

Table S1. Summary of classified pixels within crowns as part of the majority classification using variable set #5 with reduced correlation (Table 6). Data are percent of pixels that were in a crown's majority class, which then classified the crown correctly or incorrectly to species with the majority vote rule.

Species	Crown Classification	Pixel Classification (Majority Percent)			
		Min	Max	Mean	N
BAEL	Incorrect	45.4%	87.3%	58.8%	10
	Correct	26.8%	98.0%	75.2%	26
CEPE	Incorrect	n/a	n/a	n/a	0
	Correct	50.2%	90.7%	71.5%	8
DIPA	Incorrect	42.1%	82.8%	64.8%	8
	Correct	39.3%	99.5%	79.5%	71
HYAL	Incorrect	28.8%	72.5%	48.6%	3
	Correct	39.7%	94.9%	76.6%	30
HYME	Incorrect	33.1%	33.1%	33.1%	1
	Correct	44.7%	91.7%	63.6%	12
LEAM	Incorrect	44.5%	77.5%	61.0%	2
	Correct	37.3%	84.1%	61.2%	15
TEOB	Incorrect	41.4%	65.4%	53.4%	2
	Correct	47.4%	96.3%	79.2%	26
All	Incorrect	28.8%	87.3%	58.2%	26
	Correct	26.8%	99.5%	75.6%	188

Table S2. Important hyperspectral metrics at tissue scales ranked by Random Forests. Results are for variables in set #5, with full and reduced correlation and importance ranked high to low based on mean decrease in overall accuracy (see Methods, Section 2.3). Metrics not used by the RF are not listed.

Rank	Leaves		Bark		Leaves + Bark	
	Full Correlation	Reduced Correlation	Full Correlation	Reduced Correlation	Full Correlation	Reduced Correlation
1	† RVS1	* NIR2-A	* WBI	‡ SWIR3-As	* NIR2-A	* NIR2-A
2	* NIR2-A	† RVS1	‡ SWIR3-D	* WBI	† RVS1	* WBI
3	* NIR2-D	* WBI	‡ SWIR3-As	‡ SWIR3-D	* WBI	‡ SWIR3-D
4	* WBI	* NIR1-A	‡ SWIR3-W	† RE-Mag	* NIR2-D	† RVS1
5	† RE-Wvl	† GP-Wvl	* NDWI	† BE-Mag	‡ SWIR3-D	† RE-Wvl
6	‡ SWIR3-D	† RE-Wvl	† RE-Mag	* NE2-Wvl	† RE-Wvl	† NIR1-A
7	‡ SWIR3-A	‡ SWIR3-D	† RE-DArea	* NE2-Mag	‡ SWIR3-A	‡ SWIR3-W
8	* NIR1-A	‡ SWIR3-A	† BE-Mag	‡ SWIR3-A	* NIR1-A	† PRI
9	† GP-Wvl	† ARI2	‡ NDLI	‡ NDLI	* NE2-Mag	† ARI2
10	† ARI2	‡ NDLI	‡ SWIR3-A	* NIR1-W	* NDWI	‡ CAI
11	* NDWI	‡ NDNI	‡ SWIR1-D	‡ RE-Wvl	‡ SWIR3-W	‡ NDLI
12	* NE2-Mag	† RW-Wvl	* NE2-Wvl	* NE1Mag	† ARI2	‡ NIR2-W
13	† PRI	‡ CAI	† BE-DArea	† RW-Ref	† PRI	† GP-Wvl
14	† RW-Wvl	‡ SWIR3-W	* NE2-Mag	* NIR2-As	‡ CAI	‡ NDNI
15	‡ NDLI	† RE-Mag	† RW-Ref	† PRI	* NIR2-W	† BE-DArea
16	‡ NDNI	† BE-DArea	* NIR1-W	† ARI2	† RW-Wvl	† RW-Wvl
17	* NIR1-D	† Red-W	* NE1-Mag	‡ NDNI	‡ SWIR3-As	† RE-Mag
18	‡ CAI	† Blue-A	‡ SWIR1-A	* NIR2-W	‡ NDLI	† YE-DArea

Table S2. Cont.

Rank	Leaves		Bark		Leaves + Bark	
	Full Correlation	Reduced Correlation	Full Correlation	Reduced Correlation	Full Correlation	Reduced Correlation
19	‡ SWIR3-W	‡ SE-Wvl	† RE-Wvl	‡ SE-Mag	† BE-DArea	† RE-DArea
20	† RE-Mag	† Blue-D	† PRI	* EWT	† GP-Wvl	† Blue-D
21	† BE-DArea	† YE-DArea	‡ SE-Mag	‡ SWIR1-As	† RE-Mag	‡ SWIR1-As
22	* EWT	SWIR1W	* NIR2-A	‡ CAI	† YE-DArea	† YE-Mag
23	† Blue-D	† RE-DArea	* NIR2-D	† Red-As	‡ NDNI	† Blue-A
24	† YE-DArea	† SAVI	‡ NDNI	† YE-DArea	* NIR1-D	† RW-Ref
25	† Blue-A	† CRI2	* NIR2-As	† Red-W	† RE-DArea	* NE2-Wvl
26	‡ SWIR1-W	† CRI1	* NIR2-W	SE-Wvl	* NIR2-As	* NE1-Mag
27	† YE-Mag	† YE-Mag	† Red-W	† CRI2	* EWT	‡ SWIR1-W
28	† Red-W	‡ SWIR1-A	‡ SWIR1-W	* NIR1-As	† Red-W	‡ SWIR1-D
29	‡ SWIR1-A	‡ SWIR1-D	† ARI2	† Red-A	‡ SWIR1-As	† CRI1
30	† RE-DArea	* NIR2-W	* NIR1-A	† RVSI	† BE-Mag	‡ SE-Wvl
31	‡ SWIR1-D	† Blue-W	‡ SWIR1-As	‡ SWIR2-A	† Red-As	† CRI2
32	‡ SE-Wvl	† Blue-As	† SAVI	† Red-D	† YE-Mag	* NIR1-W
33	† CRI1	‡ SWIR3-As	* EWT	* NE1-Wvl	† Blue-D	† Blue-As
34	† BE-Mag	* NIR2-As	† YED-Area	† YE-Mag	† SAVI	† Blue-W
35	† SAVI	† SE-Mag	† Red-As	† CRI1	* NE1-Mag	† BE-Wvl
36	† Red-As	* NE1-Mag	‡ CAI	‡ SWIR2-D	† RW-Ref	‡ SE-Mag
37	‡ SWIR1-As	† BE-Wvl	* NIR1-D	† ARVI	† Blue-A	* NIR1-As
38	† Blue-W	† GP-Ref	† CRI1	† RW-Wvl	‡ SWIR1-D	† YE-Wvl
39	* NIR2-W	† ARVI	† RVSI	‡ SWIR2-W	† CRI1	* NE1-Wvl
40	* NIR2-As	‡ SWIR2-W	† CRI2	† BE-Wvl	‡ SWIR1-W	‡ SWIR2-W
41	‡ SWIR3-As	‡ SWIR2-D	† RW-Wvl	† NDVI	† CRI2	‡ SWIR2-A
42	† CRI2	* NIR1-W	† Red-A	† Blue-D	* NIR1-W	‡ SWIR2-D
43	† BE-Wvl	‡ SWIR2-As	* NIR1-As	† Blue-A	* NE2-Wvl	‡ SWIR2-As
44	† Blue-As	† YE-Wvl	‡ SWIR2-A	† YE-Wvl	‡ SWIR1-A	
45	‡ SE-Mag	* NE1-Wvl	† YE-Mag	† Blue-As	‡ SE-Wvl	
46	† NDVI	* NIR1-As	‡ SWIR2-D	† Blue-W	† NDVI	
47	† GP-Ref	‡ SWIR2-A	† Red-D	† GP-Ref	* NIR1-As	
48	† Red-D	* NE2-Wvl	‡ SE-Wvl	† GP-Wvl	† Blue-As	
49	† Red-A		† Blue-D		† ARVI	
50	* NE1-Mag		‡ SWIR2-W		† SR	
51	† RW-Ref		† ARVI		† Red-D	
52	* NIR1-As		† NDVI		† GP-Ref	
53	‡ SWIR2-D		* NE1-Wvl		† Blue-W	
54	* NIR1-W		† YE-Wvl		‡ SE-Mag	
55	‡ SWIR2-W		† BlueA		† BE-Wvl	
56	† SR		† BE-Wvl		† Red-A	
57	† ARVI		† SR		* NE1-Wvl	
58	‡ SWIR2-As		† Blue-W		† YE-Wvl	
59	* NE1-Wvl		‡ SWIR2-As		‡ SWIR2-D	
60	‡ SWIR2A		† GP-Wvl		‡ SWIR2-A	
61	† YE-Wvl		† GP-Ref		‡ SWIR2-W	
62	* NE2-Wvl		† Blue-As		‡ SWIR2-As	

† = Photosynthetic pigments, LAI, structure, physiology, stress (VIS-NIR); * = Water and structure (NIR); ‡ = Lignin, cellulose, nitrogen, proteins (SWIR); £ = Spectral Mixture Analysis fractions; uses all biochemical absorption and structural features (Full-spectrum).

Table S3. Important hyperspectral metrics at pixel and crown scales ranked by Random Forests. Results are for variables in set #5, with full and reduced correlation and importance ranked high to low based on mean decrease in overall accuracy (see Methods, Section 2.3). Metrics not used by the RF are not listed.

<i>Rank</i>	Pixel		Crown	
	<i>Full Correlation</i>	<i>Reduced Correlation</i>	<i>Full Correlation</i>	<i>Reduced Correlation</i>
1	† ARI2	‡ SWIR1-As	‡ SWIR1-W	‡ SWIR1-W
2	† RW-Wvl	† ARI2	‡ SWIR1-As	‡ SWIR2-A
3	‡ SWIR1-As	* NIR1-A	‡ SWIR2-A	† Red-D
4	‡ SWIR1-W	† RW-Wvl	† Red-D	† BE-Wvl
5	* NIR1-A	* NDWI	‡ SWIR1-A	† PRI
6	* NDWI	£ NPV	£ NPV	† BE-Mag
7	£ NPV	‡ SWIR2-A	† BE-Mag	* NIR1-A
8	‡ SWIR2-A	‡ SWIR2-W	‡ SWIR2-D	* NDWI
9	† PRI	† PRI	† RW-Wvl	† RW-Wvl
10	† RVS	‡ SWIR1-A	† BE-Wvl	† RE-Mag
11	‡ SWIR2-W	* NE1-Mag	† PRI	† YE-Mag
12	† RE-Wvl	† RVS	* NIR1-A	† Blue-W
13	* NIR1-D	† YE-DArea	† ARVI	† ARI2
14	† CRI2	† CRI2	† NDVI	‡ SWIR2-W
15	† YE-DArea	† CRI1	‡ SWIR3-D	‡ SWIR2-As
16	† CRI1	† RE-Wvl	† Red-A	‡ SWIR3-D
17	† Blue-D	† Red-D	† SR	† CRI2
18	* NIR1-As	† Blue-D	† Blue-W	† RVS
19	* NE1-W	RMSE	† ARI2	† GP-Wvl
20	‡ SWIR2-D	† ARVI	* NDWI	‡ NDNI
21	‡ SWIR1-A	‡ SE-Wvl	‡ SWIR2-W	* NE1-Mag
22	‡ SE-Wvl	‡ SWIR2-D	‡ SWIR1-D	‡ SE-Wvl
23	* NE1-Mag	† Red-W	† Red-As	* NE1-Wvl
24	* NIR2-A	† Red-As	* NIR2-A	£ RMSE
25	‡ NDNI	‡ SE-Mag	† Blue-D	‡ SE-Mag
26	RMSE	† BE-DArea	† RE-Mag	£ Shade
27	‡ SWIR2-As	* NE1-W	† YE-Mag	† RE-DArea
28	† Red-D	‡ NDLI	† Red-W	† RE-Wvl
29	† Blue-A	† BE-Mag	† Blue-As	‡ NDLI
30	* EWT	* NIR1-As	† Blue-A	‡ SWIR3-A
31	† RW-Ref	Shade	‡ SWIR2-As	* NE2-Mag
32	† ARVI	* NE2-Mag	* EWT	† GP-Ref
33	† Red-W	† GP-Wvl	† RVS	* NIR1-As
34	‡ SWIR1-D	‡ CAI	* NE1-Mag	* NE2-Wvl
35	* NIR2-D	† BE-Wvl	† BE-DArea	‡ SWIR3-W
36	* WBI	‡ SWIR3-D	† SAVI	* NE1-W
37	† GP-Wvl	* NE1-Wvl	‡ NDNI	* NIR2-As
38	† GP-Ref	* NE2-W	* WBI	‡ SWIR3-As
39	‡ SE-Mag	* NIR2-As	† CRI1	* NE2-W
40	† BE-Mag	† YE-Mag	‡ SE-Mag	† YE-Wvl
41	† Red-As	* NE2-Wvl	* NIR1-D	
42	‡ NDLI	‡ SWIR3-A	* NE1-Wvl	

Table S3. Cont.

Rank	Pixel		Crown	
	Full Correlation	Reduced Correlation	Full Correlation	Reduced Correlation
43	† BE-DArea	† Blue-As	£ RMSE	
44	* NE1-Wvl	† Blue-W	* NIR2-D	
45	* NIR2-As	‡ SWIR3-W	† GP-Wvl	
46	† Red-A	‡ SWIR3-As	† RW-Ref	
47	* NE2-W	† YE-Wvl	† CRI2	
48	‡ CAI		‡ SE-Wvl	
49	‡ SWIR3-D		† YE-DArea	
50	† SR		£ GV	
51	£ GV		† RE-DArea	
52	† NDVI		‡ SWIR3-A	
53	£ Shade		‡ CAI	
54	† RE-Mag		‡ NDLI	
55	† RE-DArea		£ Shade	
56	† SAVI		* NE2-Wvl	
57	† BE-Wvl		† RE-Wvl	
58	* NE2-Wvl		† GP-Ref	
59	† YE-Mag		* NE2-Mag	
60	* NE2-Mag		* NIR1-As	
61	‡ SWIR3A		* NE2-W	
62	† Blue-W		* NE1-W	
63	† Blue-As		‡ SWIR3-As	
64	‡ SWIR3-W		† YE-Wvl	
65	‡ SWIR3-As		‡ SWIR3-W	
66	† YE-Wvl		* NIR2-As	

† = Photosynthetic pigments, LAI, structure, physiology, stress (VIS-NIR); * = Water and structure (NIR); ‡ = Lignin, cellulose, nitrogen, proteins (SWIR); £ = Spectral Mixture Analysis fractions; uses all biochemical absorption and structural features (Full-spectrum).

Table S4. Mean and coefficient of variation for hyperspectral metrics across all species, grouped by dominant absorption features and spectral regions.

Metric	Leaves		Bark		Pixels		Crown	
	Mean	C.V.	Mean	C.V.	Mean	C.V.	Mean	C.V.
<i>Photosynthetic Pigments, LAI, Structure, Physiology, Stress (VIS-NIR)</i>								
SR	9.59	0.41	2.37	0.37	14.85	0.39	12.87	0.40
NDVI	0.78	0.11	0.38	0.31	0.85	0.08	0.83	0.08
SAVI	0.57	0.13	0.28	0.37	0.54	0.28	0.54	0.17
ARVI	0.74	0.14	0.20	0.70	0.78	0.12	0.76	0.12
ARI2	0.86	1.21	1.95	0.52	3.31	0.33	3.12	0.21
CRI1	11.14	0.69	2.37	0.42	42.32	2.52	23.15	0.39
CRI2	13.51	0.71	6.86	0.44	54.13	2.13	32.27	0.32
PRI	-0.005	-7.27	-0.073	-0.25	-0.002	-21.65	-0.012	-1.72
RVSI	0.0014	3.80	0.0055	0.36	0.0148	0.49	0.0140	0.32
Blue-D	0.32	0.44	0.06	0.45	0.40	0.38	0.36	0.28
Blue-W	45.85	0.08	44.07	0.07	44.71	0.22	47.24	0.03
Blue-A	14.82	0.49	2.53	0.45	18.85	0.38	17.33	0.30
Blue-As	0.91	0.01	0.91	0.01	0.87	0.20	0.91	0.00

Table S4. Cont.

<i>Metric</i>	Leaves		Bark		Pixels		Crown	
	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>
<i>Photosynthetic Pigments, LAI, Structure, Physiology, Stress (VIS-NIR)</i>								
BE-Wvl	521.8	0.00	510.8	0.13	517.8	0.07	519.9	0.00
BE-DArea	0.04	0.51	0.02	0.42	0.02	0.43	0.32	0.25
BE-Mag	0.0017	0.52	0.0006	0.44	0.0009	0.44	0.0008	0.26
GP-Wvl	548.7	0.08	26.0	4.62	548.9	0.11	552.3	0.07
GP-Ref	0.09	0.38	0.00	4.73	0.04	0.46	0.04	0.22
YE-Wvl	568.2	0.08	564.1	0.13	534.6	0.26	562.4	0.12
YE-DArea	−0.02	−0.64	0.01	0.50	−0.01	−0.69	0.34	0.25
YE-Mag	−0.001	−0.93	0.0003	0.77	−0.0005	−0.68	−0.0004	−0.51
Red-D	0.80	0.10	0.29	0.46	0.84	0.10	0.82	0.09
Red-W	101.56	0.09	73.57	0.15	109.59	0.05	108.12	0.04
Red-A	81.36	0.16	22.30	0.58	92.34	0.14	88.96	0.13
Red-As	0.86	0.01	0.89	0.02	0.85	0.01	0.85	0.01
RW-Wvl	669.48	0.01	412.30	0.79	664.17	0.05	666.00	0.00
RW-Ref	0.05	0.53	0.09	0.90	0.02	0.51	0.03	0.36
RE-Wvl	712.1	0.01	692.7	0.01	724.8	0.02	724.7	0.00
RE-Mag	0.0077	0.19	0.0029	0.56	0.0054	0.47	0.0050	0.30
RE-DArea	0.36	0.19	0.21	0.43	0.34	0.43	0.00	0.54
<i>Water and Structure (NIR)</i>								
WBI	1.01	0.02	0.94	0.09	1.10	0.08	1.09	0.06
NDWI	0.02	1.36	−0.14	−0.86	0.03	1.44	0.03	1.51
EWT	0.04	0.65	0.07	1.62	0.33	0.52	0.30	0.44
NIR1-D	0.02	0.42	0.03	1.34	0.13	0.42	0.12	0.37
NIR1-W	61.88	0.26	46.86	0.44	63.38	0.15	65.55	0.11
NIR1-A	1.23	0.49	1.96	1.56	8.49	0.42	8.13	0.38
NIR1-As	0.94	0.02	0.89	0.26	0.94	0.01	0.93	0.01
NE1-Wvl	1003.5	0.17	997.1	0.18	979.8	0.13	988.2	0.07
NE1-Mag	0.000	0.60	0.001	0.48	0.001	0.50	0.001	0.34
NIR2-D	0.04	0.33	0.05	0.91	0.18	0.42	0.17	0.36
NIR2-W	73.03	0.04	73.95	0.06	74.24	0.16	77.52	0.12
NIR2-A	2.58	0.33	3.80	0.93	13.45	0.42	12.80	0.34
NIR2-As	0.94	0.00	0.94	0.00	0.94	0.01	0.94	0.01
NE2-Wvl	1128.1	0.12	1109.7	0.18	694.2	0.79	753.5	0.71
NE2-Mag	−0.001	−0.37	−0.001	−1.34	−0.002	−1.05	−0.002	−0.88
<i>Lignin, Cellulose, Nitrogen, Proteins (SWIR)</i>								
CAI	−0.30	−0.23	−0.15	−0.47	−0.17	−0.64	−0.16	−0.51
NDLI	−0.03	−0.16	0.03	0.30	−0.15	−37.17	−0.05	−0.19
NDNI	0.13	0.15	0.12	0.25	0.15	0.26	0.14	0.18
SWIR1-D	0.001	2.76	0.009	1.23	0.064	0.33	0.064	0.23
SWIR1-W	2.66	2.45	18.26	0.87	43.68	0.21	45.69	0.16
SWIR1-A	0.01	5.52	0.27	1.44	2.92	0.45	3.02	0.34
SWIR1-As	0.24	1.77	0.67	0.69	0.97	0.04	0.97	0.00
SWIR2-D	0.001	4.79	0.002	3.58	0.065	0.49	0.057	0.37
SWIR2-W	2.81	4.21	6.46	2.96	67.02	0.45	78.48	0.29
SWIR2-A	0.06	5.42	0.13	3.79	4.68	0.68	4.69	0.49

Table S4. Cont.

<i>Metric</i>	Leaves		Bark		Pixels		Crown	
	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>	<i>Mean</i>	<i>C.V.</i>
<i>Lignin, Cellulose, Nitrogen, Proteins (SWIR)</i>								
SWIR2-As	0.06	3.78	0.12	2.71	0.96	0.10	0.96	0.01
SWIR3-D	0.03	0.66	0.05	0.53	0.10	0.67	0.07	0.21
SWIR3-W	50.02	0.58	57.11	0.36	48.55	0.52	65.09	0.19
SWIR3-A	1.86	0.87	2.72	0.50	4.73	0.73	4.29	0.30
SWIR3-As	0.95	0.19	0.98	0.01	0.97	0.10	0.97	0.01
SE-Wvl	1269.8	0.42	1407.2	0.26	1325.9	0.38	1307.8	0.40
SE-Mag	0.0010	0.46	0.0010	0.35	0.0008	0.64	0.0008	0.47
<i>All Absorption Features: Full-Spectrum (Crown and Pixel only)</i>								
GV	n/a	n/a	n/a	n/a	0.42	0.45	0.39	0.29
NPV	n/a	n/a	n/a	n/a	0.14	1.01	0.17	0.68
Shade	n/a	n/a	n/a	n/a	0.44	0.49	0.43	0.21
RMSE	n/a	n/a	n/a	n/a	0.01	0.39	0.01	0.33