

Conservation Reserve Program, Politics, and Land Use

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Overview of Farm Payments

- Farm payments are financial aid provided by government to support farmers and stabilize agricultural markets.
- Agricultural practices, promoting rural development, R&D, and addressing other agricultural challenges.

Common Types of Farm Payments

- Direct Payments,
- Counter-cyclical Payments,
- Price Support and Crop Insurance Subsidies,
- Conservation and Disaster Assistance

- Conservation Reserve Program (CRP) is administered by the Farm Service Agency.
- Remove environmentally sensitive land from agricultural production and plant species that will improve environmental health and quality.
- Contracts ranging from 10 to 15 years. Payments varies according to length of contract, soil productivity, location, etc.

Common Types of Farm Payments

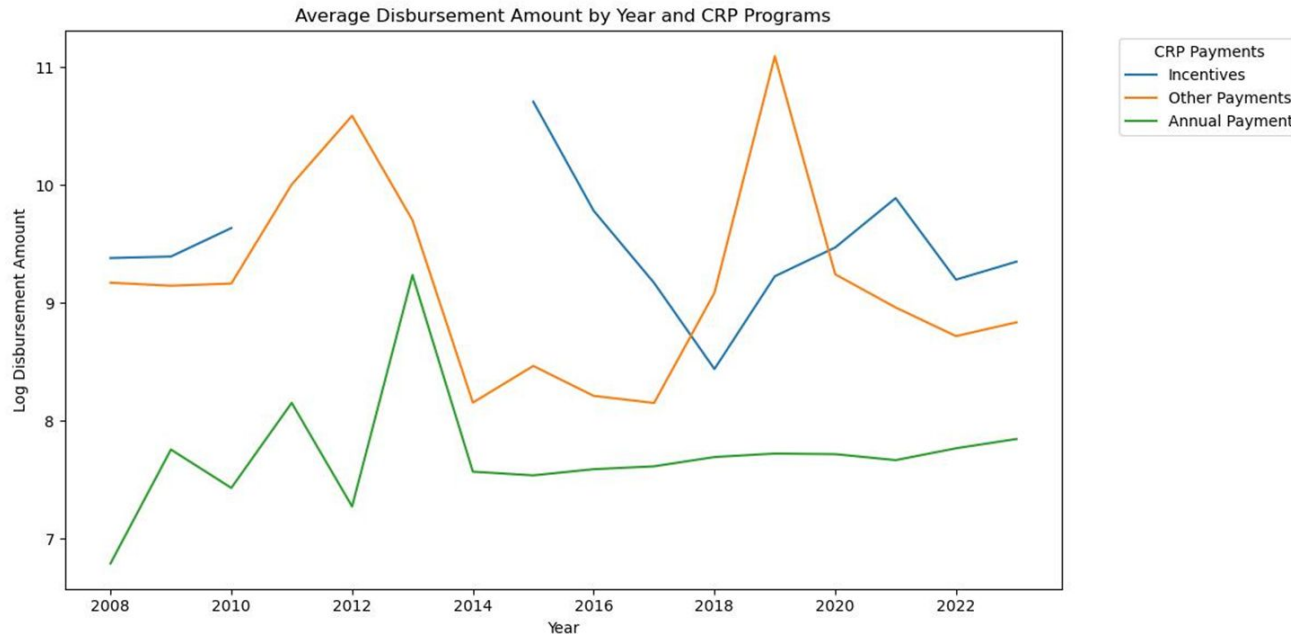
- Annual Rental Payments
- Signing and Practice Incentive Payments
- Cost-Share and Maintenance Payments
- Habitat Development Payments

We perform a web scraping to extract links to Excel files (.xlsx) from FSA payment webpage. The script identifies all the tags (hyperlinks) within the webpage and filters out only those links that point to Excel files. After extracting the desired links, it constructs the absolute URLs by appending them to the main URL of the FSA website. For each Excel file URL, it retrieves the file using `urllib.request.urlretrieve()` and saves it locally.

[Payment Files Information \(usda.gov\)](#)

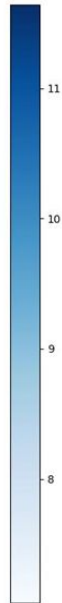
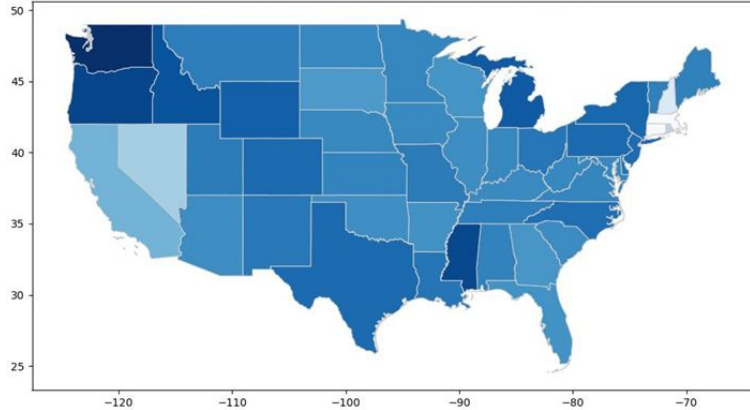
Analysis of CRP Payment Trends

- Annual Payments: Significant decrease post-2013 indicating possible policy shifts.
- Incentive-Based Payments: Suspension and subsequent decline from 2011 to 2018.
- Other Payments: Peaks in 2012 and 2019 due to specific programs like the Biomass Crop Assistance and emergency forestry efforts.

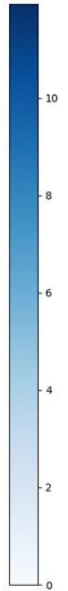
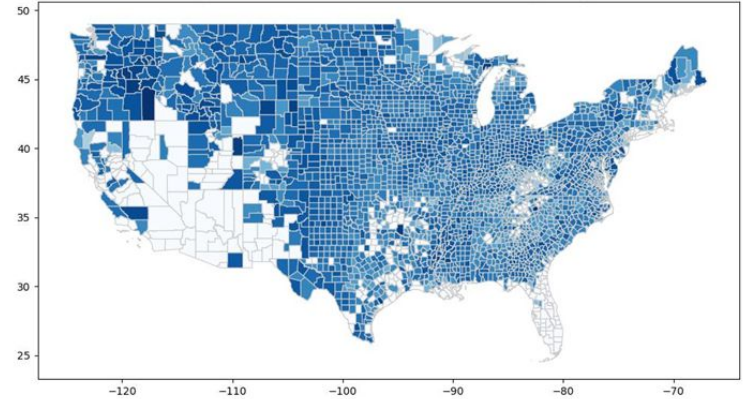


- CRP Payments by County and State
- Visual representation of average CRP payments per county from 2008-2023.
- Washington state as the highest recipient, followed by Mississippi, Oregon, and Michigan.
- Explanation of how geographical and ecological diversity influences CRP payment distribution.

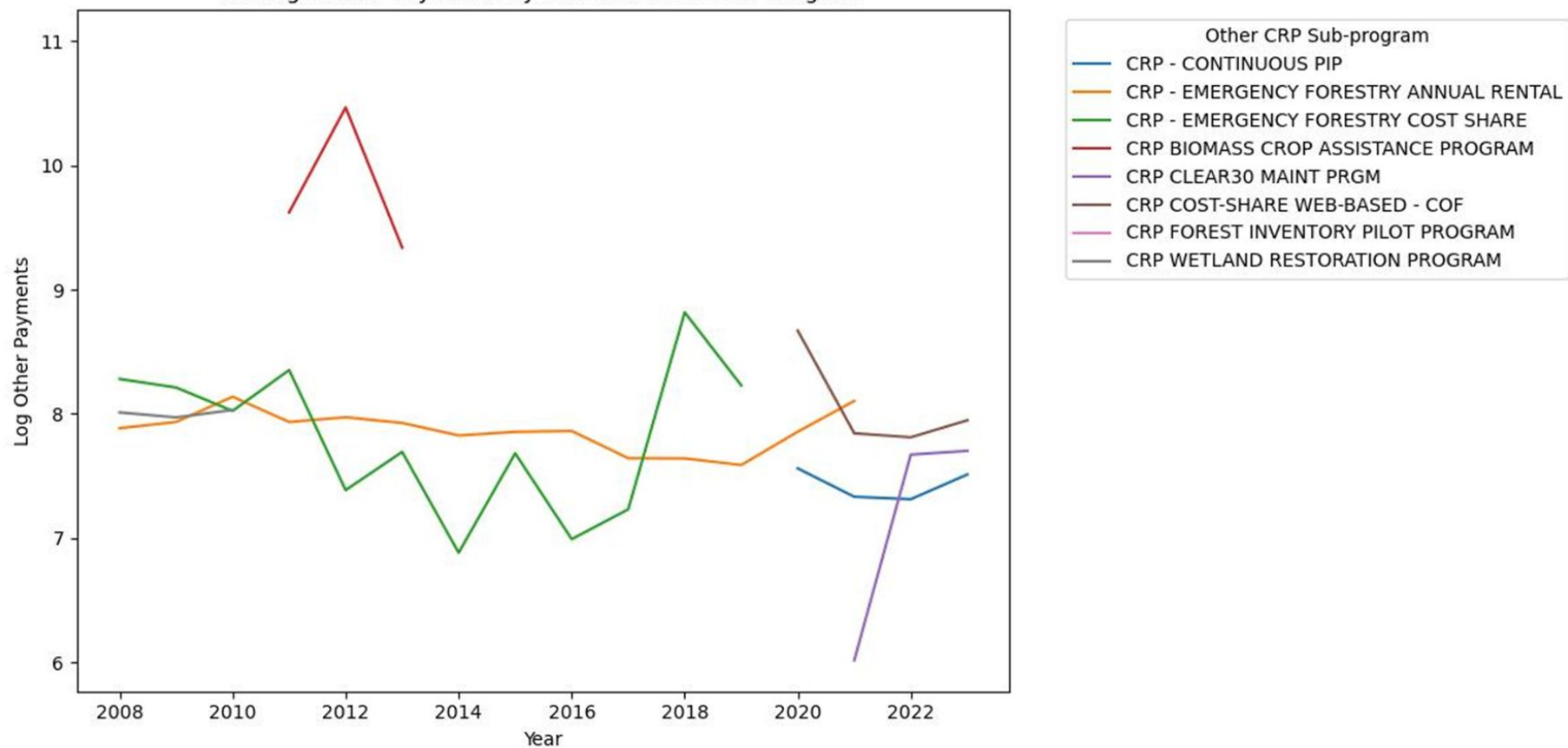
Logarithmic Transformed Total Disbursement Amount by State



Logarithmic Transformed Total Disbursement Amount by County



Average Other Payments by Year and Other CRP Program



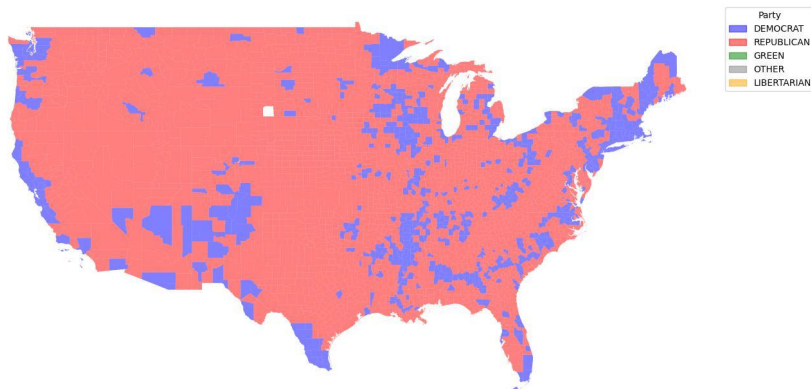
The US Farm Bill is a legislative bill that is renewed approximately every 5 years. Policy landscape for some

- food security,
- agricultural subsidies,
- land conservation, and
- rural development

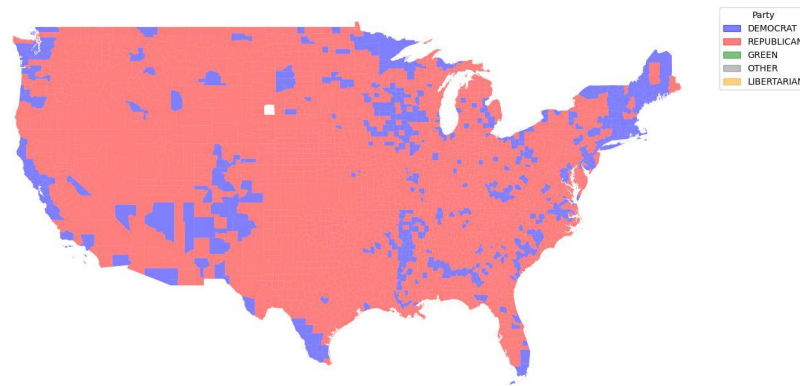
We take [MIT's Election Data + Science Lab](#) for county level data on winning presidential candidates from 2000-2020

The [Nutrition title](#) (welfare programs) dominate with more than 80% of the Bill

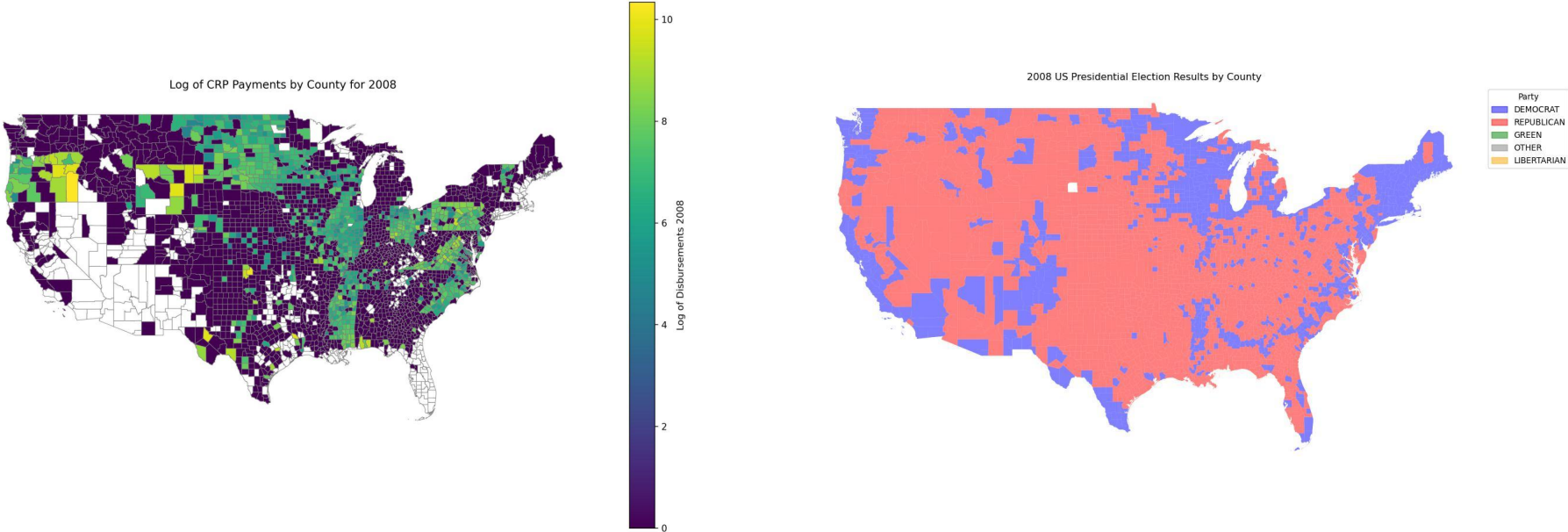
2000 US Presidential Election Results by County



2004 US Presidential Election Results by County

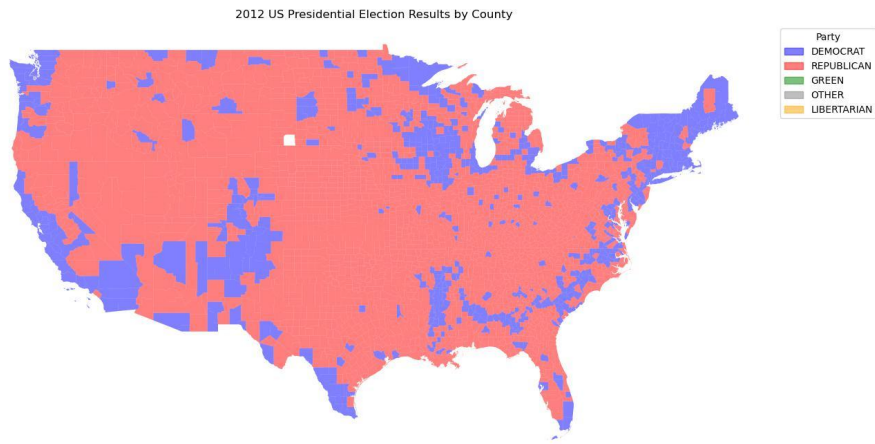
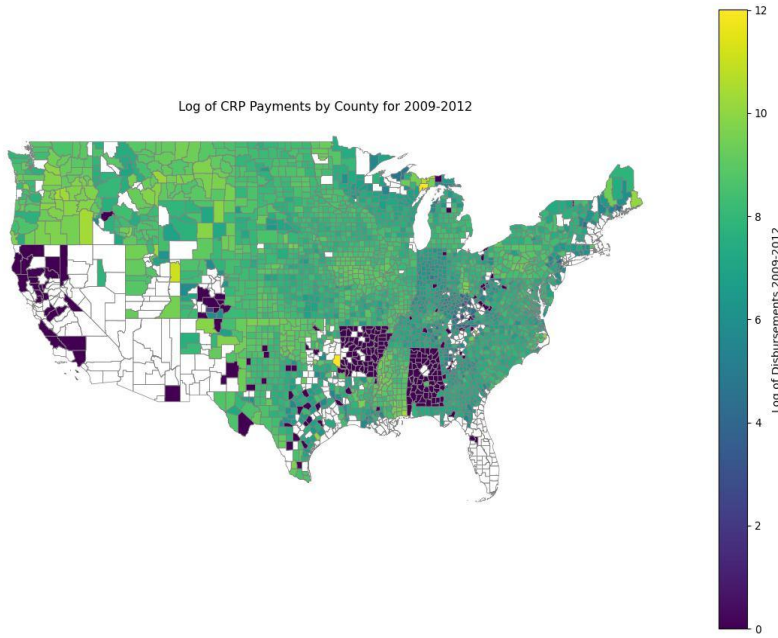


The earliest CRP data we have begins in 2008. Aggregate and take the average by county in 2008 on the left panel, and the county level presidential winners are on the right panel in 2008. George W. Bush signed in the 2007 Farm Bill, and the election shows that Barack Obama won in 2008.



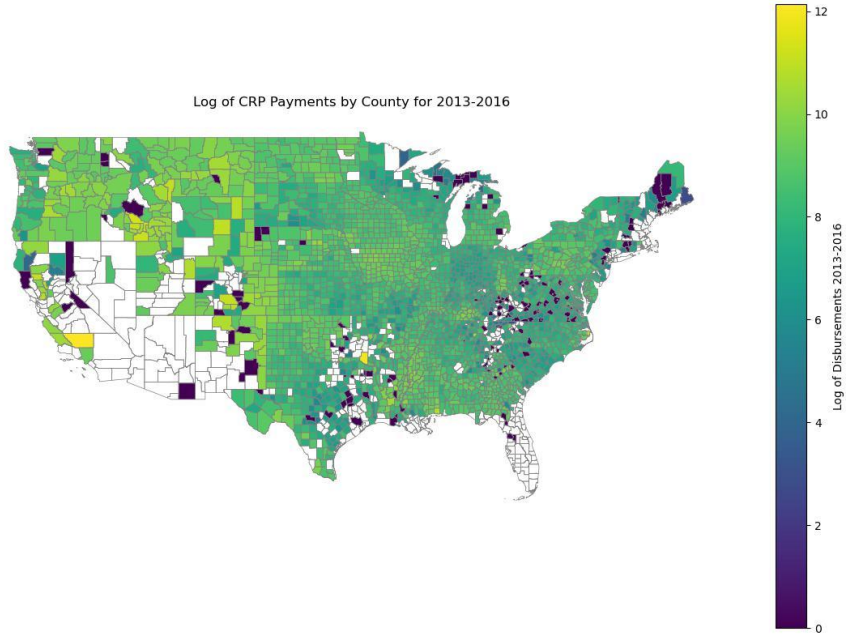
Aggregate and take the average by county across 2009-2012 on the left panel, and the county level presidential winners are on the right panel in 2012.

The upcoming Farm Bill was to be signed in 2013, was then signed in 2014 by Barack Obama

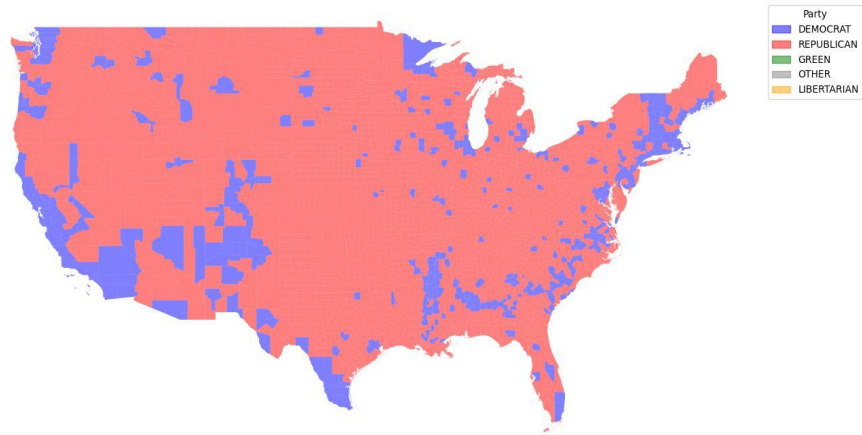


Aggregate and take the average by county across 2013-2016 on the left panel, and the county level presidential winners are on the right panel in 2016. The upcoming Farm Bill was to be signed in 2017, was then signed in 2018 by Donald Trump

Log of CRP Payments by County for 2013-2016



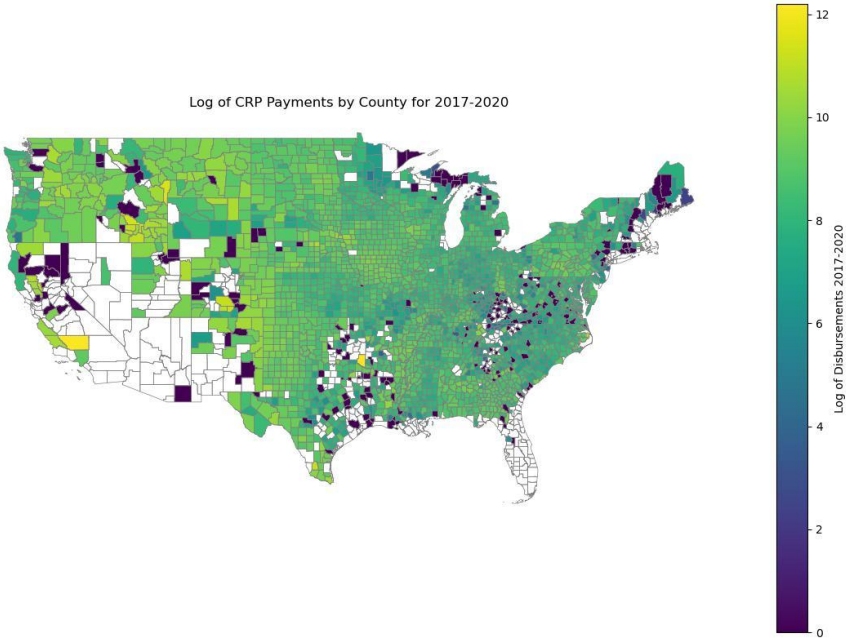
2016 US Presidential Election Results by County



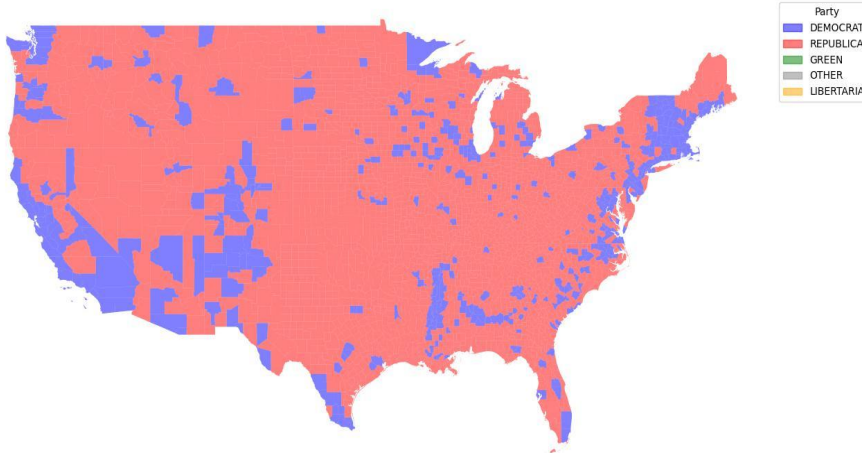
Aggregate and take the average by county across 2017-2020 on the left panel, and the county level presidential winners are on the right panel in 2020.

The previous Farm Bill was set in place in 2018 by Donald Trump, and the upcoming one is in 2024 where we have the new election of Biden vs Trump again.

Log of CRP Payments by County for 2017-2020



2020 US Presidential Election Results by County



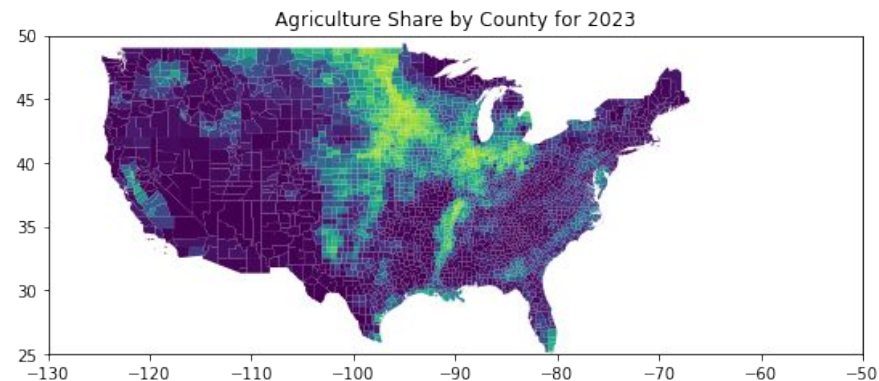
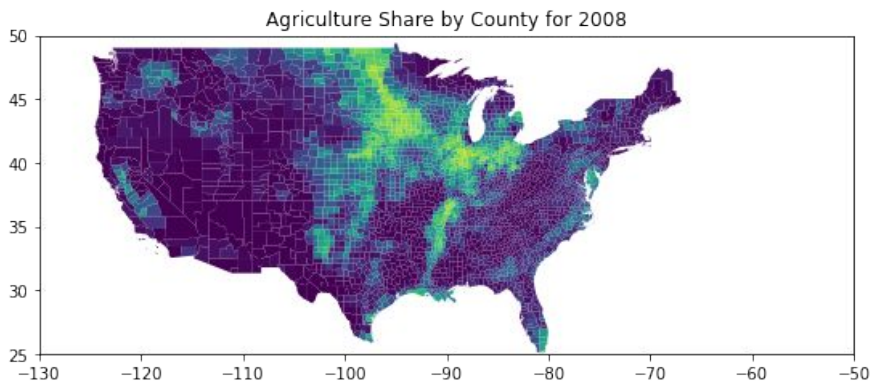
- Map Visualization Across the U.S
 - Land Use Pattern
 - CRP Payments of Different Categories

● Land Use Pattern Across the US

- Data source:
 - Cropland Data Layer (2008 - 2023)
 - US county level shapefile
- Land types:
 - Agriculture, Fallow, Pasture/Grass, Forest, Wetlands
- Measures:
 - County area, and area of different land use type
 - Key variable: Share of different land use type at county level
 - Comparable among different counties

- Land Use Pattern Across the US

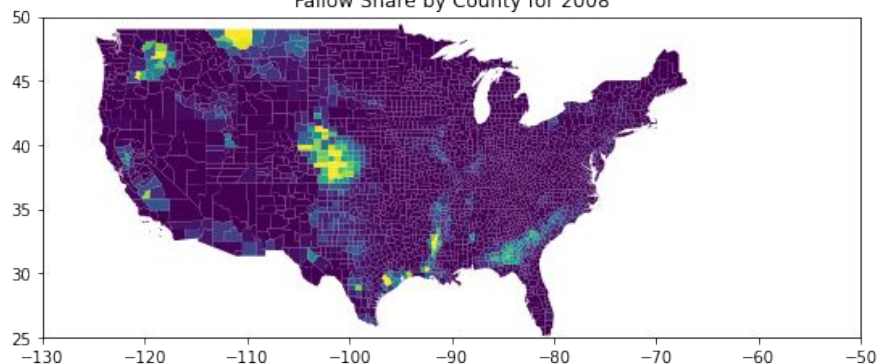
- Agriculture



- Land Use Pattern Across the US

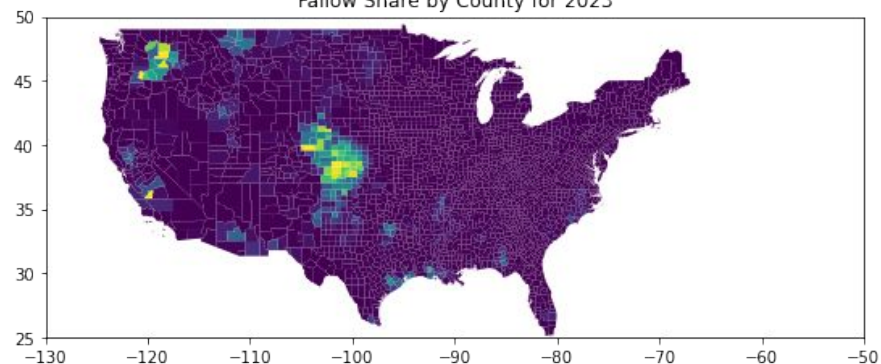
- Fallowed

Fallow Share by County for 2008



Fallow Share (%)

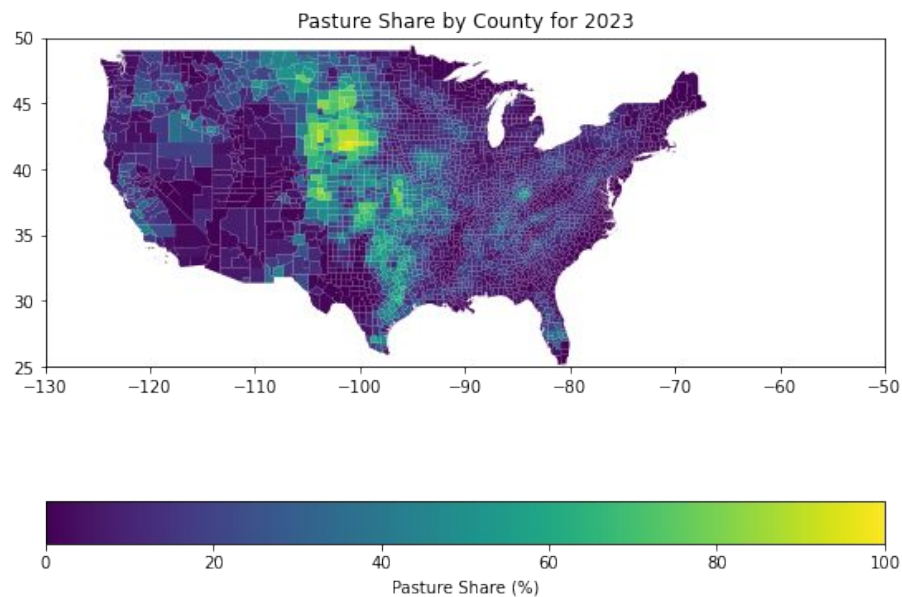
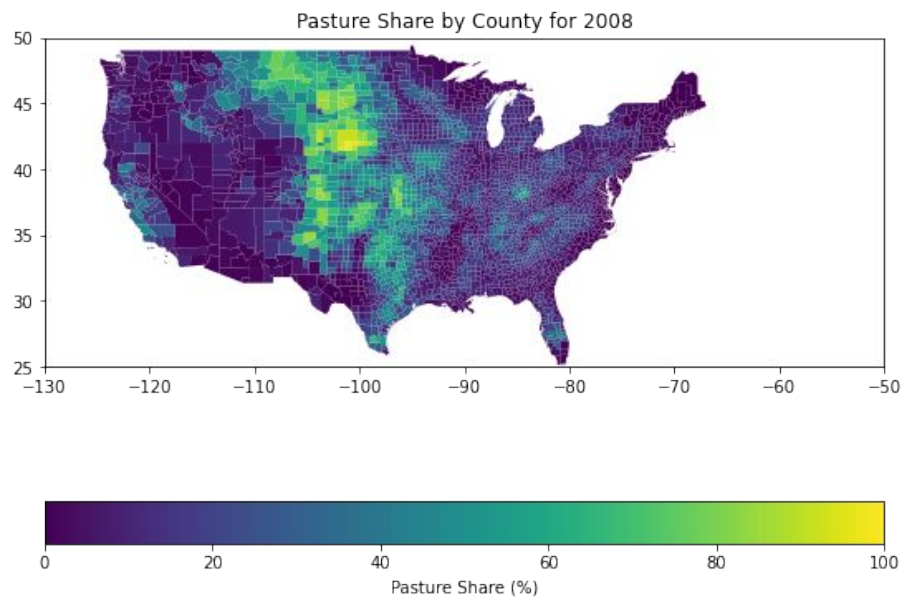
Fallow Share by County for 2023



Fallow Share (%)

- Land Use Pattern Across the US

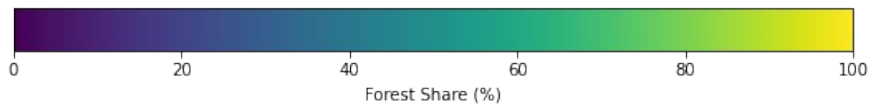
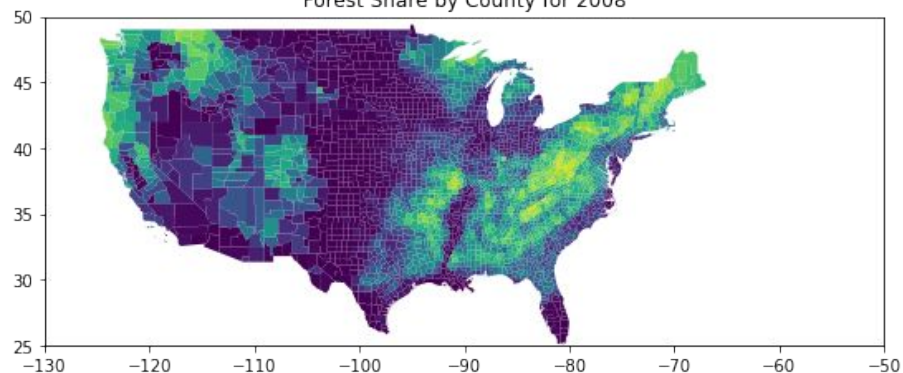
- Pasture/Grass



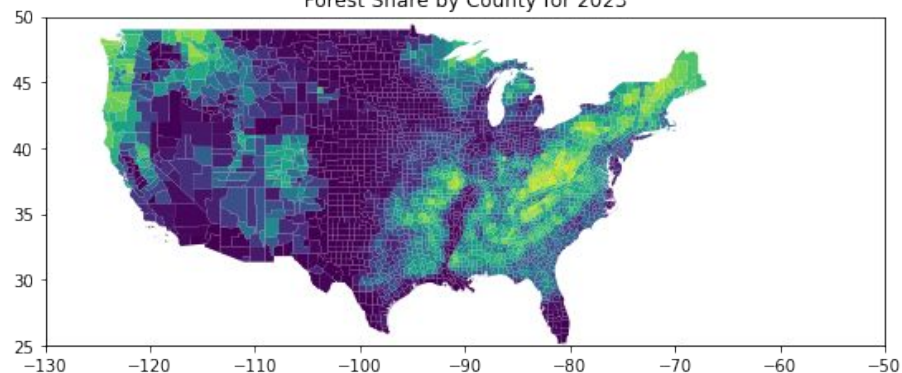
- Land Use Pattern Across the US

- Forest

Forest Share by County for 2008

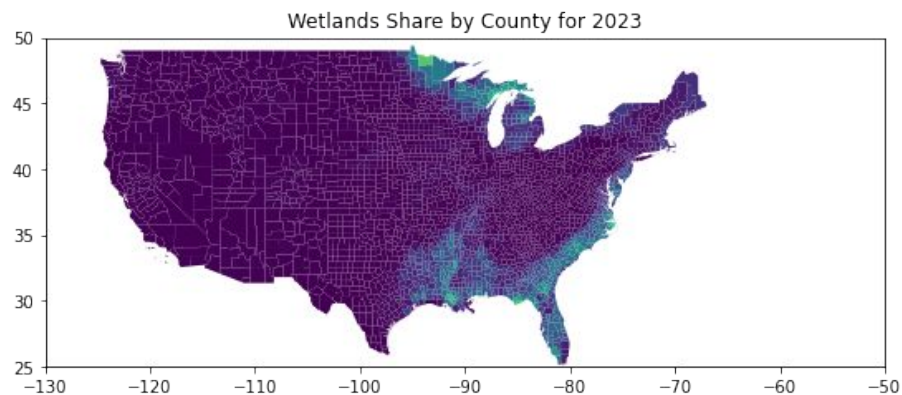
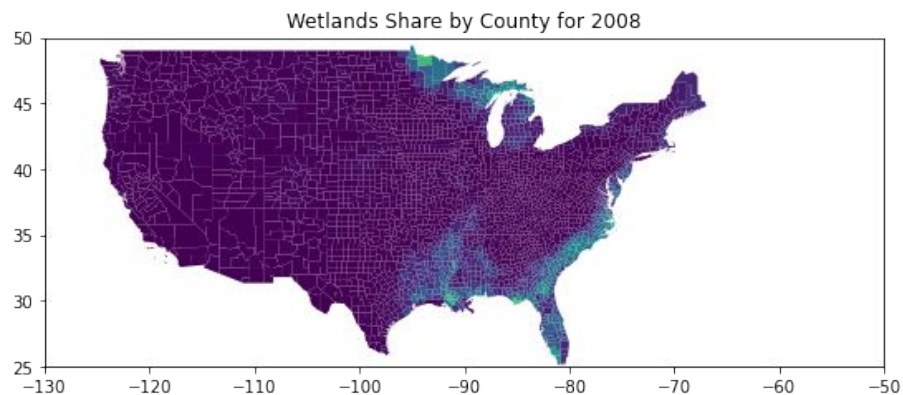


Forest Share by County for 2023

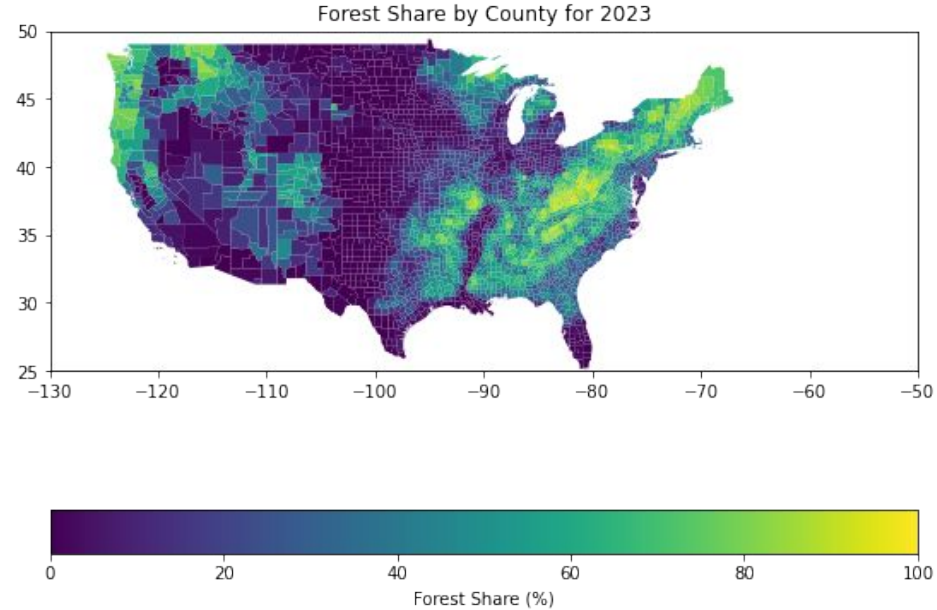
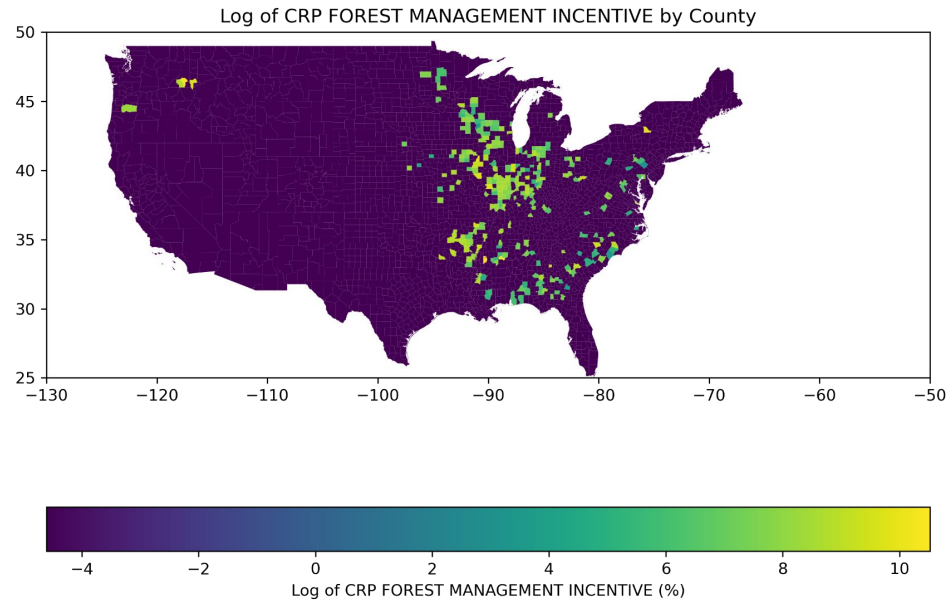


- Land Use Pattern Across the US

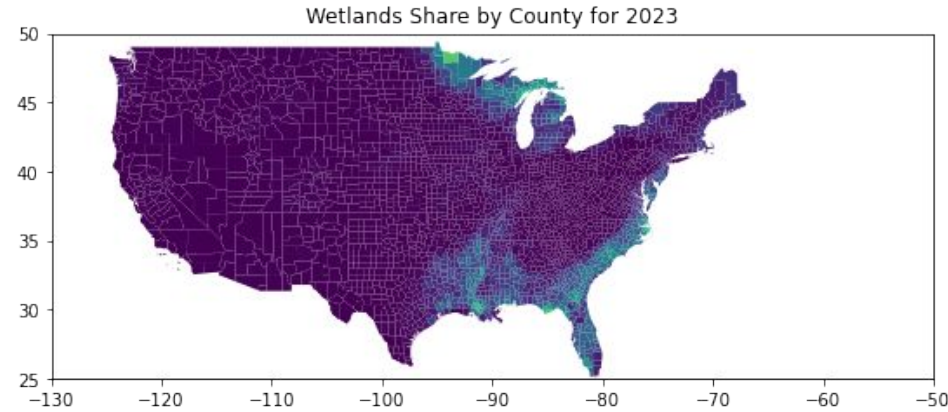
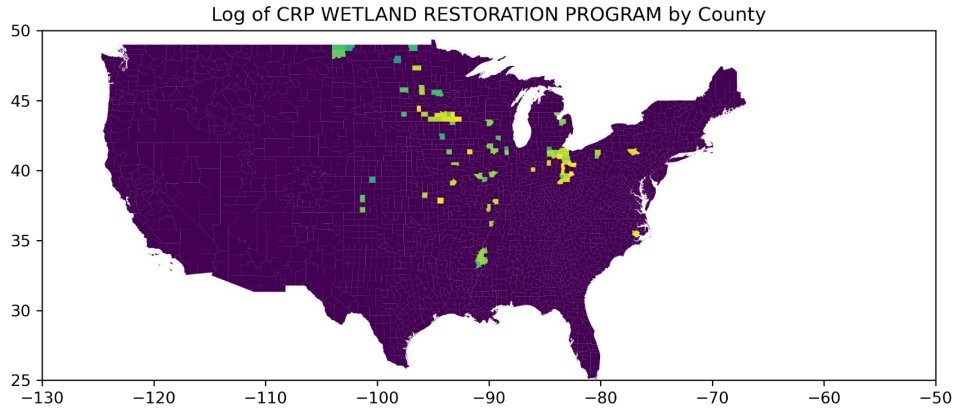
- Wetland



- Forest and CRP Forest Management Incentive Payment



- Wetland and CRP Wetland Restoration Program Payment



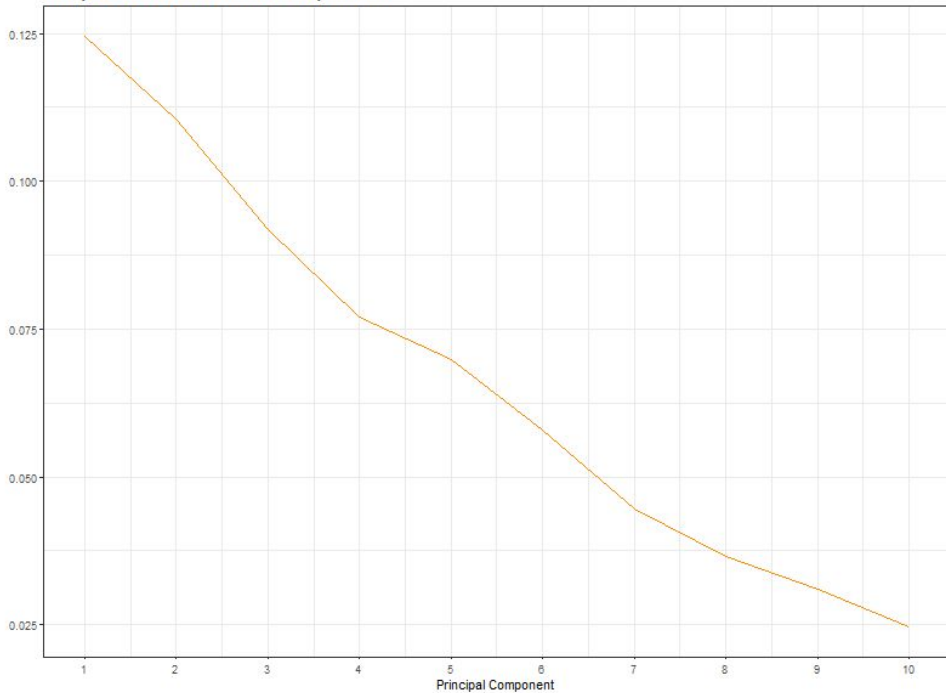
- Land Use Change Patterns in Illinois
- Effects of CRP Payment on Land Use Change

Disaggregated Land Use Data from CropScape

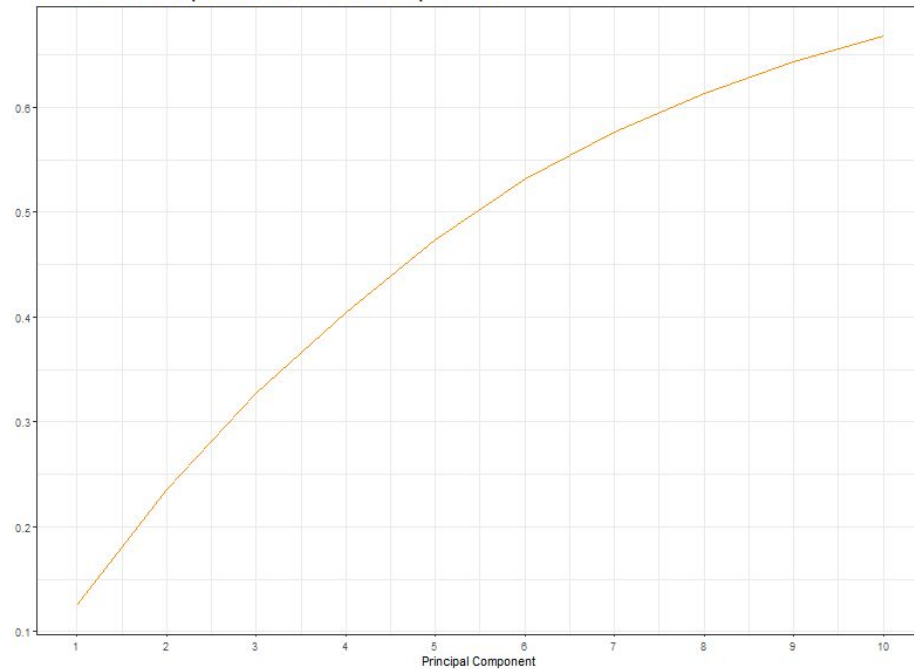
- We extract Illinois land use change data using the R package 'CropScapeR', which provides access to the Cropland Data Layer (CDL) via the 'CropScape' web service.
- This dataset offers comprehensive land use change data for 96 counties in Illinois from 2008 through 2023, featuring 3,707 types of land use changes such as 'corn to corn' and 'corn to soybean'.
- Issue: too many missing values. -> Trade-off in dropping columns (types of land use changes) and rows (combinations of year and county).
- Next step: Adopt PCA to reduce the dimension of land use change

PCA Results - No Clear Cut-off Value

Proportion of Variance Explained



Cumulative Proportion of Variance Explained



PCA Results

From	To	From	To
Woody Wetlands	Deciduous Forest	Barren	Barren
Barren	Corn	Developed/Low Intensity	Developed/Low Intensity
Corn	Barren	Soybeans	Alfalfa
Barren	Soybeans	Soybeans	Corn
Soybeans	Barren	Corn	Soybeans

Table 1: The 5 Most Important Land Use Changes in PC1 (left) and PC2 (right)

From	To	From	To
Corn	Developed/Open Space	Other Hay/Non Alfalfa	Grass/Pasture
Developed/Open Space	Corn	Corn	Grass/Pasture
Soybeans	Developed/Open Space	Alfalfa	Grass/Pasture
Developed/Open Space	Soybeans	Other Hay/Non Alfalfa	Corn
Developed/Low Intensity	Corn	Winter Wheat	Grass/Pasture

Table 2: The 5 Most Important Land Use Changes in PC3 (left) and PC4 (right)

Empirical Strategy - Two-way Fixed Effect Model

Land use change in acreage \sim CRP disbursement + Year + County

- Year and county fixed effects
- Year or County cluster standard error

Results - CRP Payments Promote Corn-Soybean Rotation

From	To	Coefficient	Year Cluster SE	County Cluster SE
Corn	Soybeans	5.424e-03 ***	***	***
Soybeans	Corn	5.731e-03 ***	***	***

Results - Mixed Effects of CRP Payments on Crop-Veggie Change

Land use changes from crops to vegetative covers

From	To	Coefficient	Year Cluster SE	County Cluster SE
Soybeans	Alfalfa	1.290e-05 *	*	
Corn	Other Hay/Non Alfalfa	1.029e-05 *		*
Soybeans	Other Hay/Non Alfalfa	1.653e-05 ***	*	**

Land use changes from vegetative covers to crops or similar

From	To	Coefficient	Year Cluster SE	County Cluster SE
Corn	Grass/Pasture	-5.900e-04 ***		
Other Hay/Non Alfalfa	Corn	2.260e-05 ***	**	**
Winter Wheat	Grass/Pasture	-2.906e-05 *	*	