

## **18. Pasture Rainfall Insurance and Associated Issues**

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*Monte Vandever joined the KSU Extension Farm Management team in February 2016 as the Southwest Area extension agricultural economist, based in Garden City. He grew up on a farm in south-central Kansas with wheat and cow-calf operations. He received B.S. and M.S. degrees in agricultural economics from Kansas State University and a Ph.D. in agricultural economics from Purdue University. Besides working for K-State Research and Extension, he also has experience working with the Economic Research Service, (USDA), the University of Nebraska-Lincoln's Extension Service, and volunteer service in Vietnam. He has a special interest in risk management, particularly crop insurance.*

### **Abstract/Summary**

*Kansas has a pilot program for insuring pasture and perennial forage production that is backed by USDA's Risk Management Agency, just like traditional multi-peril crop insurance. This insurance product – Pasture, Rangeland, and Forage coverage, or PRF – covers only one peril, however: low precipitation. Learn how this area-based system works and whether it might be a suitable risk management tool for your operation.*



# **Pasture, Rangeland, & Forage (PRF) Insurance: Rainfall Insurance for Livestock and Forage Producers**

KSU Risk and Profit Conference

Manhattan, KS

August 18-19, 2016

Dr. Monte Vandever

KSU Extension Agricultural Economist, SW Area



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## **Insurance for pastures and perennial forage production?**

- Pasture, Rangeland, and Forage (PRF) insurance available from RMA
  - What are pros and cons from a producer's perspective?
- Kansas has huge area devoted to grazing lands and perennial forages
- Drought is significant: major event 1 year in 5?



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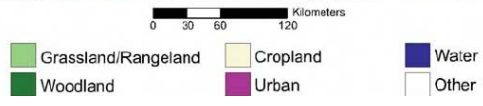
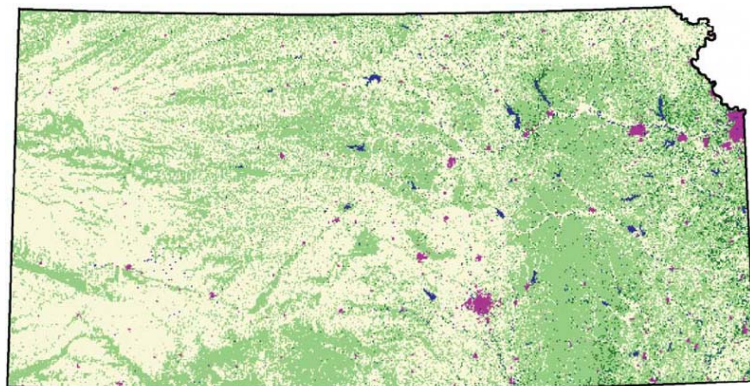
# How much land are we talking about?

15.5 million acres of permanent pasture

308,000 acres of woodland pastures

2.2 million acres of alfalfa, tame & wild hay

18.0 million acres eligible for PRF



Source: 2012 Census of Agriculture



# How much is 18 million acres? How many are insured?

Crop	Acres planted In 2015	Acres insured In 2015	% insured In 2015
Wheat	8.8 million	8.4 million	95
Grain sorghum	3.0 million	2.7 million	88
Corn	4.1 million	3.6 million	95
Soybeans	3.8 million	3.2 million	84
<b>Total BIG 4 crops</b>	<b>19.7 million</b>	<b>17.9 million</b>	<b>91</b>
Pasture & perennial forages	18.0 million	974,412	5.4

Source: Risk Management Agency, USDA





## PRF Insurance: background

- Program of Risk Management Agency (USDA)
  - Started in 2007, available in Kansas since 2009
  - Sold by private insurance agents
  - Significant premium subsidy: 51-59% paid by USDA
  - Can insure grazing land or perennial forages
  - Area-based: uses a grid system
  - Single peril: only insures precipitation



## PRF Insurance: more background

- Guarantee from 70% to 90% of normal rainfall
- Uses dollar coverage per acre
- Policy runs January to December
- Pick time periods you want to insure
  - at least two 2-month intervals and allocate \$ coverage
  - maximum of 60% of \$ coverage for any interval



## PRF uses a rainfall index

- Convert rainfall amounts to an index:
  - Simply express actual rainfall amount as a percent of long-term normal rainfall

Example:

- long term normal rainfall for two-month period is 6 inches
  - actual rainfall is 4.5 inches for that time
  - your index is 75 (=  $4.5/6 \times 100$ )
- If actual rainfall index falls below guaranteed level, the insurance pays an indemnity



## But why insure rainfall?

- PROBLEM: how can we insure forage production when we usually don't measure pasture / forage output?
- ANSWER: use another measure as a proxy for forage production
  - Precipitation: easy to measure, can't be concealed
  - Hopefully will closely reflect forage production

## Rainfall insurance? Not a new idea...

- Use rainfall as a proxy for crop output considered in some countries since 1980's
- Underlying issues:
  - Scant or unreliable yield records
  - Better data for rainfall histories for actuarial work
  - Difficulty in verifying yields
    - Concern over concealed output
    - Yields not usually measured (e.g., grazing)

## Area-based coverage: find your grid

- 0.25 degrees longitude x 0.25 degrees latitude
- 17 miles N-to-S , 13 miles E-to-W
- If your land lies in 2 adjacent grids, you can insure it in one or the other, or split it into both
- Only one composite rainfall value for entire grid

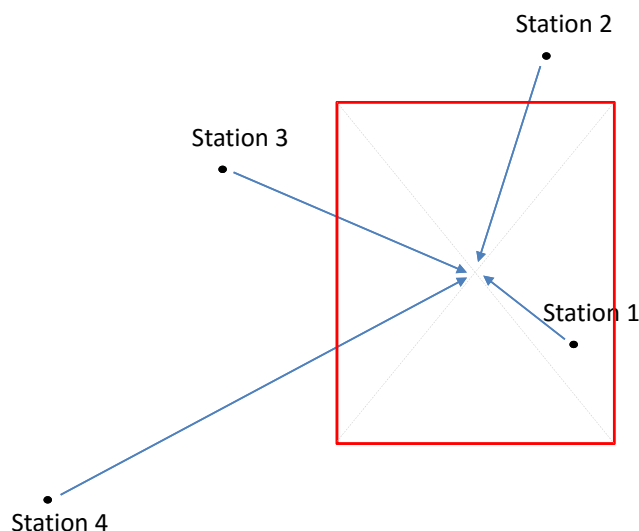


## How is grid rainfall value calculated?

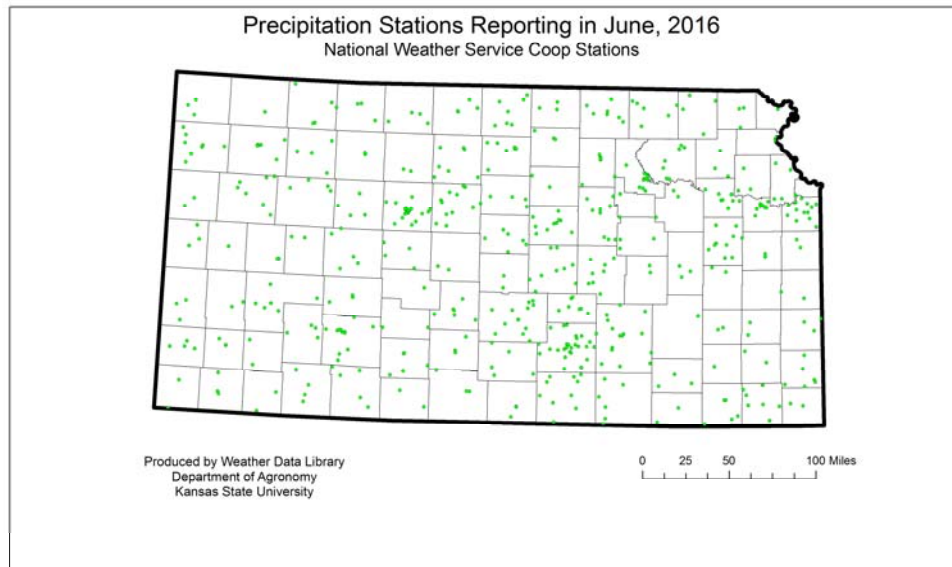
- Measure precipitation at NOAA weather stations
- Rainfall at four nearest reporting stations to center of grid are used to calculate the rainfall index
  - Weighted average of 4 stations; closest stations get greater weights
  - Coverage is area-based
  - Index is not for an individual farm or ranch or specific weather station

## Weighted by distance from grid center

- Weight based on distance
- More distant stations get smaller weight
- Your location in the grid doesn't matter



## Where are the reporting stations?



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## Rainfall insurance has some issues...

- Other perils aren't insured
  - Fire
  - Hail
  - Heat
  - Insects
  - Disease
  - Plant vigor
- Rainfall is still only a proxy measure for forage production
  - 3 important "gaps"

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## “Know the gaps”

- **Rainfall Proxy Gap:** rainfall doesn't precisely correspond to forage output
- **Distance/Basis Gap:** area (grid) rainfall index may not closely match one's own rainfall experience
- **Perennial Production Gap:** what happens this year may affect next year's production



## Actual PRF insurance process

- Producers identify:
  - intended use (grazing or haying)
  - acres to insure, grid location
  - rainfall guarantee level (70% to 90%)
  - dollars of protection (with Productivity Factor)
  - time periods to insure
  - allocation of coverage across time periods
- Coverage must be purchased by November 15.

# EXAMPLE: Riley County Diversified Farm/Ranch

- 2,500 Acres Rangeland/Pasture
- 250 Acres Alfalfa/Grass Hay
- Look at 1980-2015 (36 years)

- Use the RMA Decision Support Tool

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USDA Risk Management Agency  
United States Department of Agriculture

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You are: Home / Crop Policies and Pilots / Pasture, Rangeland, Forage

### Popular Topics

- ▶ Appendix III/M-13
- ▶ Bulletins and Handbooks
- ▶ Crop Policies and Pilots
- ▶ Federal Crop Insurance Corp
- ▶ Field Offices: ROs | COs
- ▶ Frequently Asked Questions
- ▶ Information Browser
- ▶ Laws and Regulations
- ▶ Livestock Policies
- ▶ Reinsurance Agreements

### Pasture, Rangeland, Forage

Pasture, Rangeland, and forages cover approximately 55 percent of all U.S. land. Forage grows differently in different areas, so it's important for farmers and ranchers to know which types and techniques work best for their region. The following insurance program is available for Pasture, Rangeland, and Forage (PRF). Also see livestock policies or PRF NAP Table.

PRF Archive

#### New

- USDA Expands Forage Crop Insurance Option Nationwide for Livestock Producers (Aug 31, 2015)
- PM-15-044 - Rainfall and Vegetation Index Pasture, Rangeland, Forage and Apiculture Modifications Effective for 2016 and Succeeding Crop Years (Aug 31, 2015)
- Pasture, Rangeland, Forage Pilot Insurance Program Fact Sheet
- Summary Overview of Rainfall Index Insurance plan for Pasture, Rangeland, and Forage
- Pasture, Rangeland, Forage FAQs
- Rainfall Index and Vegetation Index Pasture, Rangeland, and Forage General Program Overview
- Rainfall Index Pasture, Rangeland, and Forage Technology
- Rainfall Index and Vegetation Index Pasture, Rangeland, and Forage Shares
- Rainfall Index and Vegetation Index Pasture, Rangeland, and Forage Tools

**Rainfall Index (RI)** - is based on weather data collected and maintained by NOAA's Climate Prediction Center. The index reflects how much precipitation is received relative to the long-term average for a specified area and timeframe.

- County Availability (PDF): Map | Text
- Basic Provisions (PDF)
- Policy Provisions (PDF)
- Insurance Standards Handbook (PDF) (Aug 2015)
- Grid ID Locator, Decision Support Tool, Historical Indices

[www.rma.usda.gov/policies/pasturerangeforage/](http://www.rma.usda.gov/policies/pasturerangeforage/)

**Grid Locator**  
Pasture, Rangeland, Forage

Find a Location:  Search

Enter name, address, or latitude/longitude values. [More Info](#)

Vegetation Rainfall

Grids:  Countries:  Marker Info:  Labels:  Labels:

Map Satellite Hy and Labrador

Current Location

Grid ID: -  
Latitude: -  
Longitude: -  
County: -  
State: -  
Address: -

Grid Tools:

- Decision Support Tool
- Historical Rainfall Indices
- View Actuarial Info
- View Cost Estimator

Steps

1. Enter nearest town or address
2. Click Search
3. Navigate to property
4. Click a point on property
5. Print view for records
6. Note the Grid ID
7. Choose grid tool to view data

<http://maps.agforceusa.com/prf/ri>



**Grid Locator**  
Pasture, Rangeland, Forage

Find a Location:  Search

Enter name, address, or latitude/longitude values. [More Info](#)

Vegetation Rainfall

Map Satellite    Clear All

Zoom to Grids

Grid ID: 22934  
Latitude: 39° 11' 0.99" N  
Longitude: 96° 34' 18.01" W  
County: Riley  
State: Kansas  
Address: 1001 Fremont St, Manhattan, KS 66502, USA

Grid Tools:

- Decision Support Tool**
- Historical Rainfall Indices
- View Actuarial Info
- View Cost Estimator

Steps

1. Enter nearest town or address
2. Click Search
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# Decision Support Tool

## Pasture, Rangeland, Forage

This tool is for illustration purposes only. Your actual information may differ. For additional information, please [click here](#).



Please Select a Location: State:  County:  Grid:

Grid Locator Print

### Protection Information

Intended Use:

Coverage Level (%):

Productivity Factor (%):

Insurable Interest (%):

Insured Acres:

Sample Year:

Table  Graph

Index Interval	Percent of Value (%)	Policy Protection per Unit	Premium Rate per \$100	Total Premium	Premium Subsidy	Producer Premium	Actual Index Value	Indemnity
Jan-Feb		\$0	22.77	\$0	\$0	\$0	18.4	\$0
Feb-Mar		\$0	18.25	\$0	\$0	\$0	40.1	\$0
Mar-Apr		\$0	13.23	\$0	\$0	\$0	95.3	\$0
Apr-May	N/A	\$0	13.49	\$0	\$0	\$0	51.6	\$0
May-Jun	60	\$78,975	12.73	\$10,054	\$5,127	\$4,927	54.3	\$31,327
Jun-Jul	N/A	\$0	16.59	\$0	\$0	\$0	52.2	\$0
Jul-Aug	40	\$52,650	16.59	\$8,735	\$4,455	\$4,280	78.1	\$6,962
Aug-Sep	N/A	\$0	15.59	\$0	\$0	\$0	07.4	\$0
Sep-Oct		\$0	18.63	\$0	\$0	\$0	51.6	\$0
Oct-Nov		\$0	17.48	\$0	\$0	\$0	34.9	\$0
Nov-Dec		\$0	24.51	\$0	\$0	\$0	45.8	\$0
Per Acre	N/A	N/A	N/A	\$7.52	\$3.83	\$3.68	N/A	\$15.32
Policy Total	2,500	\$131,625	N/A	\$18,788	\$9,582	\$9,206	N/A	\$38,289

County Base Value	\$39.00
Dollar Amount of Protection	\$52.65
Total Insured Acres	2,500
Total Policy Protection	\$131,625
Subsidy Level	51.0%
Maximum Percent of Value per Index Interval	60.0%

Calculate

[prf.agforceusa.com/ri](http://prf.agforceusa.com/ri)

### Protection Information

Intended Use:

Coverage Level (%):

Productivity Factor (%):

Insurable Interest (%):

Insured Acres:

Sample Year:

### Intended Use:

- haying or grazing

### Coverage Level:

- 90% to 70%

### Productivity Factor:

- 60% to 150%

### Insurable interest:

- 100% = full ownership



County Base Value	\$39.00
Dollar Amount of Protection	\$52.65
Total Insured Acres	2,500
Total Policy Protection	\$131,625
Subsidy Level	51.0%
Maximum Percent of Value per Index Interval	60.0%

**COUNTY BASE VALUE =**  
 base \$ value of production per acre; set by RMA

**DOLLAR AMOUNT of PROTECTION =**  
 County Base Value x Productivity Factor % x Guarantee Level %

**TOTAL POLICY PROTECTION =**  
 \$ Amount of Protection x Total Insured Acres



Index Interval	Percent of Value (%)
<u>Jan-Feb</u>	<input type="text"/>
<u>Feb-Mar</u>	<input type="text"/>
<u>Mar-Apr</u>	<input type="text"/>
<u>Apr-May</u>	N/A
<u>May-Jun</u>	60
<u>Jun-Jul</u>	N/A
<u>Jul-Aug</u>	40
<u>Aug-Sep</u>	N/A
<u>Sep-Oct</u>	<input type="text"/>
<u>Oct-Nov</u>	<input type="text"/>
<u>Nov-Dec</u>	<input type="text"/>

- INDEX INTERVALS**
- Time periods for which you insure rainfall
  - Must choose at least two intervals
  - Must allocate % of coverage to each (max 60%, min 10%)

**CHOOSE PERIODS WHICH ARE KEY FOR PRODUCTION**





Index Interval	Percent of Value (%)	Policy Protection per Unit	Premium Rate per \$100	Total Premium	Premium Subsidy	Producer Premium
Jan-Feb		\$0	22.77	\$0	\$0	\$0
Feb-Mar		\$0	18.25	\$0	\$0	\$0
Mar-Apr		\$0	13.23	\$0	\$0	\$0
Apr-May	N/A	\$0	13.49	\$0	\$0	\$0
May-Jun	60	\$78,975	12.73	\$10,054	\$5,127	\$4,927
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Aug-Sep	N/A	\$0	15.59	\$0	\$0	\$0
Sep-Oct		\$0	18.63	\$0	\$0	\$0
Oct-Nov		\$0	17.48	\$0	\$0	\$0
Nov-Dec		\$0	24.51	\$0	\$0	\$0
Per Acre	N/A	N/A	N/A	\$7.52	\$3.83	\$3.68
Policy Total	2,500	\$131,625	N/A	\$18,788	\$9,582	\$9,206

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Index Interval	Percent of Value (%)	Policy Protection per Unit	Actual Index Value	Indemnity
Jan-Feb		\$0	118.4	\$0
Feb-Mar		\$0	140.1	\$0
Mar-Apr		\$0	95.3	\$0
Apr-May	N/A	\$0	51.6	\$0
May-Jun	60	\$78,975	54.3	\$31,327
Jun-Jul	N/A	\$0	52.2	\$0
Jul-Aug	40	\$52,650	78.1	\$6,962
Aug-Sep	N/A	\$0	107.4	\$0
Sep-Oct		\$0	51.6	\$0
Oct-Nov		\$0	34.9	\$0
Nov-Dec		\$0	45.8	\$0
Per Acre	N/A	N/A	N/A	\$15.32
Policy Total	2,500	\$131,625	N/A	\$38,289

## RESULTS FOR 2012

Coverage level = 90%

May-Jun:

Actual Index = 54.3

Payment Factor =

$$\frac{90 - 54.3}{90} = .3967$$

Indemnity =

Payment Factor x  
\$ Policy Protection

$$= .3967 \times \$78,975 \\ = \$31,327$$

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# Insuring Perennial Forages

- Perennial hay crops can be insured
- Winter feed is critical to many operations
- PRF insurance helps compensate for loss

## Protection Information

Intended Use:

Irrigated  Non-Irrigated

Coverage Level (%):

Productivity Factor (%):

Insurable Interest (%):

Insured Acres:

Sample Year:

County Base Value	\$166.00
Dollar Amount of Protection	\$224.10
Total Insured Acres	250
Total Policy Protection	\$56,026
Subsidy Level	51.0%
Maximum Percent of Value per Index Interval	60.0%



							2012 RESULTS	
Index Interval	Percent of Value (%)	Policy Protection per Unit	Premium Rate per \$100	Total Premium	Premium Subsidy	Producer Premium	Actual Index Value	Indemnity
Jan-Feb		\$0	22.77	\$0	\$0	\$0	118.4	\$0
Feb-Mar		\$0	18.25	\$0	\$0	\$0	140.1	\$0
Mar-Apr		\$0	13.23	\$0	\$0	\$0	95.3	\$0
Apr-May	N/A	\$0	13.49	\$0	\$0	\$0	51.6	\$0
May-Jun	50	\$28,013	12.73	\$3,566	\$1,819	\$1,747	54.3	\$11,112
Jun-Jul	N/A	\$0	16.59	\$0	\$0	\$0	52.2	\$0
Jul-Aug	50	\$28,013	16.59	\$4,647	\$2,370	\$2,277	78.1	\$3,704
Aug-Sep	N/A	\$0	15.59	\$0	\$0	\$0	107.4	\$0
Sep-Oct		\$0	18.63	\$0	\$0	\$0	51.6	\$0
Oct-Nov		\$0	17.48	\$0	\$0	\$0	34.9	\$0
Nov-Dec		\$0	24.51	\$0	\$0	\$0	45.8	\$0
Per Acre	N/A	N/A	N/A	\$32.85	\$16.76	\$16.10	N/A	\$59.26
Policy Total	250	\$56,026	N/A	\$8,213	\$4,189	\$4,024	N/A	\$14,816



# Premiums & Indemnities for 2012

- Total Premiums    \$13,230
  - Grazing    \$9,206
  - Haying    \$4,024
  
- Total Indemnities    \$53,105
  - Grazing    \$38,289
  - Haying    \$14,816
  
- Net of \$39,875







## Experience over 1980-2015

90% Coverage, 150% Productivity

- Paid 21 out of 36 years
- Annual Premium = \$13,230
- Average Annual Indemnity = \$19,167
- \$1.45 received for every \$1 spent

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## Experience over 1980-2015

80% Coverage, 150% Productivity

- Paid 15 out of 36 years
- Annual Premium = \$7,932
- Average Annual Indemnity = \$12,822
- \$1.62 received for every \$1 spent

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## Experience over 1980-2015

70% Coverage, 150% Productivity

- Paid 14 out of 36 years
- Annual Premium = \$4,227
- Average Annual Indemnity = \$8,077
- \$1.91 received for every \$1 spent



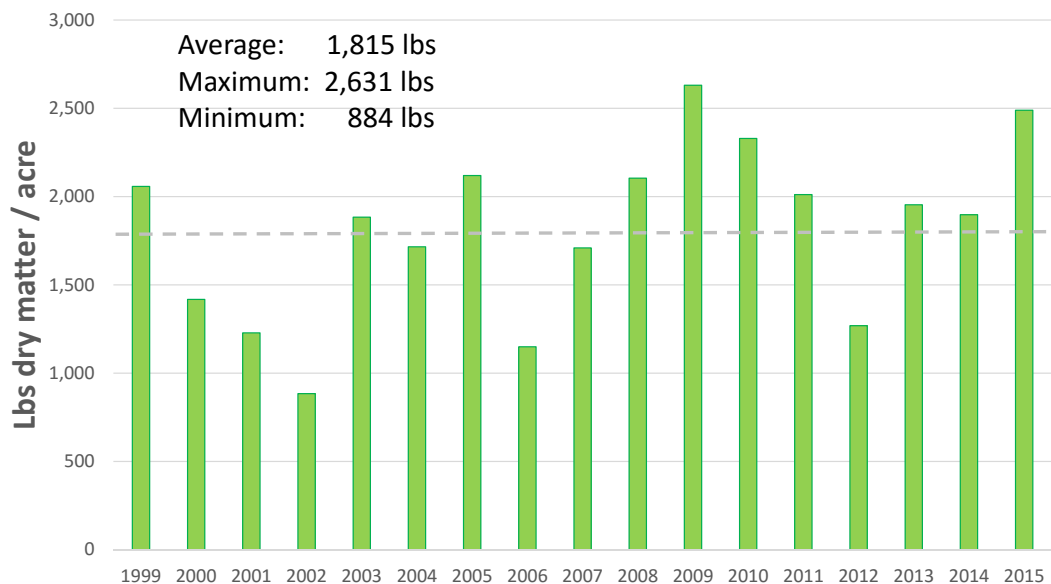
## We are now studying...

- Which time periods should be insured to provide the best risk reduction?
- How should coverage be allocated across the insured time intervals?
- How would PRF change our risk and returns?

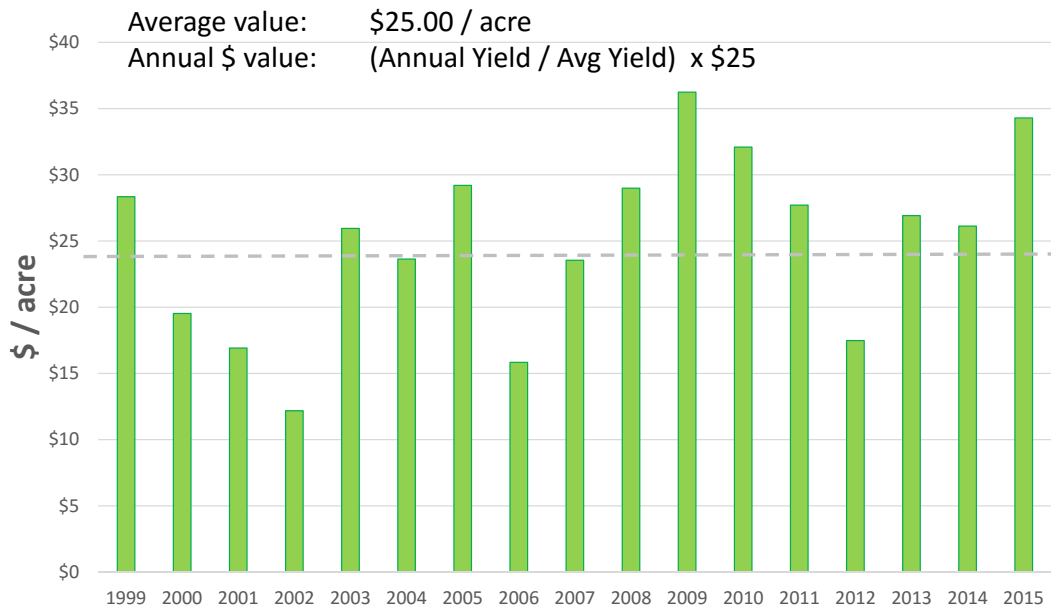
## Example: Barta Brothers Ranch

- Rock County, NE
  - Just west of Hwy 183, north-central Nebraska
  - Annual average rainfall of 22 inches
  - Mostly warm-season grasses
- Operated by University of Nebraska
- Forage yield data from 1999 to 2015

## Forage production, 1999-2015



## Value of production, 1999-2015



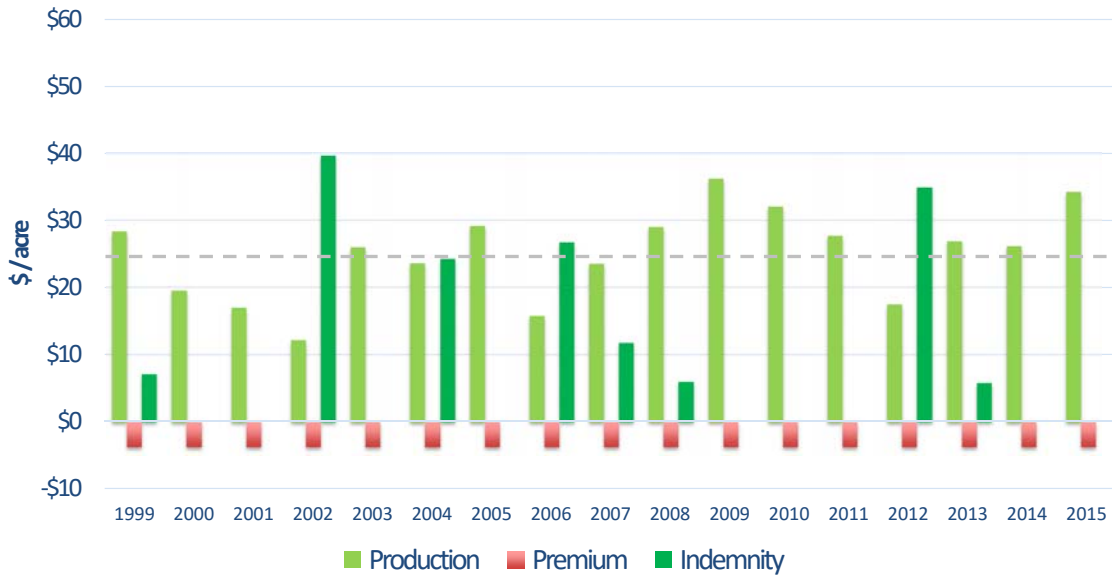
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## Add PRF insurance...

- 2016 parameters:
  - \$41.00 /acre County Base Value
  - 150% Productivity Factor
  - 90% Coverage level
  - \$55.35 /acre Dollar Amount of Protection
  - 51% Premium Subsidy

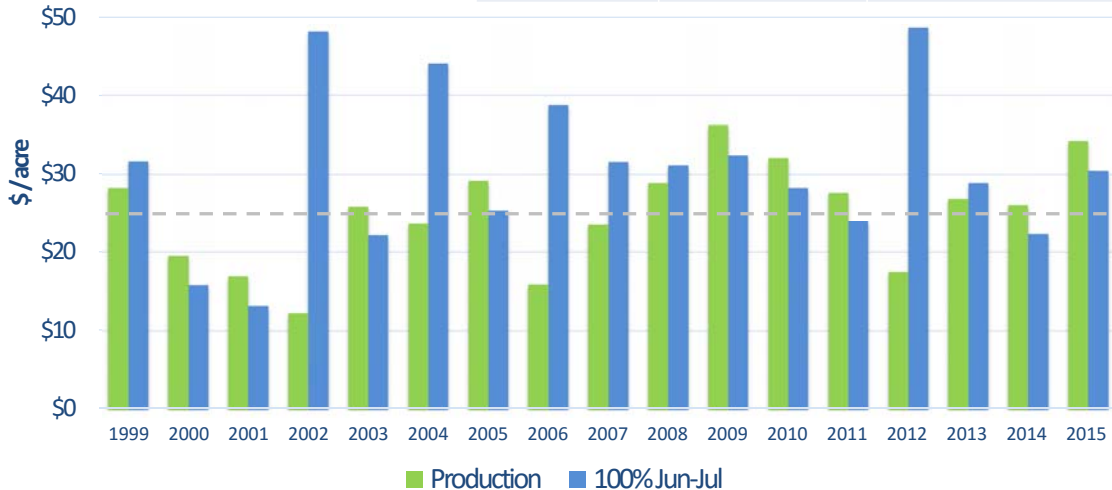
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# Adding 100% Jun-Jul coverage



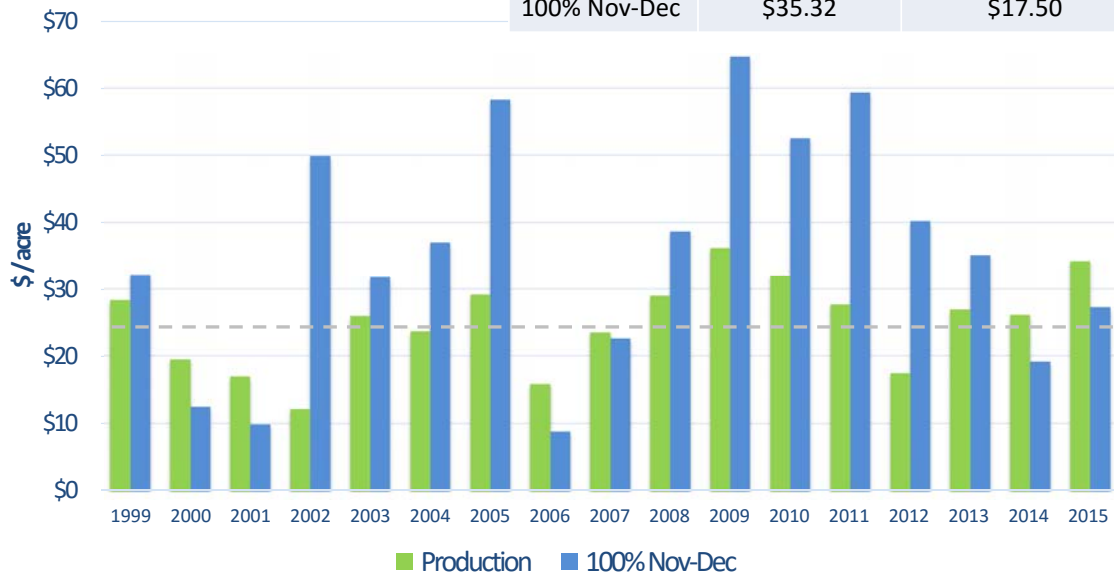
# Income stream becomes....

Option	Avg returns	Std dev of returns
No insurance	\$25.00	\$6.73
100% Jun-Jul	\$30.43	\$10.10

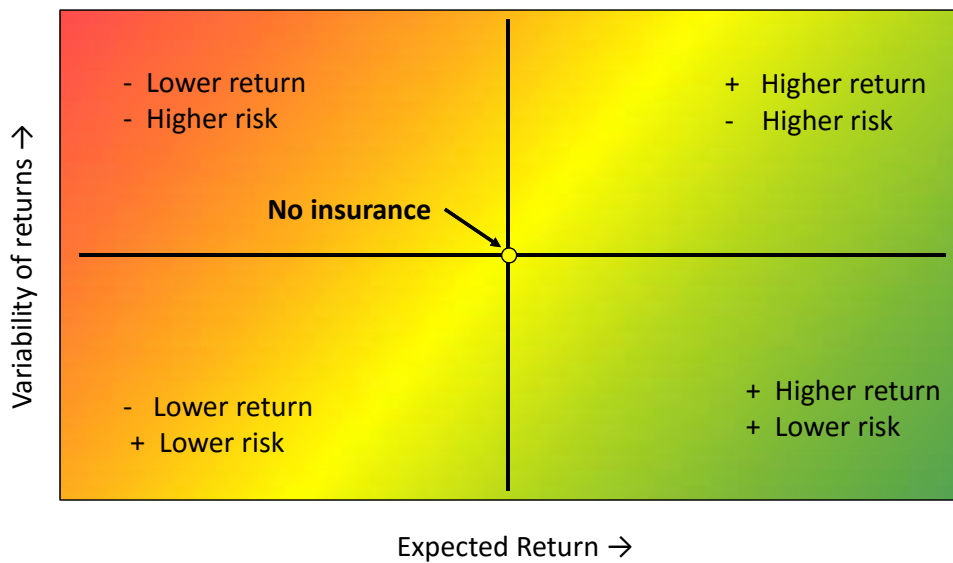


# Insure Nov-Dec?

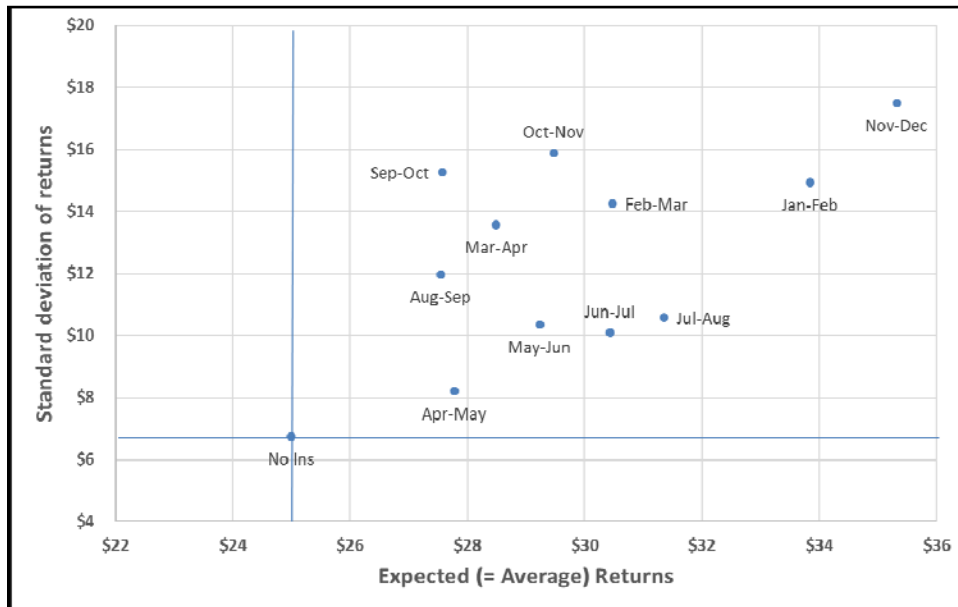
Option	Avg returns	Std dev of returns
No insurance	\$25.00	\$6.73
100% Nov-Dec	\$35.32	\$17.50



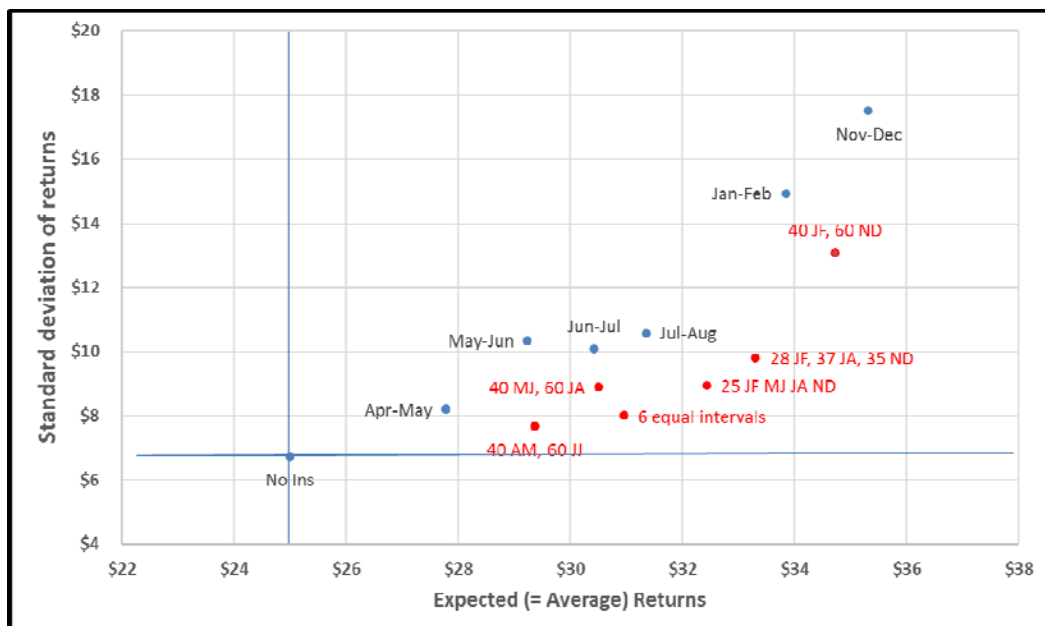
# Comparing risk-return trade-offs



## All PRF index intervals at 100% coverage



## Selected PRF allocations across multiple intervals





## Some observations...

- Buy coverage in growing season months to reduce risk
  - Best candidates to ensure payments in drought years
  - Tend to have less variability in payments
- Higher indemnity payments in winter months
  - Better chance of near-zero precipitation and hence larger indemnities; premiums are also higher
  - Weakest correlation between precipitation and forage yield
  - Tends to raise variability of returns; may get no protection in a drought year and big payoff in a good year



## MORE observations...

- Insurance increases expected returns
  - Effect of premium subsidy over many years
  - Higher Productivity Factor magnifies this effect
- Insurance can increase income variability
  - Higher Dollar Protection Per Acre makes for bigger premiums and indemnities
  - Also results from weaker correlation between rainfall index and forage output for some months
- Points to portfolio perspective for selecting intervals and allocating coverage



## PRF: What to evaluate?

- Use the Decision Support Tool to evaluate your options
  - How well does your production track with your PRF indices?
  - Insurance performance in drought years?
  - Which time periods to insure?
  - How much coverage to allocate to each insured period?
  - Levels of coverage, productivity factor?
  - Premium costs, indemnity payments?
  - Long run participation may work best....
  
- November 15 is sales deadline

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**Questions?**

**Comments?**

**Thank you!**

**Dr. Monte Vandever**

KSU Extension Agricultural Economist

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