RightRisk™

How Much Risk Is Right For You?

Technical Guide **(August, 2013 #TG-13-08)**

Risk Scenario Planning

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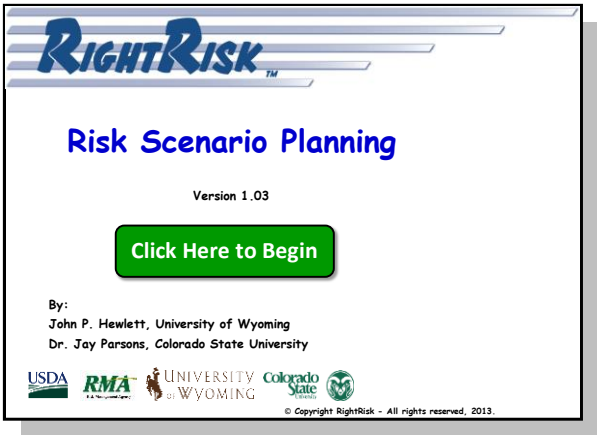
Assessing changes to your operation in the face of uncertainty



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Risk Scenario Planning

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Introduction

When a person contemplates making changes to their operation, they do it with a feeling for the future. In other words, the change is based on a forecast for what the future holds. Uncertainty is almost always present when these decisions are made and with it comes anxiety.

Partial budgets are often useful when contemplating a change to an operation especially if the change is relatively simple. For example, do I retain and breed back more heifers in order to take advantage of a good market for replacements? This is a question that can be analyzed fairly easily with a partial budget approach. However, in order for the budget to calculate, you must put in real numbers for prices, yields, and costs. What happens if those numbers are surrounded by uncertainty? What happens if the yes/no answer to the question is dependent upon some key uncertain numbers?

There are a number of ways to handle this dilemma but what most people come up with is a best guess for the uncertain numbers and plug them into the budget. This best guess can be a most likely outcome or it can be an average of all of the possible outcomes. Either way, it is meant to be an estimate for the uncertain number. However, the proxy nature of this value is often forgotten when the decision-making process unfolds. What started out as an estimate evolves into a certain number in deciding if the change is worth pursuing.

A better way to handle the presence of uncertainty is to think in terms of distributions. Instead of trying to come up with a best guess to fill in the spot for an uncertain number, take the time to think of the range of possible values it may have in the future. In a simplistic sense, this is playing a "what-if" game. In a slightly more sophisticated sense this might be called scenario planning or scenario case analysis. The idea is rather than try to boil the uncertain number down to a single "certain" value for decision-making, embrace the uncertainty and bring it into the decision-making process to create a more robust answer to your question.

Tool Description

Computers can be tremendous assets when it comes to analyzing several different scenarios in the presence of uncertainty. The Risk Scenario Planning tool was developed to help producers play the "what-if" game while analyzing proposed changes to their operation. The tool is based on the standard set-up for a partial budget.

A partial budget is a simple framework used to analyze changes to a portion of an operation. It is based on the fact that changes to business operations can lead to four different effects on the bottom line. The change can: (1) add returns; (2) reduce costs; (3) add costs; or (4) reduce returns. The effects of (1) and (2) will increase profits while the effects of (3) and (4) will decrease profits. The net financial benefit of making the change can be calculated as (1) + (2) – (3) – (4).

The Risk Scenario Planning tool provides a template for the decision-maker to enter the financial effects of making proposed change(s) to their operation. It then adds the ability for the decision-maker to further refine estimates for some of input values as uncertain numbers. This produces a more robust

analysis of the proposed change and a more thorough understanding of the possible outcomes if the change is implemented.

It is easiest to understand the usefulness of this tool by seeing it used to analyze proposed changes in a few examples. We have prepared three examples using proposed changes for a Wyoming crop farm and for a Wyoming cattle operation with uncertain prices included in the mix.

Case I: Cattle Change

Suppose you run a 350 head cow/calf operation in central Wyoming. Each year you expect to replace about 15 percent of your mother cows or 52 head. As a result, you normally keep 52 heifers out of each calf crop over the winter to breed as replacement animals. You are considering making a change that would involve keeping back an additional 40 heifers to put through your replacement program. Your thought is that people are going to need replacement heifers as they rebuild their herds following recent droughts, your genetics are pretty strong, and you are pretty good at raising replacement heifers and getting them bred.

The Risk Scenario Planning tool will allow you to analyze the expected profitability of this proposed change using a partial budget approach, while including the uncertainty that you will no doubt see in future market prices. Figure 1 contains the completed partial budget analysis as calculated in the Risk Scenario Planning tool.

Figure 1: Completed partial budget analysis for raising 40 extra replacement heifers.

RightRisk™ **Partial Budget For:** *Raise Bred Heifers to Sell*

Positive Effects				*Negative Effects*			
Added Returns	**Quantity**	**Value**	**Total**	**Added Costs**	**Quantity**	**Value**	
Bred Heifers	34	$ 1,200.00	$ 40,800.00	*Private Grazing (40 hd. X 6 AUMs)*	240	$ 20.00	$ 4,800.00
6 Feeder Heifers (9 cwt.)	54	$ 134.50	$ 7,263.00	*Hay (40 hd. X 1.75 tons)*	70	$ 190.00	$ 13,300.00
Cull Bulls (cwt./year)	6	$ 85.00	$ 510.00	*Vet & Medicine*	40	$ 10.00	$ 400.00
			$ -	*Hired Labor (hours)*	275	$ 12.00	$ 3,300.00
			$ -	*Interest -Operating Capital*	27400	$ 0.08	$ 2,192.00
			$ -	*Bull Opportunity Cost*	2	$ 34.56	$ 69.12
			$ -	*Annual Bull Depreciation*	2	$ 333.33	$ 666.66
			$ -	*Fuel, Supplies, Repairs, Maintenance, etc.*	40	$ 29.81	$ 1,192.40
			$ -				$ -
			$ -				$ -
Total Added Returns			$ 48,573.00	**Total Added Costs**			$ 25,920.18
Reduced Costs	**Quantity**	**Value**		**Reduced Returns**	**Quantity**	**Value**	
			$ -	*40 Heifer Calves @ 5 cwt.*	200	$ 137.00	$ 27,400.00
			$ -				$ -
			$ -				$ -
Total Reduced Costs			$ -	**Total Reduced Returns**			$ 27,400.00

Total Positive Effects (Added Returns + Reduced Costs)	$48,573.00	**Total Negative Effects** (Added Costs + Reduced Returns)	$53,320.18
		Net Benefit of: Raise Bred Heifers to Sell	$ (4,747.18)

Let's begin with a look at the positive side of the ledger, the (1) added returns and the (2) reduced costs. First of all, you don't expect any reduced costs. As far as added returns go, you expect 34

of the 40 extra replacement heifers to be bred and ready to sell as herd replacements each fall. Your price expectations are that these should sell for around $1,200 per head or $40,800 total. The 6 heifers that do not get bred can be sold as yearling feeder animals. You are expecting them to weigh about 900 pounds each and bring about $134.50 per cwt. This will result in another $7,263 in additional revenue. Finally, the extra replacement heifers will require a couple of additional bulls to run with your herd. You estimate that this change will result in about 600 more pounds of cull bull sales each year at $85.00 per cwt. or $510 total. The total positive effects that you expect to gain from making this change to your operation are $48,573 in added returns.

Now, let's look at the negative side of the ledger, the (3) added costs and the (4) reduced returns. First of all, saving back 40 extra replacement heifers means that you will have 40 fewer weaned heifers to sell each fall. You estimate that your weaned heifers weigh about 500 pounds each and the market price for them is about $137.00 per cwt. This results in $27,400 in total reduced returns.

The more complicated part of this side of the equation is totaling up the additional costs you expect as a result of this change. You start with an estimate of additional feed costs. Six AUMs of grazing per head at $20 per AUM adds an expense of $4,800. A winter feed estimate of 1.75 tons of hay per head at $190 per ton adds an additional hay expense of $13,300. You also estimate $10 per head or $400 total in additional vet & medicine expenses. Additional labor expenses are a little more difficult to estimate but your best guess is about 275 additional hours will be needed to check, move, handle, and feed the animals with the rest of your herd. At $12 per hour, this totals to $3,300 in added labor costs.

The $27,400 in reduced returns from not selling the 40 heifers as weaned calves is money you do not have in the bank and it will be a full year before you see the returns from selling the heifers as yearlings. At 8 percent interest, this adds $2,192 in interest costs. Having two more bulls in the herd will also cost you in terms of opportunity costs ($69.15) and depreciation ($666.66). Finally, you tally up a subset of your fuel, supplies, repairs, and maintenance costs that you expect to increase with the additional animals and come up with a current cost of $29.81 per cow. Applying this to 40 head of additional replacement heifers being raised results in $1,192.40 in added costs. The end result is $25,920.18 in added costs resulting from making this change to your operation.

The total added costs and the total reduced returns result in a total negative effect of $53,320.18 as a result of making this change. Coupled with the $48,573 in expected added returns, this does not look like a good idea because the net benefit is a loss of $4,747.18. However, you feel you are a bit conservative with some of your numbers. Specifically, you feel your estimate of receiving $1,200 per head for your replacement heifers might be as high as $1,500 per head given your genetics and general herd health. You also feel your estimate of $190 per ton for hay may be on the high side for long term planning. The Risk Scenario Planning tool allows you to designate two values in your partial budget as uncertain and analyze the range of possible results.

Figure 2 depicts the interface for entering possible risk scenarios into the Risk Scenario Planning tool. The first steps are to identify which value(s) you want to make uncertain and which cell it resides in.

Given the above discussion, let's suppose you want to make the value of your bred heifers uncertain. The current value of $1,200 (see Figure 1) is in cell D6 of the Risk Scenario Planning tool. Therefore, you enter "Bred Heifer Value" as the description and "D6" as the cell under Uncertain Value 1 in the Risk Scenarios section of the Risk Scenario Planning tool (see Figure 2). Furthermore, you enter in 1200 as the current value, 1100 as a possible minimum value, and 1500 as a possible maximum value. This creates a distribution of possible bred heifer values to use in analyzing the risk scenarios.

Figure 2: Sample risk scenarios analyzed for the decision involving raising 40 more replacement heifers.

Risk Scenarios

Uncertain Value 1		☑ Include	Uncertain Value 2		☑ Include
Description	**Cell**		**Description**	**Cell**	
Bred Heifer Value	D6		*Hay Price*	H7	
Current Value (Most Likely)	1200		Current Value (Most Likely)	190	
Minimum Value	1100		Minimum Value	130	
Maximum Value	1500		Maximum Value	250	

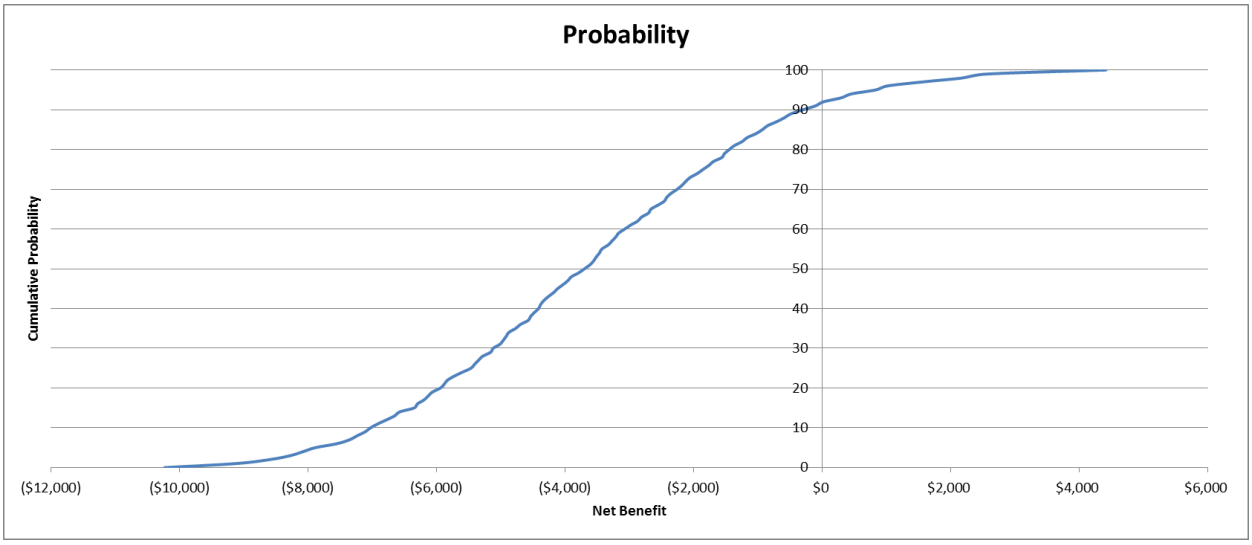
Given the earlier discussion, suppose you also want to make hay price an uncertain value. The current hay price of $190 per ton (see Figure 1) is contained in cell H7 of the Risk Scenario Planning tool. Therefore, you enter "Hay Price" as the description and "H7" as the cell under Uncertain Value 2. You use 190 as the current value, but also enter 130 as a possible minimum value, and 250 as a possible maximum value for hay price on a per ton basis. Notice in Figure 2 that you can choose to include (check) or not include (uncheck) either one or both of the uncertain values in the analysis by using the checkbox in the upper right area next to each input section. This allows you to look at each of the uncertain scenarios separately or together.

Clicking the "Run" button in the Risk Scenario Planning tool causes the risk analysis to run using these two uncertain values to introduce uncertainty into what might be called spot analysis completed in Figure 1. The Risk Scenario Planning tool executes repeated random draws from the distributions of each of the uncertain values as described in Figure 2. The result is a distribution of possible results as shown in Figure 3. The results are displayed as a cumulative distribution graph. A few of the key points are labeled in Figure 3 and discussed in more detail in the next paragraph.

A cumulative distribution graph tells you the probability of earning a net return at or below any certain value. For example, in Figure 3, the lowest point on the graph is at (($10,231), 0). This is means you have 0 percent probability of the net benefit falling below a net loss of $10,231 in the risk scenarios in Figure 2. The ($10,231) serves as a lower bound on the possible outcomes. Similarly, the highest point on the graph is at ($4,412, 100). This means a positive net return of $4,412 is the upper bound on possible outcomes. In between these two extremes, a couple of other points are of immediate interest. In Figure 1, a net benefit loss of $4,747 was estimated as the most likely outcome from making the change to your operation. In Figure 3, the graph label (($4,772), 35) is the closest point to this outcome value. The cumulative probability of 35 percent indicates that there is roughly a 35 percent probability that your actual outcome will be at or below this value and a 65 percent probability that your actual

outcome will be higher than this value. This reflects the relatively pessimistic values used for bred heifer value and hay price in the most likely partial budget analysis of Figure 1.

Figure 3: Distribution of results from uncertainty introduced into the replacement heifer decision.



Finally, notice in Figure 3 the point at which the graph cross the $0 net benefit axis. This point is approximately 92 percent. This indicates that you have a 92 percent probability of being at or below a $0 net benefit return and, consequently, only an 8 percent probability of the net return being positive. Along with the static analysis of the most likely outcome being a negative return of $4,747, this seems to indicate that making this change is not such a good idea from an economic standpoint. Even though the initial partial budget analysis of Figure 1 was pessimistic, the uncertainty introduced with risk scenarios doesn't indicate much more optimism for success. The chances of doing better than the estimated loss of $4,747 are good (65 percent) but the chances of doing well enough to achieve a positive net return are not.

Case II: Crop Change

Suppose you run an irrigated farm in eastern Wyoming and you have become concerned about the recent slide in corn prices in light of current high input costs. Your current rotation of crops consist of 100 acres of alfalfa hay, 100 acres of sugar beets, 75 acres of dry beans, and 125 acres of corn. On average, half of your corn acres are harvested for grain and half are harvest for silage. You are considering a move that would switch the dry beans and corn acres. Dry bean prices have been holding strong lately and the outlook for future expenses related to their production seem to be more stable and reasonable than for corn. The Risk Scenario Planning tool will allow you to analyze the expected profitability of this proposed change involving 50 more acres of dry beans and 50 fewer acres of corn each year. Figure 4 contains the completed partial budget analysis as calculated in the Risk Scenario Planning tool.

Let's begin with a look at the positive side of the ledger, the (1) added returns and the (2) reduced costs. As far as added returns go, you expect your dry bean yields to be around 20 cwt. per acre for a total of 1,000 cwt. more of dry bean sales each year. With an expected price of $42 per cwt. this provides $42,000 in added returns on an annual basis. As far as reduced costs go, you do not have

Figure 4: Completed partial budget analysis of replacing 50 acres of corn with 50 acres of dry beans.

RightRisk™ **Partial Budget For:** *Replace Corn with more Dry Beans acres*

Positive Effects				*Negative Effects*			
Added Returns	**Quantity**	**Value**	**Total**	**Added Costs**	**Quantity**	**Value**	
*Dry Bean Sales (20 cwt/ac * 50 ac)*	1000	$ 42.00	$ 42,000.00	*Dry Bean Operating & Use Related Ownership*	50	$ 438.86	$ 21,943.00
			$ -				$ -
			$ -				$ -
Total Added Returns			$ 42,000.00	**Total Added Costs**			$ 21,943.00
Reduced Costs	**Quantity**	**Value**		**Reduced Returns**	**Quantity**	**Value**	
Corn Operating & Use Related Ownership	50	$ 499.14	$ 24,957.00	*Corn Grain Sales (180 bu/ac * 25 ac)*	4500	$ 4.70	$ 21,150.00
Corn Grain Harvest	25	$ 125.94	$ 3,148.50	*Corn Silage Sales (23 tons/ac * 25 ac)*	575	$ 35.00	$ 20,125.00
Corn Silage Harvest	25	$ 200.00	$ 5,000.00				$ -
			$ -				$ -
			$ -				$ -
Total Reduced Costs			$ 33,105.50	**Total Reduced Returns**			$ 41,275.00

Total Positive Effects (Added Returns + Reduced Costs)	$ 75,105.50	**Total Negative Effects** (Added Costs + Reduced Returns)	$ 63,218.00
Net Benefit of: Replace Corn with more Dry Beans acres			$ 11,887.50

the expense of raising corn on the 50 acres in the rotation that are transitioned to dry beans. Not including harvest expense, the operating costs of growing corn and the use related ownership costs total approximately $499.14 per acre. Grain harvest costs run about $125.94 per acre and silage harvest costs run about $200 per acre. This results in a total of $33,105.50 in expected reduced costs each year. Together with the added returns, this means the total positive effects that you expect to gain from making this change are $75,105.50.

Now, let's look at the negative side of the ledger, the (3) added costs and the (4) reduced returns. First of all, growing 50 more acres of dry beans means that you have 50 more acres of dry bean growing and harvesting expenses. These are estimated to be about $438.86 per acre or $21,943 in total added costs. Second, you no longer have corn grain and silage sales revenue from those converted 50 acres. With an expected yield of 180 bushels per acre over 25 acres of harvested grain, you can expect to lose out on approximately 4,500 bushels of corn grain sales. At $4.70 per bushel, this equates to $21,150 in reduced returns. Similarly, lost corn silage sales total $20,125 for a total of $41,275 in reduced returns.

The total added costs and total reduced returns result in a total negative effect of $63,218 as a result of making this change. Coupled with the $75,105.50 in expected added returns, this yields an expected net benefit of $11,887.50. However, you feel there is considerable uncertainty in the price of corn and the price of dry beans that could change this bottom line. The Risk Scenario Planning tool allows you to make both corn grain and dry bean prices uncertain and look at the possible results.

Figure 5 depicts the interface for entering possible risk scenarios for this decision into the Risk Scenario Planning tool. Given the above discussion, let's suppose you want to make the corn grain price Uncertain Value 1. The current value of $4.70 (see Figure 4) is in cell H28 of the Risk Scenario Planning tool. Therefore, you enter "Corn Grain Price" as the description and "H28" as the cell under Uncertain Value 1 in the Risk Scenarios section of the Risk Scenario Planning tool (see Figure 5).

Figure 5: Sample risk scenarios analyzed for the decision involving replacing 50 acres of corn with beans.

Risk Scenarios

Uncertain Value 1		☑ Include	Uncertain Value 2		☑ Include
Description	**Cell**		**Description**	**Cell**	
Corn Grain Price	H28		*Dry Bean Price*	D6	
Current Value (Most Likely)	4.7		Current Value (Most Likely)	42	
Minimum Value	3.5		Minimum Value	30	
Maximum Value	6		Maximum Value	45	

Furthermore, you enter in 4.70 as the current value, 3.50 as a possible minimum value and 6.00 as a possible maximum value. This creates a distribution of possible corn grain prices for the tool to analyze the risk scenarios.

Now, let's make the price of dry beans Uncertain Value 2. The current dry bean price value of $42 per cwt. (see Figure 4) is contained in cell D6 of the Risk Scenario Planning tool. Therefore, you enter "Dry Bean Price" as the description and "D6" as the cell under Uncertain Value 2. You use 42 as the current value but you also enter in 30 as a possible minimum value and 45 as a possible maximum value for dry bean price on a per cwt. basis.

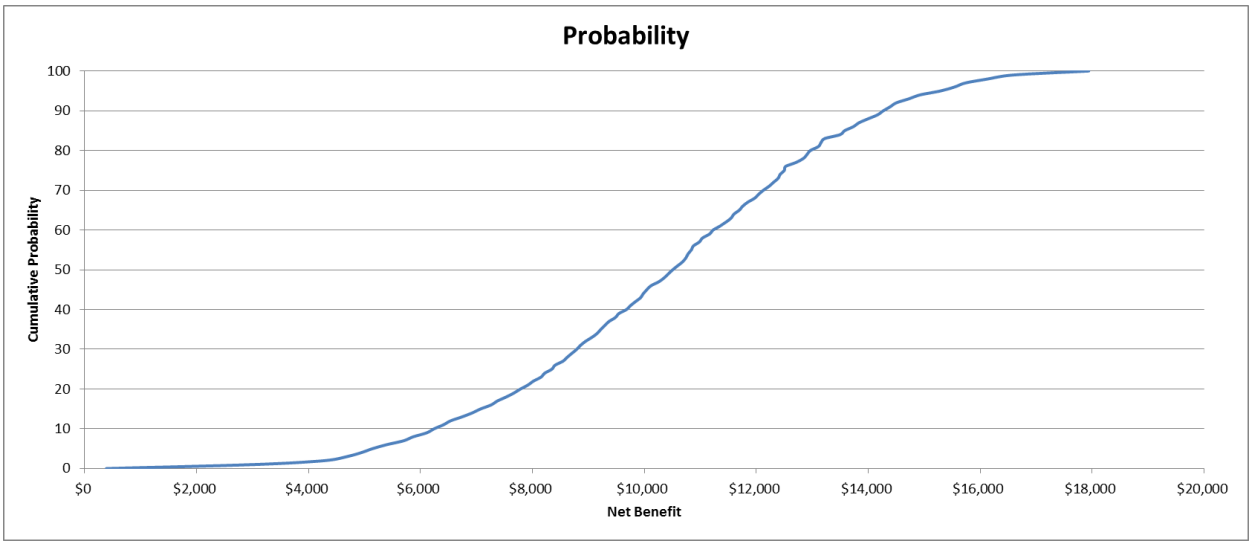
Clicking the "Run" button in the Risk Scenario Planning tool causes the risk analysis to run using these two uncertain values to introduce uncertainty into the spot analysis completed in Figure 4. The Risk Scenario Planning tool executes repeated random draws from the distributions of each of the uncertain values as described in Figure 5 and the result is a distribution of possible results as shown in Figure 6. The results are displayed as a cumulative distribution graph. A few of the key points are labeled in Figure 6 and discussed in more detail in the next paragraph.

A cumulative distribution graph tells you the probability of earning a net return at or below any certain value. For example, in Figure 6, the lowest point on the graph is at ($387, 0). This is means you have 0 percent probability of the net benefit falling below a net return of $387 in the risk scenarios in Figure 5. The $387 serves as a lower bound on the possible outcomes. Similarly, the highest point on the graph is at ($17,941, 100). This means a positive net benefit of $17,941 is the upper bound on possible outcomes.

In Figure 4, a net return of $11,887.50 was estimated as the most likely outcome from making the change to your farming operation. In Figure 6, the graph label ($11,847, 67) is the closest point to this outcome. The cumulative probability of 67 percent indicates that there is roughly a 67 percent

probability that your actual outcome will be at or below this value and a 33 percent probability that your actual outcome will be better than this value. This reflects that relatively optimistic values were used for the dry bean price value and the corn grain price value in the most likely partial budget analysis of Figure 4 relative to the distribution of price risks you anticipate facing. However, notice in Figure 6 that all of the net benefit values are positive. This indicates that you have a 100 percent probability of achieving a positive net return given the values included in the analysis. Along with the static analysis of the most likely outcome being a positive return of $11,887.50, this seems to indicate that making such a change is a good idea from an economic standpoint given current circumstances.

Figure 6: Distribution of results from uncertainty introduced into the corn to dry beans decision.



Case III: Insurance Change

With a little creativity, the Risk Scenario Planning tool can also be used to analyze a variety of other decisions including insurance decisions. For example, suppose you run a cow/calf operation in central Wyoming and are contemplating the purchase of Livestock Risk Protection insurance for your weaned calves (LRP-Feeder Cattle). The Risk Scenario Planning tool will allow you to analyze your expected net revenue with this insurance product in place. Figure 7 contains the completed partial budget analysis as calculated in the Risk Scenario Planning tool.

Let's begin with a look at the positive side of the ledger, the (1) added returns and the (2) reduced costs. In the Added Returns section, the first three lines are used as placeholders for values pertaining to the decision. The first value is the basis value of $10.00 which is the assumed difference between the local cash markets and the LRP-Feeder Cattle Price Index Actual Ending Value at the time of marketing. In this case, you expect your local cash price for feeder cattle be $10.00 per cwt. below the LRP-Feeder Cattle Price Index Ending Value. The second value is the LRP Price Index. This is the Actual Ending Value for the LRP-Feeder Cattle Insurance price index. Currently, you have it set at $160.99 which is the published Expected Ending Value for the particular LRP-Feeder Cattle Insurance product you are

purchasing. The third value is the LRP Coverage Price of $160.47. This is the coverage price for the LRP-Feeder Cattle Insurance product you are purchasing and represents 99.68 percent of the Expected Ending Value at the time you purchase the insurance.

Figure 7: Completed partial budget analysis for purchasing LRP-Feeder Cattle Insurance.

RightRisk™				Partial Budget For:	LRP Insurance Decision			
Positive Effects					*Negative Effects*			
Added Returns	**Quantity**	**Value**	**Total**		**Added Costs**	**Quantity**	**Value**	
Basis Value		$ 10.00	$ -		*LRP Premium*	500	$ 3.68	$ 1,840.00
LRP Price Index		$ 160.99	$ -					$ -
LRP Coverage Price		$ 160.47	$ -					$ -
			$ -					$ -
Calf Sales (cwt.)	500	$ 150.99	$ 75,495.00					$ -
LRP Indemnity	500	$ -	$ -					$ -
			$ -					$ -
			$ -					$ -
Total Added Returns			$ 75,495.00		**Total Added Costs**			$ 1,840.00
Reduced Costs	**Quantity**	**Value**			**Reduced Returns**	**Quantity**	**Value**	
			$ -					$ -
			$ -					$ -
Total Reduced Costs			$ -		**Total Reduced Returns**			$ -
Total Positive Effects (Added Returns + Reduced Costs)			$75,495.00		**Total Negative Effects** (Added Costs + Reduced Returns)			$ 1,840.00
					Net Benefit of: LRP Insurance Decision			$73,655.00

As far as added returns go, you have two sources of possible revenue to consider. The first is cash sales revenue from selling calves in the cash market and the second is a possible LRP insurance indemnity payment if price falls below expectations. Let's assume that you are looking at protecting price on 100 head of 500 pound weaned calves. That equates to 500 cwt. being sold. Your local price will equal the LRP Price Index plus the basis effect of $10. In the Risk Scenario Planning tool, the LRP Price Index of $160.99 is in cell D7 and the Basis Value of $10.00 is in cell D6. Therefore, you enter the formula "=D7-D6" into cell D10 so that the price you receive in the local cash market is automatically calculated for you below the LRP Price Index by the amount of the Basis Value. In this case, that is calculated as $160.99 - $10.00 = $150.99.

With 500 cwt. being sold at $150.99 per cwt., you expect to receive $75,495 in revenue from the sale of your 100 calves. In a moment, we will let the Risk Scenario Planning tool make price an uncertain value so we need to set the LRP Indemnity as a calculated value if triggered. The indemnity would be applied to the same 500 cwt. of calves. The value per cwt. is only non-zero if the LRP Price Index ends at a value that is less than the LRP Coverage Price. Where this is the case, the indemnity will be the difference between the two as a payment per cwt. Therefore, cell D11 in the Risk Scenario Planning tool contains the formula "=IF(D8>D7,D8-D7,0)." At present, the result is zero where the LRP Price Index is greater than the LRP Coverage Price. The total positive effects include the $75,495 you expect to get from the sale of your calves.

Now, let's look at the negative side of the ledger, the (3) added costs and the (4) reduced returns. The only thing to worry about here is the cost of insurance policy. The producer share of the premium rate comes to $3.68 per cwt. For the same 500 cwt. of calves, this results in a producer premium of $1,840. Given current expectations, this $1,840 insurance premium expense will subtract from expected revenues of $75,495 to provide an expected net benefit of $73,655.

"Why purchase the LRP-Feeder Cattle insurance?" for the protection it provides. You would only do this if you feel there is considerable uncertainty in the price of feeder cattle and you are worried about possible price declines. The Risk Scenario Planning tool allows you to make both the LRP Price Index and the Basis Value uncertain and look at the possible results.

Figure 8 depicts the interface for entering possible risk scenarios for this decision into the Risk Scenario Planning tool. Given the above discussion, let's suppose you want to make the LRP Price Index Uncertain Value 1. The current value of $160.99 (see Figure 7) is in cell D7 of the Risk Scenario Planning tool. Therefore, you enter "LRP Price Index" as the description and "D7" as the cell under Uncertain Value 1 in the Risk Scenarios section of the Risk Scenario Planning tool (see Figure 8). Furthermore, you enter in 160.99 as the current value, 140 as a possible minimum value and 170 as a possible maximum value. This creates a distribution of possible actual ending values of the LRP Price Index for use in analyzing the risk scenarios.

Figure 8: Sample risk scenarios analyzed for the decision involving LRP-Feeder Cattle insurance.

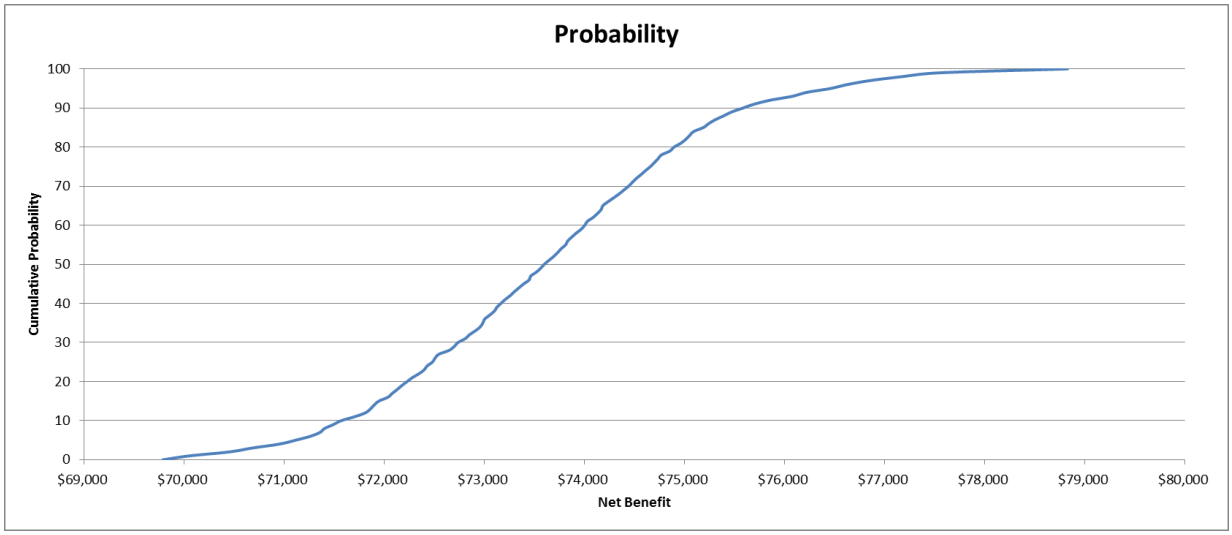
Risk Scenarios

Uncertain Value 1		☑ Include	Uncertain Value 2		☑ Include
Description	**Cell**		**Description**	**Cell**	
LRP Price Index	D7		*Basis Value*	D6	
Current Value (Most Likely)	160.99		Current Value (Most Likely)	10	
Minimum Value	140		Minimum Value	5	
Maximum Value	170		Maximum Value	20	

Now, let's make the Basis Value Uncertain Value 2. The current Basis Value of $10.00 per cwt. (see Figure 7) is contained in cell D6 of the Risk Scenario Planning tool. Therefore, you enter "Basis Value" as the description and "D6" as the cell under Uncertain Value 2. You use 10 as the current value but you also enter in 5 as a possible minimum value and 20 as a possible maximum value for basis value on a per cwt. basis.

Clicking the "Run" button in the Risk Scenario Planning tool causes the risk analysis to run using these two uncertain values to introduce uncertainty into the spot analysis completed in Figure 7. The Risk Scenario Planning tool executes repeated random draws from the distributions of each of the uncertain values as described in Figure 8 and the result is a distribution of possible results as shown in Figure 9. The results are displayed as a cumulative distribution graph. A few of the key points are labeled in Figure 9 and discussed in more detail in the next paragraph.

Figure 9: Distribution of results from uncertainty introduced into the LRP insurance decision.

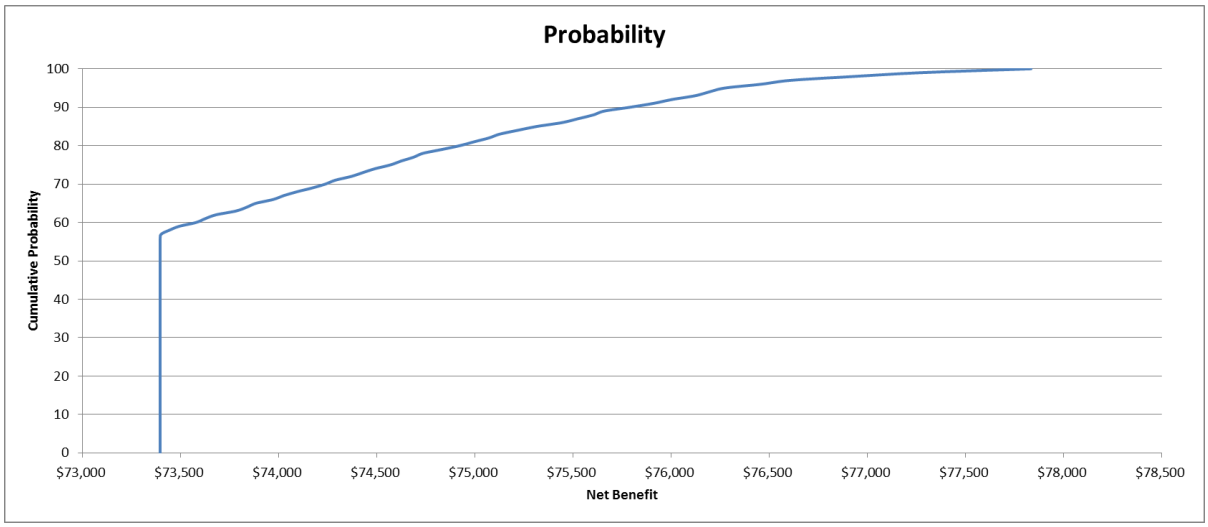


A cumulative distribution graph tells you the probability of earning a net return at or below any certain value. For example, in Figure 9, the lowest point on the graph is at ($69,787, 0). This is means you have 0 percent probability of the net benefit falling below a net return of $69,787 in the given the risk scenarios in Figure 8. The $69,787 serves as a lower bound on the possible outcomes. It represents low price and a wide basis scenario occurring. Understand that the LRP insurance is providing you protection. In looking at Figure 8, the worst case scenario is that the LRP Price Index drops to $140 per cwt. and the Basis Value widens to $20 per cwt. This would leave you with a cash price in the local market of $120 per cwt. Without LRP insurance you would net $60,000 in sales revenue. You don't know if this worst case scenario actually occurred in the random draw but you do know that the LRP insurance improved your worst case scenario by about $10,000 even including the premium expense that comes with it.

Similarly, the highest point on the graph is at ($78,828, 100). This means a positive net benefit of $78,828 is the upper bound on possible outcomes. In Figure 7, a net benefit of $73,655 was estimated as the expected outcome of adding LRP-Feeder Cattle insurance to your operation. In Figure 9, the graph label ($73,644, 51) is the closest point to this outcome. The cumulative probability of 51 percent indicates that there is roughly a 51 percent probability that your actual outcome will be at or below this value and a 49 percent probability that your actual outcome will be better than this value. This reflects the relatively small impact that LRP insurance has on your expected revenue outcome especially if current expectations for the LRP Price Index are somewhat in the middle of the high and low possibilities for it.

Why is the bottom of the graph smooth in Figure 9? Doesn't LRP insurance provide a floor to your possible outcomes? Yes and no. LRP insurance does not provide protection against basis risk. The smoothness at the bottom end of the curve in Figure 9 is the result of uncertainty in the Basis Value. To see this more clearly, you can choose not to include that uncertainty in the analysis by unchecking the box in the upper right corner of Figure 8. The result is depicted in Figure 10.

Figure 10: Distribution of results of the LRP insurance decision without basis value uncertainty.



With the Basis Value fixed at $10, the LRP Coverage Price provides a fixed floor of $150.47 on local net price outcome. If the actual ending value of the LRP Price Index drops below the LRP Coverage Price of $160.47, the LRP insurance will provide a dollar of indemnity for every dollar lost in the national market. Thus, the LRP Price Index plus the LRP Indemnity will always net out to $160.47. Since the Basis Value is fixed at $10, the net price outcome for the producer is fixed at $150.47 instead of a possible range between $140.47 and $155.47, as was the case when we had an uncertain Basis Value between $5 and $20. As verification, you can check that the math on this as $150.47 * 500 cwt. - $1,840 (LRP Premium) = $73,395.

The Risk Scenario Planning tool can be used to provide insights into the LRP insurance decision. One can see in Figure 7 that current expectations are for sales revenue of $75,495. However, a worst case scenario exists of only receiving $60,000 in sales revenue. By paying an LRP insurance premium of $1,840, the Risk Scenario Planning tool demonstrates that you can control about 65 percent of this downside price risk with a worst case scenario of $69,787. The question then becomes whether or not you believe the protection is worth it.

Conclusion

The Risk Scenario Planning tool can be a useful tool for analyzing simple changes to an operation in the presence of uncertainty. In this bulletin, three cases were presented using the Risk Scenario Planning tool to analyze potential changes to a livestock operation, a grain operation, and a livestock price insurance protection plan. The Risk Scenario Planning tool represents a better way to handle the presence of uncertainty by thinking in terms of distributions, rather than trying to come up with a best guess single estimate for an uncertain number. The idea is to embrace the uncertainty and bring it into the decision-making process to create a more robust answer to your questions. The result should be a more informed decision-making process and better decisions for the future.

RightRisk™ is an innovative risk research and education effort. It uses real world farm and ranch information and agricultural economics to help farm and ranch managers better understand and explore risk management decisions and evaluate the effects of those decisions. Mangers learn about their personal risk management style and build decision-making skills.

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