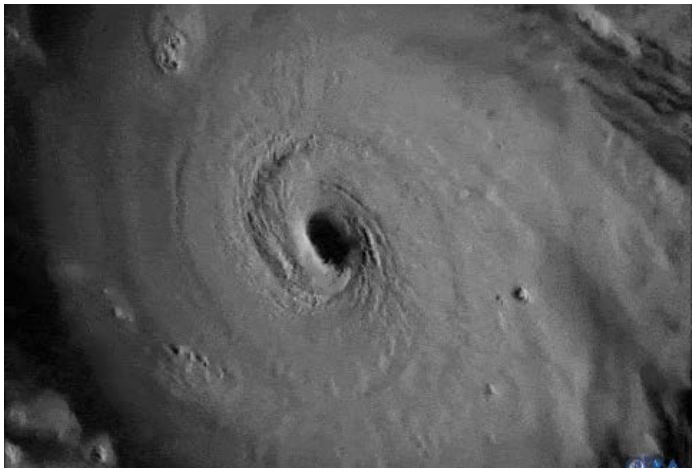
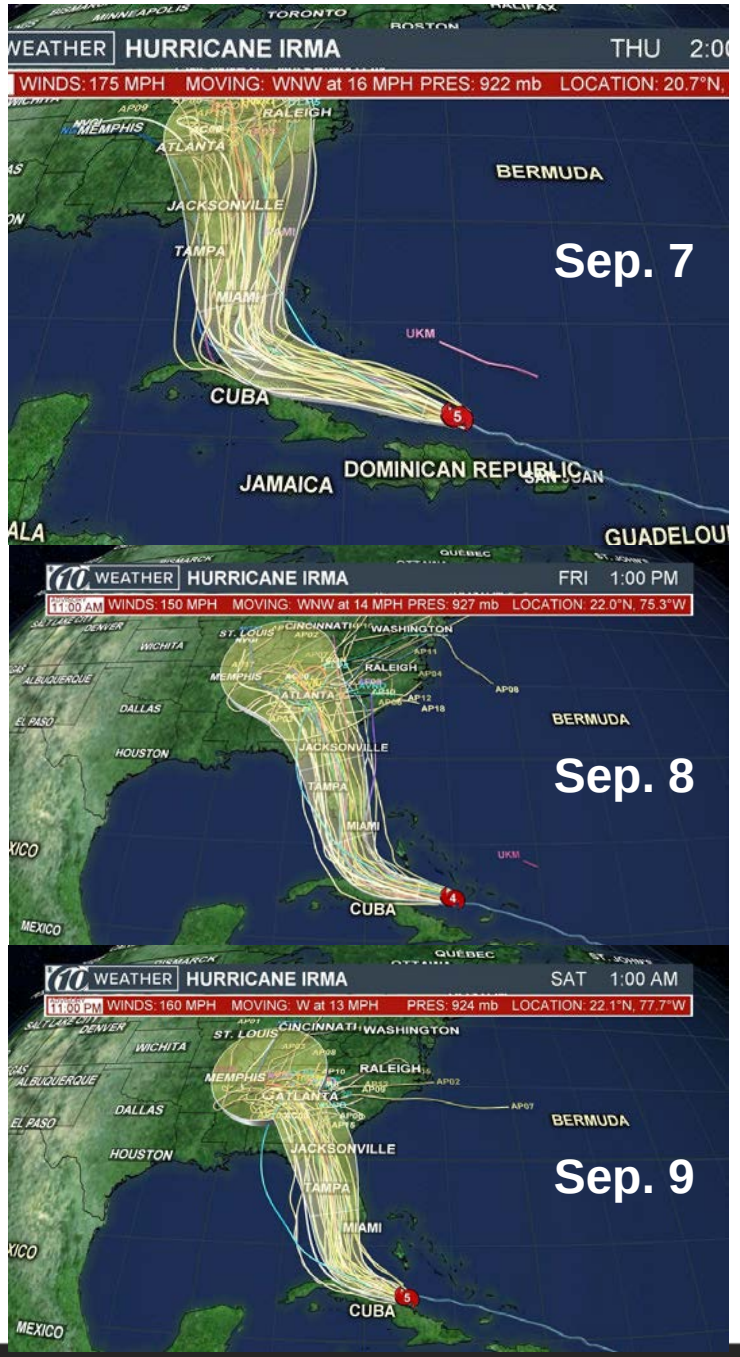
Rapid Assessment of Hurricane Irma's Damages to Florida Agriculture

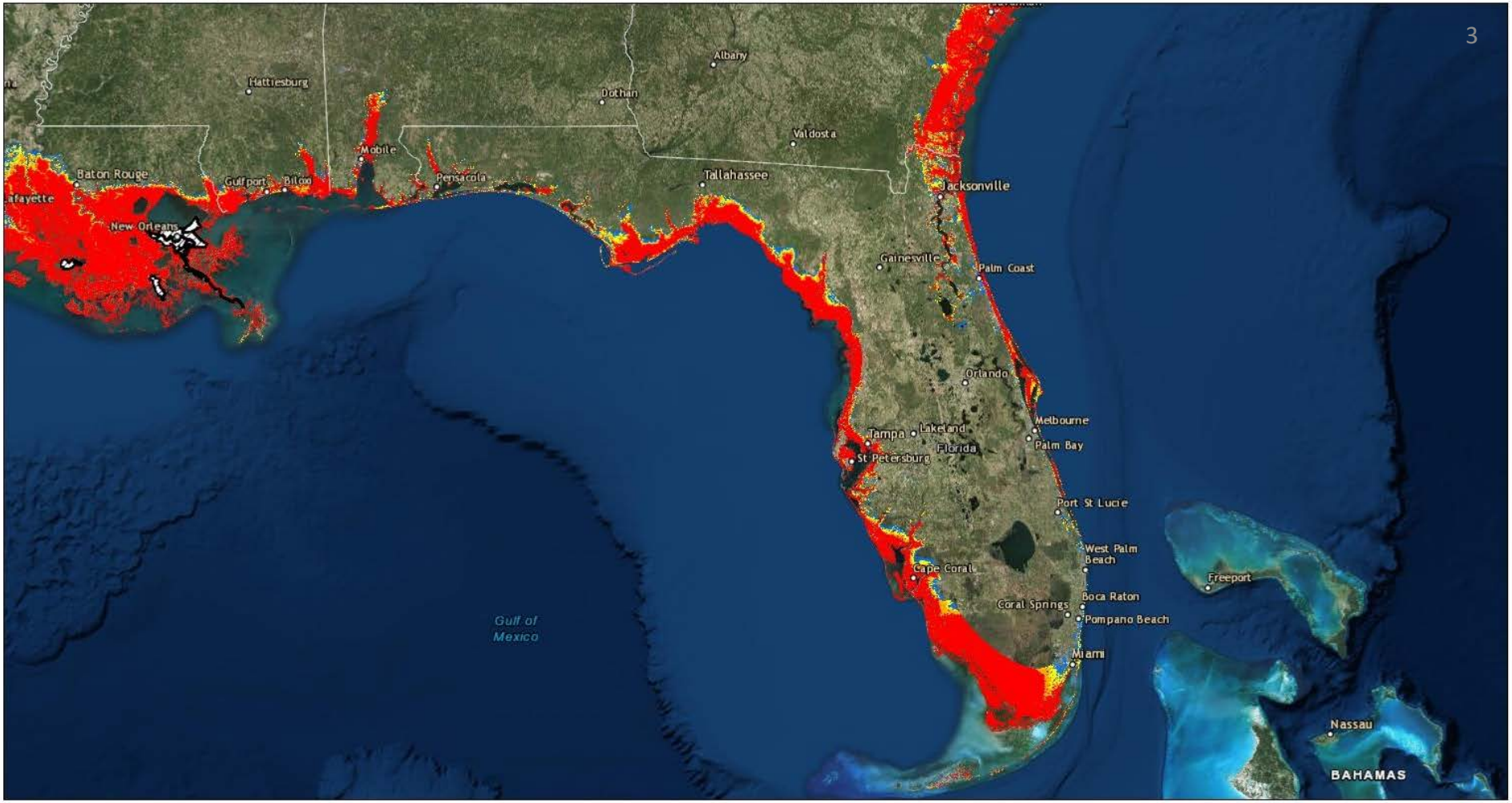


Sergio Alvarez
Chief Economist
Florida Department of Agriculture
and Consumer Services

Hurricane Irma

- Formed Aug. 30
- Cat. 5 – 185 mph max. winds
- Approach put 20+ million Floridians on edge
- Tolls suspended Sep 5
- Schools in Keys close Sep 6; tourists ordered out
- Mandatory evacuations begin Sep 7
- State offices, colleges, and universities close Sep 8





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Inundation Height

- Up to 3 feet above ground
- Greater than 3 feet above ground
- Greater than 6 feet above ground
- Greater than 9 feet above ground
- Leveed Area - Consult Local Officials For Flood Risk

1:4,622,324

0 45 90 180 mi

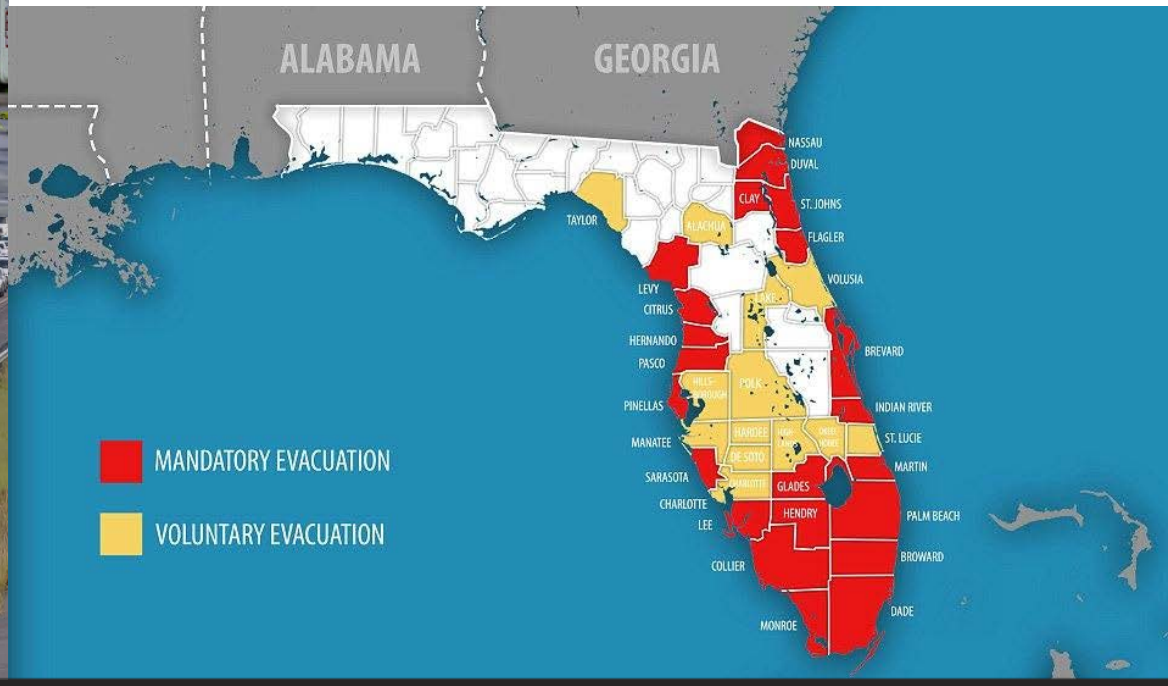
0 90 180 360 km

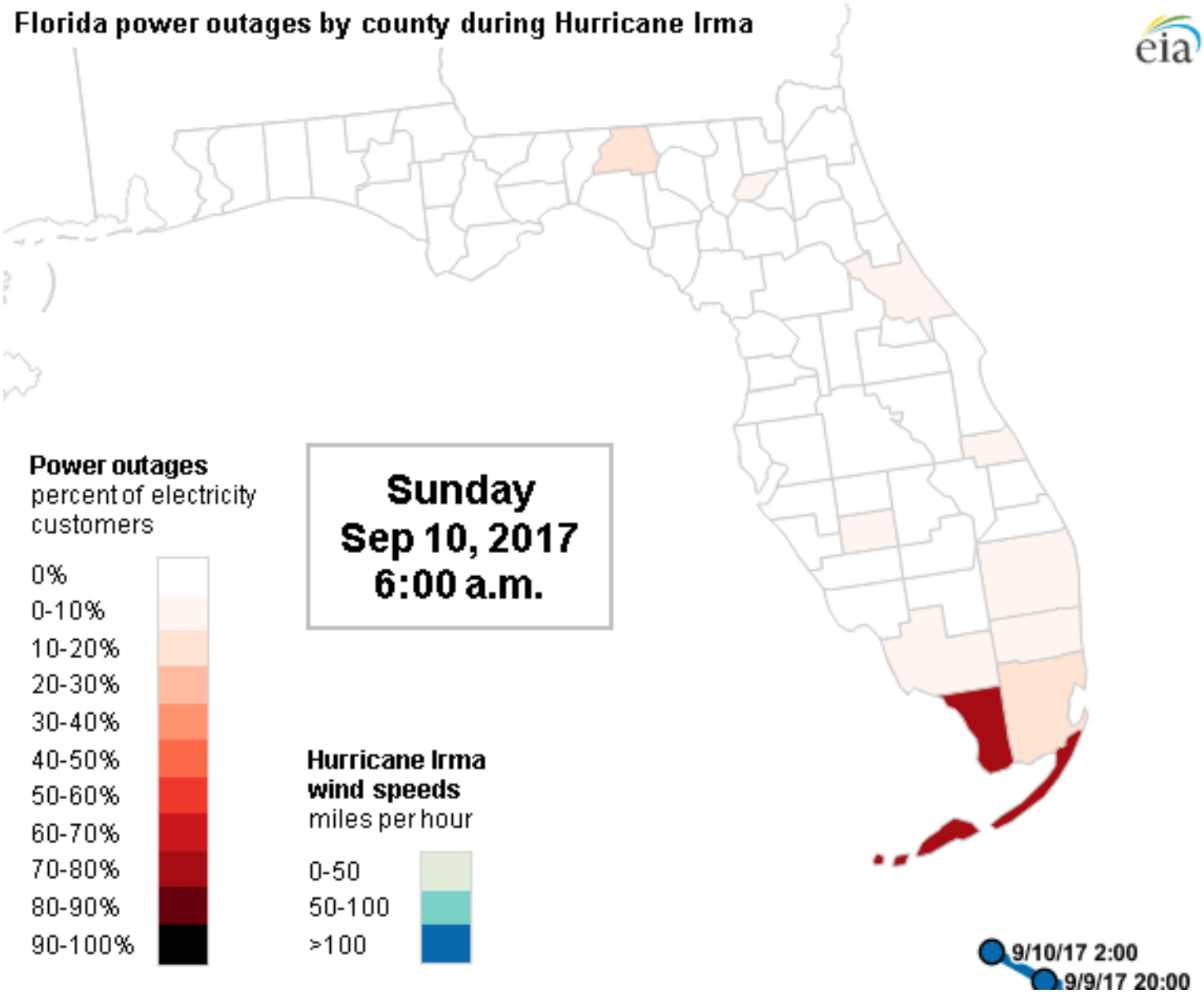
NOAA/NWS/NHC/Storm Surge Unit, NOAA/NOS/Office for Coastal Management
Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

Category 5 Storm Surge Inundation
Source: NOAA

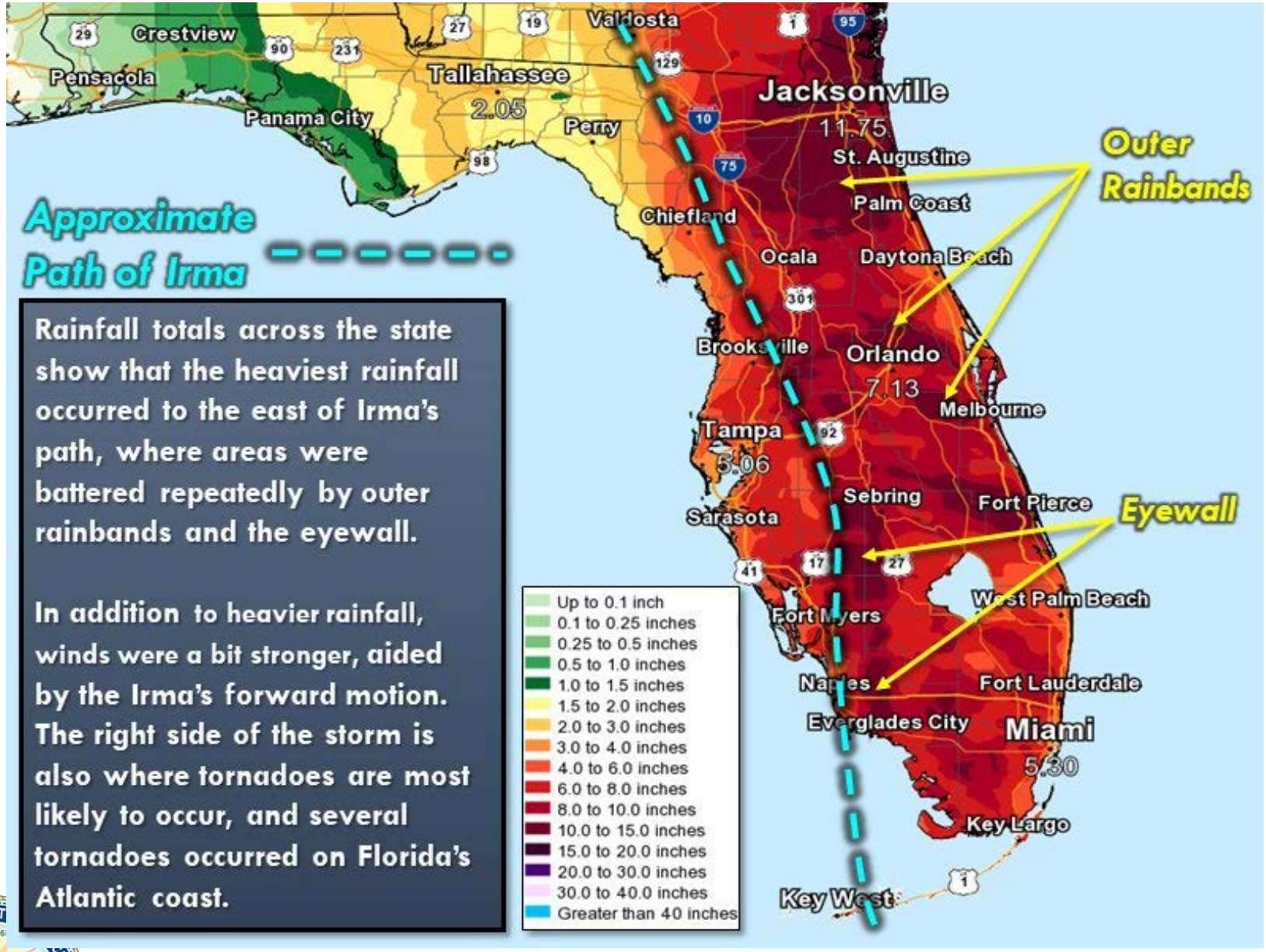
By Sep 10:

- Largest evacuation in US history - ~6 million people
- Widespread fuel shortage
- 189 shelters open (92 special needs)
- 410 healthcare facilities evacuated
- All airports and major seaports closed

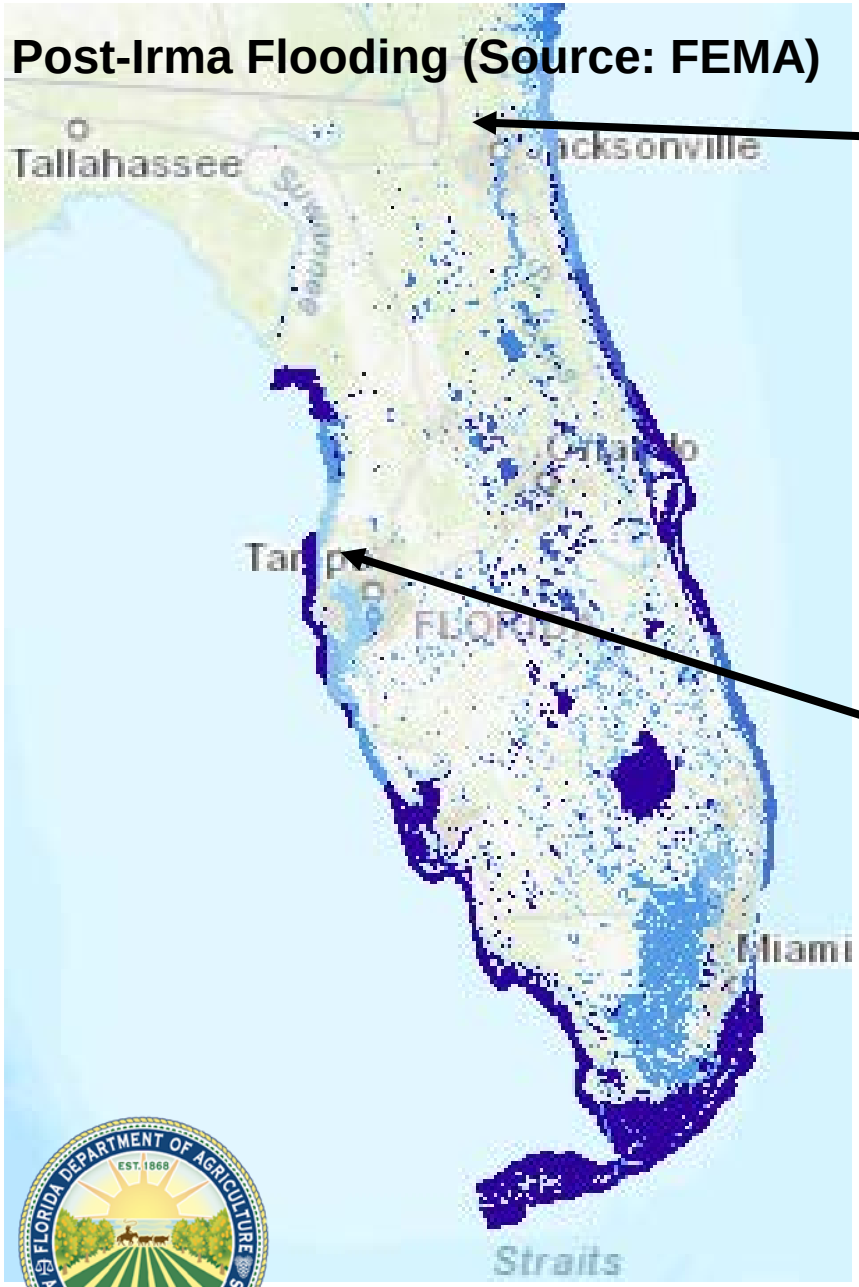


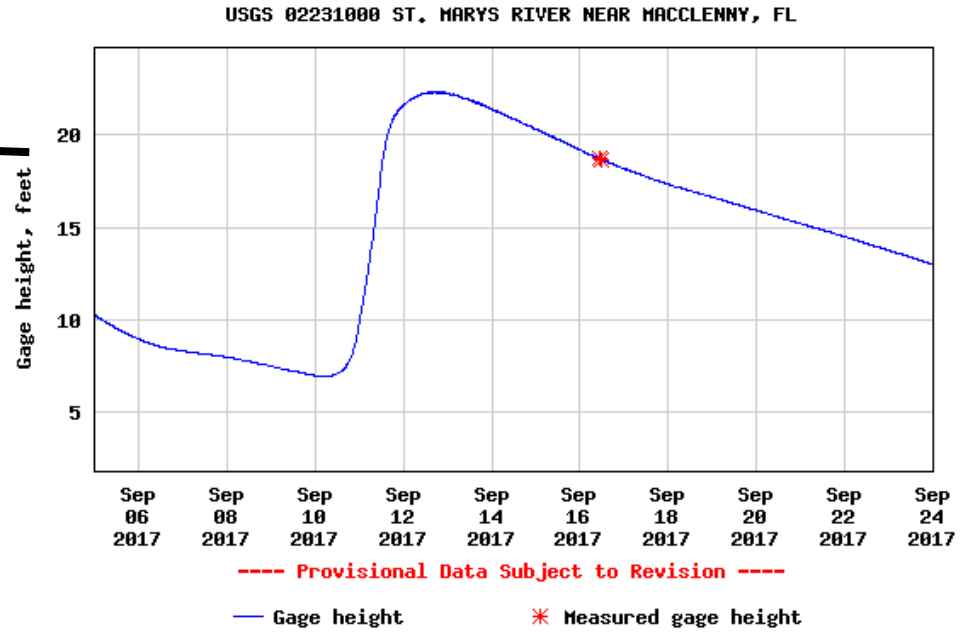


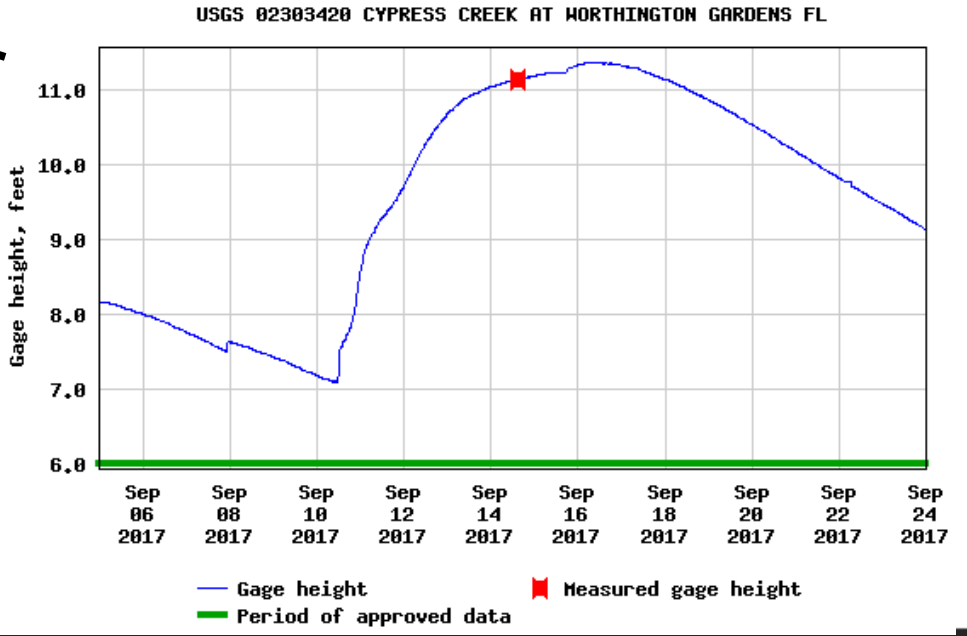
Widespread blackouts show strength of hurricane winds


Crestview
Pensacola
Panama City
Tallahassee
2.05
Perry
Valdosta
Jacksonville
11.75
St. Augustine
Palm Coast
Chiefland
Ocala
Daytona Beach
Brooksville
Orlando
7.13
Melbourne
Tampa
5.06
Sebring
Fort Pierce
Sarasota
West Palm Beach
Fort Myers
Naples
Fort Lauderdale
Everglades City
Miami
5.30
Key Largo
Key West
Approximate Path of Irma
Outer Rainbands
Eyewall
Rainfall totals across the state show that the heaviest rainfall occurred to the east of Irma's path, where areas were battered repeatedly by outer rainbands and the eyewall.
In addition to heavier rainfall, winds were a bit stronger, aided by the Irma's forward motion. The right side of the storm is also where tornadoes are most likely to occur, and several tornadoes occurred on Florida's Atlantic coast.
Up to 0.1 inch
0.1 to 0.25 inches
0.25 to 0.5 inches
0.5 to 1.0 inches
1.0 to 1.5 inches
1.5 to 2.0 inches
2.0 to 3.0 inches
3.0 to 4.0 inches
4.0 to 6.0 inches
6.0 to 8.0 inches
8.0 to 10.0 inches
10.0 to 15.0 inches
15.0 to 20.0 inches
20.0 to 30.0 inches
30.0 to 40.0 inches
Greater than 40 inches

Post-Irma Flooding (Source: FEMA)



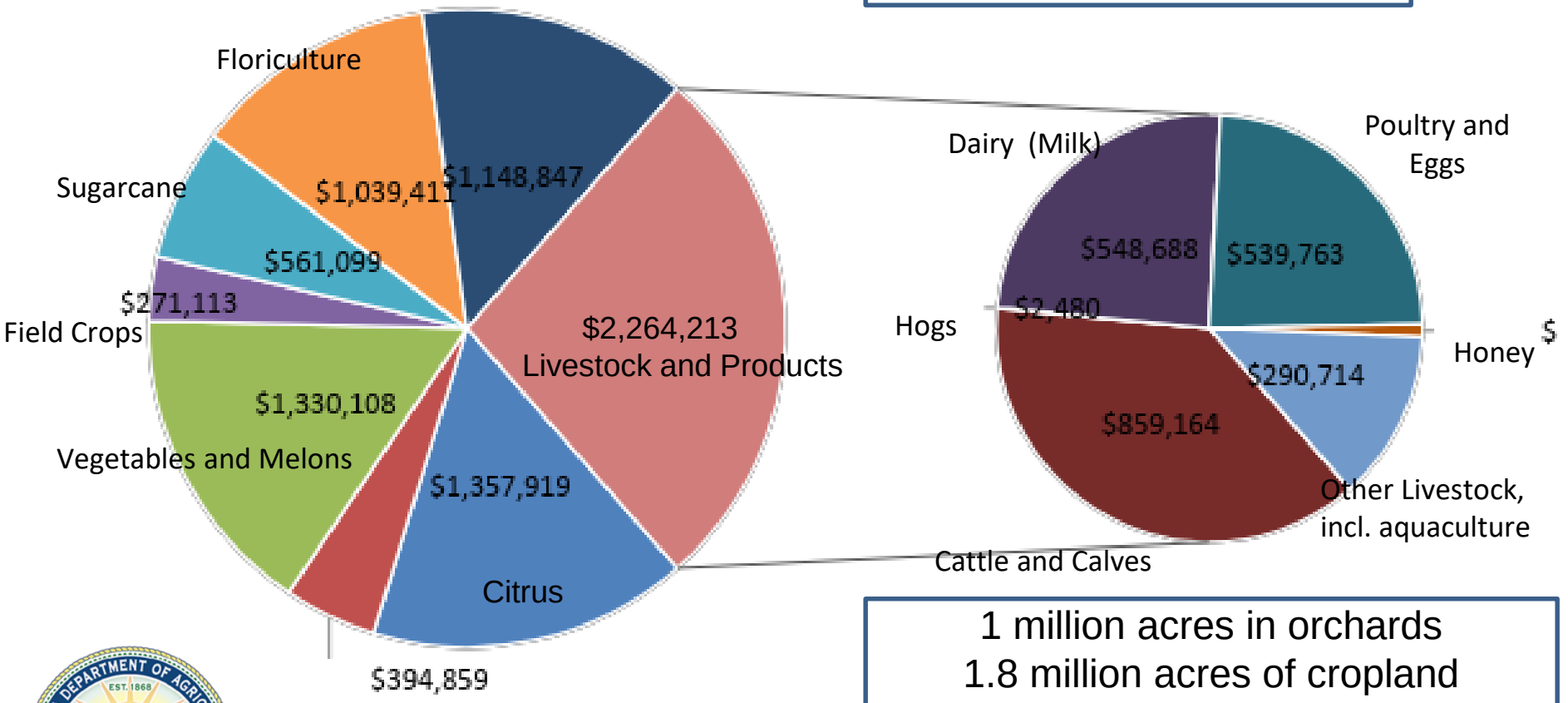




Florida Agriculture is Very Diverse

Florida Farm Cash Receipts, in Thousands (USDA – ERS, 2015)

$8.4 billion in Farm Receipts



1 million acres in orchards
1.8 million acres of cropland
4.3 million acres of pasture/grassland
16.96 million acres of forestland

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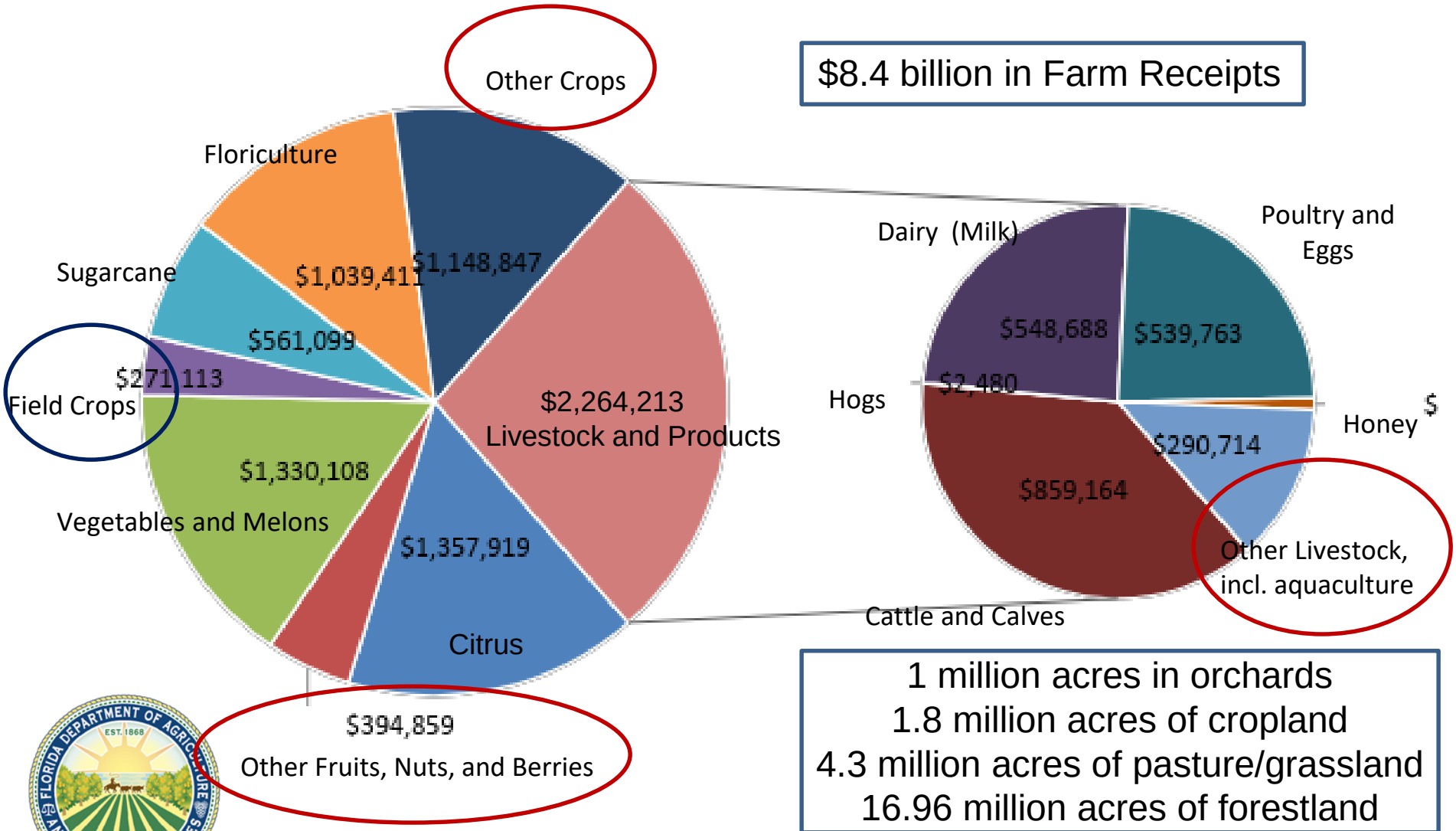
Florida Farm Cash Receipts, in Thousands (USDA – ERS, 2015)



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4.3 million acres of pasture/grassland
16.96 million acres of forestland

Types of losses/costs to Florida Agriculture

GIS Mapping (led by U of F)

Surveys with Industry Leaders (led by FL Dept. of Ag.)

Crop/Product Loss

Crop loss in plant agriculture (including ornamentals and forestry)

Livestock death and weight loss

Spoiled Milk

Loss of Productive Assets

Death or severe damage to trees, brood stock, dairy cows

Loss in Productivity

Yields impacted by higher pest pressure

Livestock reproduction impacted by stress

Other Damages

Forage crop loss leads to expenses in feed

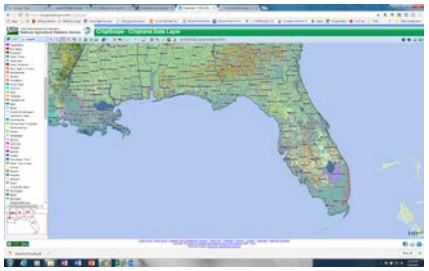
Re-plant, prepare fields

Debris clean-up

Infrastructure, irrigation, fences, roads, equipment

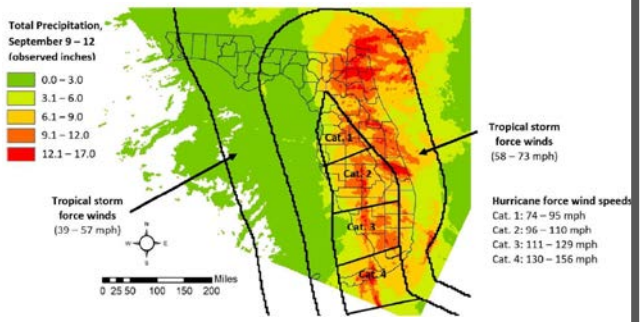
GIS Mapping Approach to Crop/Product Loss

(1)



Geospatial crop acreage database

×



Geospatial wind speed data

=

Crop acreage estimates by wind speed zone

(2)

Crop acreage estimates by wind speed zone

×

Crop damage field estimates/ assumptions by wind speed zone

×

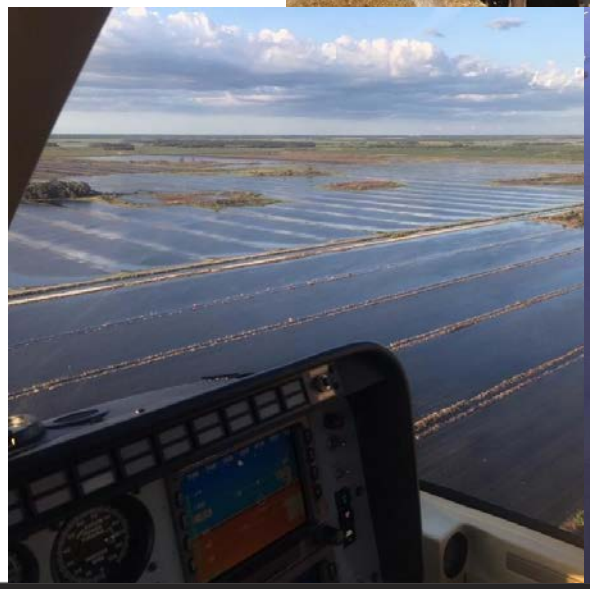
Value per acre assumptions for affected crops

=

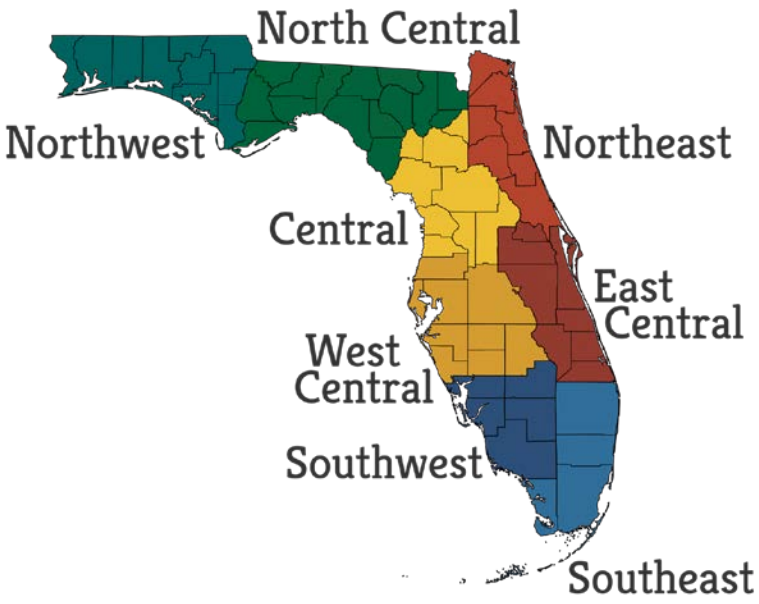
Statewide estimates of crop damage

Challenges of the GIS Approach

- Neither CropScape/NASS tables offer enough detail to cover Florida's agricultural diversity
- CropScape ≠ Ag. Census and other NASS tables
- Livestock not included in CropScape
- Livestock losses more challenging to model
- Seasonality and multiple cropping in plant agriculture



Survey with Industry Leaders



- Sampled representatives from commodity group organizations, extension agents, and individual producers
- Not anonymous
- 15 mostly open-ended questions
- Asked to estimate damage for different regions of the state
- Questions focused on different types of damage:
  - Crop loss (Realized vs. Anticipated)
  - Loss in Productivity and Productive Assets
  - Infrastructure and Equipment Loss

Challenges of the Survey Approach

- Many potential respondents out of reach
- Incentive compatible / sampling issues?
- Hasty survey development and implementation
- Difficult to develop a good survey instrument for such a diverse industry

Building a Comprehensive Estimate

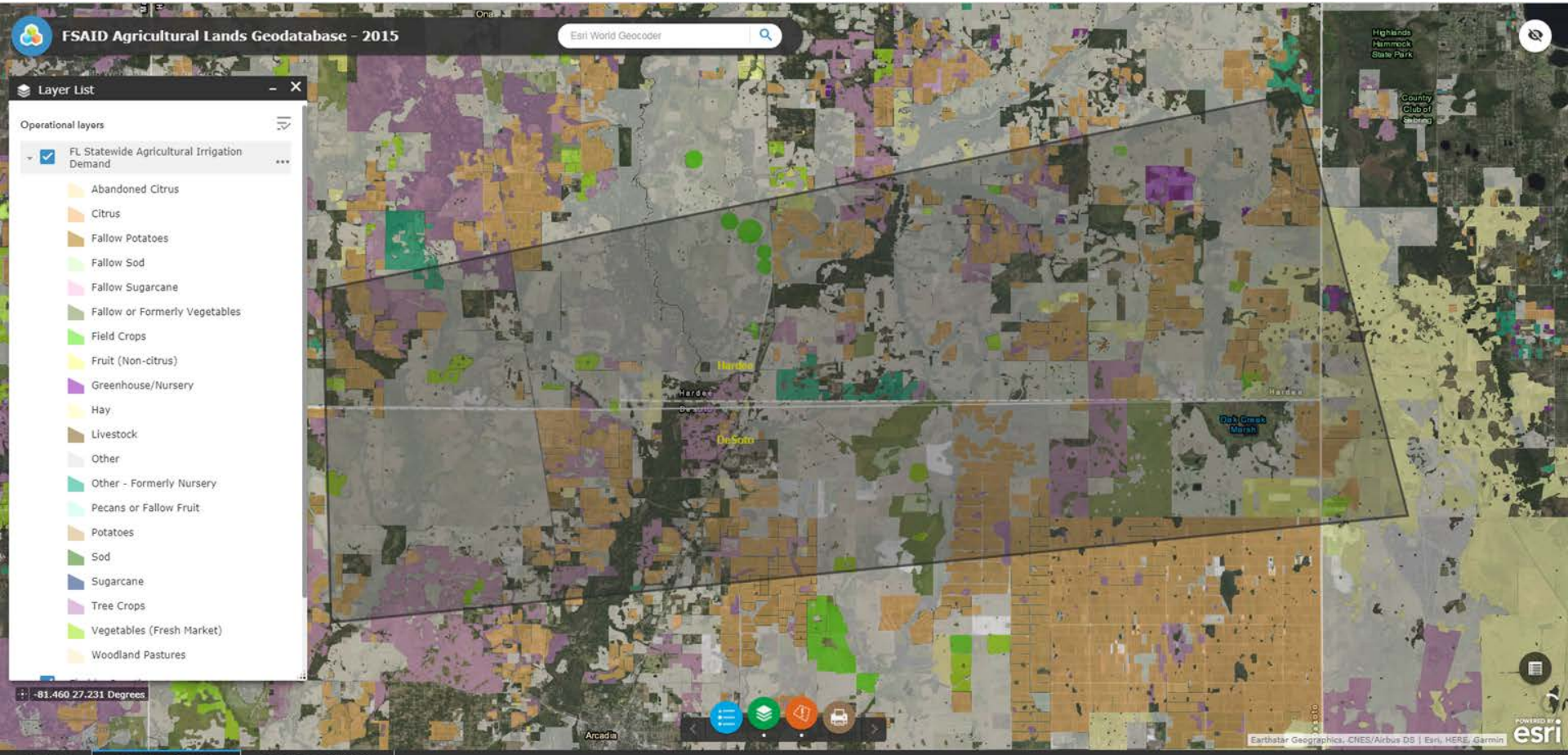
- Used NASS tables to ‘plug holes’ in CropScape
- GIS crop loss estimates used as foundation
- Augmented with information from industry surveys: livestock crop/product losses, infrastructure/equipment damage, debris cleanup, productivity loss

Estimated crop/product loss = $2.01 billion
Estimated ancillary losses = $544 million
Estimated total loss = $2.55 billion

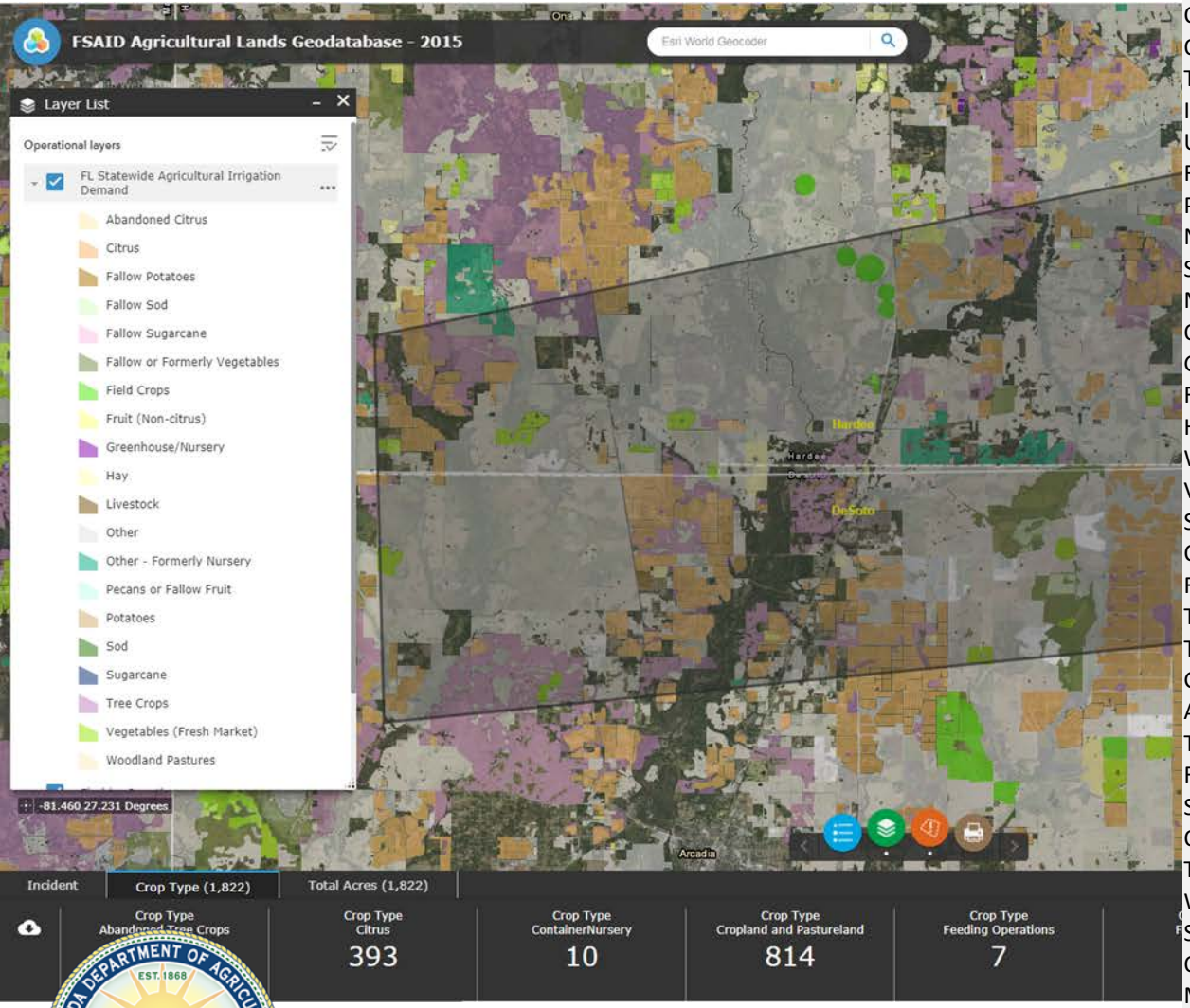
Improving Assessments in the Future

- Systematic collection and reporting of agricultural losses and damages
- Improve CropScape remote sensing algorithm and harmonize with NASS tables
- Sector-specific damage surveys (and sample frames) that can be rapidly deployed after storm event
  - Individual growers
  - Industry leaders
  - Field and extension agents
- Collaboration!

GIS Tool to Estimate Affected Acreage

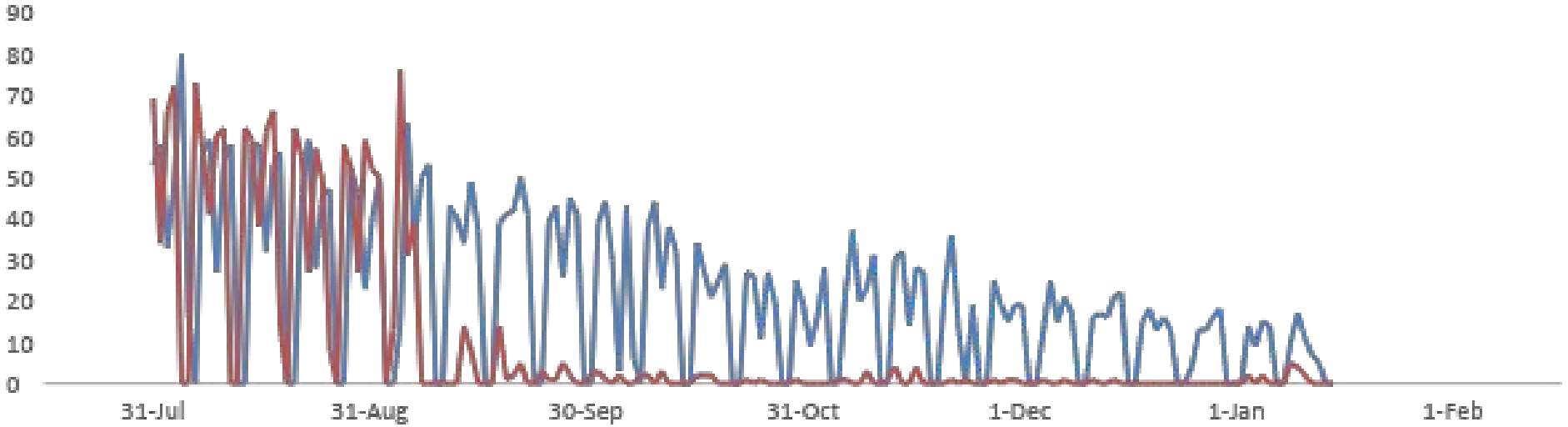


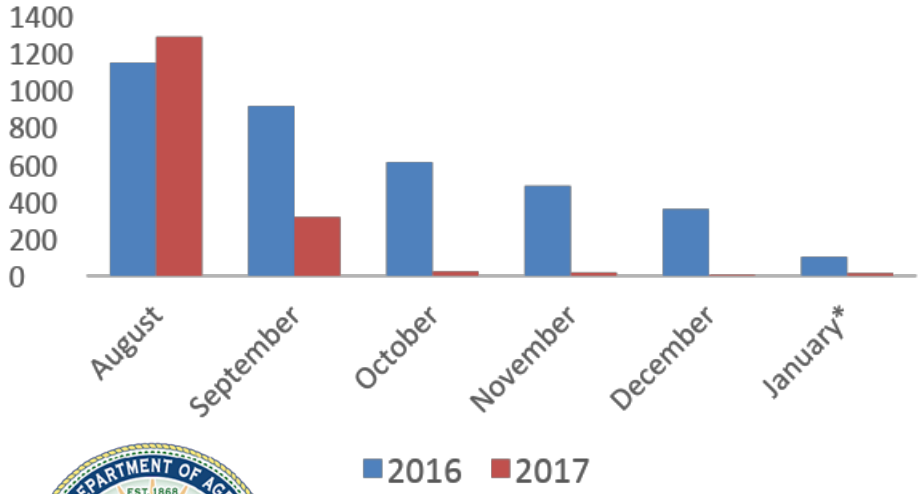
GIS Tool to Estimate Affected Acreage

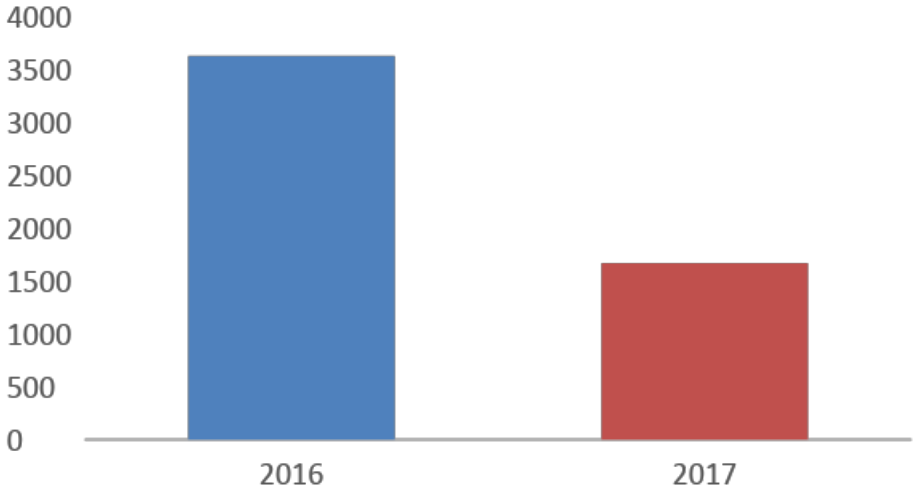


Land Use	Acres
Citrus	29,420
Other Open Lands (Rural)	20,439
Tree Crops	18,126
Improved Pasture	8,680
Unimproved Pastures	6,348
RowCrops	5,637
Pasture	2,182
Nurseries and Vineyards	2,124
Strawberries	1,549
Melons	818
Ornamentals	637
Grains	582
Formerly Citrus	548
Hay	544
Woodland Pastures	415
Vegetables	315
SmallVegFall_SmallVegSpring	286
ContainerNursery	176
Feeding Operations	135
TomatoesSpring	80
TomatoesFall_TomatoesSpring	54
Grass/Pasture	54
Abandoned Tree Crops	49
Tree Nurseries	38
Field Crops	35
Strawberries_Melons	31
Other Groves	13
Tropical Fish Farms	10
Wet Prairies	10
SmallVeg	8
Other Groves (Pecan, Avocado, Coconut, Mango, etc)	7
Specialty Farms	4

Fresh **Avocado** Shipments from Florida (x 10,000 lbs)

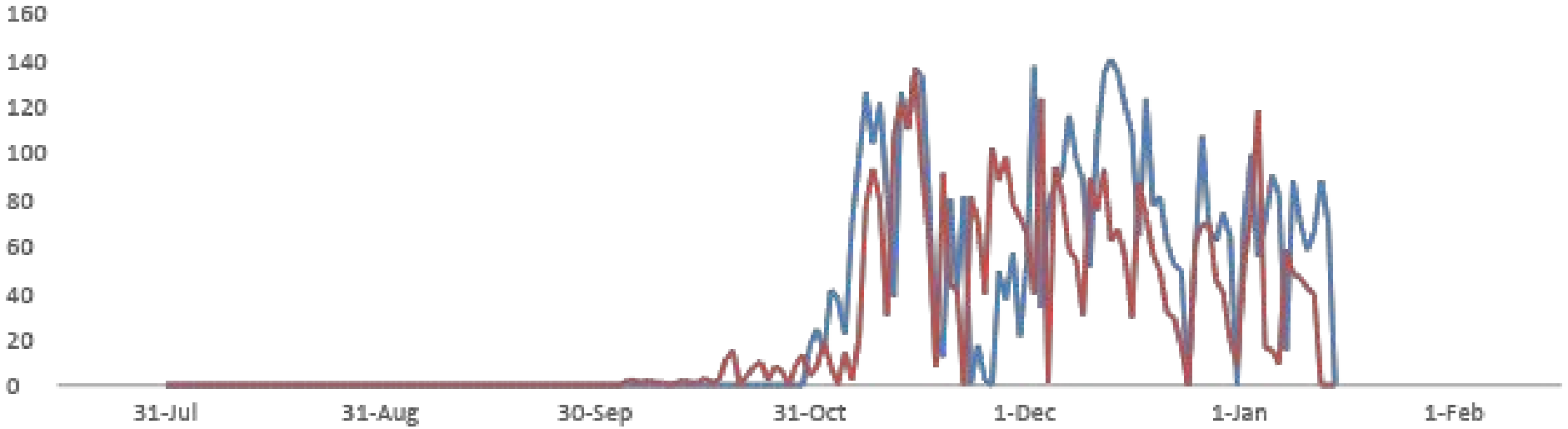


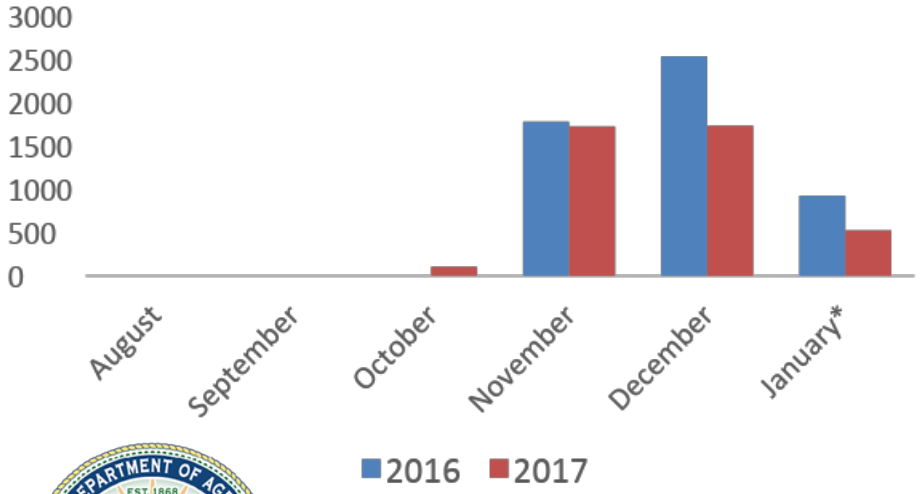


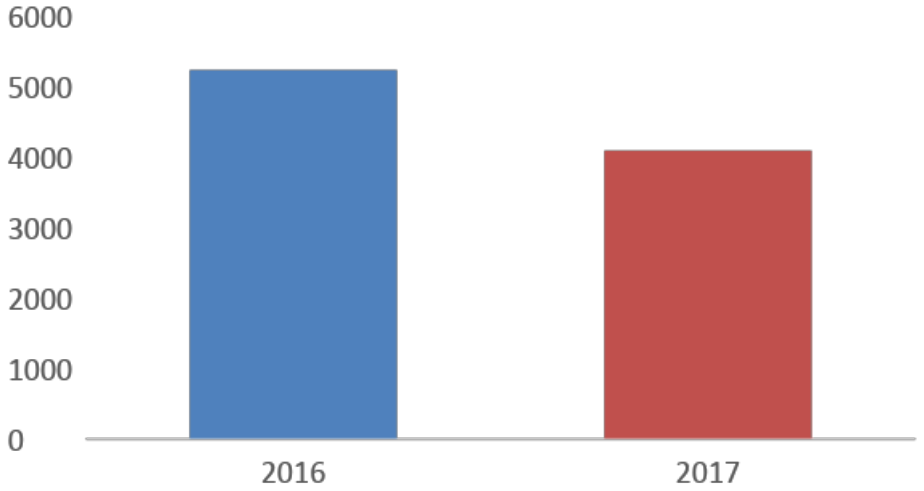


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Bean** Shipments from Florida (x 10,000 lbs)

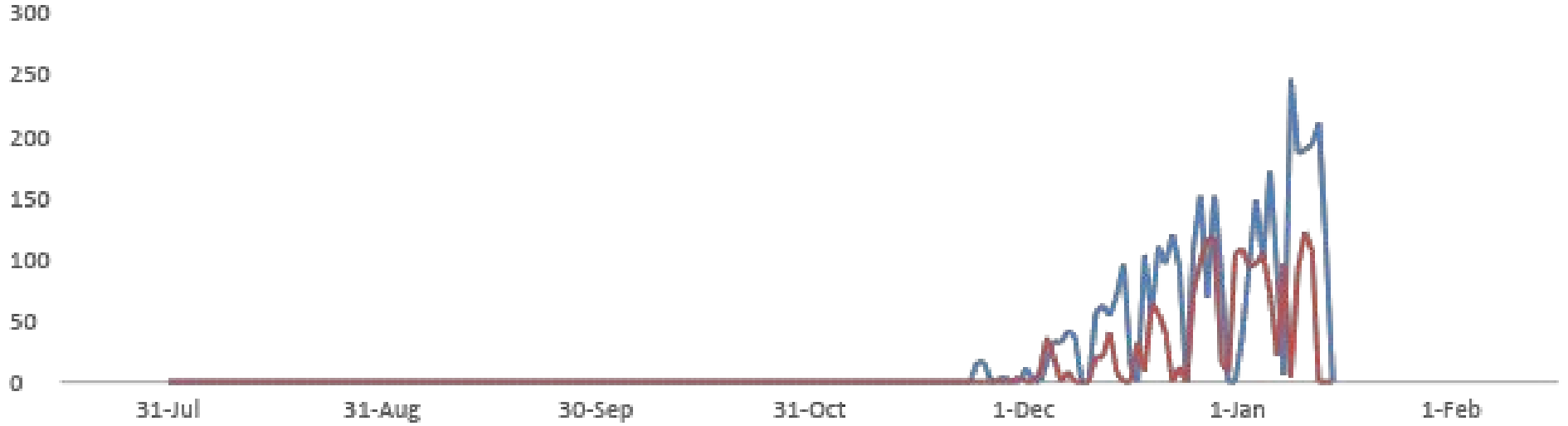


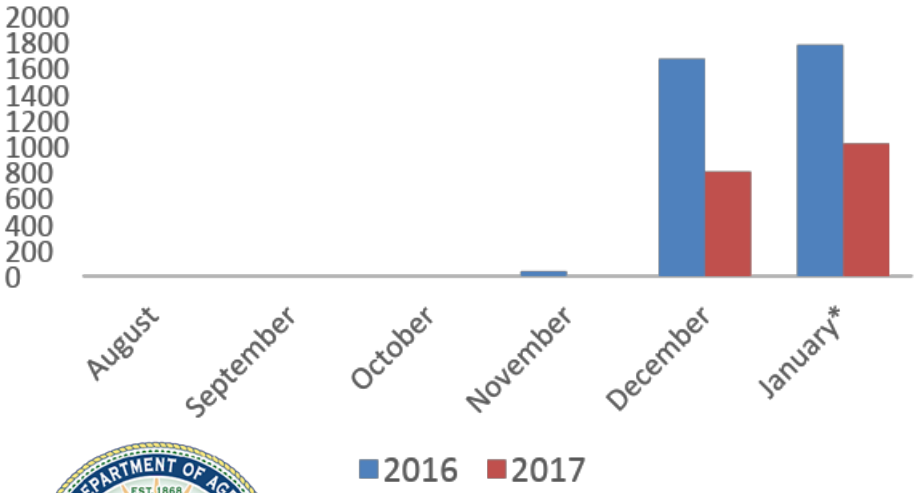


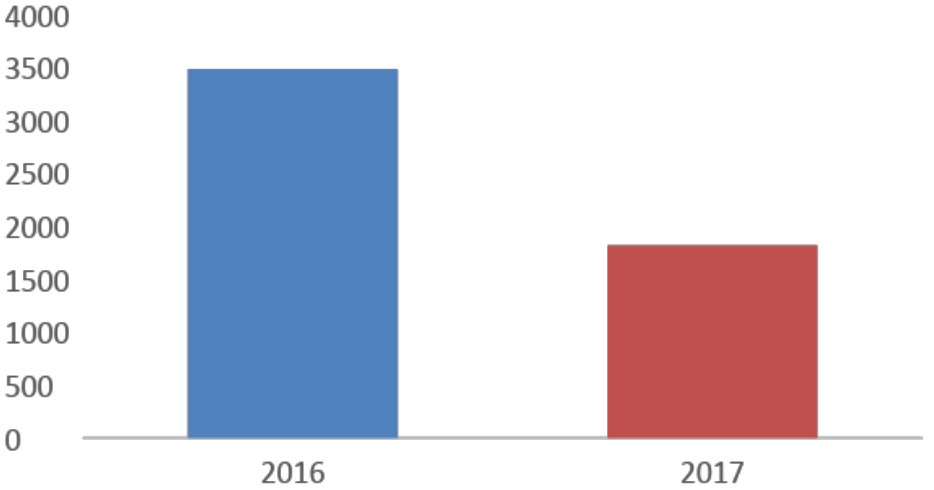


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Cabbage** Shipments from Florida (x 10,000 lbs)

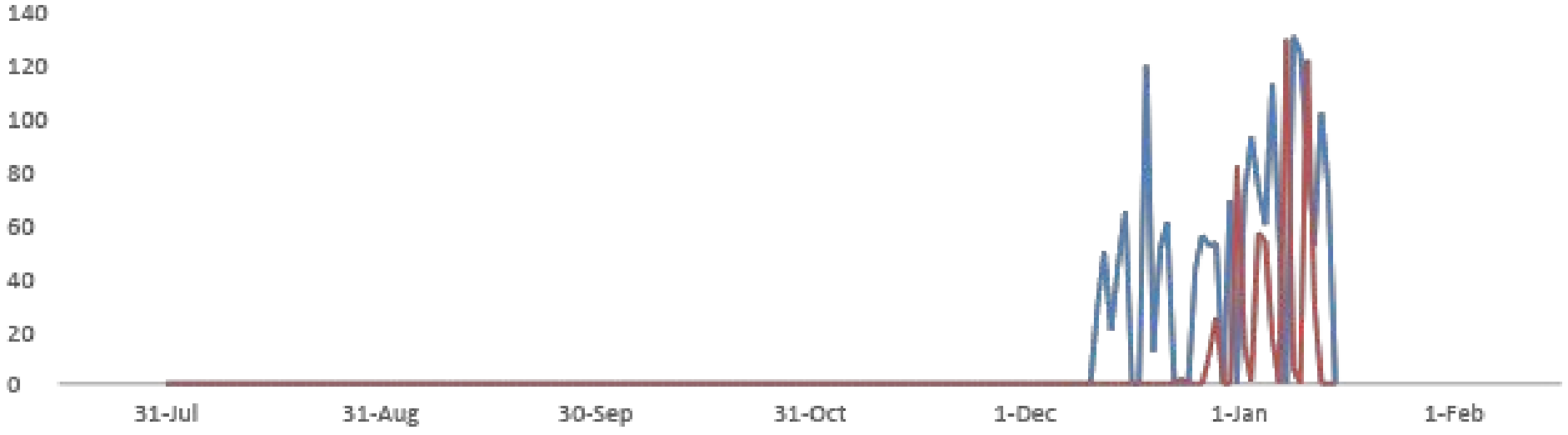


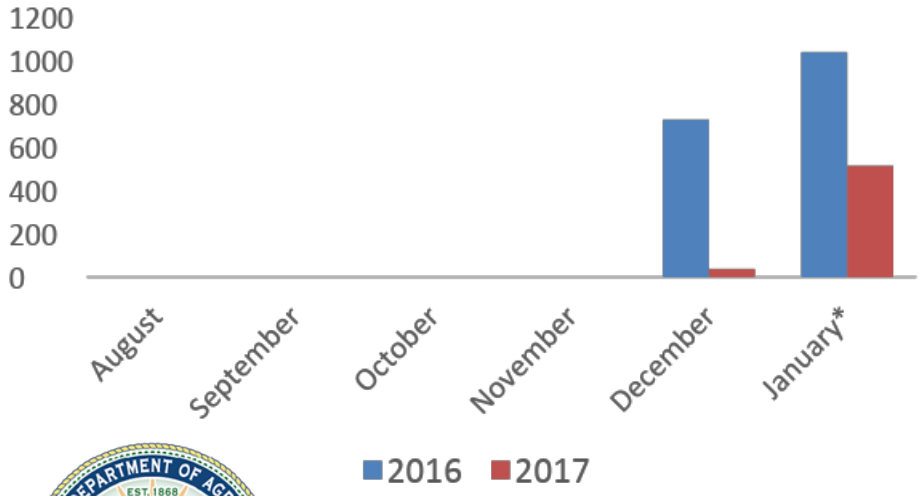


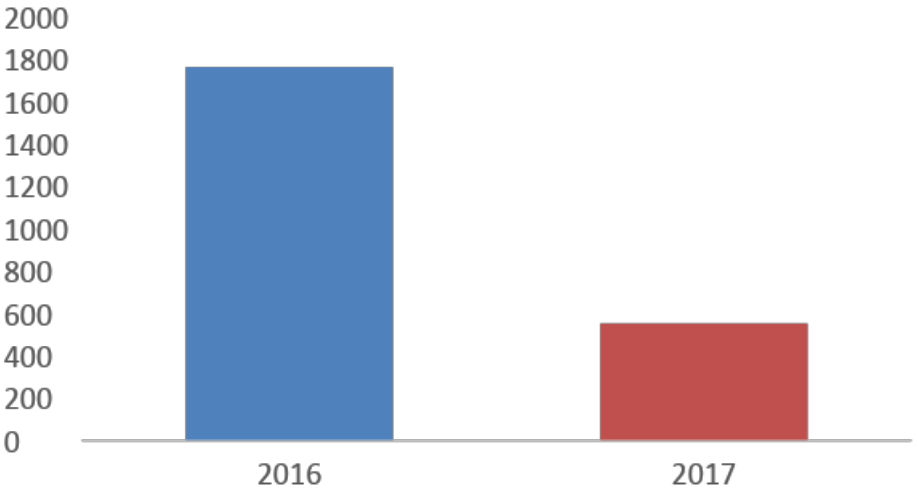


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Celery** Shipments from Florida (x 10,000 lbs)

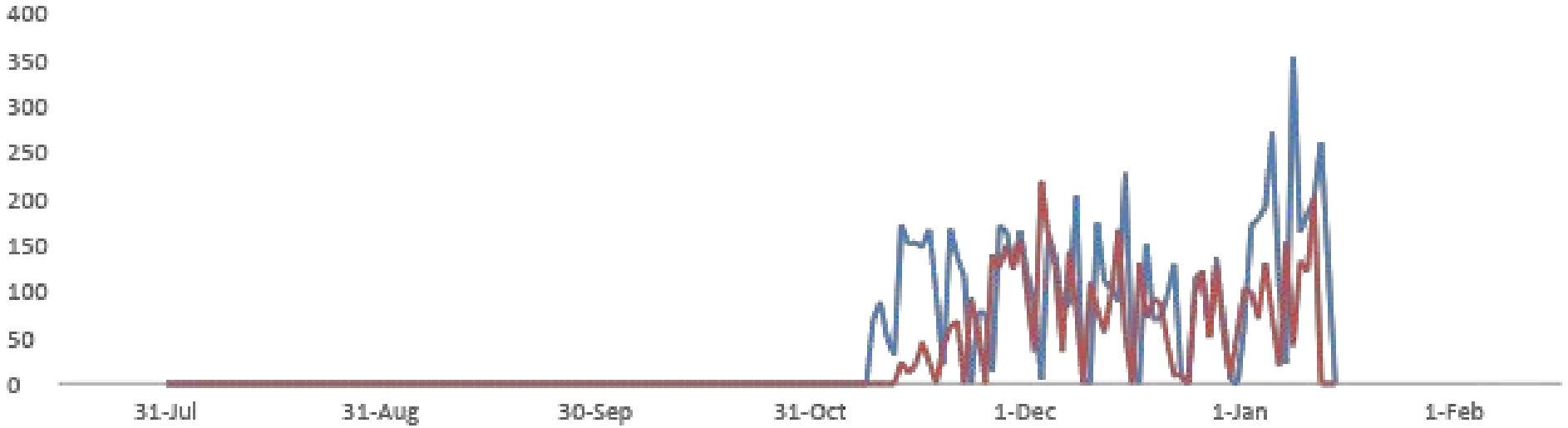


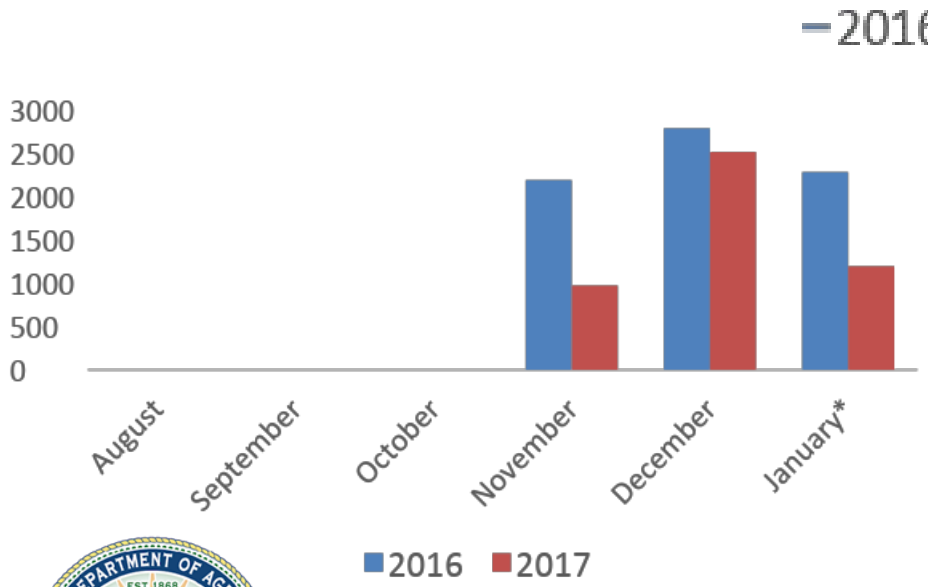


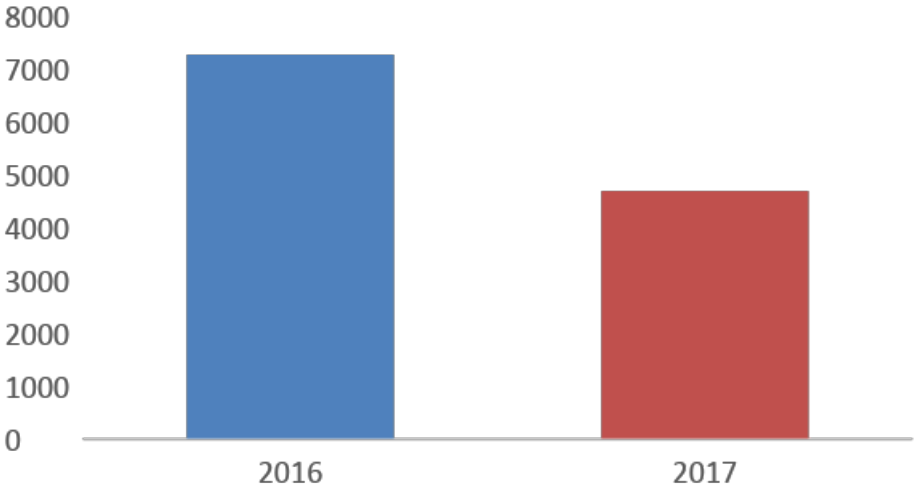


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Sweet Corn** Shipments from Florida (x 10,000 lbs)

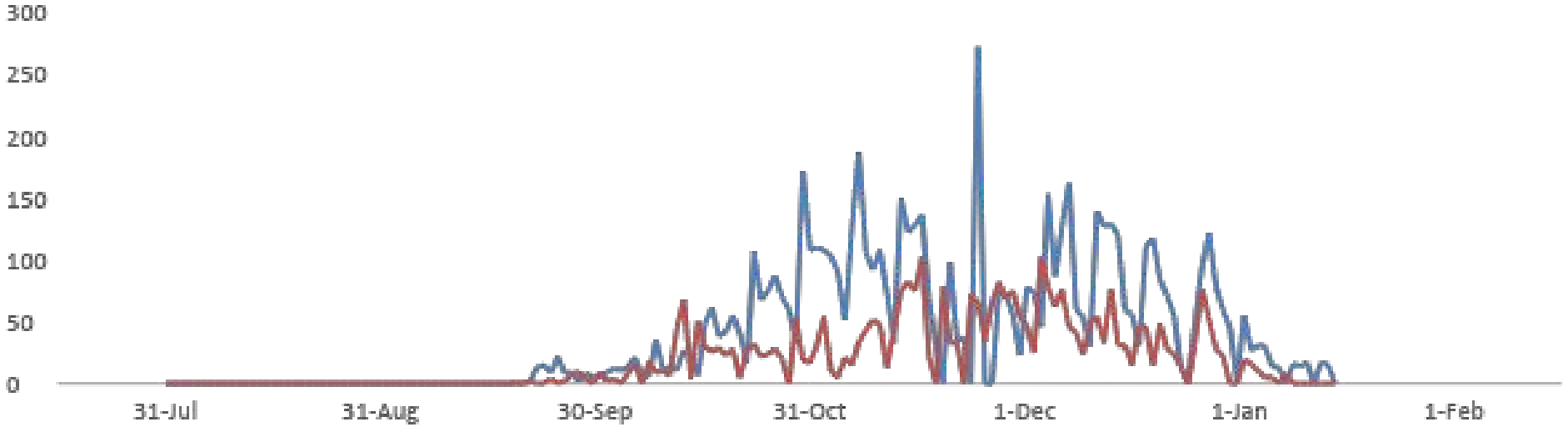


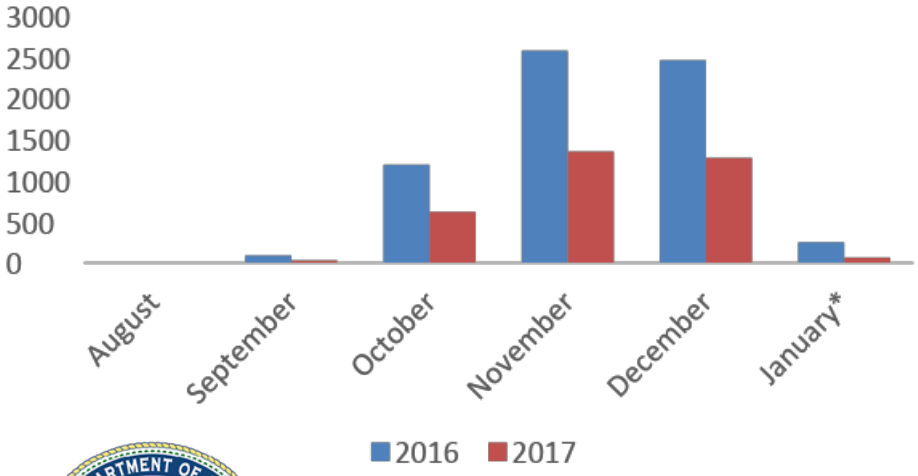


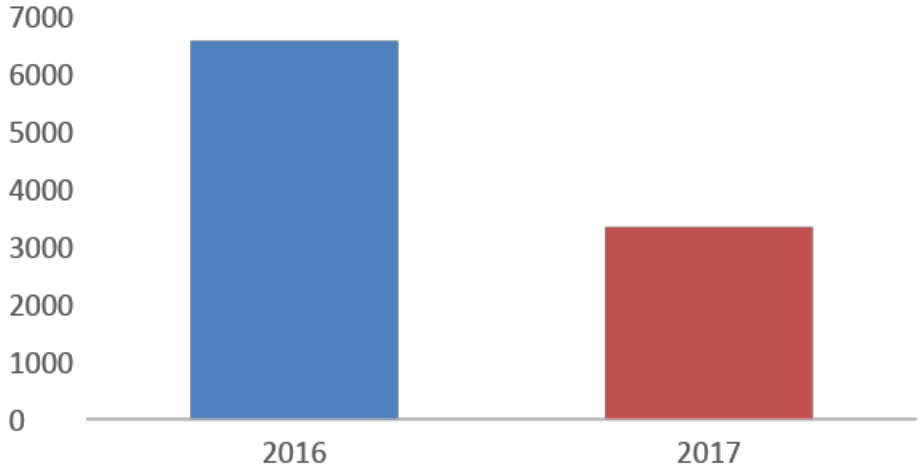


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Cucumber** Shipments from Florida (x 10,000 lbs)

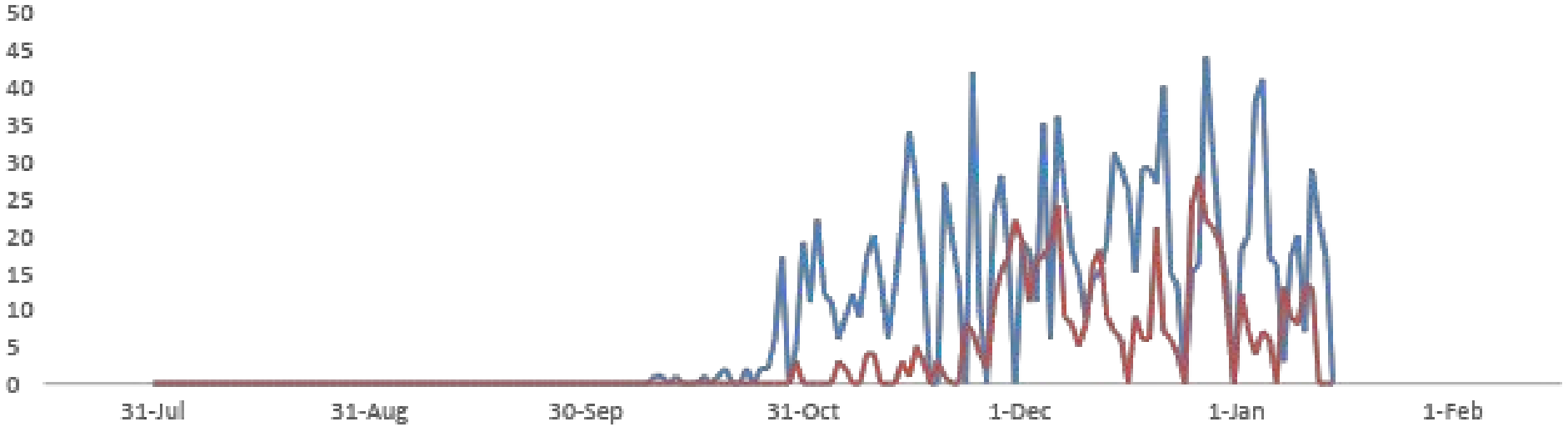


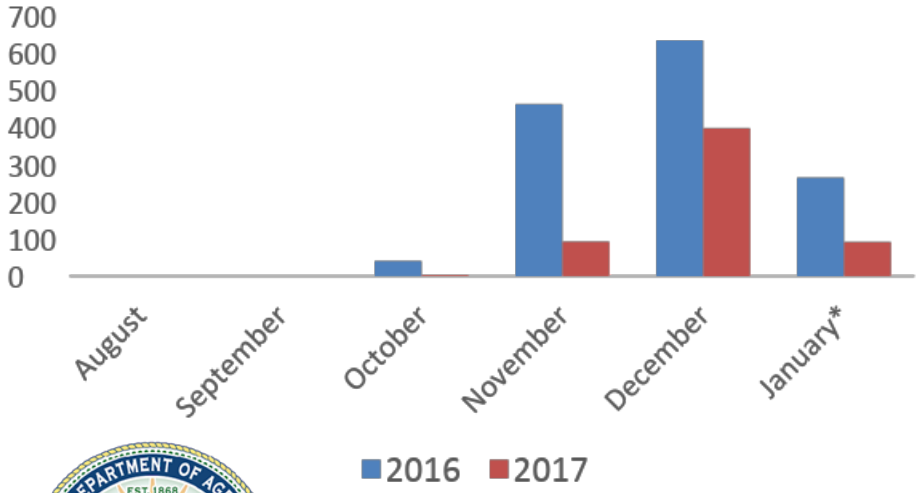


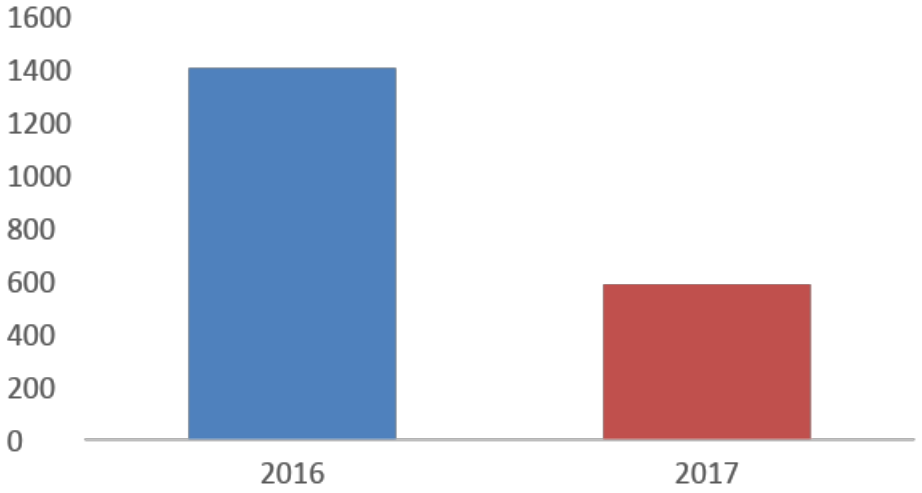


Source: USDA-AMS Daily Fresh Produce Shipments

Fresh **Eggplant** Shipments from Florida (x 10,000 lbs)

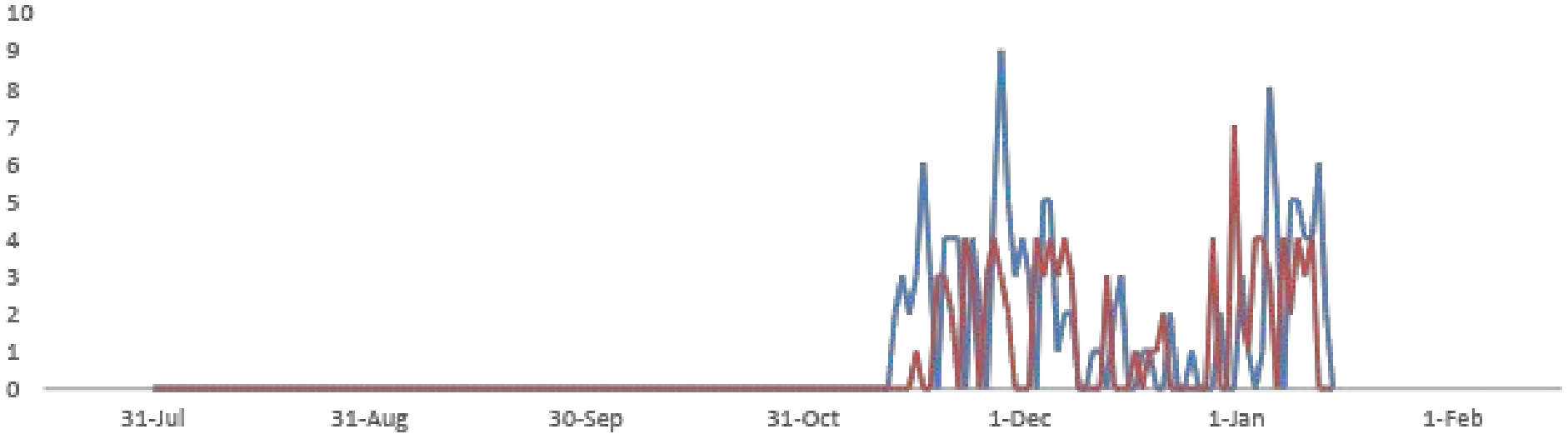


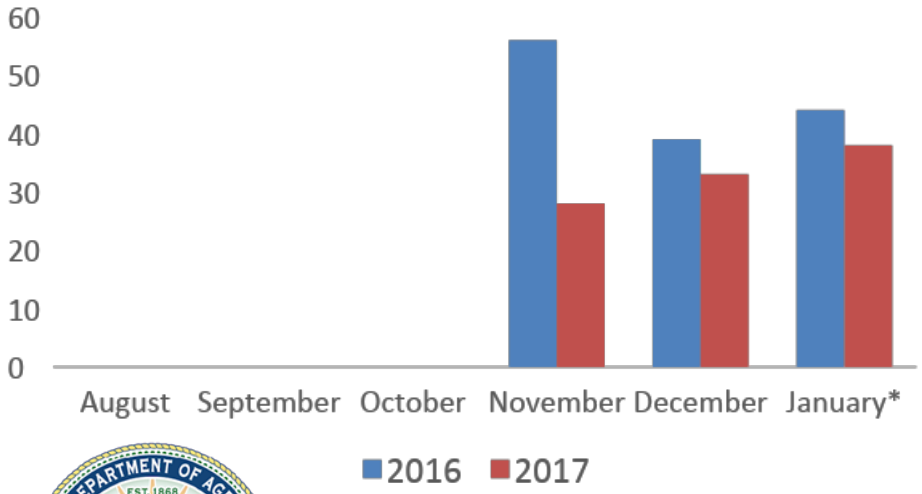


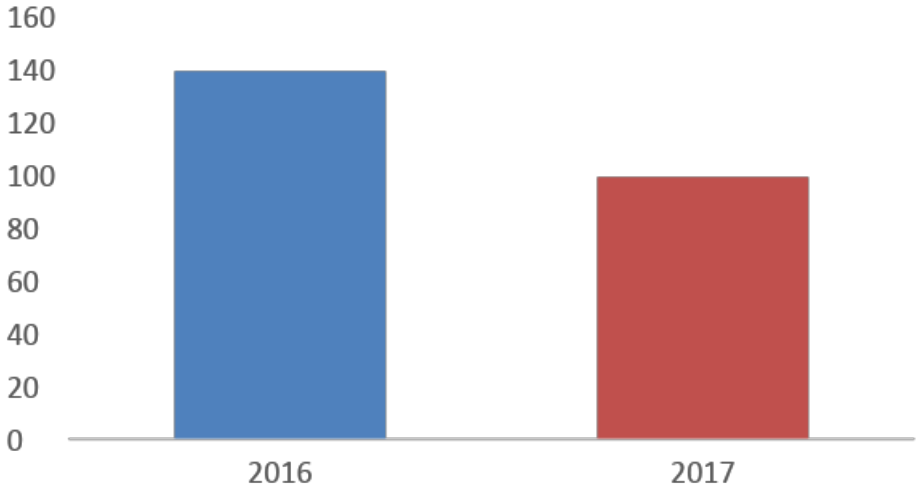


Source: USDA-AMS Daily Fresh Produce Shipments

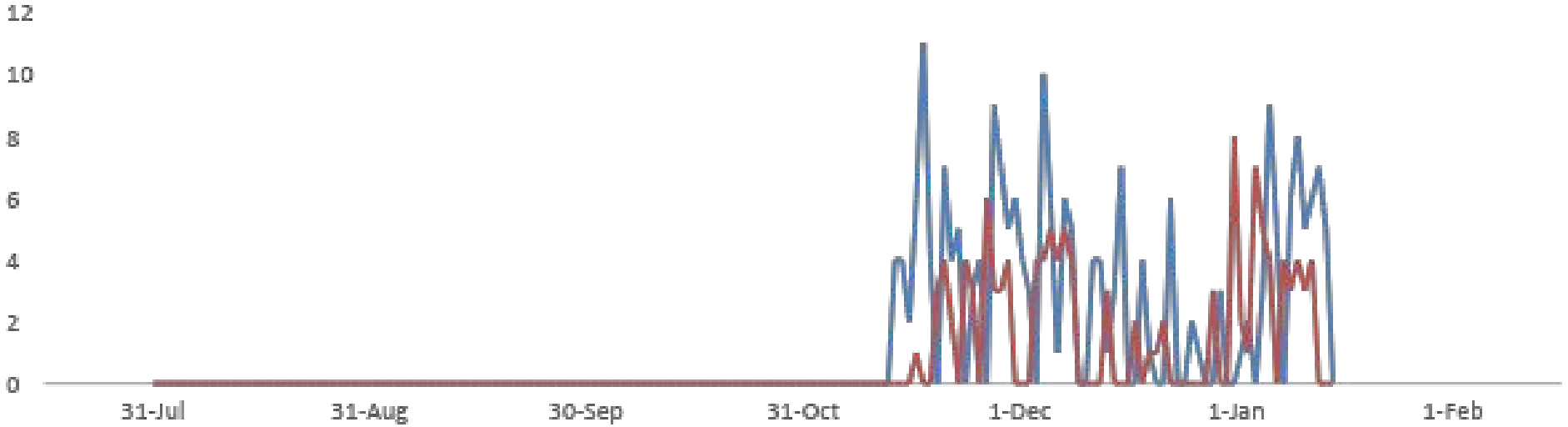
Fresh **Endive** Shipments from Florida (x 10,000 lbs)

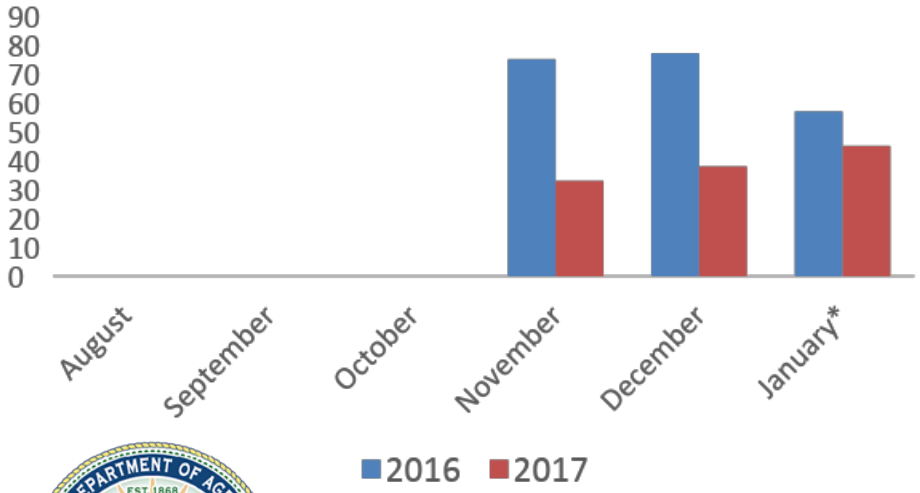


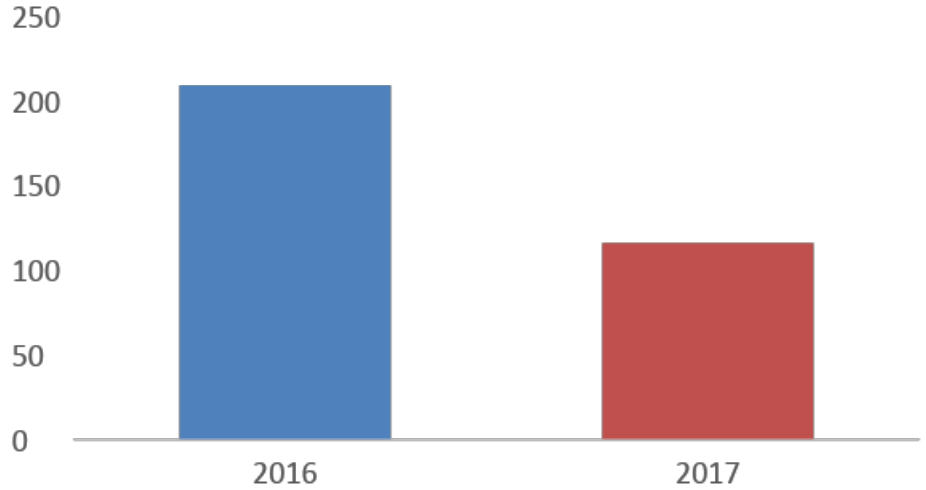




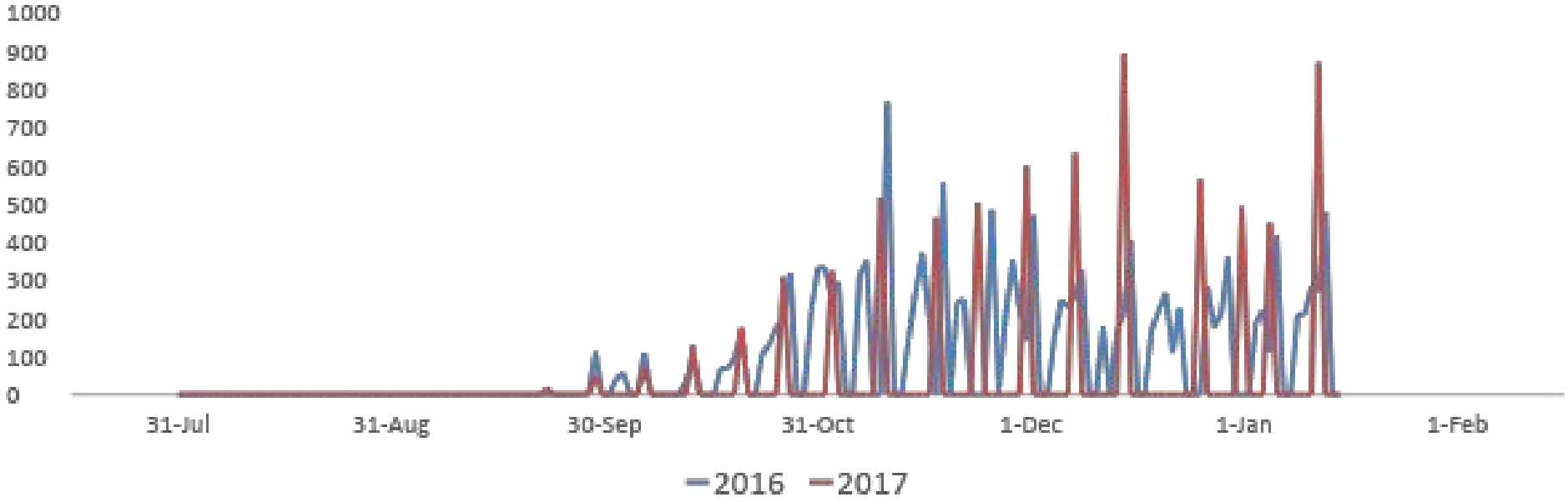
Fresh **Escarole** Shipments from Florida (x 10,000 lbs)

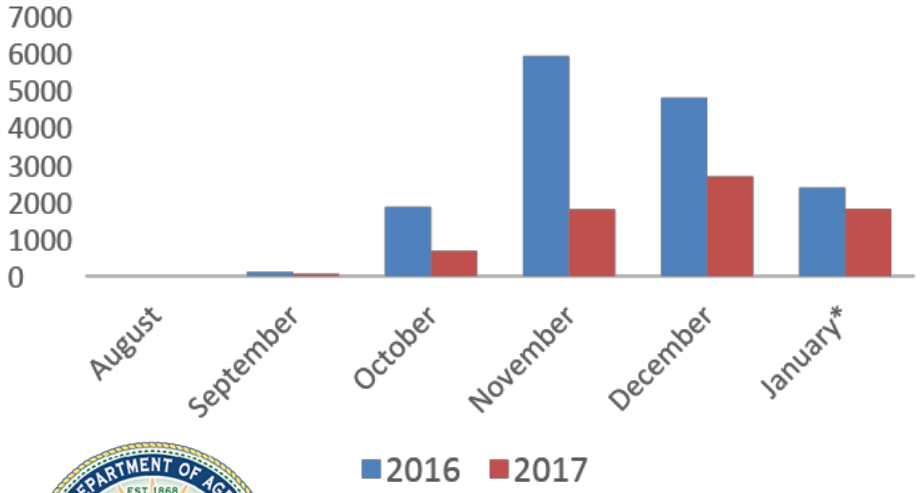


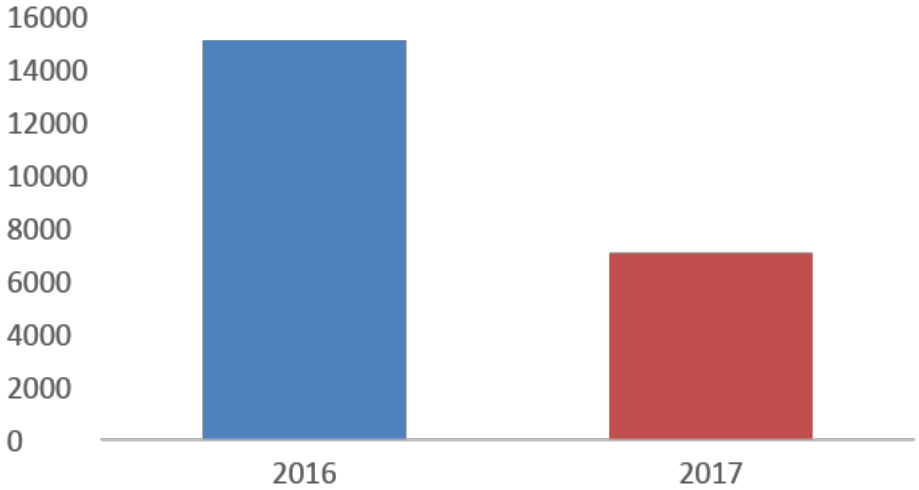




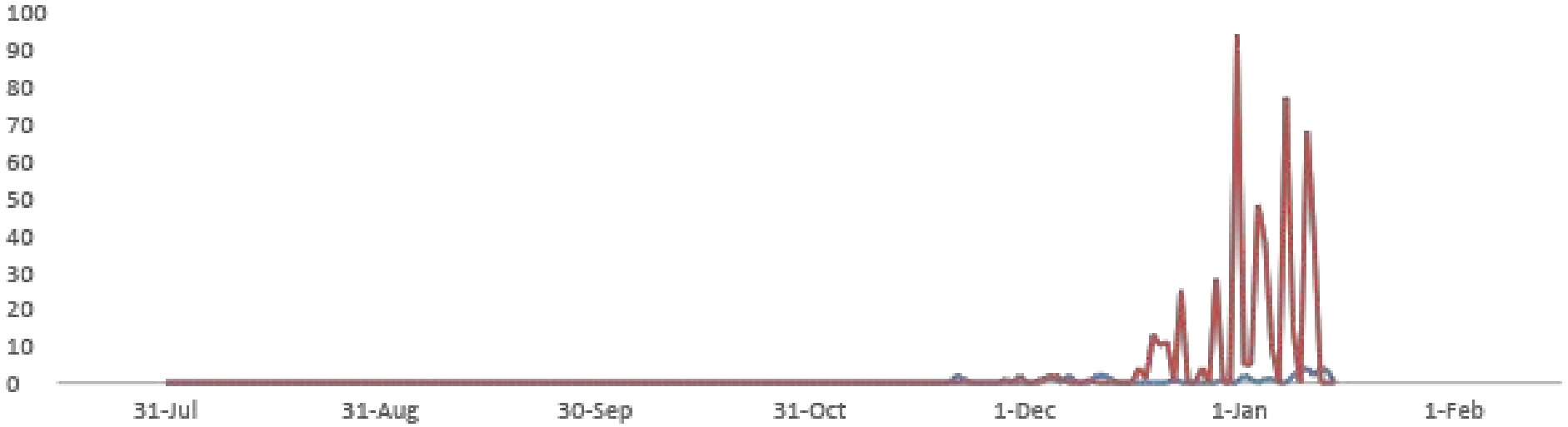
Fresh **Grapefruit** Shipments from Florida (x 10,000 lbs)

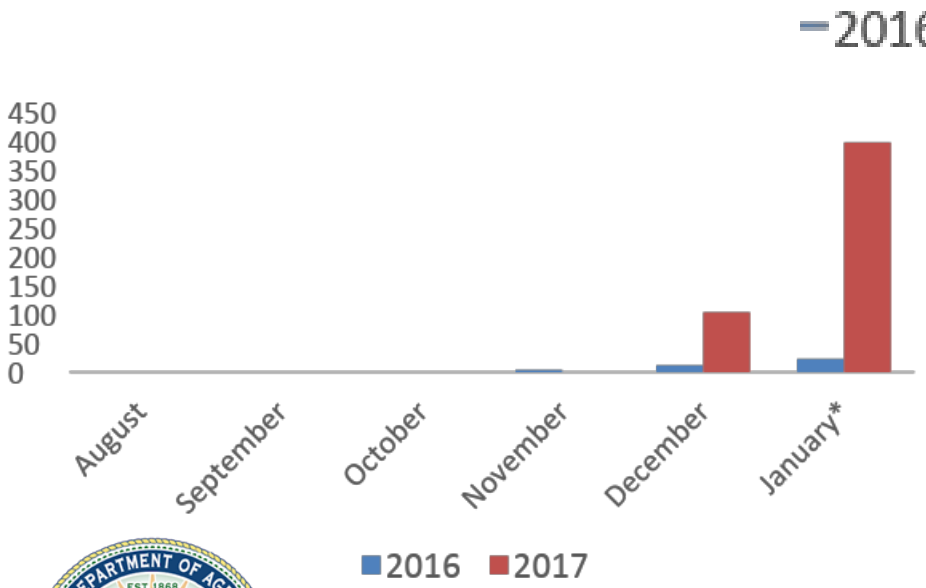


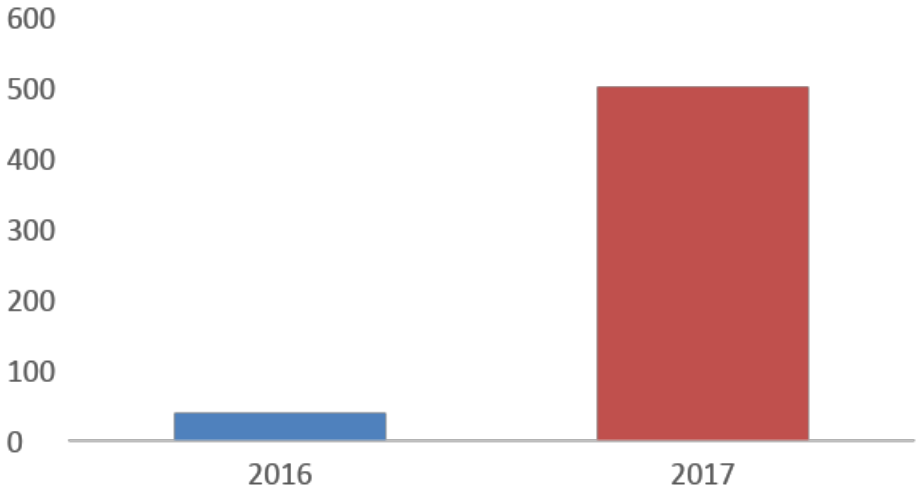




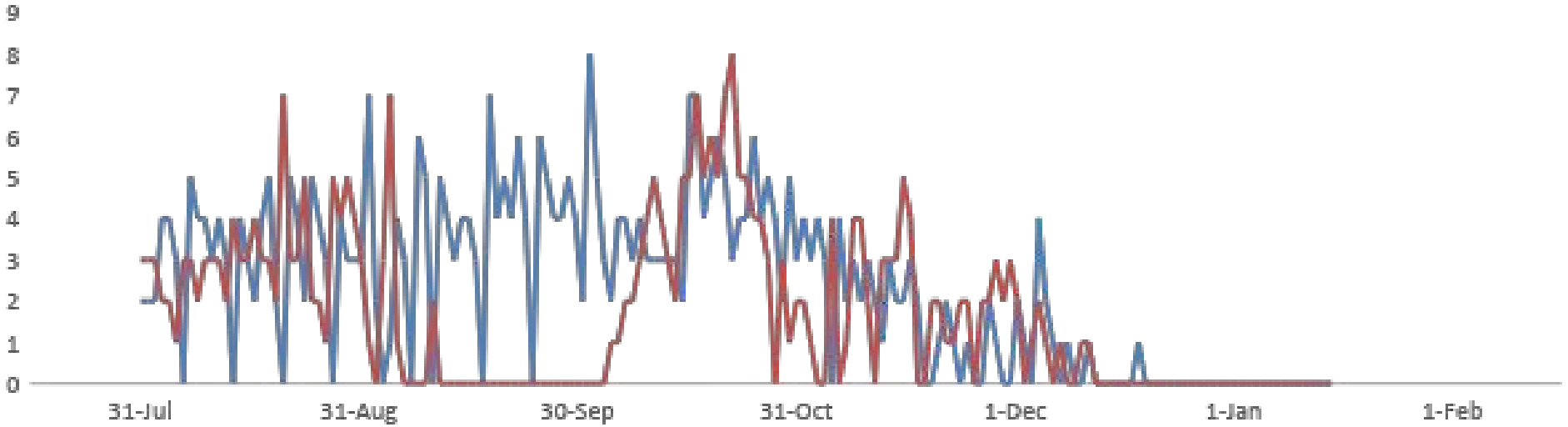
Fresh **Lettuce** Shipments from Florida (x 10,000 lbs)

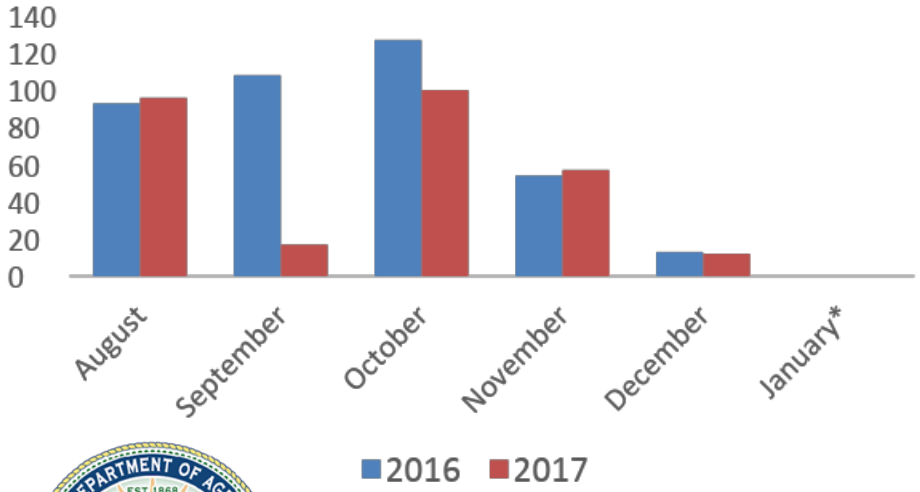


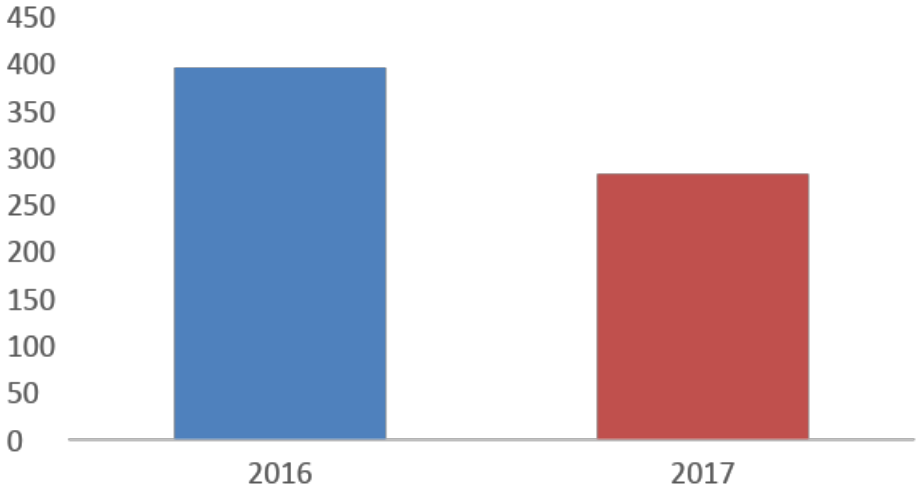




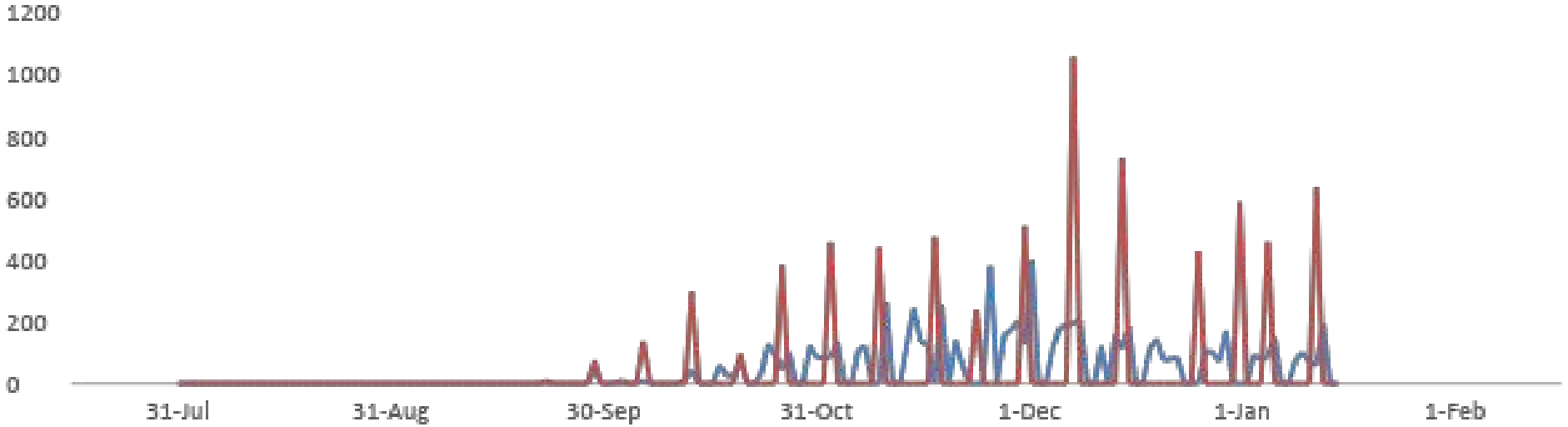
Fresh **Okra** Shipments from Florida (x 10,000 lbs)

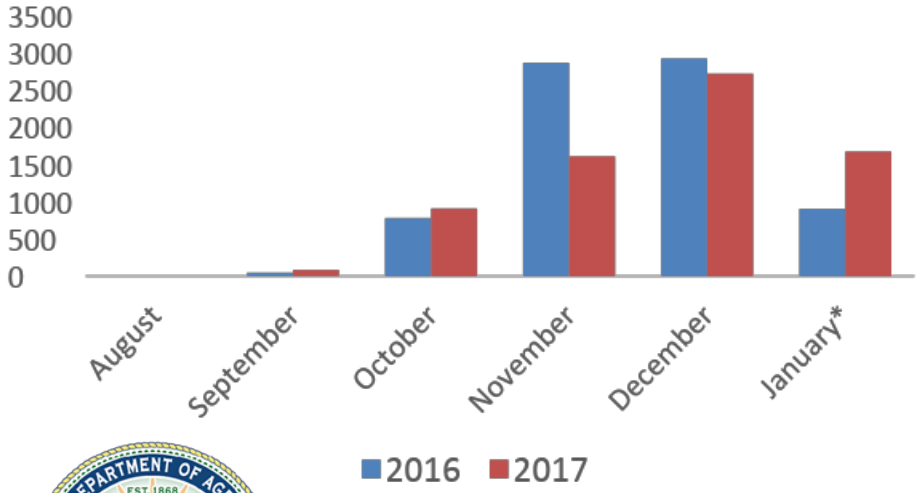


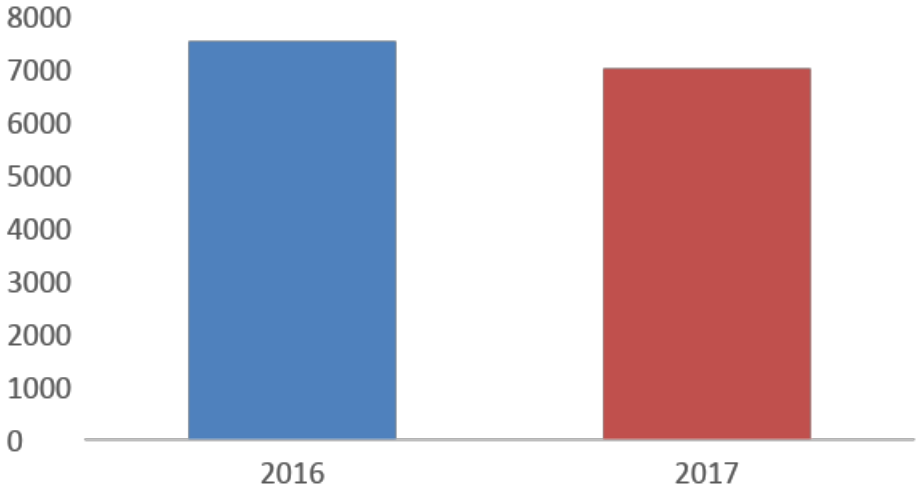




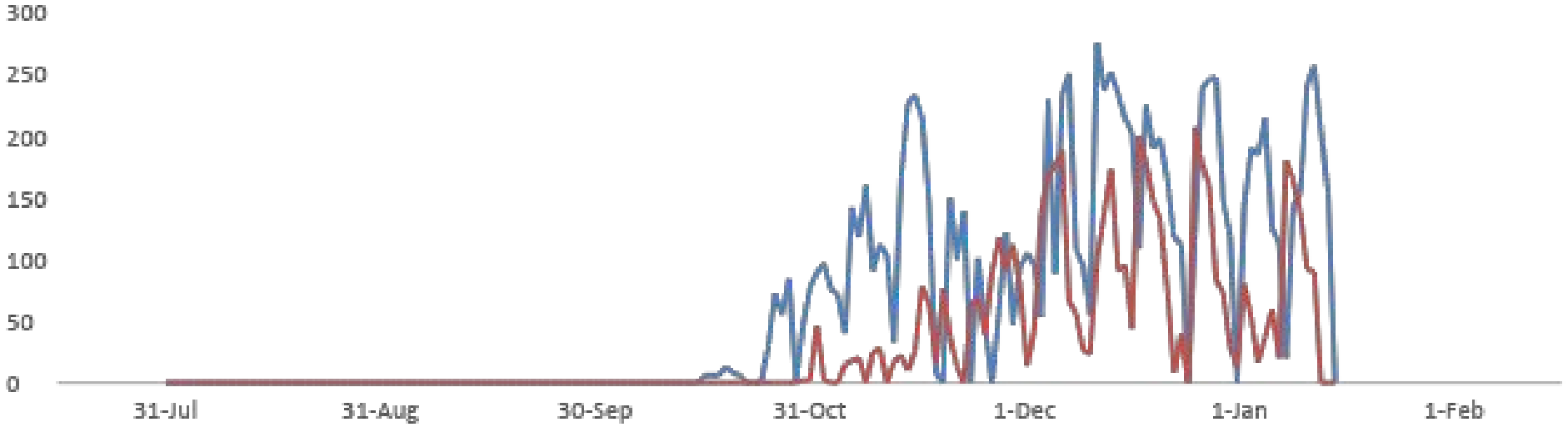
Fresh **Orange** Shipments from Florida (x 10,000 lbs)

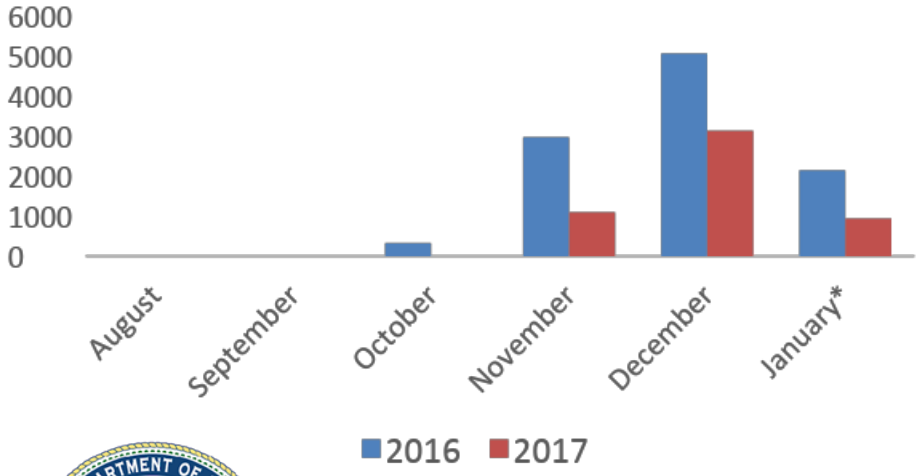


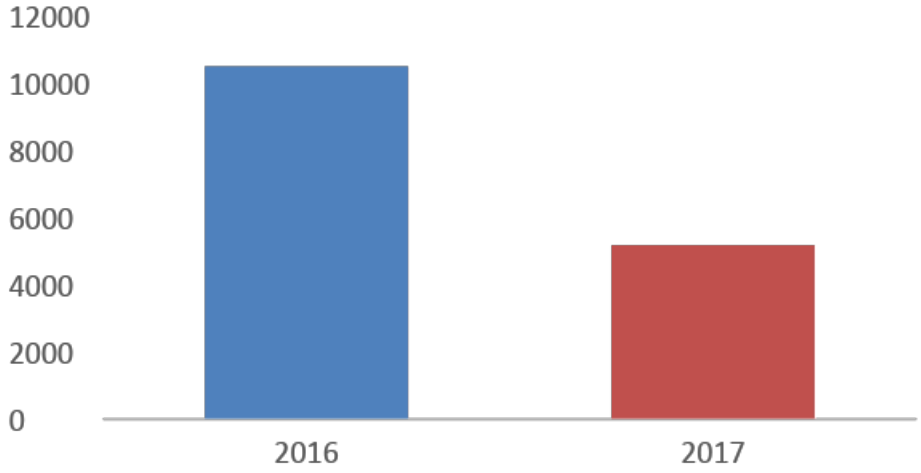




Fresh **Pepper** Shipments from Florida (x 10,000 lbs)

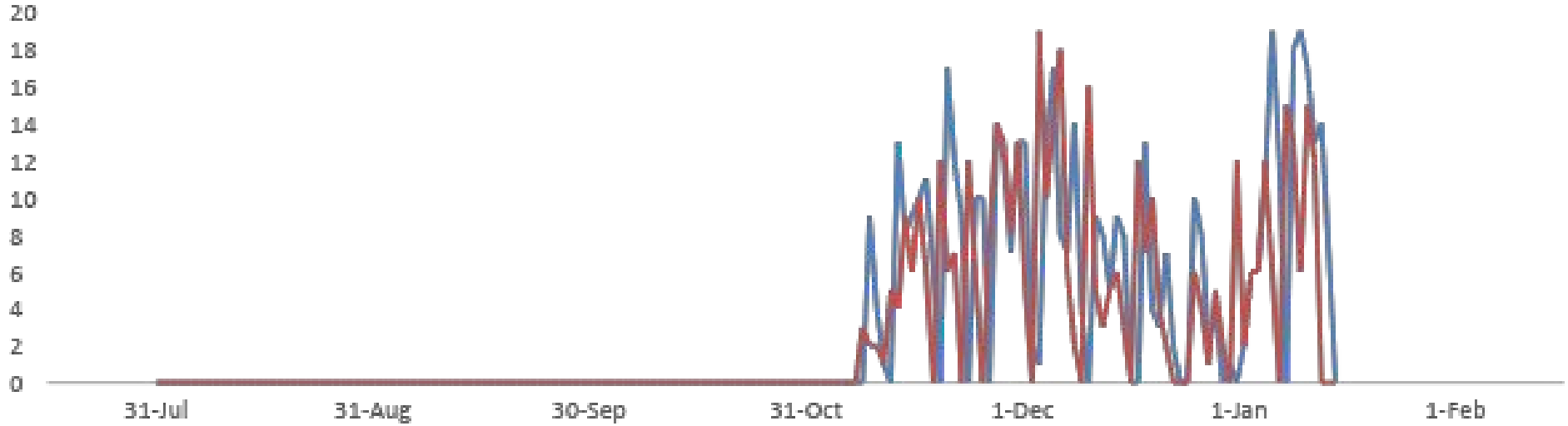


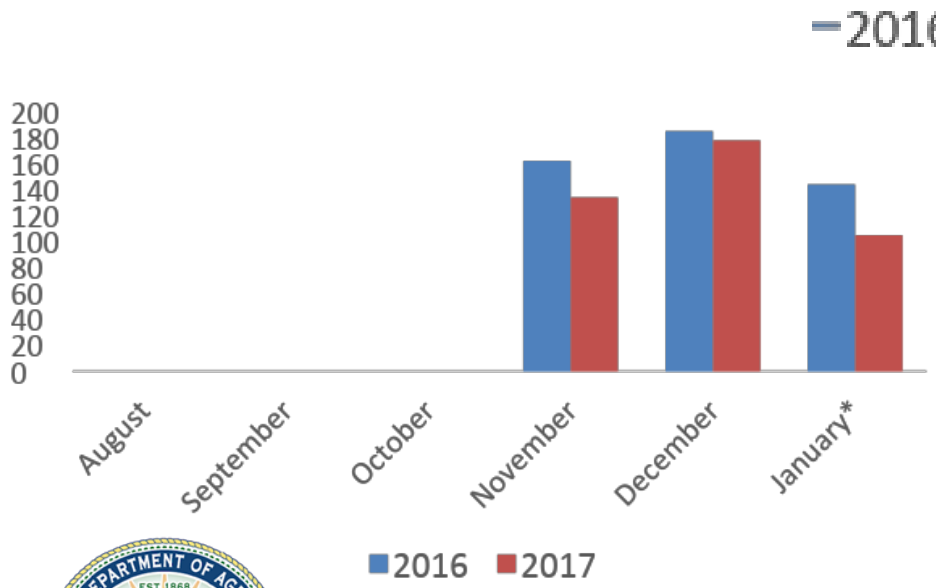


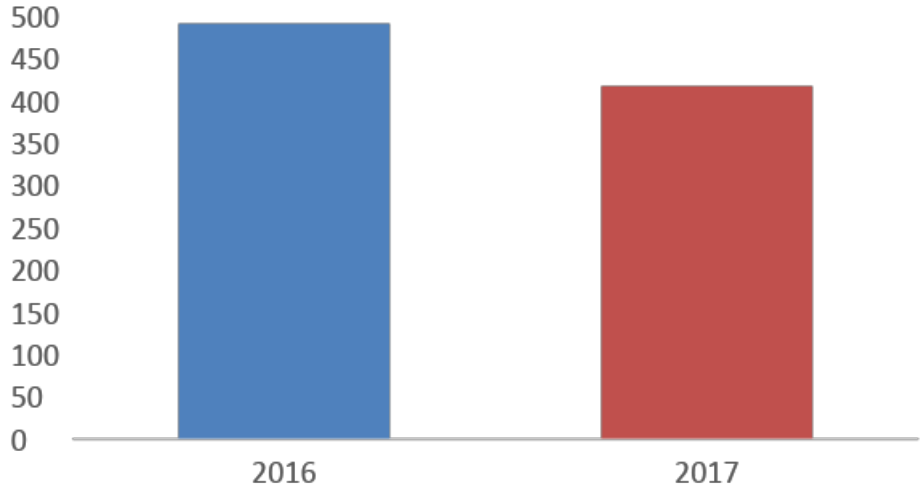


Source: USDA-AMS Daily Fresh Produce Shipments

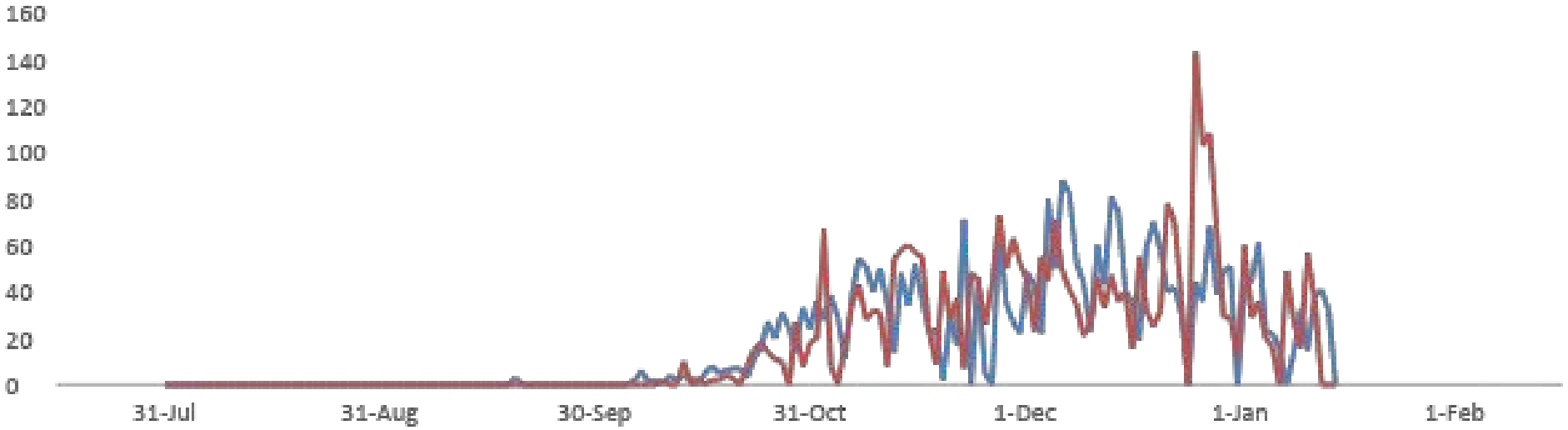
Fresh **Radish** Shipments from Florida (x 10,000 lbs)

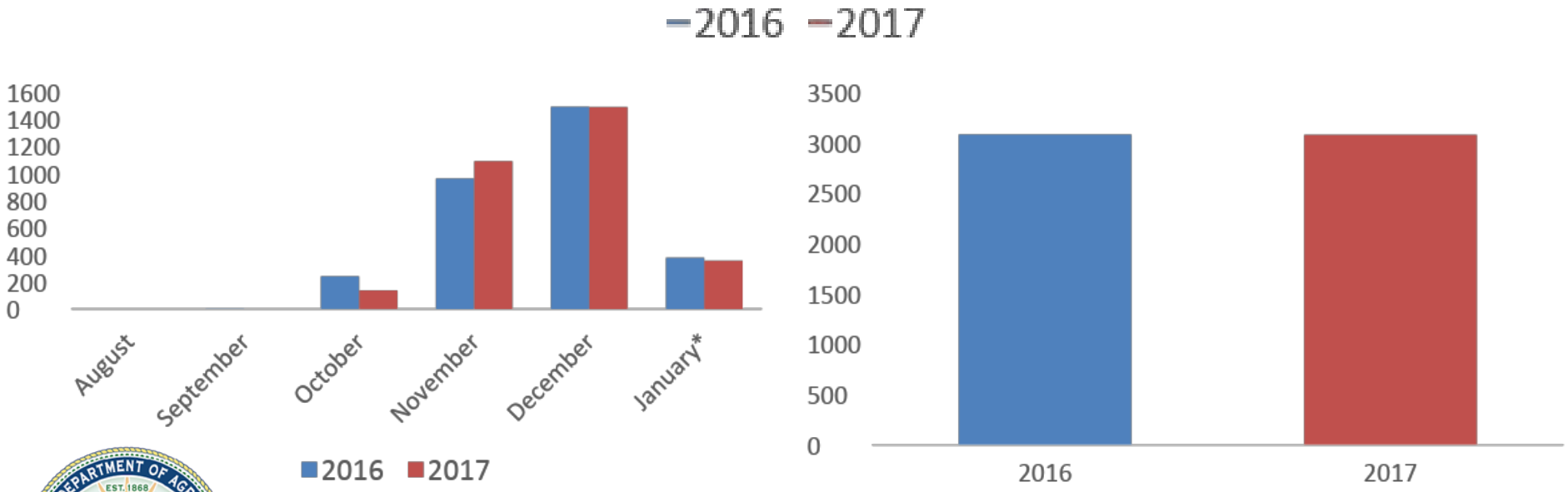




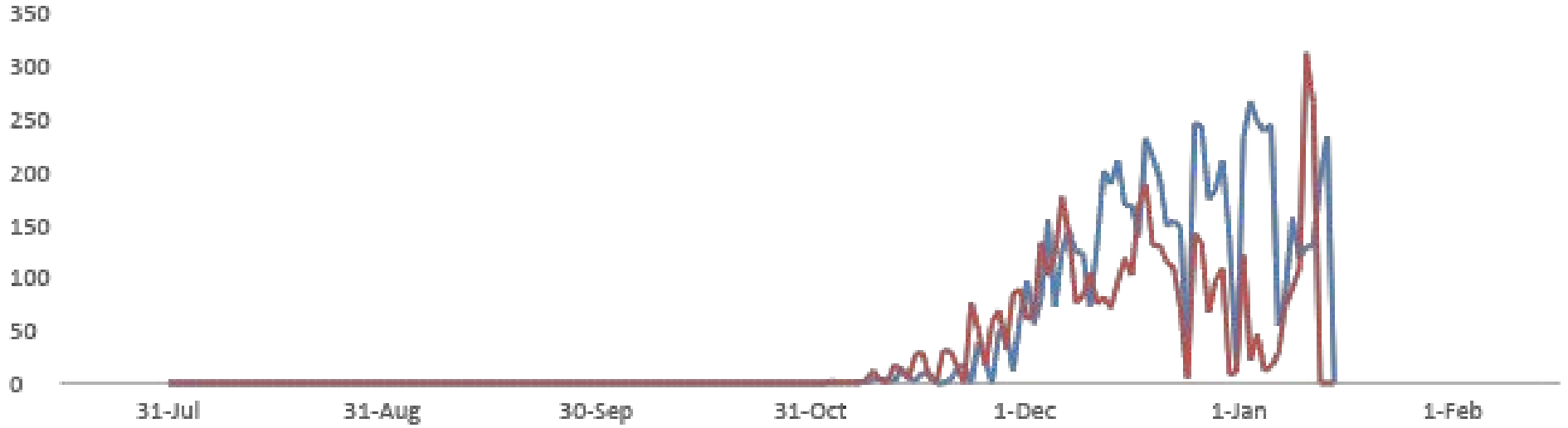


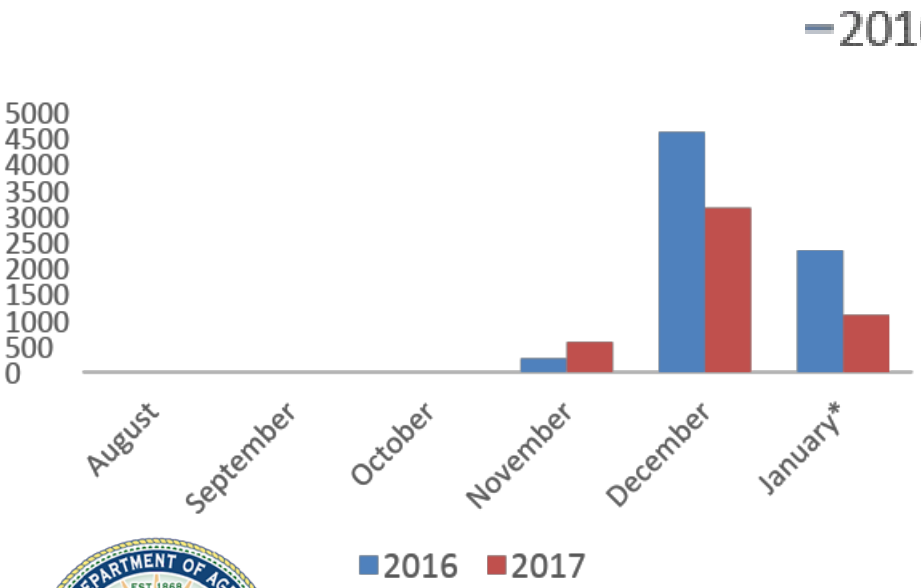
Fresh **Squash** Shipments from Florida (x 10,000 lbs)

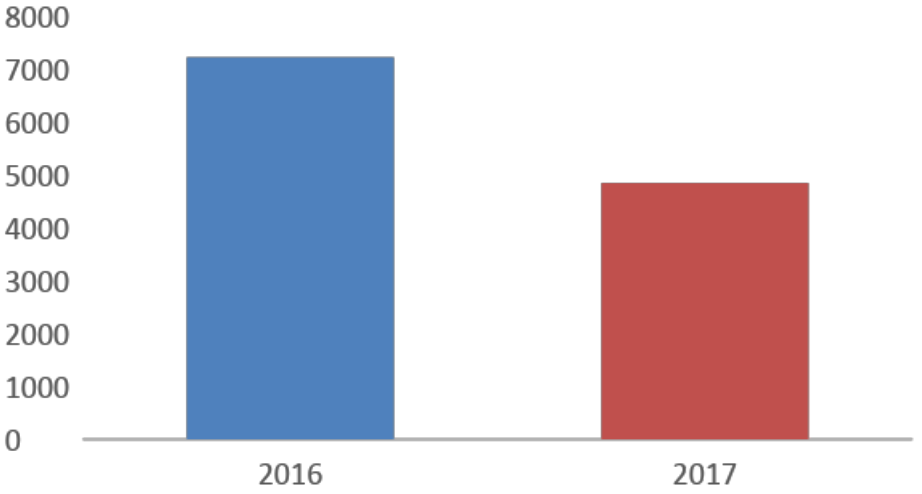




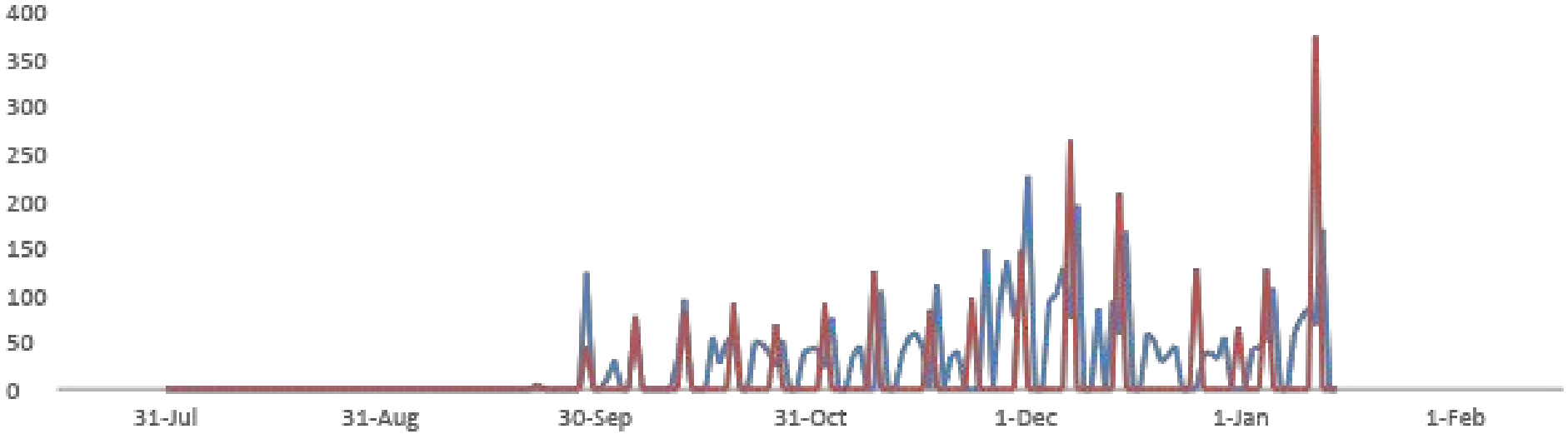
Fresh **Strawberry** Shipments from Florida (x 10,000 lbs)

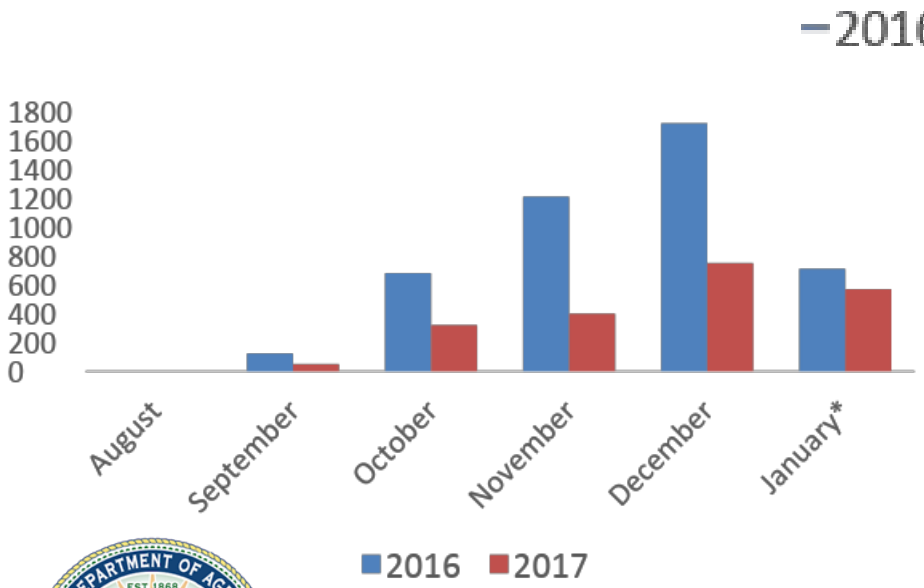


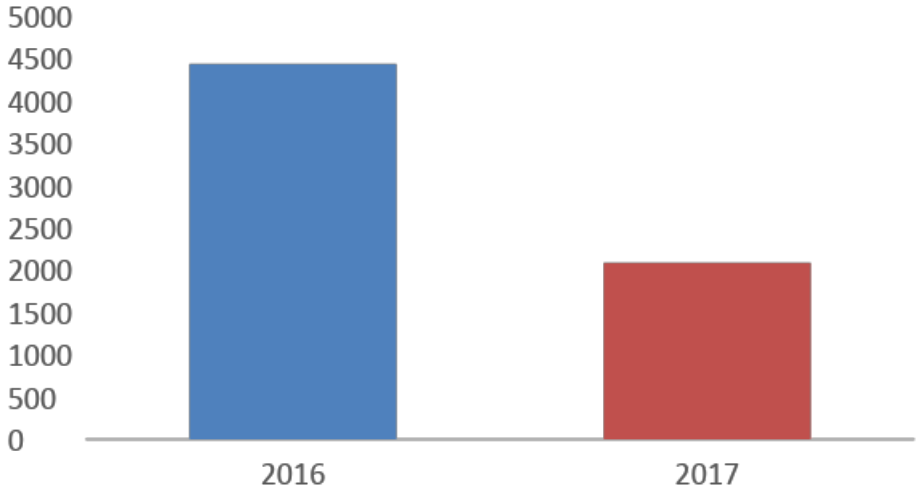




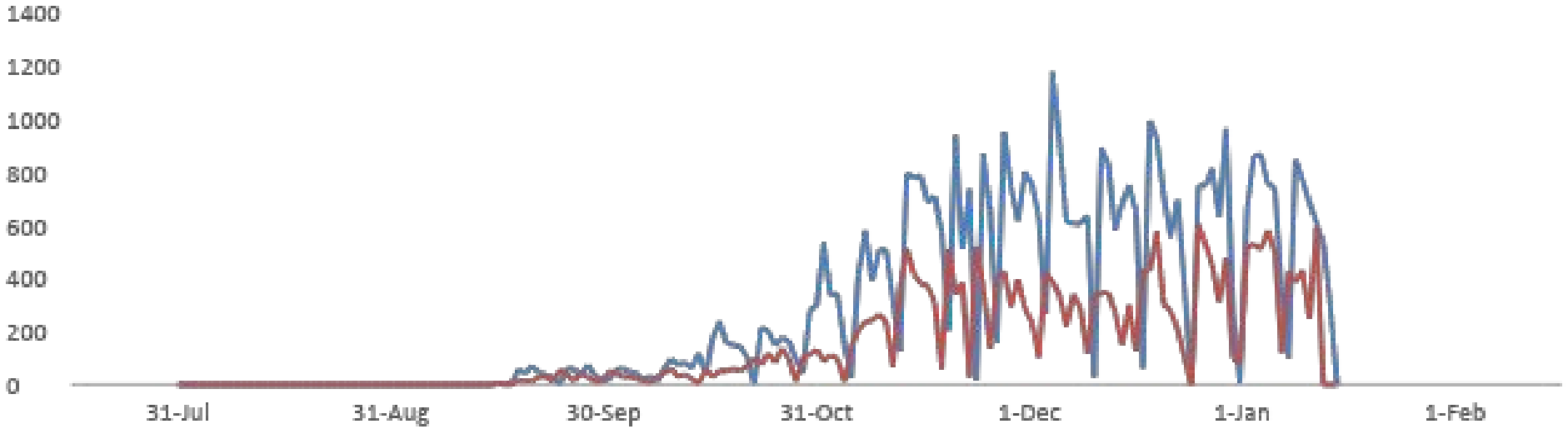
Fresh **Tangelo/Tangerine** Shipments from Florida (x 10,000 lbs)

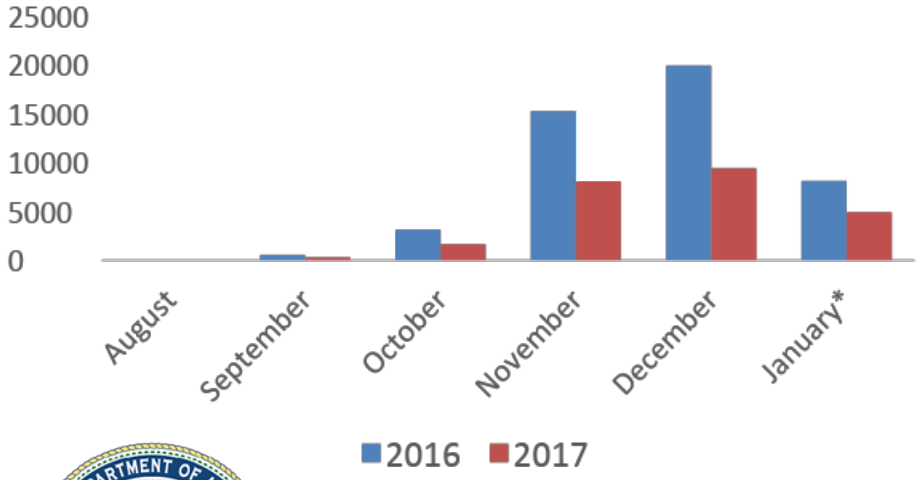


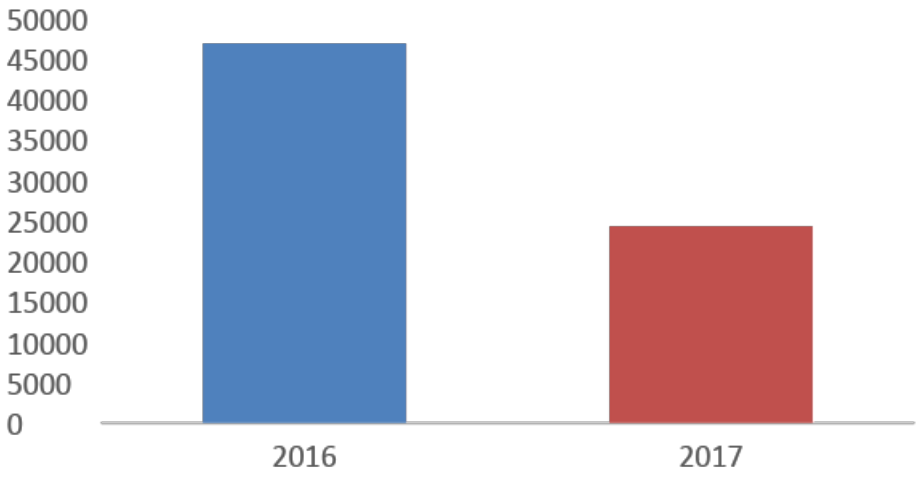




Fresh **Tomato** Shipments from Florida (x 10,000 lbs)







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