Multi-temporal risk analysis

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Tool Description

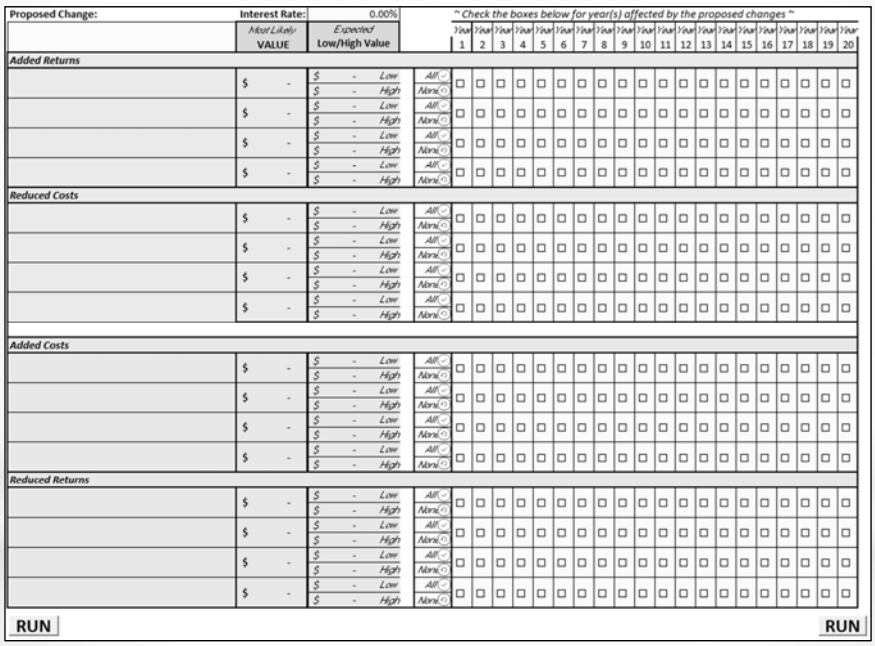
- The Multi-Temporal Risk Analyzer (MTRA) Tool is designed to provide economic analysis of multi-year management strategies and decisions involving risk.
- Examples include: investment decisions, changes in production practices, adding and subtracting enterprises, and other decisions that involve multiple years to come to fruition or a multi-year commitment in order to see a positive economic return.
- The MTRA tool uses a partial budget as its baseline for entering data reflecting the decision to be analyzed.

Partial Budget

- A partial budget is a simple financial tool used to analyze simple changes to your operation.
- Positive Effects
  - Added Returns
  - Reduced Costs
- Negative Effects
  - Added Costs
  - Reduced Returns

*The MRTA tool incorporates the ability to define some or all of the input values as **uncertain numbers in any year analyzed** creating a more thorough understanding of possible outcomes if the change is implemented.*

Input Page



Case 1: Equipment Purchase Decision

- John and Martha Hay own 300 acres of established hay ground.
- They typically get three cuttings per year off of this ground.
- Currently, they are paying a custom operator $15 per acre to windrow it each time they put up hay.
- They are considering purchasing a windrower for about $100,000 with 5% financing for five years.
- Furthermore, a neighbor has about 225 acres of hay they can custom windrow to bring in extra money.

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Case 1: Equipment Purchase Decision

Proposed Change: Windrower Purchase

Interest Rate: 5.00%

~ Check the boxes below for year(s) affected by the proposed changes ~

Windrower Purchase	Most Likely VALUE	Expected Low Value	Expected High Value		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
Added Returns																								
Custom work	$ 7,215	$ - Low	$ 8,658 High	All / None	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
Salvage value	$ 30,000	$ 20,000 Low	$ 40,000 High	All / None											✓									
	$ -	$ - Low	$ - High	All / None																				
	$ -	$ - Low	$ - High	All / None																				
Reduced Costs																								
Custom windrowing expense	$ 13,500	$ 13,500 Low	$ 13,500 High	All / None	✓	✓																		
Custom windrowing expense	$ 14,850	$ 13,500 Low	$ 16,335 High	All / None			✓	✓	✓	✓														
Custom windrowing expense	$ 16,335	$ 13,500 Low	$ 18,000 High	All / None							✓	✓	✓	✓										
	$ -	$ - Low	$ - High	All / None																				
Added Costs																								
Loan payments	$ 23,097	$ 23,097 Low	$ 23,097 High	All / None	✓	✓	✓	✓	✓															
Operating costs (labor, fuel & repairs)	$ 4,362	$ 4,362 Low	$ 4,362 High	All / None	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
Taxes, housing, and insurance	$ 1,000	$ 1,000 Low	$ 1,000 High	All / None	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓										
	$ -	$ - Low	$ - High	All / None																				
Reduced Returns																								
	$ -	$ - Low	$ - High	All / None																				
	$ -	$ - Low	$ - High	All / None																				
	$ -	$ - Low	$ - High	All / None																				
	$ -	$ - Low	$ - High	All / None																				

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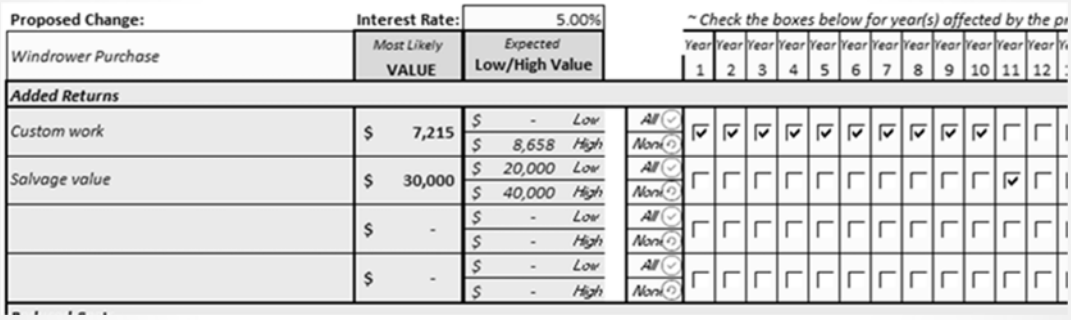
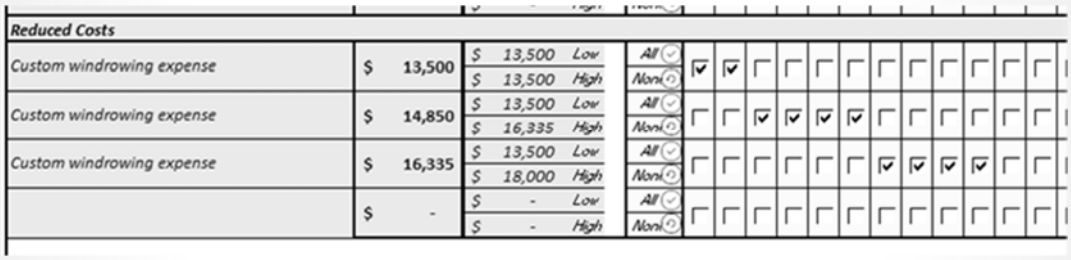
Case 1: Equipment Purchase Decision



Proposed Change:	Interest Rate:	5.00%		~ Check the boxes below for year(s) affected by the p
Windrower Purchase	Most Likely VALUE	Expected Low/High Value		Year 1 2 3 4 5 6 7 8 9 10 11 12
Added Returns				
Custom work	$ 7,215	$ - Low $ 8,658 High	All None	☑ ☑ ☑ ☑ ☑ ☑ ☑ ☑ ☑ ☑ ☐ ☐
Salvage value	$ 30,000	$ 20,000 Low $ 40,000 High	All None	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☑ ☐
	$ -	$ - Low $ - High	All None	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
	$ -	$ - Low $ - High	All None	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

- Added Returns include:
  - Possible income from custom work
  - The salvage value of the windrower after 10 years
- Both of these involve considerable uncertainty

Case 1: Equipment Purchase Decision



Reduced Costs				
Custom windrowing expense	$ 13,500	$ 13,500 Low $ 13,500 High	All None	☑ ☑ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐
Custom windrowing expense	$ 14,850	$ 13,500 Low $ 16,335 High	All None	☐ ☐ ☑ ☑ ☑ ☑ ☐ ☐ ☐ ☐ ☐ ☐
Custom windrowing expense	$ 16,335	$ 13,500 Low $ 18,000 High	All None	☐ ☐ ☐ ☐ ☐ ☐ ☑ ☑ ☑ ☑ ☐ ☐
	$ -	$ - Low $ - High	All None	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

- Reduced costs would be the savings realized from not having to pay someone to custom windrow their hay.
- Uncertainty around this cost can be customized over the course of the ten year planning horizon to reflect anticipated increases over time.

Case 1: Equipment Purchase Decision

Added Costs																	
Loan payments	$ 23,097	$ 23,097	Low	All	☑	☑	☑	☑	☑	☐	☐	☐	☐	☐	☐	☐	
		$ 23,097	High	None													
Operating costs (labor, fuel & repairs)	$ 4,362	$ 4,362	Low	All	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	
		$ 4,362	High	None													
Taxes, housing, and insurance	$ 1,000	$ 1,000	Low	All	☑	☑	☑	☑	☑	☑	☑	☑	☑	☑	☐	☐	
		$ 1,000	High	None													
	$ -	$ -	Low	All	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	
		$ -	High	None													

- Added costs would include:
  - Loan payments on the purchased windrower
  - Operating costs for the windrower
  - Taxes, housing, and insurance costs on the windrower

Case 1: Equipment Purchase Decision

Proposed Change: Windrower Purchase

New Projection

Interest Rate: 0.00%

CASH-basis analysis

YEAR	Projected Total Added Returns	Projected Total Reduced Costs	Projected Total Added Costs	Projected Total Reduced Returns	Projected NET ANNUAL Return
1	4,107	13,500	28,459	-	-10,852
2	5,516	13,500	28,459	-	-9,443
3	5,975	15,208	28,459	-	-7,276
4	7,659	15,793	28,459	-	-5,008
5	6,178	15,017	28,459	-	-7,264
6	8,531	15,583	5,362	-	18,751
7	7,057	17,208	5,362	-	18,903
8	6,458	15,526	5,362	-	16,622
9	5,983	16,531	5,362	-	17,152
10	6,980	15,033	5,362	-	16,651
11	29,243	-	-	-	29,243
12	-	-	-	-	0
13	-	-	-	-	0
14	-	-	-	-	0
15	-	-	-	-	0
16	-	-	-	-	0
17	-	-	-	-	0
18	-	-	-	-	0
19	-	-	-	-	0
20	-	-	-	-	0

Annual Return CASH-basis Return GRAPH | Annual Return CASH- & PV-basis GRAPH | Annual CASH-basis with BEST/WORST Return GRAPH | Annual PV-basis with BEST/WORST Return GRAPH

Net Return:	77,480
MIN Rtn:	-10852
AVG. Rtn:	3874
MAX Rtn:	29243

RUN

Interest Rate: 5.00%

PRESENT VALUE-basis analysis

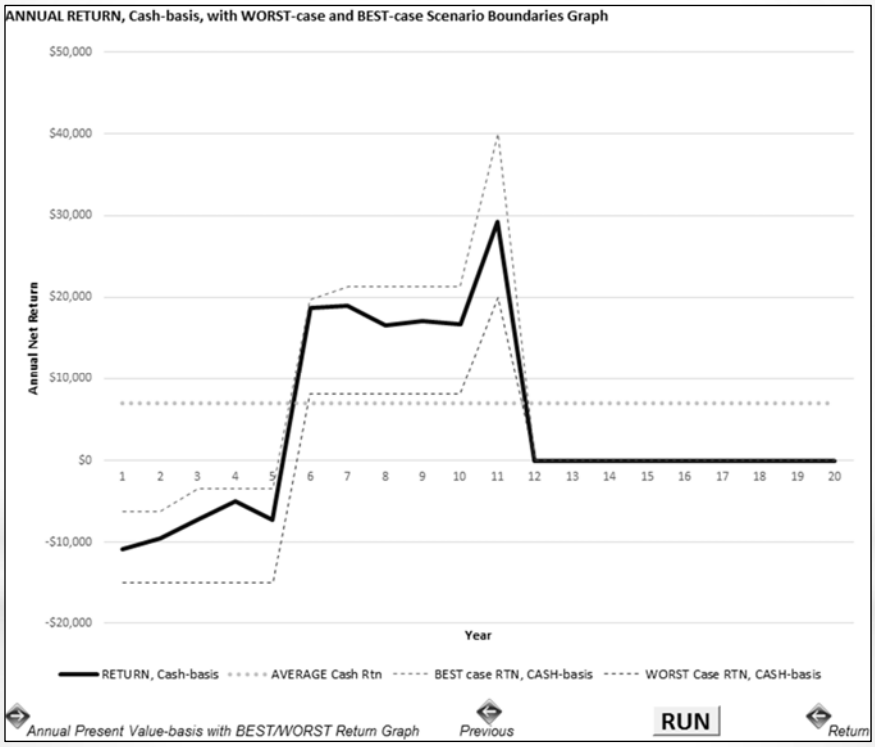
YEAR	Projected PV-Total Added Returns	Projected PV-Total Reduced Costs	Projected PV-Total Added Costs	Projected PV-Total Reduced Returns	Projected PV-NET ANNUAL Return
1	4,107	13,500	28,459	-	-10,852
2	5,254	12,857	27,104	-	-8,993
3	5,419	13,794	25,813	-	-6,600
4	6,616	13,643	24,584	-	-4,326
5	5,082	12,355	23,413	-	-5,976
6	6,684	12,209	4,201	-	14,692
7	5,266	12,841	4,001	-	14,106
8	4,589	11,034	3,811	-	11,813
9	4,050	11,189	3,629	-	11,609
10	4,499	9,691	3,456	-	10,733
11	17,952	-	-	-	17,952
12	-	-	-	-	0
13	-	-	-	-	0
14	-	-	-	-	0
15	-	-	-	-	0
16	-	-	-	-	0
17	-	-	-	-	0
18	-	-	-	-	0
19	-	-	-	-	0
20	-	-	-	-	0

Annual Return, PV-basis CPD, single draw GRAPH | Annual Return, PV-basis CPD, single- & multi-draw GRAPH | Investment Net Return Cash-basis CPD GRAPH | Investment Net Return Cash- & PV-basis CPD GRAPH

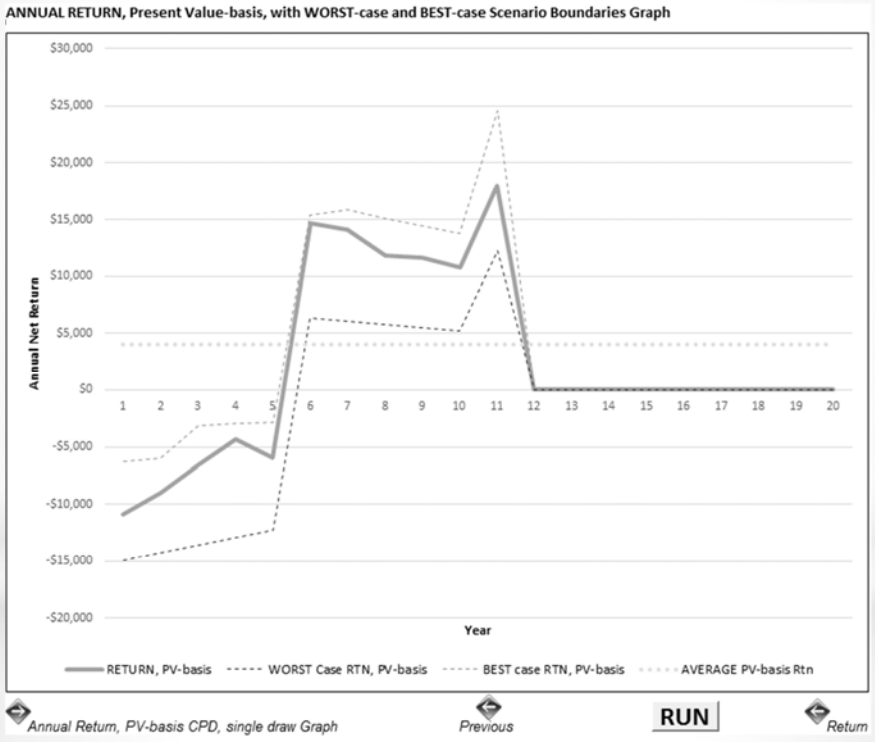
Net Return:	44,160
MIN Rtn:	-10852
AVG. Rtn:	2208
MAX Rtn:	17952

RUN

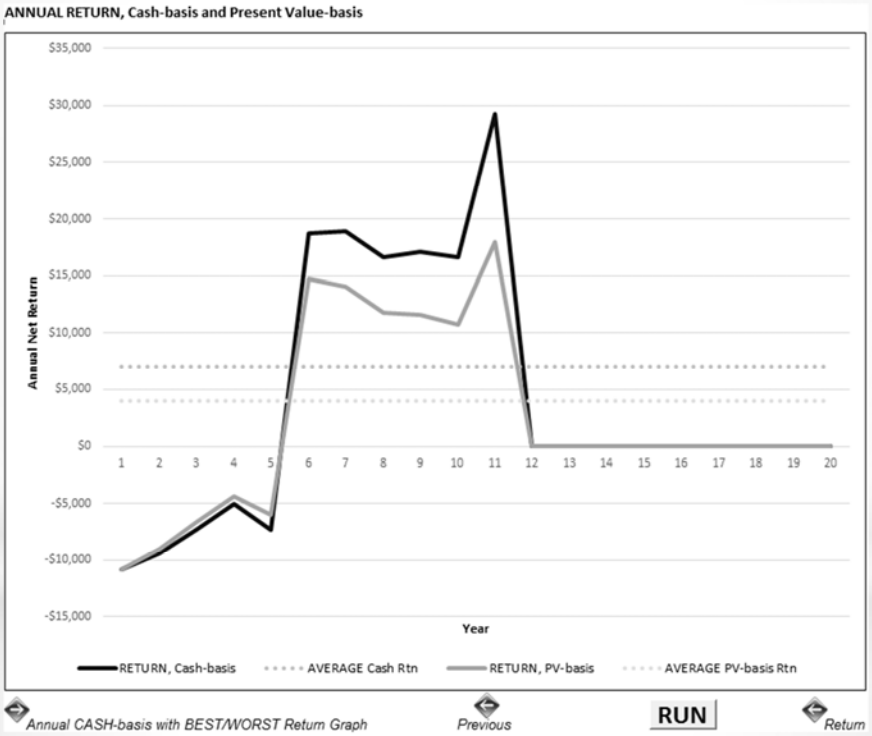
Case 1: Equipment Purchase Decision



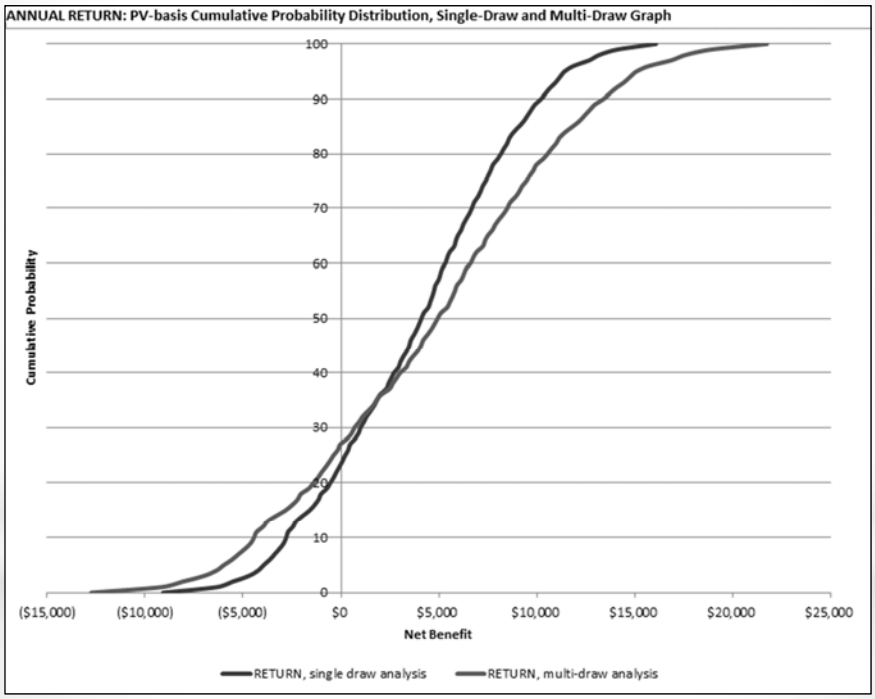
Case 1: Equipment Purchase Decision



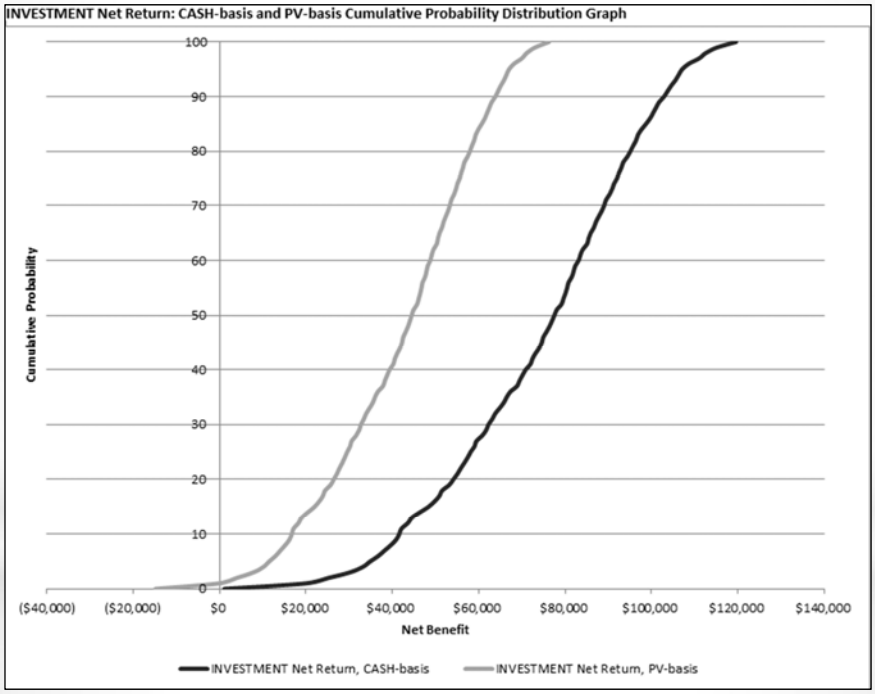
Case 1: Equipment Purchase Decision



Case 1: Equipment Purchase Decision



Case 1: Equipment Purchase Decision



Case 2: Pasture Improvement Decision

- Rex and Sara Timber currently manage a 1280-acre pasture as a single unit. The pasture has a water source at the north end and is fenced around the perimeter.
- Their normal practice is to graze 400 yearling steers in the pasture for a period of 2.5 months from June 15 to August 31 each year. The starting weight for the steers is around 550 pounds and the ending weight is usually about 660 pounds.
- The Timbers are considering making some improvements to the pasture infrastructure in order to increase the carrying capacity.

Case 2: Pasture Improvement Decision

- Specifically, they are considering cross fencing the pasture into four equal quadrants and extending a water line from an adjacent pasture into the new 4-pasture unit with a tank in each of the four pastures.
- The improvements would involve the following:
  - The installation of four miles of buried water line and four water tanks; and,
  - The construction of three miles of 4-wire cross fencing.
- The Timbers estimate that the water development and cross fencing will allow them to increase the carrying capacity to about 460 head of steers over the same grazing period while maintaining the same average ending weight of around 660 pounds.

Case 2: Pasture Improvement Decision

Item	Cost
Annual perimeter fence and water maintenance	$400
Annual depreciation of perimeter fence	$325
Annual labor hours per steer w/out cross fencing	0.2
Average land value per acre (current)	$700
Annual property taxes per acre (current)	$3.40
Cross fencing materials and installation per mile	$8,550
Cross fence annual repairs and maintenance	$225
Cross fence useful live	35 years
Waterline installation	$27,750
Water tanks ($/tank)	$3,000
Tank & waterline annual repairs and maintenance	$100
Tank & waterline useful life	20 years
Annual labor hours per steer with cross fencing	0.3
Annual property taxes per acre with proposed improvements	$3.65
Wage rate per hour	$20
Interest rate on investments	8%

Case 2: Pasture Improvement Decision

Proposed Change:	Interest Rate:	5.00%		~ Check the boxes below for year(s) affected by the proposed changes ~
Pasture Improvement	Most Likely VALUE	Expected Low/High Value		Year 1 … Year 20
Added Returns				
60 additional head of steers	$ 14,100	$ - Low $ 18,330 High	All Non	☑
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
Reduced Costs				
Current water source maintenance cost	$ 175	$ 175 Low $ 175 High	All Non	☑
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
Added Costs				
Capital improvements (fence & water) dep.	$ 3,270	$ 3,270 Low $ 3,270 High	All Non	☑
Interest	$ 3,516	$ 2,800 Low $ 4,395 High	All Non	☑
Annual labor, repairs & maintenance	$ 1,485	$ 1,053 Low $ 1,992 High	All Non	☑
Property taxes	$ 320	$ 320 Low $ 320 High	All Non	☑
Reduced Returns				
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐

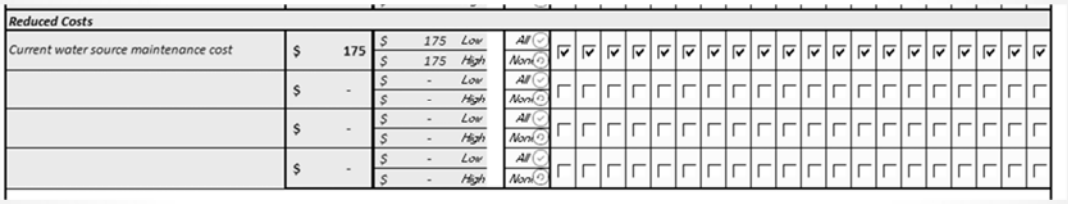
RUN RUN

Case 2: Pasture Improvement Decision

Proposed Change:	Interest Rate:	5.00%		~ Check the boxes below for year(s) affected by the proposed changes ~
Pasture Improvement	Most Likely VALUE	Expected Low/High Value		Year 1 … Year 20
Added Returns				
60 additional head of steers	$ 14,100	$ - Low $ 18,330 High	All Non	☑
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐
	$ -	$ - Low $ - High	All Non	☐

- Added Returns would result from being able to run 60 additional head of steers over the same grazing period each year
- However, this involves considerable uncertainty

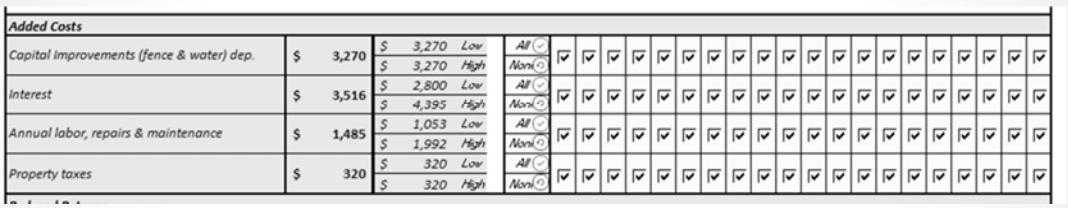
Case 2: Pasture Improvement Decision



Reduced Costs				
Current water source maintenance cost	$ 175	$ 175	Low	All
		$ 175	High	None
	$ -	$ -	Low	All
		$ -	High	None
	$ -	$ -	Low	All
		$ -	High	None
	$ -	$ -	Low	All
		$ -	High	None

- Reduced costs would result from not having to maintain their current water source
- This doesn't involve any uncertainty

Case 2: Pasture Improvement Decision



Added Costs				
Capital Improvements (fence & water) dep.	$ 3,270	$ 3,270	Low	All
		$ 3,270	High	None
Interest	$ 3,516	$ 2,800	Low	All
		$ 4,395	High	None
Annual labor, repairs & maintenance	$ 1,485	$ 1,053	Low	All
		$ 1,992	High	None
Property taxes	$ 320	$ 320	Low	All
		$ 320	High	None

- Added costs would include:
  - The investment in the capital improvements
  - Additional interest expense associated with the capital improvement investment and with buying 60 more head of steers to graze
  - Increased labor, repair & maintenance expenses
  - Increased property taxes

Case 2: Pasture Improvement Decision

Proposed Change: Pasture Improvement

New Projection

Interest Rate: 0.00%

CASH-basis analysis

YEAR	Projected Total Added Returns	Projected Total Reduced Costs	Projected Total Added Costs	Projected Total Reduced Returns	Projected NET ANNUAL Return
1	13,674	175	8,983	-	4,866
2	9,366	175	8,202	-	1,339
3	7,444	175	8,945	-	-1,326
4	13,174	175	8,215	-	5,134
5	12,344	175	8,569	-	3,950
6	13,980	175	8,373	-	5,783
7	7,509	175	8,318	-	-634
8	15,729	175	8,744	-	7,160
9	14,289	175	7,987	-	6,477
10	17,294	175	8,381	-	9,089
11	10,674	175	8,866	-	1,982
12	8,582	175	8,300	-	457
13	6,877	175	8,947	-	-1,895
14	5,653	175	8,291	-	-2,463
15	15,241	175	8,597	-	6,820
16	10,424	175	8,500	-	2,099
17	15,291	175	8,443	-	7,023
18	9,273	175	8,189	-	1,260
19	11,042	175	8,509	-	2,708
20	13,232	175	8,945	-	4,462

Annual Return CASH-basis Return GRAPH | Annual Return CASH- & PV-basis GRAPH

Annual CASH-basis with BEST/WORST Return GRAPH | Annual PV-basis with BEST/WORST Return GRAPH

Net Return:	64,291
MIN Rtn:	-2463
AVG. Rtn:	3215
MAX Rtn:	9089

RUN

Interest Rate: 5.00%

PRESENT VALUE-basis analysis

YEAR	Projected PV-Total Added Returns	Projected PV-Total Reduced Costs	Projected PV-Total Added Costs	Projected PV-Total Reduced Returns	Projected PV-NET ANNUAL Return
1	13,674	175	8,983	-	4,866
2	8,920	167	7,811	-	1,276
3	6,752	159	8,113	-	-1,202
4	11,380	151	7,096	-	4,435
5	10,155	144	7,049	-	3,250
6	10,954	137	6,560	-	4,531
7	5,604	131	6,207	-	-473
8	11,179	124	6,214	-	5,089
9	9,671	118	5,406	-	4,384
10	11,148	113	5,402	-	5,859
11	6,553	107	5,443	-	1,217
12	5,018	102	4,853	-	267
13	3,829	97	4,982	-	-1,055
14	2,998	93	4,397	-	-1,306
15	7,698	88	4,342	-	3,444
16	5,014	84	4,089	-	1,010
17	7,005	80	3,868	-	3,217
18	4,046	76	3,573	-	550
19	4,588	73	3,536	-	1,125
20	5,236	69	3,540	-	1,766

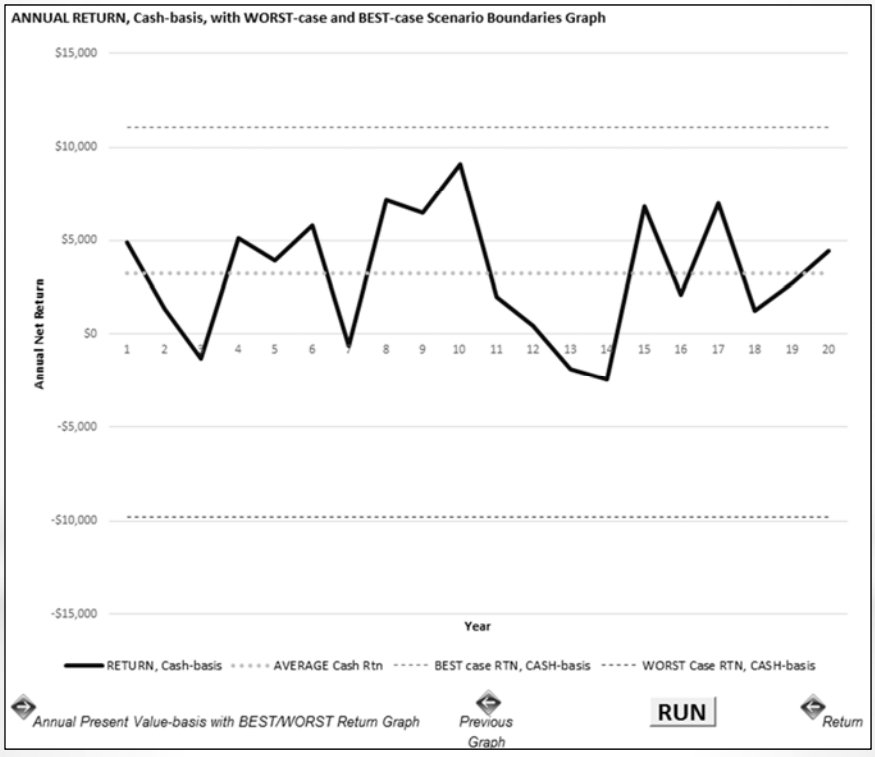
Annual Return, PV-basis CPD, single draw GRAPH | Annual Return, PV-basis CPD, single- & multi-draw GRAPH

Investment Net Return Cash-basis CPD GRAPH | Investment Net Return Cash- & PV-basis CPD GRAPH

Net Return:	42,248
MIN Rtn:	-1306
AVG. Rtn:	2112
MAX Rtn:	5859

RUN

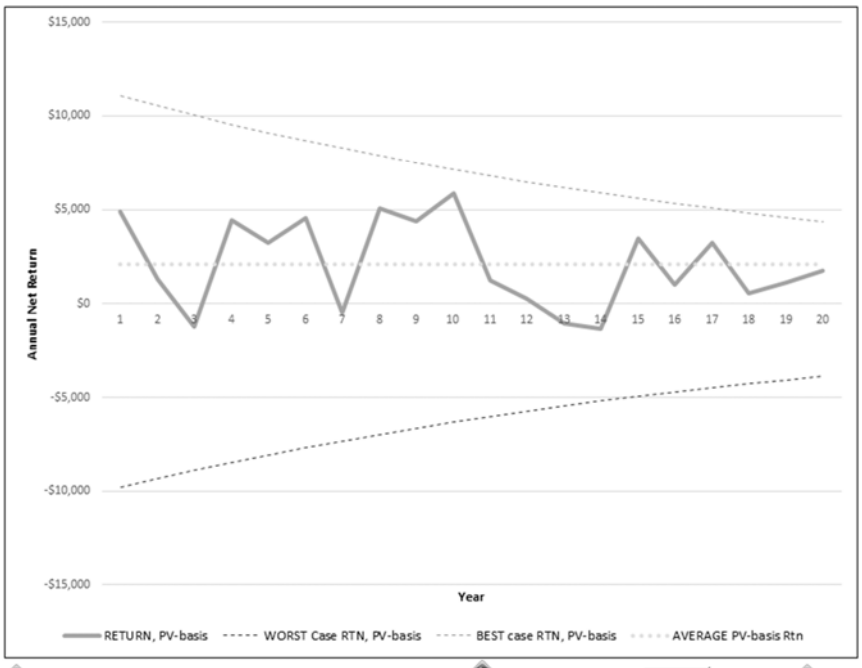
Case 2: Pasture Improvement Decision



Annual Present Value-basis with BEST/WORST Return Graph | Previous Graph | RUN | Return

Case 2: Pasture Improvement Decision

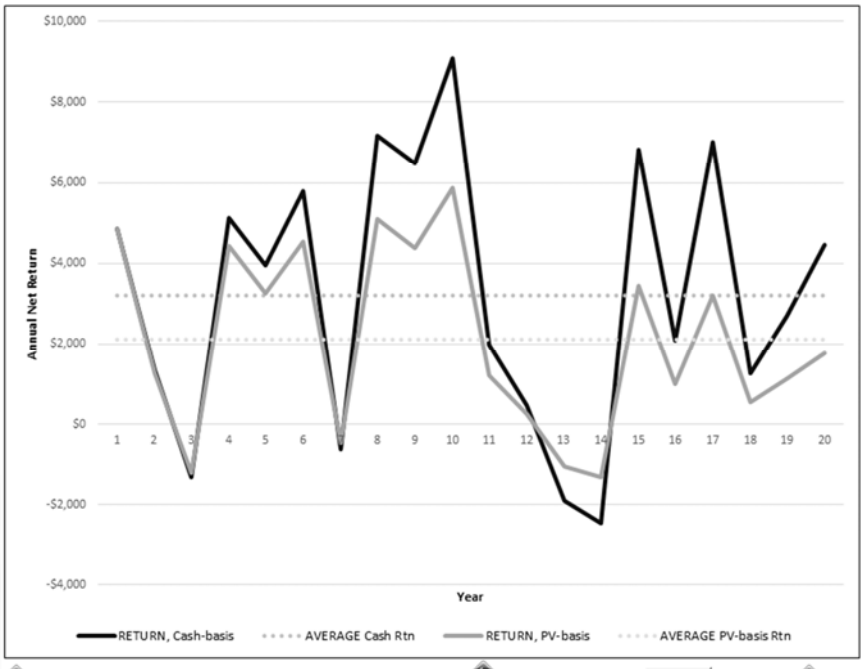
ANNUAL RETURN, Present Value-basis, with WORST-case and BEST-case Scenario Boundaries Graph



Annual Return, PV-basis CPD, single draw Graph | Previous Graph | RUN | Return

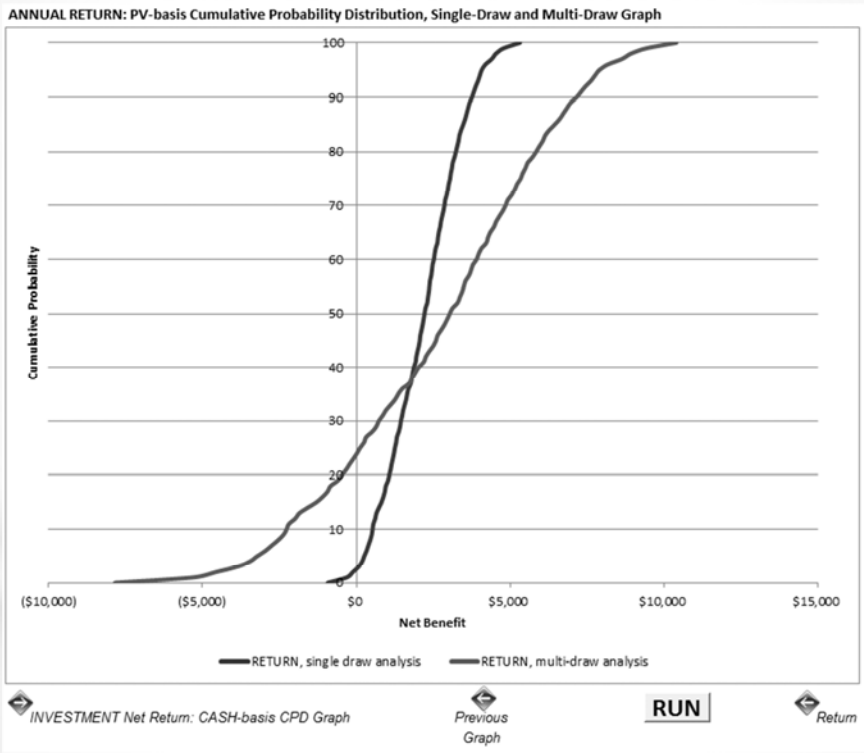
Case 2: Pasture Improvement Decision

ANNUAL RETURN, Cash-basis and Present Value-basis

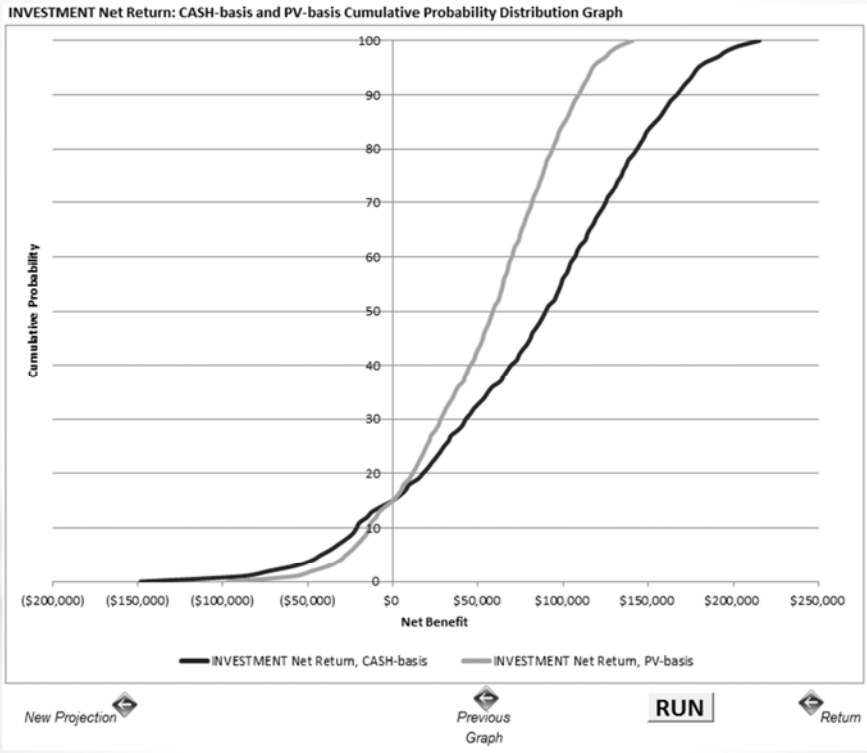


Annual CASH-basis with BEST/WORST Return Graph | Previous Graph | RUN | Return

Case 2: Pasture Improvement Decision



Case 2: Pasture Improvement Decision



Conclusion

The Multi-temporal Risk Analysis tool:

- Can be a useful tool for analyzing multi-year 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 a more informed decision-making.