



Texas Agricultural Extension Service

The Texas A&M University System

How Much Forage Do You Have?

Larry D. White and Calvin Richardson

Forage production varies considerably depending on precipitation amount, season and past and present grazing management. Since production is not predictable, the current forage supply must be monitored and compared with the livestock forage requirements. For proper management of range resources, animal numbers must be balanced with current forage supply. Thus, forage supply information can be used to forecast a forage shortage or surplus and make needed stocking rate adjustments.

Forage surveys are often conducted by riding through various pastures to observe plant and animal conditions. Many ranchers have the experience to notice changes in forage quality and quantity, but more specific information can improve stocking rate decisions and help avoid

over-utilization. Over-utilization can result in range resource damage and a crisis situation with fewer livestock marketing alternatives.

This forage survey procedure is easy to use, and it provides unbiased estimates of the forage supply, requires minimum sampling time and provides specific information to improve grazing management decisions. The only materials required are a range site map (aerial photograph), a plot frame, vegetation shears, paper sacks, drying oven, camera, weigh scales, notepad (data sheet), pencil and calculator (with linear regression capabilities). Included is an example photoguide and forage survey with calculations. This insert can be removed and used in the field.

When Should Forage Supply Be Surveyed?

Forage supply should be monitored visually throughout the year; however, more detailed information may be required before important decisions are made. Since forage production is not predictable, forage surveys should be conducted at the end of the normal forage production cycles. This allows immediate estimation of how long the accumulated forage supply will last during expected non-growth periods. Late June-early July and late October-early November surveys are

recommended for range areas that normally receive spring and fall rains. For summer rainfall areas, the late October-early November survey would be conducted in September. In addition, due to increased forage disappearance during the winter (weathering), a March survey is recommended to evaluate the remaining days of grazing prior to regrowth. This can be critical if spring forage growth is late.

* Extension Range Specialist and Extension Assistant-Wildlife/Range, Texas Agricultural Extension Service, Uvalde and Corpus Christi, Texas respectively.

Seven Steps for Conducting a Forage Survey

1. Determine grazable acres per range site and pasture.

Using a recent aerial photograph and soil survey information, draw the pasture and range site boundaries and non-grazable areas, such as lakes, roads, homestead, inaccessible terrain and unproductive areas. It may be necessary to inspect each range site to estimate unproductive acreage including brush motts or thickets not observable on the aerial photograph. Determine total acres for each range site; then calculate grazable acreage by subtracting non-grazable acreage.

2. Locate representative areas in each range site.

Representative areas in each range site will be sampled to determine the forage supply. These areas should be representative of the average grazing use for the range site. Do not sample adjacent to bed grounds, water points, mineral/feeding locations, or areas that are seldom grazed.

3. Select appropriate plot size that matches the type of vegetation to be sampled (Table 1).

Construct the plot frame using 3/8" reinforcement rod (welded) with inside dimensions as shown in Table 1.

4. Develop a representative photoguide.

A photographic reference of known forage quantities for the various range sites on your ranch is used to improve estimation consistency between samples. The photoguide represents the variation of forage supply conditions that will be observed in the pastures. Approximately 10 photographs of known forage quantities arranged from the lowest to the highest quantity should be used (Figure 1).

In the representative range site areas, select plot locations that show different quantities and species mixtures. Place the plot frame over the vegetation to be photographed. The frame perimeter should be clearly visible in the photograph (i.e. pvc pipe was

used in the example photoguide). Only vegetation rooted in the plot should be sampled; therefore, separate vegetation into or out of the plot frame. Each photograph should indicate height, density and cover of vegetation. High contrast black and white photographs are recommended.

After photographing, make any notes you consider important. Then clip all the standing vegetation close to the soil surface within the plot frame. Do not include dead material on the ground. Place the sample in a properly labeled sack (pasture name, date, range site, and plot number) for oven drying and weighing. To calculate the actual pounds per acre of forage in the plot, oven dry each sample at 140° F for a minimum of 24 hours. Then determine dry weight (less sack weight) in grams or ounces. The pounds per acre equals grams or ounces per plot times the appropriate conversion factor shown in Table 1. Construct your photoguide with actual pounds per acre as shown in Figure 1.

5. Sample each representative area.

The forage survey on each representative area involves four basic steps: A) tossing the plot frame, B) estimating the forage quantity in the plot, C) determining the number of samples needed, and D) correcting estimates. In each representative area, walk in a selected direction and toss the plot frame every 10 paces. Avoid biasing where the frame hits. Samples should represent actual conditions for example, bare spots as well as different quantities of forage. Using the photoguide, estimate the amount of forage in each plot and record information.

Estimate 10 plots, then determine the number of samples needed for this range site. Based on the 10 estimates, calculate the average estimate and the range of estimates (maximum minus minimum estimate). Then divide the average estimate by the

Table 1. Suitable Plot Sizes for Most Rangelands and Associated Conversion Factors.

Vegetation Type	Plot Dimensions	Conversion Factor*	
		grams	ounces
Arid, less than 15" rainfall	39.4" x 39.4"	8.92	25.29
Semi-arid, 16 to 30" rainfall	27.8" x 27.8"	17.84	50.59
Humid, 31" or more rainfall	19.7" x 19.7"	35.64	101.05

* Measure harvested oven-dry sample weight (less sack weight) in grams or ounces and multiply by the conversion

range to determine the forage supply ratio. Using the chart in Table 2, determine the total number of samples required for this representative area. This is repeated for each range site. If the number of samples required is excessive, fewer samples can be used, but the estimated forage supply will be less reliable.

While conducting the survey, a minimum of 10 estimated plots per day are clipped to establish the relationship between actual and estimated forage supply. The clipped plots should represent the range of forage quantities that are estimated each day. Oven dry the clipped vegetation and determine actual pounds per acre of forage per plot as described in the photoguide section (step 4). The survey is best conducted with two people – an estimator and a recorder. To reduce estimator bias, the recorder determines which plots to clip without telling the estimator until estimates are recorded. With this forage survey method, consistency among estimates is more important than accuracy.

6. *Determine the forage supply.*

After completing the forage survey, calculate the average estimated pounds per acre of forage for each range site per pasture. During the forage survey, estimates were made for plots that were clipped. Summarize the data into two columns – estimate versus actual for each plot. The relationship between estimated and actual dry weight values will be used to correct the average estimated pounds per acre of forage for each range site per pasture. A statistical calculator (or computer) is required to develop a

linear regression. The equation resulting from this analysis is used to obtain the corrected average forage supply. See regression example in Table 2. The forage supply per range site per pasture is determined by multiplying the grazable acres by the corrected average pounds per acre of forage. Sum all range sites per pasture to determine the total pounds of forage per pasture.

7. *Determine stock unit days of grazing available.*

A stock unit is based on the metabolizable energy requirements (17.3 mega calories per day) for a 1,000 pound cow in the last third of pregnancy (Troxel and White, 1988). This requirement converts to a daily forage intake of 19.6 lbs. of 53.6 percent digestible forage. To calculate the stock unit days of grazing available, first multiply the total pounds of forage supply per pasture by 0.25. (The quantity of forage that can be eaten by livestock under proper management is approximately 25 percent of the total forage supply.) Divide this number by the pounds of forage required per day (19.6 lb) per stock unit to determine the number of stock unit days of grazing available.

The number of stock unit days of grazing available per pasture can be used to determine if the forage supply is adequate for the planned stocking rate until regrowth is expected. Determine the average number of stock units that you plan to graze during this period of time. Divide the planned number of stock units into the stock unit days of grazing available. This estimates the number of days this forage supply will last at this stocking rate.

Example Forage Survey

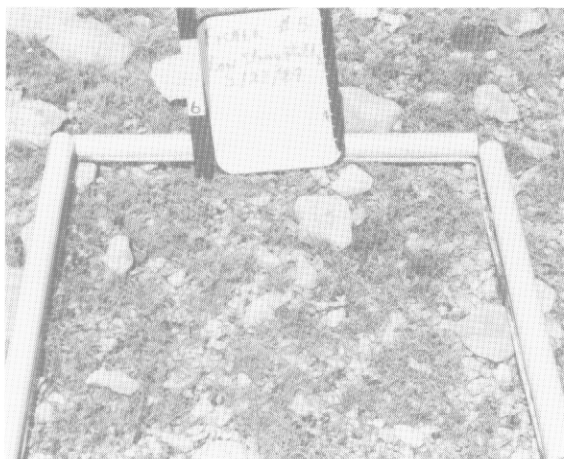
Application and interpretation of a forage survey can best be understood by using an example pasture. The pasture is 1,014 acres in size. Roads and gas pads and

nongrazable brush motts occupy approximately 5 percent of the Low Stony Hill and Shallow Divide range sites. Three range sites occur in the pasture (Table 3).

Table 3. Grazable acres in Dago pasture

Range Site	Total Area (acres)	Nongrazable Area (acres)	Grazable Area (acres)
Clay Loam	72	2	70
Low Stony Hill	666	33	633
Shallow Divide	276	14	262
Total	1,014	49	965

Figure 1. An example photoguide.



69 lb/ac
hairy tridens, red grama



212 lb/ac
buffalograss



416 lb/ac
buffalograss, curly mesquite



826 lb/ac
little bluestem, seep muhly, dropseed, sideoats grama



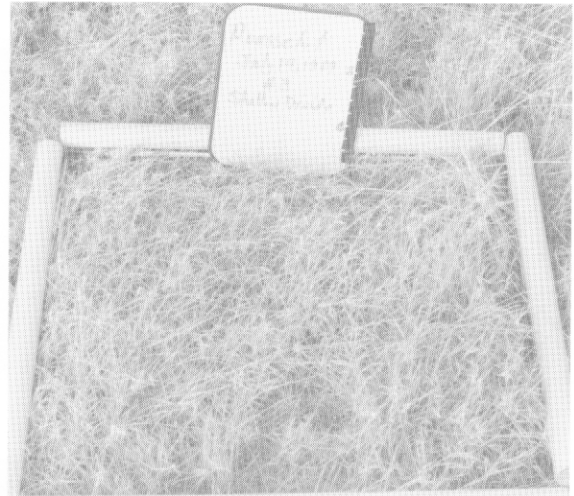
1090 lb/ac
threeawn, curly mesquite, Tx. wintergrass, doveweed



1247 lb/ac
Tx. wintergrass, dropseed



1484 lb/ac
sideoats grama, Tx. wintergrass



1756 lb/ac
curly mesquite, Tx. wintergrass



2264 lb/ac
curly mesquite, Tx. wintergrass, doveweed



2651 lb/ac
buffalograss, Tx. wintergrass



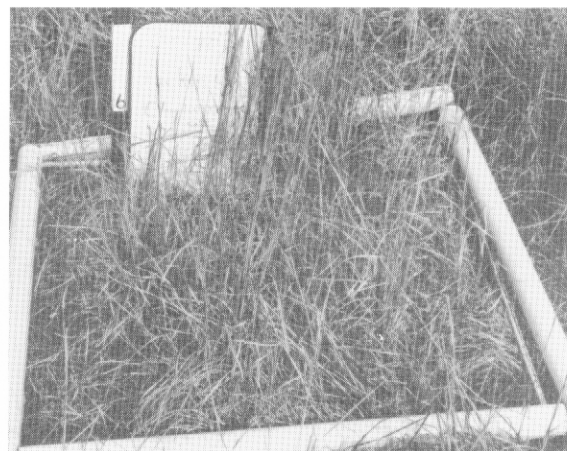
2806 lb/ac
sideoats grama, curly mesquite, Tx. grama, hails panicum



3001 lb/ac
curly mesquite, Tx. wintergrass (mesquite omitted)



3379 lb/ac
little bluestem, dropseed, sedge, anemone



3866 lb/ac
little bluestem, dropseed, sedge, anemone



4230 lb/ac
sideoats grama, Tx. wintergrass



4808 lb/ac
sideoats grama, Tx. wintergrass, white tridens



6936 lb/ac
kleingrass



7448 lb/ac
little bluestem, sedge, anemone

Table 2. An example forage supply survey on a shallow divide range site and calculation of results.

Pasture Dago
Range Site Shallow Divide

Date Sampled 07-12-89
Estimator Faris

Plot Conversion
Factor 17.84

Note: Circle plots that are clipped.

Plot Number	Estimated Weight (lbs/ac)	Dry Weight (grams/ounces)	Actual Weight (lbs/ac)	Remarks
1	1150			Location #1
②	350	27.8 grams	496	"
3	275			"
④	1800	69.7 grams	1243	"
⑤	700	68.7 grams	1226	"
6	1375			"
7	1675			"
8	1325			"
⑨	1100	48.3 grams	862	"
10	1725			"
⑪	2300	116.0 grams	2069	Location #2
12	700			"
13	600			"
⑭	2250	129.7 grams	2313	"
15	1150			"
⑮	175	13.5 grams	241	"
⑯	250	22.7 grams	405	"
18	425			"
⑰	3000	148.5 grams	2649	"
⑲	750	44.0 grams	785	"
Total	23075			
Average	1154			

Calculations

Number of Samples Required
Average of Plots 1-10 = 1147.5
Range of Plots 1-10 = 1800 - 275 = 1525
Forage Supply Ratio = 0.75
Ratio from chart below = 20 samples

Regression Equation

Estimate (X)	Clipped (Y)
350	496
1800	1243
700	1226
1100	862
2300	2069
2250	2313
175	241
250	405
3000	2649
750	785

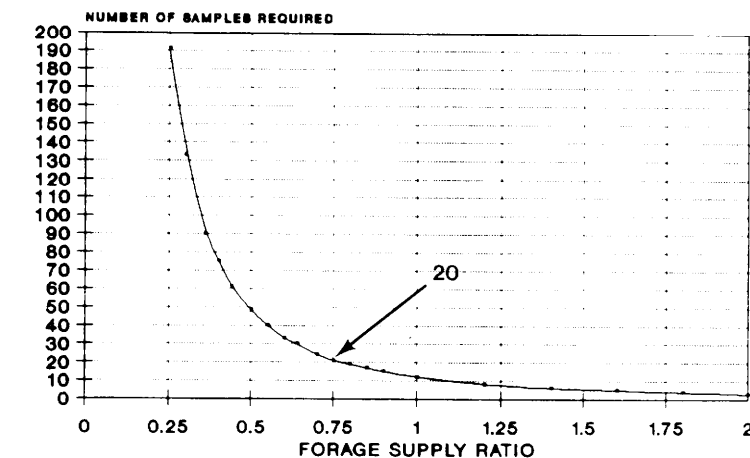
Regression results

R squared = 0.917
a = 203.8
b = 0.808791
Y = a + b (X)
Y = 203.8 + 0.8088 (avg. est.)

Corrected average forage supply

= 204 + 0.8088 (1154)
= 1137 lbs/acre

REQUIRED SAMPLE NUMBER FOR FORAGE SUPPLY SURVEY



FORAGE SUPPLY (F.S.) RATIO EQUALS
AVERAGE F.S. / MAX. - MIN. F.S.

A forage survey was conducted for each range site in July 1989. Details for the shallow divide site are shown

in Table 2. Results of the survey indicated the following amounts of forage by range site in the pasture:

Range Site	Grazable Area (acres)	Average Forage Supply (lb/ac)	Total Forage Supply (lb)
Clay Loam	70	1,372	96,040
Low Stony Hill	633	601	380,433
Shallow Divide	262	1,137*	297,894
Total			<u>774,367</u>

* See Table 2 for method of calculation.

Of the 774,367 pounds of forage only 25 percent can be eaten by livestock if the pasture is properly stocked. Hence, 193,592 pounds are available for grazing. The pasture is currently stocked at 25 acres per stock unit. How long will this forage supply last without additional forage growth?

To determine the number of days of grazing available, calculate the number of stock units in the pasture (1,014 acres/25 = 41). Determine the amount of forage required by the herd for each day (41 stock units x 19.6 pounds per stock unit per day = 803.6 lb/day). Divide the pounds available for grazing by the pounds required per day to determine how many days this forage supply

should last ($193,592/803.6 = 241$ days). Therefore, regrowth must occur within this period of time or the present herd will have to be removed from the pasture to prevent over-utilization.

If the rancher expected good regrowth by November 1 (111 days from July 12th), the stocking rate could be increased. However, surplus forage may be desirable for winter grazing. The increased number of stock units would be based on excess forage available [$193,592 - (803.6 \times 111 \text{ days}) = 140,392$ lbs. Divide the excess by the total amount required for 1 stock unit (111 days x 19.6) to determine the number of stock units that could be added ($140,392/2175.6 = 48$).

Conclusion

Using this forage survey procedure should help improve grazing management decisions and reduce range resource damage due to over-utilization. More timely destocking during drought will help keep plants healthy for future growth and provide cover for increased rainfall effectiveness with less soil erosion. Rather than waiting until the forage supply is gone, a forage supply survey will help forecast whether a change in stocking

rate is appropriate. This allows better planning to meet crisis situations.

Reference

Troxel, T.R. and L.D. White. 1988. Balancing forage demand with forage supply. Texas Agricultural Extension Service, B-1606, 7pp. College Station, Texas.

Acknowledgement

The authors wish to acknowledge John K. Finegan, Val Verde County rancher; Jim Willingham, Uvalde County rancher; Preston Faris, Sutton County Extension Agent; Tom Payton, Soil Conservation Service; Total Ranch Management Workshop participants; Dr.

Charles Taylor, Nick Garza and Dr. Keith Owens, Texas Agricultural Experiment Station for valuable suggestions, field testing, editorial comments and support for this effort.

Educational programs of the Texas Agricultural Extension Service are open to all people without regard to race, color, sex, disability, religion, age or national origin.

Issued in furtherance of Cooperative Extension Work in Agriculture and Home Economics, Acts of Congress of May 8, 1914, as amended, and June 30, 1914, in cooperation with the United States Department of Agriculture. Zerle L. Carpenter, Director, Texas Agricultural Extension Service, The Texas A&M University System.

5M-10-95, Reprint

RS