



QUALITY OF THE UNITED STATES FOOD SOYBEAN CROP: 2019

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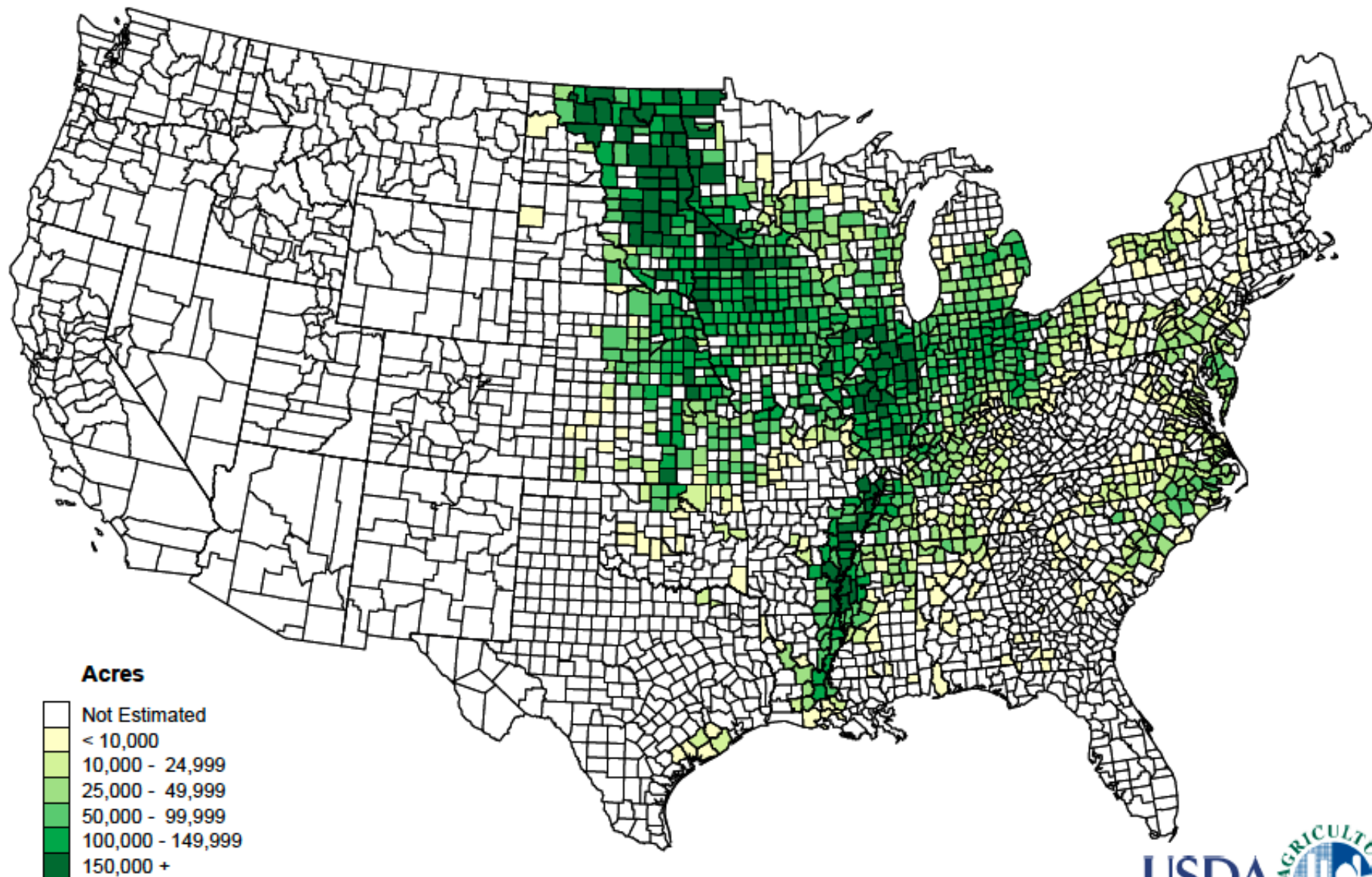
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OUTLINE

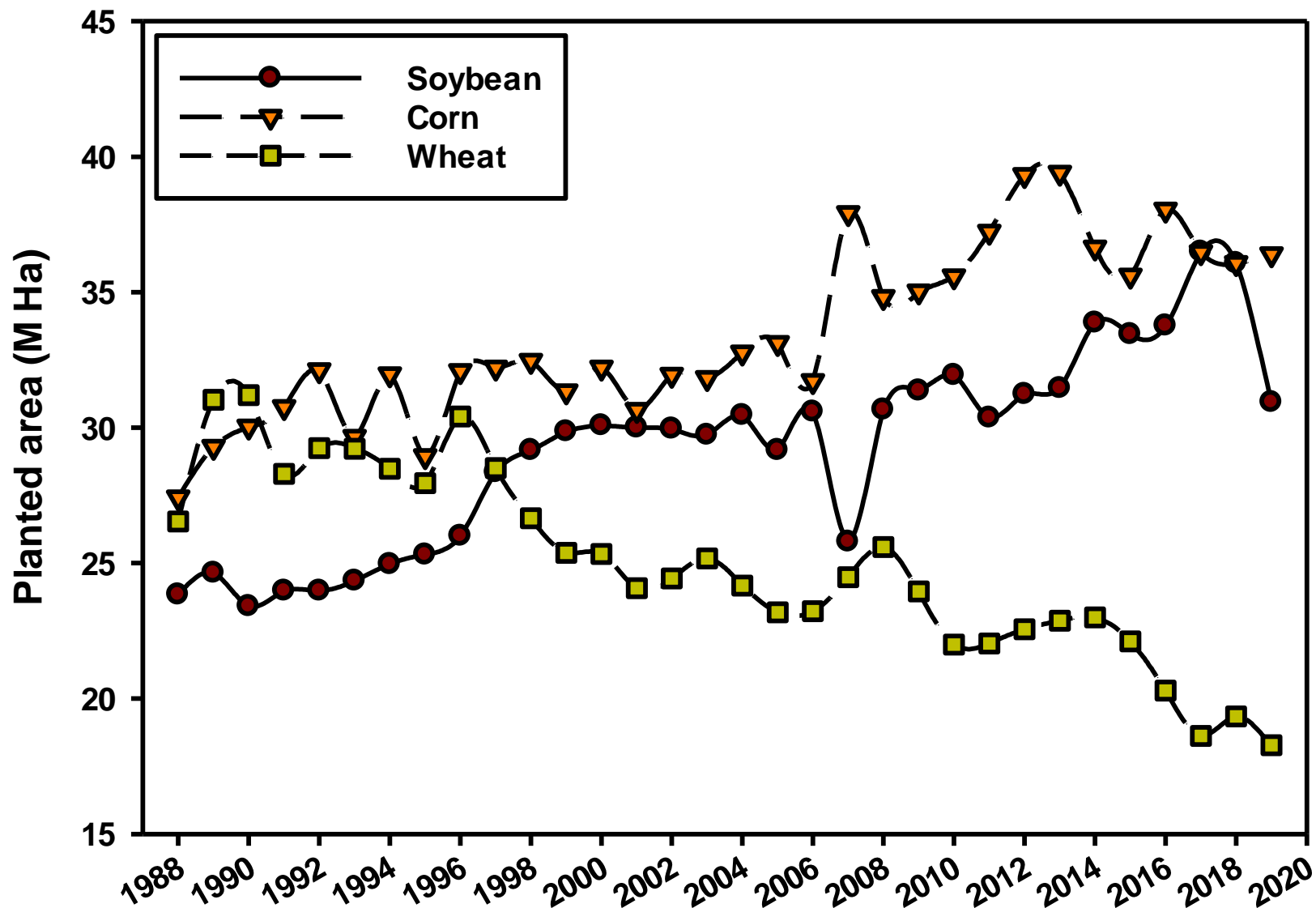


- 2019 Growing season
- Historical protein and oil variation
- 2019 survey results



U.S. Department of Agriculture, National Agricultural Statistics Service

Soybean, Corn, and Wheat in the US (planted ha)



A close-up photograph of two soybean pods hanging from a stem. The pods are brown and covered in fine hairs, with sunlight highlighting their texture. The background is a soft, out-of-focus brown.

THE 2019 GROWING SEASON

2019 GROWING SEASON

- The big stories of 2019 included
 - Excess spring rains
 - Quantities of rainfall were at record or near record levels
 - Duration of this rainy period was long (4-6 weeks) and bracketed the planting period
 - Distribution of this anomaly was extremely broad
 - Mid-season drought was relatively confined
 - Excess rains returned to most of the Northern Corn Belt before and throughout harvest



2019 GROWING SEASON

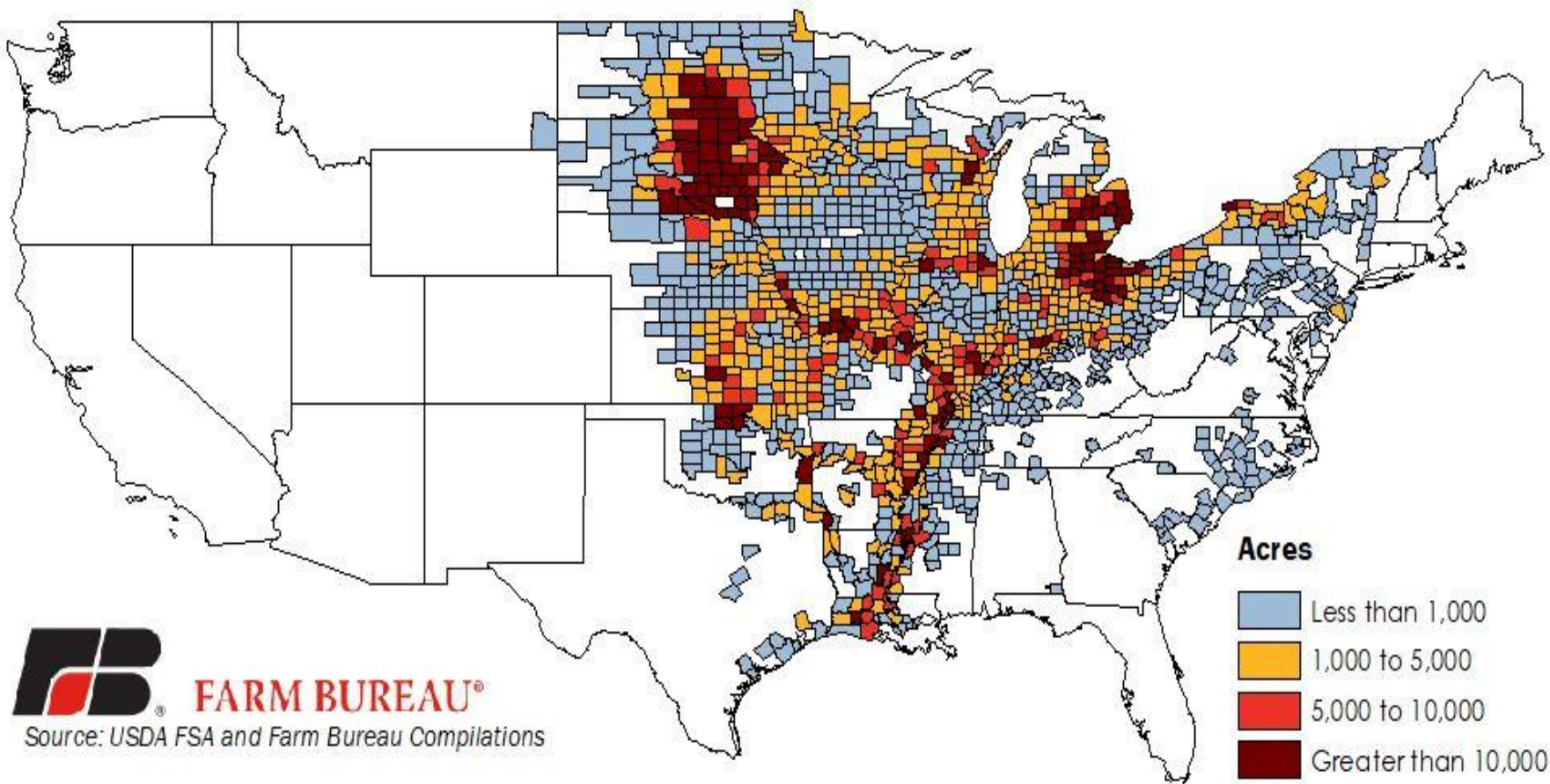
- Spring conditions
 - The excess rain events in the spring delayed planting across much of the Midwest.
 - Large and broad rain events caused flooding of minor rivers affecting farms directly and impacted shipping along major waterways.

2019 GROWING SEASON

- Prevent Plant
 - Due to heavy rainfall, large numbers of acres across a very broad geography could not be planted to soybean or other crops.
 - 7.9 M Ha of US farmland was left unplanted
 - 1.8 M Ha of soybean

Figure 6. Soybean Acres Prevented From Being Planted, 2019

August 22 Release



FARM BUREAU®

Source: USDA FSA and Farm Bureau Compilations

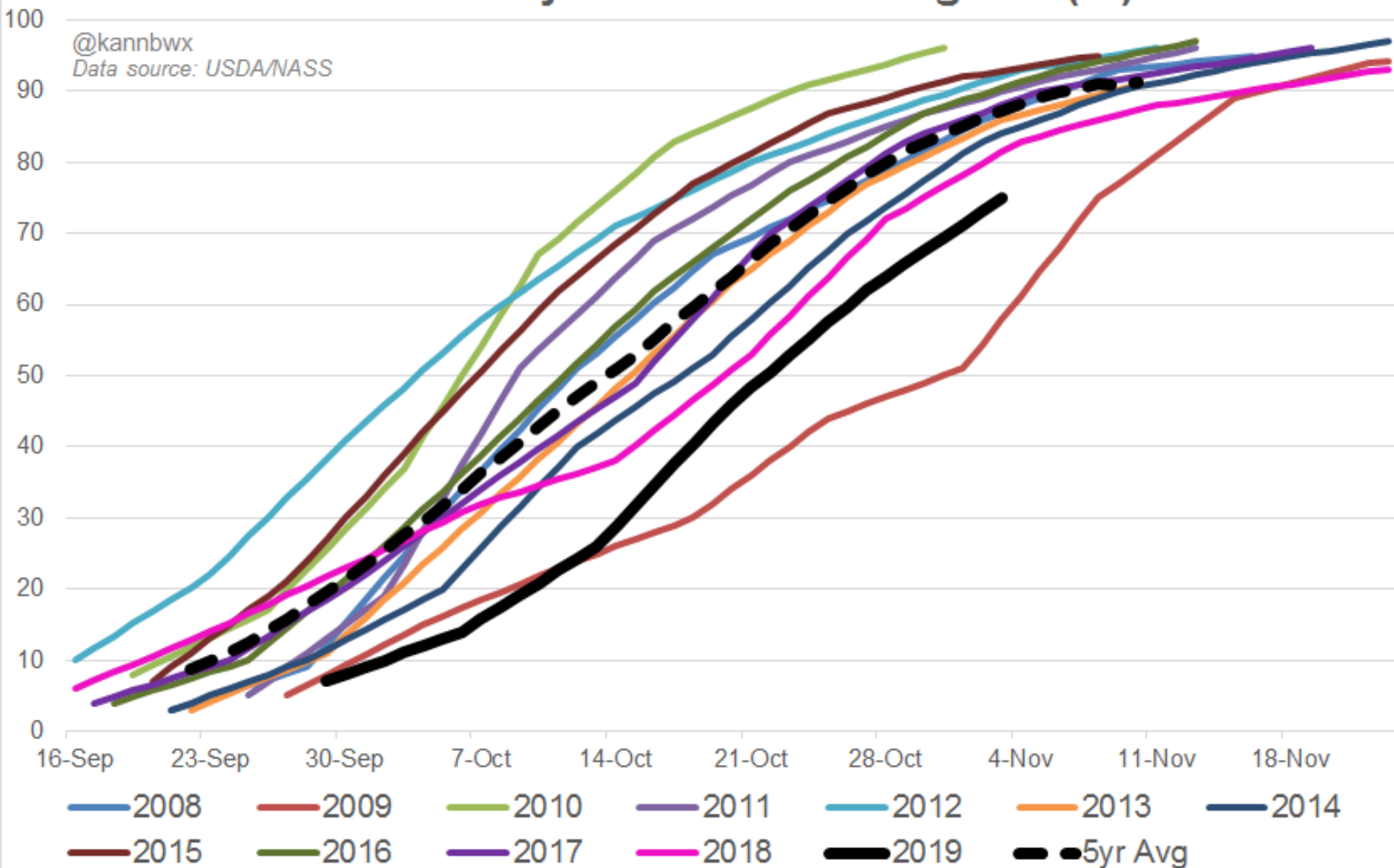
2019 GROWING SEASON

- Mid-season and fall conditions
 - Crop development was delayed throughout the summer in most states due to delayed plantings.
 - Crop development tended to 'catch up' across the "I-states" and Ohio where excess rainfall was limited and temperatures tended to be above average.
 - Crop development in the Dakotas continued to lag far behind normal due to excess rain and limited temperatures.
 - Heavy and broad rain events in the Northern states severely delayed harvest in these states.

U.S. Soybean Harvest Progress (%)

@kannbwx

Data source: USDA/NASS



SOYBEAN YIELDS OCTOBER USDA REPORT

- **Total production of 96.7 M MT**
 - Production will decrease by 20% from 2018
 - Harvested area decreased by 14%
 - to 30.6 M Ha
 - Yields decrease by 7.3% from 2018
 - to 3.5 MT/ha
 - Smallest crop since 2013

A close-up photograph of several soybean pods hanging from a stem. The pods are brown and covered in fine hairs. The background is a soft, out-of-focus brown. A semi-transparent dark teal banner is overlaid across the middle of the image, containing the title text in white.

HISTORICAL PROTEIN AND OIL VARIATION



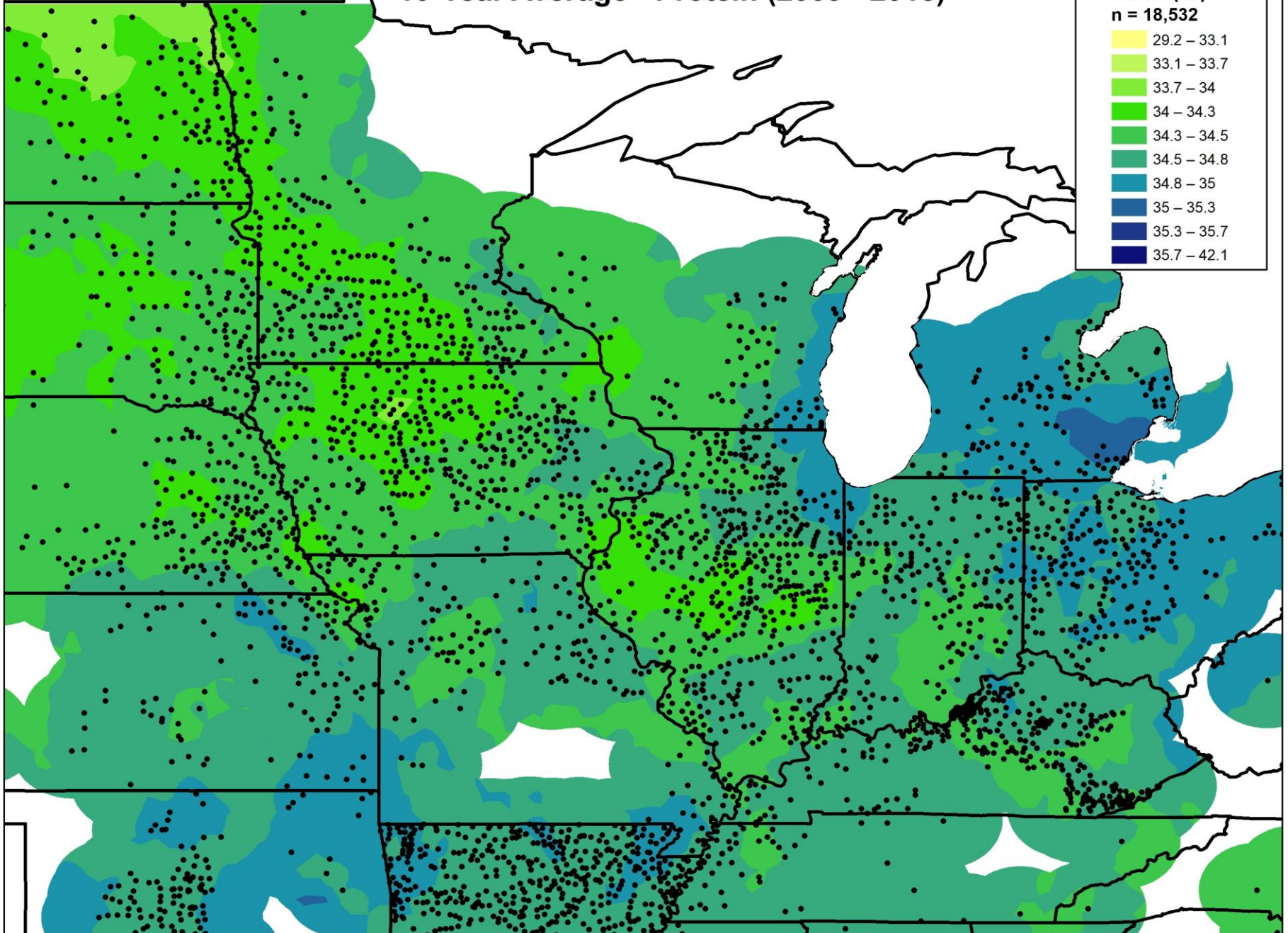
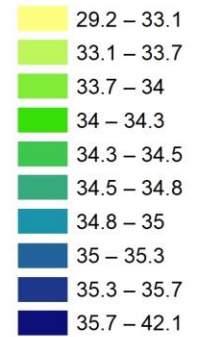
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 **SOY.ORG**

10-Year Average - Protein (2009 - 2018)

Protein (%)

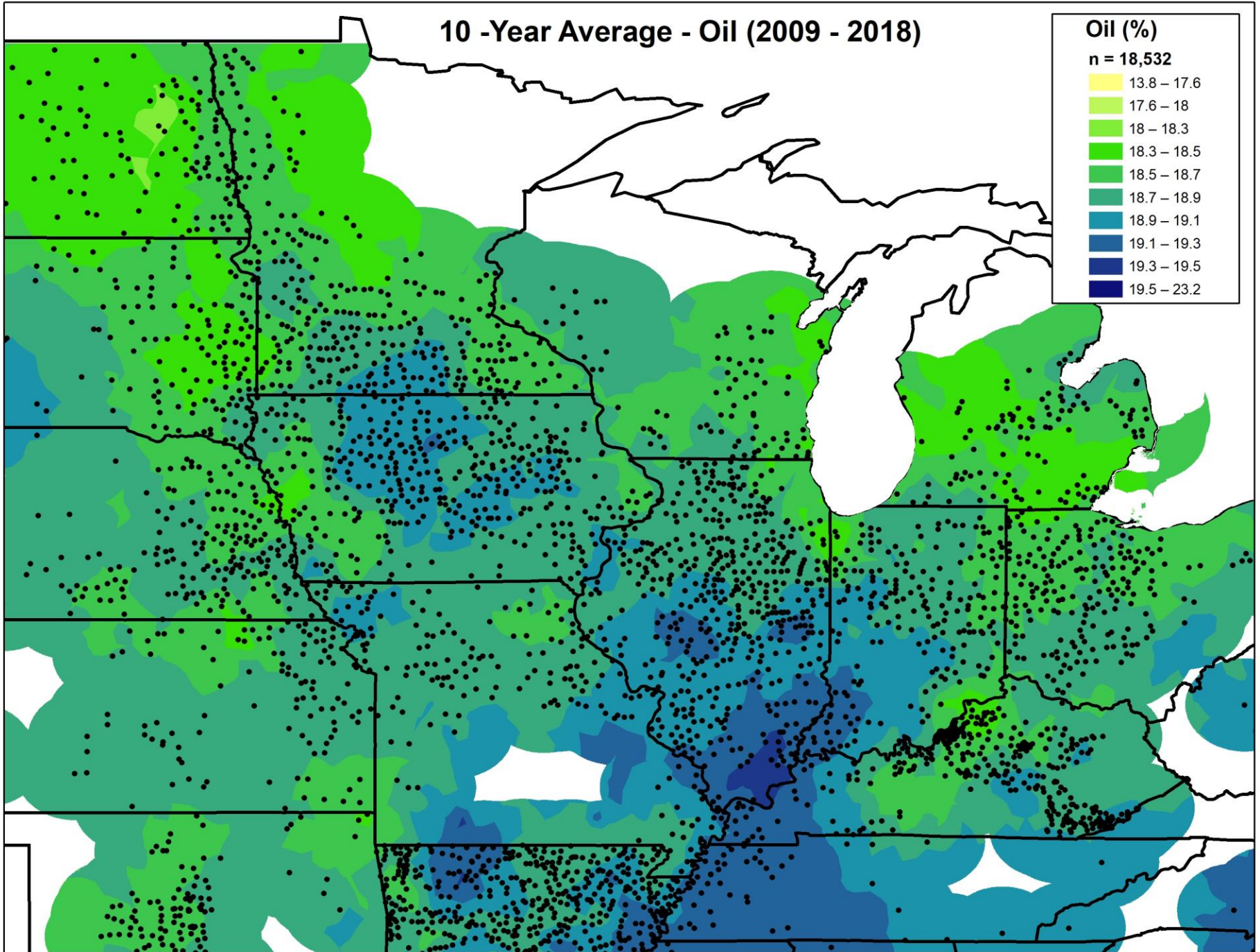
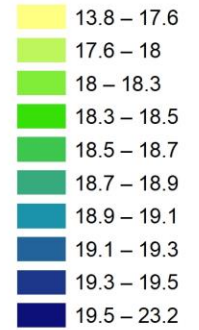
n = 18,532



10 -Year Average - Oil (2009 - 2018)

Oil (%)

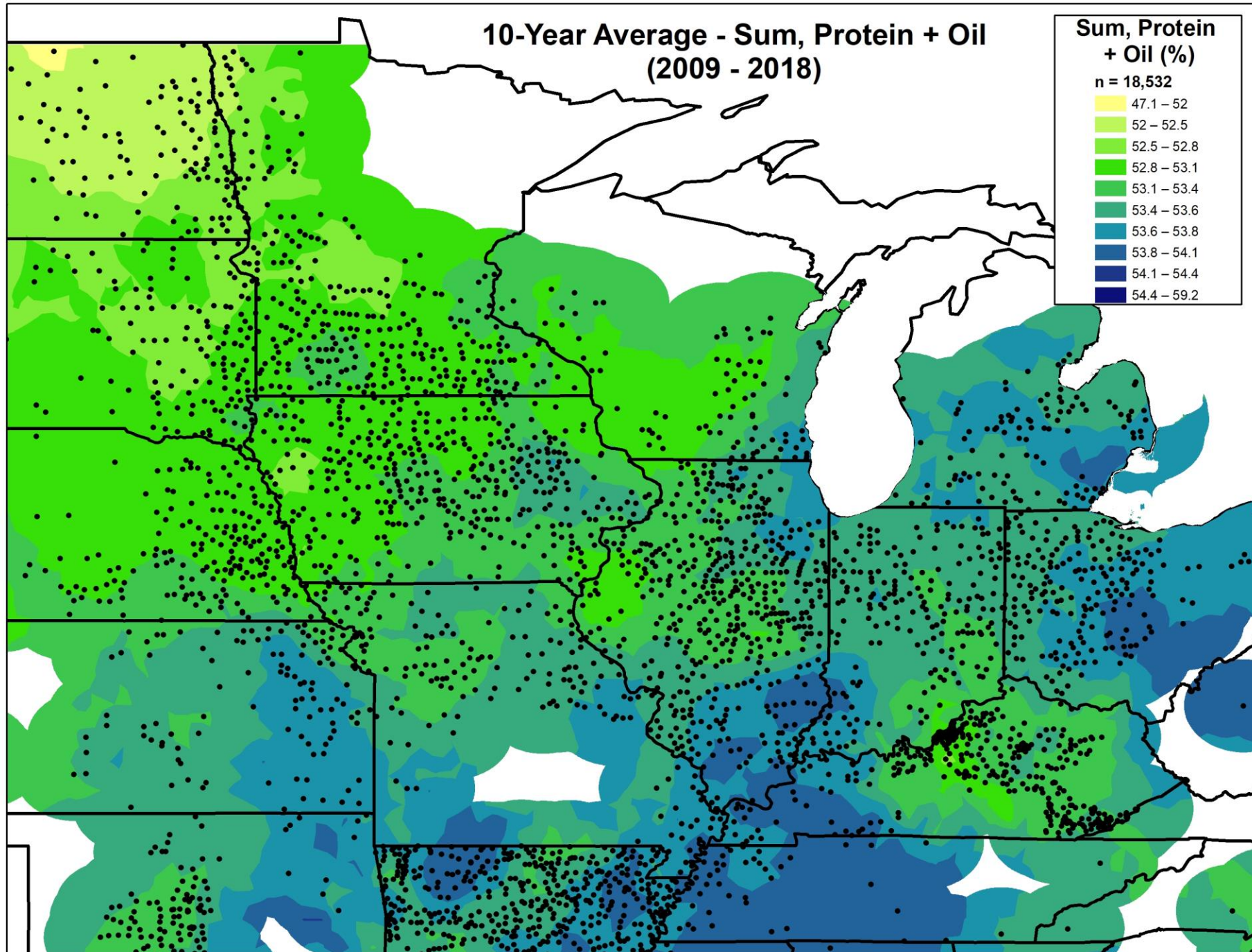
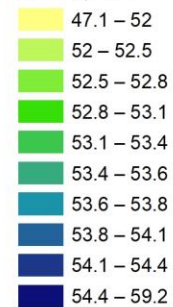
n = 18,532



10-Year Average - Sum, Protein + Oil (2009 - 2018)

Sum, Protein
+ Oil (%)

n = 18,532



ENVIRONMENTAL IMPACTS ON SOYBEAN PROTEIN AND OIL

- Location-specific environmental impacts (latitude, climate, and soil type) affect long-term quality trends
- However, annual variation in weather patterns affects year-over-year variation in soybean quality
- Rainfall patterns appear to have the greatest impact on soybean quality
 - Excessive rainfall early in the season appears to reduce protein deposition in the seed
 - Drought conditions during the seed-filling stages exacerbate this condition

2019 SURVEY RESULTS



A close-up photograph of soybean pods hanging from a stem. The pods are brown and fuzzy, with a dark stem running through them. The background is a soft, out-of-focus brown.

PROTEIN AND OIL

| Region | Number of Samples | Protein (13%) | Change from 2018 | Oil (13%) | Change from 2018 | Seed Weight (g/100 seeds) |
|-----------------------------------|-------------------|---------------|------------------|-----------|------------------|---------------------------|
| US Average | 1,226 | 34.1 | | 19.0 | | 17.1 |
| Average of 2019 Crop [†] | | 34.1 | -0.2 | 19.0 | +0.1 | 16.9 |
| US 2009-2018 Average [†] | | 34.6 | | 18.9 | | |

[†]US average values weighted based on estimated production by state, as estimated by USDA, NASS Crop Production Report (October, 2019)

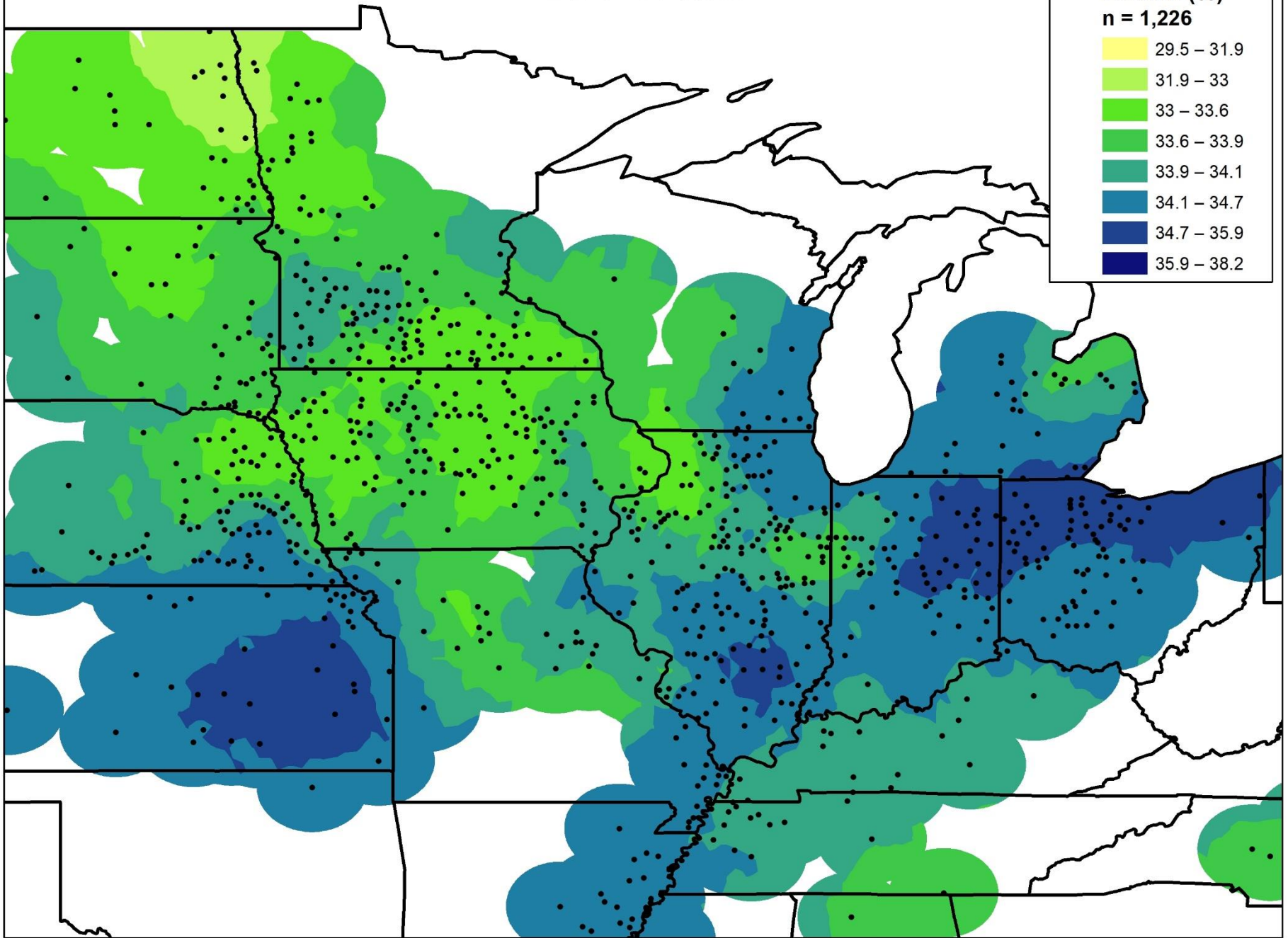
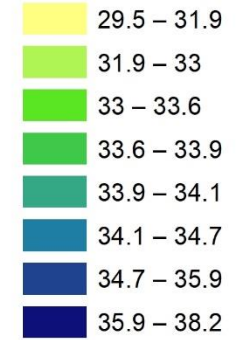
| Region [†] | Number of Samples | Protein (13%) | Change from 2018 | Oil (13%) | Change from 2018 | Seed Weight (g/100 seeds) |
|---------------------|-------------------|---------------|------------------|-----------|------------------|---------------------------|
| Western Corn Belt | 648 | 33.8 | -0.2 | 18.9 | +0.2 | 16.9 |
| Eastern Corn Belt | 439 | 34.4 | +0.1 | 18.9 | -0.1 | 17.5 |
| Midsouth | 89 | 34.4 | -0.5 | 19.8 | +0.3 | 15.8 |
| Southeast | 16 | 33.8 | -1.1 | 19.8 | +0.5 | 14.8 |
| East Coast | 34 | 34.3 | -0.7 | 18.8 | -0.3 | 16.1 |

[†]Regional average values weighted based on estimated production by state, as estimates by USDA, NASS Crop Production Report (October 2019)

2019 - Protein

Protein (%)

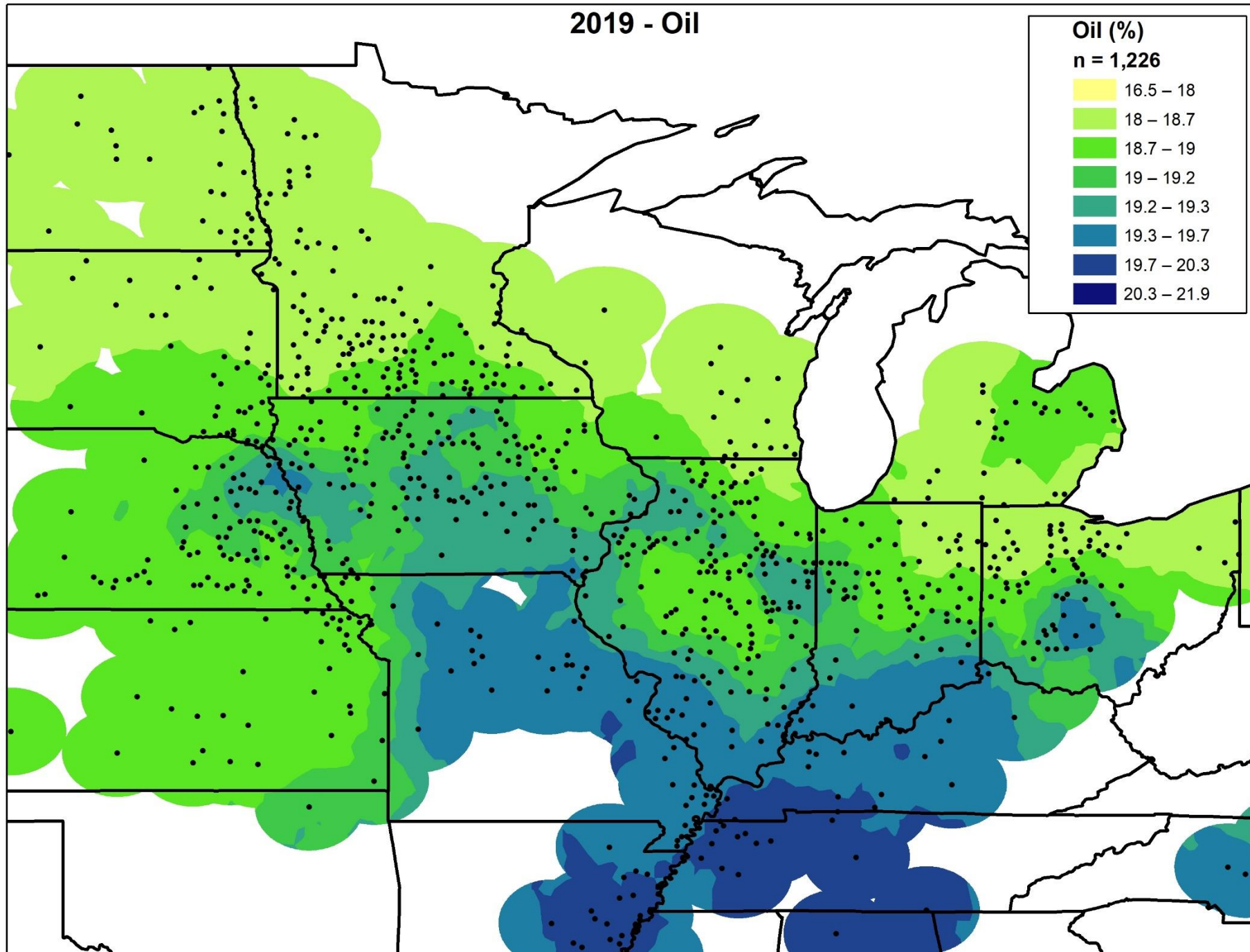
n = 1,226



2019 - Oil

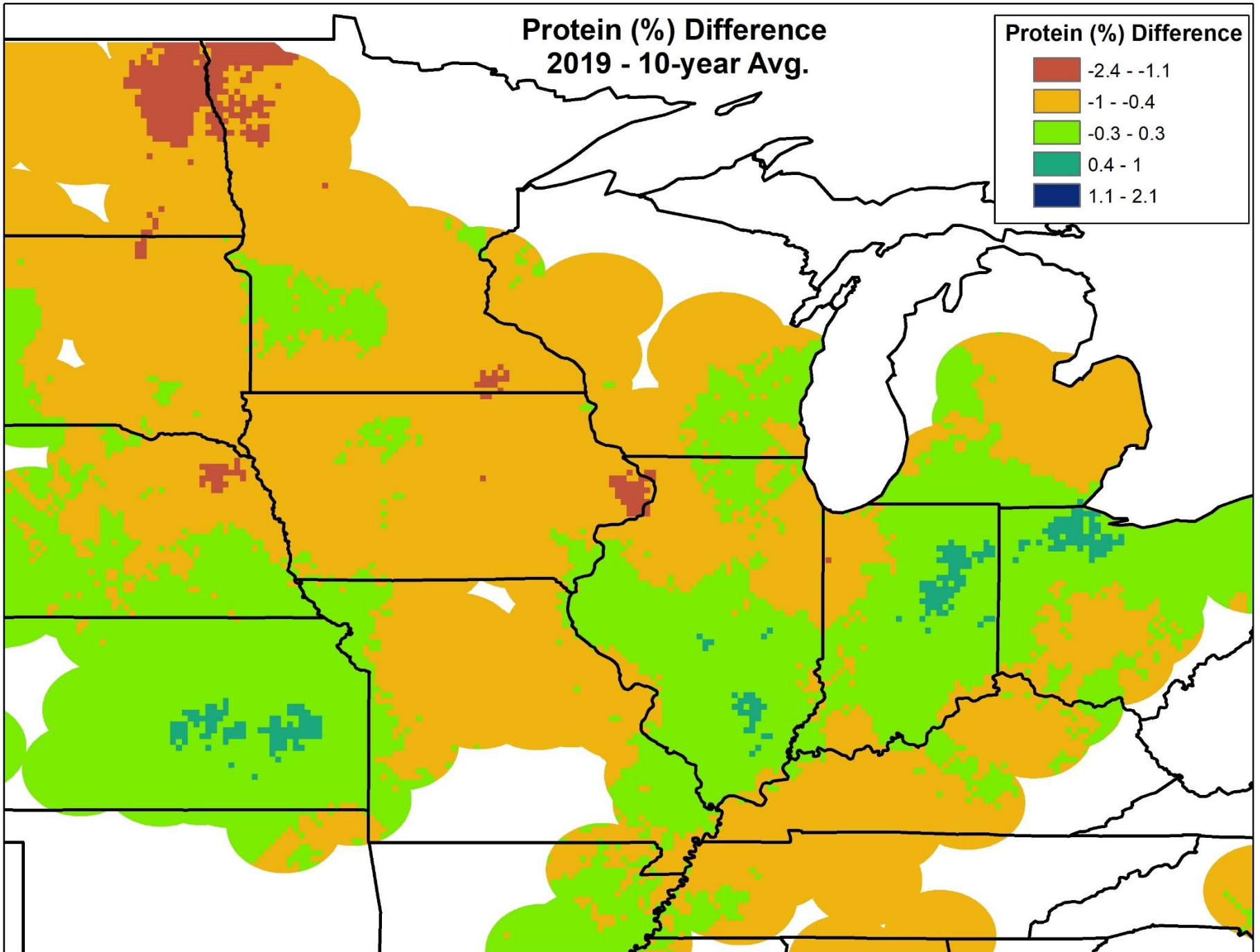
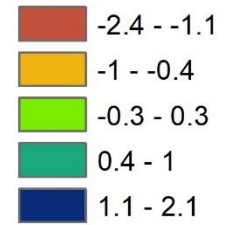
Oil (%)

n = 1,226



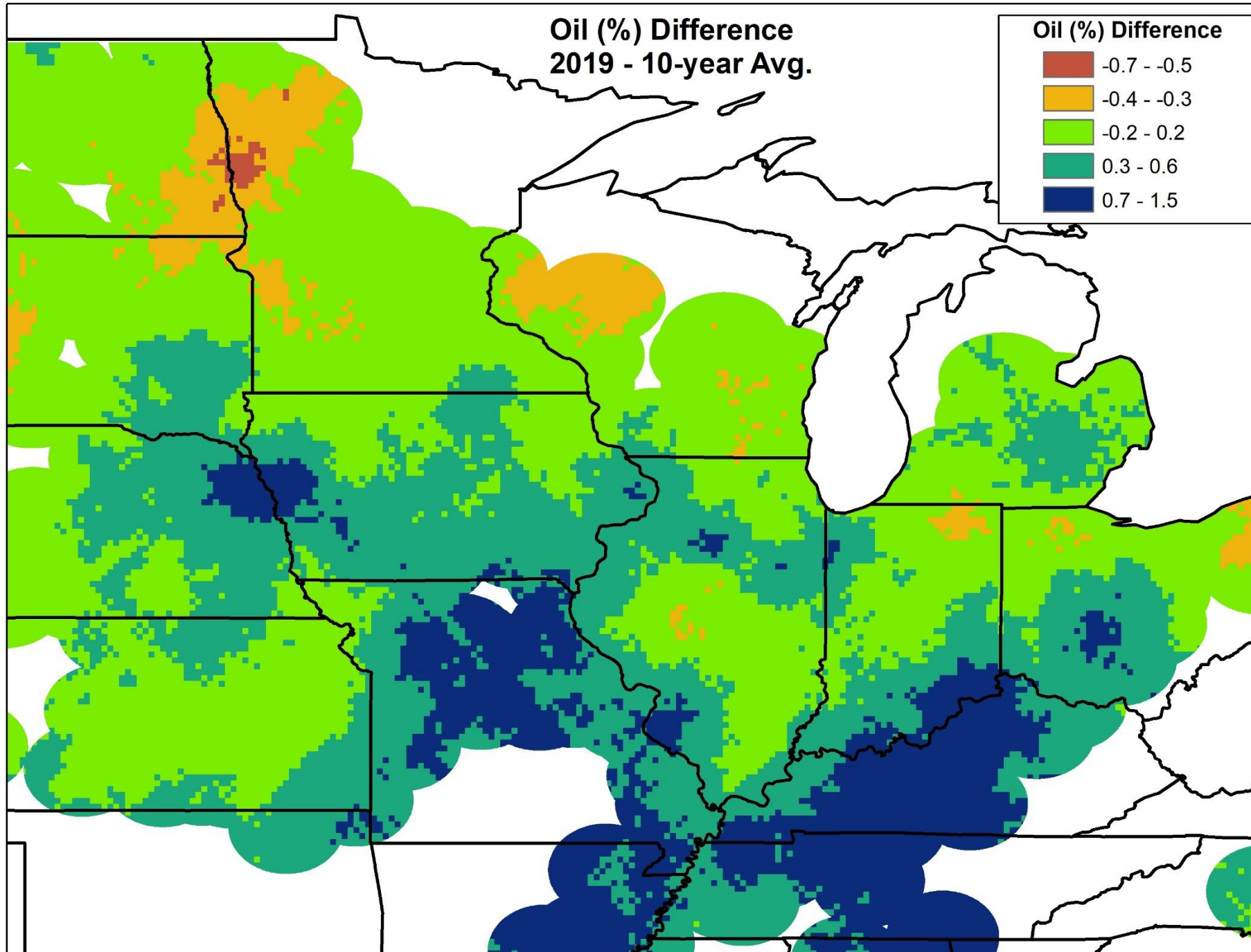
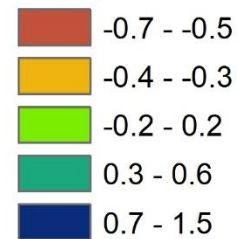
**Protein (%) Difference
2019 - 10-year Avg.**

Protein (%) Difference



**Oil (%) Difference
2019 - 10-year Avg.**

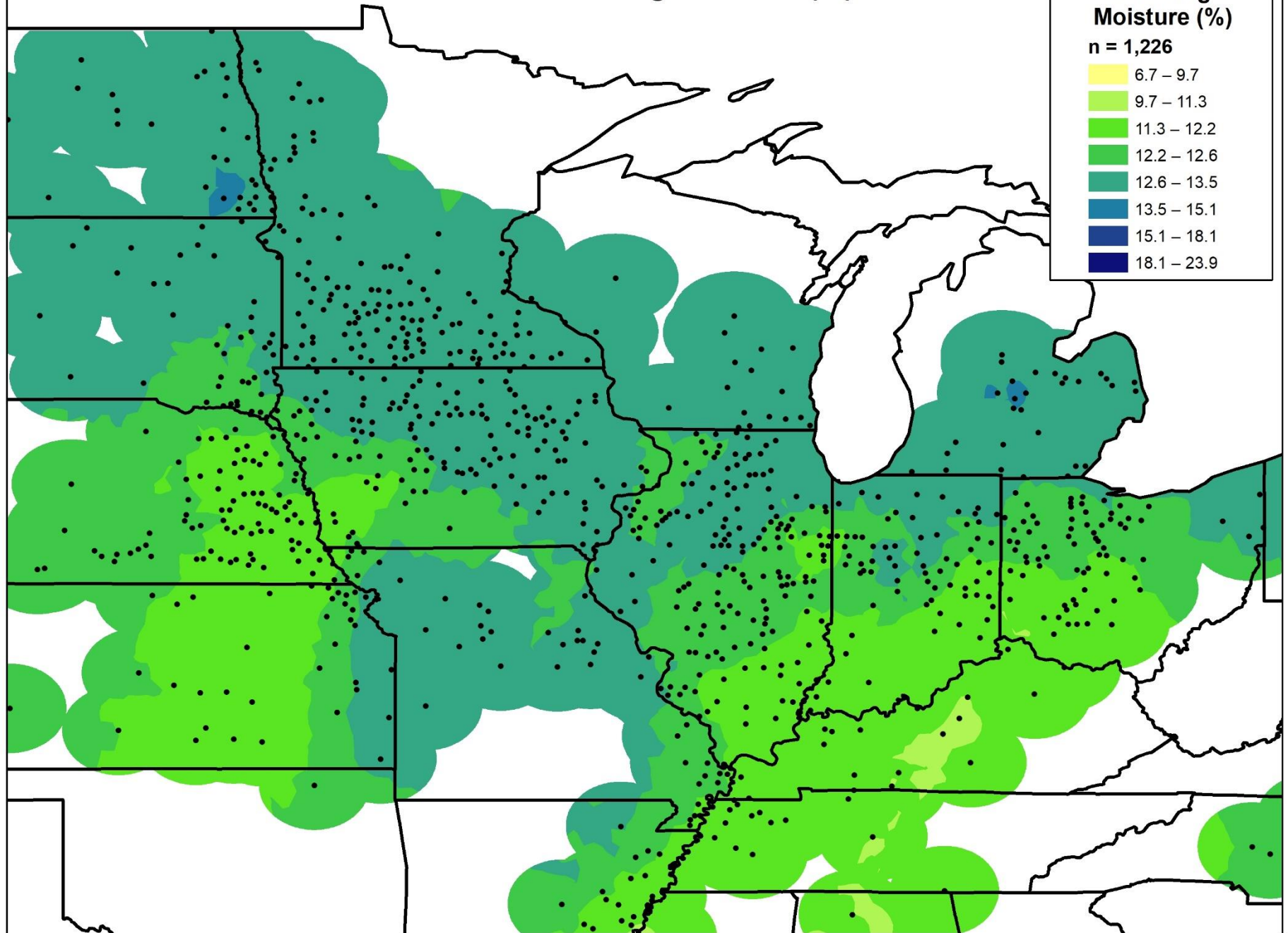
Oil (%) Difference



A close-up photograph of two soybean pods hanging from a stem. The pods are brown and covered in fine hairs. The background is a soft, out-of-focus brown. A semi-transparent teal banner is overlaid across the middle of the image, containing the title text.

PHYSICAL CHARACTERISTICS

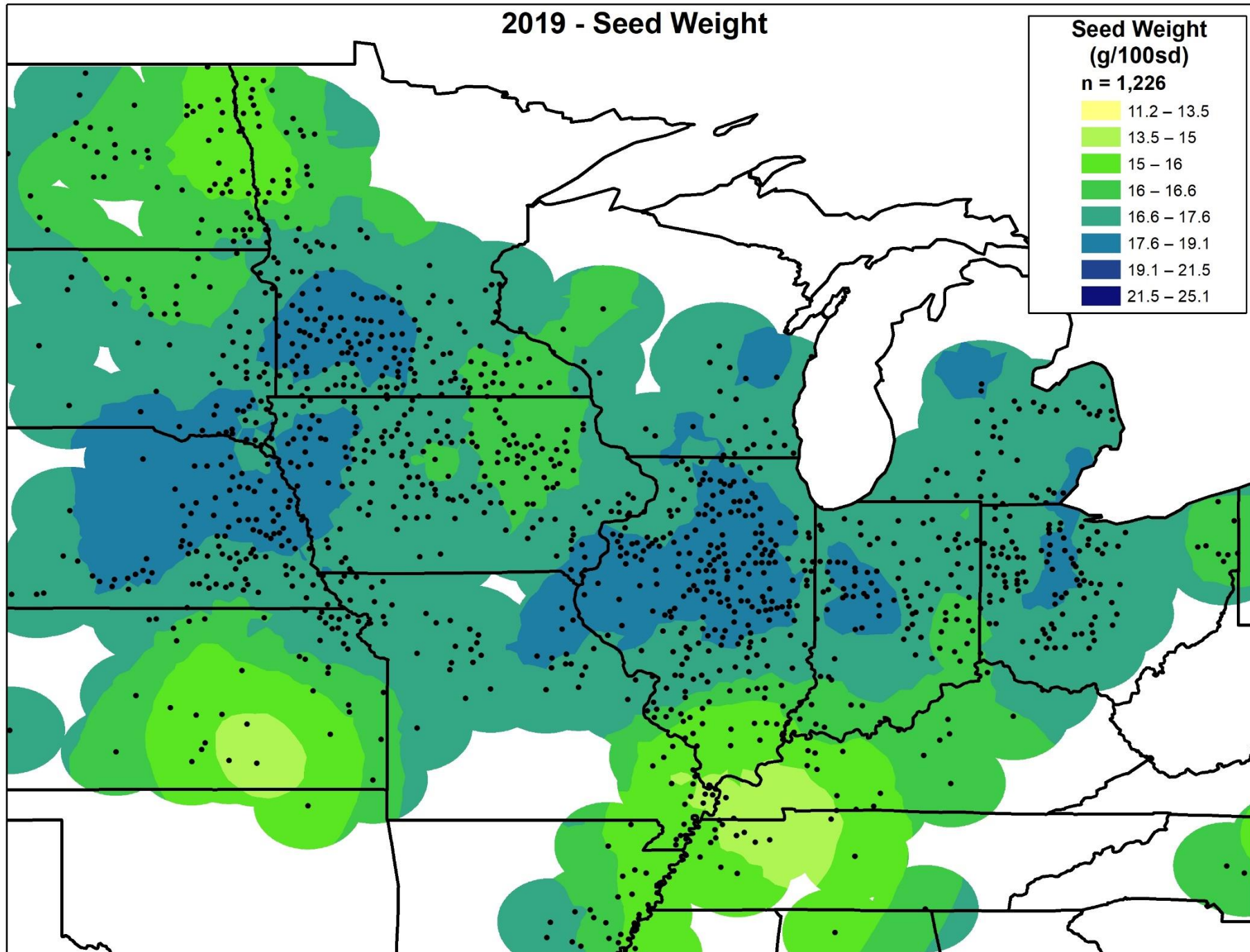
2019 - Incoming Moisture (%)



2019 - Seed Weight

Seed Weight
(g/100sd)

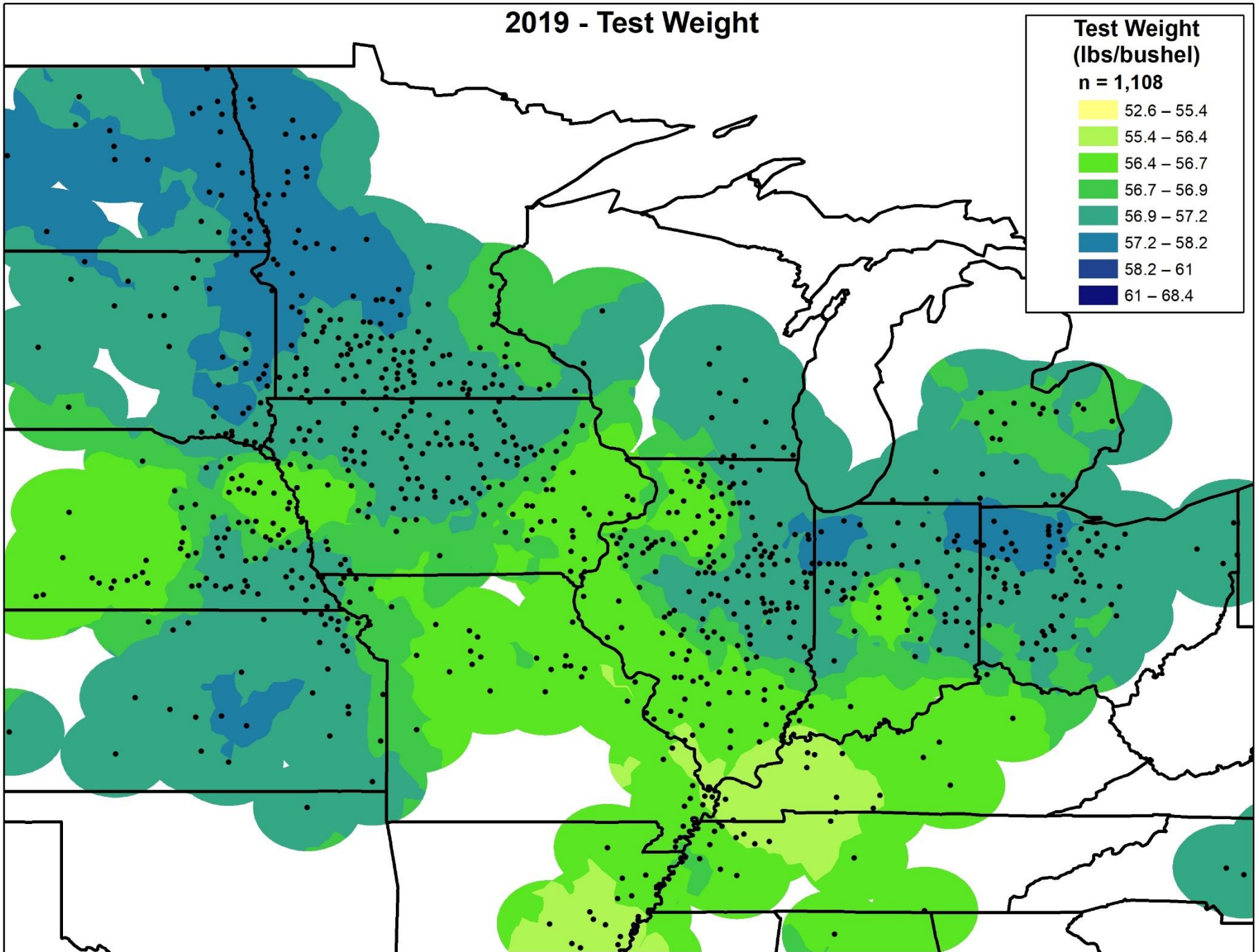
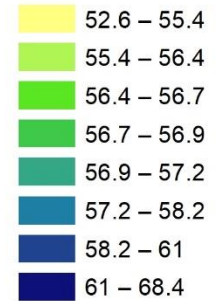
n = 1,226



2019 - Test Weight

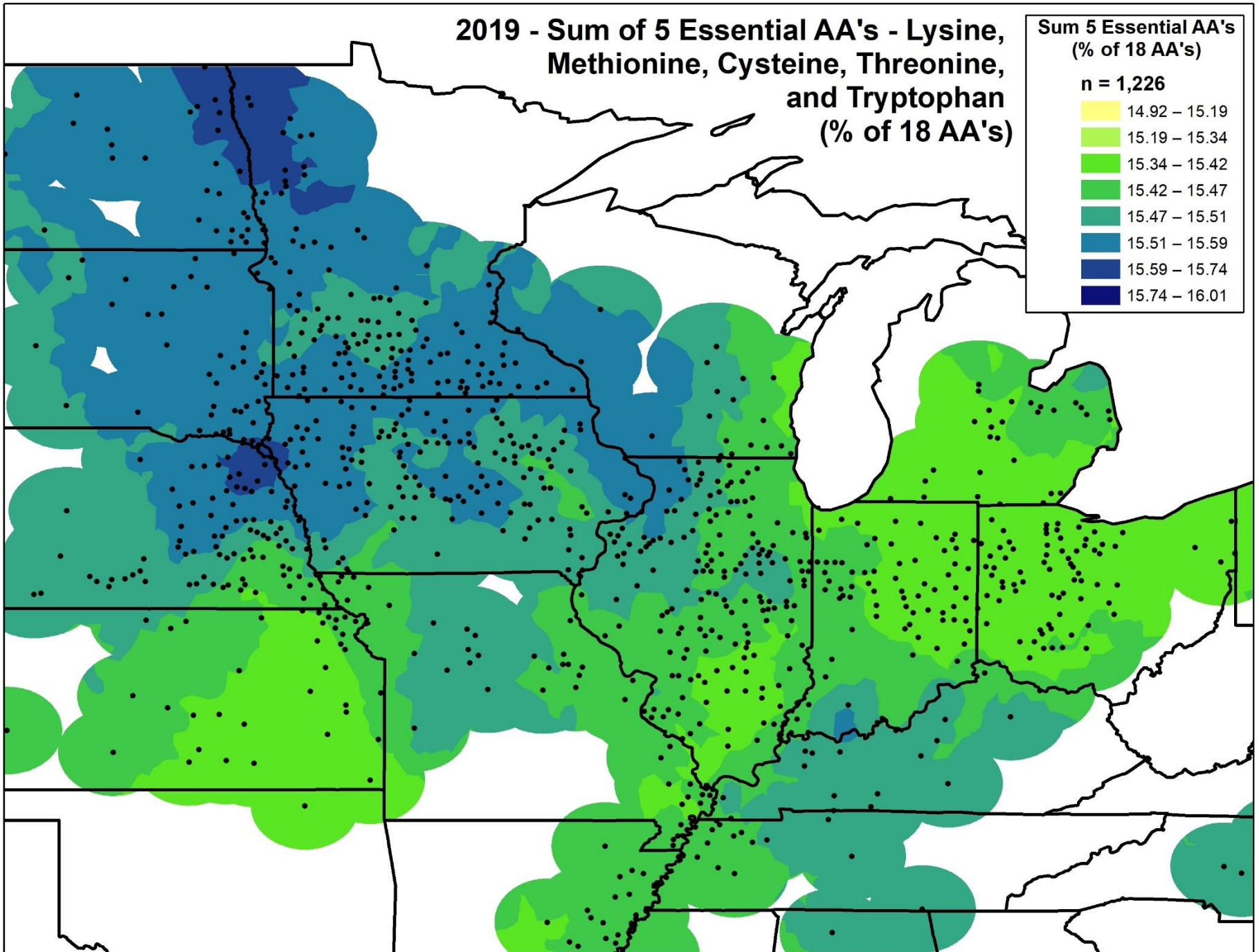
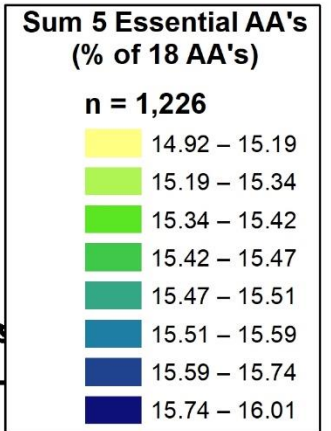
Test Weight
(lbs/bushel)

n = 1,108



BETTER MEASURES OF QUALITY: A.K.A. AMINO ACIDS

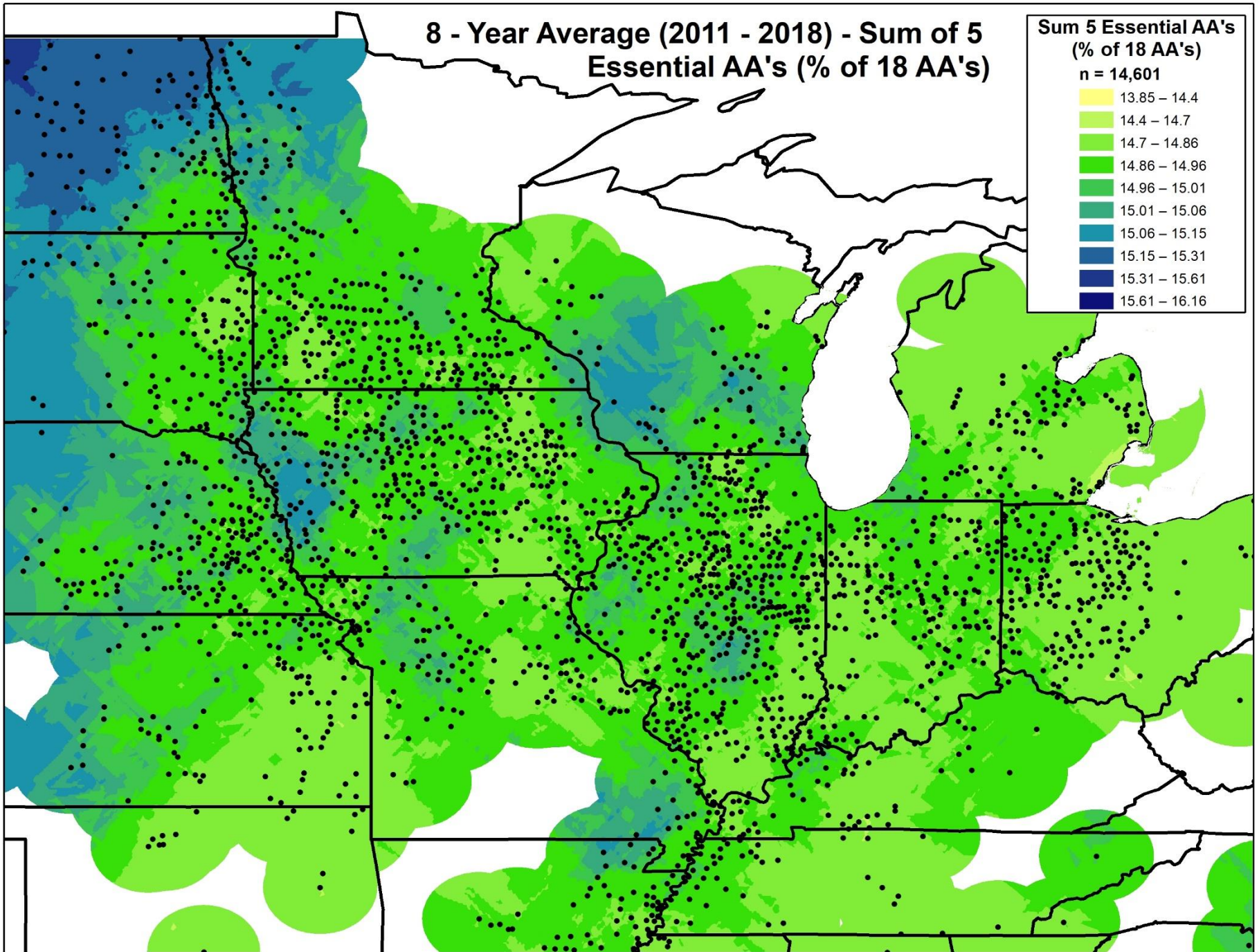
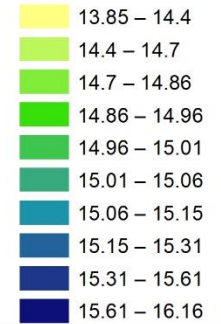
**2019 - Sum of 5 Essential AA's - Lysine,
Methionine, Cysteine, Threonine,
and Tryptophan
(% of 18 AA's)**



8 - Year Average (2011 - 2018) - Sum of 5 Essential AA's (% of 18 AA's)

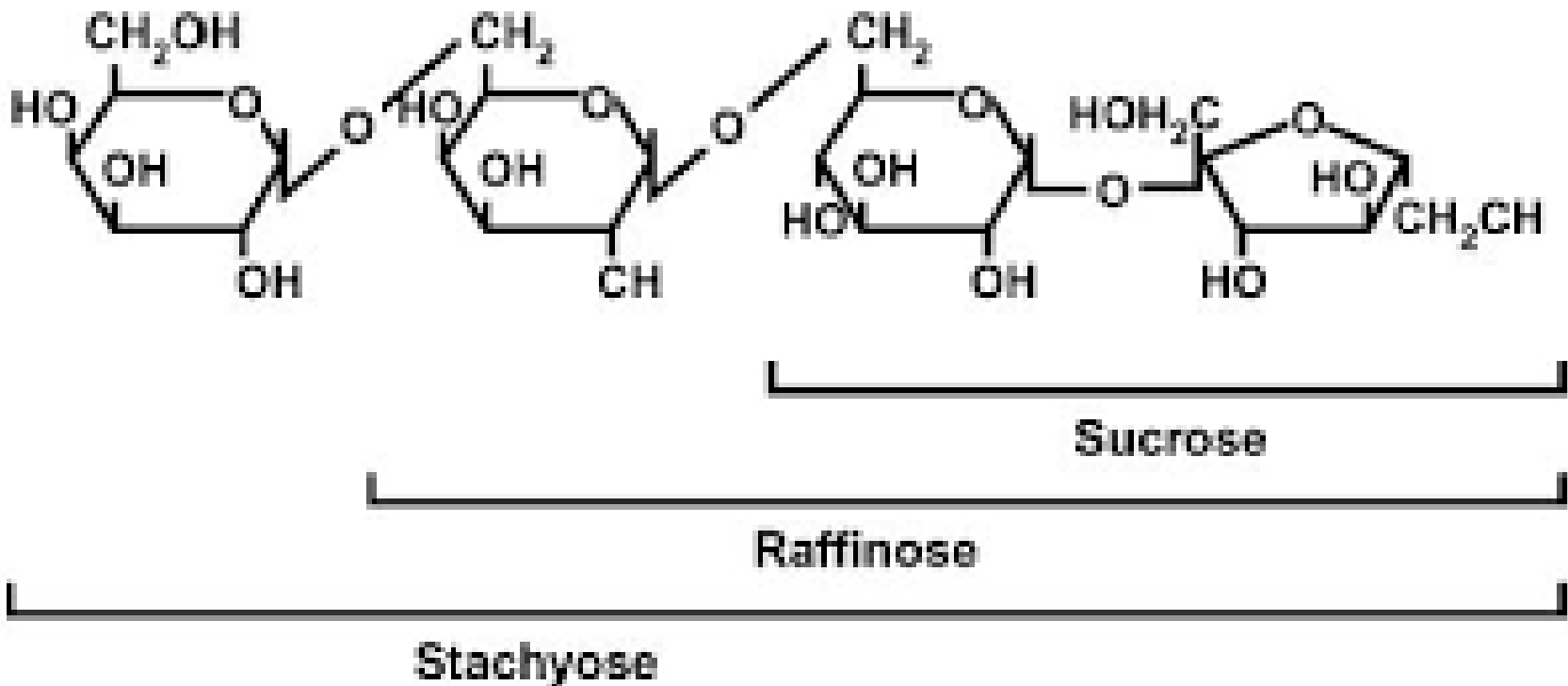
Sum 5 Essential AA's
(% of 18 AA's)

n = 14,601



BETTER MEASURES OF QUALITY:

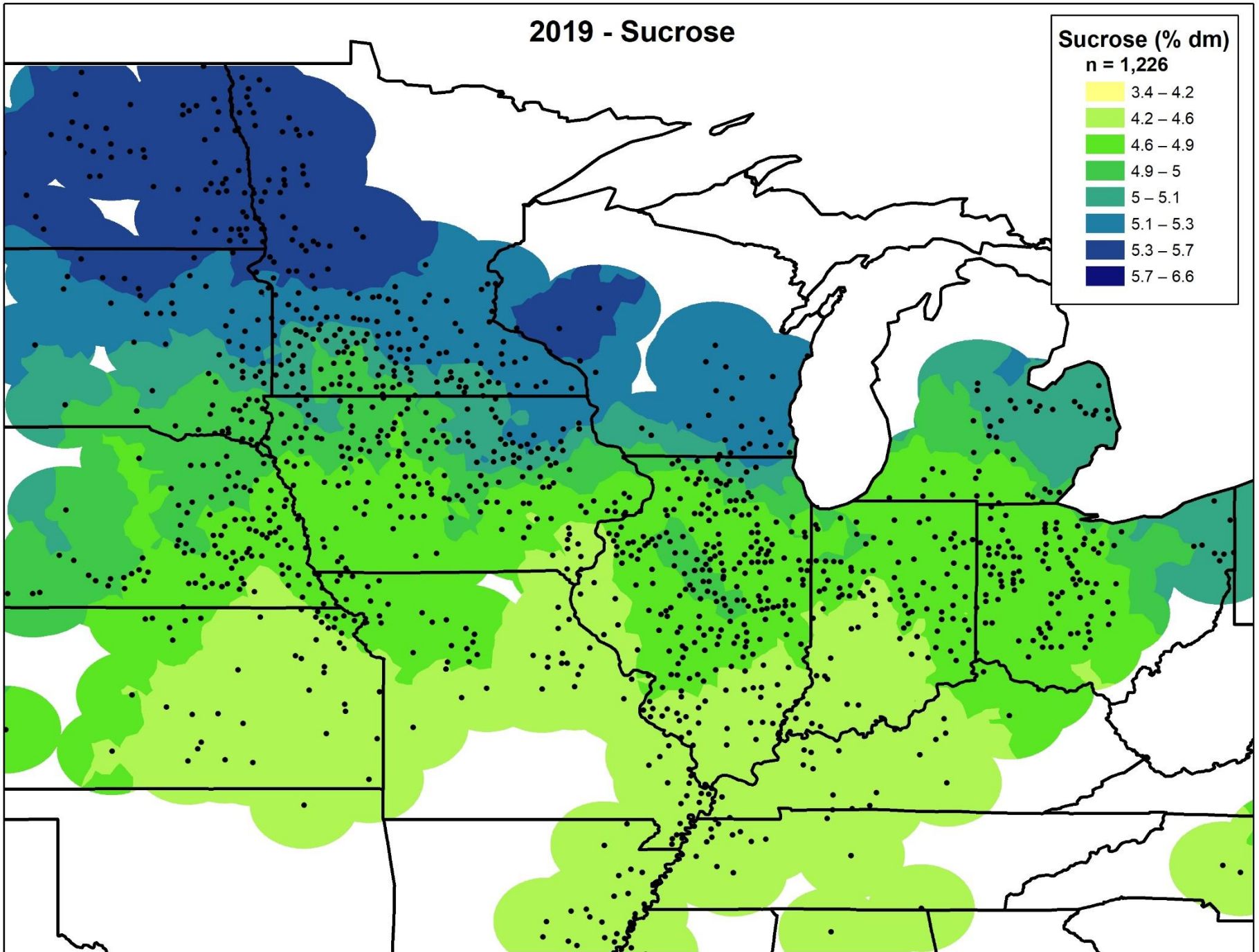
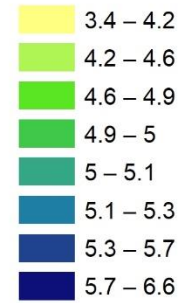
B) SOLUBLE SUGARS



2019 - Sucrose

Sucrose (% dm)

n = 1,226



8 - Year Average (2011 - 2018) - Sucrose

Sucrose (% DM)

n = 14,607

0 - 4.4

4.4 - 4.8

4.8 - 5.1

5.1 - 5.3

5.3 - 5.5

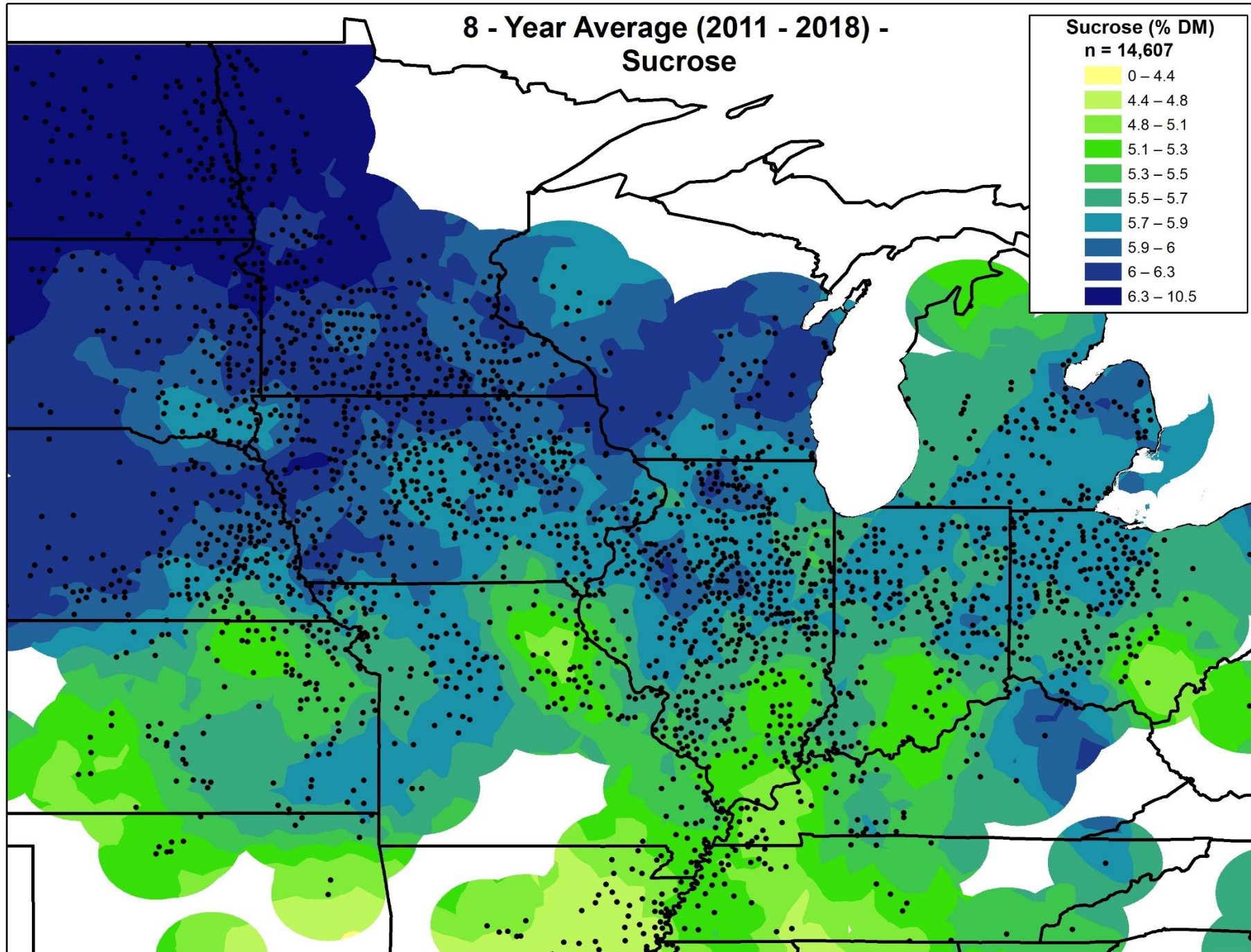
5.5 - 5.7

5.7 - 5.9

5.9 - 6

6 - 6.3

6.3 - 10.5



2019 SUMMARY

- 2019 was one of the most trying production years for most US farmers in recent memory
 - Every year, some farmers face very difficult environmental and business challenges. This year, these affected the majority of US farmers.
- Despite the severity and breadth of the challenges, US farmers will still produce
 - Nearly 100 MMT of -
 - High quality, low FM soybeans, capable of producing quality soybean meal with exceptional amino acid composition and high in energy.

A close-up photograph of soybean pods hanging from a stem. The pods are brown and fuzzy, with a dark stem running through them. The background is a soft, out-of-focus brown.

2019 FOOD SOYBEAN SURVEY

| State (# of samples) | Region | Protein * (%) | Regional Protein Average | Oil * (%) | Regional Oil Average |
|-------------------------|--------|------------------|-----------------------------|--------------|-------------------------|
| Iowa (5) | WCB | 36.2 | 35.6 | 17.4 | 17.6 |
| Minnesota (19) | WCB | 35.3 | | 17.8 | |
| Nebraska (4) | WCB | 36.2 | | 17.4 | |
| Illinois (64) | ECB | 35.6 | 35.7 | 18.1 | 18.1 |
| Indiana (1) | ECB | 36.7 | | 17.4 | |
| Michigan (23) | ECB | 35.1 | | 17.9 | |
| Ohio (14) | ECB | 37.8 | | 18.3 | |
| Wisconsin (42) | ECB | 35.3 | | 18.0 | |

Data as of October 29, 2019

§ WCB: Western Corn Belt; ECB: Eastern Corn Belt (see Table 1 for complete list of states included in these regions)

* 13% moisture basis

| Region | Seed Size | Number Samples | Seed Size (g/100 seeds) | Protein* (%) | Oil* (%) |
|--------|-----------|----------------|-------------------------|--------------|----------|
| WCB | Average | 17 | 18.4 | 35.5 | 17.7 |
| | Large | 11 | 22.4 | 35.9 | 17.5 |
| ECB | Small | 1 | 8.5 | 35.1 | 16.7 |
| | Average | 92 | 18.2 | 35.6 | 18.1 |
| | Large | 51 | 22.4 | 35.8 | 18.1 |

Data as of October 29, 2019

‡ Small seed: ≤13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: >21 g/100 seeds (unofficial categories)

§ WCB: Western Corn Belt (Iowa, Minnesota, and Nebraska); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)

* 13% moisture basis

| Region | Seed Size | Number Samples | Seed Size (g/100 seeds) | Sucrose (% DM) | Raffinose (% DM) | Stachyose (% DM) |
|--------|-----------|----------------|-------------------------|----------------|------------------|------------------|
| WCB | Average | 17 | 18.4 | 4.97 | 0.24 | 3.55 |
| | Large | 11 | 22.4 | 5.08 | 0.29 | 3.56 |
| ECB | Small | 1 | 8.5 | 5.77 | 0.27 | 3.66 |
| | Average | 92 | 18.2 | 4.79 | 0.34 | 3.61 |
| | Large | 51 | 22.4 | 4.68 | 0.33 | 3.56 |

Data as of October 29, 2019

‡ Small seed: ≤13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: >21 g/100 seeds (unofficial categories)

§ WCB: Western Corn Belt (Iowa, Minnesota, and Nebraska); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)

| Region | Seed Size | Number Samples | Seed Size (g/100 seeds) | Protein* (%) | Lysine (% of 18 AAs) | Five Limiting Essential [¶] Amino Acids (% of 18 AAs) |
|--------|-----------|----------------|-------------------------|--------------|----------------------|--|
| WCB | Average | 17 | 18.4 | 35.5 | 7.0 | 15.4 |
| | Large | 11 | 22.4 | 35.9 | 7.0 | 15.3 |
| ECB | Small | 1 | 8.5 | 35.1 | 7.1 | 15.3 |
| | Average | 92 | 18.2 | 35.6 | 7.0 | 15.3 |
| | Large | 51 | 22.4 | 35.8 | 7.0 | 15.3 |

Data as of October 29, 2019

‡ Small seed: ≤13.0 g/100 seeds; Average: 13.1-21.0 g/100 seeds; Large: >21 g/100 seeds (unofficial categories)

§ WCB: Western Corn Belt (Iowa, Minnesota, and Nebraska); ECB: Eastern Corn Belt (Illinois, Indiana, Michigan, Ohio, and Wisconsin)

* 13% moisture basis

¶ Five limiting essential amino acids: cysteine, lysine, methionine, threonine, and tryptophan

SUMMARY – 2019 FOOD SOYBEAN SURVEY

PROTEIN

Overall:

WCB 35.6 ≈ ECB 35.7

Examined by seed size & region:

Average: ECB 35.6 ≈ WCB 35.5

Large: WCB 35.9 ≈ ECB 35.8

Small: ECB 35.1

Sample numbers within the groups differed:

Average: WCB 17 < ECB 92

Large: WCB 11 < ECB 51

Small: ECB 1

SUMMARY – 2019 FOOD SOYBEAN SURVEY

OIL

Overall:

ECB 18.1 > WCB 17.6

Examined by seed size & region:

Average: ECB 18.1 > WCB 17.7

Large: ECB 18.1 > WCB 17.5

Small: ECB 16.7

SUMMARY – 2019 FOOD SOYBEAN SURVEY

SOLUBLE SUGARS

- Usually WCB sucrose is higher than ECB – this is true in 2019 when comparing the 2 regions by size categories:

| | | | |
|---------|------------|---|------------|
| AVERAGE | WCB (4.97) | > | ECB (4.79) |
| LARGE | WCB (5.08) | > | ECB (4.68) |
- The ECB SMALL sample was slightly higher (3.66) than ECB AVERAGE (3.61) and LARGE (3.56) samples for stachyose, and lower sucrose & higher stachyose are desirable for making natto
- Sucrose concentrations were lower in 2019 than in 2018, because of warmer temperatures during the seed-filling period

SUMMARY – 2019 FOOD SOYBEAN SURVEY

AMINO ACIDS

- Lower protein samples tend to have higher concentrations of the five limiting essential amino acids (5 EAAs), regardless of seed size
 - lower protein → higher 5 EAAs (as % 18 AAs)
 - higher protein → lower 5 EAAs
- In 2019, this is true; for example, the WCB average seed size samples are lower protein (35.5) but higher 5 EAAs (15.4)

THANK YOU

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