RightRisk ™

How Much Risk Is Right For You?

Risk Scenario Planning

Evaluating the Potential Benefits of Adopting a Commercial Mineral Mix Supplementation Program

John P. Hewlett - University of Wyoming
Dr. Mark Thorne - University of Hawaii
Dr. Jay Parsons - University of Nebraska-Lincoln
Jeffrey Tranel - Colorado State University

Assessing changes to your operation in the face of uncertainty

RightRisk ™

Risk Scenario Planning

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By:
John P. Hewlett, University of Wyoming
Dr. Jay Parsons, University of Nebraska-Lincoln

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Risk Scenario Planning

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Introduction

When a person contemplates making changes to their operation, managers 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) (FIGURE 1).

FIGURE 1. The Partial Budget Framework

Added Returns	Added Costs
Reduced Costs	Reduced Returns

The Risk Scenario Planning (RSP) 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 the 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 change in a few examples. We have prepared two examples using proposed changes for a Hawaii ranch looking at converting to a commercial mineral supplementation program with uncertain mineral prices and calf sales included in the mix.

Convert to Commercial Mineral Supplementation - TOTAL Ranch Analysis

For our first example, we consider the JR L&L, a 200 cow/calf operation near Keokea, Maui that has not followed any regular or organized program for mineral supplementation of its cattle herd over the past 15 or so years. Each year the ranch routinely observes symptoms of copper deficiency in its herds, especially during the winter and spring.

Working with the University of Hawaii Cooperative Extension Service JR L&L managers learned that high amounts of iron found in their upcountry Kikuyu – Pangola grass forage can be expected to interfere with copper absorption in the rumen of the beef cattle. The operators are becoming convinced that the problem is costing them in terms of cow performance, and managers want to investigate what the economic implications might be.

Here we analyze the situation for the total ranch net return (example two evaluates the per cow costs and returns).

Added Returns:

After visiting extensively with one of the neighboring ranch families, JR L&L managers learned the benefits from supplementing the needed mineral should result in the ranch selling an additional 40 weaned calves at 6 months of age, weighing around 400 lbs./head. Prices are currently around $135/cwt on these lighter calves. Increased calf sales: 40 additional weaned calves per year at 6 months of age @ 400# = 16,0000 cwt * $135/cwt = $21,600 total added returns per year.

Reduced Costs:

Managers also expect that their annual veterinary costs ($6,015) will decrease, due to overall improved herd health, by 10 percent or $602 per year.

Another expected change is a cut in the culling rate. This is a reduction in revenue (see Reduced Returns section), but managers would also save on transportation and marketing costs for these cull animals. The annual cost for transporting cull animals usually totals around $740/year.

Total benefits from added returns and reduced costs for the commercial mineral mix program are expected to total $22,942.00 per year (FIGURE 2).

FIGURE 2. Partial Budget: Convert to Commercial Mineral Mix Supplementation – TOTAL/year

RightRisk™ Partial Budget For:				CONVERT to Commercial Mineral Mix Supplementation (200 cows/year)			
Positive Effects				**Negative Effects**			
Added Returns	Quantity	Value	Total	Added Costs	Quantity	Value	
Calf sales: 40 head or 0.80 cwt/cow/year	160	$ 135.00	$ 21,600.00	Commercial mineral: $31.89/cow/year	200	$ 31.89	$ 6,378.00
			$ -	Mineral labor: $4.20/cow/year	200	$ 4.20	$ 840.00
			$ -	Other expenses (fuel, maintenance, etc)	200	$ 1.50	$ 300.00
			$ -	Mineral bunk costs: $0.50/cow/year	200	$ 0.50	$ 100.00
			$ -	Opportunity interest: $0.18/cow/year	200	$ 0.18	$ 36.00
			$ -	Added management: $1.25/cow/year	200	$ 1.25	$ 250.00
			$ -	Transportation and marketing for			$ -
			$ -	40 added calves: $2.68/cow/year	200	$ 2.68	$ 536.00
			$ -				$ -
Total Added Returns			$ 21,600.00	**Total Added Costs**			$ 8,440.00
Reduced Costs	Quantity	Value		Reduced Returns	Quantity	Value	
Vet and medicine: $3.01/cow/year	200	$ 3.01	$ 602.00	Cull female sales: $59.84/cow/year	200	$ 59.84	$ 11,968.00
Transportation and marketing for			$ -				$ -
17 fewer cull females: $3.70/cow/year	200	$ 3.70	$ 740.00				$ -
			$ -				$ -
Total Reduced Costs			$ 1,342.00	**Total Reduced Returns**			$ 11,968.00

Total Positive Effects (Added Returns + Reduced Costs)	$ 22,942.00	**Total Negative Effects** (Added Costs + Reduced Returns)	$ 20,408.00

Net Benefit of: CONVERT to Commercial Mineral Mix Supplementation (200 cows/year)	$ 2,534.00

Added Costs:

Recent work by the UH Cooperative Extension Service has found that mineral program using a commercial mineral mix could provide much of the mineral supplementation managers need at around $31.89/cow/year * 200 head=> $6,378/year total cost for the ranch.

Labor to distribute the mineral is expected to cost around $20/hour, including all payroll taxes and benefits. Managers estimate that 3/4 of an hour per week or around 42 hours would be needed for the year, giving: 42 hrs/year @ $20/hr = $840 total labor cost for the year.

In addition, managers expect that other expenses for fuel, maintenance, etc. under the new mineral program will be around $300 total for the year.

The ranch expects that two new mineral bunks (1 bunk/100 head) would need to be constructed at an estimated cost of $500 each and are expected to last 10 years. 1 bunk/100 cows => 2 bunks @ $500/bunk = $1,000/10 years = $100/year annual cost.

Currently managers are paying about 7 percent interest on their operating capital. Managers calculate the increased operating debt interest charge as: $500/year @ 7% interest = $35 total per year.

The ranch anticipates management will be required to spend about 5 additional hours per year managing the new mineral program. This is expected to increase annual costs around $250/year to manage the new mineral program: 5 hrs/year @ $50/hr = $250 total over the year.

Finally, after some additional thought, the managers realize that managers should expect an increase in transportation and marketing cost associated with the added calves, as: 40 head/year @ $536 total cost per year.

Reduced Returns:
 JR L&L expects to sell 17 fewer cull females each year due to improved reproductive performance and longevity in the herd. Managers typically sell these cull females at around $704/head * 17 head = $11,968 reduced returns per year.

Total negative effects due to the added costs and reduced returns from adopting the commercial mineral mix program are expected to total $20,408.00 per year (FIGURE 2).

The total net benefit of converting to a commercial mineral mix program (Total Postitive Effects - Total Negative Effects) is estimated at $2,534.00 for the entire herd over the course of a year (FIGURE 2).

Risk Considerations:
 The ranch is interested in minimizing the chance of any losses under the new mineral program. One way that it can do that is to look at historic variations in the cost of the commercial mineral mix, as well as past changes in calf sale prices.

Based on past prices, managers find that the commercial mineral mix could be expected to range between $29.46 and $39.86/cow/year. Again, current costs are expected to remain constant in the near future around $31.89/cow/year.

To make the price of the commercial mineral mix uncertain, managers enter "Commercial Mineral Mix" as the description and "H6" as the cell under Uncertain Value 1, then enter $39.86 as the current value (most likely), $29.46 as a possible minimum value, and $39.86 as a possible maximum value (FIGURE 3).

The JR L&L also wants to make calf sale prices associated with the added calf revenues uncertain. Managers enter "Added Calf Sales" as the description and "D6" as the cell under Uncertain Value 2, enter $135 as the current value (most likely) per hundredweight (cwt), $120 as a possible minimum value, and $165 as a possible maximum value (FIGURE 3).

FIGURE 3. Convert to Commercial Mineral Mix Supplementation, Risk Considerations – TOTAL/year

Risk Scenarios						
Uncertain Value 1		☑ Include		**Uncertain Value 2**		☑ Include
Description	Cell			Description	Cell	
Commercial mineral mix	H6			*Added calf sales*	D6	
Current Value (Most Likely)	31.89			Current Value (Most Likely)	135	
Minimum Value	29.46			Minimum Value	120	
Maximum Value	39.86			Maximum Value	165	

Analysis Results:
 Figure 4 shows the graph resulting from allowing the price of the commercial mineral mix and the added calf sales prices to vary from their current values. The net return at any combination of mineral quantity and increased calf sales is easily calculated by the RSP tool. What is not so easy is assigning a probability to each of those net returns. When the user clicks the "Run" button, the RSP tool performs an analysis based on the specified risk scenario (1,000 iterations). The results are depicted as a cumulative distribution graph (FIGURE 4).

In this graph, we can see that the net return values range from a possible low of -$253.26 to a high of $6,129.22. In addition, we can see there is a 50/50 probability the value will fall above or below $2,687.93.

FIGURE 4. Convert to Commercial Mineral Mix Supplementation, Simulation Results – TOTAL/year
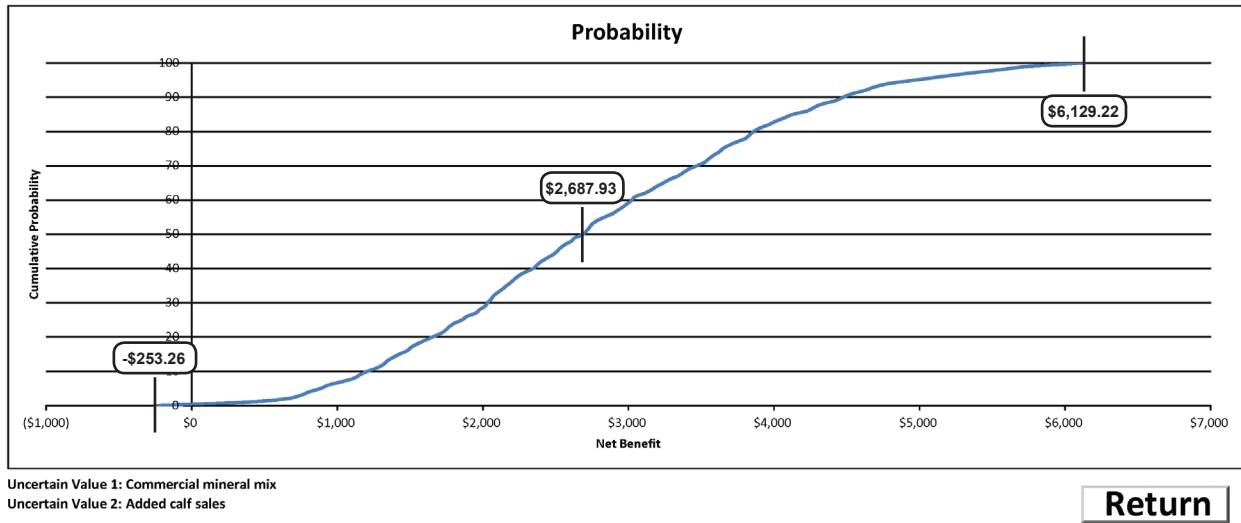
Probability

Uncertain Value 1: Commercial mineral mix
Uncertain Value 2: Added calf sales

Return

Keep in mind that these net return values are compared to the program the ranch has been following prior to this point: no regular or organized program for mineral supplementation of its cattle herd. As such, these net return values describe the improvement in net return the ranch could reasonably expect to earn where mineral and added calf sale prices vary between the high and low values entered (FIGURE 3).

Within the RSP tool, the user can mouse-over points on the graph to directly read the probabilities for earning individual returns. In this way, the graph describes the range of possibilities, as well as the probability of achieving a particular threshold of net revenue. Reading the probabilities from points along the curve in Figure 4, the analysis shows we could expect the commercial mineral program to offer positive net returns nearly every year, with a small loss of -$253.26 per year at the low end. The very best the ranch could hope for would be a net return improvement of $6,129.22 per year and it can reasonably expect that the improvement would return more than the most likely outcome of $2,534 a little more than 50 percent of the time looking forward.

Users interested in evaluating other ranges of mineral prices, added calf sale prices or changes in the most likely values can easily make changes in the appropriate entry blank (FIGURE 3) and rerun the analysis. In addition, the RSP tool could also evaluate allowing other factors to vary in the analysis could easily designate one or more items identified in the partial budget (FIGURE 2) to vary across a range of values by making changes in the entry blanks (FIGURE 3) and rerunning the analysis to learn the impact of changes that those factors have on the resulting net return values.

In this way, the Risk Scenario Planning tool represents a better way to address the presence of uncertainty in various management decisions by describing results in terms of distributions, rather than only using a "best guess" single estimate for an uncertain number. The tool embraces the uncertainty involved in the decision and brings it into the process to create a more robust approach to evaluating proposed management changes. The result should be a more informed decision-making process and better risk management decisions in the future.

Convert to Commercial Mineral Mix Supplementation - per COW Analysis

For our second example, we consider the JR L&L, a 200 cow/calf operation near Keokea, Maui that has not followed any regular or organized program for mineral supplementation of its cattle herd over the past 15 or so years. Each year the ranch routinely observes symptoms of copper deficiency in its herds, especially during the winter and spring.

Working with the University of Hawaii Cooperative Extension Service JR L&L managers learned that high amounts of iron found in their upcountry Kikuyu – Pangola grass forage can be expected to interfere with copper absorption in the rumen of the beef cattle. The operators are becoming convinced that the problem is costing them in terms of cow performance and want to investigate what the economic implications might be.

Here we analyze the situation on a per cow, net return basis (example one evaluates the TOTAL ranch costs and returns). The per cow approach and associated net return values would be the basis to use when comparing results for one ranch with another.

Added Returns:

After visiting extensively with one of the neighboring ranch families, JR L&L managers have learned that the benefits from supplementing the needed mineral should result in the ranch selling an additional 40 weaned calves at 6 months of age, weighing around 400 lbs./head. Prices are currently around $135/cwt on these lighter calves. Increased calf sales: 40 additional weaned calves per year at 6 months of age @ 400# = 16,0000 cwt * $135/cwt = $21,600 per year / 200 cows = $108/cow/year.

Reduced Costs:

Managers also expect that their annual veterinary costs ($6,015) will decrease, due to overall improved herd health, by 10 percent or $602 per year / 200 cows = $3.01/cow/year.

Another expected change is a cut in the culling rate. This is a reduction in revenue (see Reduced Returns section), but the ranch would also save on transportation and marketing costs for these cull animals. The annual cost for transporting cull animals usually totals around $740 per year / 200 cows = $3.70/cow/year.

Total benefits from added returns and reduced costs for the commercial mineral mix program are expected to total $22,942.00 per year / 200 cows = $114.71/cow/year (FIGURE 5).

Added Costs:

Recent work by the UH Cooperative Extension Service has found that mineral program using a commercial mineral mix could provide much of the mineral supplementation the ranch needs at around $31.89/cow/year. Labor to distribute the mineral is expected to cost around $20/hour, including all payroll taxes and benefits. Managers estimate that 3/4 of an hour per week or around 42 hours would be needed for the year, giving: 42 hrs/year @ $20/hr = $840 per year / 200 cows = $4.20/cow/year.

In addition, managers expect that other expenses for fuel, maintenance, etc. under the new mineral program will be around $300 per year / 200 cows = $1.50/cow/year.

The ranch expects that two new mineral bunks (1 bunk/100 head) would need to be constructed at an estimated cost of $500 each and are expected to last 10 years. 1 bunk/100 cows => 2 bunks @ $500/bunk = $1,000/10 years = $100 per year / 200 cows = $0.50/cow/year.

FIGURE 5. Partial Budget: Convert to Commercial Mineral Mix Supplementation – per COW/year

Partial Budget For: — CONVERT to Commercial Mineral Mix Supplementation (per cow/year)

Positive Effects				Negative Effects			
Added Returns	Quantity	Value	Total	**Added Costs**	Quantity	Value	
Calf sales: 40 head or 0.80 cwt/cow/year	0.8	$ 135.00	$ 108.00	Commercial mineral: $31.89/cow/year	1	$ 31.89	$ 31.89
			$ -	Mineral labor: $4.20/cow/year	1	$ 4.20	$ 4.20
			$ -	Other expenses (fuel, maintenance, etc)	1	$ 1.50	$ 1.50
			$ -	Mineral bunk costs: $0.50/cow/year	1	$ 0.50	$ 0.50
			$ -	Opportunity interest: $0.18/cow/year	1	$ 0.18	$ 0.18
			$ -	Added management: $1.25/cow/year	1	$ 1.25	$ 1.25
			$ -	Transportation and marketing for			$ -
			$ -	40 added calves: $2.68/cow/year	1	$ 2.68	$ 2.68
			$ -				$ -
Total Added Returns			$ 108.00	**Total Added Costs**			$ 42.20
Reduced Costs	Quantity	Value		**Reduced Returns**	Quantity	Value	
Vet and medicine: $3.01/cow/year	1	$ 3.01	$ 3.01	Cull female sales: $59.84/cow/year	1	$ 59.84	$ 59.84
Transportation and marketing for			$ -				$ -
17 fewer cull females: $3.70/cow/year	1	$ 3.70	$ 3.70				$ -
			$ -				$ -
Total Reduced Costs			$ 6.71	**Total Reduced Returns**			$ 59.84

Total Positive Effects
(Added Returns + Reduced Costs) $ 114.71

Total Negative Effects
(Added Costs + Reduced Returns) $ 102.04

Net Benefit of: CONVERT to Commercial Mineral Mix Supplementation (per cow/year)	$ 12.67

Currently managers are paying about 7 percent interest on their operating capital. Managers calculate the increased operating debt interest charge as: $500/year @ 7% interest = $35 per year / 200 cows = $0.18/cow/year.

Finally, managers anticipate management will be required to spend about 5 additional hours per year managing the new mineral program. This is expected to increase annual costs around $250/year to manage the new mineral program: 5 hrs/year @ $50/hr = $250 per year / 200 cows = $1.25/cow/year.

Finally, after some additional thought, the managers realize that managers should expect an increase in transportation and marketing cost associated with the added calves, as: 40 head/year @ $536 per year / 200 cows = $2.36/cow/year.

Reduced Returns:

JR L&L expects to sell 17 fewer cull females each year due to improved reproductive performance and longevity in the herd. Managers typically sell these cull females at around $704/head * 17 head = $11,968 reduced returns per year or $11,968 / 200 = $59.84/cow/year.

Total negative effects due to the added costs and reduced returns from adopting the commercial mineral mix program are expected to total $20,408.00 per year or $20,408 / 200 = $102.04/cow/year (FIGURE 5).

The total net benefit of converting to a commercial mineral mix program (Total Positive Effects - Total Negative Effects) is estimated at $12.67 per cow over the course of a year (FIGURE 5).

Risk Considerations:

The ranch is interested in minimizing the chance of any losses under the new mineral program. One way that managers can do that is to look at historic variations in the cost of the commercial mineral mix, as well as past changes in calf sale prices.

Based on past prices, managers find that the commercial mineral mix could be expected to range between $29.46 and $39.86/cow/year. Again, current costs are expected to remain constant in the near future around $31.89/cow/year.

To make the price of the commercial mineral mix uncertain, managers enter "Commercial Mineral Mix" as the description and "H6" as the cell under Uncertain Value 1, then enter $39.86 as the current value (most likely), $29.46 as a possible minimum value, and $39.86 as a possible maximum value (FIGURE 3).

The JR L&L also wants to make calf sale prices associated with the added calf revenues uncertain. Managers enter "Added Calf Sales" as the description and "D6" as the cell under Uncertain Value 2, enter $135 as the current value (most likely) per hundredweight (cwt), $120 as a possible minimum value, and $165 as a possible maximum value (FIGURE 6).

FIGURE 6. Convert to Commercial Mineral Mix Supplementation, Risk Considerations – per COW/year

Risk Scenarios						
Uncertain Value 1		☑ Include		Uncertain Value 2		☑ Include
Description	Cell			Description	Cell	
Commercial mineral mix	H6			Added calf sales	D6	
Current Value (Most Likely)	31.89			Current Value (Most Likely)	135	
Minimum Value	29.46			Minimum Value	120	
Maximum Value	39.86			Maximum Value	165	

Analysis Results:

Figure 7 shows the graph resulting from allowing the price of the commercial mineral mix and the added calf sales prices to vary from their current values. The net return at any combination of mineral quantity and increased calf sales is easily calculated by the RSP tool. What is not so easy is assigning a probability to each of those net returns. When the user clicks the "Run" button, the RSP tool performs an analysis based on the specified risk scenario (1,000 iterations). The results are depicted as a cumulative distribution graph (FIGURE 7).

In this graph, we can see that the net return values range from a possible low of -$1.27/cow to a high of $30.65/cow. In addition, we can see there is a 50/50 probability the value will fall above or below $13.44/cow. Keep in mind that these net return values are compared to the program the ranch has been following prior to this point: no regular or organized program for mineral supplementation of its cattle. As such, these net return values describe the improvement in net return the ranch could reasonably expect to earn where mineral and added calf sale prices vary between the high and low values entered (FIGURE 6).

FIGURE 7. Convert to Commercial Mineral Mix Supplementation, Simulation Results – per COW/year
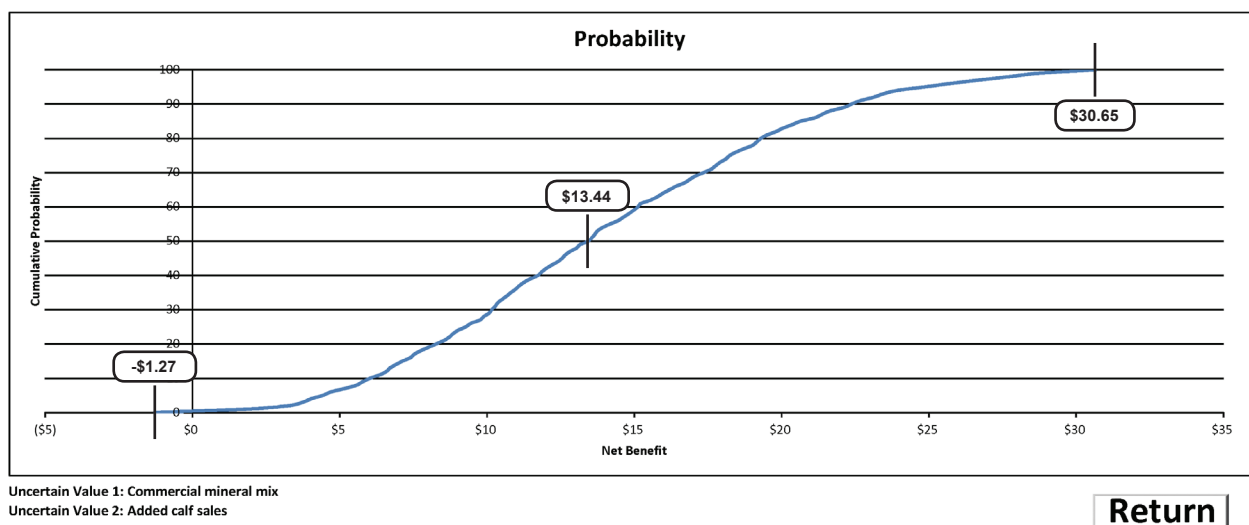
Uncertain Value 1: Commercial mineral mix
Uncertain Value 2: Added calf sales

Return

Within the RSP tool, the user can mouse-over points on the graph to directly read the probabilities for earning individual returns. In this way, the graph describes the range of possibilities, as well as the probability of achieving a particular threshold of net revenue. Reading the probabilities from points along the curve in Figure 7, the analysis shows we could expect the commercial mineral program to offer positive net returns nearly every year, with a small loss of -$1.27/cow/year at the low end. The very best the ranch could hope for would be a net return improvement of $30.65/cow/year and managers can reasonably expect that the improvement would be above their estimate of the most likely outcome of $12.67/cow/year more than 50 percent of the time looking forward.

Users interested in evaluating other ranges of mineral prices, added calf sale prices or changes in the most likely values can easily make changes in the appropriate entry blank (FIGURE 6) and rerun the analysis. In addition, the RSP tool could also evaluate allowing other factors in the partial budget (FIGURE 5) to vary across a range of values by making changes in the entry blanks (FIGURE 6) and rerunning the analysis to learn the impact of changes that those factors have on the resulting net return values.

Conclusions

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, two cases were presented using the Risk Scenario Planning tool to analyze potential changes to a mineral supplementation program, shifting from a commercial mineral mix to a free-choice, cafeteria-style approach. This change was evaluated on a TOTAL ranch basis, as well as on a per COW basis. The per cow approach and associated net return values would be the basis to use when comparing results for one ranch with another.

The Risk Scenario Planning tool represents a better way to handle the presence of uncertainty by thinking in terms of distributions, rather than only 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.

FIGURE 8. Cows on a Commercial Mineral Mix Supplementation Program