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By Mark W. Brunson and Elizabeth A. Burritt

Many in the range profession are perplexed by the apparent discrepancy between experimental studies suggesting that rotational grazing carries no advantage over continuous grazing[1] and the observations of ranchers and range managers who have personally seen benefits for livestock production and plant communities by shifting to a rotational system.[2,3] We believe one reason for this seeming contradiction is that research on plant and animal production is typically designed to control for the effects of behavior of grazing animals and their owners. As researchers who have spent many years studying the behavior of range livestock and people, we argue that understanding human and animal behavior as it relates to grazing management can help to bridge the gap between science and practice. In this paper we discuss how livestock behavior factors (such as prior experience and stress) and managers' learning processes can influence the outcomes of grazing management practices, why a standard experimental approach may not detect those influences, and how an improved knowledge of behavior can help both ranchers and researchers achieve their goals with respect to rotational grazing systems.

Behavior and the Scientific Process

Before discussing behavioral factors in grazing management, we would like to explore briefly the behavioral factors in experimental science that may help to explain why research results do not seem to match experience with rotational grazing. There is a long and illustrious history of using experimental methods to study behavior. Many of the greatest breakthroughs in psychology came from carefully controlled experiments with human subjects. Similarly, behavioral researchers use animal models in experiments to understand both human and animal behavior.[4,5] In our own profession, hundreds of experiments have been published examining aspects of livestock behavior with regard to diet and habitat selection, social influences, effects of stress, and how animals learn. In this paper we are guided by the experimental studies of herbivory by Fred Provenza along with collaborators that include Beth Burritt, the second author of this paper.[6,i]

[i] For an overview of this work see BEHAVE: Behavioral Education for Human, Animal, Vegetation & Ecosystem Management (http://www.behave.net) or Provenza.[6]

Yet when the topic of study is *not* behavior, researchers go to great lengths to filter out its potentially confounding effects. Behavior can vary over time and from individual to individual, whether the individual is an experimental subject or a researcher. Therefore scientific protocols typically spell out very specific steps that must be taken whenever a treatment is administered or a measurement is taken in order to reduce the potential effects of variations in how experimenter and subject behave during the trial.

Researchers conducting animal studies often try to limit variability by using animals similar in age, breed, and sex; they are less likely to consider how prior experiences can profoundly affect their experimental animals. Numerous studies show that experiences early in life affect acceptance and preference for different foods.[7–10] Habitat use and foraging skills also are influenced by prior experience, and these can influence how effectively an experimental animal adapts to its new surroundings.[11,12] Social scientists, especially survey researchers, take an opposite tack: they incorporate enough different individuals into a study that the differences between respondents are averaged out, and a statistically derived picture emerges of a "typical" individual.

While such approaches are valid and have greatly increased our certainty about scientific phenomena, these approaches have pitfalls. In their search for statistical power and rigor, scientists who tightly control or fail to control for behavioral variation may have to create artificial situations that do not match the conditions under which the results will be applied. Just as a researcher's behavior must be consistent, a successful grazing manager's behavior must be adaptive, changing over time as influenced by information and experience. Similarly, livestock engage in behaviors that are shaped by consequences (intentionally or unintentionally) to produce desirable or undesirable outcomes.

Experiments isolate the effects of one or a few factors (e.g., grazing frequency, timing, or intensity) on a particular variable (e.g., forage production). However, a livestock operation is a complex system. It may be difficult to isolate particular factors and to predict how the entire system will respond. To exclude the confounding effects of year-to-year climate variation, grazing systems studies normally compare effects of different systems on similar tracts of land in the