EXTENSIVE LIVESTOCK PRODUCTION: GRAZING MANAGEMENT ON RANGELANDS

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Studies on stocking rate, grazing system, and season of use effects on vegetation productivity, range trend, livestock productivity, and financial returns from various parts of the world are reviewed. Nearly all the available studies are from North America (United States and Canada) and South Africa. Studies from both regions were remarkably consistent in showing stocking rate had much more impact on range trend, vegetation productivity, livestock productivity, and financial returns than type of grazing system. A commonly held belief has been that continuous or season-long grazing over time will degrade rangeland vegetation. However, actual research studies from a wide variety of range types shows continuous grazing at conservative to moderate stocking rates has generally increased vegetation productivity and given an upward trend in rangeland ecological condition. Livestock productivity and financial returns have generally been higher under continuous or season-long grazing than rotation grazing. Rotation grazing systems involving three to five pastures and multiple herds of livestock, such as the Merrill three head/four pasture system, appear advantageous over continuous grazing in terms of vegetation, livestock, and financial responses. Based on available research, grazing intensity is much more important than season of use in determining vegetation responses to grazing management.

1. Introduction

Selections of the correct stocking rate and grazing system are the most important grazing management decisions from the standpoints of vegetation, livestock, wildlife, and financial return. They have been the basic problems confronting ranchers and range managers since the initiation of scientific range management in the early twentieth century. Specific approaches for setting stocking rates have been developed only recently. However, it is still generally agreed that there is no substitute for experience in stocking rate decisions on individual ranges.

Stocking rate is defined by the Society of Range Management (1989) as the amount of land allocated to each animal unit for the entire grazing period of the year. The Society for Range Management defines an animal unit as one mature (450 kg, 1000 lb) cow. Based on the most recent research, this animal would be expected to consume 20 lb of forage per day, 600 lb per month, and 7300 lb per year. An animal unit month is the amount of feed or forage (600 lb) required by one animal unit for one month.

Grazing capacity is often used when discussing stocking rate. This term refers to the maximum stocking rate possible through time without degrading the range. In most cases, ranches are bought and sold based on their grazing capacity.

A major controversy in range management has centered on the importance of grazing intensity versus grazing system. One school of thought has held the belief that heavy grazing intensities can be applied under rotation of grazing or properly timed grazing without detriment to the range or animal production. Another school considers grazing intensity to be the primary factor in grazing outcomes. We will explore this issue based

on experimental grazing studies conducted in various parts of the world.

During our careers in range management, we have encountered few range professionals who have actually read any of the long-term stocking rate and grazing system studies that provide the scientific foundation for modern range management. Part of the problem is that many of these studies were published as government reports or university experiment station bulletins that are buried in libraries or government archives. Generally they are lengthy, detailed documents that do not lend themselves to easy reading. However, in our opinion, knowledge of these studies is essential to anyone engaged in range management, ranching, or range research. We believe less controversy would exist over approaches to grazing management, range condition, and range trend if teachers, scientists, and managers had a more thorough understanding of the "classics".

Our objective is to identify these "classic" studies and provide a brief synopsis of their findings. We will focus on forage production, range condition, range trend, livestock productions, and financial returns. Rather than attempting to discuss all the studies, we will concentrate on those involving native (non-seeded) rangelands that are most complete in terms of replication in time and space, collection of biological and financial data, and interpretation of results.
We will begin by providing a summary of overall findings of various grazing studies, and then examine the more complete grazing studies for individual range types (deserts, semiarid grasslands, humid grasslands, annual grasslands, coniferous forests, humid woodlands). Over the last 20 years, grazing systems have been a major focus of range researchers and managers. Grazing systems commonly used on rangelands throughout the world include continuous or season-long, deferred rotation, rest-rotation, short duration, Merrill three-herd/four-pasture, high intensity/low frequency, best pasture, and seasonal-suitability systems. We will discuss the conditions under which each of these systems should provide the best results based on existing research.

2. Grazing Intensity

Nearly all the stocking rate studies characterize grazing intensity treatments as heavy, moderate, and light. Heavy grazing is defined as the degree of herbage utilization that does not permit desirable forage species to maintain themselves. Moderate grazing means the degree of herbage utilization that allows the palatable species to maintain themselves but usually does not permit them to improve in herbage producing ability. Light grazing means a degree of herbage utilization that allows palatable species to maximize their herbage producing ability.

The primary measure of grazing intensity used in the long-term grazing studies has been percent use of palatable forage species. Although it has limitations as a measure of grazing intensity, percent use is more easily understood by ranchers and non-range professionals than other measurements such as stubble heights, percentage of grazed plants, or minimum residues.

When all the stocking rate studies were averaged, heavy grazing averaged 57% use of primary forage species compared to 43% use for moderate and 32% use for light grazing (see Table 2). Conventional wisdom has been that moderate stocking involves

50% use of forage. This guideline applies well in the humid woodlands, humid grasslands, and annual grasslands, but results in rangeland deterioration in the semiarid grasslands, desert, and coniferous forest rangelands. Here the research was remarkably consistent in showing that moderate grazing involved about 35 to 45% use of forage.

Conservative stocking is a term commonly used by range researchers to define a level of grazing between light and moderate, generally involving about 35% use of forage. Several researchers recommended conservative stocking over either light or moderate stocking in their conclusions.

3. Grazing Studies in the United States

3.1. Description by Grazing Region

More scientific information is available on grazing management from the Great Plains and western coniferous forest types than from arid rangelands (see Table 1). It is remarkable that, although the sagebrush grassland is one of the largest range types, there have been no long-term, replicated stocking rate studies with cattle in this type. Stocking rates have been better evaluated than rotation grazing systems. Several scientific reports on specific aspects of the studies listed in Table 1 can be found in the *Journal of Range Management.*

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Biographical Sketch

During 25 years at New Mexico State University, **Dr. Jerry Holechek**, a professor of range science, has published over 130 peer reviewed papers related to range management, worked on several ranches as a private consultant, and is well known for integrating rangeland ecology and economics. He teaches range management, range animal ecology, range improvements, and plant community ecology courses. In 2004 Dr. Holechek completed the fifth revision of "Range Management: Principles and Practices", an undergraduate textbook he co-authored with Dr. Rex Pieper and the late Dr. Carlton Herbel. He recently completed the second edition of another textbook titled "Natural Resources: Ecology, Economics and Policy", which he senior authored with Drs. Richard Cole, James Fisher, and Raul Valdez. Dr. Holechek is a former president of the New Mexico Section of the Society for Range Management. He has received several awards for his professional accomplishments.