Supplementary material

1 Table S1 List of spectral indices generated for Sentinel-2 imagery

Table S1. List of spectral indices generated for Sentinel-2 imagery

No.	Spectral indices	Calculation formulas	References
	Red edge position indices		
1	Chlorophyll Green Index（Chlorgreen）	$\mathrm{Chlogreen} = \frac{NIR2}{Green + Rededge1}$	[1]
2	Leaf Anthocyanid Content（LAnthoC）	$\mathrm{LAnthoC} = \frac{Rededge3}{Green - Rededge1}$	[2]
3	Leaf Carotenoid Content（LCaroC）	$\mathrm{LCaroC} = \frac{Rededge3}{Blue - Rededge1}$	[2]
4	Leaf Chlorophyll Content（LChloC）	$\mathrm{LChloC} = \frac{Rededge3}{Rededge1}$	[2]
5	Normalized Difference of Red-edge and SWIR2（NDrededgeSWIR）	$\mathrm{NDrededgeSWIR} = \frac{Rededge2 - SWIR2}{Rededge2 + SWIR2}$	[3]
6	Red-edge Normalized Difference Vegetation Index 1（NDVIre1）	$\mathrm{NDVIre1} = \frac{NIR2 - Rededge1}{NIR2 + Rededge1}$	[4]
7	Red-edge Normalized Difference Vegetation Index 2（NDVIre2）	$\mathrm{NDVIre2} = \frac{NIR2 - Rededge2}{NIR2 + Rededge2}$	[5]
8	Red-edge Normalized Difference Vegetation Index 3（NDVIre3）	$\mathrm{NDVIre3} = \frac{NIR2 - Rededge3}{NIR2 + Rededge3}$	[5]
9	Red-edge Peak Area（RededgePeakArea）	$\mathrm{RededgePeakArea} = Red + Rededge1 + Rededge2 + Rededge3 + NIR2$	[3]
10	Simple Blue and Red-edge 1 Ratio（SR-BlueRededge1）	$\mathrm{SR-BlueRededge1} = \frac{Blue}{Rededge1}$	[6]
11	Simple Blue and Red-edge 2 Ratio（SR-BlueRededge2）	$\mathrm{SR-BlueRededge2} = \frac{Blue}{Rededge2}$	[7]
12	Simple Blue and Red-edge 3 Ratio（SR-BlueRededge3）	$\mathrm{SR-BlueRededge3} = \frac{Blue}{Rededge3}$	[8]
13	Normalized Difference Red-edge 1（NDre1）	$\mathrm{NDre1} = \frac{Rededge2 - Rededge1}{Rededge2 + Rededge1}$	[4]
14	Normalized Difference Red-edge 2（NDre2）	$\mathrm{NDre2} = \frac{Rededge3 - Rededge1}{Rededge3 + Rededge1}$	[4]

15	Chlorophyll Index Red-edge（CIre）	$\mathrm{CIre} = \frac{Rededge3}{Rededge1 - 1}$	[9]
	Reference spectral indices		
16	Normalized Difference Vegetation Index（NDVI）	$\mathrm{NDVI} = \frac{NIR2 - Red}{NIR2 + Red}$	[10]
17	Difference Vegetation Index（DVI）	$\mathrm{DVI} = NIR2 - Red$	[10]
18	Enhanced Vegetation Index（EVI）	$\mathrm{EVI} = 2.5 \times \frac{NIR2 - Red}{NIR2 + 6Red + 7.5Blue + 1}$	[11]
19	Built-up Area Index（BAI）	$\mathrm{BAI} = \frac{Blue - NIR2}{Blue + NIR2}$	[1]
20	Greenness Index（GI）	$\mathrm{GI} = \frac{Green}{Red}$	[1]
21	Moisture Stress Index（MSI）	$\mathrm{MSI} = \frac{SWIR1}{NIR2}$	[1]
22	Normalized Difference Tillage Index（NDTI）	$\mathrm{NDTI} = \frac{SWIR1 - SWIR2}{SWIR1 + SWIR2}$	[12]
23	Normalized Green（Norm-G）	$\mathrm{Norm-G} = \frac{Green}{NIR1 + Red + Green}$	[13]
24	Normalized Near Infra-red（Norm-NIR）	$\mathrm{Norm-NIR} = \frac{NIR1}{NIR1 + Red + Green}$	[13]
25	Normalized Red（Norm-R）	$\mathrm{Norm-R} = \frac{Red}{NIR1 + Red + Green}$	[13]
26	Normalized Difference Water Index 1（NDWI1）	$\mathrm{NDWI1} = \frac{NIR2 - SWIR1}{NIR2 + SWIR1}$	[14]
27	Normalized Difference Water Index 2（NDWI2）	$\mathrm{NDWI2} = \frac{Green - NIR2}{Green + NIR2}$	[4]
28	Normalized Humidity Index（NHI）	$\mathrm{NHI} = \frac{SWIR1 - Green}{SWIR1 + Green}$	[1]
29	Soil Adjusted Vegetation Index（SAVI）	$\mathrm{SAVI} = \frac{NIR2 - Red}{NIR2 + Red + 0.5} \times 1.5$	[1]
30	Bands Difference（RedSWIR1）	$\mathrm{RedSWIR1} = Red - SWIR1$	[1]
31	Ratio Vegetation Index（RVI）	$\mathrm{RVI} = \frac{NIR2}{Red}$	[10]
32	Water Body Index（WBI）	$\mathrm{WBI} = \frac{Blue - Red}{Blue + Red}$	[1]
33	Soil Tillage Index（STI）	$\mathrm{STI} = \frac{SWIR1}{SWIR2}$	[12]

2 Table S2 Carbon density of each component in different land cover types in different years

Table S2. Carbon density of each component in different land cover types in different years (units: t/ha).

Vegetation with different years	C_above	C_below	C_soil	C_dead	Vegetation with different years	C_above	C_below	C_soil	C_dead
Rubber (1 year)	7	3	132	0	Natural forest (+1 year)	80	16	100	25
Rubber (2 years)	9	3	132	0	Natural forest (+2 years)	83	17	101	26
Rubber (3 years)	10	4	126	1	Natural forest (+3 years)	86	18	102	27
Rubber (4 years)	12	4	126	1	Natural forest (+4 years)	89	19	103	28
Rubber (5 years)	13	5	126	1	Natural forest (+5 years)	92	20	104	29
Rubber (6 years)	15	5	120	2	Natural forest (+6 years)	95	21	105	30
Rubber (7 years)	17	6	120	2	Natural forest (+7 years)	98	22	106	31
Rubber (8 years)	20	6	120	2	Natural forest (+8 years)	101	23	107	32
Rubber (9 years)	23	7	120	3	Natural forest (+9 years)	104	24	108	33
Rubber (10 years)	26	7	120	3	Natural forest (+10 years)	107	25	109	34
Rubber (11 years)	29	8	120	3	Natural forest (+11 years)	110	26	110	35
Rubber (12 years)	35	9	114	3	Natural forest (+12 years)	113	27	111	36
Rubber (13 years)	37	10	114	3	Natural forest (+13 years)	116	28	112	37
Rubber (14 years)	42	11	114	3	Natural forest (+14 years)	119	29	113	38
Rubber (15 years)	48	12	114	4	Natural forest (+15 years)	122	30	114	39
Rubber (16 years)	54	13	114	4	Natural forest (+16 years)	125	31	115	40
Rubber (17 years)	62	14	114	4	Natural forest (+17 years)	128	32	116	41
Rubber (18 years)	70	15	108	4	Natural forest (+18 years)	131	33	117	42
Rubber (19 years)	75	16	108	4	Natural forest (+19 years)	134	34	118	43
Rubber (≥ 20 years)	80	16	108	4	Natural forest (+20 years)	137	35	119	44
Cultivated land	5	5	15	0					

Note: C_above, C_below, C_soil, and C_dead represented the carbon density of above-ground, below-ground, soil, and dead matter, respectively.

3 Table S3 Confusion matrix of the forest and rubber plantation mapping

Table S3. Confusion matrix of the forest and rubber plantation mapping.

	Forest	Non-forest	Total	Producer's Accuracy
Forest	237	20	257	92.22%
Non-forest	19	213	232	91.81%
Total	256	233	489	
User's accuracy	92.58%	91.42%		
Overall accuracy: 0.92; kappa: 0.84				
	Natural forest	Rubber plantation	Total	Producer's Accuracy
Natural forest	90	12	102	88.24%
Rubber	10	139	149	93.29%
Total	100	151	251	
User's accuracy	90.00%	92.05%		
Overall accuracy: 0.91; kappa: 0.82				

4 Table S4 Confusion matrix of identification results of rubber planting years

Table S4. Confusion matrix of identification results of rubber planting years.

	1-5 years	6-10 years	10-15 years	16-19 years	≥20 years	Total	Producer's Accuracy
1-5 years	545	58	44	10	2	659	82.70%
6-10 years	46	578	55	12	8	699	82.69%
10-15 years	32	56	744	63	23	918	81.05%
16-19 years	14	32	56	687	67	856	80.26%
≥20 years	8	8	24	20	486	546	89.01%
Total	645	732	923	792	586	3678	
User's accuracy	84.50%	78.96%	80.61%	86.74%	82.94%		
Overall accuracy: 0.83; kappa: 0.78.							

5 Figure S1 List of spectral indices generated for Sentinel-2 imagery

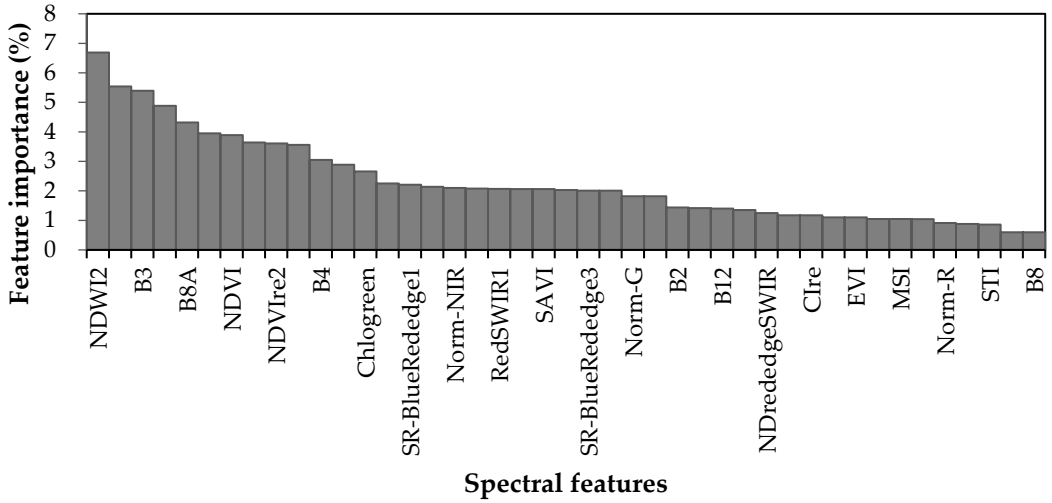

Figure S1. Importance statistics of spectral features.

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