Applied Risk Analytics

Rough Country, High Costs, Hard Fencing Choices

The Carver Ranch* is an owner-operated cow-calf operation running 600 pairs across about 18,000 deeded acres in rough western foothill country. The ranch has a sound physical perimeter fence, working corrals, several developed water points, and a mix of open benches, timbered draws, and steep canyon breaks. The issue facing the ranch is not perimeter control. The issue is whether to rebuild failed interior fence or use Virtual Fence (VF) for part of the ranch's internal grazing control.

During spring runoff, high water, debris, and bank cutting damaged several interior fence crossings in the north pasture. The worst damage was concentrated in one drainage, but the affected fence line connects to other old cross-fence segments that are also nearing the end of their useful life, Figure 1. When the Carvers asked for a repair estimate, the contractor advised that patching only the washed-out section would not solve the larger problem. To restore reliable interior control, the ranch would need to rebuild about 3.5 miles of cross-fence.

That rebuild is expensive because the fence line crosses steep, rocky, and timbered ground. The cattle do not graze the cliff faces or the heaviest timber, but they do use the benches, draws, side slopes, and water-points connected to that terrain. The cost problem comes from where the old fence was built: much of the line is difficult to reach with equipment, materials must be packed or staged by hand in several places, and future repairs would remain difficult.

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The contractor's estimate is about $25,000 per mile for this type of rough-terrain interior fence work. For 3.5 miles, the capital cost is approximately $87,500. That estimate includes wire, posts, braces, difficult access, and added labor for hand work on the steepest sections.

At the same time, the ranch is facing a labor question. For the past eleven years, one experienced hand has done most of the canyon riding, checked the

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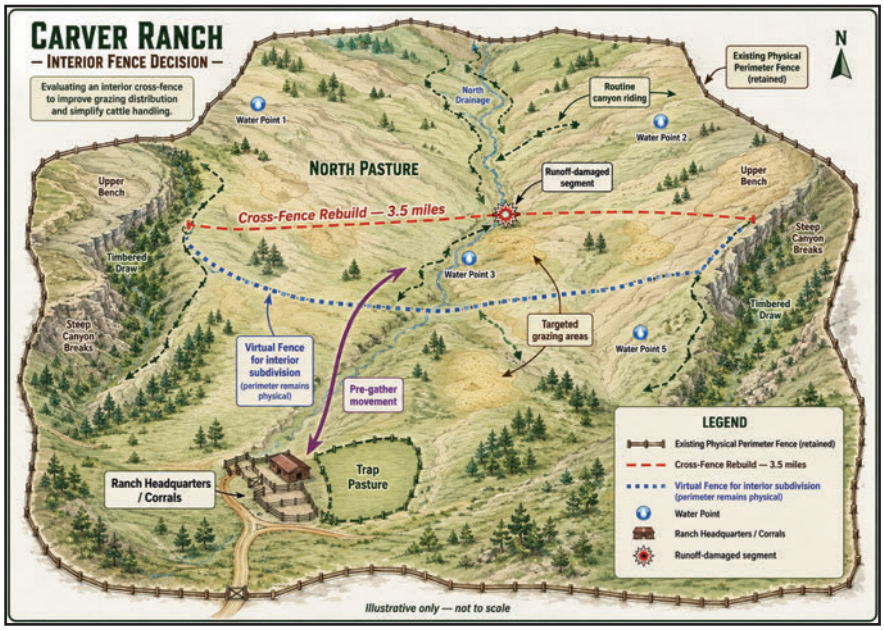
north pasture, pushed cattle out of the rougher draws before fall gather, and helped keep grazing pressure from concentrating too heavily near the easiest water. That employee has said he expects to cut back to part-time after this season.

The operator is therefore facing a linked infrastructure and labor decision: *Should the ranch rebuild the failed interior cross-fence, or should it implement a Virtual Fence system for interior subdivision while keeping the existing physical perimeter fence?*

Figure 1. Carver Ranch: Cross-Fence Rebuild Location



Carver Ranch Profile

Herd: 600 cow-calf pairs, plus about 25 retained replacement heifers each year

Land base: About 18,000 deeded acres

Current perimeter fence: Physical perimeter fence in working condition; not part of this decision

Interior fence problem: About 3.5 miles of failed or failing cross-fence in rough terrain, see Figure 1

Physical fence estimate: $25,000 per mile × 3.5 miles = about $87,500

Current labor pattern: Owner plus one full-time hand; the hand handles much of the routine canyon riding

Labor concern: The full-time hand may move to part-time, creating a gap in routine pasture monitoring and gather support

Possible VF use: Interior subdivision, pre-gather movement toward trap/water, and targeted grazing on safe-use areas within rough pasture

Likely decision outcome being tested: Partial adoption, VF used for interior livestock management, while the physical perimeter remains in place

Where the Ranch Is Now

The ranch already has a working perimeter fence and does not need VF to hold cattle on the deeded property boundary. That matters because it narrows the decision. The operator is not comparing “all wire” against all virtual.”

Table 1. Risk Mitigation Filter Entries for Cross-Fence Rebuild: Status Quo and Five Other Responses

Alternative (up to 5 named)	Problem Fit S/M/C/P	Risk Source M•P•I•H•F underline primary	Control Type Av•RP•RC•Tr•Ca•Ac underline primary	Feasibility I•L•Lg•A•C underline primary	Up-front Cost L/M/H/C	Recurring Cost L/M/H/C	Failure Consequence L/M/H	Next Step tool/specialist or “filter ok”
Status quo (no change)	P	H F P	Ac	N N Y C N	M	M	H	Not Sufficient
Permanent physical fence rebuild	M	F H P	Av RP	Y Y Y Y C	H	M	M	MTRA Tool
Temporary electric fence	P	H P F	RP RC	N N Y C N	M	H	H	Do Not Carry Fwd
Labor-based herding or riding	C	H F P	RP RC	Y N Y C N	L	H	M	MTRA Tool
Virtual Fence for interior subdivision	C	H F P	RP RC	C C Y C C	H	H	H	MTRA Tool
Hybrid system	S	H F P	RP RC Ca	C C Y C C	H	M / H	M / H	MTRA Tool

The realistic comparison is between:

1. Rebuilding the 3.5 miles of interior cross-fence;
2. Implementing VF for interior subdivision;
3. Using more rider labor instead of rebuilding fence;
4. Delaying the rebuild and accepting reduced control for a season;
5. Using a hybrid approach, with the physical perimeter retained and VF used only where interior wire is most expensive.

The dominant risks are human risk and financial risk. Human risk comes from the possible loss of an experienced rider and the added management skill needed to operate a VF system. Financial risk comes from the large up-front fence rebuild cost, the recurring cost of a VF system, and the possibility that the chosen option does not perform well enough to solve the labor and grazing-control problem.

What the Ranch Wants to Accomplish

The operator's goal is not simply to buy new technology or avoid building fence. The goal is to keep reliable control of cattle in the north pasture while reducing dependence on hard-to-maintain interior fence and routine canyon riding.

A successful alternative would need to do five things:

1. Keep cattle out of areas that are being rested or protected;
2. Help move cattle toward water, supplement, or the trap pasture before gather;
3. Reduce routine riding enough to matter if the current hand moves to part-time;
4. Avoid placing cattle in unsafe terrain;
5. Keep total multi-year cost within a range the ranch can absorb.

The operator is also clear about what cannot be compromised. The physical perimeter fence stays. Any VF system must be backed by a workable contingency plan if collars fail, base-station coverage is poor, or cattle do not train adequately.

Risk Mitigation Filter Screening Summary

The ranch first uses the Risk Management Filter (RMF) to screen the realistic alternatives. The RMF does not make the final decision. It helps identify which alternatives are feasible and whether a deeper tool is needed, Table 1. (See ARA-20260608.262, for more on using the Risk Mitigation Filter.)

Status quo (no change): Leaves the failed interior fence and labor gap unresolved. Problem Fit: Poor (P); Risk Source: Human (H) / Financial (F) / Production (P); Control Type: Accept (A); Feasibility: Infrastructure-No (N), Labor-No (N), Legal-Yes (Y), Animal Management-Contingency (C), Contingency-No (N); Up-Front Cost: Low (L); Recurring Cost: Moderate (M); Failure Consequence: High (H); Next Step: Not sufficient.

Permanent physical fence rebuild: This alternative is a strong fit for physical containment and does not require new animal training. It has a high up-front cost and does not solve the longer-term labor issue. Future repairs would still be difficult because the fence would remain in rough country. Problem Fit: Moderate (M); Risk Source: Financial (F) / Human (H) / Production (P); Control Type: Avoid (A) / Reduce Probability (RP); Feasibility: Infrastructure-Yes (Y), Labor-Yes (Y), Legal-Yes (Y), Animal Management-Yes (Y), Contingency-Contingency (C); Up-Front Cost: High (H); Recurring Cost: Moderate (M); Failure Consequence: Moderate (M); Next Step: Compare in MTRA.

Temporary electric fence: This alternative is a poor fit in this case. The same terrain that makes permanent fence expensive also makes temporary fence difficult to place, check, and maintain. It would likely increase labor rather than reduce it. Problem Fit: Poor (P); Risk Source: Human (H) / Production (P) / Financial (F); Control Type: Reduce Probability (RP) / Reduce Consequence (RC); Feasibility: Infrastructure-N, Labor-N, Legal-Y, Animal Management-Contingency (C), Contingency-No (N); Up-Front Cost: Moderate (M); Recurring Cost: High (H); Failure Consequence: High (H); Next Step: Do not carry forward.

Labor-based herding or riding: This alternative fits the ranch's historic management style, but depends on labor that may not be available. It also does not address the failed interior fence. Problem Fit: Conditional (C); Risk Source: Human (H) / Financial (F) / Production (P); Control Type: Reduce Probability (RP) / Reduce Consequence (RC); Feasibility: Infrastructure-Yes (Y), Labor-No (N), Legal-Yes (Y), Animal Management-Contingency (C), Contingency-No (N); Up-Front Cost: Low (L); Recurring Cost: Moderate (M); Failure Consequence: Moderate (M); Next Step: Compare in MTRA as support/contingency solution.

Virtual Fence for interior subdivision: This alternative has a conditional-to-strong fit because it directly addresses interior control without rebuilding wire across the steepest country. Its fit depends on signal coverage, collar performance, cattle training, and the operator's ability to manage the system. Problem Fit: Conditional (C); Risk Source: Human (H) / Financial (F) / Production (P); Control Type: Reduce Probability (RP) / Reduce Consequence (RC); Feasibility: Infrastructure-Contingency (C),

Labor-Contingency (C), Legal-Yes (Y), Animal Management-Contingency (C), Contingency-Contingency (C); Up-Front Cost: High (H); Recurring Cost: High (H); Failure Consequence: High (H); Next Step: Compare in MTRA as supporting practice.

Hybrid system: This is the most realistic VF configuration for the case: keep the physical perimeter, do not rebuild all failed interior wire, and use VF for internal pasture control. Problem Fit: Strong (S); Risk Source: Human (H) / Financial (F) / Production (P); Control Type: Reduce Probability (RP) / Reduce Consequence (RC) / Increase capacity to bear (Ca); Feasibility: Infrastructure-Contingency (C), Labor-Contingency (C) Legal-Yes (Y), Animal Management-Contingency (C), Contingency-Yes (Y); Up-Front Cost: High (H); Recurring Cost: Moderate (M) / High (H); Failure Consequence: Moderate (M) / High (H); Next Step: Compare in MTRA.

Why the Multi-Temporal Risk Analyzer Is the Correct Tool

The RMF screening shows that this is not a simple one-season decision. The physical fence rebuild is a large up-front cost with a long useful life. VF has a different cost pattern: initial setup, collars, base-station infrastructure, recurring fees or service costs, battery or collar replacement, training labor, and monitoring labor. The labor benefit, if it occurs, would also appear over multiple years.

Because the alternatives under consideration by the Carvers have different cost streams over time, the ranch uses the *Multi-Temporal Risk Analyzer* (MTRA). MTRA is designed to provide users with a long-term perspective on the uncertainty associated with proposed business changes. It follows a partial budget framework and allows users to incorporate expected changes for up to 20 years into the future, offering a comprehensive view of long-term budget expectations. MTRA is appropriate when a proposed change should be evaluated across multiple years and when the producer wants to see how uncertainty in costs and benefits affects the long-term outcome.

For this case, the Carvers build an MTRA comparison over a seven-year horizon. The seven-year period is long enough to capture more than one collar or subscription cycle, several seasons of labor savings or added labor, as well as the annualized effect of avoiding or delaying the interior fence rebuild.

Table 2. Carver Ranch Reduced Costs - Cross-Fence Rebuild

Reduced Cost Item	Low	Most Likely	High	Years Active	Notes
Avoided interior fence rebuild	$87,500	$87,500	$87,500	Year 1 only	Assumes the hybrid VF option allows the ranch to avoid the full rebuild; some physical spot repair may still occur but is treated as negligible for this analysis.
Reduced canyon-riding labor	$10,240	$12,800	$16,000	Years 1–7	Most likely = 50 labor-days × 8 hours/day × $32/hour; Low assumes only 40 days saved; High assumes 50 longer 10-hour days. The range reflects the added difficulty of the Carver Ranch terrain relative to baseline assumptions.
Reduced interior fence maintenance / checking	$3,000	$5,000	$7,000	Years 2–7	Avoided annual checking, patching, travel, and repair on the steep interior fence line.
Pre-gather labor savings	$1,000	$2,500	$4,000	Years 2–7	Pre-gather labor results in reduced gather labor in the fall. The experienced hand currently pushes cattle out of draws before fall gather, and VF's passive-capture capability can partially replicate that function.

MTRA Input Structure

The analysis is set up as a partial budget comparing the hybrid VF alternative against rebuilding the physical interior fence.

Table 3. Carver Ranch Added Costs - Cross-Fence Rebuild

Added Cost Item	Low	Most Likely	High	Years Active	Notes
VF equipment, collars, base-station setup, and installation	$80,000	$110,000	$140,000	Year 1 only	Main up-front VF system cost before cost-share. The high end reflects a configuration requiring more base stations than flatter terrain would require.
Training, collar deployment, and start-up labor	$2,500	$5,000	$8,000	Year 1 only	Based on added chute time, collar fitting, training observation, and initial troubleshooting.
Annual platform, connectivity, service, or subscription cost	$6,000	$12,000	$16,000	Years 1–7	Recurring system access/support
Maintenance, replacement, and added management reserve	$2,500	$5,000	$10,000	Years 2–7	Collar/battery replacement reserve, equipment repair, software/system management time after startup

Added costs

Added costs may include VF collars, base-station or communications equipment, installation, training labor, recurring service costs, repairs, replacement collars or batteries, and added management time during the training period, Table 3.

Reduced returns

Reduced returns may include any expected loss from training failure, cattle breach, delayed gather, reduced grazing efficiency during the learning period, or areas that must be rested because the VF system does not work as planned, Table 4.

Added Returns

No direct added livestock sales are assumed in the base case. Any improved grazing distribution is treated as an enabling benefit unless the ranch can estimate a defensible change in calf weight, carrying capacity, or grazing days

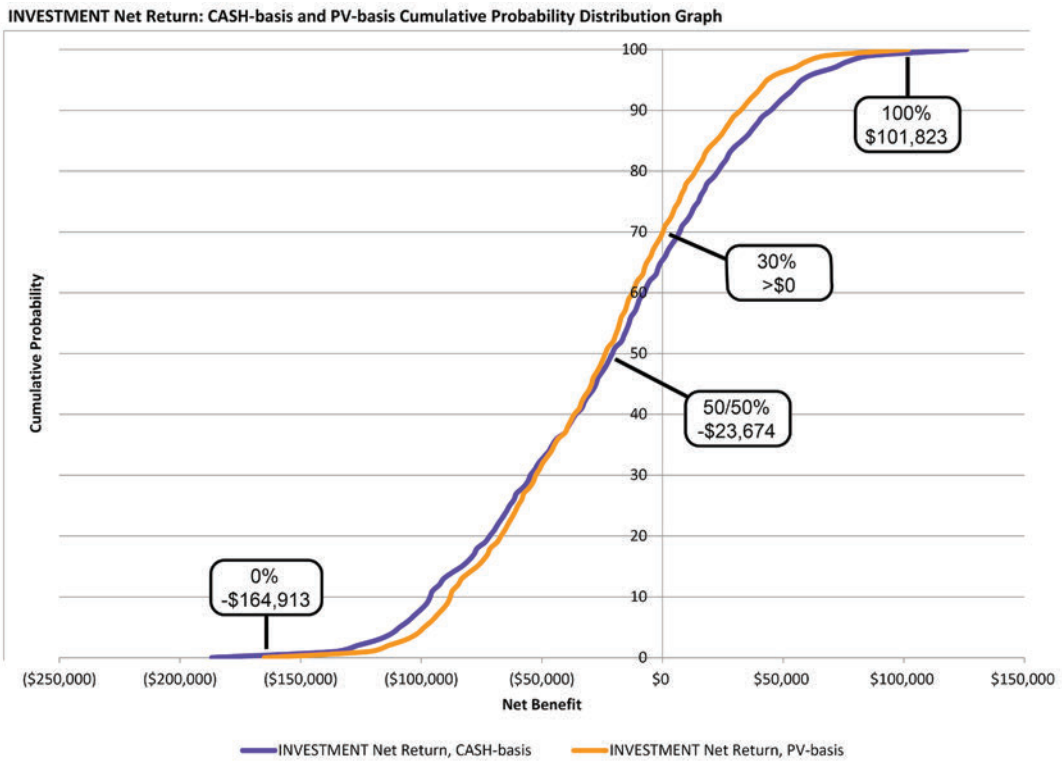
Reduced costs

Reduced costs may include avoided interior fence rebuild expense, reduced annual interior fence maintenance, and reduced routine riding if VF can replace some canyon-checking trips, Table 2.

Table 4. Carver Ranch Reduced Returns - Cross-Fence Rebuild

Reduced Return Item	Low	Most Likely	High	Years Active	Notes
VF startup, animal-response, and boundary-performance revenue risk	$0	$7,500	$20,000	Year 1	Accounts for a small number of animals that do not train well and must be moved, handled again, or managed separately.
Ongoing VF boundary-performance revenue risk	$0	$1,000	$5,000	Years 2–7	Expected-value allowance for reduced performance, delayed movement, or lost use if the system does not function as planned.

Figure 2. MTRA Results: Carver Ranch Cross-Fence Rebuild



The operator enters low, most-likely, and high values for the uncertain items. The most important uncertain values are: VF setup cost, recurring system cost, labor savings from reduced riding, added training labor, and the amount of physical fence cost actually avoided. In addition, the Carver Ranch uses a 7.5% interest rate to reflect the time value of money and the opportunity cost of capital for a multi-year fence or Virtual Fence investment. Results would change if the ranch had access to lower-cost capital or faced a higher borrowing/opportunity-cost rates.

Interpreting the MTRA Results

MTRA generates results based on a thousand random simulation draws of potential outcomes, both on a Cash-basis and a Present Value (PV)-basis, which accounts

for the time value of money. The resulting graph illustrates the likelihood of various outcomes based on the data entered and the random simulation results. The most likely outcome is near the midpoint of the curve, with a 50/50 chance of occurring.

After the MTRA run is completed, the ranch compares the cumulative net benefit of the hybrid VF alternative against rebuilding the interior cross-fence. The result is not interpreted as a yes-or-no technology answer. It is interpreted as a risk-informed comparison.

The net return is most likely to be around -$3,382/year on a PV-basis (-$23,674 over seven years). The highest net benefit the Carver Ranch could expect is $14,546/year ($101,823 over seven years), while the lowest would be -$23,559/year (-$164,913 over seven years). This mixed result shows that the decision depends heavily on one or two assumptions, such as whether the full fence rebuild is avoided and the hours of rider labor actually saved or the actual deployed-system cost on an annual basis.

Decision Pathway

In this example, the RMF and MTRA analysis point toward a conditional Partial Adoption pathway rather than an immediate full commitment to the hybrid VF system. The MTRA comparison does not show a clear financial advantage under most-likely assumptions, with the 50/50 present-value outcome estimated at about -$23,674 over seven years. However, the range of possible outcomes shows that the decision is sensitive to a few key assumptions: whether the full cross-fence rebuild is avoided, how much rider labor is actually saved, and what the actual deployed system costs on an annual basis.

For the Carvers, the result supports a measured approach. The ranch would keep the physical perimeter fence in place, use VF only for selected interior-control jobs, and closely monitor coverage, cattle response, labor savings, and system reliability before expanding use. If the first-season results match or exceed the MTRA assumptions, the hybrid system could become a stable Partial Adoption strategy. If labor savings are lower, coverage is unreliable, or recurring costs are higher than expected, the ranch would revisit the analysis before committing further.

Uncertainty That Remains

Several uncertainties remain even after the MTRA analysis:

- Whether signal coverage is reliable across the north pasture;
- Whether cattle train well enough for the virtual boundaries to function as intended;
- Whether the ranch can actually reduce routine riding without increasing risk;
- Whether VF can help move cattle toward water or the trap pasture before gather;
- Whether the system remains dependable during weather, battery, or equipment problems;
- Whether the operator has enough time and technical capacity to manage the system during busy seasons.

These uncertainties do not automatically rule out VF. They define what the ranch would need to monitor if it proceeds.

Monitoring and Reassessment

If the ranch proceeds with partial adoption, the operator tracks several measures during the first grazing season:

1. Number of rider trips avoided;
2. Number of cattle that fail to respond to the virtual boundary;
3. Time required for training and system management;
4. Battery, collar, and base-station problems;
5. Success in moving cattle toward water, supplement, or trap pasture;
6. Use of targeted grazing areas compared with previous years;
7. Any cases where cattle enter an excluded or rested area.

At the end of the season, the operator compares actual results with the MTRA assumptions. If labor savings are lower than expected, coverage is unreliable, or the system requires more management time than planned, the ranch may revise the analysis before expanding VF use. If results match or exceed the conservative assumptions, the ranch may continue using VF as a partial interior-control system while maintaining the physical perimeter.

Further Analysis

A deeper financial analysis would be warranted if the ranch planned to finance a large VF purchase, replace additional physical fence, expand VF across the full operation, or make changes that affect whole-ranch cash flow. In that case, MTRA may need to be followed by *RDFinancial* or another whole-operation tool. If the issue is limited to the 3.5-mile interior fence question, the RMF plus MTRA analysis is sufficient for this case.

For More Information

Visit **VirtualFence.RightRisk.org** for more details on how the *Risk Mitigation Filter* and the *Multi-Temporal Risk Analyzer* can assist in risk management planning for your operation. **RightRisk.org** offers a wide range of budgeting tools, courses, producer profiles, and other resources designed to help producers understand and manage risk, ensuring their operations thrive.

** The Carver Ranch is a case study example created to demonstrate RightRisk tools and their applications. No identification with actual persons living or deceased, places, or agricultural operation is intended nor should be inferred.*

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