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Nature's Meme Bank and Grazing Systems

Nature has all along yielded her flesh to humans. First, we took nature's materials as food, fibers, and shelter. Then we learned to extract raw materials from her biosphere to create our own new synthetic materials. Now Bios is yielding us her mind—we are taking her logic.

Clockwork logic—the logic of machines—will only build simple contraptions. Truly complex systems such as a cell, a meadow, an economy, or a brain (natural or artificial) require a rigorous nontechnological logic. We now see that no logic except bio-logic can assemble a thinking device, or even a workable system of any magnitude. (p. 2).

Thus wrote Kevin Kelly, Executive Editor of *Wired* magazine in the introduction of his 1994 book, *Out of Control—The New Biology of Machines, Social Systems, and the Economic World* (New York, NY, USA: Addison-Wesley).

About the time Kelly wrote *Out of Control*, range management's resident thinker James K. "Tex" Lewis said cattle in the future would be implanted with microchips and brain probes. Data from the chips would be sent to a computer with system data such as forage availability and quality, water, etc. The real time location of each animal would be displayed on a screen. If animals were concentrating in riparian areas, a few key strokes would cause them to become uncomfortable and move themselves to a lightly grazed area. Most people laughed. Those who knew Tex realized he always used logic to back up his imagination. He was usually a step ahead. Fifteen years have passed since Kelly and Tex made those predictions. Computers have become more powerful. New modeling techniques have developed. Information sharing mechanisms have become more sophisticated. Google is now a verb. Cameras and computers are in phones clipped to the belt where land managers once carried a knife or a gun.

The technology for Tex's ranch is now available. Satellites are in place. Computers and models are technically capable of doing those things he suggested. But do we know enough to find the "postindustrial paradigms" Kelly said were hidden in nature? Tex's system can only work when we understand the nature of rangelands. Complex mechanical systems are no better than the logic gained from sound biological science and good experience.

My first overseas assignment was as part of a Food and Agriculture Organization of the United Nations (FAO) team sent to Somalia. Our goal was to assist pastoral nomads in management of land and livestock. We pitched camp among several herds of camels tended by men and many flocks of sheep and goats tended by women. The vegetation was acacia savanna with denser bush along the ridges. To my eye, distribution of livestock was good, but the forage plants were heavily grazed.

Working through an interpreter, we attempted to explain why we were there. We agreed to have more formal discussions the next afternoon under a mott of acacia trees. Just before night a group of young men arrived with notched sticks and big smiles. Men gathered

around and talked excitedly. Then they segregated themselves into smaller groups.

The young men were a reconnaissance group sent to check the results of rains that had fallen 50 miles to 100 miles from camp. The notched sticks represented depth of soil moisture and height of key forage plants. Men were discussing when and where to send herds of camels and flocks of small stock. Conditions where animals now grazed indicated it was time to move, and the destination of each herd and class of animals was being determined by elders analyzing notches on sticks.

At dawn camps began moving to dispersed locations—camels to some areas, small stock to others. Over the centuries nomads had developed a meme bank that allowed them to apply past experiences quickly as conditions changed.

I was fortunate, and born long enough ago, to study range management under one of the pioneers of our profession, Dr Vernon A. Young. I was his last PhD student, and he was past his prime. Many undergraduates, and even some of the younger faculty, complained that his courses were not up on techniques of his time.

But he brought something lacking in current techniques and modern science—wisdom. Through his actions he demonstrated the commitment and dedication necessary to be a professional. He was a giant, a walking meme bank. Many of us who had the privilege of knowing him are better for his teachings. And the world's rangelands are better because of him.

Dr Young stressed four important management principles: 1) always balance animal numbers with the forage available—never exceed the carrying capacity; 2) graze at the correct season of the year—give plants a chance to grow and reproduce; 3) use the correct class of animal or combination of animals—the preference of animals should promote a healthy plant community; 4) distribute the animals over the range—do not allow overgrazing around water or other areas preferred by the animals. Our goal was to take care of the land; animals were one tool we could use.

He repeated that so often, students joked that all they knew were four “importances.” But his real message was not unlike that of the Somali elders. It was our responsibility, as future land care professionals, to apply our experience to present and future communities.

A theme in this issue of *Rangelands* is grazing systems. Papers elsewhere in this issue will describe some of the major systems range managers have used and discuss the successes and failures people have observed.

A system is a set of connected parts or things forming a complex whole, in particular a set of things functioning together in an interconnected network. Few of what range managers call grazing systems meet this definition. Most are mechanistic recipes for moving livestock from one area to another based on calendar dates, forage height, or other plant data.

The more mechanical the recipe, the less judgment is required. Such recipes are attractive because they can be run by people with little knowledge or training. But unless the recipes are based on principles that have measurable indicators, replicated thousands of times under varying conditions, they tend to be site specific. A rest-rotation or a deferred-rotation scheme developed in one area may not produce similar results in another. Those developed in a run of good years may be harmful in a drought.

“Systems” that depend more on logic and experience tend to be less site specific. For instance, the “Next Best Pasture” system developed by Don Dwyer depends on the judgment and experience of the manager to decide when an area has been grazed enough and to choose the best place to put animals in the future, even if it is the pasture they grazed last. Like the Somali nomads, decisions were based on condition of the land. Past experience provided the logic of when to move.

The “Savory” system is less a recipe than most. Its success depends on logic and experience. It forces the operator to be intimately involved with all aspects of his operation. It succeeds when managers monitor details closely, know what is going on, and make judgments based on experience. It often fails when operators consider the “system” just a bunch of paddocks to be mechanically rotated.

Fifteen years ago, Kelly warned, “the more mechanical we make our fabricated environment, the more biological it will eventually have to be if it is to work at all” (p. 2). He commented,

As we look at human efforts to create complex mechanical things, again and again we return to nature for directions. . . . Nature is also a ‘meme bank,’ an idea factory. Vital postindustrial paradigms are hidden in every jungly ant hill. . . . Destroying a prairie destroys not only a reservoir of genes but also a treasure of future metaphors, insight, and models for a neo-biological civilization. (p. 3)

With improving computers, artificial intelligence, agent-based modeling, and other new tools, it is theoretically possible to have a grazing system that manages plants and animals without human control. Computers could teach themselves to make adjustments as climate or other conditions change. But machines cannot do that without biological logic.

Managers who think, use good science, and have sound experience cannot be replaced. It is not likely land care professionals who understand nature's idea factory will lose out to a machine.

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