Effects of the Conservation Reserve Program on Agriculture, Hydrology, and Wildlife in Kansas

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Introduction

The Conservation Reserve Program (CRP) is a voluntary USDA program that has had a major influence on how land is used and managed across the state of Kansas. It represents one of the largest, long-running conservation experiments in the U.S., making it highly relevant to environmental and agricultural science. CRP removes environmentally sensitive cropland from production and replaces it with perennial vegetation, especially in regions dominated by row crop agriculture and semi-arid environments. The program was created to reduce soil erosion, improve water quality, and provide wildlife habitat, but its benefits are not the same everywhere. Outcomes vary depending on factors such as soil type, climate, vegetation, and management practices.

While CRP was designed as a conservation initiative, its influence extends far beyond environmental protection and into the long-term sustainability of Kansas agriculture. While the program is often discussed in terms of outcomes, its impact on agriculture is equally important. In semi-arid regions like Kansas, where soil degradation, water limitations, and economic pressures are constant concerns, CRP influences not only land use but also long-term farm sustainability and resilience of agricultural systems. Previous research has shown that CRP can improve soil structure, reduce runoff and erosion, and influence producer management decisions and farm profitability (Huang et al. 2002; Zheng et al. 2004; Taylor et al. 2021). To better understand the influence of CRP on agricultural systems in Kansas, this report focuses on three major areas: soil quality, crop health and productivity, and farm economics.

Hydrology, particularly groundwater, is also an important factor for understanding the impacts of CRP in Kansas, where low precipitation and a large agricultural industry require a strong dependence on groundwater. The High Plains aquifer has experienced increasing stress as a result of excessive pumping driven by high irrigation demands. Although the CRP was not originally created to address groundwater recharge, it may have the unintended benefit of improving hydrological conditions. Maintaining or increasing water levels in the High Plains aquifer is critical for the long-term sustainability of agriculture in the Midwest. Evaluating the extent to which the CRP enhances soil infiltration and subsequent aquifer recharge is therefore vital for ensuring Kansas's future water security (Riley et al. 2019). Additionally, the CRP can influence hydrological processes, such as groundwater quality and quantity, both of which play a key role in determining recharge rates and water conditions. Encouraging landowners to enroll their land in conservation programs, such as the CRP, will be tremendously impactful on the environment.

CRP plays a major role in supporting populations of Lesser Prairie Chickens by restoring and protecting large areas of grassland habitat. Many native prairies across the Great Plains have been converted to cropland, reducing the amount of suitable nesting and breeding habitat available for this species. CRP lands help recreate the open grassland environments that Lesser Prairie Chickens need for lekking, nesting, brood rearing and predator detection. These restored habitats also improve habitat connectivity between populations, which supports movement and genetic diversity amongst the species. In regions such as Western Kansas, CRP grasslands have become especially important for maintaining stable and concentrated populations for this species. In recent years, the importance of the CRP program has become more evident, particularly in the concentrated repopulation efforts of the Lesser Prairie Chicken. As land-use and climate shifts in the great plains, having reliable systems to support the chickens via the conservation reserve program is vital to ensuring the rebounding of the species.

Objectives

The goal of this research project was to evaluate the impacts of the Conservation Reserve Program on Kansas agriculture, hydrology, and wildlife. The CRP provides landowners with an opportunity to convert environmentally sensitive farmland into conservation areas that support wildlife habitat, reduce erosion, and improve water management. This study aimed to determine whether these intended environmental benefits are being achieved across the state of Kansas. The agricultural portion of this project focuses on the effects of CRP on soil quality, crop health, and farm economics, all of which are essential to agricultural productivity. The hydrology component examined impacts on water quality, soil properties, and soil infiltration, which are especially important in a state heavily reliant on groundwater. The wildlife portion focused on prairie chicken habitat and population trends.

Data & Methods

The data for this project was obtained from the United States Department of Agriculture's Farm Service Agency. A downloadable Microsoft Excel spreadsheet is available for public use, and gives information about the different types of CRP practices, along with total acres of land enrolled in the CRP per county. Although this data is available for several states, we selected and analyzed data from the state of Kansas.

Several programs, including Microsoft Excel, R Studio, and ArcGIS Pro, were used to analyze our data. For each study focus (agriculture, hydrology, and wildlife), the CRP practice acres associated with that focus were totaled in order to identify and visualize where positive benefits would be likely to occur.

Results & Discussions

General Trends

Statewide Totals

Total statewide CRP acres show a clear V-shaped trend (see Figure 1). There is a decline from about 1.90 million in 2020 to 1.74 million in 2022 (reduction by 158,000 acres, or 8.3%), followed by a rebound to 2.03 million by 2025. The early drop likely reflects expiring contracts and commodity prices encouraging a return to crop production, while the recovery suggests renewed USDA incentives and improved rental rates. The largest annual loss occurred in 2021 (loss of 112,151 acres), with the strongest gains in 2023 (increase of 95,894 acres) and 2024 (increase of 132,219 acres), with growth slowing down in 2025 but still remaining positive (see Figure 2).

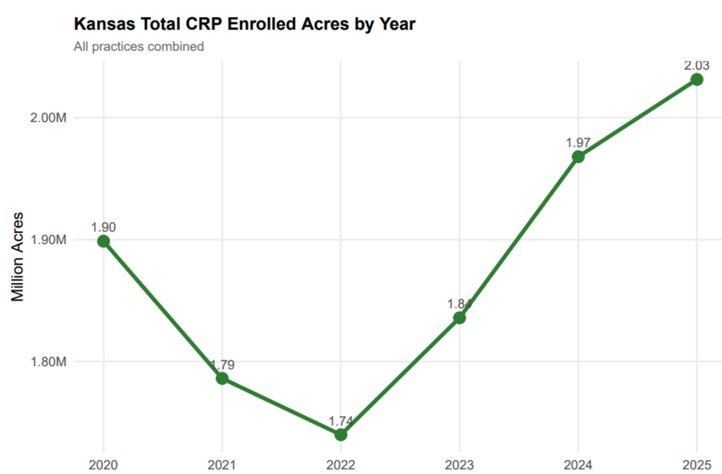
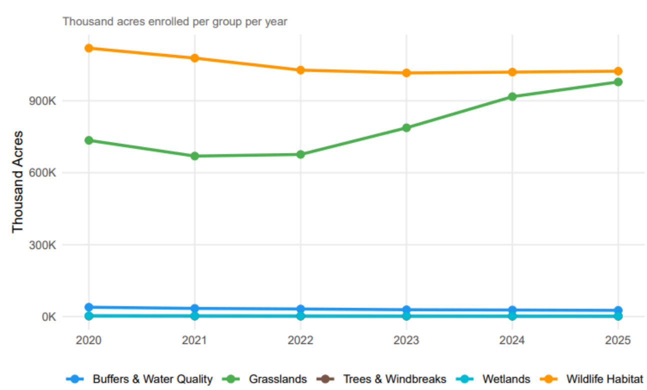


Figure 1. Source: own illustration based on total CRP acres enrolled per year in Kansas

Year	Total Acres	Change (acres)	Change (%)
2,020	1,898,705	—	
2,021	1,786,155	-112,551	-5.9
2,022	1,739,945	-46,210	-2.6
2,023	1,835,839	95,894	5.5
2,024	1,968,058	132,219	7.2
2,025	2,031,432	63,374	3.2

Figure 2. Source: own illustration based on CRP data

By practice, grasslands drive most of the growth, increasing roughly 46% from about 670,000 acres in 2021 to 979,000 in 2025. Wildlife habitat remains the largest category, around 1.0-1.1 million acres, but declines slightly over time, indicating a shift towards grasslands. Buffers and water quality practices have fallen by about 24% (38,900 to 25,500 acres), which suggests reduced enrollment in these practices. Wetlands and trees/windbreaks enrollment acres remain minimal (less than 3,000 acres annually) and continue to decline.



Practice Group	2020	2021	2022	2023	2024	2025
Buffers & Water Quality	38,897	33,913	31,451	28,409	27,293	25,813
Grasslands	735,086	669,542	676,227	787,389	917,412	978,730
Trees & Windbreaks	1,869	1,714	1,501	1,314	1,262	1,192
Wetlands	2,987	2,693	2,502	2,235	2,105	1,992
Wildlife Habitat	1,119,811	1,078,292	1,028,263	1,016,493	1,019,986	1,023,705

Figure 3. Source: own illustration based on Kansas CRP acres by practice group

County Level Summaries

When looking at data for individual Kansas counties, there is a trend of higher CRP enrollment in the western and southwestern portion of the state. This is due to the region being dominated by cropland and semi-arid ranges that are most eligible for CRP enrollment. In 2025, the county with the highest enrollment in the CRP was Hamilton county with roughly 167,000 acres enrolled. Many counties in eastern Kansas saw modest enrollment due to land uses that are not eligible for CRP. For example, the Flint Hills region in eastern Kansas is already dominated by native grasslands, and therefore does not need to enroll acreage into the CRP. The Shannon Diversity Index was calculated for each Kansas county in order to determine the range of conservation practice types. Northeastern Kansas was seen to have the higher practice diversity, while southeastern Kansas had lower practice diversity.

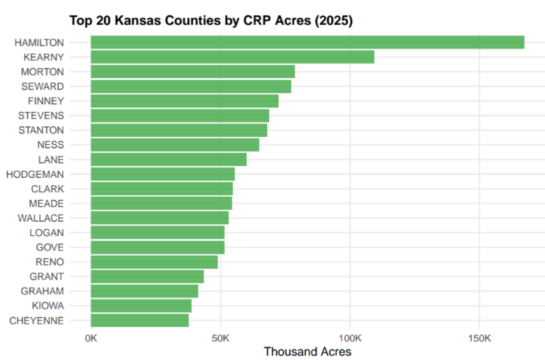


Figure 4. Top 20 Kansas Counties by CRP Acres in 2025

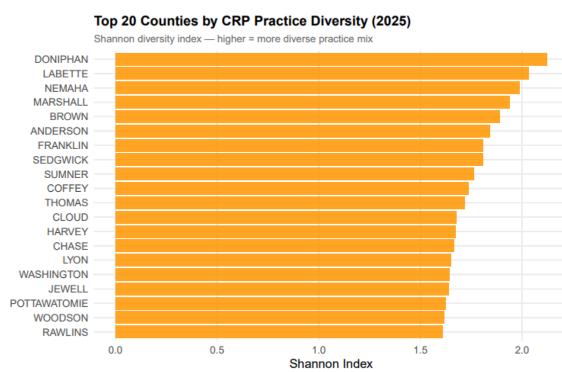


Figure 5. Top 20 Counties by CRP Practice Diversity in 2025

Figure sources: own illustrations based on Kansas CRP data

Agriculture

Soil Quality

A consistent finding across the literature is that CRP enrollment improves soil quality compared to continuous cultivation. Huang et al. (2002) found that soils under CRP in Kansas exhibit stronger aggregation, improved structure, and greater resistance to erosion than nearby cropped soils. These improvements are largely driven by reduced tillage disturbance and the presence of perennial vegetative cover, which help stabilize the soil surface and increase organic matter accumulation over time.

Similarly, Zheng et al. (2004) demonstrated that CRP land experiences lower runoff and erosion rates compared to actively cultivated cropland. Perennial vegetation slows surface water movement, improves infiltration, and reduces sediment loss, all of which help protect long-term soil productivity. However, it was noted that many of these improvements can decline when CRP land is converted back into annual crop production, emphasizing the importance of continued conservation management.

Recent CRP enrollment trends in Kansas further support the continued importance of these soil conservation benefits. Figure 1 shows that CRP enrollment in Kansas increased from approximately 1.74 million acres in 2022 to over 2 million acres by 2025.

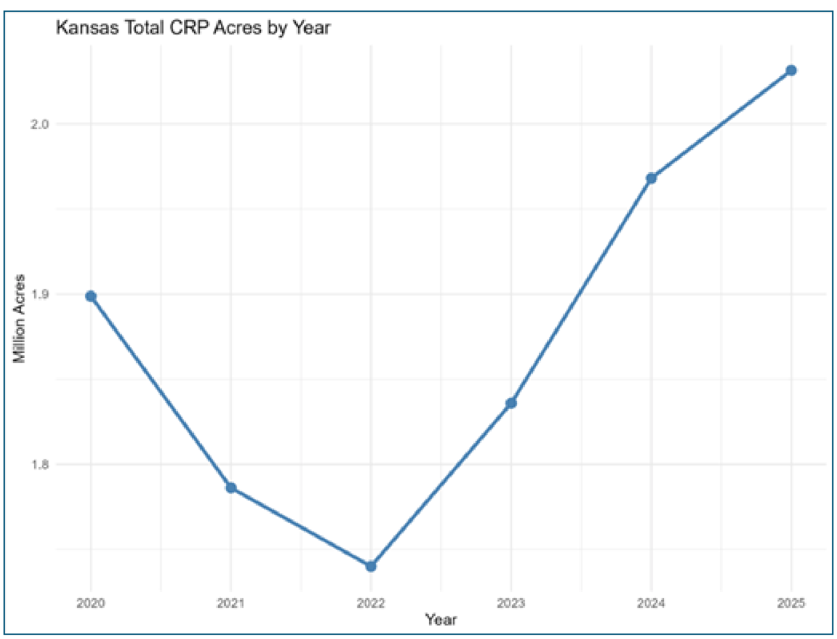


Figure 6. Kansas total CRP enrolled acres from 2020–2025. Source: Own illustration based on USDA-FSA CRP acreage data.

This increase suggests that producers continue to see value in conservation practices, particularly in regions facing drought stress, erosion risk, and declining soil productivity. In western Kansas, where wind erosion and limited water availability are major agricultural concerns, maintaining perennial cover through CRP can help improve soil stability, increase water infiltration, and reduce long-term land degradation.

Together, these studies and statewide enrollment trends demonstrate that CRP plays an important role in rebuilding and protecting soil resources across Kansas. Improved aggregation, reduced erosion, and increased soil stability all contribute to stronger long-term agricultural resilience, particularly in environmentally vulnerable regions of the state.

Crop Health and Productivity

The relationship between CRP and crop productivity is complex and often indirect. Although CRP removes land from annual crop production, it can improve long-term agricultural sustainability by protecting soil resources and reducing land degradation. Healthier soils generally support better water retention, root development, nutrient cycling, and microbial activity, all of which are important for maintaining crop productivity over time. In semi-arid regions such as western Kansas, these improvements may also help agricultural systems become more resilient to drought and environmental stress.

Recent CRP practice trends in Kansas suggest that producers are increasingly adopting conservation systems that still provide some level of agricultural functionality. Figure 2 shows that grassland and wildlife habitat practices continue to make up the largest portion of CRP enrollment in Kansas, with grassland acreage increasing noticeably between 2020 and 2025. This increase indicates that many producers are choosing practices that allow land to remain productive through managed grazing, forage production, or biomass harvest while still maintaining conservation benefits.

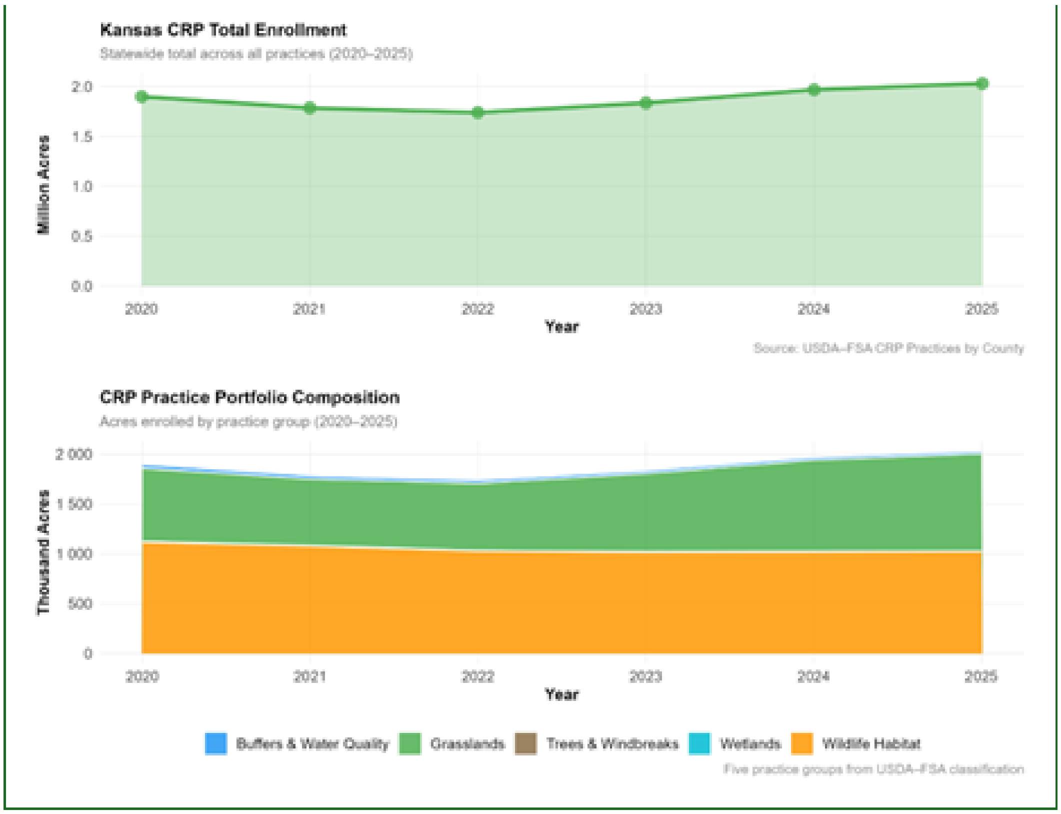


Figure 7.. Kansas CRP practice portfolio composition by year. Source: Own illustration based on USDA-FSA CRP data.

Lin et al. (2023) further demonstrated that CRP grasslands can contribute to agricultural productivity under managed systems. Their research found that nitrogen application and harvest timing significantly affected biomass yield and nutrient composition in grass-legume CRP mixtures. These findings suggest that CRP land does not always represent a complete loss of agricultural productivity, but instead may provide opportunities for alternative forms of production while still protecting soil and water resources.

At the same time, there are tradeoffs associated with increasing productivity on CRP land. Greater biomass harvest intensity or nutrient inputs may reduce some conservation benefits by altering nutrient cycling, soil cover, or ecosystem stability. Because of this, CRP's influence on crop productivity should be viewed as a balance between short-term production goals and long-term agricultural resilience. While the program can reduce annual crop acreage in the short term, it may also improve the long-term sustainability and productivity of agricultural systems by preserving soil health and reducing environmental degradation.

Farm Economics

Economic considerations are central to understanding CRP's impact on agriculture in Kansas. Producer participation in CRP is heavily influenced by profitability, land value, crop prices, and production risk. Taylor et al. (2021) explain that CRP enrollment largely depends on opportunity cost, or the income producers give up by enrolling land into conservation instead of keeping it in crop production. Their findings suggest that CRP is generally more attractive when commodity prices are low, input costs are high, or land is less productive. In contrast, when crop prices rise, producers are often more likely to return CRP land to active production in order to maximize short-term revenue.

Rental payment trends in Kansas help illustrate the relationship between economics and CRP participation. Figure 3 shows historical CRP rental rate trends over time and demonstrates how conservation payments must compete with the profitability of agricultural production. As land values and crop returns increase, CRP payments may become less financially competitive for producers, especially in highly productive farming regions. This creates constant economic pressure between maintaining conservation practices and maximizing crop income.

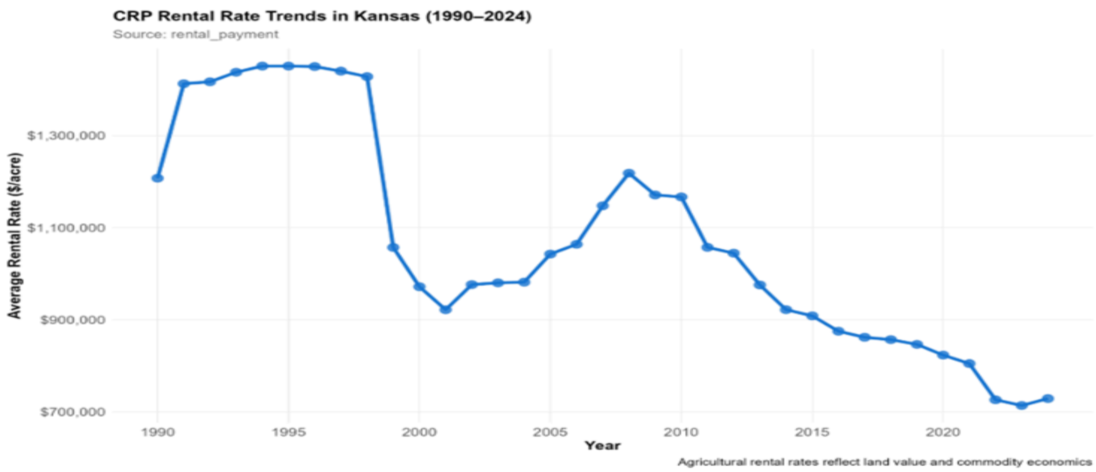


Figure 8. Historical CRP rental payment trends in Kansas from 1990–2024. Source: Own illustration based on USDA-FSA rental payment data.

Leathers and Harrington (2000) further complicate the economic impact of CRP through the concept of land "slippage." Their research found that when producers enroll environmentally sensitive land into CRP, they may compensate by increasing cultivation on other acres. As a result, some of the environmental benefits of CRP may be offset if overall agricultural intensity remains high at the regional scale. This demonstrates that producer decisions are often driven by broader economic realities rather than conservation goals alone.

At the same time, CRP can provide important financial stability for producers operating in environmentally vulnerable regions. In western Kansas especially, where drought stress, declining groundwater supplies, and yield variability increase production risk, guaranteed CRP payments may help reduce economic uncertainty on marginal land. By taking less productive acres out of annual cultivation, producers may reduce input costs, lower erosion risk, and improve long-term land sustainability.

Overall, CRP exists at the intersection of conservation and economics. Producers are constantly trying to balance long-term land stewardship with the need to remain profitable. Because of this, the long-term success of CRP depends not only on environmental outcomes, but also on whether the program continues to make economic sense for producers under changing agricultural conditions.

CRP works best when conservation and profitability can exist together. Protecting soil, reducing erosion, and improving long-term land health are important, but producers also need systems that make economic sense for their operations. As environmental challenges continue to grow across Kansas, programs like CRP will likely remain important for helping producers balance productivity with long-term land health.

Hydrology

Research of CRP impacts on water quality and other hydrologic functions is minimal, which requires inferences to be made based on past research and what we know about the behaviors of land management practices such as buffer strips and grasses.

Groundwater Quality

Conversion of cropland to grassland through the CRP has shown promising results in improving groundwater quality. Due to Kansas's large agricultural industry, a common pollution problem includes runoff from chemical fertilizers. The CRP has been shown to reduce groundwater recharge rates in some studies due to less overall water being applied to the soil from irrigation (Townsend et al. 2002). While this can negatively affect water levels, it can also improve groundwater quality by slowing the movement of contaminants into the aquifer.

Testing groundwater concentrations of nutrients such as nitrogen and phosphorus before and after CRP land conversion is a common study method for evaluating its effectiveness in improving water quality. Results have indicated that CRP enrollment is often associated with reductions in nitrogen concentrations in groundwater, suggesting improved water quality following the transition from cropland grassland (Spor Leal et al. 2024). This could be due to a reduction of total applied fertilizers, or the grasslands' ability to absorb excess nutrients. A study in central Kansas comparing CRP grasslands to continuously cropped land (CCL) found that soils under CRP management had significantly lower available phosphorus levels (Huang et al. 2001). This reduction is beneficial for water quality because fewer nutrients are available to infiltrate into groundwater and contribute to contamination.

Common land management practices used to reduce the amount of contaminants entering groundwater include buffer strips, riparian buffers, grassed waterways, and wetlands. Because direct measurements of groundwater contaminant concentrations are limited, CRP enrollment patterns can be used as an indicator for likely environmental impacts. The graph below displays total acreage for different CRP practices associated with groundwater protections. As displayed in the graph, filter strips have the most acres (0.6%), followed by grassed waterways (0.2%), and riparian buffers (0.1%). This pattern may indicate that groundwater protection has received less emphasis within CRP enrollment compared to other conservation objectives.

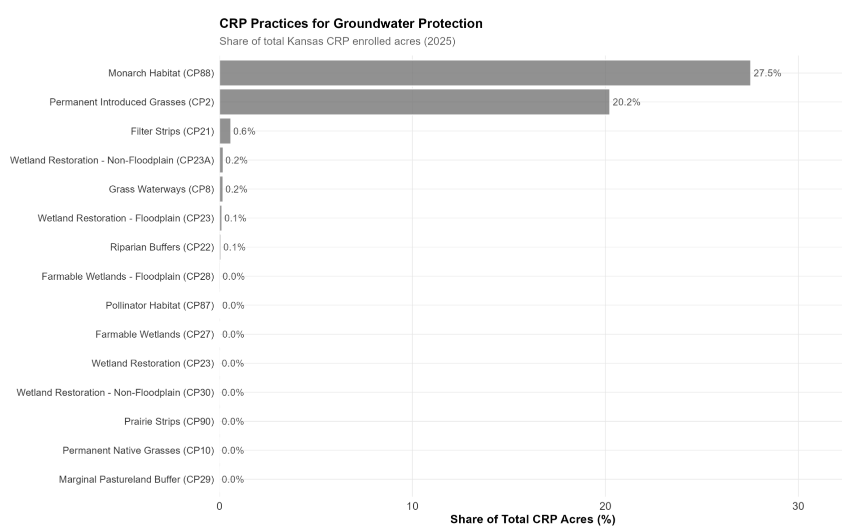


Figure 9. Source: own illustration based on CRP practice acres

The graph below highlights areas of Kansas where reductions in groundwater contamination may be more likely due to the implementation of the discussed conservation practices. While water quality CRP acres appear to represent around 40% of total CRP acreage, almost all of that is composed of grasslands, whose effects are discussed later. Although there is a limitation that land management practice enrollment does not equal measured water quality improvement, an inference can be made about likely improvements.

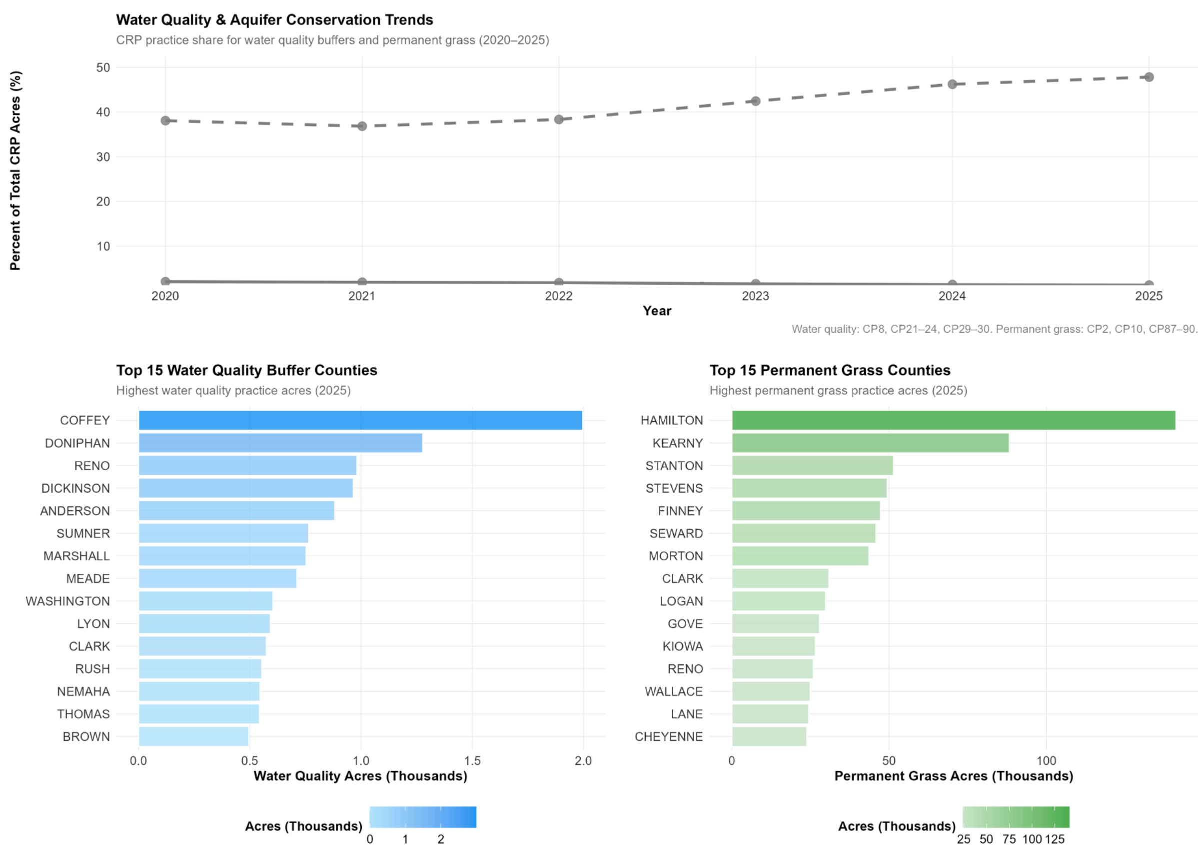


Figure 10. Source: own illustration based on water quality CRP practices

Soil Properties and Water Infiltration

Soil properties and water infiltration are important factors when talking about hydrological processes, especially in terms of groundwater, because they influence how water moves through, is stored in, and recharges subsurface systems. The rate of water infiltration is a determining factor in how quickly aquifers can be recharged, and soil properties must be managed to ensure the best possible infiltration rates.

Soil erosion associated with agricultural practices has led to excess sediment deposition across landscapes, resulting in reduced water infiltration capacities by limiting the soil's ability for water penetration (Daniel et al. 2014). Studies done to evaluate the effect of the CRP on sediment deposition in wetlands across the High Plains aquifer region have found that the sediment levels of CRP watersheds were substantially lower than cropland watersheds (Daniel et al. 2014). This demonstrates that CRP enrollment is effective in reducing sediment accumulation compared to active agricultural land use, therefore helping to maintain or improve water infiltration conditions.

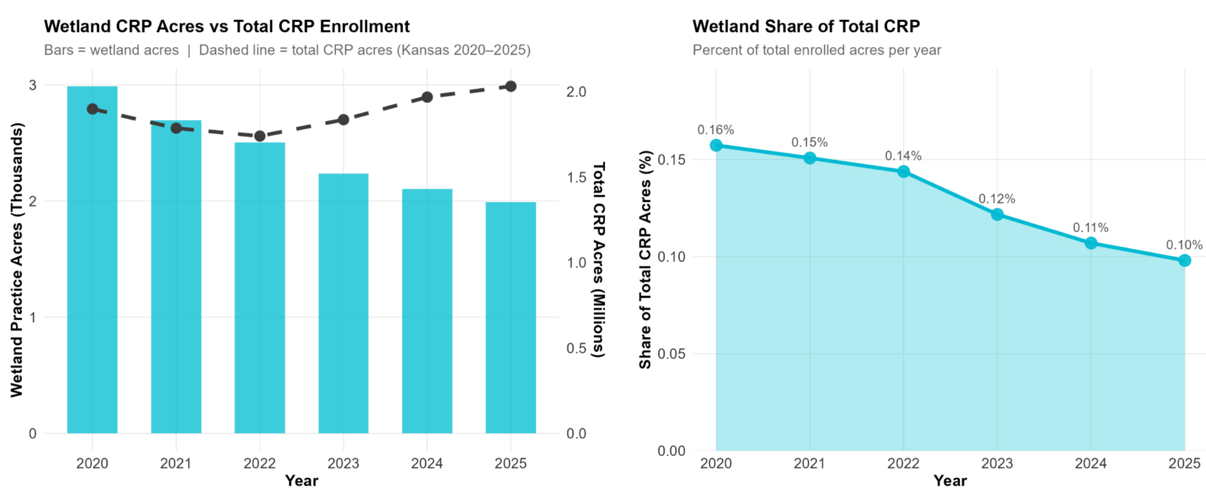


Figure 11. Source: own illustration based on CRP wetland acres and total CRP acres

The figure above shows wetland CRP acres compared to total CRP acres in Kansas from 2020-2025. Although total CRP enrollment has generally increased since 2022, wetland CRP acres have continued to decline over the same period. Because wetlands account for only a small proportion of CRP acres in Kansas, CRP enrollment may be relatively ineffective at reducing sediment accumulation and improving soil infiltration capacities at the statewide scale.

A native prairie grassland site at the Konza Prairie was compared to a continuously cultivated agricultural site to evaluate soil hydrologic processes influencing infiltration. The prairie site showed more consistent infiltration across the landscape, along with higher mean values for matrix flux potential and sorptivity, which indicated a greater ability for water to enter the soil (Govindaraju et al. 1996). These findings suggest that native grasslands promote more efficient and stable water infiltration processes. Because CRP grasslands are designed to mimic native prairie systems, similar improvement in infiltration capacity can be expected following the conversion of cropland to CRP grasslands.

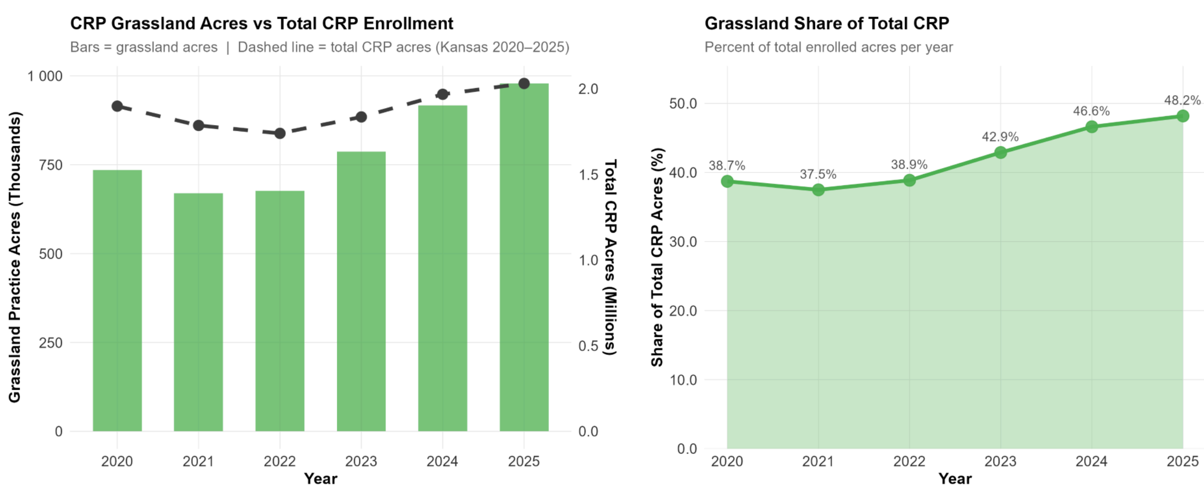


Figure 12. Source: own illustration based on CRP grassland acres and total CRP acres

The figure above shows grassland CRP acres compared to total CRP acres in Kansas from 2020-2025. Both grassland CRP and total CRP acres have been generally increasing since 2022. Grasslands account for a substantial portion of CRP enrollment (approximately 40%), which reflects their common use and ease of implementation. Based on this high implementation, CRP grassland practices are likely promoting improved soil infiltration rates and would appear to be one of the more effective CRP practices in Kansas based on acreage.

Wildlife

The distribution of Lesser Prairie Chicken populations across Kansas is strongly influenced by habitat conditions, climate, and land use patterns. Western Kansas provides the open shortgrass and mixed-grass prairie ecosystems that these birds require for nesting, predator detection, and lekking behavior. In contrast, Eastern Kansas contains higher rainfall, increased woody vegetation, and greater agricultural fragmentation, all of which reduce the amount of suitable habitat available. Human-made vertical structures such as roads, power lines, and wind turbines further contribute to habitat avoidance and population decline. Together, these environmental and ecological factors explain why Lesser Prairie-Chicken populations are more concentrated and stable in western Kansas than in the eastern portion of the state.

Western Vs Eastern Kansas

When looking into the plots of CRP across Kansas, Lesser Prairie Chickens tend to usually fall into their more dense populations on the Western side of Kansas which makes sense in retrospect. Lesser Prairie Chickens need open short grass and mixed grass prairie habitats with scattered shrubs such as sand sagebrush and these open habitat options are sustainable in Western

Kansas which helps these chickens with predator detection along with optimal lekking environments which will be discussed later. The climate gradient across Kansas also plays a role into where these chickens set up their habitats as Western Kansas has a dry and semiarid climate that limits tree growth and preserves the open prairie landscape making it more suitable than the Eastern side of Kansas as it gets a significant more precipitation which opens the land to more tree growth which falls under woody encroachment as well as the heavy urbanization which takes away more habitat potential for these chickens. Such features create vertical structures such as trees and electricity poles, which the birds generally avoid due to increased predator activity and altered mating behavior. Land use is a big factor as it determines the population distribution of these chickens. Western Kansas has more rangeland and lands under watch of the CRP program which offer appropriate breeding grounds similar to the natural grasslands they nest in while Eastern Kansas compromises mainly row crop farms that produce unsuitable grounds for sustaining any significant population of the species. This makes the Western populations not only existent but also highly concentrated because of the availability of appropriate habitats. Lesser Prairie Chickens tend to have a habitat specificity and avoidance tendencies when it comes to where they live. These chickens thrive in large areas of open prairie with minimal woodland, and actively avoid anthropogenic structures such as power lines, wind turbines and even roads. (Sullins et al. 2019). Such avoidance leads to a term called functional habitat loss which although there seems to be enough land to support these birds, it cannot due to the tendency to avoid certain features of the environment. As compared to Western Kansas, eastern Kansas has a lot of encroaching woody vegetation and man-made structures, and this leads to reduced usable habitat for the birds. Related to this is lekking behavior and its impact on reproduction success. These birds are characterized by leks which is where these birds gather for mating, and this requires clear space to enable males to show off their characteristics while the females assess them. These leks need visibility and space since even little fragmentation could affect this. On the east side of Kansas, there are few sites available for leks, and these sites are not within easy reach. But in the west side of Kansas, continuous open space provides the ideal lek habitat that remains constant from one season to another. Distribution trends seem to reinforce this finding as the vast majority of Lesser Prairie Chickens are found in the counties on the lower great plains with most continuous CRP.

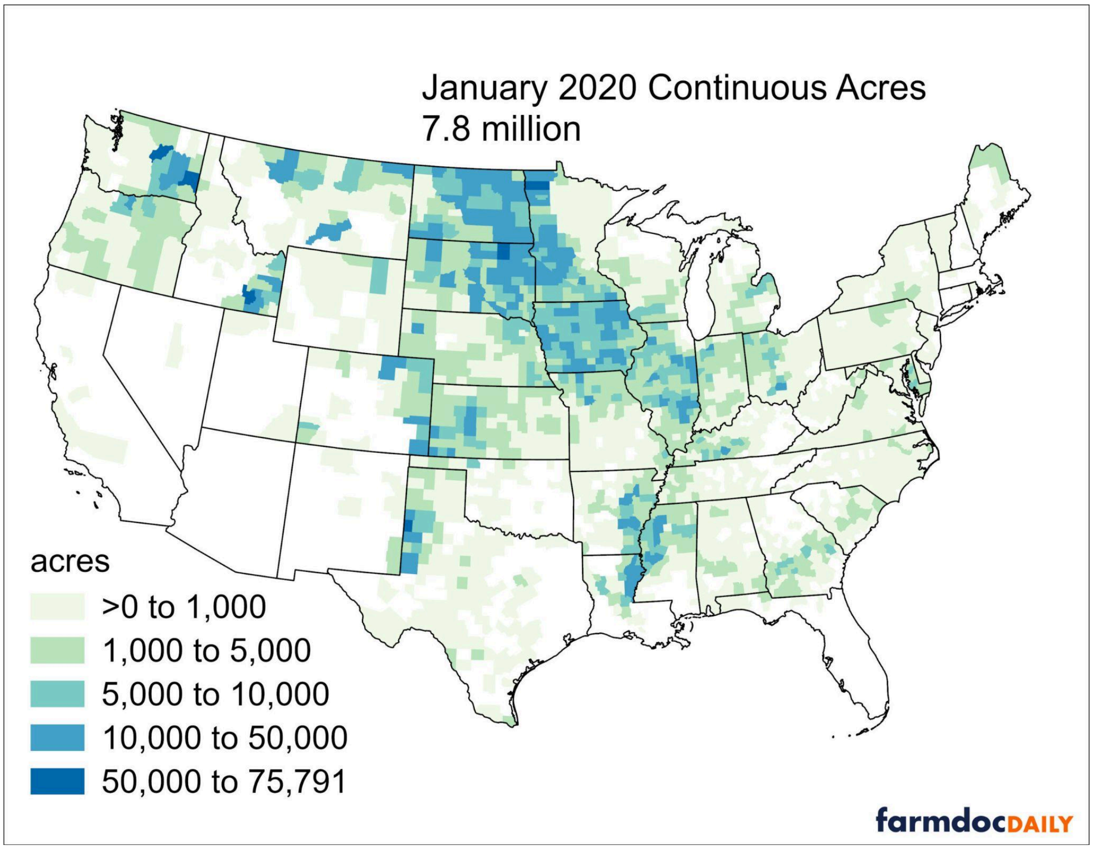


Figure 13. Source: Coppess, J. Mapping the Farm Bill: Reviewing the CRP (2022)

Greatest Risks Posed to Prairie Chickens

Disturbance regime, especially in the form of fire and grazing, is another important variable. Fire and grazing were important historically for generating a mosaic pattern of grassland habitats in the Great Plains. Another large contributor to the function habitat loss of the Lesser Prairie chicken is the lack of strategic enrollment in CRP. Many patches of CRP are small and isolated plots that remain unsuitable for habitat remediation due to their isolation. Currently, in western Kansas, controlled grazing tends to create a patchwork of vegetation height that provides both good nesting sites (taller vegetation) and suitable areas for chick brooding (open areas). In eastern Kansas, because of fire prevention and higher levels of rainfall, woody plant invasion is becoming more common, which changes the composition of vegetation height and, therefore, decreases the suitability of the habitat for birds. Lastly, population dynamics and connectivity are key elements that provide an explanation on why the western populations are relatively stable and abundant. The Lesser Prairie-Chicken is a network of subpopulations joined through dispersal. The western extent of the great plains is a patchwork of ecoregions suitable to housing the chickens. “We found genetic structuring along ecoregion boundaries and minimal gene flow between them, suggesting that landscape composition and configuration may be important drivers of gene flow.” (Oyler-McCance et al. 2016). Prairie chickens are a species where only a fraction of the males successfully pass on their genes, this mixed with the firm ecoregion boundaries has led rise to concerns of genetic breakdown; fortunately, few prairie chickens have not been in Hardy Weinberg Equilibrium. Beyond a few individuals in Eastern Texas with particularly low diversity, Lesser Prairie Chickens are not currently facing a genetic collapse as a species but it is important to monitor diversity before it erodes.

Conclusion

Our understanding of CRP’s effects have undergone many iterations since the rollout of the program in 1985. What were once considered systems that were distantly linked to the health of native grasslands are now considered more vital than previously thought. While these findings are reinforcing for CRP, further research of the extent of benefits from native grasses is necessary for the most efficient remediation and long-term management strategies. While proper quantification of the effects of these practices is not complete, CRP enrollment may soon become the force to lead the slow restoration of the agroecology of Kansas.

This report demonstrates that the impacts of CRP extend far beyond conservation alone. Across Kansas, CRP influences agricultural sustainability, hydrological processes, and wildlife habitat, all of which are closely connected with the state's environmental systems. In agriculture, CRP has shown important benefits for improving soil quality, reducing erosion, increasing water infiltration, and supporting long-term land productivity, especially in environmentally vulnerable regions of western Kansas. Although producers often face economic tradeoffs when enrolling land into conservation programs, CRP can also provide financial stability on marginal acres while protecting valuable soil resources for future generations.

Hydrologically, CRP practices such as grasslands, riparian buffers, and wetlands may help improve groundwater quality, reduce sediment transport, and support more stable infiltration processes across the High Plains region. However, these improvements are not yet quantified due to lack of data. These improvements are increasingly important as Kansas continues to face challenges associated with drought stress and declining groundwater resources. From a wildlife perspective, CRP has also become critical for maintaining and restoring habitat for Lesser Prairie Chickens, particularly in western Kansas where large, connected grassland systems remain essential for nesting and breeding success.

Overall, CRP exists at the intersection of conservation, agriculture, and long-term resource management. As environmental pressures continue to increase across Kansas, the continued success of CRP will likely depend on its ability to balance environmental protection with the economic realities faced by producers. Even so, the program will likely remain an important tool for improving resilience, protecting natural resources, and supporting the long-term sustainability of both Kansas agriculture and native ecosystems.

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