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A West that works

Instinctual grazing



Dr. Fred Provenza, a professor of animal science at Utah State University, believes that teaching livestock better grazing habits can save the land.

Photo courtesy of Dr. Fred Provenzat

USU professor believes, and a Montana rancher proves, that animals can be taught to forage in a way to improve the range

By Courtney White
for Headwaters News
May 22, 2006

What do the "Far Side" cartoons of Gary Larsen, plant toxicity levels, the Bhudda, intellectual paradoxes, an image of a sheep in drag, Forrest Gump, and a brief history of Western science have in common?

The short answer is: they are all part of a typical lecture by Dr. Fred Provenza, a professor in the College of Natural Resources at Utah State University.

The long answer is: they are integral parts of his thoughtful analysis of the interconnections between the habits of animals, the nature of scientific inquiry, the role of stewardship in natural resource management, questions of sustainability, and the knowledge that we live in a universe of ceaseless and relentless change.

Delivered with a refreshing sense of humor, which is where the cartoons come in.

Forrest Gump, however, has a more serious job. In a recent lecture, Fred (he refuses to be addressed as "Dr. Provenza"), began with what he



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White is executive director of the Quivira Coalition, a Santa Fe-based group devoted to collaboration as the approach to an ecologically healthy region.

Much of Quivira's emphasis is on ranching, but its principles of education, cooperation and innovation apply to many of the region's biggest issues.

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considered to be Gump's dilemma: is life all about one's destiny, as the character of Lieutenant Dan believed (to die on the battlefield), or is it dominated by randomness – symbolized by a box of chocolates – as Forrest's mother suggested?

In short, what is our role in the universe?

In an attempt to answer this meaty question, Fred follows with a lesson in the history of science.

For more than two hundred years, Newtonian physics taught three basic truths: 1) nature was knowable and predictable (i.e., mechanistic); 2) a whole equaled the sum of its parts (i.e., reductionistic); and 3) time and space were absolute and separate. The role of scientist in this 'belief' system was to discover the rules that governed how nature worked.

Then Einstein turned things upside down in 1905 by proving that time and space were relative – subject to forces such as gravity – as well as interconnected. This unsettling insight was followed closely by the even more disturbing development of quantum physics, which declared that while nature is knowable it is NOT predictable, and the sum of the parts does NOT equal the whole.

In other words, as Fred put it, contrary to Einstein's famous declaration, God DOES play dice with the universe.

"Our Western culture teaches us to think in linear, hierarchical ways," he said. "In fact, there is no one central controlling force, only a large number of agents, all interacting and adapting to each other and to their local environments. Ultimately, a highly complex order emerges from the local interactions of all of the parts."

Old ideas of cause-and-effect were replaced with new ideas of functional relationships between behavior and consequences. Life, in other words, is an ongoing series of choices made in the face of uncertainty and change.

"Animals can better meet their needs for nutrients and regulate their intake of toxins when offered a variety of foods that differ in nutrients and toxins than when constrained to a single food, even if that food is 'nutritionally balanced.'"

**– Dr. Fred Provenza,
Utah State University professor"**

This idea has important implications for conservation, Fred argued, because just as physicists have been forced to relinquish their rigid Newtonian views, ecologists, animal scientists and managers of natural resources need to abandon inflexible perspectives for ones that reflect the dynamics of life.

This includes environmentalists as well. To make the point, he quotes the novelist G. K. Chesterton: "All conservation is based upon the idea that if you leave things alone you leave them as they are. But you do not. If you leave a thing alone you leave it to a torrent of change."

All of which leads Fred to a Big Question:

"How does one manage ongoing interrelationships among facets of complex, wholly interconnected, poorly understood, ever changing ecological, cultural, and economic systems in light of a future not known and not necessarily predictable, in ways that will not diminish options for future generations?"

This is where the picture of a sheep in drag comes in (hint: it has something to do with the idea that animals have culture too).

Habits

Professionally, the focus of Fred's research and teaching is animal behavior, livestock specifically and wildlife more generally. It was an area of interest that developed early in his life. Growing up in the Salida Valley of southern Colorado and working on area ranches, he became fascinated by what sheep, cattle, deer and elk ate on the open range and curious about why.

Observing that efforts to help people make a living often ignored "how animals make their living," Fred pursued his interest in range and wildlife science and animal behavior through a master's degree and a Ph.D. at Utah State. His dissertation focused on goats and Blackbrush. Why did goats act like "natural pruning machines?" he wondered. Why did they make the choices they did?

To answer these, and other, questions, Fred moved the goats into pens and separated them into groups. This was unusual for the time – traditional animal research meant describing the animal's behavior in the field, not understanding behavior by asking goats questions in isolated pens.

But as Fred quickly learned, we are all creatures of habit. And we do things for good reasons – though it sometimes it doesn't seem like it.

Take nutrition for example. Herbivores eat a diverse array of species – as many as 100 species – but studies showed that the bulk of a meal normally contains less than ten species, and typically as few as three to five. Their selections are guided by nutrients and toxins in foods, and they begin to learn these behaviors early in life from their mothers.

These studies demonstrated that herbivores are "nutritionally wise" which, according to Fred, contradicted the long-standing belief that herbivores are generally "unwise" because they don't always choose the most nutritious foods.

This belief created a paradox: we are often baffled when animal performance declines despite an abundance of suitable habitats and nutritious forage.

One key to resolving this paradox, Fred learned, has been a clearer understanding of the role of experiences early in life on shaping diet and habitat selection behavior – essentially creating locally adapted animals that when moved to unfamiliar environments don't perform well.

Another key to resolving this paradox has been a clearer understanding of the role toxins play in animal diet and the regulation they require on food intake – a role that influences behavior. By setting limits on intake of any one food, toxins force animals to eat a variety of foods to meet their nutrient needs.

In a recent paper, for example, Fred asserted that "Animals can better meet their needs for nutrients and regulate their intake of toxins when offered a variety of foods that differ in nutrients and toxins than when constrained to a single food, even if that food is 'nutritionally balanced.'"

Moreover, every individual is different in its needs for nutrients and ability to cope with toxins. Thus, grazing practices that allow the individuality of animals to be expressed are likely to improve performance of the herd.

Another key is how animals learn. Fred and his colleagues discovered that when young herbivores are encouraged to eat only the most preferred plants, they are not likely to learn to mix foods high in nutrients with foods that contain toxins. Experienced animals learn to eat a variety of foods, even when more nutritious foods are available.

This information clashed with traditional grazing management which focused on key species and attempted to maintain uniform distribution

across landscapes in order to maintain carrying capacity.

Other insights that Fred and fellow researchers uncovered include:

- Since life for herbivores exists at the boundary between order and chaos, animals, humans included, learn habits to create order and predictability.
- The origins of animal food habits and habitat preferences involve interactions between the social organization (culture) of the herd and the individual.
- Although both people and herbivores strive for order, they also seek variety.
- Ongoing changes in social and physical environments require old dogs to learn new tricks all the time.

"Thus, while the behavior of herbivores may appear to be little more than the idle wanderings of animals in search of food and a place to rest," Fred wrote, "foraging is a process that provides insights into an age-old dilemma faced by herbivores and human alike: how do creatures of habit survive in a world whose only habit is change?"

"Cattle can be trained to prefer uplands over riparian areas, but only if people manage using behavioral principles. No gene codes for living in riparian areas.
– Dr. Fred Provenza

Habits are the products of consequences. If the consequence is positive, then the habit is reinforced. The drawback to habit, however, is that as the world changes, individuals must change or risk becoming obsolete. In the case of foraging behavior, as a result of selecting particular foods and foraging in specific locations, the responses of adults can become rigid to the point that habit is nature.

"Well-fed animals are cautious of new things," noted Fred.

The issue of habit is important because for long-term sustainability, he continued, behavior is better shaped by positive reinforcement than by punishment. The paradox is that animals often must be coerced to change their habits.

"Coercion can quickly change behavior," Fred observed, "but its long-term negative consequences – the desire to escape the circumstance and avoid anything remotely related – far outweigh its short-term benefits."

Behavior

If we are, as Aristotle once remarked, "what we repeatedly do" then how do we break bad habits and manage for long-term sustainability?

The first step, according to Fred, is to try to understand what part of our behavior is cultural and what is not.

Take, for instance, livestock grazing in riparian zones – a common source of conflict between ranchers, environmentalists, and federal agencies in the West. Cattle are not genetically pre-programmed to wallow in riparian areas, said Fred. Instead, it is a learned behavior – a habit.

"Cattle can be trained to prefer uplands over riparian areas, but only if people manage using behavioral principles," said Fred. "No gene codes for living in riparian areas."

As another example, Fred often cites the example of rancher Ray Bannister, who manages cattle on his property in eastern Montana according to "boom-bust" principles which require intensive, soil-and-plant stressing periods of heavy grazing followed by two years of complete rest. This system forces the cattle to eat all the forage in a pasture, not just the "ice cream" plants, thus eliminating the competitive advantage of the unpalatable plants.

As a result, said Fred, "It is hard to find any part of the ranch that lacks abundant plant cover even during years of drought."

Bannister's challenge, however, was convincing his Herefords to change their eating habits. It took three years – a typical period – for his animals to adjust, during which their weight and performance dropped dramatically before recovering. Now the mother cows teach their calves the system and all is well on the Bannister ranch.

In fact, Fred believes that management-intensive systems, like the one employed by Ray Bannister, balance animal, plant, social, and economic concerns.

"These endeavors have made vast strides to integrate the science of plant-herbivore interactions with the art of grazing management across landscapes."

Which raises another paradox: Why have we come to rely so heavily on fences and grazing systems to manage livestock when vast herds of wild herbivores apparently managed their grazing just fine for eons without the help of humans?

The answer, says, Fred, is that we rely too much on technology and not enough on the culture inherent to social animals. In herbivores, social organization leads to culture, which is the collective knowledge and habits acquired and passed from generation to generation about how to survive in a particular environment. Culture, therefore, is key.

Which is where the humorous slide of a sheep in women's clothing comes in – too often, humans don't understand that animals have culture too.

"Unfortunately, social organization and culture are rarely considered important in the structuring and functioning of ecosystems," said Fred, "and indeed we manage wild and domestic animals in ways that thwart the development of cultures perhaps to our long-term detriment."

If we instead allow cultures to evolve we may lessen our dependency on technological fixes and come to rely more on behavioral solutions which cost very little to implement and are easily transferred from one situation to the next. Unfortunately, said Fred, scientists and managers often ignore the power of behavior to transform systems, despite compelling evidence.

"Once mastered," he continued, "behavioral principles and practices provide an array of solutions to the problems people face in managing to improve the integrity of the land and to make a living from the land."

This is, of course, easier said than done because change often involves stress.

"The Bhudda teaches us that all suffering arises from trying to cling to fixed forms – objects, people, ideas," said Fred. "The challenge is to accept the world as it moves and changes."

Which brings us back to Forrest Gump, who concluded: "I don't know if we each have a destiny, or if we're all just floating around, accidental like, on a breeze. But I think maybe it's both, maybe both happening at the same time."

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