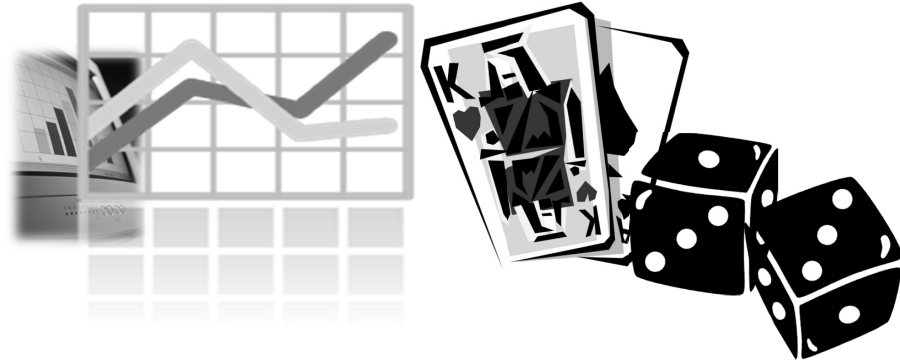


# RISK SCENARIO PLANNING

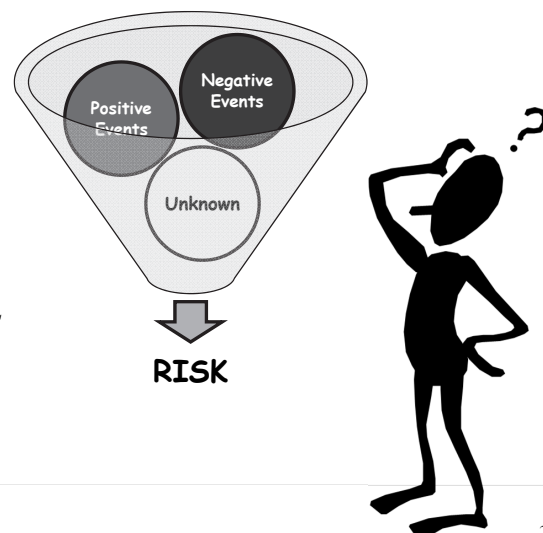
## Evaluating Mineral Supplementation for Hawaii Beef Production



**John P. Hewlett – University of Wyoming**

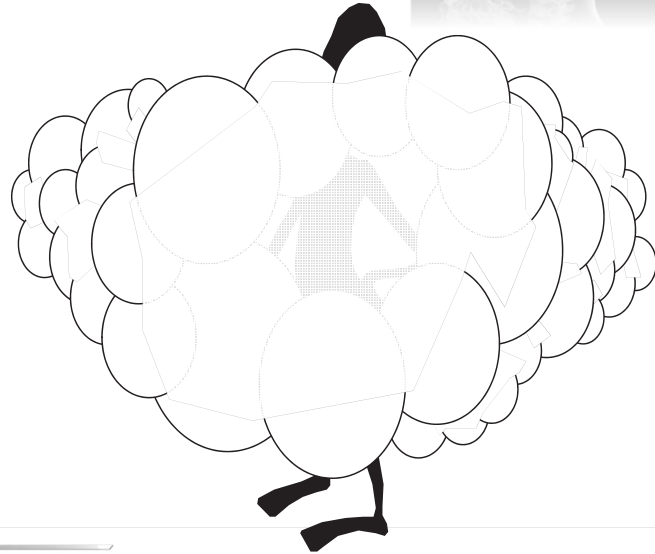
### What is RISK?

- **Cost of Loss**
  - *Income*
  - *Resources*
  - *Productive capacity, etc.*
- **Cost of Uncertainty**
  - *Worry, doubt, fear, misallocation of resources, etc.*
  - *With potential for gain or loss comes moral or ethical implications*



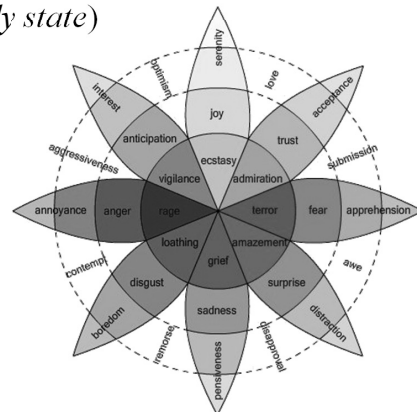
## The HUMAN Dimension of Risk

- Emotionally we avoid risk (uncertainty) to avoid the shame of:
  - *Failure,*
  - *Being wrong,*
  - *Being laughed at*
  - *Being made fun of,*
  - *Loosing the farm, etc.*



## HUMAN Dimension of Risk: Implications for Risk Management

- Emotions = physical state of our body as it responds to external stimuli
- Emotions are *separate* from our feelings
  - **Emotions**- result in us from our **actions** (*body state*)
  - **Feelings**- result in us from our **perspective** on our actions (*consciousness*)
- Emotions have been found by research to be *necessary* for decision making\*








\* MIT Technology Review, A. Damasio, 2014.

# Risk Biases

- Anchoring
- Availability
- Bandwagon
- Blind-spot
- Choice-supportive
- Clustering illusion
- Confirmation
- Conservatism
- Information
- Ostrich effect

### 20 COGNITIVE BIASES THAT SCREW UP YOUR DECISIONS

<p><b>1. Anchoring bias.</b> People are over-reliant on the first piece of information they hear. In a salary negotiation, whoever makes the first offer establishes a range of reasonable possibilities in each person's mind.</p> 	<p><b>2. Availability heuristic.</b> People overestimate the importance of information that is available to them. A person might argue that smoking is not unhealthy because they know someone who lived to 100 and smoked three packs a day.</p> 	<p><b>3. Bandwagon effect.</b> The probability of one person adopting a belief increases based on the number of people who hold that belief. This is a powerful form of groupthink and is reason why meetings are often unproductive.</p> 	<p><b>4. Blind-spot bias.</b> Failing to recognize your own cognitive biases is a bias in itself. People notice cognitive and motivational biases much more in others than in themselves.</p> 
<p><b>5. Choice-supportive bias.</b> When you choose something, you tend to feel positive about it, even if that choice has flaws. Like how you think your dog is awesome — even if it bites people every once in a while.</p> 	<p><b>6. Clustering illusion.</b> This is the tendency to see patterns in random events. It is key to various gambling fallacies, like the idea that red is more or less likely to turn up on a roulette table after a string of reds.</p> 	<p><b>7. Confirmation bias.</b> We tend to listen only to information that confirms our preconceptions — one of the many reasons it's so hard to have an intelligent conversation about climate change.</p> 	<p><b>8. Conservatism bias.</b> Where people favor prior evidence over new evidence or information that has emerged. People were slow to accept that the Earth was round because they maintained their earlier understanding that the planet was flat.</p> 
<p><b>9. Information bias.</b> The tendency to seek information when it does not affect action. More information is not always better. With less information, people can often make more accurate predictions.</p> 	<p><b>10. Ostrich effect.</b> The decision to ignore dangerous or negative information by "burying" one's head in the sand, like an ostrich. Research suggests that investors check the value of their holdings significantly less often during bad markets.</p> 	<p><b>11. Outcome bias.</b> Judging a decision based on the outcome — rather than how exactly the decision was made in the moment. Just because you won a bet in Vegas doesn't mean gambling your money was a smart decision.</p> 	<p><b>12. Overconfidence.</b> Some of us are too confident about our abilities, and this causes us to take greater risks in our daily lives. Experts are more prone to this bias than laypeople, since they are more convinced that they are right.</p> 

**SOURCES:** Risk Biases, PRISMA International, Psychology, Harvard Magazine, HowStuffWorks, Forer/Dick, Outcomes bias in decision evaluation, Journal of Personality and Social Psychology, Psychology Today, The Bias Blind Spot, Perceptions of Bias in Self Versus Others, Personality and Social Psychology Bulletin, The Bias in More Effect, Profoundness and Levels, Judgment and Decision Making, The New York Times, The Wall Street Journal, Wikipedia, You Are Not So Smart, Charismatic.

**Business Income**



# Risk Tradeoffs

*Profits are returns for taking risks*



- **Upside:** Greater risk taking usually leads to greater wealth over time
- **Downside:** Losses from risk taking can potentially be devastating
- Managing risks are a matter of **evaluating tradeoffs**
- How much **risk** (uncertainty) are you willing to accept for **possible higher returns?**



# Sources of Risk in Agriculture - *Ag Risk 5*

1. Marketing/Price Risk
2. Production Risk
3. Institutional/Legal Risk
4. Human Risk
5. Financial Risk

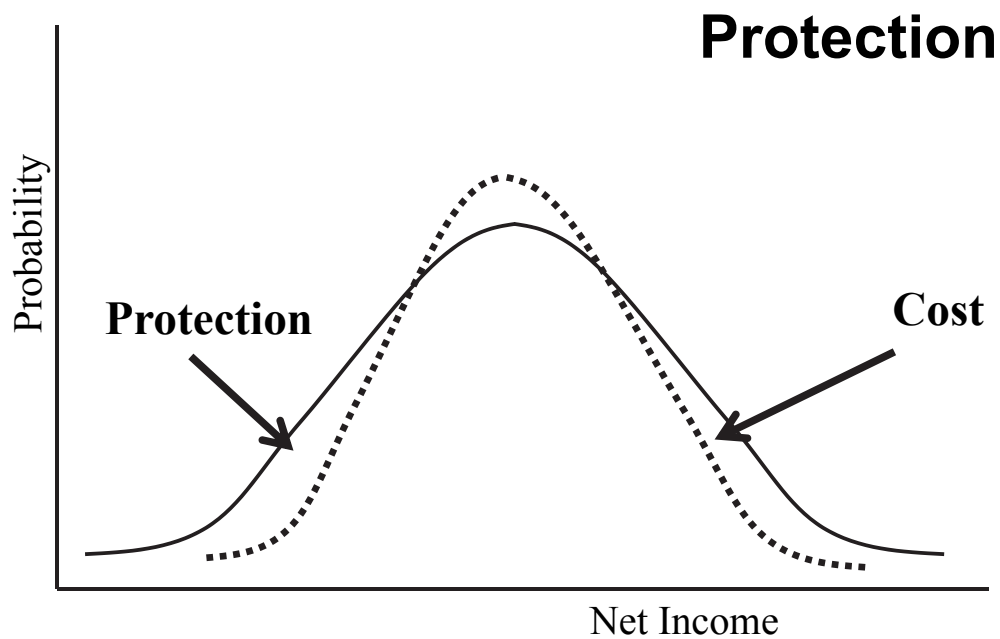


## Strategies for Managing Risk

1. **Avoid it**
2. **Reduce it**
  - a) Reduce the probability it will happen
  - b) Reduce the impact if it does happen
3. **Transfer it outside the business**
  - a) Insurance
  - b) Contracting
4. **Increase capacity to bare**
  - a) Increase reserves
  - b) Maintain flexibility
5. **Accept it**



# How much risk is right for you?

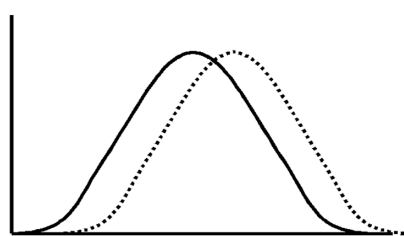


## Strategy Impacts

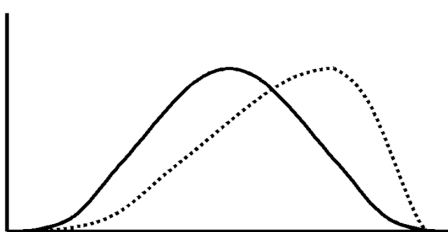
Panel 1: Same Mean, Less Dispersion



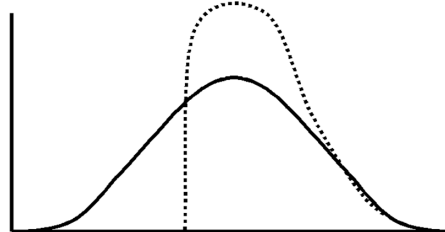
Panel 2: Same Dispersion, Higher Mean



Panel 3: Skewing the distribution



Panel 4: Truncating the Distribution



# Key Point

*Risk management is an active learning process that involves considering tradeoffs and making decisions to alter or not alter the probability distribution for a future event...*



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## Risk Treatment

- Selecting one or more *risk treatments* and implementing those treatment practices
- Involves a *cyclical process* of assessing a risk treatment and deciding whether residual risk levels are acceptable
- If not, then selecting a *new risk treatment* and assessing the effect of that treatment until the residual risk matches the risk criteria

LIKELIHOOD (Probability) How likely is the event to occur at some time in the future (Scale some specific matrix)	CONSEQUENCES What is the Severity of injuries / potential damages / financial impacts (if the risk event actually occurs)? (Logarithmic Scale, property industry specific matrix)				
	Insignificant	Minor	Moderate	Major	Catastrophic
No Injuries First Aid required No Envir. Damage -- \$1,000 Damage	Some First Aid required Low Envir. Damage -- \$10,000 Damage	External Medical Medium Envir. Damage -- \$100,000 Damage	Extensive injuries High Envir. Damage -- \$1,000,000 Damage	Death or Major Injuries Toxic Envir. Damage -- \$1,000,000 Damage	
Almost certain - expected in normal circumstances (100%)	MODERATE RISK	HIGH RISK	HIGH RISK	CRITICAL RISK	CRITICAL RISK
Likely - probably occur in most circumstances (50%)	MODERATE RISK	MODERATE RISK	HIGH RISK	HIGH RISK	CRITICAL RISK
Possible - might occur at some time (1%)	LOW RISK	MODERATE RISK	HIGH RISK	HIGH RISK	CRITICAL RISK
Unlikely - could occur at some future time (0.1%)	LOW RISK	MODERATE RISK	MODERATE RISK	HIGH RISK	HIGH RISK
Rare - only in exceptional circumstances (0.01%)	LOW RISK	LOW RISK	MODERATE RISK	MODERATE RISK	HIGH RISK

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## Risk Treatment: Options



- *Avoid* the risk
- Deciding to *start* or *continue* an activity likely to create or improve risk exposure
- *Remove* the source of risk
- Change the *nature* and *magnitude* of the likelihood
- Change the *consequences*
- *Share* the risk with another
- *Retain* the risk

*Not all options  
are  
mutually exclusive*

*Not all options  
are appropriate  
in every  
circumstance*



**RIGHTRISK**

## Evaluating Alternatives



**RIGHTRISK**

# RightRisk Analytics: ~ tools to evaluate alternatives

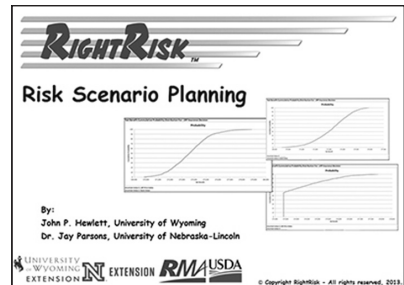
## Risk Scenario Planner relatively minor changes, risk analysis

- **Machine Risk Calculator**  
machine costs, custom rates, risk analysis
- **Forage Risk Analyzer**  
lease arrangements, forage supply, housing costs
- **Enterprise Risk Analyzer**  
larger enterprise-level, enterprise mix changes
- **RDFinancial**  
substantial changes, whole farm budgets, financial analysis, credit scoring
- **Multi-Temporal Risk Analysis**  
partial budgets incorporating time, risk analysis
- **Risk Navigator**  
strategic risk planning and analysis



## Risk Scenario Planner Description

- The Risk Scenario Planner (RSP) Tool is designed to provide financial analysis of management strategies and decisions involving **risk**
- Examples include: changes in production practices, adding and subtracting operating inputs, or other management alternatives that are fairly straight forward to define and evaluate
- The RSP tool uses a **partial budget framework** for collecting data to reflect one or more decisions for analysis

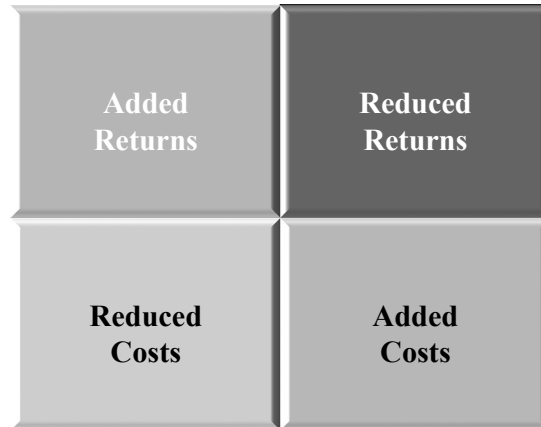




## Partial Budget Framework

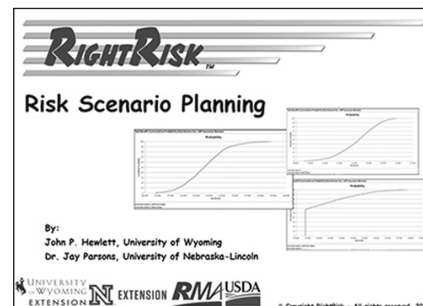
A partial budget is a tool used to analyze the **financial effect** of simple management changes

- **Positive Effects**
  - *Added Returns*
  - *Reduced Costs*
- **Negative Effects**
  - *Reduced Returns*
  - *Added Costs*



## RSP Tool

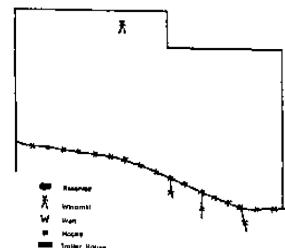
- The RSP tool goes beyond a partial budget by taking **risk** (change over time) into consideration
- The RSP tool allows one or possibly two of the input values to be **uncertain numbers** for any alternative analyzed
- This can lead to a more thorough understanding of **possible outcomes** if the change is implemented





## Case 1: Bred Heifers

- The WX Ranch runs a 350 head cow/calf operation in central Wyoming. Each year they expect to replace about 15 percent of their mother cows or 52 head. As a result, they normally hold 52 heifers out of each calf crop over the winter to breed as replacement animals.
- The WX Ranch is considering making a change that would involve keeping back an additional 40 heifers to put through the heifer development program.



## Case 1: Bred Heifers

- For **added returns** the WX expects 34 of the 40 extra replacement heifers to be bred and ready to sell as herd replacements each fall. They expect 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. The WX expects 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 the herd. The WX estimates 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 the WX Ranch expects to gain from making this change to the operation are \$48,573 in added returns.

## Case 1: Bred Heifers

- For **reduced returns**, saving back 40 extra replacement heifers means the WX will have 40 fewer weaned heifers to sell each fall. They estimate that their 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.



## Case 1: Bred Heifers

- For **added costs**, the WX estimates that six AUMs of grazing per head would be needed at \$20 per AUM that 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.
- The WX also estimates \$10 per head or \$400 total in additional vet & medicine expenses.
- Additional labor expenses are a little more difficult to estimate but their 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.



## Case 1: Bred Heifers

- The \$27,400 in reduced returns from not selling the 40 heifers as weaned calves is money the WX does not have in the bank and it will be a full year before they 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 the WX in terms of opportunity costs (\$69.15) and depreciation (\$666.66).
- Finally, they tally up a subset of their fuel, supplies, repairs, and maintenance costs that they 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 results in \$1,192.40 in added costs.
- The end result is \$25,920.18 in added costs resulting from making the change to the WX Ranch operations.

## Case 1: Bred Heifers

RIGHT RISK			
Partial Budget For:			
Positive Effects			
Added Returns	Quantity	Value	Total
Bred Heifers	34	\$ 1,200.00	\$ 40,800.00
6 Feeder Heifers (9 cwt.)	54	\$ 134.50	\$ 7,263.00
Cull Bulls (cwt./year)	6	\$ 85.00	\$ 510.00
			\$ -

- **Added returns** would result from
  - *Selling 40 bred heifers each year*
  - *Selling 6 feeder open heifers each year*
  - *Selling 6 additional cull bulls each year*

## Case 1: Bred Heifers

Reduced Returns	Quantity	Value	
40 Heifer Calves @ 5cwt.	200	\$ 137.00	\$ 27,400.00
			\$ -
			\$ -
<b>Total Reduced Returns</b>			<b>\$ 27,400.00</b>

- **Reduced returns** would result from not selling the 40 heifer calves each fall

## Case 1: Bred Heifers

Added Costs	Quantity	Value	
Private Grazing (40 hd. X 6 AUMs)	240	\$ 20.00	\$ 4,800.00
Hay (40 hd. X 1.75 tons)	70	\$ 190.00	\$ 13,300.00
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

- **Added costs** would include:
  - *Added grazing and added hay,*
  - *Added vet & medicine*
  - *Added labor*
  - *Interest on operating capital*
  - *Bull depreciation*
  - *Added fuel, supplies, repairs, maintenance, etc.*

# Case 1: Bred Heifers RSP Input Screen

Positive Effects		Negative Effects			
Quantity	Value	Quantity	Value		
	\$ 20.00		\$ 4,800.00		
	\$ 190.00		\$ 13,300.00		
	\$ 10.00		\$ 400.00		
275	\$ 12.00		\$ 3,300.00		
27400	\$ 0.08		\$ 2,192.00		
2	\$ 34.56		\$ 69.12		
2	\$ 333.33		\$ 666.66		
40	\$ 29.81		\$ 1,192.40		
	\$ -		\$ -		
	\$ -		\$ -		
<b>Total Added Returns</b>	<b>\$ 48,573.00</b>	<b>Total Added Costs</b>	<b>\$ 25,920.18</b>		
Reduced Costs	Quantity	Value	Reduced Returns	Quantity	Value
		\$ -	40 Heifer Calves @ 5cwt.	200	\$ 137.00
		\$ -			\$ -
		\$ -			\$ -
<b>Total Reduced Costs</b>		<b>\$ -</b>	<b>Total Reduced Returns</b>		<b>\$ 27,400.00</b>
<b>Total Positive Effects</b>		<b>Total Negative Effects</b>			
(Added Returns + Reduced Costs)		(Added Costs + Reduced Returns)			
\$48,573.00		\$53,320.18			
<b>Net Benefit of: Raise Bred Heifers to Sell</b>				<b>\$ (4,747.18)</b>	



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# Case 1: Bred Heifers RSP Input Screen

Risk Scenarios	
Uncertain Value 1 <input checked="" type="checkbox"/> Include	
Description	Cell
Bred Heifer Value	D6
Current Value (Most Likely)	1200
Minimum Value	1100
Maximum Value	1500

What if the WX wants to make the value of your bred heifers uncertain?

- The current value of \$1,200 is in cell D6 of the Risk Scenario Planning tool. We enter “Bred Heifer Value” as the description and “D6” as the cell under Uncertain Value 1
- Then enter 1200 as the current value,
- 1100 as a possible minimum value, and
- 1500 as a possible maximum value.



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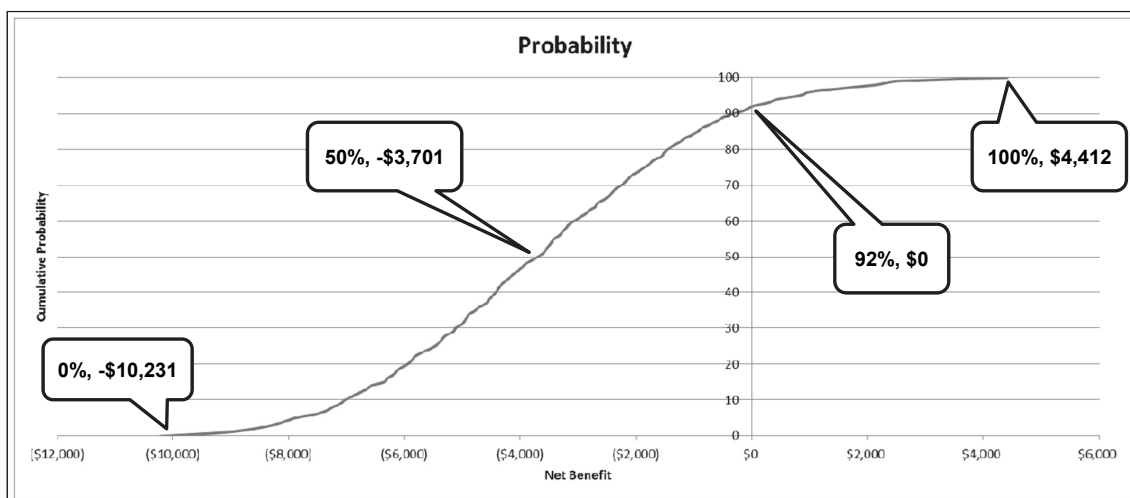
# Case 1: Bred Heifers RSP Input Screen

Uncertain Value 1		<input checked="" type="checkbox"/> Include	Uncertain Value 2		<input checked="" type="checkbox"/> 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	

The WX Ranch wants to make hay price an uncertain value as well.

- The current hay price of \$190 per ton is contained in cell H7, so we enter “Hay Price” as the description and “H7” as the cell under Uncertain Value 2.
- We use 190 as the current value, and
- 130 as a possible minimum value, and
- 250 as a possible maximum value for hay price

# Case 1: Bred Heifers RSP Results Screen



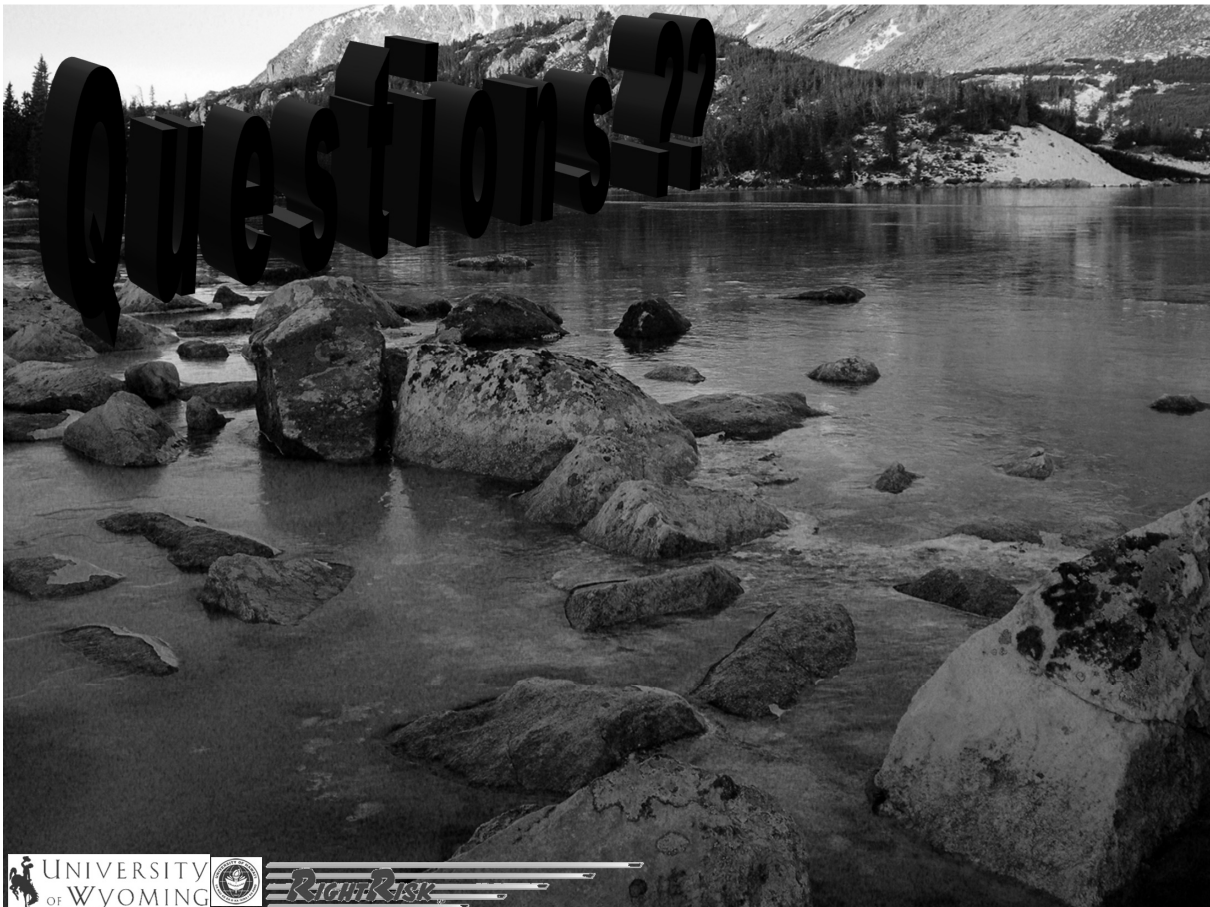
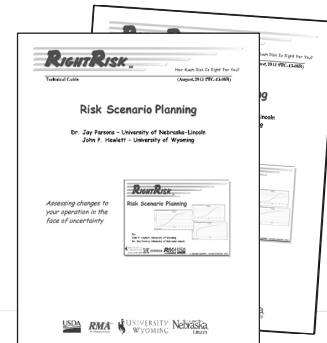
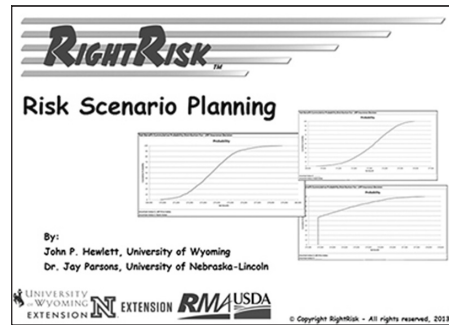
- A cumulative distribution graph gives the probability of earning a net return at or below any certain value.



# Summary

## The Risk Scenario Planning tool:

- Can be a useful tool for analyzing **management** strategies and decisions involving **risk**
- Represents a better way to handle the presence of **uncertainty** by thinking in terms of **distributions** of possible outcomes over time
- Results in more **informed** decision-making



## Case 2: Convert to Free-Choice Mineral Supplementation

- The X Bar Ranch, a 500 cow/calf operation near Koloa, has been supplementing their cattle with a commercial mineral mix for over the past 10 years.
- Current prices for commercial mineral mix runs about \$34.66/cow/year. 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.

## Case 2: Convert to Free-Choice Mineral Supplementation

- 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. Currently they are paying about 7 percent interest on their operating capital.
- They anticipate they will spend an average of about 1 additional hour per week putting out mineral following the free-choice approach. Labor cost is around \$20/hour, including all payroll taxes and benefits.
- Other expenses for additional fuel, vehicle maintenance and miscellaneous costs are expected to increase about \$250/year.
- They also anticipate management costs will increase around \$500/year to manage the new mineral program.





## Case 1: Convert to Free-Choice Mineral Supplementation - RSP Input Screen

Risk Scenarios		
Uncertain Value 1		<input type="checkbox"/> Include
Description	Cell	
Free-choice mineral mix	H6	
Current Value (Most Likely)	16.69	
Minimum Value	14.19	
Maximum Value	19.19	

The X Bar wants to make the price of the free-choice mineral mix uncertain:

- The current value of \$16.69/cow/year is in cell H6 of the Risk Scenario Planning tool. We 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,
- \$14.19 as a possible minimum value, and
- \$19.19 as a possible maximum value.

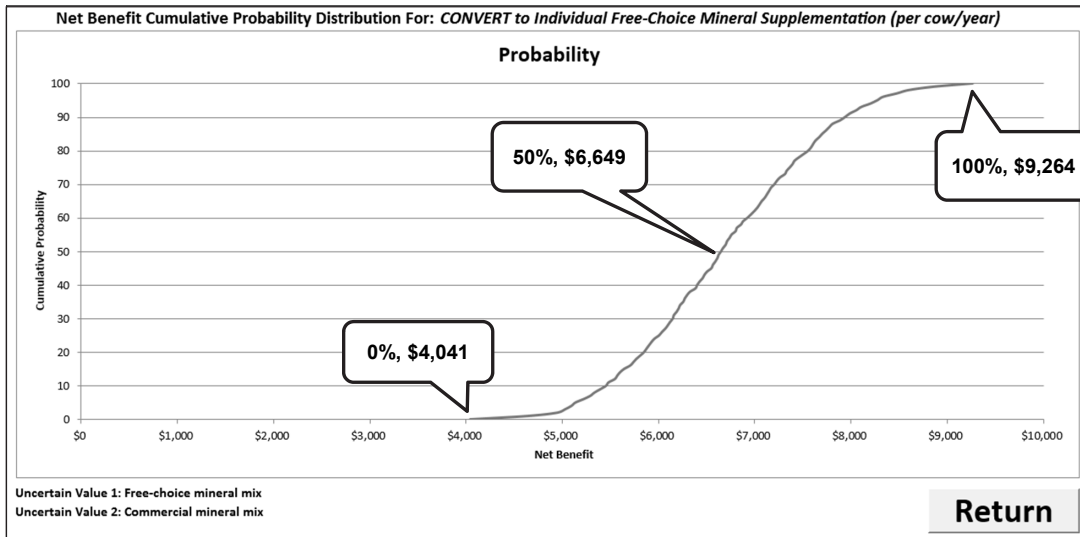
## Case 1: Convert to Free-Choice Mineral Supplementation - RSP Input Screen

Risk Scenarios					
Uncertain Value 1		<input type="checkbox"/> Include	Uncertain Value 2		<input type="checkbox"/> 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	

The X Bar also wants to make the price of the commercial mineral mix uncertain:

- The current value of \$34.66/cow/year is in cell D28 of the Risk Scenario Planning tool. We enter “Free-choice Mineral Mix” as the description and “D28” as the cell under Uncertain Value 1
- Then enter \$34.66 as the current value,
- \$29.46 as a possible minimum value, and
- \$39.86 as a possible maximum value.

## Case 2: Covert to Free-Choice Mineral Supplementation



- A cumulative distribution graph gives the probability of earning a net return at or below any certain value.



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UNIVERSITY OF WYOMING  RIGHT RISK