

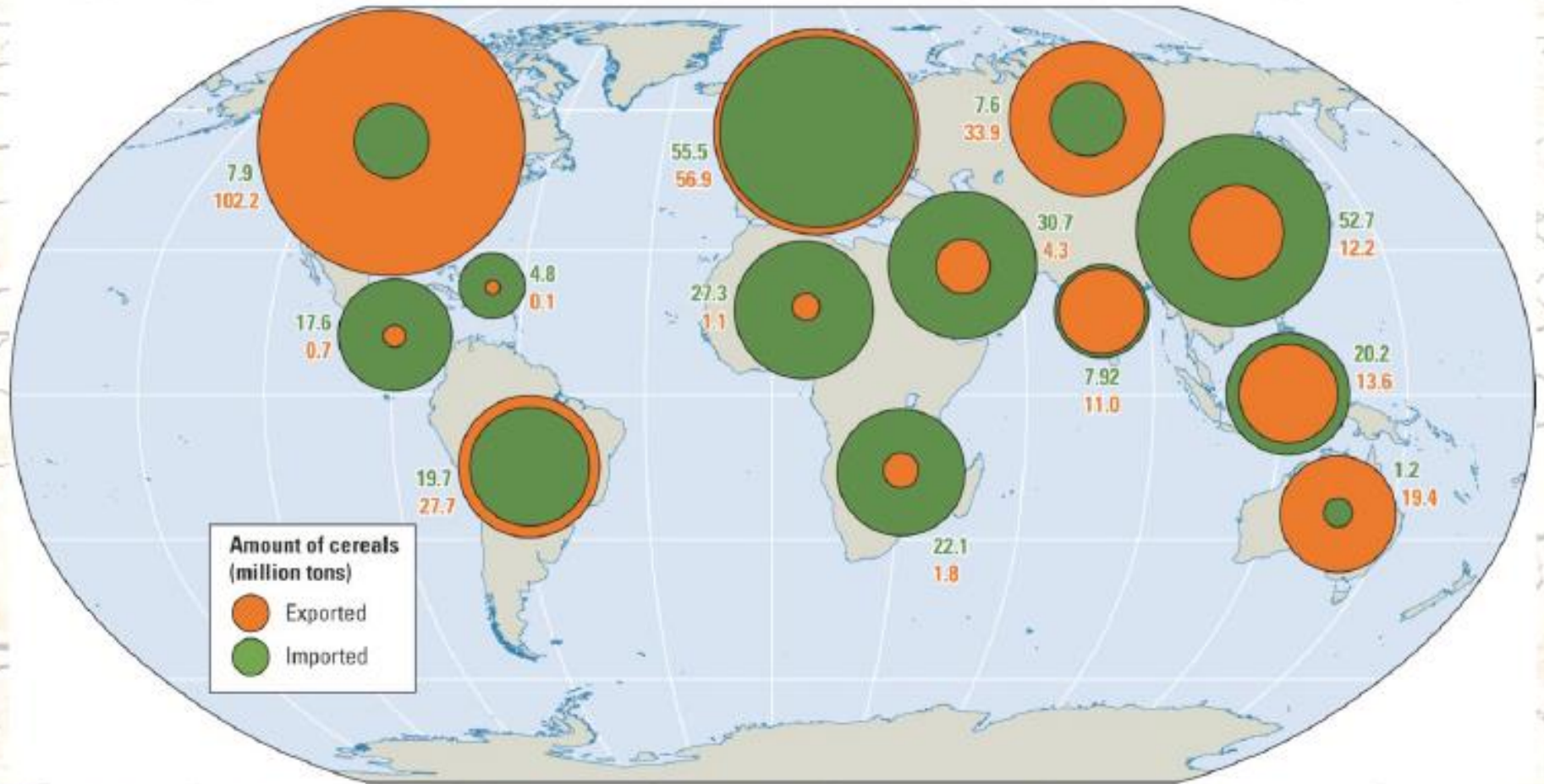
# Challenges for Drought Mitigation in Agriculture



Michael Hayes, Director, National Drought Mitigation Center



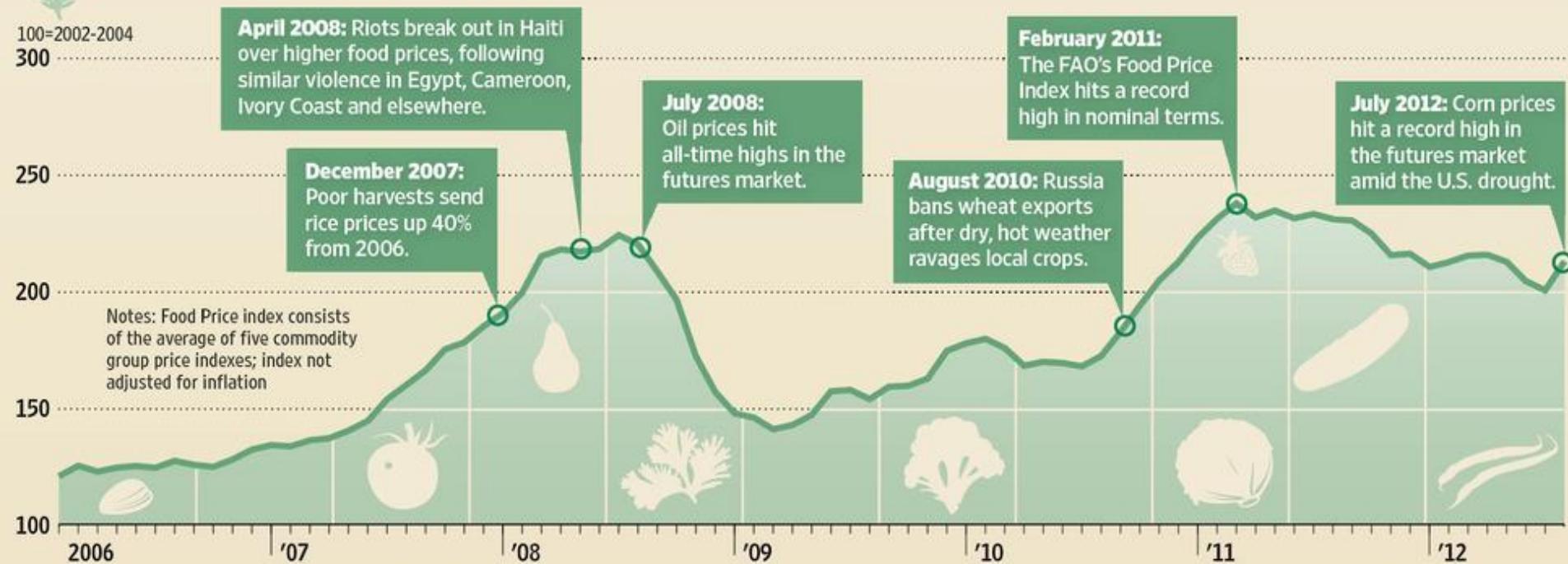
# Drought and Food Security



World grain trade depends on exports from a few countries

FAO 2009

## Growing Concern | Heat, drought and rain are pushing world food prices higher

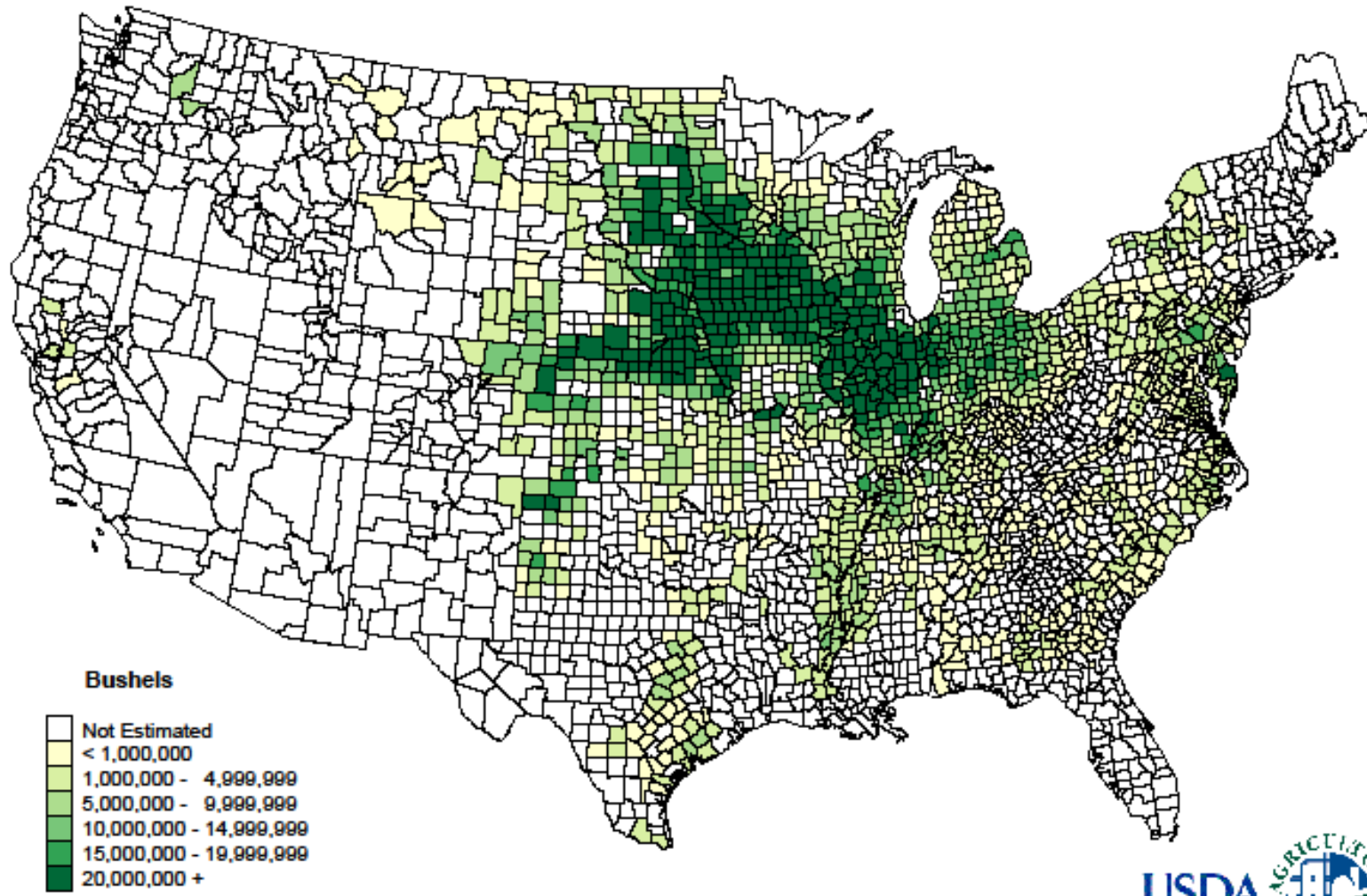


Source: Food and Agriculture Organization of the United Nations

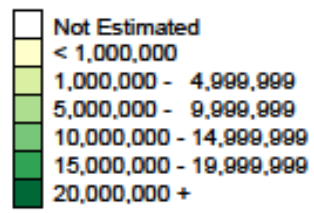
The Wall Street Journal

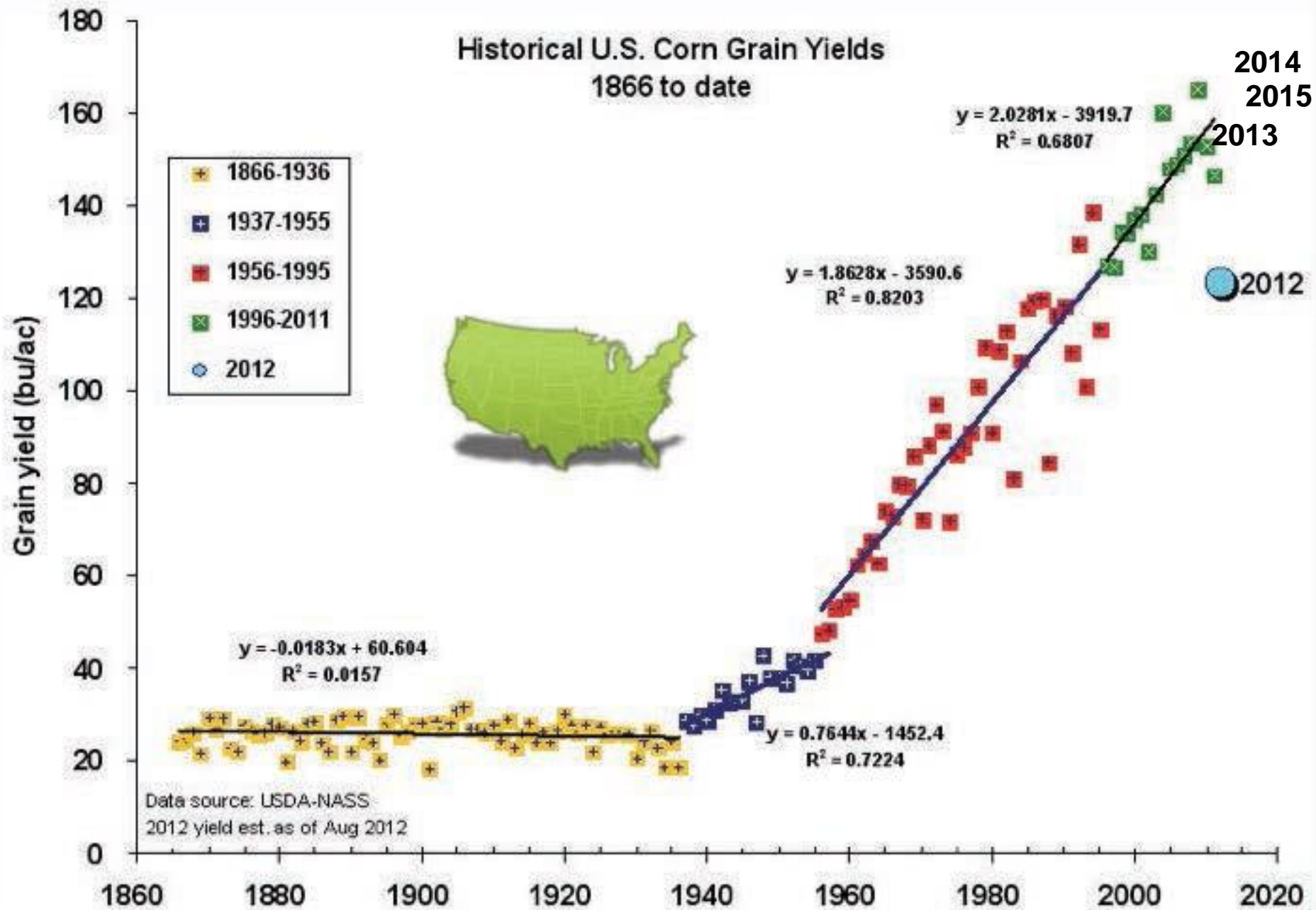


### Corn for Grain 2014 Production by County for Selected States



#### Bushels

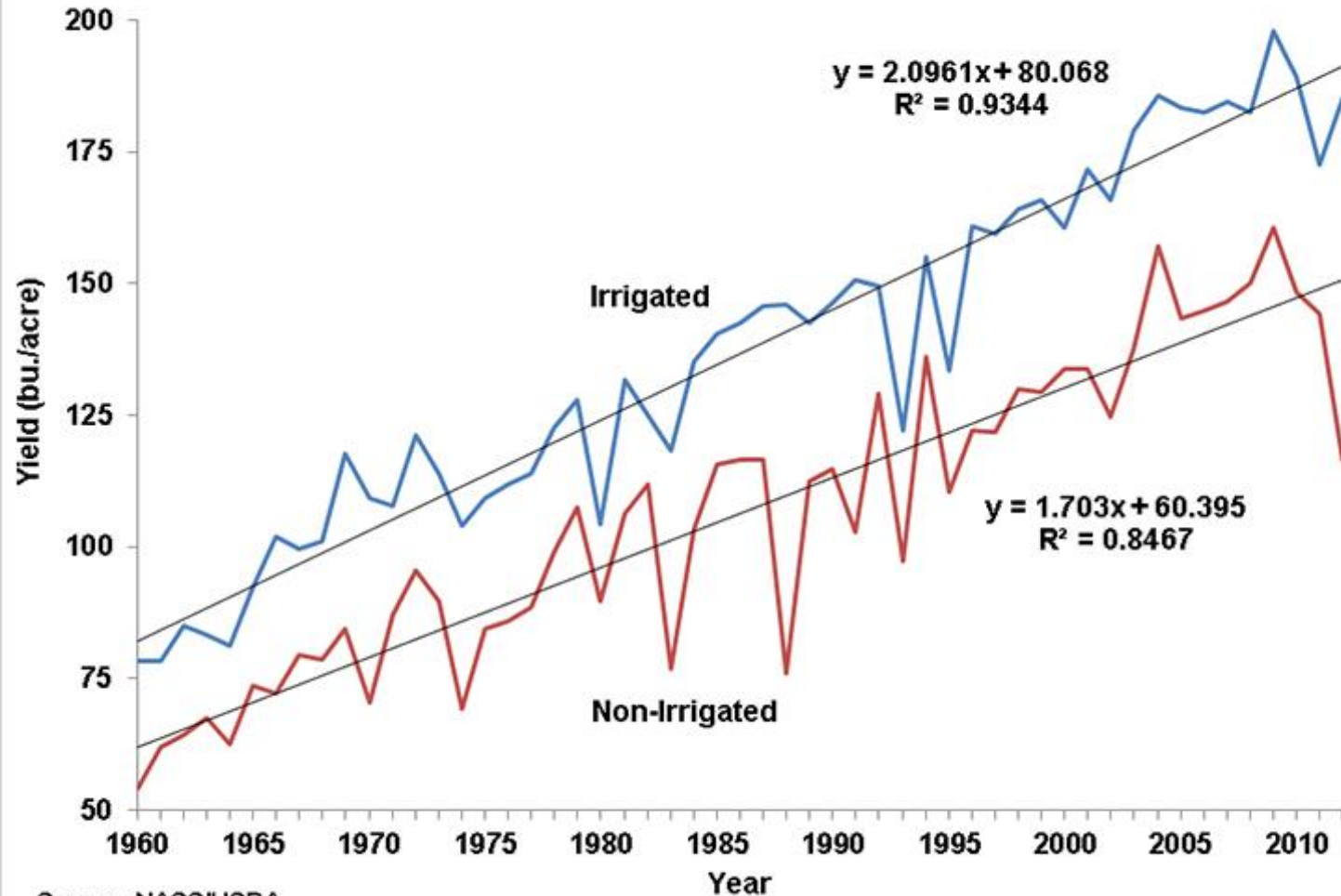




Courtesy: Marty Hoerling et al., NOAA, 2013

# Challenges: 2011-2012 Droughts

Figure 2. U.S. Irrigated and Non-Irrigated Corn Yield, 1960-2012

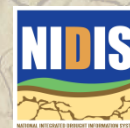
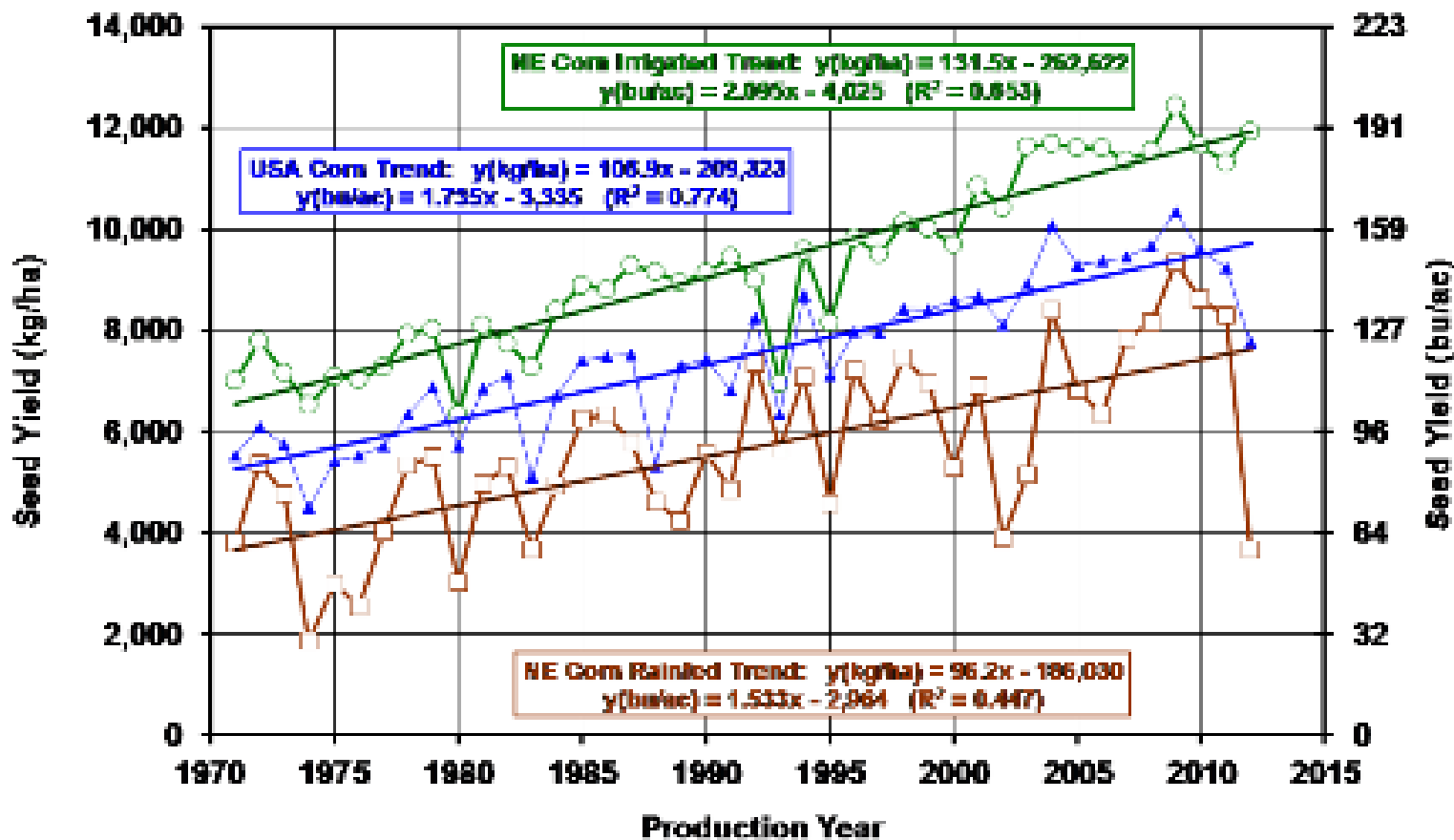


Source: NASS/USDA



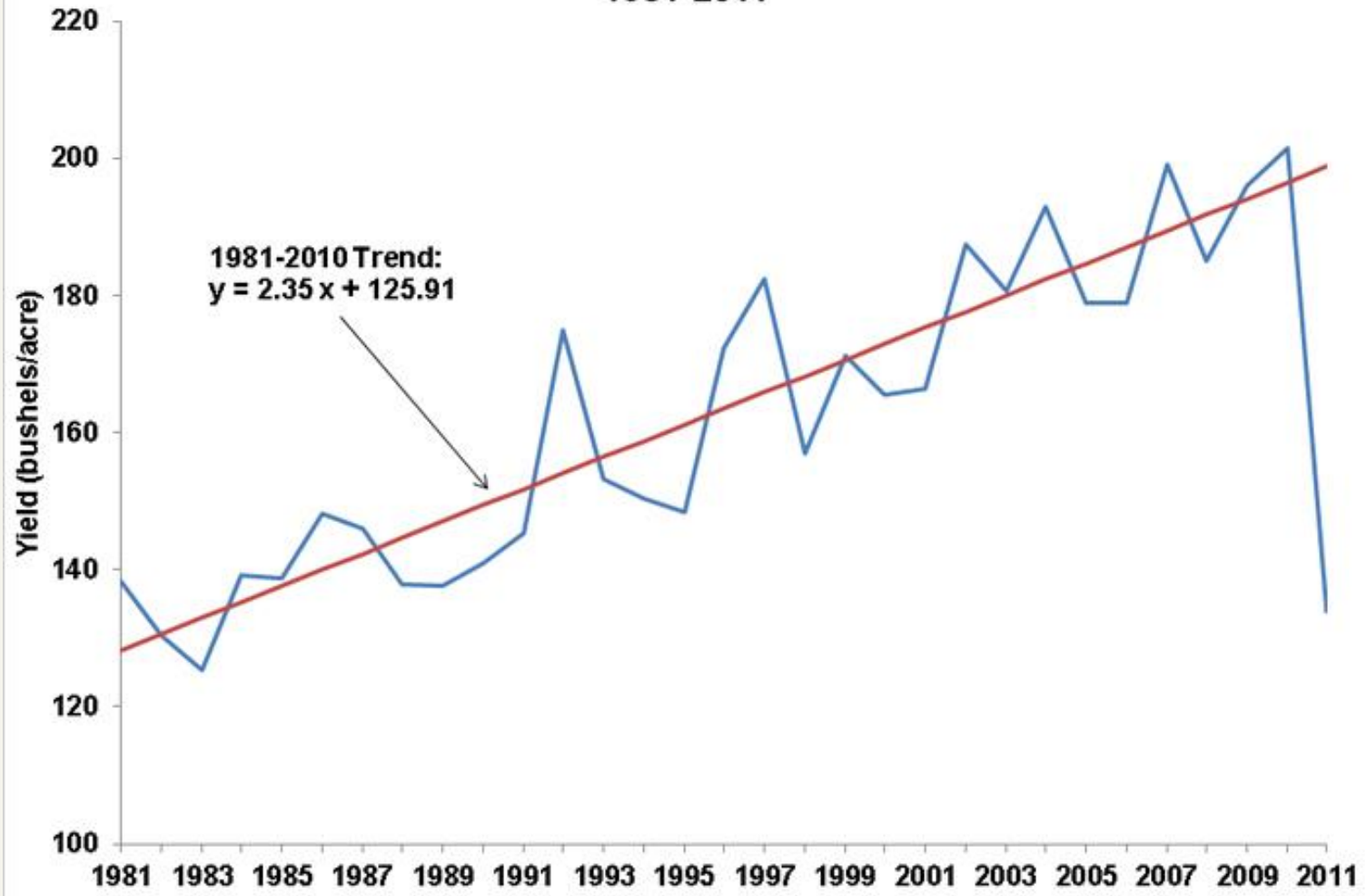
# Challenges: 2011-2012 Droughts

**USA & NE Corn Yield Trends (1971-2012)**



# Challenges: 2011-2012 Droughts

Figure 1. State Average Irrigated Corn Yield in Texas, 1981-2011





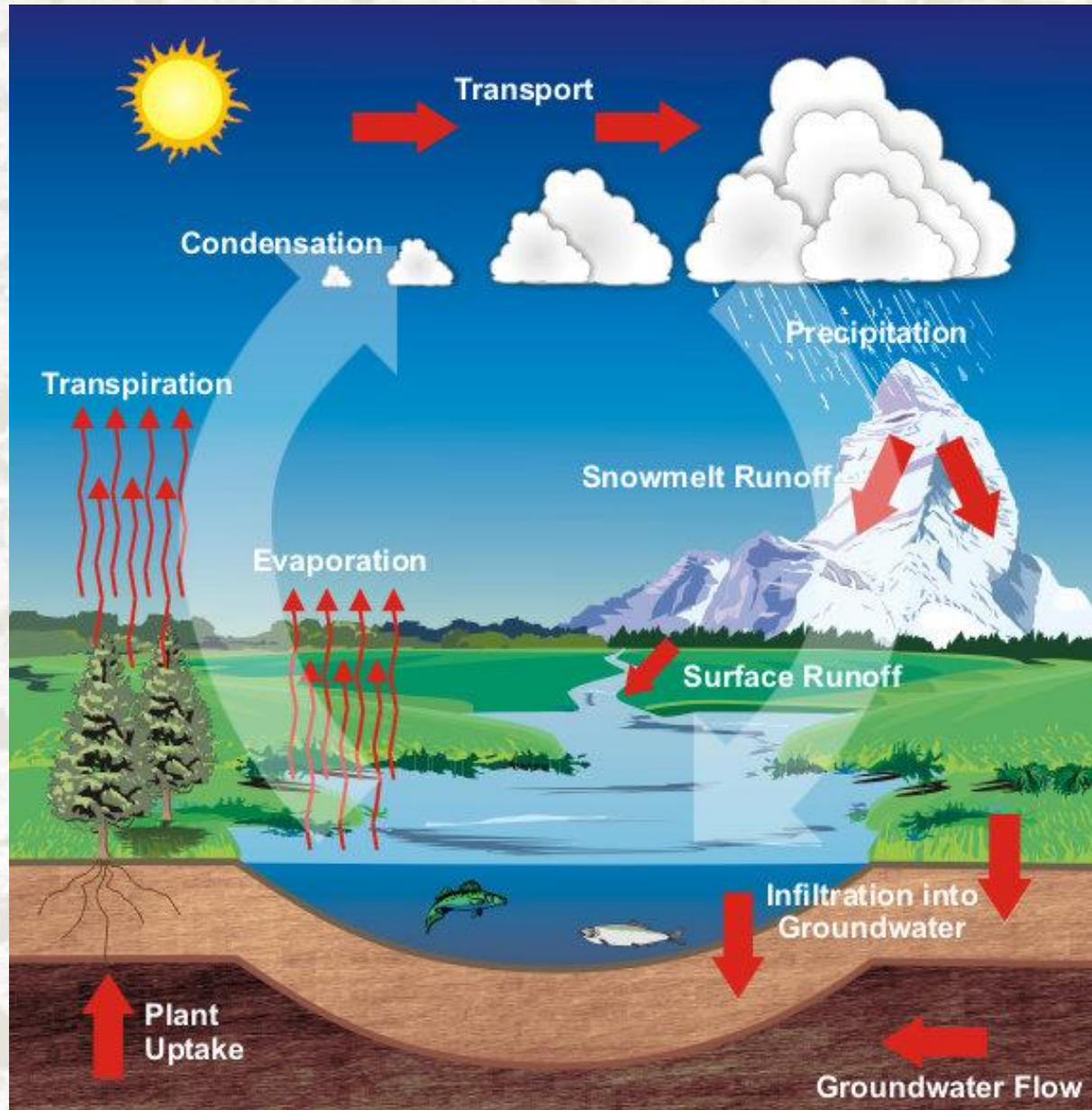
- Challenge: Given these issues, how does agriculture address mitigation for drought in the future?







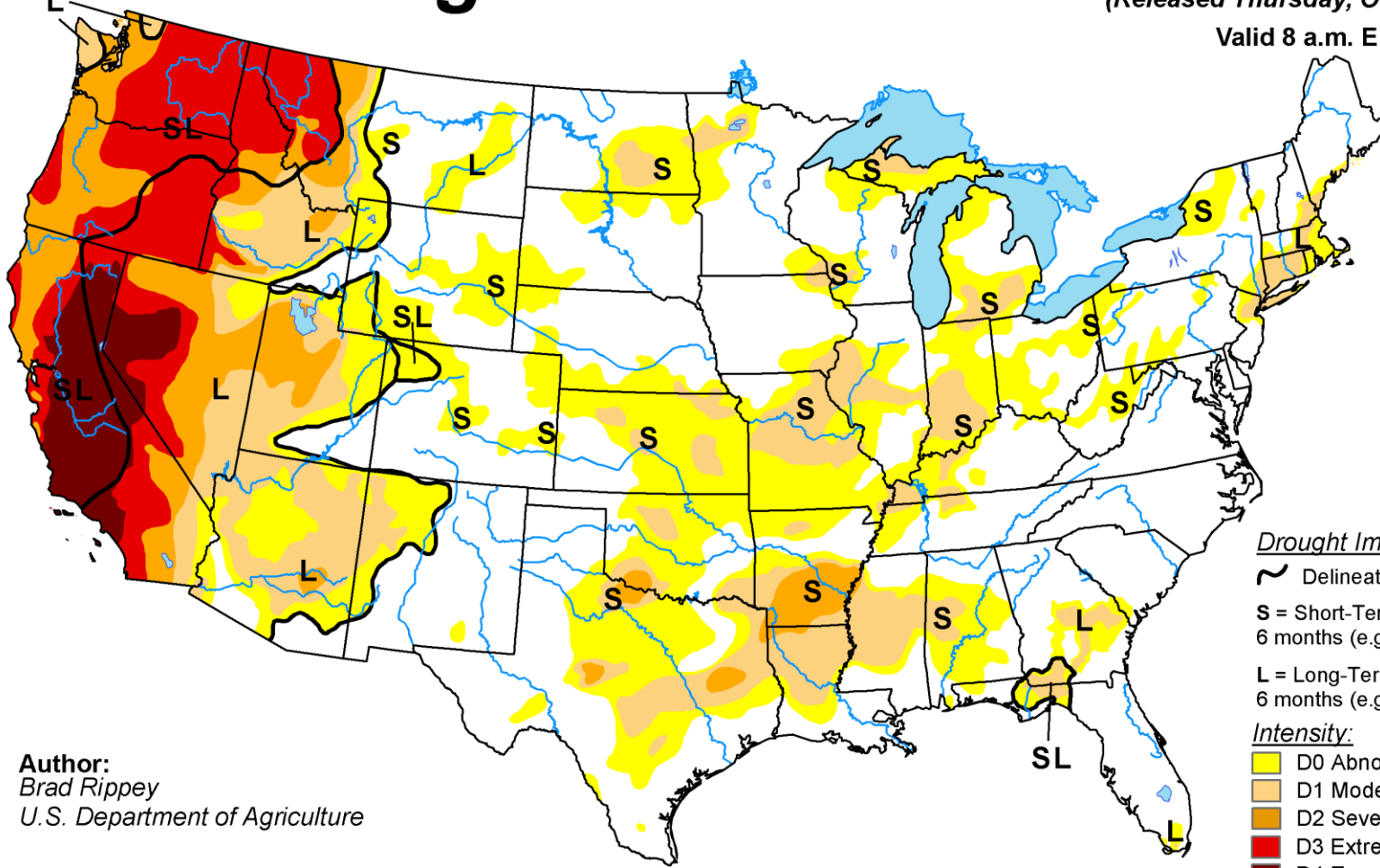
# Drought Monitoring and Early Warning





# U.S. Drought Monitor

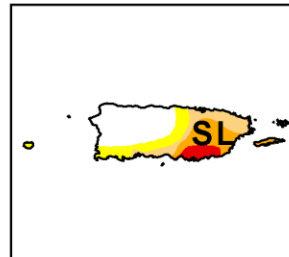
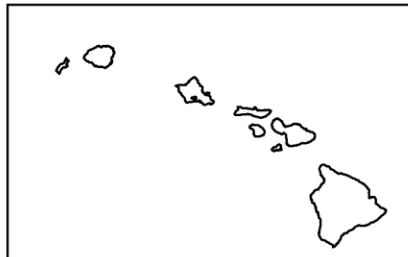
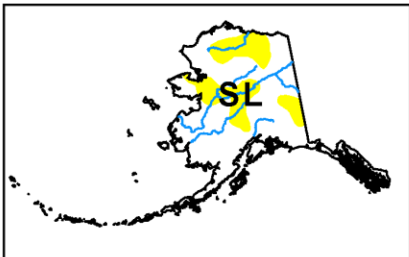
October 27, 2015  
 (Released Thursday, Oct. 29, 2015)  
 Valid 8 a.m. EDT



**Author:**  
 Brad Rippey  
 U.S. Department of Agriculture

- Drought Impact Types:
- Delineates dominant impacts
  - S** = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)
  - L** = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)
- Intensity:
- D0 Abnormally Dry
  - D1 Moderate Drought
  - D2 Severe Drought
  - D3 Extreme Drought
  - D4 Exceptional Drought

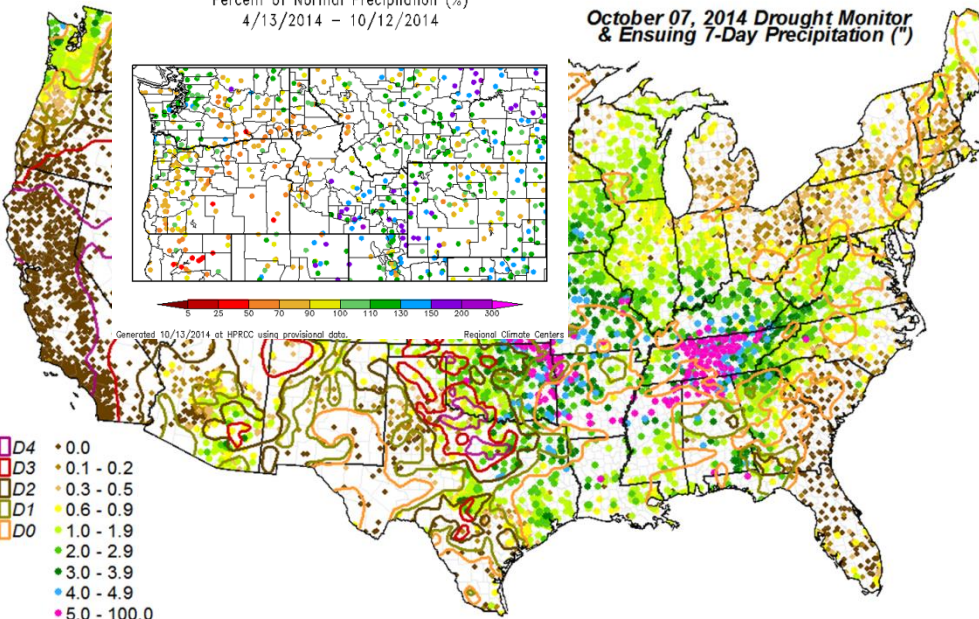
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



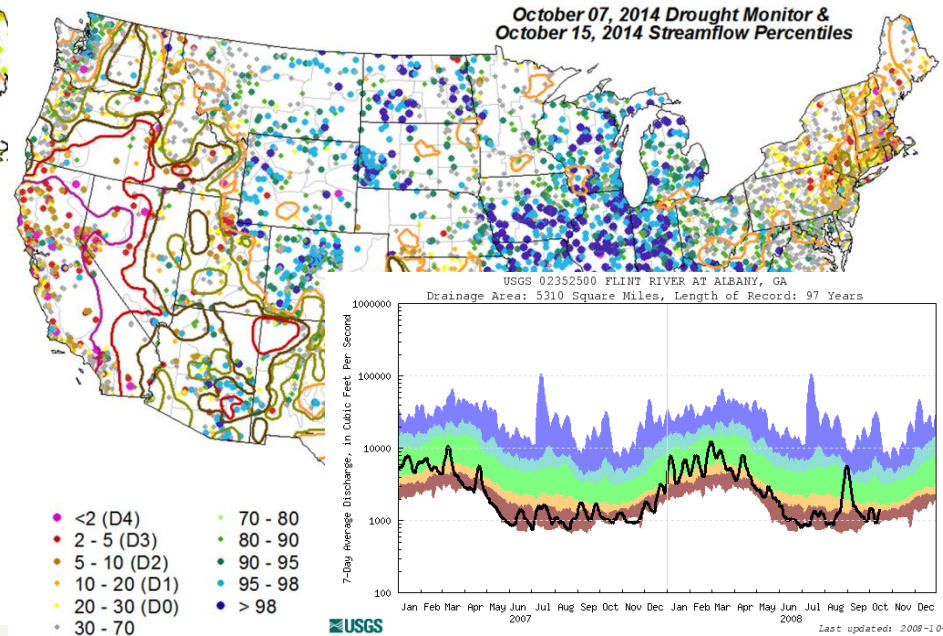
<http://droughtmonitor.unl.edu/>

Percent of Normal Precipitation (%)  
4/13/2014 - 10/12/2014

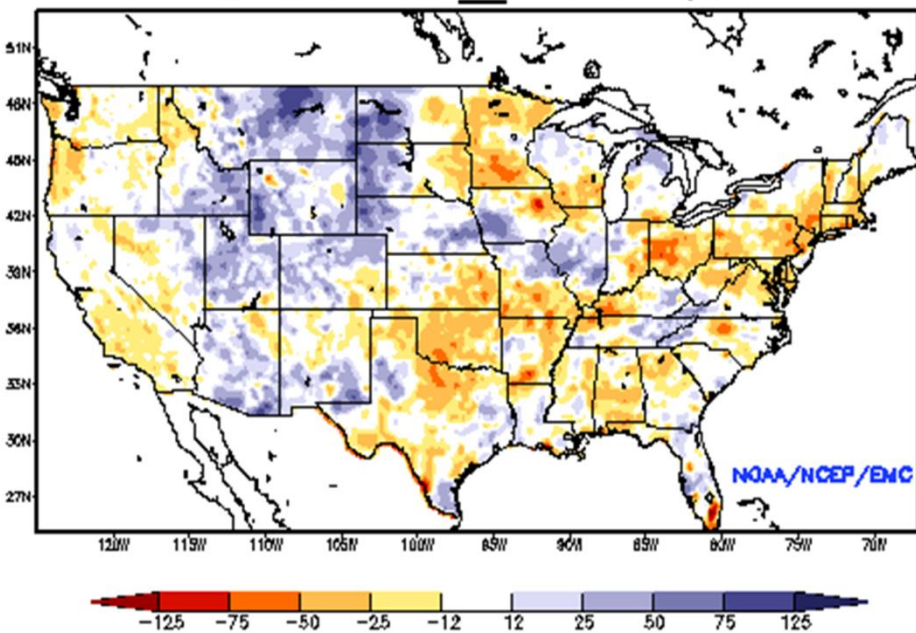
**October 07, 2014 Drought Monitor & Ensuing 7-Day Precipitation (\*)**



**October 07, 2014 Drought Monitor & October 15, 2014 Streamflow Percentiles**

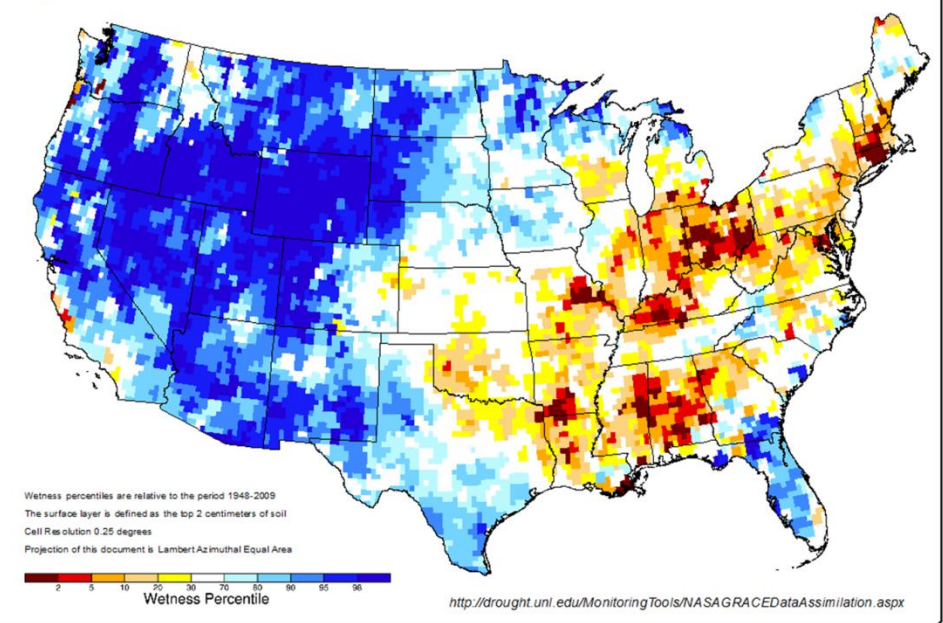


**Ensemble-Mean - Current Top 1M Soil Moisture Anomaly (mm)  
NCEP NLDAS Products Valid: OCT 09, 2014**



**GRACE-Based Surface Soil Moisture Drought Indicator**

October 06, 2014



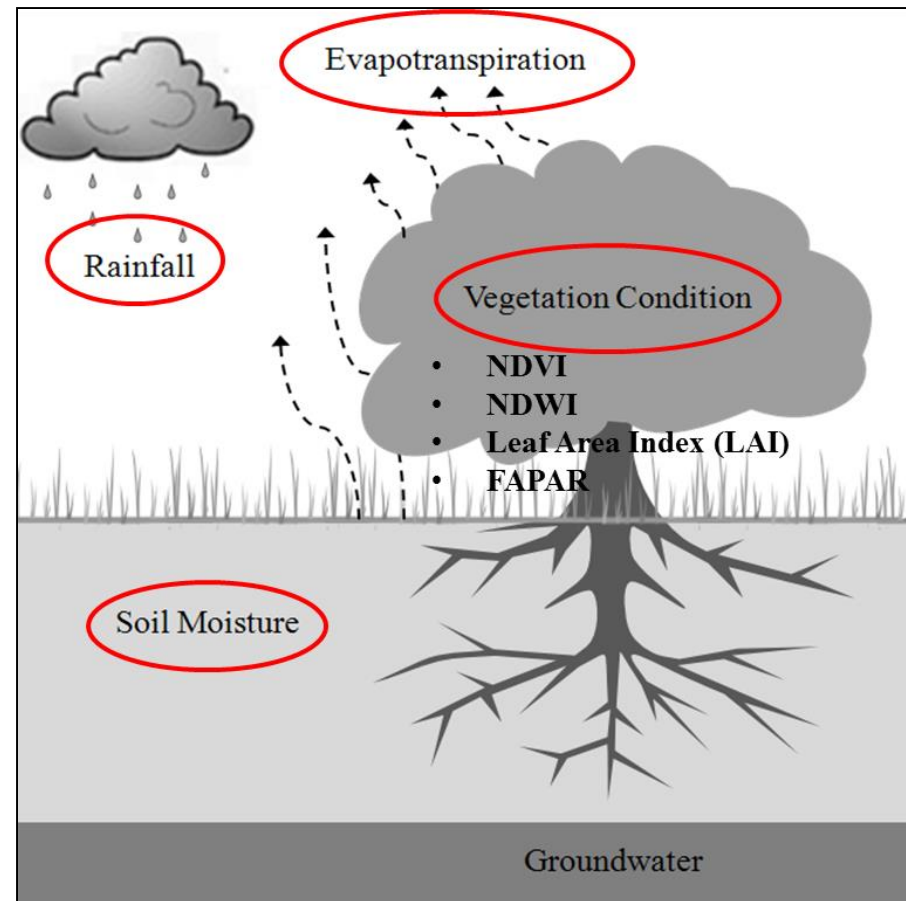


# Remotely Sensed Indicators for Agricultural Drought Monitoring

Over the past decade, satellite remote sensing advanced to develop suite of tools and data products that characterize several components of hydrologic cycle related to vegetation and agricultural drought.

Remotely sensed data tools and products that describe:

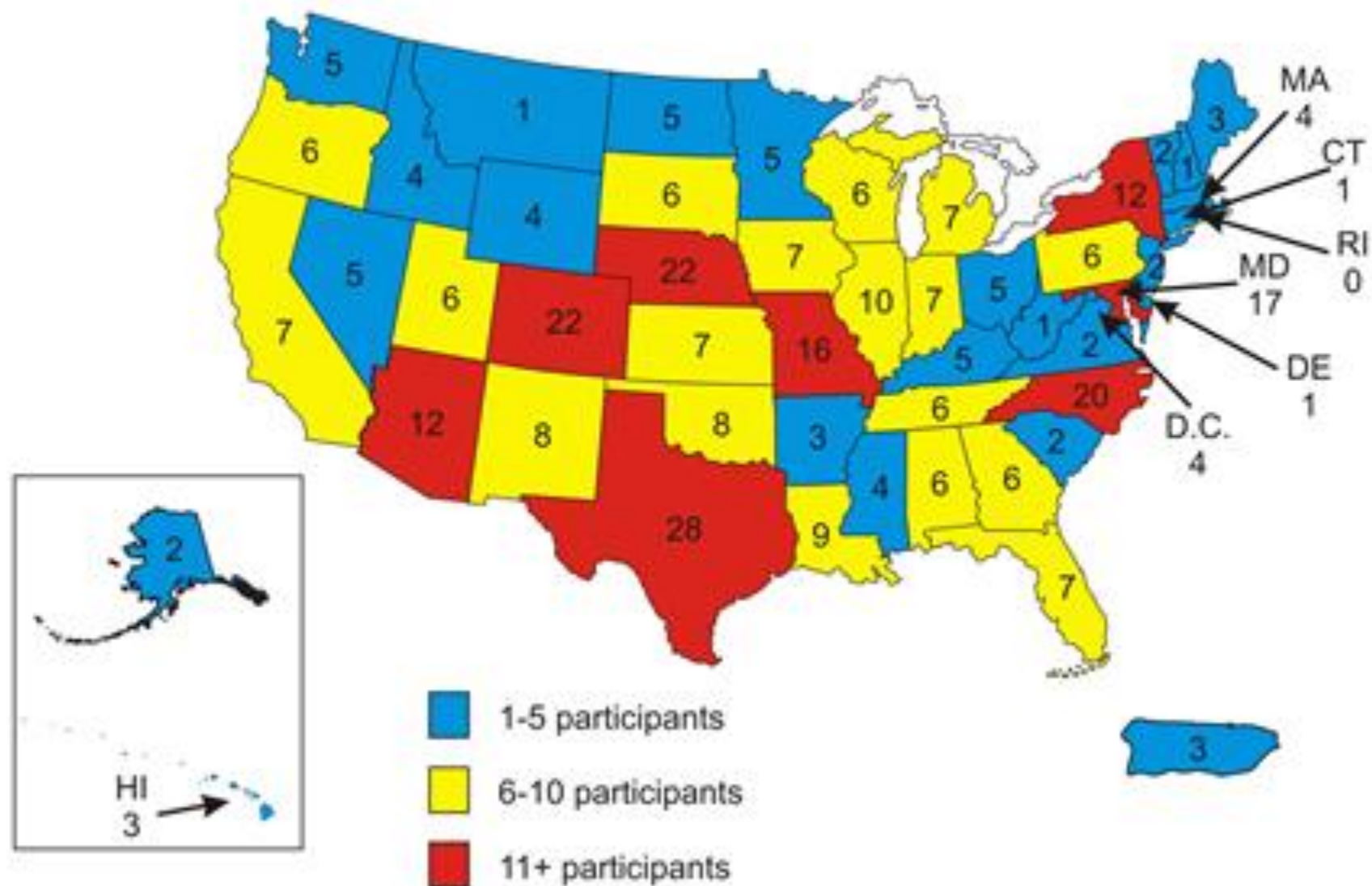
- 1) **sub-surface conditions** = soil moisture
- 2) **Vegetation conditions** = NDVI, NDWI, VHI, LAI, and FAPAR
- 3) **Vegetation-atmosphere boundary layer conditions** = evapotranspiration (ET)
- 4) **Precipitation inputs** = rainfall estimates





# USDM Listserve Subscribers

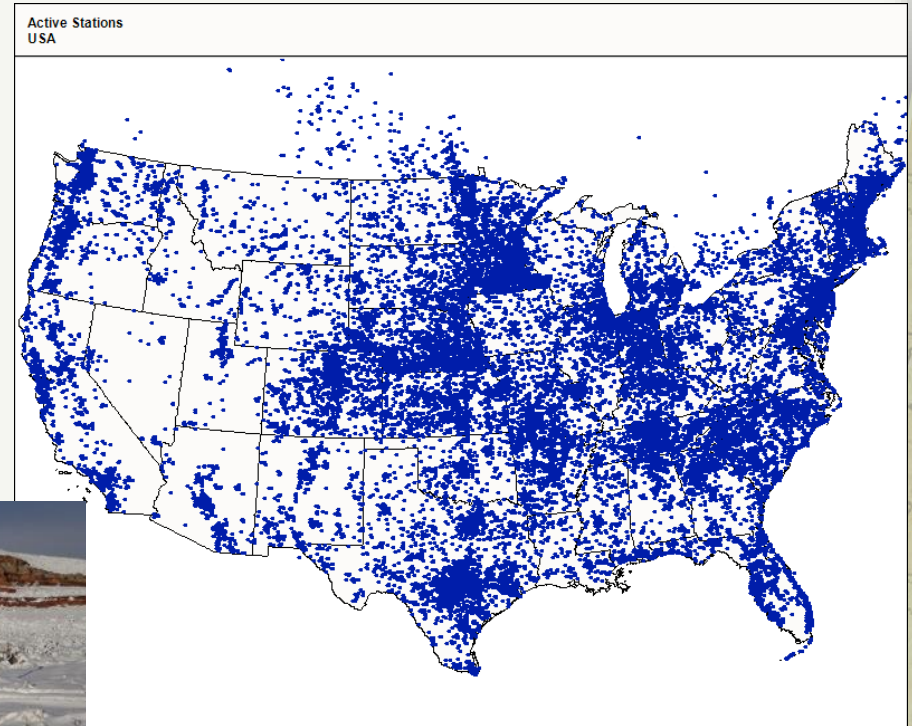
(as of September 4, 2014)



**Total: 351 (does not include 1 participant from Canada and 2 participants from Brazil)**

# CoCoRaHS

20,000+ observers in 50 states, Canada and Puerto Rico



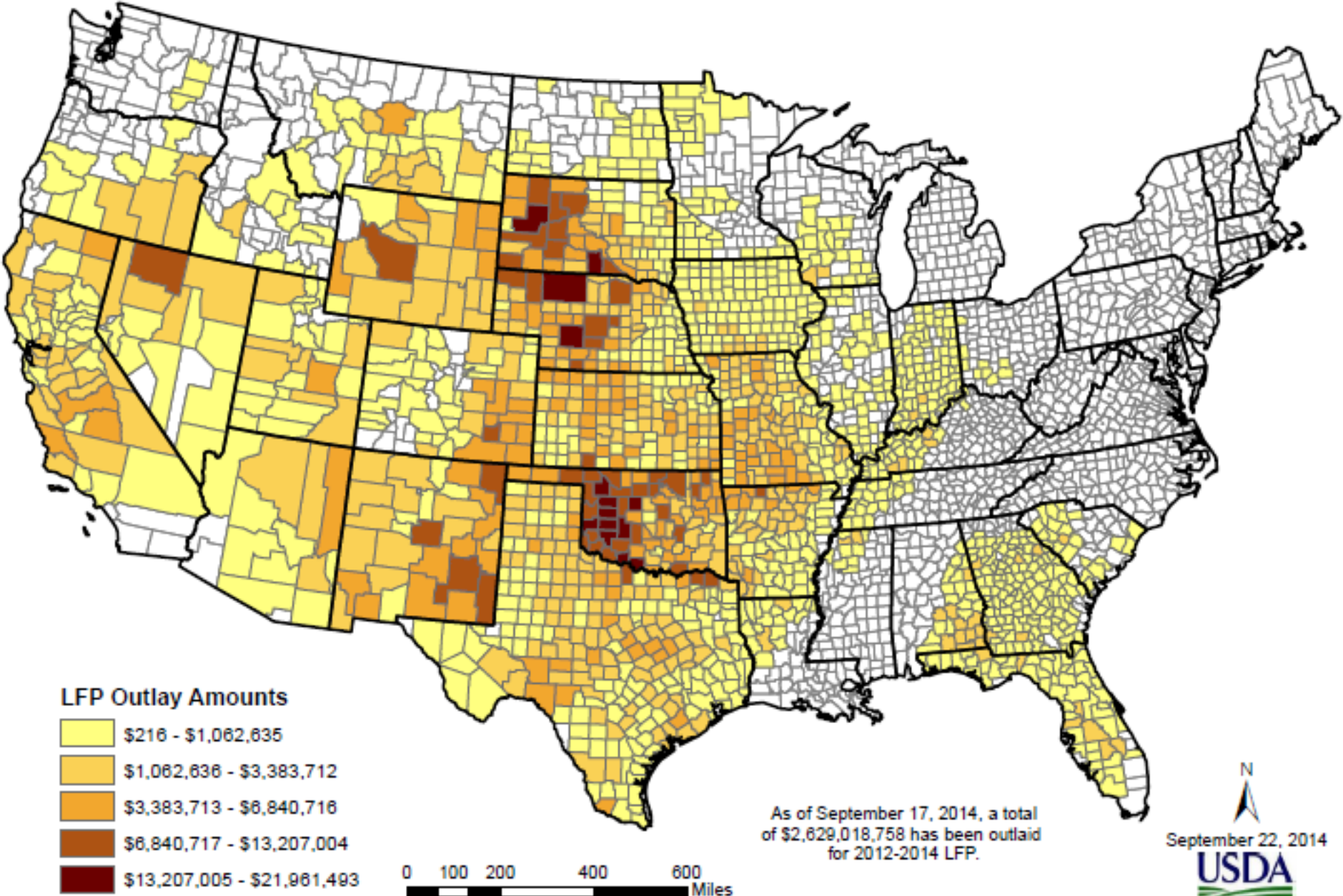
Variety of locations, both rural and urban

Slide modified from Henry Reges.





# Total 2012-2014 LFP Outlay Amounts

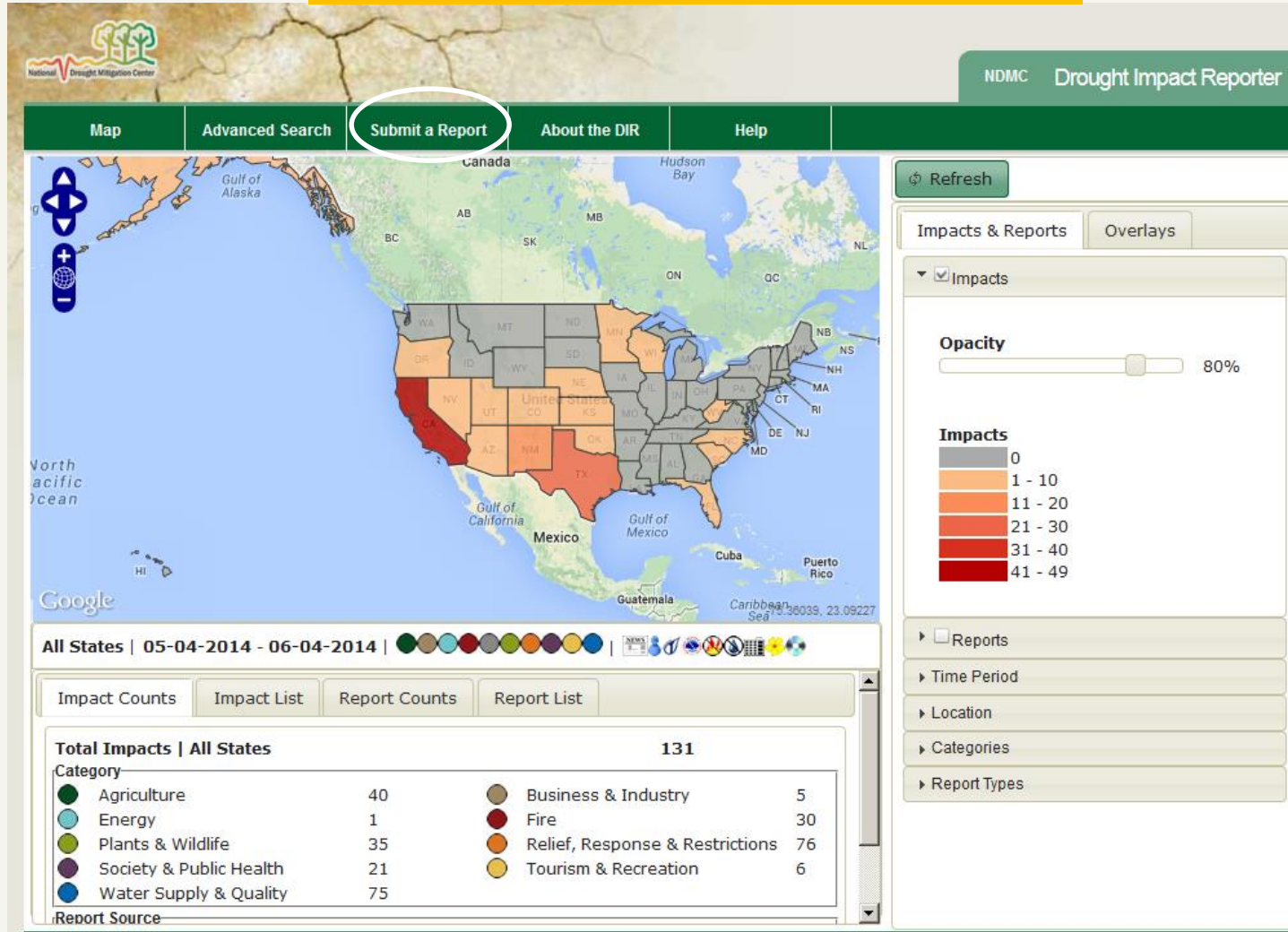


Data as of September 17, 2014



# Drought Impact Information

<http://droughtreporter.unl.edu/>



NDMC Drought Impact Reporter

Map Advanced Search **Submit a Report** About the DIR Help

Refresh

Impacts & Reports Overlays

Impacts

Opacity 80%

Impacts

- 0
- 1 - 10
- 11 - 20
- 21 - 30
- 31 - 40
- 41 - 49

Reports

Time Period

Location

Categories

Report Types

All States | 05-04-2014 - 06-04-2014

Impact Counts Impact List Report Counts Report List

**Total Impacts | All States 131**

Category	Count	Category	Count
Agriculture	40	Business & Industry	5
Energy	1	Fire	30
Plants & Wildlife	35	Relief, Response & Restrictions	76
Society & Public Health	21	Tourism & Recreation	6
Water Supply & Quality	75		

Report Source

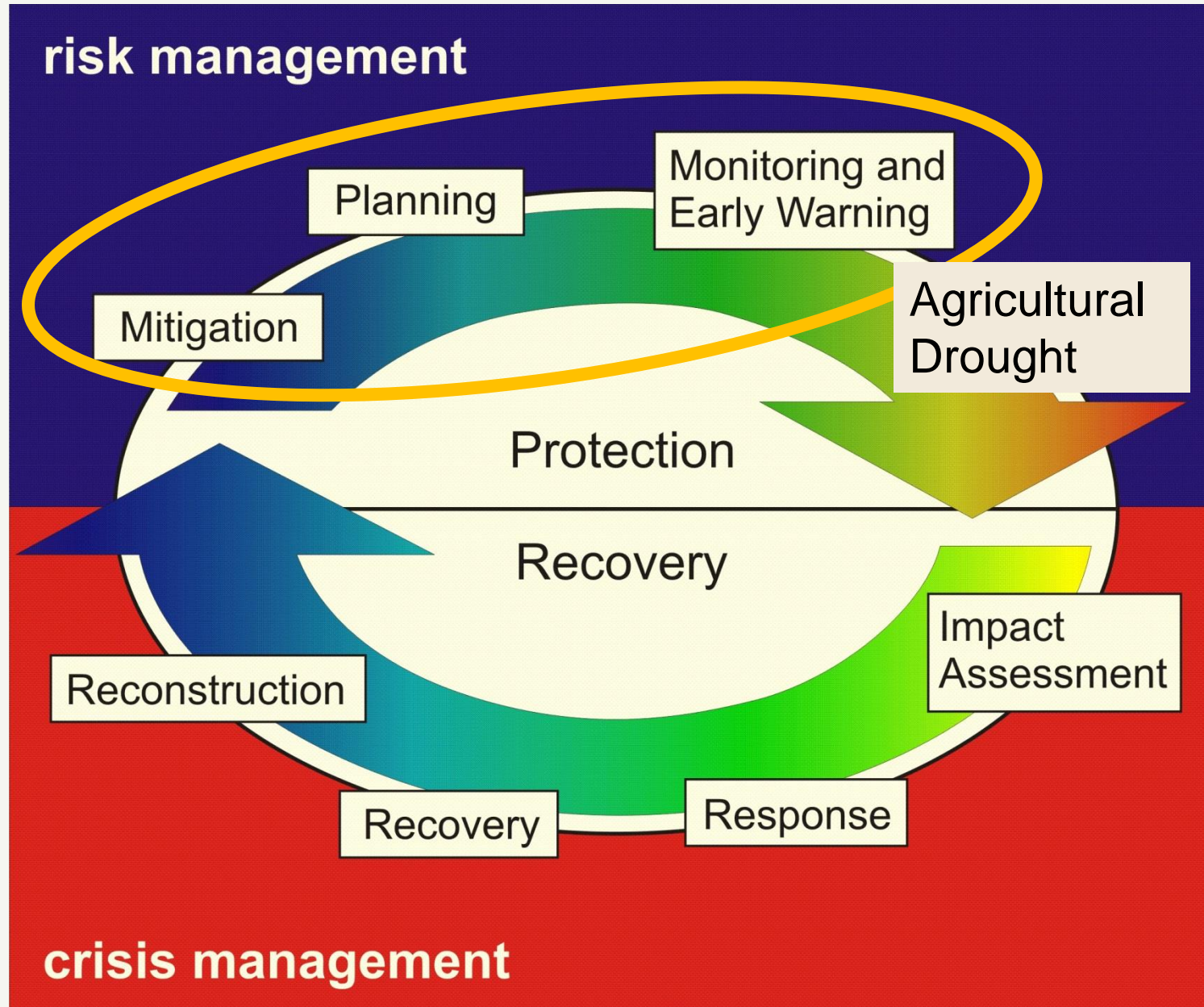
# Anyone can provide drought impact information

- Archive of drought related impacts since 2005 with some historical impacts also available
- Over 20,000 impacts logged to date from all sources
- Partnerships with groups like **CoCoRaHS** (5,000 since 2010) have enhanced submissions directly into the DIR.





# The Cycle of Disaster Management





# Useful to Useable

## Climate Information to Midwest Corn Producers

State climatologists

Crop modelers

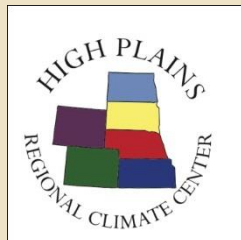
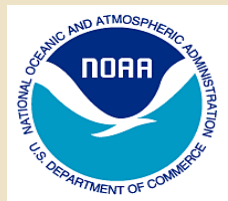
Agronomists

Economists

Social scientists

RCC staff

NOAA staff







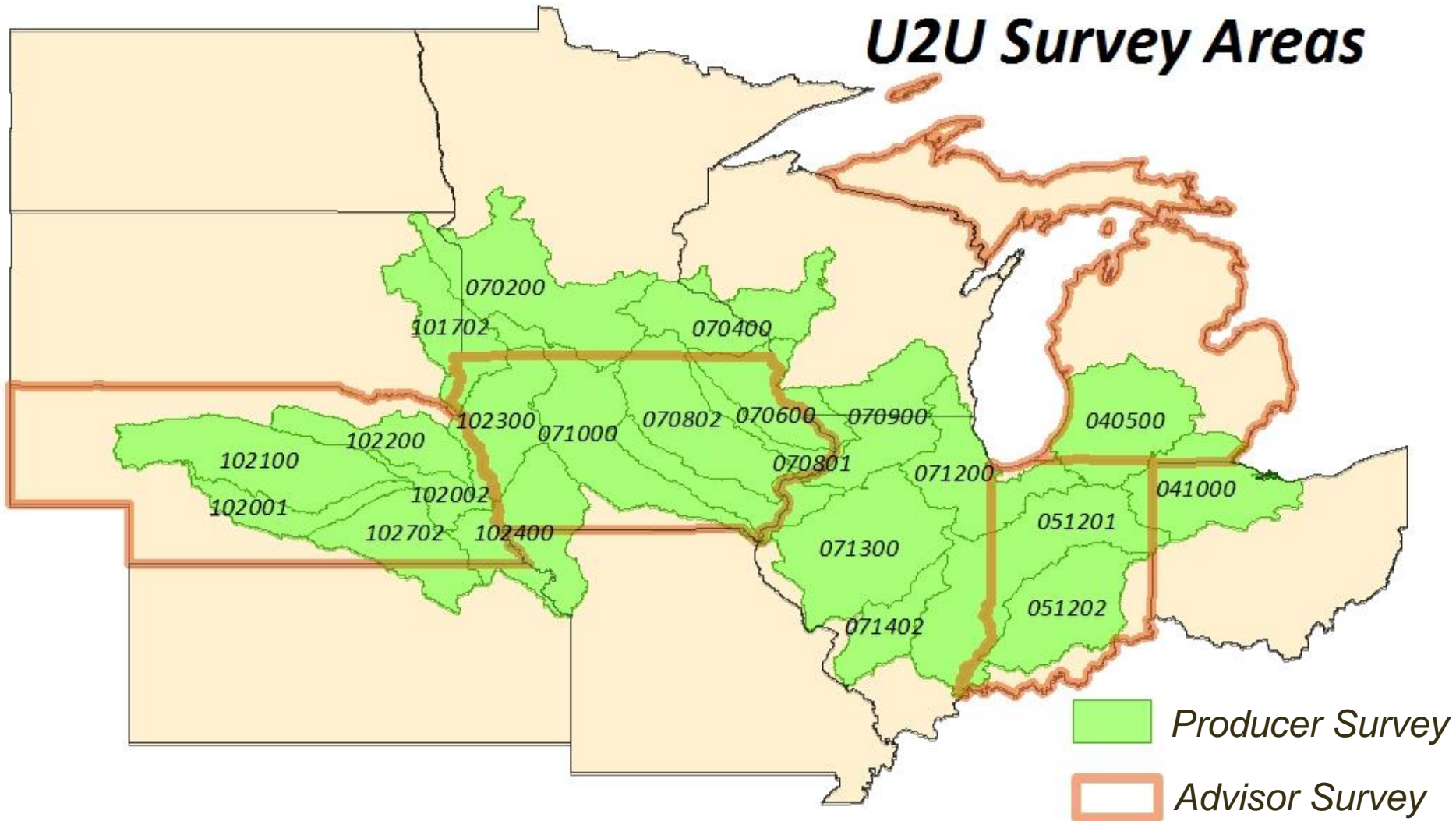
## Useful to Useable

Climate Information to Midwest Corn Producers

- ▣ Challenge 1: who do agricultural producers trust for assisting them with making decisions?



## U2U Survey Areas

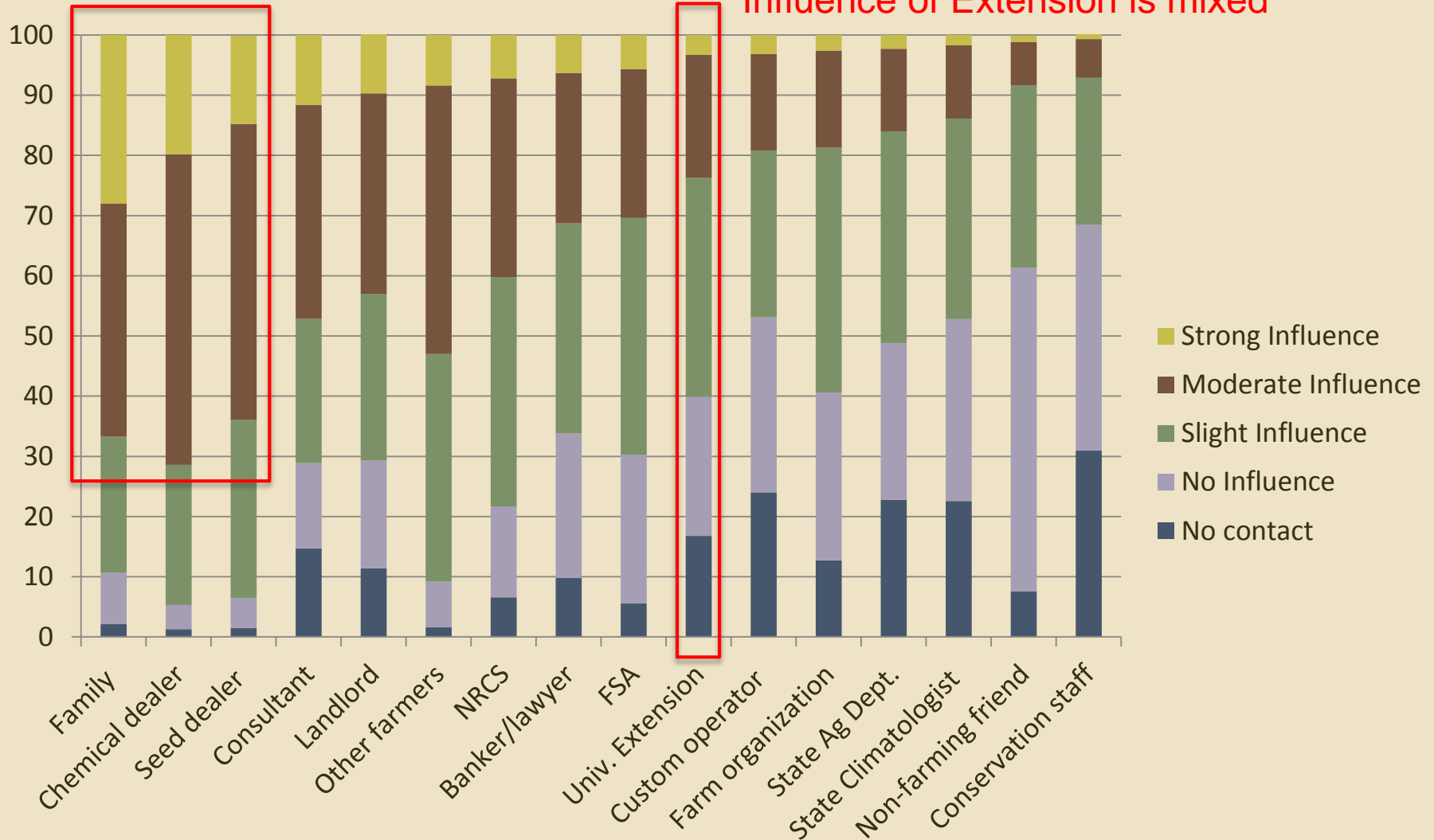






Please indicate how influential the following groups and individuals are when you make decisions about agricultural practices and strategies. (16 options)

Family, chemical dealers, and seed dealers are most influential  
Influence of Extension is mixed





# Advisors – Trusted Info Sources

How much do you trust or distrust the following agencies, organizations, and groups as sources of information about climate change and its potential impacts? (15 options)

Most Trusted

	Distrust	Neither trust nor <u>distrust</u>	Trust
<b>1. University Extension</b>	4.2%	14.8%	<b>81.1%</b>
2. Scientists	10.9%	19.6%	69.6%
3. Farm groups	11.7%	43.1%	45.2%
4. Family and friends	7.1%	49.7%	43.2%

Least Trusted

	Distrust	Neither trust nor <u>distrust</u>	Trust
1. The mainstream news media	64.9%	26.9%	8.2%
2. Online social media, such as blogs, Twitter, etc.	64.4%	31.8%	3.8%
3. Radio talk show hosts	63.1%	31.6%	5.2%
4. Environmental organizations	55.7%	26.3%	18%



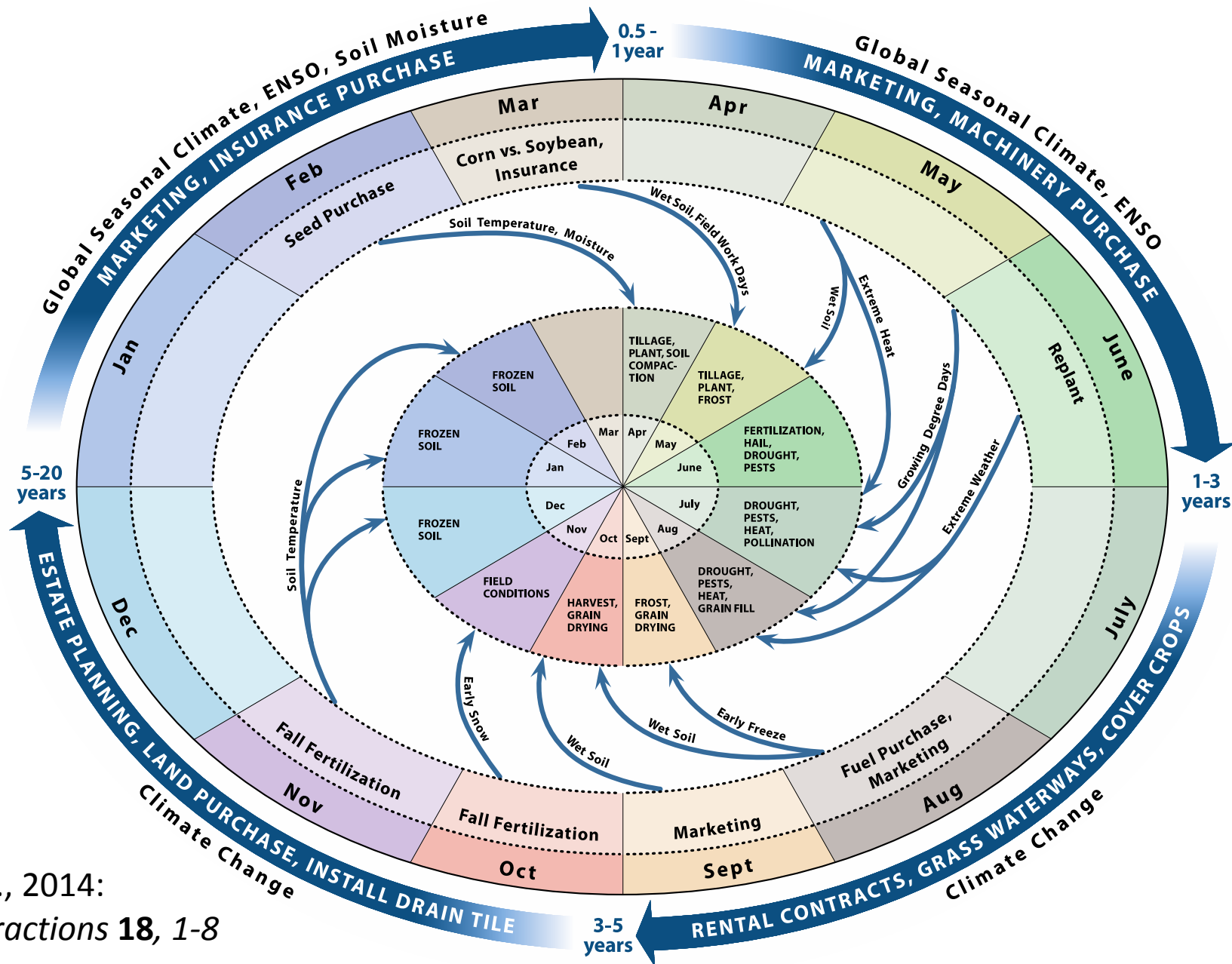


## Useful to Useable

Climate Information to Midwest Corn Producers

- ▶ Challenge 2: how can the dialog between climate scientists and agricultural producers improve?

# Midwest Corn Growers' Decision Calendar



Takle et al., 2014:  
*Earth Interactions* **18**, 1-8

ANCE POT

Feb

Seed Purchase

Mar

Corn vs. Soybean,  
Insurance

Apr

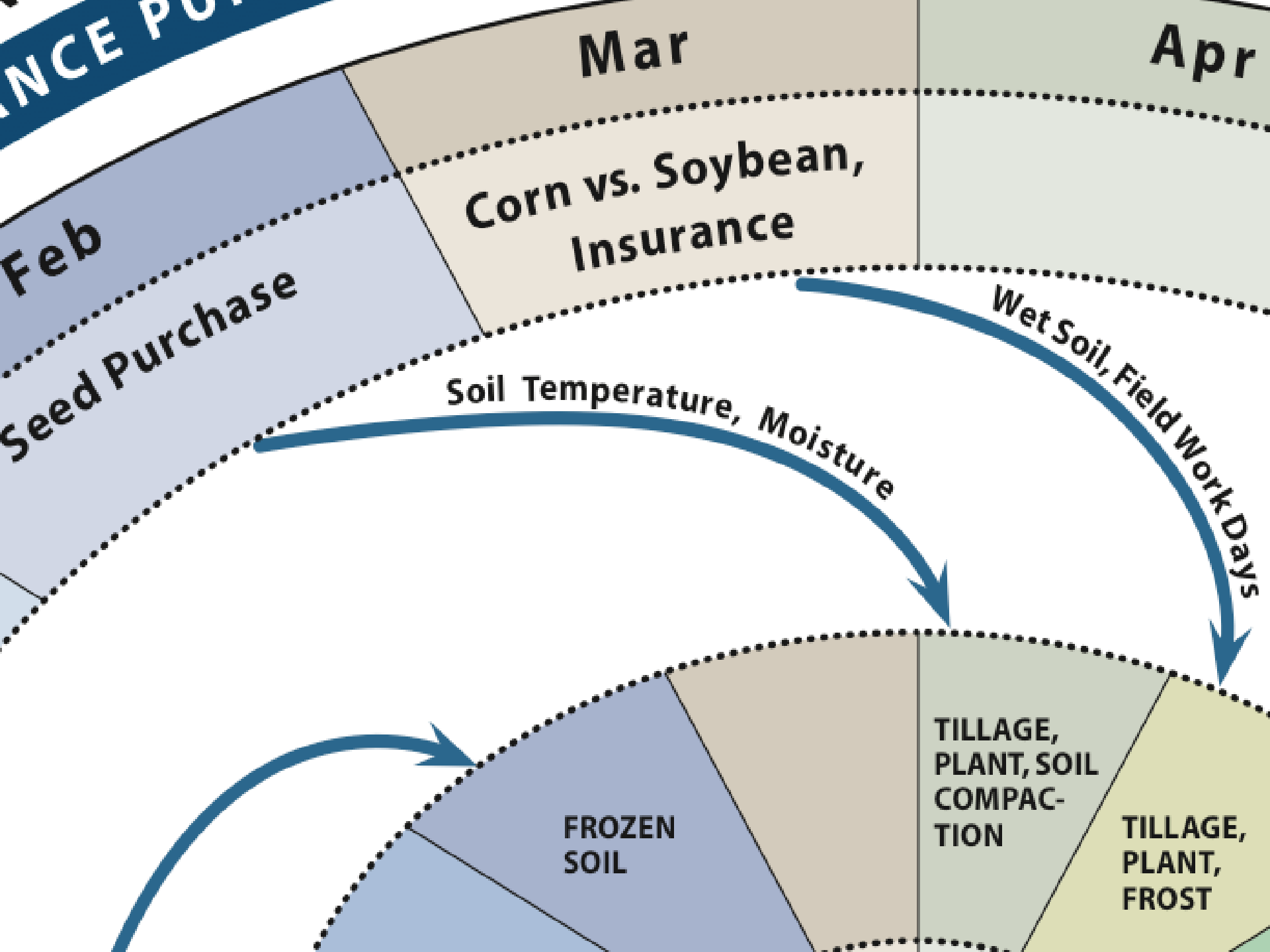
Soil Temperature, Moisture

Wet Soil, Field Work Days

FROZEN  
SOIL

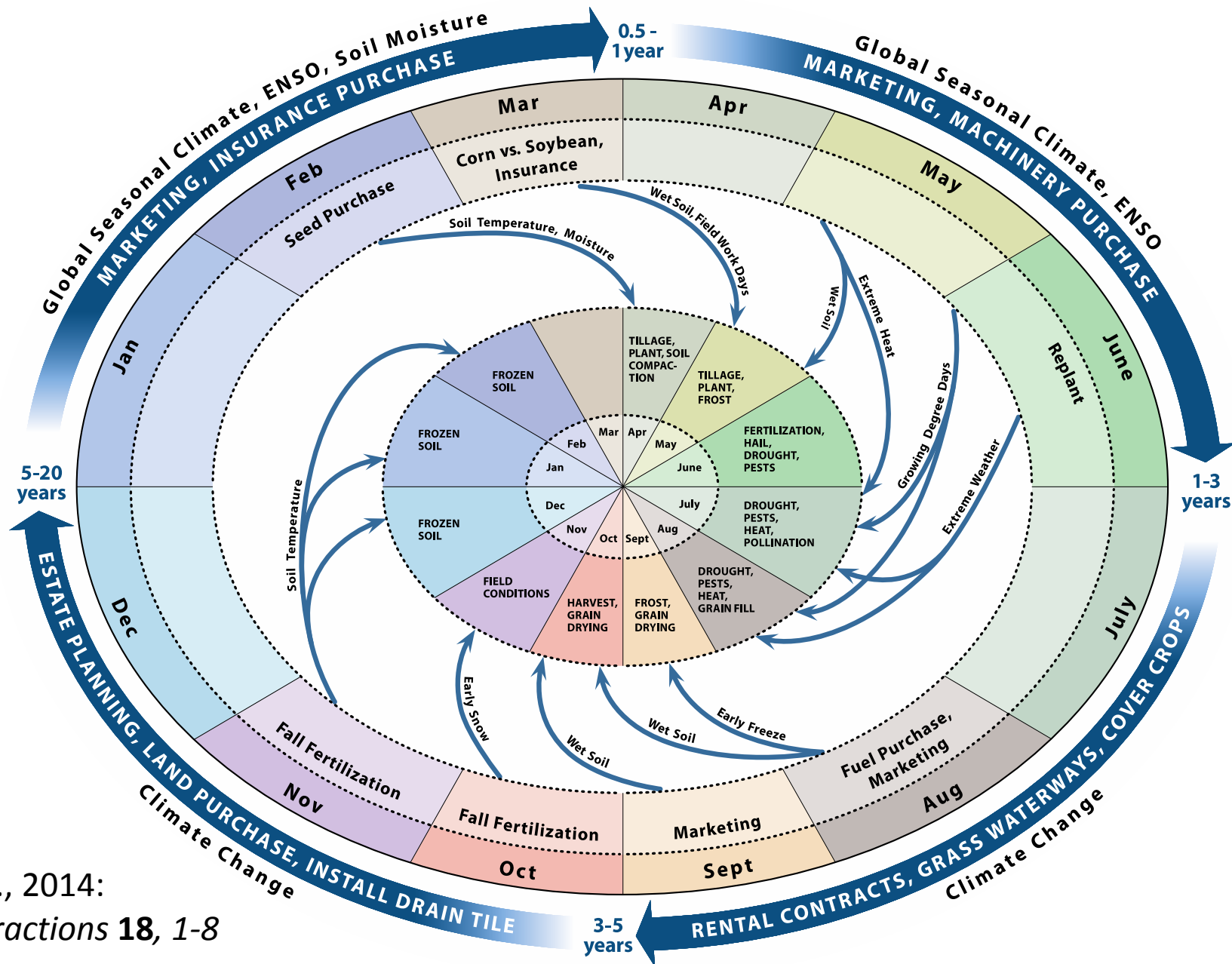
TILLAGE,  
PLANT, SOIL  
COMPAC-  
TION

TILLAGE,  
PLANT,  
FROST





# Midwest Corn Growers' Decision Calendar



Takle et al., 2014:  
*Earth Interactions* **18**, 1-8

# Drought Mitigation in Agriculture

- ▶ Agricultural producers face many challenges
  - Drought/climate/water issues are just one subset
- ▶ Better monitoring and early warning improves planning and mitigation
- ▶ Likewise, planning and mitigation strategies should include monitoring and early warning
- ▶ Find ways to improve the dialog between climate scientists and producers





**Michael Hayes**  
**National Drought Mitigation Center**  
**mhayes2@unl.edu**  
**<http://drought.unl.edu>**



**Photo: Nicole Wall, NDMC, Platte River, August 2012**