The Role of Federal Incentives in Developing Local Institutions: Implications of Post-Dust Bowl Agricultural Reforms*

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Abstract

Local institutions play a pivotal role in shaping environmental and development policies. This study examines the role of federal policies in fostering the creation and expansion of local institutions and evaluates how these institutions contribute to long-term economic development. I examine Conservation Districts (CDs), federally backed natural resource management institutions established in the U.S. in response to the Dust Bowl. Using a newly constructed database from historical maps and annual reports, I find that counties with greater federal incentives were more likely to establish CDs. Using Difference-in-Differences (DID) and Instrumental Variable (IV) methods with agricultural and population census data, the study demonstrates that CDs enhance farm values and crop yields, with effects persisting through 2000. In addition, CDs improve climate resilience during droughts and contribute to social capital. Despite these benefits, fluctuations in federal budgets undermine the effectiveness of local institutions.

Keywords: Local Institutions,Conservation, Climate, Resilience, Agriculture, Collective Action
JEL Codes: N22, N52, Q15, Q24, D02

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1 Introduction

The role of local institutions in managing public goods, natural resources, and collective action challenges is gaining increasing attention from governments and policymakers across the globe (Mbow et al., 2017; Sultana and Thompson, 2010; Agrawal and Perrin, 2009; Dietz, Ostrom, and Stern, 2003; Poteete, Janssen, and Ostrom, 2010; Ostrom, 1990). Theorists in economics and political science emphasize how the federal government can help create and strengthen local institutions, and how federal and state actors can leverage these institutions to manage agriculture and natural resources (Ostrom, 2000; Besley and Coate, 2003; Inman and Rubinfeld, 1997; Rodden, 2006). The importance of such institutional support becomes even more pronounced in the face of climate change and other forms of environmental and economic uncertainty. While there are strong theoretical arguments and case studies on the benefits of local institutions and the role of federal support, systematic empirical evidence remains limited. Research on local institutions and common property management—particularly on how federal incentives can support them—is still scarce, largely due to data constraints.

Early studies in institutional economics have highlighted the significance of local institutions in managing natural resources or commons (Commons, 1931; McCay and Acheson, 1990; Veblen et al., 1898). Additionally, beyond their impact on natural resource management, the literature also links local institutions with pathways to increased climate resilience.[1] While classical theory demonstrates how rational economic modeling predicts the over-exploitation of natural resources or the "tragedy of the commons" (Hardin, 1968), several scholars argue that people cooperate to manage local resources under specific conditions and social norms (Poteete, Janssen, and Ostrom, 2010; Ahn, Ostrom, and Walker, 2003). Institutional differences between top-down and bottom-up approaches are well documented (Ostrom, 1992), with a focus on underlying heterogeneity among social groups to explain local institution success rates. Without federal incentives, it may be difficult to establish consistent local institutions across space (Ostrom, 2010).[2] Empirical evidence on the role of federal incentives in creating local institutions, as well as the short- and long-term benefits of new institutional arrangements for managing natural resources, remains largely absent. The main empirical challenge in addressing research questions around the formation and success of local institutions is the lack of an existing dataset that tracks the formation and collective actions of local institutions from their inception.

To address this gap, in this paper, I compile a new database from archival sources. I

[1] While private ownership dominates as economies develop (Shleifer, 1998; Linke et al., 2015), certain local resources continue to rely on collective management systems amidst increasing climate uncertainty and environmental damage. The Intergovernmental Panel on Climate Change (IPCC) recommends strengthening local institutions to reduce biodiversity loss (Mbow et al., 2017). Many developing countries have started planning for local institutions to combat climate change (Sultana and Thompson, 2010), and strong local institutions have been asserted as a tool for ensuring climate resilience (Agrawal and Perrin, 2009; Agrawal, 2008; Dietz, Ostrom, and Stern, 2003).

[2] Examples of such federally backed local institutions include irrigation districts in the Western U.S. or community forests in Nepal. These institutions were incentivized by the federal government, which also encouraged people to participate in collective action through these frameworks (Burt and Styles, 2000; Chand, Kerr, and Bigsby, 2015).

aim to answer two specific questions: a) What are the underlying mechanisms for creating a local environmental institution, and how can federal incentives boost this process? and b) How do local institutions affect economic development and enhance the resilience of agricultural land to climate extremes? I explore these questions within the historical context of American farmland conservation. After the Dust Bowl in the 1930s, one of the essential agrarian institutional changes implemented by the Federal Government in 1937 was the development of a farmowner-governed institution to manage topsoil and reduce the impact of wind erosion on farmland. This policy, known as the Soil Conservation and Domestic Allotment Act of 1937, introduced a key mechanism for common-pool resource management through farmland conservation and topsoil erosion control.

Topsoil, as a natural resource, flows across different plots of land, necessitating joint decisions among farmers to maintain it, especially in regions prone to wind erosion (McConnell, 1983; Barbier, 1990).[3] The Dust Bowl, a series of severe dust storms that devastated the American and Canadian prairies, was caused by the blowing away of topsoil due to over-farming and grassland destruction in the Great Plains (Hornbeck, 2012; Howlader, 2024). Following federal recommendations, each state passed new legislation within a few years (Table 1). However, the time required to establish Conservation Districts (CDs) on a county-by-county basis in the Great Plains ranged from just a few years to as long as sixty years (Figure 3). These local institutions are referred to as Soil Conservation Districts in some states, while others call them Natural Resource Conservation Districts or simply Conservation Districts (CDs), which is the term I will use throughout this paper.

In this paper, I draw evidence from these local institutions and compile a primary dataset on Conservation Districts (CDs) using annual reports and maps archived in the National Archives and Records Administration at College Park Helms, 1992. With this newly constructed database, I examine how these federally backed but locally organized institutions were formed and how they affected the local economy and agricultural outcomes. Federal expenditure on technical and financial assistance is presented in Figure 1. The Dust Bowl's magnitude as an ecological disaster—combined with the federal government's support for local institutions and the spatial distribution of CDs—makes this case an ideal context for exploring questions related to agricultural and environmental collective action and federal mechanisms. For the main analysis, I include data from across the entire United States (Figure 3 and Figure 4).[4]

I begin the empirical analysis by examining how spatial variation in federal policy, ecological shocks, and farmer characteristics affects the timing of Conservation District (CD) formation, measured in years. The conceptual framework identifies key externalities and proposes that cooperative activities among farmers can internalize them. Specifically, it predicts that: (1) the visual experience of soil erosion influences the decision to form a CD; (2) heterogeneity in farming characteristics shapes coordination costs; and (3) public infrastructure, such

[3]The on-site and off-site costs of severe topsoil erosion include lost future productivity, reduced productivity on adjacent plots, health hazards, and, in extreme cases, the creation of natural disasters like the Dust Bowl of the 1930s.

[4]For more detailed institutional analysis using annual reports, I focus on eight states in the Great Plains: Montana, South Dakota, North Dakota, Wyoming, Kansas, New Mexico, Oklahoma, and Nebraska.

as USDA demonstration plots, reduces knowledge gaps and facilitates institutional formation (Barbier, 1990). Given the time-based nature of the outcome, I employ a survival framework using both parametric and non-parametric duration models to estimate the effects of covariates, accounting for time-varying and time-invariant factors (Friedman et al., 1982; Austin, 2017). The results show that counties with medium and high erosion levels are significantly more likely to establish CDs, with hazard ratios of 1.86 and 1.49, respectively. Proximity to USDA demonstration plots also plays a critical role, with closer counties more likely to form CDs. The hazard of formation peaks immediately after enabling legislation and declines over time. In contrast, other agricultural characteristics play a more limited role.

The subsequent section of this paper examines how the establishment and growth of local institutions affect both short- and long-term economic development and climate resilience. The outcome variables are primarily drawn from the Agricultural Census, providing county-level data on crop production (harvested and planned), farmland value, agricultural revenue, and crop yield. The empirical analysis begins with a county-level panel fixed effects model to estimate the impact of conservation activities on per-acre crop yield and farmland value. However, simultaneity in the decision-making process introduces endogeneity into the regression, even after controlling for observed variables. For example, a farmer who performs well in both conservation and crop production could bias the results upward. To address this concern, I employ a difference-in-differences framework, leveraging spatial variation in erosion levels and temporal variation in CD adoption. Specifically, I compare counties with and without CDs over time and across erosion categories to isolate the effects of institutional exposure.

Difference-in-Differences (DID) results show that Conservation Districts (CDs) significantly increase farm values, particularly in low erosion areas, with benefits that grow over time and are especially pronounced in regions like the Great Plains and Midwest. CDs also improve crop yields, with substantial gains in corn and cotton production in low erosion areas. Heterogeneous Treatment Effects (HTE) analyses indicate that larger farm size and proximity to USDA technical assistance enhance the effectiveness of CDs, whereas proximity to the 100th meridian reduces it. Beyond economic outcomes, CDs foster social capital, as reflected in rising civic engagement over time, although their effects on voter turnout are mixed. CDs also yield notable public health benefits, including significant reductions in infant mortality rates, particularly 10 to 20 years after implementation. These findings highlight the broad and enduring impacts of local institutions on economic, environmental, and social outcomes, and underscore the importance of sustained federal support. Notably, variation in USDA technical and financial assistance budgets plays a key role, with lower funding levels substantially weakening the effectiveness of CDs.

Next, the paper investigates the long-term impacts of local institutions on economic and environmental outcomes. I employ an instrumental variable (IV) approach, following methods commonly used in public finance and labor economics (Bartik, 1992). The instrument is based on historical narrative reports that document variation in early adoption rates of conservation practices near federally established demonstration plots.[5] Farmers located closer to these plots

[5] I collected the demonstration plot map from the National Archives.

were more likely to adopt conservation methods, creating spatial variation in institutional adoption that is plausibly exogenous to farmers' unobserved characteristics. Leveraging this institutional feature, I use distance to the nearest demonstration plot as an instrument for institutional capacity in the 1950s. The IV estimates reveal that early and effective management of Soil Conservation Districts (SCDs) had lasting effects, with significant impacts on economic and environmental outcomes observed as late as 2000. Counties with weaker initial institutional capacity saw substantially smaller long-term benefits compared to those with stronger, federally supported conservation institutions.

This paper makes several contributions to the literature on public finance. First, it contributes to the field of fiscal federalism, which examines how federal government interventions influence local institutional behavior. Riker's seminal work underscores the double-edged nature of federal influence on local institutions: while federal intervention can strengthen local institutions by providing resources and guidance, it can also constrain their autonomy and responsiveness, effectively turning them into implementers of federal policy rather than independent entities (Riker, 1964). Building on this foundation, theoretical and empirical studies in institutional and public finance have explored how federal interventions may benefit local institutions under certain conditions.

Ostrom (Ostrom, 1990) highlights the role of higher-level government incentives in fostering local collective action and institutional development, as seen in examples such as irrigation districts and Nepalese community forests. Along similar lines, this paper investigates how federal incentives can, under specific circumstances, promote effective local collective action. Besley and Coate (Besley and Coate, 2003) discuss the allocation of public goods between federal and local governments, emphasizing the governance implications of these arrangements. Moffitt (Moffitt, 1992) examines the impact of federal welfare programs on local equity and institutional roles, while Oates (Oates, 1972) explores the economic rationale behind federal fiscal policies and their effects on local governance and autonomy. Rodden (Rodden, 2006) analyzes how fiscal dependence on federal funding shapes local institutional capacity and decision-making. Similarly, Inman and Rubinfeld (Inman and Rubinfeld, 1997) evaluate the economic efficiency and equity implications of federal versus local governance, and Baskaran and Feld (Baskaran and Feld, 2013) investigate the trade-offs between fiscal decentralization and economic performance. By synthesizing insights from these foundational works, this paper advances the understanding of the nuanced ways in which federal incentives impact local institutional behavior, particularly in fostering collective action and addressing governance challenges.

Second, this paper also demonstrates how the reinforcement of local institutions can effectively shape public policy. Early studies on institutional mechanisms underscore the importance of designing public policy to provide efficient public goods (Samuelson, 1954). The ongoing decline of natural grazing systems in the West has sparked debates on the effective management of natural resources (Gordon, 1954; Hardin, 1968; Gilles and Jamtgaard, 1981). Early neoclassical economic studies suggest that bargaining and property rights can mitigate the problems of overuse and exploitation of natural resources (Coase, 1960). Theoretical studies

identify the relative importance of different factors underlying the formation of local institutions, calling for empirical studies to understand this heterogeneity (Ostrom, 2002; Dietz, Ostrom, and Stern, 2003; Agrawal and Gibson, 1999; Schlager and Ostrom, 1992; Ostrom, 1992; Bromley, 1990; Blomquist et al., 1992; Banerjee, Iyer, and Somanathan, 2007). Theoretical studies also explore the optimal provision of public goods and mechanisms to address collective action problems (Hardin, 2015; Ostrom, 2000; Ostrom, 2002). Lab-based experiments investigate optimal ways to manage common-pool resources (Hackett, Schlager, and Walker, 1994; Isaac, McCue, and Plott, 1982). Case studies like this paper contribute insights into the variables influencing the formation of local institutions managing topsoil erosion and farmland conservation, and offer guidance on designing incentive policies to mitigate inequalities.

Third, the paper also contributes to the growing literature by showing how common shocks may foster a spirit of cooperation. Political scientists and economists have studied how war and conflict encourage collaboration (Bellows and Miguel, 2009; Bellows and Miguel, 2006; Blattman, 2009; Voors and Bulte, 2014). This paper explores how climate and ecological shocks may similarly foster cooperation, aligning with macroeconomic literature on creative destruction and institutions (Caballero, 2010; Diamond Jr, 2006). In this context, the paper highlights the role of natural disasters, such as the Dust Bowl, as a source of creative destruction and long-term economic growth (Crespo Cuaresma, Hlouskova, and Obersteiner, 2008). The role of local institutions in managing resources amid shared threats and uncertainties has been extensively documented in literature related to civil war (Bauer et al., 2016), urban crime (McCarthy, Hagan, and Cohen, 1998; Reid, Roberts, and Hilliard, 1998), and labor movements (David, 2008; Olzak, 1989; Olson, 2009). In the face of increasing climate uncertainty, it is also crucial to understand the capacity of local institutions and the role of collective action, so that federal, state, and local climate policies can be designed accordingly (Bréchet et al., 2012; Dryzek, Norgaard, Schlosberg, et al., 2011; Raihani and Aitken, 2011).

Finally, the paper also contributes to the growing literature on compiling new data sources and understanding the New Deal. Recent empirical economists have explored various facets of the New Deal, benefiting from the detailed county-level data available over extended periods (Fishback, 2017). This paper extends the literature by compiling data for Conservation Districts and demonstration plots, offering a new perspective on understanding the impacts of New Deal policies. Despite substantial investment in land and soil conservation, there has been no specific study examining the success of these policies in achieving long-term conservation effects.

2 Historical Background

To understand the influence of federal policies on the formation and effectiveness of local institutions in building climate resilience, I examine a unique situation created after the Dust Bowl in the 1930s. During this period, the federal government took action to decentralize natural resource management systems. As part of this effort, the federal government passed a law to establish local conservation districts, which remain the primary local units for conserving

natural resources.

2.1 Federal Policies on Land Conservation

Land conservation processes, activities, and organizations in the United States can be traced back to the establishment of Yellowstone National Park in 1871. However, these early efforts were primarily motivated by wildlife and nature conservation, with farmland or soil conservation not being a priority (Hays, 1999). The conservation of working land, specifically soil conservation, gained federal attention in 1914 with the introduction of the Smith-Lever Act. This act empowered land-grant universities to disseminate knowledge about soil erosion through bulletins and reports published by the Agricultural Extension Service. However, the law had minimal impact on farmers. Due to the high demand for wheat in Europe and the conditions set by the Homestead Act, farmers continued to uproot native grassland from the Great Plains region. This widespread removal of native grasslands disrupted the biological soil organic system, eventually culminating in the destructive ecological event known as the Dust Bowl (Webb, 1959).

The Dust Bowl experience in the 1930s prompted policymakers to prioritize soil conservation activities. Hugh Bennett, the chief USDA soil scientist, proposed a solution that involved removing marginal land from production to control soil erosion and stabilize production levels. Under Bennett's leadership, the USDA conducted a detailed soil survey from 1931 to 1933 to assess the implications of erosion. In 1933, Franklin D. Roosevelt was elected to office and implemented the First New Deal within his first 100 days of presidency. Land use policies, such as the purchase of submarginal, eroded farmland, became a key component of the Agricultural Adjustment Act under the New Deal. The initial soil conservation plan focused on two main areas: a) purchasing submarginal land through the set-aside program, and b) demonstrating soil conservation techniques to farmers through demonstration plots (Hansen and Libecap, 2004; Howlader, 2024). Later, in 1937, the federal government decided to decentralize natural resource management as farmers were highly independent-minded.

Figure 1 illustrates the annual variation in federal assistance for farmland conservation, with technical assistance primarily directed to conservation districts. The data comes from Pavelis, Helms, and Stalcup (2011) and uses annual USDA records on farmland conservation, including both technical and financial assistance, adjusted to 2009 dollar values and reported in millions. Panel (a) displays real expenditures in 2009 dollars, while panel (b) shows the percentage allocation between technical and financial assistance. Financial assistance involves payments to landowners for land use improvements, such as those under the Conservation Reserve Program or the Agricultural Adjustment Act of 1933. Technical assistance, on the other hand, includes support provided by Soil Conservation Service (SCS) technicians to help farmers implement conservation activities on working lands. The figure reveals that financial assistance expenditures generally exceeded technical assistance expenditures. However, during the 1970s and early 1980s, technical assistance expenditures temporarily surpassed financial assistance. We will study the implication of this technical assistance on agricultural and

economic development.

2.2 The Origins and Evolution of Conservation Districts

The decision to decentralize stemmed from the recognition of the need for effective communication between farmers and the Soil Conservation Service (SCS). To address this, the USDA proposed establishing local institutions in each community. These institutions would enable farmers to form groups and develop management plans with the assistance of SCS technicians. The federal government would provide the necessary technical aid for farmland management. The SCS established demonstration plots to teach farmers how to take care of the soil. Beginning in 1937, states started to adopt the law.[6] Table 1 presents the dates of Soil Conservation and Domestic Allotment Act adoption by states. The creation of the CDs was democratic and referendum-based; only landowners were eligible to vote for the CDs. Three external institutions were involved in the process of helping the CD farmers: a) the SCS of USDA (with technical assistance); b) the Extension Service (with educational programs); and c) the Work Projects Administration (with financial aid). The United States currently has more than 3000 CDs, most of which coincide with county administrative borders. Sampson, R. Neil (1985) explores the historical development of conservation districts, the bureaucratic challenges they faced and the broader efforts to promote soil and water conservation in the U.S. (Sampson, 1985).

CDs continue to play a vital role in disseminating knowledge of soil conservation techniques at the county level. The primary purpose of a CD is to design conservation surveys of farm plots, assign and suggest essential conservation techniques (for both short-term and long-term use) based on the surveyed soil type, and help with structural conservation techniques (Sampson, 1985; Geiger, 1955). CDs acquire funds through assessments, private contributions, equipment rental projects, and state and county fund appropriations. It is important to note that CDs do not define ownership rights to topsoil, nor can they restrict farmers from over-exploiting the soil. Instead, CDs monitor soil conservation practices, educate farmers about sustainable practices, and coordinate ongoing and future planning.

2.3 Management of CDs in Different States

Following the model state law, individual states began passing laws in 1937, incorporating certain variations. The process of establishing a district involved submitting a petition to a state soil conservation committee, signed by at least 25 landowners, followed by a public hearing. The landowners defined the district boundaries and conducted a referendum.

The purpose of CDs was to create farm plans in collaboration with SCS technicians to address farmers' needs. CDs are required to submit annual reports to the USDA. While some

[6]On April 27, 1935, Congress passed Public Law 74-46, in which it recognized that "the wastage of soil and moisture resources on farm, grazing, and forest lands . . . is a menace to the national welfare," and it directed the Secretary of Agriculture to establish the Soil Conservation Service (SCS) as a permanent agency within the USDA. The Department published a model state law in May 1936 which would authorize farmers to organize soil conservation districts.

technical assistance was provided by the USDA, CDs were primarily self-funded by counties, with some matching grants from the states. Elected supervisors, who mostly volunteered their time and effort, oversaw the districts. Unlike the county-level Agricultural Adjustment Programs of the USDA, which received rental payments, conservation district officials were unpaid. The formation and management of CDs varied across states. There is also considerable variation in institutional design.

For example, Montana established six regions for organizational purposes within the Montana Association of Conservation Districts (CDs). Conservation districts in Montana operate at the county level and are responsible for implementing programs to conserve soil and water, protect water bodies, and preserve wildlife habitat areas. Montana has 58 CDs corresponding to its 56 counties. The state passed legislation in 1939 following the federal law, granting authority to county districts to collect taxes and providing state grants to support the CDs. Supervisors are non-paid, nonpartisan boards of elected landowners. Additionally, many conservation districts in Montana offer services such as tree sales for conservation plantings, provision of landowner maps, and other conservation-related services.

In South Dakota, each of the state's 69 districts is governed by a board of five elected supervisors, and the districts are a subdivision of state government. Similarly, Kansas has 105 Conservation Districts, which are political subdivisions of the state and are governed by a five-member board of supervisors. Funding for the districts comes from county and state allocations, with some districts collecting funds from conservation services. Oklahoma also has a five-member board of elected supervisors for its soil conservation districts. Soil conservation programs in the United States have evolved over decades and are a careful combination of scientific and social institutions. CDs continue to act as the local point of contact for many federal conservation and natural resource management programs. The main soil conservation activities conducted by CDs include farm surveys, terracing, cover cropping, water management, tree plantations, contour cropping methods, land leveling, and shelterbelt management, among others (Sampson, 1985; Geiger, 1955). Conservation Districts are primarily engaged in hands-on activities such as teaching cover crop plantation, organizing demonstration plots, designing farm plans, conducting soil surveys, recommending conservation techniques, providing technical assistance on irrigation and terracing, and recognizing the best conservation farmers (for a list of activities by CD, see Table 2).[7]

2.4 Current Federal, State, and Local Relationships in Conservation Delivery Services (CDS)

Since their establishment in the mid-1930s, nearly 3,000 conservation districts—almost one in every county—have played a crucial role in the United States' conservation efforts. These districts work directly with landowners to conserve and promote healthy soils, water, forests, and wildlife and provide technical assistance. The National Association of Conservation Dis-

[7]For a detailed summary of county-level conservation activities collected from the annual reports in the National Archives and Records Administration (NARA), see the Appendix.

tricts (NACD) represents these districts (Conservation Districts (NACD), 2024a; Conservation Districts (NACD), 2024b).

Conservation districts share a unified mission: to coordinate assistance from all available sources—public and private, local, state, and federal—to create locally driven solutions to natural resource challenges. In addition to coordinating conservation efforts, districts implement conservation practices on farms, ranches, and forestlands to protect soil productivity, water quality and quantity, air quality, and wildlife habitats. They conserve and restore wetlands to purify water and provide habitats for birds, fish, and other wildlife. Conservation districts also protect groundwater resources and assist communities and homeowners in planting trees and other vegetation to stabilize soil, clean the air, provide wildlife cover, and enhance neighborhood aesthetics. Moreover, they help developers control soil erosion and protect water and air quality during construction projects. Conservation districts also conduct outreach to communities and schools to educate on the value of natural resources and encourage conservation initiatives.[8]

This collaborative, multi-tiered structure highlights the critical role of cooperation among federal, state, and local levels in advancing the CDS's mission of delivering effective conservation through technical assistance.

3 Conceptual Framework

I develop primary hypotheses regarding the formation and effectiveness of Conservation Districts (CDs) by drawing on models in previous research on local institutions and collective action. Several researchers have developed criteria for collective action models in different settings, including irrigation and forest management-related local institutions (Ayres, Edwards, and Libecap, 2017; Libecap, 1993). I lay out a conceptual model for farmers' production decisions, closely following previous agricultural economics literature on the effects of soil erosion (McConnell, 1983; Barbier, 1990). Under the regularity assumptions of the production function, it is possible to predict the effects of spatial and temporal climatic uncertainty, along with farm characteristics, on the formation and effectiveness of a local institution aimed at addressing soil erosion.

Following Barbier (1990), I consider an open-access model for farmers, showing how ecological uncertainty may affect production decisions through excessive topsoil erosion, and we then explore the nature of the negative externalities resulting from this erosion. Farmers maximize personal farm profit, with land divided into n parcels. The production function includes input packages, some of which conserve soil, such as seeds, fertilizers, and soil depth. The level of wind erosion (climatic uncertainty) is unknown, which introduces production

[8] As Philip M. Glick, a retired USDA attorney and a key contributor to the 1937 *Standard State Conservation Districts Law*, aptly stated in a 1990 retrospective interview:

> "We can do far more through the cooperative action by the federal government, the State government, and the local government than we do separately."

uncertainty. Without any institutional arrangement, for a single farmer, the value function is the present discounted profit over time. The constraint in this optimization function represents the evolution of soil depth, which depends on both the production input package and previous topsoil extraction. The key insight from this framework is that the condition and optimal soil extraction path under open access depend on how the farmer's yield function changes with soil health and input use, as well as how soil transitions between plots change with wind erosion, input use, and soil health.

Next, following Barbier's (1990) model, I examine the potential of institutional arrangements to address the negative externalities of soil erosion across plots and intertemporal costs. There are two social problems inherent in the open-access model: a) farmers' current soil extraction may negatively impact future profits (on-site cost), and b) there is a neighborhood effect where soil erosion from one plot affects another (off-site cost) (Hansen and Libecap, 2004; McConnell, 1983). Previous literature has identified that a key barrier to internalizing these negative externalities is the conservation knowledge gap among farmers. Some soil conservation techniques are labor- and skill-intensive, requiring assistance and support for farmers to learn them (McConnell, 1983). The USDA provided technical support by establishing demonstration plots. A CD forms only when collective action yields greater aggregate benefits than individual actions by farmers. For an optimal management plan at the social level, soil extraction decisions must consider all nearby land parcels.

Farmers will participate in forming a local institution to internalize the negative externalities only if the aggregate benefit outweighs individual benefits (individual rationality or participation constraint). The likelihood of institutional agreement at any point in time depends on several factors. All else being equal, the greater the anticipated aggregate benefits of institutional change, the more likely it is that new property rights will be sought and adopted (Libecap and Wiggins, 1984). There are three sets of variables that may influence the adoption and effectiveness of CDs: 1) climatic and ecological variables that influence production uncertainty; 2) farm characteristics that affect transaction or coordination costs, such as the number of farms; and 3) access to demonstration plots to learn the importance of conservation activities.

Firstly, climatic and ecological variations affect both production uncertainty and baseline knowledge of soil erosion. Higher uncertainty may foster the formation and success of CDs. Alternatively, extreme uncertainty could push farmers below survival levels, reducing the likelihood of cooperation. Secondly, farmers who live near USDA demonstration plots may better understand the importance of conservation and thus form CDs more quickly. Thirdly, farm characteristics that influence coordination costs include farm size, number of farms, and access to alternatives like irrigation or windbreaks. Land tenure also plays an important role, as landowners may be more likely to vote for CDs. Thus, a higher percentage of tenancy could either negatively impact CD formation or, alternatively, require additional labor, in which case tenancy could have a positive impact. Heterogeneity in the population, such as differences in population density or racial composition, may delay the adoption process. The empirical strategy and data construction sections of this paper outline a strategy to identify these factors

and their impact on the decision to establish a CD.

4 Data Construction and Summary Statistics

To examine the formation and success of local institutions, I compiled a dataset on Conservation District (CD) formation, expansion, and activities, sourced from the National Archives at College Park. The empirical analysis relies on a county-level database spanning the years 1930 to 2000, covering the entire United States. For a more detailed examination using annual reports, I focused on eight Great Plains states: Montana, North Dakota, South Dakota, Nebraska, Kansas, New Mexico, Oklahoma, and Wyoming. To maintain consistent observation units over time, I adjusted all data to 1910 boundaries, following the approach of Hornbeck (2012). The baseline empirical work investigates the relationship between exposure to new local environmental institutions and agricultural revenue, along with other economic outcomes during periods of climate distress. In this section, I outline the data used in the baseline analysis, including measures of exposure to local institutions, agriculture, economic outcomes, and county characteristics.[9]

4.1 Exposure to Local Institutions

One challenge in studying the impact of local environmental institutions on the local economy and climate resilience is the limited availability of data that measures the formation and activities of these institutions at a fine-grained geographic level. For this paper, I assemble a unique data set from several sources that are particularly suited to measure the formation and expansion of local institutions over a large geographic area. I compile the timing of the formation of the Soil Conservation Districts (CD) that the USDA created after the Dust Bowl. I extracted the formation timing information for all these CDs from the historical maps and annual reports of the CDs deposited in the National Archives at College Park (NARA) (Sampson, 1985).

Table 1 and corresponding Figure 2 illustrate the timeline of state-level adoption of the Soil Conservation and Domestic Allotment Act, showing when each state implemented the policy between 1935 and 1948. Most states adopted the act by 1940, with a few later adopters extending through the 1940s. However, significant variation existed at the county level in the timing of CD formation. Figure 2 illustrates this variation through a series of maps: Panel A shows the expansion of Conservation Districts (CDs) up to 1938, Panel B up to 1944, Panel C up to 1950, and Panel D up to 1953. By 1953, most counties had access to a CD.[10]. I digitized these maps using ArcGIS to create a county-level database of CD formation years. The maps display the counties with established CDs, but they do not convey the intensity of Conservation District (CD) activities. To capture this, I also collected maps showing the intensity of conservation

[9]Some of the scanned copies of the reports that I digitized from the NARA are available in the Appendix.

[10]Missouri experienced bureaucratic issues with the Farm Bureau, causing delays in compliance with CD formation (Howlader, 2023)

activity across counties. Figure 3 highlights the counties based on the intensity of CD activities within their boundaries.

My primary data sources, aside from the maps mentioned above, consist of the annual reports of Conservation Districts (CDs) deposited in the National Archives at College Park. The USDA mandated that all CDs submit annual reports, detailing significant progress in soil conservation. These reports not only highlight the progress made but also outline plans for future soil conservation activities. They are archived in the National Archives at UMD-College Park (RG 114). I gathered these reports for the Great Plains states and extracted essential information on referendum timing, CD formation, and detailed conservation activities.

Typically, the reports begin with a narrative description of the CD's formation. I collected information on CDs from eight Great Plains states: Montana, North Dakota, South Dakota, Nebraska, Kansas, New Mexico, Oklahoma, and Wyoming. This narrative includes institutional formation, voting details, supervisors' duties, farmers' perceptions, and relationships with the extension service and other institutions. Additionally, these reports shed light on the CDs' relationships with banking services and the USDA. Occasionally, the reports also describe incentives for various groups of farmers, such as Farmers' Day, Women's Day, and Black Farmers' Day. The CD reports then provide a comprehensive list of conservation activities undertaken by the CDs. Some reports include conservation planning for the upcoming years, spatial details in the form of maps, and information on budgets and expenditures. Table 2 presents a detailed list of activities conducted by CDs.

For consistency, I extracted information that was available across all CDs in my sample states. I incorporated data on all conservation activities, measured in acreage, across the CDs, as well as CD formation dates, referendum dates, and exact locations. CD boundaries mostly overlap with county boundaries. This overlap was not required by any federal- or state-level laws, but over the following decades, CDs have generally aligned with existing administrative boundaries. Some counties initially had more than one CD, but these were eventually consolidated into a single CD per county. In such cases, and to maintain consistency with my other explanatory variables, I use the first CD within the county border for empirical purposes.

Figure 5 and Figure 6 shows the summary statistics from these maps. Figure 4 displays the number of counties by their respective Conservation District (CD) formation year. Figure 5 displays the number of counties by their respective Conservation District (CD) completion status in 1951. The categories represent the percentage of conservation activities completed by the counties' CDs: 0-10%, 10-25%, 25-50%, and 50% or more. This provides an overview of how far along different counties were in their conservation efforts by 1951, highlighting variations in the intensity of CD activities across the nation.[11]

[11]Table 1 in the Appendix summarizes short-term and long-term conservation activities extracted from historical annual reports of Conservation Districts. Short-term activities primarily focus on immediate interventions such as crop rotations and brush control, while long-term activities involve structural improvements like irrigation systems, land leveling, and tree planting to promote sustainable land management.

4.2 Placement of Demonstration Plots

The USDA established demonstration plots across various states to help farmers understand the processes and benefits of soil conservation. These plots were designed to teach farmers about soil erosion and farmland conservation practices. However, narrative accounts suggest that the placement of these plots created some inequality, as not all farmers had access to technical assistance from them (Sampson, 1985). I obtained a historical map from the National Archives at College Park that shows the locations of these demonstration plots, which I digitized to create a distance variable for each county (Fig. 7).[12]

The demonstration plots were extensive, with an average size of around 25,000 acres. Since farmers often traveled to neighboring counties to observe these demonstrations, I classified counties within 100 miles of a demonstration plot as "near demonstration plot" counties for the regression analysis. To construct the instrumental variable for the conservation area, I digitized the demonstration plots for all ten states from the National Archives. During this period, the plots typically encompassed entire counties.

Figure 10 presents the density plot of the distance to the nearest demonstration plot. It shows that some farmers were located more than 100 miles away from a demonstration plot, indicating limited access. I later use this variation to explore the relationship between proximity to demonstration plots and access to conservation knowledge. The annual federal budget for technical and financial conservation support is sourced from Dimitri et al., 2005. State-level appropriations for the conservation budget were gathered from the annual reports of the National Association of Conservation Districts (source: Iowa State University Special Archives). County-level data on Agricultural Adjustment Act budget flows were sourced from Fishback, Kantor, and Wallis, 2003.

4.3 Climate Data: Exposure to Shock

Climate variables are sourced from PRISM (Daly, Taylor, and Gibson, 1997; Moscona and Sastry, 2023), a modeled climate dataset that includes information on precipitation, temperature, dew point, and more. Data specific to the core Dust Bowl area, including initial soil erosion information, are collected from Hornbeck, 2012.

The county-level climate data includes average precipitation and temperature from PRISM, while county latitude and longitude are determined using the coordinates of 1920 county centroids. Since crop-specific conservation activities are not available, this paper does not account for crop-specific climate sensitivity. Instead, the Palmer Drought Severity Index (PDSI) is used as a drought variable, which captures the non-linear effects of temperature and precipitation on crop yield and local revenue.

The PDSI is a standardized index that ranges from -10 (extreme drought) to +10 (extreme wet conditions). Monthly PDSI data is collected for the growing season, from April to October. High drought months are defined as those with a PDSI of -4 or lower, moderate drought from -2 to -4, normal conditions from -1.9 to 1.9, unusual moisture from 2 to 2.9, and moist conditions

[12]The original map from the archives is also included in the appendix.

from 3 to 10. This index provides a clear measure of climate extremes for each month, county, and year. Figure 12 visually illustrates the distribution of climate extremes across months, counties, and years based on this index.

Soil erosion data is sourced from Hornbeck (Hornbeck, 2012), which categorizes counties into medium, low, and high erosion areas based on the proportion of land affected in 1934. Due to the absence of erosion data for some counties with CD information, only counties with available erosion data are included in the analysis.

4.4 Data from the Agricultural and Population Census

The primary outcome variable of interest is the annual per-acre crop yield for counties within the Great Plains region, sourced from the Census of Agriculture. The National Agricultural Statistics Service provides annual county-level data on winter wheat and corn output, yields, harvesting, and planting. However, this database does not include other agricultural characteristics.

Explanatory variables related to farming characteristics are primarily sourced from the 1934 Census of Agriculture, the 1930 Census of Population, and county data books. These variables include the percentage of farms operated by tenant farmers, farm sizes, the total number of farms, the proportion of farmland, the proportion of cropland failure, the proportion of area under irrigation, and more. Population density data is also derived from the Census of Population. Table 2 in the Appendix lists the names and sources of all variables used in this paper.

Table 2 presents the means of the relevant variables across all census years. As shown, the Great Plains region has a very low percentage of black population in the sample. Over time, tenancy rates decrease, while farm sizes increase. Population density remains stable throughout. The distribution of Conservation Districts (CDs) across different soil erosion types is uneven, and crop failure exhibits significant spatial variation. On average, it takes 79 months to form a CD in the Great Plains.

County-level socioeconomic variables are obtained from various sources. A comprehensive set of county demographics, including population, race, age, literacy, and farm characteristics, is obtained from the ICPSR. Additionally, I analyze county-level total expenditure data from the New Deal era to explore the relationship between federal financial incentives and the establishment of new soil conservation districts. This data is sourced from Fishback (Fishback, 2017), providing insight into how federal financial support influenced the formation of local institutions.

5 Empirical Framework

5.1 Survival Model for Formation of CDs

I begin by analyzing the timing characteristics of CD formation using a survival model, which has been widely applied in land economics to examine the variation in event timings (Ando, 1999; Wrenn, Klaiber, and Newburn, 2017; Bulan, Mayer, and Somerville, 2009; Dawkins, Shen, and Sanchez, 2005). This study builds on existing literature by applying the duration framework to explore the formation of local farmland conservation institutions in the United States.

The primary event of interest is the formation of CDs. I use the duration from the initial 1937 policy enactment until the formation of CDs in each county as the key variable. For most counties, I record this duration in years, while for counties with more precise records, I capture the duration in months. This provides insights into the temporal variation of CD formation across counties.

Using this database, I examine economic, political, environmental, and demographic factors associated with the timing of CD formation. The distribution of formation times, displayed in histograms (Figures 5 and 6), shows substantial variation. To explore this further, I use non-parametric Kaplan-Meier estimates to describe the shape of the overall hazard function. While Kaplan-Meier estimates provide a descriptive understanding, they cannot account for the effects of covariates.[13]

To assess the likelihood of CD formation, I employ a hazard function, which approximates the probability of CD formation within a short interval, conditional on survival up to the start of that interval. This approach is crucial for making optimal investment decisions, such as initiating a CD to reduce soil erosion (Dixit and Pindyck, 1994). In each period t, landowners decide whether to form a CD. The length of time until CD formation, denoted by T, follows a cumulative distribution function:

$$F(t) = P(T \leq t); \quad t \geq 0$$

The survivor function, $S(t)$, is given by:

$$S(t) = 1 - F(t) = P(T > t)$$

This function represents the probability that CD formation will not occur before time t. The hazard function, $\lambda(t)$, represents the instantaneous rate of CD formation at time t, conditional on survival up to that time, and is defined as:

$$\lambda(t) = \frac{f(t)}{S(t)}$$

where $f(t)$ is the probability density function. The hazard rate captures the likelihood of CD formation within a given time interval, and we estimate this rate by modeling $f(t)$ and $S(t)$

[13] Kaplan-Meier estimates are shown in Figures 3 to 6 in the Appendix.

as functions of independent variables (X) and parameters (β). The log-likelihood function is given by:

$$L(\beta) = \prod_{i=1}^{n} f(t_i, X\beta)^{\lambda_i} \prod_{i=1}^{n} [(1 - S(t_i, X\beta))]^{1-\lambda_i}$$

To account for unobserved state-level characteristics that may influence CD formation, I use multilevel mixed-effect duration models (Austin, 2017). This approach assumes that counties within the same state share correlated random effects. I estimate a proportional hazard (PH) model, where covariates have a multiplicative effect on the hazard function. The mixed-effects Cox model incorporates state-level random effects, allowing for state-specific hazard variations:

$$h(t_{ji}) = h_0(t_{ji}) \exp(x_{ji}\beta + z_{ji})$$

where $h_0(t)$ is the baseline hazard function and z_{ji} represents the covariates for random effects.

I also apply parametric models, including the Weibull accelerated failure time (AFT) model and the proportional hazard model. The Weibull AFT model captures monotonic hazard functions, where $p < 1$ implies a decreasing hazard and $p > 1$ implies an increasing hazard. This model naturally incorporates knowledge effects in CD formation.[14] Additionally, I employ a multivariate mixed proportional hazard model to account for the timing of transitions and identify social effects while addressing correlated unobserved characteristics.

5.2 Contemporaneous Impact of the Local Institutions

To conduct the empirical analysis, ideally, we would randomly select some farms within the CDs and follow them over time to determine if access to CDs helps the treatment group manage natural resources under uncertain climatic conditions. However, this randomization is impractical. In the absence of such randomization, I attempt to approximate a random setting within the observational data as closely as possible.

To estimate the average impact of exposure to CDs on farm value, yield, and other economic outcomes, I use an event-study difference-in-difference framework. I leverage the temporal variation in CD formation and the spatial variation in erosion levels across counties. The baseline regression is:

$$\ln(Y_{i,t}) = \delta_i + \alpha_{s(i),t} + \beta \,\text{Time from CDs} + \psi \,\text{Erosion} + \gamma \,\text{Time from CD*Erosion} + \beta_2 \, X_{ct} + \epsilon_{ct}$$

where Y represents county-level outcome variables, including farm value, infant mortality, and crop yields such as cotton, corn, and wheat. The treatment variable is the duration from

[14] The Weibull distribution captures duration dependence, but I also use the non-parametric Cox proportional hazard model for flexibility, as it does not assume a specific baseline hazard.

CD formation to the survey year, which measures how long a county has had a CD. Erosion is a categorical variable capturing low, medium, and high erosion levels in each county, providing the spatial variation.

The coefficient γ represents the reduced-form estimate of exposure to CD conservation activities. The identification assumption is that highly eroded counties would have experienced similar trends in outcome variables as less-eroded counties in the absence of CDs. This assumption is partially grounded in previous literature. I aim to determine whether the impact of erosion is mitigated by access to CDs. The coefficients reflect differences in outcome variables between high-erosion and medium-erosion counties, relative to low-erosion counties. The relative impacts of CDs are identified by comparing more-eroded counties to less-eroded counties within the same state. Because CDs are established at different time period, we can utilize an event-study framework

$$\ln(Y_{it}) = \delta_i + \alpha_{s(i),t} + \sum_k \beta_k \cdot D_{kit} + \epsilon_{it}$$

where D_{kit} are event time dummies capturing time bins (e.g., 5-year leads/lags relative to CD adoption).

However, the timing of treatment may still be institutionally endogenous in theory. The identification strategy section discusses methods to address potential concerns related to causal identification and utilizes an instrumental variable approach as a robustness check.

5.3 Contemporaneous Impact of the Local Institutions on Climate Resilience

The objective of my baseline empirical analysis is to examine the long-term impact of exposure to local institutions on agricultural and economic outcomes. In this section, I investigate how the creation and expansion of local institutions shape climate resilience. I define climate resilience as the extent to which agricultural outcomes respond to county-level climate shocks, and how this relationship is mediated by the establishment of local institutions. I use the 1957 drought—the next major drought after the Dust Bowl—as a test case for this hypothesis.

Yield is a more direct outcome variable, but agricultural land price contains information on the present value of agricultural land in that county. I begin by estimating the effects of CDs on farmland value. To investigate the role of local institutions in mitigating climate damage, I estimate the following equation:

$$\begin{aligned}\ln(Y_{it}) = \delta_i + \alpha_{s(i),t} + \beta\,&\text{Climate shock} \\ &+ \psi\,\text{Existence of CDs} + \gamma\,\text{Climate Shock * Existence of CD} \\ &+ \beta_2\, X_{ct} + \epsilon_{ct}\end{aligned} \tag{1}$$

I change the outcome variables to agricultural yield, total land value, and other economic indicators in different specifications. Additionally, I use a continuous treatment variable from

the CD reports that captures the total area under conservation activities in any county. In the panel analysis, I employ a panel framework to analyze these effects over time.

5.4 Parallel Trend Assumption

Figure 12 presents a parallel trends graph showing average log farmland values over time by Conservation District (CD) treatment cohort. Each line represents counties grouped by the year they established a CD—1938, 1944, 1950, and 1953. The figure illustrates that, prior to CD formation, the outcome trends across different treatment cohorts move in a similar direction, suggesting that the parallel trends assumption holds reasonably well in the pre-treatment period. This provides visual support for the validity of the difference-in-differences framework used in the subsequent event study analysis.

To test the validity of the difference-in-differences (DID) strategy, I also use an event study design. Figure 13 presents the results from an event study estimating the dynamic effects of Conservation District (CD) establishment on farmland values. The horizontal axis displays time relative to treatment, with negative values (e.g., `lead_15_20`) indicating years before CD formation and positive values (e.g., `lag_5_10`) indicating years after. The vertical axis shows the estimated coefficients on log farmland value (`log_faval`), relative to the omitted baseline period. Each point represents a coefficient estimate, with vertical bars denoting 95% confidence intervals.

Prior to treatment, coefficients are generally small, though they exhibit a slight downward trend. This suggests mild deviations from the parallel trends assumption. After treatment, the coefficients rise sharply and remain significantly positive and indicates a strong and persistent increase in farmland value following the establishment of a CD. The effect becomes large and statistically significant within the first five years post-treatment and remains stable thereafter. These results suggest that local conservation institutions substantially improved land value, though I further explore robustness using alternative identification strategies to account for potential pre-treatment dynamics.

This is also presented in Table 5. Table 5 presents the results from an event study regression estimating the dynamic effects of Conservation District (CD) establishment on the log of farmland value. The specification includes county fixed effects and year fixed effects, with standard errors clustered at the county (FIPS) level. Coefficients on the lead indicators (years before treatment) capture pre-treatment trends, while coefficients on the lag indicators (years after treatment) estimate post-treatment effects relative to the baseline. The results show that farmland value was relatively flat 15–20 years before CD formation (coefficient of –0.016, not statistically significant), but declines modestly in the 10–15 and especially 5–10 years leading up to treatment. The coefficient becomes increasingly negative closer to treatment, with a significant drop of –0.342 in the 5–10 year lead window. After CD establishment, farmland value increases substantially. Within the first 5 years post-treatment, the effect is 0.396, and it grows to over 1.03 in the 10–25 years following CD formation. These effects are all statistically significant at the 1% level, indicating a large and sustained increase in land value over time.

5.5 Persistent Impact of Local Institutions

Next, I move on to examine the impact of CD exposure on the long-term, persistent effects on the local economy and conservation behavior. For this purpose, I regress current economic and conservation outcomes on the early timing, formation, and exposure to local institutions. Specifically, I rely on the detailed spatial variation in CD exposure across the Great Plains.[15]

However, this OLS regression is endogenous, as early exposure to CDs may be correlated with omitted variables such as risk aversion. To address this concern, I employ an identification strategy based on USDA policy related to the agricultural decision-making process. The USDA established demonstration plots to teach farmers conservation practices, and CD formation was notably higher in counties without these plots. This provides a source of plausibly exogenous variation, as the placement of demonstration plots was driven by factors related to the spatial distribution of federal site selection. To address the potential endogeneity of CD adoption, I use an Instrumental Variables (IV) approach. Specifically, I use the distance to the nearest demonstration plot as an instrument for the non-random timing of CD adoption. This section outlines the two-stage estimation strategy. In the first stage, I use the instrumental variable to predict the endogenous treatment variable (CD adoption).

The key identification assumption is that the distance to the nearest demonstration plot is not correlated with unobserved factors that influence outcomes, conditional on the covariates in Equation (1). While this assumption is not directly testable, I provide support for conditional exogeneity through covariate balance and placebo tests. These tests assess the correlation between the presence of a demonstration plot and pre-existing county socioeconomic characteristics and past economic outcomes. Once baseline controls are included, the distance to demonstration plots is not significantly correlated with past outcomes. Furthermore, demonstration plots may affect outcomes through land availability and farmers' ability to learn conservation practices, but I include state fixed effects to control for state-level variation, comparing counties within the same state.

Formally, let T_{it} represent the treatment indicator (CD adoption), and Z_{it} represent the instrumental variable (distance to the nearest demonstration plot). The first stage equation is:

$$T_{it} = \alpha + \beta Z_{it} + X'_{it}\gamma + u_{it} \tag{2}$$

In this equation, T_{it} is the endogenous treatment indicator, which reflects the timing of CD adoption, and Z_{it} is the instrumental variable, which is exogenous and correlated with T_{it} but not with the error term in the outcome equation. The term X_{it} represents a set of control variables, and u_{it} is the error term.

In the second stage, I use the predicted values of the treatment ($\hat{T}_{it}$) from the first stage in a standard DID framework to estimate the effect of CD adoption on the outcome Y_{it}. The second-stage equation is:

$$Y_{it} = \delta + \theta \hat{T}_{it} + \lambda_t + \mu_i + X'_{it}\psi + \epsilon_{it} \tag{3}$$

[15] For this part I only use Great Plains because for that part of the country I have detailed annual reports.

In this equation, Y_{it} is the outcome variable of interest (e.g., agricultural productivity or an economic outcome) for county i at time t. The term $\hat{T}_{it}$ represents the predicted treatment from the first-stage regression. Additionally, λ_t captures time fixed effects, while μ_i accounts for county fixed effects. X_{it} represents control variables, and ϵ_{it} is the error term.

This two-stage IV approach helps address the non-random timing of CD adoption, leveraging the exogenous variation provided by the instrumental variable to obtain consistent estimates of the treatment effect.

The identification primarily relies on detailed institutional knowledge and prior economic theory, which emphasize that local-level information dissemination is crucial for conservation adoption. The placement of demonstration plots was predetermined by the federal government, with each state receiving a maximum of two plots. Farmers were encouraged to visit these plots to learn about soil conservation. After 1945, federal funding for the plots ceased, leading to spatial variation in conservation uptake based on proximity to the demonstration plots. Therefore, I use the "distance to the nearest demonstration plot" as an exogenous spatial variable in my IV approach.

6 Results

6.1 Results from the Survival Model

My discussion of the results begins with descriptive analyses from the survival analysis. First, I present the frequency distribution of the time taken by a county to create a CD within its boundaries. The frequency distribution in Figure 5 shows that some counties were faster than others in forming a CD.

Figure 8 presents the results from Kaplan-Meier survival model. The survival analysis in this figure examines the timing of Conservation District (CD) formation across different U.S. regions. The Kaplan-Meier survival estimates highlight regional differences in the likelihood of CD formation over time, with some regions adopting more quickly than others. The Nelson-Aalen cumulative hazard estimates further reveal the risk of CD formation, with a high initial risk that decreases over time. Regionally, some areas experienced faster increases in risk, indicating earlier and more frequent district formation, while others had slower accumulations of hazard. Together, these results offer insights into how federal and state policies shaped their timing and distribution across the U.S. These figures suggest that CDs were created at an increasing rate, with the most recent CD in our sample taking 186 months to be established.

One limitation of the non-parametric Kaplan-Meier curves is that they cannot analyze the effects of covariates. To do so, I used regression models to estimate covariate-adjusted survival. The outcome variable is the duration measured by the number of years between government policy adoption in 1937 and the formation of a CD in the county. I used both a Cox proportional hazard model and a Weibull model to estimate the impact of covariates. The results are robust across models.

Table 3 summarizes the results from the Weibull model for Conservation District (CD)

formation, presented in Columns 1 and 2. The results indicate that counties with medium and high erosion levels are significantly more likely to form CDs, with hazard ratios of 1.86 and 1.49, respectively. This implies that greater environmental degradation is a strong motivator for collective conservation action. The distance to USDA demonstration plots is negatively associated with CD formation (hazard ratio: 0.995), highlighting that proximity to technical assistance is a crucial factor. Interestingly, the number of farms shows a minimal and statistically insignificant effect, whereas larger farm size is associated with a lower likelihood of CD formation. The percentage of tenant farmers shows a consistent positive impact on CD formation, which may reflect a stronger need or motivation for conservation efforts among tenant-operated farms. Other variables, such as crop intensity for cotton, wheat, and corn, did not show a statistically significant relationship with CD formation, suggesting that these factors are less influential in determining the timing of CD establishment.

The Cox proportional hazard model results, presented in Columns 3 and 4, are similar to the findings from the Weibull model. Both medium and high erosion levels are positively associated with CD formation, with hazard ratios of 1.49 and 1.33, respectively. The negative association between the distance to USDA demonstration plots and CD formation remains significant (hazard ratio: 0.997), suggesting that proximity to technical support is a consistent and critical factor for successful CD establishment. Similar to the Weibull model, variables such as the number of farms, farm size, and crop intensity for cotton, wheat, and corn do not show significant effects. In the Cox model with shared frailty, presented in Columns 5 and 6, high erosion areas are even more likely to form CDs, with a hazard ratio of 1.96. The inclusion of state-level shared frailty accounts for potential unobserved heterogeneity; however, the likelihood ratio test for $\theta = 0$ suggests weak evidence of heterogeneity across states. Overall, these results emphasize that erosion levels and proximity to USDA demonstration plots are crucial determinants of CD formation, while other farm-level characteristics play a less significant role.

Overall, erosion levels and proximity to USDA demonstration plots are the most critical factors determining the likelihood of CD formation. Medium and high erosion areas consistently show a higher probability of CD formation, while proximity to technical assistance remains crucial for success. I use these variations in a difference-in-differences framework to understand the effects of CDs on economic and environmental development.

6.2 Results from the Difference-in-difference Model

Figure 11 illustrates the average logged farm values over time for counties categorized by high, medium, and low erosion levels. Initially, farm values were relatively similar across all categories, but notable differences emerged after 1940. Counties with low erosion consistently maintained higher farm values compared to those with medium and high erosion throughout the observed period. While farm values increased across all erosion levels after 1940, counties with lower erosion experienced consistently higher average values, underscoring persistent disparities over time.

Table 5 presents the results from a basic Difference-in-Differences (DID) analysis. Dummy variables and interaction terms were created to evaluate the impact of the intervention (*Post CD*) across areas with varying erosion levels. Following Hornbeck (2012), dummy variables were constructed for high, medium, and low erosion categories, assigning a value of 1 to regions where erosion levels exceeded 0.7, and 0 otherwise. Interaction terms combined the intervention variable (*Post CD*) with the erosion categories to capture how the intervention's effects varied by erosion severity. The interaction between the intervention and erosion intensity measures the differential impact of the intervention in medium and low erosion areas compared to the baseline of high erosion areas.

The regression results indicate that the Conservation District (CD) intervention had a significant positive effect on farm values. In Model 1, the coefficient of *0.932* suggests that the intervention increased farm values by approximately *93.2%*, with statistical significance. In Model 2, which controls for additional factors such as average farm size, irrigation, and tenant percentages, the impact slightly decreases to *85.1%* but remains significant. These findings highlight the robust positive influence of the intervention on farm values.

For the DID estimates, the interaction term (*Post CD*Erosion Intensity*) presents the differentiated effects across erosion intensity after the introduction of CD in the county. The interaction term for medium erosion areas does not yield statistically significant results in either model, suggesting that the intervention had no measurable impact on farm values in these areas. However, the results for low erosion areas are both significant and positive. In Model 1, the coefficient of *0.058* implies a *5.8%* increase in farm values in low erosion areas following the intervention. This effect strengthens in Model 2, rising to *8.7%* with the inclusion of additional controls. Overall, these findings demonstrate that low and medium erosion areas experienced greater increases in farm values after the adoption of conservation districts compared to high erosion areas.

Table 6 presents the results of a Difference-in-Differences (DID) analysis that estimates the impact of the intervention on farm values across different time periods. Separate models were estimated for time periods prior to 1950, 1960, 1970, and 1980 to capture changes over time. For medium erosion areas, the interaction term indicates a positive and statistically significant effect on farm values before 1950, with an estimated increase of *6.6%*. This effect diminishes slightly to *5.6%* before 1960 and becomes statistically insignificant in later decades, suggesting a tapering impact over time. In contrast, for low erosion areas, the effect is initially insignificant before 1950, indicating no measurable impact during this period. However, the effect becomes both positive and significant by 1960, with farm values increasing by *20.5%*. Although the effect remains statistically significant in subsequent decades, its magnitude decreases, showing smaller but still positive impacts on farm values before 1970 and 1980. Overall, these findings suggest that the intervention had a more substantial and sustained positive impact on farm values in low erosion areas, while the benefits in medium erosion areas were more modest and short-lived.

Table 7 presents the regression results, illustrating the impact of the intervention (*Post CD*) on farm values over time, disaggregated by erosion level and years since the intervention. The

analysis captures the cumulative effects of the Conservation District (CD) intervention over specified time intervals. Variables such as *Post CD*Medium*5years*, *Post CD*Medium*5to10years*, and so on represent the effects of the intervention in medium erosion areas for time intervals within 5 years, 5 to 10 years, and beyond. Similarly, variables like *Post CD*Low*5years* and *Post CD*Low*5to10years* measure the corresponding effects in low erosion areas.

The results indicate a significant and progressively increasing positive impact of the intervention over time in both medium and low erosion areas, relative to high erosion areas. In medium erosion areas, the effect begins with a coefficient of *0.296* within the first 5 years, increases to *0.769* after 5 to 10 years, and reaches *1.328* for periods exceeding 20 years. A similar trend is observed in low erosion areas, where the initial coefficient is *0.474* within the first 5 years, rises to *0.908* after 5 to 10 years, and peaks at *1.264* for periods beyond 20 years.

Table 8 presents the results of a Difference-in-Differences (DID) regression analysis examining the impact of CD formation and erosion levels across different U.S. regions. The results indicate region-specific variations in the magnitude of the intervention's impact. The Great Plains and Midwest exhibit significant positive effects, with coefficients of *0.625* and *0.819*, respectively, while the Northeast shows the smallest significant effect, at *0.213*, reflecting a comparatively weaker relationship in that region. The coefficients for the DID interactions also vary by region and erosion level. In the Great Plains, medium erosion areas demonstrate a significant positive effect of *0.290*, while low erosion areas show an even slightly higher effect at *0.313*, indicating that these regions benefit more from CD formation compared to high erosion areas. Overall, the findings suggest that post-CD formation generally has a positive impact on farm values across all regions. However, the extent of this effect is influenced by both erosion levels and regional differences, with the strongest impacts observed in the Midwest and Great Plains.

The results thus far have primarily focused on farmland value, but it is also crucial to consider crop yields. Crop yields are particularly significant in the conservation literature, especially within the context of agroecology, which seeks to understand the interplay between conservation and production functions. Three major crops across the United States are analyzed: corn, cotton, and wheat. Cotton production is primarily concentrated in the South, wheat in the Great Plains, and corn in the Great Plains and Midwestern states. Table 9 presents the results of a Difference-in-Differences (DID) regression analysis examining the impact of Conservation District (CD) formation on the production of these crops. The estimates for medium erosion areas indicate a significant positive effect on corn production, with a coefficient of *1.779*, but no significant effects for cotton or wheat. This suggests that corn production increases in medium erosion areas following CD formation. In low erosion areas, the coefficients are significantly positive for both cotton (*21.519*) and corn (*1.137*), indicating substantial increases in cotton production and smaller, yet notable, increases in corn production post-CD formation. However, no significant effects are observed for wheat in either medium or low erosion areas. These findings underscore the varying impact of CD formation on crop production, with low erosion areas experiencing particularly large positive effects on cotton production in the Southern and Great Plains states.

6.3 Heterogeneous Treatment Effects

Table 10 presents the results of a Triple Difference-in-Differences (Triple DID) analysis, which explores the heterogeneous treatment effects (HTE) of Conservation District (CD) formation (*Post CD*) across different erosion levels (medium and low) and interacting characteristics: average farm size, distance to demonstration plots, proximity to the 100th meridian, and irrigation. High erosion counties serve as the reference category.

The results for average farm size indicate that the impact of CD formation increases in medium and low erosion areas relative to high erosion areas. The positive and significant coefficients for the interactions (*Post CD#Medium Erosion#Average Farm Size* and *Post CD#Low Erosion#Average Farm Size*, both *0.0001*) suggest that larger farms in these areas experience slightly greater benefits from the intervention. This finding underscores the role of farm size in moderating the effects of conservation policies.

For distance to demonstration plots, the results reveal that proximity plays a critical role in determining the effectiveness of CD formation. Overall, greater distance from demonstration plots reduces the effectiveness of the intervention, as indicated by the negative coefficient for *Post CD#Distance to Demonstration Plot* (*-0.0021*). However, the interaction terms for medium and low erosion areas show positive and significant coefficients (*0.0023* and *0.0029*). These findings suggest that closer proximity to demonstration plots enhances the positive impact of CD formation, particularly in low erosion areas, where the effect is strongest.

Proximity to the 100th meridian also influences the effectiveness of CD formation, albeit negatively. The coefficients for the interaction terms (*Post CD#Medium Erosion#100th Meridian* and *Post CD#Low Erosion#100th Meridian*) are both negative and significant (*-0.2406* and *-0.2460*). These results indicate that areas closer to the meridian experience a weaker positive impact from CD formation, highlighting significant geographic variation in the intervention's effectiveness.

Finally, the results for irrigation show no significant variation in the impact of CD formation across erosion levels. While the coefficients for the interaction terms (*Post CD#Medium Erosion#Irrigation* and *Post CD#Low Erosion#Irrigation*) are positive (*1.2371* and *1.5041*, respectively), they are not statistically significant. This suggests that irrigation status does not meaningfully alter the effects of CD formation in these areas.

In summary, the analysis highlights important heterogeneities in the impact of CD formation. Larger farms and proximity to demonstration plots enhance the intervention's effectiveness, particularly in medium and low erosion areas. Conversely, proximity to the 100th meridian reduces the benefits of CD formation in these areas, while irrigation status appears to have no significant influence.

6.4 Effects of USDA Technical and Financial Assistance Budgets

Table 11 presents the results of a Difference-in-Differences (DID) regression analysis that evaluates the impact of Conservation District (CD) formation (*Post CD*) on farm outcomes while accounting for variations in USDA budget categories for Technical Assistance (TA) and

Financial Assistance (FA). The model examines how differing levels of TA and FA budgets moderate the effectiveness of CD formation. The interaction terms in this DID analysis reveal that this positive effect is heavily influenced by variations in TA and FA budgets. High, medium, and low levels of USDA technical and financial assistance are defined based on thresholds at the 33rd and 66th percentiles of their respective distributions.

For TA budgets, the interaction term *Post CD#TA Low Budget* (*-1.183*) suggests that low levels of TA funding significantly reduce the positive effects of CD formation. Similarly, medium TA budgets also diminish the intervention's impact, though the reduction is less severe compared to low TA levels. These findings underscore the critical role of adequate TA funding in ensuring the effectiveness of conservation policies.

A similar pattern is observed for FA budgets. The interaction term for low FA funding (*Post CD#FA Low Budget*) has a significant negative coefficient of *-0.398*, indicating that insufficient financial assistance weakens the impact of CD formation. Medium FA budgets also reduce the effectiveness of the intervention, though the magnitude of the reduction is slightly smaller. These results highlight the importance of sufficient financial resources in maximizing the benefits of conservation programs.

Overall, the analysis highlights that while CD formation generally has a positive impact, the level of TA and FA budgets plays a crucial moderating role. Low or medium funding levels for TA and FA significantly undermine the intervention's effectiveness, emphasizing the need for sufficient investments in both technical and financial assistance to achieve the full potential of conservation efforts.

6.5 Drought Resilience: Evidence from 1957

Table 12 presents the results of a regression analysis exploring the interaction between CD and drought exposure levels on an outcome of interest. The model evaluates how the presence of a CD (*Post CD = 1*) modifies the relationship between varying levels of drought exposure and the outcome, using interaction terms to capture these effects.

The coefficient for *Post CD = 1* (*0.558*) indicates that, on average, the presence of a CD significantly improves the outcome variable, regardless of drought exposure. This result underscores the overall positive impact of CD formation on resilience or productivity, highlighting its effectiveness in fostering better outcomes in agricultural or environmental contexts.

The interaction terms for *Post CD = 0 × Drought Exposure* represent the baseline effects of drought exposure in areas without CD formation. The results show varying impacts depending on the severity of drought exposure. For mild drought exposure (*Drought Exposure = 1*), there is no measurable effect (*0.000*). However, for moderate exposure levels (*Drought Exposure = 2 and 3*), the coefficients are small but significant. At higher levels of exposure, the effects become more pronounced, with significant positive coefficients for *Drought Exposure = 5 and 6* (*0.095*, $p < 0.01$, and *0.236*, $p < 0.01$, respectively). These results suggest that, in the absence of CDs, drought exposure has varied impacts, with higher levels of exposure potentially prompting adaptive responses or mitigation efforts.

The interaction terms for *Post CD* = 1 × *Drought Exposure* capture the combined effects of CD formation and drought exposure. All coefficients for these terms are positive and highly significant, indicating that CD formation consistently enhances resilience to drought across all exposure levels. For mild drought exposure (*Drought Exposure* = *1*), the coefficient is *0.372* ($p < 0.01$), showing a strong buffering effect. At higher exposure levels (*Drought Exposure* = *2 to 6*), the coefficients remain large and significant, peaking at *0.488* for *Drought Exposure* = *3* before tapering slightly at the highest exposure levels. These results emphasize the critical role of CDs in mitigating the negative impacts of drought, providing consistent and substantial benefits regardless of the severity of drought exposure.

In summary, the findings highlight the significant benefits of CDs in enhancing resilience to drought. In areas with CDs, the positive interaction terms demonstrate that CDs consistently improve outcomes across all levels of drought exposure. These results underscore the importance of CDs as a policy tool for mitigating the impacts of climate stressors such as drought, potentially through improved water management and conservation practices.

6.6 Long-term persistent effects

Next, I study how adoption and exposure of CDs may influence long-term persistent effects at county level where my outcome variables are later farm value and conservation adoption. Table 13 presents the results of the IV regression analysis for the Great Plains. I used annual reports from the Great Plains states to create a *acreage under CD* variable. So, unlike the binary CD adoption dummy used in the DID analysis, this IV approach employs a continuous treatment variable: the total acreage under CD in a county in a given year. The analysis consists of two stages. The first stage examines the relationship between the log of CD acreage (*Log*(*CD Acres*)) and the log of the distance to the nearest demonstration plot (*Log*(*Distance to Nearest Demonstration Plot*)). The second stage investigates the impact of *Log*(*CD Acres*) on *Log*(*Farm Value*).

In the first stage (column 1), the coefficient for *Log*(*Distance to Nearest Demonstration Plot*) is negative and statistically significant at the 10% level (*-0.0188*). This indicates that counties farther from demonstration plots are less likely to adopt conservation measures, suggesting that proximity encourages participation in CD programs. The interaction terms for *Log*(*CD Acres*) with medium and low erosion areas are both positive and highly significant (*0.249*, $p < 0.01$, and *0.178*, $p < 0.01$, respectively) and indicates that erosion levels influence CD adoption. In the second stage (column 2), the coefficient for *Log*(*CD Acres*) interacted with erosion levels remains significant. For medium erosion, the coefficient is *0.357* ($p < 0.10$), and for low erosion, it is *0.204* (not significant). These results suggest that the positive relationship between CD acreage and farm value is stronger in medium erosion areas, while the effect is smaller in low erosion areas.

Table 14 extends the IV analysis to the entire United States. Due to the lack of data on CD acreage nationwide, this analysis uses a binary CD adoption dummy (*Post CD*) as the treatment indicator, instrumented by the distance to the nearest demonstration plot (*Distance*

to Demonstration Plots). In the first stage, the instrument (*Distance to Demonstration Plots*) has a significant negative coefficient (*-0.0009234*, $p < 0.01$). This indicates that greater distances from demonstration plots are associated with lower probabilities of adopting CDs. Interaction terms for medium and low erosion show strong positive associations with *Post CD* (*0.94096* and *0.87254*) and suggests that erosion levels play a significant role in CD adoption. Diagnostic tests confirm the strength of the instrument, with an F-statistic for excluded instruments of *117.54*, exceeding the Stock-Yogo critical value (*16.38*) for 10% maximal IV size. The Kleibergen-Paap LM statistic (*115.75*) rejects the null hypothesis of underidentification.

In the second stage, interaction terms for medium and low erosion areas with *Post CD* are positively and significantly associated with *Log*(*Farm Value*). These findings indicate that CD adoption improves farm value, particularly in areas with medium and low erosion. The Durbin test rejects the null hypothesis of no endogeneity.

The results from both tables demonstrate the robustness of the IV approach in addressing selection bias and omitted variable bias. Proximity to demonstration plots strongly influences CD adoption, and erosion levels moderate the impact of CDs on farm value. The IV diagnostics, including the Cragg-Donald Wald F-statistic (*406.36*) and the Stock-Yogo critical value, confirm the validity and relevance of the instrument. Overall, these findings validate the DID estimates and provide additional support for the argument that CDs improve farm value.

7 Potential Social and Political Adjustment

While the primary focus of this study is on economic variables and outcomes, local institutions and collective action also hold potential to foster social capital and influence political outcomes. Table 14 presents the results of instrumental variable (IV) regressions analyzing the impact of time since Conservation District (CD) treatment (*period_1990*, *period_1997*, and *period_2005*) on social capital and voter turnout across various years. Columns (1)–(3) report the effects on social capital indices for 1990, 1997, and 2005 (*ski90pcm*, *SKI97pcm*, *SKI05PCM*), while Columns (4)–(7) analyze voter turnout for the presidential elections of 1988, 1992, 1996, and 2004 (*pvote88*, *pvote92*, *pvote96*, *pvote04*).

The social capital index for 1990 (*ski90pcm*) was constructed using principal components analysis (PCA) from variables reflecting social and civic engagement in counties (Rupasingha, Goetz, and Freshwater, 2006). These include the total number of associations (*assn90*) per 10,000 people, the number of not-for-profit organizations (*nccn90*) per 10,000 people, the Census mail response rate for 1990 (*respn90*), and the percentage of the population voting in the 1988 presidential election (*pvote88*).

In Columns (1)–(3), the coefficients for *period_1990*, *period_1997*, and *period_2005* are positive and statistically significant. For instance, in Column (1), the coefficient for *period_1990* is 0.002, indicating that each additional year since treatment is associated with a 0.002 unit increase in the 1990 social capital index. In Column (2), the coefficient for *period_1997* is 0.001, and in Column (3), the coefficient for *period_2005* is 0.003, reflecting growth in social capital over time.

Columns (4)–(7) examine the relationship between time since CD treatment and voter turnout in the presidential elections of 1988, 1992, 1996, and 2004. The coefficients for *period_1990*, *period_1997*, and *period_2005* suggest varying impacts over time and across elections. Significant effects are observed in the 1988 and 1996 elections. For example, in Column (4), the coefficient for *period_1990* is *0.013* ($p < 0.01$), indicating a positive relationship between time since treatment and voter turnout in 1988. In Column (6), the coefficient for *period_1997* is *0.015* ($p < 0.01$), showing a similar relationship for the 1996 election. However, no significant effects are observed for the 1992 or 2004 elections, and the constant in Column (7) suggests a low baseline turnout level for 2004.

Overall, the results indicate that time since CD treatment positively influences social capital, with effects growing stronger in later years. This suggests that conservation programs like CDs can foster long-term improvements in social cohesion and civic engagement. However, the relationship between time since treatment and voter turnout is less consistent, with significant effects observed only in certain elections.

8 Impacts on Infant Mortality

Table 16 presents the results of a Difference-in-Differences (DID) regression analysis examining the impact of Conservation Districts (CDs) on infant mortality rates. The analysis considers mortality outcomes both by residence and by occurrence. Columns (1) and (2) report the overall effects of CD implementation, while Columns (3) and (4) disaggregate these effects across treatment periods. The results reveal substantial reductions in infant mortality rates over time, with the effects intensifying as the duration since treatment increases.

The overall effects of CD implementation are captured by the variable *Post CD*, which measures changes in mortality rates after CD adoption. For residence-based mortality, *Post CD* is associated with a significant reduction of 6.398 deaths per 1,000 births. For occurrence-based mortality, the reduction is even more pronounced, at 13.297 deaths per 1,000 births. These findings suggest that CDs have a substantial and meaningful impact on public health, reducing infant mortality across both residence- and occurrence-based measures.

When analyzing the effects by treatment periods, the results indicate a clear progression, with the benefits of CD implementation becoming more significant over time. In the first five years post-CD adoption, the reduction in residence-based mortality is small and not statistically significant (*-0.832*), while the reduction in occurrence-based mortality is larger but still modest (*-3.282*). Between 5 and 10 years post-treatment, the reductions increase slightly for both residence- and occurrence-based measures (*-1.265* and *-1.463*, respectively), but these effects remain statistically insignificant.

Stronger and highly significant reductions emerge after 10 years. Between 10 and 15 years post-treatment, residence-based mortality decreases by *-4.016*, and occurrence-based mortality declines by *-6.339*. These reductions continue to grow in the 15-to-20-year period, with coefficients of *-6.442* for residence-based mortality and *-9.590* for occurrence-based mortality. The largest effects are observed 20 or more years post-treatment, where residence-based

mortality decreases by *-14.138* and occurrence-based mortality by *-17.227*. These findings highlight the long-term benefits of CD implementation, with more significant public health impacts emerging as time passes.

The interaction terms between *Post CD* and medium or low erosion levels do not yield statistically significant results, suggesting that the severity of erosion does not systematically affect the relationship between CD implementation and infant mortality rates. This implies that the observed reductions in mortality rates are consistent across different levels of erosion severity. Overall, the findings underscore the significant and growing benefits of CDs in improving public health outcomes, particularly in reducing infant mortality rates.

9 Conclusion and Policy Discussion

Given the limited budgets and constrained technical support typically available from central governments, understanding and capitalizing on the conditions under which local institutions emerge and succeed at the local level is essential for effective economic and environmental policymaking.

Local institutions play a significant role in coordinating natural resource management and aiding communities in mitigating the uncertain effects of environmental shocks. This paper uses Conservation Districts (CDs) in the United States as a case study to understand how federal policies, ecological heterogeneity, climate shocks, and agrarian structures shape the formation and effectiveness of local institutions. These findings offer broader insights into the potential of local institutions to address complex environmental and economic challenges.

The analysis reveals that local institutions, such as CDs, significantly impact economic, environmental, and social outcomes. Survival analysis highlights that erosion levels and access to technical support are critical determinants of institutional formation, with areas experiencing higher environmental risks being more likely to adopt collective conservation efforts. DID models show that local institutions enhance economic outcomes, such as farm values and crop yields, particularly in regions with lower initial resource constraints. HTE analyses further reveal that proximity to federal support, farm size, and tenancy structures amplify institutional effectiveness, while geographic constraints, such as proximity to the 100th meridian, reduce their impact. These findings emphasize the need for tailored policy designs that account for regional variations and initial disparities in resource access.

The study also underscores the importance of federal incentives in supporting sustainable local institutions. Fluctuations in technical and financial assistance budgets reduce institutional effectiveness, highlighting the need for stable funding to ensure long-term benefits. Beyond economic outcomes, local institutions can foster social capital through increased civic engagement, though their influence on political outcomes, such as voter turnout, is less consistent. Additionally, local institutions demonstrate long-term public health benefits, including significant reductions in infant mortality rates, particularly in the decades following implementation.

The results in this paper align well with Riker's seminal work and federalism theory in public finance (Riker, 1964; Conlan, 1998). My findings highlight the role of federal technical

and financial support in shaping the formation and effectiveness of CDs, illustrating how these incentives act as catalysts for local institutional development. This mirrors Riker's view of federalism as a bargaining system, where local institutions align their goals with federal objectives when adequately incentivized. Riker's theory also emphasizes the importance of stable federal-local relationships for effective governance. This study's conclusion about the need for consistent federal funding to maintain the effectiveness of CDs supports this principle. Fluctuating budgets undermine institutional stability, highlighting the critical importance of thoughtfully evaluating how the federal government interacts with and designs mechanisms to support local institutions.

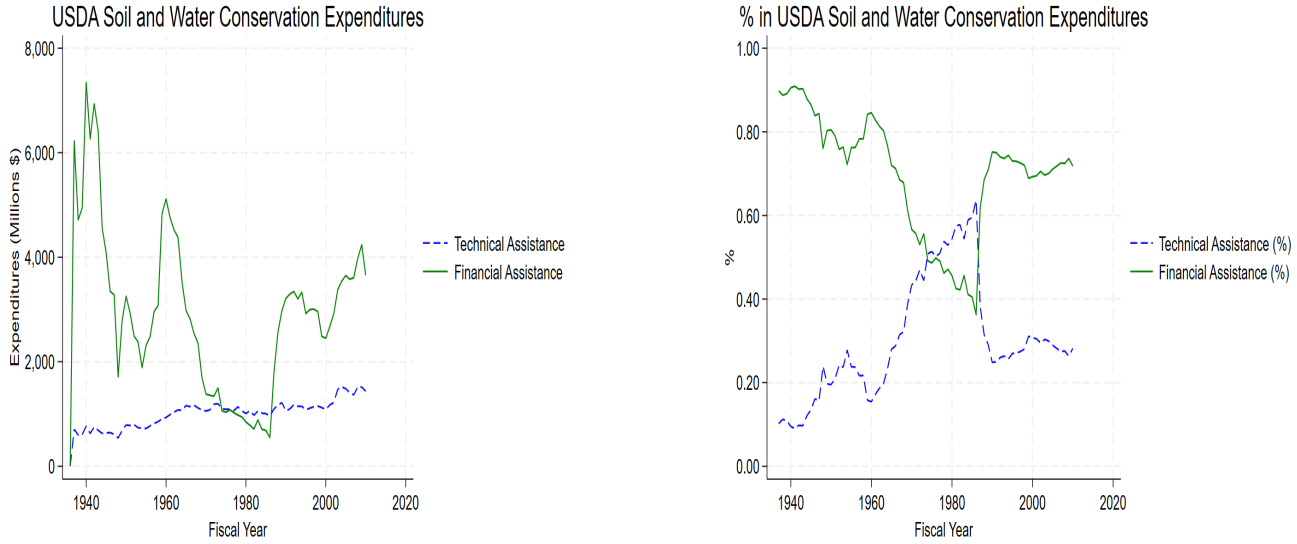
Conservation Districts (CDs) still play a pivotal role in implementing federal conservation programs such as the Environmental Quality Incentives Program (EQIP) and the Conservation Reserve Program (CRP). They assist in outreach, technical support, and the execution of conservation practices, ensuring that landowners effectively address natural resource concerns. Under the 2018 Farm Bill, CDs have facilitated the introduction of conservation incentive contracts with terms ranging from 5 to 10 years, targeting priority resource issues. Additionally, CDs support CRP by helping landowners identify eligible lands, navigate application processes, and implement practices like wetland restoration and cover crop planting. Despite their critical contributions, CDs face challenges such as limited resources, staffing constraints, and the need to adapt to evolving federal policies. Addressing these issues through increased funding, enhanced training, and improved collaboration with federal agencies can bolster their capacity to meet conservation goals and sustain their role as a bridge between federal programs and local landowners and may foster long-term environmental and economic resilience.

The findings of this paper provide several lessons for designing local institutions in both developed and developing countries. Spatial heterogeneity and existing social structures must be considered when creating top-down incentive systems. Demonstration plots and other knowledge-sharing mechanisms can effectively bridge technical gaps and encourage collective action. However, attention must also be given to the distributional consequences of institutional interventions, as variations in agrarian structures and resource access can lead to unequal outcomes.

While this study focuses on Conservation Districts, it provides a framework for understanding how local institutions function more broadly. The findings reveal the importance of aligning institutional incentives with local needs and capacities. Future research should address limitations, such as the lack of micro-level data, to better understand income distribution and potential inequalities in institutional benefits. Local institutions remain essential in bridging federal initiatives and community needs, making them a critical tool for addressing environmental and economic challenges across diverse settings.

10 Maps & Figures

Figure (1) USDA Soil and Water Conservation Expenditures: Real Values vs. Percentage

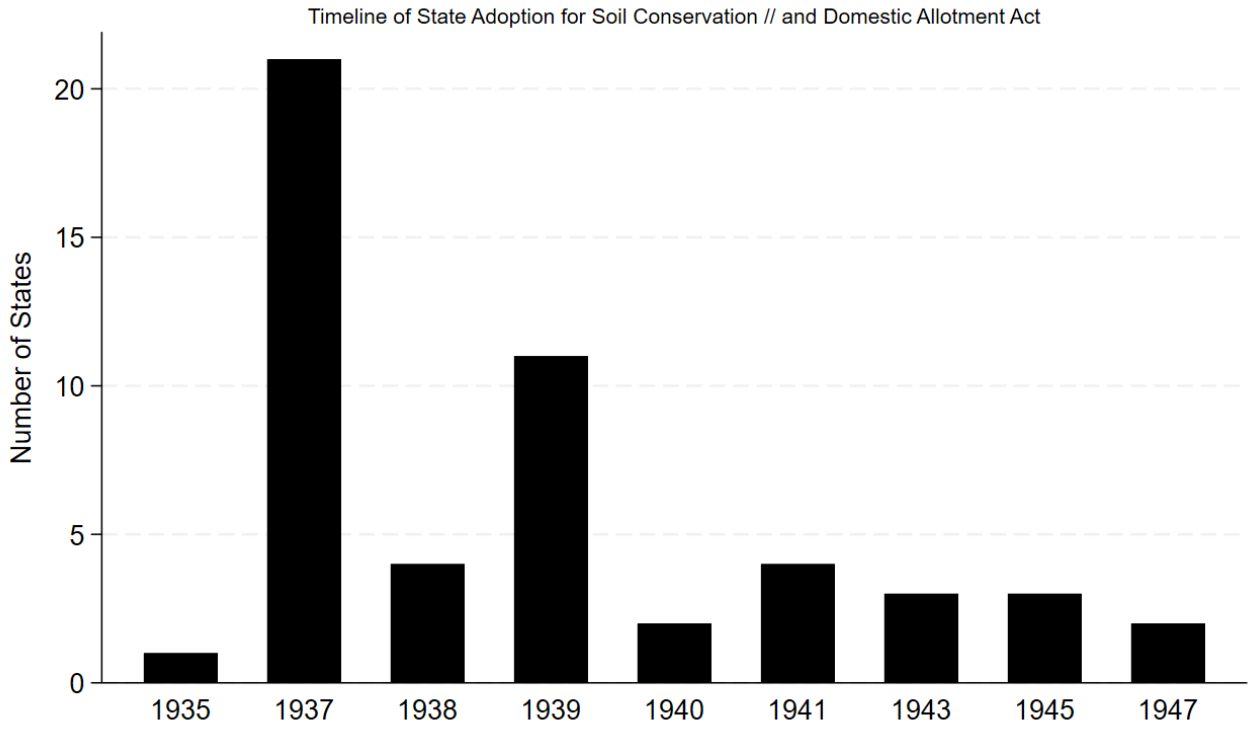


(a) Real Value Expenditures

(b) Percentage Expenditures

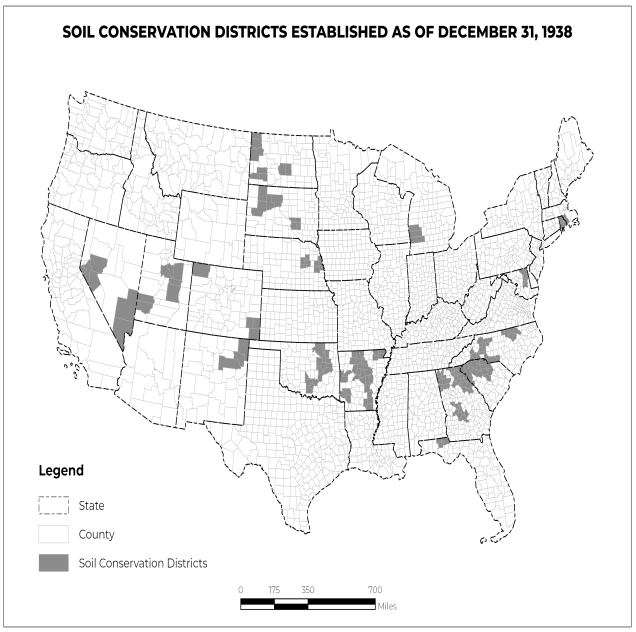
Note: This data is from Pavelis, Helms, and Stalcup, 2011. I use annual USDA data on soil conservation, which includes both technical and financial assistance, adjusted to 2009 dollar values. The budget data is reported in millions of dollars. The graph illustrates the annual variation in federal assistance, with technical assistance primarily directed to conservation districts. Panel (a) displays the real value of expenditures, while Panel (b) shows the percentage of expenditures allocated to technical and financial assistance.

Figure (2) State Law Adoption Date

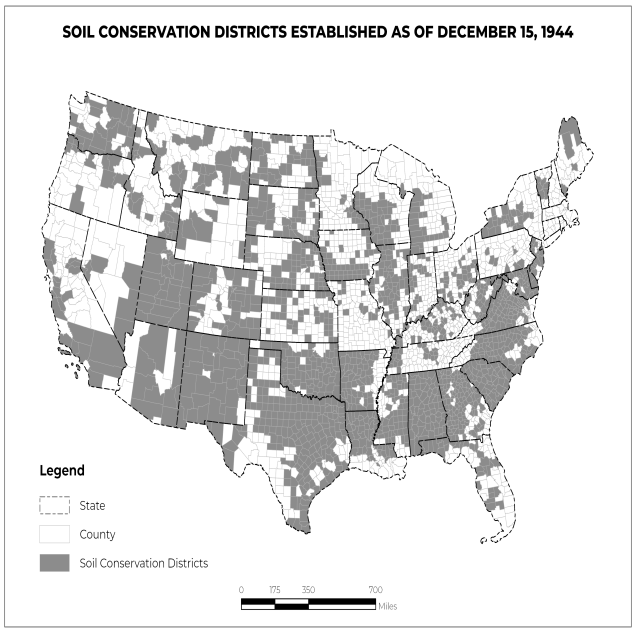


Note: The graph illustrates the timeline of state-level adoption of the Soil Conservation and Domestic Allotment Act, highlighting the years when each state implemented the policy between 1935 and 1948. Most states adopted the act by 1940, with a few later adopters extending into the 1940s. The corresponding data is presented in Table 1.

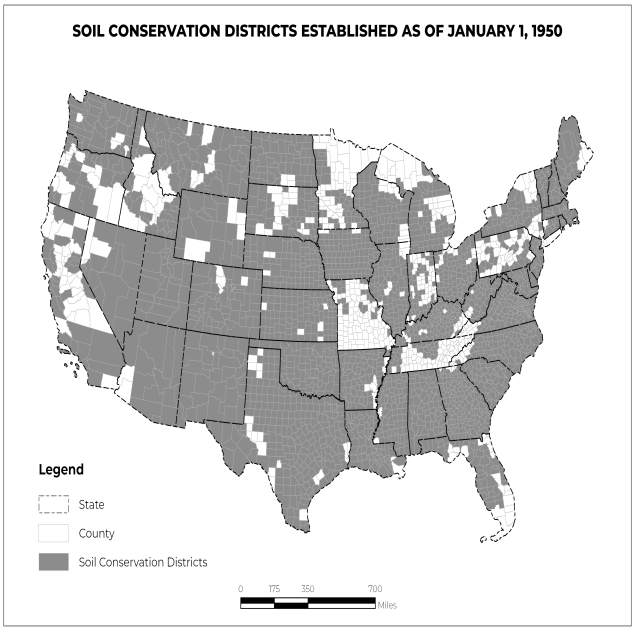
Figure (3) Expansion of Conservation Districts across the USA



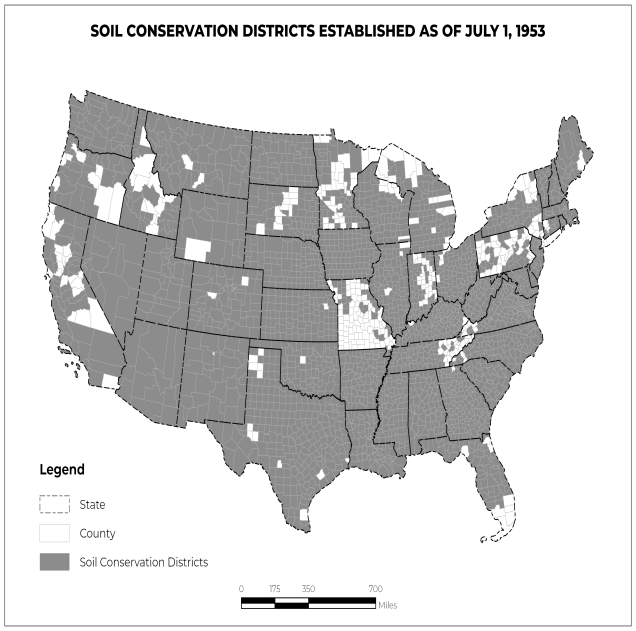
(a) CDs until 1938



(b) CDs until 1944



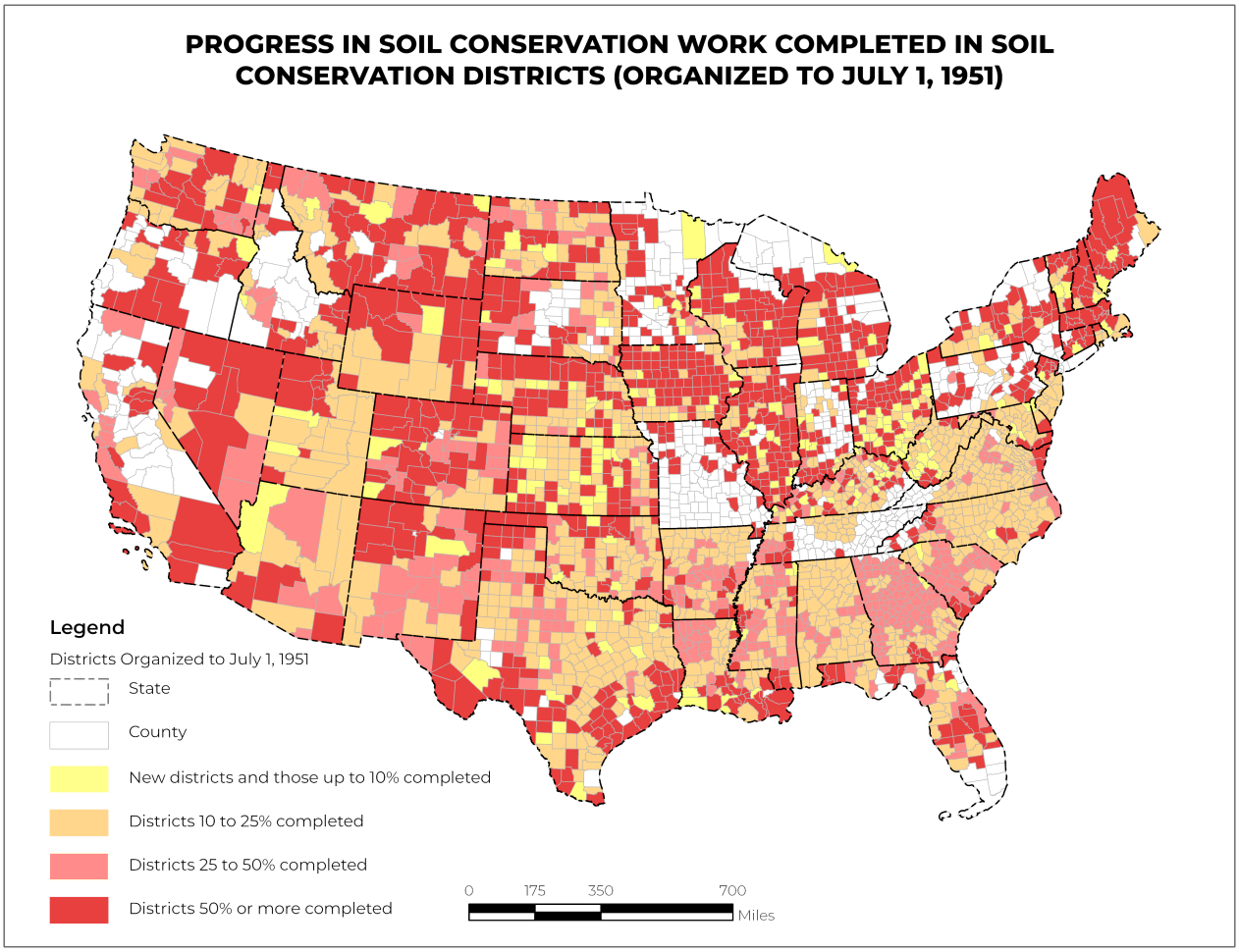
(c) CDs until 1950



(d) CDs until 1953

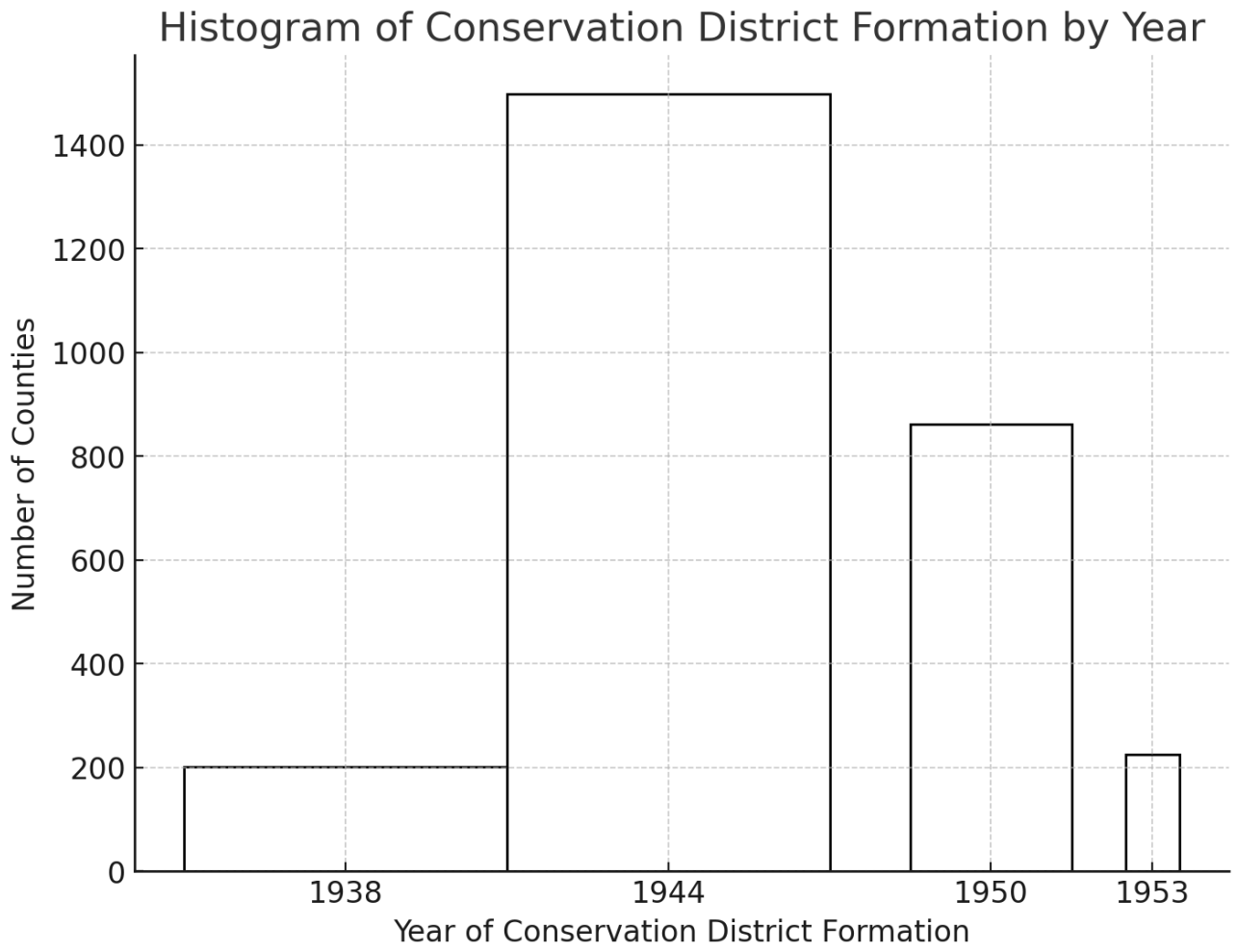
Note: I collected these series of maps from the National Archives at College Park, and digitized with ArcGIS to create a county-level formation year database. The maps show the location of counties with the existence of any CD in the boundary. However, this does not represent the intensity of the CD conservation work. See Figure 4.

Figure (4) Intensity of any CD activities



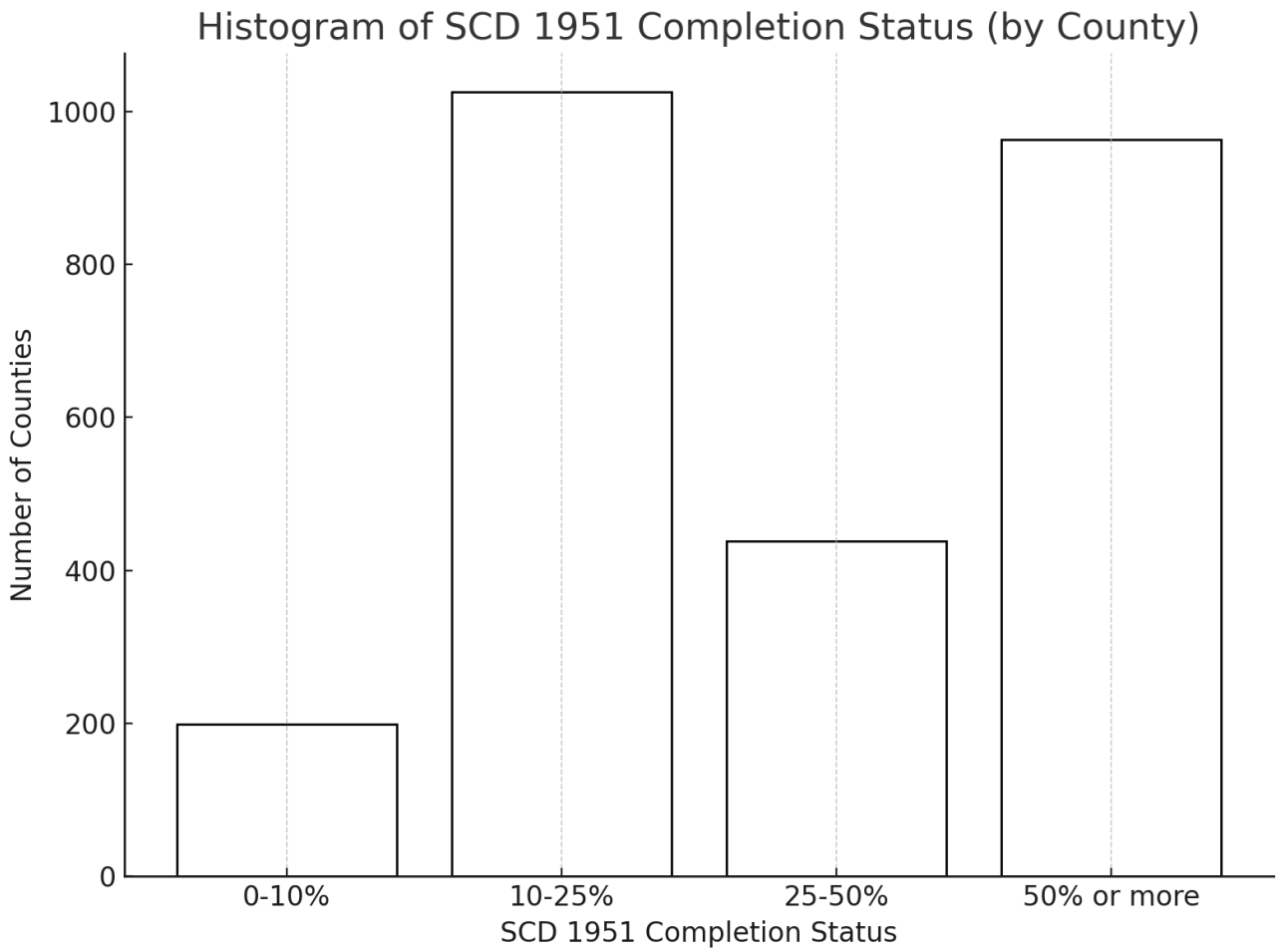
Note: I collected this map from the National Archives at College Park, and digitized with ArcGIS to create a county-level CD activity database. The maps show the location of counties with the intensity of any CD activities in the boundary.

Figure (5) Histogram of CD Formation Timing



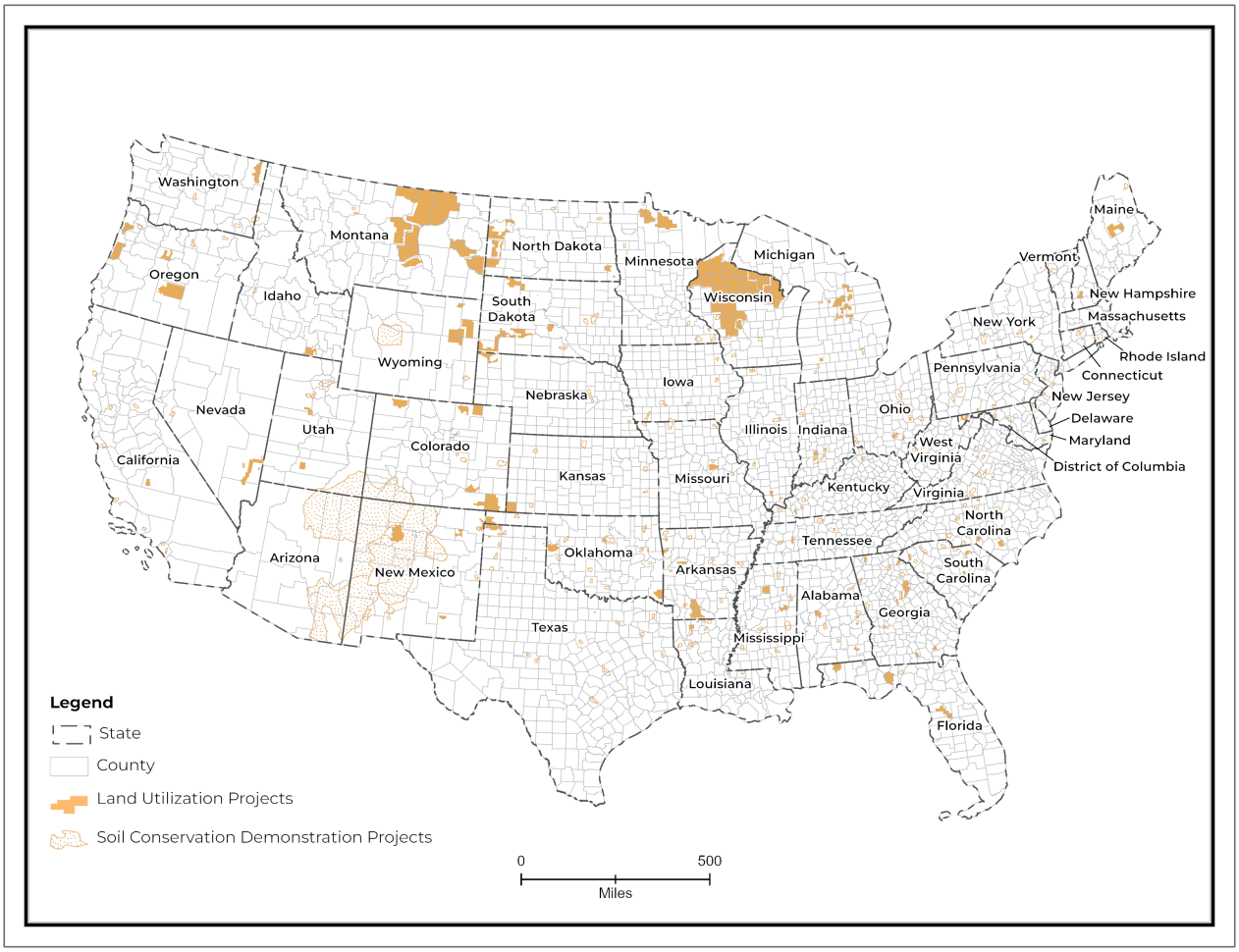
Note: The histogram displays the number of counties by their respective Conservation District (CD) formation year.

Figure (6) CD Completion Status, 1951



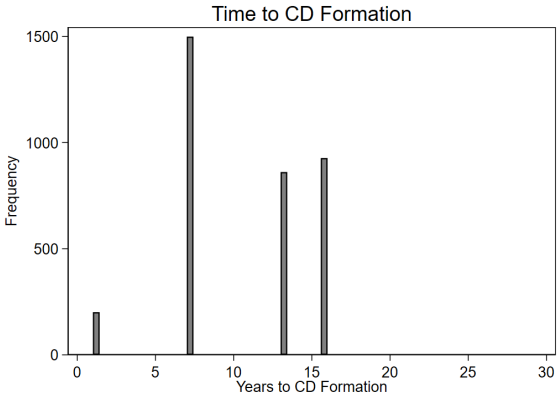
Note: The histogram displays the number of counties by their respective Conservation District (CD) completion status in 1951. The categories represent the percentage of conservation activities completed by the counties' CDs: 0-10%, 10-25%, 25-50%, and 50% or more.

Figure (7) Location of the Demonstration Plots in the post-Dust Bowl Era

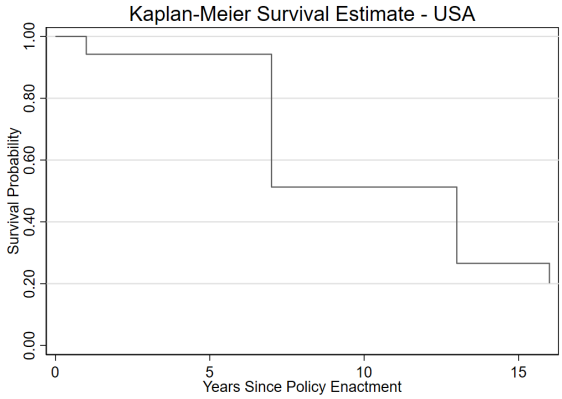


Note: Location of the Demonstration Plots in the post-Dust Bowl Era. I collected this map from the National Archives at College Park, and digitized with ArcGIS to create a location of demonstration plot database. I created a "distance to the demonstration plot" from this map.

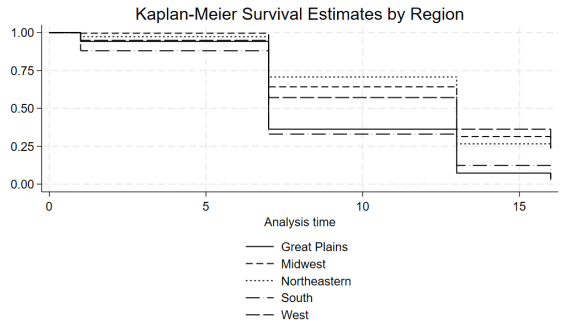
Figure (8) Survival and Cumulative Hazard Estimates for CD Formation



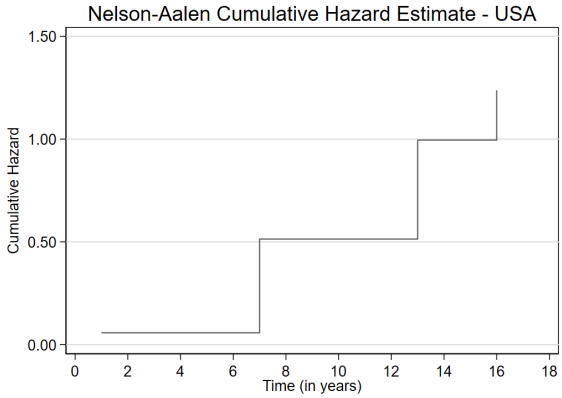
(a) Time to CD Formation



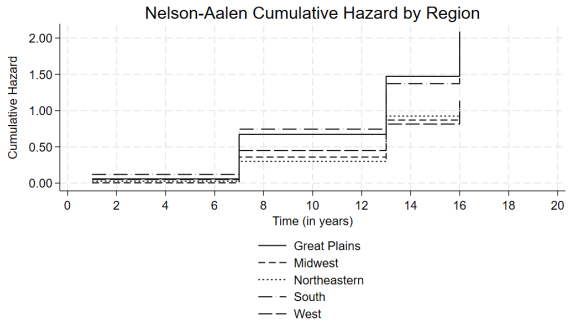
(b) Kaplan-Meier Survival Estimate - USA



(c) Kaplan-Meier Survival Estimates by Region



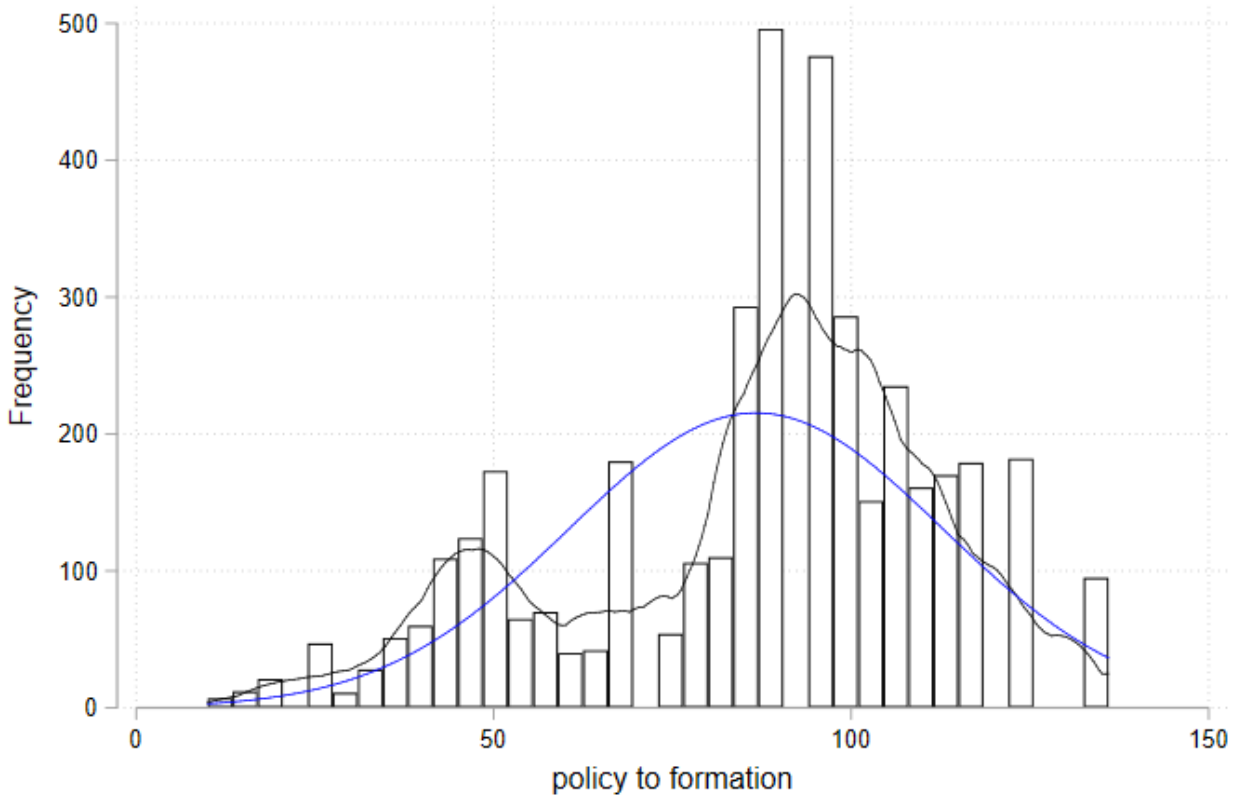
(d) Nelson-Aalen Cumulative Hazard Estimate - USA



(e) Nelson-Aalen Cumulative Hazard by Region

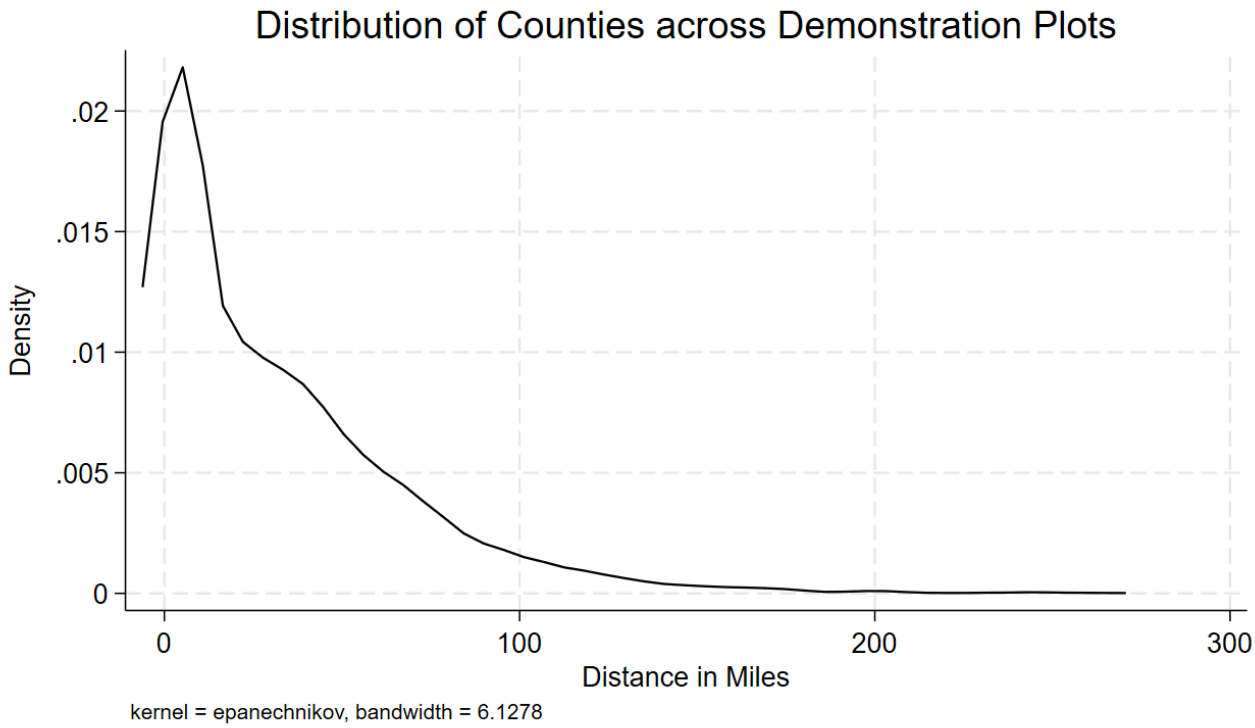
Note: The panel graph illustrates the timing of CD formation and survival estimates across different regions in the United States. The graphs provide insights into the variation in the survival probabilities and hazard rates by region, showcasing how policy enactment and regional factors influenced the establishment of Conservation Districts over time.

Figure (9) **Survival Model : Distribution of Policy to Formation Period**



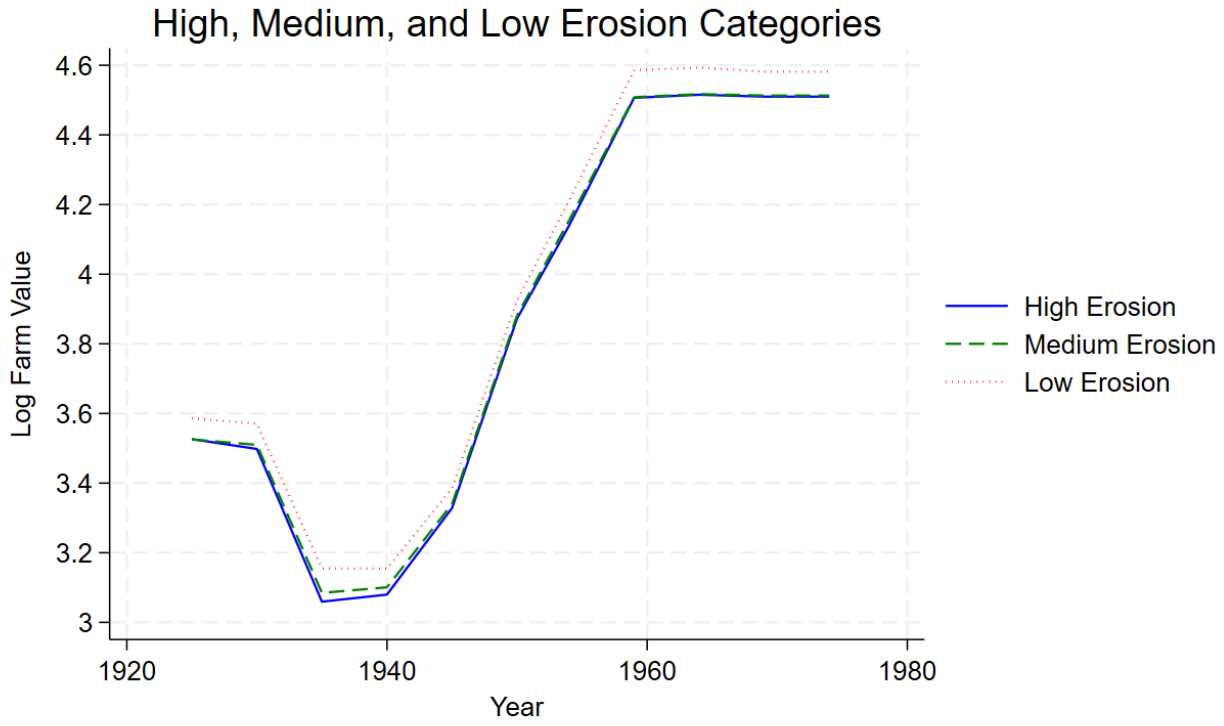
Note: This graph presents a frequency distribution of the "duration", time taken from the state polity enactment to the CD formation. Data on formation and referendum was collected from the annual reports of Soil Conservation Districts.

Figure (10) **Distribution of Counties across Demonstration Plots**



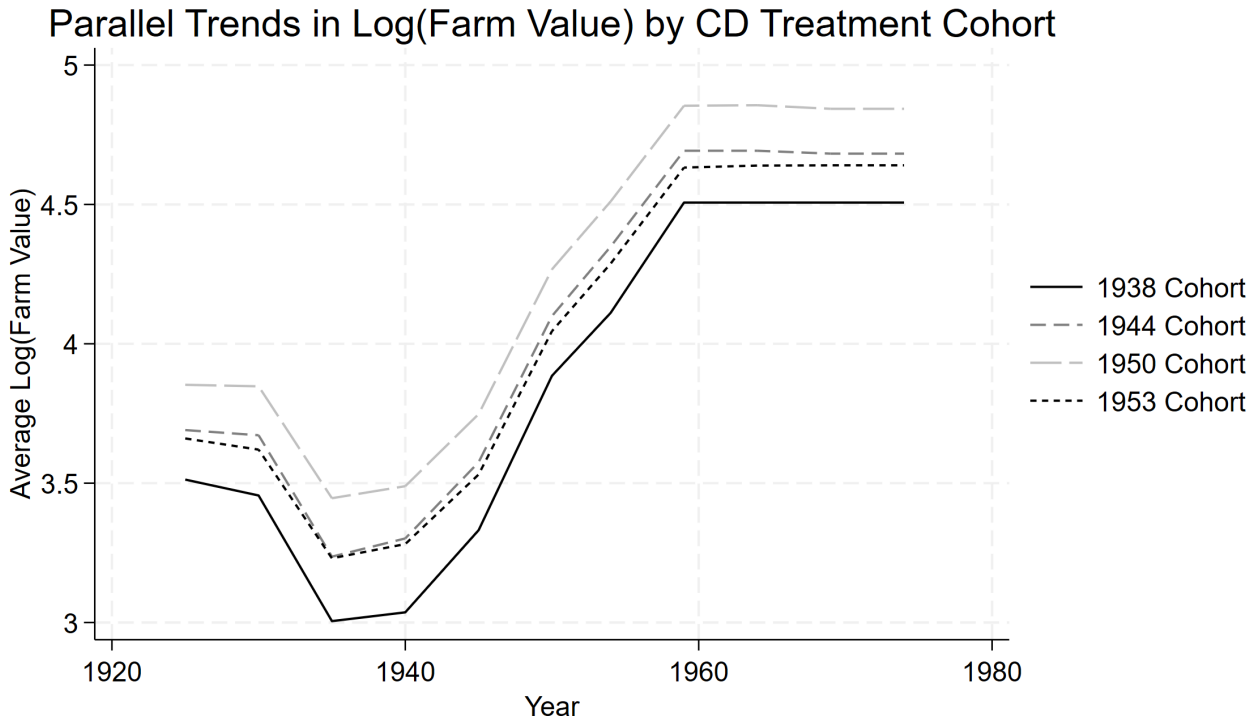
Note: The distribution illustrates the distance of counties to the nearest demonstration plot, highlighting that while many counties are close, others are considerably far. Proximity to these plots is critical for learning conservation activities and understanding their value, suggesting that closer counties are more likely to benefit from technical assistance, potentially increasing the likelihood of Conservation District (CD) formation.

Figure (11) **Log(Farm Value) by erosion categories**



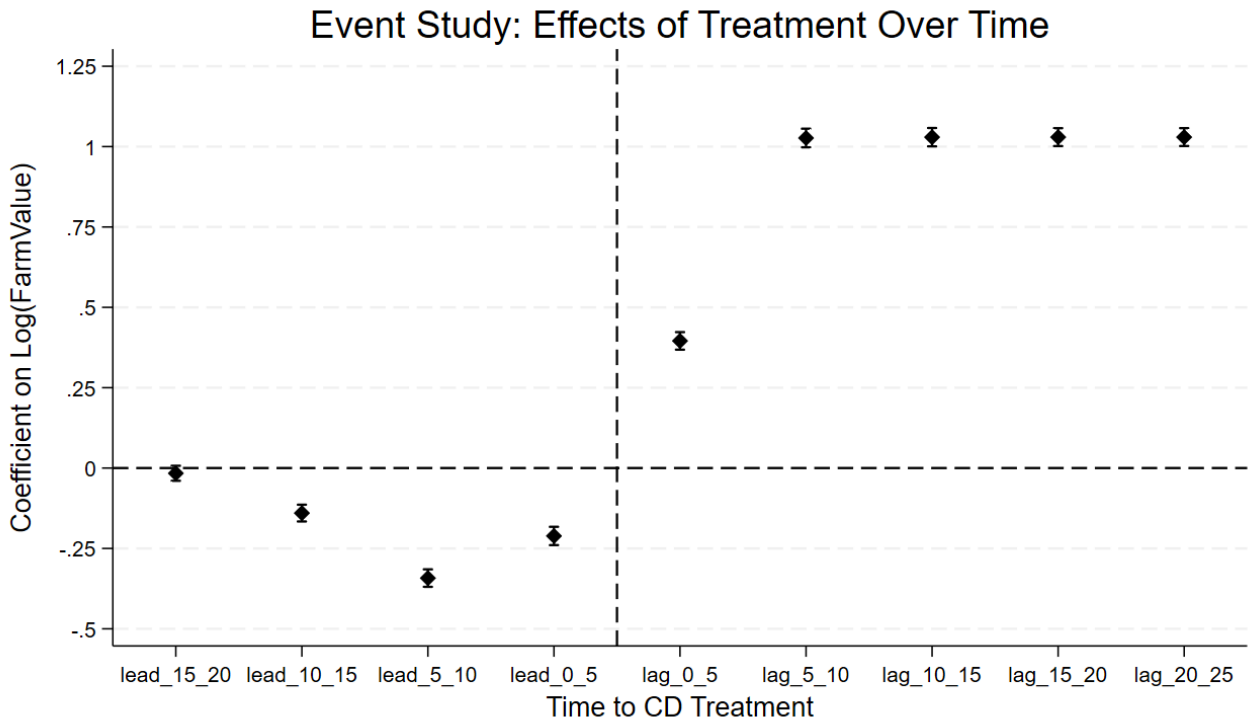
Note: The graph presents a time series of log(Farm Value) categorized by different erosion levels. Data were extracted from the Census of Agriculture. High erosion areas consistently had lower log(Farm Value) compared to medium and low erosion areas from the beginning. The graph illustrates the relative differences among high, medium, and low erosion areas. While all three erosion intensity categories show an increase in farm value over time, the rates of growth differ. Erosion category data are taken from Hornbeck, 2012.

Figure (12) **Log(Farm Value) by erosion categories**



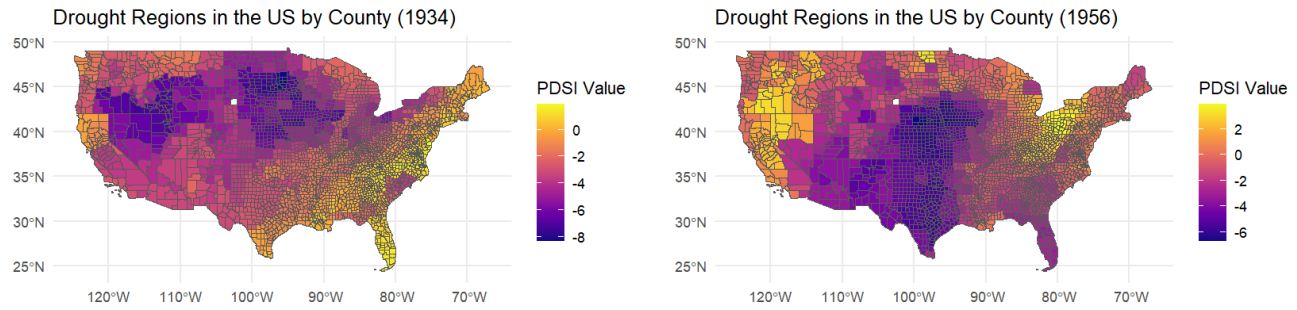
Note: This figure displays average log farmland value trends by CD treatment cohort over time. The pre-treatment trends appear relatively parallel across cohorts, supporting the parallel trends assumption of the difference-in-differences design.

Figure (13) **Event Study Plot**



Note: This figure displays event study estimates of the effect of CD treatment on log farm value over time. Coefficients are relative to the omitted baseline period before CD treatment, with county fixed effects and clustered standard errors. Following treatment, CD adoption is associated with significant and sustained increases in log farm value.

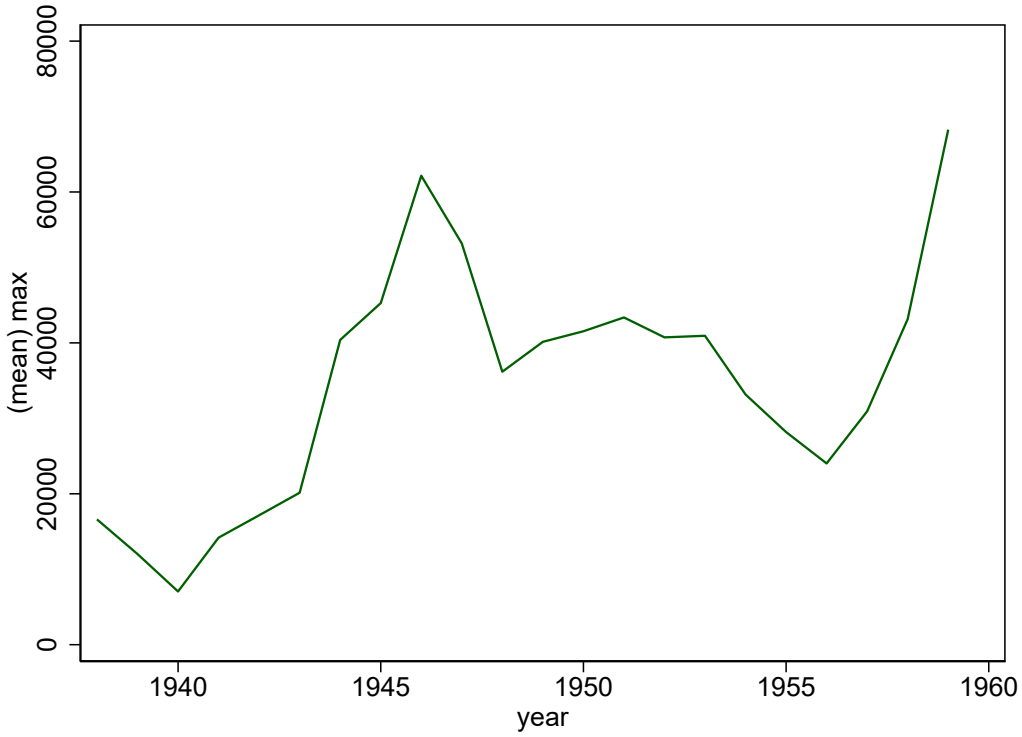
Figure (14) Drought Intensity in 1934 and 1956



(a) Drought 1934 (b) Drought 1956

Note: I created these maps from the PRISM database using PDSI for drought. The maps show the intensity of drought in 1934 and 1956. The PDSI is a standardized index that ranges from -10 (extreme drought) to $+10$ (extreme wet conditions). Monthly PDSI data is collected for the growing season, from April to October. High drought months are defined as those with a PDSI of -4 or lower, moderate drought from -2 to -4, normal conditions from -1.9 to 1.9, unusual moisture from 2 to 2.9, and moist conditions from 3 to 10. This index provides a clear measure of climate extremes for each month, county, and year.

Figure (15) **County-level mean of area under CD in the Great Plains**



Note: This figure represents the average county-level conservation areas under CDs over the years. The data are constructed from the annual reports of CDs and pertain exclusively to the Great Plains. Further details on the various CD activities can be found in the Appendix.

11 Tables

Table (1) Dates of Soil Conservation and Domestic Allotment Act Adoption

Government Level/State	**Date of Adoption**	**Government Level/State**	**Date of Adoption**
Federal Law	April 27, 1935	Alabama	March 18, 1939
Alaska	March 25, 1947	Arizona	June 16, 1941
Arkansas	July 1, 1937	California	June 26, 1938
Colorado	May 6, 1937	Connecticut	July 18, 1945
Delaware	April 2, 1943	Florida	June 10, 1937
Georgia	March 23, 1937	Hawaii	May 19, 1947
Idaho	March 9, 1939	Illinois	July 1, 1937
Indiana	March 11, 1937	Iowa	July 4, 1939
Kansas	April 10, 1937	Kentucky	June 11, 1940
Louisiana	July 27, 1938	Maine	March 25, 1941
Maryland	June 1, 1937	Massachusetts	June 28, 1945
Michigan	July 23, 1937	Minnesota	April 26, 1937
Mississippi	April 4, 1938	Missouri	July 23, 1943
Montana	February 28, 1939	Nebraska	May 18, 1937
Nevada	March 30, 1937	New Hampshire	May 10, 1945
New Jersey	July 1, 1937	New Mexico	March 17, 1937
New York	July 20, 1940	North Carolina	March 22, 1937
North Dakota	March 16, 1937	Ohio	June 5, 1941
Oklahoma	April 15, 1937	Oregon	April 7, 1939
Pennsylvania	July 2, 1937	Rhode Island	April 26, 1943
South Carolina	April 17, 1937	South Dakota	July 1, 1937
Tennessee	March 10, 1939	Texas	April 24, 1939
Utah	March 23, 1937	Vermont	April 18, 1939
Virginia	April 1, 1938	Washington	March 17, 1939
West Virginia	June 12, 1939	Wisconsin	July 1, 1939
Wyoming	May 22, 1941		

Table (3) Summary Statistis by Census Year

	(1) 1925	(2) 1930	(3) 1940	(4) 1945	(5) 1950	(6) 1954	(7) 1959	(8) 1964
Population Density	0.148	233.5	0.182	0.0439	0.154	0.0721	0.0678	0.134
	(0.895)	(1339.8)	(1.811)	(0.0424)	(1.520)	(0.0187)	(0.176)	(0.474)
Total Number of Farms	7476.0	5986.2	4228.3	67108.8	20576.1	1319876.5	30784.2	7036.8
	(36467.3)	(114237.6)	(20999.5)	(575340.0)	(303405.8)	(2311542.0)	(321084.1)	(120922.4)
Percentage of Tenants	46.41	37.10	38.14	31.10	26.50	25.47	23.15	17.05
	(22.39)	(21.18)	(18.43)	(20.61)	(11.39)	(6.498)	(11.44)	(13.57)
Total Farm Area (scaled)	0.714	1.792	7.510	14.05	488.1	33452.0	9.701	2.004
	(5.209)	(34.55)	(48.09)	(112.6)	(6570.1)	(55217.8)	(97.39)	(42.35)
Total Harvested Area (scaled)	0.233	0.342	0.481	3.976	1.337	92.57	2.556	0.508
	(1.473)	(6.550)	(2.608)	(34.68)	(19.43)	(160.5)	(26.97)	(10.94)
Average Farmsize	86.27	341.8	2037266.0	755.1	1624.8	274.0	2145.2	223.3
	(36.19)	(1662.0)	(19734963.2)	(1264.8)	(4098.8)	(152.3)	(4623.1)	(241.3)
Cotton Acreage Share	0.0982	0.0327	0.00130	0.0639	0.000711	0.000525	0.0461	0.0302
	(0.110)	(0.0739)	(0.00299)	(0.0860)	(0.00113)	(0.000545)	(0.0697)	(0.0448)
Tobacco Acreage Share	0.00365	0.00215	0.00155	0.0000175	4.19e-08	0.00000359	0.00000751	0.00497
	(0.0107)	(0.00934)	(0.0121)	(0.000141)	(0.000000743)	(0.00000659)	(0.0000855)	(0.0122)
Corn Acreage Share	0.140	0.0850	0.0120	0.0627	0.000177	0.000598	0.0131	0.0583
	(0.0554)	(0.0926)	(0.0111)	(0.0555)	(0.000255)	(0.000447)	(0.0208)	(0.0513)
Wheat Acreage Share	0.0139	0.0359	0.0106	0.00609	0.000349	0.000247	0.0210	0.00823
	(0.0309)	(0.0734)	(0.0110)	(0.0214)	(0.000803)	(0.000191)	(0.0495)	(0.0149)

Table (4) Weibull and Cox PH Model Results

	Weibull HR (1)	Weibull Coef. (2)	Cox PH HR (3)	Cox PH Coef. (4)	Cox PH Shared HR (5)	Cox PH Shared Coef. (6)
Medium erosion area	1.858***	0.620***	1.486***	0.396***	1.602***	0.472***
	(0.123)	(0.066)	(0.099)	(0.067)	(0.119)	(0.075)
High erosion area	1.486***	0.396***	1.332***	0.287***	1.959***	0.672***
	(0.118)	(0.079)	(0.106)	(0.080)	(0.178)	(0.091)
Distance to USDA demo plots (miles)	0.995***	-0.005***	0.997***	-0.003***	0.997***	-0.003***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Total number of farms	1.000*	-0.000*	1.000	-0.000	1.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Average farm size (acres)	1.000***	-0.000***	1.000***	-0.000***	1.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Irrigation area	1.123	0.116	1.095	0.091	0.977	-0.023
	(0.166)	(0.148)	(0.165)	(0.151)	(0.172)	(0.176)
Per capita New Deal expenditures	0.999*	-0.000*	1.000	-0.000	1.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Percentage of tenant farmers	1.020***	0.020***	1.014***	0.014***	1.005*	0.005*
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)
100th meridian indicator	1.363***	0.310***	1.252***	0.225***	0.975	-0.026
	(0.091)	(0.067)	(0.083)	(0.066)	(0.093)	(0.095)
Cotton crop intensity	7.20e-08	-16.447	0.000	-11.320	0.000	-8.149
	(7.24e-07)	(10.055)	(0.0001)	(9.821)	(3.36)	(11.624)
Wheat crop intensity	4.73e-07	-14.564	0.000	-8.900	0.313	-1.160
	(5.13e-06)	(10.836)	(0.0015)	(10.921)	(4.25)	(13.560)
Corn crop intensity	7.05e+07*	18.071*	103777.3	11.550	45.498	3.818
	(7.49e+08)	(10.629)	(1113513.0)	(10.730)	(595.67)	(13.092)
Constant	0.0017***	-6.360***				
	(0.0003)	(0.148)				
Shared Frailty Term						
theta					0.184***	
					(0.044)	

Note: This table presents hazard ratios and coefficients for both Weibull and Cox proportional hazards models, including shared frailty for state-level effects. The hazard ratios are included in the main paper, while the coefficients are presented here to provide a more detailed understanding of the model estimates.

Table (5) Event Study: Effects of Treatment on Log Farm Value

VARIABLES	(1) Farm Value
Lead 15 to 20 years	-0.016
	(0.012)
Lead 10 to 15 years	-0.140***
	(0.013)
Lead 5 to 10 years	-0.342***
	(0.014)
Lead 0 to 5 years	-0.211***
	(0.015)
Lag 0 to 5 years	0.396***
	(0.014)
Lag 5 to 10 years	1.027***
	(0.015)
Lag 10 to 15 years	1.029***
	(0.015)
Lag 15 to 20 years	1.030***
	(0.014)
Lag 20 to 25 years	1.030***
	(0.014)
Constant	3.769***
	(0.011)
Observations	34,173
Number of FIPS	3,119
R-squared	0.679

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Notes: This table reports coefficients from an event study regression using fixed effects with standard errors clustered at the county level. The omitted category is more than 20 years before treatment; coefficients represent deviations from this baseline.

Table (6) Difference-in-Difference Result - Impact of the CDs on Farm Value

VARIABLES	(1) Model1	(2) Model2
Post CD	0.932***	0.851***
	(0.014)	(0.020)
Post CD # Medium Erosion	-0.009	0.012
	(0.018)	(0.026)
Post CD # Low Erosion	0.058***	0.087***
	(0.017)	(0.025)
Constant	3.565***	3.592***
	(0.004)	(0.004)
Observations	28,479	21,506
R-squared	0.602	0.547
Number of FIPS	2,594	2,153
Controls		Yes

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the DID coefficients from Section 5.2. The outcome variable is farm value. Erosion intensity is interacted with the post_CD variable for the DID regression. Model 1 includes no controls, Model 2 includes year fixed effects and state-by-year fixed effects, and Model 3 includes additional controls from county-level data.

Table (7) Difference-in-Difference Result by Decades

VARIABLES	(1) year < 1950	(2) year < 1960	(3) year < 1970	(4) year < 1980
Post CD	-0.104***	0.334***	0.806***	0.851***
	(0.022)	(0.025)	(0.020)	(0.020)
Post CD # Medium Erosion	0.066***	0.056**	0.014	0.012
	(0.025)	(0.028)	(0.025)	(0.026)
Post CD # Low Erosion	0.046	0.205***	0.094***	0.087***
	(0.032)	(0.028)	(0.025)	(0.025)
Constant	3.803***	4.329***	3.592***	3.592***
	(0.030)	(0.026)	(0.004)	(0.004)
Observations	8,612	15,067	19,363	21,506
R-squared	0.014	0.528	0.527	0.547
Number of FIPS	2,153	2,153	2,153	2,153
Controls	Yes	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Note: This table presents the DID coefficients from Section 5.2. The outcome variable is farm value, with erosion intensity interacted with the post_CD variable in the DID regression. Different columns present results divided by decade.

Table (8) Difference-in-Difference Result by Treatment Periods

VARIABLES	(1) Model
Post CD#Medium#5years	0.296***
	(0.017)
Post CD#Medium#5to10years	0.769***
	(0.017)
Post CD#Medium#10to15years	0.988***
	(0.015)
Post CD#Medium#15to20years	1.248***
	(0.016)
Post CD#Medium#20+years	1.328***
	(0.017)
Post CD#Low#5years	0.474***
	(0.017)
Post CD#Low#5to10years	0.908***
	(0.021)
Post CD#Low#10to15years	1.035***
	(0.018)
Post CD#Low#15to20years	1.175***
	(0.018)
Post CD#Low#20+years	1.264***
	(0.019)
Constant	3.735***
	(0.004)
Observations	23,981
Number of FIPS	2,402
R-squared	0.600
Controls	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the DID coefficients from Section 5.2. The outcome variable is farm value, with erosion intensity interacted with the post_CD variable in the DID regression, and treatment exposure period.

Table (9) Difference-in-Difference Result by Regions

VARIABLES	(1) Great Plains	(2) Midwest	(3) NorthEast	(4) South	(5) West
Post CD	0.625***	0.819***	0.213**	1.048***	1.156***
	(0.046)	(0.027)	(0.094)	(0.018)	(0.175)
Post CD#Medium Erosion	0.290***	0.050	0.623***	-0.019	-0.296
	(0.053)	(0.037)	(0.110)	(0.028)	(0.210)
Post CD#Low Erosion	0.313***	0.057*	0.761***	0.061**	-0.116
	(0.055)	(0.034)	(0.102)	(0.030)	(0.186)
Constant	3.152***	4.168***	4.217***	3.405***	3.627***
	(0.007)	(0.006)	(0.012)	(0.006)	(0.017)
Observations	8,077	6,226	1,733	10,544	1,899
R-squared	0.550	0.661	0.689	0.626	0.543
Number of FIPS	736	566	159	960	173

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table displays regional differences in the effects of post-conservation district (CD) implementation and erosion levels on the outcome variable.

Table (10) Difference-in-Difference - Impact of the CDs on Yield

VARIABLES	(1) Cotton	(2) Corn	(3) Wheat
Post CD	3.054	-0.898*	0.005
	(2.993)	(0.512)	(0.285)
Post CD#Medium Erosion	1.563	1.779***	-0.127
	(2.494)	(0.558)	(0.327)
Post CD#Low Erosion	21.519***	1.137*	-0.341
	(3.109)	(0.610)	(0.337)
Constant	59.653***	31.586***	29.337***
	(3.616)	(0.508)	(0.234)
Observations	7,998	14,774	18,958
R-squared	0.865	0.766	0.700
Number of FIPS	2,064	2,144	2,147
State*Year FE	Yes	Yes	Yes
Controls	Yes	Yes	Yes

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the DID coefficients from Section 5.2. The outcome variable is crop yield, with erosion intensity interacted with the post_CD variable in the DID regression.

Table (11) Impact of the CDs HTE

VARIABLES	(1) Average Farm Size	(2) Demonstration Plot	(3) 100th Meridian	(4) Irrigation
Post CD#Medium Erosion#Average Farm Size	0.0001***			
	(0.000)			
Post CD#Low Erosion#Average Farm Size	0.0001***			
	(0.000)			
Post CD#Demonstration Plot		-0.0021**		
		(0.001)		
Post CD#Medium Erosion#Demonstration Plot		0.0023**		
		(0.001)		
Post CD#Low Erosion#Demonstration Plot		0.0029***		
		(0.001)		
Post CD#Medium Erosion#100th Meridian			-0.2406**	
			(0.121)	
Post CD#Low Erosion#100th Meridian			-0.2460**	
			(0.112)	
Post CD#Medium Erosion#Irrigation				1.2371
				(2.989)
Post CD#Low Erosion#Irrigation				1.5041
				(2.860)
Constant	3.5652***	3.5655***	3.5656***	3.5279***
	(0.004)	(0.004)	(0.004)	(0.004)
Observations	28,456	28,479	28,479	23,852
R-squared	0.6048	0.6019	0.6023	0.6029
Number of FIPS	2,590	2,594	2,594	2,171

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents heterogeneous treatment effects (HTE) across key variables, using a triple difference (DDD) framework to evaluate the impact of conservation district interventions and erosion levels. The analysis considers interactions with farm size, total population, demonstration plots, tenant percentage, meridian, and irrigation status to capture nuanced variations in outcomes.

Table (12) Impact of the CDs HTE

Difference-in-Differences with USDA Budget Categories

VARIABLES	(1) Model
Post CD	1.518***
	(0.012)
Post CD # TA # Low Erosion	-1.183***
	(0.010)
Post CD # TA # Medium Erosion	-0.437***
	(0.005)
Post CD # FA # Low Erosion	-0.398***
	(0.006)
Post CD # TA # Medium Erosion	-0.396***
	(0.006)
Constant	3.604***
	(0.004)
Observations	21,544
Number of FIPS	2,157
R-squared	0.804

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents heterogeneous treatment effects (HTE) using a difference-in-differences (DiD) framework. High, medium, and low levels of USDA technical and financial assistance are defined based on thresholds at the 33rd and 66th percentiles of their respective distributions.

Table (13) Impact of the CDs on Drought Resilience

VARIABLES	(1) Model
Post CD = 1	0.558***
	(0.031)
Post CD = 0 × Drought Exposure = 1	0.000
	(0.000)
Post CD = 0 × Drought Exposure = 2	0.037**
	(0.014)
Post CD = 0 × Drought Exposure = 3	0.085***
	(0.015)
Post CD = 0 × Drought Exposure = 4	-0.010
	(0.015)
Post CD = 0 × Drought Exposure = 5	0.095***
	(0.020)
Post CD = 0 × Drought Exposure = 6	0.236***
	(0.036)
Post CD = 1 × Drought Exposure = 1	0.372***
	(0.028)
Post CD = 1 × Drought Exposure = 2	0.466***
	(0.026)
Post CD = 1 × Drought Exposure = 3	0.488***
	(0.027)
Post CD = 1 × Drought Exposure = 4	0.431***
	(0.027)
Post CD = 1 × Drought Exposure = 5	0.387***
	(0.028)
Constant	3.484***
	(0.013)
Observations	29,973
Number of FIPS	2,731
R-squared	0.603

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table displays the interaction effects between post-conservation district (CD) implementation and varying levels of drought exposure on the outcome variable. The coefficients capture how the post-CD effects differ by drought exposure levels, with robust standard errors provided in parentheses.

Table (14) Impact of the CDs Great Plains(continuous treatment)

	(1) Log(CD Acres)	(2) Log(Farm Value)
Log(Distance to Nearest Demonstration Plot)	-0.0188*	
	(0.0102)	
Log(CD Acres) # Medium Erosion	0.249***	0.357*
	(0.0236)	(0.206)
Log(CD Acres) # Low Erosion	0.178***	0.204
	(0.0225)	(0.146)
Constant	7.765***	14.35**
	(0.157)	(6.133)
Observations	660	660
R-squared	0.166	
IV F-statistic		3.370
Durbin p-value		1.70e-07

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the results of an instrumental variable (IV) model examining the effect of conservation district (CD) acres on farm value. The first stage regression uses the log of distance as an instrument for log(CD acres), while the second stage assesses the impact of log(CD acres), including interaction terms for medium and high erosion levels, on log(farm value).

Table (15) Impact of the CDs USA (continuous treatment)

	First Stage	Second Stage
Distance to Demonstration Plots (Instrument)	-0.0009234***	
	(0.0000852)	
Post CD (Access to CD)		-1.28799**
		(0.63054)
Post CD#Medium Erosion	0.94096***	2.01731***
	(0.00694)	(0.59915)
Post CD#Low Erosion	0.87254***	2.05972***
	(0.00627)	(0.54334)
Constant	0.18872***	3.92908***
	(0.00670)	(0.10570)
Observations	28,479	28,479
Clusters (FIPS)	2,594	2,594
F-stat for Excluded Instruments	117.54	
Kleibergen-Paap LM Statistic	115.75	
Cragg-Donald Wald F-statistic		406.36
Stock-Yogo 10% Critical Value		16.38
Durbin p-value		0.0370

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the results of an instrumental variable (IV) model examining the effect of conservation district (CD) acres on farm value. The first stage regression uses the log of distance as an instrument for log(CD acres), while the second stage assesses the impact of log(CD acres), including interaction terms for medium and high erosion levels, on log(farm value).

Table (16) Impact of the CDs USA - Social Outcomes

VARIABLES	(1) 1990 ski90pcm	(2) 1997 SKI97pcm	(3) 2005 SKI05PCM	(4) 1988 - Voting pvote88	(5) 1992 - Voting pvote92	(6) 1996 - Voting pvote96	(7) 2004 - Voting pvote04
period_1990	0.002***			0.013***	0.002		
	(0.000)			(0.003)	(0.002)		
period_1997		0.001***				0.015***	
		(0.000)				(0.003)	
period_2005			0.003***				0.000
			(0.001)				(0.000)
Constant	-0.534***	-0.263***	-0.680***	50.598***	60.003***	51.363***	0.584***
	(0.114)	(0.083)	(0.146)	(0.783)	(0.620)	(0.703)	(0.008)
Observations	10,947	11,469	11,273	10,947	10,947	11,469	11,273
R-squared					0.000		0.001

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: This table presents the results of an instrumental variable (IV) model examining the effect of conservation district (CD) acres on social outcomes. The first stage regression uses the log of distance as an instrument for log(CD acres), while the second stage assesses the impact of log(CD acres), including interaction terms for medium and high erosion levels, on social capital index and voter turnout. Columns (1)–(3) report the effects on social capital indices for 1990, 1997, and 2005 (*ski90pcm*, *SKI97pcm*, *SKI05PCM*), while Columns (4)–(7) analyze voter turnout for the presidential elections of 1988, 1992, 1996, and 2004 (*pvote88*, *pvote92*, *pvote96*, *pvote04*).

Table (17) Impact of the CDs on Infant Mortality

Difference-in-Differences Results (Overall and by Treatment Periods)

VARIABLES	(1) Infant Mortality (R)	(2) Infant Mortality (O)	(3) Infant Mortality (R)	(4) Infant Mortality (O)
Post CD	-6.398***	-13.297***		
	(1.128)	(1.281)		
Post CD (5 years)			-0.832	-3.282**
			(1.117)	(1.543)
Post CD (5 to 10 years)			-1.265	-1.463
			(1.164)	(1.759)
Post CD (10 to 15 years)			-4.016***	-6.339***
			(1.192)	(1.559)
Post CD (15 to 20 years)			-6.442***	-9.590***
			(1.281)	(1.445)
Post CD (20+ years)			-14.138***	-17.227***
			(1.198)	(1.290)
Post CD # Medium Erosion	-0.846	-0.746	-0.681	-0.505
	(1.672)	(1.997)	(1.682)	(2.005)
Post CD # Low Erosion	0.387	1.145	-0.573	-1.157
	(1.500)	(1.807)	(1.504)	(1.820)
Constant	35.819***	39.119***	36.379***	39.157***
	(0.420)	(0.448)	(0.426)	(0.447)
Observations	20,749	17,934	20,749	17,934
R-squared	0.013	0.052	0.064	0.069
Number of FIPS	2,614	2,614	2,614	2,614

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Note: The table presents the effects of soil conservation districts on average infant mortality rates by residence ('imr_res_mean') and occurrence ('imr_occ_mean') using difference-in-difference model. Robust standard errors are reported in parentheses.

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