Supplementary for

Planting Age Identification and Yield Prediction of Apple Orchard Using Time-Series Spectral Endmember and Logistic Growth Model

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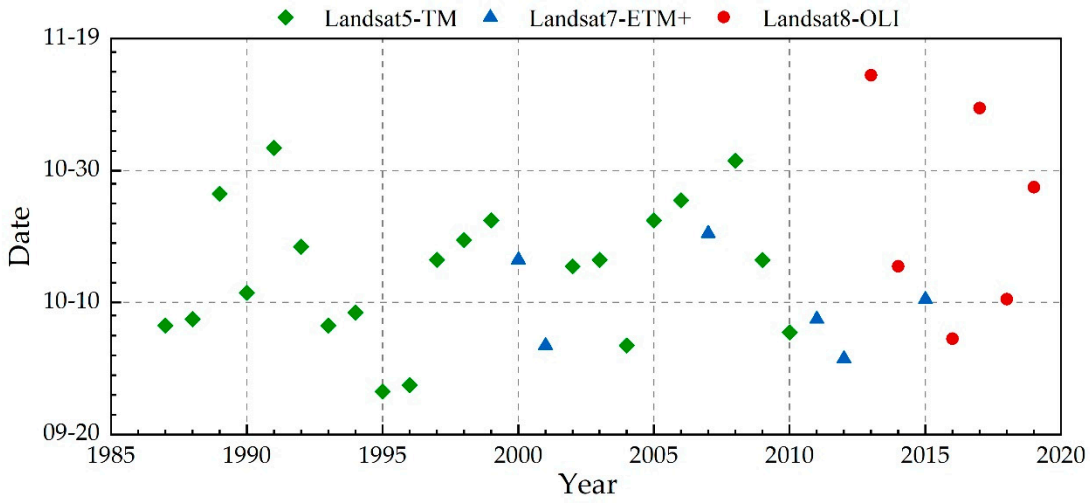

Figure S1. Data source and time of remote sensing image.

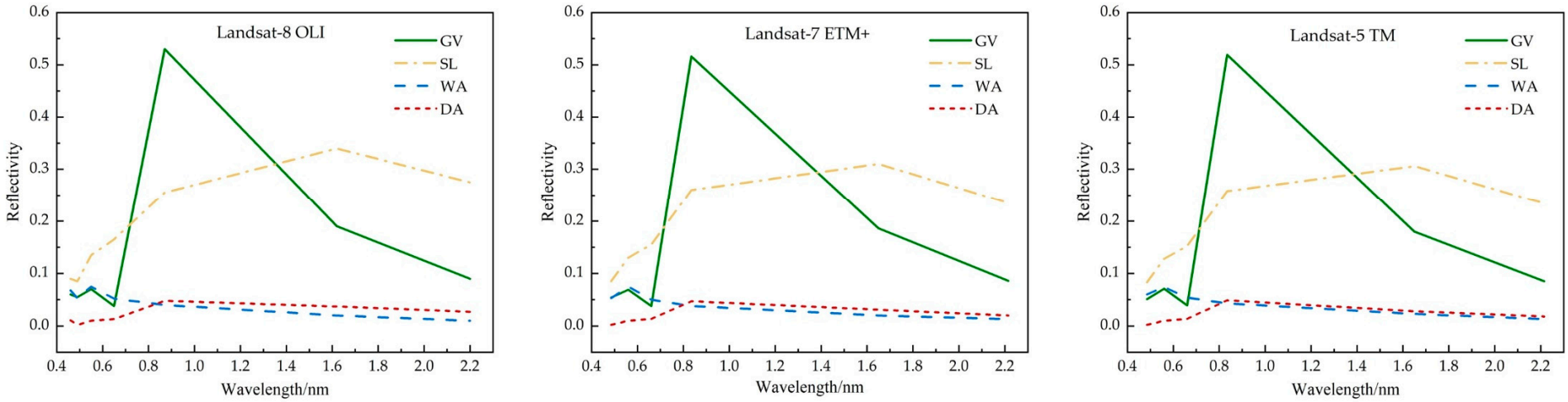

Figure S2. The spectral information of pure endmembers for each of the three sensors.

Table S1. 2018-2019 Statistical Yearbook Data

County	2018 Yield (metric ton)	2018 Area (mu)	2019 Yield (metric ton)	2019 Area (mu)
Sujiadian	129778	47260	102483	38284
Sikou	63926	21856	80974	34842
Xicheng	73103	33910	75224	30930
Guandao	189040	63165	189265	63316
Guanli	176631	59937	227892	58353
Yangchu	126646	42337	126585	42780
Shewopo	316057	117058	279012	93004
Taochun	152412	54066	130380	57699
Tingkou	171561	57325	180563	60288
Songshan	128047	45094	134733	45094
Zhuangyuan	34783	16190	34993	16510
Cuiping	48841	18981	56072	19443

1. mu, a Chinese unit of area (equal to 1/15 of a hectare).

S1. Evaluation indicators of orchard planting suitability

Water, heat, sunlight, and topographic conditions in the planting region are essential for apple growth. Research has shown that the optimum climate conditions for apple growing include 500-800 mm of annual precipitation, 9-12.5 °C of annual mean temperature, 2800-3600 °C of annual cumulative temperature, a daily temperature difference of no more than 10 °C in the summer, 2500 hours of annual sunshine, and soil pH from 6.5 to 7. We constructed an index system to evaluate the suitability of orchard planting

In addition, the spatial interpolation method, segmental scoring method and spatial simulation modeling method were used to spatially standardize each index and calculate the orchard planting suitability in the study area according to Equation (1). The orchard planting suitability can show the ecological suitability of apple planting in the study area, which is useful for comparing the spatial differences in apple planting suitability and rational planning of planting areas. The specific calculation formula is as follows.

$$S = \sum_{j=1}^{m} (\sum_{i=1}^{n} X_i \times W_i) \times W_j \quad (1)$$

Where S is the suitability of orchard planting; w_j is the weight of primary evaluation index; x_i is the standardized value of secondary evaluation index; w_i is the weight of secondary evaluation index; m is the number of primary evaluation index; n is the number of secondary evaluation index.

Table S2. Orchard planting suitability evaluation system

Dimension	Indicators	Weight
Terrain（0.1976）	Elevation (m)	0.1810
	Slope (°)	0.4095
	Slope Direction (°)	0.4095
Soil（0.3119）	Soil Texture	0.5390
	pH	0.2973
	Soil Organic Matter Content (g/kg)	0.1638
Climate（0.4905）	Annual precipitation (mm)	0.1209
	Daily difference in summer temperature (℃)	0.4168
	≥10℃ annual accumulation temperature (℃)	0.1928
	Annual sunshine hours (h)	0.2695

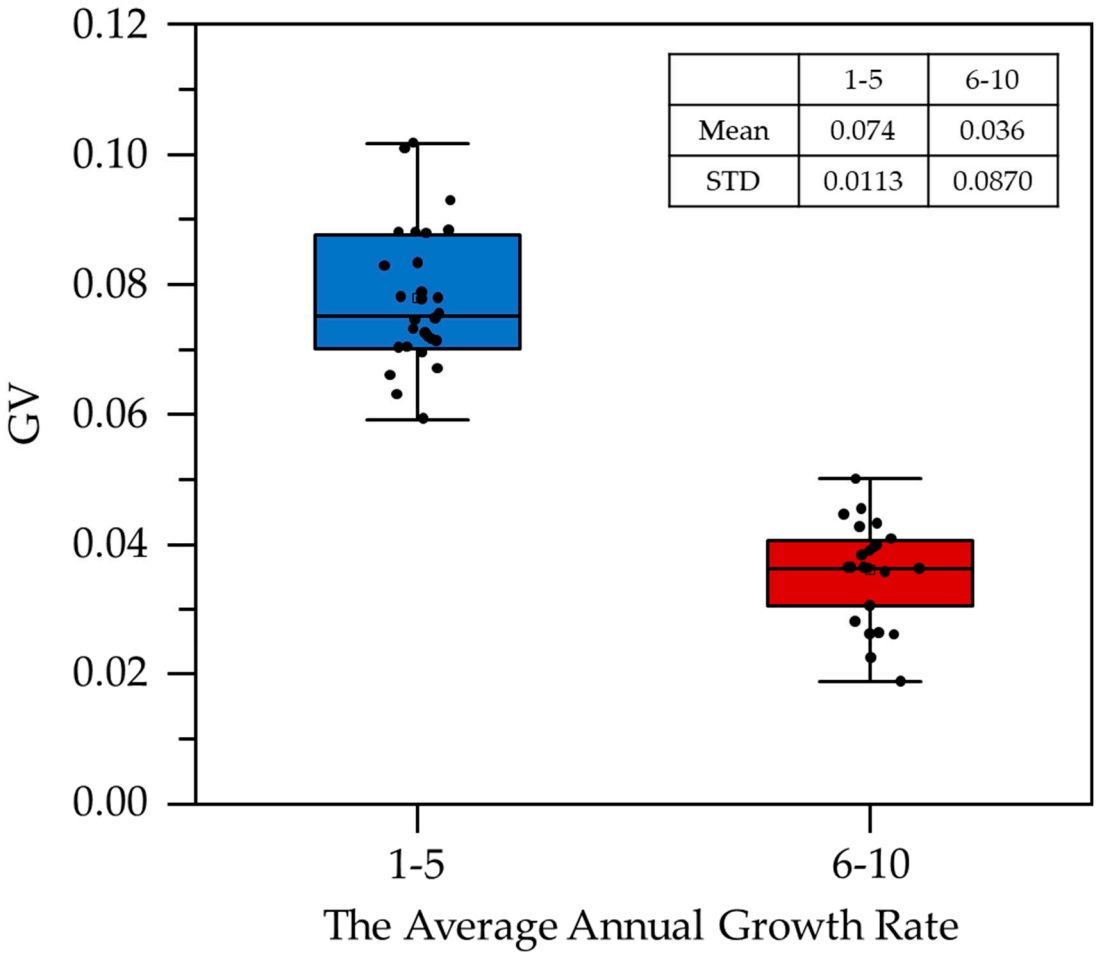

Figure S3. The average annual growth rate of different age groups.

Table S3. BP neural network input data of Guanli

Year		2020	2019	2018	2017	2016	2015
Age	**1**	73.17	79.29	27.27	33.66	275.49	50.58
	2	79.29	27.27	33.66	275.49	50.58	100.98
	3	27.27	33.66	275.49	50.58	100.98	219.87
	4	33.66	275.49	50.58	100.98	219.87	329.94
	5	275.49	50.58	100.98	219.87	329.94	579.78
	6	50.58	100.98	219.87	329.94	579.78	199.44
	7	100.98	219.87	329.94	579.78	199.44	235.26
	8	219.87	329.94	579.78	199.44	235.26	247.86
	9	329.94	579.78	199.44	235.26	247.86	101.07
	10	579.78	199.44	235.26	247.86	101.07	124.92
	11	199.44	235.26	247.86	101.07	124.92	196.56
	12	235.26	247.86	101.07	124.92	196.56	298.98
	13	247.86	101.07	124.92	196.56	298.98	57.6
	14	101.07	124.92	196.56	298.98	57.6	86.04
	15	124.92	196.56	298.98	57.6	86.04	204.66
	16	196.56	298.98	57.6	86.04	204.66	145.17
	17	298.98	57.6	86.04	204.66	145.17	93.33
	18	57.6	86.04	204.66	145.17	93.33	19.08
	19	86.04	204.66	145.17	93.33	19.08	155.7
	20	204.66	145.17	93.33	19.08	155.7	399.78
	21	145.17	93.33	19.08	155.7	399.78	351.18
	22	93.33	19.08	155.7	399.78	351.18	253.44
	23	19.08	155.7	399.78	351.18	253.44	359.55
	24	155.7	399.78	351.18	253.44	359.55	64.8
	25	399.78	351.18	253.44	359.55	64.8	45
	26	351.18	253.44	359.55	64.8	45	104.94
	27	253.44	359.55	64.8	45	104.94	46.8
	28-32	621.09	333.56	496.76	401.53	278.04	900.39
Yield		175455	178252	176931	165223	176017	188240