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FORESTLAND GRAZING

A GUIDE FOR SERVICE FORESTERS IN THE SOUTH



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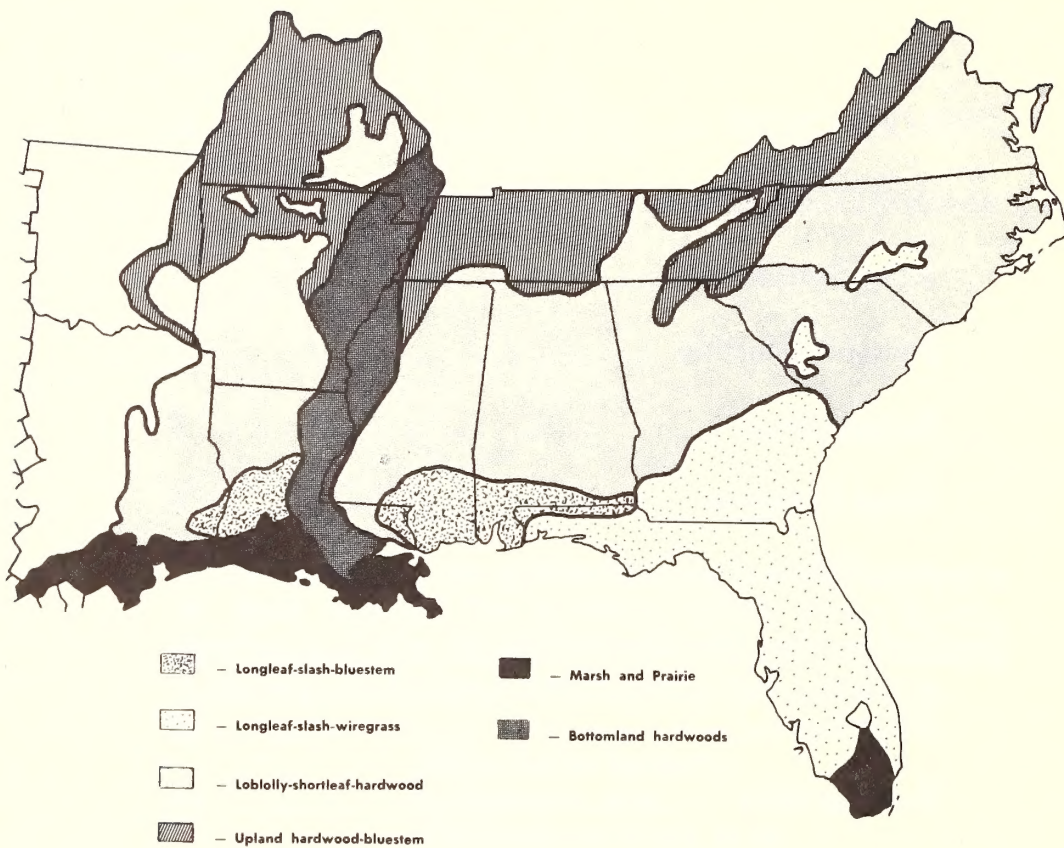
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Range Types of the South



INTRODUCTION

This handbook is designed to provide general guidelines for those who advise forest landowners on forest range grazing management. The emphasis is on management and use of forest forage for cattle in combination with other uses. For each location, and set of conditions, information unique to the area should be obtained to determine economic feasibility, compatibility with other resource management objectives and specific range management practices needed.



RESOURCE INVENTORY

DISCUSSION

Before giving any type of advice to private landowners, or attempting to work up forestland range management plans with them, there is the obvious necessity of measuring or estimating the resource that is available. This measure must include information on:

1. Size and shape of the range area. A picture of the land pattern — is it all one contiguous block, or long and narrow, or broken into intermingled patterns with lands of other ownerships? These considerations are all important to future livestock and management.
2. Suitability for grazing. How much of the area can be used by cattle? Is part of it an unusable swamp, or with an erosion condition that precludes grazing, too steep for cattle to use? You must arrive at a new figure of what there is available to be grazed.
3. Overstory and midstory vegetation. In most of the South, the kind, quantity and quality of the understory vegetation (which we are primarily concerned with in grazing cattle) will be determined by the trees and shrubs that are growing in association with it.
4. Existing range improvements. What is there available to use in the way of fences, water developments, corrals, pastures, etc.? This will have a great bearing on the economic feasibility.
5. Landowners' desires. What do the landowners want to do? Frequently an area of land can support a variety of activities; some can be better for the land

than others, or the financial rewards may be better with one use than another. Do the owners want to emphasize livestock use at the expense of other uses — do they want to raise a lot of game for commercial hunting — do they want to concentrate on timber production with livestock use being incidental? These are all questions that only the owners can decide and they frequently will be decided upon personal preference and desires, rather than dollars and cents, or land use capability.

6. Landowner access to technical help. Is qualified help available when needed?

Usually the forester will find it convenient to prepare a map and delineate unsuitable areas, overstory vegetation types, and existing range improvements. Other information pertinent to the area such as forage production, openings in the timber, fields or pastures that may be grazed in conjunction with the forested range, and points of access will also be needed.

RANGE SUITABILITY

The suitability of land for livestock grazing use is a major factor in determining grazing capacity and proper management of a unit. It is one of the most difficult items to define in the range inventory procedure, but one of the most important. It is frequently controversial and is dependent upon the knowledge and attitude of the examiner. This is the focal point of the examiner's knowledge of cattle and their habits, forests and forest forage relationships, soils and their characteristics.

Suitable range is defined as that area which is accessible to livestock, produces forage and can be grazed on a sustained yield basis under an intensive system of management without

causing damage to the range or other resource values. Generally, an area that is classed as unsuitable range will exhibit a permanent or semi-permanent condition that renders it unsuitable. For example, a swampy area not accessible to livestock would be classed as unsuitable for grazing — similarly, a dense stand of timber, so dense as to produce little or no forage, would also be classed as unsuitable. Some examples of items to be analyzed in determining suitability and suggested standards are:

1. Forage Production — An area should be producing at least 200 pounds (air-dry) of forage per acre to be classed as suitable range. With proper utilization, an animal would have difficulty in getting around and grazing enough to sustain itself on an area producing less than this.
2. Accessibility — An area must be accessible to livestock. Physical barriers to livestock movement such as brush, downtimber, dense timber, water or steep slopes render an area unsuitable for grazing.
3. Slope — Any slope over 20 percent can be considered as having reduced value as a grazing area; a slope over 30 percent should be classified as suitable only if other limiting factors are absent and a slope over 40 percent should be considered as unsuitable for grazing. Cattle can and do derive some grazing value from slopes in the 20 to 40 percent range, but will make little use of the slopes until the flatter, more accessible country is denuded of palatable vegetation and they are forced into the steeper country. Invariably, damage to the soils will result from attempting to secure proper utilization of 20 to 40 percent.

Occasionally, areas under a tree overstory will be encountered that do not meet the tests

for suitability, either through lack of forage production or because of accessibility. These can be changed to favor forage production if the landowner so desires — with no loss of timber production. Any kind of timber cut that removes part of the overstory will increase the amount and nutritive value of the grasses. Prescribed burning for rough reduction, or other purposes, will immediately increase the quality and quantity of the forage. Here again, it is up to the landowner and what he or she wants to put into it.

FORAGE PRODUCTION

Basic to any determination of the grazing potential of an area is an estimate of the amount of forage produced. This estimate of forage production is then converted into animal months of use to determine the number of cattle and the time-span of use that should be allowed on the area.

There are numerous methods of estimating forage production, but for our purposes we will be concerned with only the Ocular Weight-Estimate by Plot method. After some self-training, this method is rapid and gives satisfactory results. To develop proficiency, you must lay out, clip, and weigh several plots along a predetermined line. The number of plots to be clipped and weighed will depend upon the individual. After you develop skill in estimating the forage weight before clipping, within 20 percent of the actual amount, proceed over the range area, lay down the hoop in selected areas and estimate the forage produced within the hoop area.

Convert green weight to air-dry weight to derive usable production data. The moisture content of plants varies widely during the year — from 70 percent or more in the spring, when growing and succulent, down to almost zero during some of the winter months. Ideally, forage production estimates should be made during the late summer or fall, when the

forage has stopped growing and full production has been reached. During those months the moisture content can usually be assumed to be 40 percent, with a fair amount of accuracy — later in the year, the content will be less; earlier in the year, it will be more. The total forage weight, as clipped, is reduced by the percent moisture content to arrive at the air-dry weight for future calculations.

Determine the actual amount of moisture in the grasses by saving the grass clippings and storing them for several days. After about 10 days, weigh the clippings and weigh them again each day until no weight change is noted; then compare this actual air-dry weight with the green weight as recorded at the time of clipping. The air-dry weight, divided by the green weight, equals the percentage moisture content when clipped.

To apply this method, the following materials will be needed:

1. Hoop for defining circular plots of the desired size. These are made up in such sizes that the weight of the forage within the hoop, when measured in grams, will be directly convertible to pounds per acre. To accomplish this, use a 9.6 square-foot hoop. If used in transects of 10 plots, the total weight in grams for the 10 plots equals the pounds per acre of forage. When used singly, the grams per plot must be multiplied by 10 to arrive at the pounds per acre forage production. (For more, or less, than 10 plots, the average yield is multiplied by 10.)

These 9.6 square-foot, circular hoops are 42 inches in diameter, 131.95 inches in circumference. They may be made up of heavy wire, speedometer cable, steel rod, or other heavy materials.

2. Reliable spring scales graduated in grams.
3. Paper sacks to hold the grass clippings.

4. Grass clipping shears or pocket knife.

PRODUCTION TRANSECT LAYOUT

No attempt will be made to secure a statistically sound sample of the range area. The examiner must select the sites to be sampled. Confine each group of sample plots to a single cover type where possible and strive for mixture of sites: some of the best, some of the worst, and most in-between.

The transect line should run diagonally across a slope or type to give the best sample. Where it happens to cross an area previously designated as unsuitable, it should be discontinued and then picked up again on the other side.

The plot interval to be used will depend upon the size and uniformity of the type being sampled. Decide the direction of travel and then determine the approximate distance across the type from a map or aerial photo. Select a plot interval that will space the plots evenly across the type. Twenty plots per type are usually sufficient, except for very large types. As you gain proficiency you may be able to reduce this to a smaller number.

Measure the interval between the plots by pacing. See figure 1 for a diagrammatic sketch of plot layout.

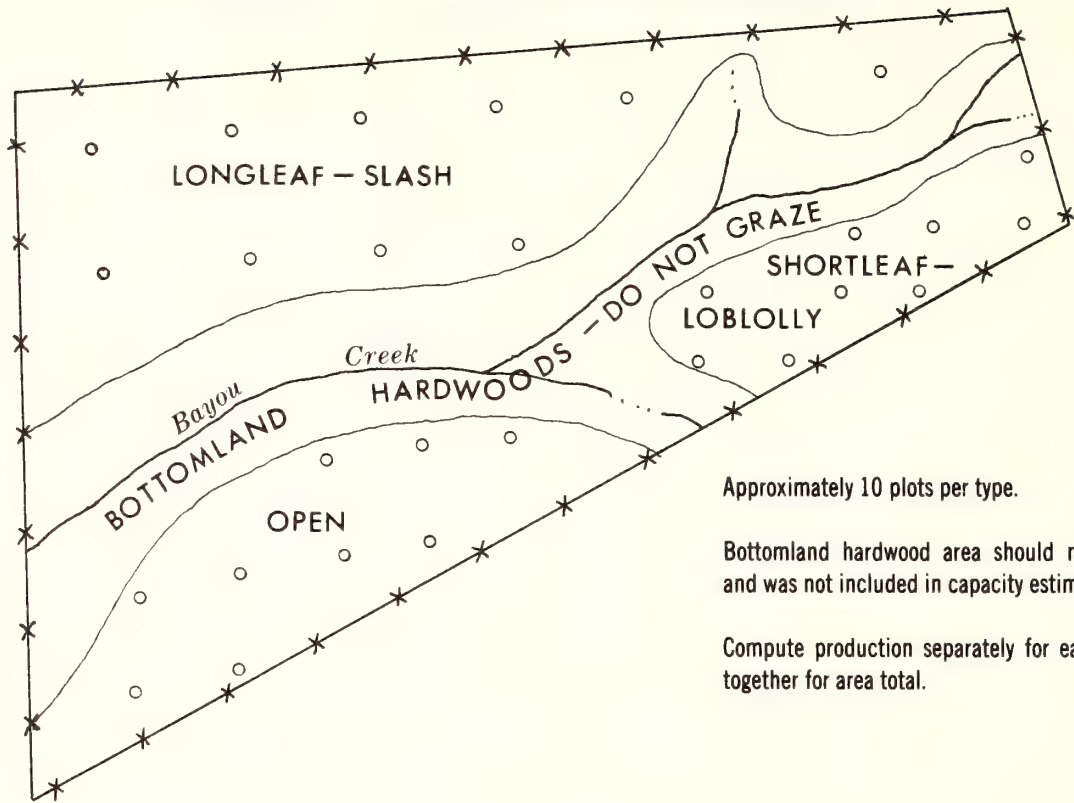
COLLECTION OF PLOT DATA

Forage production and utilization are determined in one operation.

Utilization. — Estimate and record the percent of forage utilization that has taken place on the plot. This should be done as a gross for all species.

Production. — During the training period, clip and weigh the forage on the plot, add to it the amount previously determined to have

Figure 1. — Production-utilization plot layout



been used, and reduce this figure by the moisture content to arrive at an air-dry weight. For a single plot, multiply by 10 to arrive at the pounds production per acre. In combining more than one plot, remember that the gram weight for each plot is equal to tenths of pounds per acre.

After a period of self training and a developed proficiency in estimating, the clipping and weighing may be discontinued. Proceed with ocular estimate alone with two daily checks by clipping to maintain your accuracy.

Here is an example of how the information from one vegetative type area might be recorded and the forage production for the type computed:

R. B. Jones Ranch, Shortleaf-Loblolly area southeast of Bayou Creek, 210 acres, 10/17/80.

Plot Number	Estimated Production (green) (grams)	Estimated Utilization (percent)
1	240	20
2	160	15
3	210	10
4	250	10
5	210	15
6	170	25
7	180	30
8	200	45
9	190	40
10	150	50
	<hr/>	
Total	1,960	Average 26.0

Computations: Multiply 1,960 grams by 60 percent (100-40 percent moisture content) = 1,176 air-dry grams for the 10 plots. Divide 1,176 by 10 (number of plots) = 118 average air-dry grams per plot. Multiply 118 by 10 (to convert to pounds per acre from grams per plot) = 1,180 average pounds per acre forage production observed. However, it is estimated the area has been grazed an average of 26 percent utilization (26 percent used, 74 percent unused), so the total forage production would be $1,180 \div 74$ pounds = 1,595 pounds per acre, rounded to 1,600 pounds per acre.

For use of the production data in the management of the range, see page 19.

FORAGE SPECIES

The South has many native grasses and grasslike species (about 885). However, as few as 20 make up the bulk of the annual forage yields. Some grasses are grazed throughout the year, others only when young and tender; still others are rarely grazed. Most livestock operators know that cattle are more selective in their choice of forage species than are sheep, while goats will eat almost any plant. This tendency of cattle to discriminate in their choice of forage species contributes to a major problem the livestock operator must cope with, in managing the forage resource. Cattle will seek out and use the most palatable plants first and very often overgraze them before starting to use their next choice. On a fresh burn in early spring, cattle will overgraze the lush and green first-growth when such areas are not large enough to meet the forage needs of the herd.

The livestock operator must be able to identify the more important range grasses, to estimate their percent of total ground cover and observe their response to grazing pressure for successful forage management. Because grasses are the most important of the forage plants in the South and grazing management

should principally be concerned with their culture and use, this discussion will not consider the forbs and browse plants.

GRASSES

More than 90 percent of the usable forage plants are grasses. For a grass to be recognized as a distinct species, it must have some characteristic feature or attribute which sets it apart from another species. Some grasses are so distinctly different in appearance, that you will have no difficulty in recognizing them on sight. Others may show little difference from close relatives and may require a close look with a hand lens to determine small differences. To distinguish these similar grasses from one another consult a manual or handbook applicable to your area.

A good guide to the characteristics of the grasses is, *Common Plants of Longleaf Pine — Bluestem Range* by Grelen and Duvall. It discusses minor variations of 55 of the grasses in this large area of the South. Excellent, detailed, drawings are included for many of the grasses. Copies are available on request from the Director, Southern Forest Experiment Station, T-10210 Federal Building, 701 Loyola Avenue, New Orleans, Louisiana 70113. Other publications that include range grass and forb information are USDA Agriculture Handbooks 356 and 389.

Seven genera of grasses in the South include upwards of 95 percent of the native forage species. These seven genera are the bluestems (*Andropogon* spp.), the panicums (*Panicum* spp.), paspalums (*Paspalum* spp.), dropseeds (*Sporobolus* spp.), three-awns (*Aristida* spp.), lovegrasses (*Eragrostis* spp.), and the Indiangrasses (*Sorghastrum* spp.). Other grasses are often locally important, but are not included in the aforementioned genera.

Once you are able to identify the general appearance of these seven genera when seed

heads have developed, you can be fairly sure that what you see is some kind of bluestem, panicum, three-awn, etc. See figures 2 to 8 for examples of these seven grass genera, which are fairly typical of the genus. Table 1 shows where you may expect to find 40 of the most important grasses of the South, their relative abundance, and their response to grazing and fire, when known.

RANGE CONDITION

The service forester must learn to recognize certain aspects of range condition and to discuss knowledgeably the reasons why a range might be said to be in "poor" or "good" condition. The condition of a range is usually judged upon gross visual impressions. The factors that enter into the judgement, as will be discussed, are mentally noted and a general impression formed; it is good, or it is bad. There are methods of measuring range condition that are used by administrators, but these would have little application in advising private landowners, and will not be discussed.

Range condition is the state of health of both soil and vegetation, and is based upon ecological relationships. Factors considered in the determination of range condition are the kinds and amounts of plant cover, plant vigor of desirable species and soil characteristics, particularly soil stability. Five condition classes are usually recognized in speaking of range condition: excellent, good, fair, poor, and very poor. An excellent condition designates little or no departure from the ecological potential. A very poor designation indicates extreme deterioration of the soil or vegetation.

INDICATORS OF RANGE CONDITION

On a range in good condition, you would expect to see:

- A predominance of desirable forage plants. They should be healthy and

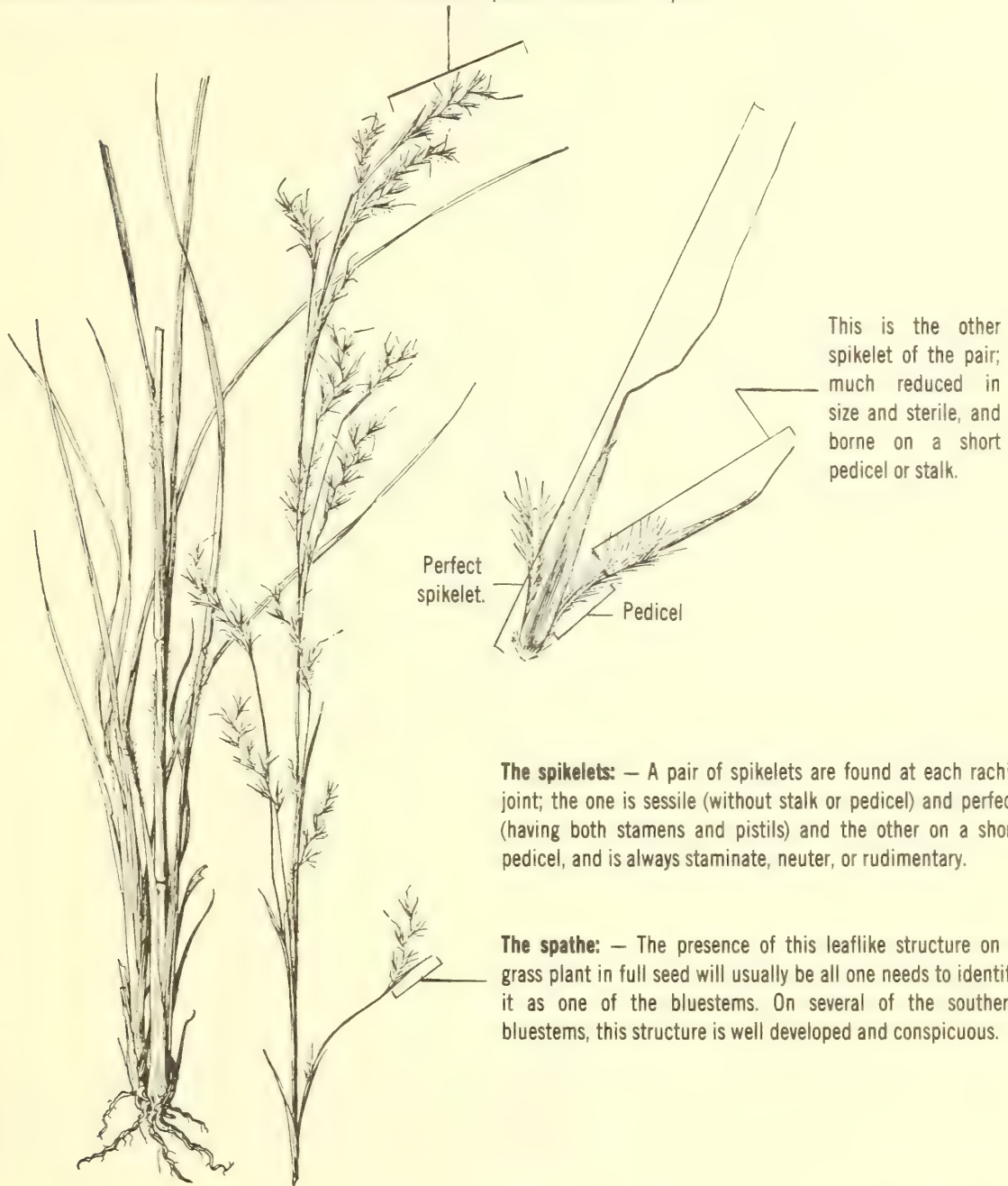
vigorous with many seed stalks, approaching maximum height and bulk and of good color. Weeds and undesirable forbs will be few or absent.

- Residue from previous years' growth should be plentiful and completely cover the soil surface that is not occupied by the live plants.
- There should be no exposed soil surface, and the soil should be easily permeable. A certain softness, from the mulch and uncompacted soil, will be felt when walking across it.
- Erosion will be generally absent, although deep gullies may persist from past abuse, with a good forage condition on the areas between.
- Soil compaction will be absent.

On a range in poor condition you would observe:

- A predominance of weeds and undesirable forbs and annual grasses. There may be perennial grasses of low palatability. Any good forage plants that may exist would form but a small part of the vegetation, and those plants would be stunted and of low vigor, have few or no seed stalks, and probably be heavily grazed. In some areas, an invasion of low value or worthless shrubby plants or trees will be occurring or have already occurred.
- Little or no residue remains from previous years' growth of plants.
- Bare soil areas probably will be interspersed between the plants. The soil may be compacted and slowly permeable. Runoff will be rapid. The area will feel hard and unyielding when you walk across it.

The raceme includes the rachis or stalk on which the several spikelets are borne in pairs.



This is the other spikelet of the pair; much reduced in size and sterile, and borne on a short pedicel or stalk.

Perfect spikelet.
Pedicel

The spikelets: — A pair of spikelets are found at each rachis joint; the one is sessile (without stalk or pedicel) and perfect (having both stamens and pistils) and the other on a short pedicel, and is always staminate, neuter, or rudimentary.

The spathe: — The presence of this leaflike structure on a grass plant in full seed will usually be all one needs to identify it as one of the bluestems. On several of the southern bluestems, this structure is well developed and conspicuous.

Figure 2. — Little bluestem (*Andropogon scoparius*). — The growth form and habit of little bluestem is typical of several of the southern members of the bluestem genus. Many of the differences of the several bluestem species are minor. All have the stalk or stem of the seedheads or raceme subtended by a modified leaf or spathe. The degree of pubescence and color with most of the bluestems is extremely variable. All bluestems are perennial grasses.



Winter rosette

All of the southern low panicums have winter rosettes and are much used by livestock at this time of year.

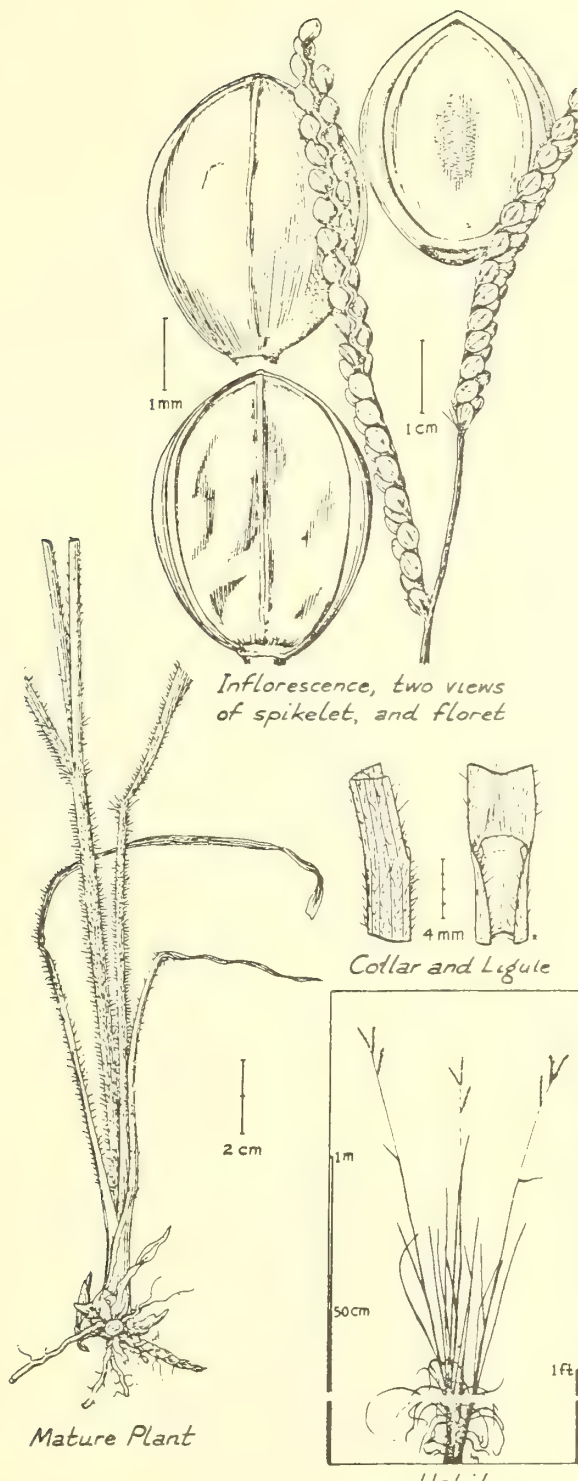


First seeds of season are borne on this early grown panicle.

The floret and two views of the spikelets of woolly panicum. There is much similarity of the spikelets among the panicums in that all glumes are nerved and rarely equal in length. The first glume is often not visible to the naked eye.

Fan-shaped branch of leafy growth harbors numerous small panicles of seeds developing in late summer, early fall and into the winter season.

Figure 3. — Woolly panicum (*Panicum lanuginosum*). — This species is fairly typical of the several southern panic grasses commonly grouped together as “low panicums.” They share three, rather distinct growth phases. The spring and early summer growth produces a seedhead on a stem that comes well out of the leafy growth below, and exhibits the typical panicle type of inflorescence shown in the illustration. By late summer and early fall, growth has developed from joints or nodes near the middle of the plant. Most of the seeds of the early growth have matured and dropped to the ground. New seedheads are borne from the leafy, fan-shaped branches, but these panicles rarely exceed the length of the numerous leaves. The winter rosette of leaves at ground level or only slightly above are usually much wider and completely dissimilar from the spring- and fall-grown leaves. They’re usually green throughout the winter. *Panicum* is an old Latin name for Millet.

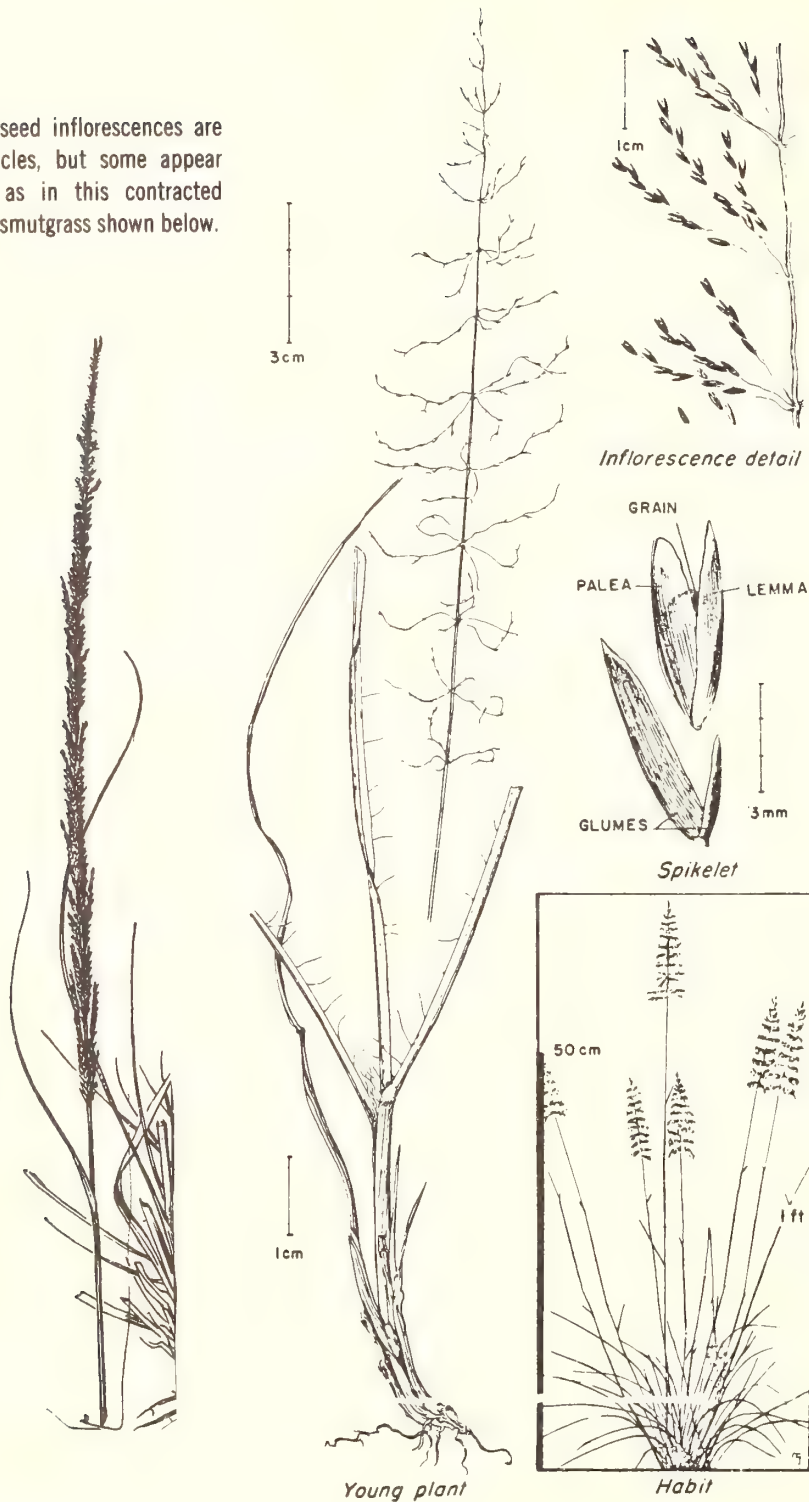


The number of racemes in paspalum vary from a single, as is often found on fringleaf paspalum, to a great many, as occur on Vasey-grass.

Except for a few species, the racemes of the paspalums are outwardly remarkably similar in appearance. The rachis of many, when devoid of seeds exhibits a zig-zag arrangement of the short stubs of stalks or pedicels which are retained on the rachis. Closely examine the naked rachis to see whether spikelets are arranged in two-rows or four-rows.

Figure 4. — Florida paspalum (*Paspalum floridanum*). — This grass is found throughout the South and East, and is typical of many of the paspalums. The South, being warm, is paspalum country, with over 30 distinct species and a number of varieties. Once you are familiar with its distinctive type of seedhead, paspalum is not likely to be confused with other grass genera. This genus includes some important introduced species, among which are dallis-grass (*Paspalum dilatatum*), bahia grass (*P. notatum*) and Vasey-grass (*P. urvillei*). All except two paspalums in the United States are perennials.

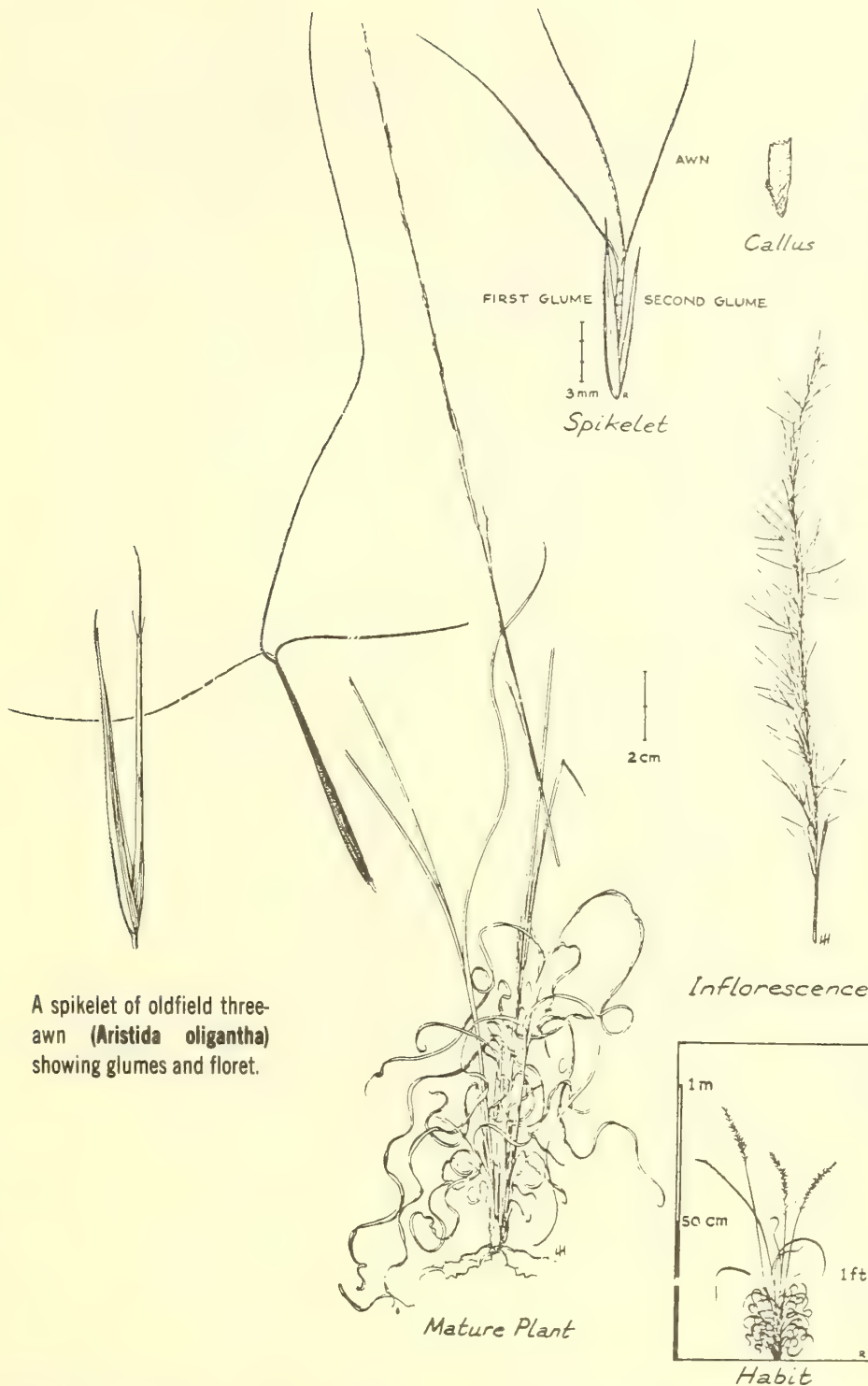
Most dropseed inflorescences are open panicles, but some appear spike-like as in this contracted panicle of smutgrass shown below.



Dropseed spikelets are always one-flowered, and usually small on an open or contracted panicle. Spikelets may show a great variation of size on the same plant.

Glumes of the dropseeds are always 1-nerved and usually unequal in length with the first glume being the shorter and the second glume commonly as long as the spikelet. Lemmas are also always 1-nerved and awnless.

Figure 5. — Pinewoods dropseed (*Sporobolus junceus*). — This is the most common of the dropseeds in the South having some forage value. When in full bloom it is a rather striking plant and easy to find among the other forage despite its usual small percentage of the total vegetation.



The floret in cross section appears round. Faint traces of nerves can be seen under magnification. Awns are usually present and the callus or lower end of floret is usually sharp and pointed. It is this part of the seed of some three-awns that penetrates clothing and oftentimes the mouths of sheep and cattle.

The lemma is distinctive in the three-awns, entirely enclosing the palea. This character is also true for the genus *Stipa*, but only one, *Stipa avenacea* is indigenous to the South and is rarely encountered.

Spikelets of the three-awns are always one-flowered and break off above the glumes with the floret falling free. The glumes may be either equal or unequal and are quite often persistent.

A spikelet of oldfield three-awn (*Aristida oligantha*) showing glumes and floret.

Figure 6. — Arrowfeather three-awn (*Aristida purpurascens*). — This is perhaps the most common three-awn grass in the South and, from the standpoint of spikelet structure, can be used as a basis to describe modifications found in other southern species of *Aristida*. The three-awns projecting from the lemma tip are generally characteristic of the genus.

The lemmas are most always sharp-pointed and 3-nerved with the 2-side nerves becoming very faint in some species.



The inflorescence is always a panicle but in some species is not open as is the one in this illustration. The common southern lovegrasses, which have some grazing value, all have open panicles.

This close overlapping of the lemmas in the lovegrass spikelet is typical for a great many of the lovegrass species. Note the large number of florets on the spikelet, which is also a common lovegrass feature.

The glumes are rarely of equal length and usually 1-nerved with the second glume sometimes 3-nerved.

Figure 7. — Stinkgrass (*Eragrostis cilianensis*). — This grass is of no value as a grazing plant; it is, in fact, a pernicious weed throughout most of the United States and was introduced here from Europe. It has been known to poison horses when eaten in large quantities. It is shown here because it is so well known to livestock producers, and because it shows so clearly some of the features of the lovegrasses, generally. It may serve to help identify others of the lovegrasses.



Slender indiagrass
(*Sorghastrum elliotii*)



Lopside indiagrass
(*Sorghastrum secundum*)



The awn of indiagrass is a projection of the lemma of the fertile spikelet. In mature plants, the awn is usually strongly twisted and bent.

Spikelets of indiagrass occur in pairs as do those of the bluestems but the imperfect spikelet in indiagrasses is reduced to only a hairy stalk or pedicel.

Figure 8. — Yellow indiagrass (*Sorghastrum nutans*). — This is one of the taller of the native grasses in the South. It ranks with big bluestem (*Andropogon gerardii*) in height and is closely related, botanically, to the bluestems. Three species of indiagrass find their range in the South and all are generally similar. Lopside indiagrass (*S. secundum*) is more common on the wiregrass ranges of Alabama, Georgia, and Florida than either of the other two species. All are excellent forage in season.

Table 1. — Some Common Range Grasses of the South

Species	Range and prevalence	Season of Most Use	Response to heavy grazing and prescribed burning	Palatability preference during season of most use		
				High	Med.	Low
Bluestems						
Pinehill bluestem	Florida to east Texas. Very common from west Ala. to east Texas	Early Spring, summer and fall — some all year.	Will maintain itself with burns every 3 years and 50-percent use.	X		
Elliott b.	Throughout Coastal Plains. Gets up into southern Ind., Ill. and Mo.	Grows with and used about the same as pinehill.	Will increase with burns more often than 3-year interval.		X	
Big b.	Scattered throughout Southeast. Never very abundant.	Early spring through July — Becomes coarse in fall.	Cannot take heavy use. Fire more frequent than once in 3 years will cause this grass to decrease in occurrence.	X		
Bushy b.	Common. Shows a marked preference for the sites with extra moisture.	February through May. Is only important on large marshy areas.	Rarely grazed out on site to which best adapted.			X
Little b.	Common in the west portion of the Piedmont and Okla. and Ark.	Apr. thru July. Some use made of this in winter. Cures well on the stem in Okla. and Ark.	Will thrive with use to as high as 50 percent. Yearly burns will kill it.	X		
Creeping b.	Very common from west Ala. to the east. Important in south Ga. and Fla.	Summer and early fall.	Stands up well to heavy grazing and burning. Outcompetes other bluestems under same grazing pressure.	X		
Slender b.	Likes drier sites. Is found throughout Coastal Plains, but is abundant only where overstory is light.	The earliest of the southern bluestems to head out, spring and summer.	Increases with prescribed burning. Is grazed heavily when young and tender.	X		
Paintbrush b.	Scattered. Rarely found in pure stands, but common throughout Southeast.	Late spring and summer into fall. Among the latest of the bluestems to flower.	Not as susceptible to smothering as other bluestems. Increases with heavy grazing.			X
Broomsedge b.	Common throughout south. Very conspicuous in old fields and disturbed areas.	March to June with open winters. Considerable use made of this in Dec. and Jan.	Rarely grazed closely except in mild winters on heavily stocked range. Generally under-rated as forage in the South.		X	
Panicums						
Cutthroat grass	Extends from S.C. south to the Keys. Not common in S.C., but important south.	Spring and summer.	Rarely burned because wet site will generally not support fire. Stands up under heavy grazing well.		X	
Beaked panicum	Found on moist sites throughout the Southeast.	Spring and summer.	Shows quick recovery when tender, young, shoots are taken in early spring.	X		
Narrowleaf p.	Throughout the Southeast. One of the more important of the low panicums.	Feb. thru May.	Tends to increase under heavy use. One of the best of the low panicums.			X
Maidencane	Common on wet sites of the coastal States. Important forage in Fla.	Winter and spring. Provides a real need for livestock when most other grasses are dormant.	Will decrease under continued heavy grazing and be replaced with cordgrass and carpetgrass.	X		
Woolly panicum	Common throughout the South. One of the better low panicums.	Early winter thru April.	Will increase under heavy grazing. Continued heavy grazing will find it replaced with annuals.		X	

Table 1. — Some common range grasses of the South (Continued)

Species	Range and prevalence	Season of Most Use	Palatability preference during season of most use			
			High	Med.	Low	
Spreading p.	<i>P. rhizomatum</i>	Confined generally to the coastal States. Likes extra moisture.	March through September	Very much like beaked panicum in both sites occupied and grazing response. Heavy seeder.	X	
Roundseed p.	<i>P. sphaerocarpon</i>	Common in the Southeast. One of the first to head in the spring.	Used from Feb. thru May and again the late fall.	Takes close grazing well. Used heavily on fresh burns in early spring. Tolerant of fire.	X	
Switchgrass	<i>P. virgatum</i>	Throughout. Sometimes locally abundant but generally least common of the important panicums.	Becomes coarse with maturity. March through July.	A decreases under heavy grazing. Difficult to keep in stand even with moderate grazing.	X	
Paspalums	Paspalum Spp.	Throughout the South. Very common. Will withstand mod. heavy grazing.	Spring and summer.	Will increase with continued heavy grazing. Moderately tolerant of fire.	X	
Fringeleaf p.	<i>P. ciliatifolium</i>	Largely confined to the Southeast. Common throughout.	Early in spring and summer.	Will decrease under heavy grazing and increase slowly with light grazing.	X	
Florida p.	<i>P. floridanum</i>	Found in all coastal plains States. Common on more moist sites.	Late summer into winter.	Often grazed heavily in spring along road ditches and other wet sites. Bluestems easily outcompete on uplands. Increases on moist sites.	X	
Brownseed p.	<i>P. plicatulum</i>					
Dropseeds	Sporobolus Spp.	Largely confined to the wiregrass ranges of S.Ga., Ala. and Fla.	Late fall and winter.	Burning will decrease the amount of Curtiss dropseed in the total cover. Tolerant of heavy grazing and shade. Increases on unburned sites.	X	
Curtiss d.	<i>S. curtissii</i>					
Pineywoods d.	<i>S. junceus</i>	Extends all along the coastal plain from Tex. to Fla. and up into Va. Common.	Spring and early summer and during the winter.	Tolerant of fire and grazing. Frequent fire will decrease amount of this in the stand.		X
Three-Awns	Aristida Spp.	Throughout the Southeast. Range extends into the Midwest and New England.	Fresh burned range in spring.	Increases. Comes close to being an invader. Very tolerant of fire.		X
Arrowfeather t.	<i>A. purpurascens</i>					
Pineland t.	<i>A. stricta</i>	Coastal Plains from Miss. east to N.C. Common in S.Ga., Ala. and Fla.	Fresh burned range in spring. Some use during winter.	Can be maintained in stand if heavily grazed. Tolerant of fire.	X	
Trinius t.	<i>A. virgata</i>	Has about the same range as pineland three-awn. Not as common however.	Fresh burned range in spring and winter.	Heavy grazing will cause it to decrease. Tolerant of fire.		X
Lovegrasses	Eragrostis Spp.	N.C. to east Texas. Shows preference for wetter sites.	Early spring. Most abundant in Fla.	Increases. Shows a good tolerance of fire.		X
Elliott l.	<i>E. Elliottii</i>	Limited to the Coastal Plains States. More common in Fla. and Ga.	Early spring.	Increases. The most palatable of the perennial lovegrasses.	X	
Coastal l.	<i>E. refracta</i>					
Purple l.	<i>E. spectabilis</i>	Common everywhere east of the 100th meridian. Very showy in fall.	Early spring.	Increases with heavy grazing and frequent burns. A sand lover.		X

Table 1. — Some common range grasses of the South (Continued)

Species	Sorghastrum Spp. <i>S. elliptii</i>	Range and prevalence	Season of Most Use	Palatability preference during season of most use		
				High	Med.	Low
Indian Grasses Slender i.		Throughout the South on sandy soil. More common in the east.	Late spring and summer.	X		
Yellow i.	<i>S. nutans</i>	Eastern U.S. west to the Rocky Mtn. Range.	Late spring and summer.	X		
Lopside i.	<i>S. secundum</i>	Largely confined to wiregrass types in Fla., S.Ga., Ala., and coastal S.Car.	April, May and June. Seed-stalks readily eaten in late summer and fall.	X		
Other Important and Common Grasses of the South						
Goobergrass	<i>Amphicarpum muhlenbergianum</i>	Fla., Ga., and S.C., very common in S.Florida.	Summer and fall. Some used yearlong.		X	
Green silkscale	<i>Anthaenantia villosa</i>	Throughout the South.	Summer.		X	
Giant cane	<i>Arundinaria gigantea</i>	Throughout the South.	May to January	X		
Switchcane	<i>A. tecta</i>	Mainly east of Mississippi River.	May to January	X		
Common carpetgrass	<i>Axonopus affinis</i>	Coastal Plains.	Spring and summer.	X		
Toothachegrass	<i>Ctenium aromaticum</i>	Coastal Plains — Mainly wetter, sandy sites.	Early spring after fresh burn.		X	
Skeleton grass	<i>Gymnopogon ambiguus</i>	Coastal Plains north to Ohio River.	Fresh growth after a burn. Becomes very coarse.			X
Cutover muhly	<i>Muhlenbergia expansa</i>	Coastal Plains, east Texas to Fla. and Va. Common on infrequently burned sites.	Late fall and winter. Is closely cropped in spring on fresh burns.		X	
Pine barrens tridens	<i>Tridens ambiguus</i>	Coastal Plains, Texas to Fla., and S.C.; mainly on poorly drained soils	Spring and early summer.			X
Purpletop	<i>T. flavus</i>	East. Most prevalent on moderately to heavily wooded sites.	Summer and early fall.		X	
Longleaf uniola	<i>Uniola sessiliflora</i>	Coastal Plains, Piedmont, and into east Texas and Okla.	Spring and early summer.			X

- Erosion and soil movement will probably be evident, depending upon several factors: duration of the poor condition, rainfall, soil type, etc. Gullies may be present, and a deposition of eroded soils will be observed at sticks, stones, or plants. Plants may be stooling — growing on a hummock caused by erosion of the surrounding soil. Rocks and sticks may be found on pedestals.

RANGE IMPROVEMENTS

An inventory of the range resource on an area must include a determination of the range improvements present and their condition. Inspect the improvements with sufficient thoroughness to answer the following questions:

Fences. Are the exterior boundaries of the tract fenced? Any interior fencing? What kind of condition are they in: good enough to contain livestock? Are gates in the right places and are they adequate? Are cattle guards needed on some well traveled roads? Watergaps in place and effective? What additional fencing or improvement of existing fence may be needed to adequately control the livestock and achieve management objectives?

Water. What kind of waters are present on the area: springs, wells, stock ponds, live

streams? Are they permanent or temporary? Do they effectively provide water for livestock? Are they well distributed over the area? Fenced or equipped with other control so that they can be made unavailable to livestock, if needed? What additional water development or improvement is needed? Should more water sources be developed to achieve better distribution or provide sufficient water? Should improvement work such as bentoniting ponds or providing additional troughs at wells be done?

Livestock Handling Facilities. What is available in the way of corrals, squeeze chutes, holding pens, traps, etc.? What is their locations? Are they adequate, and properly located, to take care of the animals?

Improved Pastures. In areas to be regenerated with more desirable species, are improved pastures available, either for rent or self-owned? Could areas scheduled for regeneration be planted to improve grasses and pines for management as a timbered pasture? Are right-of-ways available for improved pasture establishment? Do livestock have access to corn fields or other gleanings in the late fall and early winter?

Answers to the above questions are needed to give proper advice on livestock stocking rates on forested ranges.

MANAGEMENT OF THE RANGE

OBJECTIVES

Here is the objective of the entire range management profession: the grazing of livestock on a range area in a manner that provides a high level of continuous production without damage to the range or other associated resources. Many factors must be carefully blended to achieve this objective. For example: proper numbers of animals, proper seasons of use of the forage plants, proper distribution of the animals over the range, coordination with other resource uses and proper supplementation of the animals' diet with salt, minerals, concentrates, or hay.

Historically, Southern forestlands have been grazed with uncontrolled numbers and almost no management. The livestock were turned loose in the woods and shifted for themselves; the owner made an occasional roundup whenever some stock had to be sold. Under this system, calf crops were low — in the 30 to 50 percent category, with sale weights of 250 to 300 pounds. Mortality was high. Forest Service research has consistently shown that you can produce 80 percent calf crops and marketing weights of 450 to 500 pounds through good management of cattle and resources.

This chapter provides some basic information to help foresters prepare a multiple-use management plan and give advice to the private landowner. Much of the success of the plan will depend upon the skill of the forester in recognizing conditions and devising management solutions to meet the need of the individual area. The plans cannot be stereotyped — each must be tailored to meet the needs of the individual area. Each area, as well as each landowner, is different.

STOCKING RATES

One of the first questions the landowner will ask, and often the question uppermost in

mind, is “How many cows can I graze?”. Unfortunately there is no hard and fast answer. You can give an ultra-conservative answer which will limit the numbers and provide for most eventualities, but this probably would not be the most economical use that could be made. On the other hand, an answer that might provide for heavier stocking with the assumption of good landowner management of the range and cattle could then result in damage to the range through failure to get proper distribution, or make prescribed burns, or numerous other variances that affect actual safe grazing capacity.

Grazing capacity depends on many variables. The forage production that is measured represents what is available for livestock consumption at that particular time, and as a result of the specific weather and overstory conditions that existed during the year of measurement. Production could change drastically by the next year because of changes in weather or overstory or the use that has been made of the range. Regardless of the forage that is present, **the manner in which it is used** has more effect on the numbers that can be run than almost any other factor. Poor distribution of the animals, grazing at the wrong season, and failure to feed supplements or hay has a direct, profound effect on the ability of an area to support sustained livestock use.

In determining stocking rates, remember that light use will usually give the greatest weight gains per animal, and will preserve good range condition. However, light use probably will not produce the optimum beef production per acre of range. Heavy use may temporarily produce the most beef per acre, but at the expense of range condition and future production. The optimum combination

of weight gains per acre and preservation of good range condition is to be found with moderate use.

USE OF FORAGE PRODUCTION DATA

The principal purpose of establishing the forage production plots described in the preceding chapter was to secure an estimate of the production of the range area for conversion into an estimated grazing capacity. To do this, for each type:

1. Add together the green weight production figures from all of the plots in the type.
2. Reduce the above sum by an appropriate percentage to arrive at an air dry weight (40 percent recommended for late summer and fall use).
3. Divide the sum by the number of plots to arrive at a plot average.
4. Multiply the above average by 10 to give the average pounds of production per acre.
5. Reduce the above figure to 40 percent (assumed proper use) of the average to arrive at forage availability under proper use.
6. Divide by 40 (pounds per acre forage disappearance per day with a cow-calf operation) to give the number of cow-calf days available.
7. Multiply by the acres of suitable range in the type.
8. Divide by 30 (days per month) to give the number of animal months forage that is available.

For example, using the information from the equation shown on page 5.

1,600 pounds air dry forage production
 1,600 x 40 percent (proper utilization)
 = 640 pounds of forage per acre
 available

640

40 (pounds per cow-calf day)
 = 16 cow-calf days per acre

16 x 210 (acres in the
 shortleaf-loblolly type) = 3,360
 cow-calf days for the type

3360

30 (days per month) = 112 cow-calf
 months available

or 112 cows with calves for one month
 or 56 cows with calves for two months
 or 37 cows with calves for three months,
 etc.

The final figure may, as indicated, be manipulated for the desired season by dividing the animal months by the number of months in the season to arrive at the stocking rate for that period. Conversely, divide the calculated animal months by the number of animals to be grazed to arrive at a length of season. Do this for each type in the area; add all types together for an area total. Listed below is the approximate grazing capacity for a cow-calf operation in relation to the amount of forage per acre, at 40 percent use and 40 pounds per day forage disappearance:

<i>Forage per acre</i>	<i>Acres per cow month</i>
100	30.0
150	20.0
200	14.9
300	10.0
400	7.6
500	6.0
600	4.9
700	4.3
800	3.7
900	3.3
1,000	3.1
1,200	2.5
1,400	2.1
1,600	1.9
1,800	1.6
2,000	1.4

For 50 percent use, multiply acres/cm by 0.83;
For 60 percent use, multiply acres/cm by 0.66.
A quick, simple method to include proper use is allow 100 pounds per day disappearance. This incorporates 40 percent use and animal requirements.

Stocking rates calculated on the basis of forage production are the best means available to tell a landowner the number of cattle that should be permitted to graze on a given area. However, any initial stocking rate that is used must be refined over a period of years by close observation of the effects of the use on the ground.

FORAGE USE

Forage use is expressed in terms of a percentage of the plant used, of that which was available for use. In the case of grasses and forbs, the entire volume above ground is considered available for use. In the case of shrubs and trees, only that within reach of the animals is available.

Forage use is estimated by using the procedures described earlier, for estimating forage production. On grazed ranges, will you find it useful to train yourself in estimating by clipping and weighing some previously established protected plots, or by finding ungrazed areas to clip and weigh and compare them with the grazed areas. Forage use estimates will help you arrive at a rough calculation of grazing capacity on a grazed range, as follows:

1. Estimate the percent of forage use.
2. Divide this percentage by the number of months of grazing that has transpired to arrive at the percent per month that is being used.
3. At the use rate per month, calculate the number of months remaining before proper use is reached.

Example:

An area has been grazed for 3 months and is 26 percent used. Desired use is 40 percent (14 percent short of goal) —

- 3 months = 26 percent or approximately 8 percent per month use.
- 14 percent remains to reach the desired use or 2 more months at 8 percent use per month.

About 2 months grazing left at the present rate of stocking. Numbers and time may be juggled to meet the landowner's objectives. For example, twice as many cattle grazed for half the time or half the cattle for twice the time.

This method has its greatest application on seasonal ranges where growth of the plants is well along or complete before the grazing season. The greatest application of forage use information is in:

- Calculating when proper use has been made of the range and it is time to move livestock to other range.
- Seeking out areas of over-use and areas of under-use that indicate improper distribution and point towards refinements or changes that may be needed in the management plan.
- Refining the initial grazing capacity estimates. If over-use has occurred before the end of the grazing season, then the stocking is too heavy.

Nearly every plant species has its own tolerable limits of use beyond which it cannot sustain itself and reproduce. Continued grazing beyond this limit results in a weakened plant and, a reduced root system. Such plants are susceptible to drought, decreased forage production, and eventual death. Forty percent

is considered the average conservative use for most species on Southern ranges. Some plants such as carpetgrass can withstand much heavier use, and must have it in order to stay in place against competition from other plants that cannot tolerate the same degree of use.

Here are some plant appearance guides for estimating forage use:

Light Use (25 to 30 percent forage removal): Grazing patchy and leaf tips have been bitten off less than three-fourths of the grass tufts. There has been no obvious removal of leaves from pineland three-awn.

Moderate Use (40 to 45 percent forage removal): Leaf tips have been bitten off more than three-fourths of the grass tufts, but occasional patches are ungrazed.

Heavy Use (60 to 70 percent forage removal): Leaf tips have been bitten off all grass tufts and the average stubble height is 4 inches or less.

ANIMAL UNIT EQUIVALENTS

For the purpose of planning the use of grazing lands and estimating the degree of use, the standard livestock unit will be the "animal unit" defined as one mature cow, with or without an unweaned calf at its side, or the equivalent. The following equivalent values are considered as standard, for use in converting animal units to other classes of stock:

Cattle:

Weaned calves and yearlings	.6 animal unit
Mature cows and steers (cow with or without unweaned calf at side)	1.0 animal unit
Bulls, 2 years and over	1.3 animal unit

Horses:

Yearlings	.75 animal unit
Two-year-olds	1.00 animal unit
Three-year-olds	1.25 animal unit

Sheep, Goats, and Deer:

Five weaned lambs, kids, and yearlings	.6 animal unit
Five ewes, or does, with or without unweaned lambs or kids	1.0 animal unit
Five rams or bucks	1.3 animal unit
5 deer	1.00 animal unit

Converting equivalents should not be used to convert grazing capacity estimates from sheep and goats to cattle and horses, where it is possible to determine the grazing capacity on the basis of the values of forage plants for each kind of livestock.

RANGE READINESS

Range readiness is the time when livestock may safely begin grazing fresh, spring forage growth without inflicting intolerable damage to the key grazing species. It is, of course, an important economic consideration to the rancher to "turn on" fresh grass as soon as it can be safely done, to avoid prolonging the costly winter season feeding of grain and hay. Turning cattle on to spring range too soon is a common practice in the South. This is especially damaging to fresh burned range. Grasses and forbs just beginning new growth in early spring need sufficient time to develop new root growth and a healthy crown.¹ This is also a critical time for seedlings. Because of the usual soft soil conditions at this time of year, new seedlings are easily pulled from the soil by grazing livestock.

Range readiness will differ with grass species, kind of season, (early, late, wet, or dry) latitude, elevation and condition of ground and ground cover resulting from

¹An exception to this is *Arista stricta*, wiregrass that should be grazed when it is fresh and green.

management and climate the previous season or seasons. It disturbs many ranchers to see the fresh, green growth in the spring produce much more forage than their livestock can possibly use at that stage of development.¹ Many think it's grass just going to waste. Many of the grass clumps scattered throughout the stand must be allowed to mature and seed so that new seedlings of the better perennial grasses may become established.

There are marked differences in the time of range-readiness from the more southerly latitudes to the northern extremes of the southern pine belt. New growth of grasses varies by as much as a month from south Florida to north Florida. These differences are accentuated where major increases in elevation occur. As one progresses from the near sea-level coastal plain to the mountainous terrain of north Arkansas, a considerable lag in range readiness is observed.

One method to establish a sound basis for determining range readiness or "turn on" date is to identify the key perennial species of grasses that make up most of the forage, i.e., the two or three species the rancher will most depend upon to furnish feed for livestock during the normal grazing season. This is especially important when the operator intends to stock the range to its optimum safe grazing capacity. These key species should exhibit sufficient new growth to "gain" over grazing use for the first 6 weeks. Because there is so much difference in the appearance of new growth on a freshly burned range, compared to an area with a 2- or 3-year-old rough, careful attention needs to be given this item. The general appearances of new growth and the amount of new growth can be very deceptive on the rough areas.

¹An exception to this is *Arista stricta*, wiregrass that should be grazed when it is fresh and green.

INDICATORS OF RANGE READINESS

A generally reliable indicator of range readiness involves an observation of the stage of development of plants other than grasses. In the Ouachita and Ozark mountain areas when birdsfoot violet (*Viola pedata*) is in full bloom on the slopes, and wild hyacinth (*Camassia scilloides*) is blooming in the creek bottoms, grass has normally developed sufficiently to make it safe for grazing without harm. Serviceberry (*Amelanchier arboreum*) will be in full bloom and black locust (*Robinia pseudoacacia*) is just about to bloom.

In the coastal plain, longleaf pine-bluestem range, the matter of range readiness is less critical because some native grasses stay green throughout the year. However, pinehill bluestem, which is the dominant forage species, is generally ready to begin grazing when false dandelion (*Krigia dandelion*), sheep sorrel (*Oxalis violacea*), butterweed (*Senecio glabellus*) and the atamasco lily (*Zephyranthes atamasco*), sunbonnets (*Oenothera speciosa*), and yellow stargrass (*Hypoxis hirsuta*) are blooming conspicuously. Fringetree (*Chionanthus virginica*) and yaupon (*Ilex vomitoria*) are in full bloom. Moving over to the wiregrass-pine ranges of south Alabama and Georgia and north Florida, we find tarflower (*Befaria racemosa*), wicky (*Kalmia hirsuta*), and titi (*Cyrilla racemiflora*) at bloom peak about the time the wiregrasses begin to become nutritious again.

The date of range-readiness is largely determined by a rancher's past experiences with conditions in the spring. Because it is not possible to anticipate a wet, dry or normal grazing season at "turn on" time, the wise rancher should take sufficient safeguards against a possible forage shortage. Remember that a lightly-stocked range can be safely grazed earlier than can a heavily-stocked range.

LIVESTOCK DISTRIBUTION

A well-managed herd will graze forage as uniformly as possible throughout the range. Several techniques may be employed to reach this goal; however, the first step is to analyze the particular problem and determine why the cattle tend to overgraze or concentrate in one part of the pasture.

FACTORS AFFECTING DISTRIBUTION

Among some of the more important reasons leading to poor distribution in the South are steep topography, deep flowing streams, insufficient or poorly planned prescribed burns of insufficient area, heavy rough, and insufficient salting, supplemental feeding, and water locations. In the Coastal Plains, livestock use is closely tied to timber harvest and prescribed burning. After almost any type of cutting operation there is an immediate response in the amount and quality of ground cover. A fresh burn will attract cattle to the new plant growth. They will walk great distances across a 2- or 3-year old rough to get to such grazing. They will keep a burn nipped to the ground if such areas are small and cattle numbers too high. The continued, intense use of such areas may replace the more desirable bluestems and panicums with a solid cover of carpet grass.

Some areas have sizeable tracts on hillsides where cattle will graze very little until the bottoms and more gentle slopes have been overgrazed. Provide salt at strategic points on such slopes to help attract the cattle to these hilly areas.

In most instances, as soon as the cattle have satisfied their salt needs, they will drift down toward the flats, and water. A combination of salt and watering facilities is the best solution. Here again, the decision to install a permanent water facility on a slope sufficiently steep to discourage cattle from grazing must be carefully weighed. Such a slope is a prime erosion hazard; concentrations of cattle on such places can only add to the hazard. Once erosion has begun, such area are difficult and expensive to rehabilitate.

Physical barriers, such as deep streams, can often cause poor distribution. While this most often only seasonally deters cattle from crossing over to the other side of a pasture, many streams are permanently deep. Marshy areas that extend considerable distances from the stream add a further barrier to crossing. Where possible, barriers of such magnitude should be made a boundary of a management unit.

Where streams only intermittently obstruct cattle from freely crossing from one grazable area to the other, the most effective practice in getting uniform use is to rotate one side with the other — providing all facilities, such as water and salt, on both sides. Forcible driving of cattle may be necessary from time to time as dictated by the development of the forage or use observed on one side or the other.

USE OF WATER TO IMPROVE DISTRIBUTION

Insufficient or poor distribution of permanent water facilities is frequently a major cause of poor livestock distribution. Give special attention to this problem during times of drought, when concentrations of cattle around a single water facility serving a large grazing area can irreparably harm nearby forage and soil values.

Water for livestock is an absolute necessity. Therefore, it is one of the most effective means of attracting cattle to use forage in areas they habitually stay away from, because of lack of water. As a general rule of thumb, cattle should have water available within a mile of the farthest grazing. The ideal is to have a permanent water facility no farther than one-half mile from the farthest grazing.

BURNING FOR DISTRIBUTION

The practice of burning by livestock operators has been a universal custom throughout the South since the times of earliest settlement. The practice was adopted from the Indians who habitually burned the woods to provide for easier hunting of game

and for the simple expedient of making foot travel in the woods less difficult.

Controlled burning of the pine type in suitable burning areas offers the best opportunity to distribute livestock where you want them. When a prescribed burn is properly done, taking into account season, temperature, and date since the last rain, it can be controlled to effectively reduce the rough without damage to the grass plants. Such a burn will provide an immediate plant response with improved palatability, quality, quantity, and availability of grasses and forbs.

Necessarily, prescribed burning must be tied into timber and other resource considerations. Such considerations may sufficiently restrict a burning program for optimum benefits to grazing distribution — when done on small size management units and on newly regenerated areas.

There are several reasons why a good prescribed burn area attracts cattle. All new growth is fresh and green and the cattle don't have to laboriously sort out the dead material that accumulated from the growth of previous seasons. Protein, phosphorous, and calcium are higher in spring forage from burned areas. Total forage production over the years is also higher on areas where burns have been carefully controlled as to season and temperature. Seasonal gains of cattle are as much as one-third higher when grazing these areas. The problem of distribution is largely eliminated when such areas can be uniformly scattered over a large pasture or rotated with similarly-sized units on small pastures. On any area, stocking rate of cattle must conform to area size to prevent overgrazing. While close grazing of new growth on a fresh burn will keep vegetation palatable and nutritious, and extend the period of profitable grazing, care must be taken to prevent livestock from concentrating to such an extent that the native grasses are eliminated, and carpetgrass and annual weeds take over.

SALTING FOR DISTRIBUTION

Salt will attract livestock and is a useful tool in achieving better distribution. Place the salt in areas where more use is desired, and away from overused areas. This usually means that the salt will be placed well away from water, openings in the timber type, prescribed burns, roadsides, etc.

Do not establish permanent saltgrounds. Move the salt to a new location at least annually to avoid concentrations of livestock and trampling out an area. Keep the salt off the ground, and in troughs, securely fastened to tree stumps, or put on bare-rock areas.

The same principles of using salt to attract livestock and achieve better distribution also applies to locations for supplemental feeding.

COORDINATION WITH OTHER USES

Frequently a farm or ranch can support many different uses of the basic soil resource and land area. Although the tendency is towards specialization in agriculture, there is still room on most farms and ranches for more than one crop. Ideally, these crops should be so selected and organized as to be complementary and dovetailed into a land use and management entity that recognizes the needs of all crops. This management concept does not necessarily produce the maximum of any one crop that might be possible, but is directed towards something less to achieve compatibility with other crops and achieve the best return from the land.

The careful organization and coordination of multi-crop production is necessarily a problem of the landowner and will largely depend on personal desires. Livestock grazing, if properly done, can be managed to blend in with most of the major land uses and produce a profitable return.

COORDINATION WITH TIMBER

Grass yields in southern pine forests are highest when trees are small. As pines grow and their crowns close, forage declines. Rarely is grass completely eliminated. Over the bulk of the range, it persists in varying amounts. Yields of grass are least beneath dense, pole-sized stands, but increase as trees grow larger and taller and some are cut.

Natural longleaf stands generally are more open and have more forage than slash pine stands. When number, height, and size of the trees are the same, probably about as much grass grows in slash pine stands as in longleaf.

The relation between trees and grass is much the same for planted pines as for natural stands. The main difference is in tree spacing and forage composition. In natural or seeded stands, the young trees, particularly slash pine, often form thickets under which grass declines rapidly. In plantations, spacing between trees can be controlled at the beginning to encourage grass growth for several years.

When managing for timber and forage production, use initial tree spacings of 8 x 10 (or 12) feet, or more. Given more space, trees respond with more rapid diameter-growth and usually can be thinned commercially at an earlier age. Widely spaced plantations also provide longer and more productive periods of grazing. The crowns close a year or more later than 6 x 8 (or 10) feet, and other dense spacings.

Furrowing, disking, or other soil disturbance incident to planting or seeding encourages carpet grass and common Bermuda grass at the expense of native bunch grasses. These invading species are less tolerant of shade and litter and, as the timber stand develops, may be expected to give way to bluestems, panicums, three-awn, and paspalums.

As the pines grow, thinnings are necessary for optimum production of timber and grass. The first thinning usually comes when trees average about 6 inches in diameter — big enough for pulpwood. After that, thinnings may be at regular intervals, and leave only 60 to 70 square feet of basal area per acre.

In the longleaf-slash pine belt, forage and timber management are closely linked to prescribed burning. Pine litter rapidly accumulates beneath well-stocked timber stands and, unless removed by occasional prescribed burns, will drastically reduce grass growth. If done properly, burning improves the palatability, quality, and availability of grasses. From the standpoint of the timber grower, it is useful to control undesirable hardwood or pine stands, reduce the hazard from wildfire, prepare seedbeds, and control brown spot on young longleaf pines.

Except on some lands in south Florida, where timber growing is secondary to cattle grazing, burning for forage improvement should be done only after timber and other forest uses have been fully considered. Where new pines are being started, fire must usually be excluded until the trees are 8- to 10-foot tall, except as burning is necessary to reduce brown spot needle infection of longleaf seedlings in the grass stage. Thereafter, it may be used advantageously at 2- to 5-year intervals. In some sections of south Florida, separate parts of the range are occasionally burned at different seasons to maintain grazing the year round. Table 2 contains a recommended burning schedule for protecting trees under changing forage and timber conditions.

With cattle grazing the range, some damage to young trees is inevitable, especially on regeneration areas. The planted areas have been disturbed, creating forage and accessibility conditions that the cattle find favorable, and they will concentrate on such areas if given free choice. Injury to pine reproduction on

Table 2. — Recommended grazing and burning schedules to protect trees under changing forage and timber conditions.

Timber stand condition	Grass yields (green weight)		Burning schedule	Grazing Schedule	
	Bluestem	Pineland three-awn		Bluestem, yearlong	Pineland three-awn
	— pounds per acre —			— acres per cow —	
No trees	3,000	2,000	2-3 years	14	23
1-year-old seedlings	3,000	2,000	Exclude fire	20, exclude cattle or graze lightly	30, exclude cattle or graze lightly
Seedlings and saplings less than 8 feet tall	2,600	1,600	Exclude fire	30, graze lightly	40, graze lightly
Saplings taller than 8 feet but less than 6 inches in diameter	1,400	1,000	3-4 years	26, graze moderately	45, graze moderately
Pulpwood, 6-12 inches in diameter	650	700	2-4 years	39, graze moderately	66, graze moderately
Sawtimber, 12 inches and larger in diameter	—	—	—	22, graze moderately	38, graze moderately

properly managed and stocked ranges is not usually serious, but although some trampling, and at certain seasons of the year, browsing may occur, it will be well within acceptable limits.

On some pine ranges, grazing modification may be necessary to prevent cattle from concentrating where pines have been planted or seeded. The most critical period is late fall and winter when green forage is scarce, nutrient levels are low and the cattle may browse as well as trample pines. Trees that have been fertilized in the nursery have a high nutritive content and are particularly susceptible to browsing. Modifying the grazing to minimize damage on plantations as follows.

Water, supplement and salt control. — Place the salt, supplements and water well away, 1 mile if possible, from plantation areas. Close off waters near the plantations. These controls will not be completely effective, but may reduce damage to an acceptable level.

Prescribed burning or fertilization. — Prescribed burns and fertilized areas will attract and hold cattle. When planning the plantation, also plan to develop burned or fertilized areas well away from the plantation to attract and hold the cattle.

Rotation grazing. — If the range is fenced into management units, schedule the rotation of the grazing on the units to avoid the unit containing the plantation, or graze it only during the spring, summer or early fall. This will eliminate any need for additional fencing.

Removal of cattle. — Most cattle browsing and trampling of young pines occurs in the fall and winter when green forage is scarce or unavailable and the nutritive content of the grasses is low. Under light to moderate grazing, serious damage will be completely avoided by removing the cattle in the fall and not returning them until spring when ample green forage is available.

Fencing. — This is the total solution, but it's expensive and is usually unnecessary with controlled numbers and proper management. The owner will be better off to put the fence money into division fencing of the range area and adopt a rotation system of grazing that avoids use of the plantation area. Stands of slash pine may need to be fenced for only 2 to 3 years, but longleaf pines will need protection until they are well out of the grass stage. A three-strand barbed wire fence will turn cattle. Electric fences are seldom satisfactory in the woods.

Chemically treat seedlings. — For unusual situations, where control of livestock distribution is very difficult, there may be a need to chemically treat tree seedlings that are to be planted in the area. Some of the chemicals used in the past are not registered for use now. Because registration is necessary before a chemical may be recommended for use, and also because the process often changes you should consult with the State agencies responsible for disseminating such information. All chemicals should be used cautiously. Strictly follow the instructions on the label.

Use chemicals only as a last resort. One treatment is not enough to assure protection throughout a grazing season. A better choice is to remove livestock from newly planted areas or control their numbers in areas where there is doubt about seedling protection. Also, treatment may require special handling. For example, some chemicals will cause injury or death if the seedlings are stored in bundles for a day or more after treatment. Such special precautionary procedures should be understood and followed carefully.

Because registrations of pesticides are under constant review by EPA, consult your local county agricultural agency or State extension specialist to see if a suitable material has been registered by EPA since this publication was printed.

COORDINATION WITH RECREATION

Open range grazing under controlled and managed conditions is usually completely compatible with open, dispersed type recreation use of the same area and is in many cases complimentary. On some areas of public land where intensive recreation use is a major consideration, livestock grazing is being retained to enhance the recreation values and provide a means of control of shrubs and invading plant species.

Fence off areas of concentrated recreation use, such as a campground, to exclude cattle. Most people don't object to livestock in the vicinity of their camp or picnic site. Many enjoy the animals and numberless children have squealed with joy at the experience of seeing a cow, or horse or sheep. However, few people care to share their campsite or picnic with a herd of domestic animals, and a bull polishing his horns on a tent pole can be alarming. Keep the cattle away from concentrations of people — the recreation area itself can be grazed during the off season, if need be. Coordination of grazing with wildlife considerations is discussed later.

COORDINATION WITH SOIL AND WATER RESOURCES

The soil is perhaps the most important resource on any given land area. Soil is the basic nonrenewable resource upon which any farmer or rancher depends for a living. Protection and development of this resource must be the basic and overriding consideration of any land use. In the past, under unmanaged conditions and uncontrolled and excessive numbers, much damage has been done to rangelands by domestic animals. Controlled numbers of cattle and properly managed grazing permits profitable use of the forage without damage to the soil or other resources.

Coordination of grazing with the soil resource is nothing more than good range

management. The same range and livestock management activities that pay the greatest returns to the cattleman, such as proper stocking, good distribution, and proper season of use will also pay the greatest returns in the protection of development of the forage and soil. Avoid areas of overuse; manage the land to pull the livestock away from those areas.

Livestock will tend to favor certain areas and, if given free choice, will develop "lying" grounds where they prefer to rest and chew their cud. They will also develop trails when moving from one area to another. These favored areas will eventually become compacted, beat out, and subject to severe erosion if concentrated use continues. Using the methods described earlier, under "Livestock Distribution," alter the management plan to pull livestock from these favored areas.

If you wish to treat and rehabilitate eroded areas, use the same methods described earlier under "Coordination with Timber," for protection of tree plantations to reduce or eliminate livestock use from the treated area.

The production of quality water is another consideration to coordinate with livestock use of forested ranges. Avoid pollution of runoff and streams by animal wastes, dead animals and feeding operations. Some coordination practices to be considered are —

- Locate corrals, feedgrounds, saltgrounds and other areas of concentration away from streams or drainages. Contaminated water runoff from them can then pass through a filtering process before reaching the flowing stream. Location of these facilities on ridgetops or higher areas will also provide better drainage and promote a drier and more usable improvement.
- Promptly dispose, preferably by burning, of dead animals. Many States have laws requiring this, both from the standpoint

of water pollution and to prevent the possible spread of disease.

COORDINATION WITH WILDLIFE

The forestland range manager may wish to produce wildlife concurrently with livestock and timber for personal enjoyment or for economic gain. Several species of native upland game can be managed in harmony with range programs in the Coastal Plains. These include principally the white-tailed deer, wild turkey, gray and fox squirrels, bobwhite quail, and mourning doves. For optimum results, however, determined efforts in resource coordination are required.

Wildlife resources are convertible to cash income directly through the sale of hunting and fishing rights or indirectly by furnishing goods and services to sportsmen. In areas of well-stocked deer and turkey range, profits from the sale of hunting rights on a daily or seasonal basis may approach or exceed the yield from other resources. The same is true on a lesser basis for small game, as for example, pheasant hunting in South Dakota, or Georgia's renowned quail hunting.

The landowner interested in managing wildlife resources for profit will need to explore applicable State game laws, and the trespass and liability laws. The need for sporting facilities, added costs of maintaining fences and range improvements are other trade-offs. The added risk to livestock and property from possible wildfires, accidental shooting, and other hazards also must be considered. Suggestions for coordinating forestland grazing with wildlife habitat management are:

Deer. — Coordination of cattle and deer management requires control of grazing intensity, deer, and livestock numbers. Overstocking of either deer or cows will reduce the carrying capacity for the other. Generally, however,

deer and cows do not compete as strenuously for preferred foods as do deer with goats and sheep. As grazing approaches full capacity of the range, competition between deer and cows becomes more direct. Range managers should allocate forage use accordingly. One rule of thumb suggests that one cow unit of use equals five deer units.

Deer range quality varies directly with the kinds and quantities of browse available at critical times of the year. As with cattle, not all plants provide usable browse for deer; thus cattle compete with deer to the extent that they consume preferred species needed for good health, body weight gain, and reproduction. Measures recommended for coordination of deer and livestock management in forestland grazing programs are:

- Exclude cattle from hardwood bottomlands and, if feasible, from all forestlands during the winter months except in the lower Coastal Plains.
- Rotate grazing, prevent overgrazing.
- Make stock watering facilities available to deer.
- Do prescribed burning for range improvement.
- Exclude fire and cows from thickets and evergreen cover.
- Encourage maximum harvest of surplus deer by hunting.

Wild Turkey. — The need for coordination of forestland range management with wild turkey management increases from Florida westward. While grazing is not considered detrimental to turkeys in Florida, undesirable effects become more apparent to the north and west. Grazing by goats and sheep and direct competition for mast by hogs is regarded as

more detrimental to turkey than is cattle grazing. However, heavy woodland grazing that eliminates or seriously reduces the variety and production of understory fruiting shrubs and food plants will reduce turkey populations. Moderate grazing of pine types probably favors turkeys by encouraging the growth of grasses, legumes, crotons, and other foods and by maintaining open stands. Heavy grazing prevents seed production, eliminates legumes, and destroys nesting and escape cover. Recommended measures for coordination are:

- Exclude cattle from hardwood stands, especially stream bottoms.
- Prevent heavy grazing and the depletion of food supplies.
- Rotate grazing, if feasible, particularly on the more western ranges.
- Make stock watering facilities available to turkeys.
- Spare roost trees and nearby areas of escape cover in range improvement programs.
- Practice prescribed burning in pine types.

Prescribed burning will favor wild turkey if care is taken to exclude fire from hardwood stands, bottomlands, nesting and escape cover. In the longleaf pine type, burn on a 3-year rotation with cool, night fires in December, January, or February.

Turkey may be attracted to supplementary feed lots during winter months. Such areas provide prime hunting as well as important winter food supplies for turkey.

Small Game. — There are opportunities for coordinating grazing programs with small game as well as deer and turkey management. Species to consider include bobwhite quail, mourning doves, gray and fox squirrel.

Gray squirrels apparently need not only abundant hardwood mast supplies, but also a dense shrub understory that furnishes cover and concealment. Exclude cattle from hardwood sites to benefit gray squirrels. Fox squirrels generally prefer more open, park-like stands, and eat a broader range of foods. Fox squirrels are favored over grays by moderate cattle grazing. However, grazing which prevents establishment of a hardwood component in new stands, and fruit-producing shrubs in older stands, will be detrimental even to fox squirrels. Prescribed burning which encourages browse production at the expense of fruit-yielding shrubs will also harm fox squirrels.

Grazing in pine types and quail management are compatible, particularly if you practice prescribed burning to stimulate legumes. Preserve thickets and small areas of heavy rough. Employ annual burning with a fast moving, late-winter or early-spring fire to stimulate legumes, especially the preferred partridge pea. Usually, such a fire will not burn clean, thus sparing thickets on moist sites and preserving needed cover.

Old house sites often contain fruiting shrubs, vines, forbs, grasses and cover important to many species of wildlife. Fencing such areas as well as any food plot plantings may be critical to simultaneous production of wildlife and grazing uses in southern pine woodlands.

NUTRITION AND SUPPLEMENTAL FEEDING

Virtually all range forage in the South is seriously deficient in nutrients during the fall and winter. Range forage must then be supplemented if cattle are to thrive. Without supplements, susceptibility to parasites and disease is high, malnutrition results in heavy death losses, average calving seldom exceeds 50 percent, and weaned calves frequently weigh less than 300 pounds. These conditions

are not conducive to a profitable cattle operation. Table 3 shows some results of research on the production of beef from herds receiving good year-long feed, and on herds not adequately fed.

FORAGE QUALITY

Range forage is most nutritious in the spring and summer, and cattle weight gains are highest then. During this period, mature cows from herds grazing on bluestem range will produce 75- to 80-percent calf crops. The cows gain an average of about 165 pounds each. Pineland three-awn forage is not as nutritious as bluestem forage in the summer, and cows grazing the three-awn gain less weight than those on bluestem. In Georgia, dry cows on pineland three-awn range gain about 155 pounds during the spring and summer. Wet cows do little more than maintain body weight and may lose 50 pounds or more, per head, during this time.

The nutritive value of the forage declines in the fall and winter. Even when fed protein and mineral supplements, cows that calve during the winter will lose about 200 pounds on bluestem range. Dry cows generally lose less than 75 pounds. Pineland three-awn forage is so low in nutrients during the winter that cattle are ordinarily taken from the range and put in feedlots or on improved pasture.

The range manager can influence forage quality considerably by controlling the closeness of grazing and making prescribed burns. The quality of range forage is judged by protein and mineral content and by digestibility. Some factors affecting forage quality are:

Crude protein. — Protein is essential for cattle growth, weight gains, appetite, milk secretion and regular oestrus in cows. New grass shoots are relatively high in crude protein.

On pineland three-awn ranges in Georgia, the grass contains about 6 percent crude protein in the spring, but if the range is burned in winter, the spring forage will ordinarily contain 10 to 12 percent. Three to four months after grass growth begins, the crude protein falls below 6 or 7 percent — less than the minimum needed by a cow that is nursing or carrying a calf.

New grass growth on unburned bluestem range normally contains 8 to 9 percent crude protein in spring. On ranges burned in late winter or early spring, the percent will be from 10 to 12. In July and August, the protein content is about 7 percent, or slightly higher if summer rains bring on a new surge of growth. In winter, it may fall to 3 or 4 percent.

Repeated grazing has much the same effect as burning in increasing the succulence and protein content. Cattle continually seek out plants previously grazed. In Louisiana, bluestem forage that was frequently harvested contained 9 to 11 percent crude protein, while that on unharvested plots had 5 to 6 percent.

Protein holds up best through the summer on ranges containing carpetgrass, bluestem, and some of the taller bunchgrasses, such as lopsided Indiangrass and switchgrass.

Forbs, especially legumes, are often higher in protein than grasses. Swamp sunflower may contain up to 10 percent in late summer and early fall. Seed heads of sunflower, certain legumes, and other forbs often have more crude protein, and also more minerals, than the leaves.

Spring growth of browse plants such as summersweet clethra, American cyrilla, and blackgum often has 13 percent crude protein. The evergreens, dahoon and greenbriers, are sought in winter when green feed is scarce. Their protein content of 8 to 10 percent exceeds that of leached herbaceous plants.

Table 3. — Production of beef from herds receiving good year-long feed and from herds not adequately fed

Type of operation	Seasonal feed supply				Calf crop	Calf weights	Death losses	Beef produced per cow ¹
	Spring	Summer	Fall	Winter				
	Apr.-June	July-Sept.	Oct.-Dec.	Jan.-March				
Good, yearlong feed; farms and fenced National Forest range	Fenced forest range	Fenced forest range	Improved pasture	Improved pasture, 100 days' supplement of 2 lbs. cottonseed meal and 4 lbs. hulls/head/day	% 78	lbs. 355	% 2.0	lbs. 263
	Fenced forest range	Improved farm pasture	Field gleanings and farm pasture	Farm pasture and winter oats grazing, 90 days with supplement of 1 lb. cottonseed meal and 8 lbs. hay/head/day	74	350	3.0	238
Poor yearlong feed; Farms, and free forest range	Free forest range	Free forest range	Free forest range	Main herd on free forest range with no supplement. Weak cows on farm pasture and 1 lb. cottonseed meal and 2 lbs. hulls/head/day.	37	275	5.7	68
	Free forest range	Free forest range	Free forest range	Free forest range, 60 days' supplement of 1/2 lb. cottonseed meal and 2 lbs. hay/head	35	300	6.4	67

¹Beef production includes total weight of calves produced per cow, less weight of cows that died. Cows in the well-fed herds averaged 700 pounds, those in the poorly fed herds 600 pounds in fall.

Although browse contributes protein to the cattle diet in winter, it fails to compensate fully for deficits of other forage.

Where browse plants form dense thickets and grow beyond the reach of cattle, burning will open up the clumps and induce new growth. Cattle find the young, vigorous sprouts more palatable and nutritious than the twig growth of older stems.

Phosphorus. — This is the mineral most often deficient in native forage. Marked deficiencies of phosphorus are accompanied by loss of appetite and reduced rate of gain in animals. They may eventually have “stiffs” or similar bone changes, and milk production and reproductivity of cows may be impaired. Phosphorus content usually decreases as plants mature. On unburned ranges, grasses may have less than 0.08 percent phosphorus for most of the year. On ranges burned in winter, phosphorus amounts to around 0.12 to 0.14 percent for about 2 months in spring. This is barely adequate for dry cows and considerably below the 0.18 percent required by pregnant and lactating cows. Most forage species are deficient in this element. Swamp sunflower and legumes are relatively high. In winter, evergreen browse ordinarily contains more than other plants.

Calcium. — Calcium is one of the most important minerals for bone-building, growth, and reproduction. In Louisiana, most forage has more than the 0.20 percent thought necessary for breeding herds. Swamp sunflower is exceptionally high at all growth stages. Eastward into Georgia and Florida calcium in forage rarely exceeds 0.18 percent. Most browse is high in calcium, but cattle usually do not eat enough of it to compensate for the deficiency of the other forage.

Cobalt and copper. — These minor minerals may be deficient in vegetation in parts of the Coastal Plain. A lack of either cobalt or copper may cause loss of condition, stunted

growth, diarrhea, and anemia in cattle. Both are likely to be deficient in vegetation in central and southern Florida. In Georgia, commonly grazed herbaceous plants are wanting in cobalt and borderline in copper. The deficits are probably balanced by plentiful cobalt in browse plants, such as blackgum and summersweet clethra, and by liberal amounts of copper in sawpalmetto and other shrubs. Cobalt and copper are adequate in bluestem forage of Louisiana during the spring and summer, and cattle show no symptoms of deficiencies in winter.

Digestibility. — Information about the digestibility of native forage is scanty. On pineland three-awn range in south Georgia, digestible crude protein of the grasses is almost adequate for lactating cattle in spring and summer, but is extremely low in winter. Total digestible nutrients are enough for lactating cows from spring through fall.

In winter, cattle should be taken off the range because forage then is so low in total digestible nutrients that protein and mineral supplements cannot economically make up the deficiency. The 25- to 30-percent lignin in some browse plants during winter undoubtedly contributes to low forage digestibility. In Florida, weight losses of cows wintering on native range indicate that forage digestibility may be about the same as in Georgia. On bluestem range in central Louisiana, cattle wintered well when forage was adequately supplemented with cottonseed cake, plus loose salt and steamed bonemeal fed free-choice.

USE OF SUPPLEMENTAL CONCENTRATES

Forage for range cattle must be supplemented with concentrates, or hay, during periods of low, range-forage, plant nutrients. Concentrates are feeds that are low in fiber and high in total digestible nutrients. Some commercial or home-grown items available to the livestock operator are the various grains, wheat bran, cottonseed meal or cake, linseed

meal, bonemeal, etc. All so-called concentrates are not necessarily high in protein or in the necessary minerals needed for livestock, and many concentrate mixtures contain minerals that are not needed. Livestock operators should have their particular situations appraised, determine the specific nutrient deficiencies that are common to their areas and purchase concentrates and minerals to fill their needs. See table 4. Some commonly fed concentrates and minerals and their application are:

Protein concentrates. — Cottonseed meal or pellets (41 percent crude protein) is the most widely fed and practical protein concentrate. Normally, feeding starts in October or November, but it should begin earlier if crude protein of forage drops below 7 percent, or if cows show signs of losing weight rapidly. During the fall, 1 to 2 pounds per animal per day will be sufficient. When cows remain on the range, the rate should be stepped up to 3 pounds per day for the 2 or 3 winter months when forage quality is lowest. Feeding may stop after forage greens up in spring. About 375 pounds per animal each year is enough on most ranges. The best place for meal is in troughs, but pellets may be scattered on the ground without excessive loss. Troughs should be moved occasionally to prevent the vegetation from being trampled out. Feeding protein concentrates during spring and early summer has not proved practical.

Phosphorus and calcium. — These minerals should be accessible in feedboxes all year. Steamed bonemeal (32 percent calcium, 15 percent phosphorus) is most widely used and with apparent good results. To induce consumption and prevent spoilage, two parts of meal are often mixed with one part of salt. Yearly consumption of this mineral mix varies from 18 to 75 pounds per head according to weather, quality of forage, and mineral content of other feeds. If a greater intake is desired, molasses or cottonseed meal can be added to increase palatability.

Minor mineral elements. — Minor elements are often added to mineral mixtures as a precaution, but the only area of demonstrated need is south Florida. Mixtures suitable to this area contain red oxide of iron (3.12 percent), copper sulfate (0.63 percent), and cobalt chloride or cobalt sulfate (0.04 percent).

IMPROVED PASTURES

For best returns from the livestock operation, develop and use improved pastures in conjunction with forest range — the two together make a dependable source of year-long forage. This combination is especially suitable for cattle owners who have neither sufficient range nor improved pasture to support herds of practical size: 25 head or more. Because forage from improved pastures is higher in crude protein and minerals than most native forage, such pastures improve the condition of cattle and thus better the calf drop.

Several species of grasses can be planted in improved pastures. Each locality has developed favored combinations that work well. For specific advice, consult the local county agricultural extension agent. Overseeding of the planted grasses with a mixture of legumes such as lespedeza and white clover increases yields, extends the grazing period and contributes to soil nitrogen fixation.

Apply fertilizer liberally to improved pastures. Recommendations on fertilizer rates for specific soils, sites, rainfall and temperatures are best obtained from local sources such as the county agricultural extension agent.

Whenever possible, fence off ranges from improved pastures to avoid concentration on the pastures. To assure regeneration of pasture legumes, grazing pressure must be light while these plants are flowering and seeding.

During the spring and early summer, native

Table 4. — Daily nutritive requirements of beef cattle

Weight of cattle	Dry matter	Digestible protein	Total digestible nutrients	Calcium	Phosphorous	Carotene	Digestible energy
Wintering pregnant beef cows							
----- pounds -----						mg	thermus
900	13.1 - 18.4	.65- .70	6.9 - 9.7	.044	.037	55	20
1,000	14.2 - 20.0	.70- .80	7.5 - 10.5	.044	.037	55	18
1,100	15.2 - 21.5	.75- .85	8.0 - 11.3	.044	.037	55	18
1,200	16.3 - 22.8	.80- .90	8.6 - 12.0	.044	.037	55	18
Beef cows nursing calves — first 3 to 4 months							
900 to 1,100	22.0-27.0	1.2- 1.4	12 -15	.066	0.53	90	34
Growing beef cattle: fed for rapid growth							
300	7.2 - 9.0	.67- .77	5.1 - 6.2	.040	.029	20	13
400	9.1 - 11.4	.76- .87	6.2 - 7.2	.044	.033	25	14
500	10.7 - 13.0	.81- .92	7.2 - 8.4	.042	.033	30	16
600	12.4 - 14.7	.84- .95	8.1 - 9.3	.040	.033	35	17
700	14.2 - 16.5	.87- .98	8.9 - 10.2	.037	.033	40	18
800	15.9 - 18.3	.90-1.00	9.5 - 10.9	.035	.033	45	19
900	17.3 - 19.7	.93-1.03	10.1 - 11.5	.035	.033	50	20
1,000	18.6 - 21.0	.95-1.05	10.6 - 12.0	.033	.033	55	21
Wintering beef calves to gain 3/4 to 1 pound per head per day							
300	7.0 - 8.3	.52- .58	3.9 - 4.6	.035	.026	17	10
400	8.7 - 10.3	.63- .70	4.8 - 5.7	.035	.026	25	12
500	10.3 - 12.1	.71- .78	5.7 - 6.7	.035	.026	30	14
600	11.7 - 13.9	.79- .88	6.5 - 7.7	.035	.026	35	16
Wintering yearling beef cattle to gain 1/2 to 3/4 pound per head per day							
600	11.6 - 13.3	.67- .75	6.3 - 7.2	.035	.026	35	16
700	12.9 - 14.8	.76- .83	7.0 - 8.0	.035	.026	40	18
800	14.2 - 16.3	.83- .90	7.7 - 8.8	.035	.026	45	18

forage should be grazed while it is at its optimum palatability and nutritive value. Cut some of the improved pasturage for hay. One or two crops can be harvested each year. The hay from 1 acre — 1.0 to 1.5 tons — is ample to feed a cow in drylot for 3 to 4 months.

One-half to 1 acre of moderately fertilized pasture in combination with 10 to 20 acres of forest range will usually produce enough forage and hay to care for a cow all year. The ratio of pasture to range varies widely by areas and operations. The following schedule for grazing and feeding cattle and harvesting hay applies to many areas:

March-April	Graze improved pasture or pasture-range combination.
May-July	Graze range; harvest pasture for hay.
August-October	Alternately graze forest range and pasture.
November-February	Feed hay in drylot; graze forest range and pasture lightly as available.

In many areas grazed firebreaks can be established to aid in fire control for the protection of the forested area and also to serve as improved pastures for the grazing operation. They not only produce good forage for much of the year, but also improve the distribution of the cattle over the range.

TREE PLANTATIONS MANAGED AS IMPROVED PASTURES

In the Soil Bank Program, many farmers planted Pensacola bahia grass pastures to pine trees. They found that this shade-tolerant grass persists in dense stands of pine. After 30 years, when these stands are prescribed burned, lush stands of bahia grass cover the forest floor. Bahia grass can also be grazed very heavily without damage to the plants. In fact, studies at the University of Georgia have shown that close and frequent grazing is desirable for optimum cattle weight gains.

Using shade-tolerant grasses such as bahia grass, land managers can grow trees for timber production on areas managed as improved pastures. The time to incorporate such pastures is when site preparation for tree planting is done. On old fields, grass can be seeded with only light soil disturbance. However, recently cutover timbered areas will require more intensive site preparation for grass establishment than for trees. Future pasture management may require access for mowing and fertilizing. Some factors to consider in location, establishment and maintenance of such pastures are:

- The type and amount of improved forage needed.
- Soil capability for pasture purposes.
- Access to the area by roads.
- Wildlife objective: The design and layout of the area can help improve wildlife habitat for some species by providing needed habitat variety.

CATTLE MANAGEMENT

ECONOMIC CONSIDERATIONS

One of the simplest, but most overlooked, ways of making more money on a livestock operation is in the field of cattle management. The traditional, uncontrolled, and unmanaged herd of cattle ranging the woods produced little income, but was justified by many because of the low expense involved. With some added effort by the owner to control the animals, regulate their breeding, improve their quality and to breed at the proper time, a marginal operation may be turned into a profitable one. This will entail some additional expense and time, but produce a substantial return on the investment.

One of the basic objectives of the livestock operator is to produce beef and derive a profit. It will cost the rancher about the same to support a cow for a year, regardless of whether she produces a calf or not. Carrying dead weight in the form of non-producing cows is frequently the difference between profit and loss. Table 5 illustrates the increased income for each 5 percent increase in calf crop.

Desirable objectives in cow herd management are shown in figure 9. Observe closely the relationship that should exist between grass

production and nutrient values, the calving period, the lactation and the growth and sale of the calves. The preceding chapters have stressed methods of handling the forage resource and the use of the forage by cattle; now let us look at the animals themselves and see what might be done with them.

BREEDS OF CATTLE

Livestock producers, when they talk about *kind* of livestock, refer to the species of the animal, i.e., cattle, sheep, horses, or goats. *Class* of livestock refers to particular age groups (calves, yearlings, cows, colts, etc.), and *breed* indicates the special groups within the species having such characteristics or attributes that will distinctly set them apart from others within the species, (Hereford, Angus, Shorthorn, Brahma, etc.).

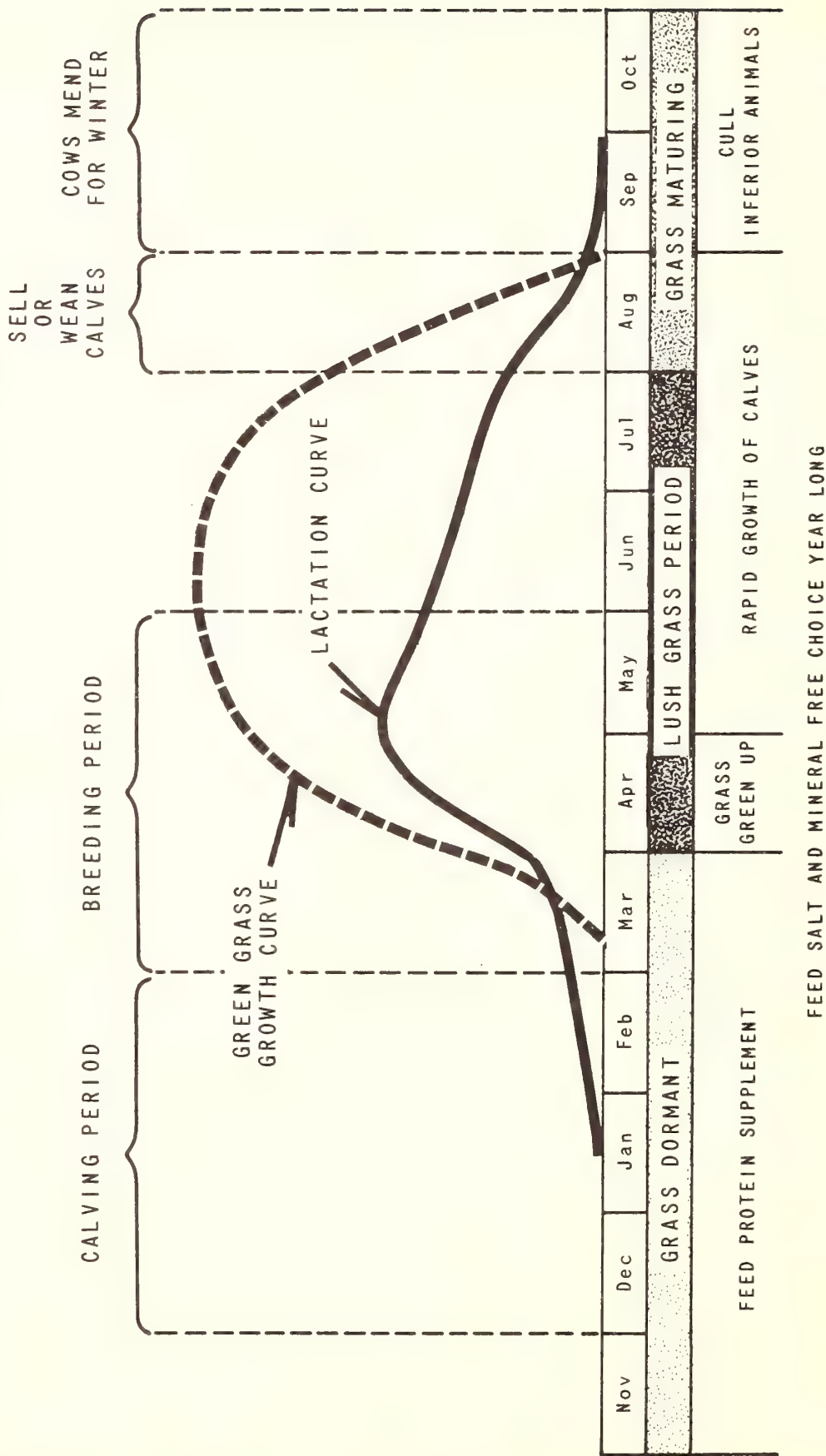
Throughout much of the South, forest range has been stocked with crossbred cattle exhibiting strains of the original introduction of English, French, and Spanish breeds. Over the years, this mixture of breeds has involved a native type of cow remarkably well suited to

Table 5. — Increased income for each 5 percent increase in calf crop¹

Average weaning weight (pounds)	Average selling price of calf per pound, live weight							\$1.00
	18c	20c	30c	40c	50c	60c	80c	
550	\$4.95	\$5.50	\$8.25	\$11.00	\$13.75	\$16.50	\$22.00	\$27.50
500	4.50	5.00	7.50	10.00	12.50	15.00	20.00	25.00
450	4.05	4.50	6.75	9.00	11.25	13.50	18.00	22.50
400	3.60	4.00	6.00	8.00	10.00	12.00	16.00	20.00
350	3.15	3.50	5.25	7.00	8.75	10.50	14.00	17.50
300	2.70	3.00	4.50	6.00	7.50	9.00	12.00	15.00

¹This table was developed by multiplying the number of extra calves (five) by the average weaning weight, by the selling price per pound, and dividing by 100.

Figure 9. — How to tie livestock management into a grazable woodland or range conservation program for greatest net returns per animal unit



the climate and sometimes adverse grazing conditions found in the southern piney woods. With very little or no attention given to supplemental feeding during the stress months of fall and winter, this unique crossbred cow shows unusual ability to survive under the most rigorous conditions. In recent years, however, there has been a slow but noticeable effort to improve the breed. Generally, very few purebred cattle are run on forestland range. These few are largely confined to the areas bordering the Coastal Plains where large areas of cut-over timberland has been converted to improved pastures.

Introduction of hybrid vigor into the herd is one of the most effective ways to increase efficiency of production in beef breeding herds. The objective of hybrid vigor is to increase the performance of the offspring resulting from crossing animals with different genetic backgrounds and performance characteristics. Care must be taken to use the best cross possible to provide the greatest percentage increase in calf numbers and weaned weight.

One of the most common and proven methods of improving herd quality and performance is the introduction of Brahman bloodlines into the breeding program. Brahman cattle have characteristics of size, resistance to heat and insects and disease, and an ability to utilize rough forage, that is not found in most of the British breeds. On the other hand, the British breeds have a beefiness, conformation, and docility that is not common to the Brahmans. A combination of the two animals produces an individual well suited to forest grazing with productive capacity that exceeds either breed alone. This distinction is marked under forestland range conditions, but tends to diminish with an increase in the amount of improved pasture that is made available.

One of the most successful crosses is the breeding of grade Hereford cows, or native

cows, to Brahma bulls to produce half-Brahma mother cows for the breeding herd. These half-Brahma cows are then bred to purebred or good quality English bulls (Shorthorn, Angus, or Hereford) producing calves that are 1/2 Shorthorn (or other British breed), 1/4 Brahman and 1/4 grade Hereford or native. Using this system of breeding in south Georgia, range research scientists observed the following results:

Management practices, and unit of measure	Bred to shorthorn bulls	
	Cows 1/2 Brahman 1/2 Hereford	Cows Grade Hereford
Weaned calf percent:		
1. Range only, no supplement	83	60
2. Average under varying supplementation and improved pasture	79	71
Weaned calf weights (pounds)	462	396
Average daily gain (pounds)	1.67	1.38
6-year cow death loss (number)	0	7

Cows with Brahman blood sometimes are considered harder to handle than cattle of predominantly British breeds. However, those who work with Brahman cattle learn their herding and driving habits and can handle them very well. Brahmans are no more difficult to keep under fence than other cattle, but corrals, chutes, and equipment for working them should be 1 or 2 feet higher than for most other breeds.

BREEDING CATTLE

Here is a fertile field for improvement in cattle management techniques. Many factors must be considered in controlling the breeding of the animals; all are important to the successful cattle operation and will be discussed in turn.

Bulls. — Some operators tend to skimp and save money, but it is false economy to take a chance that some of the cows will not get bred. Generally, it will pay to get the best bulls you can afford. Whatever breed is chosen, fast-growing bulls that were raised largely on roughage are desirable. Performance-rated purebreds are best. Bulls should be tested for fertility before putting them with the herd. Good bulls should be retained until their breeding efficiency declines or until inbreeding with their progeny becomes a problem. Normally, rotate or replace them every 3 to 4 years. Provide a separate pasture for the bulls outside of the breeding season.

Usually, in relatively gentle topography and easily accessible areas, one bull is sufficient for every 20 cows to be serviced. In rough topography, or areas of difficult travel, the number of cows per bull may be reduced; or, if the breeding season occurs while the herd is concentrated on improved pasture, more cows per bull may be permissible. Remember, don't skimp on the bulls — without a sufficient number, the calf crop and salable product will be reduced, with a consequent reduction in profits. Then the entire purpose of the operation — beef production — will be defeated.

Cows. — On forested range in many areas of the South, cows with 1/2 Brahman blood will outproduce and provide better results than will cows of one predominant breed. Continual efforts are needed to better the herd. Cows on a fairly high maintenance level should calve 3 out of 4 years under range conditions, with calves weighing more than 400 pounds at 6 to 8 months of age. Cows failing to meet these standards should be replaced.

In selecting replacements, the best choice is heifers from high-producing dams or from herds of known production. The heifers should be larger than average, and if selected from the operator's herd should be chosen from mothers of proven ability. Heifers

should be 2-years-old when first bred. If bred as yearlings, they are more apt to die at calving or, if they survive, are not very likely to have a calf the following year.

Keep cows as long as they consistently wean heavy calves. Well-nourished range cows do not seriously decline in productivity until they are at least 10- to 12-years-old. A common practice among many livestock operators is to keep a number of replacement heifers equal to 10 percent of their breeding herd. This number is usually sufficient to replace aged cows and death losses.

Breeding Season. — The breeding season for cattle on forest range is best limited to about 3 months so that all calves can be weaned and marketed at one time. When calves are dropped throughout the year, extra time and money are required to raise them, and the feeding and grazing schedule of cows is more complicated.

The generally mild temperatures in the South permit calving during the winter, and calving should be timed so the calves are old enough to eat the new grass in the spring and take advantage of the higher milk production of the mother produced by the new grass and better feed of the spring. With a gestation period of approximately 283 days, it is feasible to place the bulls with the herd from late February through June. Most calves are then dropped in December through March. Weaning in early August enable cows to retain or put on flesh before winter. Tests of this system in Louisiana resulted in calf weight gains averaging 2 pounds per day.

COSTS AND RETURNS

For combined timber and beef production operations there are several factors to consider in determining economic feasibility. These can be grouped into single and recurring payment categories.

Single Payment Expenses. — These usually come early in the stage of new business enterprises and are critical, both from the standpoint of present and future production capabilities and profit margin. Some typical, initial, single payment livestock-related expenses over a timber rotation are:

1. Site preparation for tree planting or natural regeneration can be modified to incorporate forage production objectives. Such modifications may cost extra, either in terms of actual dollar outlay or foregone timber or wildlife production.
2. Planning for coordination of management of timber and livestock is more complex and may require additional time and money.
3. Assuming that land is available for growing timber and native forage, additional land may be needed for improved pasture. Another option may be investment in improvement of land already owned, for conversion to improved pasture.
4. Fences, corrals, chutes, water tanks, and feed bunks are all necessary items in a timber-beef cattle operation. If additional fences are needed to protect or facilitate management of wildlife, recreation, or other improvements, plan to provide these in the initial investment.
5. Access roads for feeding and care of livestock and timber are necessary, if not already available.
6. Initial purchase of livestock is needed unless the owner already has cattle.
7. Truck, tractor and other equipment needs.

Some of the above-listed expenses may be unnecessary, depending on past use and the

condition of the land being considered for management. For example, old fences and corrals can frequently be rehabilitated, water may be available from streams or lakes, and roads need only be improved. These initial investments are a critical part of any operation and should be examined carefully as to need and expected future income.

Periodic activities and resulting expenses:

1. Salt, minerals, hay and other supplements to forage.
2. Forage survey, coordination of timber-range activities and general management duties.
3. Facilities maintenance.
4. Sales commissions and hauling.
5. Pasture fertilization and maintenance.

Some investor-related returns that can be expected from a timber and beef cattle operation are:

1. Sale of calves and cull cows.
2. Sale of cull bulls.
3. Sale of surplus hay.

Forage and timber production on the same land calls for additional managerial time to handle the increased complexity of these goals. However, timber, forage, and often wildlife, benefits can be achieved from such practices as prescribed burning, fencing and water developments. For example, timely burning can improve forage and wildlife habitat as well as reduce fuel buildup. Cattle grazing can also reduce the amount of dead grass, weeds and other plants that collect on forestlands — thus holding down risks from wildfires that are fueled by such undergrowth.



Figure 10. — Shade tolerant grasses planted at time of tree seedlings have provided forage for all 8 years of this plantation. Grazing offers an opportunity for annual income during precommercial stages of pine plantations.

LEASING OF GRAZING PRIVILEGES

Owners of forest range land may not have the desire or expertise to operate a livestock operation. However, there may be someone who would want to lease the resource for such an operation. Many factors need to be considered when negotiating such leases. Comparisons of several leases now in successful operation on private forest ranges indicate that the most complete leases cover the following points:

1. The exact tract of land to be grazed and the term or duration of the lease; state whether the leased grazing rights are to be exclusive with the lessee or shared jointly with other stockmen on the same area.
2. State who is to build fences, provide water or other developments that may be needed. Who is to maintain the existing or constructed improvements and to what standard. State who will own the improvements constructed under the terms of the lease and how the costs of these improvements will be amortized.
3. What kind of livestock will be permitted: cattle, sheep, or horses. Specify the class: calves, cows with calves, yearlings, 2-year olds, etc.
4. The number of livestock to be permitted. The lease should provide for periodic range examinations (including arbitration if needed) to see if animal numbers must be reduced, season of grazing changed, or stock handling and distribution altered to protect the range or other resources.
5. The season of grazing: year-long or spring, summer or fall. If less than year-long, specify the exact months.
6. The grazing fee. How much will the lessee pay for the use of the range. This fee should always be based upon an equitable charge for each month for each animal to be grazed — the animal month. A minimum total for the specified number and season may be established.
7. The exact use being leased. This should be limited to only the grazing rights with all other land and timber use reserved to the landowner.
8. Responsibility for death or injury of the livestock. The landowner should be free of any obligation in this respect.
9. The responsibility of the cattle owner for handling the livestock to avoid damage to land and timber, helping to exclude stray stock and guarding against timber theft and fire.
10. Provision for cancellation of the lease for breach of contract, with protection for the landowner in case of cancellation. Forfeiture of prepaid grazing fees or bonding, cash or surety, of the lessee are two ways to protect the landowner in case of default.

The landowner will probably find it useful to seek the assistance of an attorney in preparing the lease, although a valid contract may be prepared by the lessee. The agreement should always be written, signed by both parties, witnessed and a copy provided to each party to the agreement.

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