

Supplementary Material

Table S1. Comparison of the output accuracy of the YOLOv3 models with different confidence threshold values.

	Confidence threshold																		
	0.05	0.1	0.15	0.2	0.25	0.3	0.35	0.4	0.45	0.5	0.55	0.6	0.65	0.7	0.75	0.8	0.85	0.9	0.95
r ²	0.80	0.82	0.83	0.84	0.86	0.86	0.87	0.87	0.87	0.88	0.87	0.87	0.84	0.83	0.80	0.77	0.69	0.61	0.46
RMSE	4.71	3.05	2.36	1.94	1.66	1.43	1.25	1.11	1.02	0.96	1.00	1.06	1.29	1.55	1.90	2.34	3.03	3.82	4.91

Table S2. Descriptive statistics of the actual plant density data derived from YOLOv3 model for the observation fields.

Field name	Min	Max	Median	Mean	Variance	Standard Deviation
Field 1	0.00	6.67	1.89	2.09	2.10	1.45
Field 2	0.00	8.33	1.72	2.17	2.67	1.63
Field 3	0.44	10.89	8.00	7.71	2.70	1.64
Field 4	0.00	10.44	5.89	5.47	3.29	1.81
Field 5	0.78	13.66	9.33	9.04	3.43	1.85
Field 6	0.11	12.44	8.11	7.81	2.51	1.58
Field 7	0.44	11.78	5.67	5.65	4.24	2.06
Field 8	0.00	11.33	5.89	5.86	6.12	2.47
Field 9	2.44	11.44	6.22	6.30	1.92	1.38
Field 10	0.89	15.11	12.22	11.88	3.27	1.81
Field 11	2.33	14.44	10.55	10.31	3.45	1.86
Field 12	1.89	16.11	9.55	9.63	3.99	2.00

Table S3. Descriptive statistics of the estimated plant density data derived from three regression models (SR + NDVI-PLS, NDVI + Climate-RF, 10VarImp-RF) for the test fields.

Field name	Descriptive statistics	SR + NDVI-PLS	NDVI + Climate-RF	10VarImp-RF
Field 2	Min	-0.67	0.62	0.40
	Max	5.47	3.38	3.39
	Median	2.06	1.69	1.55
	Mean	2.05	1.85	1.61
	Variance	1.17	0.32	0.34
	Standard deviation	1.08	0.56	0.59
Field 3	Min	2.43	1.76	0.51
	Max	7.92	7.13	8.33
	Median	5.76	5.92	6.20
	Mean	5.80	5.61	5.85
	Variance	0.81	0.96	2.03
	Standard deviation	0.90	0.98	1.43

Field 8	Min	0.02	3.68	3.11
	Max	7.63	7.74	7.97
	Median	3.73	5.74	6.04
	Mean	3.65	5.79	5.82
	Variance	1.12	1.45	1.63
	Standard deviation	1.06	1.21	1.27
Field 9	Min	3.56	4.44	4.42
	Max	9.54	9.26	10.01
	Median	6.72	6.35	6.77
	Mean	6.64	6.38	6.73
	Variance	0.60	0.20	0.24
	Standard deviation	0.78	0.45	0.49
Field 11	Min	3.56	4.44	8.02
	Max	9.54	9.26	11.71
	Median	6.72	6.35	10.04
	Mean	6.64	6.38	10.12
	Variance	0.60	0.20	0.67
	Standard deviation	0.78	0.45	0.82