ESTIMATING PRELIMINARY HURRICANE DAMAGE ESTIMATES

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Disclaimer: The views are the authors' and do not necessarily represent those of the US Department of Agriculture. Estimates presented here are not official estimates from the US Department of Agriculture.

Motivation

- Shortly after a natural disaster, USDA Office of the Chief Economist is expected to develop a preliminary estimate of crop damage.
- This is problematic:
  - Crop insurance data takes weeks to solidify and months to finalize
  - Office of the Chief Economist does not have “boots on the ground”
  - Many producers have not taken full inventory of the damage themselves.
- In events, such as Hurricane Michael, the hurricane struck a few days after the NASS Crop Production forecast was released.

2018 Hurricanes

Hurricane Michael

- Date: Oct. 7 – Oct. 16, 2018
- Landfall: October 10th 2018
- Sustained winds of 155mph
- Category 4
- Primary States affected:
  - Georgia
  - Alabama
  - Florida panhandle

Hurricane Florence

- Date: Aug. 31, 2018 – Sept. 19, 2018
- Landfall: Sept. 14, 2018
- Category 4
- Primary States affected:
  - Carolinas
  - Virginia
- Costliest and deadliest storm to hit the Carolinas

Why not use state damage estimates?

- The methods used by states vary widely.
  - Eyewitness statements
  - Wind speed
- Some states are very forthcoming, while others are a black box.
- States tend to use the expected harvest immediately before the natural disaster, while USDA uses to the pre-plant expectation.
- States may include or use elements not consistent with USDA.
  - Inclusion of Market Facilitation Program payments.
  - Prices neither reported by NASS or the futures markets.
- **These points are NOT a criticism of the work performed by state governments or university extension.**

APH by State vs. NASS Forecast

	Cotton			Peanuts		
State	RMA - APH	NASS	Difference	RMA - APH	NASS	Difference
AL	852	1054	23.7%	3400	4050	19.1%
GA	927	973	5.0%	4041	4432	9.7%
NC	888	900	1.3%	3538	3824	8.1%
SC	845	880	4.2%	3482	3669	5.4%

September 2018 Forecast

October 2018 Forecast

Goals for our model

- Uses data that is within a week of the natural disaster.
- Can be used for major crops hit by a natural disaster
- Excel-based for easy-sharing with peers

Method

- Estimate the crop's yield after a natural disaster using
  - crop condition
  - when the crop was planted
  - yield trend
- Subtract this estimate from the average APH for the state
- Use projected prices from RMA to develop monetary value for crop damage

Data

- Response variable
  - Planted NASS yields for the State, must be calculated from production and planted acres
- Explanatory variables for optimization
  - Weekly crop condition (% of crop: very poor, poor, fair, good, excellent)
  - Time trend
  - % planted after Week 7
- Other variables needed
  - % harvested before the natural disaster
  - Projected price from RMA, assuming harvest price discovery has not occurred.

Optimization Problem: Planted Yield

$\min \sum_i^N (y_i - \boldsymbol{\beta}' \boldsymbol{x}_i)^2$, where $\boldsymbol{y}$ is planted yield and $\boldsymbol{x}$ are covariates.

Constraints

- $\beta_{trend} \geq 0$
  - Technology cannot result in worse yields
- $\beta_{planting} \leq 0$
  - late planting causes lower yields
- $\beta_{verypoor} \leq \beta_{poor} \leq \beta_{fair} \leq \beta_{good} \leq \beta_{excellent}$
  - better condition cannot lead to lower

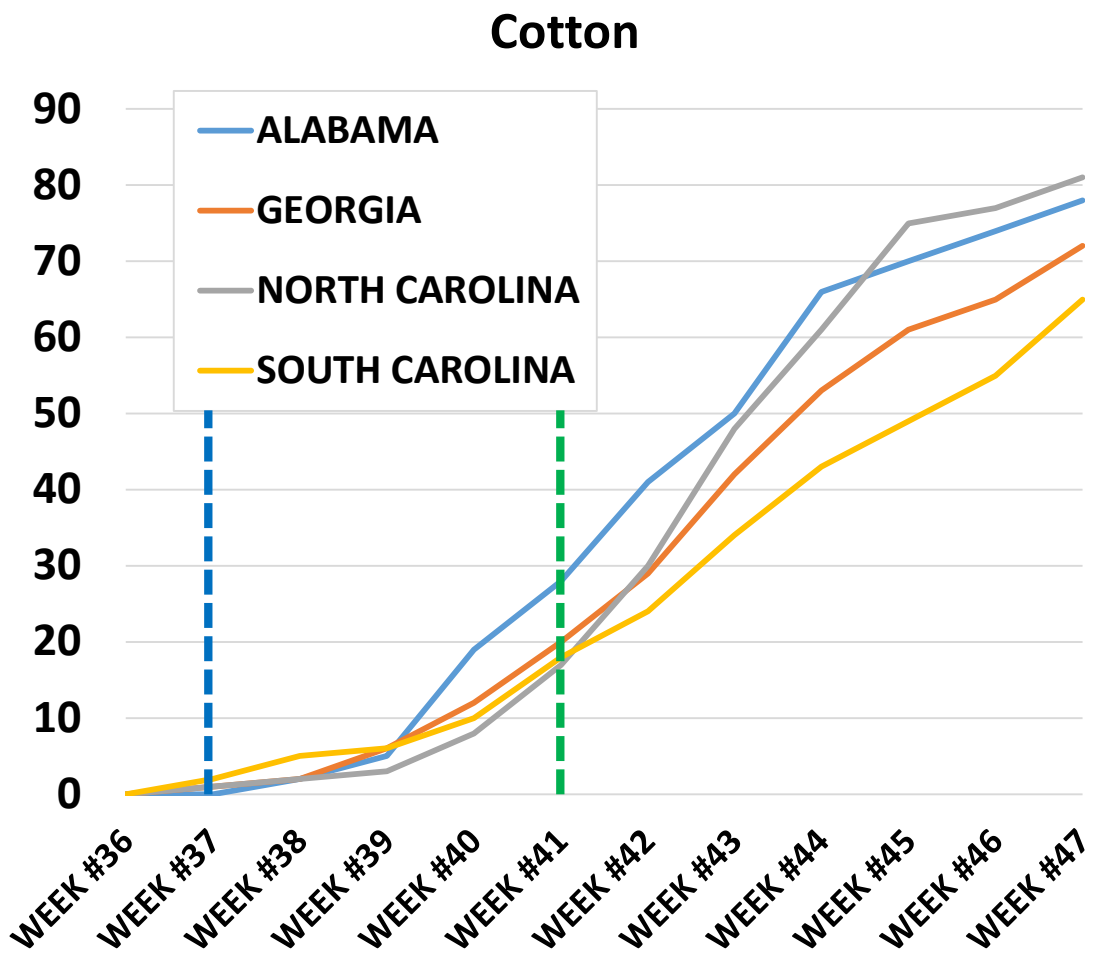
Optimization Problem: abandonment

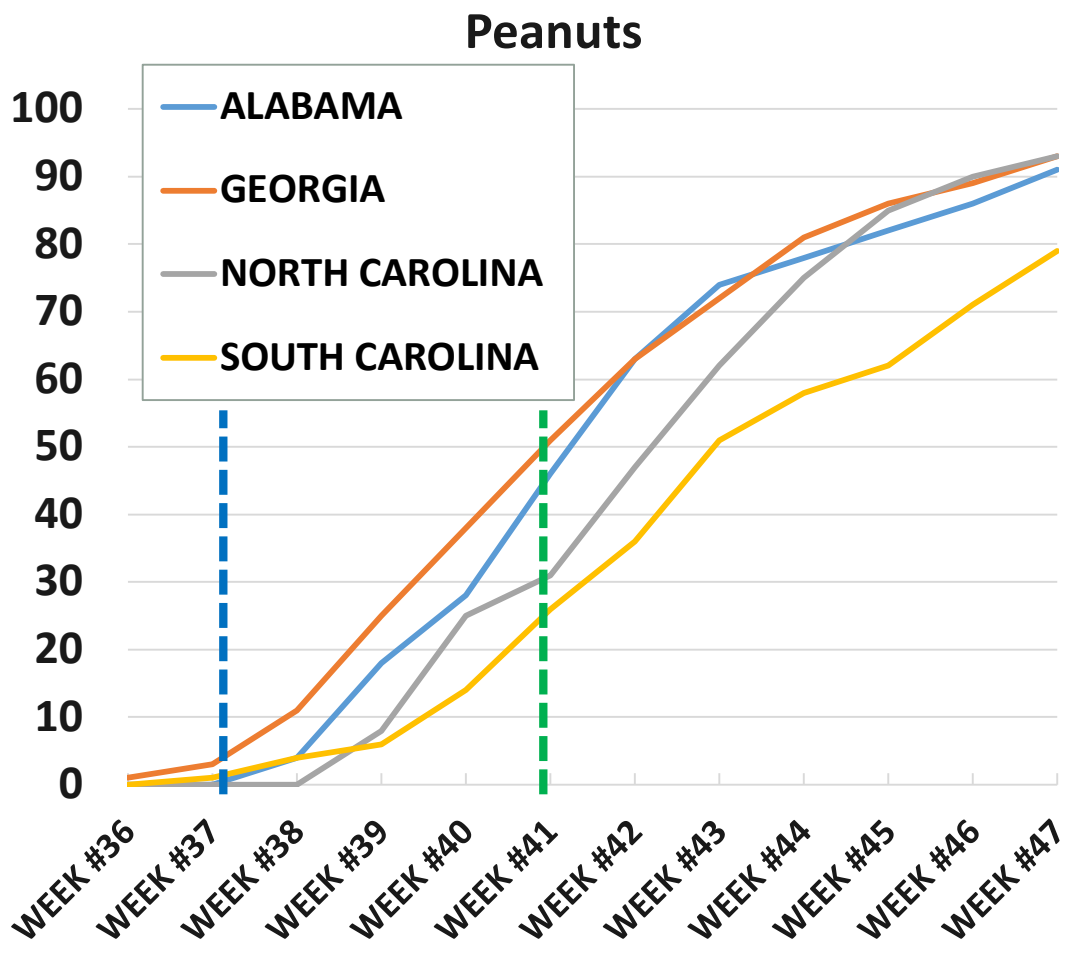
$\min \sum_i^N (y_i - \boldsymbol{\beta}' \boldsymbol{x}_i)^2$, where $\boldsymbol{y}$ is percent of land abandoned and $\boldsymbol{x}$ are the covariates

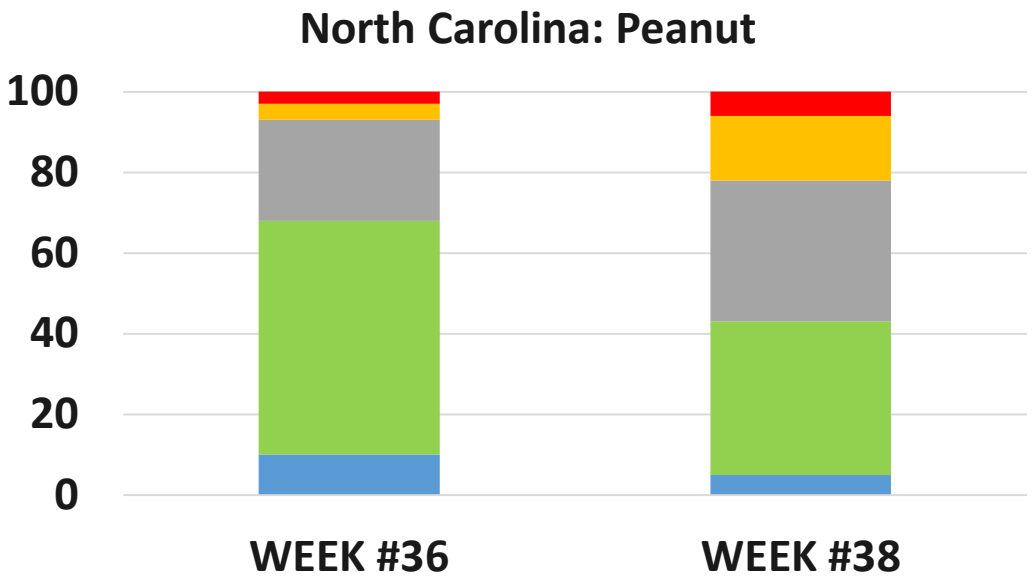
- Covariates
  - LN(%poor + %very poor + 1)
  - Intercept

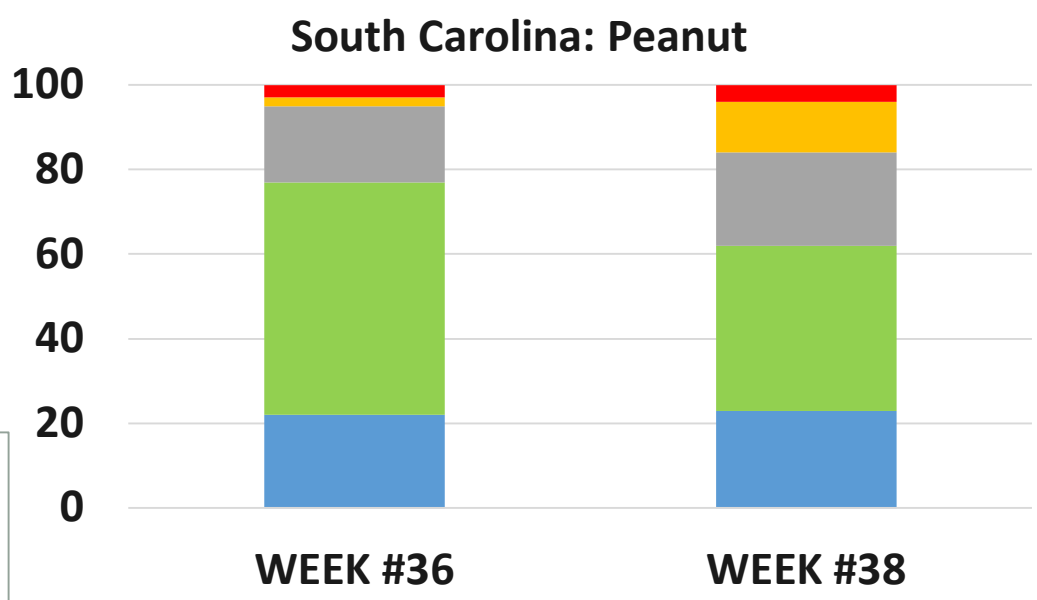
- Constraint
  - $\beta_{LN(poor+very\ poor+1)} \geq 0$
  - Worse conditions cannot lead to less abandonment

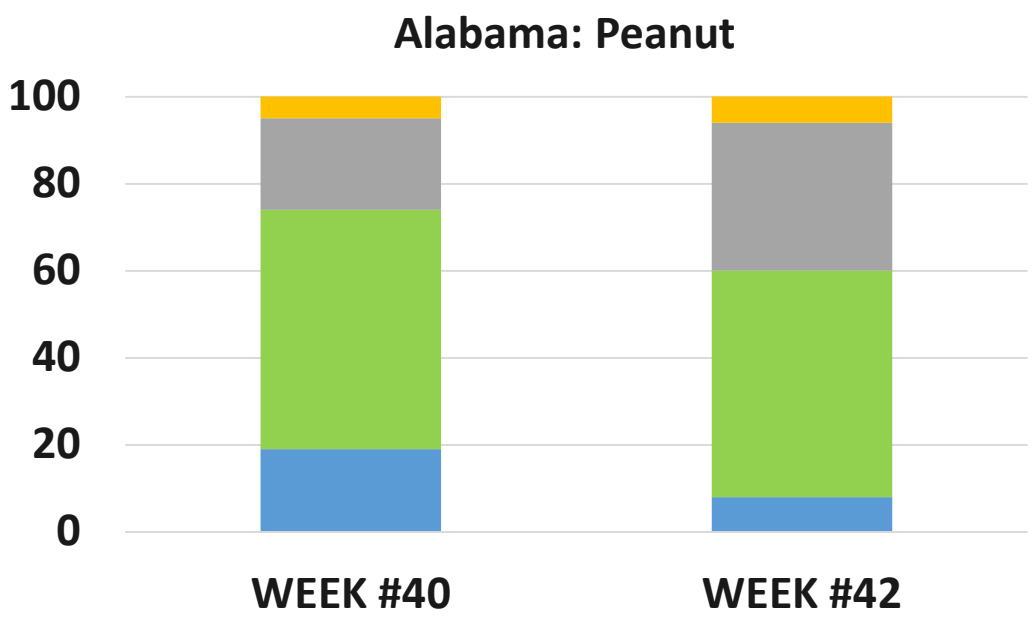
Percent harvested



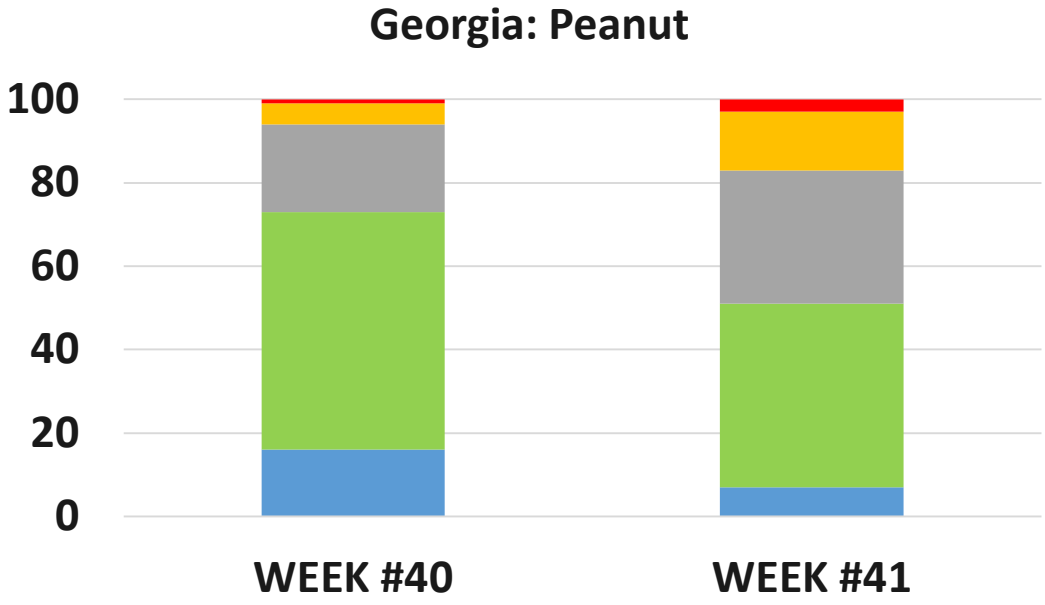


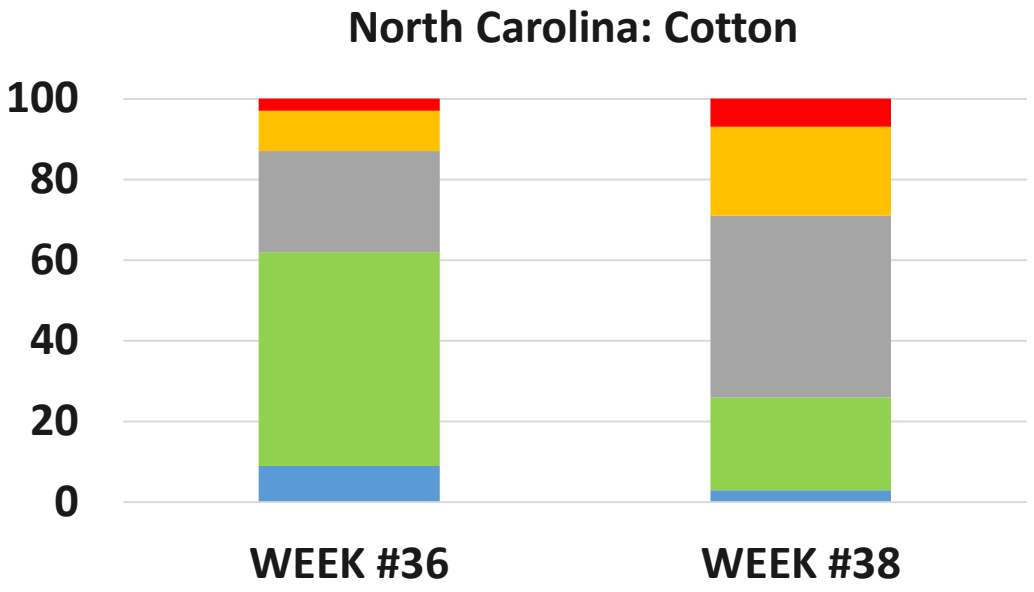

North Carolina: Peanut
100
80
60
40
20
0
WEEK #36
WEEK #38

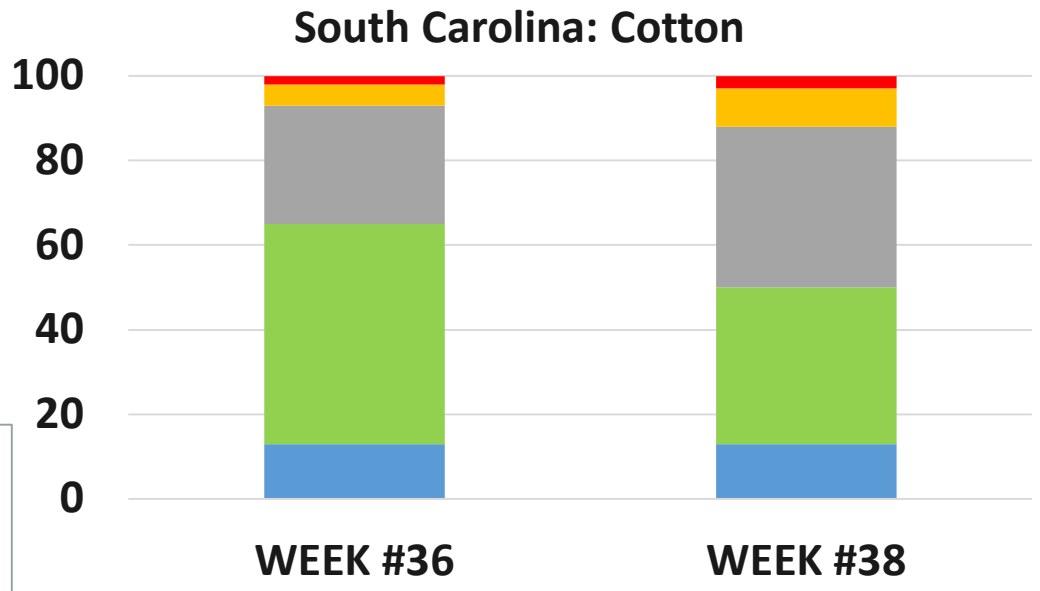

South Carolina: Peanut
100
80
60
40
20
0
WEEK #36
WEEK #38


Alabama: Peanut
100
80
60
40
20
0
WEEK #40
WEEK #42


Excellent
Good
Fair
Poor
Very Poor


Georgia: Peanut
100
80
60
40
20
0
WEEK #40
WEEK #41


North Carolina: Cotton
100
80
60
40
20
0
WEEK #36
WEEK #38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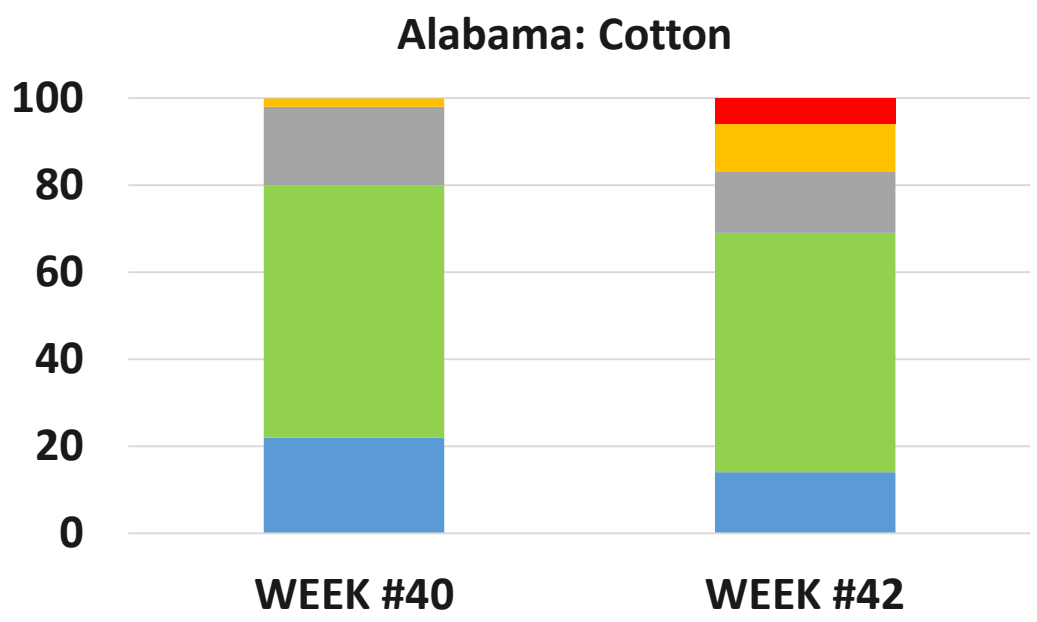
WEEK #38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WEEK #40
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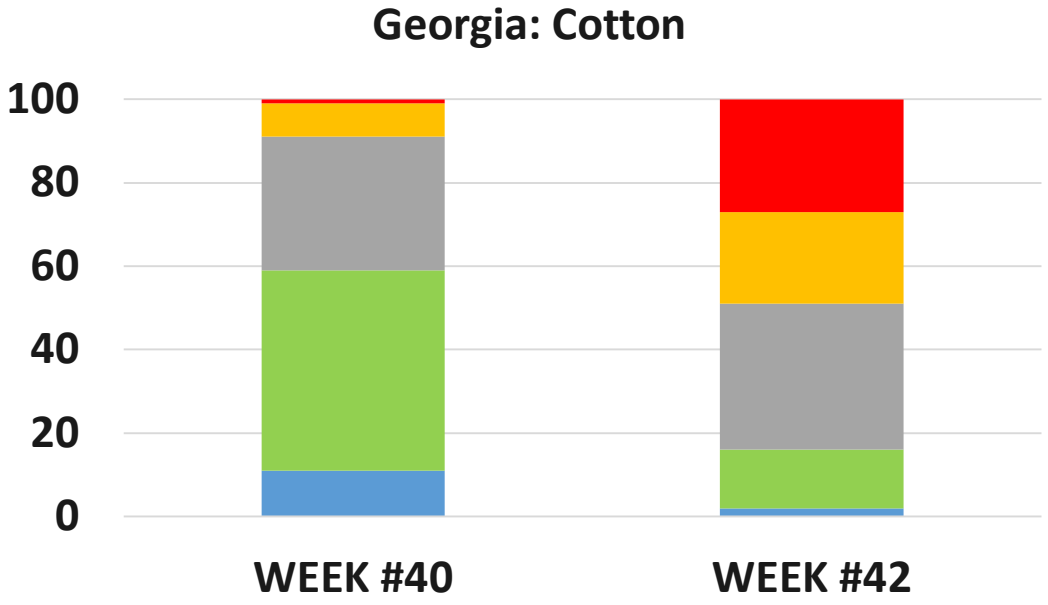
Georgia: Cotton
100
80
60
40
20
0
WEEK #40
WEEK #42

Peanut yield estimates (pounds per acre)

State	Current NASS	Model	Model +Adjustment	Initial NASS
AL	3,338	3,125	-	3,852
GA	4,350	3,844	3,191	4,235
NC	3,747	2,932	-	3,688
SC	3,205	3,569	-	3,393

Cotton yield estimates (pounds per acre)

State	Current NASS	Model	Model + Adjustment	Initial NASS
AL	809	966	906	828
GA	655	731	585	655
NC	781	650	-	748
SC	704	790	-	776

Abandonment of cotton acres

State	Current NASS	Model	Initial NASS
AL	2.0%	1.9%	8.5%
GA	5.9%	2.4%	5.9%
NC	4.9%	3.5%	7.5%
SC	3.4%	5.5%	3.4%

Blue: Closest to the current NASS abandonment estimate

Abandonment of peanut acres

State	Current NASS	Model	Initial NASS
AL	1.8%	1.6%	6.1%
GA	2.3%	1.7%	3.8%
NC	3.9%	1.9%	2.9%
SC	5.7%	0.0%	5.7%

Blue: Closest to the current NASS abandonment estimate

Conclusions and future work

- Well…that didn't go great…
- Fine tune how adjustments are done
- Explore other quadratic/non-linear optimization routines