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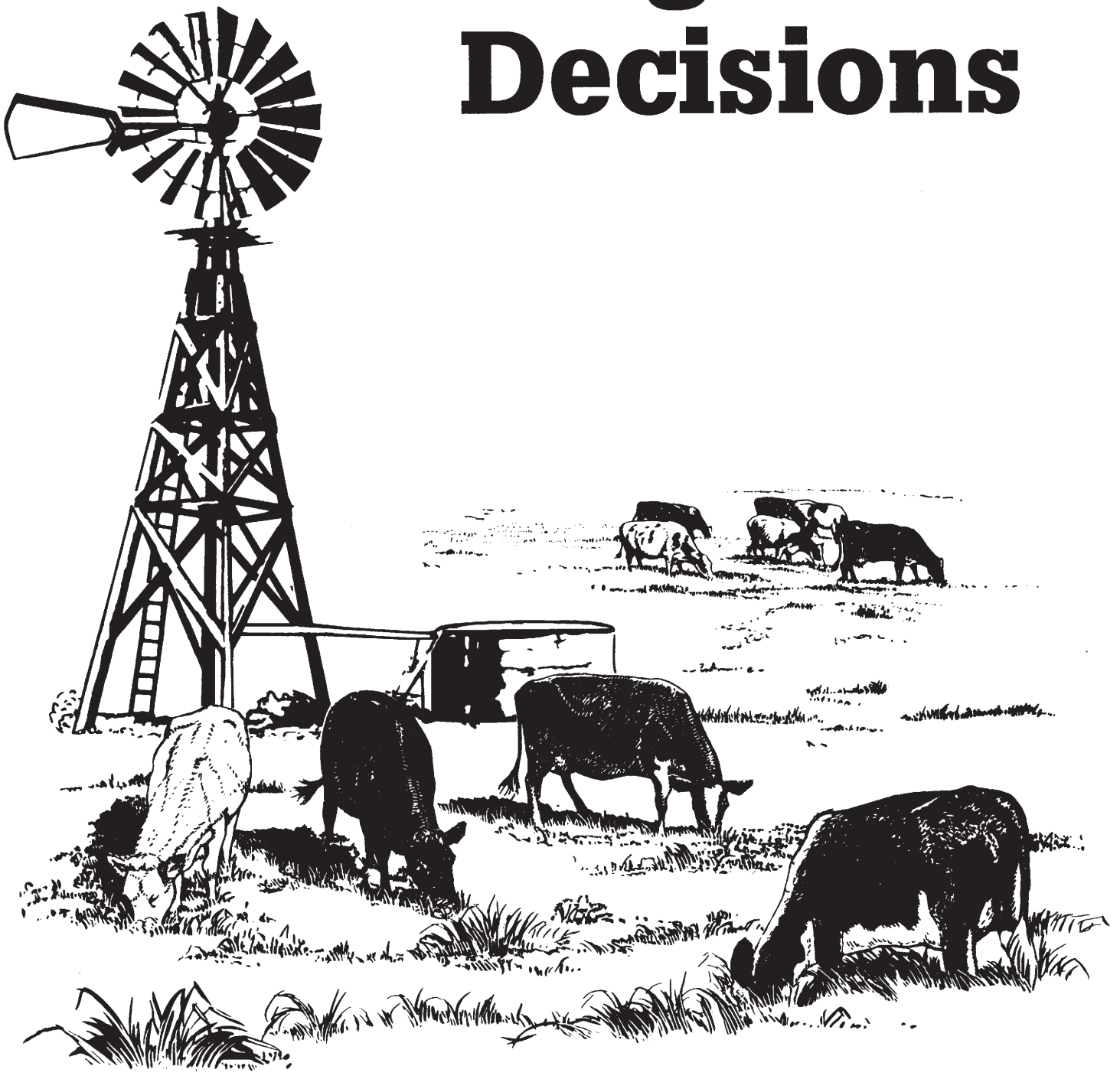
Stocking Rate Decisions



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Stocking Rate Decisions

Key to Successful Ranch Management

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On any ranch, decisions must be made as to the management of each ranch resource (land, animals, personnel, facilities and finances). When those decisions are made with specific short- and long-term goals in mind, and when all the sociological, political and environmental aspects of management are taken into consideration, the result will be successful ranch management.

The decisions that will achieve successful ranch management are different for each enterprise because each ranch has its own resources. Rangeland is a ranch's main resource for producing income and other benefits to the ranch and society. The use of the range affects all other ranch resources, the achievement of goals and the sustainability of the ranch. The stocking rate for grazing animals is a crucial decision which affects the rangeland and, therefore, the success of the ranch.

How Does Stocking Rate Affect Ranch Success?

Stocking rate determines animal performance, financial return and the long-term condition of the range. Proper stocking rates will: 1) produce optimum animal performance; 2) make the ranch profitable; and 3) sustain or improve the range resource.

Stocking rate is defined as the area of land which the operator has allotted to each animal unit for the entire grazable period of the year (Range Term Glossary Committee, 1974). An animal unit is equivalent to an 1,110-pound dry cow at maintenance (Forage and Grazing Terminology Committee, 1991). The daily forage consumption of an animal unit is 17.64 pounds. The number of animal units grazed determines the amount of forage that will be consumed each day and over the entire grazing period.

The amount of forage consumed in relation to forage supply determines the productivity of both the animals and the forage. This ratio of forage demand (forage intake needed by livestock) to forage supply is called grazing pressure. As grazing pressure increases, there is less forage from which animals can select (Figure 1). Point 1 represents a threshold of grazing pressure beyond which individual animal performance is reduced. Reduced performance, as measured by decreased weight gain and reproductive capability, translates to lower economic returns per animal. When feed is purchased to offset this higher grazing pressure, the net return per animal is even lower. Proper stocking rates occur between the threshold points for individual animal performance (point 1) and unit area performance (point 2).

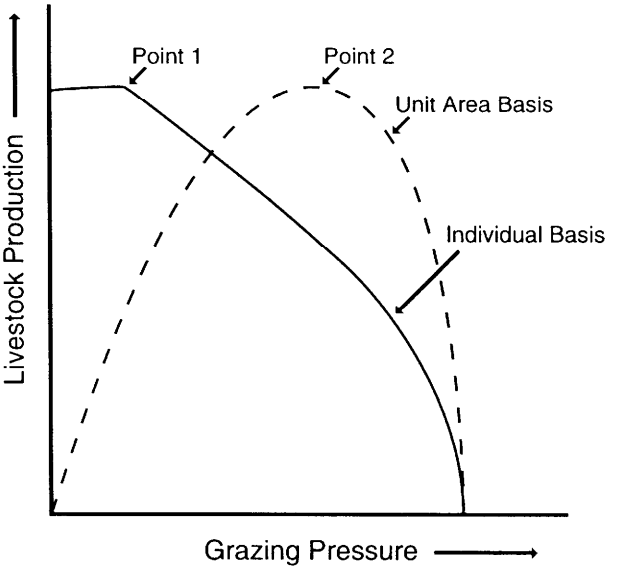

Figure 1. Livestock production per individual and per unit area as affected by grazing pressure. Proper stocking rate lies between point 1 and point 2. (Adapted from Briske, D. D. and R. K. Heitschmidt, 1991.)

High grazing pressure causes nutritional stress and greater health problems in animals, and increases the possibility that they may consume poisonous plants. High grazing pressure also increases labor requirements and competition between animal enterprises using the same range.

As regrowth is repeatedly grazed, the forage supply is depleted, the more desirable plants become unhealthy and don't reproduce well, and the diversity of plant species decreases. The loss of vegetative cover will prevent rainfall from moving into the soil and cause erosion and the pollution of surface water with sediment. High grazing pressure continued over several years causes the range to deteriorate and future productivity to be lost. If this situation develops, the enterprise may not be able to survive crises caused by climate and market variability.

> High overhead and high family expenses, coupled with excessive stocking rates, will jeopardize the ranch.

Ranch financial success depends on six factors: 1) overhead expense (fixed costs); 2) enterprise(s) selection; 3) production per unit; 4) value per unit; 5) direct cost per unit; and 6) the number of animal units grazed, i.e., the stocking rate. The optimal stocking rate required to maximize production per unit of land area varies with the quantity and quality of forage produced (Conner, 1991). This variation is reflected in the ranch's profits, because with high stocking rates production costs generally increase at a faster rate than do gross returns (Figure 2). As profit levels decline, there is a greater chance the ranch will suffer a catastrophic loss.

Ranchers must select stocking rates with limited knowledge of future forage and market conditions. But they can use past records, experience and range surveys to make realistic projections of forage and market conditions (Figure 3). Then, the planned stocking rate should be adjusted seasonally according to actual ranch conditions (Figure 4). If a conservative stocking rate is chosen initially, the rancher may not have to reduce the number of grazing animals, but may underharvest the forage resource. With this surplus forage the rancher might bring in stocker animals, lease grazing or use prescribed burning to improve the range.

At each step of the decision-making process a rancher must balance forage demand with forage supply and ensure economic survival. Both the number of animals grazed and the financial needs of the enterprise must be realistic in relation to potential forage production. By analyzing previous rainfall, animal performance, stocking rates and financial records, a rancher can better evaluate both potential forage production and risk.

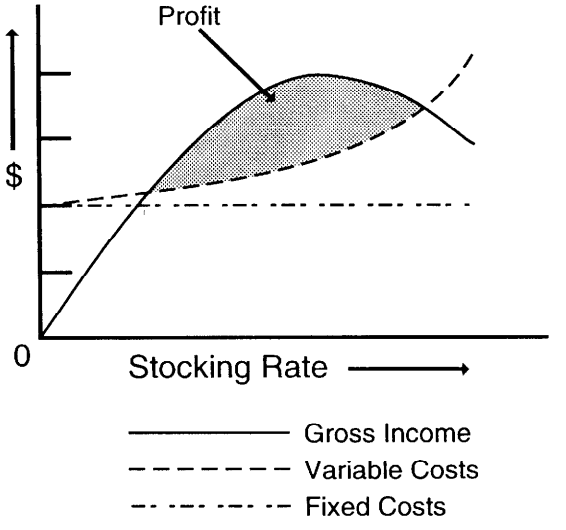

Figure 2. Proper stocking rates are actually a window of opportunity that shifts from year to year. Managing the stocking rate to remain within the window of profit requires frequent monitoring of forage supply and flexibility in adjusting animal numbers (Kothmann, 1992, personal communication).

How Does Stocking Rate Relate to Carrying Capacity?

The long-term carrying capacity of rangeland refers to the average stocking rate a given amount of land can support for several years without damage to that resource. Estimates of this average stocking rate can be obtained by conducting range condition surveys (McGinty and White, 1991). Stocking rate refers to the actual number of animals grazed, which may not match forage production.

If livestock numbers are based primarily on the average carrying capacity, the range will be overgrazed in dry years and undergrazed during wet years. To achieve maximum production and profit, livestock numbers must be matched to current and projected forage levels, not to an average carrying capacity.

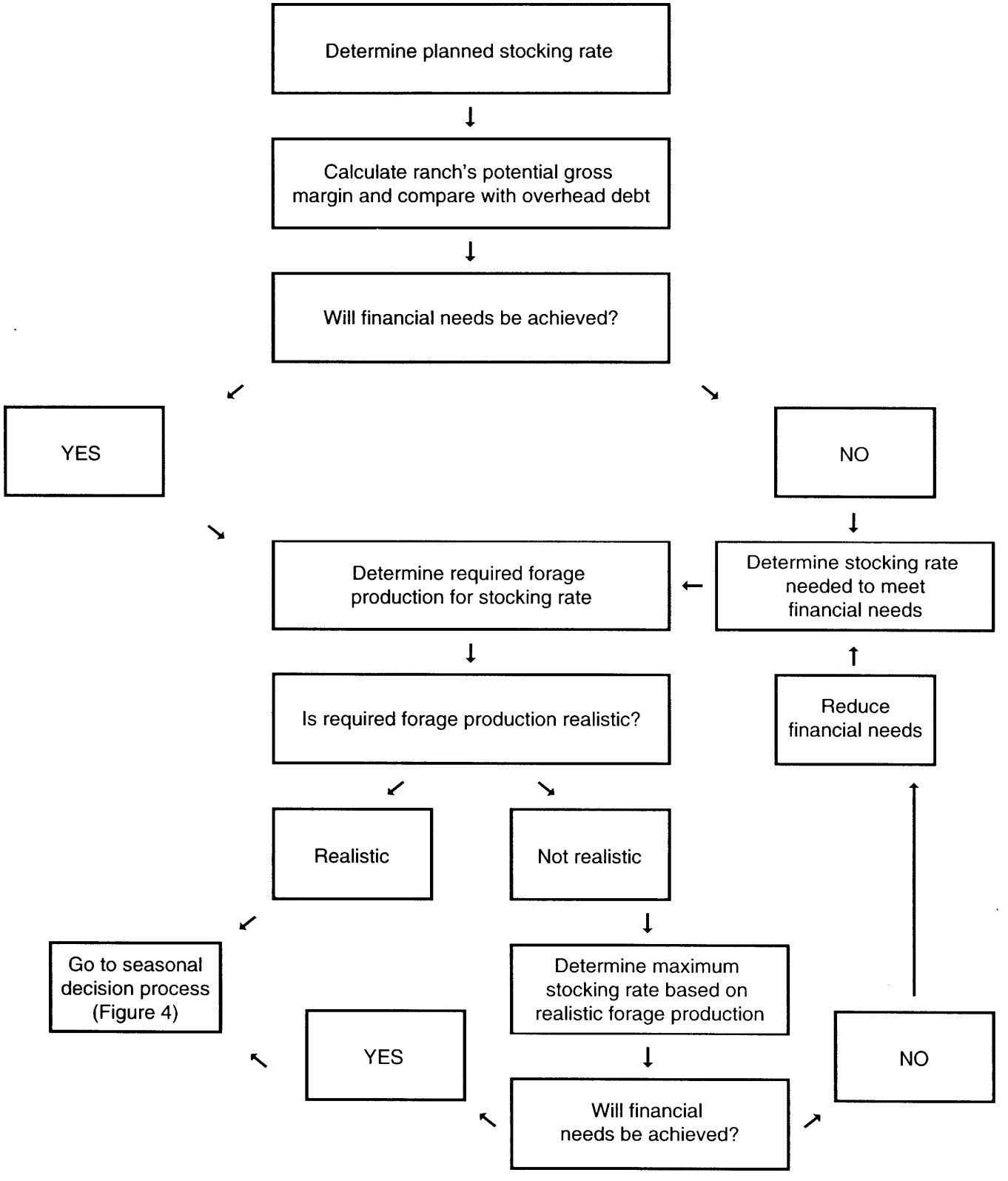

Figure 3. The process of selecting an annual stocking rate which will balance financial needs with forage availability.

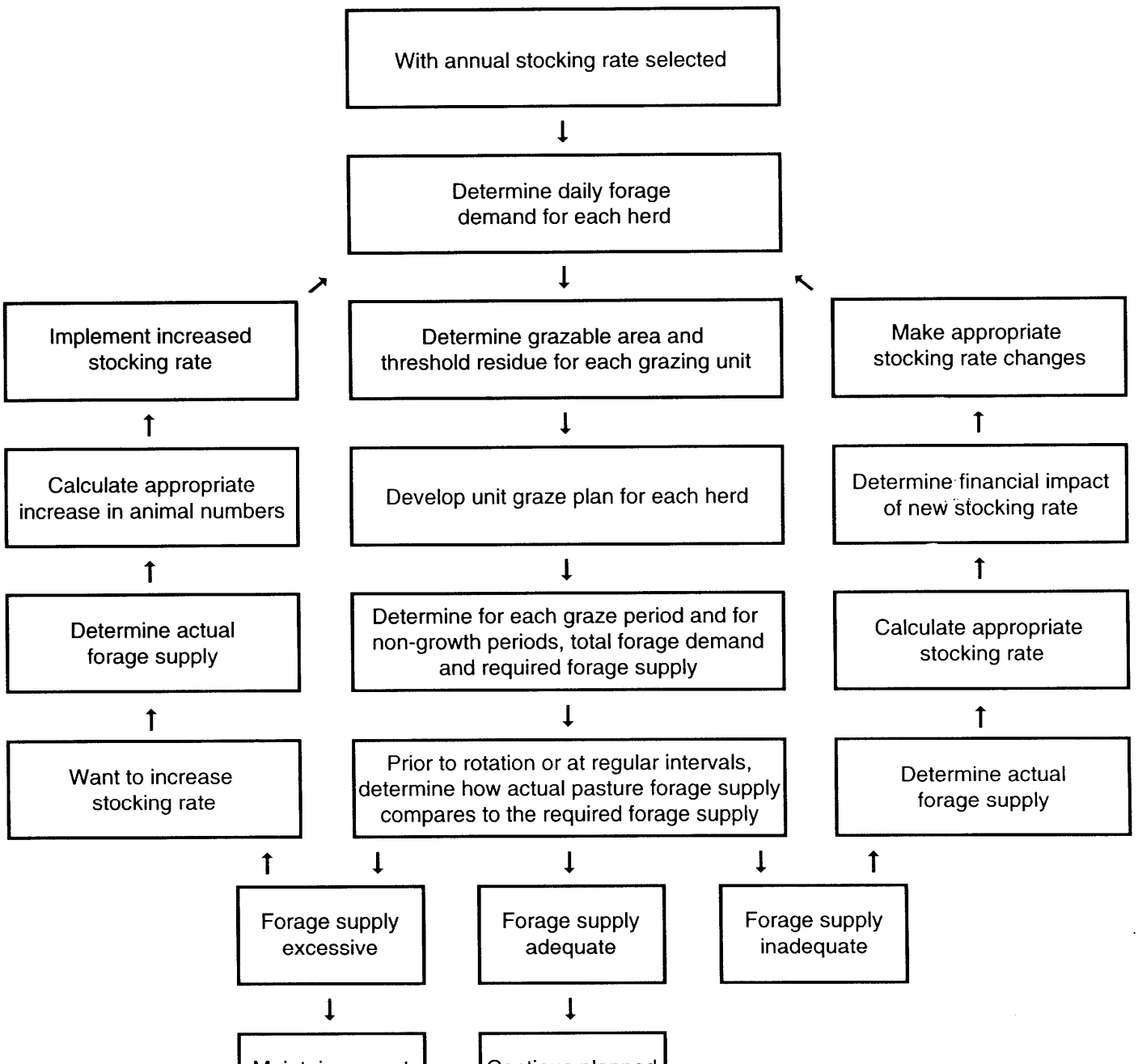

Figure 4. The process of selecting a seasonal stocking rate adjusted to current conditions.

What Factors Affect Stocking Rate Decisions?

The stocking rates selected must enable the ranch to survive financially (meet current obligations and provide for future needs), give satisfactory animal performance and allow for the future regrowth of forage. Many ranchers try to graze the maximum number of animals they believe possible under current and "hoped for" conditions. Then if forage shortfalls and overgrazing occur, they are frequently blamed on drought. In fact, it is not drought nor the amount or distribution of rainfall that is the prime cause of range degradation. The most common cause of degradation is simply that ranchers expect animal productivity from their rangelands to be much higher than is realistic (Pressland and Graham, 1989).

Financial obligations often "force" a rancher into selecting a stocking rate too high for the forage supply available. Then, if rainfall or market prices are not adequate, a crisis develops and the range deteriorates. The financial needs of the ranch must not be allowed to dictate an unrealistic stocking rate. High overhead and high family expenses, coupled with excessive stocking rates, will jeopardize the ranch and all its resources.

> Ranchers shouldn't get forced into crises that are preventable.

Crises usually occur gradually and have many early warning signs. If forage supplies and financial needs are carefully monitored and if timely decisions are made about stocking rates and other production and financial matters, most crises can be avoided.

When Should Stocking Rate Decisions be Made?

Stocking rate decisions should be made before the ranch's resources are jeopardized, and adjusted seasonally to balance forage demand with forage supply. The stocking rate chosen initially may not be the right one all year. Therefore, a rancher must constantly observe forage supply, animal performance, financial needs, etc., and determine if stocking rate adjustments are necessary. Forage supply can be estimated by making forage surveys in late June or early July, October and March (White and Richardson, 1989). At the same time, projected forage demand in the coming months can be determined and compared to the forage supply to determine if adequate forage is available.

Once stocking rate decisions are made, they should be implemented as soon as appropriate. If it is projected that there will be a forage shortfall several months in the future, there is time to take action. Ranchers shouldn't get forced into crises that are preventable.

How Much Forage Should be Ungrazed and How Much Can be Eaten?

Certain amounts of plant residue (ungrazed herbage) must be maintained to protect the soil, ensure rainfall infiltration and sustain forage production. Ungrazed herbage is an investment in future forage production. The minimum residue levels needed to sustain production are 300 to 500, 750 to 1,000 and 1,200 to 1,500 pounds per acre (oven dry weight) of shortgrasses, midgrasses and tallgrasses, respectively. Figure 5 shows the proper residue level (1,500 pounds per acre) for a tallgrass prairie site near Bowie, Texas. When forage is reduced below threshold levels, rainfall doesn't infiltrate the soil as deeply and animals don't perform as well. But when proper amounts of forage are left ungrazed, rainfall infiltrates the soil and preferred plant species become better established and produce more forage than if grazed too closely.

In one study in south Texas, when grazing pressure reduced forage supplies below about 750 pounds per acre, cattle consumed more browse and their intake of organic matter, digestible energy and crude protein rapidly declined (Hanson and Stuth, 1988). In a similar study in the eastern Rolling Plains of Texas, organic matter intake declined when forage supply was below 623 pounds per acre (Pinchak, et al., 1990). In both studies animal performance declined when forage supplies fell below these threshold levels.

The principle governing stocking rate decisions is to "take half and leave half." This means that of the total forage produced during the year, half should remain ungrazed. Of the half that is available for livestock consumption, half of that amount (25 percent of the total forage production) will generally be lost

Figure 5. This tallgrass prairie properly grazed during 1991 left 1,500 pounds per acre of residue in March 1991.

to insects, weathering, trampling, other animals and decomposition. Thus, when properly stocked, rangeland will achieve about a 25 percent harvest efficiency (25 percent actually consumed by livestock).

With intensive management, including frequent stock rotations, it is sometimes possible to achieve a slightly higher harvest efficiency by getting animals to consume forage before it is lost to trampling, weathering and other causes. However, 25 percent harvest efficiency is considered a moderate stocking rate and is the level most ranchers should strive for.

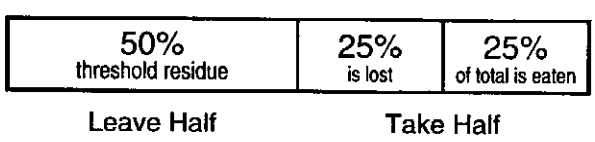

Figure 6. With a proper stocking rate, rangeland will achieve a 25 percent harvest efficiency.

Since an animal unit consumes 17.64 pounds of forage daily, in 1 year an animal unit requires 6,439 pounds of forage (365 x 17.64). This amount is called an animal unit year (auy). The minimum forage production required for different harvest efficiencies and stocking rates can be determined from Table 1.

> A rancher can never see exactly how much forage has been and is being produced.

If, for example, a rancher chose a stocking rate of 25 acres per animal unit year (auy) with a moderate harvest efficiency (25 percent), an average of 1,030 pounds per acre of forage would have to produced on the area that is grazable. At this rate, forage consumption by livestock would be approximately 258

pounds per acre, leaving approximately 515 pounds per acre of residue. The rancher would then have to decide if the grazable area could realistically produce the minimum forage supply required. If not, the grazing pressure would be higher than desired. Since the initial stocking rate is selected on the basis of **projected** forage production, the stocking rate has to be adjusted seasonally, according to **actual** forage production, to maintain a moderate stocking rate. Otherwise, at some point the forage supply might reach the threshold residue level and livestock would have to be removed completely until forage regrows.

The proper stocking rate for a pasture is affected by its topography, accessibility and range site characteristics, as well as by animal diet preference and grazing behavior. Cattle may overgraze the most productive sites and preferred species before they use less preferred sites and species. Ranchers can achieve good grazing distribution and more uniform use of all available forage species by grazing adapted animal species and by properly locating fences, water and minerals.

How Do I Determine Actual Forage Production?

A rancher can never see exactly how much forage has been or is being produced, because it is constantly growing and continuously being consumed by livestock or lost to other causes. However, if he can quantify the amount of forage on the land at any given time, he can project how much of it will need to be reserved as residue and how much can be used. Naturally, this is an on-going process and the rancher must make these evaluations often.

Table 1. The annual forage production (pounds per acre) required to meet forage demand.*

Stocking rate	Harvest efficiency (percent)		
	Light	Moderate	Heavy
(AC/AUY)	15	25	35
10	4293	2576	1840
15	2862	1717	1226
20	2146	1288	920
25	1717	1030	736
30	1431	858	613
40	1073	644	460
50	859	515	368
60	715	429	307

*Formula: ((6439 lbs./auy intake ÷ H.E.) 100) ÷ Stocking rate

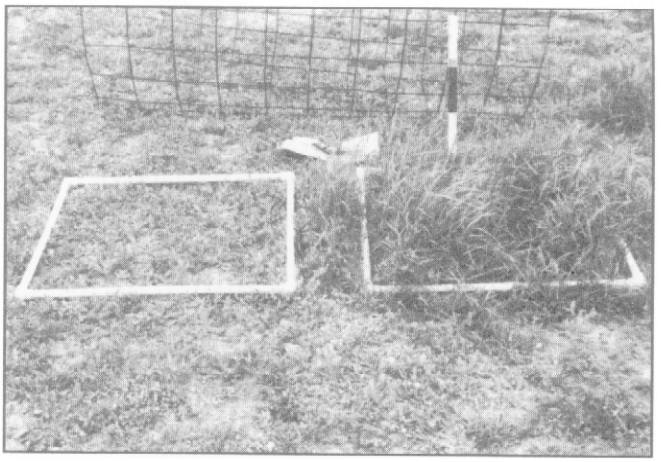

Figure 7. Cages are used to visualize disappearance of forage from grazing. Ungrazed forage inside the cage weighed 3,033 pounds per acre dry weight. Grazing had resulted in 80 percent disappearance outside the cage from June to March.

How does a rancher determine the quantity of forage he has and is likely to produce in coming months? There are three approaches to this problem.

The rancher can conduct periodic range condition surveys to compare current species composition with known ratings in the Soil Conservation Service Technical Site Guides. These provide a guideline for establishing an annual stocking rate (McGinty and White, 1991). Most ranchers are unable to project how long their current forage will last by simply observing animal and pasture conditions. But with photo guides they can better quantify forage supplies and then (with a planned stocking rate and grazing plan) estimate the amount of forage needed for consumption from each pasture and from the whole ranch (forage demand) so that seasonal adjustments can be made (White and Richardson, 1989).

A second approach to quantifying forage production is to monitor the disappearance of range forage by comparing grazed areas with small, fenced areas which are left ungrazed (Figure 7). These exclosures allow the rancher to visualize how much forage has been produced and how much has been consumed or lost. The cages should be moved periodically so that the impact of grazing on forage growth can be determined, and many exclosures are needed for an accurate assessment. With this method, the rancher measures the rate of forage disappearance at frequent intervals, which allows him to predict forage shortfalls or excesses. The animal unit days of grazing for the pasture since the last observation, divided into the amount of forage disappearance, provide an esti-

mated daily disappearance rate (forage eaten by livestock plus natural disappearance). For example, if an exclosure was established on July 1 and on August 1 (31 days later) the difference in forage supply between the grazed area and the exclosure equalled 75 pounds per acre, the disappearance would equal 2.4 pounds per day. If the remaining grazable forage (amount above desired residue) equalled 90 pounds per acre, then approximately 38 days of grazing would remain at the current stocking rate.

Stocking rate decisions should always protect threshold residue levels.

A third approach uses computer software to help with stocking rate decisions. APSAT (Annual Planning Stock Adjustment Templates) uses pasture utilization ratings and actual versus expected growing conditions to project needed stocking rate adjustments (Kothmann and Hinnant, 1990). The software will warn of potentially heavy use early enough so that adjustments in stock numbers can be made before overgrazing occurs.

Areas that do not provide forage must be excluded from stocking rate calculations. The use of stocking rate guidelines to determine the number of animal units a pasture can carry often results in overstocking unless the ungrazable area is taken into account.

The process of estimating annual forage production becomes easier if a rancher gathers historical data and pays attention to trends. A useful practice is to take photographs at several set locations on the ranch three or four times each year. When these photographs are compared for several consecutive years, the rancher will be able to see trends in forage production over time.

How Do I Determine the Correct Stocking Rate?

Stocking rate decisions should always protect threshold residue levels. A rancher wanting to leave 750 pounds per acre of threshold residue must subtract this quantity from the total forage supply to determine the forage available for consumption. For example, if the total forage supply is 1,200 pounds per acre, only 450 pounds per acre is available for consumption (1,200 - 750 = 450). At a moderate stocking rate, only half the amount available for consumption (225 pounds per acre) can be used by livestock. This equals 12.8 animal unit days of grazing per acre (225 divided by 17.64 pounds per day) before grazing must be stopped until regrowth occurs. Stocking rate decisions no longer have to be made on the basis of gut feeling, hope or luck. When stocking rates and grazing times are determined by this forage supply/forage residue approach, there is time for the rancher to predict potential forage shortfalls, determine the impact of the decision on finances and other ranch resources, and make any necessary adjustments before the forage resource is harmed or financial problems occur. Through adequate planning and periodic evaluation of range conditions, forage utilization can be controlled so that short- and long-term ranch goals are achieved.

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