

A Systems Thinking Approach to Ranching: Finding Leverage to Mitigate Drought

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On the Ground

- Drought is an adaptive challenge where management strategies and practices that work today might not work tomorrow. Adaptive challenges facing management may require thinking systemically to determine leverage points.
- Systems thinking can be an effective way to see the big picture, deal with complex situations, and create effective long-term management alternatives for the ranch.
- Successful management alternatives will provide flexibility to protect the core business (i.e., cow herd), be enterprise-diverse to spread risk, and allow management for the good of the whole, not simply to maximize the pieces.
- It is important to evaluate your own ranching system to identify the appropriate enterprises or practices, there is no best mix.

Keywords: systems thinking, drought, ranch flexibility, management alternatives.

Rangelands 36(6):2–6

DOI: 10.2111/RANGELANDS-D-14-00017

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The future of agriculture is becoming less predictable as the speed of change has accelerated dramatically.¹ Increasing volatility in the commodity and cattle markets and extreme variance in climatic conditions have become the new normal. Recently, drought has left a large number of beef producers exposed to a great deal of production and financial risk.

Producers now face more dynamic decision sets characterized by complex system interactions. For example, decisions made to cost-effectively manage through a drought may have long-term impacts on ranch profitability and sustainability. However, it is often our nature to base these management

decisions on a single portion of the operation and not the entirety of the complex ranching system. Additionally, management's current mental models, which are assumptions used to assess the current situation, predict possible outcomes, and decide how to influence the future,² can sometimes limit creative solution discovery. Drought is an adaptive challenge where management strategies and practices that worked today might not work tomorrow. Adaptive challenges facing management may require thinking systemically to determine leverage points where a small shift can produce big changes.³ Managing through drought may require a different business model that creates greater flexibility for the future. Systems thinking can expand our view of the entire operation and interactions among various components.⁴

In ranching, systems thinking provides us with a framework to generate effective management alternatives to adaptive challenges. The primary objective of our project was to build a systems map of the key variables associated with the challenge of cost-effectively managing through drought. The purpose was to use a systems thinking framework to clearly identify linkages among system components and define high-leverage control points for ranch management. Three high-leverage management alternatives were identified: 1) increase the proportion of stockers or replacement heifers that could be easily liquidated without drastic reductions in cow numbers, 2) diversify or expand wildlife or other recreational income that is more stable during dry years, and 3) secure irrigated lands that can be used for grazing or forage production in dry years.

A Systems Thinking Approach

A systems thinking approach refers to a set of conceptual methods.⁵ The systems dynamics method outlined by Forrester⁶ is the systems thinking framework used for this project. This framework allowed us to visualize, discuss, and apply a greater understanding of the associated variables important to the complex issues of ranching operations. We created a systems map by developing mental models and assessing the

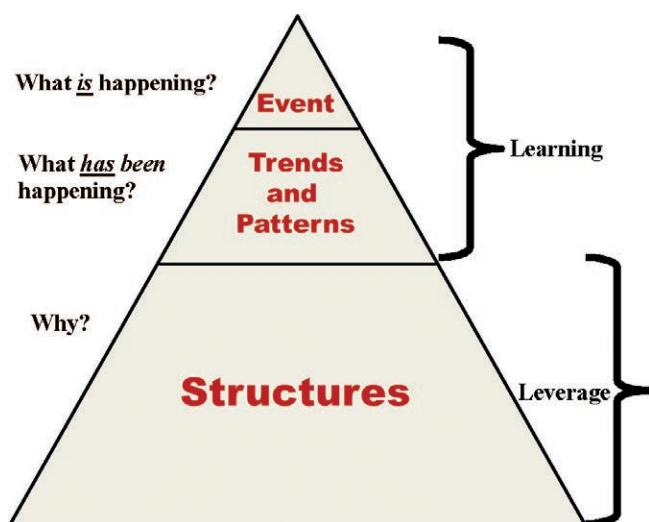


Figure 1. Diagram representing the iceberg concept including the series of questions used in the problem-structuring phase to learn about the problem through events and trends or patterns, and to find leverage within the structure of the problem.

interconnection of ranch components and decision-making processes. This framework also allowed us to identify management alternatives that might reduce the impact of the unintended consequences associated with current strategies. The development of our systems map involved two distinct steps.⁷

The first step was to gain a deeper understanding of the problem. In this problem-structuring phase, the “iceberg concept” was used to define the events, trends and patterns, and structure of the problem through a series of questions (Fig. 1). Identifying the events provides an opportunity to react. Understanding trends and patterns leads to anticipating future events. Understanding the structure of the problem well enough can lead to change that will influence trends and patterns and events that may solve the problem. Identifying leverage points that change the structure will have the greatest impact on the system. King Ranch Institute for Ranch Management (KRIRM) faculty and students first identified the problem area or issue of concern for the project by asking, “What is happening?” During this step, the focusing question was clearly established, taking into account the multiple perspectives of the faculty and students. A focusing question clearly defines the issue or challenge. Defining the events and trends or patterns helps to learn and

discover the focusing question. Trend and pattern information and data pertaining to the event were then collected to identify key variables by asking, “What has been happening?” Uncovering the structure of the problem/situation by asking “Why?” assists in finding leverage points within the system. Much like an iceberg, the top two tiers of the pyramid (i.e., events and trends/patterns) are often visible while the most important part of the system, the structure, is hidden beneath the surface. It is this underlying structure and the decisions to make change at this level that can be the most impactful.

Causal loop diagrams (CLDs) or conceptual maps of the key variables were then created (Fig. 2). KRIRM faculty and students used systems thinking techniques to: 1) develop CLDs that illustrate the relationship among ranching variables, 2) discuss behavior of the dynamics implied by the CLDs, 3) identify key leverage points, 4) create a map or systems diagram, and 5) develop management alternatives. We used a discussion-based format to complete each step; thus, faculty and students were able to work together and learn from personal experiences of managing through a drought. The group’s thorough understanding of drought-related issues allowed for several practical management alternatives to be developed.

Finding Leverage to Mitigate Drought

A system is a set of interrelated people and things that produce a pattern of behavior.⁴ External forces, such as drought, tend to drive a systems behavior. The response is seldom simple and impact can vary depending on the ranch system in place. More frequent and prolonged drought periods have drastically reduced forage quantity and overall rangeland health on most operations. Obviously, drought has become a significant external force impacting ranches across the United States.

Drought has also made it more difficult to control costs. Higher input costs (i.e., labor, supplemental feed, and depreciation), have caused some producers to continue the struggle to maintain cow numbers. Selling cows during a suppressed market and buying replacements during what will likely be an elevated cattle market compounds this struggle. It is not uncommon for management to develop a firefighting mentality when trying to deal with drought. Overall, this reaction can create a tremendous amount of unnecessary stress for ownership and/or management.

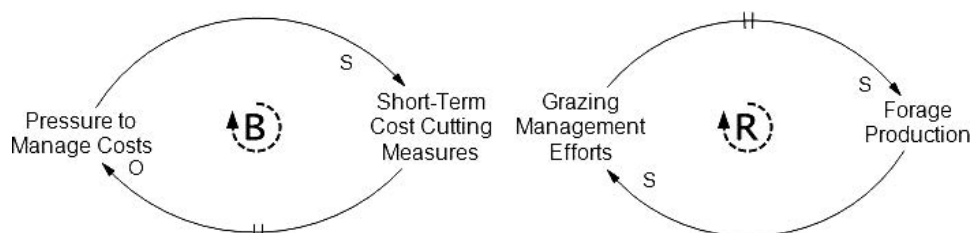


Figure 2. Diagram representing the basic concept and structure of balancing and reinforcing loops, including arrows, direction, and delays.

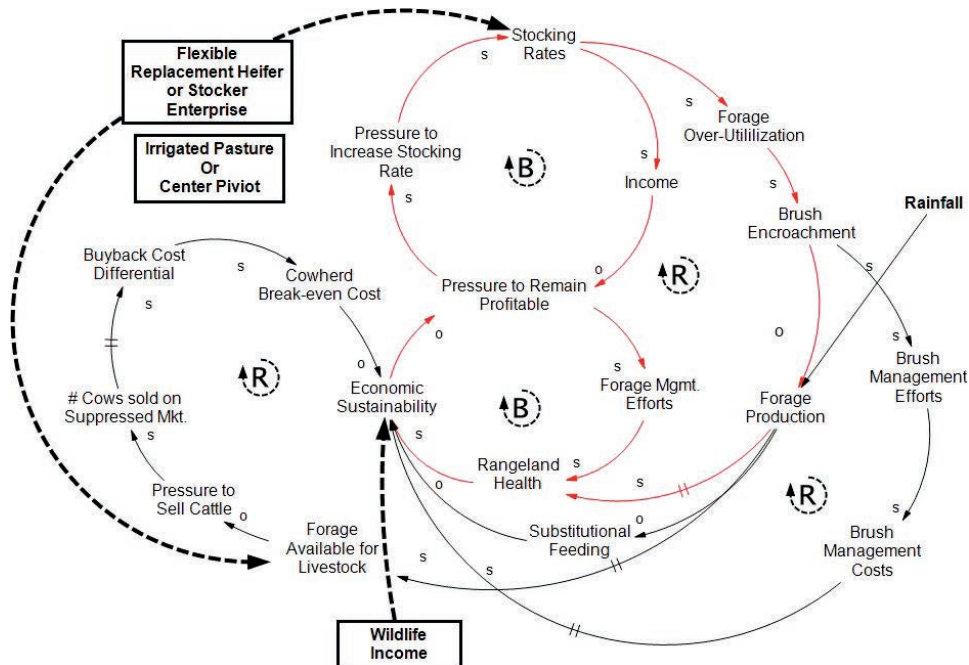


Figure 3. Systems map of challenges associated with cost-effectively managing a ranch during drought including high-leverage management alternatives.

Success in ranching will ultimately come to those who can most effectively manage their natural resource base. Those who are able to sustainably manage their resources for short-term profits while maintaining long-term productivity on those same resources will thrive. With that in mind, we used a systems thinking approach to address an adaptive challenge: “Why is it so difficult to cost-effectively manage through drought?” The task was to describe the problem and identify a few high-leverage management alternatives that would better enable ranch managers to cost-effectively navigate the challenges drought creates for long-term ranch sustainability.

Systems Map

A systems map is a useful tool used to better understand a problem and identify leverage within a complex system. Figure 2 highlights the basic concept and structure of a balancing and reinforcing loop used to build a systems map. The arrows indicate the direction of causation. For instance, the *pressure to manage costs* causes *short-term cost cutting measures* to be implemented, or *grazing management efforts* cause *forage production* to change. The letter on each arrow indicates how the two variables are related (O = opposite direction, if one goes up the other goes down; S = same direction, if one goes up the other goes up). Continuing with the previous example, as the *short-term cost-cutting measures* increase, the *pressure to manage costs* will decrease (O) or as the *grazing management efforts* increase, *forage production* will increase (S). The letter located in the center of each loop indicates whether the loop is balancing or reinforcing. A balancing loop attempts to seek stability or maintain conditions around a given level by self-correcting or regulating.⁴ In this example, as the *pressure to*

manage costs increases, the *short-term cost cutting measures* will increase, which after some delay (i.e., represented by the two parallel lines on the arrow) will reduce the original *pressure to manage costs*. A reinforcing loop causes more of the same action resulting in more growth or decline.⁴ For example, as *grazing management efforts* increase, after some delay *forage production* will increase, which should increase the original *grazing management efforts*.

Figure 3 illustrates a systems map of the drought-management dilemma. When a system faces an external pressure the corrective action works to reduce that pressure. In our diagram, there is a current *stocking rate* and desire to maintain *income*, while the *pressure to remain profitable* and subsequent *pressure to increase stocking rate* keep this portion of the system in balance. The second distinct balancing loop suggests there is a *pressure to remain profitable* while *forage management efforts* and the subsequent *rangeland health* and *economic sustainability* would keep this portion of the system in balance. Together the balancing loops create a classic systems structure known as shifting the burden, where the upper balancing loop represents a short-term fix that balances while the lower balancing loop is associated with a long-term fix that will create balance given the opportunity. When management faces a problem or pressure (i.e., *pressure to remain profitable*) the natural reaction is to respond quickly to reduce the short-term pressure. However, longer-term solutions are often more difficult and take more time to implement. It is not that managers are unaware of the value of longer-term fixes; rather they become dependent upon a quick fix. These quick fixes can generate unintended consequences (i.e., *forage overutilization*) that are not always visible prior to decision-making. The con-

sequences can make it virtually impossible to engage in the long-term solution.

These unintended consequences form reinforcing loops within the system. Building upon the previous example, an increasing *stocking rate* would cause *forage overutilization* and *brush encroachment* leading to declines in *forage production*, *rangeland health*, and *economic sustainability* of the ranch. This would increase the *pressure to remain profitable* and *pressure to increase stocking rate*, and ultimately reinforce the action to continue to increase *stocking rate*. Additionally, decreased *forage production* would lead to less *forage available for livestock* and increase the *pressure to sell cattle* on a *suppressed market*. After some delay, the *buyback cost differential* would increase, which would increase the *cow-herd break-even cost* and reduce *economic sustainability*, ultimately increasing the original *pressure to remain profitable*. These are examples of what seems to be a logical or rational short-term decision (i.e., stocking rate) that can actually lead to unintended consequences such as *brush management costs*, *substitutional feeding*, and *pressure to sell cattle*, which exacerbate the original problem or pressure. It should be clear how a reinforcing loop can generate unintended consequences. However, reinforcing loops can also represent high leverage points within the system.³

Management Strategies

How will your operation be successful given this complex dynamic? The entire system obviously hinges on precipitation. However, since precipitation cannot be controlled, three high-leverage management alternatives were identified: 1) increase the proportion of stockers or replacement heifers that could be easily liquidated without drastic reductions in cow numbers, 2) diversify or expand wildlife or other more stable income streams, and 3) secure irrigated lands that can be used for grazing or forage production in dry years. It is important to evaluate your own ranching system to identify the appropriate enterprises or practices, there is no best mix.

Increasing the proportion of stockers or replacement heifers on an operation increases flexibility during a drought situation. During dry periods, a manager can completely opt out of purchasing stockers or can purchase varying numbers of stockers in response to forage conditions, and liquidate replacement heifers at any time. This management alternative allows for the reduction of *stocking rate* which decreases *forage overutilization* and reduces the impact of the subsequent reinforcing loop. Additionally, it would increase *forage available for livestock* for the remaining cow herd, which reduces the impact of the reinforcing loop associated with a *pressure to sell cattle* in a suppressed market and buy back cows at a higher breakeven in the future. This management approach may also position the operation for rapid expansion or the marketing of high-value replacement females when conditions improve.

Wildlife income is a high-leverage point directly impacting the *economic sustainability* of the ranch because during drought, wildlife income is generally more stable than livestock revenue. This enterprise diversification or expansion in

turn reduces the *pressure to remain profitable* during dry years. Since a more stable income would ultimately reduce the pressure to increase cattle *stocking rate*, this is a high leverage point and keeps the entire system in balance.

Purchasing or leasing irrigated pasture or installing a center pivot was also determined to be a potentially feasible long-term management alternative. This alternative allows the ranch to maintain *stocking rate*, keeping the system in balance and avoiding the reinforcing loop beginning with *forage overutilization* during a drought. Similar to increasing the proportion of stocker cattle, it will increase *forage available for livestock* and reduce the need to destock or purchase expensive inputs during dry years when forage is most highly valued.

Successful management alternatives will provide flexibility to protect the core business (i.e., cow herd), be enterprise diverse to spread risk, and allow management for the good of the whole, not simply to maximize the pieces. The above-mentioned strategies are not necessarily applicable to all ranching operations, but they represent potential leverage points capable of changing long-term performance by creating flexibility within the system. Many of the successful ranches in the United States have capitalized on some or all of these high-leverage management alternatives, whereas others have not. Increasing the proportion of stockers or replacement heifers on the operation can provide a great deal of flexibility without much investment. Recreational income potential and irrigation water availability varies from ranch to ranch, so there is no one solution for all. However, where practical and cost-effective, these management strategies may minimize the long-term, unintended consequences of drought on a ranching operation. Seeing the entire structure of why it so difficult to cost-effectively manage during drought allows managers to find long-term solutions for their own operation.

Summary

Many challenges that face beef producers are complex. Most are intensified by past rational actions that attempted to mitigate a similar issue. Drought is no longer the exception but instead the norm. Systems thinking can be an effective way to see the big picture, deal with complex situations, and create effective long-term interventions for the ranch. It is important for individual managers to take a long and hard look at the challenges that the current and past droughts have caused. There are risk management interventions available that can create future success for the operation. Success in this dynamic time will be dynamic as well.

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