

## **Economic Losses of Hurricane Irma on Agriculture in Florida Counties**

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Hurricane Irma made landfall in the Florida Keys on September 10, 2017 as a category four hurricane, then continued on a northerly path along the west side of the Florida peninsula, bringing hurricane and tropical storm force winds, heavy rains, and flooding to nearly every community in the state. Hurricane Irma's path was particularly devastating for Florida agriculture, causing widespread property damages and unprecedented crop and livestock losses throughout the state. This report provides estimates of agricultural losses in Florida at the county level, as an update to a previous report on statewide estimates, titled "Impacts of Hurricane Irma on Florida Agriculture."<sup>1</sup> Note that the crop loss estimates were revised from the previous report based on additional information received from field surveys. Also, livestock and animal product losses were not estimated at the county level due to lack of information.

Hurricane and tropical storm force winds and precipitation from Hurricane Irma were mapped according to information from the National Hurricane Center and the National Weather Service, as shown in Figure 1. The windspeed zones were overlaid on the Cropland Data Layer from USDA-NASS to determine the area of various crops in each zone.<sup>2</sup> In addition, published values for specialty crops such as citrus, small fruits, and vegetables, that are not represented well in the Cropland Data Layer, were used to allocate cropland areas by county and windspeed zone.

Estimated loss values for each crop were based on the area affected (acres) together with average yields per acre and commodity prices from 2016-17 crop surveys or from the 2012 Census of Agriculture.<sup>3</sup> Statewide crop area, average value per acre, and seasonal factors for each crop are shown in Table 1. Seasonal factors represent the approximate share of the annual production period that was likely disrupted by hurricane damages. Crops were aggregated into major groups for field crops, citrus, vegetables/other fruits, and nursery/floriculture. The areas of major crop types in Florida counties are summarized in Table 2. The total cropland area was 1.947 million acres, comprised of 1.281 million acres of field crops, 412,662 acres of citrus, 188,080 acres of vegetables and other fruits, and 65,110 acres of nursery and floriculture crops. The counties with the largest crop acreage were Palm Beach (465,895), Hendry (206,874), and Jackson (110,463).

The shares of total area in each county affected by hurricane or tropical storm force winds are summarized in Table 3. Crop losses were estimated assuming a damage rate of 90 percent for areas with category 4 hurricane winds, 75 percent for category 3, 45 percent for category 2, 35 percent for category one, 25 percent for tropical storm winds 51 to 63 knots per hour (kph), and 15 percent for tropical storm

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<sup>1</sup> Impacts of Hurricane Irma on Florida Agriculture. R. Clouser, A. Hodges, C. Court, J. Vansickle, and S. Stefanou. University of Florida, Food and Resource Economics Department. Oct. 2, 2017. Available at: <https://fred.ifas.ufl.edu/economicimpactanalysis/DisasterImpactAnalysis/>.

<sup>2</sup> Cropland Data Layer available at <https://nassgeodata.gmu.edu/CropScape/>. Data are derived from Landsat 8 imagery.

<sup>3</sup> Crop area, yield and price data retrieved from USDA-NASS Quick Stats website: <https://quickstats.nass.usda.gov/>.

winds 34 to 50 kph. These damage rates are broadly consistent with damages reported by UF-IFAS Extension personnel throughout the state, and with previous studies on past hurricanes in Florida.<sup>4</sup> These damage rates were revised from the October 2017 statewide report to reflect updated information. Estimated losses for floriculture crops under protection in greenhouses were reduced by 50 percent. Losses for annual winter vegetable and berry crops that were just starting to be planted at the time of the storm reflected 10 percent of the average annual value to account for a shortened production season and expected market distortions due to later production dates. Loss estimates were not included for blueberries or melons (watermelon, cantaloupe) because these crops were generally not in production at the time of the storm, and losses for pasture/grassland were assumed to be minimal. Losses for pecans were not included because reliable yield and price information was not available.

Estimated annual crop losses in each county are summarized in Table 4. Total crop losses were estimated at \$1.313 billion, including \$349 million for field crops, \$490 million for citrus, \$151 million for vegetables and other fruits, and \$323 million for nursery and floriculture crops. Note that these loss estimates are lower than previously estimated in October 2017. The top-ten counties in terms of crop losses were Palm Beach (\$248 million), Hendry (\$236 million), Miami-Dade (\$155 million), Polk (\$96 million), Highlands (\$66 million), Collier (\$56 million), Hardee (\$52 million), Hillsborough (\$46 million), Manatee (\$42 million), and Volusia (\$34 million). Losses were generally higher in South and Central Florida counties where hurricane winds were strongest. Losses were highest in the broad Miami-Fort Lauderdale economic area (\$750 million), followed by the Orlando area (\$300 million), Sarasota-Bradenton (\$124 million), and Tampa-St. Petersburg (\$56 million), as shown in Figure 2.

A study conducted by the Florida Department of Agriculture and Consumer Services-Forest Service estimated damages to timber stands in Florida using a similar methodology, based on wind maps, together with forestland area of pine, hardwood, cypress, and other species from the USDA-Forest Inventory and Analysis. An estimated 35.8 million trees were affected, including 5.5 million in the catastrophic category (50%+ damaged) and 11.6 million in the severe category (21-50% damaged). The value of damage was estimated at \$1.633 billion at current average timber stumpage prices. This value represents timber that would normally be harvested over several years, however, the annual loss in 2017-18 was assumed to be 20 percent of this value, resulting in an annual loss net of the timber salvage value of \$261 million. Net timber losses by county are summarized in Table 5. The highest timber losses were in the north Florida counties of Taylor (\$26 million), Jackson (\$17 million), Madison (\$15 million), Hamilton (\$13 million), Lafayette (\$12 million), Nassau (\$11 million), and Marion (\$10 million).

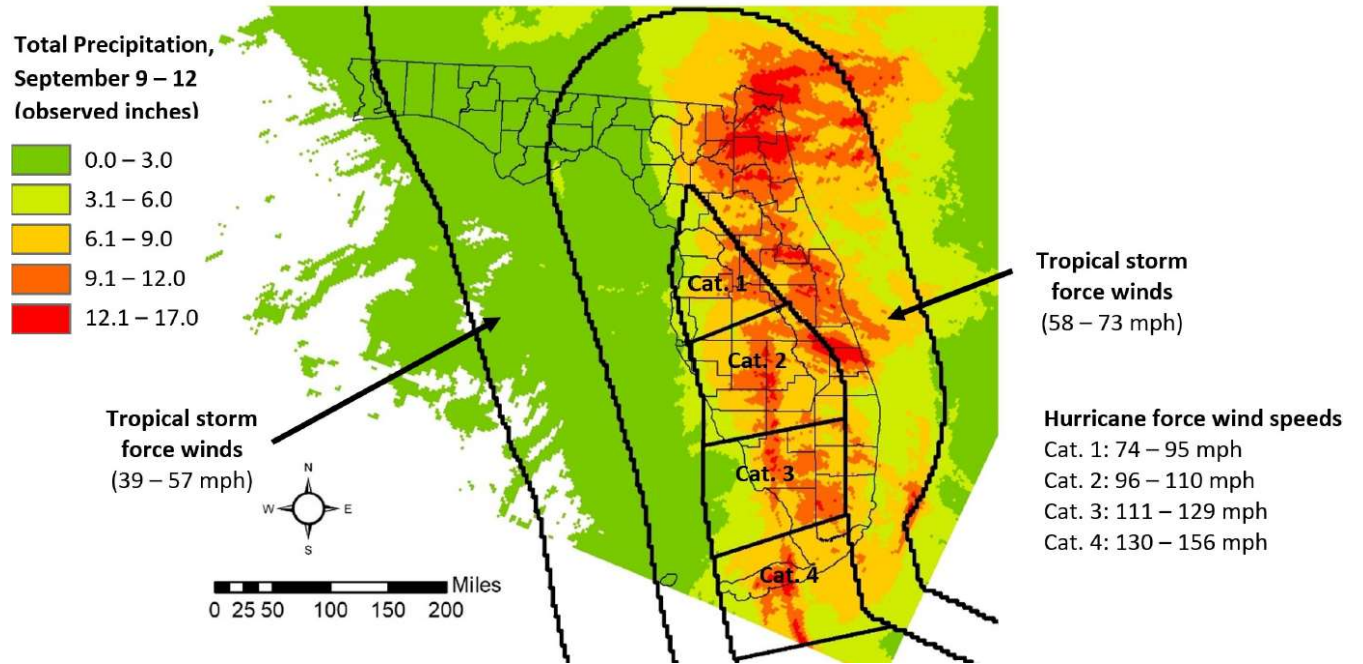
Production losses for livestock and animal products were reported by industry stakeholders at \$39 million, including \$14 million for beef cattle (dead animals and lost weight due to stress), \$7.5 million for dairy farms (lost production due to lack of refrigeration), and \$17.5 million for aquaculture production of

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<sup>4</sup> Abrigo, et al. The impact of four hurricanes in 2004 on the Florida citrus industry: experiences and lessons learned. Proc. Fla. State Hort. Soc. 118:66-74, 2005.

food fish, ornamental fish, mollusks, alligators and aquatic plants. Losses of livestock and animal products, however, were not estimated at the county level.

**Figure 1.** Map of wind speed zones and precipitation for Hurricane Irma, September, 2017



**Table 1. Florida agricultural crop production area, value per acre and seasonal production factors**

Crop Group	Crop	Production Area (Acres)	Average Value Per Acre	Seasonal Production Factor
Field Crops	Corn	66,198	\$493	100%
	Cotton	109,797	\$612	100%
	Other Hay/Non-Alfalfa	296,044	\$432	20%
	Peanuts	162,334	\$733	100%
	Rice	26,598	\$788	100%
	Sod/Grass Seed	50,927	\$2,752	10%
	Soybean	31,294	\$315	100%
	Sugarcane	534,358	\$1,249	100%
	Winter Wheat	3,729	\$117	100%
Citrus	Oranges	367,588	\$2,586	100%
	Grapefruit	33,846	\$3,462	100%
	Other Citrus	11,228	\$3,678	100%
Other Fruits and Vegetables	Strawberry	10,700	\$34,365	20%
	Tomato (field)	28,000	\$13,650	20%
	Peppers, bell	12,900	\$16,255	20%
	Beans, snap	27,300	\$3,960	20%
	Sweet corn	34,500	\$4,640	20%
	Cucumber	21,700	\$5,393	20%
	Cabbage	7,900	\$6,256	10%
	Squash	5,800	\$5,187	20%
	Potato	22,900	\$3,784	20%
	Blueberry	4,700	\$11,445	0%
	Avocado	11,680	\$3,208	100%
Nursery and Floriculture (under cover and in the open)	Floriculture	14,678	\$49,120	50%
	Nursery	50,432	\$9,498	100%
Total All Crops		<u>1,947,131</u>		

Sources: USDA-NASS, Cropland Data Layer, and 2012 Census of Agriculture

**Table 2. Production area of major agricultural crop types in Florida counties, 2016**

County	Field Crops	Citrus	Vegetables and Other Fruits	Nursery and Floriculture	Total All Crops
----- Acres -----					
Alachua	25,945	0	2,178	888	29,011
Baker	1,650	0	202	258	2,110
Bay	2,379	0	1	27	2,407
Bradford	3,762	0	55	8	3,826
Brevard	3,500	886	50	913	5,348
Broward	119	5	2	1,298	1,423
Calhoun	18,436	0	9	6	18,450
Charlotte	439	354	0	98	891
Citrus	6,268	80	97	193	6,639
Clay	458	0	19	275	752
Collier	952	15,217	11,633	671	28,473
Columbia	21,289	0	141	283	21,713
DeSoto	452	0	53	174	679
Dixie	8,333	0	0	0	8,333
Duval	549	0	21	277	847
Escambia	41,562	0	149	46	41,757
Flagler	5,017	0	1,216	10	6,243
Franklin	30	0	0	0	30
Gadsden	9,425	0	20	574	10,018
Gilchrist	29,789	0	400	185	30,373
Glades	34,144	0	70	681	34,895
Gulf	469	0	0	0	469
Hamilton	18,269	0	51	270	18,589
Hardee	1,040	37,771	122	1,081	40,014
Hendry	90,571	108,043	7,325	935	206,874
Hernando	4,979	1,027	193	685	6,883
Highlands	6,362	49,398	27	1,122	56,908
Hillsborough	1,560	6,625	19,809	1,903	29,898
Holmes	34,311	0	55	36	34,403
Indian River	5,040	37,169	19	769	42,996
Jackson	108,486	0	1,968	9	110,463
Jefferson	9,245	0	62	748	10,055
Lafayette	23,679	0	0	0	23,679
Lake	1,523	10,675	177	4,709	17,084
Lee	470	9,310	0	2,101	11,880
Leon	2,727	0	29	147	2,904
Levy	39,164	0	40	2,523	41,727
Liberty	1,906	0	0	0	1,906
Madison	42,753	0	44	99	42,896
Manatee	734	14,873	14,728	1,836	32,172
Marion	12,069	1,581	467	668	14,785
Martin	23,136	0	38	3,677	26,851
Miami-Dade	3,013	551	35,093	16,110	54,767
Monroe	15	0	0	0	15

County	Field Crops	Citrus	Vegetables and Other Fruits	Nursery and Floriculture	Total All Crops
----- Acres -----					
Nassau	876	0	56	82	1,014
Okaloosa	12,899	0	86	25	13,010
Okeechobee	9,959	0	3,213	470	13,643
Orange	107	5,380	31	1,366	6,883
Osceola	1,175	6,165	213	55	7,609
Palm Beach	401,881	0	59,881	4,133	465,895
Pasco	7,472	5,987	186	140	13,786
Pinellas	2	0	0	88	89
Polk	2,932	82,858	1,665	917	88,372
Putnam	2,697	245	3,786	1,688	8,416
Santa Rosa	57,302	0	85	10	57,397
Sarasota	94	575	0	179	848
Seminole	50	452	44	642	1,188
St. Johns	3,379	0	17,750	314	21,443
St. Lucie	15,384	16,164	0	511	32,059
Sumter	11,642	0	351	825	12,817
Suwannee	58,177	0	3,879	963	63,020
Taylor	1,959	1	10	22	1,993
Union	5,352	0	29	0	5,381
Volusia	583	1,273	40	6,253	8,149
Wakulla	805	0	45	98	948
Walton	20,159	0	97	3	20,259
Washington	20,378	0	67	31	20,476
Total	<u>1,281,279</u>	<u>412,662</u>	<u>188,080</u>	<u>65,110</u>	<u>1,947,131</u>

Values exclude grass/pasture and other crops less than 3,000 acres.

Source: USDA-NASS, 2012 Ag Census, 2016 surveys and Cropland Data Layer (field crops)

**Table 3.** Florida county percentage of area affected by hurricane force or tropical storm windspeed zones from Hurricane Irma and crop damage levels

County	Category 4 Hurricane	Category 3 Hurricane	Category 2 Hurricane	Category 1 Hurricane	Tropical Storm winds 51-63 k	Tropical Storm winds 34-50 k
----- Percentage of county area affected -----						
Alachua				0.4	99.6	
Baker					100.0	
Bay						100.0
Bradford					100.0	
Brevard					100.0	
Broward		48.8			51.2	
Calhoun						100.0
Charlotte			100.0			
Citrus				100.0	0.0	
Clay					100.0	
Collier		98.9	1.1			
Columbia					100.0	
DeSoto			100.0			
Dixie					100.0	
Duval					100.0	
Escambia						3.6
Flagler					100.0	
Franklin					33.4	66.6
Gadsden					43.4	56.6
Gilchrist					100.0	
Glades			100.0			
Gulf						100.0
Hamilton					100.0	
Hardee			100.0			
Hendry		41.5	58.5			
Hernando				100.0		
Highlands			100.0			
Hillsborough			14.2	82.7	3.0	
Holmes						100.0
Indian River			6.2		93.8	
Jackson						100.0
Jefferson					100.0	
Lafayette					100.0	
Lake				31.0	69.0	
Lee		11.6	88.4			
Leon					98.2	1.8
Levy				40.1	59.9	
Liberty					5.4	94.6
Madison					100.0	
Manatee			85.9	0.1	14.0	
Marion				18.6	81.4	
Martin			37.2		62.8	
Miami-Dade	16.7	41.2			42.2	



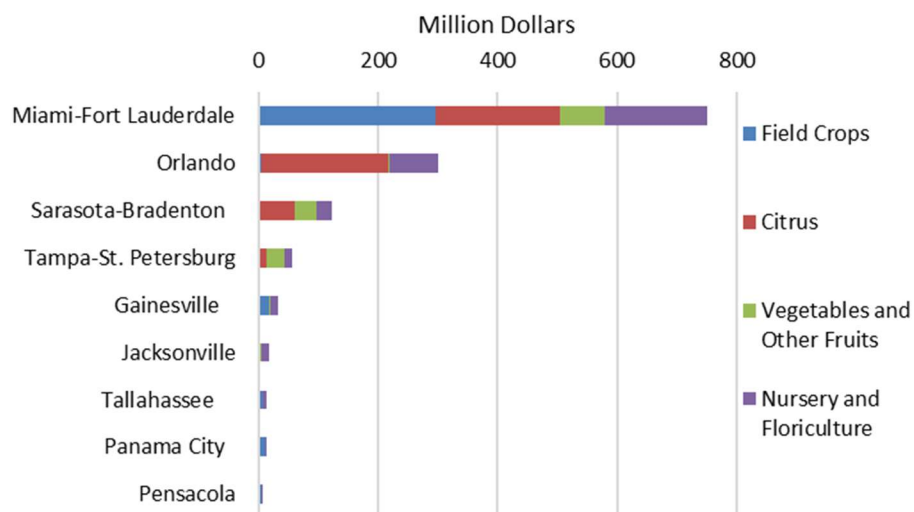
County	Category 4 Hurricane	Category 3 Hurricane	Category 2 Hurricane	Category 1 Hurricane	Tropical Storm winds 51-63 k	Tropical Storm winds 34-50 k
----- Percentage of county area affected -----						
Monroe	66.1	26.6			7.3	
Nassau					100.0	
Okaloosa						100.0
Okeechobee			99.9		0.1	
Orange				3.8	96.2	
Osceola			30.6	12.2	57.2	
Palm Beach		21.6	25.1		53.3	
Pasco				97.7	2.3	
Pinellas				52.8	47.2	
Polk			52.3	47.7		
Putnam					100.0	
Santa Rosa						78.6
Sarasota			90.1		9.9	
Seminole					100.0	
St. Johns					100.0	
St. Lucie			20.4		79.6	
Sumter				92.0	8.0	
Suwannee					100.0	
Taylor					100.0	
Union					100.0	
Volusia					100.0	
Wakulla					98.7	1.3
Walton						100.0
Washington						100.0
Crop damage level	90%	75%	45%	35%	25%	15%

**Table 4. Summary of agricultural crop losses to Hurricane Irma in Florida counties, 2017-18 season**

County	Field Crops	Citrus Fruits	Vegetables and Other Fruits	Nursery and Floriculture	Total All Crops
----- Thousand Dollars -----					
Alachua	1,446	0	220	2,277	3,943
Baker	56	0	51	679	785
Bay	116	0	0	65	181
Bradford	159	0	12	33	204
Brevard	442	591	6	2,279	3,318
Broward	69	6	3	8,040	8,118
Calhoun	1,416	0	1	22	1,439
Charlotte	175	551	0	423	1,149
Citrus	468	73	1	695	1,237
Clay	32	0	6	670	709
Collier	851	29,379	19,693	5,708	55,631
Columbia	1,675	0	54	1,158	2,888
DeSoto	63	0	70	845	978
Dixie	933	0	0	0	933
Duval	50	0	3	687	740
Escambia	100	0	1	3	104
Flagler	326	0	230	24	580
Franklin	3	0	0	0	3
Gadsden	854	0	2	1,099	1,955
Gilchrist	2,704	0	109	440	3,252
Glades	19,093	0	0	2,911	22,003
Gulf	31	0	0	0	31
Hamilton	1,611	0	8	641	2,260
Hardee	83	43,954	27	7,531	51,595
Hendry	64,198	161,271	5,629	5,243	236,342
Hernando	214	1,019	4	2,276	3,514
Highlands	1,855	57,620	0	6,160	65,635
Hillsborough	82	6,277	31,085	8,436	45,879
Holmes	1,397	0	9	103	1,508
Indian River	1,340	28,285	7	2,084	31,715
Jackson	8,148	0	325	14	8,487
Jefferson	891	0	10	1,803	2,705
Lafayette	1,916	0	0	0	1,916
Lake	48	8,405	4	14,839	23,296
Lee	272	11,980	0	10,097	22,349
Leon	195	0	9	516	720
Levy	4,738	0	6	6,989	11,734
Liberty	126	0	0	0	126
Madison	4,119	0	15	235	4,370
Manatee	74	16,254	17,227	8,274	41,828
Marion	1,399	1,200	25	2,077	4,702
Martin	9,014	0	18	11,938	20,970
Miami-Dade	2,048	1,135	35,687	116,259	155,130
Monroe	1	0	0	0	1

County	Field Crops	Citrus Fruits	Vegetables and Other Fruits	Nursery and Floriculture	Total All Crops
----- Thousand Dollars -----					
Nassau	45	0	8	210	263
Okaloosa	763	0	9	36	808
Okeechobee	728	0	1,808	2,129	4,665
Orange	4	3,535	6	5,925	9,470
Osceola	86	5,155	55	439	5,735
Palm Beach	194,781	0	31,765	21,158	247,704
Pasco	252	5,443	99	569	6,363
Pinellas	0	0	0	334	334
Polk	126	89,820	1,461	4,332	95,739
Putnam	285	160	707	10,005	11,157
Santa Rosa	3,475	0	9	29	3,512
Sarasota	14	675	0	1,087	1,776
Seminole	4	294	63	1,692	2,053
St. Johns	359	0	3,809	772	4,940
St. Lucie	5,413	16,330	0	1,854	23,597
Sumter	372	0	14	2,748	3,133
Suwannee	4,725	0	732	2,291	7,748
Taylor	86	1	3	53	143
Union	210	0	9	0	219
Volusia	56	833	13	32,788	33,689
Wakulla	39	0	10	459	508
Walton	1,128	0	9	6	1,142
Washington	1,045	0	4	44	1,093
<b>Total All</b>	<b><u>348,827</u></b>	<b><u>490,244</u></b>	<b><u>151,150</u></b>	<b><u>322,532</u></b>	<b><u>1,312,753</u></b>

**Figure 2.** Summary of agricultural crop losses to Hurricane Irma in Florida economic regions, 2017-18 season



Economic regions defined by the U.S. Bureau of Economic Analysis include metropolitan areas and surrounding rural counties.

**Table 5. Value of net annual timber losses to Hurricane Irma in Florida counties**

County	Loss (\$1000)
Alachua	8,667
Baker	7,370
Bay	3,770
Bradford	4,460
Brevard	63
Broward	43
Calhoun	4,187
Charlotte	1,202
Citrus	1,161
Clay	7,524
Collier	1,973
Columbia	7,646
Dade	0
Desoto	457
Dixie	6,806
Duval	223
Escambia	4,413
Flagler	4,515
Franklin	2,000
Gadsden	8,003
Gilchrist	9,538
Glades	283
Gulf	6,125
Hamilton	13,406
Hardee	1,364
Hendry	992
Hernando	1,330
Highlands	1,077
Hillsborough	482
Holms	8,563
Indian River	10
Jackson	16,524
Jefferson	4,367
Lafayette	12,353
lake	2,588
Lee	508
Leon	6,065
Levy	3,351
Liberty	9,381
Madison	14,766
Manatee	435
Marion	10,269
Martin	197
Monroe	0
Nassau	10,538
Okaloosa	2,769
Okeechobee	213

County	Loss (\$1000)
Orange	513
Osceola	534
Palm Beach	425
Pasco	1,273
Pinellas	234
Polk	3,283
Putnam	8,424
Santa Rosa	3,508
Sarasota	515
Seminole	154
St Johns	6,528
St Lucie	48
Sumter	1,590
Suwannee	9,994
Taylor	26,311
Union	4,623
Volusia	2,451
Wakulla	3,909
Walton	4,318
Washington	3,328
Total	<u>293,940</u>

Estimates based on 2014 timber removals adjusted to statewide estimates by Florida Department of Agriculture and Consumer Services, Florida Forest Service.