Evaluating forage insurance strategies

Pasture, Rangeland, Forage - Rainfall Index (RI-PRF) insurance is a group insurance plan designed to protect against forage loss due to reduced rainfall. RI-PRF is the most widely used crop insurance in Wyoming, both in total acres (6,978,110) and total liability ($70,304,347). Coverage offered by RI-PRF can form part of an effective drought risk management strategy. The challenge is how to evaluate that strategy, especially on a long term basis. Will a strategy using RI-PRF generate a positive return over time? How do we account for the time value of money when making comparisons between alternatives?

The Multi-Temporal Risk Analyzer (MTRA) from RightRisk.org is an excellent tool designed to help in answering these questions. MTRA was created to provide long term partial budgeting analytics and is effective for examining insurance coverage like RI-PRF.

RI-PRF Overview and Coverage Example

The Risk Management Agency (RMA) online Decision Support tool (prodwebnlb.rma.usda.gov/apps/prf), can be used to check the desired grid area, coverage levels, and view historical data for a particular grid area. This is particularly useful to determine the cost of various coverage levels and to compare historical index values (back to 1948).

Consider Platte County example BB Ranch* currently reviewing RI-PRF coverage for 640 acres of pasture. Platte county Grid #26500 has a County Base Value of $8.30/acre (Figure 1). RI-PRF coverage at 90 percent and a 150 percent productivity factor offers an estimated Dollar Amount of Protection of $11.21 per acre (or $7,171 for 640 acres). BB Ranch selects 70 percent coverage in the April-May interval and the remaining 30 coverage in the June-July interval. The total premium for both intervals is $547 (or $0.85/acre), including the producer subsidy. If we stop here, the price for this level of coverage seems reasonable. However, further analysis is necessary to determine the long term effectiveness of using this policy.

Figure 1. BB Ranch Example RMA Online Decision Support Tool Data

MTRA analytics of RI-PRF coverage

The Multi-Temporal Risk Analyzer is a risk analytics tool with entry blanks to outline any projected inflows (added returns and reduced costs) and projected outflows (reduced returns and added costs) associated with a management change. For each of these cost and return entries, users enter a most likely, minimum, and maximum value to better account for uncertainty. This helps to address one of the bigger problems inherent in budgeting; once set at a given value, the user often then assumes that the cost or return is constant with no consideration of variability. In addition, MTRA offers the option to turn on/off each projected change over a possible 20-year period (shorter time periods are also possible). This allows users the opportunity to describe the long-term expectations for a project and its associated decisions.

Table 1. BB Ranch Example MTRA Data Entry

Proposed Change:		Interest Rate:	5.00%		~ Check the boxes below				
RI-PRF Long Term Strategy	Most Likely VALUE	Expected Low/High Value			Year 1	Year 2	Year 3	Year 4	Year 5
Added Returns									
Indemnity payment (April-May interval)	$ 390	$ -	Low	All	☐	☑	☐	☐	☐
		$ 3,631	High	None					
Indemnity payment (June-July interval)	$ 157		Low	All	☐	☑	☐	☐	☐
		$ 1,563	High	None					
	$ -	$ -	Low	All	☐	☐	☐	☐	☐
		$ -	High	None					
	$ -	$ -	Low	All	☐	☐	☐	☐	☐
		$ -	High	None					
Reduced Costs									
	$ -	$ -	Low	All	☐	☐	☐	☐	☐
		$ -	High	None					
	$ -	$ -	Low	All	☐	☐	☐	☐	☐
		$ -	High	None					
			Low	All	☐	☐	☐	☐	☐
			High	None					
	$ -	$ -	Low	All	☐	☐	☐	☐	☐
		$ -	High	None					
Added Costs									
Premium Cost	$ 547	$ 547	Low	All	☐	☐	☐	☐	☐
		$ 547	High	None					
	$ -	$ -	Low	All	☐	☐	☐	☐	☐

The first step is to enter data for the added returns (potential indemnity payment) for each interval, along with the added cost (premium due). Here we need to dive a little deeper into the data available from the RMA Decision Support tool to estimate potential indemnities.

For each interval we scan for the historical high index value to establish the upper limit to any indemnity payments. The index value was 24.9 in 1966 for April-May and in 1980 it was 24.6 for June-July. We enter the indemnity values for these respective years into the MTRA entry blanks, as the corresponding high payments of $3,631 for April-May and $1,563 for June-July, respectively (Table 1). These totals serve as the maximum indemnity payments. Zero is entered for the minimum values,

as in some years there will be no indemnity. MTRA uses these estimates to project possible indemnity payments. In addition, we set the most likely values for each interval as the proportional premium cost given by the RMA Decision Support tool ($390 for April-May, and $157 for June-July). We then select 20 years as the time horizon for each cost/return item in our first evaluation of this drought risk management strategy.

Table 2. BB Ranch Example MTRA Simulation Results

Proposed Change: RI-PRF Long Term Strategy

Interest Rate: 0.00%

CASH-basis analysis

YEAR	Projected Total Added Returns	Projected Total Reduced Costs	Projected Total Added Costs	Projected Total Reduced Returns	Projected NET ANNUAL Return
1	1,561	-	547	-	1,014
2	511	-	547	-	-36
3	1,066	-	547	-	519
4	1,626	-	547	-	1,079
5	1,405	-	547	-	858
6	1,733	-	547	-	1,186
7	960	-	547	-	413
8	116	-	547	-	-431
9	1,602	-	547	-	1,055
10	1,002	-	547	-	455
11	2,253	-	547	-	1,706
12	1,252	-	547	-	705
13	706	-	547	-	159
14	167	-	547	-	-380
15	1,005	-	547	-	458
16	762	-	547	-	215
17	2,320	-	547	-	1,773
18	1,246	-	547	-	699
19	1,591	-	547	-	1,044
20	777	-	547	-	230

Net Return:	12,721
MIN Rtn:	431
AVG. Rtn:	636
MAX Rtn:	1773

Interest Rate: 5.00%

PRESENT VALUE-basis analysis

YEAR	Projected PV-Total Added Returns	Projected PV-Total Reduced Costs	Projected PV-Total Added Costs	Projected PV-Total Reduced Returns	Projected PV-NET ANNUAL Return
1	1,561	-	547	-	1,014
2	487	-	521	-	34
3	967	-	496	-	471
4	1,405	-	473	-	932
5	1,156	-	450	-	705
6	1,358	-	479	-	979
7	716	-	408	-	308
8	82	-	389	-	-306
9	1,084	-	370	-	714
10	646	-	353	-	293
11	1,383	-	336	-	1,048
12	732	-	320	-	412
13	393	-	305	-	88
14	89	-	290	-	-201
15	508	-	276	-	232
16	367	-	263	-	103
17	1,063	-	251	-	812
18	544	-	239	-	305
19	661	-	227	-	434
20	307	-	216	-	91

Net Return:	8,350
MIN Rtn:	306
AVG. Rtn:	418
MAX Rtn:	1048

MTRA Tool Results and Analytics

MTRA evaluates risk scenarios for single- and multi-year periods using a set of random draws to simulate the possible actual cost and returns to account for uncertainty. Results include annual and cumulative net returns on a cash- and net present value-basis via the output screen after clicking RUN.

The strategy results in a positive net return over 20 years on a cash basis for a total of $12,721 or an average of $636/year for this first draw (Table 2). When we factor in a 5 percent interest rate (time value of money) for the net present value analysis, the strategy results in a positive cumulative net return of $8,350 or an average of $418/year. Clicking RUN again generates another single draw of randomized results.

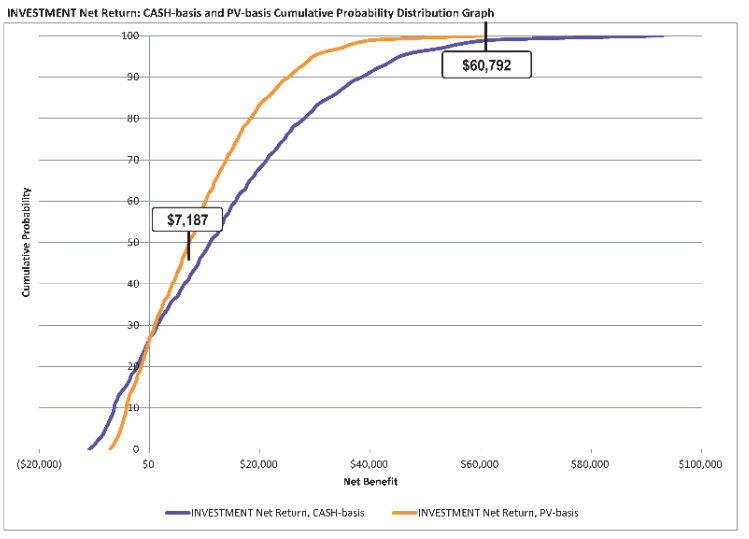
The multi-draw and probability analytics are among the more important outputs provided by MTRA, as viewing outcomes for just one 20-year draw does not provide a complete picture of the range of all possible outcomes. The multi-draw analysis reveals the expected net returns for 1,000 draws, better describing the overall range of possibilities, the expected probabilities, as well as showing the effect of the time value of money (interest rate) on the estimated net returns.

Multi-draw results are highlighted in Figure 2 in the form of a probability distribution for the expected net returns from the strategy on a cash- and net present value-basis. Net present value-basis results, assuming a 5 percent interest rate, suggest that if the RI-PRF policy were purchased consistently every year over a 20-year period, the most likely net return would result in around $7,187 or $359/year (50/50 chance). In addition, we can see there is essentially a 100 percent probability of that returns will not exceed $60,792 or $3,040/year.

These results are displayed as values along the orange curve. Cash-basis results, represented by the purple line, result in higher values, which makes sense when we remember that these are estimated under the assumption of an interest rate of zero. Both curves indicate a 73 percent probability of net returns greater than zero. Comparison of alternative strategies is relatively quick and easy using MTRA analytics. For example, assume the BB Ranch does not purchase PRF coverage consistently every year, either because they don't feel it is necessary, they are not convinced that the policy actually works very well, or the coverage purchased has not resulted in indemnity payments for several years in a row.

MTRA analytics can simulate the expected results from such a strategy by simply selecting alternate years on the input screen via the checkboxes. For this example we simply check every other year for each cost/return item. Results from this analysis show a considerably lower overall rate of return, with a most likely net present value-basis return of $3,681 or $184/year, along with a narrower range of potential outcomes (Figure 3). The variable strategy results in a lower rate of return overall, as we would anticipate. This could be due to several factors but the most obvious are the lower net returns resulting from not purchasing coverage when it is needed, coupled with the compounding effect of the time value of money over the 20-year period evaluated.

Figure 2. BB Ranch Example Probability Distribution, Cash- and Net Present Value-Basis, Every Year Enrollment



For More Information

Visit RightRisk.org to download the Multi-Temporal Risk Analyzer and for more information on RI-PRF and how it may work in your operation. A detailed user guide along with several pre-loaded examples are also available on the MTRA page.

** BB Ranch is a case study example created to demonstrate RightRisk tools and their application. No identification with actual persons (living or deceased), places, or agricultural operation is intended nor should be inferred.*