Is PRF Profitable in a Wetter State? Evidence from Arkansas



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Abstract

Despite increased enrollment in Pasture Rangeland and Forage (PRF) insurance since 2016, Arkansas has seen continued low enrollment and low loss ratios. Studies that have assisted enrollment in other forage-producing areas have not been conducted in the Southeast. We address this need by performing a profitability analysis of three distinct counties in the state across different interval selection strategies and wetness years. We find that PRF is profitable in drier to median wetness counties while showing poorer performance in the wettest county. Our results suggest the need for county-specific recommendations for enrollment and interval selection in Arkansas.

INTRODUCTION

Pasture, Rangeland, and Forages (PRF) insurance, a rainfall index (RI) insurance plan offered through the Federal Crop Insurance Program (FCIP), was first introduced in 2007 in a handful of counties and grids. Rather than using county boarders, PRF ratings are based on 0.25- by 0.25-degree longitude and latitude grids across the U.S., except for those bordering Canada and Mexico. The program was designed to solve several issues that were identified when using traditional row crop insurance plans for covering forage crop losses[1]. With PRF coverage expanded to the whole nation since 2016, though, FCIP acreage enrollment increased most as a function of PRF enrollment, moving from 6% of total acres in 2016 to 40% of total FCIP enrolled acres by 2021 (Turner et al., 2023). Further, the primary increase in PRF acreage has been in states where PRF was based on a vegetation index (Belasco and Hungerford, 2018)[2], with uneven adoption trends across the U.S.

Total enrollment in PRF has been highest in the Pacific, Mountain, and Southern Plains regions; the Delta, Lake States, and Northeast regions have seen the lowest enrollment. Total insurable acres are a significant driver of total enrollment across these regions, but other factors also play a role. Key challenges to enrollment that have previously been identified include basis risk, difficulty in selecting coverage intervals, and lack of information about the benefits of enrollment outside of key forage production areas (Zapata and García, 2022). Basis risk refers to the discrepancy between the insurance payout and the actual losses experienced by the farmer, leading to producer frustration when payouts are lower than actual losses. The complexity of interval selection for loss coverage adds to basis risk. In key production areas, research and outreach have helped to reduce such barriers and thereby have aided rapid adoption (Davidson and Goodrich, 2023). However, such research is lacking in regions such as the Lake States and the Delta.

This study aims to address this research gap, namely, by evaluating the profitability of PRF in Arkansas, a key forage production area in the Delta region. The Delta region, and Arkansas specifically, was chosen for three primary reasons. First, PRF enrollment in the region lags behind other forage-producing areas, despite being available since 2016. Second, studies that analyze the performance of PRF are lacking in the region. Third, loss ratios for participating producers in the region have been below 1 since 2018. This reflects a host of issues on the producer and program side that are currently unexplored and serve as a deterrent to participation. In addition, with Arkansas among the top 10 wettest states in the country and anecdotal evidence of poor PRF viability in wetter regions, focusing on precipitation differences across grids in the region may offer some insights. The overall intent was thus to uncover information that producers and policymakers alike can utilize to help strengthen protections for ranchers and forage producers in the region.

Since basis risk, interval selection, and low loss ratios are key factors, our analysis focuses on comparing financial performance with no PRF insurance to three different interval selection strategies described further below. These strategy comparisons were repeated for grids in the wettest, driest, and median wetness counties to assess implications of precipitation on the performance of PRF.

Our results indicate that, across all interval selection strategies, PRF performed better than the no insurance option in the dry and median wetness counties. However, more careful interval selection strategies in wetter counties is necessary, as cases existed where the no PRF protection option was most profitable. Such events are possible when excess precipitation does not trigger an indemnity payment despite forage losses from too much rain. Hence, our work suggests the need for a state/location-specific understanding of PRF for proper farm management and forage protection.

BACKGROUND

Arkansas is one of three states in the Delta region of the mid-southern U.S., bordered in the East by the Mississippi River and the Great Plains in the West. Forage production is an important source of livestock feed, with 1.5 million acres in hay and 4.5 million acres in pasture. Regions with high PRF adoption typically experience intermittent rainfall. Examples are parts of Texas, California, and much of the Great Plains that rely heavily on forage grown during the wet season to last during the months with less precipitation or periods of drought. Because of this reliance on wet-season growth and the prevalence of drought, PRF is a logical choice to help mitigate weather-related risks.

By comparison, Arkansas experiences a more consistent and higher level of rainfall throughout the year, which reduces the perceived need for PRF insurance among local farmers, leading to lower enrollment rates. Additionally, Arkansas is characterized by smaller cattle ranches and lower forage production compared to the larger, more developed operations found in the high-adoption regions. According to Barnett and Mahul (2007), weather index insurance, including products like PRF, provide a necessary safety net by offering financial protection based on objective weather indices, rather than actual loss assessments. This particularly benefits smaller operations that otherwise struggle to recover from the economic impacts of severe weather. By providing timely indemnities when weather conditions suggest a high likelihood of forage loss, PRF insurance helps smaller operations maintain their livestock, avoids distress sales, and ensures long-term viability despite adverse conditions. However, smaller operations may find the cost of premiums unappealing without a clear understanding of the potential benefits. Hence, the need for information to reduce the complexity of using PRF exists. Furthermore, as shown in Figure 1, Arkansas has the second lowest loss ratio of all states that have some level of PRF participation, with a loss ratio well below 1, implying that PRF users on average spend a dollar on premiums to receive 36 cents in indemnity payments. Policies offered through the Federal Crop Insurance Program are mandated to produce loss ratios equal to 1. Hence, low loss ratios imply potential rating issues or a lack of optimal utilization of the policy. We focus on the latter.

PRF, Forage Production, and Herd Management

Forage loss, particularly due to drought, poses a significant threat to livestock production, which is a major component of the agricultural economy. When forage resources become scarce, the direct consequence is a reduction in available feed for livestock, which can potentially lead to a series of negative outcomes. Without the necessary forage, livestock producers may be forced to reduce herd sizes through premature selling of animals, often at unfavorable market prices, leading to long-term economic losses. Moreover, a reduction in herd size may disrupt breeding programs and reduce the future productivity of the operation, further worsening the financial strain on producers. The failure to maintain sufficient forage supplies can also increase reliance on purchased feed, which is generally more expensive and can further wear away at profit margins. In some cases, persistent forage shortages can lead to the degradation of land, as overgrazing becomes a common response to limited forage availability. As Finch et al. (2016) discuss, drought conditions not only reduce forage availability but can also lead to significant environmental damage, including soil erosion and loss of vegetation cover. This degradation can have long-term environmental impacts, reducing the land's ability to support livestock production and compromising the sustainability of agricultural practices in the region (Daryanto, Wang, and Jacinthe, 2017).

Additionally, the economic strain resulting from forage loss can have community impacts as local businesses rely on a successful agricultural sector. Mitigating forage loss is crucial, not only for maintaining the capability of livestock operations but also for protecting the broader economic and ecological health of agricultural regions. Without sufficient mitigation strategies, the impacts of forage loss can be severe and enduring, affecting both current and future generations of agricultural producers.

Structure of PRF and Limits to Protection

PRF protection is based on an index of rainfall that occurs in a two-month interval in a 0.25-degree by 0.25-degree grid, with RI relative to the average rainfall of the previous 30 years; producers purchase coverage based on the grid(s) in which their fields are located. To use PRF, a producer must choose at least two specific two-month intervals, potentially based on the months the producer believes to be most important for forage production. Intervals must be selected such that at least one interval separates them, as intervals cannot have consecutive starting months. For example, a producer may decide that the late winter/early spring months are the most important for forage growth, a time that peaks in late spring to early summer in their grid. As such, the producer may select the January-February interval and a March-April or later interval, but not the February-March interval as it would overlap with the first (January-February) interval chosen.

Upon selecting intervals, a producer then decides the percent of production to cover in each grid, the sum of which must total 100% with no interval covering more than 60% or less than 10% of the total coverage value in any individual grid. The producer then decides the percent of value they will cover by choosing their coverage level. The coverage level ranges from 70% to 90% and increases in 5% increments[3]. Finally, the producer decides their productivity factor, which varies based on whether the producer is covering grazing acres or hay acres. A higher productivity factor commands a higher payment if a PRF triggering event were to occur, however, the insurance premium is also higher for higher productivity factors. The payment rates upon a trigger are determined by the County Base Value (CBV), which varies by grid and productivity factor and is a regional estimate of the monetary value of forage for an acre assigned by the RMA.

In many areas, and specifically in Arkansas, these decisions are complex. In a state where rainfall is relatively consistent, determining intervals to select that are most important for forage growth can be challenging. Basis risk, that is, when the insurance payouts based on the RI do not reflect the actual losses experienced by the farmer, also complicates matters. While index insurance programs are beneficial in reducing organizational problems and other issues such as adverse selection and moral hazard, imperfect correlation between the index (e.g., rainfall) and actual losses experienced by policyholders are problematic (Miranda and Farrin, 2012). This basis risk is larger in regions with consistent or less variable rainfall, which is where the correlation between the index and actual forage conditions can be weak, compromising the fundamental purpose of index insurance by not delivering the financial protection needed during adverse conditions (Clarke, 2016). With Arkansas's relatively stable rainfall patterns, the perceived need for single-peril RI insurance declines, making it harder for farmers to justify the premium costs. Past work has shown that the perceived value of insurance is closely linked to the frequency and severity of adverse weather events. When these events are infrequent, as is often the case in Arkansas, farmers may view PRF as an unnecessary expense rather than a valuable tool for risk management (Smith and Watts, 2019).

Therefore, we consider the effectiveness of PRF across different interval selection strategies and across counties with different levels of average wetness across different years of varying wetness. Our aim is to determine the degree to which interval selection affects PRF outcomes and whether outcomes change based on average county precipitation. We develop three simple strategies to answer these questions and compare each to the no PRF option. The first strategy involves coverage during historically significant forage months, including May through August. The second strategy focuses on peak forage protection, using the analysis below to identify and cover intervals most strongly associated with peak forage growth. The final strategy seeks to leverage basis risk by minimizing false negative probabilities and maximizing false positive probabilities that are described further below. Leveraging basis risk improves the alignment between the policy and actual forage loss.

METHODS

We inspect three grids with the largest number of pasture acres within three counties that vary with respect to precipitation (high, medium, and low)[4]. The selected counties are Boone County (low precipitation county; 11.5% less than 30-year normal state precipitation), Lee County (median precipitation county), and Polk County (high precipitation county; 16.6% more than 30-year normal state precipitation). The selected counties are shown in Figure 2.

Demand for PRF has closely followed rainfall patterns, with dryer areas seeing higher adoption of the policy versus the opposite case for higher-than-average rainfall regions in Arkansas. Hence, we evaluate whether program benefits vary across the state based on average rainfall. Further, within each county, we evaluate how the three different PRF interval selection strategies would have performed in five separate years, in the driest, wettest, median, and the 25th and 75th percentile years in terms of rainfall over the last 30 years (1994–2023). Average performance across those five scenarios and three counties with the three interval selection strategies are then compared to the no PRF strategy.

We began by devising three interval selection strategies that may be interesting to producers. The first strategy, which we call the Near Peak Forage Months strategy, assumes that rainfall in the months closest to historical peak forage production months are the most important for forage protection. Hence, the strategy selects intervals that are near the beginning of the peak forage months and the most adjacent interval after. The intuition for this strategy is that in years where peak forage is low due to low rainfall, correlations in weather across months might also suggest that rainfall before and after peak forage would be below their 30-year normal. Hence, to implement the strategy, we determine peak forage months in each county by observing the average 30-year peak Normalized Difference Vegetation Index (NDVI) values for each county. Figure 3 highlights peak forage months in the three selected counties. We assign a 50% value to each selected interval under this strategy, choosing the interval immediately prior to the 30-year peak month and the interval immediately following the 30-year peak month to cover four months of forage production centered around the peak forage months (June and July).

The second strategy, called Peak Forage Protection, is more analytical. In this case, we select two intervals within a year that are most impactful on peak forage months based on their RI. Various agroecological factors may mean that specific months are most important for forage growth despite not being within the two-month peak forage growth window. Hence, this strategy seeks to choose two intervals most likely to pay when a forage loss occurs. Like Keller and Saitone (2022), we use NDVI in the peak forage months identified in Strategy 1 above and perform regression analysis of observed NDVI versus intervals according to Equation 1 below:

$$N_{gpt} = \beta_0 + \beta_1 RI_{gkt} + \beta_2 RI_{glt} \qquad (1)$$

where N_{gpt} is the average NDVI value for the peak (p) forage months, and RI is the rainfall index in grid (g) for two intervals (k, l) that follow the non-consecutive participation rule in year (t) that have the largest impact on peak forage production on the basis of β parameters estimated. Equation 1 is thus repeatedly estimated over the 30-year period for the three identified grids using combinations of different k and l intervals, ultimately leading to interval choices with the largest and statistically significant ($P \leq 0.05$) β_1 and β_2 estimates.

The third strategy, termed Basis Risk Leveraging, is the most data-intensive and selects intervals that reduce negative basis risk while simultaneously increasing positive basis risk. Figures 4 and 5 help demonstrate the concept by highlighting the potential for false negative and false positive payments. As the concept suggests, there are instances where farmers experience forage loss and would ideally receive a payment. However, the average rainfall across the grid may not be sufficiently low to trigger a payment, resulting in a false negative. Conversely, a producer may experience good forage production due to their specific location within a grid, yet the average rainfall in the grid may be low enough to trigger a payment, illustrating a false positive. Following Keller and Saitone (2022) and Yu et al. (2019), we define the likelihood of the first scenario occurring as the False Negative Probability (FNP) and the likelihood of the second scenario as the False Positive Probability (FPP).

To select intervals using this strategy, we form an NDVI similar to the RI used by the Risk Management Agency to implement PRF as with the second strategy where NDVI was used to determine peak forage months. Assuming the chosen coverage level is 90%, a false negative event occurs if the RI is above 90 while the NDVI is below 90; similarly, a false positive event occurs when the RI is below 90 and the NDVI index is above 90. We again utilize a linear programming algorithm to find the intervals (now not limited to two intervals as with the second strategy) that best balance these two outcomes seeking to minimize FNP and to maximize FPP while simultaneously determining the percent of value that should be assigned to each interval. Figures 4 and 5 demonstrate the average occurrence of these false negative and false positive events across the state. Additionally, Tables 1-3 show the intervals selected and the accompanying percent of production values assigned to each interval under each strategy for each of the three grid locations (Figure 2).

PRF versus No Coverage Analysis

With intervals and coverage levels selected as above, we now calculate the return/loss position for a forage producer in each grid. For each county, five years were chosen, representing different rainfall conditions: the driest year, the 25th percentile year, the median year, the 75th percentile year, and the wettest year in the data set covering 1994–2023. For every combination of year, county, and producer strategy, the profit or loss per acre relative to their 30-year average outcome was calculated. This was done in three steps. First, we use the CBV for the specific county used in our scenario to calculate what the indemnity payment would have been for the grid interval and year:

$$Interval\ Indemnity = 1 - \frac{RI_{gkt}}{C} * (CBV * C * \%policy) \tag{2}$$

where RI_{gkt} is the RI value observed in the county grid g, interval k, and year t; C is the chosen coverage level; and $\%policy$ is the amount of production value assigned to that interval. Equation 2 thus shows how the indemnity for a selected interval is calculated if the RI falls below the selected coverage level.

Similarly, we use the CBV to determine the value of forage production in the year being analyzed. We use our NDVI to determine the percent of normal forage produced in the year, so for example, if our NDVI value is 0.9, this implies that forage production was 90% of normal production in that year. We can then use the CBV to determine the value of production in the grid and county that year according to Equation 3 below:

$$Forage\ (Loss|Gain)_{gpt} = CBV * N_{gpt} - CBV \tag{3}$$

where N_{gpt} is the normalized peak (p) NDVI value observed in county grid, interval, and year. The forage loss or forage gain value represents the difference between observed forage, calculated using the observed NDVI, and expected forage based on a 30-year historical average NDVI. Finally, the sum of the values of Equations 2 and 3 represent the total profit—the sum of profit from the sale of forage and the net return from PRF indemnity payments. For simplicity, we assume hay production with a single cutting in a given year. Similar analysis can be used to explore multiple cuttings or pasture forage as well.

RESULTS

We present the results of our analysis to determine the profitability of PRF under several key scenarios. We turn first to the results in Table 4 for Boone County, the historically low rainfall county. This table shows example calculations and offers insight into what drives the results for this and other counties. Table 4 also shows the calculations for two years: 2005, the year with the lowest state average rainfall, and 2009, the wettest year among the study years in the state. For the driest year, all strategies, including the no-enrollment strategy, yielded some return from the value of the production of forage[vi].

Two of the three PRF enrollment strategies yielded higher profits compared to the no-enrollment strategy. The Near Peak Forage Months and the Peak Forage Protection strategies generated indemnities (due to low rainfall in the selected intervals) that exceeded premium costs by $35/acre and $34/acre, respectively, resulting in greater overall profit relative to no enrollment. However, the basis leveraging strategy yielded indemnities that were $9/acre less than premium costs, which reduced profitability relative to no enrollment.

The results in Table 4 highlight a key finding that will be useful for some of our results in the other tables, where basis risk is possible. Shown in Table 4's right-most column, using Basis Risk Leveraging, our calculations suggest that wet years are particularly susceptible to basis risk, perhaps due to excess rainfall creating poor conditions for forage production and harvest. PRF being single-peril coverage does not provide payment for forage loss when RIs are above the trigger threshold under these conditions.

Averaged over more weather years than the two weather years shown in Table 4, Table 5 demonstrates that each enrollment strategy performed better than no enrollment in Boone County. For Boone County, Peak Forage Protection was the best-performing strategy ,with a nearly 600% increase in per acre profit, while the Basis Risk Leverage strategy was the least profitable of the enrollment strategies. However, the Basis Risk Leverage strategy outperformed the no-enrollment strategy by $.70/acre in Boone County.

The results of our profit calculations for Lee County with median rainfall (Table 6) shows that enrolling in PRF was once again more profitable than no enrollment. Across the three enrollment strategies, there was an over 300% increase in profit per acre using the Basis Risk Leveraging strategy. Using that strategy, only one year was not profitable, while for the other years, indemnity payments more than covered premium payments and potential forage loss. Also, our calculations show that across the three enrollment strategies, in the drier years of 2005, 2007, and the average rainfall year of 2016, only the Peak Forage Protection strategy, in 2005 did not trigger an indemnity payment.

In contrast with the other counties, Polk County, the one with the highest precipitation in Arkansas during the 30-year weather range in our study, did not result in PRF enrollment strategies to be clear winners (Table 7). Looking at the average outcomes across the five scenario years, it shows that only one of the strategies, the Near Peak Forage Months strategy, is more profitable than not enrolling in PRF at all. As highlighted in Table 4 the driving factor was due to basis risk in high precipitation years that resulted in forage loss where PRF indemnities would not be triggered. With PRF covering only rainfall and not claim-by-claim forage loss, this caused the other two strategies of enrolling in PRF to be worse than not enrolling at all. This indeed does suggest a potential weakness of the program for wetter areas and warrants further study.

Overall, our results suggest that despite low loss ratios reported in the RMA summary of business data, several cases exist where profitable use of PRF is possible in the state across multiple rainfall year scenarios. However, our results also seem to confirm the suggestion that PRF may not perform as well in wetter areas, with Polk County, the wettest county in the state, showing that the profitability of enrollment relative to not enrolling in PRF was heavily dependent on the strategy used, and even then, only a minority of strategies proved profitable. This case warrants further study of PRF in the state. Nevertheless, we find a wide range of profitable county cases likely exist, and further grid-level analysis may be useful for producers in areas where PRF would likely be beneficial to their operation.

CONCLUSION

This study was conducted to understand how profitable PRF is in the state of Arkansas, a low-enrollment, wetter state. Low loss ratios and anecdotes of PRF not being useful in wetter areas likely contribute to low uptake of PRF at the state level, and this study shows that the performance of PRF insurance was not uniform across all counties in the state. Across the three counties studied, though, one of the most significant findings was the observation of lower-than-expected losses in Arkansas compared to the loss ratios reported via the RMA Summary of Business data. Producers in the Delta region, including Arkansas, have historically seen loss ratios below 1, meaning they often pay more in premiums than they receive in their indemnity payments. However, this study shows that cases exist for profitable use of PRF across multiple-year scenarios.

The result potentially suggests that low loss ratios may be the result of producers who have used PRF insurance for only a short time or inconsistently across years, since the potential exists for a negative outcome in any given year, but averaged over multiple years, the insurance plan shows positive performance in most areas. Also, newer participants may lack the historical data and understanding needed to select optimal intervals, leading to poor alignment of insurance coverage and actual forage loss. Farmers who frequently change their coverage intervals from year to year may also see reduced payouts. This inconsistency can lead to missed payments during key periods, especially in regions like Arkansas where rainfall is relatively stable but still subject to unpredictable variations.

Consistent with common anecdotes, our results show that PRF performed best in low and median precipitation counties across all strategies, given consistent yearly enrollment interval selection in those years. However, our results also suggest that wet counties/areas may be exposed to additional risk of enrolling in the program perhaps due to forage loss in excessively wet years and the single-peril nature of PRF. Such a result may give some producers pause, leading them not to enroll in the program in particularly wet counties.

The results of this study emphasize the importance of tailored PRF interval selection, particularly in regions like Arkansas with its diverse rainfall patterns. As such, decision-support software that could assist with picking intervals and production value coverage, as outlined for three different strategies for three grids in this article, may help farmers make more informed decisions about their insurance policies. With forage protection, improved economic outcomes and enhanced protection against forage losses appear attainable. Meanwhile, policymakers must consider the need for region-specific adjustments to PRF structures to better serve the needs of agricultural producers in the Delta region.

Furthermore, it is worth noting that our profits/losses calculations are on an unsubsidized, per acre basis. However, at the 90% coverage level used in this study, there is a 51% subsidy on the per acre premium rate, meaning producers using PRF only pay 49% (Mitchell and Biram, 2023). With subsidized premiums in mind, it presents an even stronger case that enrolling in PRF is likely profitable, particularly in the drier counties in Arkansas. Nevertheless, our results present rich opportunities for further investigation into this subject in the state and region.

FOOTNOTES

1 Traditional FCIP policies designed for annual row crop production require an assessment of yields at the end of the production period compared to yield potential, which can be difficult to assess, particularly when forage is grazed as stocking rates can impact regrowth potential.

2 When first introduced, PRF was based on a vegetation index in some states and a rainfall index in other states. With updates to the program in 2016, PRF plans in all states were converted to a rainfall index. Additionally, the program began to offer separate coverage for irrigated and non-irrigated haying practices (Belasco and Hungerford, 2018).

3 The coverage level is like the deductible common in most other insurance policies. For example, if a producer selects a 90% coverage level, it is like selecting a 10% deductible in other insurance policies, and the program begins to pay on the portions of losses more than 10% of the insured value.

4 Representative grid rainfall is categorized according to their 30-year normal rainfall levels. County representative grids were selected based on the highest, lowest, and mean 30-year normal values.

5 The RMA reports the county base values https://public-rma.fpac.usda.gov/apps/PRF. The county base value is the county/region monetary representation of the forage grown, differing whether the acreage is covered for hay or grazing land.

6 NDVI_I suggest a 10% forage gain, which we represent as excess profit of $19.48 based on the county base value of forage.

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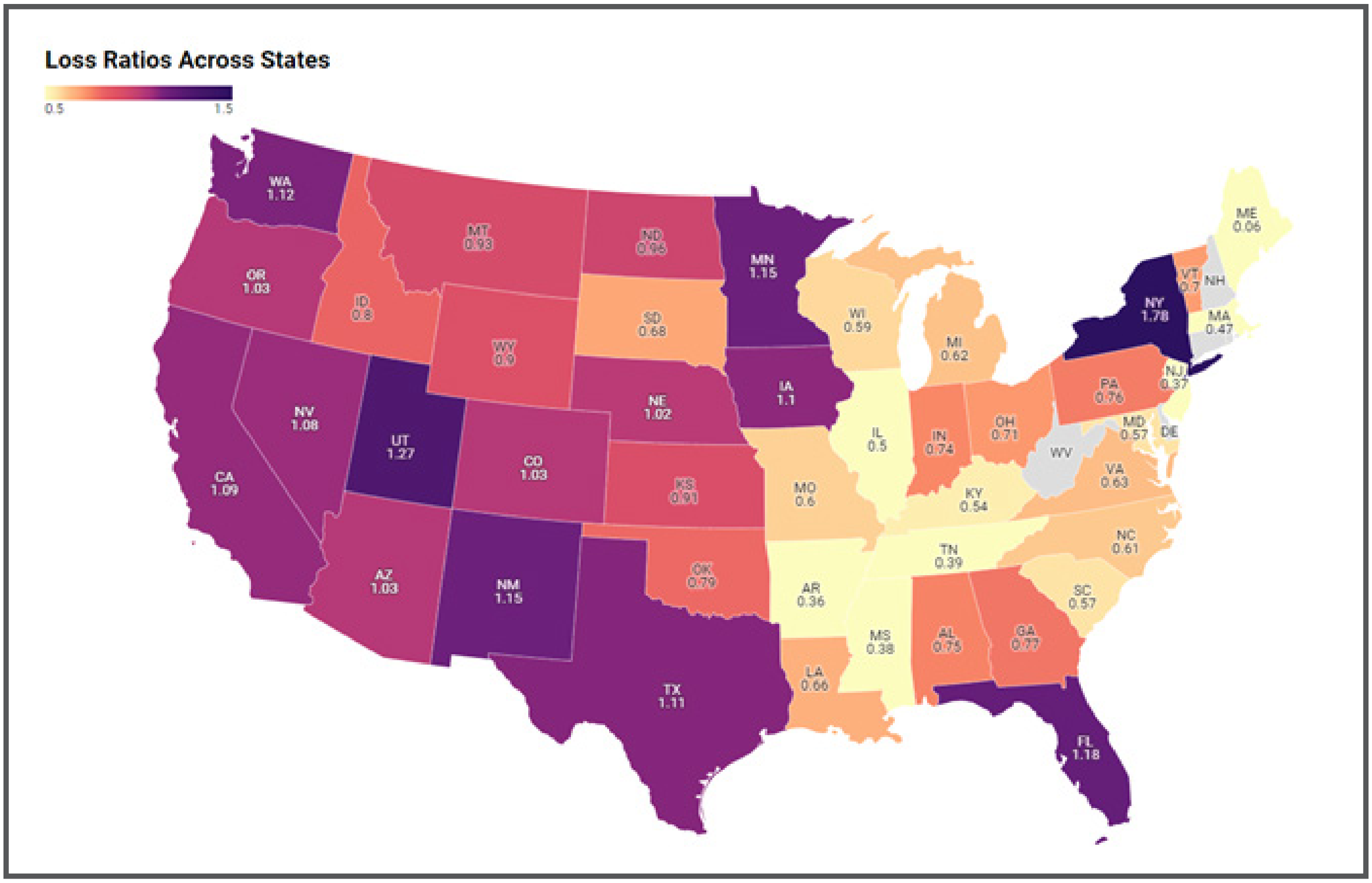

Figure 1. PRF loss ratios by state, 2018–2023

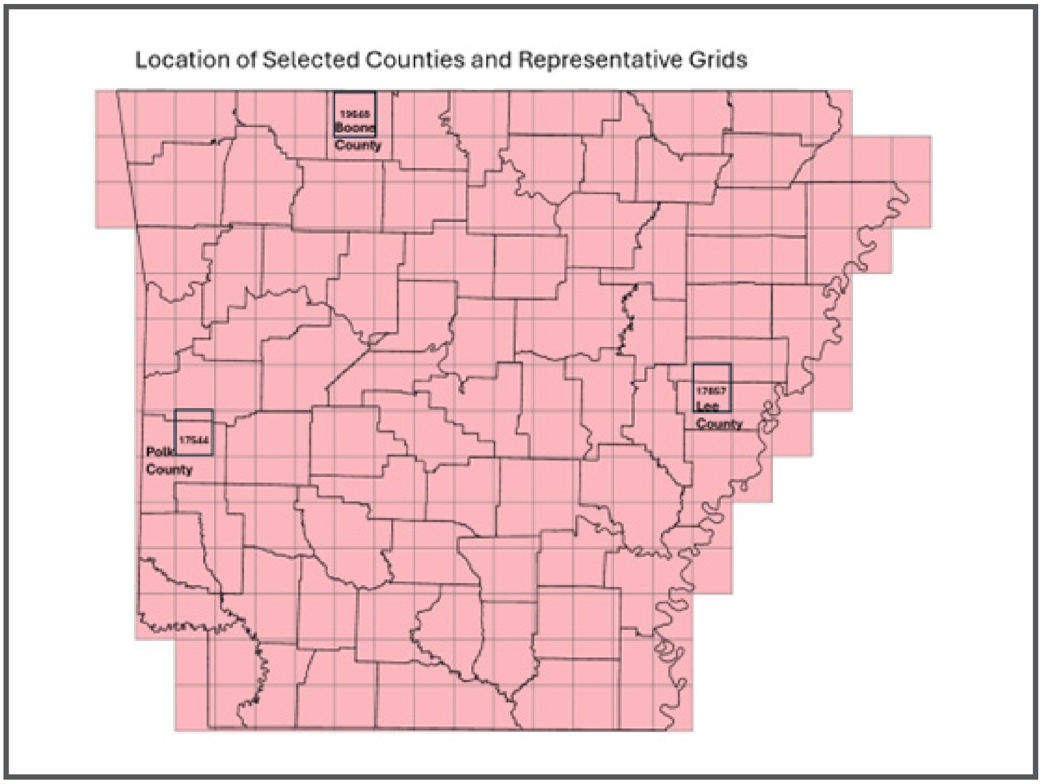

Figure 2. Selected counties and their representative grids, showcasing their geographical location in the state, where Boone County has the lowest 30-year average rainfall, Polk County has the highest 30-year average rainfall, and Lee County has the median 30-year average rainfall

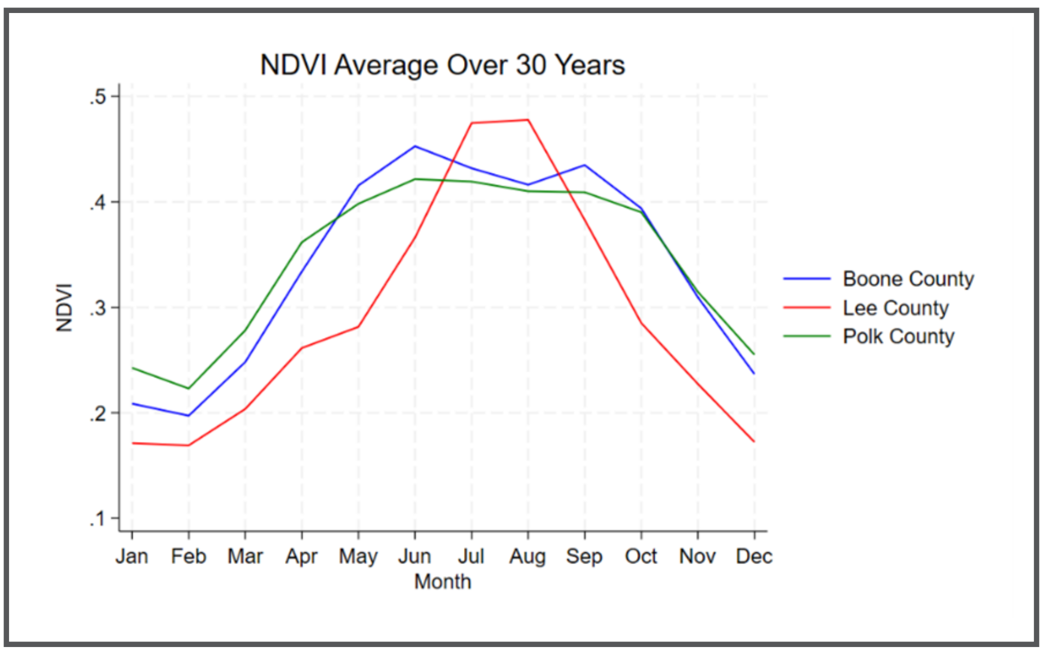

Figure 3. 30-year average Normalized Difference Vegetation Index (NDVI) values for Boone, Lee, and Polk Counties, where Boone County has the lowest 30-year average rainfall, Polk County has the highest 30-year average rainfall, and Lee County has the median 30-year average rainfall

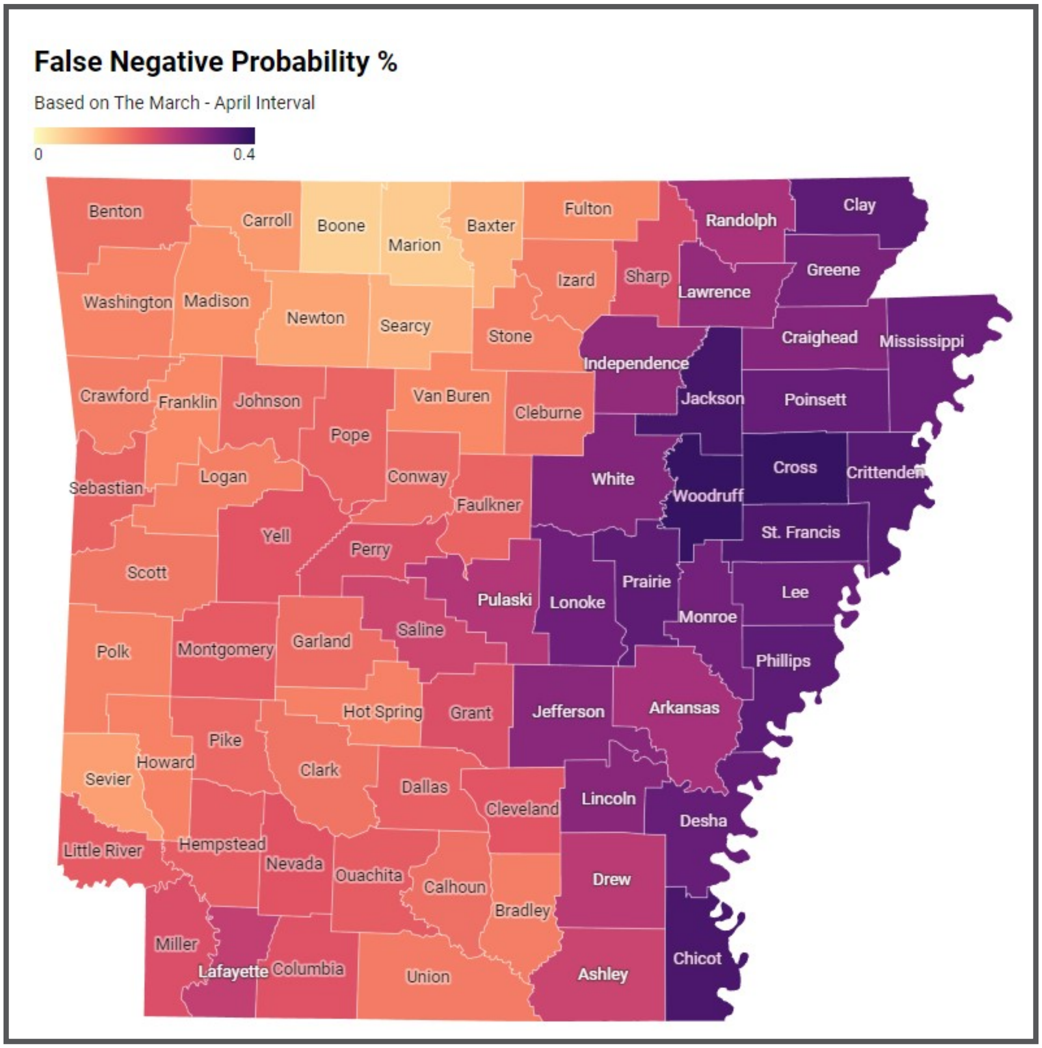

Figure 4. Degree of false-negative outcomes (not getting an indemnity when actual loss occurred) across Arkansas counties if covered by the March-April interval (notes: the March-April interval was found to be the most impactful with peak forage production (June-July) in the state using Equation 1)

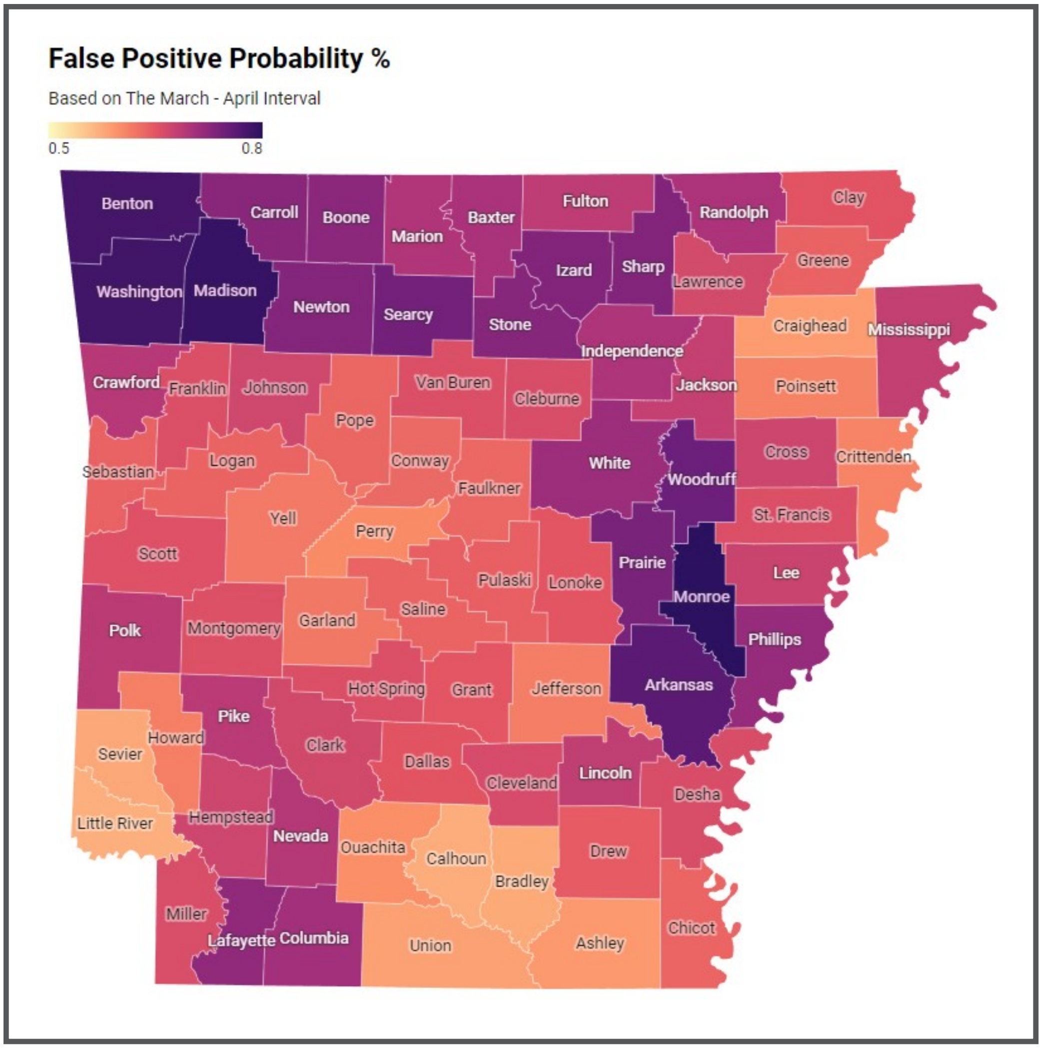

Figure 5. Degree of false-positive outcomes (getting an indemnity when no losses occurred) across Arkansas counties if covered by the March-April interval (note: the March-April interval was found to be the most correlated with peak forage production (June-July) in the state using Equation 1)

Table 1. Optimal Intervals and Interval Percentage of Production Selections for Three Selection Strategies in Boone County with Least Recorded Rainfall across Arkansas, 1994–2023*

Interval	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leveraging
(2) Feb-Mar	0%	**60%**	**60%**
(5) May-Jun	**50%**	**40%**	0%
(7) Jul-Aug	**50%**	0%	0%
(8) Aug-Sep	0%	0%	**40%**
Total Policy %	**100%**	**100%**	**100%**

*This table shows the percentage of a PRF-RI policy that should be insured in each interval based on assigned weights from consumer profiles in Boone County Arkansas. The grid that represents this county is 19648. The intervals are numbered 1 = Jan-Feb to 11 = Nov-Dec, and intervals with 0% values were removed to conserve space.

Table 2. Optimal Intervals and Interval Percentage of Production Selections for Three Selection Strategies in Lee County with Median Recorded Rainfall across Arkansas, 1994–2023*

Interval	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leveraging
(2) Feb-Mar	0%	**40%**	0%
(5) May-Jun	**50%**	0%	**12%**
(6) Jun-Jul	0%	**60%**	0%
(7) Jul-Aug	**50%**	0%	**28%**
(9) Sep-Oct	0%	0%	60%
Total Policy %	**100%**	**100%**	**100%**

*This table shows the percentage of a PRF-RI policy that should be insured in each interval based on assigned weights from consumer profiles in Lee County Arkansas. The grid that represents this county is 17857. The intervals are numbered 1 = Jan-Feb to 11 = Nov-Dec, and intervals with 0% values were removed to conserve space.

Table 3. Optimal Intervals and Interval Percentage of Production Selections for Three Selection Strategies in Polk County with Most Recorded Rainfall across Arkansas, 1994–2023*

Interval	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leveraging
(4) Apr-May	0%	**60%**	0%
(5) May-Jun	**50%**	0%	0%
(7) Jul-Aug	**50%**	0%	**60%**
(10) Oct-Nov	0%	**40%**	**40%**
Total Policy %	**100%**	**100%**	**100%**

*This table shows the percentage of a PRF-RI policy that should be insured in each interval based on assigned weights from consumer profiles in Polk County Arkansas. The grid that represents this county is 17544. The intervals are numbered 1 = Jan-Feb to 11 = Nov-Dec, and intervals with 0% values were removed to conserve space.

Table 4. Financial Impact Calculation of PRF in Boone County (Low Precipitation County in Arkansas) for the Driest and Wettest Years, 1994–2023, on a per acre basis*

Year and Weather	2005 – Dry				2009 – Wet			
Strategy	No Enrollment	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leverage	No Enrollment	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leverage
CBV	$188.00	$188.00	$188.00	$188.00	$188.00	$188.00	$188.00	$188.00
NDVI_I	1.10	1.10	1.10	1.10	0.99	0.99	0.99	0.99
Forage loss/ gain[a]	$19.48	$19.48	$19.48	$19.48	-$2.11	-$2.11	-$2.11	-$2.11
Premium	N/A	-$21.22	-$22.53	-$24.43	N/A	-$21.22	-$22.53	-$24.43
Indemnity	N/A	$56.96	$57.11[b]	$16.13	N/A	$0.00	$15.23	$15.23
Profit/Loss	**$19.48**	**$55.22**	**$54.06**	**$11.18**	**-$2.11**	**$23.33**	**-$9.41**	**-$11.31**

*Note: [a] The forage loss/gain is the forage recorded that year (NDVI_I *CBV) minus the historical average assigned to the county by the RMA (CBV) or $188*(1.1036 -1) = $19.48. [b] The indemnity in the 2005 Peak Forage Protection column, for example, was calculated as follows:

$$\left(1-\frac{75.7}{90}*(188*90\%*60\%)\right)+\left(1-\frac{35.5}{90}*(188*90\%*40\%)\right)=\$57.11,$$

where 75.7 was the RI for Feb-Mar (Table 1) and 35.5 was the RI for May-June (Table 1) in 2005 with all calculations assuming a 90% coverage level.

Table 5. Financial Impact of PRF in Boone County (Low Precipitation County in Arkansas) in Different Weather-Year Scenarios on a Per Acre Basis

Year & Weather	No Enrollment	Near Peak Forage Months	Peak Forage Protection	Basis Risk Leveraging
2005 – Dry	$19.48	$55.22	$54.06	$11.18
2007 – 25%	($35.39)	($23.39)	($6.39)	$6.61
2016 – Average	$26.73	$29.73	$52.73	$30.73
2011 – 75%	$3.28	($1.72)	($19.72)	($21.72)
2009 – Wet	($2.11)	($23.33)	($9.41)	($11.31)
Average Outcome	$2.40	$7.30	$14.25	$3.10

Table 6. Financial Impact of PRF in Lee County (Average Precipitation County in Arkansas) in Different Weather-Year Scenarios on a Per Acre Basis				
Year & Weather	**No Enrollment**	**Near Peak Forage Months**	**Peak Forage Protection**	**Basis Risk Leveraging**
2005 – Dry	$2.98	$39.98	($5.02)	$34.98
2007 – 25%	($7.90)	$36.10	$36.10	$36.10
2016 – Average	$66.98	$59.98	$40.98	$106.98
2011 – 75%	($11.75)	($11.75)	$0.25	$6.25
2009 – Wet	($26.78)	($52.78)	($44.78)	($56.78)
Average Outcome	$4.71	$14.31	$5.51	$16.31

Table 7. Financial Impact of PRF in Polk County (High Precipitation County in Arkansas) in Different Weather-Year Scenarios on a Per Acre Basis				
Year & Weather	**No Enrollment**	**Near Peak Forage Months**	**Peak Forage Protection**	**Basis Risk Leveraging**
2005 – Dry	($13.81)	$23.19	$24.19	$5.19
2007 – 25%	($48.23)	($57.23)	($59.23)	($49.23)
2016 – Average	$24.63	$29.63	$21.63	$19.63
2011 – 75%	$3.39	$1.39	($21.61)	$3.39
2009 – Wet	($10.33)	($34.33)	($35.33)	($37.33)
Average Outcome	($8.87)	($7.47)	($14.07)	($11.67)