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Risk Scenario Planning

Evaluating the Potential Benefits of a Free-Choice Mineral Supplementation Program

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Assessing changes to your operation in the face of uncertainty

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Lists of Figures

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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) (FIGURE 1).

FIGURE 1. The Partial Budget Framework

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 changes in a few examples. We have prepared two examples using proposed changes for a Hawaii ranch looking at converting to a free-choice mineral supplementation program with uncertain mineral prices included in the mix.

Convert to Free-Choice Mineral Supplementation - TOTAL Ranch Analysis

For our first example, we consider the X Bar Ranch, a 500 cow/calf operation near Koloa, Kauai that has been supplementing its cattle with a commercial mineral mix for over the past 10 years. Here we analyze the situation for the total ranch net return (example two evaluates the per cow costs and returns).

Reduced Costs:

Current prices for commercial mineral mix runs about $34.66/cow/year * 500 head = $17,330/year total cost for the ranch. This cost represents a reduced cost where the ranch does not plan to use this form of mineral under the cafeteria-style approach.

The ranch currently spends about 2 hours per week over the course of a year putting out mineral and moving mineral feeders. It will save on this labor cost when implementing the new program. Currently, labor cost totals around $20/hour, including all payroll taxes and benefits. Managers estimate the reduced labor cost as: 104 hrs/year @ $20/hr = $2,080 in total for the year.

In addition, the ranch expects that other expenses for fuel, maintenance, etc. under the new mineral program will be saved at: $750 in total for the year.

Reduced costs under the cafeteria-style mineral program are expected to total $20,160 per year (FIGURE 2).

Added Costs:

Recent work by the UH Cooperative Extension Service has found that an individual, cafeteria-style mineral program may reduce the cost of supplementation to about $16.69/cow/year * 500 head = $8,345 total for the year.

Ranch management anticipates it will spend an average of about 1 additional hour per week putting out mineral following the free-choice approach, for an average of around three hours per week. Labor cost is around $20/hour, giving: 156 hrs/year @ $20/hr = $3,120 total labor cost for the year.

In addition, managers expect that other expenses for fuel, maintenance, etc. under the current mineral program will be around $1,000 or an increase of $250/year, giving: $1,000 total for the year.

FIGURE 2. Partial Budget: Convert to Free-Choice Mineral Supplementation – TOTAL/year

RightRisk™	Partial Budget For:	CONVERT to Individual Free-Choice Mineral Supplementation (total/year)			
Positive Effects				*Negative Effects*			
Added Returns	**Quantity**	**Value**	**Total**	**Added Costs**	**Quantity**	**Value**	
			$ -	*Free-choice mineral mix:*	500	$ 16.69	$ 8,345.00
			$ -	*Mineral labor costs:*	156	$ 20.00	$ 3,120.00
			$ -	*Other expenses (fuel, vehicle maint., etc.)*	1	$ 1,000.00	$ 1,000.00
			$ -	*Mineral bunk costs:*	5	$ 100.00	$ 500.00
			$ -	*Opportunity interest:*	500	$ 0.07	$ 35.00
			$ -	*Added management:*	10	$ 50.00	$ 500.00
			$ -				$ -
Total Added Returns			$ -	**Total Added Costs**			$ 13,500.00
Reduced Costs	**Quantity**	**Value**		**Reduced Returns**	**Quantity**	**Value**	
Commercial mineral:	500	$ 34.66	$ 17,330.00				$ -
Mineral labor:	104	$ 20.00	$ 2,080.00				$ -
Other expenses (fuel, maintenance, etc)	1	$ 750.00	$ 750.00				$ -
			$ -				$ -
Total Reduced Costs			$ 20,160.00	**Total Reduced Returns**			$ -

Total Positive Effects		**Total Negative Effects**	
(Added Returns + Reduced Costs)	$ 20,160.00	(Added Costs + Reduced Returns)	$ 13,500.00

Net Benefit of: CONVERT to Individual Free-Choice Mineral Supplementation (total/year)	$ 6,660.00

The ranch expects that five new mineral bunks (1 bunk/100 head) would need to be constructed at an estimated cost of $1,000 each and are expected to last 10 years. 1 bunk/100 cows => 5 bunks @ $1,000/bunk = $5,000/10 years = $500/year annual cost.

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

Finally, managers anticipate spending about 10 additional hours per year managing the new mineral program. This is expected to increase annual costs around $500/year to manage the new mineral program: 10 hrs/year @ $50/hr = $500 total over the year.

Added costs for the cafeteria-style mineral program are expected to total $13,500.00 per year (FIGURE 2).

The total net benefit of converting the mineral program from a commercial mineral mix to a cafeteria-style mineral program (Total Positive Effects - Total Negative Effects) is estimated at $6,660.00 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 cafeteria-style mineral components, as well as past changes in the cost of commercial mineral mix.

Based on past prices, managers find that the free-choice mineral mix could be expected to range between $14.19 and $19.19/cow/year. Again, current costs are expected to remain constant in the near future around $16.69/cow/year.

FIGURE 3. Convert to Free-Choice Mineral Supplementation, Risk Considerations – TOTAL/year

Risk Scenarios					
Uncertain Value 1		☑ Include	Uncertain Value 2		☑ Include
Description	Cell		Description	Cell	
Free-choice mineral mix	H6		*Commercial mineral mix*	D28	
Current Value (Most Likely)	16.69		Current Value (Most Likely)	34.66	
Minimum Value	14.19		Minimum Value	29.46	
Maximum Value	19.19		Maximum Value	39.86	

To make the price of the free-choice mineral mix uncertain, managers enter "Free-choice Mineral Mix" as the description and "H6" as the cell under Uncertain Value 1, then enter $16.69 as the current value (most likely), $14.19 as a possible minimum value, and $19.19 as a possible maximum value (FIGURE 3).

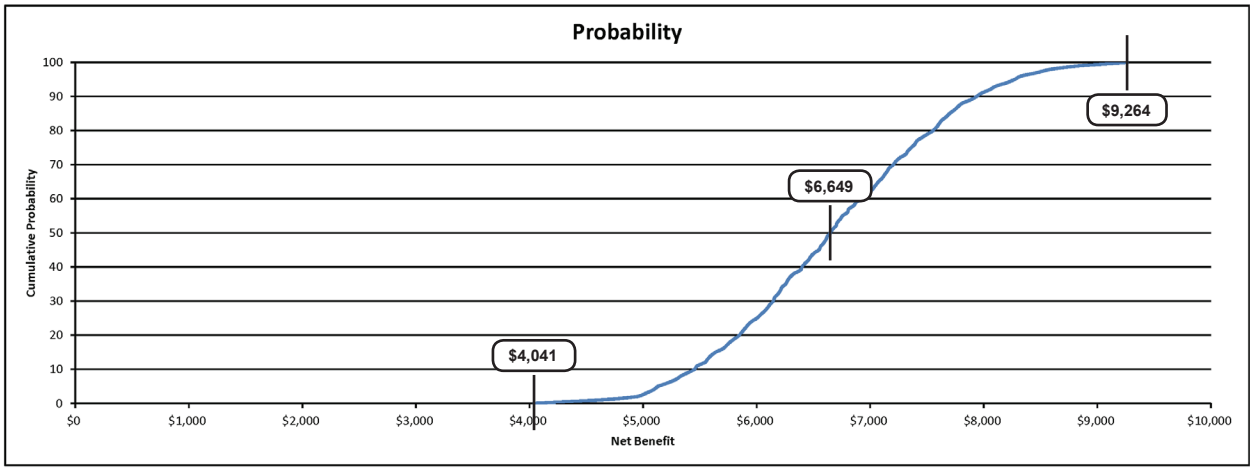
The X Bar also wants to make the price of the commercial mineral mix uncertain. Managers enter "Commercial Mineral Mix" as the description and "D28" as the cell under Uncertain Value 2, enter $34.66 as the current value (most likely), $29.46 as a possible minimum value, and $39.86 as a possible maximum value (FIGURE 3).

Analysis Results:

Figure 4 shows the result of allowing the price of the free-choice mineral mix and the price of the commercial mineral mix to vary from their current values. The net return at any combination of mineral values 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 $4,041 to a high of $9,264. In addition, we can see there is a 50/50 probability the value will fall above or below $6,649. Keep in mind that these net return values are compared to the mineral program the ranch has been following prior to this point: the commercial mineral mix program. As such, these net return values de-

FIGURE 4. Convert to Free-Choice Mineral Supplementation, Simulation Results – TOTAL/year



scribe the improvement in net return the ranch could reasonably expect to earn where mineral 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 free-choice mineral program to offer positive net returns every year, with the minimum improvement of $4,041 per year. The very best the ranch could hope for would be a net return improvement of $9,264 per year and it can reasonably expect that the improvement would most likely exceed $6,649/year about 50 percent of the time looking forward.

Users interested in evaluating other ranges of mineral 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 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 Free-Choice Mineral Supplementation - per COW Analysis

For our second example, we consider the same X Bar Ranch, a 500 cow/calf operation near Koloa, Kauai that has been supplementing its cattle with a commercial mineral mix for over the past 10 years. 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 associate net return values would be the basis to use when comparing results for one ranch with another.

Reduced Costs:

Current prices for commercial mineral mix runs about $34.66/cow/year. This cost represents a reduced cost where the ranch does not plan to use this form of mineral under the cafeteria-style approach.

The ranch currently spends about 2 hours per week over the course of a year putting out mineral and moving mineral feeders. The ranch will save on this labor cost when implementing the new program. Currently, labor cost totals around $20/hour, including all payroll taxes and benefits. Managers estimate the reduced labor cost as: 104 hrs/year @ $20/hr = $2,080 in total for the year. $2,080 / 500 cows = $4.16/cow/year.

FIGURE 5. Partial Budget: Convert to Free-Choice Mineral Supplementation – per COW/year

RightRisk™				Partial Budget For:	CONVERT to Individual Free-Choice Mineral Supplementation (per cow/year)			
Positive Effects					*Negative Effects*			
Added Returns	**Quantity**	**Value**	**Total**		**Added Costs**	**Quantity**	**Value**	
			$ -		*Free-choice mineral mix: $16.69/cow/year*	1	$ 16.69	$ 16.69
			$ -		*Mineral labor costs: $6.24/cow/year*	1	$ 6.24	$ 6.24
			$ -		*Other expenses (fuel, vehicle maint., etc.)*	1	$ 2.00	$ 2.00
			$ -		*Mineral bunk costs: $1/cow/year*	1	$ 1.00	$ 1.00
			$ -		*Opportunity interest: $0.50/cow/year*	1	$ 0.07	$ 0.07
			$ -		*Added management: $1/cow/year*	1	$ 1.00	$ 1.00
			$ -					$ -
Total Added Returns			$ -		**Total Added Costs**			$ 27.00
Reduced Costs	**Quantity**	**Value**			**Reduced Returns**	**Quantity**	**Value**	
Commercial mineral: $34.66/cow/year	1	$ 34.66	$ 34.66					$ -
Mineral labor: $4.16/cow/year	1	$ 4.16	$ 4.16					$ -
Other expenses (fuel, maintenance, etc)	1	$ 1.50	$ 1.50					$ -
			$ -					$ -
Total Reduced Costs			$ 40.32		**Total Reduced Returns**			$ -

Total Positive Effects (Added Returns + Reduced Costs)	$ 40.32	**Total Negative Effects** (Added Costs + Reduced Returns)	$ 27.00

Net Benefit of: CONVERT to Individual Free-Choice Mineral Supplementation (per cow/year)	$ 13.32

In addition, mangers expect that other expenses for fuel, maintenance, etc. under the current mineral program will be saved at: $750 in total for the year. $750 / 500 cows = $1.50/cow/year.

Reduced costs under the cafeteria-style mineral program are expected to total $40.32/cow/year (FIGURE 5).

Added Costs:

Recent work by the UH Cooperative Extension Service has found that an individual, cafeteria-style mineral program may reduce the cost of supplementation to about $16.69/cow/year.

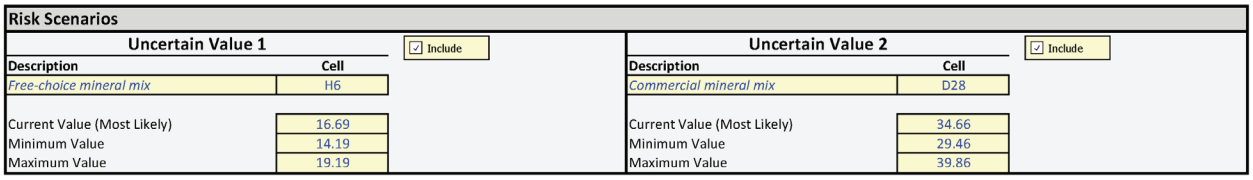
Managers anticipate they will spend an average of about 1 additional hour per week putting out mineral following the free-choice approach, for an average of around three hours per week. Labor cost is around $20/hour, giving: 156 hrs/year @ $20/hr = $3,120 total labor cost for the year. $3,120 / 500 cows = $6.24/cow/year.

In addition, managers expect that other expenses for fuel, maintenance, etc. under the new mineral program will be around $1,000 or an increase of $250/year, giving: $1,000 total for the year. $1,000 / 500 cows = $2/cow/year.
The ranch expects that five new mineral bunks (1 bunk/100 head) would need to be constructed at an estimated cost of $1,000 each and are expected to last 10 years. 1 bunk/100 cows => 5 bunks @ $1,000/bunk = $5,000/10 years = $500/year annual cost. $500 / 500 cows = $1/cow/year.

Currently the ranch is paying about 7 percent interest on its operating capital. Managers calculate the increased operating debt interest charge as: $500/year @ 7% interest = $35 total per year. $35 / 500 cows = $0.07/cow/year.

Finally, managers anticipate spending about 10 additional hours per year managing the new mineral program. This is expected to increase annual costs around $500/year to manage the new mineral program: 10 hrs/year @ $50/hr = $500 total over the year. $500 / 500 cows = $1.00/cow/year.

FIGURE 6. Convert to Free-Choice Mineral Supplementation, Risk Considerations – Per COW/year



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Minimum Value	14.19		Minimum Value	29.46	
Maximum Value	19.19		Maximum Value	39.86	

Added costs for the cafeteria-style mineral program are expected to total $27.00/cow/year (FIGURE 5).

The total net benefit of converting the mineral program from a commercial mineral mix to a cafeteria-style mineral program (Total Positive Effects - Total Negative Effects) is estimated at $13.32/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 it can do that is to look at historic variations in the cost of the cafeteria-style mineral components, as well as past changes in the cost of commercial mineral mix.

Based on past prices, managers find that the free-choice mineral mix could be expected to range between $14.19 and $19.19/cow/year. Again, current costs are expected to remain constant in the near future around $16.69/cow/year.

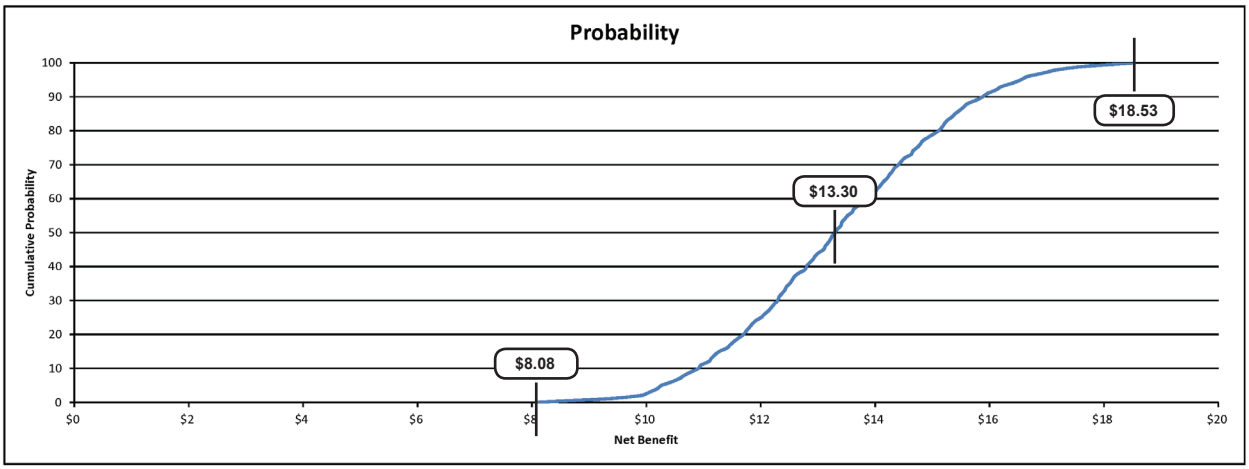
To make the price of the free-choice mineral mix uncertain, managers enter “Free-choice Mineral Mix” as the description and “H6” as the cell under Uncertain Value 1, then enter $16.69 as the current value (most likely), $14.19 as a possible minimum value, and $19.19 as a possible maximum value (FIGURE 6). The X Bar also wants to make the price of the commercial mineral mix uncertain. Managers enter “Commercial Mineral Mix” as the description and “D28” as the cell under Uncertain Value 2, enter $34.66 as the current value (most likely), $29.46 as a possible minimum value, and $39.86 as a possible maximum value (FIGURE 6).

Analysis Results:

Figure 7 shows the result of allowing the price of the free-choice mineral mix and the price of the commercial mineral mix to vary from their current values. The net return at any combination of mineral values 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 $8.08/cow/year to a high of $18.53/cow/year. In addition, we can see there is a 50/50 probability the value will fall above or below $13.30/cow/year. Keep in mind that these net return values are compared to the mineral program the ranch has been following prior to this point: the commercial mineral mix program. As such,

FIGURE 7. Convert to Free-Choice Mineral Supplementation, Simulation Results – per COW/year



these net return values describe the improvement in net return the ranch could reasonably expect to earn where mineral prices vary between the high and low values entered (FIGURE 6).

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 free-choice mineral program to offer positive net returns every year, with the minimum improvement of $8.08/cow/year. The very best the ranch could hope for would be a net return improvement of $18.53/cow/year and it can reasonably expect that the improvement would most likely exceed $13.30/cow/year about 50 percent of the time looking forward.

Users interested in evaluating other ranges of mineral 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 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 Free-Choice Mineral Supplementation Program, Maui | 2019