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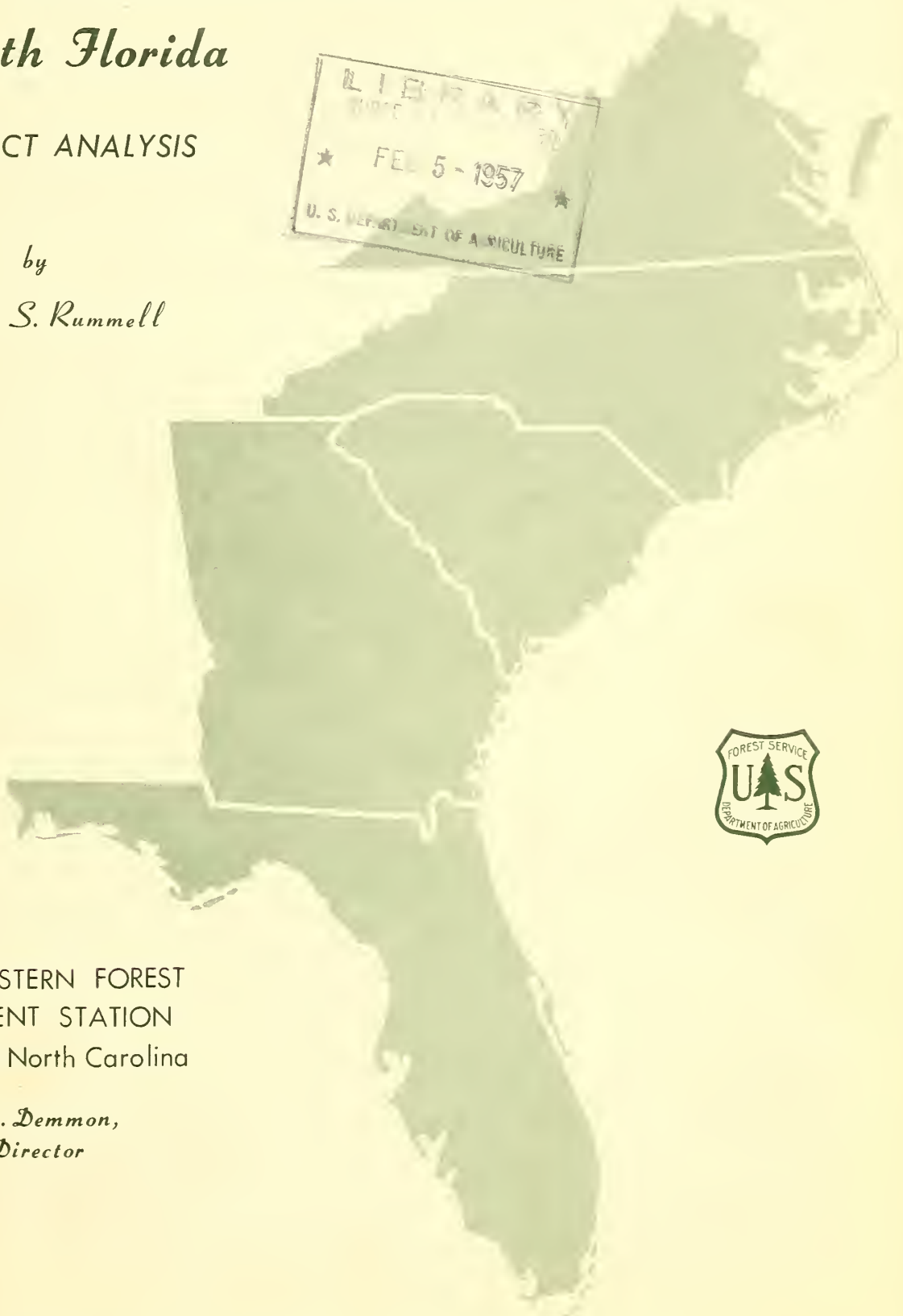
# Range Management Research in South Florida

## A PROJECT ANALYSIS



*by*

*Robert S. Rummell*



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## FOREWORD

Management of the native range in south Florida has received little research attention until recently, although cattle have been grazed in Florida since the early 1500's. Many methods of livestock management have been developed, varying from excellent to poor. One very prominent Florida rancher has stated that Florida is now pioneering as the West was in the 1880's. Existing challenges if met can result in greatly increased productivity from the range.

The objective of the U. S. Forest Service's program of native range management research in south Florida is to meet these challenges. Through study of past land use practices, study of the literature and of research currently under way by other public agencies, major range management problems have been evaluated. A program based on relative importance, urgency, and susceptibility to solution through research has been proposed. The program and background evidence supporting it are presented in this project analysis.

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# RANGE MANAGEMENT RESEARCH IN SOUTH FLORIDA

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## GENERAL DESCRIPTION OF THE PROJECT AREA

South Florida is a flat to gently rolling country of sandy soils, abundant ponds and marshes (fig. 1) with no point in the area more than 60 miles from salt water. The highest point is about 325 feet above sea level, and most of the interior is from 25 to 100 feet in elevation. Much of the extreme southern part is known as the Everglades, an area of low, grassy swamplands inhabited by abundant wild life, and is of little agricultural value unless properly drained.

The 17.6-million-acre area (fig. 2) supports extensive plantings of citrus, thousands of acres of winter vegetables, melons, and sugar cane, large phosphate diggings and fertilizer plants, commercial fishing fleets, pulpwood and lumber operations, and large herds of beef cattle which graze both native and improved ranges. All these are important to the area's economy.

In 1949, citrus, truck crops, livestock, and other miscellaneous agricultural crops including forest products sold from farms in the project area for 255 million dollars (64). Polk County alone mined about 70 percent of the world's supply of phosphate (22). Citrus grows on 394,000 acres (55) while about 277,000 acres of commercial vegetables, strawberries, and melons are raised (47).

Figure 1.--Broad expanses of flat terrain dotted with ponds and patches of pines and cypress typify south Florida. Scattered truck crop farms occur.

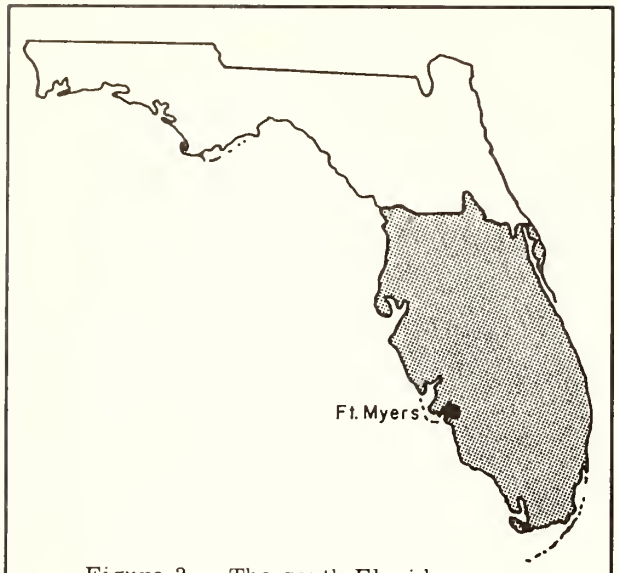


Figure 2.--The south Florida project area includes the 30 southern counties of Florida. Project headquarters are in Fort Myers.

Evidence of an expanding economy is seen in the 34-percent gain in population for the project area between April 1, 1950 and July 1, 1954. Population in the project area increased from 1,696,934 to an estimated 2,277,100 during this period, while State population increased from 2,771,305 to 3,493,100. 1/ Contributing to the welfare of the project area is a large percentage of the 5 to 6 million people who vacation in Florida and spend more than a billion dollars every year. 2/

Only 12.8 percent of the land in the project area is publicly owned; the remaining 87.2 percent is privately owned often in large tracts (appendix, table 3). For example, almost two million acres of land is owned by five of the largest companies or individual land holders. Other ownerships from 25,000 to 50,000 acres are common. The principal enterprise on the large land holdings is raising beef cattle, with interest in forest management showing up on individual ownerships. In 1950, the average farm contained 1,028 acres, compared to a state-wide average size of 290 acres (64).

## CLIMATE

The climate is subtropical. Average monthly temperatures vary from 63.4°F. in January to 82.0°F. in August (fig. 3). Killing frosts may occur annually in the north half of the project area and are likely to occur in half the years along the coasts and in the area south of Lake Okeechobee (65). Humidities are high. Precipitation is highly seasonal and varies from an average of 2 inches in November to 7.47 inches in August. Annual precipitation averages 52.86 inches. During the low precipitation months beginning in late October and extending into May, many ponds and marshes go dry. However, with the onset of summer rains in June, these ponds and marshes fill up, and by late summer many low-lying tracts of land are flooded.

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1/ Data from Bureau of Economics and Business Research, University of Florida; reported in Tampa Tribune, July 31, 1955.

2/ Cameron, Herbert D. Collins (Gov. Leroy) says state lure to industry not cheap labor. Tampa Tribune, July 30, 1955.

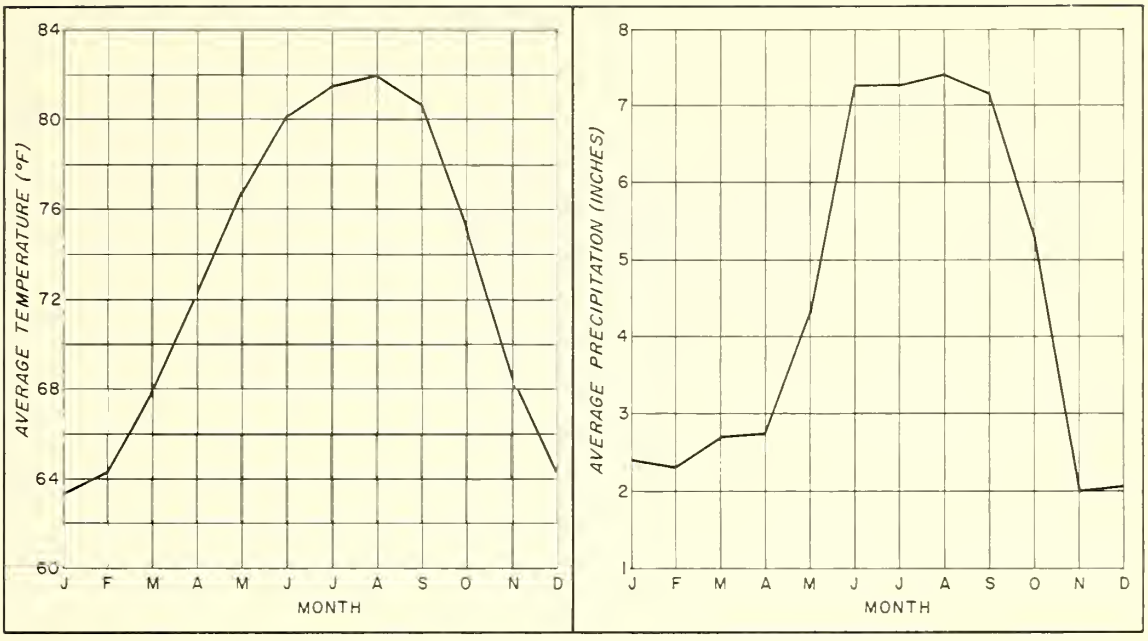


Figure 3.--Average monthly temperature and precipitation for 49 weather stations in south Florida project area.

## SOILS

Most soils in the project area have developed from noncalcareous sands overlying limestone deposits (27). Eight of the Great Soil Groups are represented. These are:

(1, 2) Red and yellow soils (sands)
( 3 ) Ground water podzols (sand)
( 4 ) Half-bog soils
( 5 ) Dry soils
( 6 ) Bog soils
( 7 ) Lithosols
( 8 ) Alluvial soils

Generalized soil associations are presented in figure 4.

In general, the soils supporting range vegetation are sands low in organic matter, poorly drained (27, 39) and having a pH of 4.0 to 5.0 (32). Soils of organic origin exist in the Everglades region and are used for truck crops, sugar cane, and improved pasture when properly drained (27).

The soils generally are deficient in nitrogen, phosphorus, potassium, calcium and magnesium. In addition, certain soils also are deficient in copper, manganese, zinc and boron (27). Lime is frequently added to improved pasture soils to help correct soil acidity and as a source of calcium and magnesium (27). Magnesium deficiency is most pronounced in sands, especially in high, well-drained areas in the citrus belt, while copper deficiencies have been found on raw organic soils in the Everglades and some other areas (27).

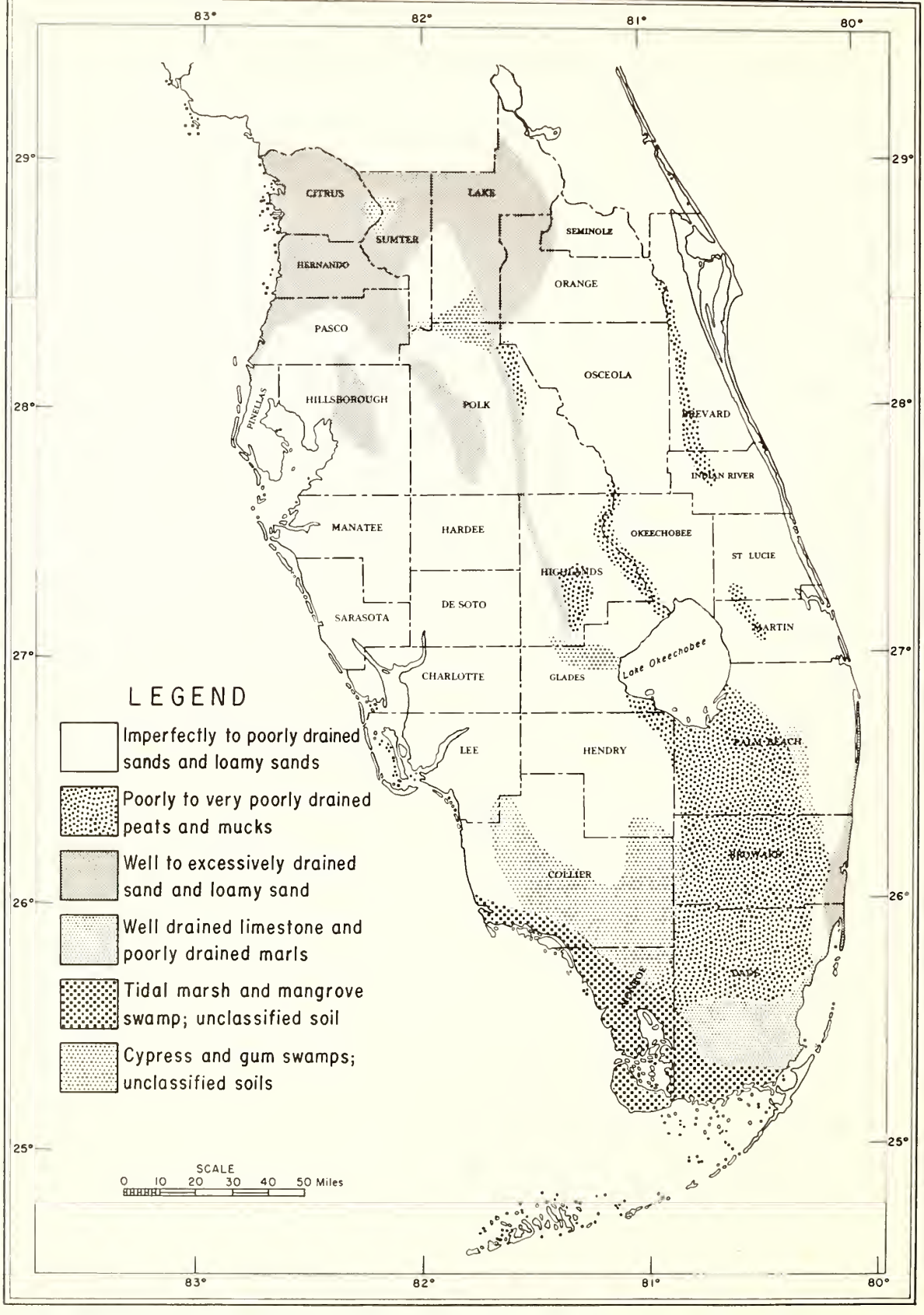


Figure 4.--Generalized soil associations in south Florida project area.

## THE RANGE RESOURCE

Approximately 11.2 million acres or 65 percent of south Florida's lands are grazed or grazeable (appendix, table 4). Of this 11.2 million acres, 10.2 million acres are native rangeland. The remaining 1 million is land which has been improved by partial or total destruction of existing native vegetation followed by planting of a variety of pasture grasses (34). Locations of the major vegetation types are shown in figure 5.

Approximately 80 percent of the "land in farms" as defined by the 1950 census, is used for range and pasture (64). Lake, Dade and Monroe are the only counties with less than 50 percent of land in farms used for range and pasture.

Very little work has been done in classifying range vegetation into forage types, but work by Davis (15) provides excellent ecologic groupings, useful in delineating range types. For this project analysis, areas important for livestock grazing have been grouped into four plant associations, from material collected by Davis and information gathered by the U. S. Forest Service during 1954 and 1955. Vegetation on each of these associations is briefly discussed in the following sections.

### Pine Flatwoods

Pine flatwoods cover about 5.7 million acres. They are spread over the north half of the project area from the Gulf of Mexico to the Atlantic Ocean, and extend down each coast line to the vicinity of Naples on the west and in a narrow band as far south as Homestead on the east. Five pines, South Florida slash pine (Pinus elliottii var. densa), longleaf pine (P. palustris), common slash pine (P. elliottii var. elliottii) and some loblolly pine (P. taeda) and sand pine (P. clausa) form the timber overstory which, though largely cutover, varies from sparse to fully stocked. Dominating the range aspect are saw-palmetto (Serenoa repens), grass species of the genera Aristida, Andropogon, Axonopus, Panicum, Paspalum, Sorghastrum, Sporobolus, other grasses and grasslike plants, a number of weeds and a variety of shrubs such as gallberry (Ilex glabra), staggerbush (Lyonia spp.), huckleberry (Vaccinium spp.), paw paw (Asimina spp.) and runner oak (Quercus spp.) (figure 6).

Over 170 species of forage plants were found by the Forest Service to be grazed during the summer of 1954 in the pine flatwoods type.

### Dry Prairies

"Dry" prairies or naturally treeless ranges cover approximately two million acres in south Florida (fig. 7). They are quite similar in plant composition to much of the cutover pine flatwoods, except that they do not support pine trees. They do have scattered hammocks containing cabbage palmetto (Sabal palmetto).

### Wet Prairies

Wet prairies generally are found in the pine flatwoods on very poorly-drained and frequently-flooded sites (fig. 8). They are readily distinguished from the dry prairie and pine flatwoods types by scarcity or absence of saw-palmetto (15). A great variety of forage plants occurs within this forage type. In 1954, the Forest Service found over 100 plant species which cattle had grazed in this type. Among the common plants are longleaf threeawn (Aristida affinis), panicgrasses (Panicum

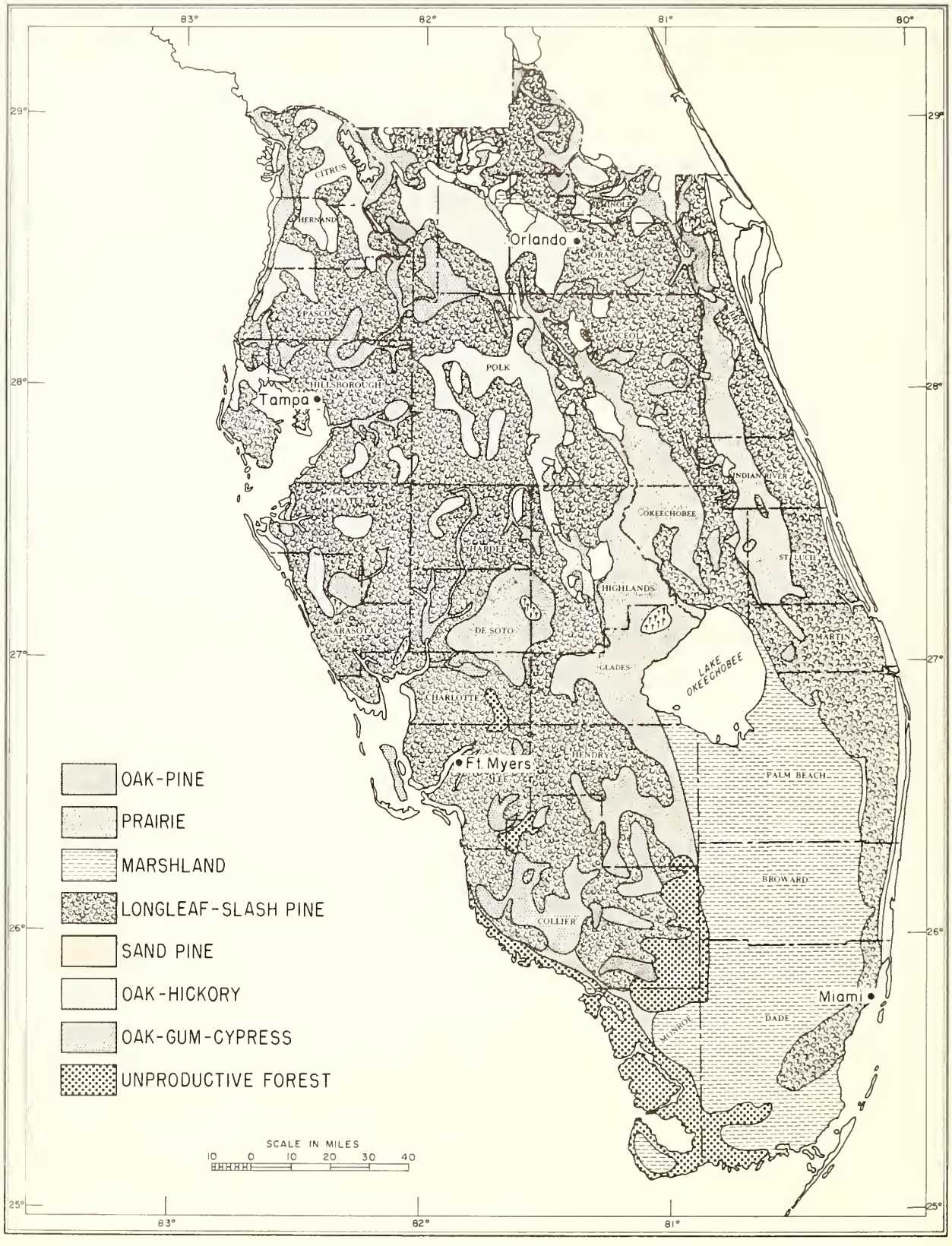


Figure 5.--Generalized major vegetation types in south Florida project area. Adapted from Larson (37).

Figure 6.--Some pine flatwoods ranges are fully stocked with trees but most are cutover. Cattle obtain forage from forest ranges in all degrees of tree stocking.

Figure 7.--Treeless ranges or "dry prairies" are important forage producers in south Florida.

Figure 8.--Cattle frequently graze wet prairies in the winter and early spring.

spp.), lovegrasses (Eragrostis spp.), beakrushes (Rhynchospora spp.), nutrushes (Scleria spp.), umbrellagrasses (Fuirena spp.), St. Johnswort (Hypericum spp.), corkwood stillingia (Stillingia aquatica), marsh hay cordgrass (Spartina patens) and hairawn huhly (Muhlenbergia capillaris). Grazed plants such as maidencane (Panicum hemitomon) and bearded sprangletop (Leptochloa fascicularis) are found in many of the abundant ponds adjacent to the wet prairies.

Vegetative Types of Minor Importance

Although not of high forage value, hammocks and oak-scrub types are briefly discussed here because of their common occurrence in the project area.

In the oak-cabbage palm hammocks are found the cabbage palmetto, water oak (Quercus nigra), live oak (Q. virginiana), stiffcornel dogwood (Cornus foemina), baccharis (Baccharis spp.) and grasses and grasslikes such as Panicums and beakrushes. Principal value of these hammocks is for shade, protection from cold rains and wind, and for dry ground during seasonal periods of flooding.

Cypress hammocks are dominated by baldcypress (Taxodium ascendens), with several subdominants such as southern wax myrtle (Myrica cerifera), stiffcornel dogwood, red maple (Acer rubrum), pond apple (Annona glabra), and redbay (Persea borbonia).

The oakscrub association is a well drained white sand area represented by such dominants as myrtle oak (Quercus myrtifolia), sand live oak (Q. virginiana var. maritima), Asimina spp., and saw-palmetto. Some grasses and weeds occur but the type generally does not produce good forage.

## FORESTRY

Approximately 53 percent of the project area is classed as forest land (44, 45), and most of this is used for cattle grazing. The land once supported good stands of pine timber but heavy logging since the 1920's, combined with a high incidence of wildfires and other fires set to burn off the "rough" for grazing, has left the forests in a severely depleted condition (fig. 9). In 1949, 86 percent of all commercial forest land and 94 percent of all commercial pine forest land was understocked with trees (fig. 10).

Value of forest products sold from farms in 1949 was only $627,000 (64). In 1954, pulpwood production amounted to 233,425 standard cords, which was only 14 percent of the production for the entire State (60).

Although timber growth potential on much of the forest land is not high (37), some of the large private land owners have profitable forest management programs under way. Preeminent among the factors preventing an acceleration of interest in forest management is the lack of organized fire protection project-wide. In 1954, only 9 of the 30 counties in the project area were wholly under forest fire protection by the Florida Board of Forestry (20). Sixteen counties had no fire protection. Another important deterrent to the practice of more forest management is the apathy among landowners, many of whom are engaged principally in raising beef cattle.

Figure 9.--Tree cover on much of south Florida's forest land is sparse and scattered because of heavy logging and frequent fire.

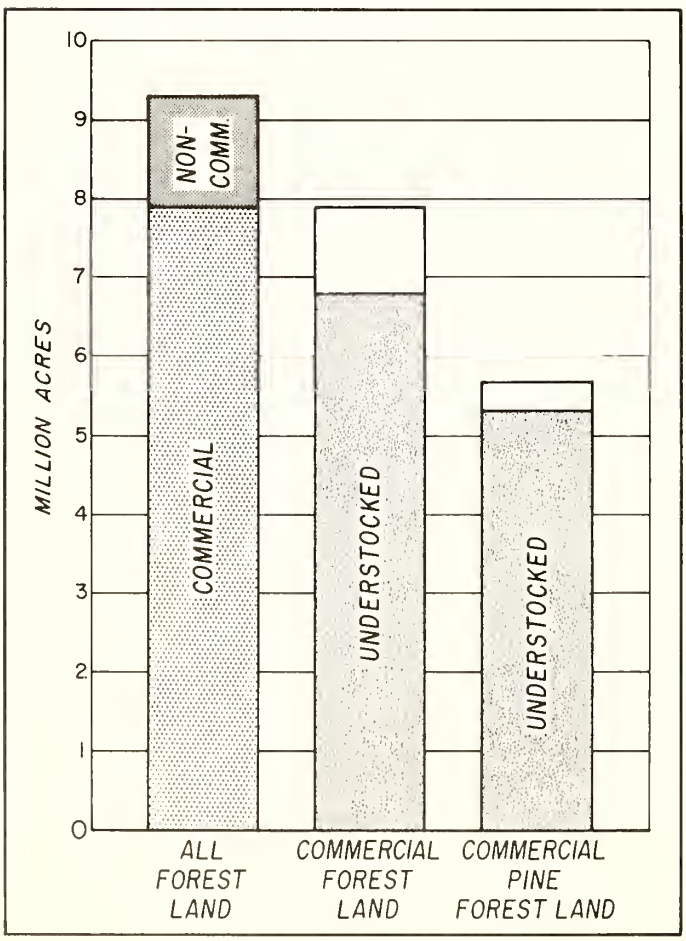


Figure 10.--Forest land and stocking condition in south Florida project area. Data from McCormack (44, 45).

Forestry and forest land grazing are not entirely compatible in the project area under present management systems. The periodic range fires annually destroy many young trees. If forestry is to assume importance as a major land practice, wildfires must be reduced in extent. Application of adapted controlled or prescribed burning techniques appears desirable on grazed lands where forestry is one of the important land use objectives.

With application of better fire control, natural regeneration of trees will occur where a seed source exists. However, since a high percentage of the forest land is understocked with trees, and natural regeneration would be slow to result in well stocked stands, forestry in the project area will be based principally upon plantations. How extensive will tree planting be? What will be the effects of tree plantations on the range picture?

From 1928 to and including the 1954-55 planting season, 38,000 acres of trees were planted in the project area (appendix, table 5). This is 8 percent of the 490,170 acres planted for the entire State of Florida in that same period. Recent accelerated interest in tree planting shows up in the 9,140 and 6,575 acres which were planted in the project area during the 1953-54 and 1954-55 planting seasons. This 15,715 acres amounts to 41 percent of the total acreage of trees planted since 1928.

Should planting be done at more than double the rate of the past two planting seasons or at 20,000 acres per year, 188 years would be required to completely reforest the 3,765,000 acres of poorly stocked and unstocked lands in the project area in need of planting (44, 45). To do the job in even 50 years would require nursery production of 51,204,000 seedlings per year. Additional seedlings would be needed to replant lands from which 25-year-old trees would be clearcut for pulpwood or on which trees might be destroyed by fire or other causes. It is difficult to see where this huge amount of seedlings would come from, especially when current nursery production available for the entire state is around 70 million seedlings and demand for them is expected to continue at high levels in those parts of the State not in the project area. In the 1954-55 planting season, 60 million seedlings were planted in the 37 Florida counties not in the south Florida project area, while only about 4.5 million seedlings were planted in the project area.

It is probable that tree planting within the next 10 years will result in a total of 125,000 acres of plantations. This would be a sizeable forest, but even so it represents only 1.2 percent of the total range area. The effect on range use could be of importance to specific property owners who engage in large scale tree planting but the over-all effect for the whole project area would be of minor significance.

Should reforestation by direct aerial reseeding prove practical in the future, or should a large pulpmill begin operation in south Florida, reforestation doubtless would be speeded up. The figures given above would not then apply and the impact on range use could be greater than presented.

## SHIFTING AGRICULTURE

Truck crops are commonly raised in a shifting type of agriculture in south Florida (fig. 11). Range lands are cleared of natural vegetation, cultivated, and planted with vegetable or other seed. After one or two years' use, the land is abandoned because of excessive competition from Bermuda grass (Cynodon dactylon)

or disease problems. The farm operator moves to another piece of range or forest land and begins his cultivation anew. Size varies considerably, but "farms" containing from 60 to 320 acres are common.

Figure 11.--In south Florida's shifting agriculture, farms are carved out of forest and rangelands, one or two crops are raised, and the land is abandoned to grow up in miscellaneous grasses and weedy vegetation. The white line in the photo is a long mound of sandy soil left when a ditch was dug around this farm for 2-way water control--irrigation in the dry season and drainage in the wet.

Carpetgrass (Axonopus spp.) and Bermudagrass, which invade the cultivated areas, provide fair forage. Many ranchers allow cattle free choice between native range and the abandoned truck farm areas. While some operators do not encourage the productivity of grass on these areas, other operators try to convert them to improved pastures by planting Pangola (Digitaria decumbens) or other pasture grasses.

Accurate data on acreage are not available, but it is estimated that 100,000 acres are farmed by shifting agriculture each year in the project area. In the Immokalee area alone, between 10,000 and 12,000 acres of wild land are cleared for truck crops annually while a corresponding acreage becomes idle each year. Figure 12 shows the principal truck crop areas. Lands farmed by shifting agriculture are generally west of Lake Okeechobee in the interior of the project area.

## WILDLIFE

Quail, turkey and deer, the most important shootable game species in the project area, live principally on lands used for livestock raising.

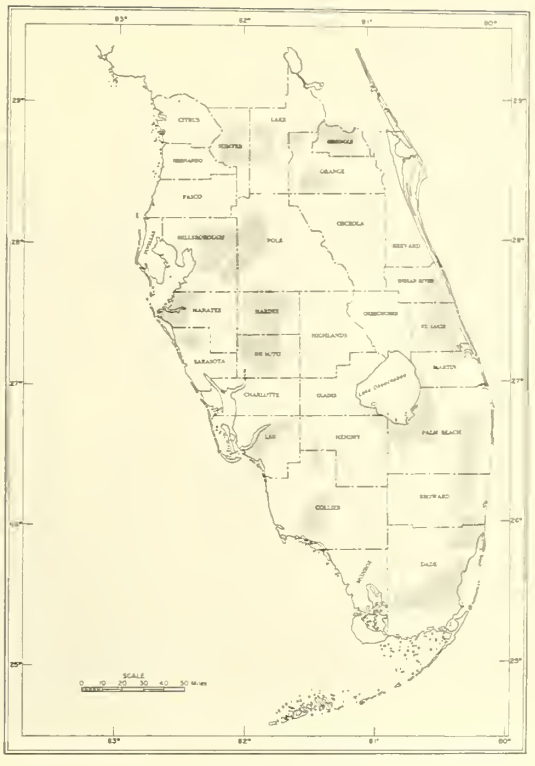

Figure 12.--Principal truck crop areas in south Florida. From Reuss (51).

Deer populations have increased during the past several years throughout Florida because of better law enforcement, public recognition of game regulations and improved habitat conditions. Upward trends in numbers are expected to continue for the next several years even though some loss in habitat will occur due to urban and agricultural expansion. Present deer populations are relatively low in the project area, with only 12,570 head reported (appendix, table 6).

The Florida Game and Fresh Water Fish Commission has found that controlled range burning combined with other management treatments is one of the most practical quail management techniques for south Florida cattle lands (9). Studies are under way by the Commission on amount of deer browse available under varying degrees of pressure from cattle and deer in various habitat types.3/

## RANGE MANAGEMENT SYSTEMS AND PRACTICES

The native range continues to be the foundation of the Florida beef cattle business, and most beef cattle have access to native grazing land during some part of the year (32). A great variety of management systems and practices are used. Native ranges provide all the forage for many ranchers, some use native range in combination with improved pastures, and still others rely on improved pastures only. Discussions of these management systems follow, along with other important practices.

### SEASONS OF USE

Many south Florida ranchers with fairly well drained land run cattle on the same range year-round without any system of deferment or rotation. Some ranchers rotate between ranges twice a year. Of necessity, other ranchers place cattle in the higher pine rangeland areas during the late summer period when extensive low-lying areas may be covered with 2 to 6 inches or more of water.

During the dry season cattle often make good use of forage growing in large sloughs or fresh water marshes (fig. 13). Frequently, the sloughs are a part of large pastures which contain higher forest rangeland. The entire pasture may be available to cattle yearlong but the marshes are less heavily grazed during high water periods. This,in effect, constitutes a type of grazing deferment system controlled by the amount of water present.

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3/ Personal communication from E. B. Chamberlain, Jr., Chief, Game Division, Florida Game and Fresh Water Fish Commission (Aug. 19, 1955).

Figure 13.--Maiden cane and other valuable forage plants growing in ponds provide good forage in the winter and spring when they are accessible to cattle.

## RANGE BURNING

Range burning, the most widespread tool of management used by ranchers on south Florida's native range, was carried out by Indians to stir up game and create habitats where game would concentrate. It was continued with the beginning of the turpentine industry to protect trees from accidental outbreaks of fire (6). Cattle ranchers now burn to destroy accumulations of dry grass and provide accessible green foliage for grazing during the winter and early spring (fig. 14). The green shoots of "wiregrass" (Aristida spp.) are reported to be about equal in nutritive value to most other grasses (17). Studies in other parts of the South have described the effects of burning on range plants, their nutritive values and cattle use patterns (7, 8, 25, 40, 56, 66).

Procedures used in burning vary considerably in accordance with the needs, habits, and desires of individual ranchers. Most burning is done from November through February, but some ranchers begin burning the range in September and some may burn as late as the first part of May. Some rangelands may be burned over every year, but the more common practice is to burn a unit of range every two to three years. One deterrent to yearly burning is the fact that not enough dead organic material accumulates in one year to carry a fire.

Some ranchers practice a scheme of progressive burning. They may set their first fires in November; about the first of January they set another series of fires to burn additional grass; still later, perhaps in the middle of February, they set another and last series of fires for the season. This progressive type of burning lengthens the period during which the native range grasses are palatable for winter and spring grazing.

Figure 14.--Uncontrolled grazing following severe winter burn has resulted in excessively heavy forage utilization on this south Florida rangeland.

Under the commonly employed methods of burning, tree reproduction and older trees frequently are injured or killed. Many ranchers who utilize native range for most of their forage say they could not stay in business without the use of fire. One large ranch burned 20,000 acres in 1953. A few ranchers mow rather than burn. Those who are forestry and conservation conscious deplore what sometimes seems to them a harmful practice.

The practice of range burning results in a kind of range deferred-rotation system. Cattle congregate on newly burned range during the winter and apparently obtain little forage from those parts of the range which are unburned. Since burning is done usually only every 2 to 3 years on one piece of native range, the unburned range could be considered to be deferred.

## COMPLEMENTARY USE OF NATIVE RANGE AND IMPROVED PASTURES

Improved pasture plantings of appreciable size were first made in the mid-1920's, when common bahia (Paspalum notatum) and carpetgrass seed were imported (34). Argentine and Pensacola bahia (Paspalum notatum var. saurae), Bermudagrass, pangolagrass and St. Augustine (Stenotaphrum secundatum) now are among the more common improved pasture grasses (fig. 15).

Of the many ranchers who use both improved pasture and native range, some may have native range and improved pasture accessible at all times to animals; others rotate cattle between improved pasture and native range. Young brood cows are kept by some ranchers on improved pastures until they have had one or two calves. They are then run entirely on the native range for the rest of their productive life. One large ranch runs its cattle on improved pasture from October to February. Cattle are on native range from February to July. Pregnant cows are on improved pasture from July to October while the dry cows and steers are on native range.

Figure 15.--Mr. H. D. Ryals, De Soto County rancher, grazes steers on well-maintained pangolagrass pasture.

## RANGE LIVESTOCK MANAGEMENT

Compared with other range areas, south Florida's livestock management practices generally are poor. Many improved livestock management methods are available but they have not been put into widespread use by ranchers grazing native range. Some current practices are discussed in the following sections.

### BREEDS AND BREEDING

Since 1859, when four Brahman crossbred bulls were brought into the State by Daniel C. Ambler, [4/] significant progress has been made in upbreeding Florida's range cattle from the Spanish cattle introduced by Ponce de Leon in 1521 (21). Most of the native cattle now have been bred up with Brahman and British bulls (13). Approximately 70 percent of the commercial cattle in Florida have about one-half native and one-half Brahman breeding; about 20 percent have British blood, and approximately 10 percent have very little improved breeding. By 1950, Florida had over 550 purebred herds of beef cattle (34).

In Charlotte County, purebred Brahman bulls are commonly crossed with native cows for the first or second cross, then following with Angus, Shorthorns or Herefords. [5/] Brahmans, Santa Gertrudis, Aberdeen-Angus, Shorthorn, Charolaise, Charbray and Herefords are included among Lee County cattle. [6/] Brangus, Brafords, Beefmasters and Afrikanders also are used, while many cattle throughout south Florida display some evidence of Devon, Red Poll, and Ayrshire or other dairy type blood.

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4/ Dodd, Dorothy. Popular Brahman cattle first introduced into Florida in 1859. Fort Myers (Fla.) News-Press, Feb. 17, 1954.

5/ McQueen, N. H. Better pasture grasses boost cattle industry. Fort Myers (Fla.) News-Press, February 17, 1954.

6/ Hueck, Carl P. Lee County farming one of leading revenue sources. Fort Myers (Fla.) News-Press, February 17, 1954.

Brahman-English crosses do well in south Florida's hot and humid climate. Furthermore, the introduction of some English blood has resulted in beef animals which better meet market requirements. The better blooded cattle purportedly require better ranges but improved blood of the desirable type will stand the range if managed properly (fig. 16) (42).

Although many good bulls are in service in Florida, an additional 18,000 good quality bulls are needed to replace lowgrade and scrub bulls (42). In 1948, 60 percent of a sample of ranchers having over 3,200 acres used purebred bulls exclusively (49). For a sample of ranchers having less than 3,200 acres, 84.4 percent used purebred bulls exclusively.

Even though many of the more progressive ranchers use a breeding season of 4 to 5 months, and separate bulls from cows at the end of that time, many other ranchers still leave bulls with the cows for a longer period--some even yearlong. This of course, means that calves are born throughout the year. According to a 1948 survey (49), the average length of breeding season on ranches of less than 3,200 acres was 8.6 months; on ranches of 3,200 acres and over, 6.7 months. Cows frequently are bred to calve beginning in December or January. Danger from screwworms and other parasites is low during this period and calves can be weaned prior to the high water season of late summer and fall.

Figure 16.--Excellent quality Brahman cattle frequently are grazed on forest rangelands.

Ranges containing 10,000 to 15,000 or more acres under one fence are not unusual. With this size acreage and with 500 to 1,000 or more brood cows in one range, effective service by bulls is difficult to obtain. Bulls commonly graze by themselves in groups of 3 to 5 or more and are not readily available when cows come into heat. Some ranchers attempt to obtain better service by placing bulls with cows in corrals, and then driving the herd back to the range after the bulls have had an opportunity to become associated with the cow group.

In Alachua County, number of cows used per bull varied considerably, although the average number was 32 cows per bull (appendix, table 7). A later survey showed somewhat similar results (49). On ranches with less than 3,200 acres, 36 cows were run per bull, with variation from 15 to 75 cows. For ranches having 3,200 acres and over, 29 cattlemen reported an average of 32 cows per bull, with variation from 15 to 50. Lewis (42) recommends one bull to 25 cows and never less than 3 bulls to 100 cows for Florida ranges. Cunha (12) says that many low calf crops in Florida may result from use of sterile bulls. He recommends one bull to every 15 to 20 cows on rough or poor ranges.

Parvin (49) reported for ranches 3,200 acres and over that the average age of heifers at first calving was 33.4 months. For ranches of less than 3,200 acres the average age of heifers at first calving was 30.0 months. Lewis (42) recommends that heifers be bred for the first time when they are about 2 years old, to calve at about 3 years.

## CALF CROPS

Average calf crops in Florida are very low. For 1954, the average calf crop was reported as 50 percent, with a prediction that by 1964 it will have increased to 70 percent (18). Appendix table 8 presents some calf crops for 1935, 1940 and 1947 (49). Average calf crop percentage in Florida during 1953 was reported as 66 percent (29).

A major cause of low calf crops in Florida reportedly is underfeeding, usually associated with feed deficient in protein, phosphorus, and perhaps certain trace elements (29). In Alachua County the calf crop was found to be quite variable (6) (appendix, table 9). This was attributed to several factors of which the physical condition of the breeding animals was the most striking. Research in Georgia has indicated that quality of native forage was not high enough to satisfy requirements for lactation and reproduction at the same time (56).

Low calf crops are not, of course, universal. One large ranch which makes some use of native range but bases its management program principally on improved pastures reports a calf crop of 75 percent. Another large operator reports a calf crop of 65 to 70 percent. A third and excellent operator consistently obtains calf crops of 85 to 90 percent.

## WEANING WEIGHTS

Weaning weights of range calves may vary from 225 to 400 pounds or more, depending upon age, breeding, time of calving, type of range, and management program. Some ranchers try to wean calves at 6 to 8 months of age, but calves frequently are left on the cow until 10 months or more of age. Some average weights of calves at 6 months of age are presented in table 10.

Calves born from December through February averaged 14 pounds heavier at weaning than those born in March and April in one study (50). One progressive rancher who practices excellent cattle management and who runs his cattle principally on improved pasture, but without supplemental feed, consistently weans calves in October at weights around 500 pounds.

## HANDLING AND RAISING OF CATTLE

Throughout the south Florida range country, branding, dehorning, castration and inoculation are commonly done in the winter months, when danger from screwworm and other infection is lowest (fig. 17). Spraying for ox warbles and other parasites is done three or four times a year by the better operators.

Because of the year-round warm climate, barns or sheds are a rarity on south Florida's rangelands. During times of high winds or infrequent cold spells, cattle secure necessary protection in the forests or hammocks.

Cattlemen recently have shown interest in leaving patches of native pine or in planting trees for livestock shelter in their improved pastures. The Florida Board of Forestry has as one of the objectives of its Tropical Forestry Project the finding of exotic trees which could provide effective shelter.

Figure 17.--Calves are branded, dehorned, castrated, and inoculated during the late winter on the Collier Company ranch.

## Mineral Supplementation

The need for proper mineral supplementation of range cattle has been recognized in Florida, although as late as 1931 only 15 percent of the range herds studied in Alachua County were supplied salt (6). By 1931, a nutritional anemia called "salt-sick" had been found to be the result of lack of iron or iron and copper in the forage (3). In some areas cobalt was found to be deficient. Other minerals that may be deficient in Florida range forage are calcium, phosphorus, and sodium chloride (2). Iodine is not lacking and no evidence has been found of nutritional deficiency resulting from insufficiency of fluorine, potassium, magnesium, manganese, sulfur or zinc (2).

A mineral mixture developed by the Florida Agricultural Experiment Stations has been recommended for range areas of Florida (2). It contains elements deficient in the forage, has good keeping qualities, and is palatable to cattle.

No mineral deficiency symptoms have been observed in Florida Agricultural Experiment Station herds while using the recommended mineral supplements, except for a few individual animals which do not eat the minerals (2). The factor most affecting mineral consumption has been the quality of the pasture as it reflects the soils and fertilization. The poorer the pasture, the larger is the amount of mineral supplement consumed. Cattle grazing recently burned native range or recently fertilized improved pastures reportedly eat little, if any, mineral supplement but an increase in mineral consumption has been noted as forage matures.

In studies by the Florida Agricultural Experiment Stations, cattle on unburned, unimproved pasture consumed an average of 77.64 pounds of mineral per head per year (2). This consumption was considerably higher than registered by cattle on range one-half of which was burned yearly and where cane molasses or fresh sugarcane or cottonseed pellets were fed. Consumption on the unimproved pasture also was higher than on pasture where the cattle had access to a combination of improved unimproved range.

A second wintering test with different animals showed lower average mineral consumption (2). However, average mineral consumption by cattle on unburned, unimproved pasture again was higher than consumption on pastures where different combinations of burning and supplemental feeding were used and where cattle had access to improved pasture and burned and unburned native range.

Analyses of "wiregrass" at the Range Cattle Station, Ona, Florida, showed an average calcium content of 0.54 percent and phosphorus of 0.08 percent (2). Calcium proved adequate for cattle obtaining all their feed from wiregrass grown on a fairly good soil but less than one-half the phosphorous requirement was met. Studies in Georgia (26) indicated that the native forage rarely meets calcium requirements and always falls below phosphorous requirements for normal growth of young animals and reproduction of lactating cows.

## Water for Cattle

Throughout south Florida an adequate supply of water generally is available throughout much of the year. However, during late winter and early spring when many ponds and streams dry up, supplying adequate water can be a problem. Some ranchers pump water from shallow wells into troughs or let the water flow onto the ground. Other ranchers dig pits deeper than the expected low ground water level and allow cattle to obtain water there. Abandoned artesian wells left by itinerant truck farmers furnish water for cattle on other ranges.

Winter Feeding

During the winter, range cattle in Florida commonly undergo weight losses which may vary from 50 to 125 or 150 pounds (28, 29). These losses may affect the economy of the beef cattle operation through lowered calf crops and mortality of mature animals.

Loss of weight may result from lack of sufficient high quality feed on the range during the winter period (35). Grasses on sand lands in Florida start becoming low in protein as early as July, August, and September, depending on the area and type of soil (11). Seasonal variation in the amount and quality of forage on the range has been considered the most important factor responsible for weight changes of range cattle throughout the year (36). Other factors which cause loss in weight are extended periods of heavy rainfall when pastures become excessively wet, cold driving rains, and birth of calves.

Recent research by the Florida Agricultural Experiment Stations has shown the benefits of proper winter feeding. Cows fed oranges and grapefruit were in better condition than those on native pastures alone (35). While cows on native range alone lost an average of 51 pounds per head, those fed oranges lost 28 pounds. Cows getting grapefruit as a supplement lost only 10 pounds per head. Giving cattle free access to citrus molasses without adequate protein has not proved satisfactory under range conditions (35), and sufficient roughage and protein should be supplied along with molasses. Winter feed reportedly needs to supply from 7 to 9 percent total protein for range cows and 13 percent for weaning calves, or a high analysis (36 to 41 percent) protein supplement such as cottonseed meal is needed to raise protein content (29).

Hentges (29) states that Florida's major nutritional problems are a lack of adequate feed to properly winter gestating, lactating cows, and a lack of sufficient protein and phosphorus to nourish both the cow and the foetus.

## ENEMIES OF BEEF CATTLE

Because of abundant moisture, favorable temperatures, and frequent concentrations of cattle, parasites have ample opportunity to increase in numbers. Among the external parasites which cause damage are horn flies, houseflies, stable flies, mosquitoes, horseflies, deer flies, screwworms, lice and ticks (61). Oxwarbles (*Hypoderma lineata*) appear in the backs of cattle in November, December and January and the flies of the oxwarble grub frequently bother cattle in late winter. Screwworms, which have been present since 1933, are particularly damaging to newly born calves and to animals at dehorning time or when the skin tissue is broken (63). Research currently under way by USDA may result in screwworm control throughout Florida through release of sterlized male screwworm flies. Plans are being laid for widespread control which may be undertaken by 1957 or 1958.[7/]

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7/ Unpublished statement by Dr. E. F. Knipling, Chief, Entomology Research Branch, Agricultural Research Service, USDA, to Florida Cattlemen's Association meeting, Fort Myers, Florida, June 17, 1955.

Liver fluke, lungworms, and stomach worms are important internal parasites. The yearly loss to livestock producers in Florida from liver fluke is estimated to be at least $100,000 (62). Liming to sweeten soil during truck crop farming or for improved pasture may foster liver fluke infections by providing good breeding conditions for the snail which acts as an intermediate host for liver flukes. Abandoned artesian wells also may provide good habitats for the liver fluke snail and result in greater cattle infestations.

Accurate information on livestock losses from disease is not available for Florida (57). However, anaplasmosis probably is one of the diseases causing frequent losses. Until eradication of the Texas fever tick through a concentrated dipping program which began in 1924 and continued in some parts of the project area until the early 1940's, Texas fever caused high losses among range cattle. Hyperkeratosis, or "X-disease," has been found in Florida's beef cattle herds (38). "Swollen joints," for which one of the causal agents is the microorganism Streptococcus pyogenes, has occurred on Florida ranges for a number of years and can be responsible for loss of 5 to 10 percent of the calf crop on individual ranches (16). Acute ergotism resulting from grazing Dallis grass, argentine bahia grass, and brownseed paspalum infested with the fungus Claviceps paspali (Stevens and Hall) has been observed in Florida (58).

West and Emmel (68) list a large number of plants potentially poisonous to livestock on Florida ranges. Losses from poisoning have been severe in some instances. In 1952, 25 head of cattle died on one ranch after eating seeds of coffeeweed (Glottidium vesicarium) (59). Losses from other poisonous plants are occasionally reported.

Loss from predators is negligible in south Florida. Although bear and cougar inhabit the Everglades and bobcats are fairly common, they do not cause significant losses. Occasional losses from snake bite and turkey buzzards do occur.

## MARKETING

Florida's beef cattle industry is essentially a "cow and calf" business and is built around production of canner, cutter, and utility beef animals (46). A survey in 1953 (1) showed that 93 percent of the readers of the Florida Cattleman and Livestock Journal were in the "cow and calf" business and owned beef-type brood cows. Most cattle are marketed directly off grass, although interest in feeding is increasing rapidly (fig. 18). Evidence of the increase is shown in Fifield's (18) prediction that the number of steers on feed may increase from the estimated 1954 number of 25,000 head to 75,000 by 1964, followed more recently by Cunha's (14) statement that approximately 120,000 head of cattle will be fed out in 1956.

Although Florida currently produces only about 60 percent of its total beef and veal needs (55) cattlemen probably produce more low quality beef than is being consumed in the State (46). To meet the demand for top grades of meat, large volumes of good, choice and prime beef and beef animals produced in the midwest are shipped to plants serving Florida markets. A possible 75 percent of the steers fed out in Florida to good, choice and prime grades are produced in Georgia, Alabama, Tennessee and other states, and shipped into Florida as feeders because of the scarcity of high quality feeders produced in Florida (53).

Figure 18.--Feeding trials by the Collier Company proved successful in raising market grades of steers in 1955.

In 1953 only 10.1 percent of the slaughter cattle sold in seven Florida auction markets graded commercial, good, and choice (46). Less than 20 percent of the slaughter calves graded commercial, good, and choice and only 6 percent of the stockers and feeders sold in these auctions graded medium or above. Appendix table 11 presents data on number of animals by class and grade sold in five south Florida markets in 1954. The data in the table emphasize the low quality of Florida's cattle but they do not entirely show the true quality, for many of the better grades of animals are marketed by private treaty or direct sale. About one-half of the cattle sold in Florida are sold through auctions and about one-half are sold privately or direct to packers, dealers, or other farmers (55). Many of the auctioned cattle are desired by both stockers and slaughter buyers. As in other range areas, need exists for cattlemen to distribute marketings more evenly throughout the year to avoid market gluts in late summer and fall (55).

The comparative quality of Florida's cattle is reflected by the average value of $62.00 per head in 1954 compared to $92.40 for the entire United States (55). In 1953, the average live weight of cattle (excluding calves) slaughtered in Florida was 723 pounds compared to a national average of 937 pounds (48).

## THE GRAZING SITUATION

### LIVESTOCK NUMBERS AND GRAZING LOAD

Since the early 1500's, cattle have grazed the native range, and more recently, improved pastures, in generally increasing numbers. In 1924, the State supported 623,000 head of beef cattle (fig. 19). By January 1, 1954, the beef cattle population had reached an all time high of 1,386,000 head, ranking Florida thirteenth among all the States.

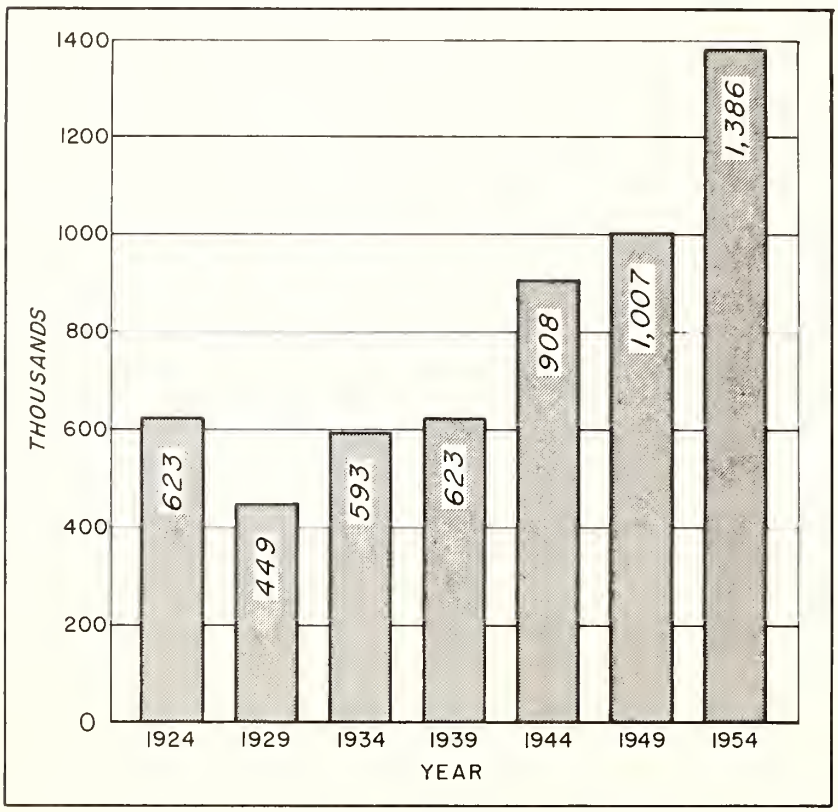


Figure 19.--Number of beef cattle and calves on Florida farms. Data from Scruggs and Scarborough (55).

Among the factors encouraging the increase in beef cattle numbers have been the eradication of the Texas fever tick and the great increase in acreage of improved pastures (42). Possible future eradication of the screwworm fly may favor further increases.

A million head of beef cattle graze the project area (fig. 20)--more beef cattle than are found in the individual western range states of Arizona, Idaho, Nevada, Utah, or Washington, and closely approaching Oregon, Wyoming, or New Mexico. Beef cattle numbers by class are shown in table 12.

The following tabulation presents data on size of cattle herds for Florida (1):

| Cattle (Number) | Ranches (Percent) |
|---|---|
| More than 500 cattle | 8 |
| Less than 500 cattle | 92 |
| Less than 100 cattle | 65 |

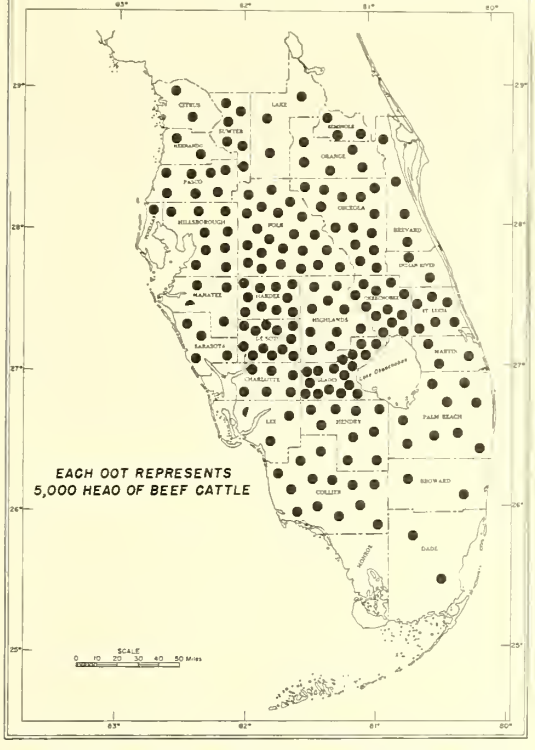


Figure 20.--The 1 million head of beef cattle in south Florida are distributed approximately as shown.

These data do not clearly represent the project area, for they include the many small ranches of northern Florida. For the project area, the percentage of ranches having more than 500 head would be higher than 8 percent. Many individual ranches have over 1,000 head of cattle and several support between 10,000 and 15,000 head.

In arriving at the grazing load in south Florida, it is necessary to convert grazing by the different classes of livestock to a common denominator. That denominator will be called an "animal unit." One cow, bull or steer over one year of age, or one mature horse or mule will constitute one animal unit. Mature sheep and hogs will constitute $\frac{1}{4}$-animal unit. All livestock less than one year old will be rated at 30 percent of mature stock for animal unit computations.

In following these computations through, it becomes necessary to determine the approximate ratio of total population of one class of livestock to mature animals of that class. For cattle this is done by the following: Total cattle population of the entire State of Florida January 1, 1954 was 1,679,000 (55). Of this, 255,000 were calves. The difference, or 1,424,000, is the cattle population over one year of age. The number of cattle units becomes 1,424,000 + (.3 x 255,000) = 1,500,500. The ratio of total cattle population to "mature" cattle becomes 1,679,000 to 1,500,500, or 1 to 0.894. Since 1954 or 1955 statistics are not available on numbers of calves for the project area, the statewide ratio determined from 1954 population will be used. This same ratio will be used for horses, mules, sheep and pigs. The figure 0.894 will be called an "age factor," and will be used to convert all animals to animal units. These computations leading to 1,060,030 adjusted animal units are presented in table 1.

## GRAZING CAPACITY OF IMPROVED PASTURE AND NATIVE RANGE

An estimate of the grazing capacities of improved pastures and native range is difficult to obtain because of the wide variability in improved pasture development and management and the lack of well-founded data on native range production and grazing capacities. However, figures useful to this analysis have been secured by using published data on improved pasture grazing capacity and estimates of native range grazing capacity made in the literature and by reliable ranch operators and technicians.

Two acres of well managed and fertilized Pangola grass reportedly have carried a mature cow throughout the year and her calf to 6 months of age (32). If all of south Florida's estimated 1,000,000 acres of improved pastures were equally productive, the total grazing capacity would be around 500,000 animal units on a yearly basis. Using a more nearly representative figure of 3.5 acres of improved pasture per year, which is midway between the 3 to 4 acres Lewis (42) states are

needed, south Florida's improved pastures have a grazing capacity of 285,714 animal units. Since the project area has an estimated 1,060,030 animal units (table 1), improved pastures provide approximately 27 percent of the total amount of forage. The native range must provide the remaining 73 percent.

Table 1.--Estimated livestock units in south Florida project area as of January 1, 1955

| Class | 1950 1/ population | Percentage change 2/ 1950 to 1/1/55 | Estimated population 1955 | Animal unit factor | Gross animal unit factor | Age factor | Adjusted animal units | Percent of adjusted animal units |
|---|---|---|---|---|---|---|---|---|
| Cattle & calves | 785,188 | +46.4 | 1,149,515 | 1.00 | 1,149,515 | 0.894 | 1,027,666 | 96.9 |
| Hogs & pigs | 75,561 | +15.6 | 87,348 | 0.25 | 21,837 | 0.894 | 19,522 | 1.8 |
| Horses & colts | 13,604 | -19.2 | 11,128 | 1.00 | 11,128 | 0.894 | 9,948 | 0.9 |
| Mules & colts | 3,501 | -17.0 | 2,906 | 1.00 | 2,906 | 0.894 | 2,598 | 0.2 |
| Sheep & lambs | 1,584 | -16.4 | 1,324 | 0.25 | 331 | 0.894 | 296 | T |
| Total | 879,438 | | 1,252,221 | | | | 1,060,030 | 99.8 |

1/ U. S. Census of Agriculture, 1950 (64).

2/ Percentage change figures used are statewide. County figures unavailable. Statewide percentage figures provided by Florida State Marketing Bureau, June 17, 1955.

No records have been found of studies to determine grazing capacities of south Florida native ranges. The ranges have been stocked on an experience basis. In reporting on an experiment in which cattle were grazed on improved pasture with free access to native range at all times, Jones, Hodges, and Kirk (33) stated "it appeared that one acre of well maintained improved pasture replaced 8 to 10 acres of native range and provided higher quality feed over a much larger portion of the year, resulting in a larger calf crop and heavier and higher-grading calves at weaning." Although herbage yields were not measured in this study, it was estimated that the cattle obtained 30 to 40 percent of their forage from the native pasture.

Stockmen's estimates of grazing capacities in Alachua County are presented in appendix table 13. Other estimates on grazing capacity for native wiregrass range are quite variable. Blaser and Stokes (4) report from 5 to 20 acres are required to furnish grazing for one annual unit. For ranches having 3,200 acres and more, Parvin (49) reported an average grazing capacity of 14.8 acres per cow. For ranches having less than 3,200 acres, the average grazing capacity was 8.3 acres per cow. Hodges (31) says that native forage species growing on soils deficient in plant nutrients have a low grazing capacity with a cow unit requirement of 8 to 20 acres for year-round maintenance. Jones, Hodges, and Kirk (33) state that about 15 acres of native range is needed to support one cow weighing 800 to 900 pounds. Fifield (17) says tests have shown that 15 to 30 acres of native unimproved Florida range--mostly wiregrass and weeds--are required to support one cow on an annual basis.

For this analysis let us assume that the 10.2 million acres of native rangeland can be stocked at the rate of 1 cow for each 20 acres per year. Using this stocking rate, the grazing capacity of the native range becomes 510,000 animal units (table 2).

Table 2.--Estimated grazing capacity and load in south Florida for 1955 and 1964

| Year and class | Area | Estimated grazing capacity | | Estimated grazing load | |
|---|---|---|---|---|---|
| | Million acres | Acres per animal unit per year | Animal unit years | Animal unit years | Percent of capacity |
| The year 1955 | | | | | |
| Native range | 10.2 | 20.0 | 510,000 | 774,316 | 152 |
| Improved pasture | 1.0 | 3.5 | 285,714 | 285,714 | 100 |
| Total | 11.2 | | 795,714 | 1,060,030 | 133 |
| The year 1964 | | | | | |
| Native range | 9.2 | 20.0 | 460,000 | 666,286 | 145 |
| Improved pasture | 2.0 | 3.5 | 571,428 | 571,428 | 100 |
| Total | 11.2 | | 1,031,428 | 1/ 1,237,714 | 120 |

1/ Assuming 20 percent increase over 1955 figures (18).

Since the estimated grazing capacity of improved pastures is 285,714 animal units and the estimated grazing capacity of native range is 510,000 animal units, the estimated total grazing capacity for the project area is 795,714 animal units. From table 1 it is seen that the estimated grazing load is 1,060,030 animal units. These calculations indicate that the native range and improved pastures are presently stocked at 133 percent of estimated grazing capacity. Fifield (18) has estimated that 90 percent of Florida's ranches are overstocked. The calculations in this analysis are not directly comparable to Fifield's estimate of overstocking, since they are based on animal units irrespective of individual ranch, but they do agree in general principle. Florida's improved pastures and native ranges are stocked at heavier rates than the current forage supply and levels of management warrant.

Further analysis of the data on stocking is desirable. The improved pastures have been shown to furnish 285,714 animal units if stocked at a rate of one animal unit to 3.5 acres per year. This requires the native range to furnish the remainder, or 774,316 animal units. Since the native range has been estimated to have a grazing capacity of only 510,000 animal units, native ranges are currently stocked at 152 percent of estimated grazing capacity.

Optimum animal production cannot be sustained from overstocked ranges. This has been shown by a large number of grazing trials (10, 54, 69). Continued overstocking eventually results in decreased animal production, followed by range retrogression. South Florida's ranges need relief from an overstocked condition.

By the end of the next decade, changes in major land use patterns will affect the range livestock rate of stocking and capacity situation. Fifield (18) estimates that improved pasture acreage will double for the entire State by 1964. For the project area, improved pasture acreage may increase to 2 million acres. Fifield (18) further predicts that numbers of cattle on Florida ranches will increase not more than 20 percent. Using these estimates of changes in major land use patterns and cattle numbers and disregarding possible changes experienced by populations of

livestock other than cattle (which currently total only 3 percent of the entire grazing load in terms of animal units), let us estimate the stocking situation and grazing load for 1964.

Improved pastures will increase to 2 million acres. Let us assume that the added 1 million acres of improved pasture will be obtained by cultivation and planting of lands currently now classed as native range. This may penalize the native range, since undoubtedly some of the increased improved pasture acreage will be obtained by reclamation or development of muck or marshlands and other lands such as abandoned truck crop acreage. However, for this analysis, we will reduce the present 10.2 million acreage figure for native range to 9.2 million acres.

If improved pastures and native range hold to their present estimated grazing capacities, the project area can support 1,031,428 animal units. The grazing load will increase to 1,237,714 animal units and we find that improved pastures and native ranges will be stocked at 120 percent of estimated grazing capacity. The native range will have to support 666,286 animal unit years while its grazing capacity will have been reduced to 460,000 by loss of 1 million acres to improved pastures. As a result, the native range would be stocked at 145 percent of its estimated capacity under present levels of productivity and management. The native range will be furnishing 54 percent of the forage, with 46 percent coming from improved pastures. Overstocking will still be a serious problem in 1964 unless present production levels can be raised on both improved pastures and native ranges.

Public agencies thus have a heavy obligation to provide range management systems which can increase productivity from the native range. Part of this obligation possibly can be satisfied by development of management systems which will result in increased grazing capacity. The remainder of the obligation must be satisfied by more efficient use of forage through improved means of livestock management.

Use of rangelands for tree growing will have some effect, though small, on grazing capacity. By 1964, an estimated 125,000 acres of native forest rangeland may be planted and managed principally for tree production. Range forage productivity in south Florida can be expected to decrease on tree-planted range areas somewhat in line with other parts of the South, where studies have shown that forage production is less beneath planted and other stands of trees than on open range (5, 23). Grazing demands on unplanted forest range lands will be somewhat intensified through this change in land use.

## FEED SUPPLIES

The contributions made by improved pastures and native range far outweigh hay crops and silage, and concentrates. In 1949, only 5,406 acres were used for hay crops and silage, and production of hay amounted to only 11,363 tons (64). Within the past 5 years, alfalfa hay has been successfully raised on a limited acreage. Silage is coming into favor as a means of utilizing surplus summer forage and is being winter-fed, although in 1949 the project area produced only 869 tons of green weight corn silage (64). A marked increase in the use of silage for fattening cattle and for winter feeding is predicted by 1964 (18).

In the 1951-52 season, 200,468 tons of dried citrus pulp, 17,597 tons of citrus meal, and 54,183 tons of citrus molasses were produced in the entire state (55). These citrus products were second to corn as a source of concentrated feed

nutrients for Florida livestock. In 1952, 9,304,000 gallons or 55,824 tons of blackstrap molasses were produced in Florida (55). An estimated 15 percent of the citrus pulp and over 50 percent of the molasses produced in the 1949-50 season were fed to beef cattle (11).

The citrus byproduct feeds are rich in sugars and pectins but are low in protein, and are considered as energy feeds (35). Protein concentrates such as cottonseed meal or peanut meal are recommended for use with citrus byproducts in an adequate feeding ration (35).

## DEFINITION OF THE PROBLEMS

This project analysis has weighed range problems according to their relative importance, urgency, and susceptibility to solution through research. Study priorities are based on these factors but also on available funds and personnel, and the extent to which other research agencies are studying the problems.

The many problems in south Florida rangeland use and management can logically be separated into six groups: (1) study of the range per se and determination of efficient ways to sample it (these are not range problems in the true meaning of the word, but they are tools through which the real problems can be solved); (2) problems revolving about major past, present, and possible future land management practices; (3) problems which have arisen from the kinds of range management employed; (4) problems associated with livestock management; (5) problems engendered by the inherent range enviroment; (6) problems in deer-cattle relationships on the range.

Study of the range per se and determination of efficient ways to sample it: In the south Florida project area there has been little study of the native range. The range management research program must begin by accumulating knowledge of what constitutes the range before progressing to studies leading to better management systems.

Highly important to the work is the cataloging of range plants. Over 350 forage species collected and identified in 1954 form a backbone inventory which will be important to technicians in all the future research (fig. 21). However, further intensive plant collection will be needed to assure that all range plants of significance are known and properly identified. The collection work should seek out grazed species, species which invade or regress with changing environment and which might be termed plant indicators, and species whose presence or absence may influence the micro-environment. Certain shrubs and broad-leaved trees will fall into this last group.

Studies of phenology and growth habits will be needed. Data on growth habits are essential for season of use and deferred rotation and other later studies.

Reactions of plant species to different grazing intensities, seasons of use, and other management treatments including fire will need to be measured through plant species composition, herbage production, and nutritive analysis studies. Changes in kind and amount of herbage produced can be one means for measuring the relative success of management treatments.

Figure 21.--Correct identification of range plants is an important part of range management research.

Plant species need to be grouped according to environment through ecological studies leading to more refined definitions of range types. Other studies should be designed to define range condition classes and prescribe ways for judging trend in condition. Such information will be valuable in establishing goals for the management of vegetation and will provide essential background information necessary in design of management studies. Studies in these fields are considered of high priority, for their results may influence correct interpretation of vegetation trends found in other studies. Findings should have immediate value to progressive ranchers.

Practical ways are needed for decreasing the abundance of saw-palmetto, a shrubby plant of low forage value (fig. 22). The Forest Service is constituted to study effects of different management systems on relative abundance of undesirable plant species, but studies in mechanical or herbicidal control will be encouraged from other properly constituted agencies. Studies in saw-palmetto control are relegated to medium priority in this analysis because the plant apparently resists control through management, because presently known herbicides or mechanical means for controlling it are costly, and because we need greater knowledge of its autecology before efficiently designed studies can begin. Incident to grazing capacity and other management studies, data can be obtained on the effects of the management systems on saw-palmetto.

Though existing devices and techniques for sampling vegetation will be useful under south Florida range conditions, studies in methodology are needed. The highly complex vegetation contains many species of little-known characteristics. Furthermore, the long growing season results in an almost year-round progression of plant development stages. Many forage species complete their growth cycles during the summer, while others continue growth into the fall and winter. Regrowth also occurs during the winter by some species following burning and quite possibly also following grazing of unburned herbage at that time. Forage plants entirely accessible during the dry season in ponds and sloughs are partially or wholly submerged in the wet season, and even submerged may form part of the cattle diet. Generally accepted experimental techniques for obtaining reliable data on herbage production, utilization, and even range condition and trend do not appear entirely suitable for south Florida.

Figure 22.--Saw-palmetto grows abundantly over much of the pine flatwoods in south Florida.

Problems revolving about major past, present, and possible future land management practices: For many of the 400 years during which Florida's rangelands have been grazed by cattle, fire has been used as a management tool. What has been the effect of fire on the range? Do we now have a disclimax vegetation type because of fire? If so, is this more desirable for grazing than the vegetation that might have occurred in relative absence of fire? What would that vegetation have been? If fire has not materially affected the species composition of the range since European settlement, then what have been the effects on amount of forage produced? What will the vegetation be if fire is kept out during periods of timber stand establishment? How has fire affected the soil? These are all questions which have not been fully answered, although studies in the South provide good leads (24, 25, 30, 41, 56). In the answers lie the means for more efficient use of rangelands.

Study of ecological aspects of burning is rated of high priority because the range is almost universally burned, because the hypothesis exists that burning as currently practiced is detrimental to range vegetation and other land resources, and because reports have been published supporting benefits from fire (25, 30, 67).

Once knowledge on ecological effects of burning has been obtained, studies leading to development of improved burning methods can be instituted. Studies leading toward improved systems of burning for range purposes must include study of effects on trees. Extention to the project area of prescribed burning methods developed through research in other parts of the South may be beneficial. However, because of the peculiar conditions of climate, soils and vegetation in this project area, local research is needed. Such studies are rated of medium priority.

Heavy cutting of south Florida's timber has brought questions needing answers. To what extent has the livestock operator benefited from complete removal of the timber overstory? Herbage production probably has increased, but there is no experimental evidence as to the amount of the increase. Nor is there recorded evidence of species composition changes which have occurred because of changed micro-environmental conditions.

What species composition changes can be expected in the next 50 to 100 years on cutover forest lands, both unplanted and planted? Will these changes be significant? Studies to find out the answers to these problems may be difficult, but the information will be important to landowners in deciding how far to go in reforestation. The results may significantly affect the extent to which future range management research will be needed.

For those lands where an intensive forest program is planned, studies are needed to find how forestry and range management can be integrated. The extent to which forestry will be practiced as a major land management objective in the project area must be analyzed in evaluating the need for such studies.

This analysis has shown that 86 percent of the commercial forest land is understocked with trees. Future forestry activities on approximately 3.75 million acres now devoid of seed trees must of necessity be based on planted stands. Appendix table 5 has shown that only about 38,000 acres of trees have been planted in the project area since 1928 and that this represents only 8 percent of the planting made during the same period for the entire State. Other analyses based on this table indicate that even with greatly accelerated rates of tree planting, encouraged by better fire protection project-wide, complete reforestation may not occur within the next 50 to 100 or more years. Limitations of production of tree seedlings would be one important factor. Another factor is the management goal of private landowners who own 87 percent of the land in the project area. Some large owners are growing wood products from plantations along with raising beef cattle, but most smaller landowners have not planted trees.

Because of the strong interest in cattle raising, the probable minor role of forestry within the next decade, the large backlog of unsolved problems in managing the range, and the lack of proven experimental range measurement techniques, emphasis should be placed first upon solving the range problems *per se* and then considering the problems involved in fitting tree growing and grazing together. Problems in integration, thus, are rated of high relative importance, but current medium priority.

Studies in integrated use should provide methods for securing most efficient grazing use of forest rangelands managed for pulpwood production. Studies also should be directed towards the effects of grazing--including soil compaction, physical disturbance of tops, and browsing--on both planted trees and natural regeneration.

Though old growth forest stands in the project area are not plentiful, studies on the integration of timber production and grazing should be designed to yield information applicable to such stands.

Studies in other parts of the South (5, 23, 25) and observation in the project area have shown that herbage production drops as the forest canopy closes. Within this project area plantings are being made of the South Florida slash pine (Pinus elliottii var. densa), a tree found only in the Florida peninsula and its keys (43) and which may have growth responses different from other pines planted elsewhere in the South. Studies are needed in planted tree stands of this tree variety to measure herbage trends. This information will be highly useful in anticipating needed adjustments in range stocking and predicting when it will no longer be practicable to graze in planted stands of trees.

Of significance in the development of the native range management research program is the extent to which native rangelands will be tapped for improved pastures and raising of truck crops.

Establishing improved pasture is expensive, but returns under good management and good markets generally have been satisfactory, particularly for raising steers and stock of high breeding. The possible addition of 1 million acres of improved pasture by 1964 will strengthen the need for studies leading toward better complementary use of native ranges and improved pastures. Studies specifically in this category currently are rated only of medium priority, however, because much of the needed knowledge can be obtained in management studies of herbage production, utilization, season of grazing, and others currently rated of higher priority.

Studies may be needed in grazing management of the approximate 100,000 acres handled under shifting agriculture each year. Over a 10-year period the native vegetation on approximately 1 million acres of rangeland will be destroyed and an invading plant cover will take its place. Most efficient grazing use of abandoned farm lands may be in conjunction with undisturbed native rangelands in some system of deferred-rotation grazing.

The Florida Agricultural Experiment Stations are exploring the feasibility of re-using this land in some system of vegetable crop-pasture rotation (19). Should this work prove successful, the effects of shifting agriculture on the native range will be lessened. In view of such a possibility, studies in developing management systems useful for abandoned cropland are rated of low priority.

An unknown but sizeable acreage of rangeland seeded to carpetgrass and other forage species is maintained at relatively low levels of productivity through lack of fertilization and other approved agronomic practices. Cattle frequently graze this seeded range along with unimproved native range. Studies leading to greater productivity from the seeded range through more desirable management systems can be of value. They should await results of management studies on unimproved native range.

Problems which have arisen from the kinds of range management employed: Preeminent among these problems, which have been fostered by lack of research in range management or failure to apply good recommendations, is the apparent overstocking of rangelands. Studies are needed to find how many head of cattle can be grazed per unit of range commensurate to proper use of range vegetation and

without disturbance to other land resources. Separate studies will be needed for the several major forage types supplemented by auxiliary studies to set up grazing capacities for different condition classes of the major types.

Studies in grazing capacity will be needed where fire is used. However, these studies should be accompanied by other work which sorts out the most desirable burning methods. Studies of grazing capacity on unburned rangeland are needed to obtain a true measure of the native range's potential productivity. Included will be studies on plant species composition, herbage production, and utilization, and other items, all of which are treated in detail in other paragraphs.

Studies of phenology and plant growth habits will be needed, followed by other studies to show when individual plant species can best stand grazing. Once the growth habits of individual plant species and their respective resistances to grazing have been found, season of use studies will be needed for the major plant communities. Management systems which would favor all species in a given community may be impractical to devise, so research must determine the important species to be favored through selected seasons of use.

Hand in hand with the season of use studies are studies in deferred-rotation grazing with and without burning. Fencing different range types and employing some system of deferred-rotation grazing between types might be most satisfactory. Maiden cane, an important and highly-palatable grass, and other desirable species might attain their highest productivity under this plan. However, because range types frequently are intermingled--with ponds, cypress strands, and pineland range all occurring in one large range unit--fencing of major types may prove impractical. Whatever systems of rotation-deferred grazing are tested, the resulting recommended method must prove practical from a fencing standpoint as well as applicable to the peculiar yearlong grazing periods which exist in south Florida.

Problems associated with livestock management: Research in Florida and elsewhere has provided good breeding practices applicable in the project area. Acceptance of good breeding practices already developed needs to be encouraged. This, of course, does not constitute a research need, but the full value of well developed range management systems cannot be realized unless accompanied by good cattle management including good breeding practices. Further study is needed to determine breeding practices most suitable under range conditions in the project area, and is given high priority.

Only a limited amount of information is available on performance and production by cattle grazing native ranges. Acceptance of range research results will depend greatly upon expected increased yields. Studies yielding data on cattle performance and production are thus considered of high priority.

The Florida Agricultural Experiment Stations have obtained valuable data on mineral needs and consumption. Because of this, mineral studies currently are rated of medium priority. South Florida ranges generally are well watered for 9 or 10 months of the year. Studies in cattle water requirements can be delayed until information on more urgent and higher priority management questions is made available.

Supplemental feeding of brood cows and creep feeding of calves on native range may prove highly important in attaining optimum beef cattle production. Information on the value of these practices is certainly needed, but studies must wait until basic management techniques are explored.

Parasitism of range cattle will result in reduced returns. Research by such agencies as the Florida Agricultural Experiment Stations has shown the value of parasite control. Additional study of parasites should be encouraged through cooperation with properly constituted agencies.

Problems engendered by the inherent range environment: The south Florida project area, in common with other major range areas and particularly with other parts of the Coastal Plain of the South, has range problems directly attributable to the environment. As previously pointed out, rainfall is high in summer and low in winter. A high percentage of the soils are sands of relatively low fertility which, although poorly drained, are drouthy during the winter dry periods.

Study is needed to determine whether concentration of livestock on unsubmerged range lands during high rainfall periods is detrimental to the range. If so, further work will be needed for obtaining better distribution. These studies should explore the practicability of fencing; they tie directly to studies of properly spacing water developments under south Florida climatic conditions.

Range plants growing on the sandy soils have been found deficient in some elements important to good animal nutrition. To achieve optimum production of beef from the native range, grazing management systems must take full advantage of the nutritive capabilities of range forage. Studies are needed to completely explore these capabilities, as well as the limitations of important forage plants.

Some nutritive analysis work has been done on pineland threeawn (Aristida stricta) in the project area (2, 4, 6). This work should be strengthened by extensive collection and analysis of herbage samples throughout the grazing year. Because the range vegetation is not limited to pineland threeawn but is made up of several hundred grazed forage species, nutritive analysis study should be extended to most of the range plants found to be important through plant abundance and palatability tests. Nutritive analysis study should include plants from both burned and unburned ranges. If plants are found which are especially desirable from a nutrition standpoint, studies should be undertaken to increase their abundance.

Problems in deer-cattle relationships: At present, deer populations are low in south Florida and generally no real competition exists between cattle and deer for forage. However, sportsmen's desires for increased numbers of shootable deer could conceivably favor large increases in deer numbers. Should this happen, problems in dual range use could arise. Studies in finding approved range management systems for cattle should anticipate need for possible future adjustments favoring integration of deer and cattle range use.

## SCOPE OF RESEARCH

Problems will be studied which occur on or relate to forest rangelands both stocked and nonstocked with trees. Native prairie-type ranges adjacent to the forest lands and marshy rangelands intermingled with both forest and native prairie ranges are included in the problem field. Because of the present and probable future small numbers of other livestock which graze native range, only cattle and cattle management problems will be considered. The program will emphasize finding management systems applicable to cow and calf operations.

Some range problems outside the scope of Forest Service responsibilities are touched upon in the analysis because of their significance to the over-all range management program. Chemical and mechanical control of undesirable range plants is one example. Livestock management research is not strictly a Forest Service responsibility, but optimum use of rangelands requires good livestock management and justifies encouragement by the Forest Service of further development and application of best possible livestock management techniques. Although research in range seeding is not within Forest Service responsibilities, management of seeded range is, and problems in this field are discussed. Improved pasture research is within the scope only as it relates to research on native rangelands.

Where research or assistance is needed in fields outside the scope of Forest Service responsibilities to foster complete attainment of range management research objectives, the possibilities of cooperative effort will be explored with responsible groups. The scope of responsibility for agencies cooperating with the Forest Service will be closely defined prior to initiation of specific cooperative projects.

Need for cooperation is anticipated from the Agricultural Research Service of USDA and the Florida Agricultural Experiment Stations in problems relating to nutritional studies, native range grazing in relation to improved pastures, herbicidal or mechanical control of undesirable plants, animal response to grazing practice, supplemental feeding, animal diseases, and general animal husbandry aspects. In the event of future studies in cattle-deer relationships, cooperation will be desirable between the Forest Service and the Florida Game and Fresh Water Fish Commission. The Soil Conservation Service, USDA, may be called upon to assist with certain problems relating to soils.

## PROPOSED PROGRAM

| Problem | Relative importance | Urgency | Susceptibility to solution through research | Priority |
|---|---|---|---|---|
| I Problems in study of the range per se, and sampling techniques | | | | |
| A. Collection and identification of important range plants | High | High | High | High |
| B. Phenology and growth habits of important range plants | High | High | Medium | High |
| C. Herbage production of important range plants | High | High | Medium | High |
| D. Nutritive values of important range plants (also listed under V) | High | Medium | Medium | Medium |
| E. Miscellaneous ecological studies | | | | |
| 1. Defining of south Florida range types | High | Medium | High | High |
| 2. Range condition and trend studies | High | Medium | Medium | High |
| 3. Autecology of saw-palmetto | High | High | Low | High |
| F. Control of saw-palmetto | High | Medium | Low | Medium |
| G. Efficient devices and techniques for sampling range vegetation | High | High | Medium | High |
| II Problems revolving around major past, present, and possible future land management practices | | | | |
| A. Range burning | | | | |
| 1. Ecological aspects of burning on range vegetation and soils (the long-time effects) | High | High | Low | High |
| 2. Develop improved burning methods | | | | |
| a. Determine best seasons for burning | High | High | Medium | Medium |
| b. Proper time intervals between fires on same piece of range | Medium | Medium | Medium | Medium |
| c. Proper periods of grazing deferment following burning | High | High | Medium | Medium |
| d. Relations between degree of herbage utilization and species resistance to fire | Medium | Medium | Low | Medium |
| e. Effects of range fires on trees | Medium | Medium | Medium | Low |
| B. Ecological aspects of timber removal, past and future | Medium | Low | Low | Low |

| | | | | |
|---|---|---|---|---|
| C. Determine practicability of and methods for integration of forestry and grazing | High | Medium | Medium | Medium |
| 1. Effects of trees on range productivity | Medium | Medium | Medium | Low |
| 2. Effects of grazing on tree growth | Low | Low | Medium | Low |
| D. Determine grazing management systems useful for seeded range | Medium | Medium | Medium | Medium |
| 1. Ecological studies | Low | Low | Medium | Low |
| 2. Herbage production and utilization studies | Medium | Medium | High | Medium |
| 3. Practical management systems for: | | | | |
| a. Seeded range alone | Medium | Medium | Medium | Medium |
| b. Seeded range in combination with native range | Medium | Medium | Medium | Medium |
| E. Develop better ways for complementary use between native range and improved pastures | Medium | Medium | Medium | Medium |
| F. Determine grazing management systems useful for abandoned crop land | Medium | Low | Medium | Low |
| 1. Ecological studies | Low | Low | Medium | Low |
| 2. Herbage production and utilization studies | Medium | Medium | High | Low |
| 3. Practical management methods for: | | | | |
| a. Abandoned cropland alone | Low | Low | Medium | Low |
| b. Abandoned cropland in combination with native range | Medium | Low | Medium | Low |
| III Problems resulting from kind of range management employed | | | | |
| A. Determine optimum rate of range stocking for high sustained production of livestock without deterioration of range vegetation and soils through studies in grazing capacity | High | High | Medium | High |
| B. Proper seasons of use | High | High | Medium | High |
| C. Applicability of deferred-rotation grazing to south Florida ranges | High | Medium | Medium | Medium |
| IV Problems associated with livestock management | | | | |
| A. Performance of brood cows on the native range under different systems of management | High | High | High | High |

| | | | | |
|---|---|---|---|---|
| B. Animal production from the native range in terms of calf crop and weaning weight | High | High | High | High |
| C. Mineral requirements and consumption by beef cattle on native range | High | Medium | Medium | Medium |
| D. Water requirements of beef cattle on native range (also listed under V) | Medium | Medium | High | Medium |
| E. Improved cattle breeding practices for the native range | High | High | Medium | High |
| F. Values of supplemental feeding of brood cows or creep feeding of calves on native range | High | Medium | Medium | Medium |
| G. Effects of parasites on range cattle, including values of certain control techniques | High | Medium | Medium | Medium |
| V Problems engendered by the inherent range environment | | | | |
| A. Effects on range as a result of livestock concentration during high water periods. | Medium | Medium | Medium | Medium |
| B. Water requirements for cattle and proper spacing of water developments on dry-period ranges | Medium | Medium | High | Medium |
| C. Nutritive values of important range plants | High | Medium | Medium | Medium |
| VI Problems in native range, cattle-deer relationships | | | | |
| A. Competition between cattle and deer for forage | Low | Low | Low | Low |
| B. Effects of prescribed burning on deer habitat | Medium | Low | Medium | Low |
| C. Range and cattle management systems favoring integration of deer production with cattle | Medium | Low | Medium | Low |

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# APPENDIX

Table 3.--Ownership of land in south Florida project area, 1949 [1]

| Class of ownership | Land area | |
|---|---|---|
| | Acres | Percent |
| Public land | | |
| Federal | | |
| National forest | 70,300 | 0.4 |
| Indian | 78,500 | 0.4 |
| Other Federal | 1,036,400 | 5.9 |
| Total Federal | 1,185,200 | 6.7 |
| State | 960,000 | 5.5 |
| County and municipal | 105,000 | 0.6 |
| Total public | 2,250,200 | 12.8 |
| Private land | 15,382,900 | 87.2 |
| Total all ownership | 17,633,100 | 100.0 |

1/ Data from McCormack (44, 45)

Table 4.--Grazing lands in south Florida

| Kind | Amount |
|---|---|
| | Acres |
| Forest land [1] | |
| Pine | 5,661,300 |
| Hardwoods | 1,575,000 |
| Palm | 129,600 |
| Nonproductive forest [2] | 835,700 |
| Total grazeable forest land | 8,201,600 |
| Treeless prairie [3] | 2,000,000 |
| Improved pasture [4] | 1,000,000 |
| All grazing land | 11,201,600 |

1/ Data from McCormack (44, 45)

2/ McCormack's 1,335,700 less 500,000 acres for ungrazeable, nonproductive forests.

3/ Estimated by Rummell.

4/ Estimated by Florida Agricultural Experimental Station personnel.

Table 5.--Approximate amount of land planted to tree seedlings 1/

| Planting period | So. Florida project area | State of Florida |
|---|---|---|
| | Acres | Acres |
| 1928 - 53 | 22,285 | 287,544 2/ |
| 1953 - 54 | 9,140 | 107,020 |
| 1954 - 55 | 6,575 | 95,606 |
| 1928 - 55 | 38,000 | 490,170 |

1/ From Florida Forest Service reports.
2/ Adjusted to compensate for discrepancy between totals issued in 1954 summary for Volusia County for period 1928-54 and totals given in 1955 summary for 1928-54 period.

Table 7.--Cows per bull on different range types in Alachua County, Florida 1/

| Range type | Minimum | Maximum | Average |
|---|---|---|---|
| | | Number | |
| Flatwoods | 4 | 83 | 33 |
| Prairie | 7 | 40 | 34 |
| Hammock | 12 | 43 | 31 |
| Blackjack | 16 | 34 | 30 |

1/ Data from Camp (6).

Table 8.--Average calf crop for 1935, 1940 and 1947 reported by 19 large and 15 small Florida ranchers in 1948 1/

| Year | Ranch 3,200 acres and over | Ranch less than 3,200 acres |
|---|---|---|
| | Percent | Percent |
| 1935 | 42.0 | 48.0 |
| 1940 | 50.0 | 59.0 |
| 1947 | 57.0 | 75.0 |

1/ Data from Parvin (49).

Table 6.--Estimated deer population by county in south Florida 1/

| County | Population |
|---|---|
| | Number |
| Citrus | 1,000 |
| Sumter | 130 |
| Seminole | 800 |
| Brevard | 500 |
| Orange | 850 |
| Hernando | 180 |
| Pasco | 160 |
| Polk | 250 |
| Osceola | 1,400 |
| Lake | 350 |
| Hillsborough | 10 |
| Pinellas | -- |
| Manatee | 20 |
| Sarasota | 25 |
| DeSoto | 35 |
| Highlands | 230 |
| Okeechobee | 170 |
| Indian River | 150 |
| St. Lucie | 200 |
| Martin | 130 |
| Palm Beach | 150 |
| Glades | 80 |
| Hendry | 350 |
| Charlotte | 500 |
| Lee | 800 |
| Collier | 1,800 |
| Broward | 450 |
| Dade | 500 |
| Monroe | 1,300 |
| Hardee | 50 |
| Total | 12,570 |

1/ Personal communication from E. B. Chamberlain, Jr., Chief, Game Division, Florida Game and Fresh Water Fish Commission (August 19, 1955).

Table 9.--Minimum, maximum and average percentage calf crop on four types of ranges in Alachua County [1]

| Range type | Minimum | Maximum | Average |
|---|---|---|---|
| | Percentage calf crop | | |
| Flatwoods | 20 | 50 | 34.4 |
| Prairie | 20 | 75 | 54.1 |
| Hammock | 20 | 90 | 71.6 |
| Blackjack | 15 | 100 | 37.1 |

1/ Data from Camp (6).

Table 10.--Weights of calves at 6 months of age [1]

| Breeding | Ranch 3,200 acres and over | | Ranch less than 3,200 acres | |
|---|---|---|---|---|
| | Cattlemen reporting | Weight | Cattlemen reporting | Weight |
| | Number | Pounds | Number | Pounds |
| Grade bull X native cow | 10 | 230 | 4 | 231 |
| Purebred bull X native cow | 18 | 261 | 9 | 283 |
| Purebred bull X grade cow | 19 | 312 | 26 | 327 |
| Purebred bull X purebred cow | 3 | 342 | 3 | 342 |

1/ Data from Parvin (49).

Table 11.--Classes and grades of cattle sold in five south Florida markets in 1954 [1]

| Grade | Steers | Heifers | Cows | Bulls | Calves | Total | |
|---|---|---|---|---|---|---|---|
| | Number | Number | Number | Number | Number | Number | Percent |
| SLAUGHTER ANIMALS | | | | | | | |
| Prime | 0 | 0 | -- | -- | 0 | 0 | 0 |
| Choice | 2 | 0 | 0 | 0 | 67 | 69 | 0.1 |
| Good | 132 | 5 | 0 | 0 | 3,933 | 4,070 | 5.3 |
| Commercial | 1,677 | 368 | 175 | 53 | 8,815 | 11,088 | 14.5 |
| Utility | 5,769 | 1,512 | 3,960 | 856 | 16,297 | 28,394 | 37.2 |
| Cutter | 3,617 | 2,362 | 7,695 | 1,302 | -- | 14,976 | 19.6 |
| Canner | 1,265 | 531 | 7,343 | 604 | -- | 9,743 | 12.8 |
| Cull | -- | -- | -- | -- | 7,965 | 7,965 | 10.4 |
| Total slaughter | 12,462 | 4,778 | 19,173 | 2,815 | 37,077 | 76,305 | 99.9 |
| STOCKER ANIMALS | | | | | | | |
| Fancy | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Choice | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Good | 23 | 0 | 0 | 0 | 17 | 40 | 0.1 |
| Medium | 1,059 | 215 | 9 | 75 | 485 | 1,843 | 5.1 |
| Common | 8,968 | 2,627 | 920 | 445 | 3,769 | 16,729 | 46.3 |
| Inferior | 4,834 | 3,000 | 3,584 | 394 | 5,668 | 17,480 | 48.4 |
| Total stocker | 14,884 | 5,842 | 4,513 | 914 | 9,939 | 36,092 | 99.9 |

1/ Data compiled from Rhodes (52).

Table 12.--Beef cattle by class, January 1, 1955

| Class | Entire State [1] | Estimates for project area [2] |
|---|---|---|
| | Number | Number |
| Steers | 184,000 | 134,000 |
| Heifers (1-2 yrs) | 162,000 | 118,000 |
| Calves | 207,000 | 150,000 |
| Cows | 777,000 | 565,000 |
| Bulls | 46,000 | 33,000 |
| Total | 1,376,000 | [3] 1,000,000 |

1/ Data from Rhodes (53).
2/ Proportionate to State class figures.
3/ Computed by Rummell

Table 13.--Estimated average grazing capacity of four types of native range in Alachua County, Florida [1]

| Type of range | Range per animal per year |
|---|---|
| | Acres |
| Flatwoods | 10 |
| Prairie | 1 |
| Hammock | 5 |
| Blackjack | 22 |

1/ From Camp (6).



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