Profitability of and Choice to Enroll in the Pasture, Rangeland and Forage Rainfall Index Insurance Program

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Motivation

- Subsidized insurance must be profitable with actuarially fair premium.
- Non-participation implies either a) money left on the table or b) premiums are not actuarially fair – it is challenging to derive fair premiums for about 150,000 grid-intervals.

Key Research Questions

- Does the "profitability of enrollment" differ across grids, years, and index intervals?
- How does the "profitability of enrollment" relate to the participation patterns?

The Pasture, Rangeland, and Forage Rainfall Index Program (PRF-RI)

This is an index insurance program:

- The participants get paid based on the realization of rainfall *indices*. The *indices* are computed based on precipitation data from at least 4 weather stations closest to the center of a grid.
- The *indices* are correlated with the actual rainfall on a field and economic losses. Lower degree of correlations means higher basis risks.
- Premium is highly subsidized (ranges from 51 to 59%).
- In 2018, about 98 million acres are insured? (eligible pasture land is about 540 million acres).

How PRF-RI Works

- An operator chooses coverage level (70%-90%), which is a share of historical average rainfall for the grid where the operator is located, and assigns dollars to two or more two-month intervals to be insured.
- If the rainfall index falls below the guarantee for any insured two-month intervals, the operator gets paid in proportion to the value he assigned to those intervals.
- Land owners or renters (operators) conducting grazing or haying activities on a land parcel can purchase the insurance.

Data

1. We use NOAA CPC daily precipitation data from 1948 to 2018. The smallest unit grid is 0.25 degree times 0.25 degree which is about 144 square miles in Kansas. RMA uses these data to construct the indices and to determine indemnity payments.

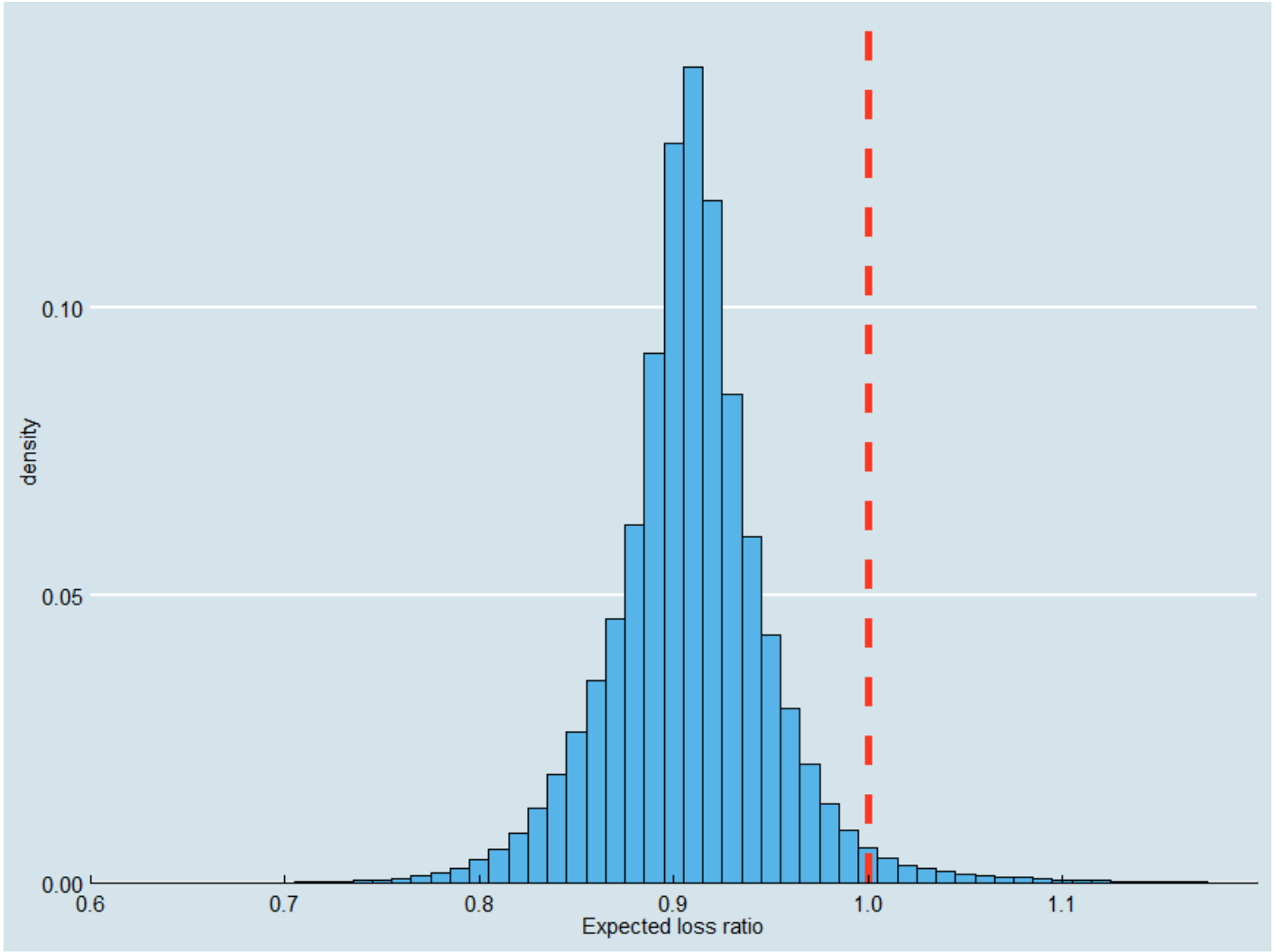
2. We also use RMA premium rates.

Define and Compute Expected Loss Ratios

- Expected Loss Ratio = Expected Indemnity/Premium
- This is also equal to "Expected Indemnity per unit of Liability/(RMA's) Premium Rate".
- Our key challenge is to construct "Expected Indemnity per unit of Liability". Current approach:
  - For each grid and each two-month interval, we estimate log normal kernel density of historical precipitation event equally weighted from 1948 to a year prior to the insured year.
  - We then compute expected indemnity per unit of liability for the insured year by using the estimated density.

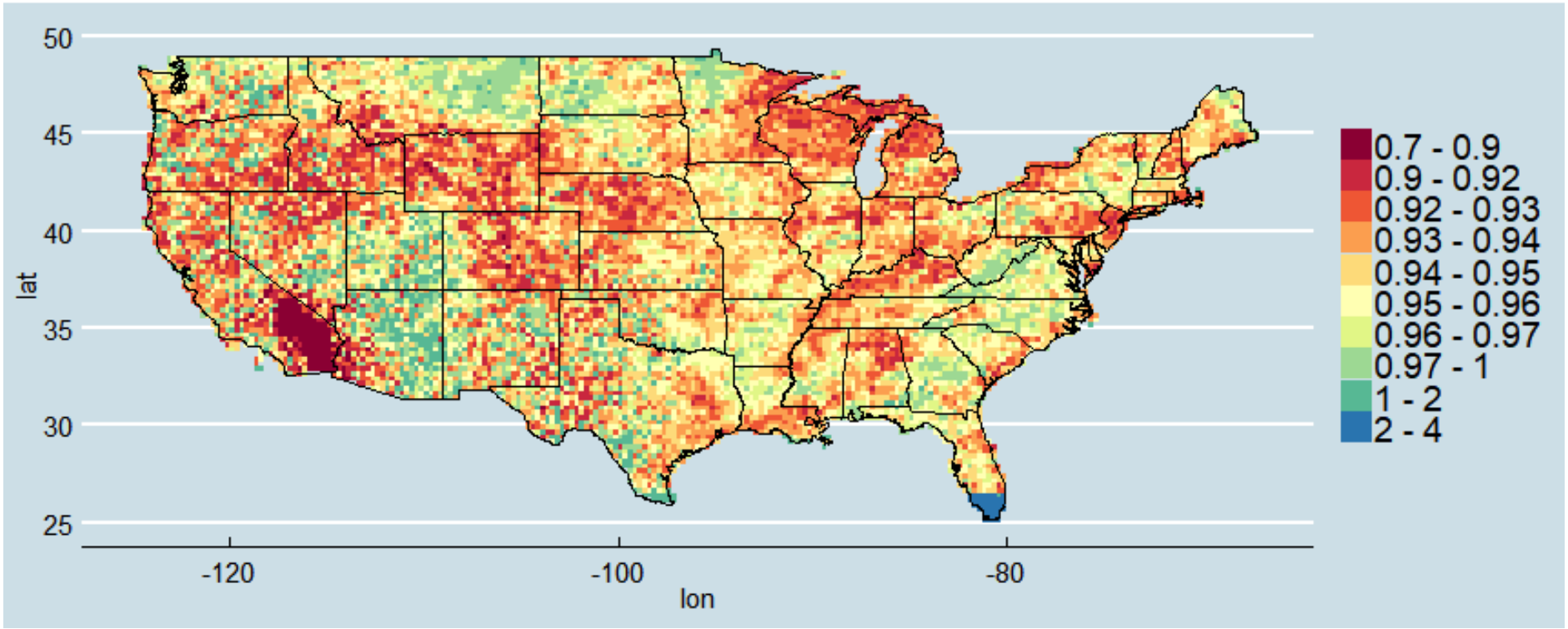
Expected Loss Ratios

Distribution of 830,000 grid-intervals from 2011 to 2018



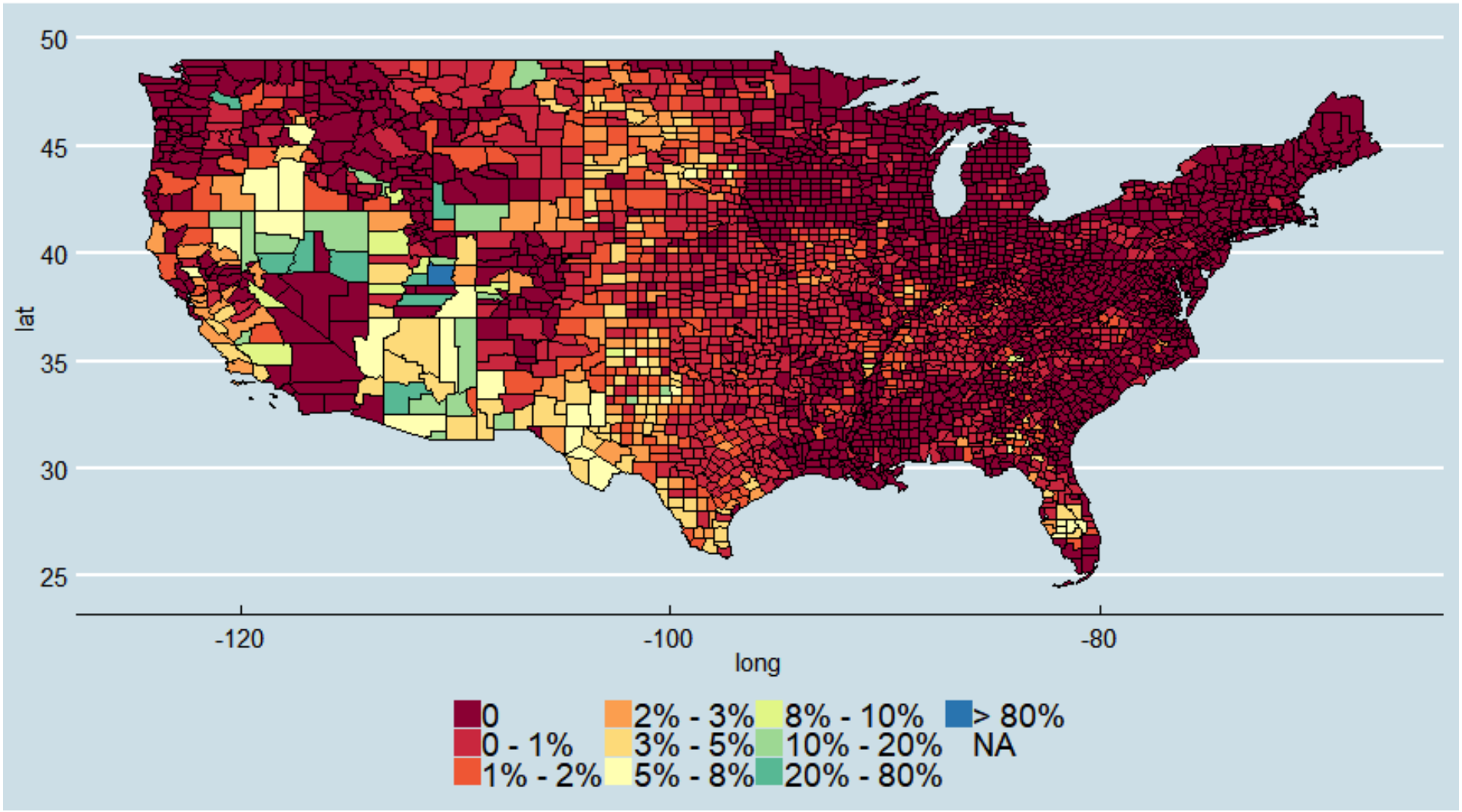
Expected Loss Ratios (avg. of two highest intervals for 13,462 grids)

United States, 2018



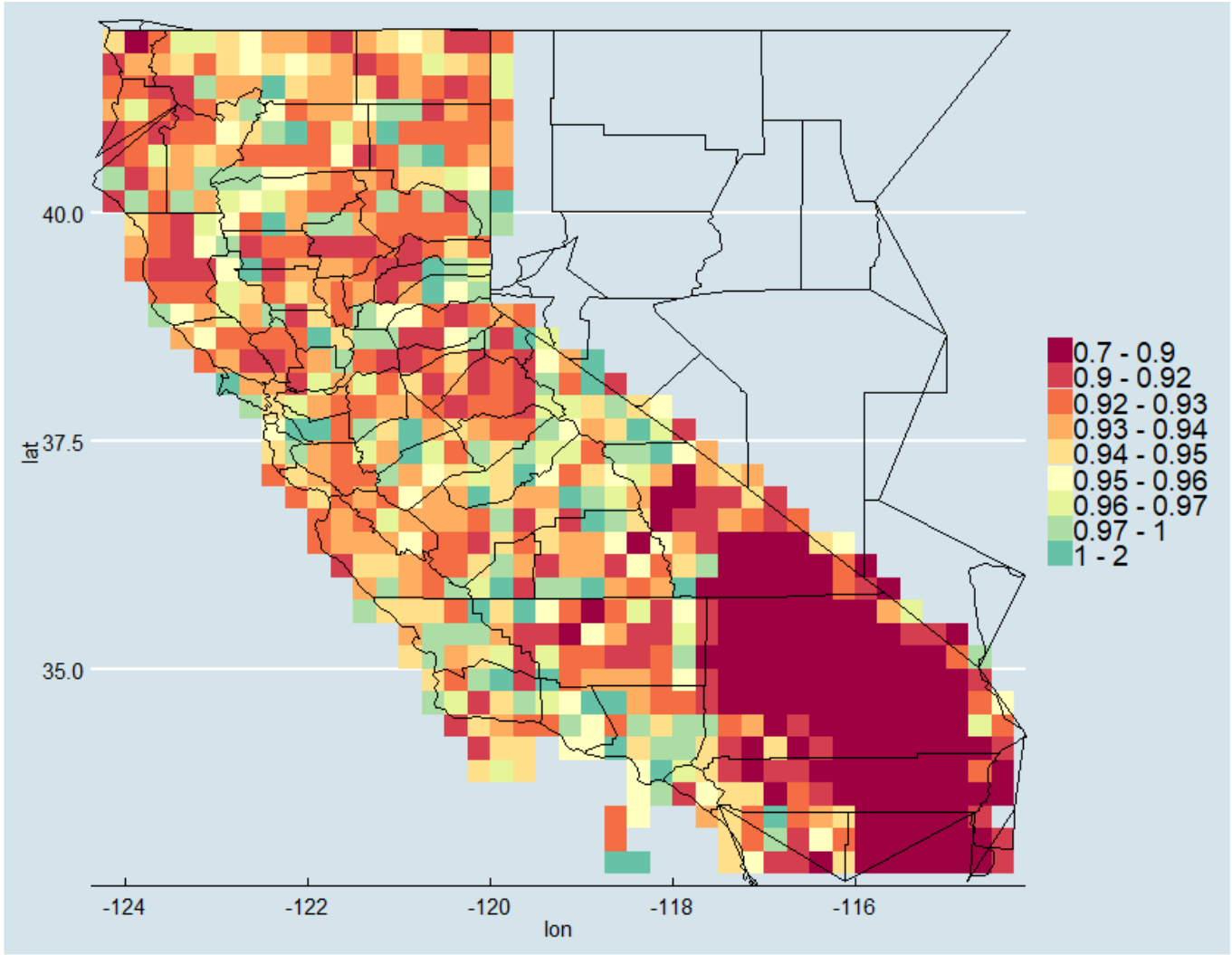
Participation Pattern (avg. of two highest intervals for 3,069 counties)

United States, 2018



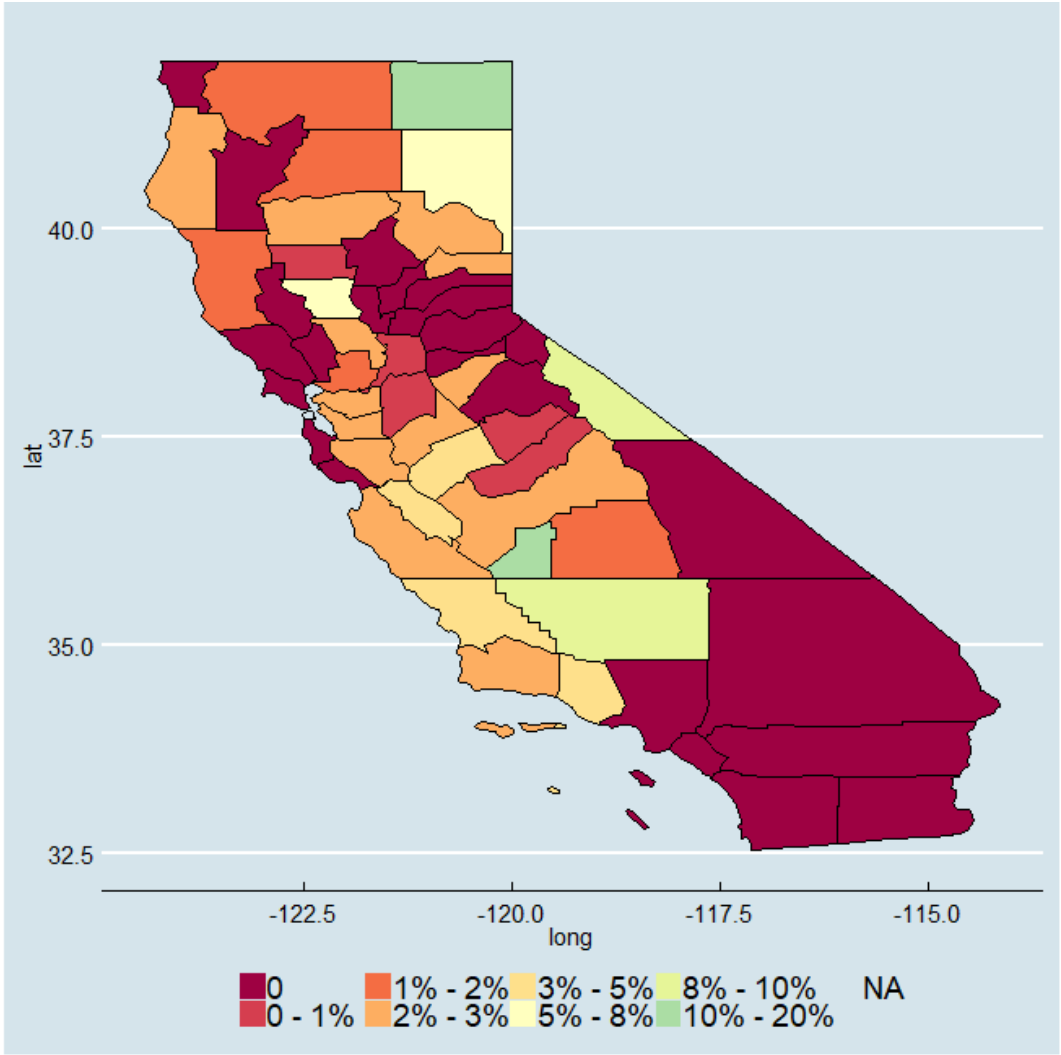
Expected Loss Ratios (avg. of two highest intervals for 750 grids)

California, 2018



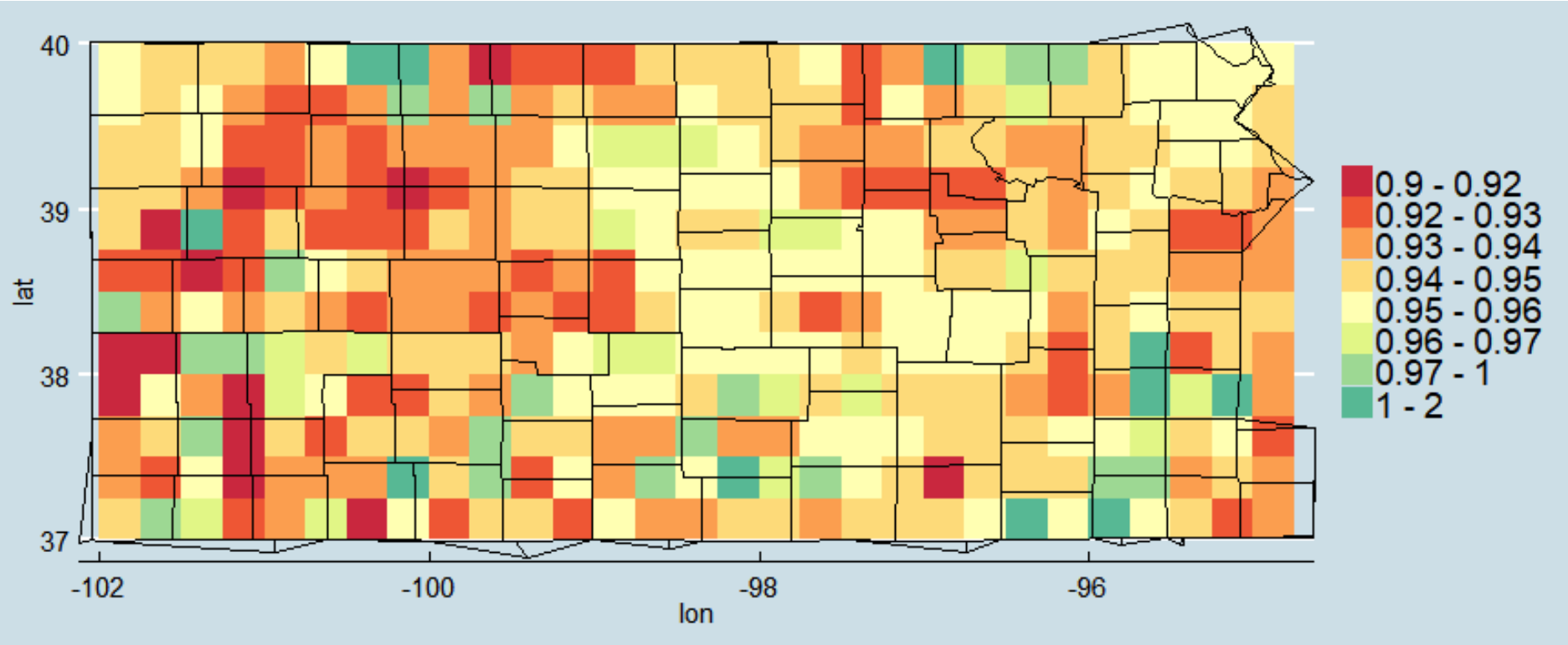
Participation Pattern (avg. of two highest intervals for 58 counties)

California, 2018



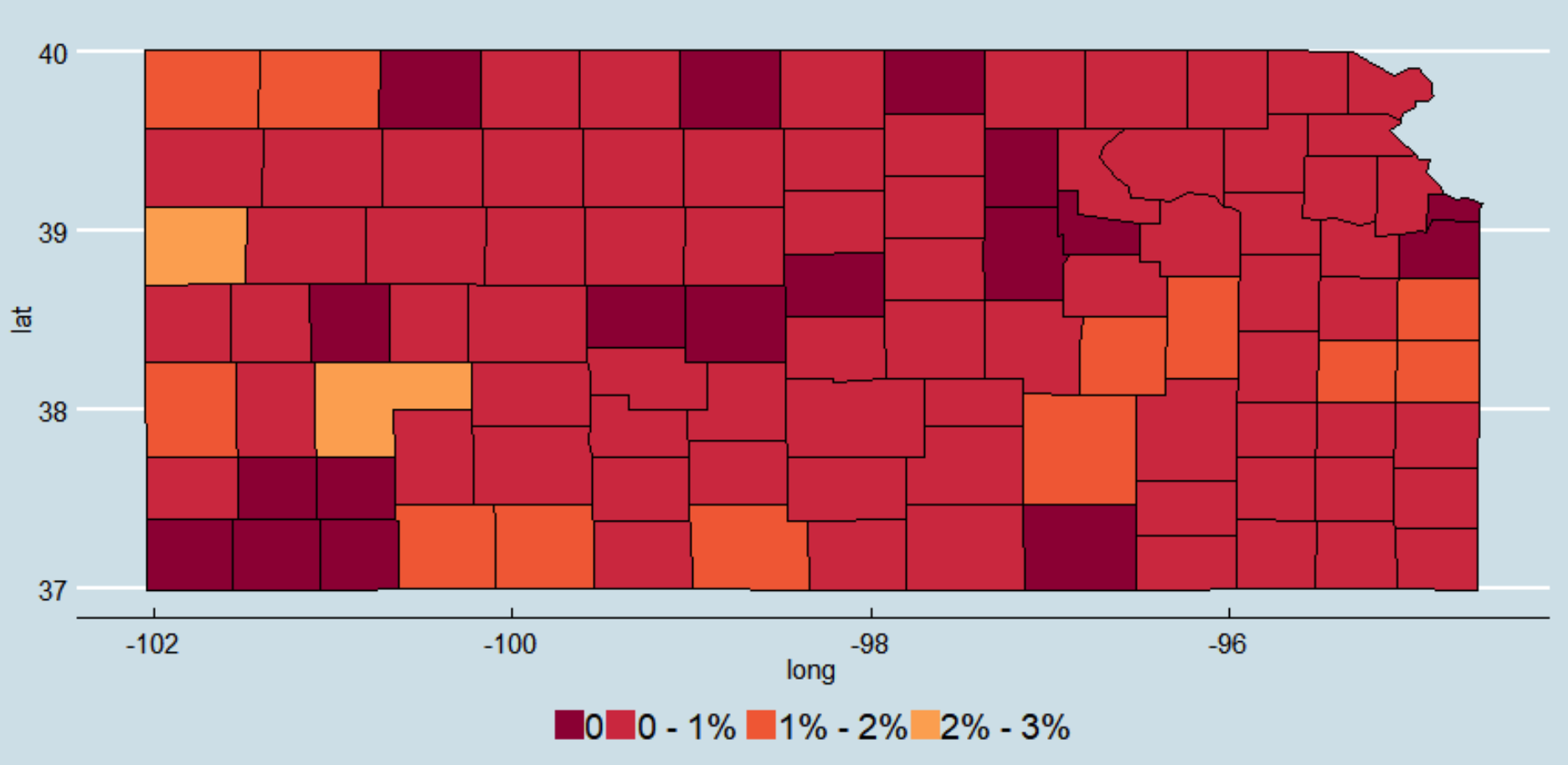
Expected Loss Ratios (avg. of two highest intervals for 425 grids)

Kansas, 2018



Participation Pattern (avg. of two highest intervals for 105 counties)

Kansas, 2018

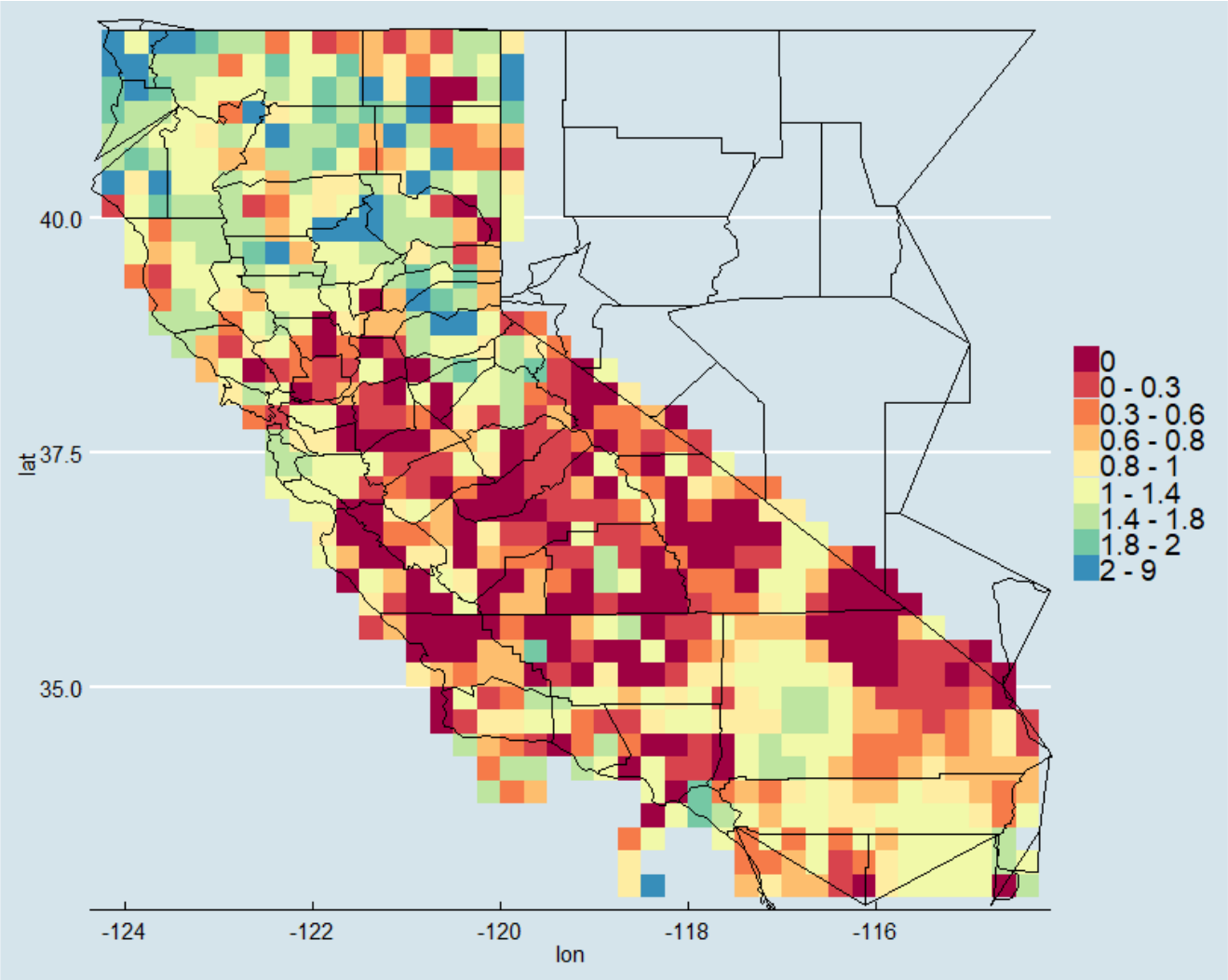


Next Steps

1. Work with alternative ways to compute the expected indemnities and the expected loss ratios.
2. Incorporate climate changes (or expectations on climate change) in constructing the expected indemnities and the expected loss ratios.
3. Examine the correlations between the expected loss ratios and the insured acres.

Appendix: Loss Ratios Based on the Realized Precipitation

California, 2018



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Kansas, 2018