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## **Texas Agricultural Extension Service**

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# **Grazing and Brush Management On Texas Rangelands**

*An Analysis of Management Decisions*

**September 30, 1990**

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Barron S. Rector  
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# Introduction

Proper management of Texas rangeland is vital to protect future ranch production and profitability. Range management technology and understanding has increased dramatically during the past 20 years due to excellent research, education and increasing experience of managers. Rangelands continue to make improvement overall but often regress under adverse weather influences and perceived improper management decisions. Grazing and brush management decisions have been recognized as major factors affecting current and future rangeland resources. Professional range managers have concentrated on the technology transfer of practices for improving or maintaining the range resource. However, the owner and/or operator of Texas rangelands make the decisions. This human element is the major influence, yet little is known about the decision-making process used by Texas ranchers and why they select or do not select various technologies.

This analysis of Texas rangeland management is designed to provide knowledge concerning ranch characteristics, criteria used for making grazing and brush management decisions, and the types of decisions and technologies applied.

The overall goal of the project is to better understand today's ranching community so that more effective and practical technology transfer can occur. This will result in improved ranch profitability and maintenance or improvement of Texas rangelands. Agencies such as the Texas Agricultural Extension Service and the Soil Conservation Service will be able to use this information to develop improved educational/technical assistance programs.

## Materials and Methods

The state was divided into seven vegetation/management regions based on experiences of the range Extension group (Figure 1). An area of Texas designated "East Texas" was not included in the survey because it does not contain significant amounts of rangeland.

A mailing list of approximately 80,000 names was obtained from the Texas Beef Industry Council (BIC). The BIC database was sorted into the seven regions according to county boundaries. The survey recipients were randomly selected from each region to assure a more uniform statewide coverage. A computer program was written to select 1,000 names per region (7,000 total) to receive the mail survey. The procedure followed was a modification of a randomized systematic sampling. Before sampling began, each region was sorted by zip code in ascending order. This was done to spread the sampling across all areas of each region.

The surveys were sent to respondents by first class mail with pre-paid postage for respondents. Surveys were mailed beginning in late February and completed on March 2, 1990. Returned surveys were sorted as follows: non-deliverable, non-usable (marked on front as non-owners and unanswered), deceased, refused to answer (returned completely unanswered) and usable. The database was updated to include the appropriate sort category.

The second mailing to respondents who had not answered the first survey began April 19, 1990 and was completed on April 26, 1990. This was followed by a mailing of postcards on May 14 encouraging completion of the survey to the same respondents who received the second survey.

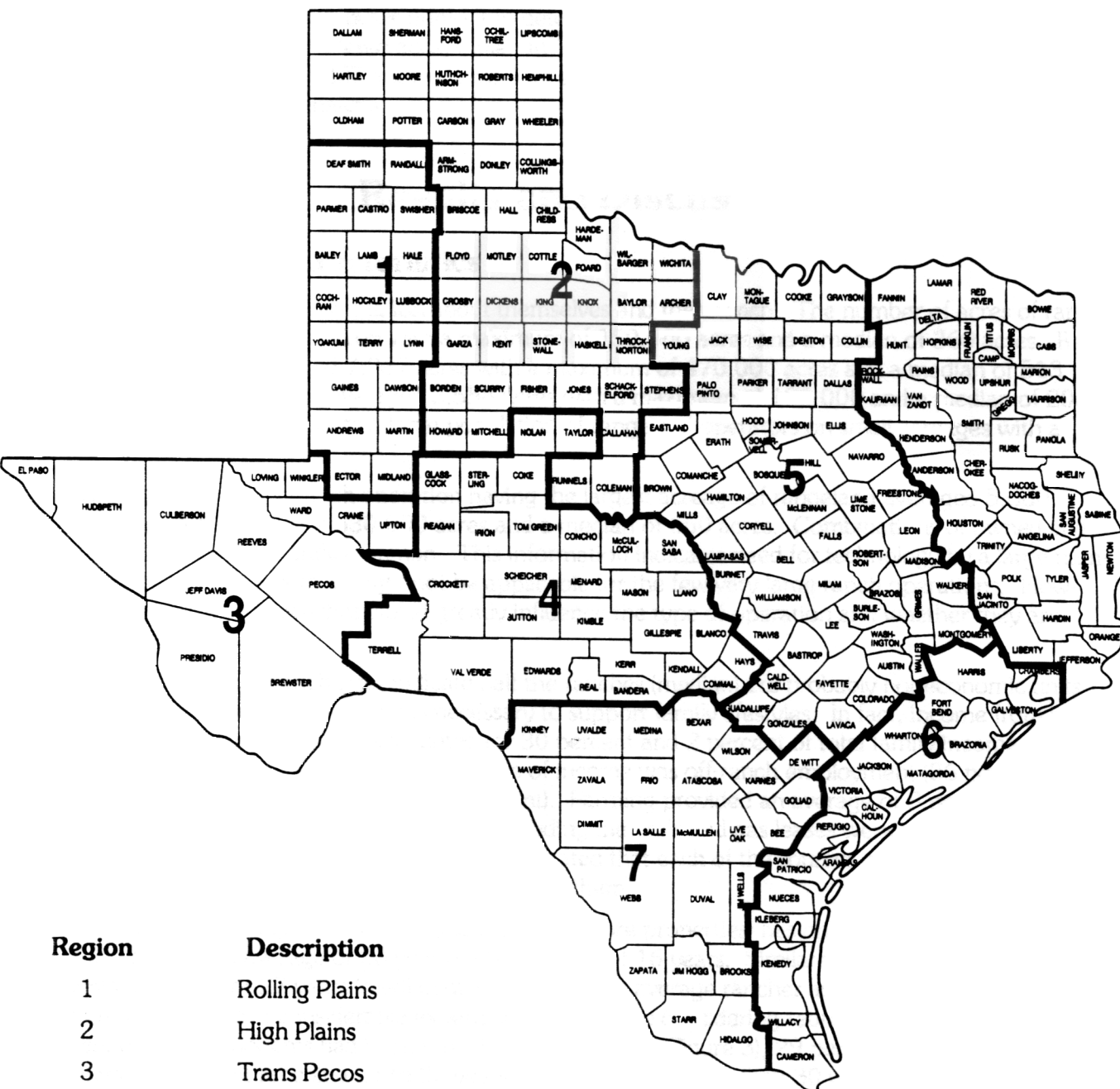


Figure 1. Rangeland vegetation/management regions surveyed.

Analysis of survey responses consisted of computing frequencies, means, standard deviations, medians and correlations. Prior to the final analysis, 10 percent of the usable surveys were manually checked against the computer printout to determine random and systematic errors. A random error of 5 percent is considered acceptable. In 10 percent of the surveys checked, there were 30 individual errors out of 42,222 entries (a random error of less than 0.1 percent). All errors were corrected before the final analysis.

## **Results and Discussion**

### **Respondent Characteristics**

Respondents provided information about themselves and their ranch. The number of acres of rangeland owned averaged 3,105 with a maximum of 150,000 acres and a median of 360 acres. Rangeland managed averaged 7,967 acres with a maximum of 470,000 acres and a median of 513 acres. Leased rangeland averaged 3,558 acres with a maximum of 185,000 and a median of 200 acres. These results indicate a large population of rangeland operators on small acreages with a few very large operations.

In a given county, the ranch operation having the largest acreage of rangeland averaged 5,660 acres with a maximum of 530,000 acres and a median of 650 acres. Combinations of owned and leased land are apparently common. This information indicates need for technology by a large number of small operators that might not be applicable for the few very large ranch operations. However, the location of ranches would greatly influence the type of operation and whether they are economical units.

The relatively small ranch sizes indicate half the ranches (median) are probably not economic units and other means of employment is necessary to support family lifestyles. In fact, income from live-stock and wildlife production accounted for 30 percent and 2 percent of total family income, respectively (Figure 2). The second highest source of income was off-ranch employment (26 percent) followed by off-ranch investments (19 percent). Farming provided an average of 8 percent total family income. Other sources of income including minerals and gas leases were a minor source to most families. However, some individuals indicated that each of the sources of income was the only source of income or was of major importance to them.

The ranch containing the most rangeland (one or more properties) has operated with current management an average of 20 years with a median of 16 years. Similarly, the average rancher has been ranching for 27 years (median of 25 years). The average rancher age was 56 years. Thus most ranchers have considerable experience and may be considering retirement. In fact, 15 percent of the respondents had been ranching 0 to 10 years (Figure 3), 29 percent ranching 11 to 20 years, 22 percent ranching 21 to 30 years and 33 percent more than 30 years. The majority of ranchers completed high school and attended college (69 percent). A four year college degree was achieved by 28 percent of the respondents with 15 percent completing advanced degrees. Only 40 percent of those ranchers completing a college degree majored in agriculture.

The majority of ranches operate a cow/calf enterprise (76 percent), of which 20 percent have purebred/registered cattle, 21 percent have stocker cattle, 9 percent have commercial sheep, 1 percent have purebred/registered sheep, 6 percent have spanish goats, 5 percent have commercial Angora goats, 3 percent have mutton Angora goats and 1 percent have purebred/registered Angora goats.

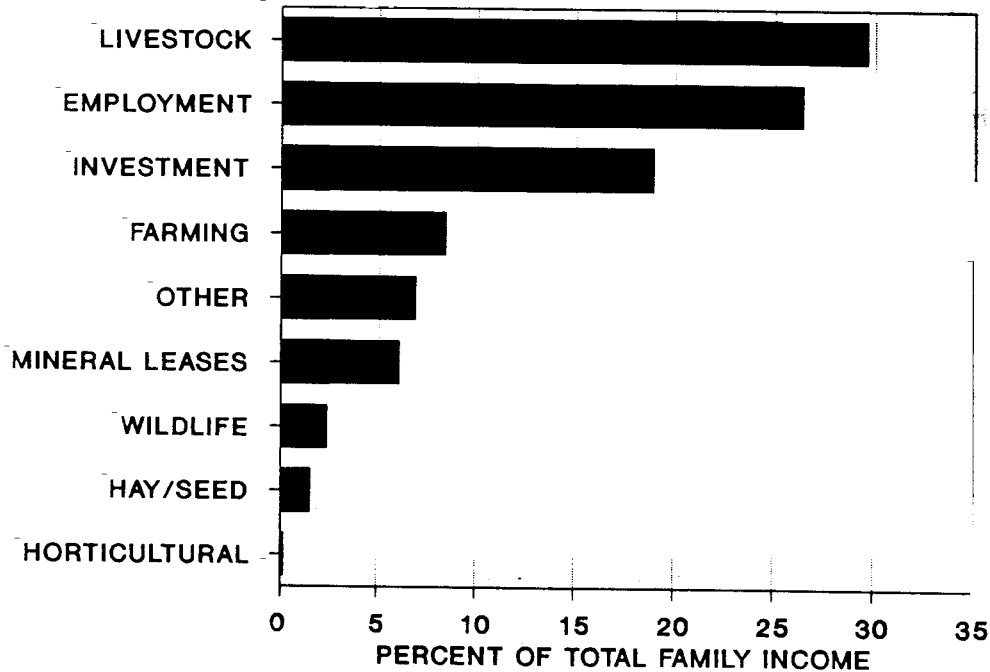


Figure 2. The average percentage of total family income from different activities.

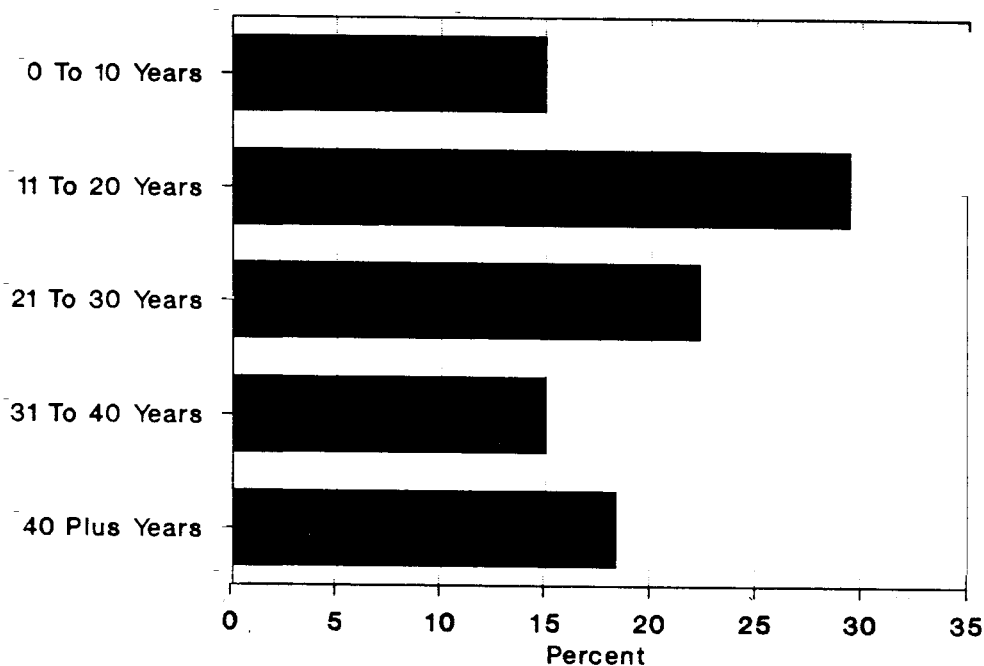


Figure 3. Years of ranching experience.

Wildlife was managed as follows: 32 percent of the ranches surveyed manage for deer/antelope, 25 percent for quail, 17 percent for other native wildlife and only 3 percent manage exotic wildlife. Some bias to enterprises managed may be present in the survey due to use of the Beef Industry Council mailing list. In addition, the high percentage of small landowners/operators probably prevents successful management of most wildlife.

As discussed earlier, wildlife production accounted for 2 percent of total family income. Livestock production was the highest on-ranch income source. Any combination of these enterprises may be operating on a given ranch; however, there should be definite regional differences (eg. sheep and goats are known to be most common in the Edwards Plateau). In addition, combinations of enterprises are probably more common on larger ranches (further analysis will determine if this is true).

## **Grazing Management**

Grazing management decisions affect current and future range resources, animal performance and overall ranch profitability. These major grazing decisions are made by ranchers:

1. kinds of animals grazed
2. numbers of animals grazed (stocking rate)
3. distribution and timing of grazing (grazing program)

## **Stocking Rate**

The setting and fluctuation of livestock stocking rates represents the most important management decision for Texas ranchers. Stocking rates affect short-term cash flow because of the impact on individual animal performance, number of marketable animals, supplemental feed and labor costs, etc. Long-term, stocking rates dictate future ranch profitability through it's impact on range condition and trend.

Maintenance of proper livestock stocking rates has always been a significant problem on leased rangeland. When surveyed, only 54 percent of the ranchers indicated they owned and operated all of their ranch acreage. Eighteen percent leased all of their grazing, while 18 percent operated a combination of leased and deeded grazing land. Ten percent of those surveyed owned their ranch but leased all the grazing to others.

The tenure of the lease is also known to impact livestock stocking rates. Short-term leases tend to promote overgrazing as lessees often attempt to maximize per acre production with little regard to the long-term impact on forage production and range condition. Thirty-six percent of the respondents who leased rangeland reported a lease tenure of one year or less, while 38 percent responded with lease contracts of two to five years. Six- to 10-year lease contracts were reported for 8 percent of the respondents, while 17 percent have tenures of greater than 10 years.

When asked if the lease agreement included clauses that dictated stocking rate, 78 percent responded **NO**. Of those that indicated such a clause was included, the majority (15 percent) indicated only a maximum stocking rate was dictated.

Lease agreements were also found to be lacking in clauses that dictated the type of livestock that could be grazed. Eighty-seven percent reported this to be the case.

The method in which lease payments are determined also impacts livestock stocking rates, especially when no cap on livestock numbers is included in the contract. When lease payments are based on a per acre charge, lessees are encouraged to reduce per animal grazing costs by maximizing live-

stock numbers. Eighty percent of those that leased reported this to be the case. Lease payments were determined by the number of animals grazed only 11 percent of the time. Eight percent indicated lease payments were based on a combination of annual or monthly payments, exchange of services or percentage of income.

All respondents, whether they leased, owned or managed rangeland were asked to rate the importance of several factors when they establish their annual livestock stocking rate for rangeland (Figure 4). Forage and livestock considerations as well as past experience and weather all rated high. Wildlife considerations and other people's advice rated much lower.

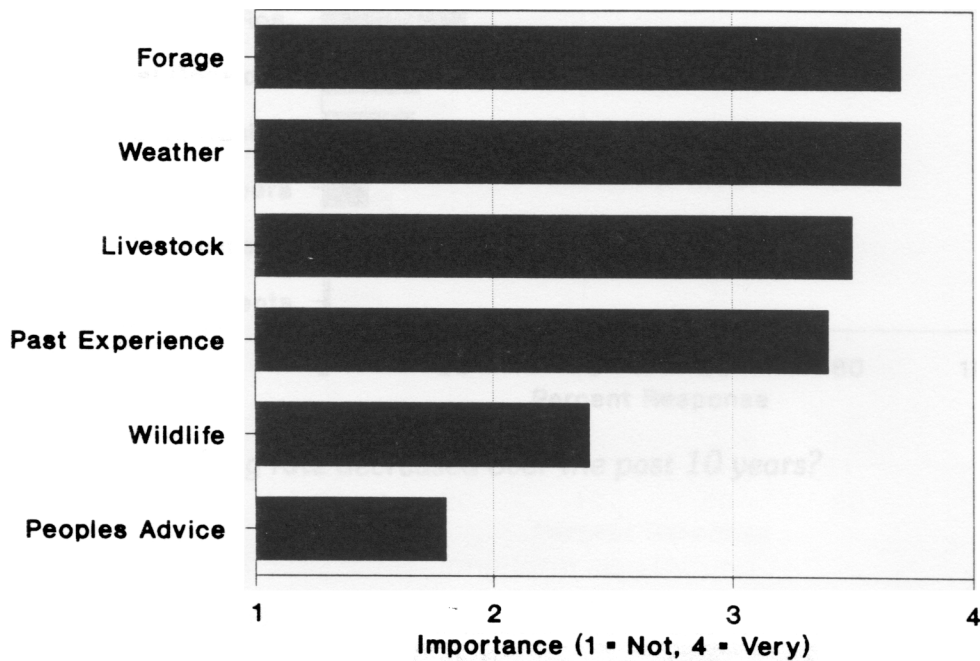


Figure 4. Importance of factors in establishing rangeland stocking rates.

Each respondent was also asked if his annual stocking rate had decreased, increased or stayed the same over the past 10 years. Thirty-eight percent reported no change, 37 percent reported a decrease while 25 percent increased stocking rate.

When those who reported a decrease in stocking rate were asked what factors influenced that change, 88 percent indicated drought as a major factor (Figure 5). Brush and weed invasion (28 percent), less forage available (39 percent) and the need to increase forage reserves (22 percent) or individual animal performance (32 percent) also received high ratings.

Essentially the same question was posed to those who reported a stocking rate increase for the past 10 years (Figure 6). Factors the respondents felt most responsible included weed and brush control (68 percent), more forage available (58 percent), changed grazing programs (44 percent) and fence development (47 percent).

It is known that to properly balance livestock numbers with fluctuating forage supplies some type of "seasonal" adjustment of livestock numbers is necessary. It should be noted that 45 percent of the respondents indicated they did *not* make this type of adjustment.

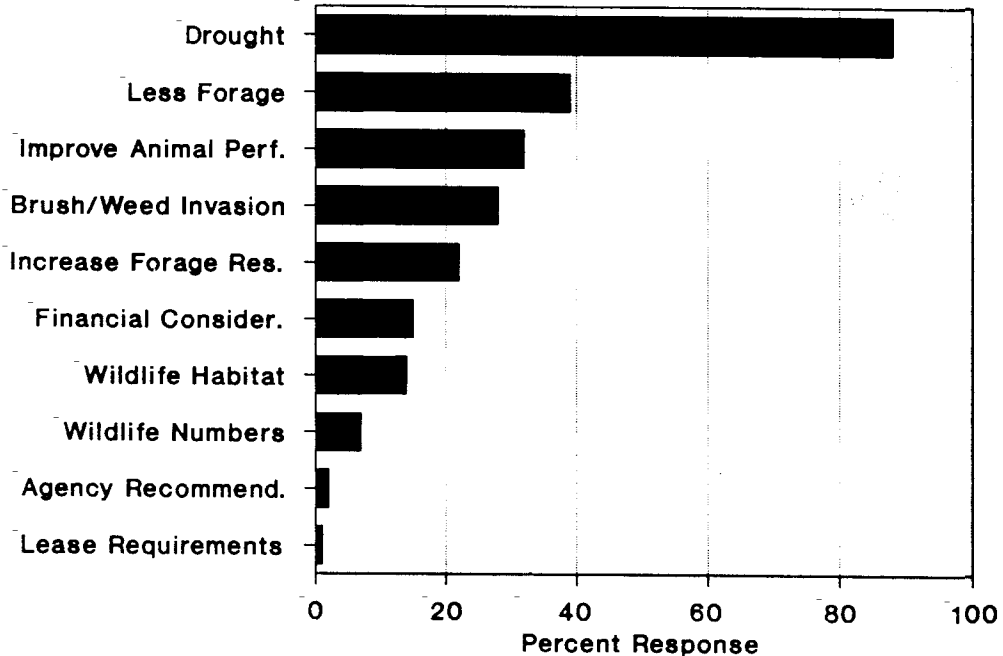


Figure 5. Why has stocking rate decreased over the past 10 years?

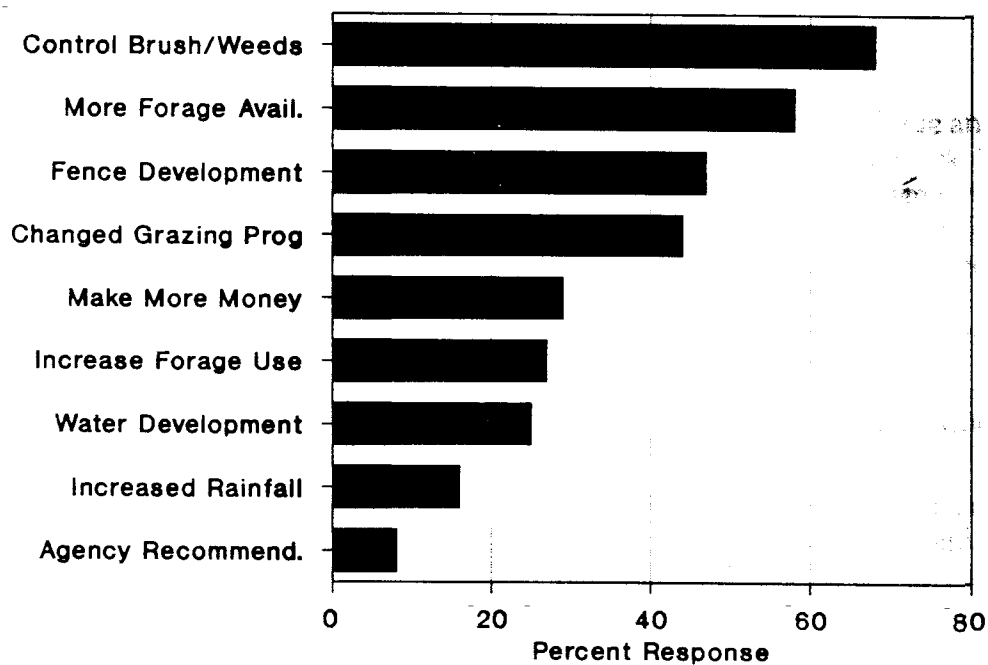


Figure 6. Why has stocking rate increased over the last 10 years?

Of equal importance to the actual setting and fluctuation of livestock numbers is a "feed-back" mechanism to monitor the effect of stocking rate on range condition and trend. Visual inspection of pastures (89 percent) and animal performance (62 percent) were the two most used techniques by respondents to monitor long-term changes in range vegetation (Figure 7). These two techniques represent the two poorest choices for objective, long-term measurement of stocking rate impact. Only 8 percent reported the use of vegetation transects, 10 percent use grazing exclosures and 2 percent use photopoints or repeat photographs.

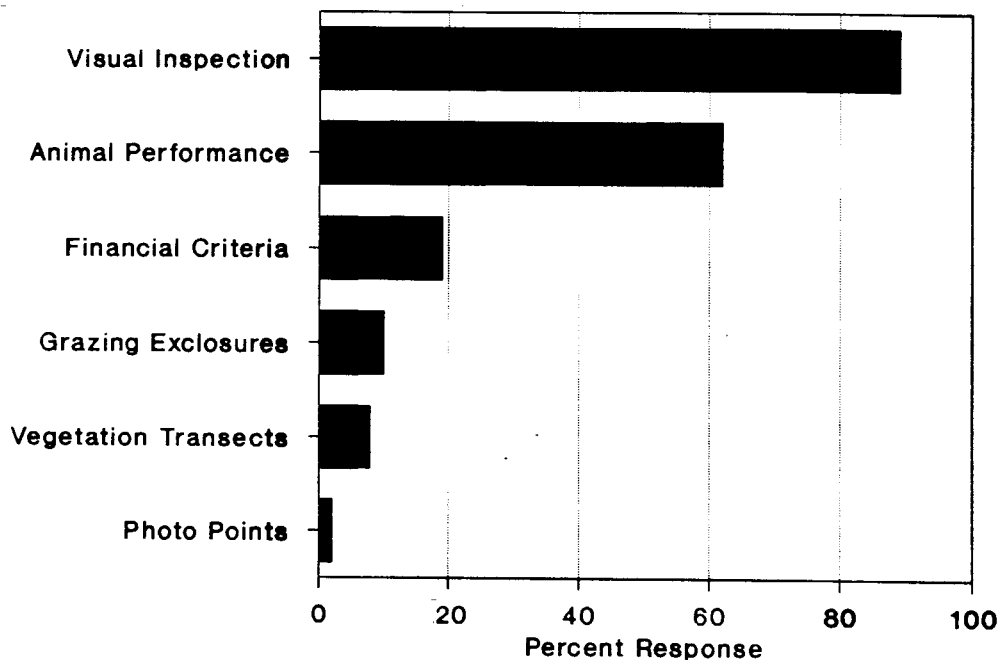


Figure 7. How respondents determined long-term vegetation.

## Grazing Programs

It has been a major emphasis of range management education nationwide to encourage and demonstrate to range landowners and managers the positive benefits of rotating livestock. Rotational grazing has been shown to be a management tool useful for maintaining or improving the forage base, assisting in forage allocation and harvesting, and decreasing soil and water erosion. Deciding when to rotate livestock has been a major problem for managers due to the complex forage base and understanding the response of graze and rest periods on range plants, the water cycle and the range resource. A total of 71 percent of respondents indicated that they rotate livestock grazing among pastures.

Many techniques are used to decide when to rotate livestock. Respondents were asked which of 15 criteria they use to rotate livestock (Figure 8).

Through this survey, it was found that 16 percent of the respondents rotate livestock on a calendar date. It was found that forage attributes and livestock condition were the factors most often used to decide when to rotate livestock (90 percent and 51 percent respectively). To use quantity and quality of forage as a decision tool suggests that the rancher is attempting to match forage production with forage demand. Due to the delay period for visual observation of declining forage attributes and animal condition, the high preference for these factors indicates an educational need.



Water availability is a significant constraint to livestock production in Texas. In the mid-1800's, livestock were grazed in some parts of Texas only during the wet season. As conditions became dry, water holes and wet season creeks dried up, livestock were driven or transported to areas where permanent water could be found. With the advent of the windmill and stock ponds, animals could be maintained in an area "permanently." Today as drought conditions continue to plague many areas of Texas and demand for groundwater and surface water continue to grow, livestock movement is still done with water in mind. The survey of respondents indicates that 24 percent may make a decision to rotate livestock based on water availability.

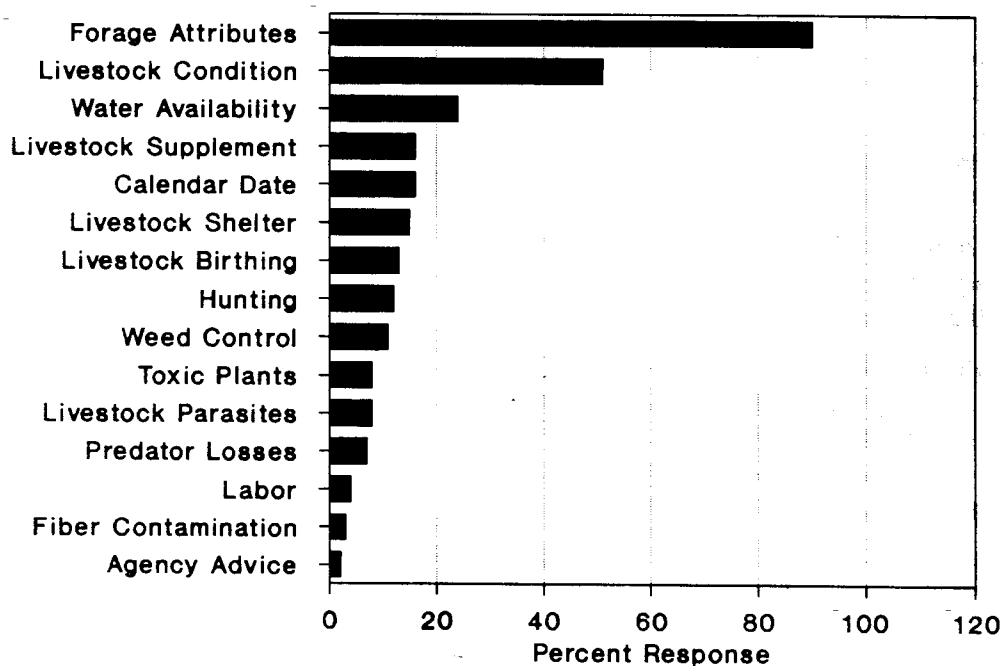


Figure 8. Factors used to decide when to rotate livestock.

Other decisions to rotate livestock were asked each respondent related to livestock, environment, livestock needs or other ranch management aspects. One of the most economical methods to manage around a poisonous plant problem, is to not graze a pasture when a poisonous plant condition could exist. A total of 8 percent of the respondents indicated they rotate livestock based on toxic plants.

Resting an area or pasture when combined with weed control allows grasses to grow without the competitive effect of weeds for moisture, nutrients and light. Additionally, ranchers will rotate grazing to a pasture to control certain weed species. In the survey, only 11 percent of the respondents used the control of weeds as a criteria for rotating livestock although many have treated much of their land in the past 10 years.

Many livestock managers have recognized that the consumption of free choice supplement can indicate when the quality and quantity of available forage in a pasture has declined. Others may rotate livestock to a pasture because they can supplement there. Of the respondents answering this question, 16 percent indicated that they use livestock supplementation as a criteria to decide when to rotate livestock. In addition, rotating livestock has been a tool used to break the cycle of some parasites that require the animal as a host or intermediate host. In the survey, it was found that 8 percent of the respondents use livestock parasite reduction as a criteria for deciding to rotate live-

stock. A similar tactic has been used for reducing livestock predator losses. Rotating livestock to a new pasture or distant pasture has been shown to be a practical method to avoid some losses due to predators for a short period. Approximately 7 percent of the survey respondents answered that they use livestock predator losses to decide when to rotate.

Providing livestock with shelter has been a management tool in many areas of Texas. In some cases animals may be rotated to pastures which provide shade in the form of woody plants during the summer heat, or provide barriers from approaching cold fronts and winds, or provide protection from rain, such as for shorn sheep or goats in late winter/early spring. From this survey, it was found that 15 percent of the respondents may decide to rotate livestock from shelter reasons. In addition, a decision may be made to rotate during lambing, kidding and calving season. Many times animals may be rotated to new pastures to place livestock in closer proximity to the ranch headquarters or other facilities for easy access by management to assist with the birthing process, ear tagging, matching pairs and for supplemental feeding. A total of 13 percent of the respondents indicated that they may rotate for this criteria.

In much of the Central Texas sheep and goat production area, certain weeds produce fruit or other plant parts which can contaminate and lower the salability of wool and mohair. Only 3 percent of the respondents noted that they rotate livestock because of a wool or mohair contamination criteria.

From the survey, it was found that 4 percent of the respondents may use labor availability as a criteria for rotating livestock. A total of 12 percent may use the on-ranch hunting program as criteria for rotating livestock. Only 2 percent made use of agency/consultant recommendations in deciding to rotate livestock. To manage the forage base, improve livestock performance and meet the needs for rotation as cited above, range managers have used many grazing programs.

Many different grazing programs have been used in Texas over the years (Figure 9). Because of the detrimental effects of heavy year-long continuous grazing on the forage base some kind of rotational grazing has been recommended through range management education. Year-long continuous grazing at a light to moderate stocking rate has been used by many ranchers successfully. When asked about grazing programs used in the last 10 years, the largest response (37 percent) had used year-long continuous grazing. Many researchers have felt that decisional rotation or the unplanned rotation of multiple herds and pastures was the most frequently used grazing program. From the survey, 18 percent of the respondents stated they had used decisional rotation in the last 10 years. With the recent introduction of short duration grazing in the late 1970's, only 3 percent of the respondents had used this grazing management program in the last 10 years.

Besides year-long continuous grazing programs, the most used grazing management programs have been the one herd grazing two pastures in rotation (Switchback) (21 percent) and rotational grazing programs (21 percent). Other systems have been used at a lower degree as follows (in order of use): seasonal continuous (17 percent), deferred rotation (6 percent), one herd grazing five to seven pastures in rotation (HILF) (4 percent), and the Merrill system or three herds grazing four pastures in rotation (3 percent). Of major interest is the lack of use of the Merrill system as research has consistently shown that this program provides a good tool for long-term range improvement if proper stocking rates are used.

When we examine the responses for current grazing programs being used, year-long continuous grazing is being used by 21 percent of the respondents. Decisional rotation is being used by 19 percent of the respondents, consistent with those used over the last 10 years. The switchback (18 percent) and rotational grazing (20 percent) are still being used extensively, down only a percent or two from the past 10 years. Seasonal continuous is used by 14 percent of the respondents while deferred rotation (5 percent), Merrill system (3 percent), HILF (4 percent) and short duration (one

herd grazing eight or more pastures) (3 percent) are used less.

There is a trend in Texas for fewer ranchers to use a continuous grazing program. Many respondents are apparently trying the one herd concept but have not developed pasture numbers to reach the levels of 7, 8, 16 or more pastures necessary for short duration grazing. This may be due to the high costs for fencing and new water development and/or skepticism toward published unresearched claims.

Survey respondents were asked to indicate a level of satisfaction for grazing programs they have used in the past 10 years (Figure 10). The year-long continuous grazing program showed the lowest level of satisfaction (2 percent) of any of the nine grazing programs identified. However, this grazing program continues to be the most used grazing program.

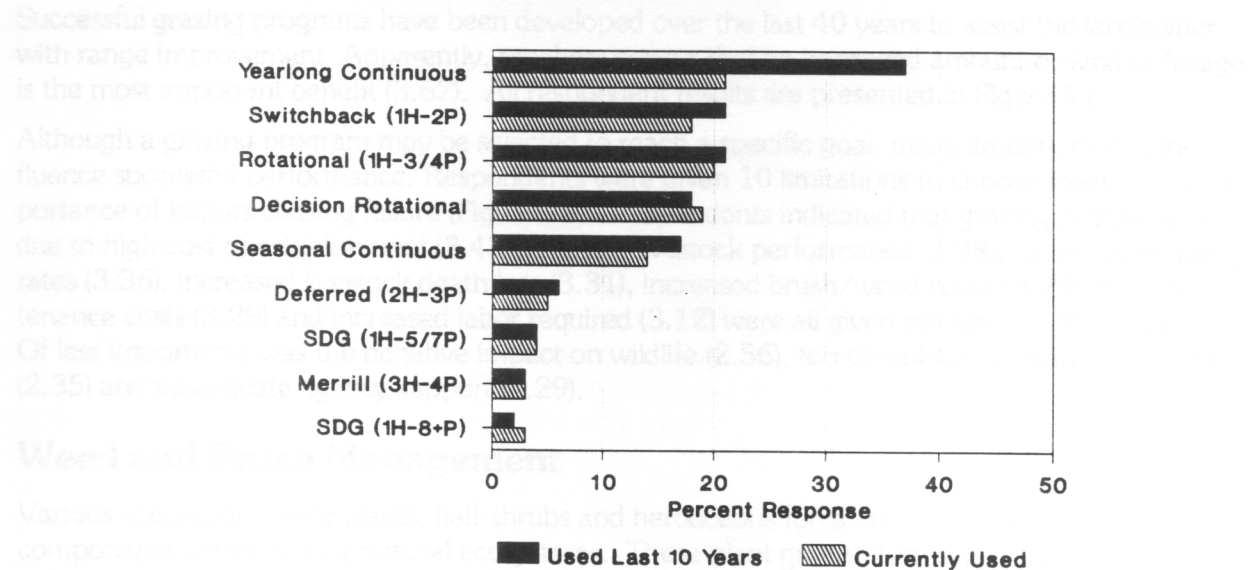


Figure 9. Types of grazing programs used (current and last 10 years)

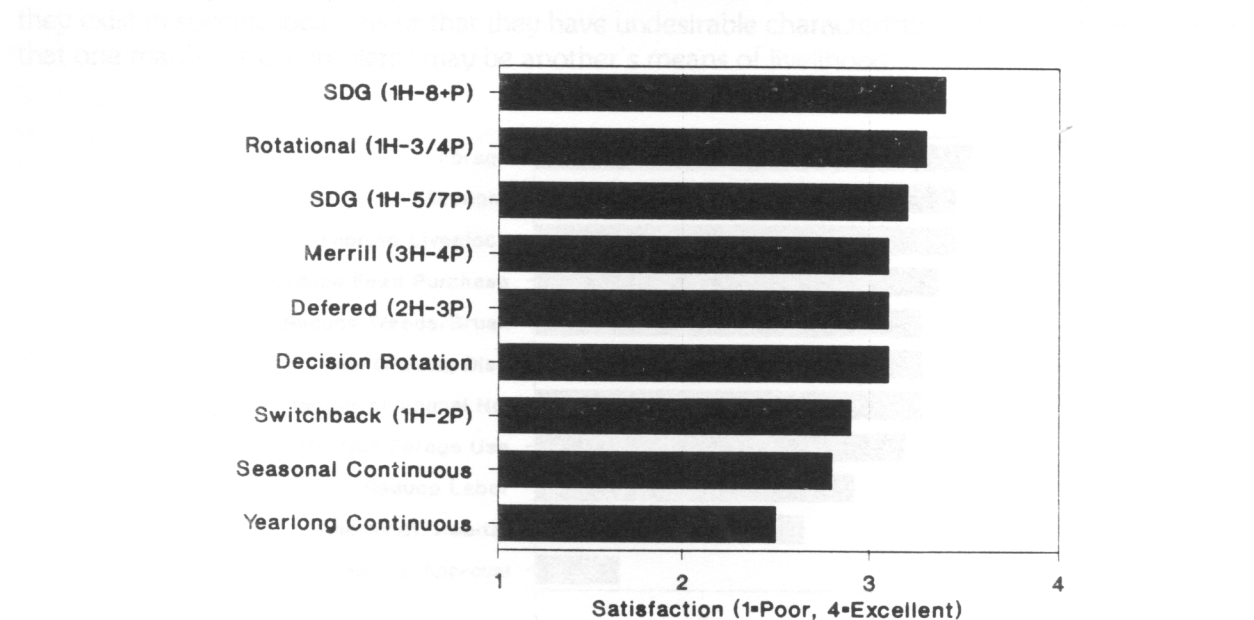


Figure 10. Level of satisfaction of ranchers using a grazing program.

Grazing programs receiving a satisfaction rating of 3.00 or greater included short duration grazing (eight or more pastures) (rating = 3.40), rotational grazing (3.30), short duration (five to seven pastures) (rating = 3.17), decisional rotation (3.14), Merrill (3.11) and deferred rotation (3.11).

All benefits received relatively high ratings (3.00 or greater) with the exception of reduced labor (2.88), improved wildlife habitat (2.56) and obtaining other people's approval (1.48). Respondents were given a series of benefits to rate their importance for the successful performance of a grazing program (Figure 11). The goal(s) and immediate needs of the landowner greatly influence the importance ratings. For instance, the importance of improved wildlife habitat may only be important to those who have a goal toward wildlife. Improved wildlife habitat was identified by 20 percent of the respondents as not an important benefit, while 23 percent stated it was a very important benefit.

Successful grazing programs have been developed over the last 40 years to assist the landowner with range improvement. Apparently, ranchers concur that an improved amount or kind of forage is the most important benefit (3.62). All respondent results are presented in Figure 11.

Although a grazing program may be selected to reach a specific goal, many limitations can influence successful performance. Respondents were given 10 limitations to choose from to rate importance of factors causing failure (Figure 12). Respondents indicated that grazing programs fail due to high cost of establishment (3.43), reduced livestock performance (3.38), excessive stocking rates (3.36), increased livestock death loss (3.31), increased brush/weed cover (3.29), high maintenance costs (3.29) and increased labor required (3.12) were all given ratings of 3.00 or greater. Of less importance was the negative impact on wildlife (2.56), too complex/too many questions (2.35) and inadequate agency support (2.29).

## Weed and Brush Management

Various species of woody plants, half-shrubs and herbaceous forbs are, or can be, major vegetation components of nearly all terrestrial ecosystems. These plant growth forms are adapted to a wide range of ecological conditions. This adaptability, resilience and ability to persist or increase in the face of adversity make them "problems" where man perceives them to be too numerous, where they exist in specific locations or that they have undesirable characteristics. It is well to remember that one man's "brush problem" may be another's means of livelihood.

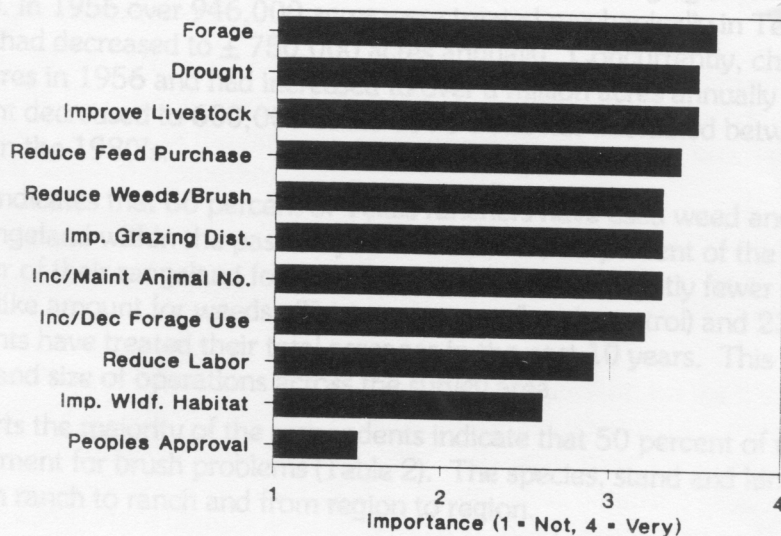
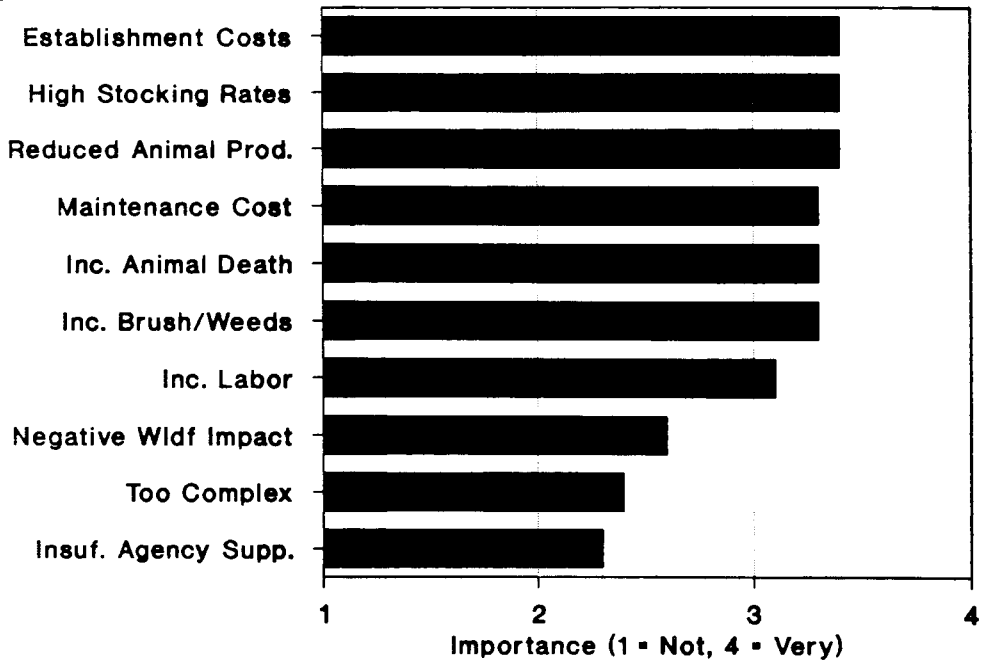


Figure 11. Importance of selected benefits for successful grazing programs.



*Figure 12. Importance of limitations when grazing programs fail.*

Brush management is thus a range improvement option designed to increase rangeland benefits by either increasing or decreasing densities, species composition, height, accessibility, etc. of the brush component. Eighty-seven percent of Texas rangelands support stands of one or more species of brush. In spite of the large percentage of the area supporting brush, the stands are often sparse and/or scattered and are not considered a problem. The 1982 National Resource Inventory reported that 32 percent of the brushlands in Texas required treatments for improvement to occur, and 13.6 percent needs additional forage re-establishment efforts.

The major brush management technologies can be categorized into mechanical, chemical, biological and fire. Each category has its supporters and critics. Technologies have changed through time with research and education activities, public attitudes, environmental concerns and changing economic scenarios.

Records of acres treated for brush and weed problems indicate the changing attitudes toward various technologies. In 1956 over 946,000 acres were treated mechanically in Texas. In the 1980's this amount had decreased to  $\pm$  750,000 acres annually. Concurrently, chemicals were used on 148,000 acres in 1956 and had increased to over a million acres annually in the mid-1960's. This amount decreased to 600,000 in the 1970's and has fluctuated between 1,000,000 and 650,000 acres in the 1980's.

The present survey indicates that 66 percent of Texas ranchers have used weed and brush control practices on their rangeland within the past 10 years. However, 57 percent of the ranchers have treated only a quarter of their rangeland for brush species (Table 1). Slightly fewer ranchers (47 percent) have treated a like amount for weeds. Thirteen percent (brush control) and 23 percent (weed control) of respondents have treated their total acreages in the past 10 years. This may reflect regional differences and size of operations across the survey area.

In spite of these efforts the majority of the respondents indicate that 50 percent of their rangeland presently needs treatment for brush problems (Table 2). The species, stand and kind of practice needed will vary from ranch to ranch and from region to region.

Table 1. Percentage of rangeland treated for weeds and brush one or more times in the past 10 years (percent of respondents).

Treatment(s)	% of Rangeland Treated			
	25%	50%	75%	100%
Brush	57	23	7	13
Weed	47	21	9	23

Table 2. Percentage of rangeland needing weed and brush treatments at the present time (percent of respondents).

Treatment(s)	% of Rangeland Needing Treatment			
	25%	50%	75%	100%
Brush	48	32	10	10
Weed	50	27	9	14

Texas ranchers have definite opinions concerning the impact of weed and brush management practices on various aspects of their operations. The survey indicated that weed and brush management had the greatest impact upon forage production (Figure 12). A total of 88 percent of the respondents indicated that weed and brush management increases their forage production. Only 1 percent indicated a decrease in forage.

Livestock production is closely related to forage production and is usually a major objective in weed and brush control efforts. Texas ranchers ranked livestock production as being positively impacted by these practices (Figure 13). Production was increased for 77 percent of the respondents whereas 21 percent indicated no effect and 2 percent showed a decrease in production. Weed and brush invasion is blamed for decreasing stocking rates by 28 percent of Texas ranchers (Figure 5). Conversely, 69 percent of the ranchers surveyed said that their stocking rates increased as a result of weed and brush management (Figure 6).

Undesirable plant species also affect grazing programs. The majority of ranchers (84 percent) feel that an important benefit for grazing programs to perform successfully is reduced weed and/or brush cover. Eighty-four percent of the ranchers also believe that increased brush cover is an important factor contributing to grazing program failure.

Profitability from brush and weed control is increased according to 71 percent of the respondents. This is a reflection of increased production by livestock and desired forages. Surprisingly, Texas ranchers view brush management as being largely neutral in regards to wildlife production and labor requirement.

The impact of other ranch operations, particularly grazing management, on the success of weed and brush control practices is generally viewed as being important (Figure 14). Most ranchers (97 percent) realize that proper stocking rates are necessary. Likewise, most view the use of a grazing program (84 percent), destocking during drought (82 percent), and deferring grazing after brush control (73 percent) are important components of brush and weed management. Deferring grazing prior to control and the use of goats were not important considerations.

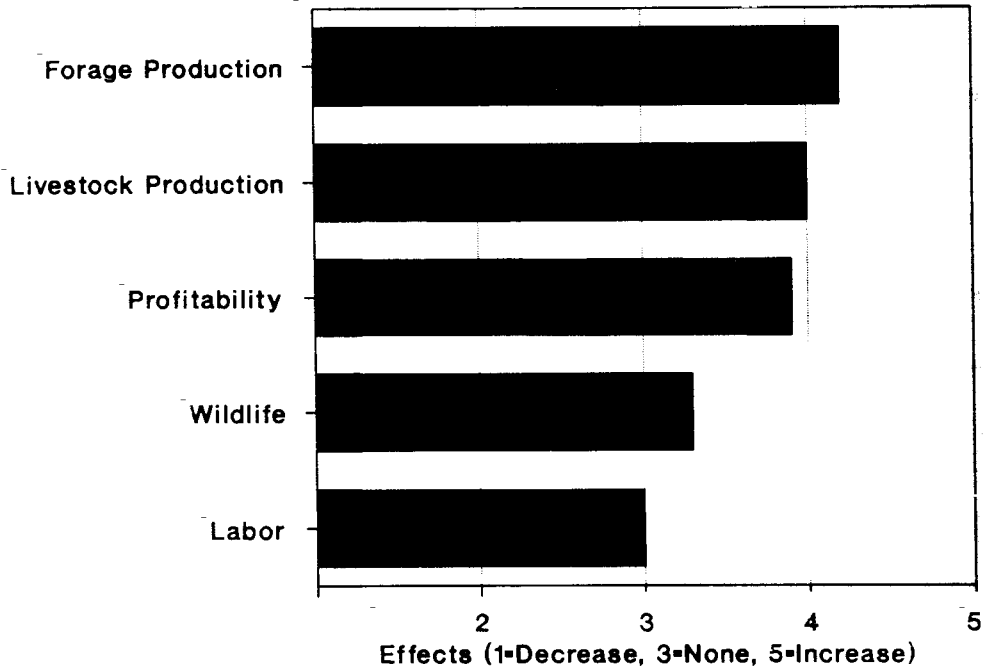


Figure 13. The effects of weed and brush management practices on ranch resources.

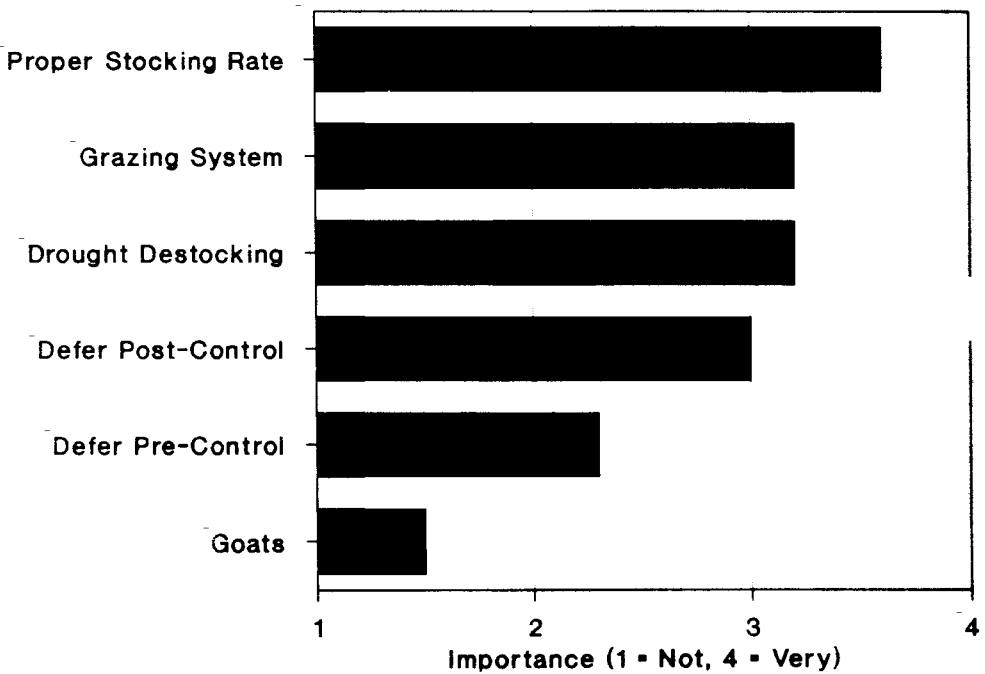


Figure 14. The importance of grazing management to the success of brush management programs.

### Weed and Brush Management Practices Used

A wide variety of methods and technology are available to Texas ranchers. The survey shows that most are being used by segments of the population with varying levels of success. Table 3 shows

the percentage of use/non-use by respondents over the state. Additional analysis is needed to identify regional differences.

The use of herbicides vary according to method of application and necessary equipment. Approximately one-third of the ranchers use aerial foliar applied herbicides, whereas one-half use broadcast foliar herbicides applied with ground equipment (Table 3). Few use broadcast soil applied herbicides. Close to half (41 percent) use basal applied chemicals for individual plant treatments, and fewer use high volume foliar (23 percent) and soil applied herbicides (26 percent).

Table 3. Respondents use of available technologies.

	Not Used	Used
<i>Aerially Broadcast Application</i>		
Foliar Applied Herbicides	69	31
Soil Applied Herbicides	84	16
<i>Ground Broadcast Applications</i>		
Foliar Applied Herbicides	54	46
Soil Applied Herbicides	75	25
<i>Individual Plant Applications</i>		
Basal Applied Herbicides	59	41
Soil Applied Herbicides	74	26
High Volume Foliar Applications	77	23
<i>Mechanical Treatments</i>		
Shredding	34	66
Roller Chopping	89	11
Grubbing	58	42
Discing	62	38
Chaining	82	18
Root Plowing	63	37
Dozing	52	48
<i>Prescribed Fire</i>	74	26
<i>Grazing Goats</i>	82	18
<i>Grazing Sheep</i>	88	12

The most popular mechanical method is shredding (66 percent). Dozing (48 percent), grubbing (42 percent), discing (38 percent), and root-plowing (37 percent) follow in order of use. Three-fourths of Texas ranchers do not use prescribed burning as a brush management tool. Likewise, 82 percent do not use goats and 88 percent do not use sheep in their programs.

In general, ranchers that used a method ranked it as successful weed and brush control (Table 4.) However, 69 percent of those using aerial broadcast foliar herbicides rated the method as being successful to very successful, while 31 percent rated the technology as not successful.



Table 4. Percentage of respondent success with available brush treatments.

	Not Successful		Very Successful	
	1	2	3	4
<i>Aerially Broadcast Application</i>				
Foliar Applied Herbicides	8	23	47	22
Soil Applied Herbicides	8	19	50	23
<i>Ground Broadcast Applications</i>				
Foliar Applied Herbicides	4	12	54	30
Soil Applied Herbicides	9	21	46	24
<i>Individual Plant Applications</i>				
Basal Applied Herbicides	6	16	50	28
Soil Applied Herbicides	8	24	48	20
High Volume Foliar Applications	4	16	51	29
<i>Mechanical Treatments</i>				
Shredding	7	24	48	21
Roller Chopping	17	29	35	19
Grubbing	7	13	48	32
Discing	11	25	47	17
Chaining	21	24	41	14
Root Plowing	5	11	46	38
Dozing	7	18	46	29
Prescribed Fire	6	19	51	24
Grazing Goats	6	18	49	27
Grazing Sheep	8	27	43	22

The perception of lack of success will certainly influence future use of the method. Also, personal experience and word-of-mouth communication will have an affect on perceptions and use of the technology. As a result there is a tendency by some to change methods or at least change the level of use in the future (Table 5). Those using herbicides indicated that more herbicide (65 percent) is planned for the future. Costs and returns were the dominant reasons for this trend. However, 18 percent said they will not use herbicides in the future and cited safety, high costs, low returns and environmental concerns as reasons.

Users of mechanical methods indicate that the majority (79 percent) will continue to use more mechanical techniques in the future. Again, their perception of costs-returns were reasons for this trend. Those indicating less or no use also cited higher costs for altering their use of these methods.

Users and non-users of prescribed fire were evenly split on more, less or no use in the future. Returns were the reason for increased use while safety was the major factor for decreased or no use.

Sixty-eight percent of the ranchers indicated that they do not plan to use sheep or goats in the future. High costs and low returns were factors for this decision. On-the-other hand, those ranchers planning to use more sheep and goats (27 percent) indicated returns as the major reason.

Table 5. Plans to change technology in the future and why?

		<b>Safety</b>	<b>Costs</b>	<b>Returns</b>	<b>Environmental</b>
Chemicals	more - 65%	5	12	78	5
	less - 17%	9	29	17	45
	none - 18%	18	31	22	29
Mechanical	more - 79%	6	21	56	17
	less - 11%	2	53	40	5
	none - 10%	1	57	29	9
Prescribed fire	more - 46%	6	31	52	11
	less - 4%	50	0	21	28
	none - 50%	65	5	5	25
Sheep and goats	more - 27%	3	14	72	11
	less - 5%	0	20	64	15
	none - 68%	5	35	40	20

### *Decision-Making*

The decision process is usually based on a variety of factors. Ideally, the factors include goals and objectives, resource inventories, available options, economics, etc. Texas ranchers indicate that four major factors enter into their decisions to initiate a weed and brush management program (Figure 15). Forage quality and quantity are favored by 94 percent of the respondents. Most ranchers realize that weed and brush plant response and control success, as well as forage response, are affected by rainfall. Eighty-six percent of the respondents consider rainfall as very important.

Livestock management considerations are major factors to 86 percent of the ranchers surveyed. Costs of the treatment(s) and projected (and real) economic returns are major factors to 83 percent of those surveyed.

Most of the other factors were rated as important but were ranked lower. Wildlife management considerations were ranked as neutral.

Once the decision is made to initiate a program then the various available technologies need to be studied in order to make decisions on which treatment(s) to use. When, where and how much need to be determined.

Plant composition, size, height, density, etc. were ranked as the major considerations by 93 percent of the respondents (Figure 16). A close second was treatment costs (92 percent). Rising costs of chemicals and mechanical methods are major considerations for ranchers. Projected and real economic returns are important to 86 percent of those surveyed. Most of the other factors were considered as slightly important but largely are considered as neutral in the decision process.

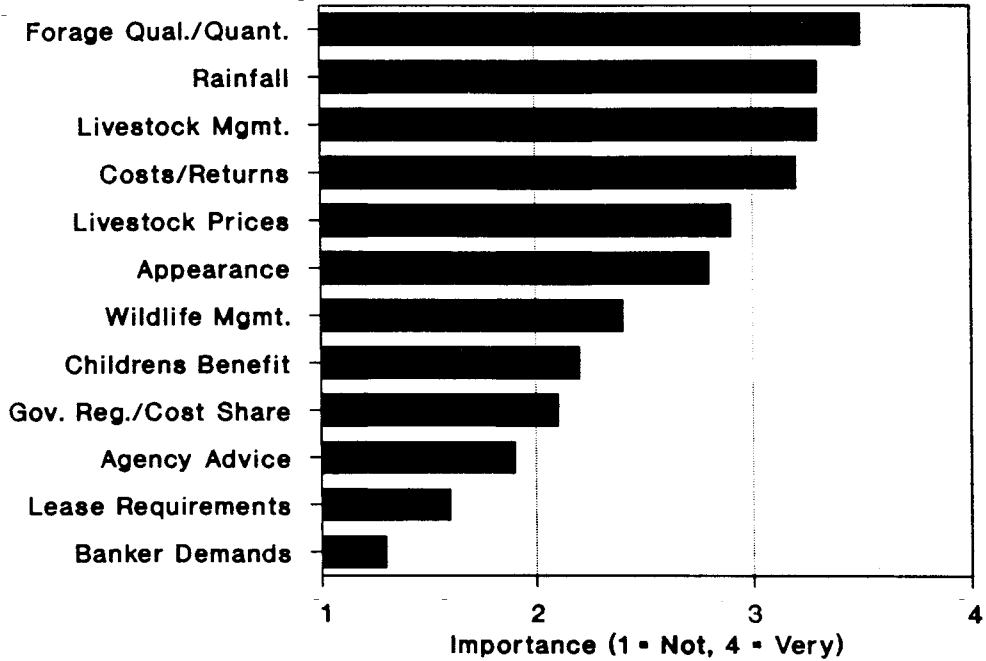


Figure 15. The importance of factors in decisions to control weeds and brush.

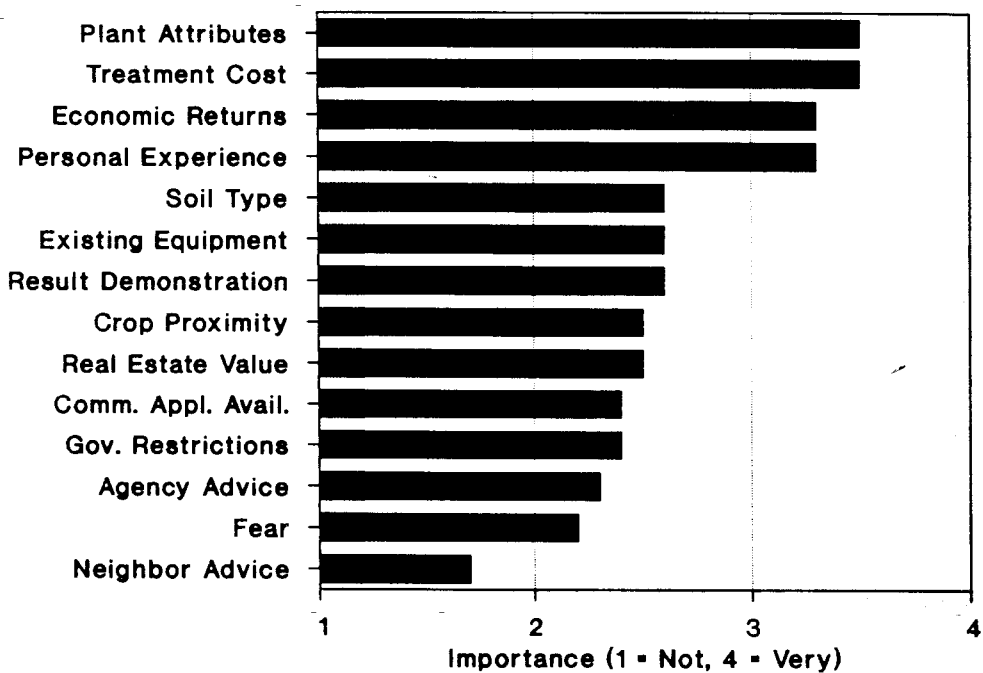


Figure 16. The importance of factors in decisions concerning weed and brush control techniques.

# Summary and Conclusions

The results of the respondent survey indicate a number of problems we believe that limit the success and survivability of Texas rangeland ranches. These are discussed below.

## **Problem**

Fifty-two percent of ranchers in Texas operate less than 640 acres of rangeland, while 70 percent operate less than 2,155 acres. Rangelands greater than 10,000 acres are operated on less than 15 percent of the ranches. In addition, 45 percent of the average family income is obtained from off-ranch employment and investments.

## *Impact*

High cost of land and inefficiency of scale of operation concerning production cost often result in attempts to maximize stocking rates with few grazing management decisions. In addition, range resource carrying capacity is usually grossly overestimated resulting in rapid depletion of forage resources, dependence on feed purchases and ultimate range deterioration as well as a drain on family income.

## *Recommendation*

Everyone is concerned about the environment. Small landowners need to be motivated to apply good conservation ethics to their rangelands. In addition, current and future small rangeland owners need information concerning the realities of carrying capacity and production costs and returns. To enjoy a ranching lifestyle on small acreages will require outside resources, therefore the range can be conservatively managed to produce a quality resource while providing some livestock and wildlife production. Range professionals should develop a recognition program with publicity and awards for outstanding range management for small landowners.

## **Problem**

Almost 50 percent of the ranchers surveyed obtain all or part of their rangeland grazing from leased land. Of those leasing, 75 percent or greater have contracts that are short-term (five years or less); the lease costs are determined on a per acre basis; and leases include no stocking rate limitations.

## *Impact*

The above factors tend to promote deterioration of range resources due to excessive stocking rates and non-flexible stocking rate decisions. Also, this may be a major factor in determining the type of grazing program, i.e. continuous verses rotational.

## *Recommendation*

Lessors must be advised and encouraged to use lease contracts that are long-term, charge on a per animal unit basis and include provisions that allow the seasonal adjustment and limitation of live-stock numbers. Rotation of livestock should be encouraged, if not required in the lease contract. With long-term leases, range improvement would benefit the current lessee as well as the land-owner.

## **Problem**

Less than 20 percent of the ranchers surveyed use quantifiable techniques to monitor the impact of their grazing management/stocking rate decisions on the range resources.

### *Impact*

Most Texas ranchers have no objective, accurate measurement or record of the past or current range condition and trend. Therefore it is impossible for them to make necessary corrections in their grazing management programs.

### *Recommendation*

Ranchers must adopt at the minimum the use of permanent photopoints and/or exclosures evaluated on an annual basis to monitor range condition and trend. More adequate monitoring could include a combination of photopoints, vegetation transects and grazing exclosures evaluated seasonally. Periodic analysis should result in adoption of needed grazing management adjustments.

## **Problem**

Forty-five percent of the ranchers surveyed do not make seasonal adjustments in livestock numbers.

### *Impact*

Static livestock numbers result in inefficient harvest of rangeland vegetation, usually resulting in overuse of that resource, especially during drought.

### *Recommendation*

Ranchers must adopt the use of forage sampling techniques that allow the rapid determination of existing forage supplies, project future livestock demands and determine appropriate seasonal stocking rate. Ranchers must utilize the knowledge of precipitation probabilities and patterns, plant growth cycles, forage inventory procedures, balancing forage demand with forage supplies and flexible livestock marketing techniques.

## **Problem**

More ranchers have used and are continuing to use year-long continuous grazing than any other single grazing program even though rancher satisfaction with year-long continuous grazing was the lowest for all grazing programs.

### *Impact*

In many cases year-long continuous grazing reduces overall management flexibility while severely limiting improvement of range condition.

### *Recommendation*

The percentage of ranchers who have used year-long continuous grazing in the last 10 years has dropped considerably as compared to those presently using this form of grazing management, thus, some progress has been made educating ranchers to the benefits of more advanced grazing programs. Educational efforts should continue to promote the virtues of other grazing programs as compared to year-long continuous grazing.

## **Problem**

Although 66 percent of the respondents have treated weeds or brush in the past 10 years, half indicated that 27 percent of their rangeland needs weed control and 32 percent needs brush treatments at the present time.

### *Impact*

The continuing regrowth of brush and weed species requires constant maintenance. The survey reveals that ranchers realize the need for treatment but just over two-thirds have had programs in the last 10 years.

### *Recommendation*

The art of brush management must be taught to targeted audiences-large, small, absentee, etc. The value of maintenance methods must be stressed. This shows a continuing **need** for education.

## **Problem**

Although most ranchers indicate they will continue to use chemical and mechanical methods, there are concerns over cost/benefits and the environment.

### *Impact*

As costs rise and benefits fluctuate or remain level, and because of environmental and safety concerns, there will be a tendency not to treat or to postpone treatments. Previous benefits may be negated and range resources will deteriorate.

### *Recommendation*

Educational programs on planning and implementing integrated brush management systems must be intensified. Resource materials on environmental and safety considerations should be developed.