A Tour of USDA NASS's Decision Support System

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Outline and Disclaimer

1. Motivating need for Decision Support System (DSS)
   - Relevant, timely, consolidation of multiple data sources
   - National Academies of Sciences, Engineering, and Medicine (2017a,b,c, 2019)
2. Project origins, open source software, and public data inputs
3. Added value for National Agricultural Statistics Service (NASS) estimation programs

Disclaimer: The findings and conclusions of this presentation are those of the authors and should not be construed to represent any official USDA or U.S. Government determination or policy.

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Mother Nature Does **NOT** Respect Due Dates!

Hurricane season 2017: Harvey (August 25), Irma (September 10)

Crop Production

ISSN: 1936-3737

Released September 12, 2017, by the National Agricultural Statistics Service (NASS), Agricultural Statistics Board, United States Department of Agriculture (USDA).

Special Note

Hurricane Harvey made landfall on Friday, August 25 near Rockport, Texas. The resulting rainfall caused flooding in parts of southeastern Texas and southwestern Louisiana. As a result, data collection activities for the September *Crop Production* report were impacted in these areas and the full impact of this weather event may not be fully reflected in this report. Therefore, NASS will collect harvested acreage information in both Texas and Louisiana for a number of crops in preparation for the October *Crop Production* report. Harvested acreage information will be collected from all producers surveyed in Louisiana for corn, Upland cotton, rice, sorghum, soybeans, and sugarcane; and in Texas for corn, Upland cotton, alfalfa hay, other hay, rice, sorghum, and soybeans.

Hurricane Irma made landfall on Sunday, September 10. NASS will also collect harvested acreage information in preparation for the October *Crop Production* report in Alabama, Florida, Georgia, and South Carolina. Harvested acreage will be collected in these four States from all producers surveyed for Upland cotton, peanuts, and soybeans.

Corn Production Up Less Than 1 Percent from August Forecast
Soybean Production Up 1 Percent
Cotton Production Up 6 Percent

Figure: September 2017 Crop Production Report

"To be...

		Acres	.	.
10.	Acres left **to be planted**		610 .	610 .
11.	Acres irrigated **and to be irrigated** [If double cropped, include acreage of each crop irrigated.]		620 .	620 .
16.	**Winter Wheat** (include cover crop)	Planted	540 .	540 .
17.		For grain or seed	541 .	541 .
20.	**Oats** (include cover crop)	Planted **and to be planted**	533 .	533 .
21.		For grain or seed	534 .	534 .
24.	**Corn** [exclude popcorn and sweet corn]	Planted **and to be planted**	530 .	530 .
25.		For grain or seed	531 .	531 .
29.	**Other uses** of grains planted (Abandoned, silage, green chop, etc.)	Use		
		Acres	.	.
30.	**Hay** [Cut **and to be cut** for dry hay.]	Alfalfa and Alfalfa Mixtures	653 .	653 .
31.		Grain	656 .	656 .
33.		Other Hay	___ .	___ .
34.	**Soybeans**	Planted **and to be planted**	600 .	600 .
35.		Following another harvested crop	602 .	602 .
81.	**Other crops**	Acres planted or in use	848 .	848 .

- June Area Survey
- Example Ohio instrument
- June 1 reference date
- Two-week data collection
- Respondents also report intentions ('to be')
- *Acreage* report published June 28, 2019

Intentions may change...

...or not to be"

Heavy rains impacted subsequent planting activity

- User interest in planted area totals published June 28, 2019
- Announced re-contact efforts[1] with release of *Acreage* report

State	Corn			Soybeans		
	2018 Final (1,000 Acres)	*2019 June*[2] (% Change)	*2019 August*[3] (% Change)	*2018 Final* (1,000 Acres)	*2019 June*[2] (% Change)	*2019 August*[3] (% Change)
Illinois	11,000	0%	-3%	10,800	-5%	-7%
Indiana	5,350	3%	-5%	5,950	-11%	-9%
Kansas	5,450	8%	17%	4,750	-1%	-3%
Michigan	2,300	0%	-13%	2,300	-9%	-24%
Missourri	3,500	-3%	-7%	5,850	-9%	-13%
Ohio	3,500	-6%	-20%	5,000	-6%	-16%
South Dakota	5,300	-9%	-15%	5,650	-22%	-38%

References and Data–Accessed September 15, 2019

(1) Reference: June 28, 2019 USDA NASS Agricultural Statistics Board Notice
(2) Reference: American Farm Bureau Federation–Groundtruthing USDA's June Acreage Report
(3) Author calculations based on Corn Data and Soybean Data in NASS August 2019 *Crop Production*

Mother Nature Controls Key Factors of Crop Production

Anecdotes provided by state Farm Bureau agents:

- **Illinois**–"prevented-planting of corn...planting soybeans"
- **Michigan**–"corn...will go to silage, not grain"
- **Ohio**–"[crops are] behind, struggling...in need of replant"
- **Indiana**–"Anticipated yields...less than the 10-year average"
- **Kansas**–"...will require near optimal temperatures and...precipitation...an earlier than normal frost could be devastating"

Economic decisions, progress, condition, trend yield, and phenology

University of Florida/NASS Collaboration

AgroClimate Tools

- Origins with Southeast Climate Consortium (SECC)
- Currently managed by University of Florida
- Decision tools for farmers

Collaboration to customize tools for NASS internal use

- Nebraska pilot began in 2015
- Nationwide expansion summer 2017

Public Data Inputs and Software

Statistics in DSS derived from NASS data and these inputs:

1. Oregon State University PRISM Climate Data
2. NOAA National Centers for Environmental Prediction Real-Time Mesoscale Analysis (RTMA) Data
3. USDA Natural Resources Conservation Service Soil Survey Geographic Database (SSURGO)

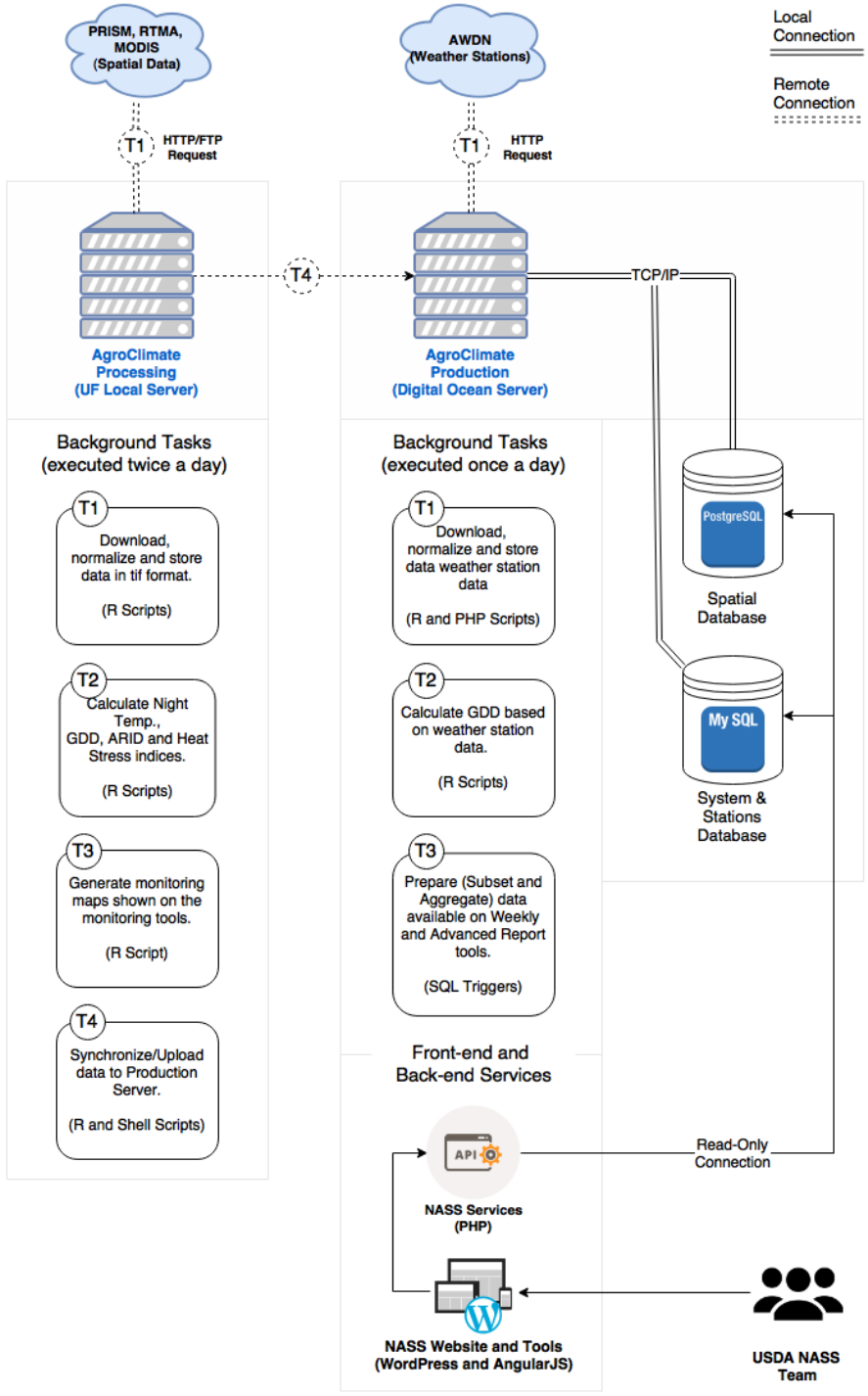
Free or open-source software underpinnings:

- MySQL and PostgreSQL with required PostGIS 2.4.5 extension
- Apache Server, PHP, WordPress
- R v3.4.3: reshape, reshape2, ggplot2, rJava, zoo, stringr, sp, RPostgreSQL, RMySQL, rgdal, RCurl, raster, plyr, ncdf4, maptools, mailR, Jsonlite, RJSONIO, doMC, compare, foreach, AgroClimate

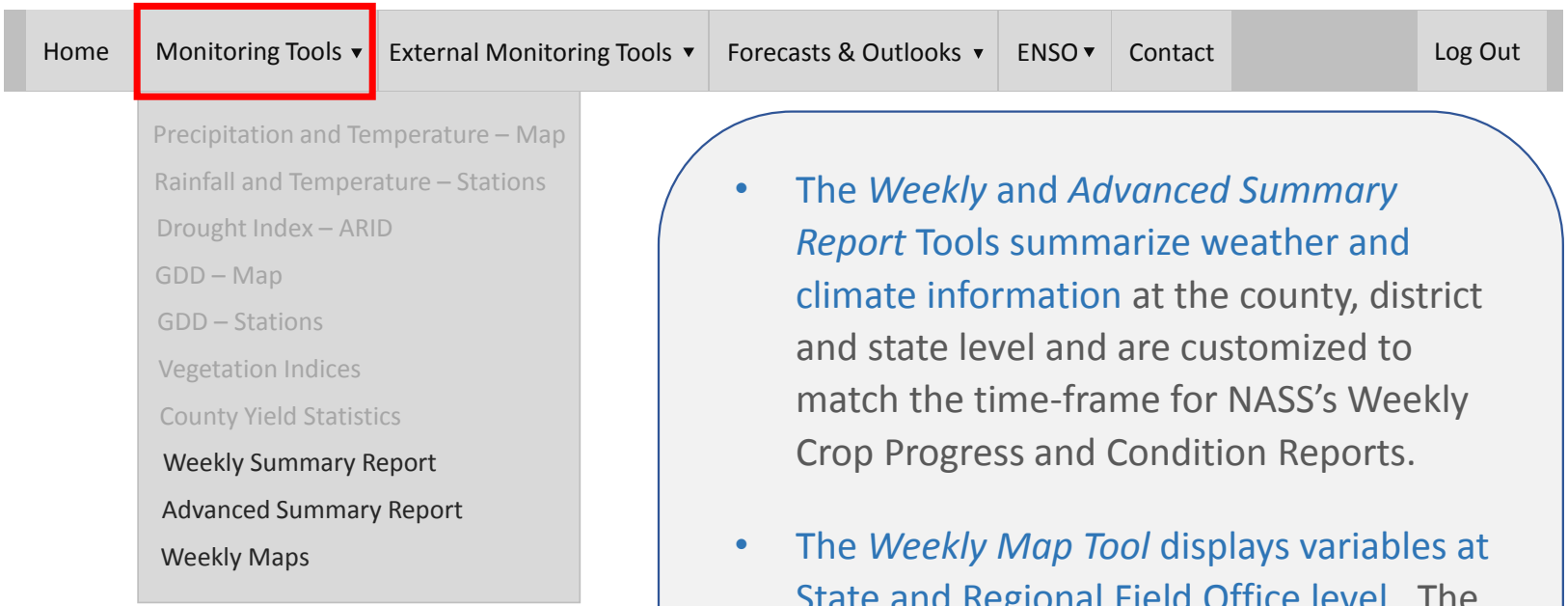
DSS Structure

Browser-based, menu-driven

- Intuitive, user-friendly
- Read-only connection
- Spatial and systems databases
- `R` scripts derive and aggregate statistics
- Curated data matched to NASS deliverables
- Visualize, summarize, export

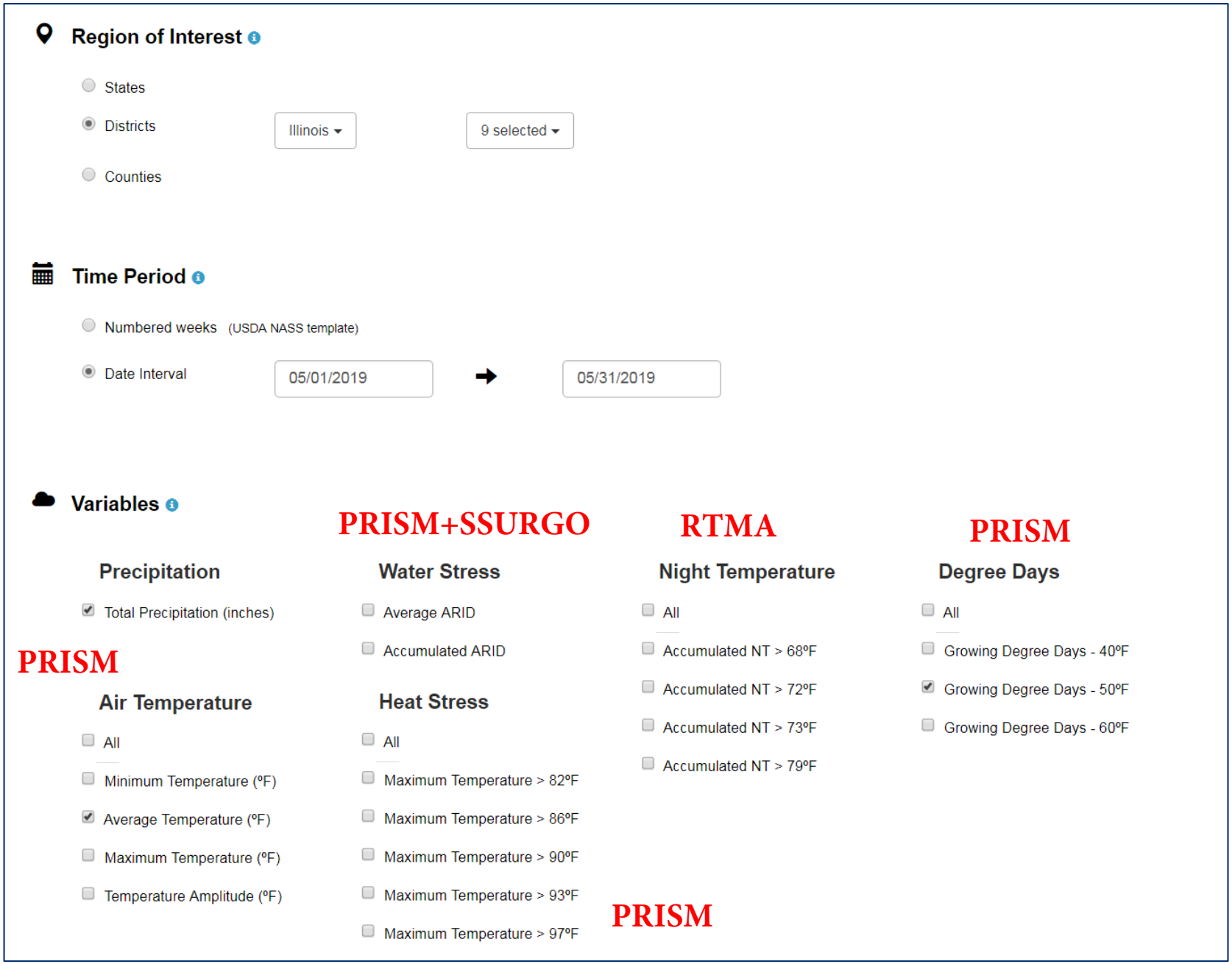


Monitoring Capabilities



- The *Weekly* and *Advanced Summary Report* Tools summarize weather and climate information at the county, district and state level and are customized to match the time-frame for NASS's Weekly Crop Progress and Condition Reports.
- The *Weekly Map Tool* displays variables at State and Regional Field Office level. The summary of the weather information - for the week ending on Sunday - is available *every* Monday morning at 9:00 am EST.

Menu for Summary Reports: Derived Statistics



Field Office Review and Weekly Reports

Compare/contrast April 29, 2019 *Crop Progress and Condition*

Features	**Wyoming**	**Illinois**
Weekly Narrative	X	X
Crop/Livestock Progress	X	X
Crop/Livestock Condition	X	X
# Days for Fieldwork	X	X
Soil Moisture	X	X
State/District Weather		X
Weather Maps		X

Opportunities: standardize, provide additional useful data

- Link: Wyoming Crop Progress for April 29
- Link: Illinois Crop Progress for April 29

Wyoming District Weather: April 22-April 28, 2019

Report

Export

Wyoming - Districts Report

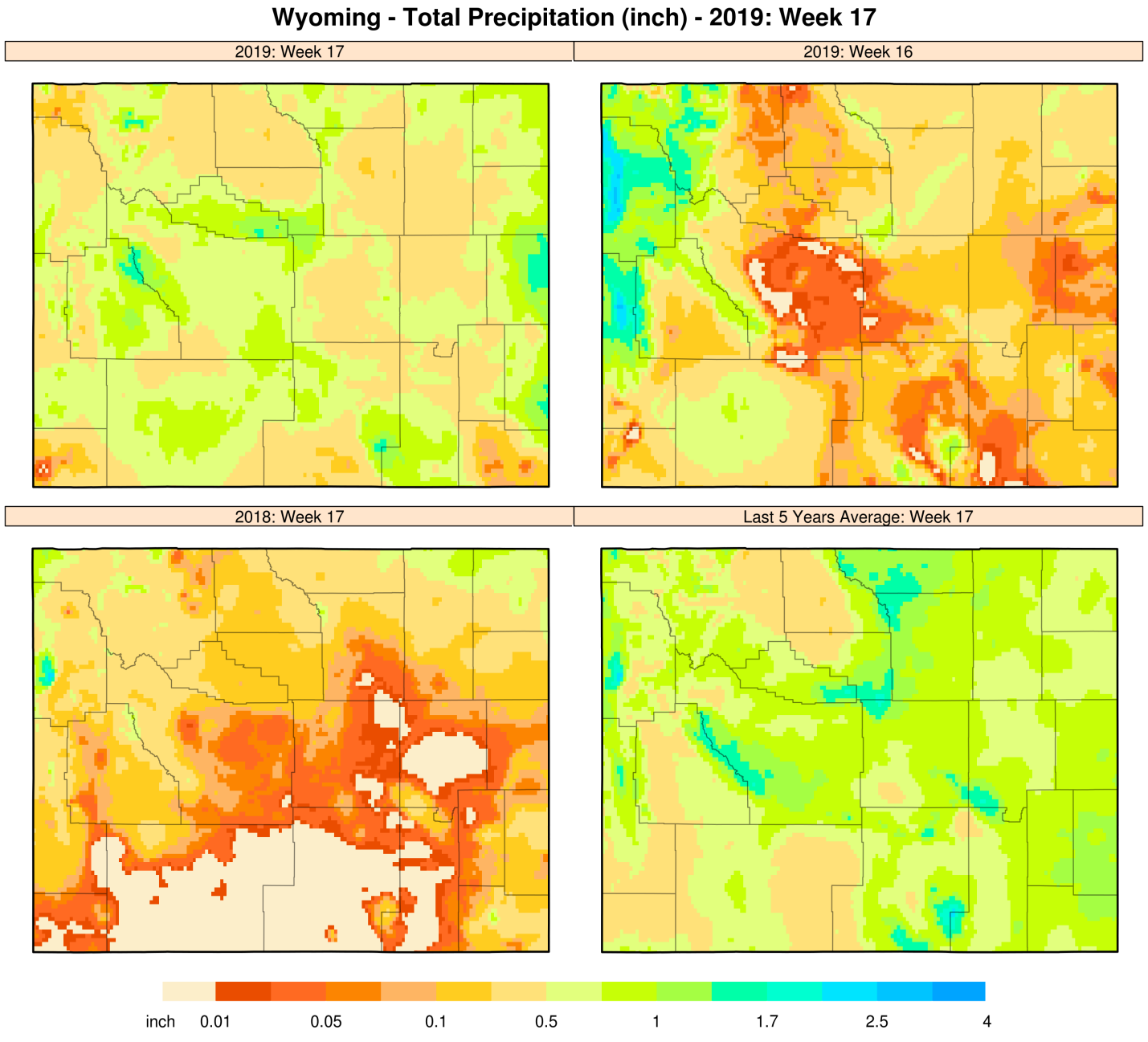
Week 17 of 2019. (2019-04-22 to 2019-04-28)

Variables	Districts					State			
	Northwest	Northeast	West	South Central	Southeast	Selected Week	Previous Week	Previous Year	5-yr Avg.
Total Precipitation (inches)	0.5	0.5	0.4	0.5	0.5	0.5	0.3	0.1	0.7
Temperature (°F)									
Minimum.....	32.1	35.5	30.2	32.9	35.2	33.2	34.1	30.5	30.4
Average.....	44	46.3	42.4	45.5	48.2	45.3	46	45.8	41.8
Maximum.....	56	57.2	54.6	58.2	61.2	57.4	58	61.2	53.2
Amplitude.....	23.9	21.7	24.3	25.3	25.9	24.2	23.8	30.7	22.8

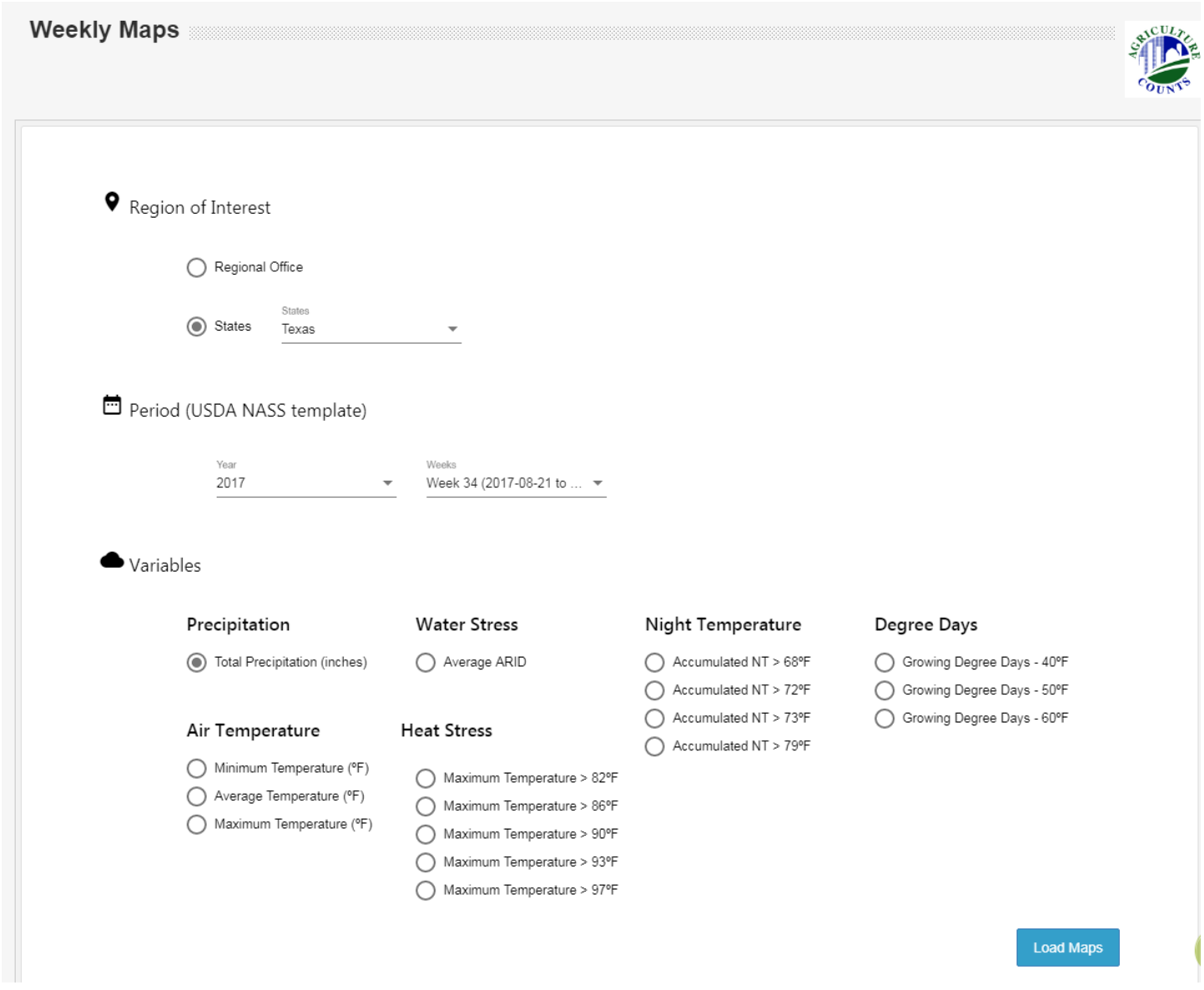
USDA

AgroClimate

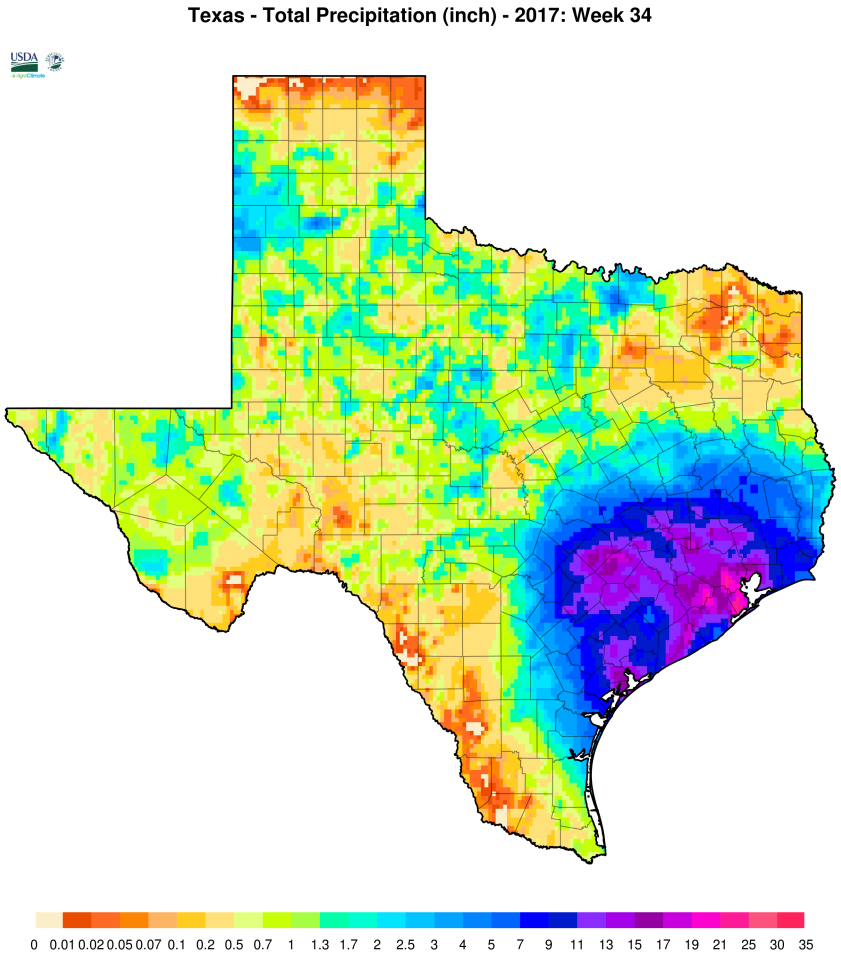
Wyoming Weather Map: April 22-April 28, 2019

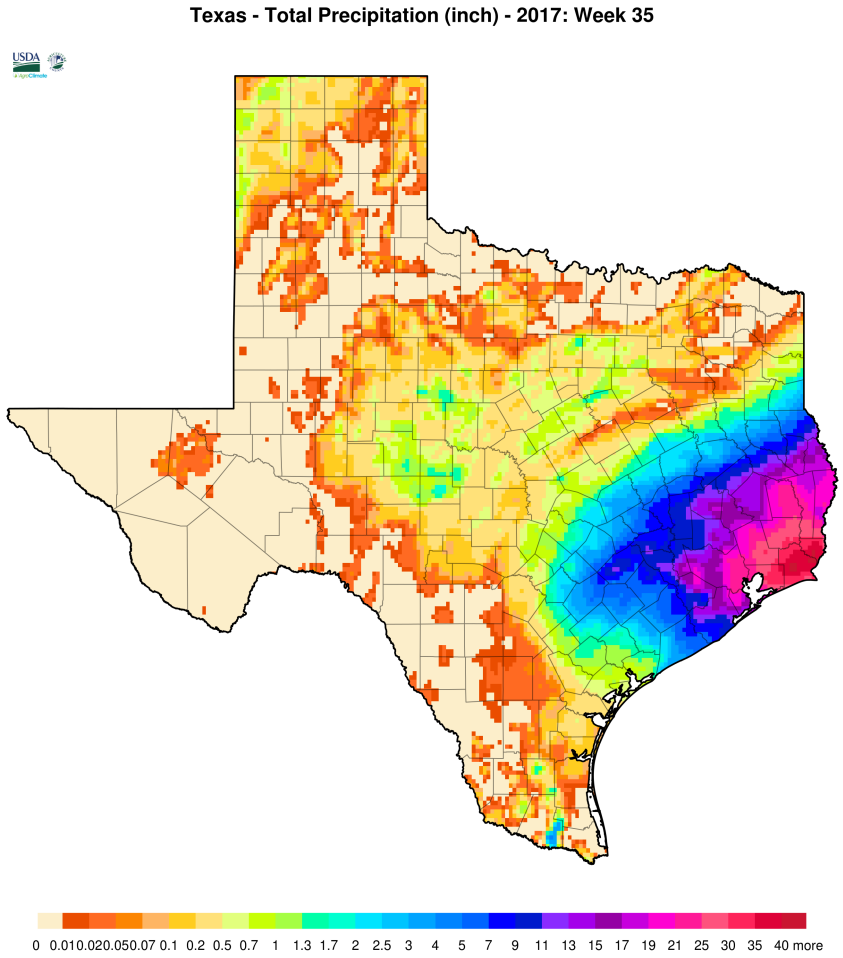


Weekly Map Menu–Exporting Texas Precipitation



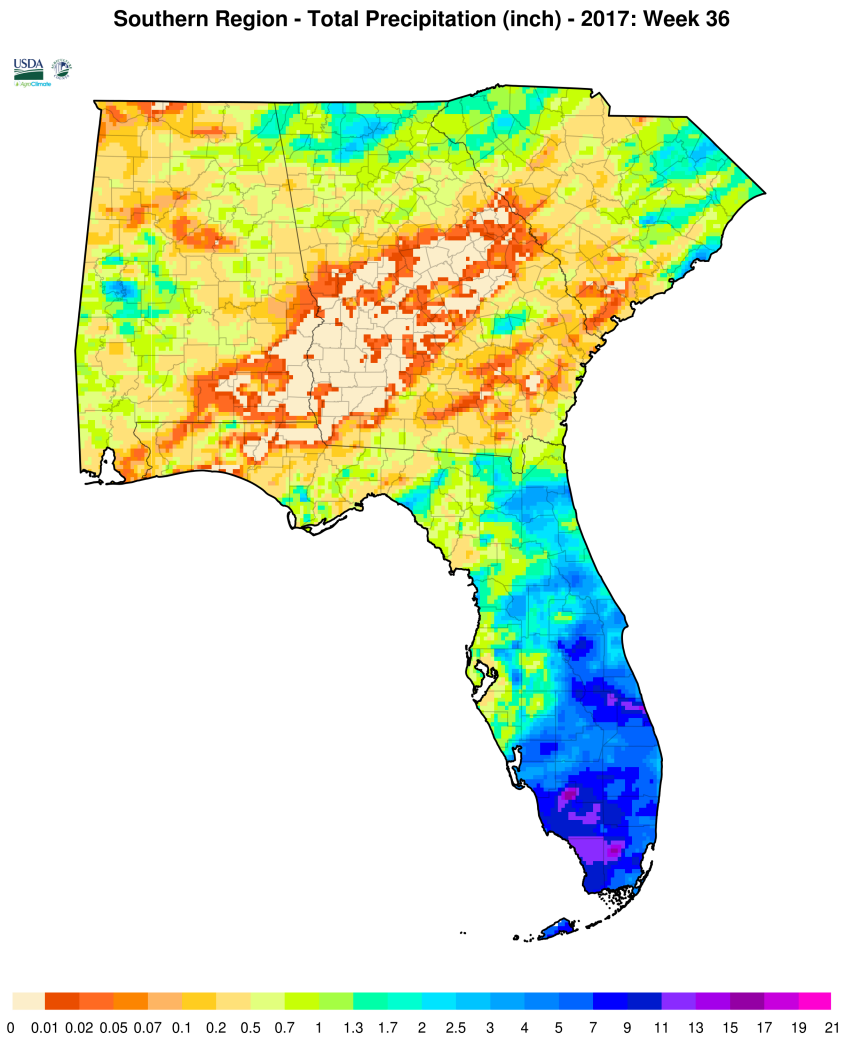
Texas Precipitation: August 21-September 3, 2017

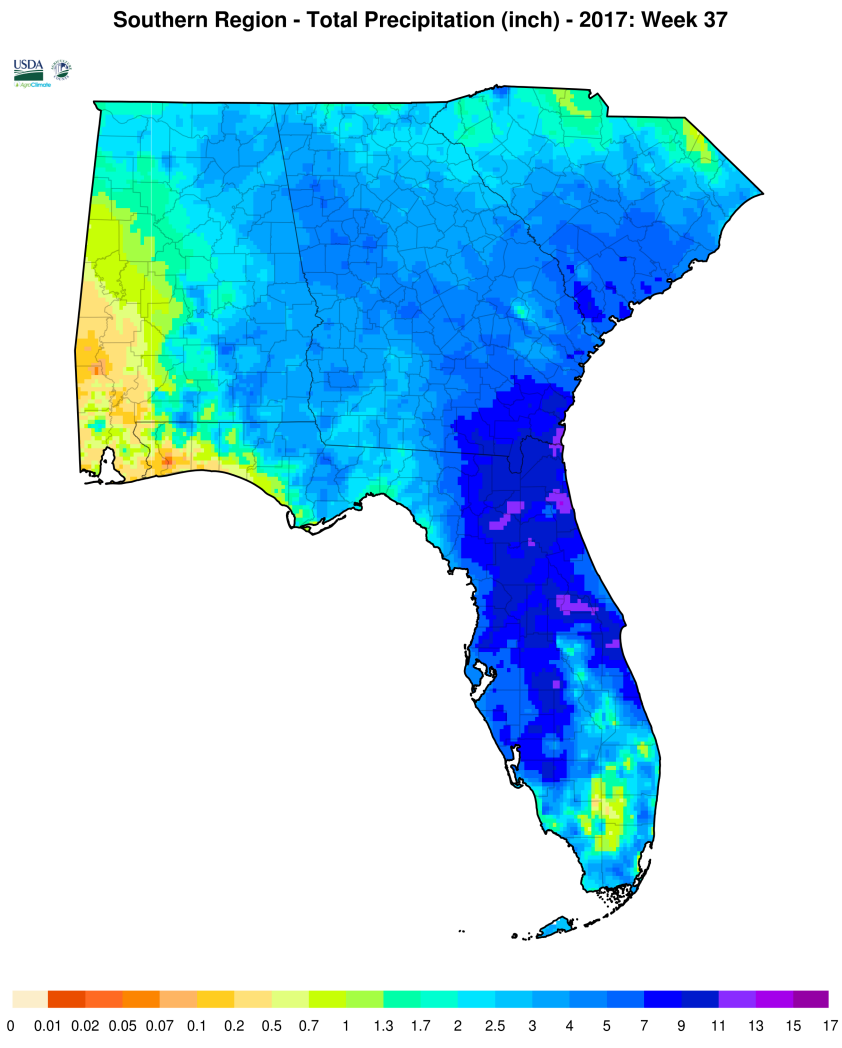




- See also Boryan et al. (2017)
- Benecha et al. (2019)

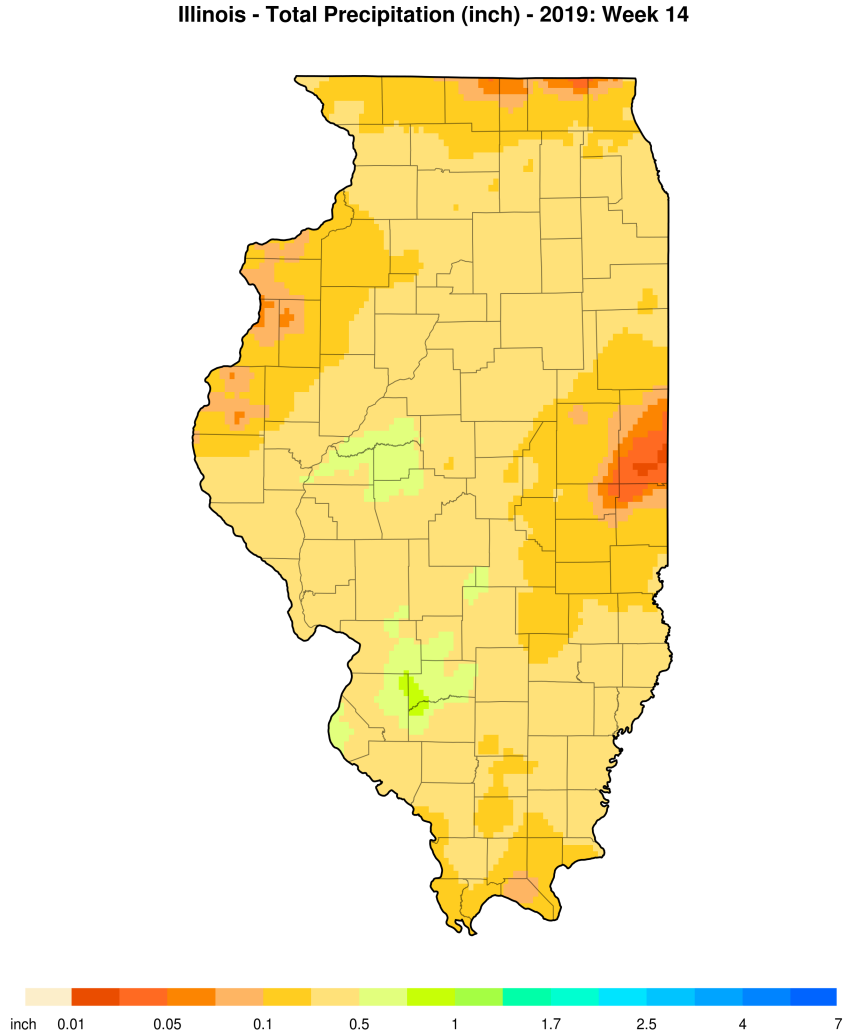
Southern Region Precipitation: September 4-17, 2017

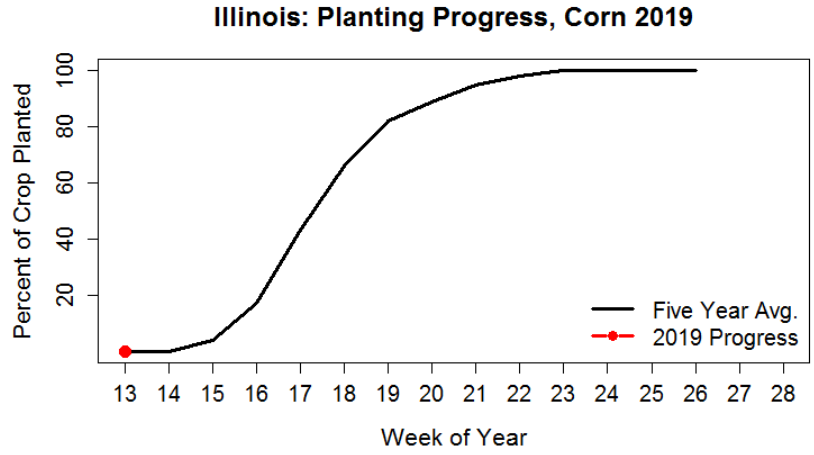


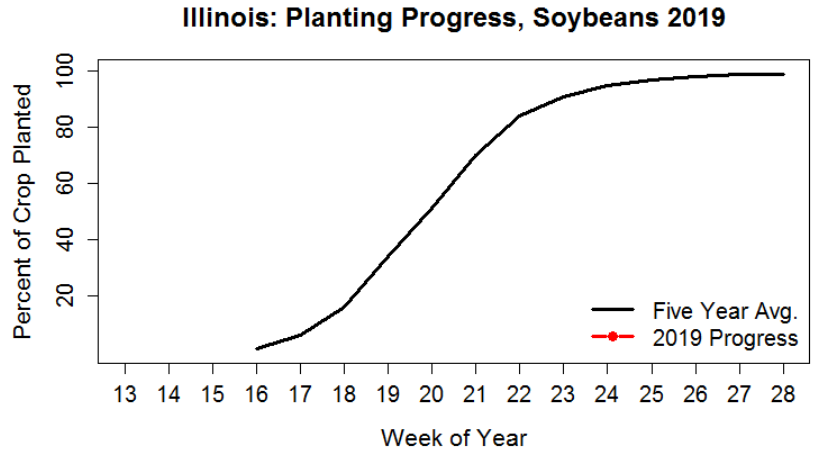


- See also Hurricane Irma: NASS Flood Assessment Report

2019 Illinois Precipitation and Planting Progress







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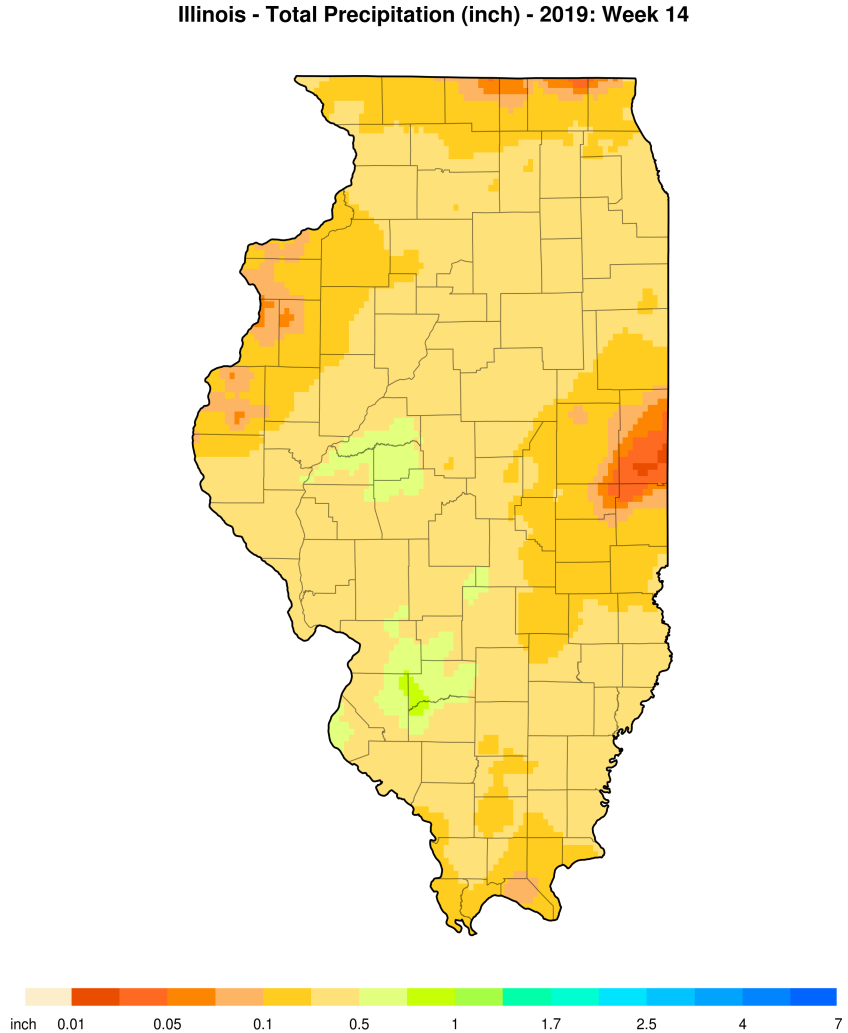

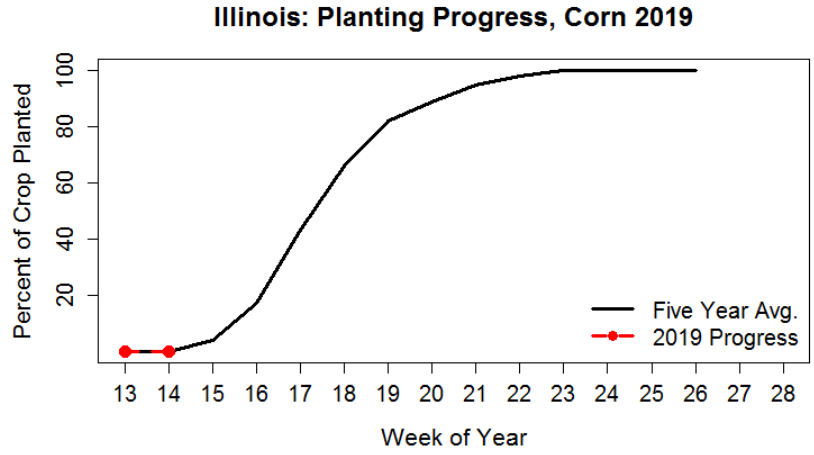

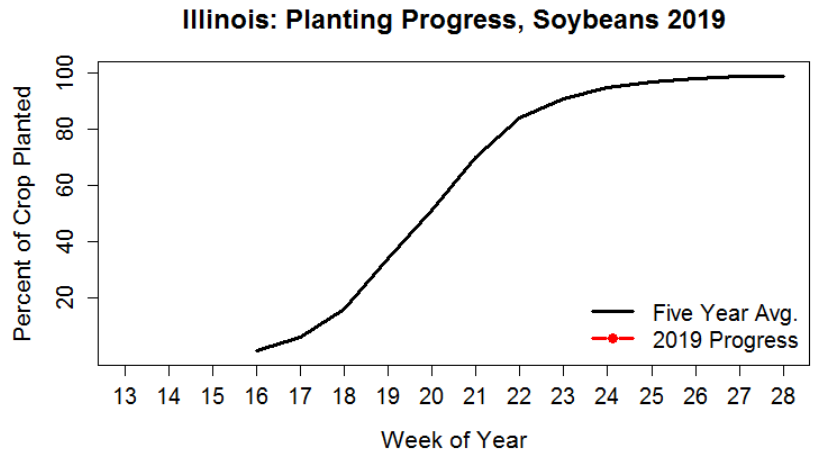

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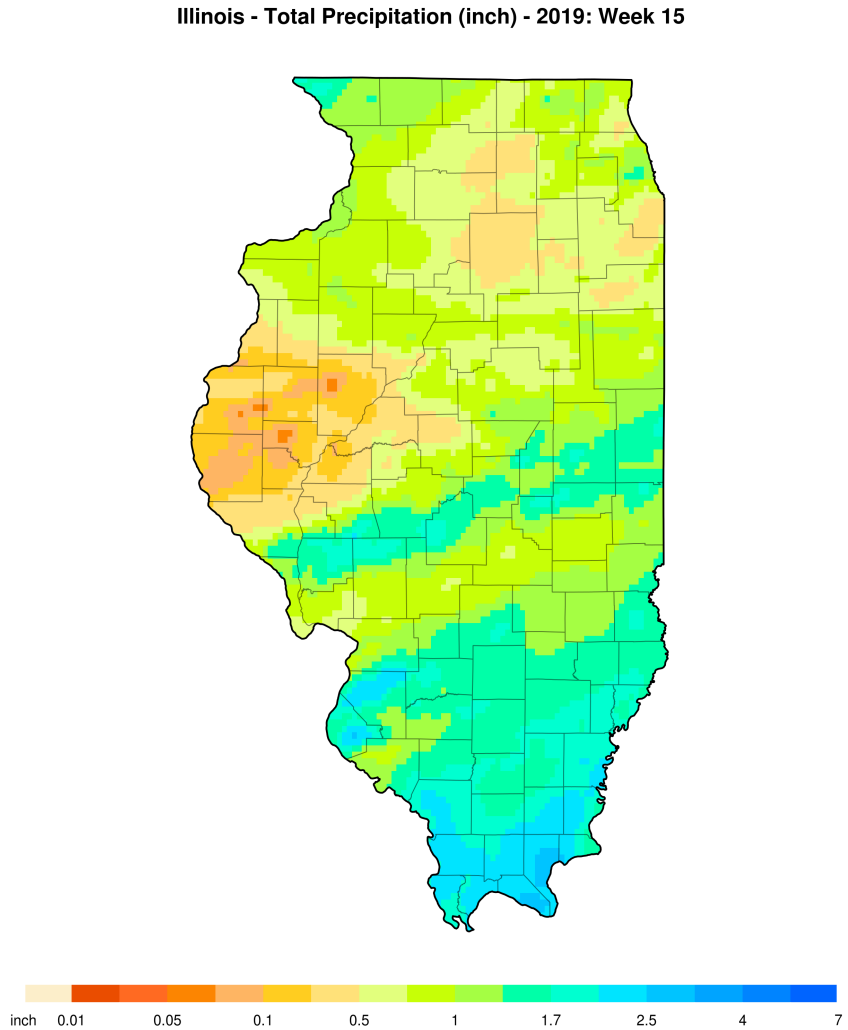

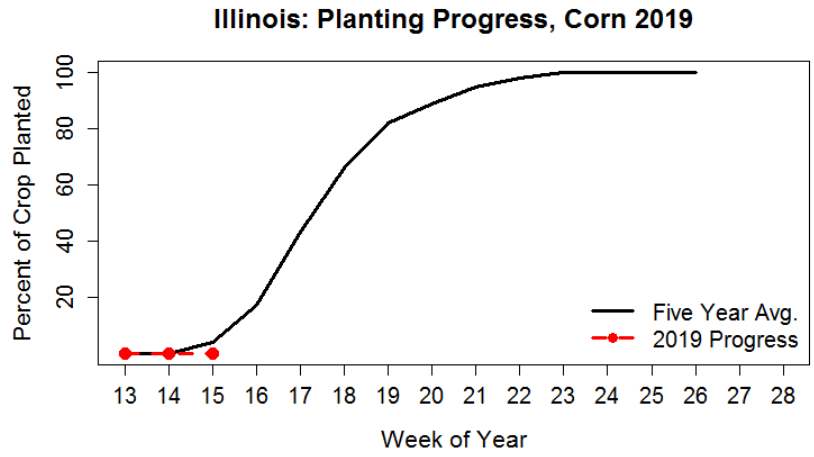

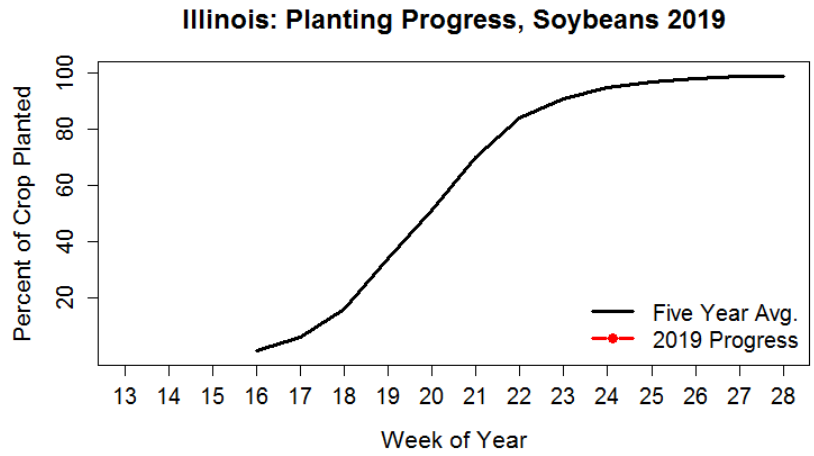

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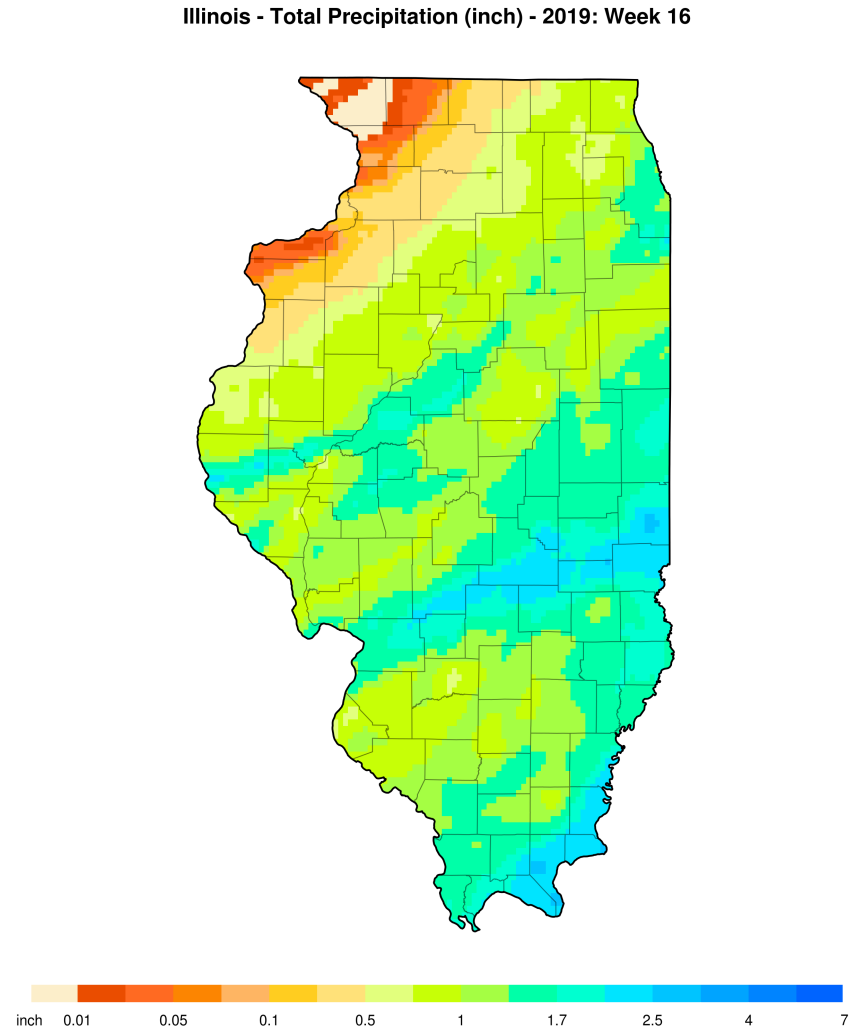

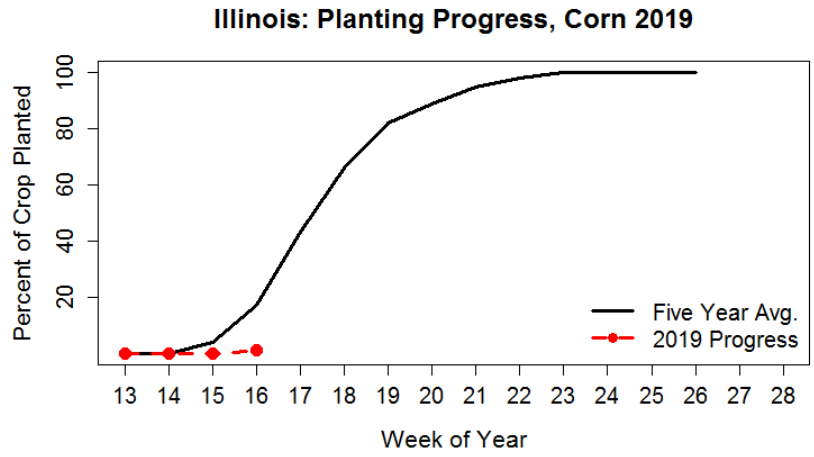

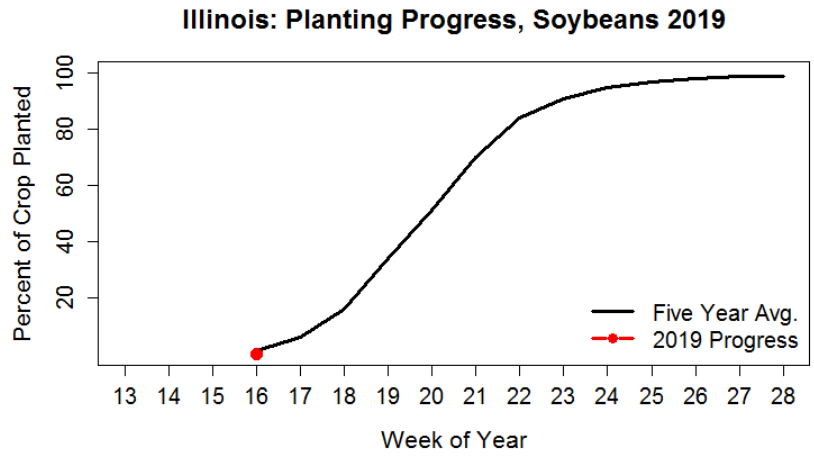

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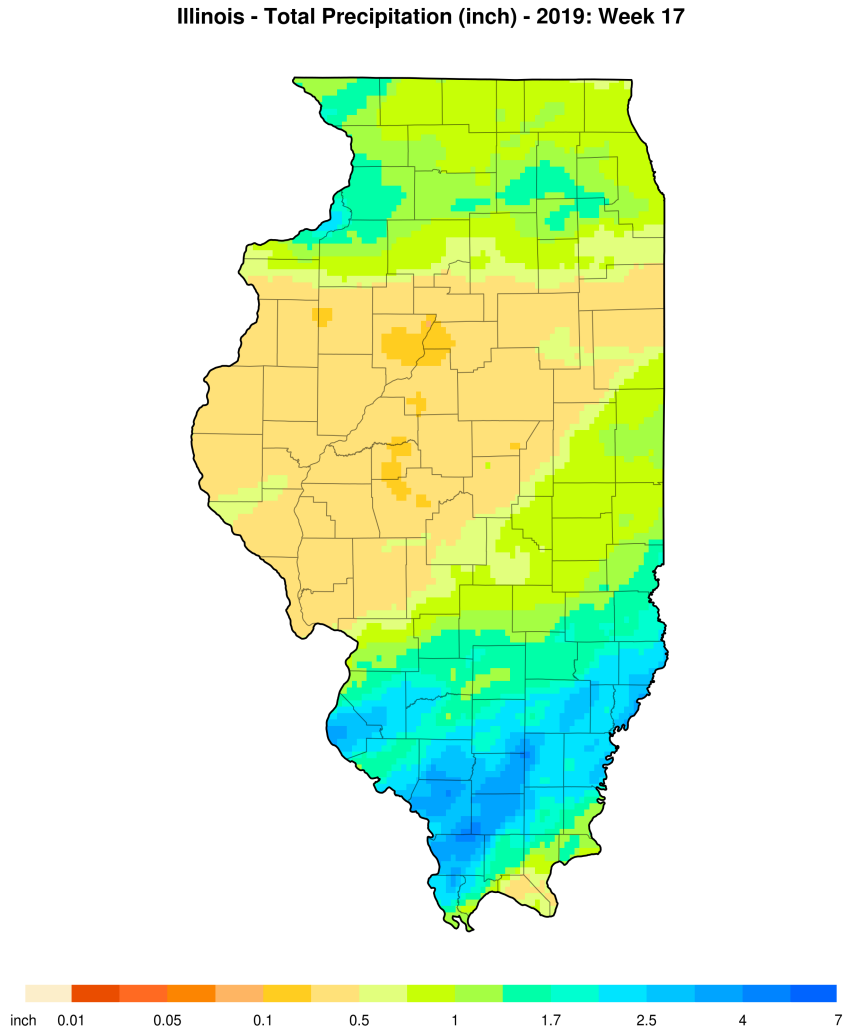

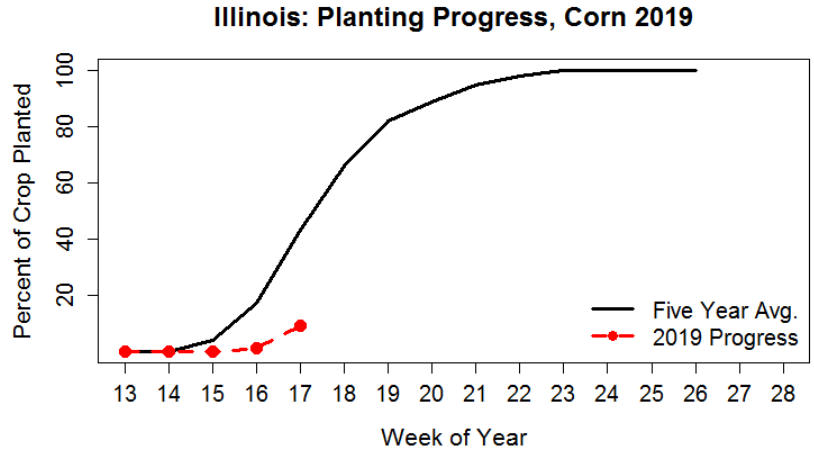

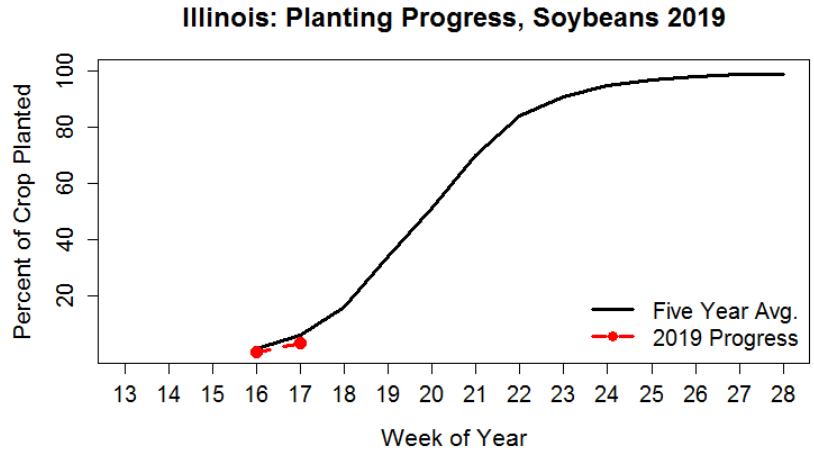

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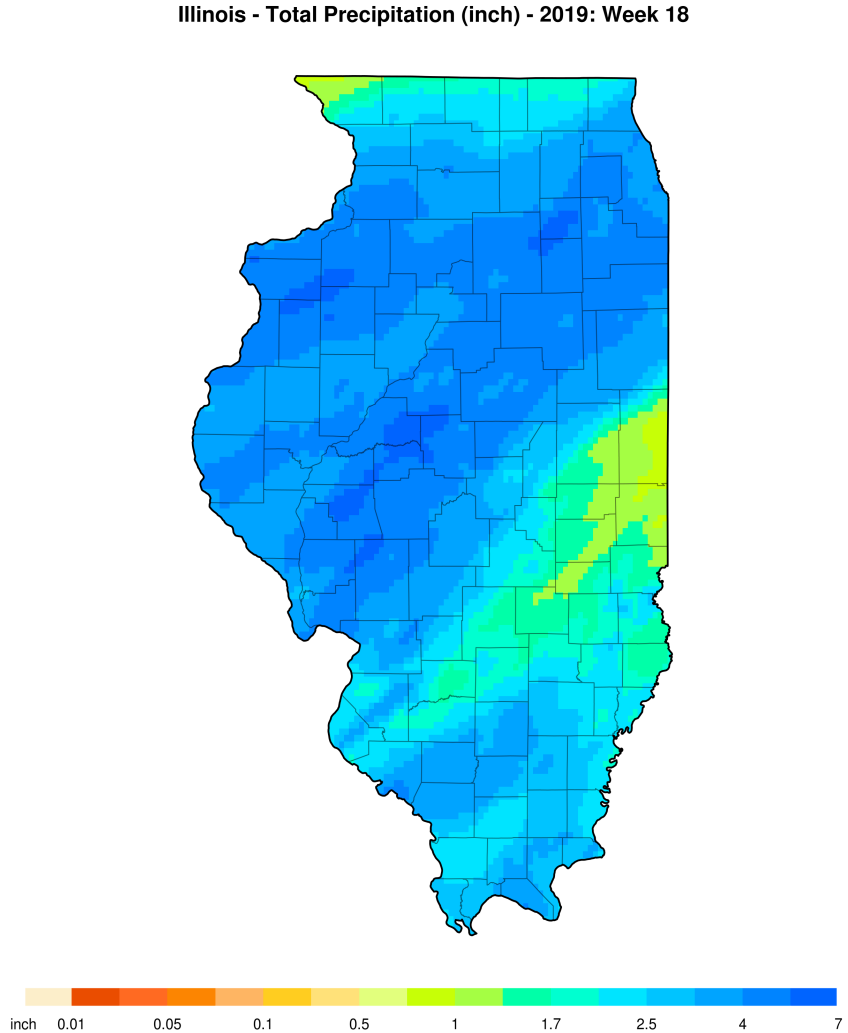

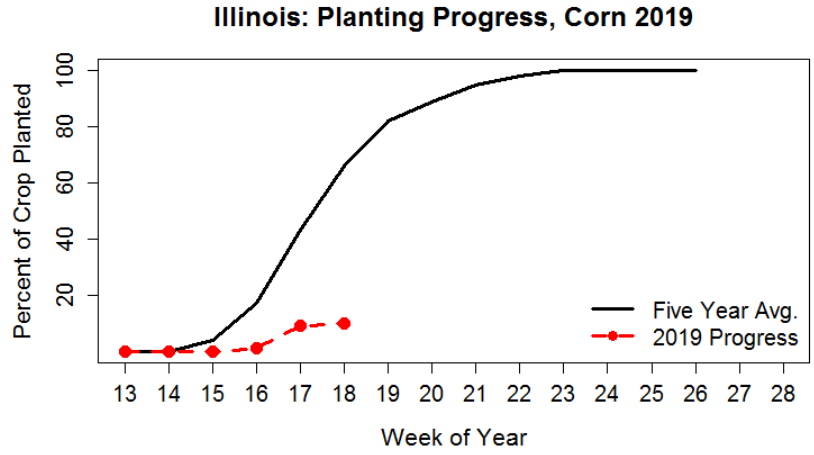

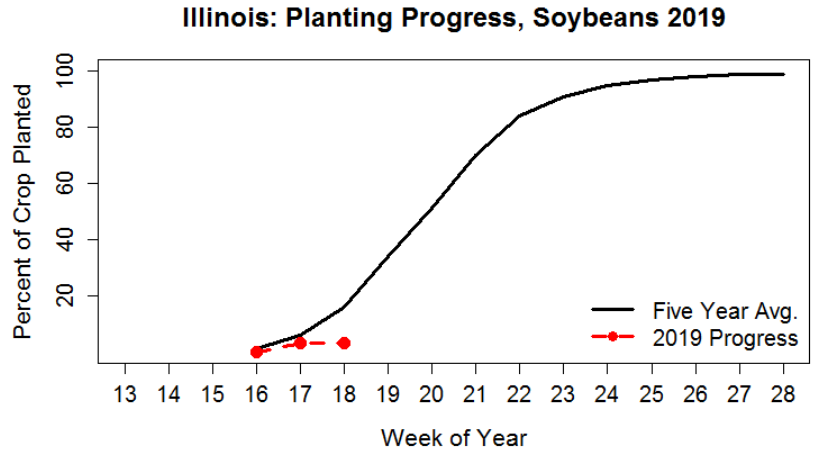

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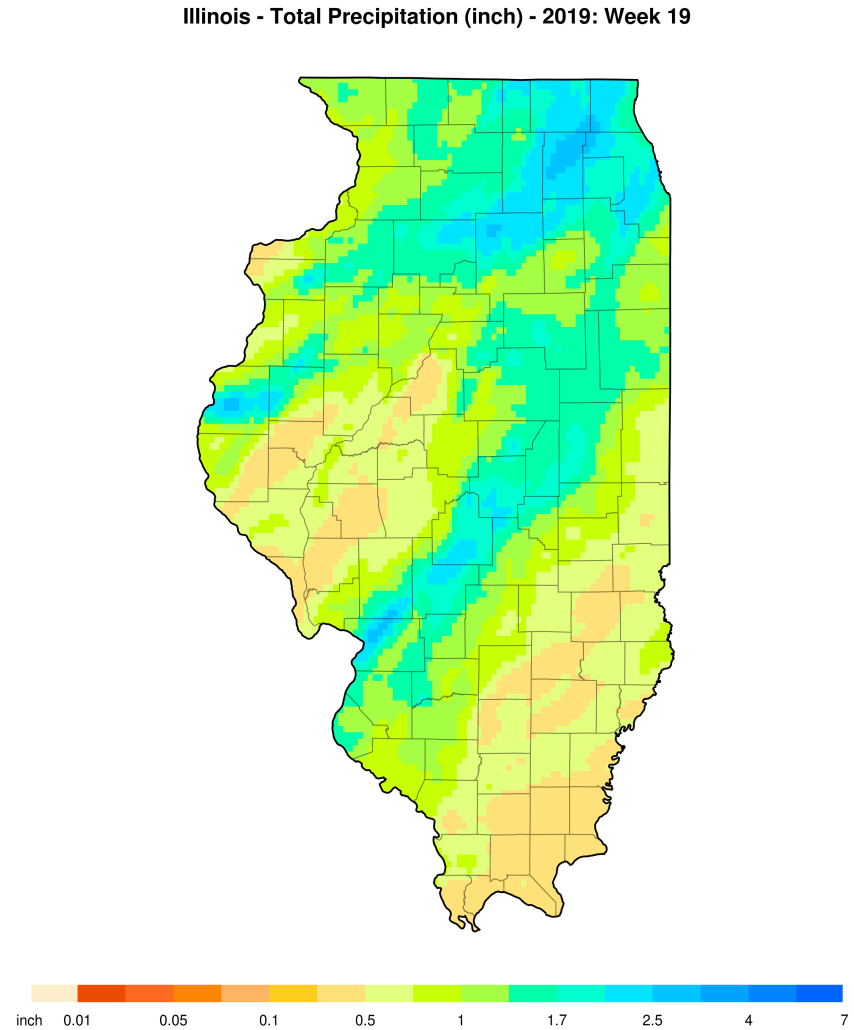

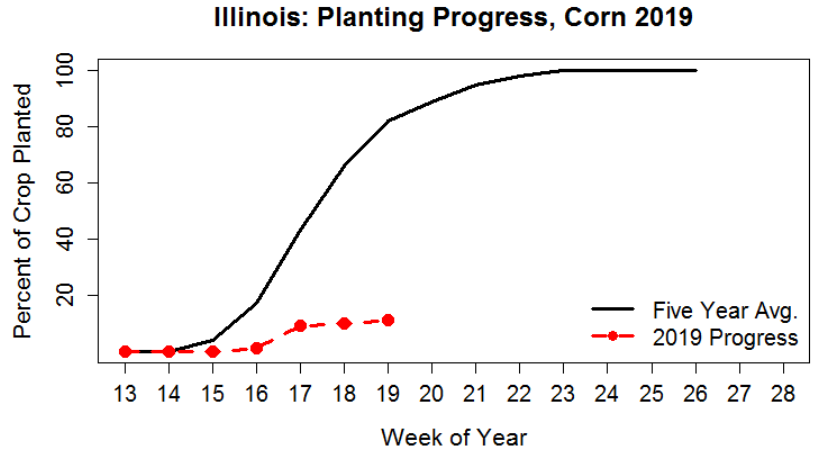

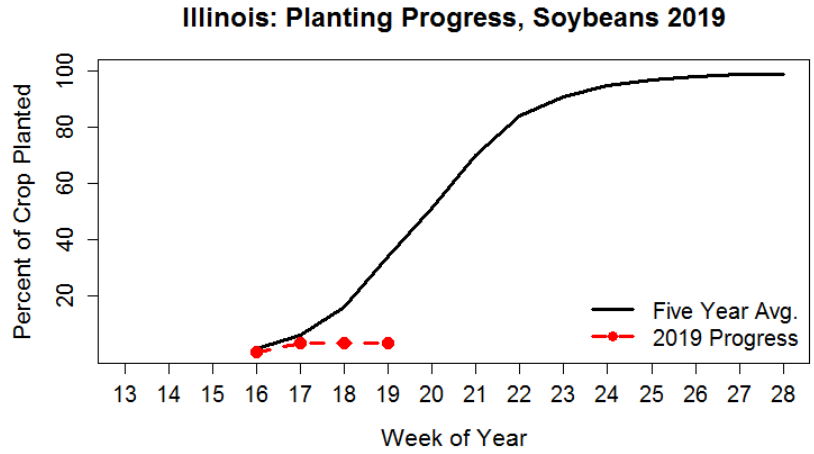

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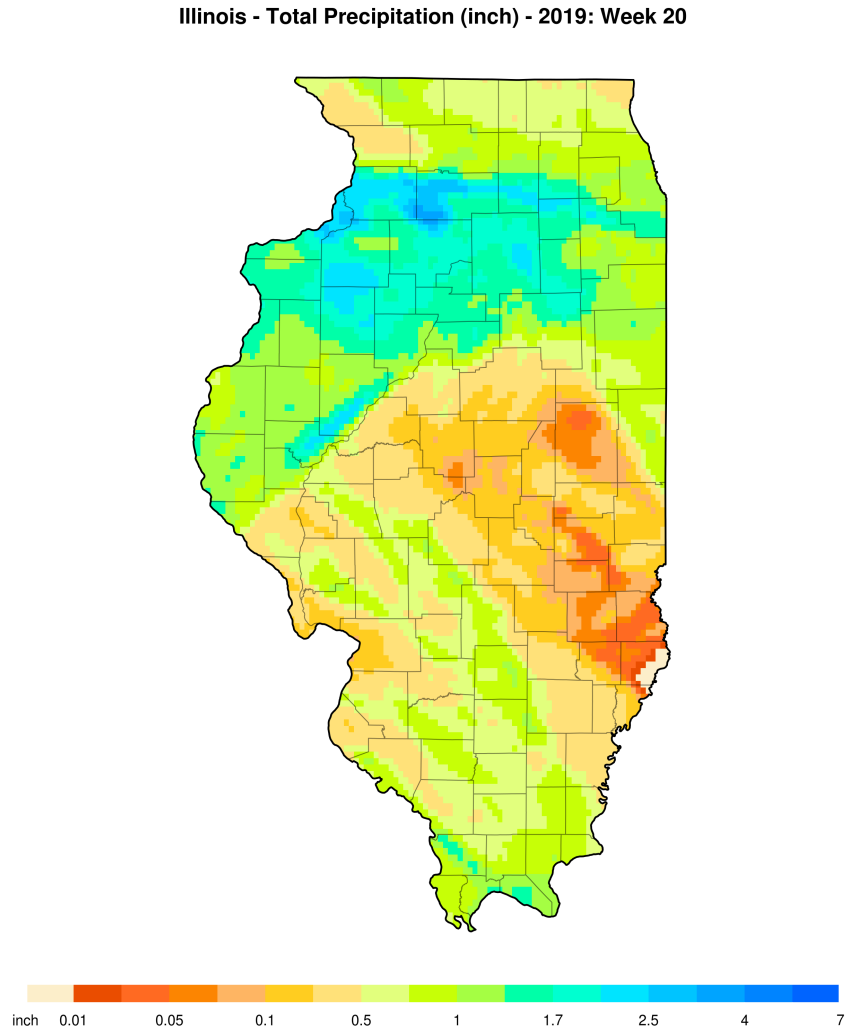

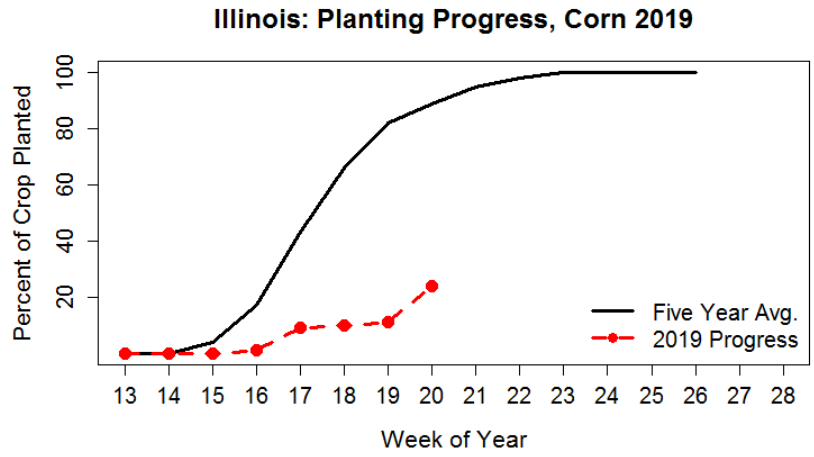

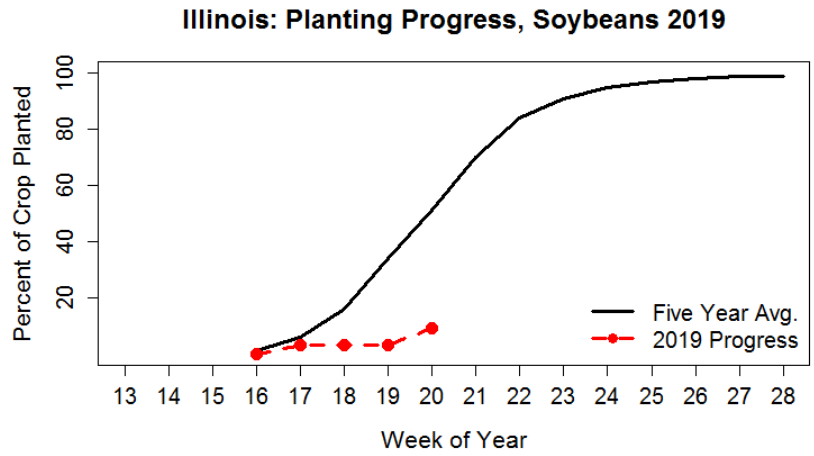

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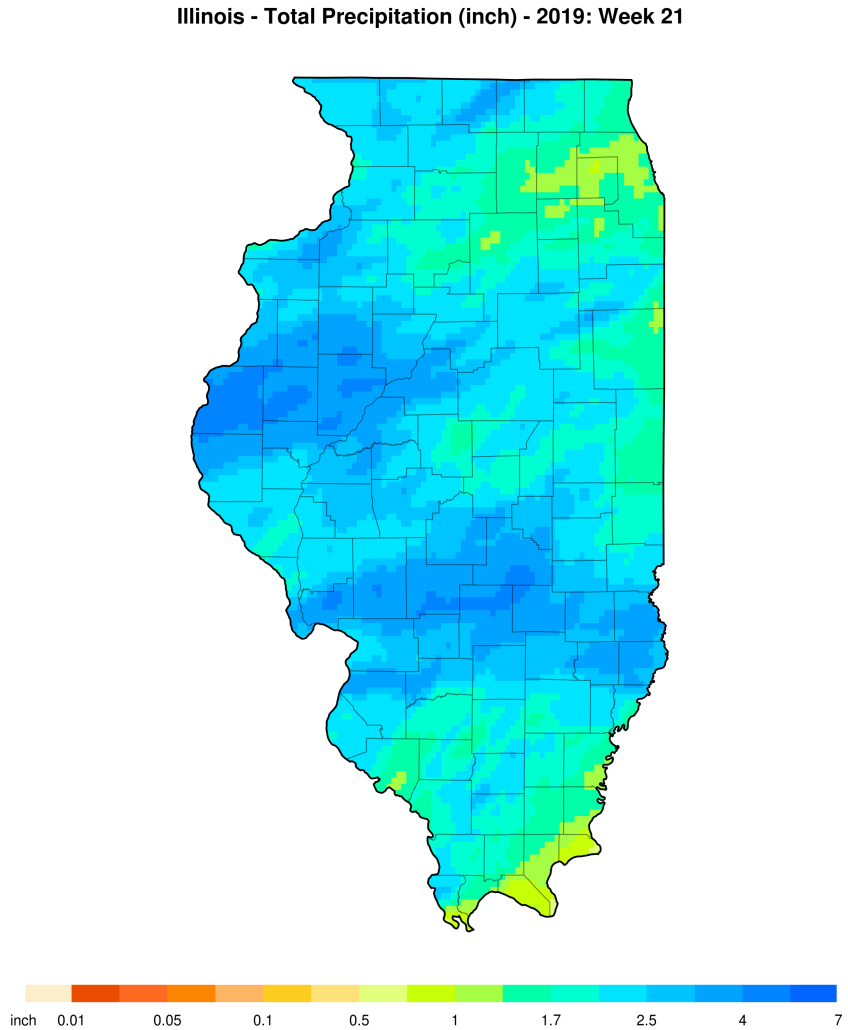

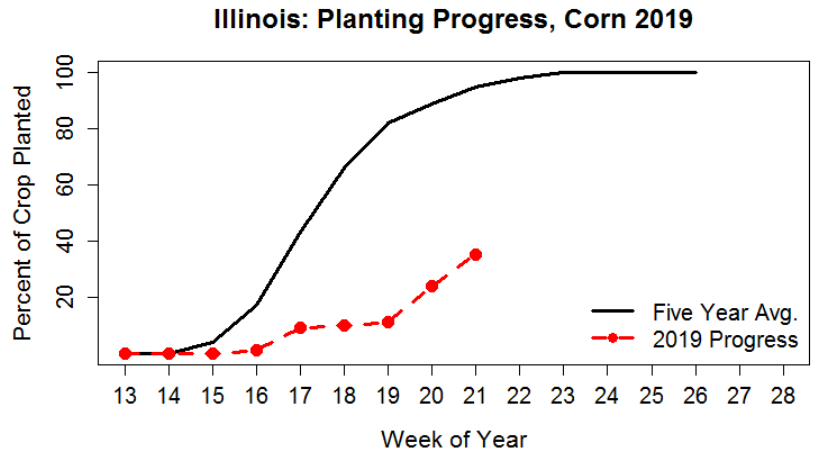

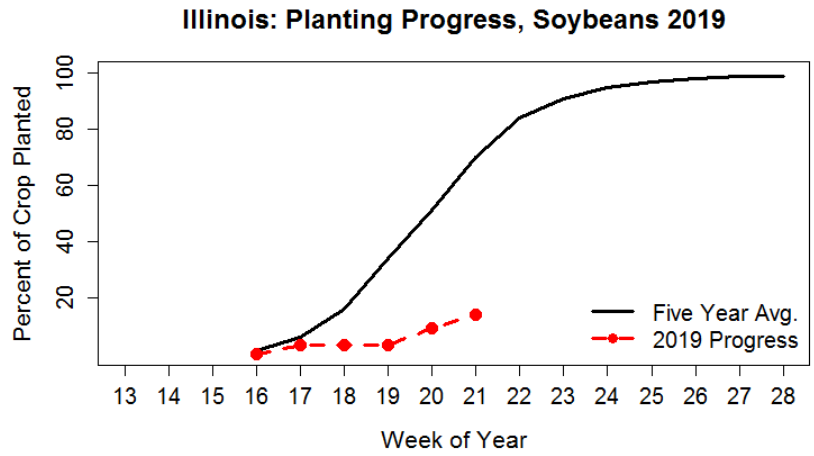

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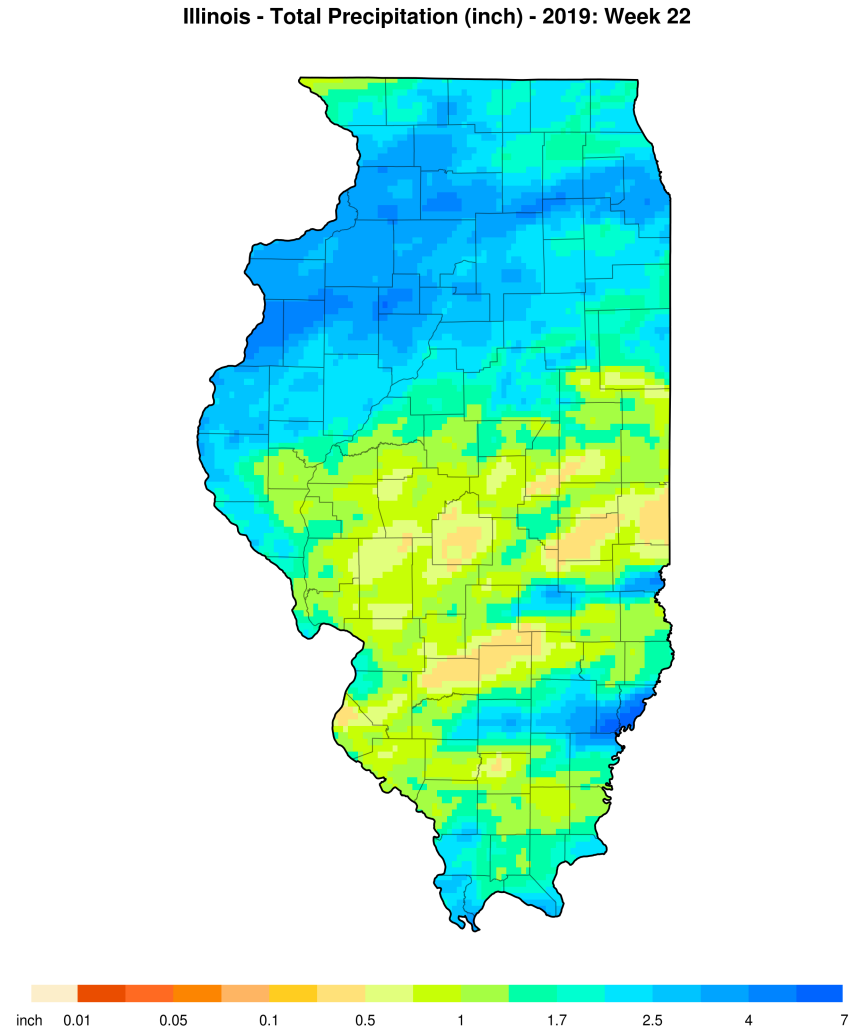

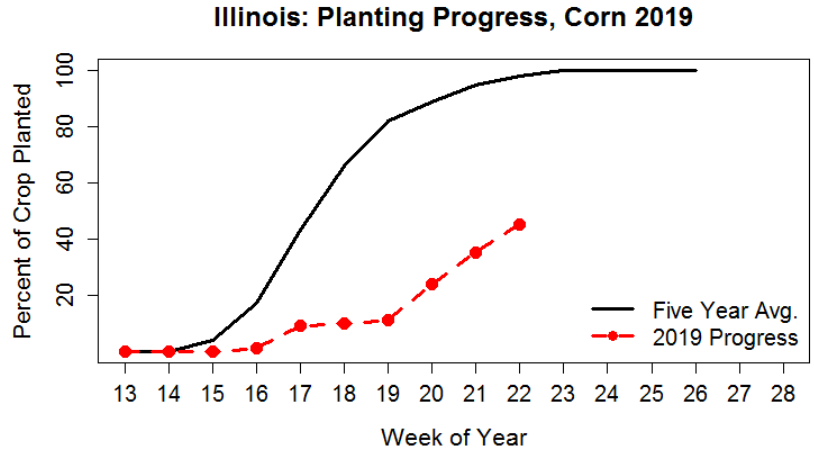

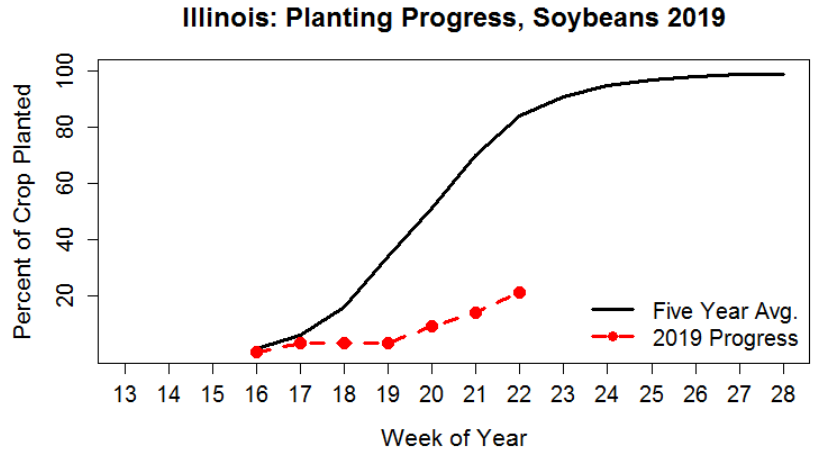

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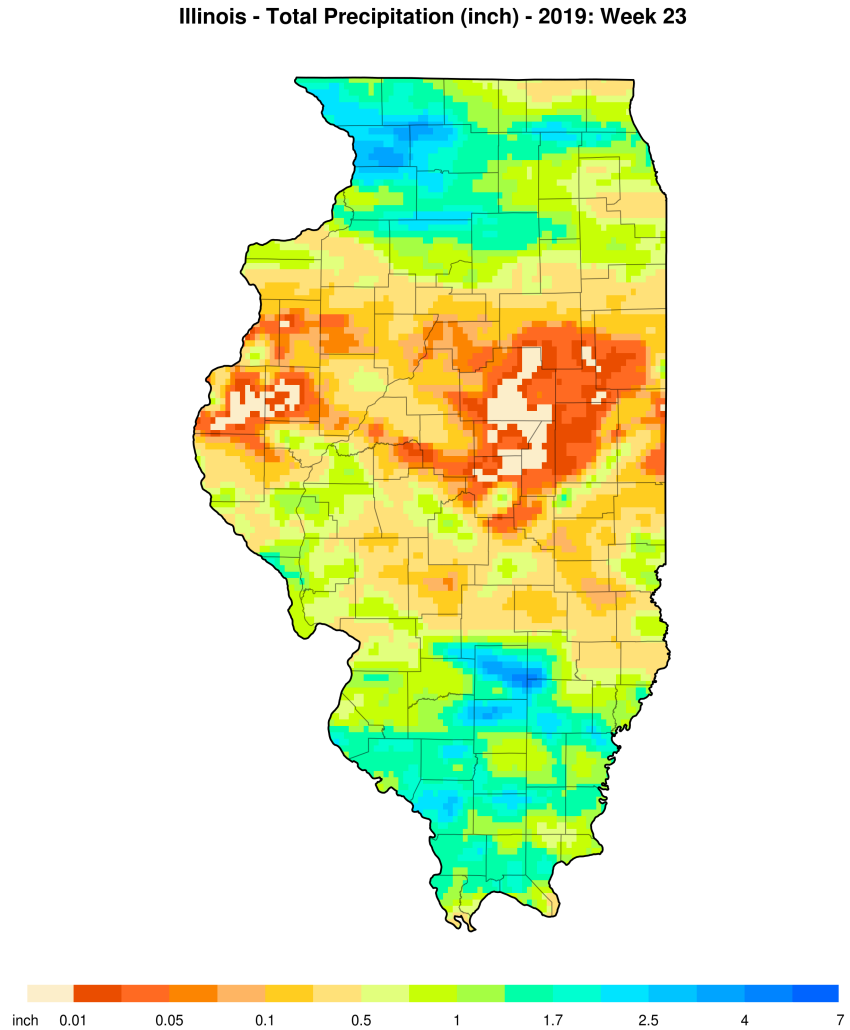
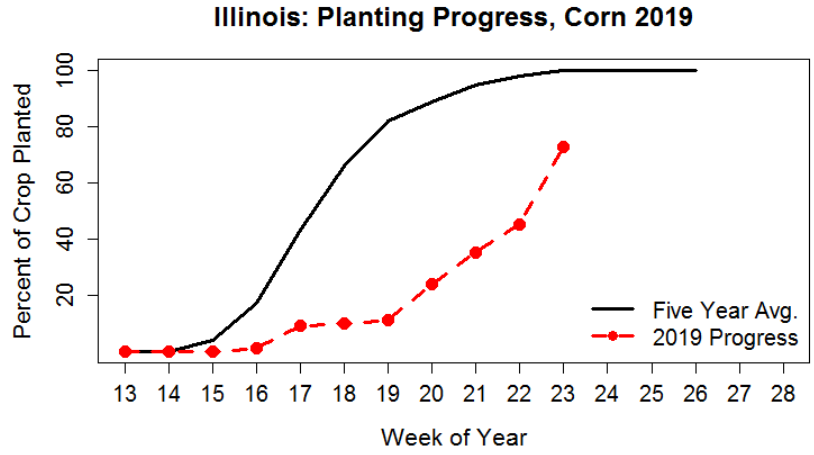
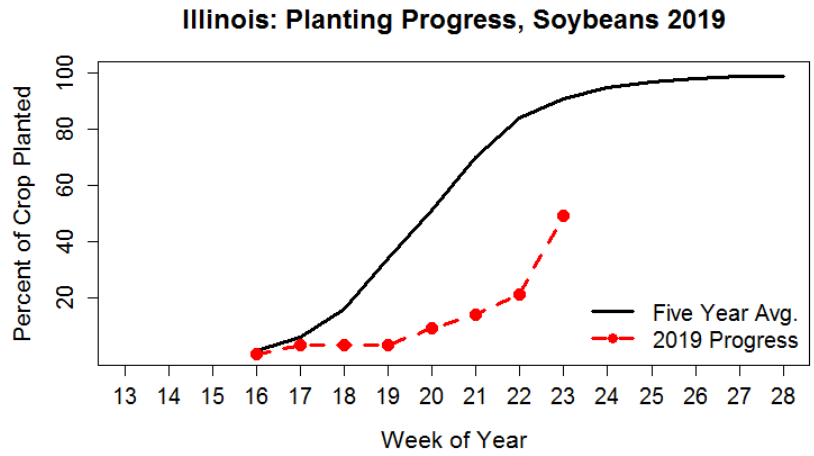
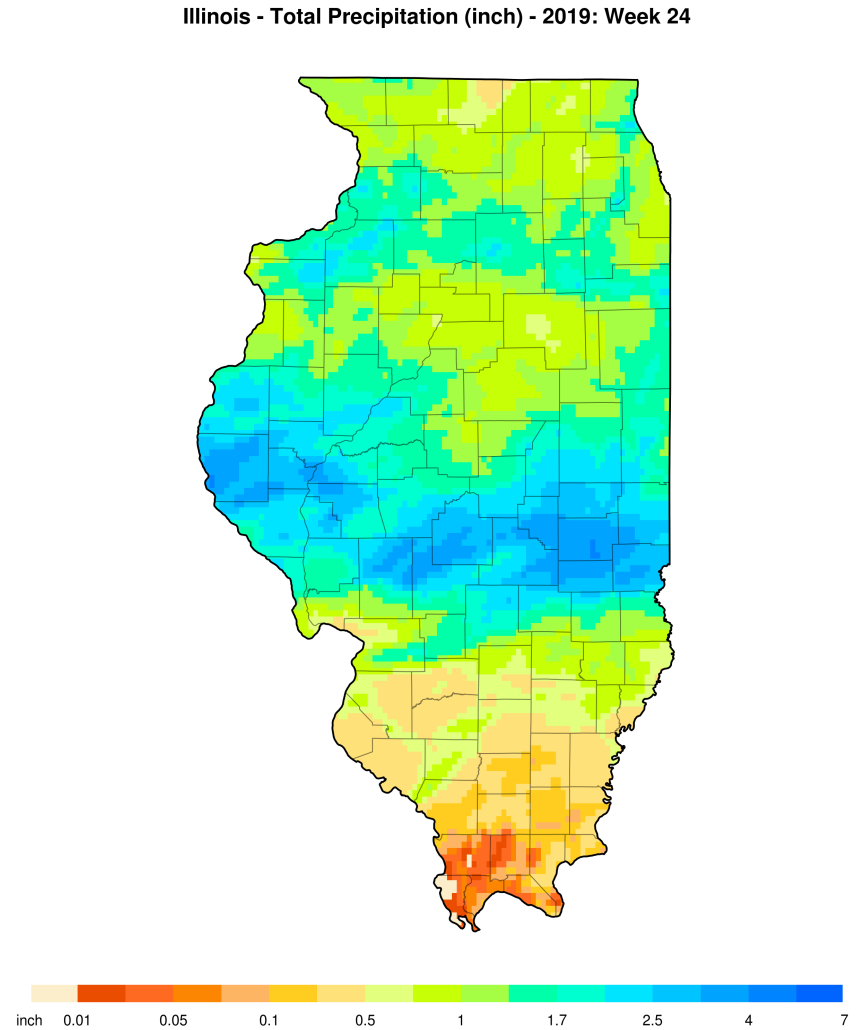
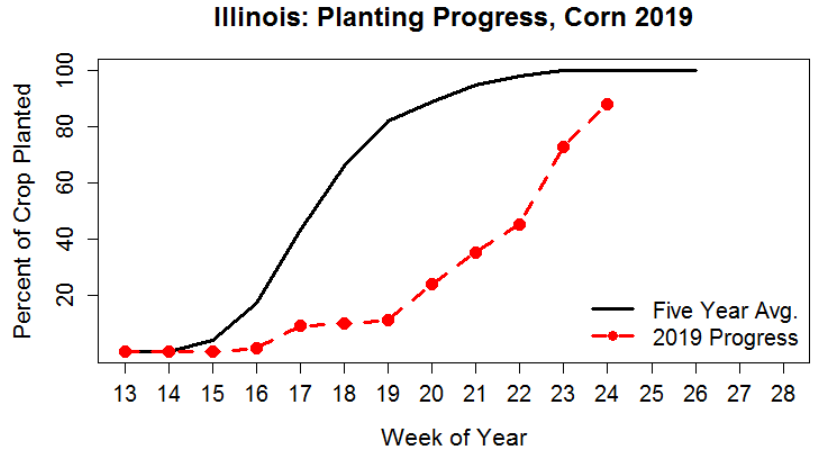


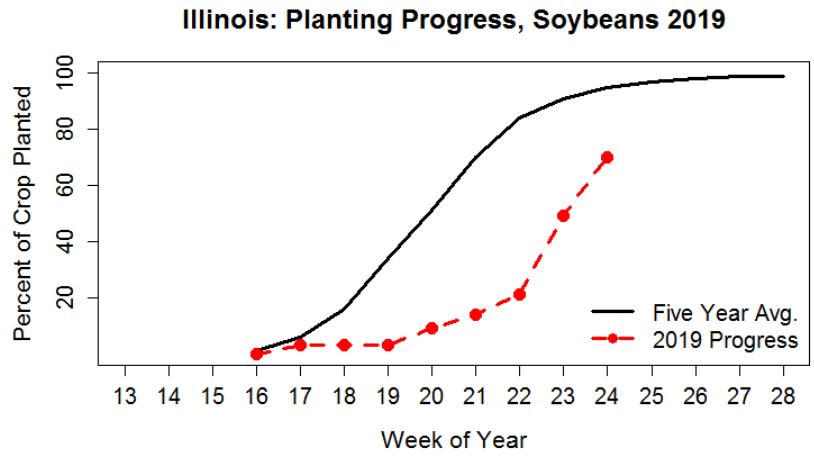




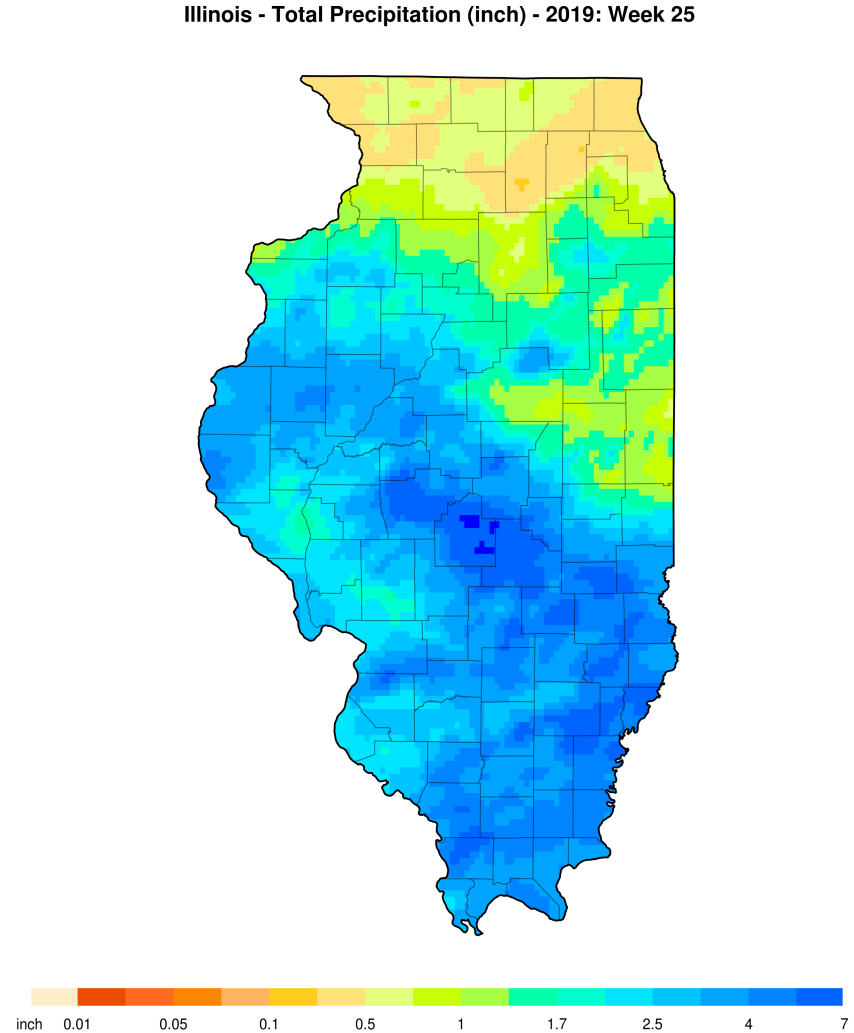
2019 Illinois Precipitation and Planting Progress

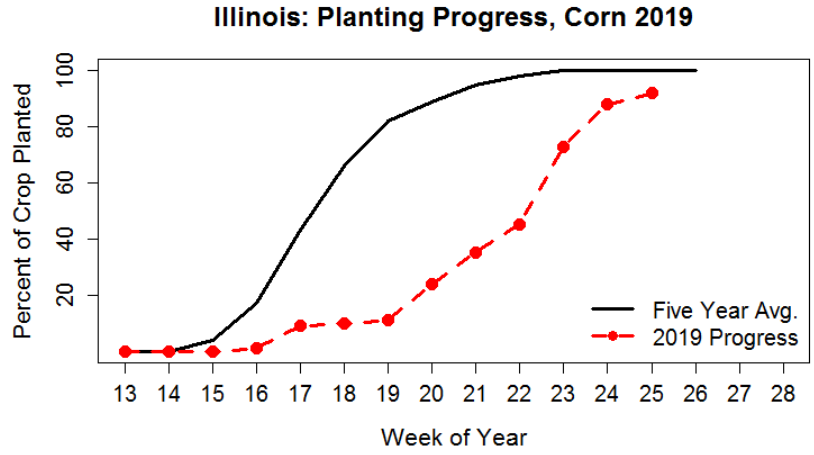


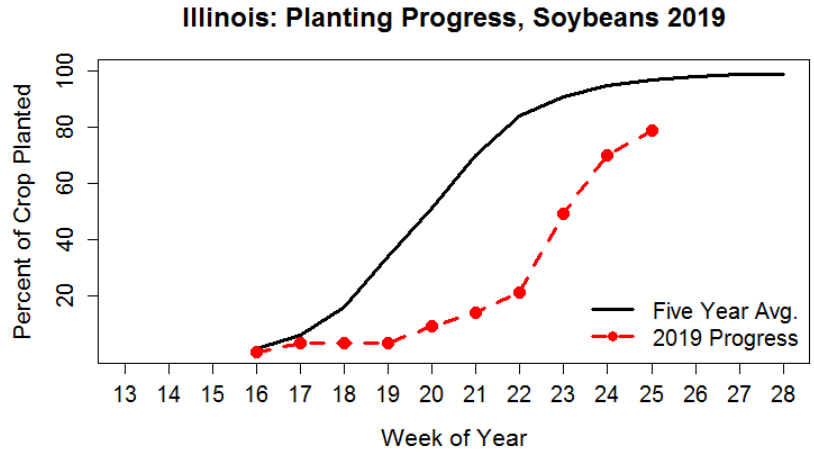




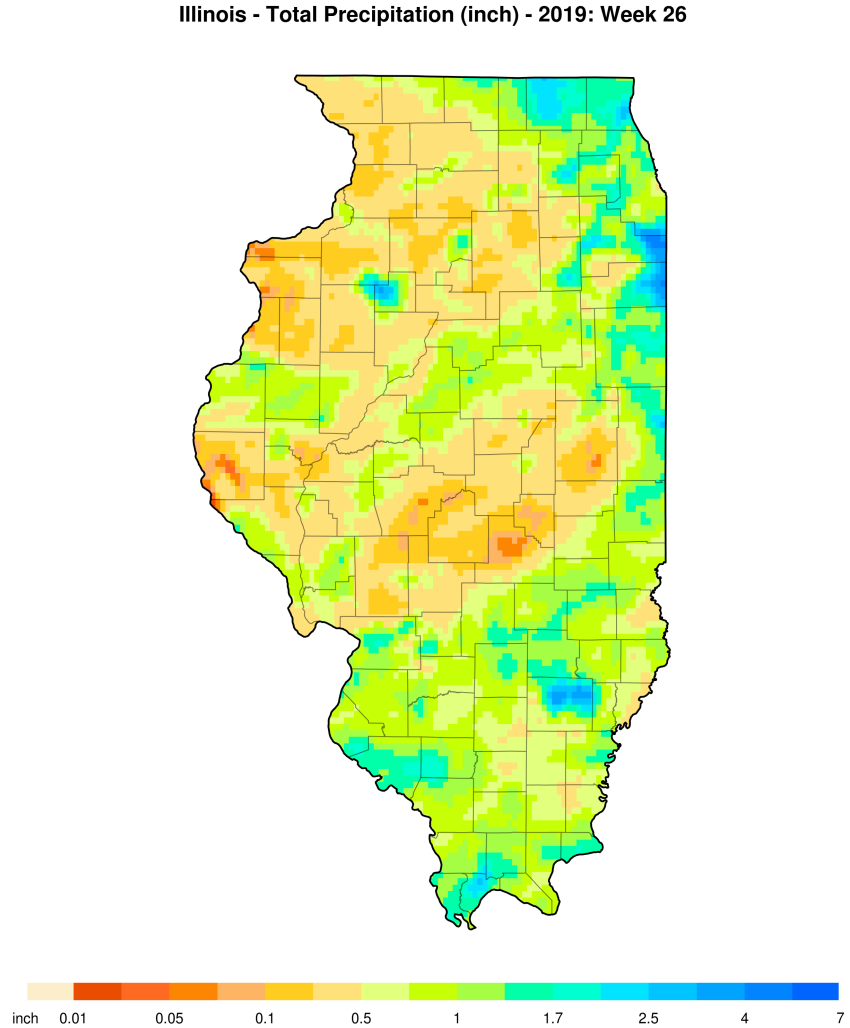
2019 Illinois Precipitation and Planting Progress

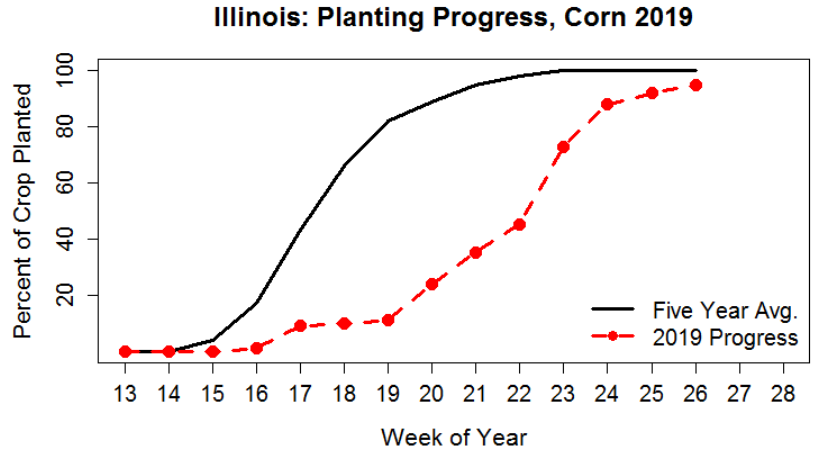


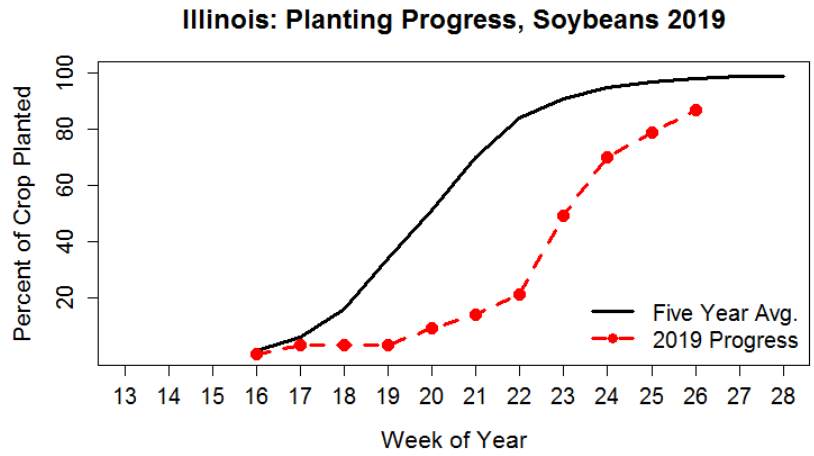




2019 Illinois Precipitation and Planting Progress







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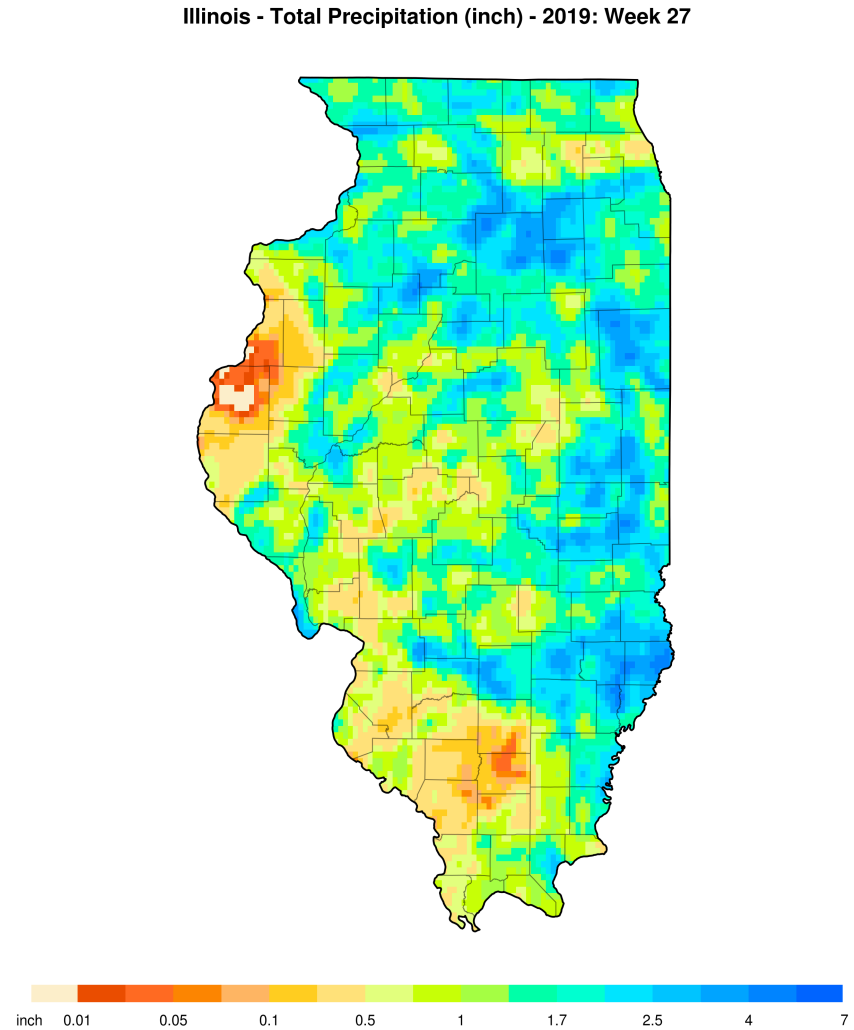
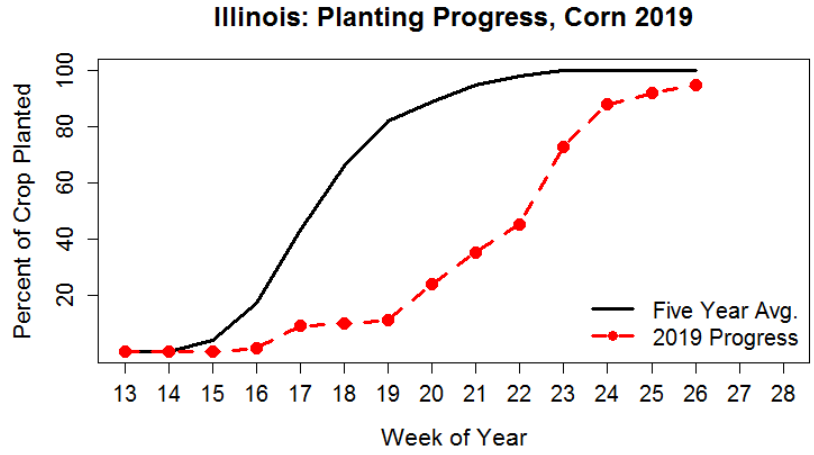
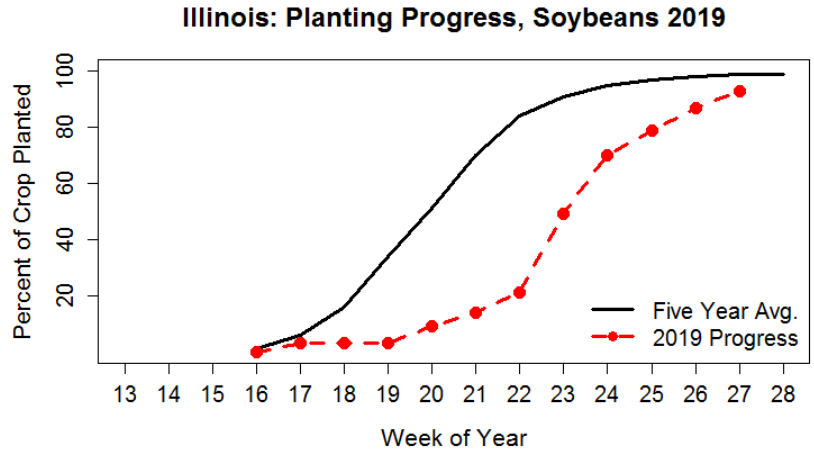
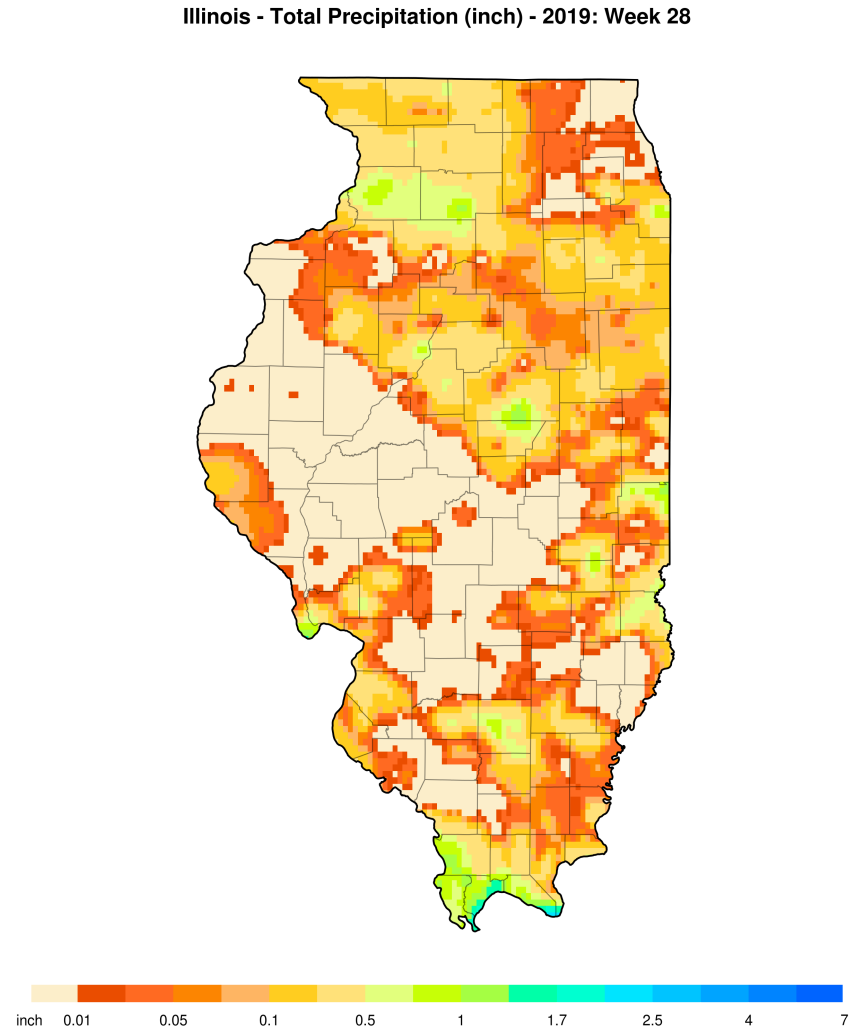
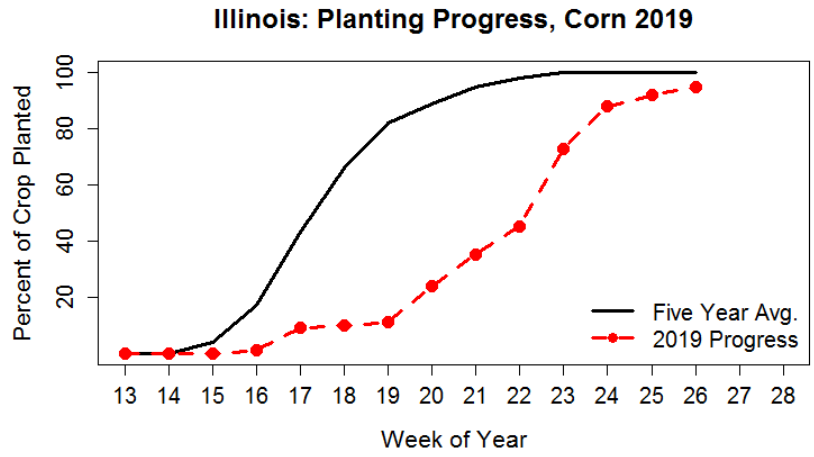


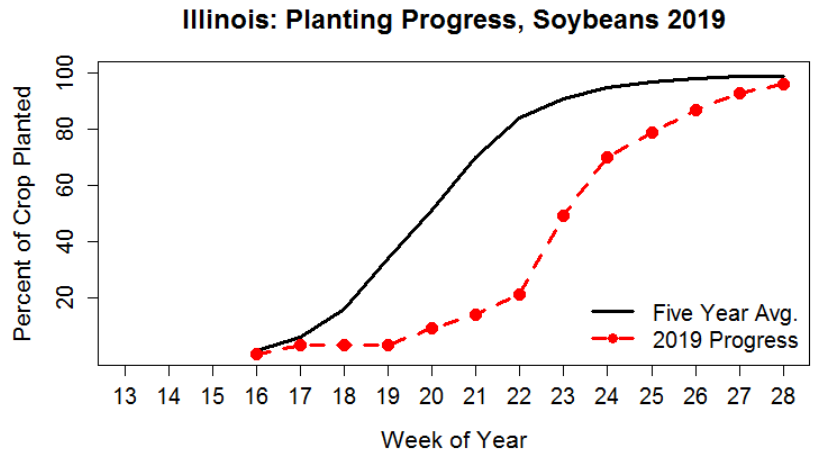




2019 Illinois Precipitation and Planting Progress







Illinois 2019: Corn and Soybeans Planted Progress Data

Planned Extensions: Alerts and Modeling

Report

Export

Illinois - Districts Report

Time period of **05/01/2019** to **05/31/2019**

District Code	District Name	Total Precipitation (inches)				Average Temperature (°F)				GDD-50°F			
		Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg	Observed	Percentile of all long-term observations (%)	Deviation from long-term Avg	5-year Avg
10	Northwest	9.6	100	5.4	5.8	58	34.2	-2.3	61	265	26.3	-66	351
20	Northeast	9.2	100	5	6.1	57.4	34.2	-2.1	60.2	250	28.9	-61.8	331
30	West	11.3	100	6.6	5.7	61.4	34.2	-1.1	64	358	34.2	-34.6	434
40	Central	9.5	97.3	5.1	5.4	62.2	47.3	-0.3	64.3	380	47.3	-13.4	443
50	East	7.8	97.3	3.4	5.1	61.7	50	-0.3	63.6	366	50	-14.1	424
60	West Southwest	8.2	89.4	3.6	5.5	64.5	57.8	0.4	65.9	449	60.5	11.6	491
70	East Southeast	6.5	78.9	1.7	4.8	65.4	63.1	1.1	66.1	475	60.5	32.6	498
80	Southwest	7	78.9	1.8	6	67.5	73.6	1.6	67.6	538	71	46.6	542
90	Southeast	7.5	86.8	2.4	5.4	67.4	73.6	1.8	67.3	534	73.6	51.5	534

USDA AgroClimate

Trend: Platte County, Non-Irrigated Corn Yield, 2015

Select crop

- Corn irrigated
- Corn non irrigated
- Soybeans irrigated
- Soybeans non irrigated
- Winter wheat irrigated
- Winter wheat non irrigated

Select year

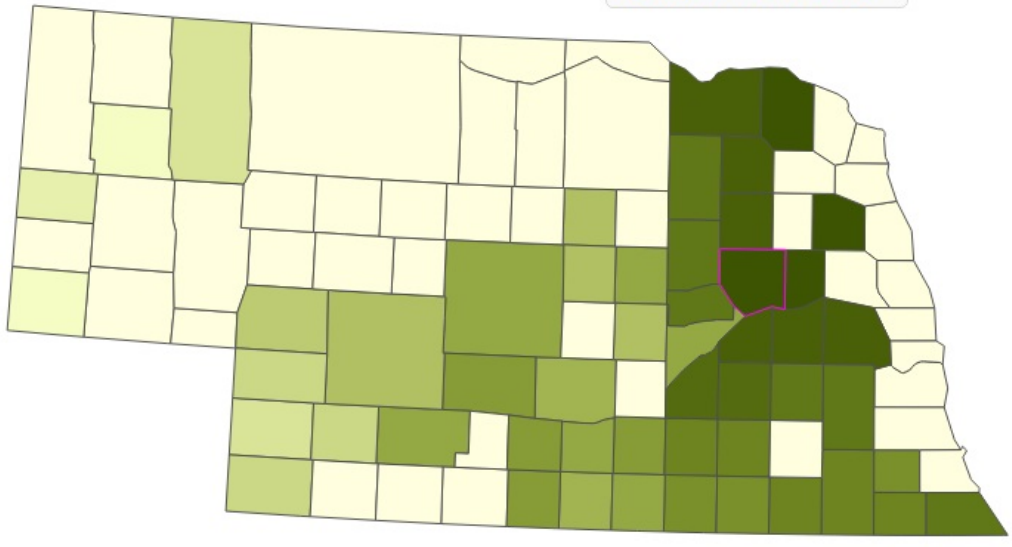
Select counties

About

Yield | Residuals

Corn non Irrigated - 2015 Year

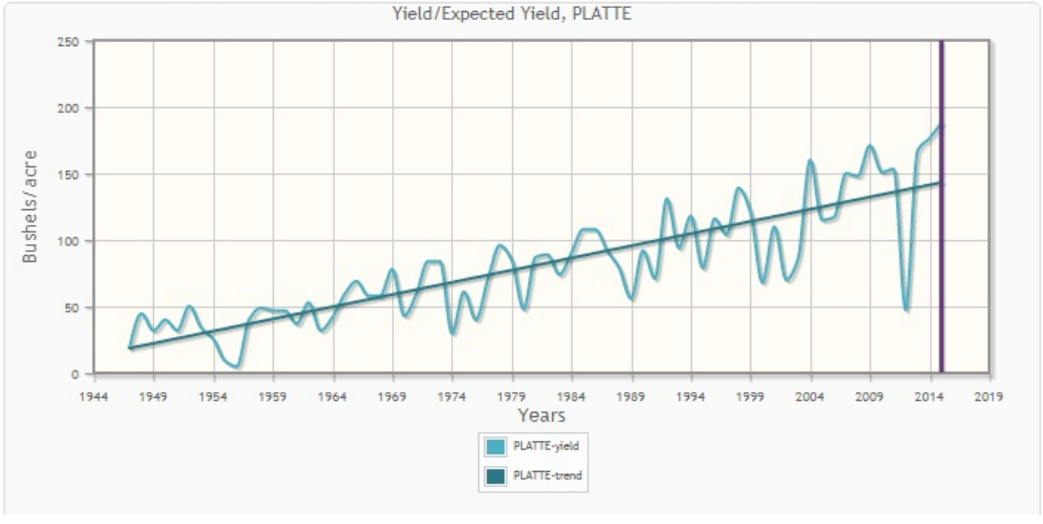
Residuals:	31.2%
Yield:	188 bushels/acre
Expected yield:	143.3 bushels/acre



Yield (bushels/acre)

N/A Less 60 69 78 87 96 105 114 123 133 142 151 160 169 178 More

Data



Planned Extensions: Crop Simulation Modeling

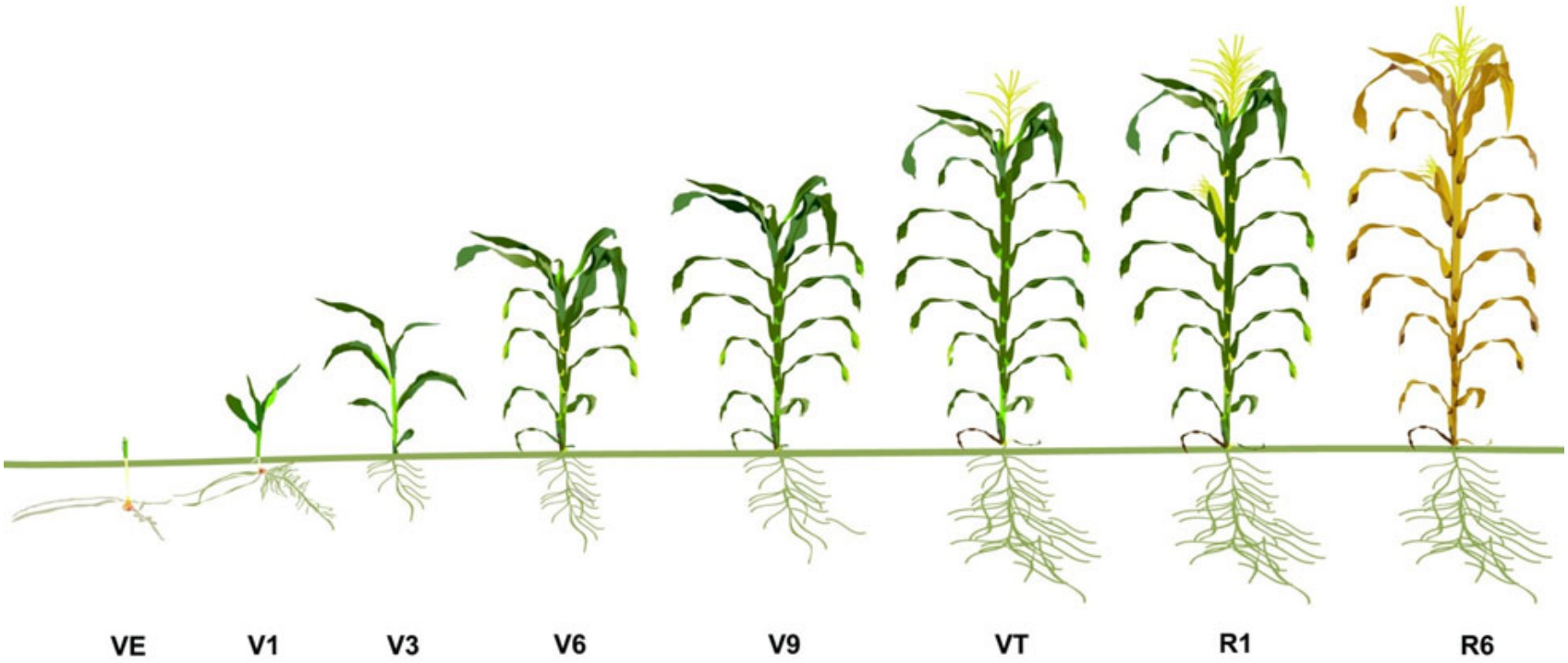


Figure: Image Source–Pioneer Agronomy Sciences

- Simulate progress as functions of weather, soil, management
- Crop phenology and health of crop at critical points in time

Linking to External Monitoring Tools from One Dashboard

- NASS Cropland Data Layer
- UNL U.S. Drought Monitor
- NWS Climate Prediction Center ENSO Diagnostics
- NOAA NWS National Hurricane Center
- UNL High Plains Regional Climate Center

Conclusions

The DSS provides timely and relevant auxiliary data

1. Tailored for internal use at NASS
2. Offered first to field offices for use in routine duties
3. Standardization of *Crop Progress and Condition* reports
4. Weather data complements and augments other approaches
   - Survey data
   - Administrative data
   - Remote sensing of disasters
   - Modeling
5. Planned enhancements coming soon

Additional References

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