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## RANGELAND GRAZING CAPACITY - AN OVERVIEW

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### Introduction

Control of animal numbers is the most important management tool available for use on extensive pastoral lands. Other complementary tools include the control of animal distribution through the location of waters, salt or fences, and control of the season of use. Use of fire, reseeding, cultivation and supplementary feeding might also be considered, though are less important in the pastoral areas.

Control of animal numbers, including the ratio of age classes and animal species within the herd, has a direct influence on the growth and development of the pasture and on the productivity of each animal within the herd. As each animal grazes, it reduces the quantity and quality of the available forage. It influences the diet of other animals in the herd and it influences the growth or development of the pasture. Grazing studies have shown that excessive stocking rates result in pasture deterioration and a fall in animal production. However low stocking rates result in inefficient use of pasture and lower productivity per hectare. There is a need to reliably assess the grazing capacity of the pasture and to set stocking rates accordingly.

Grazing capacity has been defined as the maximum number of animals which can be grazed on a given area of land without damage to the vegetation or related land resources. It is often recognised as a year round, whole property figure and incorporates the concept of an area of pastoral land being able to carry the same number of animals year after year. In practice, the ability or capacity of a given area of pastoral land to be grazed varies considerably from year to year with seasonal conditions, with the location of stock waters or fences, and with animal management. The production of perennial forage can be 2 to 3 times as much in one year as in another and annual forage production can be 10 times as much in one year as in another. The location of stock waters, and whether animals are grazed year round or seasonally, affects the grazing capacity. In effect, the grazing capacity varies from year to year and even from season to season. While for administrative purposes, a year in year out 'average' grazing capacity is desirable, the manager of the pastoral property must take the variation from year to year into account and adjust his animal numbers accordingly.

Stocking rate has been defined as the actual number of animals using a given area of land. It is an inventory figure of the number of cattle, sheep, goats, kangaroo, deer or wild horses using the area of pastoral land and hence is not usually subject to the same debate as is grazing capacity. It is varied by the land manager according to the seasonal conditions, the market, the economic situation or his own management goals.

The carrying capacity results from the productivity levels of all the land resources. These may be recreational, water, forest, clean air or wildlife resources. It should not be confused with the grazing capacity. Hence, as many carrying capacities can be defined as there are management objectives and the

carrying capacity is defined in terms of the products. It expresses the greatest return of combined products without damage to the land resources.

The use of grazing capacity in management of pastoral lands has been subject to dispute and lengthy debate by land administrators and teachers. Grazing capacity is extensively used to value pastoral land for rental or sale. However some land managers and teachers, particularly within parts of America, dispute its use as an aid to pastoral land management. The criticism has come from closer settled pastoral areas which have the capability and the infrastructure to move animals at any time of the year. In the extensive pastoral areas of Australia where animals can only be mustered once or twice a year, and pastures cannot be assessed in the same detail as in closer settled areas, assessment of grazing capacity is an important aid to management of the pastoral property.

### Assessment of Grazing Capacity

Determination of grazing capacity is not an easy task as it incorporates many production variables. The assessment techniques can provide only an estimate of grazing capacity and are inherently subject to bias. General guidelines cannot cover all possible situations and the final evaluation and interpretation is the responsibility of the assessor. The estimate is, however, still the proper place for management to begin.

Methods to assess grazing capacity fall into 3 general categories:

1. Those based on actual use records, regional statistics or personal experience of an area, all of which imply a knowledge of the area or a similar area over a period of time.
2. Those based on the forage available for use or the utilization of the available forage and which provide a grazing capacity for the particular grazing season.
3. Those based on a rating of the natural resource characteristics of the area being assessed and which may be related to a standard area.

In practice, the experienced assessor will most likely use at least 2 of the above methods either mentally or in a formal assessment to arrive at a grazing capacity. For clarity of presentation the assessment methods are best discussed individually according to their technique and background.

#### (1) Assessment by the Use of Records

##### (a) Actual Use Records -

Stocking records from a selection of 'best properties' or stocking rate experiments can provide the best guide to grazing capacity. However they are only of value when (a) they are accurate; (b) they are in sufficient detail to indicate the area and days grazed each year; and (c) the land was being properly grazed. These 3 requirements unfortunately eliminate many of our available actual use records.

Rangeland managers in the U.S.A. have been provided with data from a series of grazing intensity experiments established in each of the major range types during the 1930s. With grazing at high, medium and low levels of

pasture utilization, these areas have provided basic information on animal production and pasture response. Subsequent work has added to these results. For example, rangeland research workers advise that maximum returns are achieved from grazing blue gramma range of the American prairie to a level which leaves 300 kg./hectare of herbage for soil protection and the next season's growth. Grazing studies have provided similar information about the dry veldt in South Africa.

Many country people abhor detailed records, statistics or anything to do with paperwork but there are some who have kept detailed and accurate records of stock and pastures in tabular form or in diaries. They provide a good basis for grazing capacity assessment when analysed together with a study of the current condition and trend of the pastures on the property.

The use of records has been extended to what has been called the 'best property analysis'. This is a detailed analysis of records of property operations and performance from a group of leading properties in each main resource area. The aim of the analysis is to determine the maximum potential or the production capacity for each pasture type under the best management system. As only the maximum potential is required, the sample properties in the survey need only be the leading properties of an area. The records must be collected accurately, in detail, and be adequate to separate the effect of animals moving from pasture to pasture. The data sheets for collection of records, while looking formidable at first sight, are relatively easy to follow. The procedure is being used by the Department of Agricultural Technical Services in South Africa and by the university extension services in the U.S.A.

#### (b) Regional Statistics -

Annual returns of animal numbers are the stocking rates for the area and may bear little relationship to the grazing capacity. Their accuracy, especially from extensive pastoral areas, is often in doubt and because they are a whole property figure, they relate to a variety of pasture types and even to non-grazed portions of the property. They are of little use in assessing the grazing capacity of a property or pasture.

#### (c) Personal Experience -

Most guides to grazing capacity assessment end with the advice to use local experience to determine if the assessment is reasonable or even to adjust a formal assessment. Such advice is given with good reason for, even with the considerable advances of science, management of pastoral lands is still an art, dependent very much on experience. The ability to co-ordinate the many variables influencing grazing capacity, e.g. climate, soil type, forage quality, animal preference, grazing distance, is still largely unsolved by science and cannot be expressed simply by mathematical formulae alone.

The efforts of individuals assessing the same area independently can lead to varying results. However, the efforts of a group working together lead to a more reliable result. Individuals within the group will use an overlapping set of variables including seasonal variation, the productivity of the pasture, the animal requirements, the effect of waters, fences, management, etc. As a group they can influence each other to form a balanced result. The group must be broadly based to avoid bias.

## (2) Assessment based on Forage Availability

Assessment of grazing capacity based on the available forage is well adapted to those pastoral lands with short and variable seasonal growth periods. Estimates or measurements of the available forage are made within the pasture and are either compared to a similar area of known grazing capacity or simply divided by the pasture requirements of the animal per day, month or year. Some experience is required by the assessor to estimate the mass of forage within the pasture and he must also have a knowledge of the forage requirements and pasture preferences of the animal. The method is flexible and does relate the forage produced by the pasture directly to the animal requirements.

The use of the forage supply in assessment of grazing capacity is widely used, e.g. by the U.S. land management agencies and extension services, in Africa by the British Overseas Development Administration, Land Resources Division, and in Australia by the Rangeland Management Branch of the Western Australian Department of Agriculture.

The methods fall into 3 groups: (a) forage mass available; (b) a forage acre factor; and (c) a forage utilization method. The assessments of forage supply might also be by visual assessments, by cut samples or by double sampling techniques involving some cut samples and some visual assessments.

### (a) Forage Available/Animal Requirement -

The method is based on an assessment of the mass of forage available and the requirements of the animals to be grazed. It should take into account the preference of the animal for particular species at different times of the year and the differences between species, size, age and reproductive status of animals.

A good land resource map is essential before starting the forage survey. If not available it should be prepared and should include the boundaries of the pasture types on the property, the waters, fences and other structural improvements. It should also indicate inaccessible, special use, or problem areas.

In each pasture type the total mass of forage and the percentage composition by weight of the major forage species are assessed. The forage available to the animal can then be calculated by either using a forage utilization factor, e.g. the residual of 300-400 kg./ha. on the 'blue gramma range' mentioned earlier, or by applying a proper use factor. In practice, from experience the proper use factor is normally 50%. The species preference of the animal and the seasonal availability of species is also taken into account when calculating total forage available.

From a knowledge of the animal intake requirements, the grazing capacity in terms of animals per unit area per unit time can then be calculated. In practice, the method is subject to the problems of sampling pastoral areas, of knowing animal preferences, and to the variability in animal intake.

### (b) Forage Acre Factor -

Essentially the method is similar to the available forage method in that

the forage species are listed for each pasture unit together with the composition of the pasture and the total density of the pasture. The composition of each species is multiplied by its safe use factor and by the pasture unit density to arrive at a forage index which is the forage acre factor. This factor expresses the area covered with available vegetation which can be eaten in entirety by animals without damage to the pasture. The forage acre factor is then multiplied by the total area of the pasture type and the grazing capacity assessed from a standard for the pasture type. The method is difficult to follow and its accuracy is questionable. Forage production per unit of plant density varies tremendously between species and the reproductibility of the method is doubtful.

### (c) Forage Utilization -

Forage utilization by a known number of animals is used extensively on seasonal pastoral lands in the U.S.A. to determine grazing capacity. The procedure requires a knowledge of the actual amount of use in terms of animal days or animal months and of the pasture available for use at the start of the grazing period. The known use when related to the degree of utilization and the amount of forage remaining can be used to determine the remaining grazing capacity. The method is dependent on knowledge of proper use for the pasture and of an adequate sample of utilization. The main difficulty is how one estimates something which has disappeared or has been eaten. Use has been made of cages and paired plots to overcome this difficulty. The method is a good check on the effect of the current stocking rate. If it is used with estimates of forage availability early in the season, it would provide a good estimate of grazing capacity, especially if utilized over several seasons.

### (3) Assessment by Rating of Natural Resource Characteristics

The methods under this category assign a factor or a rating to those characteristics of the pasture unit which determine its productivity. They utilize the factor for comparison with a standard pasture unit and calculation of a grazing capacity. The characteristics rated in the methods studied included the soils, topography, pasture condition, presence or absence of trees or hills and the climate of the pasture unit.

The method developed by the Soil Conservation Service of New South Wales for use in central Australia and in the western division of N.S.W. is in this category. A very similar technique is used by the Division of Land Utilization in Natal, South Africa. The method unfortunately suffers from the lack of objective data on which to rank the characteristics of the pasture unit. It also suffers from the lack of a reliable base grazing capacity for the standard. Error in the base grazing capacity can create a greater error than the ranking factor given to characteristics of the unit. This is unfortunate for the method is easy to use as an administrative tool for assessment of pastoral properties.

### Conclusion

There is no entirely satisfactory method to assess grazing capacity of pastoral areas. Until actual use records are available for several years, managers and land administrators must continue to rely heavily on experience backed by a number of imperfect procedures.

The collection of actual use records should be a goal for those involved in management of pastoral lands. These must include the number, age and species of animals, the pasture composition and yield and the degree of utilization of the pasture, for a range of major pasture units.

With the limiting manpower resources in pastoral areas it will not be possible to gain use records for all pasture units. A better understanding of the composition and amount of animal intake and of safe levels of pasture utilization would assist assessments of grazing capacity on areas for which records are not available.

A reliable method of grazing capacity assessment would directly assist the property manager to adjust herd numbers to maintain an adequate level of animal production under safe levels of pasture utilization. This would maintain the productive potential of his pasture resources in spite of varying seasons. It would also provide a better base for land administrators using grazing capacity to assign land values and rental.

#### Summary

The importance of grazing capacity assessment in pastoral areas is discussed in this paper. Methods of assessing grazing capacity based on (a) actual use data; (b) forage availability; and (c) a rating of natural resource characteristics are described and briefly discussed. The paper outlines base studies and data required to improve the known methods.