Determining Correct Stocking Rate on Range Land[1]

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Range technicians have been recipients of considerable abuse and criticism because of their seeming inability to correctly diagnose the grazing capacity of the range. Actually, the management and conservation of land is one of the most essential and noble of all the professions of man. The land is our wealth and our future. Care of this basic resource is vital not only to the agriculturist as a direct user but to every American.

Land problems seem particularly critical on western ranges, where shallow, rocky, and salty soils combine with aridity to reduce vegetation production to a minimum and where steep and rugged topography encourage rapid erosion. This delicate balance with which nature has endowed so much of the range land makes proper use and good management paramount in importance.

More than half of these ranges, and certainly the most critical half, are government-owned lands. This would seem a desirable ownership since it assures the land of complete use regulation and provides the land with the services of technical managers. It is the duty of these managers first to conserve the resource and second to facilitate orderly and coordinated use of the land to the benefit of the public.

Grazing by livestock is among the top-priority uses of the public lands. It becomes the duty of the manager to evaluate the grazing potential of the land, plan the grazing management, and arrange its orderly use. It is to the first of these that this discussion is addressed.

What is correct stocking rate?

One of the most difficult tasks of the range manager is determining the numbers of animals which will give maximum meat and wool yields and yet not endanger soil and water stability nor unduly interfere with other land uses.

Unfortunately range does not lend itself, as does a stack of hay, to exact formula conversion into cow months potential. In the first place, range production is not the same each year, varying largely with annual precipitation and temperature characteristics. It is immediately evident that there is no single correct stocking rate for all years and that grazing capacity is not a constant feature of range land. Yet the federal technician is compelled to issue grazing permits for a 10-year period during which he obviously cannot forecast production.

This brings up the question of what is actually meant by grazing capacity. No satisfactory definition has ever been given for this term. The term "capacity" carries an unfortunate implication of permanence and lack of variation which is not justified. The implied permanent feature seems associated with 10-year permits to graze federal lands since few ranchers expect to use private ranges at a constant level. The term grazing capacity also implies a fixed characteristic of the land irrespective of how the grazing is done, when it is done, and how the land is managed. Correct stocking rate is dependent in large measure upon the kind of *range management.* No one can examine a range and judge its capacity without knowing *how it will be grazed.* You cannot tell the production of range land by a look at the land alone any more than you can look at a cultivated land and forecast production without

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[1] *A paper delivered before a conference of federal range technicians and stockmen held in Salt Lake City, Utah, February 16, 1960, to discuss methods of determining capacity of rangelands.*

knowing whether the weeds will be kept out, what fertilizers will be used, what implements are available, and similar management factors. One hundred cows under poor management may ruin a range which is perfectly capable of supporting 100 cows under proper management. Perhaps, then, we should forget the term grazing capacity and use instead the term correct stocking rate.

Factors in determining forage production

Many things affect the ability of range land to support livestock. Among the most important, of course, is forage production. Four factors are recognized as important here.

1. *Weather and climate.* The long-time climatic pattern, especially precipitation and temperature, more than any single factor influences inherent ability of a range to grow forage. Current weather conditions cause major fluctuations in forage production, especially among annual plants.

2. *Soil type.* Soil depth, saltiness, sandiness, fertility, ability to absorb and hold water, and many other soil characteristics influence forage production. In addition to their effect upon forage production, soils also affect proper grazing numbers through their influence upon management. Thus, how closely vegetation can safely be grazed may be determined by the stability of the soil.

3. *Amount of vegetation.* Herbage yield is perhaps the most important single factor influencing grazing capacity. It is a natural character of the land but it is variable. It is a product largely of weather conditions and nature of the soil.

4. *Quality of the vegetation.* Quality is a product of several characteristics. Perennials generally are superior to annuals. High palatability is desirable if grazing animals are to make full use of the herbage. High nutritive value of the consumed herbage is important. Plants which can tolerate close and frequent grazing are preferred.

The science of range management has failed to develop grazing tolerance data for any single species or set of circumstances. Data from Utah Agricultural Experiment Station show that, on dryland, bluebunch wheatgrass can be killed in a single year by 3 weekly late-season clippings. Crested wheatgrass, however, was clipped each week of the growing season for 5 years and still remained alive.

Undoubtedly on arid hillsides plants can withstand much less grazing than can the same species on sub-irrigated bottomlands. Under extreme habitat conditions, a plant may exist with difficulty even with no grazing at all.

Poisonous plants may limit the use that can be made of a range. Light grazing may be perfectly feasible on ranges that have poison plant problems. Full use may be impossible.

Other natural features of land affecting stocking

The above factors influence herbage available to an animal for grazing and so directly influence correct stocking rate. Other physical features determine how much of that vegetation can be grazed.

5. *Topography.* Steepness and rockiness affect the readiness with which animals can cover the range to secure the forage produced. Few far-western ranges are level and animals, especially cattle, tend to climb to less accessible areas only when bottomlands have been used dangerously heavy. Available forage, then, may be the measure of proper livestock numbers rather than total forage.

6. *Water.* Drinking water is necessary for domestic animals, and ranges may be useless without it despite abundant forage. Grazing is more limited on some ranges by quantity and spacing of water than by forage supply. Water is like topography in influencing distribution of animals. They tend to concentrate around water and will graze distant forage only after dangerous over-use of the better-watered range.

Management Factors

In addition to the above factors, which are natural features of the land and are largely beyond man's control, the number of animals a range will support is influenced sharply by how the land is grazed. These range management factors are largely the product of the user's judgment.

It should be clear that a field examiner can note items 1 to 6 inclusive, which are characters of the land, and that these alone must be the basis for an estimate of any long-term capacity inherent to that land. In addition, however, correct stocking must be based upon the following management characteristics.

7. *Kind of stock.* The efficiency with which land produces livestock will depend upon how ideally it is suited to the particular kind of animal. Steep ranges are more suitable to sheep than to cattle because unherded cattle will not make uniform use of steep slopes. Poorly watered ranges are more suitable to sheep because sheep require less water than cattle and can be made to utilize areas distant from water more uniformly. Generally, ranges composed of grass species are better suited to cattle, and sheep make more efficient use of brush and forb species. It is not unusual at all that a given range might safely graze twice as many animal units of one kind of stock as another kind. Total meat yield of many ranges in fact can be maximized only by use of several species of grazing animal, simultaneously.

8. *Operation objectives.* To an

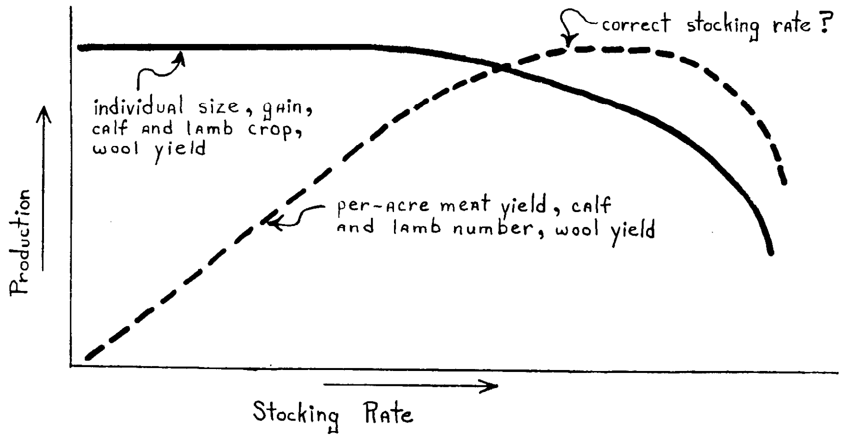

FIGURE 1. Theoretical relationships between stocking rates and animal production on range land.

extent, the purpose to which it is being devoted will determine how heavily land should be stocked. Maintenance of dry heifers or a dry ewe band obviously takes less forage than required for equal numbers of wet stock. If the producer wants top production, he must supply top quality feed in adequate amounts. Numerous experiments have shown conclusively that reducing numbers (up to a point) will increase individual performance as measured by gain, calf or lamb percentage, or wool yield (Figure 1). It is doubtful that maximum production *per animal* is ever an economically sound management objective, because stocking rate light enough to give this performance will result in a too low production per acre. Doubling numbers will double production on lightly stocked ranges but under heavy stocking, increased numbers may so decrease individual performance as to actually decrease total meat and wool yield. If the operator is trying to put out grass-fat steers, to top-off his lambs, or to get high calf or lamb crops, he must stock accordingly. The right stocking for the range will vary with these objectives.

9. *Other animals sharing forage.* Forage can be consumed only once. If native animals such as deer, rabbits, and rodents are present in large number, there may be nothing remaining for domestic livestock. Forage production records tell us only what is produced. Many ranges are now too heavily used by deer alone or by rabbits alone and have no capacity at all for livestock. To put domestic stock on areas already fully grazed is certain to result in misuse of the range.

10. *Supplements.* Supplemental feeding may reduce dependency of livestock upon range forage and so increase numbers that can occupy the range. Also, supplements may balance the diet and bring about more efficient use of the range herbage. However, there is reason to believe that supplemental feeds may reduce the tendency of animals to seek natural forage and cause concentration of livestock that might actually reduce capacity of the land.

11. *Season grazed.* Grazing mountain ranges too early in the spring may induce soil compaction and erosion beyond that resulting from grazing equivalent numbers after the soil becomes firm. Physiological response of the plant to grazing varies tremendously with the season. Damage generally is greatest when food storage in the plant root is least; and damage is least when the plant is dormant during dry or cold seasons.

There is no reason to believe that because 3 acres keeps a cow in June that 3 acres will also keep a cow in September. Plants vary greatly in forage value in different seasons. For example, cheatgrass *(Bromus tectorum)* is an excellent sheep forage in spring but by mid-summer it may be almost valueless. Cattle numbers are freely multiplied by time to give us cow months, yet we have no reason to believe that one cow for twelve months constitutes the same grazing pressure as twelve cows for one month.

12. *Effectiveness of distribution.* There is a direct relationship between distribution of livestock and the productivity of mountainous range land. Topography and water have been mentioned as land characteristics affecting livestock distribution. Operators have available numerous management techniques that aid greatly in improving uniformity of land use. Judicious herding is effective, especially with sheep. Fencing is useful especially with cattle. Salt draws animals to distant ranges if carefully placed. Salt-supplement mixes may be even more effective. Development of new drinking places or perhaps a pipe system for distributing water over the range may open up great areas formerly ungrazed. Hauling water has proved economic in some areas. Stimulating plant growth by fertilizing, spraying brush, or burning tends to attract animals into areas formerly little used. Trail construction is profitable on some ranges to facilitate natural movement of stock from stream bottoms to adjacent mesas. Every device that is used to increase grazing in areas normally underused or to decrease grazing in normal concentration areas will increase the numbers of stock that can safely graze the range.

13. *Grazing systems.* Several

range research projects have shown that the capacity of range to carry livestock will be increased by various combinations of rotation grazing by which the land is alternately rested and grazed rather than continuously grazed. There is reason to believe, for example, that range used both spring and fall might be more productive if it were divided into two units, one part being grazed spring only and one part fall only. The season of use then would be alternated every few years. Productivity of cultivated grass pasture has been markedly increased by a rotation system which provides dairy cows with a new pasture each day of sufficient size that they can just consume all the forage present. The pastures then are not regrazed for perhaps two weeks. Improved distribution and full, uniform consumption of the feed may be the greatest single benefit from rotation grazing systems on range land.

Administration considerations

Items 1 to 13 are factors that influence production on all ranges. On some private land and on virtually all publicly owned land, grazing may be only one of several uses to which land is put. The number of livestock placed on such ranges will be determined not by normal standards of maximum long-time production of meat and wool but by the owner's or administrator's idea of what part he determines livestock should play in a multiple-use land management plan.

14. *Importance of livestock grazing relative to other land uses.* Where livestock grazing is not the only use of the land, and perhaps not even the main use, grazing intensity may be reduced to prevent undue interference with other land uses. For example, a watershed supplying drinking water to a city literally may have no "capacity" for livestock. Interests of irrigation and industrial water supplies may be such as to permit only partial grazing in order to prevent undue silt deposits and reduced capacity of water-storage dams. Hazardous floods have resulted from heavy grazing on certain types of range. Use of land for recreation such as sightseeing, fishing, and picnicking may limit extent of grazing to a level below that theoretically possible were these interests not present. Obviously, the number of animals that will be put on a given piece of land is a very different thing when you are trying to maximize meat yield per acre and when you are trying to fit a little grazing in with a lot of other land uses.

It is necessary to remember that on all ranges some herbage must be allowed to remain when the grazing animals are removed. This is absolutely necessary for plant welfare. Further, we must remember that animals do not remove vegetation uniformly, as a lawn-mower does. They select species and locations for grazing and may completely denude certain accessible areas of certain desirable species before moving elsewhere. Hence, a percentage reduction must be made in the apparent forage supply of any range to arrive at actual or usable forage.

The amount of this reduction is the cause of much contention in arriving at a stocking figure. All agree that we cannot harvest every pound of forage produced. But how much can be harvested? This is a decision which must be made by the land manager after considering all interests and all objectives. It is important to realize that this decision directly determines the numbers of animals that will be placed on the range.

This problem gave rise to the key area concept. This concept involves a decision as to whether over-use should be allowed on certain restricted areas in the interest of a more full use of the less accessible areas. It is difficult to force use of inaccessible spots and undesirable species without injury to accessible areas and desirable species. The key area concept involves determining the point beyond which we will not graze in order to make more full use of the range. The key area is the most heavily grazed area upon which over-use will not be tolerated.

If we are unwilling to allow any excessive use even on concentration areas around water holes and level valley bottoms, then these become key areas. This ordinarily would be necessary only on valuable recreation areas, erosive watershed, and the like. But this is a management decision. The livestock numbers allowed on the range may be doubled by a more liberal attitude on the part of the manager of mountain range as to what area will be his key area.

Summary

There is no right stocking that can be determined for each bit of land and adhered to thereafter. Vegetation production is a variable thing. How fully a unit of production can be grazed is also a variable thing. Stockmen cannot expect the range technician to commit himself on a safe or correct stocking rate that is inviolable. There is no method whereby any technician can go into a new country and measure anything which will automatically give him the grazing capacity. He can only estimate and try out a certain stocking rate. The Soil Conservation Service term, *Initial Stocking Rate,* makes good sense in this respect.

In every case, it will be necessary for the technician to have knowledge of actual range performance, and to have experience and knowledge necessary to translate this known information in terms of what he can expect from the range upon which he has no experience. Once his estimate of initial stocking rate is determined, he commences grazing but he keeps records of *trend*. Trend is simply a measure of change and may involve amount of vegetation, kind of vegetation, erosion, litter on the ground, vigor of vegetation, and the like. If any undesirable trends accompany grazing, then obviously either numbers must be reduced or management must be improved.

Federal range permit cuts are as likely to result from poor management as from any inherent productivity limitation on the part of the range itself. Stockmen should look to good management as a means of increasing livestock numbers. On public ranges, land administrators should reward stockmen who do practice good management by protecting their place on the land among other competing use demands.