Estimated
AGRICULTURAL LOSSES
Resulting from
HURRICANE HELENE

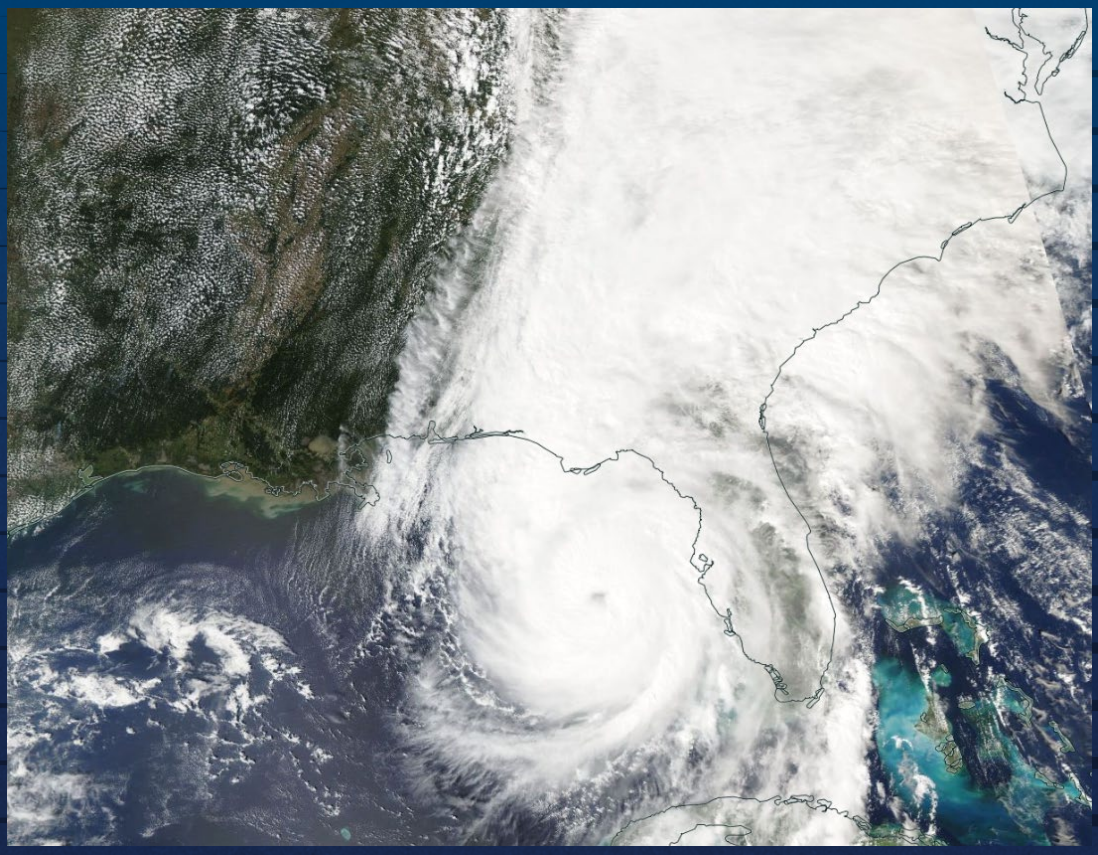

Image courtesy of NASA Worldview

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INTRODUCTION

The tropical system that would become Hurricane Helene developed into a tropical storm on September 24, 2024 in the northwest Caribbean Sea near the Yucatan Peninsula and then strengthened into a hurricane the next day as it moved northeast. It rapidly intensified, attaining Category 4 strength with 140 mph winds prior to making landfall near Perry, FL (Taylor County) on September 26. After landfall, Helene continued moving north-northeast, impacting north-central Florida and the southwestern peninsula. It downgraded to a Category 2 hurricane after crossing into Georgia, and then further weakened as it moved through the Appalachian region, affecting parts of South Carolina, North Carolina, Virginia, and Tennessee. Hurricane Helene was associated with heavy rainfall, significant storm surge, and moderate inland flooding.

Agricultural producers in Florida experienced both losses (changes in economic flows) and damages (changes in economic stocks) as a result of the weather conditions associated with Hurricane Helene. The University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) Economic Impact Analysis Program (EIAP) distributed a survey (UFIRB ET00041674) titled "Assessment of Losses and Damages to Florida Agriculture from Hurricane Helene" on September 27, 2024 to begin assessing losses and damages associated with Hurricane Helene. A report was released by the UF/IFAS EIAP on November 19, 2024 summarizing preliminary findings on statewide agricultural production losses in Florida for the calendar year 2024 (or marketing year 2024–2025) due to Hurricane Helene (Court et al., 2024a). Within the preliminary report, estimated losses ranged from $40.3 million to $162.2 million, with the most significant impacts observed in the Field and Row Crops, Animals and Animal Products, and Vegetables, Melons, and Potatoes commodity groups. Survey respondents also reported damage to infrastructure (e.g., barns, fences, equipment), stored inputs (e.g., feed, fertilizer), and harvested products (e.g., meat, eggs, hay, millet). In the following weeks and months, the UF/IFAS EIAP also published state and county-level summaries of preliminary findings on their website (Court et al., 2024b, 2025).

Following continued efforts on data collection and refined analysis, this final report presents a comprehensive assessment of agricultural production losses in Florida at both the state and county levels for specific agricultural commodity groups due to Hurricane Helene. It updates the preliminary estimates with finalized loss values, offering a more accurate and complete picture of Hurricane Helene's impact on Florida's agricultural sector. While this will be the final report associated with rapid assessment for this event, data will continue to be collected via the **Assessment of Losses and Damages to Florida Agriculture from Hazard/ Disaster Events tool** through marketing season 2024–2025 to be used in broader studies of the agricultural impacts of these types of events as well as to inform assessments of future events.

UPDATED EVENT DATA

The wind swath of Hurricane Helene, shown as Figure 1, has been updated using the latest data from the National Oceanic and Atmospheric Administration (NOAA) National Hurricane Center (NHC), which was revised after the release of UF/IFAS EIAP preliminary report on Hurricane Helene (Court et al., 2024a). Event-specific data for estimated flood inundation depths, shown as Figure 2, has been updated using the latest hindcast of Hurricane Helene from the Pacific Northwest National Laboratory's Rapid Infrastructure Flooding Tool. The updated wind swath data indicates that hurricane conditions impacted 11 counties in Florida: Suwannee, Taylor, Lafayette, Dixie, Wakulla, Hamilton, Madison, Jefferson, Levy, Gilchrist, and Columbia. A larger swath of the Florida peninsula experienced tropical storm force winds, which extended across 53 additional counties. Event data for 7-day cumulative precipitation (September 23–29, 2024) from NOAA's National Weather Service (NWS) has not changed since the preliminary report. To avoid redundancy, the cumulative precipitation map and analyses are not repeated here.

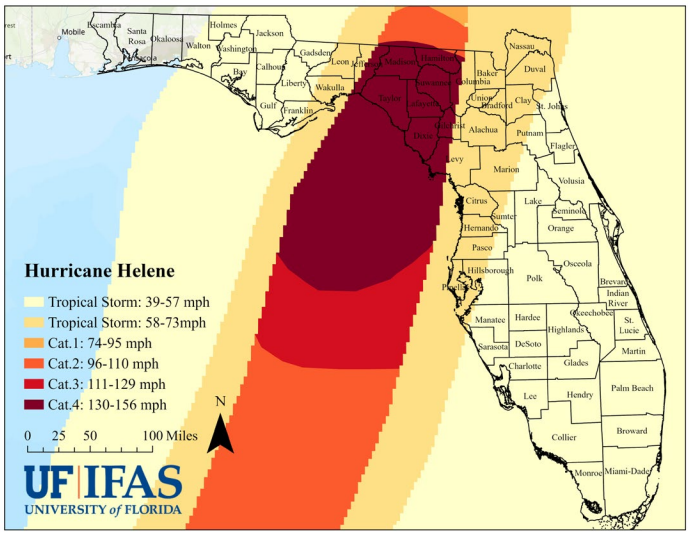

Figure 1. *Wind swath pattern of Hurricane Helene as it impacted Florida.*

Source: Geospatial data on the wind swath of Hurricane Helene are derived from NOAA NHC (www.nhc.noaa.gov/gis/).

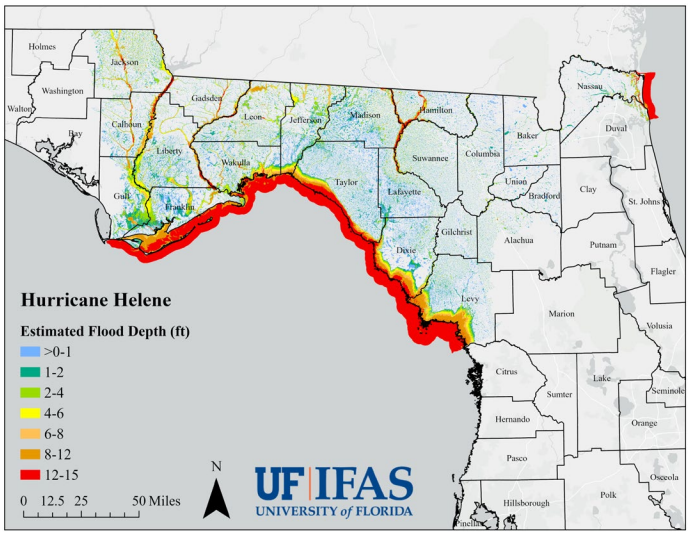

Figure 2. *Estimated flood inundation depth caused by Hurricane Helene in north central Florida.*

Source: Estimated flood inundation data are retrieved from the hindcast of Hurricane Helene flooding from Pacific Northwest National Laboratory's Rapid Infrastructure Flooding Tool (open-rift-pnnl.hub.arcgis.com/maps/5e2d8101ce264e1fbb4800b4dcf3c33e/about).

AFFECTED AGRICULTURAL LANDS

Using geographic information systems (GIS) software (Esri ArcGIS Pro), the shapefiles of wind swath, cumulative precipitation, and flood inundation depth were overlaid on a geospatial database of agricultural lands in Florida to determine the wind, rainfall, and flooding intensity experienced by each affected agricultural parcel. The geospatial database of agricultural lands in Florida is the Florida Statewide Agricultural Irrigation Demand (FSAID) Agricultural Lands Geodatabase (ALG) developed by the Florida Department of Agriculture and Consumer Services (FDACS). The Hurricane Composite Intensity Index (HCII), calculated as the sum of the intensity indices of wind, rainfall, and flooding, was computed for each affected agricultural parcel, as shown in Figure 3. The methodology used to quantify the HCII is the same as what was described in the preliminary report (Court et al., 2024a). Definitions for the wind, precipitation, and flooding intensity indices are provided in Table 1. Due to the update in wind swath and flood depth data, parcel-level HCII values differ from those presented in the preliminary report. Table 2 summarizes the revised estimates of agricultural land acreages affected by Hurricane Helene by commodity group and HCII level across Florida.

Table 1. *Definition of intensity indices for wind, rainfall, and flooding associated with tropical cyclone events, which are components of the UF/IFAS EIAP's Hurricane Composite Intensity Index (HCII).*

Intensity Index	Wind Speed (mph)	Precipitation (inches)	Flood Depth (ft)
1	TS1: 39–57	3–6	> 0–1
2	TS2: 58–73	6–9	1–2
3	Cat. 1: 74–95	9–12	2–4
4	Cat. 2: 96–110	12–15	4–6
5	Cat. 3: 111–129	15–18	6–8
6	Cat. 4 & up: > 130	> 18	> 8

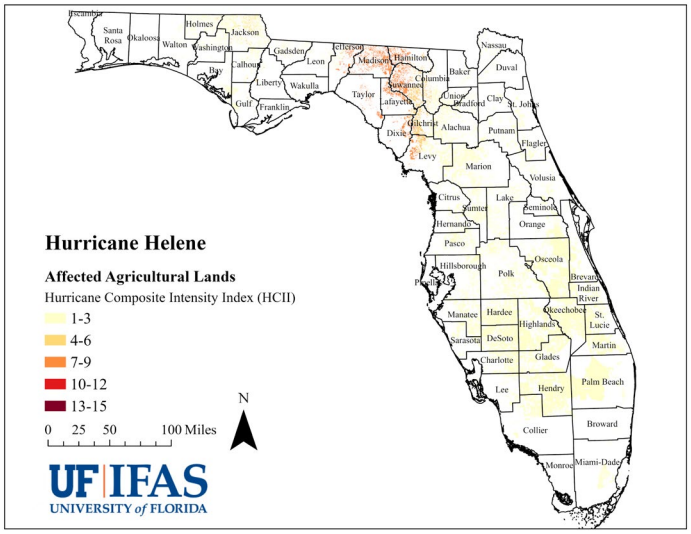

Figure 3. *Hurricane Composite Intensity Index (HCII) level of affected agricultural lands in Florida for Hurricane Helene.*

Source: The agricultural lands geospatial data are from the Florida Statewide Agricultural Irrigation Demand (FSAID) Agricultural Lands Geodatabase (ALG) developed by the Florida Department of Agriculture and Consumer Services (FDACS) (www.fdacs.gov/Agriculture-Industry/Water/Agricultural-Water-Supply-Planning).

Table 2. *Estimated acreage of agricultural lands affected by Hurricane Helene, categorized by commodity group and HCII level.*

Commodity Group	Hurricane Composite Intensity Index (HCII)					Total
	1–3	4–6	7–9	10–12	13–15	
Animals and Animal Products[1]	4,060,966	103,648	192,194	11,046	1,623	**4,369,477**
Field and Row Crops[2]	984,207	85,720	145,365	7,034	857	**1,223,183**
Citrus[3]	274,705	-	-	-	-	**274,705**
Vegetables, Melons, and Potatoes	191,687	2,721	8,425	660	335	**203,828**
Greenhouse/Nursery	76,781	2,123	2,295	<100	-	**81,286**
Fruit and Tree Nuts[4]	16,450	1,043	2,104	346	<100	**20,002**
Total	**5,604,796**	**195,255**	**350,383**	**19,173**	**2,874**	**6,172,481**

Notes: [1] Animals and Animal Products acreage includes grazing land. [2] Field and Row Crops acreage includes field crops, hay, and sugarcane. The acreage of cotton is adjusted with the county level harvested acres of cotton from USDA 2022 Census data. [3] Citrus acreage includes non-bearing acreage and was adjusted to reflect the 2024 Commercial Citrus Inventory Preliminary Report from USDA NASS. [4] The acreage of pecan in the Fruit and Tree Nuts Crops group is adjusted with the county level bearing and non-bearing acres of pecan from USDA 2022 Census data. Acreages less than 100 are represented as '<100' in the table.

Nearly 6.2 million acres of agricultural lands were affected by Hurricane Helene, of which over 66% was grazing land. Across all commodity groups, around 90.8% of affected acreage experienced low-intensity weather conditions (HCII levels 1–3), 8.8% of affected acreage experienced moderate-intensity weather conditions (HCII levels 4–9), and only 0.4% of affected acreage experienced high-intensity weather conditions (HCII levels 10–15). The commodity groups that were most affected (in terms of acreage impacted by moderate- or high-intensity weather conditions) by Hurricane Helene were Field and Row Crops (238,976 acres), Animals and Animal Products (17,150 acres, not including grazing land), and Vegetables, Melons, and Potatoes (12,140 acres).

County-level affected acreage of agricultural lands by commodity group are provided in Table A-1 in Appendix A. Information on the percentage of agricultural lands affected in each county of Florida are shown in Table A-2 in Appendix A. Sixty-two (62) of the 64 affected counties had 100% of their agricultural lands affected.

The estimated annual value of production on the affected acreage areas by commodity group and HCII level are displayed in Table 3. County-level estimates of annual value of production by commodity group and HCII level are shown in Table A-3 in Appendix A. The data sources and methodology for estimating the annual value of production on the affected lands did not change between the preliminary and final report (Court et al., 2024a). In estimating the annual production value for acreage affected by Hurricane Helene, we have accounted for the final estimates of the dollar-value losses caused by Hurricane Debby, which affected the same region earlier in the season. This approach ensures our assessment accurately reflects the incremental losses attributable solely to Hurricane Helene, thereby avoiding any double-counting within agricultural areas impacted by both events.

Table 3. *Estimated value of annual production (2024$, Thousands) on affected acreage by commodity group and HCII level.*

Commodity Group	Hurricane Composite Intensity Index (HCII)					Total
	1–3	4–6	7–9	10–12	13–15	
Greenhouse/Nursery	$2,387,897	$19,384	$21,484	$580	$-	**$2,429,346**
Vegetables, Melons, and Potatoes	$2,198,957	$23,449	$91,453	$7,630	$4,741	**$2,326,231**
Animals and Animal Products	$1,322,566	$145,655	$244,157	$14,635	$1,351	**$1,728,366**
Field and Row Crops	$1,488,436	$53,372	$97,330	$4,581	$384	**$1,644,103**
Citrus	$544,785	$-	$-	$-	$-	**$544,785**
Fruit and Tree Nuts	$98,802	$9,629	$19,780	$3,141	$514	**$131,866**
Total	**$8,041,444**	**$251,489**	**$474,205**	**$30,568**	**$6,990**	**$8,804,696**

Note: Values less than $100K are represented as '<$100' in the table.

Hurricane Helene affected agricultural lands that produce over $8.8 billion of agricultural products (crops, livestock, aquaculture, etc.) throughout a calendar or marketing year, some across multiple growing seasons (e.g., Vegetables, Melons, and Potatoes) and others that might produce year-round (e.g., Greenhouse/Nursery, Animals and Animal Products). Considering hurricane conditions of all intensities, the commodity groups that were most affected in terms of "annual value at risk" by Hurricane Helene include Greenhouse/Nursery, Vegetables, Melons, and Potatoes, and Animals and Animal Products. A majority, 99.6%, of the estimated value of annual production across all commodities, was affected by low-intensity conditions (HCII levels 1–3) or moderate-intensity conditions (HCII levels 4–9). The annual value of agricultural products grown or raised in areas that experienced high-intensity conditions (HCII levels 10–15) is estimated to be $37.6 million, including Animals and Animal Products ($16.0 million), Vegetables, Melons, and Potatoes ($12.4 million), and Field and Row Crops ($5.0 million).

AGRICULTURAL LOSSES IN FLORIDA

On May 25, 2025, completed survey responses from both the English- and Spanish-language versions of the UF/IFAS "Assessment of Losses and Damages to Florida Agriculture from Hurricane Helene" were downloaded and prepared for analysis by investigators from the UF/IFAS EIAP. The investigators compiled the survey information for all commodities in each county affected by the disaster. The methodologies used to relate survey responses to HCII levels and to estimate production loss percentages (%) for different commodity groups at each HCII level remain consistent with those employed in the preliminary report (Court et al., 2024a). The area-weighted HCII levels of each affected county calculated with the updated wind swath and flood depth data are shown in Figure 4.

Table 4 displays the estimated annual production loss percentages (%) by commodity group and HCII level. Production loss percentages (%) convey the percentage of annual production (calendar year 2024 or marketing year 2024–2025) that has been lost due to Hurricane Helene. Note that some producers (e.g., vegetable farms) have multiple growing seasons in Florida and others (e.g., beef and dairy cattle operations) sell products year-round. Considerations related to multiple growing seasons, planting and harvesting progress prior to Hurricane Helene, delayed planting in the face of Hurricane Helene, or the potential for growers to replant damaged or destroyed acreage for some commodity groups are reflected in these annual production loss estimates.

These production loss percentage estimates by commodity group and HCII level were then applied to the estimated annual production values of affected agricultural lands to calculate total production losses. The resulting estimated production losses for agricultural producers in Florida due to Hurricane Helene amount to approximately $116.5 million.

Table 4. *Estimated annual production loss percentages (%) by commodity group at each HCII level based on analysis of survey data for Hurricane Helene along with observations from previously analyzed tropical cyclone events (Irma [2017], Michael [2018], Ian [2022], Idalia [2023], and Debby [2024]).*

Commodity Group	Hurricane Composite Intensity Index (HCII)				
	2–3	4–6	7–9	10–12	13–15
Animals and Animal Products	2%	5%	10%	15%	25%
Citrus	0%	0%	5%	20%	40%
Field and Row Crops	2%	5%	15%	30%	50%
Fruit and Tree Nuts	5%	10%	20%	30%	50%
Greenhouse/Nursery	2%	10%	10%	15%	25%
Vegetables, Melons, and Potatoes	5%	10%	10%	20%	20%

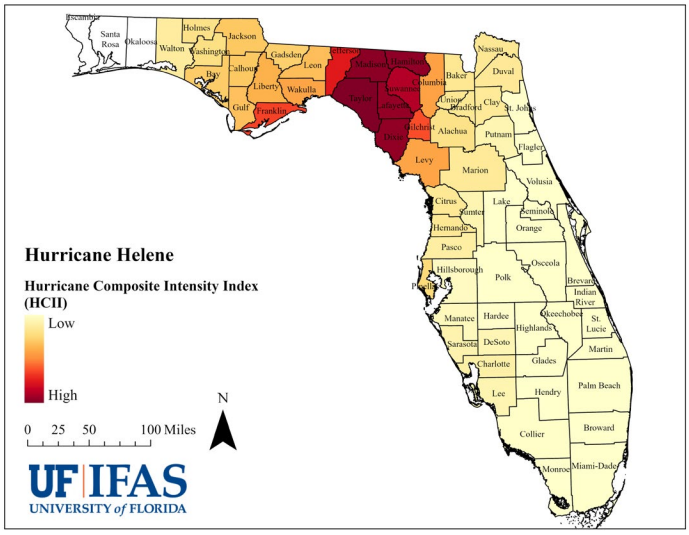

Figure 4. *Area-weighted HCII levels of affected counties in Florida.*

Agricultural Losses by Commodity Group

The estimated agricultural losses by commodity group and HCII level are displayed in Table 5. The baseline data contributing to these estimations include information on acreage, value per acre, and season or growth stage for specific commodities compiled from sources such as the United States Department of Agriculture (USDA)'s 2022 Census of Agriculture, annual surveys by the USDA National Agricultural Statistics Service (USDA-NASS), IMPLAN, Ask IFAS, as well as data published within the FDACS FSAID Geodatabase.

The commodity groups with the highest estimated production losses are Animals and Animal Products ($43.8 million), Vegetables, Melons, and Potatoes ($31.6 million), and Field and Row Crops ($23.2 million).

Table 5. *Estimated agricultural losses (2024$, Thousands) due to Hurricane Helene by commodity group and HCII level.*

Commodity Group	Hurricane Composite Intensity Index (HCII)					Total
	1–3	4–6	7–9	10–12	13–15	
Animals and Animal Products	$9,618	$7,283	$24,416	$2,195	$338	**$43,849**
Vegetables, Melons, and Potatoes	$17,656	$2,345	$9,145	$1,526	$948	**$31,621**
Field and Row Crops	$4,317	$2,669	$14,600	$1,374	$192	**$23,151**
Greenhouse/Nursery	$5,467	$1,938	$2,148	<$100	$-	**$9,641**
Fruit and Tree Nuts	$2,114	$963	$3,956	$942	$257	**$8,232**
Citrus	$-	$-	$-	$-	$-	**$-**
Total	**$39,171**	**$15,198**	**$54,265**	**$6,125**	**$1,735**	**$116,494**

Note: Authors' calculations based on analysis of survey data along with observations from previously analyzed tropical cyclone events (Irma [2017], Michael [2018], Ian [2022], Idalia [2023], and Debby [2024]). Values less than $100K are represented as '<$100' in the table.

Production losses associated with animal operations (including beef and dairy cattle, poultry, goats, shellfish aquaculture, apiculture, etc.) and producers of animal products (milk, eggs, honey) in the affected area are estimated at $43.8 million. These losses stem from damage to fencing and livestock housing structures (barns, sheds, poultry houses, goat shelters, etc.), damaged aquaculture structures, loss of feed and hay due to water damage and contamination, power outages disrupting water pumps and cooling systems, and delays in securing and marketing livestock. Damages such as roofs blown off chicken houses were reported, with the extent estimated at 1 in 7 broiler houses in Florida damaged or destroyed (Munch, 2024). Some operations reported downed trees damaging fences and obstructing pasture access. Beef and dairy cattle operations reported stressed or injured cattle, with several producers reporting calf loss and minimal but expected increase in mortality over time due to forage loss and illness. Apiculture operations experienced hive losses due to water damage, wind, and debris. In some dairy operations, the stress from the storm and loss of electricity to the housing and cooling systems was reported to have caused a drop in milk production that could potentially persist for months (Bohnert, 2024). Shellfish aquaculture operations reported salinity issues, water quality issues, and closure of access to aquaculture lease areas during the hurricane.

Production losses for operations within the Vegetables, Melons, and Potatoes commodity group in the affected area are estimated at $31.6 million. The losses vary by crop and are heavily dependent on the time since planting as well as the ability (or inability) to harvest prior to the

hurricane event or to replant damaged or destroyed crops after the event. Survey responses described wind damage that stripped leaves, blooms, and immature fruit from crops such as tomatoes, peppers, and melons. Some growers also reported damage to plastic mulch and planting beds, requiring repairs before replanting. Acres of sweet corn knocked over from winds, excessive rainfall, and flooding further delayed harvests and pest management in vegetable fields, increasing the risk of disease and quality loss (Schnabel, 2024; Turner, 2024). While some growers delayed planting due to previous impacts from Hurricane Debby, those with crops already in the ground faced varying degrees of impact. Even relatively low levels of damage across large acreages of high-value vegetables can lead to significant cumulative losses.

Field and Row Crop production losses ($23.2 million) in the affected area are largely due to strong winds that bent, lodged, or completely flattened crop stalks, reducing yield and quality. Survey respondents reported severe damage to crops such as millet and peas, as well as concerns about disease development and harvest delays in flooded peanut fields. There were also reports that infrastructure damaged by Hurricane Helene, such as broken irrigation systems, flipped semi-trailers, and damaged fences impeded the ability of producers to water or harvest some fields as scheduled. Delays and disruptions of harvest can impact overall crop yields and quality in these fields.

Production losses associated with Greenhouse/Nursery operations in the affected area are estimated at $9.6 million, which occurred due to damaged hoop houses, greenhouse structures, and nursery infrastructure as well as loss of electricity, which is critically important to these operations for cooling and irrigation. Survey responses reported that high winds ripped plastic coverings off greenhouses and hoop houses, and in some cases, entire structures collapsed. The resulting exposure left plants vulnerable to wind, rain, pests, and extreme temperatures, leading to the loss of both young and mature plants. Power loss further exacerbated plant stress by disrupting irrigation and ventilation. Additional damage to fans, shade structures, and irrigation systems was also reported, highlighting the sensitivity of greenhouse and nursery operations to storm impacts.

Fruit and Tree Nuts production losses in the affected area are estimated at $8.2 million. These losses can be attributed primarily to fruit drop and tree or plant damage caused by strong winds, as well as damaged infrastructure (irrigation equipment, storage sheds, etc.) reducing overall farm productivity. Persimmon growers reported severe fruit drop, defoliation, and significant tree damage, including broken limbs and uprooted trees. Pecan producers also reported the loss of mature trees due to storm impacts, which may affect long-term productivity.

Production losses for Citrus in the affected area are estimated at $0. There were no reports of significant or widespread losses for oranges and grapefruit due to Hurricane Helene.

Agricultural Losses by County

The top five counties in terms of agricultural losses were Suwannee ($25.1 million), Madison ($15.7 million), Lafayette ($8.4 million), Hamilton ($6.9 million), and Jefferson ($6.7 million), as shown in Figure 5 and Table A-4 in Appendix A. Losses were generally higher in counties that experienced higher intensity hurricane conditions, where the value of agricultural production in the path of the storm was high, or where both of these conditions were met. County-level losses by commodity group are shown in Figure 6 and Table A-4. The counties with the highest Animals and Animal Products losses were Suwannee ($14.2 million), Lafayette ($6.1 million), Madison ($5.6 million), Gilchrist ($2.9 million), and Marion ($2.2 million). The top five counties in terms of Vegetables, Melons, and Potatoes losses were Manatee ($6.0 million), Suwannee ($4.7 million), Madison ($3.8 million), Charlotte ($3.4 million), and Hamilton ($3.3 million). The highest losses associated with Field and Row Crops were in Madison ($5.0 million), Suwannee ($4.1 million), Hamilton ($2.1 million), Jackson ($2.1 million), and Lafayette ($1.8 million).

Additional Considerations

This report focuses on the assessment of statewide production losses for the calendar year 2024 or marketing year 2024–2025 for agricultural operations in Florida due to Hurricane Helene. The value of the following categories of damages or losses are not included in these estimates and should be considered in addition to production losses suffered by impacted agricultural producers:

- Value of damages to agriculture-related infrastructure (including perennial plantings and lost/deceased animals that are used to produce animal products) that will need to be repaired or replaced.
- Value of stored inputs (seed, fertilizer, etc.) or stored harvested products that were damaged or destroyed.
- Expenses related to Hurricane Helene-specific preparations ahead of the storm and expenses related to clean-up after the storm.
- Value of production losses that might carry over into calendar year 2025, marketing season 2025–2026, or beyond due to damages to agriculture-related infrastructure or other effects of the storm.
- Production losses for agricultural operations that specialize in post-harvest processing, packing, or

distribution that might be impacted as a result of impacts to production agriculture operations (e.g., operations specializing in peanut drying, cotton ginning, seafood packaging and distribution, etc.).

- Value of timber- or forestry-related losses, which were assessed by the Florida Forest Service at $114 million. The preliminary Florida Forest Service report has been published by the Florida Forestry Association.
- Value of production losses to capture fisheries; however production loss estimates in this report do include shellfish and finfish aquaculture as these operations are considered agriculture. Capture fisheries might be covered by surveys conducted by other organizations.

It is also important to note that the estimates of production losses represent the estimated total value of agriculture-related production losses due to Hurricane Helene and do not account for the fact that some crop losses might be eligible for or covered by crop insurance or other risk management tools available to producers.

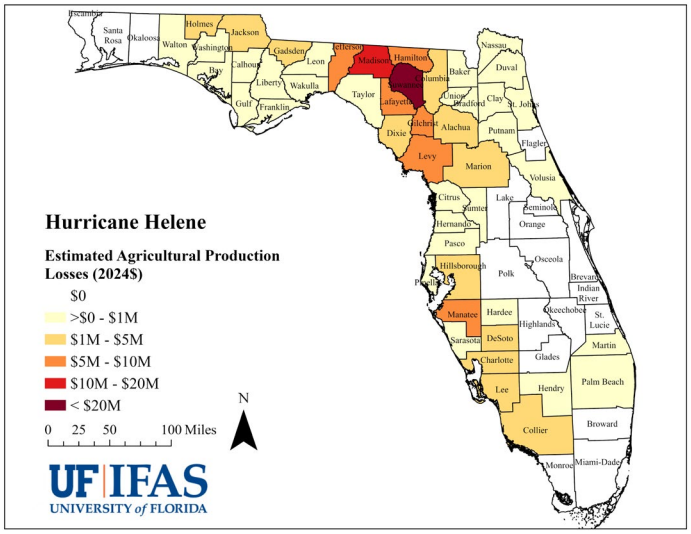

Figure 5. *Estimated total county-level agricultural production losses due to Hurricane Helene (2024$).*

Note: Authors' calculations based on analysis of survey data along with observations from previously analyzed tropical cyclone events (Irma [2017], Michael [2018], Ian [2022], Idalia [2023], and Debby [2024]).

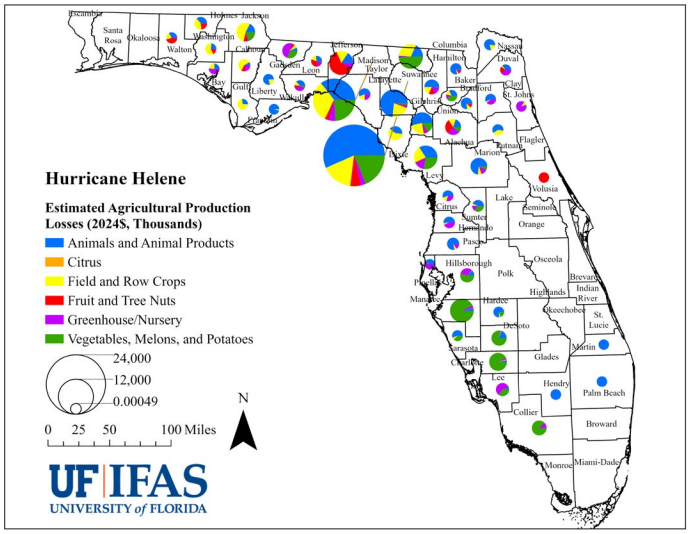

Figure 6. *Estimated county-level agricultural production losses due to Hurricane Helene by commodity group (2024$, Thousands).*

Note: Authors' calculations based on analysis of survey data along with observations from previously analyzed tropical cyclone events (Irma [2017], Michael [2018], Ian [2022], Idalia [2023], and Debby [2024]).

AGRICULTURAL DAMAGES IN FLORIDA

Agricultural damages include both asset damages (buildings, equipment, perennial plantings, and livestock structures, etc.) and production-related damages (stored feed, stored fertilizer, harvested and stored crops, etc.). This final damage assessment builds upon the preliminary assessment of agricultural damages caused by Hurricane Helene. While the core methodology and agricultural baseline data remain consistent with the preliminary report, key inputs on wind speed zones and flood depth and extent have been updated based on newly available data. Consequently, the estimates on agricultural buildings and infrastructure that might have been impacted have been revised accordingly. For a detailed explanation of the data sources and methodology, please refer to the preliminary report on agricultural damages from Hurricane Helene (Court et al., 2024a).

As noted in the preliminary report, these figures represent the value of assets that experienced wind, precipitation, and/or flooding associated with Hurricane Helene, and do not provide any information on impacts or repair or replacement costs associated with any damage or destruction to these assets as a result of conditions experienced.

Due to data limitations and survey design, in which supplemental questions on damages were optional, not all producers provided responses on agricultural damages. The reported damages to infrastructure include conservation structures, farm equipment, fences, perennial plantings, greenhouse and other growing structures, homes, irrigation systems, livestock sheds, livestock watering points, pallets, and storage structures. The reported damages to stored agricultural inputs include fertilizer, feed grain, pesticides, animal medicine, and seeds. Some respondents also

reported seeds being blown off fields by strong winds and erosion of pastureland. The damages to stored harvested products from the survey include reported damages to stored meat, eggs, milk, hay, and millet.

Agriculture-Related Buildings

While precise statewide damage estimates could not be developed, available data allow for an assessment of the scale of agricultural infrastructure and assets at risk. With the updated weather event data, the updated affected square footage of agricultural structure footprints by HCII level is provided in Figure 7. Note that the square footage represents only the structures' footprints and does not account for square footage on floors above the first level in multi-story structures. The footprint of structures on the Florida agricultural lands affected by moderate-intensity conditions (HCII levels 4–9) and high-intensity conditions (HCII levels 10–15) is 20.4 million square feet and 0.35 million square feet, respectively. As a comparison, the total footprint of agricultural structures in the path of moderate- and high-intensity conditions during Hurricane Helene is about 16 times larger than the footprint of The Pentagon in Arlington, VA, including the area encompassed by the central courtyard.

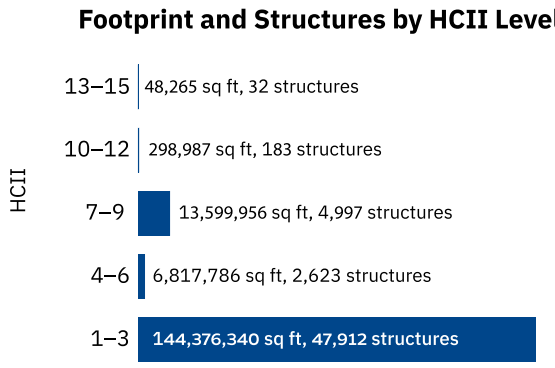

Figure 7. *Number of structures and area of footprint on Florida agricultural lands by HCII level.*

Note: Square footage represents the building footprint only and does not account for square footage on floors above the first level in multi-story structures. Structures with a footprint of less than 450 square feet are not included in the database.
Source: FEMA USA Structures geospatial data (gis-fema.hub.arcgis.com/pages/usa-structures).

In terms of estimated value (adjusted to 2024 dollars), agricultural buildings at risk were valued at approximately $5.5 billion in areas that experienced moderate-intensity conditions (HCII 4–9) and $531.9 million in areas that experienced high-intensity conditions (HCII 10–15), as shown in Figure 8.

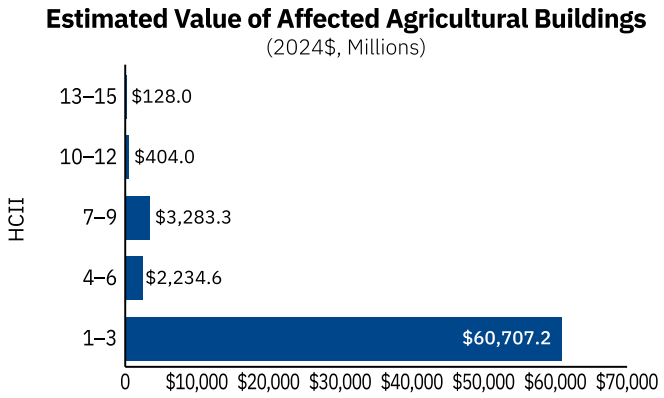

Figure 8. *Estimated value of affected agricultural buildings by HCII level.*

Agriculture-Related Machinery and Equipment

In terms of estimated value (adjusted to 2024 dollars), agricultural machinery and equipment at risk were valued at approximately $484.7 million in areas that experienced moderate-intensity conditions (HCII 4–9), and $44.0 million in areas that experienced high-intensity conditions (HCII 10–15), as shown in Figure 9.

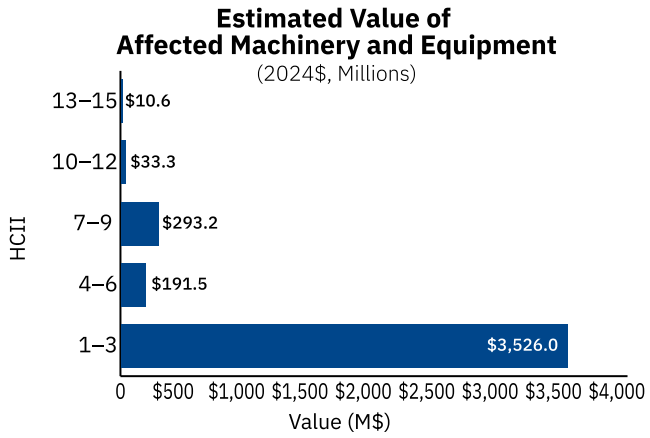

Figure 9. *Estimated value of affected agricultural machinery and equipment by HCII level.*

Irrigation System

Over the agricultural lands affected by Hurricane Helene (approximately 6.2 million acres), there were about 1.7 million acres of irrigated agricultural lands, shown in Table 6. There are over 131,000 acres of irrigated agricultural lands that experienced Category 4 hurricane conditions, about 90% of which employ center pivot/lateral move irrigation systems, which are vulnerable to wind damage. Around 34,700 acres of irrigated agricultural lands might have experienced flooding, less than 6% of which employ micro spray, gravity systems, or drip irrigation systems.

Table 6. *Estimated affected irrigated acreage by Hurricane Helene, categorized by irrigation system by HCII level.*

Commodity Group	Hurricane Composite Intensity Index (HCII)					Total
	1–3	4–6	7–9	10–12	13–15	
Gravity Systems	865,453	-	38	-	-	**865,491**
Micro Spray	381,341	492	405	8	-	**382,246**
Center Pivot / Lateral Move	108,147	33,473	84,789	5,761	422	**232,593**
Drip	126,387	3,917	5,383	212	2	**135,900**
Impact Sprinkler	27,466	487	226	5	-	**28,184**
Container Nursery	25,968	478	437	30	2	**26,915**
Traveling Gun	20,530	802	1,886	75	-	**23,293**
Total	**1,555,292**	**39,648**	**93,164**	**6,092**	**425**	**1,694,621**

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APPENDIX A

Table A-1. *Estimated acreage of affected agricultural lands by commodity group in each county of Florida.*

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
Alachua	89,398	-	31,930	1,656	1,195	691	**124,870**
Baker	11,513	-	1,134	<100	149	<100	**12,865**
Bay	22,618	-	1,920	-	<100	-	**24,548**
Bradford	19,940	-	5,347	<100	<100	<100	**25,457**
Brevard	86,405	254	6,833	-	457	-	**93,949**
Broward	3,990	-	151	<100	445	705	**5,307**
Calhoun	12,794	-	23,004	108	<100	-	**35,916**
Charlotte	101,665	4,764	2,522	-	<100	9,427	**118,416**
Citrus	27,271	<100	2,204	-	176	-	**29,686**
Clay	15,087	-	490	-	274	-	**15,851**
Collier	58,943	15,305	2,057	<100	601	31,901	**108,809**
Columbia	42,744	-	20,053	380	265	<100	**63,530**
DeSoto	164,581	51,800	2,731	-	466	4,737	**224,315**
Dixie	19,929	-	8,987	-	<100	106	**29,031**
Duval	12,705	-	874	129	295	-	**14,002**
Flagler	24,117	-	2,016	-	486	1,474	**28,094**
Franklin	108	-	<100	-	-	-	**135**
Gadsden	15,607	-	11,892	172	799	1,052	**29,521**
Gilchrist	32,691	-	32,734	<100	234	993	**66,728**
Glades	206,743	1,498	45,336	-	531	987	**255,095**
Gulf	25,905	-	2,196	-	361	-	**28,462**
Hamilton	23,292	-	19,962	-	252	3,135	**46,641**
Hardee	184,885	36,017	2,989	-	1,439	2,214	**227,543**
Hendry	260,315	27,813	114,900	<100	5,384	27,514	**435,951**
Hernando	31,766	<100	1,929	<100	663	-	**34,398**
Highlands	272,583	40,737	11,540	<100	2,842	3,696	**331,428**
Hillsborough	75,835	713	2,422	-	1,502	7,067	**87,540**
Holmes	30,499	-	35,989	497	<100	<100	**67,044**
Indian River	57,863	7,251	1,888	-	1,107	3,048	**71,157**
Jackson	57,965	-	103,693	347	530	1,384	**163,918**
Jefferson	26,410	-	14,890	2,551	1,019	<100	**44,880**
Lafayette	20,760	-	19,678	<100	324	190	**40,988**
Lake	98,777	3,593	3,845	198	3,764	342	**110,519**
Lee	34,537	1,055	301	<100	2,238	3,276	**41,490**
Leon	10,938	-	2,724	107	<100	<100	**13,820**
Levy	99,069	-	42,708	<100	1,750	3,366	**146,945**
Liberty	4,465	-	1,666	-	<100	-	**6,142**
Madison	50,564	-	44,782	202	345	2,177	**98,070**
Manatee	81,566	2,574	4,022	-	1,689	29,918	**119,770**
Marion	204,928	237	15,334	<100	1,514	536	**222,615**
Martin	108,047	-	24,646	<100	3,029	9,506	**145,239**
Miami-Dade	3,614	-	6,753	10,496	19,578	14,686	**55,127**
Monroe	<100	-	-	-	-	-	**<100**
Nassau	15,457	-	3,182	-	<100	<100	**18,753**
Okeechobee	312,303	1,865	4,411	-	857	4,101	**323,536**
Orange	74,008	110	594	-	1,314	167	**76,192**
Osceola	444,886	2,650	4,895	-	1,666	3,115	**457,212**
Pasco	76,727	477	5,000	<100	560	<100	**82,782**
Palm Beach	14,960	-	400,112	<100	5,317	10,224	**430,637**
Pinellas	503	-	<100	-	<100	-	**533**
Polk	221,183	58,516	4,375	<100	1,312	238	**285,690**
Putnam	39,894	<100	9,272	<100	2,206	909	**52,341**
Sarasota	48,841	16,378	1,216	-	373	1,056	**67,863**
Seminole	18,662	623	275	-	675	<100	**20,252**

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
St. Lucie	91,398	101	1,060	920	1,692	10,853	**106,023**
St. Johns	8,194	-	8,154	-	204	3,181	**19,733**
Sumter	87,937	-	5,406	-	778	952	**95,073**
Suwannee	62,784	-	58,688	935	1,397	4,268	**128,073**
Taylor	18,094	-	1,139	-	215	-	**19,448**
Union	17,978	-	5,501	<100	<100	383	**23,896**
Volusia	48,981	270	2,287	<100	6,514	<100	**58,111**
Wakulla	4,416	-	1,205	<100	<100	<100	**5,697**
Walton	9,079	-	8,363	489	<100	-	**17,966**
Washington	19,752	-	16,929	113	<100	<100	**36,850**
Total	**4,369,477**	**274,705**	**1,223,183**	**20,002**	**81,286**	**203,828**	**6,172,481**

Note: Acreage less than 100 are represented as '<100' in the table.

Table A-2. *The area-weighted intensity of wind, precipitation, and flood, HCII, and percentage of affected agricultural land in each county.*

County	Area-Weighted Wind Speed Index	Area-Weighted Precipitation Index	Area-Weighted Flood Index	Area-Weighted HCII	% Affected Agricultural Land
Alachua	2.00	0.16	0.10	2.27	100%
Baker	2.00	0.00	0.05	2.05	100%
Bay	1.00	1.91	0.00	2.91	100%
Bradford	2.00	0.00	0.04	2.04	100%
Brevard	1.00	0.00	0.00	1.00	100%
Broward	1.00	0.00	0.00	1.00	100%
Calhoun	1.00	1.90	0.37	3.26	100%
Charlotte	1.00	0.67	0.00	1.67	100%
Citrus	2.00	0.00	0.00	2.00	100%
Clay	1.96	0.00	0.00	1.96	100%
Collier	1.00	0.05	0.00	1.05	100%
Columbia	3.68	0.00	0.14	3.82	100%
DeSoto	1.00	0.49	0.00	1.49	100%
Dixie	6.00	0.91	0.39	7.31	100%
Duval	1.96	0.00	0.01	1.97	100%
Flagler	1.00	0.00	0.00	1.00	100%
Franklin	1.55	2.72	1.03	5.31	100%
Gadsden	1.01	1.71	0.12	2.84	100%
Gilchrist	4.82	0.06	0.24	5.12	100%
Glades	1.00	0.00	0.00	1.00	100%
Gulf	1.00	2.13	0.06	3.19	100%
Hamilton	6.00	0.80	0.55	7.35	100%
Hardee	1.00	0.04	0.00	1.04	100%
Hendry	1.00	0.00	0.00	1.00	100%
Hernando	1.97	0.07	0.00	2.04	100%
Highlands	1.00	0.00	0.00	1.00	100%
Hillsborough	1.07	0.13	0.00	1.20	100%
Holmes	1.00	1.25	0.00	2.25	98%
Indian River	1.00	0.00	0.00	1.00	100%
Jackson	1.00	1.70	0.41	3.11	100%
Jefferson	4.44	1.24	0.27	5.95	100%
Lafayette	6.00	0.87	0.42	7.29	100%
Lake	1.00	0.00	0.00	1.00	100%
Lee	1.00	0.53	0.00	1.53	100%
Leon	1.99	1.03	0.19	3.21	100%
Levy	3.28	0.23	0.21	3.72	100%

County	Area-Weighted Wind Speed Index	Area-Weighted Precipitation Index	Area-Weighted Flood Index	Area-Weighted HCII	% Affected Agricultural Land
Liberty	1.00	2.21	0.27	3.48	100%
Madison	6.00	1.00	0.40	7.40	100%
Manatee	1.02	0.24	0.00	1.26	100%
Marion	1.94	0.01	0.00	1.95	100%
Martin	1.00	0.01	0.00	1.01	100%
Miami-Dade	1.00	0.00	0.00	1.00	100%
Monroe	1.00	0.00	0.00	1.00	100%
Nassau	2.00	0.00	0.02	2.02	100%
Okeechobee	1.00	0.00	0.00	1.00	100%
Orange	1.00	0.00	0.00	1.00	100%
Osceola	1.00	0.00	0.00	1.00	100%
Palm Beach	1.00	0.00	0.00	1.00	100%
Pasco	1.72	0.01	0.00	1.73	100%
Pinellas	2.00	0.52	0.00	2.52	100%
Polk	1.00	0.00	0.00	1.00	100%
Putnam	1.40	0.05	0.00	1.45	100%
Sarasota	1.00	0.53	0.00	1.53	100%
Seminole	1.00	0.00	0.00	1.00	100%
St. Lucie	1.00	0.00	0.00	1.00	100%
St. Johns	1.02	0.00	0.00	1.02	100%
Sumter	1.47	0.00	0.00	1.47	100%
Suwannee	6.00	0.57	0.31	6.88	100%
Taylor	6.00	0.99	0.58	7.58	100%
Union	2.00	0.00	0.10	2.10	100%
Volusia	1.00	0.00	0.00	1.00	100%
Wakulla	1.99	1.14	0.60	3.73	100%
Walton	1.00	0.81	0.00	1.81	33%
Washington	1.00	1.35	0.01	2.36	100%

Table A-3. *Estimated value of annual production (2024$, Thousands) on affected agricultural lands by commodity group in each county of Florida.*

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
Alachua	$24,897	$-	$17,812	$15,486	$29,835	$6,118	**$94,148**
Baker	$14,265	$-	$959	$284	$1,601	$293	**$17,402**
Bay	$1,253	$-	$1,236	$-	$2,688	$-	**$5,177**
Bradford	$18,603	$-	$2,698	$759	$545	$186	**$22,792**
Brevard	$12,593	$504	$6,137	$-	$37,397	$-	**$56,632**
Broward	$2,511	$-	$148	$155	$35,880	$6,651	**$45,346**
Calhoun	$2,749	$-	$15,726	$1,119	$8,860	$-	**$28,453**
Charlotte	$7,699	$9,448	$2,512	$-	$6,312	$91,446	**$117,418**
Citrus	$6,085	<$100	$1,603	$-	$3,249	$-	**$11,005**
Clay	$4,736	$-	$364	$-	$3,060	$-	**$8,161**
Collier	$9,229	$30,392	$1,962	<$100	$49,340	$475,707	**$566,656**
Columbia	$30,539	$-	$11,182	$3,399	$6,979	$740	**$52,838**
DeSoto	$48,702	$102,836	$1,935	$-	$17,869	$50,667	**$222,009**
Dixie	$6,587	$-	$6,966	$-	<$100	$314	**$13,900**
Duval	$6,023	$-	$665	$1,233	$6,636	$-	**$14,556**
Flagler	$2,479	$-	$1,441	$-	$2,911	$14,443	**$21,274**
Franklin	$448	$-	<$100	$-	$-	$-	**$468**
Gadsden	$6,792	$-	$7,483	$1,782	$52,435	$13,410	**$81,902**
Gilchrist	$65,266	$-	$21,872	$677	$3,398	$8,660	**$99,873**
Glades	$26,417	$2,975	$93,305	$-	$3,644	$13,491	**$139,832**
Gulf	$1,121	$-	$1,373	$-	$-	$-	**$2,493**

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
Hamilton	$12,813	$-	$13,686	$-	$1,623	$30,735	**$58,855**
Hardee	$90,121	$71,483	$2,401	$-	$36,390	$24,037	**$224,432**
Hendry	$24,914	$55,230	$233,565	$271	$8,534	$294,289	**$616,803**
Hernando	$14,151	<$100	$1,262	<$100	$11,190	$-	**$26,705**
Highlands	$66,609	$80,894	$13,953	$272	$48,735	$34,861	**$245,324**
Hillsborough	$55,708	$1,406	$1,932	$-	$115,833	$76,518	**$251,398**
Holmes	$19,535	$-	$21,938	$4,962	$356	<$100	**$46,853**
Indian River	$11,454	$14,399	$1,129	$-	$9,171	$33,250	**$69,402**
Jackson	$26,473	$-	$77,701	$3,594	$3,035	$14,623	**$125,427**
Jefferson	$13,734	$-	$9,391	$24,845	$6,066	<$100	**$54,121**
Lafayette	$65,779	$-	$12,000	$308	$2,141	$1,671	**$81,899**
Lake	$34,299	$7,132	$2,445	$1,640	$154,608	$3,135	**$203,259**
Lee	$7,205	$2,095	$290	$796	$46,479	$45,572	**$102,436**
Leon	$2,243	$-	$1,639	$1,003	$1,573	$141	**$6,600**
Levy	$55,154	$-	$30,544	$465	$18,337	$26,560	**$131,061**
Liberty	$2,533	$-	$947	$-	$-	$-	**$3,480**
Madison	$54,499	$-	$31,625	$1,900	$8,886	$30,164	**$127,073**
Manatee	$43,914	$5,034	$3,348	$-	$41,386	$413,676	**$507,357**
Marion	$118,440	$469	$10,892	$638	$21,041	$4,228	**$155,708**
Martin	$17,123	$-	$49,215	$107	$51,449	$99,027	**$216,921**
Miami-Dade	$11,941	$-	$6,749	$40,688	$726,927	$127,859	**$914,165**
Monroe	$3,460	$-	$-	$-	$-	$-	**$3,460**
Nassau	$11,996	$-	$2,598	$-	$111	$162	**$14,868**
Okeechobee	$211,834	$3,703	$2,223	$-	$18,178	$37,588	**$273,527**
Orange	$7,512	$218	$537	$-	$257,797	$2,742	**$268,807**
Osceola	$39,522	$5,262	$4,595	$-	$25,594	$29,378	**$104,352**
Pasco	$41,334	$943	$3,489	$113	$5,819	<$100	**$51,765**
Palm Beach	$18,722	$-	$828,245	$223	$195,167	$100,587	**$1,142,944**
Pinellas	$899	$-	<$100	$-	$1,220	$-	**$2,138**
Polk	$56,678	$116,130	$3,455	$625	$55,070	$2,303	**$234,262**
Putnam	$20,078	<$100	$7,163	$169	$16,222	$8,832	**$52,533**
Sarasota	$7,276	$32,052	$929	$-	$14,505	$10,125	**$64,887**
Seminole	$2,088	$1,237	$268	$-	$21,408	$167	**$25,169**
St. Lucie	$15,252	$201	$777	$9,527	$14,856	$104,390	**$145,003**
St Johns	$2,663	$-	$5,707	$-	$14,399	$29,854	**$52,624**
Sumter	$30,360	$-	$3,476	$-	$17,838	$8,542	**$60,215**
Suwannee	$172,457	$-	$34,022	$7,996	$7,164	$45,231	**$266,870**
Taylor	$2,731	$-	$604	$-	$1,226	$-	**$4,561**
Union	$6,007	$-	$2,772	<$100	$1,932	$3,327	**$14,093**
Volusia	$15,414	$535	$1,951	$326	$172,129	$150	**$190,503**
Wakulla	$2,031	$-	$647	$152	$1,195	$143	**$4,168**
Walton	$7,901	$-	$4,944	$5,065	$470	$-	**$18,380**
Washington	$4,513	$-	$11,635	$1,170	$615	<$100	**$17,956**
Total	**$1,728,366**	**$544,785**	**$1,644,103**	**$131,866**	**$2,429,346**	**$2,326,231**	**$8,804,696**

Note: Values less than $100K are represented as '<$100' in the table.

Table A-4. *Estimated county-level agricultural losses (2024$, Thousands) due to Hurricane Helene by commodity group.*

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
Alachua	$523	$-	$375	$797	$641	$320	**$2,657**
Baker	$293	$-	<$100	<$100	<$100	<$100	**$374**
Bay	<$100	$-	<$100	$-	<$100	$-	**$103**
Bradford	$378	$-	<$100	<$100	<$100	<$100	**$493**
Brevard	$-	$-	$-	$-	$-	$-	**$-**
Broward	$-	$-	$-	$-	$-	$-	**$-**
Calhoun	<$100	$-	$461	<$100	$180	$-	**$789**
Charlotte	<$100	$-	<$100	$-	$114	$3,357	**$3,615**
Citrus	$122	$-	<$100	$-	<$100	$-	**$219**
Clay	<$100	$-	<$100	$-	<$100	$-	**$158**
Collier	<$100	$-	<$100	$-	$261	$1,835	**$2,103**
Columbia	$1,079	$-	$383	$251	$379	<$100	**$2,145**
DeSoto	$465	$-	<$100	$-	<$100	$1,784	**$2,301**
Dixie	$659	$-	$988	$-	<$100	<$100	**$1,683**
Duval	$116	$-	<$100	<$100	$133	$-	**$325**
Flagler	$-	$-	$-	$-	$-	$-	**$-**
Franklin	<$100	$-	<$100	$-	$-	$-	**<$100**
Gadsden	$155	$-	$155	$119	$1,157	$676	**$2,262**
Gilchrist	$2,895	$-	$1,321	<$100	$306	$838	**$5,427**
Glades	$-	$-	$-	$-	$-	$-	**$-**
Gulf	<$100	$-	<$100	$-	$-	$-	**<$100**
Hamilton	$1,235	$-	$2,114	$-	$163	$3,340	**$6,852**
Hardee	<$100	$-	<$100	$-	$-	<$100	**<$100**
Hendry	<$100	$-	$-	$-	$-	$-	**<$100**
Hernando	$273	$-	<$100	<$100	$224	$-	**$523**
Highlands	$-	$-	$-	$-	$-	$-	**$-**
Hillsborough	$202	$-	<$100	$-	$582	$938	**$1,735**
Holmes	$391	$-	$433	$238	<$100	<$100	**$1,072**
Indian River	$-	$-	$-	$-	$-	$-	**$-**
Jackson	$704	$-	$2,112	$242	$105	$791	**$3,955**
Jefferson	$1,027	$-	$1,066	$4,097	$489	<$100	**$6,688**
Lafayette	$6,146	$-	$1,767	<$100	$221	$182	**$8,378**
Lake	$-	$-	$-	$-	$-	$-	**$-**
Lee	<$100	$-	<$100	<$100	$747	$471	**$1,334**
Leon	<$100	$-	<$100	<$100	<$100	<$100	**$202**
Levy	$2,198	$-	$1,497	<$100	$910	$1,794	**$6,452**
Liberty	<$100	$-	<$100	$-	$-	$-	**$114**
Madison	$5,594	$-	$5,022	$405	$894	$3,765	**$15,680**
Manatee	$215	$-	<$100	$-	$232	$5,983	**$6,444**
Marion	$2,230	$-	$214	<$100	$361	$211	**$3,038**
Martin	<$100	$-	$-	$-	$-	$-	**<$100**
Miami-Dade	$-	$-	$-	$-	$-	$-	**$-**
Monroe	$-	$-	$-	$-	$-	$-	**$-**
Nassau	$242	$-	<$100	$-	<$100	<$100	**$304**
Okeechobee	$-	$-	$-	$-	$-	$-	**$-**
Orange	$-	$-	$-	$-	$-	$-	**$-**
Osceola	$-	$-	$-	$-	$-	$-	**$-**
Pasco	$602	$-	<$100	<$100	$110	<$100	**$763**
Palm Beach	<$100	$-	$-	$-	$-	$-	**<$100**
Pinellas	<$100	$-	<$100	$-	<$100	$-	**<$100**
Polk	$-	$-	$-	$-	$-	$-	**$-**
Putnam	$159	$-	$103	$-	<$100	$-	**$268**
Sarasota	<$100	$-	<$100	$-	<$100	<$100	**$144**
Seminole	$-	$-	$-	$-	$-	$-	**$-**
St. Lucie	$-	$-	$-	$-	$-	$-	**$-**

County	Animals and Animal Products	Citrus	Field and Row Crops	Fruit and Tree Nuts	Greenhouse/ Nursery	Vegetables, Melons, and Potatoes	Total
St. Johns	<$100	$-	<$100	$-	<$100	$-	**<$100**
Sumter	$291	$-	<$100	$-	$104	$235	**$667**
Suwannee	$14,226	$-	$4,107	$1,336	$726	$4,709	**$25,104**
Taylor	$286	$-	<$100	$-	$124	$-	**$505**
Union	$125	$-	<$100	<$100	<$100	$166	**$390**
Volusia	$-	$-	$-	<$100	$-	$-	**<$100**
Wakulla	<$100	$-	<$100	<$100	<$100	<$100	**$181**
Walton	$123	$-	<$100	$162	<$100	$-	**$370**
Washington	<$100	$-	$229	<$100	<$100	<$100	**$386**
Total	**$43,849**	**$-**	**$23,151**	**$8,232**	**$9,641**	**$31,621**	**$116,494**

Note: Authors' calculations based on analysis of survey data along with observations from previously analyzed tropical cyclone events (Irma [2017], Michael [2018], Ian [2022], Idalia [2023], and Debby [2024]). Values less than $100K are represented as '<$100' in the table.

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All photos courtesy of survey respondents.