Assessing Agricultural Vulnerability to Recent Climate Change and Variability in Wisconsin Using USDA Crop Insurance Indemnity Data

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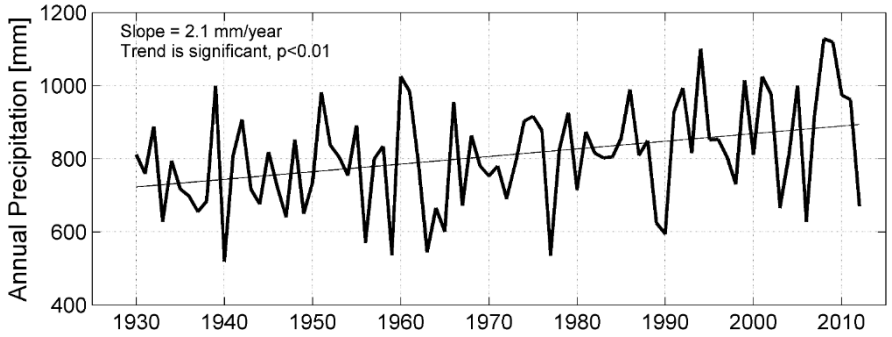
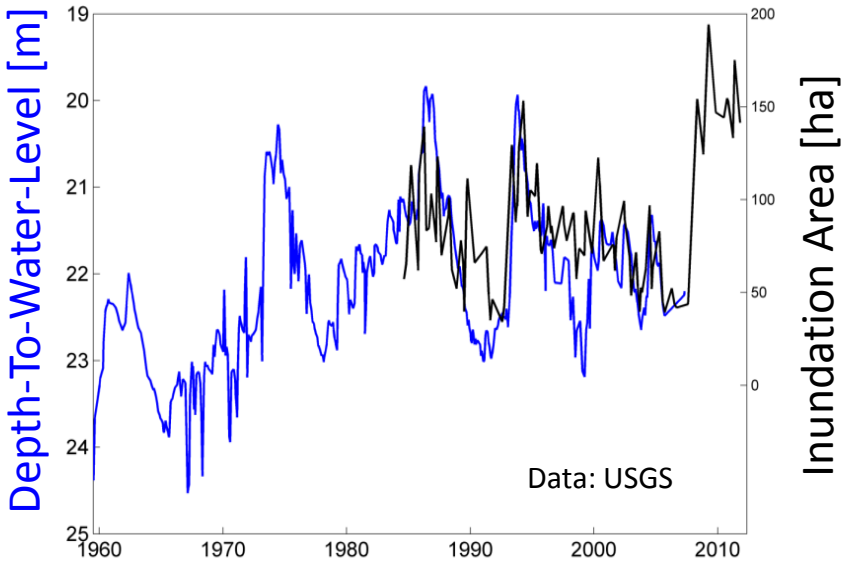
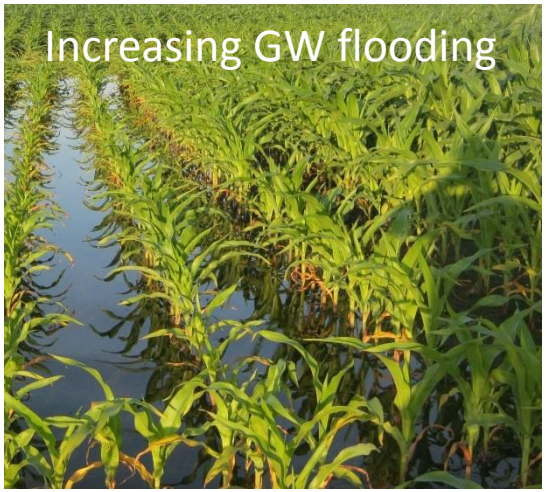
Dane County

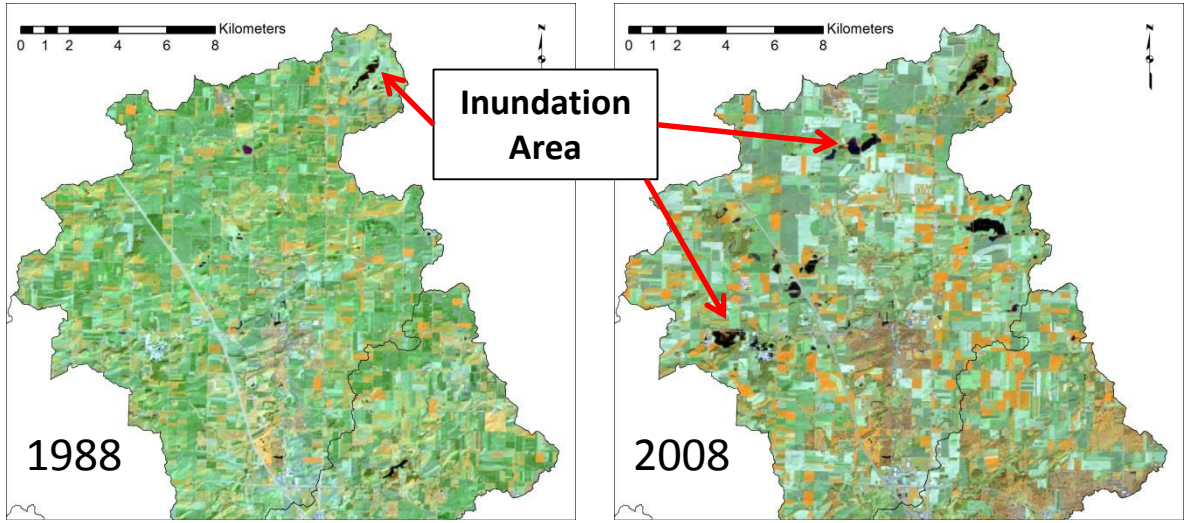
Increasing Annual Precipitation



Rising Water Table







Data: LandSAT (NASA)

What is Crop Insurance?

- "A critical aspect of the risk management safety net for food security in the United States as well as a factor in protecting rural economies and the availability of agricultural jobs by providing **financial stability** in agriculture"

  - USDA Risk Management Agency

Why Crop Insurance?

- It represents a fundamental connection between water and humans
- It is now the **centerpiece** of the U.S. agriculture safety net
- More attention being paid to it for its role in
  - Agricultural subsidization
  - Climate change adaptation
  - International agricultural development

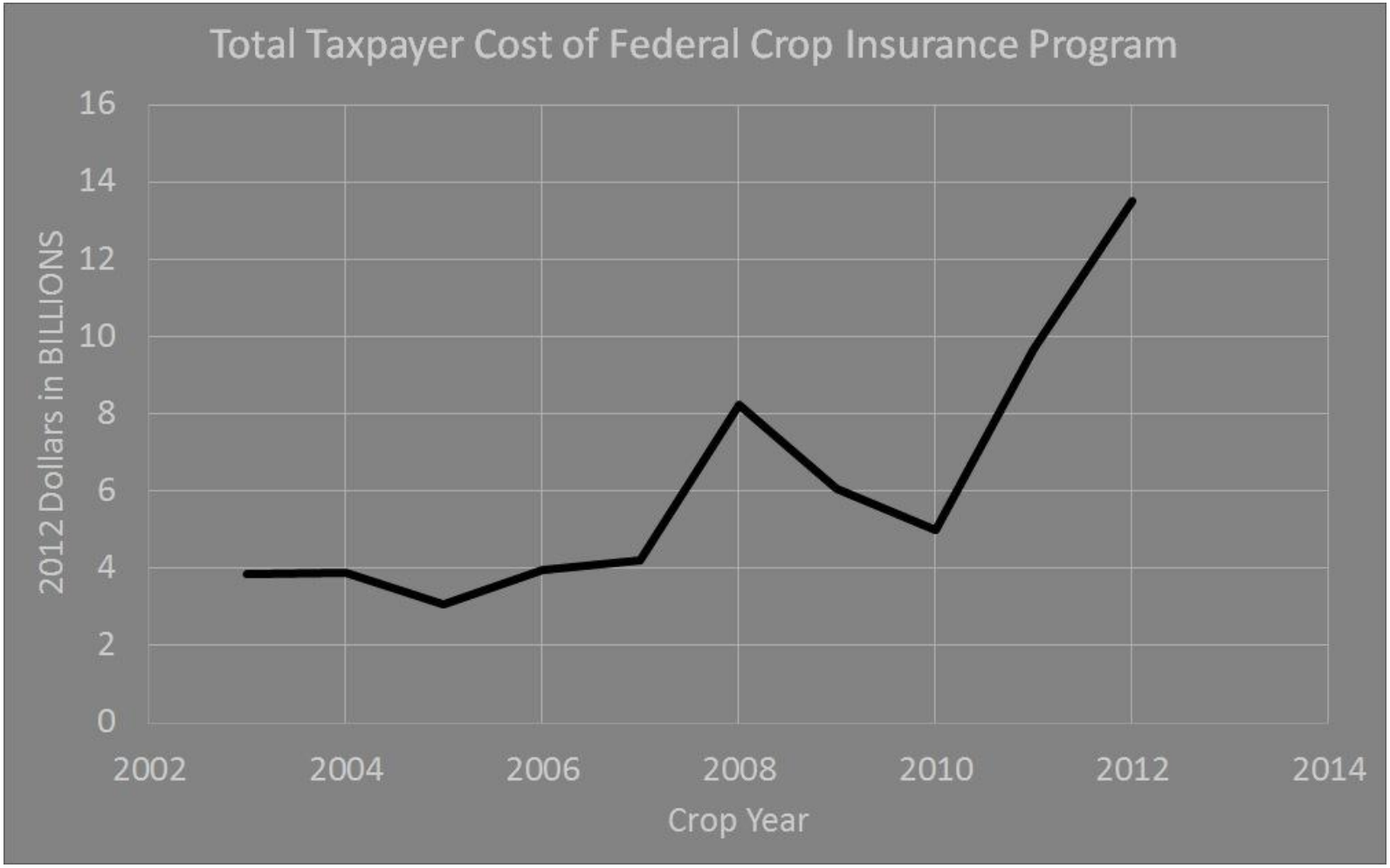
2014 Farm Bill

"This is not your father's Farm Bill…From now on, farmers will protect themselves from disaster with risk management programs like crop insurance. Instead of getting a government check even in good times, farmers will pay an insurance bill every year and will only receive support from that insurance in years when they take a loss."

Senate Agriculture Committee Chairman Debbie Stabenow

Source: Huffington Post, 2/4/2014

Increasing Cost to Taxpayers



Recent Statistics

- National
  - Over 280 million acres enrolled (2012)
    - 29% was corn
    - ~85% of insurable cropland
- Wisconsin
  - Over 5 million acres enrolled (2012)
    - 59% was corn

Primer on Crop Insurance

- Liability: total loss coverage
  - Determined by coverage level, production history, commodity price
- Premium: cost of insurance policy
  - Subsidy from USDA : 38-80% (mean = ~60%)
  - Determined by liability, policy type
- Indemnity: amount paid to farmer for loss
- Cause of Loss
- Yield-based vs Revenue-based
- Federal cost = (Indemnity – Premium) + Premium Subsidy + Private Insurer Subsidy + Admin Costs
- Administered and operated by 18 Private Insurance Companies
- Overseen by USDA-Risk Management Agency

Figure 1. Federal Crop Insurance Program

Farmers

- 1.2 million policies purchased in 2012
- 282 million acres insured
- $117 billion in loss coverage (total liability)

Farmers pay a portion of total premium to insurance companies, who forward funds to FCIC

Within approximately 30 days of loss, indemnity is paid to farmer by FCIC through insurance companies' claims adjustment and payment process

18 Private Insurance Companies

- sell crop insurance policies through 12,500 agents
- collect and forward premiums to FCIC
- determine individual crop losses through 5,000 adjusters
- pay claims with funds from FCIC
- share gains/losses with federal government

FCIC pays A&O expense reimbursement to each company for delivery costs (subsidy to farmer)

In an annual settlement for each company, FCIC determines and pays (receives) the company portion of any underwriting gain (loss)

Federal Crop Insurance Corporation (FCIC)

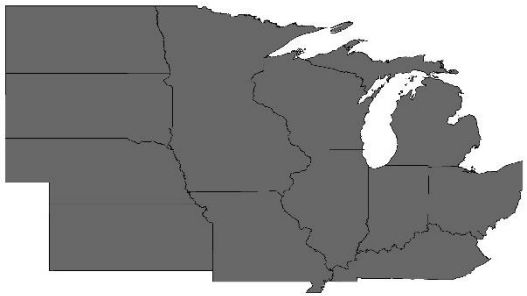
- sets standards and premium rates
- approves new products
- subsidizes farmer premiums (62% on average)
- pays 100% of delivery costs through Administrative and Operation (A&O) reimbursement to companies
- shares gains/losses with private companies
- reinsures insurance company losses
- USDA's Risk Management Agency operates the program (employees: 77 in DC Headquarters and 406 in field offices)

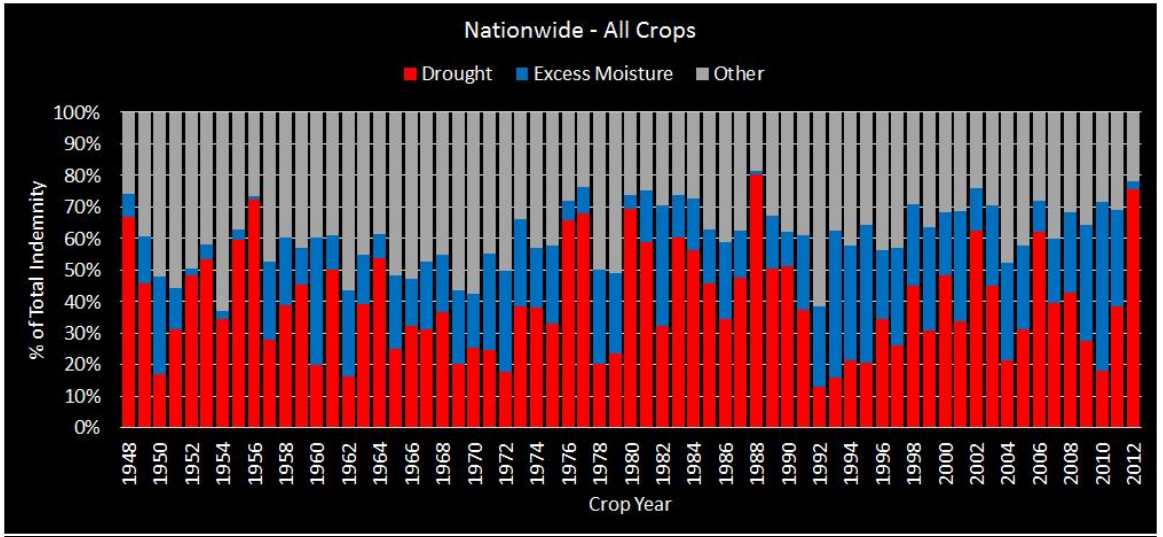
Causes of Loss

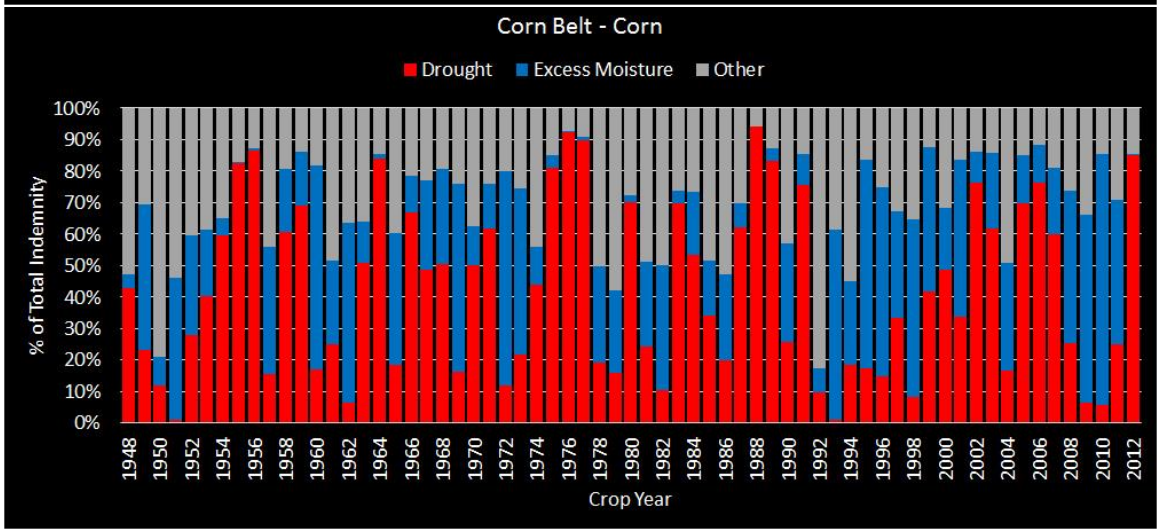
WATER IS IMPORTANT!

DROUGHT

EXCESS MOISTURE





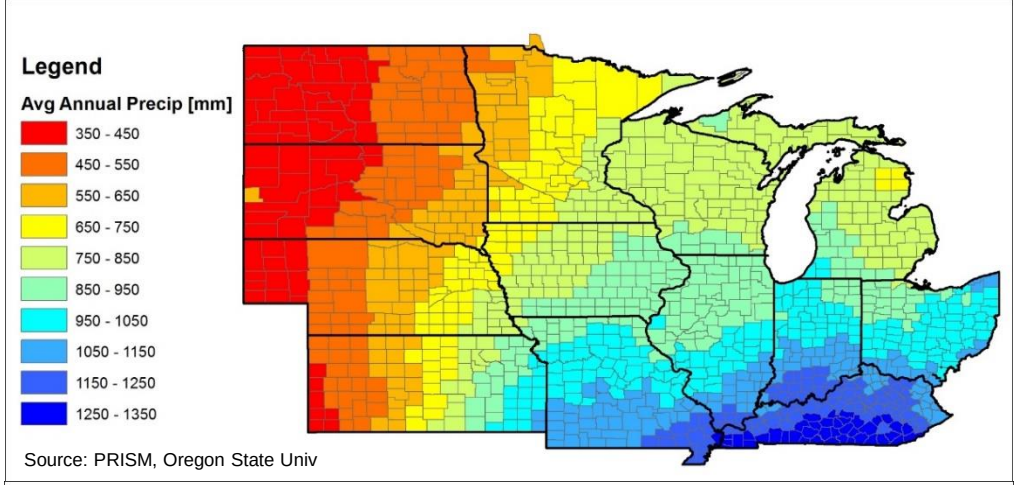


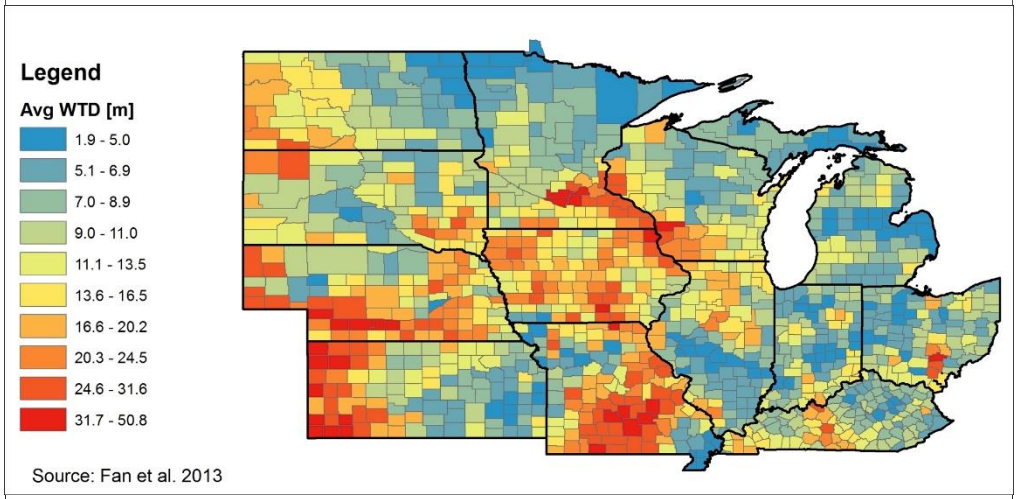
Research Questions

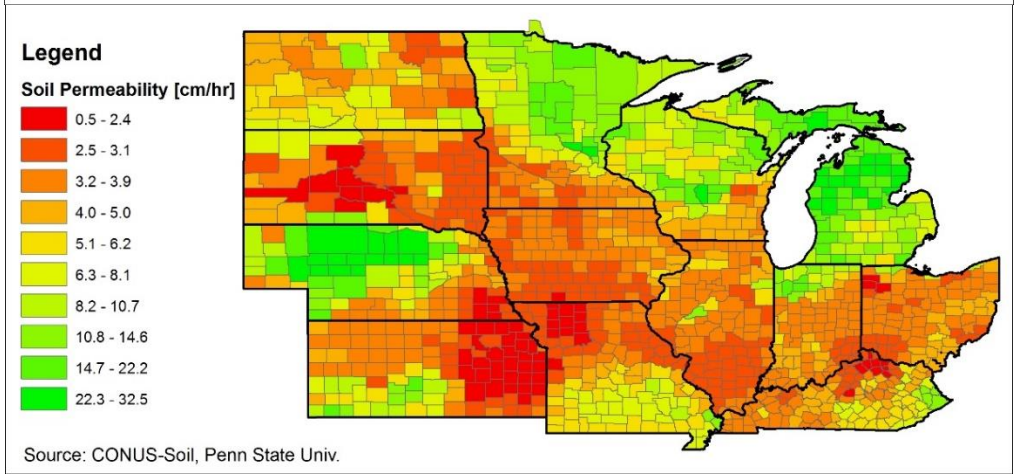
- What areas of the U.S. corn-belt have been particularly vulnerable to drought and excessive moisture losses?
- What is the relationship between crop insurance indemnities for “drought” and “excessive moisture” and
  - Precipitation anomalies
  - Average water table depth
  - Soil texture characteristics

Other Data Sources

- PRISM
  - Monthly Precipitation
- Fan et al. 2013
  - Water table depth
- CONUS-SOIL
  - Soil permeability

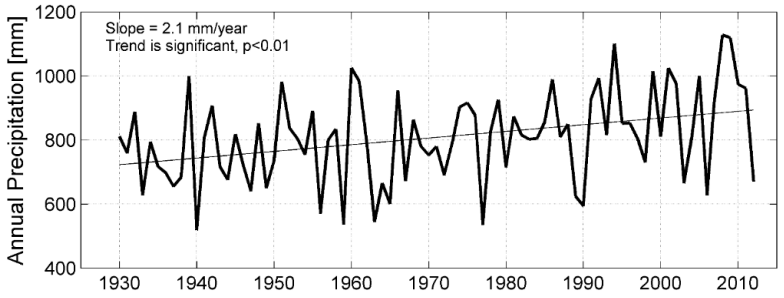


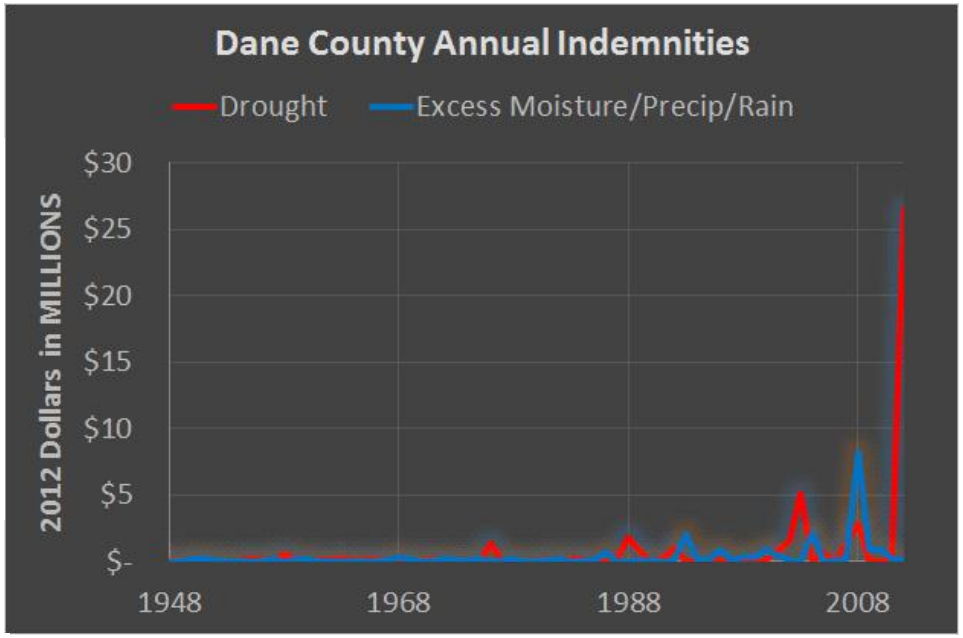


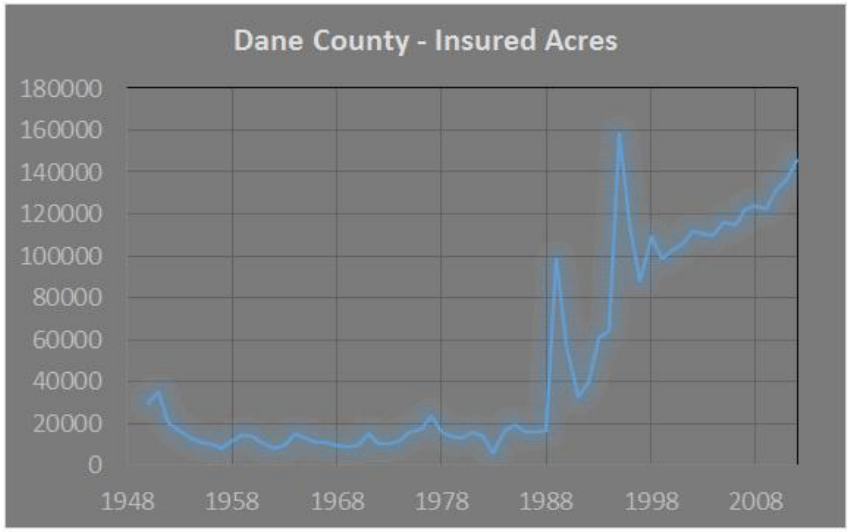


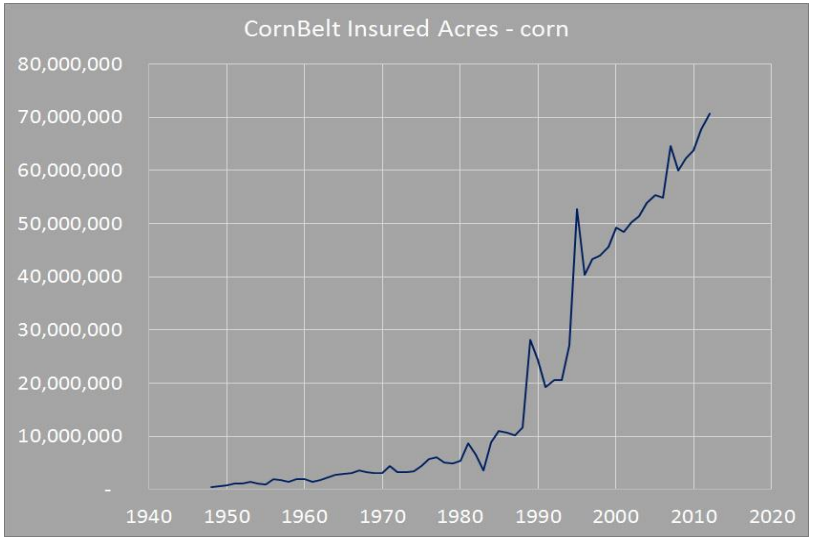
Back to Dane County

Increasing Annual Precipitation









Normalized Indemnity Metric

$$\frac{\text{INDEMNITY}}{\text{LIABILITY}} = \text{Premium Rate}$$

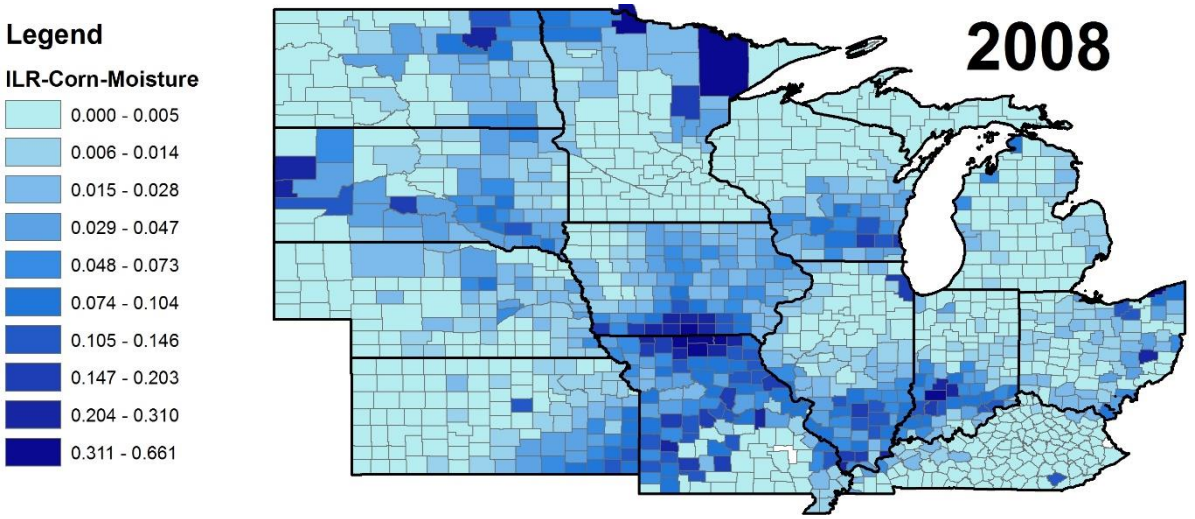
$$= \text{Rate of Loss}$$

$$= \text{ILR}$$

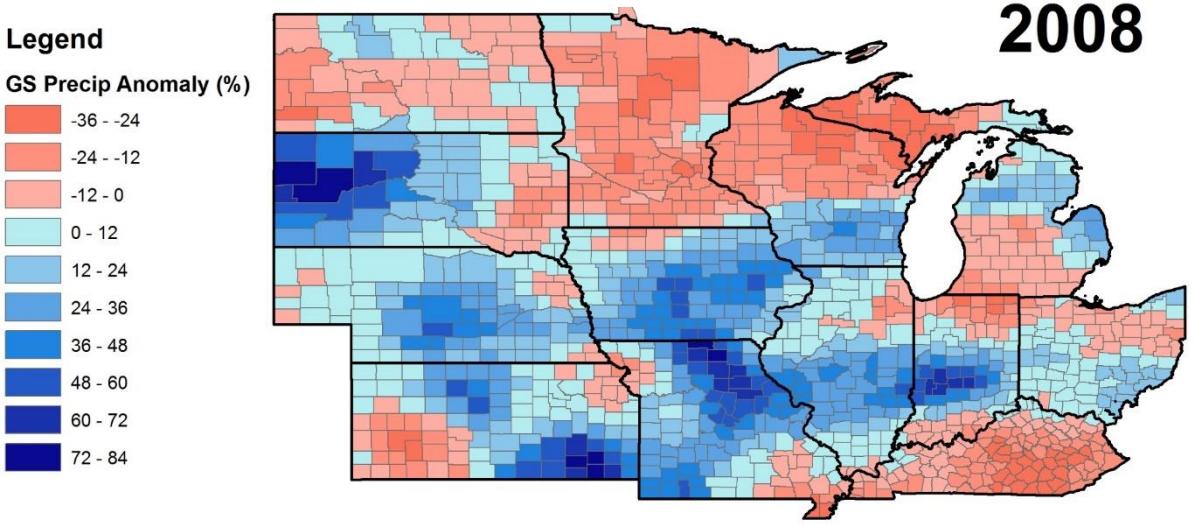
- Accounts for increases in insured acres, liability, commodity prices

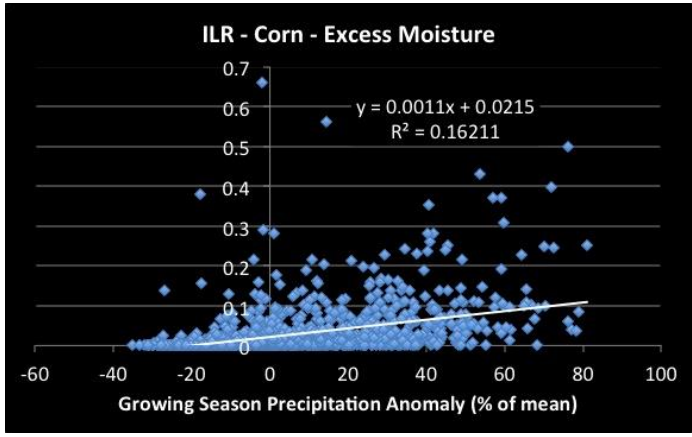
2008 Excess Moisture/Rainfall

ILR – Corn – Excess Moisture



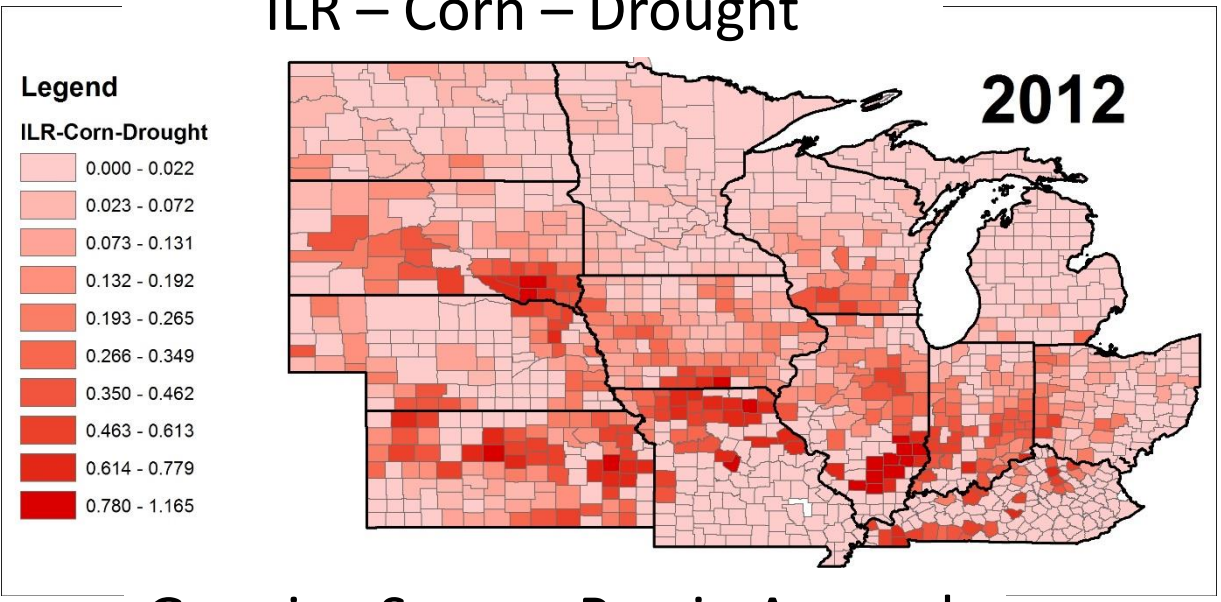
Growing Season Precip Anomaly





2012 Drought

ILR – Corn – Drought



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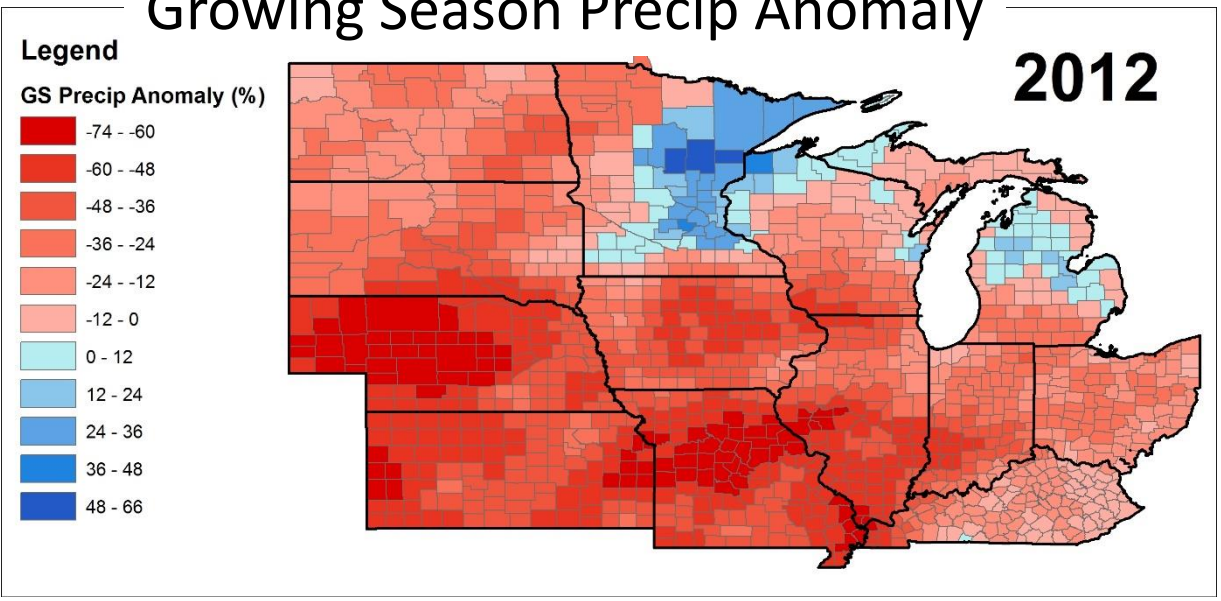
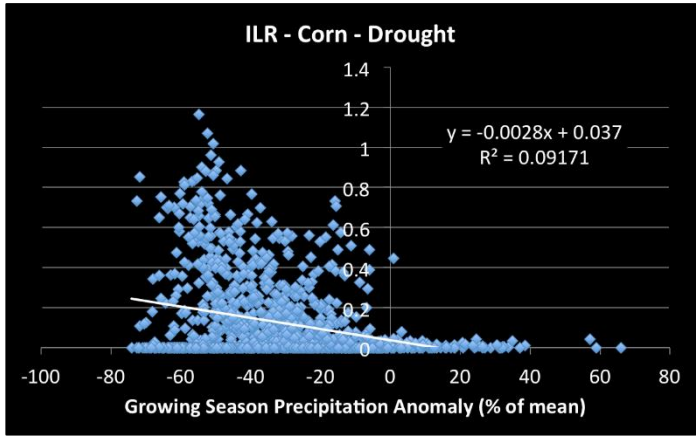
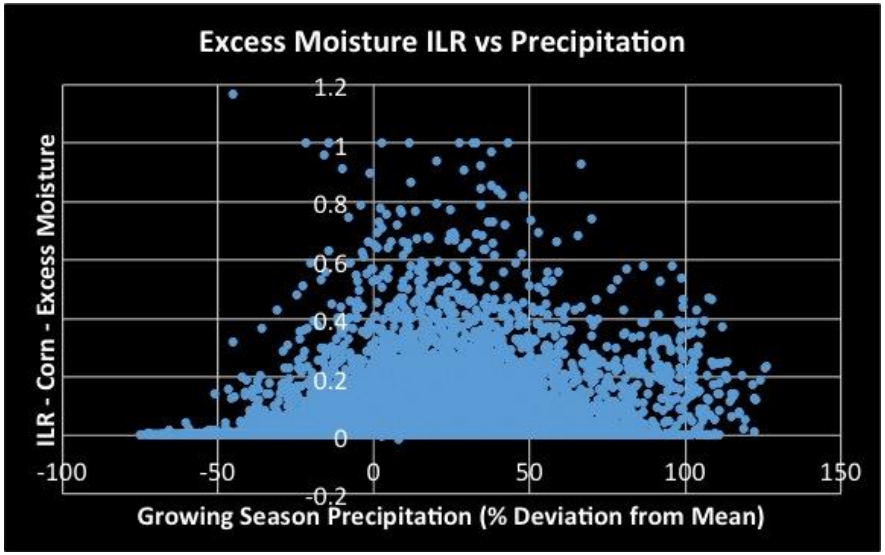


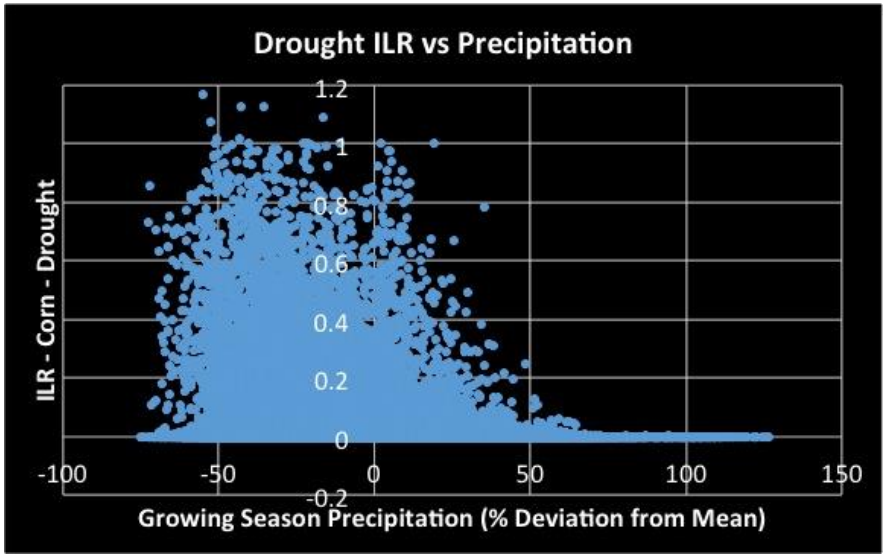


Adding soil permeability: $R^2 = 0.1279$

Exploring Relationships on Annual Basis

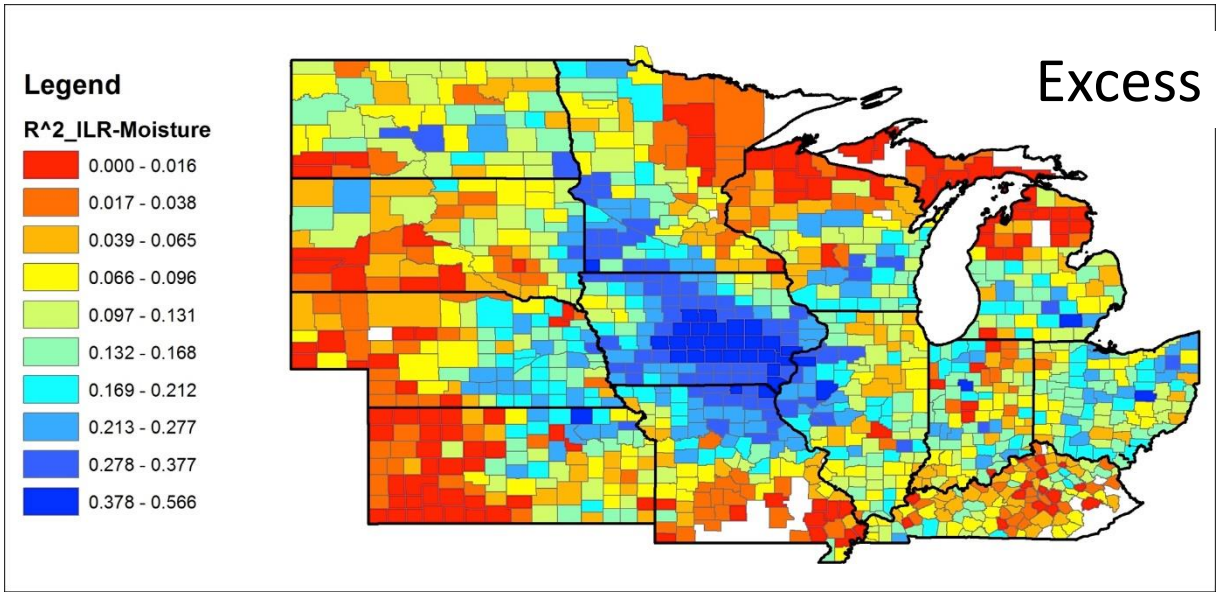
- 1948-2012
- All counties
- Growing Season Precipitation Anomaly (% of mean)





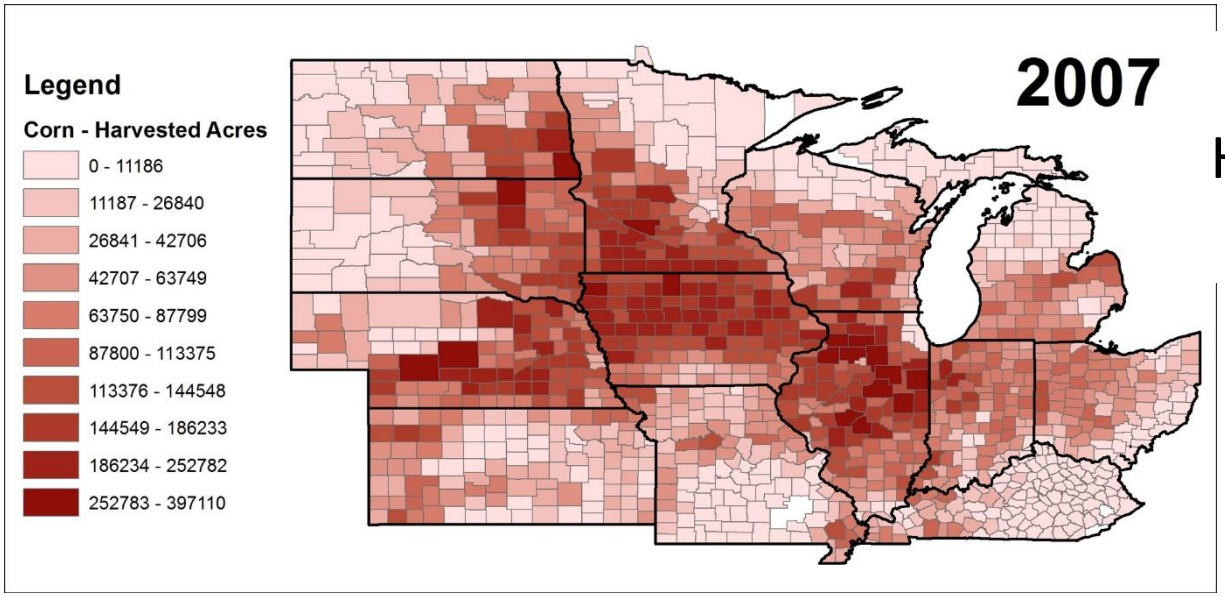
Exploring Relationships on Annual Basis

1948-2012



Excess Moisture

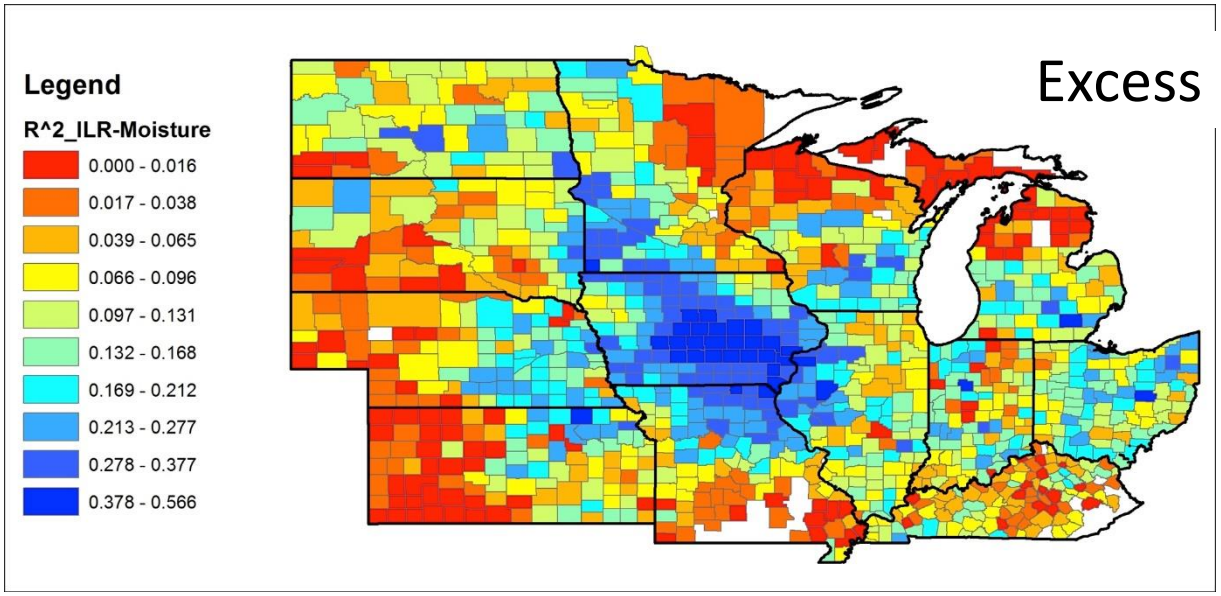
2007



Corn Harvested Acres

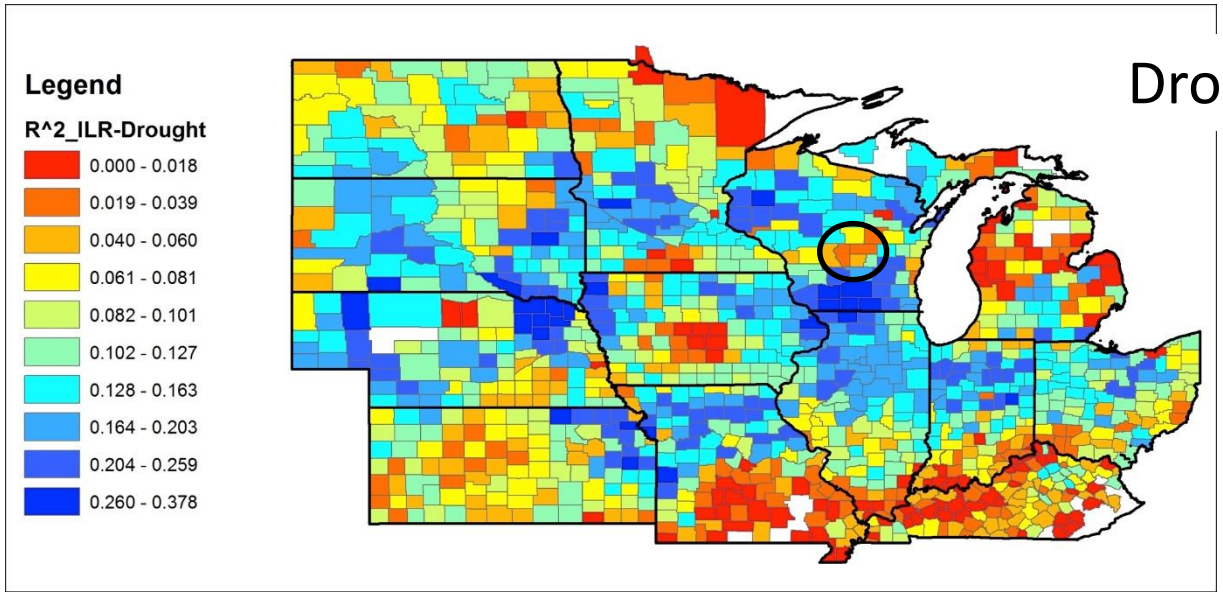
Exploring Relationships on Annual Basis

1948-2012



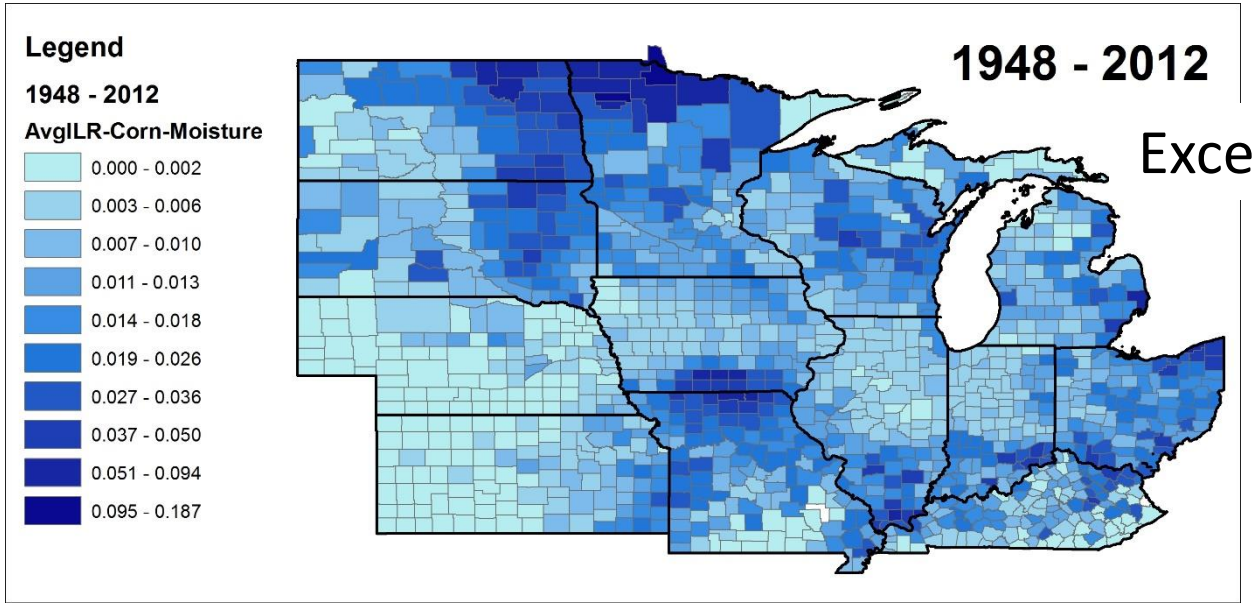
Excess Moisture

1948-2012

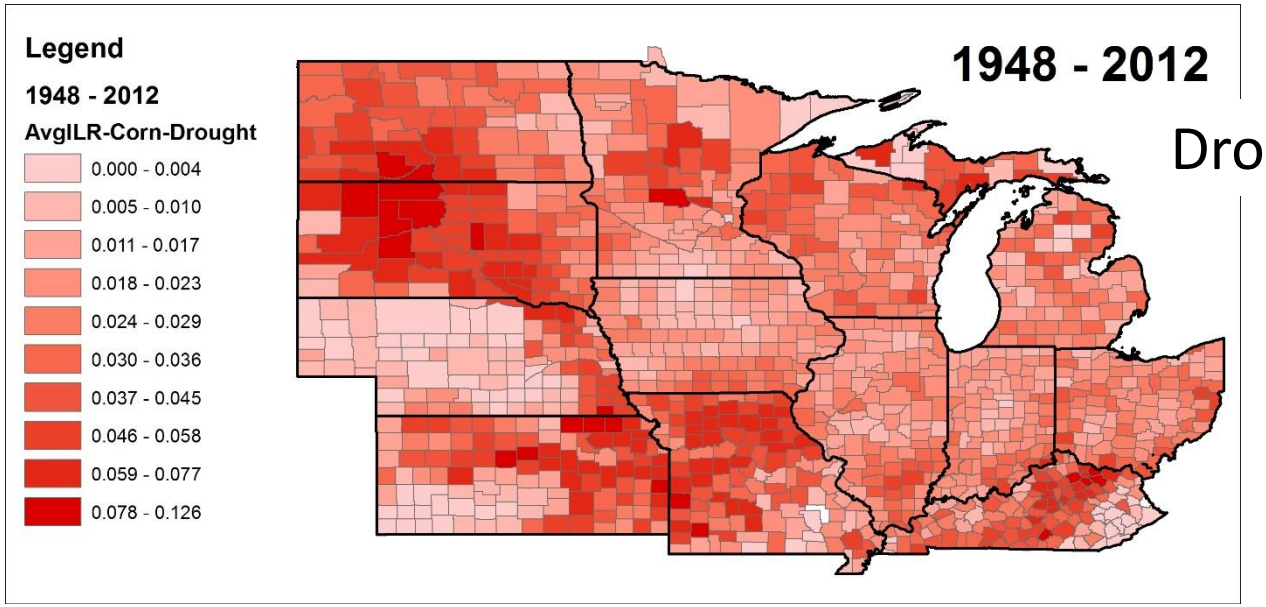


Drought

Exploring Relationships on Average Basis



Excess Moisture



Drought

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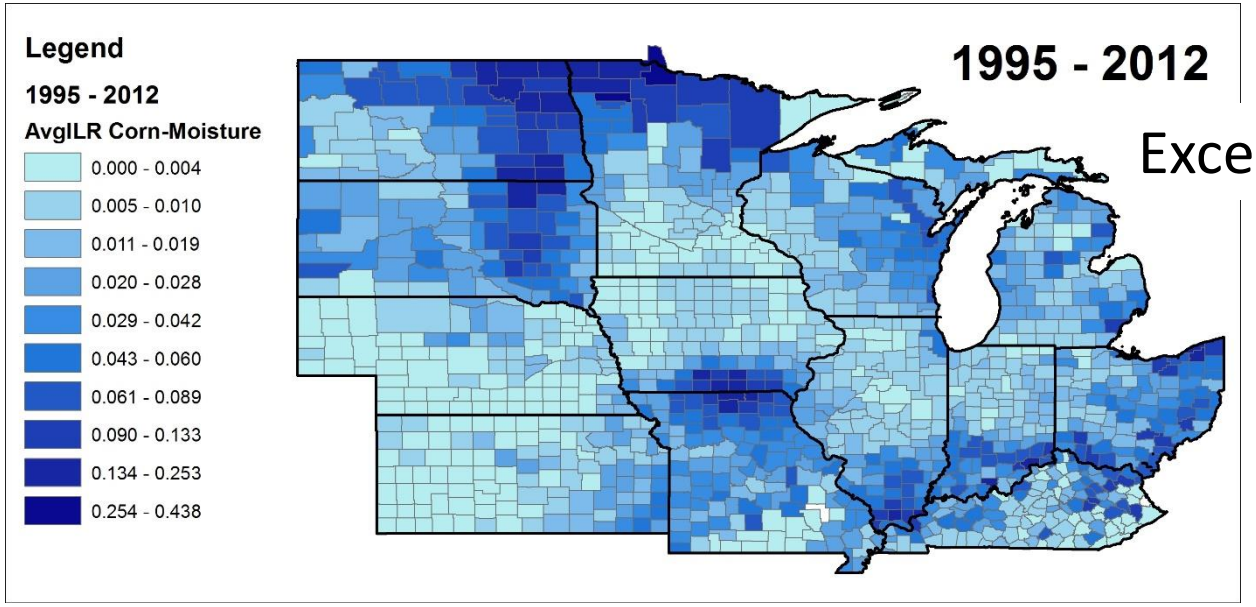
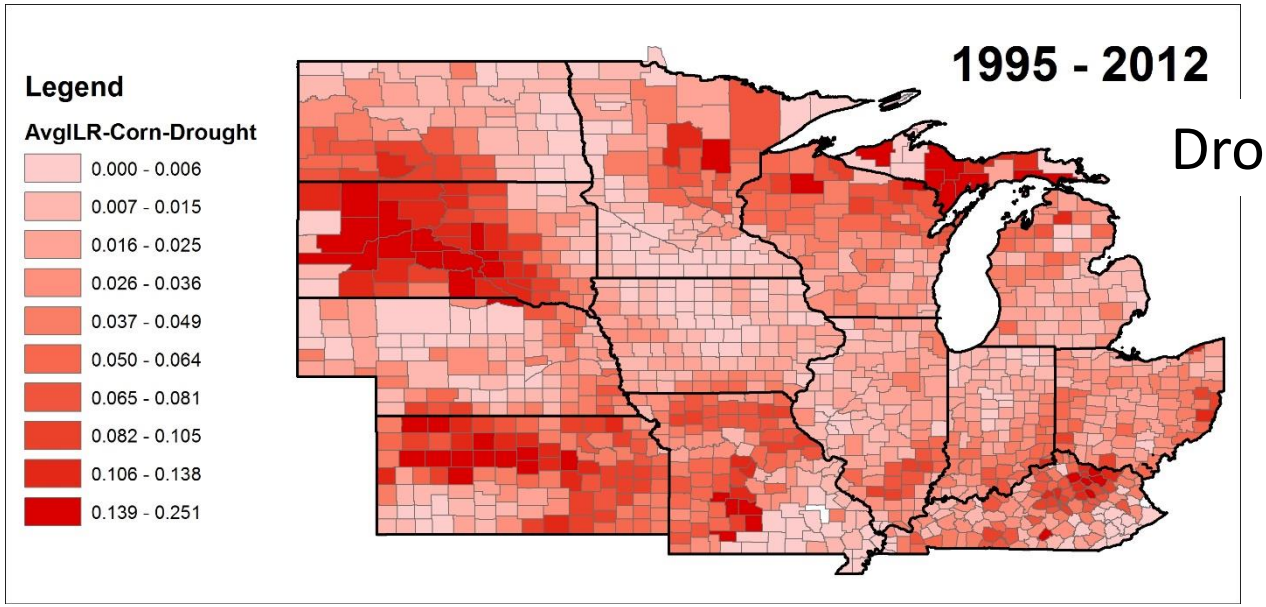


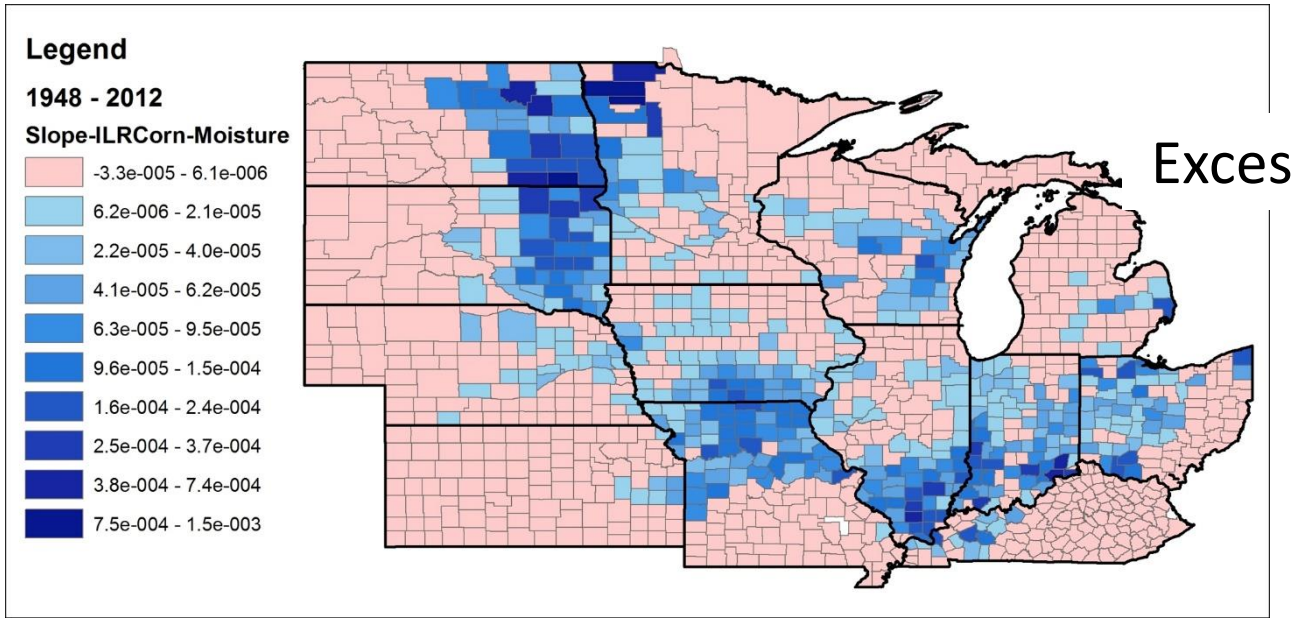
Excess Moisture



Drought

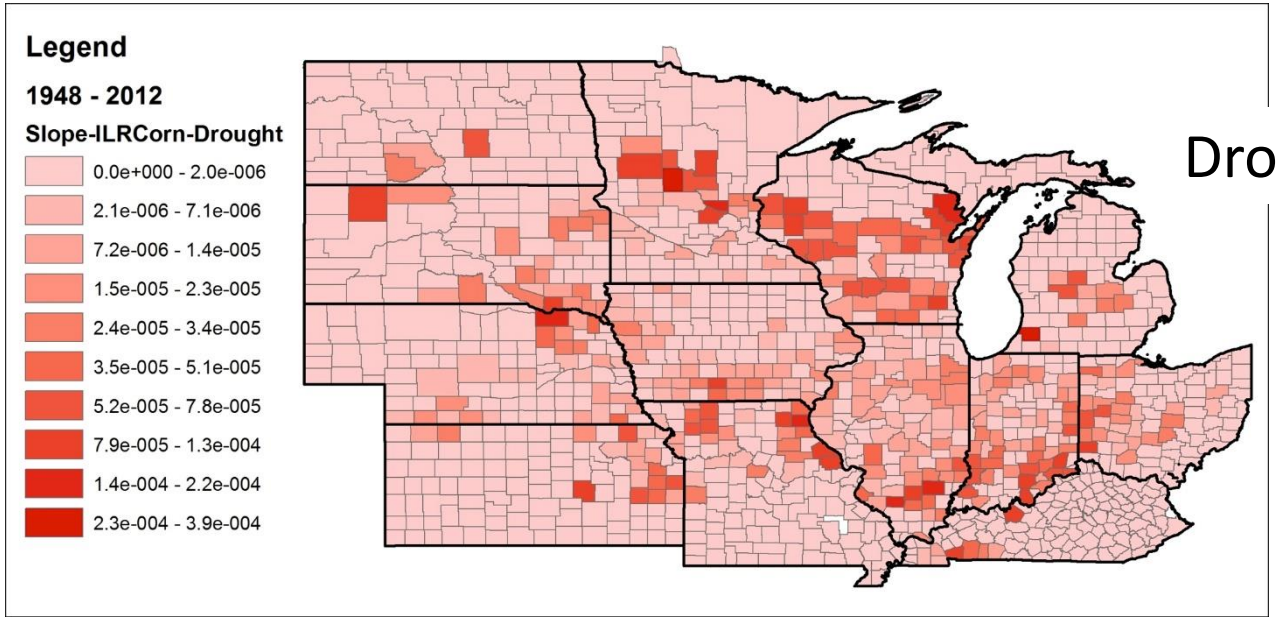
Exploring Relationships on Trend Basis

1948-2012



Excess Moisture

1948-2012

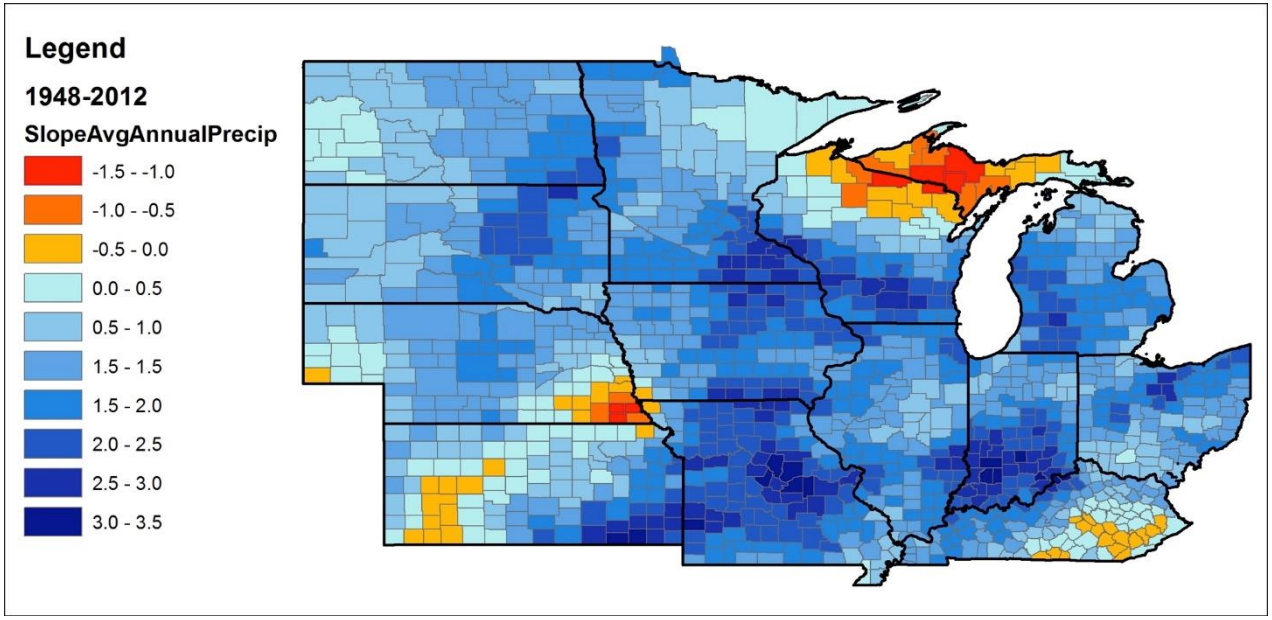


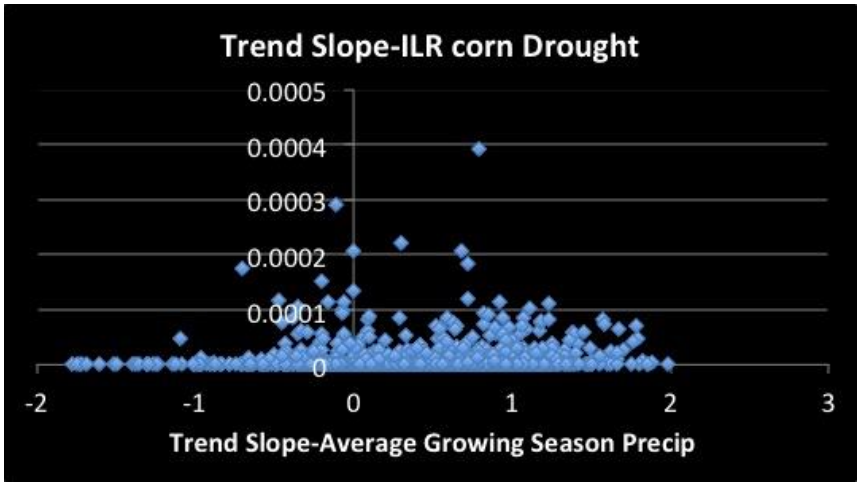
Drought

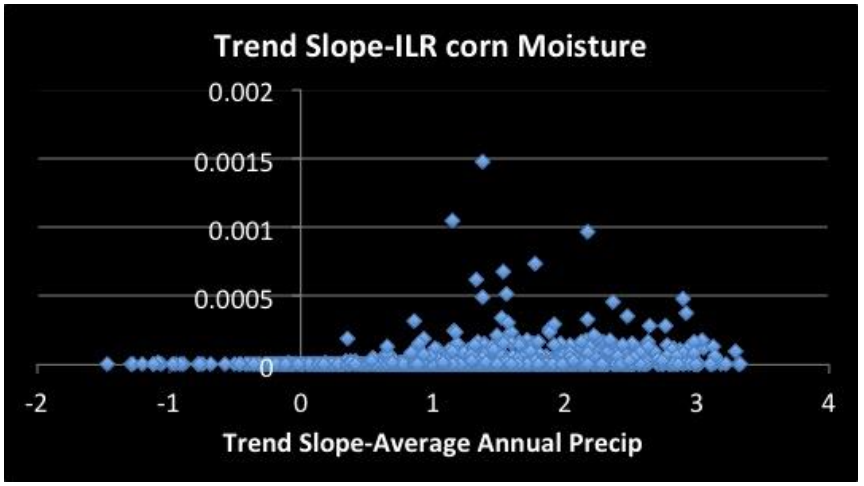
Exploring Relationships on Trend Basis

Annual Precipitation Trend

1948-2012

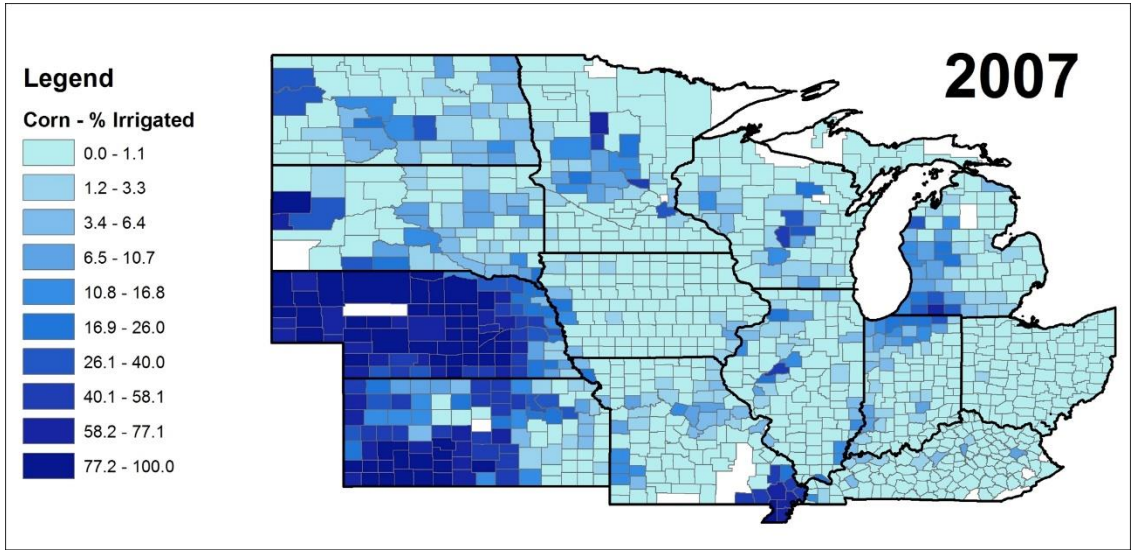






Next Steps

- Systematically test different precipitation metrics to look for best explanatory power
- Determine metrics for characterizing marginal land
- Use other statistical tools (e.g. CART)
- Remove counties under certain production threshold
- Use % irrigated acres as additional variable?



Questions?

- Contact: Eric Booth
- egbooth@wisc.edu

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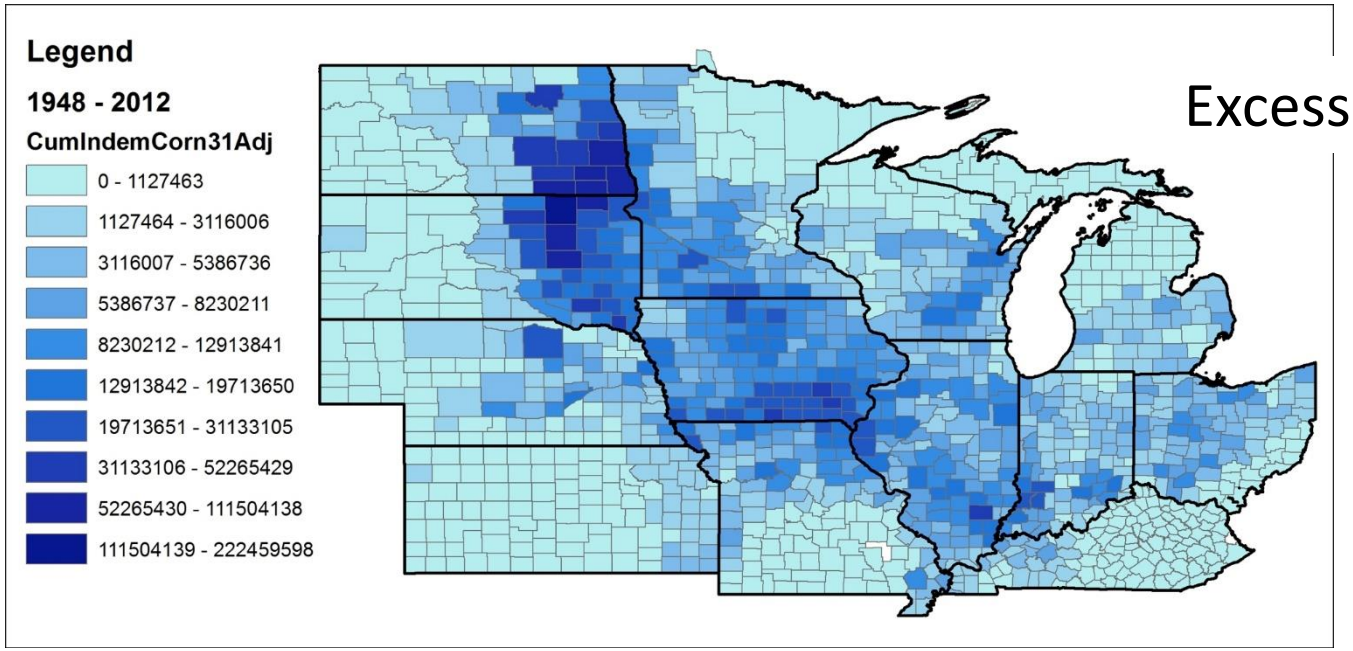
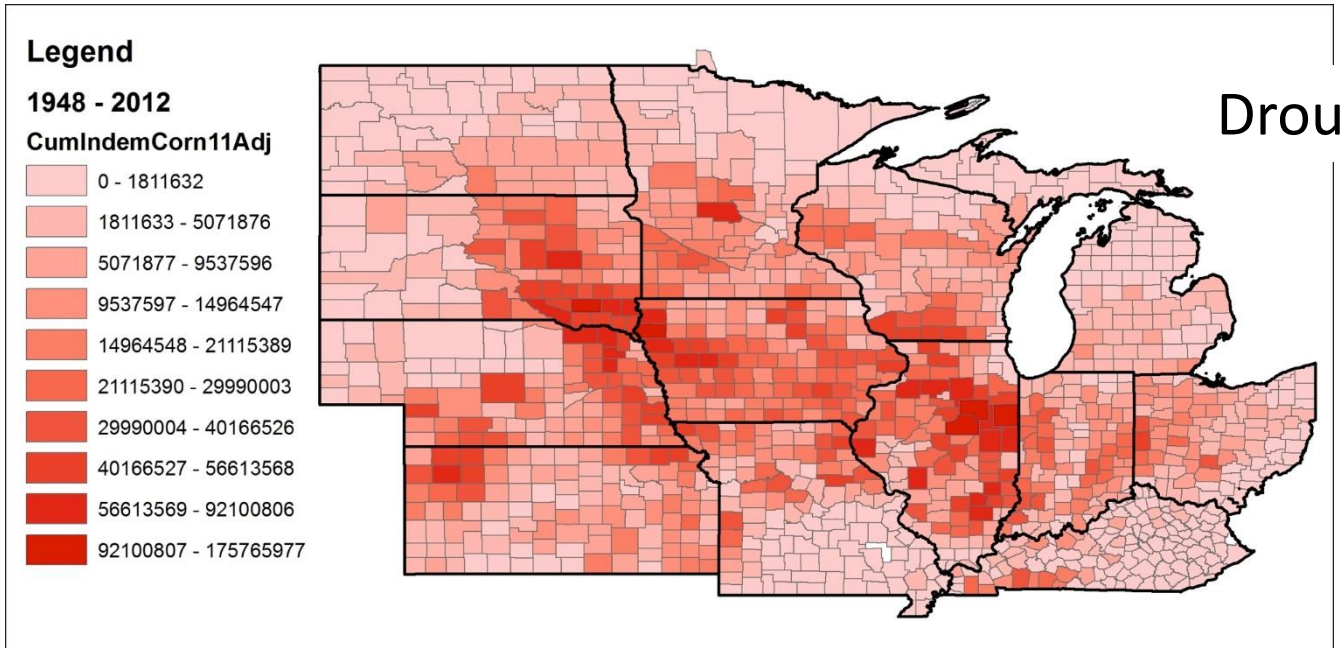
Cumulative Indemnities (2012 Dollars) – 1948-2012



Excess Moisture



Drought