

Evaluating the Classification Accuracy of Specialty Crops in California Using 22m Disaster Monitoring Constellation Imagery Compared to 30m Imagery

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National Agricultural Statistics Service

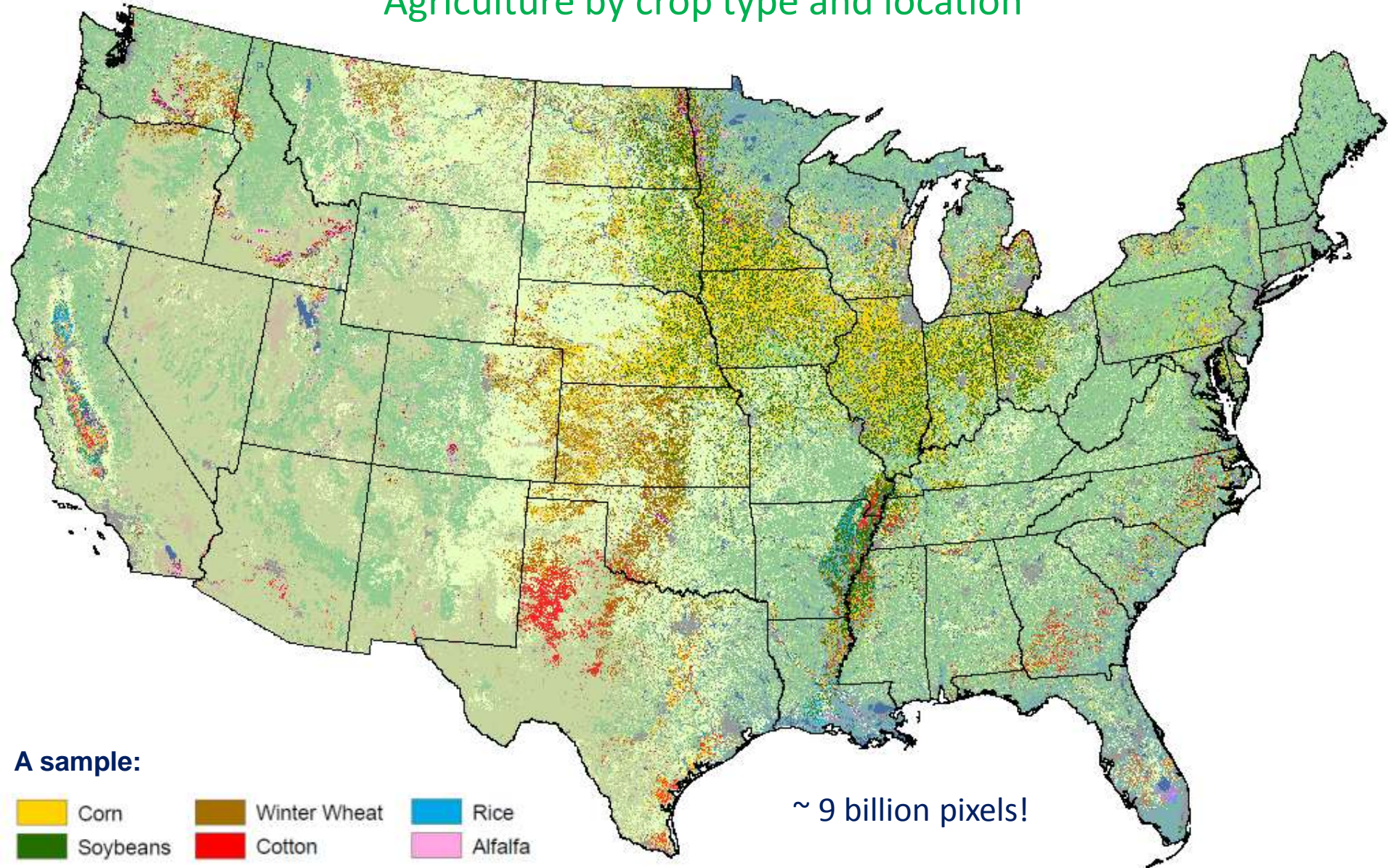


“ . . . providing timely, accurate, and useful statistics in service to U.S. agriculture.”

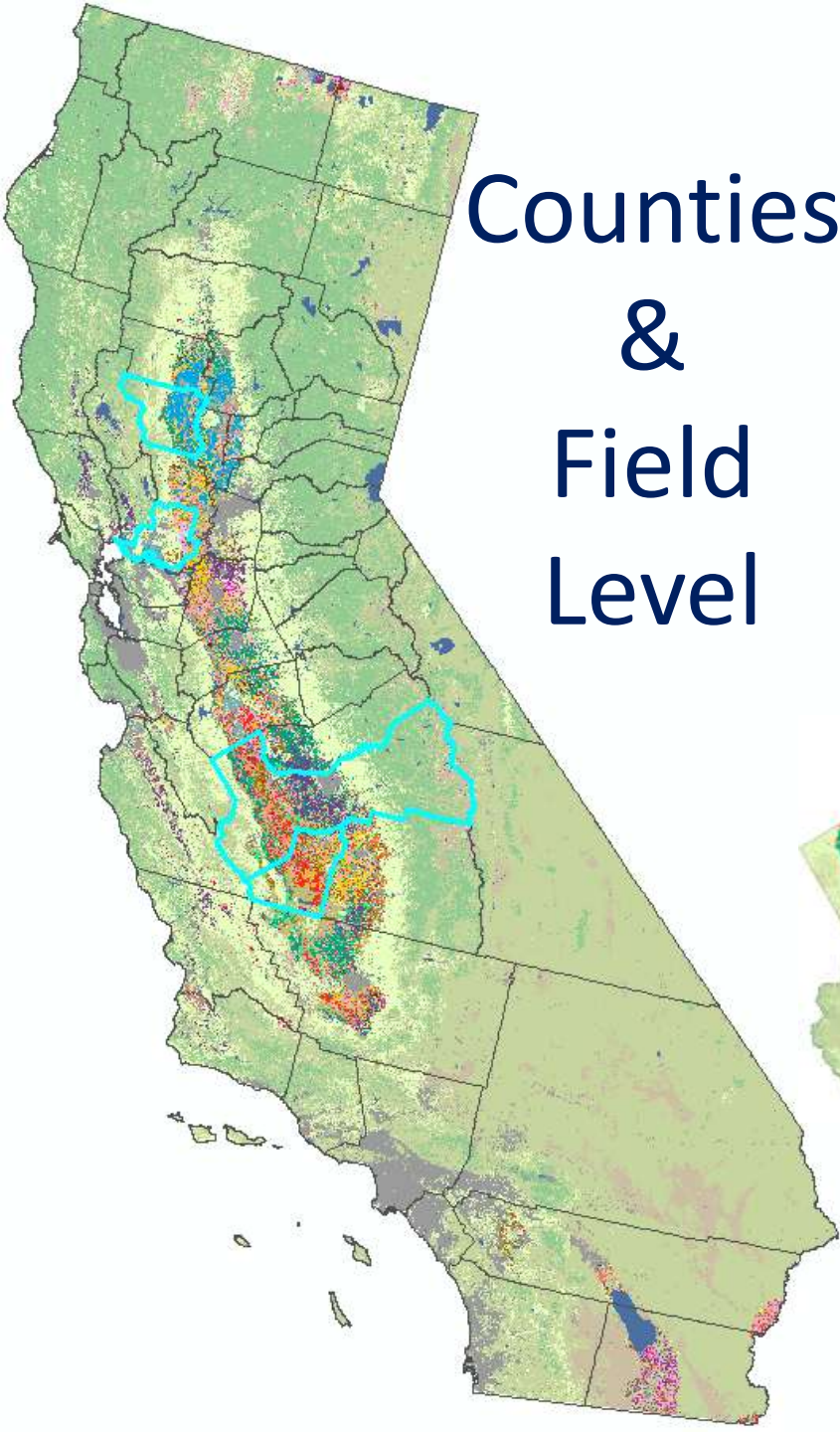


Cropland Data Layer 2012

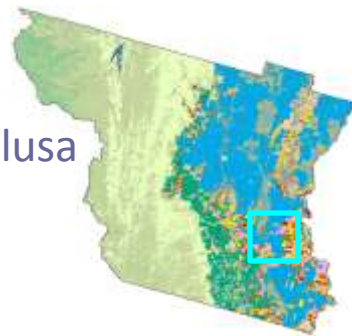
Agriculture by crop type and location



Counties & Field Level



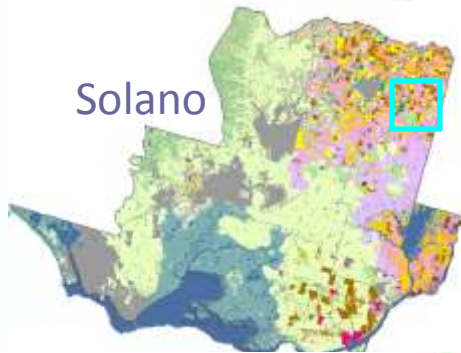
Colusa



- Rice
- Sunflower
- Dry Beans
- Winter Wheat



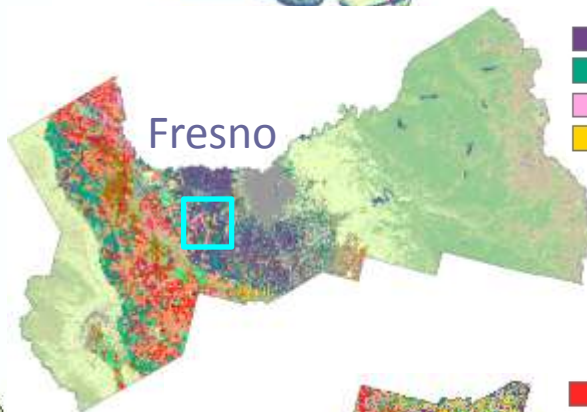
Solano



- Clover
- Tomatoes
- Sunflower
- Alfalfa



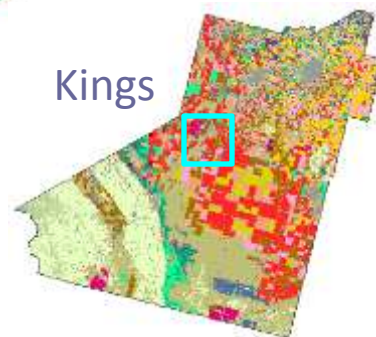
Fresno



- Grapes
- Almonds
- Alfalfa
- Corn



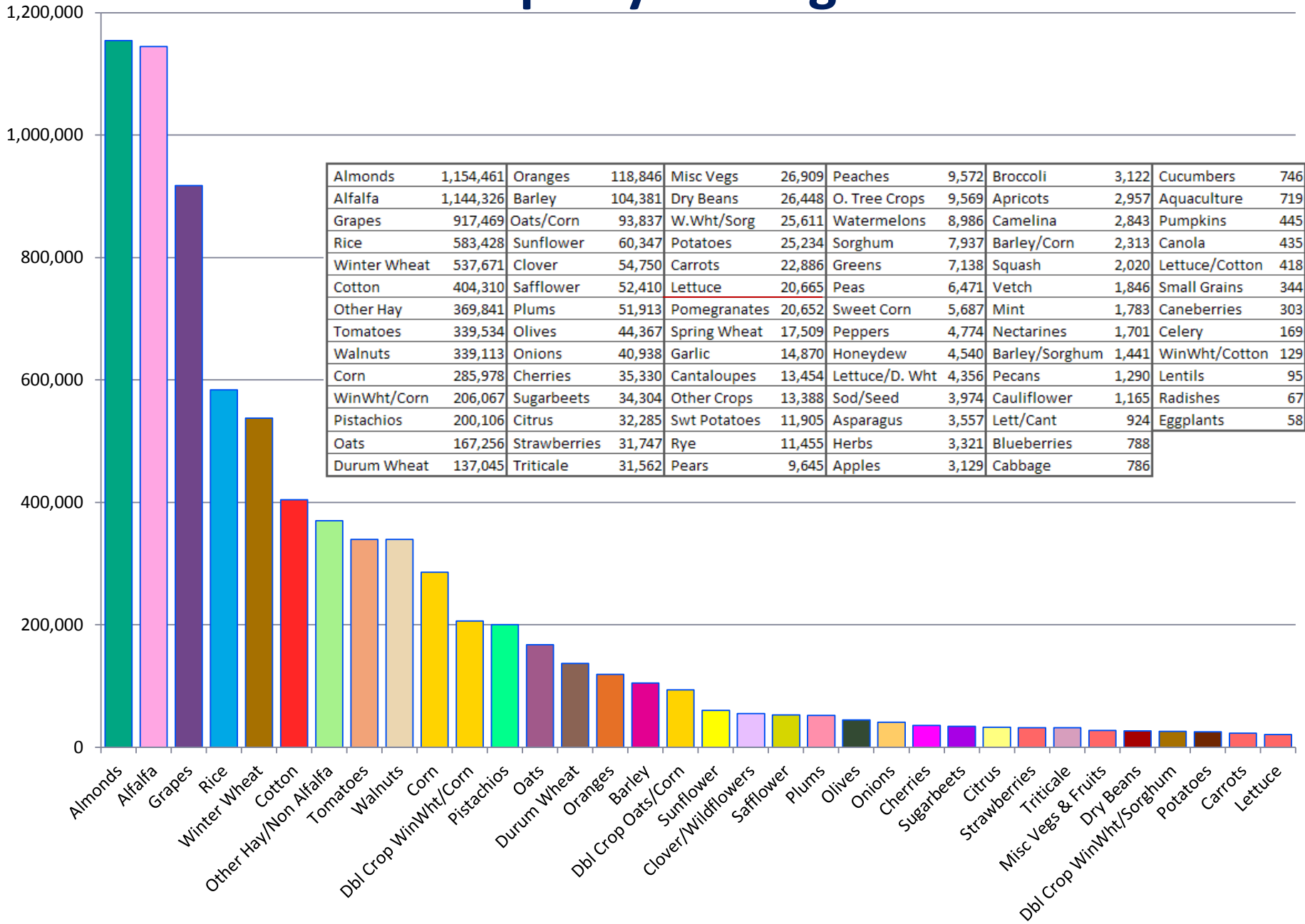
Kings



- Cotton
- Pistachios
- Tomatoes
- Safflower



Crops by Acreage



Deimos-1/UK2 Satellite

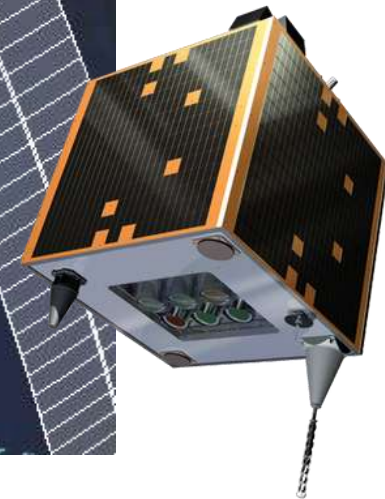
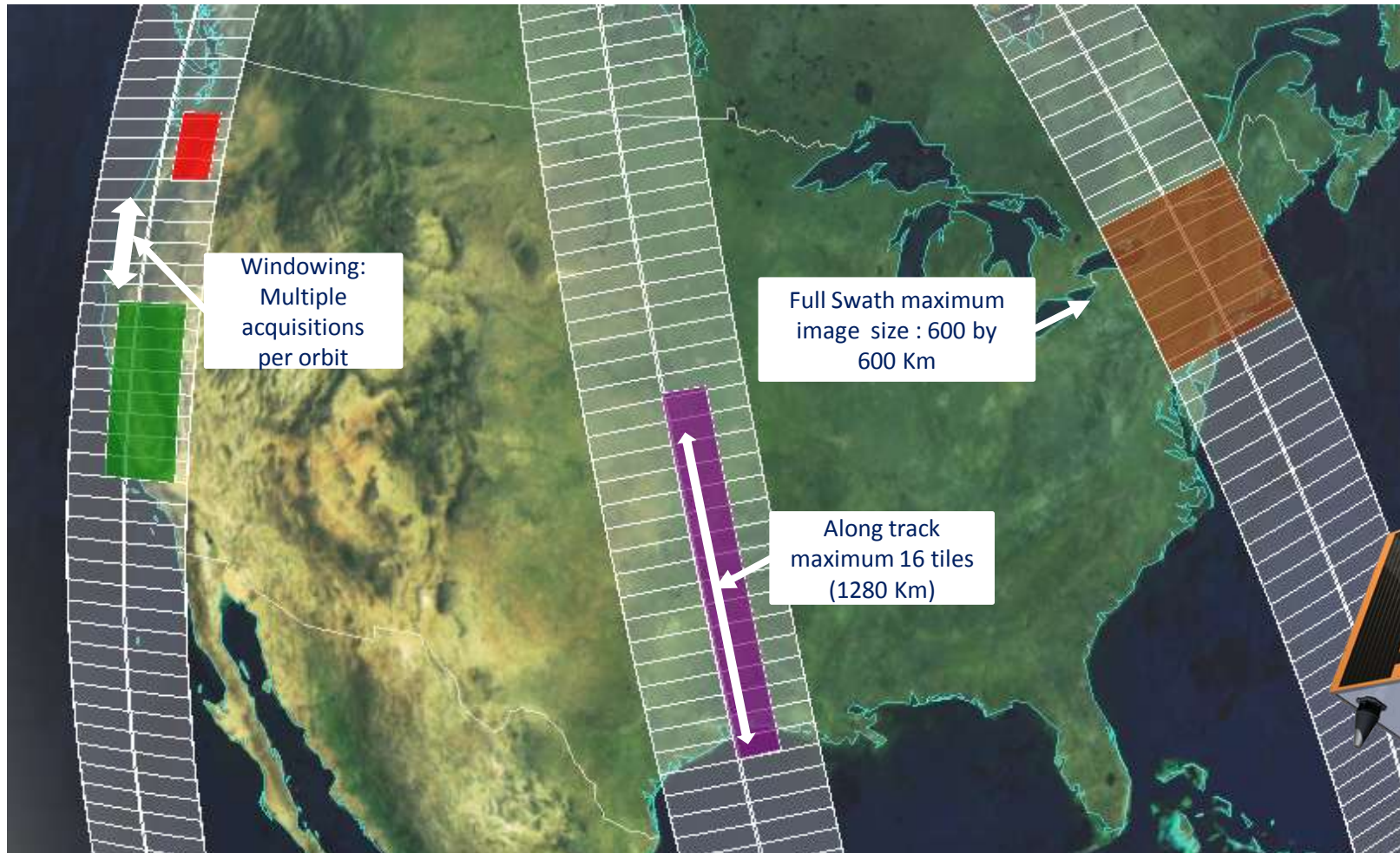
Default

Resolution - 22 meters

2011 & 2012

Upscaled to 30 meters

- For consistency
- Match resolution of Landsat TM



Research Plan



Control – 30m – Completed In Season

3,136,000 pixels sampled
~700,000 acres sampled

43 Images (North)
33 Images (South)



Run 1 – 22m – Equal Acreage Test

~6,000,000 pixels sampled
~700,000 acres sampled

43 Images (North)
33 Images (South)

Run 2 – 22m – Equal Pixel Test

3,136,000 pixels sampled
~375,000 acres sampled

43 Images (North)
33 Images (South)

Imagery Selection



North Imagery Dates

5	Sep 2011	2	3	5	7	18				
4	Oct 2011	2	12	17	18					
2	Apr 2012	16	20							
6	May 2012	2	5	6	18	19	22			
5	Jun 2012	1	3	16	17	20				
9	Jul 2012	2	3	6	18	20	22	23	25	28
6	Aug 2012	3	7	10	16	17	20			
6	Sep 2012	2	8	12	17	20	21			

43 Total Images

South Imagery Dates

4	Sep 2011	2	3	18	19					
4	Oct 2011	2	7	16	18					
1	Apr 2012	19								
4	May 2012	2	3	9	18					
6	Jun 2012	1	3	6	16	17	26			
6	Jul 2012	2	6	19	22	23	25			
4	Aug 2012	4	10	16	19					
4	Sep 2012	12	17	18	24					

33 Total Images

STORAGE*	
30 meter	22 meter
38 GB	76 GB

*Imagery sizes do not include unused/cloudy imagery



Processing Times

IN SEASON CONTROL

Extent	Pixel Size	Processing Step	Time
North (ERDAS 2011)	30m	Sample #1	1:16
		Sample #2	1:16
		Sample #3	0:57
		Sample #4	2:27
		Sample #5	1:47
		Decision Tree	0:44
		Classifier	3:59
TOTAL TIME		12 Hours 26 Minutes	
South (ERDAS 2011)	30m	Sample #1	0:44
		Sample #2	0:42
		Sample #3	0:30
		Sample #4	0:42
		Sample #5	1:04
		Sample #6	1:03
		Decision Tree	0:29
Classifier	2:50		
TOTAL TIME		8 Hours 4 Minutes	
NORTH + SOUTH		20 Hours 30 Minutes	

RUN 1 - Equal Acreage Test

Extent	Pixel Size	Processing Step	Time
North (ERDAS 2011)	22m	Sample #1	2:16
		Sample #2	2:08
		Sample #3	2:07
		Sample #4	2:52
		Sample #5	2:43
		Decision Tree	1:19
		Classifier	7:43
TIME		21 Hours 8 Minutes	
South (ERDAS 2011)	22m	Sample #1	1:19
		Sample #2	1:35
		Sample #3	1:18
		Sample #4	1:09
		Sample #5	1:37
		Sample #6	1:07
		Decision Tree	0:51
Classifier	5:34		
TIME		14 hours 30 Minutes	
NORTH + SOUTH		35 Hours 38 Minutes	

RUN 2 - Equal Pixel Test

Extent	Pixel Size	Processing Step	Time
North (ERDAS 2011)	22m	Sample #1	2:21
		Sample #2	2:06
		Sample #3	2:21
		Sample #4	2:23
		Sample #5	2:22
		Decision Tree	0:40
		Classifier	7:24
TIME		19 Hours 37 Minutes	
South (ERDAS 2011)	22m	Sample #1	1:17
		Sample #2	1:16
		Sample #3	1:16
		Sample #4	1:37
		Sample #5	1:19
		Sample #6	1:35
		Decision Tree	0:22
Classifier	4:59		
TIME		13 Hours 41 Minutes	
NORTH + SOUTH		33 Hours 18 Minutes	



Storage Needs

IN SEASON CONTROL

Extent	Pixel Size	Processing Step	Time
North (ERDAS 2011)	22m	Imagery	22.73
		Groundtruth	0.16
		Samples	2.98
		Decision Tree	2.42
		CDL	0.49
STORAGE NEEDS			28.78 GB
South (ERDAS 2011)	22m	Imagery	15.67
		Groundtruth	0.10
		Samples	1.98
		Decision Tree	2.52
		CDL	0.33
STORAGE NEEDS			20.61 GB

NORTH + SOUTH

50 GB

RUN 1 - Equal Acreage Test

Extent	Pixel Size	Processing Step	Gigabytes
North (ERDAS 2011)	22m	Imagery	45.7
		Groundtruth	0.23
		Samples	5.53
		Decision Tree	4.00
		CDL	1.11
STORAGE NEEDS			56.57 GB
South (ERDAS 2011)	22m	Imagery	30.52
		Groundtruth	0.14
		Samples	3.65
		Decision Tree	2.93
		CDL	0.75
STORAGE NEEDS			37.98 GB

NORTH + SOUTH

97 GB

RUN 2 - Equal Pixel Test

Extent	Pixel Size	Processing Step	Storage
North (ERDAS 2011)	22m	Imagery	45.69
		Groundtruth	0.23
		Samples	2.98
		Decision Tree	2.42
		CDL	1.11
STORAGE NEEDS			52.43 GB
South (ERDAS 2011)	22m	Imagery	30.52
		Groundtruth	0.14
		Samples	1.98
		Decision Tree	1.61
		CDL	0.75
STORAGE NEEDS			35 GB

NORTH + SOUTH

90 GB



Visual Comparison



Run 1 – Equal Acreage



Control

Run 2 – Equal Pixels



Visual Comparison



Run 1 – Equal Acreage



Control

Run 2 – Equal Pixels



- Rice
- Dry Beans
- Alfalfa
- Sunflower
- Corn
- Winter Wheat
- Almonds



Visual Comparison



Run 1 – Equal Acreage

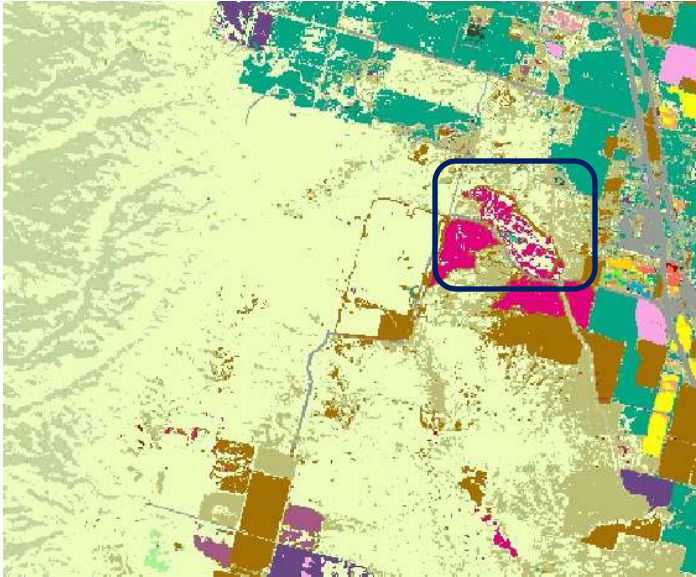


Control

Run 2 – Equal Pixels

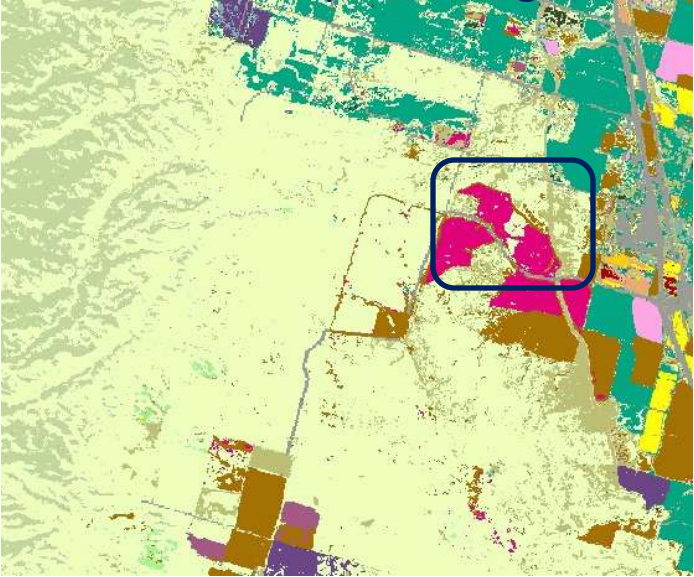


Visual Comparison

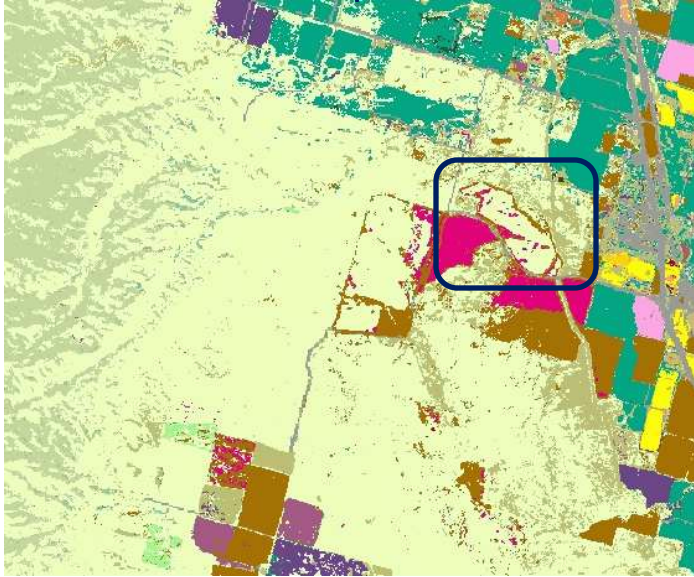


Control

Run 1 – Equal Acreage



Run 2 – Equal Pixels



- Barley
- Almonds
- Grapes
- Winter Wheat



Visual Comparison

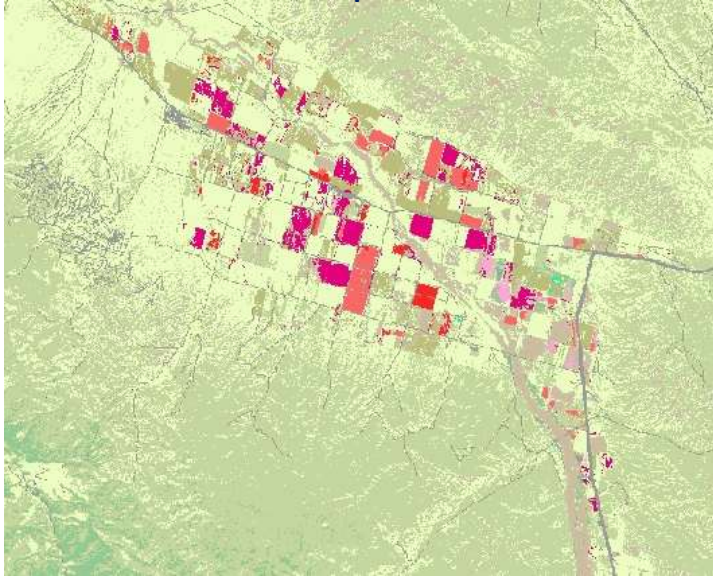


Control

Run 1 – Equal Acreage



Run 2 – Equal Pixels



Carrots
Barley



Accuracy Assessments

Overall	Correct	Total	Accuracy	Error	Kappa
7,393,935	6,283,040	84.1%	15.9%	0.831	
FSA Crops	5,624,869	6,724,428	83.7%	16.3%	0.822
Physiocal Crops	2,739,038	3,285,000	80.9%	19.1%	0.780
Tilled Crops	3,602,592	4,506,691	79.9%	20.1%	0.779
Forage	1,221,452	1,484,069	82.0%	18.0%	0.799
Vegetables	411,725	582,061	69.0%	31.0%	0.594
Orchards	747,888	1,000,891	74.8%	25.2%	0.732
Berries	2,527	4,081	61.9%	38.1%	0.078

Category	Correct	Total	Producer Accuracy	User Accuracy	Kappa	Bias					
Corn	1	274,537	99.6%	10.4%	0.932	306,419	9.2%	9.7%	0.909	-1.8%	
Cotton	2	955,807	98.0%	2.6%	0.979	169,463	84.3%	6.7%	0.939	3.9%	
Rice	3	927,379	894,301	96.3%	0.8%	0.991	846,327	86.5%	1.5%	0.963	0.7%
Sorghum	4	9,888	10,472	27.8%	62.2%	0.377	6,776	78.3%	24.9%	0.750	-49.7%
Sunflower	5	91,822	62,200	67.7%	16.9%	0.930	62,241	67.3%	16.7%	0.932	-0.3%
Wheat Corn	12	1,437	6,888	21.8%	79.9%	0.239	2,792	62.0%	39.7%	0.673	-55.9%
Maize	14	1,235	2,107	58.2%	41.7%	0.583	2,056	63.0%	39.5%	0.636	-5.1%
Buckeye	21	83,791	102,542	81.7%	36.6%	0.628	95,457	67.8%	12.2%	0.876	-28.0%
Quorn Wheat	22	136,946	96,874	82.1%	17.9%	0.917	87,091	62.0%	18.0%	0.916	0.1%
Spring Wheat	23	11,994	15,053	79.6%	20.4%	0.796	15,366	78.0%	22.0%	0.780	2.0%
Winter Wheat	24	374,442	592,300	73.1%	26.9%	0.778	492,364	76.0%	24.0%	0.748	-3.3%
Other Small Grains	25	2	38	5.3%	94.7%	0.053	52	3.8%	96.2%	0.038	-36.8%
Rye	27	7,136	9,224	44.0%	56.0%	0.439	6,605	60.0%	19.0%	0.910	-45.7%
Oats	28	49,894	110,288	45.0%	55.0%	0.489	88,498	70.2%	29.8%	0.686	-29.6%
Canola	31	359	596	60.2%	43.3%	0.597	359	86.9%	14%	0.946	-39.6%
Saltwater	33	87,488	68,846	82.3%	17.7%	0.823	62,874	80.1%	0.915	-8.8%	
Alfalfa	36	1,040,289	1,689,590	61.6%	5.4%	0.330	1,125,969	92.4%	7.8%	0.313	2.4%
Non-alfalfa Hay	37	593,076	223,930	64.8%	35.4%	0.638	385,297	64.4%	18.6%	0.809	-30.6%
Sugarcane	41	34,067	42,941	79.3%	20.7%	0.792	40,606	82.9%	16.1%	0.829	-5.5%
Dry Bean	42	13,177	28,456	50.4%	49.4%	0.505	9,228	69.6%	30.4%	0.695	-37.2%
Potatoes	43	8,895	2,054	74.3%	25.7%	0.743	20,634	77.5%	22.5%	0.775	-4.1%
Other Crops	44	3,283	13,001	70.8%	29.2%	0.708	10,690	87.6%	12.4%	0.875	-19.2%
Sweet Potatoes	46	1,581	2,867	69.4%	30.6%	0.694	2,626	78.0%	24.2%	0.758	-8.4%
Misc. Veg. & Fruits	47	3,933	9,202	54.3%	45.7%	0.543	12,480	73.7%	26.3%	0.736	-36.2%
Leguminosae	48	1,134	1,624	11.8%	88.2%	0.118	2,594	45.3%	0.446	-78.5%	1.1%
Onion	49	33,869	49,520	67.7%	32.3%	0.698	41,801	62.1%	17.9%	0.820	-15.2%
Cucumber	50	297	638	46.6%	53.4%	0.465	567	44.5%	55.5%	0.445	4.5%
Peanut	53	2,299	3,035	35.4%	74.6%	0.254	4,617	55.5%	48.5%	0.514	-50.6%
Tomatoes	54	296,891	326,480	90.2%	9.8%	0.989	303,775	89.3%	10.7%	0.888	10%
Herbs	57	2,724	5,654	48.2%	51.8%	0.482	3,676	74.1%	25.9%	0.741	-36.0%
Clover/Mulch/lowers	58	31,534	36,223	87.0%	13.0%	0.824	34,425	90.6%	0.4%	0.938	-10.0%
Sod/Grass Seed	59	3,262	6,744	48.4%	51.6%	0.483	3,296	36.3%	3.3%	0.961	-49.6%
Fallow/Idle Cropland	61	364,194	486,856	75.3%	24.7%	0.739	487,254	72.6%	27.4%	0.721	2.2%
Cherries	66	3,602	9,569	37.6%	39.9%	0.601	12,602	75.0%	25.0%	0.750	-19.8%
Peaches	67	781	3,249	24.0%	76.0%	0.243	1,243	62.8%	37.2%	0.628	-41.7%
Apples	68	1,842	1,969	93.5%	2.5%	0.775	1,953	98.0%	1.0%	0.790	-1.0%
Grapes	69	179,338	205,660	87.2%	12.8%	0.869	199,692	88.5%	11.5%	0.862	-1.9%
Other Tree Nuts	71	1,573	9,080	36.4%	63.6%	0.364	4,177	68.5%	14.5%	0.685	-57.4%
Almonds	72	37,318	36,462	77.7%	22.3%	0.776	30,121	80.7%	9.3%	0.907	-14.2%
Peanut	74	284	1,804	15.8%	84.2%	0.158	1,120	23.6%	76.4%	0.236	-37.3%
Almonds	75	393,279	436,689	89.7%	10.3%	0.891	426,927	92.7%	7.3%	0.917	-2.7%
Walnuts	76	79,844	92,835	77.5%	22.5%	0.772	94,614	63.5%	16.5%	0.833	-7.3%
Peanut	77	4,829	4,896	62.0%	17.2%	0.620	4,636	67.7%	12.3%	0.670	-4.9%
Apricots	82	349	1,275	27.4%	72.6%	0.274	544	64.2%	35.8%	0.641	-57.3%
Open Water	101	33,522	55,242	60.7%	39.3%	0.607	97,267	62.2%	4.8%	0.952	2.0%
Perennial Forbush	102	144	268	55.0%	44.2%	0.550	197	74.6%	25.4%	0.746	-35.2%
Developed, Open Spa	121	51,357	62,278	82.5%	17.5%	0.823	65,034	60.4%	39.6%	0.604	36.5%
Developed, Low Intra	122	22,588	33,557	67.3%	32.7%	0.673	37,699	60.3%	39.7%	0.603	12.0%
Developed, Medium Intra	123	27,740	34,231	81.0%	19.0%	0.810	36,146	76.9%	23.1%	0.768	2.7%
Developed, High Intra	124	6,038	7,310	76.3%	23.7%	0.763	7,469	66.8%	19.2%	0.860	-5.6%
Barren Land	131	79,864	90,912	73.9%	26.1%	0.739	97,383	72.5%	27.5%	0.732	0.4%
Developed Forest	141	4,895	9,520	29.6%	70.4%	0.296	4,442	42.6%	57.4%	0.427	-30.7%
Evergreen Forest	142	369,595	403,401	91.6%	7.4%	0.917	427,489	88.5%	11.5%	0.896	6.5%
Non-Forest	149	22,873	49,303	46.4%	53.6%	0.464	40,331	66.0%	34.0%	0.660	-16.2%
Strawberries	152	801,398	852,433	94.1%	5.9%	0.989	826,688	98.2%	1.8%	0.946	4.1%
Grassland/Herbaceous	171	289,377	257,306	77.3%	22.7%	0.769	400,936	50.0%	50.0%	0.494	58.8%
Woody Wetlands	180	2,452	4,770	51.4%	48.6%	0.514	7,074	35.0%	65.0%	0.349	47.0%
Herbaceous Wetlands	195	9,888	10,263	49.2%	50.8%	0.492	10,430	25.8%	74.2%	0.257	87.5%
Plataleas	204	87,452	88,576	76.2%	23.8%	0.760	79,731	84.6%	15.4%	0.844	-9.3%
Triticale	206	24,109	46,411	51.9%	48.1%	0.519	30,555	76.4%	23.6%	0.763	-32.0%
Carrots	206	9,712	19,846	59.0%	41.0%	0.589	37,844	65.6%	34.4%	0.655	-10.0%
Asparagus	207	1,452	4,552	31.9%	68.1%	0.319	1,654	67.8%	12.2%	0.678	-64.0%
Garlic	208	18,213	26,594	72.3%	27.7%	0.723	17,227	67.6%	12.4%	0.677	-16.8%
Cantaloupes	209	1,111	1,111	100%	0%	1.000	1,111	100%	0%	1.000	0%
Olives	211	14,418	20,471	70.4%	29.6%	0.704	16,075	89.3%	10.7%	0.931	-21.0%
Oranges	212	6,888	9,861	70.1%	29.9%	0.701	8,235	83.2%	16.8%	0.832	-16.3%
Honeydew Melons	213	2,888	5,843	60.7%	39.3%	0.607	4,812	74.8%	25.2%	0.749	-19.0%
Broccoli	214	35	3,523	0.9%	99.1%	0.009	3,672	0.8%	99.2%	0.188	-52.5%
Peppers	216	1,487	5,051	29.4%	70.6%	0.294	2,204	67.5%	32.5%	0.674	-56.8%
Pomegranates	217	9,724	14,052	69.2%	30.8%	0.692	9,936	67.8%	12.2%	0.670	-29.2%
Neonaxine	218	195	725	26.9%	73.1%	0.269	329	60.0%	40.0%	0.600	-59.2%
Greens	219	1,413	6,061	23.3%	76.7%	0.233	6,235	28.8%	71.2%	0.287	-19.8%
Strawberries	220	4,512	62,027	36.6%	63.4%	0.366	6,970	63.7%	36.3%	0.637	-34.3%
Strawberries	221	2,414	4,262	56.5%	43.5%	0.565	2,675	64.5%	35.5%	0.645	-41.2%
Squash	222	224	2,769	8.1%	91.9%	0.081	728	36.8%	63.2%	0.368	-66.7%
Aspicola	223	278	572	48.1%	51.9%	0.481	948	50.2%	49.8%	0.502	-4.2%
Yetch	224	792	1,204	27.3%	72.7%	0.273	1,238	64.0%	36.0%	0.640	-57.4%
Dbl Crop Win/Wht/Col	225	283,341	241,209	84.3%	15.7%	0.838	273,879	74.2%	25.8%	0.738	19.5%
Dbl Crop Oats/Col	226	52,278	76,538	68.3%	31.7%	0.680	60,426	62.7%	37.3%	0.623	9.0%
Lettuce	227	6,888	9,266	41.6%	58.4%	0.416	1,338	60.0%	40.0%	0.600	-30.8%
Dbl Crop Lettuce/Dur	230	1,543	6,888	25.0%	75.0%	0.250	4,085	37.9%	62.1%	0.379	-34.0%
Dbl Crop Lettuce/Col	231	381	797	47.8%	52.2%	0.478	1,348	25.0%	75.0%	0.250	70.2%
Dbl Crop Lettuce/Spa	232	112	889	12.6%	87.4%	0.126	454	47.7%	52.3%	0.477	-33.3%
Dbl Crop Baley/Spa	235	252	797	31.6%	68.4%	0.316	460	52.5%	47.5%	0.525	-39.8%
Dbl Crop Win/Wht/Spa	236	11,942	26,290	53.1%	46.9%	0.530	21,287	68.2%	31.8%	0.681	-18.6%
Dbl Crop Baley/Col	237	938	2,875	31.5%	68.5%	0.315	1,580	68.0%	32.0%	0.680	-53.8%
Dbl Crop Win/Wht/Col	238	63	945	6.7%	93.3%	0.067	73	86.3%	13.7%	0.863	-78.8%
Blueberries	242	33	237	13.9%	86.1%	0.139	73	53.8%	46.2%	0.538	-37.0%
Cabbage	243	26	344	7.6%	92.4%	0.076	82	36.0%	64.0%	0.360	-52.3%

Save your eyes – Don't try to read that!
 Note: Nearly 100 land cover types to assess

Crops that had > 2% improvement in both
 Producer and User Accuracy

Control

Overall Producer Accuracy = 85.0% ★

- Fallow/Idle Cropland
- Garlic
- Dbl Crop Win/Wht/Sorghum

Run 1 - Equal Acreage

Overall Producer Accuracy = 84.1%

- Canola
- Pears
- Triticale
- Oranges
- Honeydew Melons
- Strawberries
- Dbl Crop Oats/Corn

Run 2 - Equal Pixel Sizes

Overall Producer Accuracy = 83.7%

- Potatoes
- Carrots

Accuracy Assessments – Top 20 Crops

2% improvement in one accuracy measure

2% improvement in both accuracy measures

Top 20 Crops (by acreage)	Producer Accuracy			User Accuracy		
	Original	Acreage	Pixels	Original	Acreage	Pixels
	In Season	Run1	Run2	In Season	Run1	Run2
Corn	89.0%	89.6%	89.2%	90.9%	91.3%	91.1%
Cotton	97.9%	98.0%	97.8%	94.2%	94.3%	94.8%
Rice	99.1%	99.2%	99.1%	98.7%	98.5%	98.6%
Sunflower	83.3%	83.2%	82.6%	82.4%	83.3%	81.1%
Barley	61.7%	63.2%	62.3%	86.5%	87.8%	86.0%
Durum Wheat	83.1%	82.1%	81.6%	82.7%	82.0%	82.7%
Winter Wheat	73.5%	73.1%	72.3%	77.2%	76.0%	76.1%
Oats	48.6%	49.5%	47.5%	70.2%	70.2%	68.5%
Safflower	82.3%	82.3%	80.7%	91.3%	91.2%	92.7%
Alfalfa	94.7%	94.6%	94.5%	92.3%	92.4%	92.1%
Non-alfalfa Hay	65.3%	64.6%	65.1%	81.3%	81.4%	79.4%
Onions	73.1%	69.7%	71.1%	82.6%	82.1%	81.7%
Tomatoes	89.9%	90.2%	90.2%	89.9%	89.3%	88.8%
Fallow/Idle Cropland	89.7%	75.3%	76.9%	75.5%	73.6%	72.3%
Grapes	88.3%	87.2%	87.7%	87.0%	88.5%	88.2%
Almonds	89.7%	89.7%	89.4%	93.1%	92.1%	92.3%
Walnuts	76.0%	77.5%	77.3%	80.2%	83.5%	83.5%
Pistachios	75.6%	76.2%	75.3%	85.3%	84.6%	84.3%
Dbl. Crop WinWht/Corn	83.4%	84.3%	83.8%	74.3%	74.2%	73.5%
Dbl. Crop Oats/Corn	65.0%	68.3%	68.1%	60.1%	62.7%	61.5%
Totals	87.4% ★	86.3%	86.2%	87.7% ★	87.6%	87.2%

★ Control – Original

Overall Producer

Overall User

Fallow/Idle

Onions

Run 1 – Equal Acreage

Oats/Corn

Non-alfalfa Hay

Sunflower

Walnuts

Run 2 – Equal Pixels

Walnuts



Accuracy Assessments – Small/Mid Acreage

2% improvement in one accuracy measure

2% improvement in both accuracy measures

Small-mid acreage crops	Producer Accuracy			User Accuracy		
	<i>Original</i>	<i>Acreage</i>	<i>Pixels</i>	<i>Original</i>	<i>Acreage</i>	<i>Pixels</i>
	In Season	Run1	Run2	In Season	Run1	Run2
Sorghum	36.5%	37.8%	38.3%	77.4%	75.1%	79.5%
Sunflower	83.3%	83.2%	82.6%	82.4%	83.3%	81.1%
Spring Wheat	77.5%	79.6%	75.0%	76.5%	78.0%	76.9%
Rye	42.2%	44.0%	41.2%	76.9%	81.0%	71.9%
Sugarbeets	81.6%	79.3%	81.7%	80.4%	83.9%	81.6%
Dry Beans	55.9%	50.6%	55.7%	76.2%	69.6%	70.8%
Potatoes	76.4%	74.3%	76.8%	80.0%	77.5%	81.3%
Other Crops	74.3%	70.8%	76.2%	90.1%	87.6%	84.8%
Misc. Veggies. & Fruits	52.9%	54.3%	41.4%	69.3%	73.7%	77.3%
Watermelons	12.4%	11.5%	15.9%	41.9%	46.1%	57.8%
Clover/Wildflowers	82.6%	82.5%	81.4%	87.7%	91.6%	90.8%
Cherries	48.2%	60.1%	53.4%	79.5%	75.0%	75.4%
Other Tree Nuts	31.5%	36.4%	24.8%	87.7%	85.5%	73.8%
Citrus	78.2%	77.7%	71.0%	90.5%	90.7%	89.2%
Triticale	49.9%	51.9%	49.8%	73.6%	76.4%	73.2%
Carrots	55.2%	59.0%	64.7%	72.7%	65.6%	75.9%
Garlic	81.1%	73.9%	80.2%	89.6%	87.8%	86.3%
Cantaloupes	50.5%	47.7%	53.2%	74.7%	68.7%	75.3%
Olives	69.1%	70.4%	70.0%	87.0%	89.1%	86.1%
Oranges	67.5%	70.1%	66.5%	81.7%	83.8%	82.1%
Pomegranates	61.1%	62.0%	63.7%	86.8%	87.8%	81.9%
Plums	36.7%	36.6%	38.0%	58.2%	65.7%	60.0%
Lettuce	41.4%	41.6%	42.2%	59.8%	60.0%	56.2%
Dbl. Crop WinWht/Sorghum	54.5%	53.1%	52.0%	66.4%	65.3%	62.7%
Totals	63.9%*	63.9%*	63.4%	79.5%	79.8%*	78.8%

Control – Original

Garlic
WinWht/Sorghum
Other Tree Nuts
Citrus

★ Run 1 – Equal Acreage

Triticale *Sunflower*
Oranges *Spring Wheat*
Olives *Rye*
Plums *Clover/Wildflower*
Lettuce

Run 2 – Equal Pixels

Potatoes
Carrots
Cantaloupes
Sorghum



Accuracy Assessments – Specialty Crops

Specialty & Small Acreage Crops	Producer Accuracy			User Accuracy		
	<i>Original</i>	<i>Acreage</i>	<i>Pixels</i>	<i>Original</i>	<i>Acreage</i>	<i>Pixels</i>
	In Season	Run1	Run2	In Season	Run1	Run2
Sweet Corn	33.4%	23.1%	28.5%	67.3%	51.3%	55.5%
Mint	65.2%	58.3%	57.1%	58.3%	61.5%	60.1%
Other Small Grains	85.0%	5.3%	0.0%	6.1%	3.8%	0.0%
Canola	41.5%	59.7%	39.6%	79.4%	98.6%	92.1%
Sweet Potatoes	69.5%	69.4%	68.5%	76.5%	75.8%	71.2%
Cucumbers	19.6%	46.6%	14.6%	47.9%	44.5%	49.2%
Herbs	47.9%	48.2%	34.5%	84.8%	74.1%	70.8%
Peaches	22.0%	24.3%	20.2%	67.6%	63.6%	53.9%
Apples	71.8%	77.5%	73.7%	75.5%	79.0%	89.8%
Pecans	16.3%	14.6%	12.3%	53.7%	23.6%	52.0%
Pears	79.3%	82.8%	82.2%	85.8%	87.1%	85.0%
Aquaculture	21.2%	27.4%	14.8%	86.6%	64.2%	65.4%
Asparagus	33.9%	31.6%	33.4%	81.6%	87.8%	92.9%
Honeydew Melons	46.7%	60.7%	48.9%	64.9%	74.9%	74.3%
Peppers	35.5%	29.4%	23.8%	72.3%	67.5%	65.9%
Nectarines	23.1%	26.9%	20.8%	66.2%	60.0%	45.3%
Greens	20.1%	23.1%	16.8%	23.7%	26.8%	22.4%
Strawberries	43.7%	55.5%	51.0%	89.7%	94.5%	92.6%
Squash	16.6%	10.2%	6.9%	51.2%	30.8%	26.7%
Apricots	44.3%	48.1%	50.0%	53.1%	50.2%	55.1%
Vetch	26.0%	27.3%	27.0%	44.3%	64.0%	73.1%
Dbl. Crop Lettuce/Durum Wht	21.7%	25.0%	28.6%	45.1%	37.9%	45.4%
Dbl. Crop Lettuce/Cantaloupe	45.4%	51.7%	52.0%	24.4%	29.0%	31.4%
Dbl. Crop Lettuce/Upland Cotton	48.0%	36.3%	35.9%	37.7%	47.7%	45.7%
Dbl. Crop Barley/Sorghum	21.2%	31.6%	28.2%	29.4%	52.5%	28.9%
Dbl. Crop Barley/Corn	41.4%	31.5%	36.4%	86.7%	68.0%	71.4%
Blueberries	20.9%	39.2%	30.8%	50.0%	53.8%	21.7%
Totals	37.4%	38.6%*	35.5%	60.3%	60.4%*	60.0%

Control – Original

Sweet Corn *Sweet Potatoes*
 Pecans *Herbs*
 Peppers *Peaches*
 Barley/Corn *Squash*
 Other Small Grains

★ Run 1 – Equal Acreage

Canola
 Pears
 Honeydew
 Strawberries
 Barley/Sorghum
 Blueberries

Run 2 – Equal Pixels

Lettuce/Cantaloupe
Asparagus
Vetch
Lettuce/Durum Wheat



Acresage Estimates

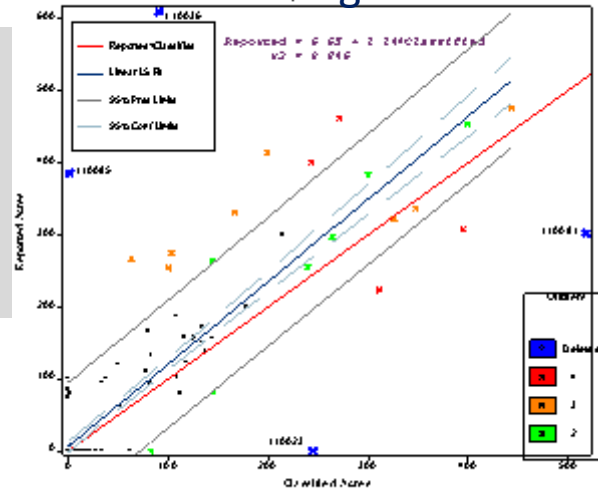
Original

Crops:
Alfalfa
Corn
Cotton
Oats
Rice

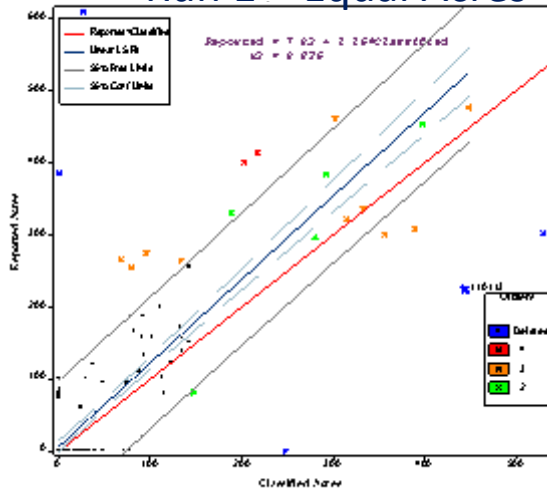
Linear Regression

Y (Dependent) = June Ag Survey

X (Independent) = # CDL Pixels



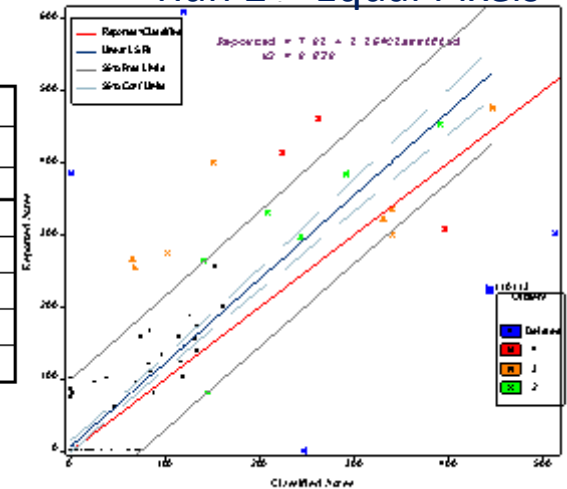
Run 1 – Equal Acres



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	Acresages		Coefficient of Variation		
	Run # / Orig		CV = σ / μ		
	Run 1	Run 2	In Season	Run 1	Run 2
Alfalfa	-0.2%	2.8%	11.2	10.7	10.9
Corn	1.3%	0.4%	10.4	10.8	10.6
Cotton	-1.0%	-0.5%	6.0	5.9	5.9
Oats	0.3%	1.9%	15.8	15.9	15.6
Rice	-0.2%	-0.3%	2.9	2.9	2.9

Run 2 – Equal Pixels



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Final Verdict!

PROCESS STEPS	Original 30 meter	Run 1 Equal Acreage	Run 2 Equal Pixels
<i>Processing Times</i>	✓		
<i>Storage Needs</i>	✓		
<i>Overall Accuracy</i>	✓		
<i>Top 20 Crops</i>	✓		
<i>Small/Mid Acre Crops</i>		✓	
<i>Specialty Crops</i>		✓	
<i>Acreage Estimates</i>	✓	✓	

Questions?

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