

Supplementary : Accuracy assessments (confusion matrices) for classifications of small unmanned aerial system (sUAS) and National Agriculture Imagery Program (NAIP) imagery

Table S1 Accuracy assessment for manual classification of sUAS imagery. Overall accuracy was 89%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	20	0	0	0	0	0	20	100%
Blackberry (BB)	0	62	0	0	0	0	62	100%
Forbs (F)	1	0	118	0	2	26	147	80%
Grasses (G)	0	0	0	152	0	0	152	100%
Trees/shrubs (TS)	0	5	20	0	17	0	42	40%
Common reed (CR)	0	0	0	0	0	78	78	100%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	95%	93%	86%	100%	89%	75%		

Table S2 Accuracy assessment for manual classification of National Agriculture Imagery Program imagery. Overall accuracy was 76%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	14	0	0	0	1	0	15	93%
Blackberry (BB)	1	66	1	0	0	0	68	97
Forbs (F)	1	0	67	0	2	0	70	96%
Grasses (G)	1	1	70	152	0	37	261	58%
Trees/shrubs (TS)	4	0	0	0	16	0	20	80%
Common reed (CR)	0	0	0	0	0	67	67	100%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	67%	99%	49%	100%	84%	64%		

Table S3 Accuracy assessment for random forest classification of 1.58-cm sUAS imagery with a canopy height model. Overall accuracy was 69%.

Classified data	Reference data from ground surveys							
Land cover classes	AO	BB	F	G	TS	CR	Row total	User's accuracy
Autumn olive (AO)	4	3	0	0	0	0	7	57%
Blackberry (BB)	2	49	6	15	1	5	78	63%
Forbs (F)	7	7	113	31	3	19	180	63%
Grasses (G)	0	0	9	97	0	5	111	87%
Trees/shrubs (TS)	3	1	3	0	13	4	24	54%
Common reed (CR)	5	7	7	9	2	71	101	70%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	19%	73%	82%	64%	68%	68%		

Table S4 Accuracy assessment for random forest classification of 1.58-cm sUAS imagery without a canopy height model. Overall accuracy was 60%.

Classified data	Reference data from ground surveys							
Land cover classes	AO	BB	F	G	TS	CR	Row total	User's accuracy
Autumn olive (AO)	6	2	0	5	0	1	14	43%
Blackberry (BB)	3	49	3	16	2	11	84	58%
Forbs (F)	3	8	87	20	2	21	141	62%
Grasses (G)	1	0	7	85	0	1	94	90%
Trees/shrubs (TS)	0	2	27	0	8	3	40	20%
Common reed (CR)	8	6	14	26	7	67	128	52%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	29%	73%	63%	56%	42%	64%		

Table S5 Accuracy assessment for random forest classification of 5-cm sUAS imagery with a canopy height model. Overall accuracy was 63%.

Classified data	Reference data from ground surveys							
Land cover classes	AO	BB	F	G	TS	CR	Row total	User's accuracy
Autumn olive (AO)	4	3	0	0	0	0	7	57%
Blackberry (BB)	5	40	1	9	0	6	61	66%
Forbs (F)	5	9	111	47	4	26	202	55%
Grasses (G)	2	1	10	93	0	5	111	84%
Trees/shrubs (TS)	2	6	3	0	12	12	35	34%
Common reed (CR)	3	8	13	3	3	55	85	65%
Column total	21	67	138	152	19	104	501	

Producer's accuracy	19%	60%	80%	61%	63%	53%
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Table S6 Accuracy assessment for random forest classification of 5-cm sUAS imagery without a canopy height model. Overall accuracy was 66%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	9	0	0	1	0	0	10	90%
Blackberry (BB)	4	40	1	0	0	6	51	78%
Forbs (F)	4	16	90	17	1	24	152	59%
Grasses (G)	1	1	6	109	0	2	119	92%
Trees/shrubs (TS)	0	2	27	1	14	2	46	30%
Common reed (CR)	3	8	14	24	4	70	123	57%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	43%	60%	65%	72%	74%	67%		

Table S7 Accuracy assessment for random forest classification of 20-cm sUAS imagery with a canopy height model. Overall accuracy was 65%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	1	1	0	0	0	1	3	33%
Blackberry (BB)	4	40	2	0	0	3	49	82%
Forbs (F)	3	8	92	4	3	23	133	69%
Grasses (G)	6	0	14	113	0	5	138	82%
Trees/shrubs (TS)	5	6	11	2	13	3	40	33%
Common reed (CR)	2	12	19	33	3	69	138	50%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	5%	60%	67%	74%	68%	66%		

Table S8 Accuracy assessment for random forest classification of 20-cm sUAS imagery without a canopy height model. Overall accuracy was 61%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		

Autumn olive (AO)	5	0	0	0	0	0	5	100%
Blackberry (BB)	5	52	4	1	1	10	73	71%
Forbs (F)	3	4	78	3	3	28	119	66%
Grasses (G)	1	1	8	104	1	6	121	86%
Trees/shrubs (TS)	0	5	40	0	12	3	60	20%
Common reed (CR)	7	5	8	44	2	57	123	46%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	24%	78%	57%	68%	63%	55%		

Table S9 Accuracy assessment for random forest classification of 60-cm sUAS imagery with a canopy height model.

Overall accuracy was 56%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	2	2	0	0	0	0	4	50%
Blackberry (BB)	4	38	3	3	0	5	53	72%
Forbs (F)	4	8	103	42	6	31	194	53%
Grasses (G)	5	1	23	78	0	9	116	67%
Trees/shrubs (TS)	3	5	4	5	8	6	31	26%
Common reed (CR)	3	13	5	24	5	53	103	51%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	10%	57%	75%	51%	42%	51%		

Table S10 Accuracy assessment for random forest classification of 60-cm sUAS imagery without a canopy height model. Overall accuracy was 59%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	5	2	0	0	0	13	20	25%
Blackberry (BB)	8	52	1	2	3	14	80	65%
Forbs (F)	5	2	82	4	5	25	123	67%
Grasses (G)	0	1	19	101	0	6	127	80%
Trees/shrubs (TS)	0	7	24	0	9	0	40	23%
Common reed (CR)	3	3	12	45	2	46	111	41%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	24%	78%	59%	66%	47%	44%		

Table S11 Accuracy assessment for random forest classification of National Agriculture Imagery Program imagery with a canopy height model and segmented using near-infrared, red, and green blue bands. Overall accuracy was 43%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	3	0	0	0	1	14	18	17%
Blackberry (BB)	0	11	3	0	0	0	14	79%
Forbs (F)	5	0	95	63	2	30	195	49%
Grasses (G)	0	0	10	62	0	8	80	78%
Trees/shrubs (TS)	8	56	20	10	12	19	125	10%
Common reed (CR)	5	0	10	17	4	33	69	48%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	14%	16%	69%	41%	63%	32%		

Table S12 Accuracy assessment for random forest classification of National Agriculture Imagery Program imagery without a canopy height model and segmented using near-infrared, red, and green bands. Overall accuracy was 47%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	2	0	0	0	0	0	2	100%
Blackberry (BB)	0	12	13	0	0	0	25	48%
Forbs (F)	13	0	113	73	6	57	262	43%
Grasses (G)	0	0	12	79	0	24	115	69%
Trees/shrubs (TS)	2	55	0	0	9	3	67	13%
Common reed (CR)	4	0	0	0	4	22	30	73%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	10%	18%	82%	52%	47%	21%		

Table S13 Accuracy assessment for random forest classification of National Agriculture Imagery Program imagery with a canopy height model and segmented using red, green, and blue bands. Overall accuracy was 49%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	5	0	0	0	0	0	5	100%
Blackberry (BB)	3	23	0	0	1	1	27	82%

Forbs (F)	2	11	110	75	6	48	252	44%
Grasses (G)	0	0	18	65	0	24	107	61%
Trees/shrubs (TS)	4	32	0	0	9	0	45	20%
Common reed (CR)	7	1	10	12	3	31	64	48%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	24%	34%	80%	43%	47%	30%		

Table S14 Accuracy assessment for random forest classification of National Agriculture Imagery Program imagery without a canopy height model and segmented using red, green, and blue bands. Overall accuracy was 31%.

Classified data	Reference data from ground surveys						Row total	User's accuracy
Land cover classes	AO	BB	F	G	TS	CR		
Autumn olive (AO)	7	0	9	2	0	0	18	39%
Blackberry (BB)	4	1	0	0	0	0	5	20%
Forbs (F)	0	7	41	13	5	3	69	59%
Grasses (G)	0	0	0	13	0	0	13	100%
Trees/shrubs (TS)	2	59	30	8	10	19	128	8%
Common reed (CR)	8	0	58	116	4	82	268	31%
Column total	21	67	138	152	19	104	501	
Producer's accuracy	33%	1%	30%	9%	53%	79%		