erally throughout the region. A few farmers, however, have found it profitable to make the necessary installations to provide the water where needed, and it seems safe to predict that these experiences will lead to a larger acreage of grass on the farms of the central bluegrass counties.

Limited supplies of stock water are also retarding the development and utilization of pastures in southwestern Kentucky counties, but experience of a few farmers in that region also indicates that they can afford to provide an adequate supply of good stock water in good permanent pastures. It has been the experience of numerous farmers that such pastures can be produced by proper soil treatment at reasonable cost.

GRAZING ON FORESTED LANDS

JOHN T. CASSADY, W. O. SHEPHERD

THE CHEAPEST feed for livestock in the South is obtained from native grasses on some 200 million acres of forest land. Since early Colonial times the clearings and cut-over forests have provided free grazing. On them an important livestock industry developed—at first, the unmanaged grazing by poor-grade stock and later, increasingly and gradually, the yearlong management of improved herds.

Progressive stockmen realize that although native forage is inexpensive it is valuable only when it is used wisely. Most native grass furnishes good forage for about 3 months in the spring and a few weeks in early fall. During the rest of the year ranges usually furnish roughage only. Cultivated pastures, harvested forages, concentrated feeds, and minerals are needed for balanced yearlong nutrition.

Conflicts have developed between forestry and grazing because forest lands produce most of the native forage. Close grazing and fires set to remove old grass are often detrimental to forest reproduction. Most farm wood lots are so badly trampled and grazed that they produce very little forage or timber. Forestry and grazing, however, can be worked together successfully.

Most Southern forest lands are 5 to 10 times more valuable for timber production than for native forage. Thus forestry must be given first consideration on forest lands. Grazing may furnish the major income from clear-cut lands while the new crop of trees is growing to merchantable size. Grazing has a real value in lowering the forest-fire hazard by reducing the amount of rough. Forested areas are really better suited for grazing than open areas because the trees furnish shade and a greater variety of forage. The most ideal native grazing is found on lands where open areas, young trees, and mature timber are somewhat mixed. Such mixtures usually exist where good forestry is practiced.

To make good use of native forage it is well to know the different range plants and their grazing values. Natural vegetation occurs in distinct types composed of certain dominant or abundant plants from which the types are named. Grazing management is based largely on characteristics of the types.

The Southern range area can be divided by forest types and geographic regions. Most Southern forest range is in the longleaf-slash pine forests extending through the lower South near the coast from the Carolinas to Texas. This area of 55 million acres was heavily cut over and has been slow to reforest. Forage is abundant in it.

Next in importance for grazing are the shortleaf-loblolly-hardwood forests, which cover nearly 80 million acres. They usually are dense; forage is sparse.

The bottom-land hardwood forests

of the Mississippi and other large river valleys cover about 30 million acres. Not much grass grows under dense hardwood forests, but there are considerable amounts of browse forage.

The upland hardwood forests of the hills and mountains cover nearly 35 million acres. Grazing capacity of the uplands is low, and soils are easily eroded so that grazing should be carefully regulated.

Of the three major geographic land areas in the South—the Coastal Plain, Piedmont Plateau, and Mountain regions—the Coastal Plain is the largest and most important for grazing. It includes Florida, Mississippi, Louisiana, and parts of Texas, Arkansas, Alabama, Georgia, the Carolinas, and Virginia. The longleaf-slash pine, shortleaf-loblolly-hardwood, and bottom-land-hardwood forest types are mostly in the Coastal Plain. The region is essentially a low plain with flat to rolling land, low elevations, slow drainage, sandy loam soils, and relatively open forests with much forage.

The principal range types of the Coastal Plain are wiregrass, bluestem, switch cane, bottom-land, coastal prairie, and marshgrass. We describe these types in the approximate order of their importance.

Wiregrass, the leading grazing type in the Southeast, extends from South Carolina into Georgia, Florida, and Alabama, mainly in longleaf-slash pine forests. Frequent burning has created a type of wiry, fire-tolerant bunchgrass. Important grasses are pineland threeawn, Curtiss dropseed, several bluestems, panicums, cut-over muhly, and carpetgrass. Shrubs such as gallberry and palmetto, which are characteristic of the type, are useless for grazing. A few others and hardwood tree sprouts are browsed to some extent.

From mid-March to late June, wiregrass range furnishes good grazing, and cattle gain about a pound a day on it. Cattle barely maintain weight from July to October, however, and lose weight rapidly the rest of the year unless they get supplemental feed.

Grazing capacity varies from about 1.5 acres a cow-month on open wiregrass range to more than 5 acres in well-stocked timber stands. Grazing capacity, as used here, means the number of acres of range needed to furnish ample forage to a mature cow for a month without damage to the forage or timber stand.

Curtiss dropseed and pineland threeawn furnish the best forage in March, April, and May. From then until fall the bluestems, panicums, and carpetgrass are important. Curtiss dropseed furnishes a good share of winter grazing. The foliage of this species (and of many others) remains green in winter, but the nutritional value of the forage is particularly low at that season.

A dozen species of bluestem grasses—also called broomsedge, sedge, and sage—furnish half of the native forage on the pine and upland hardwood forest lands of Mississippi, Louisiana, eastern Texas, eastern Oklahoma, and Arkansas. This important bluestem type also occurs in other Southern States. The principal forage plants are pinehills bluestem, little bluestem, slender bluestem, yellow bluestem, panicums, paspalums, carpetgrass, blue dropseed, muhly, and three-awns. Grasses furnish 80 to 90 percent of the forage. Grasslike plants called beakrushes and green sedges furnish 5 percent of the forage. Other imported species include beggar lice, common lespedeza, and swamp sunflower.

Certain shrubs as well as hardwood sprouts are grazed in winter and on heavily forested ranges where grass is sparse. Grazing capacities of bluestem ranges vary from about an acre a cow-month on old fields and clear-cut areas to more than 6 acres a cow-month on the heavily forested areas typical of shortleaf-loblolly-hardwood forests.

Bluestem ranges furnish excellent forage from March 20 to May 1, and beef cattle gains of more than 2 pounds a day are not uncommon. Thereafter forage values decline. Poor forage is produced in July when it is hottest, fairly good forage for 4 to 6 weeks in

late August and September, and very poor forage from October to March. Without supplemental feed, mature cattle on bluestem ranges lose up to 25 percent, or 200 pounds, during fall and winter. Similar losses occur on many other southern ranges.

Switch cane, a tall reed of the bamboo tribe, forms the best native grazing type in the South. Although cultivation, fire, and heavy grazing have reduced former stands, extensive areas of switch cane still remain on uncultivated bottom lands of the Mississippi Delta and in large swamps of eastern Virginia and the Carolinas. Other forage plants found with switch cane are bluestems, panicums, beakrushes, cinnamonfern, greenbrier, and various hardwoods.

Grazing capacities of the switch cane type vary from ½ acre a cow-month in the tall canebreaks on deep organic soils to about 2 acres a cow-month on less favorable sites. Switch cane furnishes the best grazing from May to November, but some farmers save this type for winter use. Heavy grazing in the spring or soon after a fire seriously damages this type.

A large variety of trees, shrubs, vines, grasses, and sedges grow in the bottom lands of the Mississippi and other rivers throughout the South. Prominent forage plants are carpetgrass, bluestems, beakrushes, sedges, switch cane, greenbrier, and many hardwood sprouts. Some of them provide nutritious winter forage. Spring and summer grazing is even better, but care must be taken to protect valuable hardwood-timber reproduction from excessive grazing damage.

The true grasslands of southeastern Texas, southern Louisiana, and southern Florida support large cattle operations. The marshgrass type hugs the coastline and the coastal prairie is situated on slightly higher ground bordering the flat pinelands.

Principal forage plants in the coastal prairie are bluestems, carpetgrass, Bermuda-grass, maidencane, and several paspalums. The grazing capacities are higher than on bluestem ranges and closer grazing is permissible because damage to tree reproduction is here of no concern.

The marshgrass type includes large areas of fresh-water marsh and a fringe of salt-water marsh along the southeastern and Gulf coasts. Predominant species are cattails, bulrushes, maidencane, sawgrass, cordgrasses, saltgrasses, and black rush. The fresh-water marshes provide the best forage, but some grazing is obtained in the salty marshes at low tide.

Southern range grazing is concentrated in the Coastal Plain. The Piedmont Plateau and Mountain regions have little open range and, as a whole, furnish limited range grazing. Forage values are low in comparison to timber and watersheds. Soils and hardwood tree reproduction are easily damaged by unrestricted grazing. Livestock production is largely a farm-pasture operation and native ranges are best used in spring to supplement farm pastures.

The Piedmont Plateau occupies a wide belt between the Appalachian Mountains and the Coastal Plain. It is characterized by rolling topography, sandy loam to clay soils, mixed pine-hardwood forests, farms, and old fields. A common practice is to abandon fields when soils are worn out or eroded. Weeds and grasses soon cover the fields and furnish fairly good spring forage until new crops of trees shade out the grass. The forage is composed of about the same plants found on bluestem ranges. Grazing capacities vary from 2 acres a cow-month on open areas to about 10 acres on forests that are well stocked.

In the southern Appalachian Mountains such excellent forage plants as Kentucky bluegrass, orchardgrass, and clovers grow naturally in the clearings. As long as the land is clear these plants furnish excellent forage, but when the forest stand recovers, forage is sparse and the grazing capacity is low. It is not practical to combine forestry and grazing on the same areas in the mountainous districts.

The southern range-livestock industry developed on a philosophy of minimum investment in capital and labor. Large areas of free range on cut-over lands and the mild climate favored haphazard management. Most range livestock are still left to forage for themselves. Under this system the return per animal is low, but the investment is lower still and some profit is made.

Problems and Benefits

The prevailing practices have several undesirable features. Yearlong grazing on strictly seasonal ranges results in severe weight losses in winter, high death losses, low calf crops, and poor calves. With mixed herds and yearlong breeding, one man who tries to salt or feed supplements on the range also feeds his neighbors' stock, and good bulls compete with scrub bulls. With free grazing on open ranges, the range is free only as long as the landowner permits; it may be fenced and leased to some other stockman, so that former users are left without sufficient range. Uncontrolled grazing, frequent burning, and hog rooting have kept trees from growing on valuable forest lands. Under a system of large and absentee ownership of unfenced forest lands, the average farmer is not interested in protecting forest reproduction from fires and grazing; even his farm wood lot is used more like a feed lot than a pasture.

Under prevailing practices, a few individuals have profited, but the community and forests have lost. More and more people have gone into the livestock business and the ranges are becoming crowded. Young trees are growing up and there is less forage. The answer lies in proper seasonal use of the range, more cultivated pastures and home-grown feeds, a higher grade of stock, and careful yearlong herd management.

A change toward better livestock management is evident throughout the South. Experience has shown the necessity for improved practices. The greatest need in range livestock production is for adequate nutrition when native forage is poor. This can be provided by the use of cultivated pastures, home-grown feeds, and supplements.

Ways to increase production and improve the quality of native range are being developed by experience and research. In central Louisiana, for example, 300 pounds of commercial fertilizer per acre on bluestem range doubled the yield and improved the quality of native grasses. The range was further improved by broadcasting lespedeza seed on fertilized areas. Best results were obtained by burning to remove rough and by fertilizing, seeding, and harrowing. Costs were high and pine reproduction was damaged.

A large number of forage plants are being tested on native ranges at the Georgia Coastal Plains Experiment Station. Lespedeza, carpetgrass, and Bahiagrasses have given best results so far. Carpetgrass is already widely distributed in cut-over lands. It is spread by cattle droppings and will grow on relatively poor soils. Common Bahiagrass will also grow on poor soils. It produces better forage than carpetgrass but is harder to get started and is less frost-resistant. The production of beef must be fairly high to offset the cost of improving native ranges. This leads to close grazing and damage to forest reproduction. In many cases it may prove more practical to establish permanent pastures on selected areas and manage forest lands for maximum tree production.

Because livestock belonging to many individuals frequently use the same range, cooperation is needed to improve the stock and their management. The formation of community associations of cattle growers provides an efficient way to handle cattle on forest ranges. Some of the operations that an association can effectively perform are to obtain grazing rights on forest lands; to purchase good bulls, feed, and minerals; to hire riders; and to effect the necessary improvements and opera-

tions in management. A good association will give stability to the local livestock enterprise.

The major problem on forest ranges in the South is to obtain integration of grazing and forestry on a basis that will result in utilizing the forage resource without damaging the forest. Forest range grazing, cultivated pastures, farming, and forestry, if properly coordinated, will provide a higher income for southern farmers.

THIS IS OUR UNFINISHED BUSINESS

W. W. WOODHOUSE, JR., R. E. BLASER

SOUTHERN CLIMATE permits the growth of a wide variety—an embarrassingly wide variety—of pasture and forage plants. So many new ones appear and so great has been the upsurge of interest in them that it has been hard to keep up with them and their specific requirements. Faced with so many possibilities, farmers and research workers have tended to dissipate their efforts on the many while learning too little about any one. Research workers particularly need to develop facilities and methods for evaluating properly the new plants and reevaluating some of the older ones.

We do know enough about the available plants, however, to build a fairly satisfactory pasture and forage program for most southern farms and to realize that other plants are urgently needed to fill gaps in the program for certain sections.

A major item of this nature is a warm-weather grass, high in nutritive value, that will grow well with legumes and at the same time allow legumes to grow—a plant, that is, to replace carpetgrass. It should be easy and rapid of establishment and disease-resistant. Unlike carpetgrass, it should be palatable and nutritious and should lend itself to a type of management that would encourage the growth and survival of legumes in the sod.

Dallisgrass, with all its limitations, seems now to be the most promising candidate for this spot. Dallisgrass will require considerable remodeling before it will fill the bill because it is a poor seed producer, it is slow and expensive to establish, and its nutritive value is less than desired.

Also, a good perennial hay legume is needed for the districts where alfalfa does not do well.

Alfalfa promises to go a long way toward solving the problem of hay production in much of the region, but, elsewhere, the perennials now in use are low-yielding, unpalatable, slow to establish, or difficult to manage and harvest. As a result, most of the hay produced there is from annual crops, which have the added risk and expense of establishment each year. The plant to fill this gap should be nutritious, persistent, high-yielding, and fairly easy to establish. Such a plant is not now in sight.

Disease resistance is a prime requirement in any plant to be grown in the South, where leaf and stem diseases are intensified by the warm, humid climate. Lack of resistance to any one of them can completely eliminate a plant from certain areas and lessen its value everywhere. For example, the annual lespedezas and white clover are almost useless on some of the sandy Coastal Plain soils because of their susceptibility to nematodes. Thus, while several fairly good grasses are adapted to these soils, the lack of legumes makes good pastures scarce. We have little hope for anything better than unproductive, pure-grass sods on these soils until the nematodes can be overcome. The incorporation of disease resistance into plants is a major objective in breeding new or improved forage plants for the South.