

Background

- ▶ The USDA RMA introduced the Pasture, Rangeland, and Forage (PRF) subsidized insurance program in 2007 to mitigate weather-related losses in forage production and smooth farm net income.
- ▶ Approximately 23% of California's rangeland was insured in 2023 for a total liability of \$307 million.

Table 1. PRF Annual Statistics - California

Year	Insured Acres (millions)	Liability (millions)	Indemnity (millions)	Premium per Acre (No Subsidy)	Premium per Acre (with Subsidy)
2015	3.05	\$44.63	\$18.39	\$4.05	\$1.84
2016	2.59	\$52.97	\$6.87	\$5.75	\$2.59
2017	2.94	\$57.82	\$15.70	\$5.43	\$2.44
2018	3.12	\$64.71	\$20.55	\$5.79	\$2.60
2019	5.28	\$108.99	\$22.49	\$6.07	\$2.74
2020	5.40	\$114.91	\$58.38	\$6.03	\$2.72
2021	7.71	\$170.71	\$59.35	\$6.31	\$2.86
2022	10.31	\$237.17	\$106.43	\$6.54	\$2.98
2023	13.34	\$307.31	\$56.59	\$6.56	\$2.99
2024	13.10	\$298.28		\$6.62	\$3.08

- ▶ PRF insurance contracts use a bimonthly rainfall index computed as the ratio of rainfall in the contract year to the average rainfall from 1948 to 2 years prior.

Table 2. Insured Acres by Interval (%) - CA 2023

Index Interval	Insured Acres (%)
Jan - Feb	23.66
Feb - Mar	5.73
Mar - Apr	13.47
Apr - May	6.15
May - Jun	6.83
Jun - Jul	6.20
Jul - Aug	2.52
Aug - Sep	5.15
Sep - Oct	11.35
Oct - Nov	6.65
Nov - Dec	12.29

- ▶ The rainfall index is an imperfect predictor of individual forage yield and sometimes the index will not trigger an indemnity payment when significant forage losses occur. We call this a false negative.
- ▶ CA's unique climate patterns and grasslands create a disconnect in the time between rainfall and forage growth. Winter rainfall determines spring and summer forage yield. This dynamic can hinder the rainfall index's effectiveness.
- ▶ Keeler and Saitone (2022) estimated that the probability of false negatives across CA rangelands was 31% to 46%.
- ▶ In contrast, Yu et al (2019) estimated a probability of only 26% in Kansas and Nebraska where rainfall is a better predictor of forage yield.

Objectives & Questions

- ▶ Evaluate the quality of PRF Insurance for three field stations in CA across varying climates and forage environments. We define contract quality as the degree to which a rancher's net income is smoothed in the face of shocks to the availability of forage on their pasture
- ▶ How well does PRF insurance smooth farm net income compared to being uninsured or alternative insurance designs using direct measurements of yield and local rainfall?
- ▶ Is PRF insurance in CA worth the premium cost with or without the subsidy?

Data

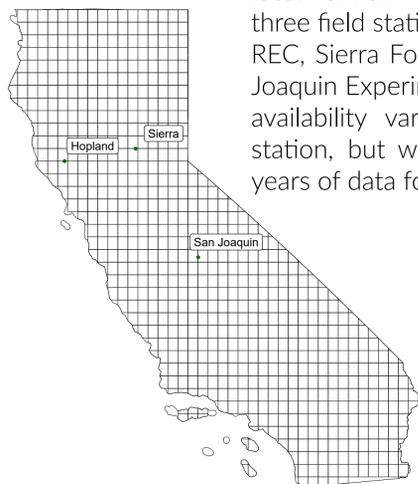
Rainfall Index & Actuarial Data

The USDA RMA uses interpolated rainfall data from the NOAA Climate Prediction Center to generate bimonthly rainfall index values for 0.25latitude by 0.25longitude grids across the continental United States. We scraped both index values and rainfall measurements from the RMA's PRF Support Tool for all 750 grids in California from 1948 to 2021. Premium rates and county base values were also obtained from the RMA.

- ▶ Index values are in "percent of normal" terms with 1.0 representing average precipitation for a bimonthly interval, > 1.0 being above normal, < 1.0 being below normal
- ▶ An indemnity is paid only if the realized index value is below the coverage rate (0.70, 0.75, 0.80, 0.85, 0.90)

Field Station Forage and Local Rainfall

We obtained annual forage and local rainfall measurements from three field stations in CA: Hopland REC, Sierra Foothill REC, and San Joaquin Experimental Range. Data availability varies between each station, but we have at least 30 years of data for each.



Enclosures (see image above) at each field station provide direct measurement of forage yield.

Table 3. Field Station Statistics

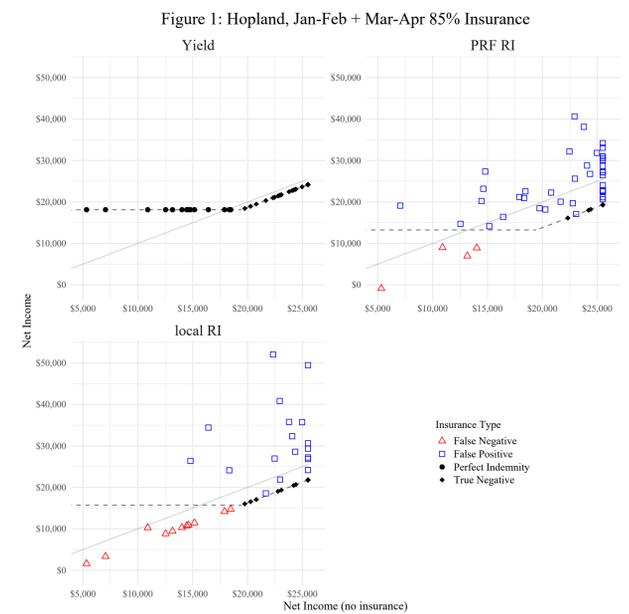
Field Station	Acre	Avg. Yield (lb/acre)	Avg. Rainfall (in)
Hopland	822	2.50	53.44
Sierra	703	3.23	44.99
San Joaquin	1006	2.22	19.00

Methods

- ▶ For each field station, we define a prototypical cattle operation and the pasture area required to support it using UCANR's 2019 Sample Costs for Beef Cattle rescaled to a herd size of 300.
- ▶ For each year, we also estimate the total cost of purchasing hay to replace any deficit in forage
- ▶ We then simulate the net income at each station for each year in our data set under four scenarios: no insurance, PRF index insurance, local rainfall index insurance, "perfect" yield insurance which covers all forage replacement costs up to the insured coverage level
- ▶ We restrict our analysis to the 85% coverage level and assume the producer picks the Jan-Feb and Mar-Apr intervals (equal weights). These are the most common choices by a large margin.

Results

- ▶ Figure 1 plots the net income in each year with vs. without insurance at the Hopland station. Yield insurance perfectly maintains net income at a minimum of 85% percent of normal, but isn't feasible in practice. PRF insurance outcomes vary wildly with many false positive payments, but has very few false negatives. Surprisingly, local rainfall based insurance fails to consistently smooth net income.



- ▶ Table 4 reports how much a risk averse producer would need to be paid to forgo operating at all. Higher values are better. We see that the PRF contract performs better than not having insurance. This implies that a producer at the Hopland station would be better off with PRF insurance than without.

Table 4. Certainty Equivalent - Hopland

Insurance Program	Certainty Equivalent
Yield	\$3.17
PRF RI	\$3.12
Local RI	\$2.97
No Insurance	\$3.10

Conclusions & Impact

- ▶ We find that the PRF Rainfall index is a relatively poor predictor of forage outcomes on field stations in CA. However, it tends to overpay rather than underpay producers for forage losses. Hence, the program increases producer welfare.
- ▶ Since the program is subsidized, these overpayments may not prohibitively raise premiums beyond what producers are willing to pay. Yet, this may lead to future concerns over the financial viability of the program and subsidy.
- ▶ This study demonstrates how data and research from UCANR is an essential input for developing and improving state and federal policy concerning agricultural risk management and producer welfare.

References

- Keeler, James B., and Tina L. Saitone. 2022. "Basis risk in the pasture, rangeland, and forage insurance program: Evidence from California." *American Journal of Agricultural Economics* 104.4: 1203-1223.
- Yu, J., M. Vandever, J.D. Volesky, and K. Harmoney. 2019. "Estimating the Basis Risk of Rainfall Index Insurance for Pasture, Rangeland, and Forage." *Journal of Agricultural and Resource Economics* 44: 179-193.