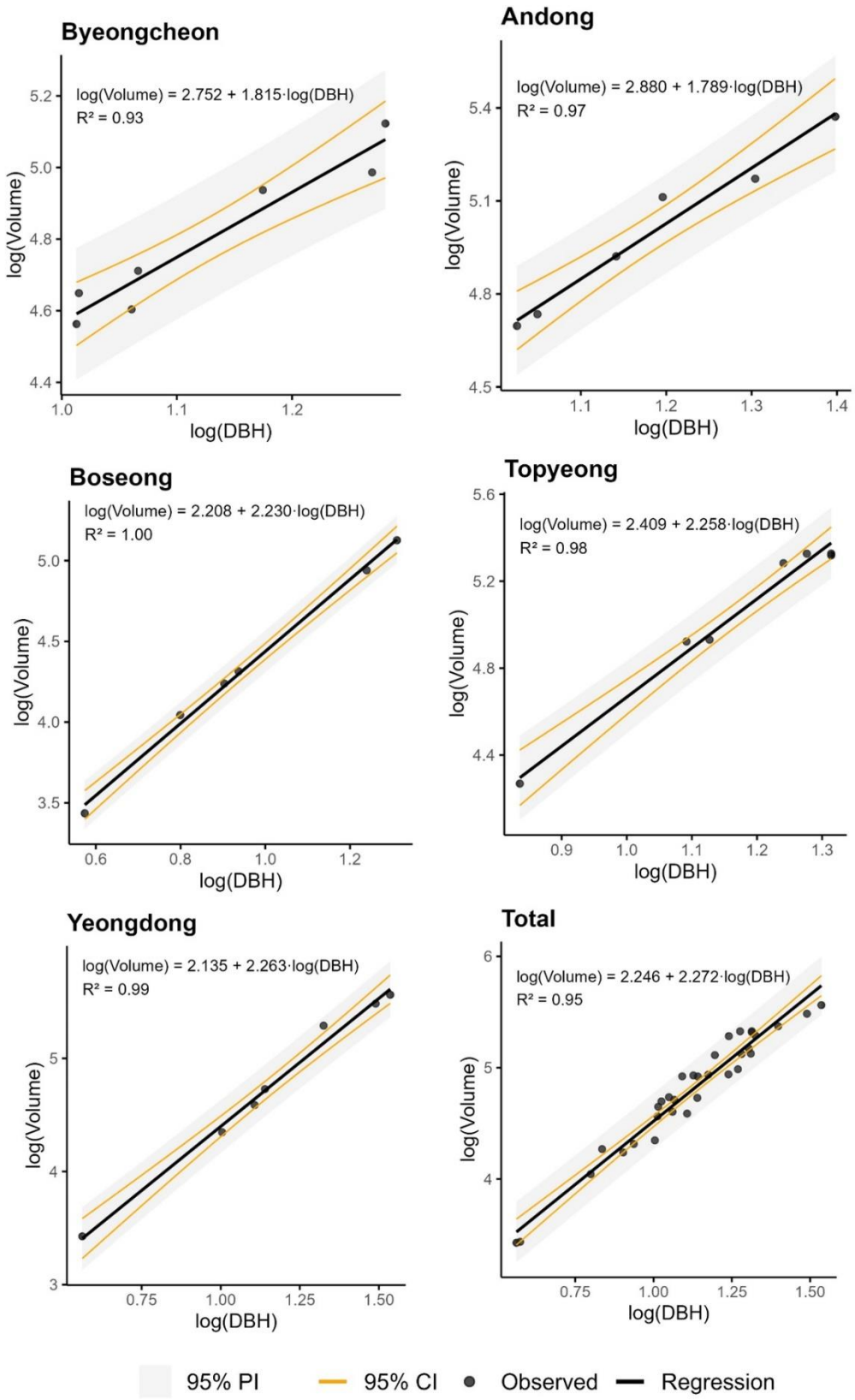
Supplementary Figure S1d. Allometric relationships between diameter at breast height (DBH) and dry biomass of stems, branches, leaves, roots, and whole trees of *S. chaenomeloides* from Topyeong Stream (TP). Red dotted lines represent regression models. Each regression equation was obtained from seven samples obtained from each organ and from the whole tree.



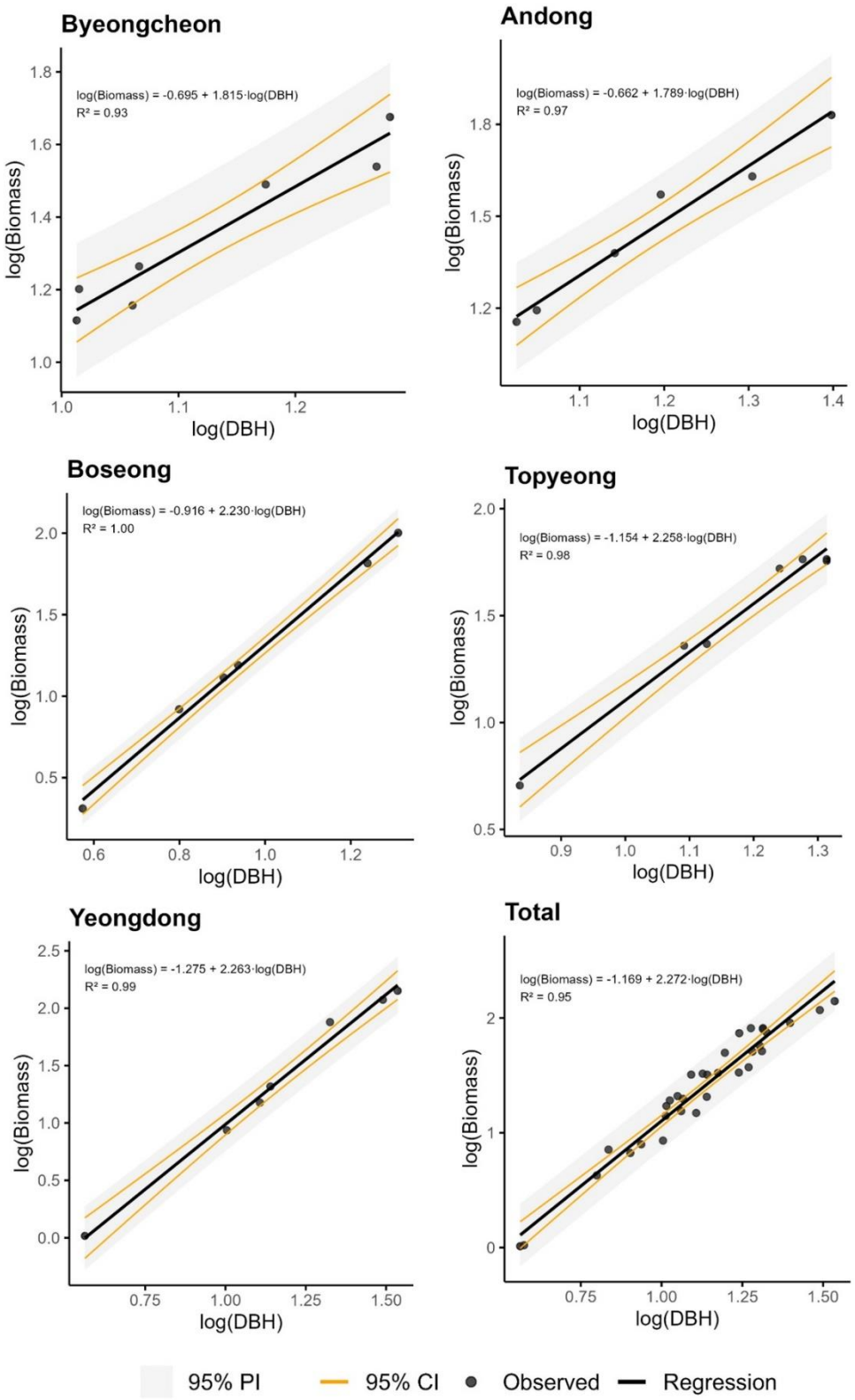
Supplementary Figure S1e. Allometric relationships between diameter at breast height (DBH) and dry biomass of stems, branches, leaves, roots, and whole trees of *S. chaenomeloides* from the Youngdong reach of Geum River. Each regression equation was obtained from seven samples obtained from each organ and from the whole tree.



Supplementary Figure S1f. Allometric relationships between diameter at breast height (DBH) and dry biomass of *S. chaenomeloides* obtained from five riparian zones. Each regression equation was obtained from 33 samples obtained from each organ and from the whole tree.



Supplementary Figure S2. Allometric relationships between DBH and stem volume of S. *chaenomeloides* from the Byeongcheon, Andong, Boseong, Topyeong, and Yeongdong Rivers, as well as the combined dataset ("Total").



Supplementary Figure S3. Allometric relationships between diameter at breast height (DBH) and biomass estimated from stem analysis of *Salix chaenomeloides* excavated at the Byeongcheon, Andong, Boseong, Topyeong, and Yeongdong Rivers, as well as the combined dataset ("Total").