PRELIMINARY REPORT ON A DEER BROWSE CENSUS BASED ON 100% CLIPPING METHOD

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During the course of various deer investigations in Florida, it became apparent that some method was necessary to evaluate as accurately as possible such factors as deer and cattle pressure, effects of controlled burning and exclusion of fire, deer food production in various habitat types, and relative value of these types. To accomplish this, a browse census was devised.

The census considered most applicable to appraise these influences was the 100% clipping method originated by R. S. Campbell and J. T. Cassidy of the U. S. Forest Service in 1931, and termed the Forage Weight Method of Range Inventory. Originally, this inventory was used for grasses only; in the present study it is applied to all forms of green vegetation available as deer food. This form of inventory was chosen in preference to others because its decreases the margin of error which accompanies the estimated percentage system of analysis. All types of vegetation were included because of the rather limited knowledge of the preferred deer foods in the various habitats in Florida and because cattle pressure may be more completely evaluated.

PROCEDURE

The procedure followed in this study may be described briefly as follows:

1. Habitat types to be censused are isolated and acreage determined.

2. A random sample of the vegetation on the habitat types is obtained by use of sample plots taken in a wooden frame quadrat 3.1 feet square. The reason for using a quadrat 9.61 square feet in size is that the number of grams of vegetation per plot is then equal to the pounds per acre.

3. Sample plots are spaced closer together in the habitat types of small acreage such as hammocks and swamps while in the larger habitats of uniform type the plots are spaced farther apart. Spacings between plots are equal and in straight lines as nearly as possible perpendicular to the plant types. The number of plots run is determined by the variety of browse plants to be sampled.

4. Quantity of vegetation is obtained by weighing on a gram scale that portion of each plant species occurring on a plot considered edible by both deer and livestock (100% clipping method). Only those portions of a plant within reach of deer and cattle are counted.

5. Green weighed samples of each species of vegetation clipped are saved in paper bags labeled with date, plant species, type, and green weight in grams, and air dried in order to obtain the percent moisture loss for that species. Average pounds per acre of a plant is then determined by multiplying the average air dry weight in grams per plot by 10.

6. Plot data are placed on 3 x 5 file cards and contained the following information: area, date, green weight in grams, percent utilization, and habitat type.

7. Green weight samples of the same plant species found in more than one habitat type are saved. Samples of green vegetation collected for air dry weight should weigh at least 100 grams.

8. A two- or three-man survey team is desirable in order that two clip the vegetation and place it in the containers while one weighs and records needed information on file cards and paper sacks. For convenience in carrying, fasten scale in a close fitting wooden box open in front and on top.

9. Clipping studies were conducted during the months of October, early November, late January, February and early March. Hunting season activities intervened during most of November, all of December, and most of January.

Utlization of grasses and herbaceous material is determined by the following descriptive scale taken from Campbell and Cassidy's Forage Weight Method of Range Inventory.

Description	*Utilization %*
Leaf tips bitten off on occasional grass tufts (or herb)	10
Leaf tips bitten off ¼ to ½ of grass tufts present	20
Leaf tips bitten off ½ to ¾ of grass tufts	30
Leaf tips bitten off more than ¾ of grass tufts present, occasional patches left ungrazed	40
Leaf tips bitten off on nearly all grass tufts; average height of remaining grass stubble about 4-5 inches. Evidence of trampling	50
Nearly all grasses closely grazed, especially on burned range, average stubble only 1-3 inches in height. Trampling	60–95

Utilization of small trees and shrubs is determined by counting the number of browsed and unbrowsed twigs on each plant. The percentage of browsed to unbrowsed twigs is the percent of utilization. Average utilization was determined on all plants by adding the total percentage figures for each species and dividing by the number of plots in which the species occurred.

DESCRIPTION OF AREAS STUDIED

Chinsegut Deer Enclosure and Inverness Area

The 374-acre Chinsegut deer enclosure is located in Hernando County near Brooksville. It is under ownership of the U. S. Fish and Wildlife Service. Habitat breakdown is as follows: 71.0% longleaf pine-turkey oak, 11.7% live oak hammock, 10.7% open water, and 6.6% fresh water marsh.

The predominant soil types found in the longleaf pine habitat are medium to well drained, derived from non-calcareous sands and clays to calcareous sand clays and limestone. The live oak hammocks range from well drained soils derived from calcareous sand, clays, and limestone to soils of medium and poor drainage derived from calcareous sands, clays and limestone and non-calcareous sands and sandy clays.

The overstory composition in the longleaf pine-turkey oak range from very light to moderate in density while the hammocks range from moderately dense to dense.

The major vegetative cover is as follows in the longleaf pine-turkey oak and live oak hammock:

Longleaf Pine-Turkey Oak

Overstory—Longleaf pine, slash pine, post oak, live oak and upland willow oak.

Understory—Turkey oak, post oak, upland willow oak, persimmon, and blueberry.

Ground cover—Wiregrasses, gopher apple, broadbladed grasses, yucca, low bush blueberry, *Elephantopus* sp., *Solidago* sp., *Eupathorium* sp., and legumes.

Live Oak Hammock

Overstory—Live oak, laurel oak, water oak, and longleaf pine.

Understory—Sparkleberry, live oak, laurel oak, low bush blueberry, French mulberry, *Ilex ambigua,* blackberry, summac, grape, persimmon, greenbriar, St. John's wort, vibernums, sea myrtle, gallberry, sweet gum, and hawthorne.

Ground cover—Broadbladed grasses and wiregrasses.

On March 25, 1950, a deer drive was conducted for the purpose of removing all deer from the enclosure to restock it with Wisconsin white-tails. This attempt was unsuccessful, but 11 were driven from the enclosure, two were trapped and taken out, two died when their necks were broken against the fence, and 15 remained inside the enclosure. A total of 30 was observed during this drive, one per 13 acres. Since 1950, six skeletal remains have been found. Reproduction continues, as fawns have been sighted annually.

Land management practices include maintenance of fire lanes, and controlled burning up to 1951.

The number of plots taken in the live oak hammock type was 50 spaced 10 paces apart, and in the longleaf pine-turkey oak, 25 spaced 25 paces apart. Field work was done on 29, 30, and 31 January and 4 and 5 February, 1951.

The Inverness Area is located mainly in Citrus County near Inverness and extends south from Highway 44. At present it is under management of the U. S. Forest Service.

The study area is 40,876 acres in size, of which approximately 2.4% is in live oak hammock and 97.6% in longleaf pine-turkey oak. Habitat overstories are similar to Chinsegut Area. Soil types are the same as in the Chinsegut enclosure.

The vegetative cover is the same in longleaf pine-turkey oak habitat as the Chinsegut area while the hammock vegetation differs slightly.

Live Oak Hammock

Overstory—Live oak, longleaf pline, red cedar, American holly, laurel oak.

Understory—Low bush myrtle, French mulberry, American holly, grape, live oak, persimmon, paw paw, red cedar, blackberry, greenbriar, low bush blueberry, hawthorn, viburnums, upland willow, turkey oak, sweet gum.

Ground cover—Broadbladed grasses, wiregrasses, gopher apple.

Based on a track count census conducted during June, 1954, the Inverness area ranked highest in the state in the number of tracks counted per mile. Results of these counts on the three highest areas in the state were:

Area	*Miles Counted*	*Tracks/Mile*
Inverness	27.7	43.66
Ocala	105.6	15.57
Eglin	96.3	7.58

Cattle lease records kept by the U. S. Forest Service indicated the following number of cattle ranged over the study area during 1954 (12 mos. period):

Cattle	*Calves*	*Cattle for 12-Mo. Period*
522	256 (128)	650

The carrying capacity of the area as determined by the U. S. Forest Service using the Forage Weight Method of Range Inventory is one head to 60 acres. Land management practices include cattle and hog raising, pulpwood cutting, and fire lane maintenance.

In the longleaf pine-turkey oak type, 35 quadrate 100 feet apart were taken. In the live oak hammock, 55 plots, 10 to 15 paces apart, were taken. Field work was done at the same time as at Chinsegut.

LAKE BUTLER DEER ENCLOSURE AND MANAGEMENT AREA

The Lake Butler deer enclosure is located in Union County, north of Lake Butler and east of Highway 100. It is a part of the Lake Butler Wildlife Management Area which is owned by the National Turpentine and Pulpwood Company. The deer enclosure is 344 acres in size.

The three major habitat types censused and their percent coverage are flatwoods (80.4%), softwood swamp (9.8%), and hardwood hammock (9.8%). Habitat overstories ranged in the following density classes: flatwoods, light to moderately dense; softwood swamp, moderately dense to dense; and hardwood hammock, dense.

Vegetative cover breakdown is as follows:

Flatwoods

Overstory—Slash pine.

Understory—Ground oak, gallberry, low bush blueberry, saw palmetto, wax myrtle and blackberry.

Ground cover—Wiregrasses, broadbladed grasses, and various herbaceous species.

Softwood Swamp

Overstory—Slash pine, pond cypress, wax myrtle, black gum, and red maple.

Understory—High bush huckleberry, dahoon holly, sweet bay, greenbriar, dogwood, fetterbush, vibernums, and black gum.

Ground cover—Sphagnum moss, sedges, aquatic and semi-aquatic herbaceous plants.

Hardwood Hammock

Overstory—Live oak, water oak, Florida maple, basswood, flowering dogwood, American elm, and sweet gum

Understory—Vibernums, wax myrtle, greenbriar, and wild grape.

Ground cover—Broadbladed grasses and other herbaceous species.

The predominant soil type found in the flatwoods is poorly drained, level to undulating, derived from non-calcareous sands and sandy clays, with gray surface and brown impervious hardpan. The softwood swamps contain poorly drained soils derived from non-calcareous sands and sandy clays with black surface and light gray to white friable subsoil. The hardwood hammocks contain soils having medium to fair drainage derived from non-calcareous sands and sandy clays with dark gray surface soils and light yellow and gray subsoils.

The animal population in the enclosure includes both deer and livestock. Fifteen years ago, 29 deer were counted in the enclosure but no census has been attempted since then. On April 20, 1955, one juvenile buck was found dead, cause unknown. According to range riders the deer looked in poor condition. This may be partly the result of the saw palmetto mast failure. During the census study two Brahman bulls, two cows and one calf were present in the enclosure. Cattle grazing is the only land management practice presently being carried out.

In the flatwoods type, 25 quadrats 18 paces apart were taken. The same number was taken in both the softwood swamp and hardwood hammock, but were 15 and 10 paces apart, respectively. Field work was done 5 and 6 October in the flatwoods, 7 October and 3 November in the swamp, and 6 and 7 October, 1954 in the hammock.

The Lake Butler Wildlife Management Area is located in Baker, Union, and Columbia Counties north of the town of Lake Butler and east of Highway 100. The area is approximately 96,000 acres in size, of which 72.5% is in flatwoods, 17.8% in softwood swamps, 8.7% roads, fire lanes, ponds and open water, and 1% in hardwood hammocks.

Habitat overstories are same as in the enclosure with the exception of one of the softwood swamps which was sampled. In this habitat, a two-year-old cutting had increased understory density. Major vegetation in the three habitats is as follows:

Flatwoods

Overstory, understory and *ground cover*—same as for deer enclosure.

Softwood Swamp

Overstory—Pond cypress, black gum, longleaf pine, and sweet bay.

Understory—Fetterbush, black gum, Virginia willow, greenbriar, Yaupon holly, guinea cypress.

Ground cover—Wooly berry, sphagnum moss, semi-aquatic and aquatic herbaceous species.

Hardwood Hammock

Overstory—Florida maple, American elm, laurel oak, white ash, American hornbeam, sweet bay, hickory, southern white cedar, sweet gum.

Understory—American hornbeam, vibernums, ground palmetto, greenbriar, wild grape, French mulberry, dogwood.

Ground cover—Broadbladed grasses.

Soils include those found in the enclosure. Of 13 management areas where deer track count census were run, the Lake Butler Area ranked eleventh, with only .62 tracks per mile in 22.6 miles counted. The cattle population based on lessee records was estimated at 1,800 head or 1 animal to 53.3 acres.

Current land management practices are livestock grazing, pulpwood cutting, turpentining, and controlled burning.

The number of quadrats taken and the spacing were the same as in the deer enclosure. Field work was run in the flatwoods on 25, 26, and 27 October, in the softwood swamp 8 November, and in the hardwood hammock 3 and 4 November, 1954.

BLACKWATER DEER ENCLOSURE AND WILDLIFE MANAGEMENT AREA

The deer enclosure is part of the Blackwater Wildlife Management Area which is located in Santa Rosa and Okaloosa Counties in northwest Florida, north of U. S. Highway 90. It is controlled by the Florida Forest Service. This tract is approximately 430 acres in size and is composed of the following habitat types: 81.3% longleaf pine-turkey oak, 13.9% hardwood titi swamp, 4.1% flatwood (not included in study), and .7% hardwood hammock.

Overstory in the longleaf pine-turkey oak is light to moderate in density; moderately dense to dense in the hardwood hammock; and light to moderately dense in the hardwood swamp. Most common species in the three habitats studied are:

Longleaf Pine-Turkey Oak

Overstory—Longleaf pine and slash pine.

Understory—Low bush huckleberry, low bush myrtle, upland willow oak, post oak, turkey oak, gopher apple, persimmon, blackberry, horse sugar, and ground oak.

Ground cover—Broadbladed grasses, wiregrasses, legumes, St. Peter's wort, and many herbaceous flowering plants.

Hardwood Hammock

Overstory—Florida maple, sweet bay, black yum, a few longleaf pine, eastern red cedar, southern white cedar, and cypress.

Understory—Yaupon holly, gallberry, black titi, big leaf gallberry, fetterbush, greenbriar, yellow jessamine, sweet bay, cedar, American holly, vibernums, odorless myrtle, and chokeberry.

Ground cover—Sedges, broadbladed grasses, and sphagnum moss.

Hardwood Titi Swamp

Overstory—Sweet bay, black titi, wax myrtle, and an occasional longleaf pine.

Understory—Odorless myrtle, big leaf gallberry, black titi, fetterbush, sweet bay, and chokeberry.

The major soil found in the longleaf pine-turkey oak in this area is well drained, derived from non-calcareous sands and clays with gray surface soil and yellow friable subsoil. The hammocks and swamps consist of poorly drained soils, level to undulating, with non-calcareous sands and sandy clays. Most of them have black surface with light gray to white friable subsoil.

During 1950 a drive census indicated the population to be 41 deer or one animal to 10.4 acres. Some were trapped and a census again taken in 1951. Twenty-nine deer were counted. The present deer population is stimated to be close to the 41 seen during the 1950 drive. Cattle were excluded from the enclosure after 1952. Up to then, approximately eight cows were allowed to pasture inside the enclosure 6 to 8 months of the year.

The current land management practices are controlled burning on a three-year rotation, trapping deer for restocking purposes, and fire lane plowing.

In the longleaf pine-turkey oak, which was sampled on 13 and 14 October, 1954, 28 quadrats 25 paces apart were taken. Thirty quadrats ten paces apart were taken in the hardwood hammock on 10 February, and five quadrats ten paces apart were done in the softwood swamp on 17 February, 1955.

The Blackwater Wildlife Management Area is approximately 85,000 acres in size. The study area (Holt Fish Hatchery) which lies within the management area and adjacent to the deer enclosure is 320 acres in size. Of this 62.7% is in longleaf pine-turkey oak, 12.4% in hardwood hammock, and 4.5% in hardwood (titi) swamp.

The Blackwater Management Area had the lowest number of deer tracks counted per mile of those management areas censused in the state during 1954. Only 0.12 tracks per mille were seen in 42.0 miles of road covered. Only recently have any deer been seen on the hatchery grounds. Some of those seen have probably been ones trapped out of the enclosure during the past three years and released near the hatchery. Land management practices include fire lane plowing, controlled burning, cattle grazing, road maintenance, pulpwood

cutting, and logging. The number of plots run and spacings were the same as in the enclosure. The inventory was run in the longleaf pine-turkey oak on 14 through 17 October, 1954, in the hardwood hammock on 16 February and the hardwood swamp 17 February, 1955. Overstory, densities, vegetative composition, and soil types are the same as for the deer enclosure.

THE EGLIN AIR FORCE RESERVATION

This area, owned by the U. S. Air Force, is located in Santa Rosa, Okaloosa and Walton Counties in northwest Florida. It comprises about 440,000 acres. Clipping studies were run on three deer drive areas of varying deer population densities. These three areas were among many that are periodically drive censused by servicemen stationed at the base. The deer population is estimated from these drives and compared to the annual deer track count census.

Three different deer concentrations within one management area, drive estimates of these populations, the absence of any livestock, and no burning for approximately 20 years present conditions unusually favorable to comparative analysis. The three drive areas were situated far enough apart so that mixing of the three deer populations is not likely to occur.

The area of low deer concentration, 0.625 deer per 100 acres, is 640 acres in size, while the area of medium concentration, 2.083 deer per 100 acres, is 480 acres and the area of high concentration, 5.000 deer per 100 acres, is 160 acres in size. Locations of all deer drive areas and the results of these drives are maintained in the records of Florida Project W-27-R.

The types of habitat in each drive area and their percent coverage are: Area of low deer concentration, longleaf pine-turkey oak (99.5%), upland hammock and fluvial swamp (0.5%); area of medium concentration, longleaf pine-turkey oak (99%), upland hammock and fluvial swamp (1%); and area of high deer concentration, longleaf pine-turkey oak (99%), upland hammock and fluvial swamp (1%).

Overstory density in the longleaf pine-turkey oak is light, in the upland hammock moderate, and light to heavy in the fluvial swamp. Vegetative cover is as follows:

Longleaf Pine-Turkey Oak

Overstory—Longleaf pine.

Understory—Turkey oak, post oak, upland willow oak, live oak, hawthorn, low bush blueberry, laurel oak, and greenbriar.

Ground cover—Broadbladed grasses, wiregrasses, *Chrysopsis* sp., and *Elephantopus* sp.

Upland Hammock

Overstory—Laurel oak, live oak, post oak.

Understory—*Osmanthus* sp., gallberry, dogwood, white titi, and horse sugar.

Ground cover—Wiregrasses and broadbladed grasses.

Fluvial Swamp

Overstory—Sweet bay, black titi, and laurel oak.

Understory—High bush blueberry, fetterbush, big leaf gallberry, black titi, *Oamanthus* sp., *Persea* sp., and *Vibernum* sp.

Ground cover—Sedges, broadbladed grasses, and semi-aquatic herbaceous vegetation.

The major soil type found in the longleaf pine-turkey oak and upland hammock habitat is well drained, derived from sand with gray surface and mainly white sand subsoil. The fluvial swamps have poorly drained soils derived from non-calcareous sands and sandy clays with black to gray surface soils and light gray to white friable subsoil or light dingy gray subsoil with irregular pockets of clay. Fire lanes are maintained, and no grazing or burning are allowed.

The number of plots taken in each drive area and in each habitat type is as follows:

Area of low deer concentration
Longleaf pine-turkey oak—25 plots spaced 50 paces apart
Upland hammock—15 plots spaced 25 paces apart
Fluvial swamp—25 plots spaced 10 paces part
Area of medium concentration
Longleaf pine-turkey oak—25 plots spaced 50 paces apart
Upland hammock—15 plots spaced 25 paces apart
Fluvial swamp—10 plots spaced 10 paces apart
Area of high concentration
Longleaf pine-turkey oak—25 plots spaced 50 paces apart
Upland hammock—15 plots spaced 50 paces apart
Fluvial swamp—10 plots spaced 10 paces apart
Field work was done 9 through 11 March, 1955.

TABLE I

COMPARISON OF THE CHINSEGUT DEER ENCLOSURE AND INVERNESS AREA ON AMOUNTS OF VEGETATION AVAILABLE TO LIVESTOCK AND DEER, AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE LONGLEAF PINE-TURKEY OAK HABITAT. STUDY WAS CONDUCTED 1-29, 1-30-55

	Chinsegut—25 Plots (Deer)			*Iverness—30 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Quercus virginiana	42.0	13.0	12.0	75.0	45.0	40.0
Vaccinium myrsinites	3.6	16.0	12.0	6.6	26.0	10.0
Rhus copallinum	.2	40.0	4.0	0	0	0
Gelsimium sempervirens	1.8	0	4.0	0	0	0
TOTAL	46.4	14.0	. . .	81.6	17.7	. . .
Forbes						
Miscellaneous herbs	4.4	10.7	76.0	6.2	20.7	70.0
Chrysopsis sp.	59.0	8.8	84.0	28.0	15.0	80.0
Elephantopus tomentosus	1.0	0	12.0	0	0	0
TOTAL	64.4	6.5	. . .	34.2	11.9	. . .
Grasses						
Wiregrasses	142.0	0	88.0	233.0	1.8	100.0
Broadbladed grasses	23.0	2.9	88.0	13.0	17.0	96.0
TOTAL	165.0	1.4	. . .	246.0	9.4	. . .
COMBINED TOTALS	275.8	7.3	. . .	361.8	13.0	. . .

Utilization of plants in the longleaf pine-turkey oak habitat by deer and cattle is light during January and February except on recent burns. Herbaceous plants have been winter killed, and acorns almost entirely consumed. The annual growth on small trees and shrubs is tough and unpalatable, with the foliage having dropped off deciduous species such as post oak, turkey oak, and persimmon. The number of different browse plants present is relatively small when compared to companion habitats.

The Inverness area, where both deer and cattle range, showed a higher average percent utilization of all three plant groups. This heavier utilization evidently did not affect the two main browse plants, *Quercous virginiana* or *Vaccinium myrsinites,* by decreasing the quantity available.

Wiregrass is much more abundant in a green stage on the Inverness area, where a three-year burning program is practiced. Burning has been discon-

tinued on the Chinsegut area since 1949. Chrysopsis was more abundant on the Chinsegut area than the Inverness due possibly to the absence of fire.

Ground cover (forbes and grasses) constituted 83% of the available vegetation present on the Chinsegut area and 77% on the Inverness area. The understory consisted mainly of scattered outcroppings of shrub-size live oak and low bush blueberry. Their abundance and pattern of distribution may possibly affect the seasonal value of this type of range for deer.

Live oak was the most common shrub, occurring in 40% of the plots taken on the Inverness area and in 12% of the plots taken on the Chinsegut area.

The winter study on this habitat showed no evidence of excessive browsing where deer and cattle range.

TABLE II

COMPARISON OF CHINSEGUT AND IVERNESS AREAS BASED ON AMOUNTS OF VEGETATION AVAILABLE TO LIVESTOCK AND DEER AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE LIVE OAK HAMMOCK HABITAT. STUDY CONDUCTED 2-4, AND 2-5-55

	Chinsegut—50 Plots (Deer)			*Iverness—55 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Quercus virginiana	62.0	34.0	40.0	10.8	67.0	29.0
Quercus cinerea	0	0	0	2.2	58.0	20.0
Quercus laurifolia	78.0	15.1	80.4	.10	85.0	1.8
Ilex opaca	0	0	0	7.0	0	5.4
Ilex glabra	.3	10.0	4.0	0	0	0
Crataegus sp.	6.1	36.0	6.0	.12	94.0	5.4
Batodendron arboreum	2.9	37.0	20.0	0	0	0
Vaccinium myrsinites	3.6	46.0	22.0	3.2	30.0	3.6
Kalmiella hirsuita	0	0	0	.10	50.0	1.8
Rubus sp.	8.2	30.0	6.0	11.0	64.0	23.0
Myrica cerifera	4.6	0	12.0	1.0	0	1.8
Myrica pumila	0	0	0	4.7	5.0	1.8
Juniperus silicicola	0	0	0	2.3	89.0	12.7
Gelsimium sempervirous	16.8	9.0	38.0	.05	37.0	7.2
Smilax sp.	2.8	45.0	18.0	1.2	81.0	16.3
TOTAL	185.3	26.7	...	43.8	50.7	...
Forbes						
Legumes	0	0	0	.02	85.0	3.6
Ascyrum sp.	0	0	0	.11	17.0	3.6
Asimina sp.	0	0	0	.10	40.0	3.6
Miscellaneous herbs	.70	5.0	16.0	1.10	40.0	38.0
TOTAL	.70	5.0	...	1.33	45.0	...
Grasses						
Wiregrasses	.40	0	10.0	1.50	13.0	16.3
Broadbladed grasses	.60	0	14.0	1.70	68.0	65.4
TOTAL	1.00	0	...	3.20	40.0	...
COMBINED TOTALS	187.0	15.8	...	48.3	45.2	...

One of the most common companion habitats to the longleaf pine-turkey oak in Citrus and Hernando Counties is live oak hammock. This habitat contains a much greater variety of understory plants than the longleaf pine-turkey oak, with 15 different species sampled. Based on pounds per acre, small trees, shrubs and vines totaled 99% of the vegetation present on the Chinsegut area and 91% present on the Inverness area.

The Chinsegut area enclosure had a much greater quantity per acre of available small trees, shrubs and vines present in the live oak hammock habitat, due principally to the three species live oak, willow oak and yellow jessamine. The Inverness area had present, however, a greater variety of different plant species reflecting the land management practices, cattle grazing and controlled burning.

Average utilization on all plants for all plots was nearly twice as much on the Inverness area as it was on the Chinsegut.

The hammock sampled in the deer enclosure, due to the presence of *Ilex glabra* and *Baccharis halimifolia,* (not encountered in the plots) will be considered in this survey a low live oak hammock. Five hammocks were sampled in the Inverness area. All were high land hammocks as indicated by the presence of *Quercus cinerea, Diospyrus* sp. and *Asimina* sp., with the exception of one, 30 acres in size, surrounding a small pond. Plant species which were present in both areas but not sampled were *Vibernum semi-tomentosum, Vibernum obovatum* and *Vitis* sp. Random observation indicated much greater quantities of these three species available in the Chinsegut deer enclosure.

Heavy reproduction of live oak, willow oak, and yellow jessamine in the Chinsegut refuge has very probably been encouraged by the absence of fire and light browsing.

Live oak hammocks provide year round deer food because of the variety of available browse plants. This habitat, although small in acreage when compared to longleaf pine-turkey oak, is essential for the maintenance of a deer herd. The value of a range may possibly be determined by the proportion of live oak hammock to longleaf pine-turkey oak.

Comparing frequency of occurrence of these browse plants found in the enclosure and on open range, all species with the exception of blackberry occurred most frequently inside the enclosure.

TABLE III

COMPARISON OF AMOUNTS OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION BY DEER AND CATTLE ON THE LAKE BUTLER DEER ENCLOSURE AND THE LAKE BUTLER WILDLIFE MANAGEMENT AREA IN THE FLATWOODS HABITAT TYPE. STUDIES CONDUCTED IN FLATWOODS OCTOBER, 25, 26, 27, 1954

	Lake Butler Deer Enclosure 25 Plots (Deer and Cattle)			*L. Butler W'life Mgt. Area 25 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Quercus minimi	47.1	5.0	44.0	5.5	5.0	16.0
Vaccinium myrsinites	30.3	7.0	40.0	22.7	6.8	56.0
Polycodium sp.	5.3	0	8.0	0	0	0
Gaylussacia sp.	6.0	6.0	24.0	36.0	5.0	64.0
Ilex glabra	212.0	1.8	56.0	399.0	.66	60.0
Myrica pumila	24.0	0	8.0	6.5	0	12.0
Rubus sp.	0	0	0	.12	0	4.0
TOTAL	324.7	4.9	...	469.82	4.3	...
Forbes						
Trilissa odoratissma	0	0	0	3.3	13.3	12.0
Ascyrum sp.	0	0	0	1.7	0	4.0
Rhexia sp.	0	0	0	.50	0	8.0
Legume sp.	0	0	0	.47	5.7	28.0
Miscellaneous herbs	1.0	0	8.0	6.2	0	28.0
Chrysopsis sp.	7.1	0	8.0	13.3	0	20.0
Stillingia sp.	0	0	0	2.6	0	16.0
Cnidoscolus stinulosus	0	0	0	1.2	0	4.0

TABLE III—*Continued*

COMPARISON OF AMOUNTS OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION BY DEER AND CATTLE ON THE LAKE BUTLER DEER ENCLOSURE AND THE LAKE BUTLER WILDLIFE MANAGEMENT AREA IN THE FLATWOODS HABITAT TYPE. STUDIES CONDUCTED IN FLATWOODS OCTOBER, 25, 26, 27, 1954

	Lake Butler Deer Enclosure 25 Plots (Deer and Cattle)			*L. Butler W'life Mgt. Area 25 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Elephantopus tomentosus	0	0	0	.01	0	4.0
Pterocaulon sp.	0	0	0	1.1	13.0	12.0
Fern	0	0	0	1.4	0	4.0
Eupatorium sp.	0	0	0	.40	0	4.0
Solidago sp.	0	0	0	.40	0	4.0
Pluchea sp.	1.9	5.0	8.0	0	0	0
Centella repanda	0	0	0	.40	0	4.0
TOTAL	10.0	5.0	. . .	32.98	10.0	. . .
Grasses						
Wiregrasses	120.0	5.5	72.0	49.0	0	40.0
Broadbladed grasses	26.0	10.0	48.0	76.0	.83	96.0
TOTAL	146.0	7.7	. . .	125.0	.83	. . .
COMBINED TOTALS	480.70	5.8	. . .	627.80	6.67	. . .

Small trees, shrubs and vines constituted the predominant vegetative class in the flatwoods habitat, totalling 67% of all available plants in the enclosure and 74% in the management area. Utilization was light in both areas.

Grasses were next in quantity with wiregrasses more abundant in the deer enclosure than in the management area and broadbladed grasses more abundant in the management area.

Forbes, the least abundant form of vegetation, were greater in both quantity available and number of species present on the management area.

Ilex glabra, the most abundant shrub, constituted 65% of shrubs in the deer enclosure and 84% on the management area.

Comparable to the longleaf pine-turkey oak habitat, shrub species available to deer are restricted in variety on the flatwoods though the quantity present is great.

Serrenoa serrulata was found in four of the 25 plots sampled in the deer enclosure and in six of the plots in the management area. Cattle have been observed browsing on saw palmetto foliage but only rarely. Saw palmetto berries are available during the fall months and are utilized heavily by deer. Saw palmetto foliage has not been found in any of the deer stomachs analyzed to date. This plant when bearing gives the flatwoods a seasonal importance.

Controlled burning, which is practiced on the management area, may account in part for the greater quantity and variety of plants present.

TABLE IV

COMPARISON OF AMOUNTS OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION BY DEER AND CATTLE ON THE LAKE BUTLER DEER ENCLOSURE AND MANAGEMENT AREA IN THE HARDWOOD HAMMOCK TYPE. STUDIES CONDUCTED 3 AND 4 NOVEMBER, 1954

	Lake Butler Deer Enclosure 25 Plots (Deer and Cattle)			*L. Butler W'life Mgt. Area 25 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Quercus laurifolia	0	0	0	6.8	34.0	56.0
Quercus nigra	3.5	93.0	52.0	1.5	47.0	20.0
Acer rubrum	0	0	0	.63	12.5	32.0
Liquidambar stryaciflua	9.0	10.0	4.0	5.0	0	8.0
Carpinus caroliniana	0	0	0	2.1	54.0	40.0
Ulmus americana	0	0	0	.20	10.0	4.0
Tilia floridana	.62	0	4.0	0	0	0
Cornus florida	0	0	0	5.0	30.0	4.0
Crataegus sp.	0	0	0	.60	80.0	4.0
Myrica cerifera	51.0	6.4	28.0	6.0	13.0	12.0
Itea virginica	0	0	0	.90	75.0	4.0
Ilex coriacea	0	0	0	.38	90.0	4.0
Rubus sp.	.03	80.0	4.0	4.4	27.5	16.0
Vibernum obovatum	5.0	75.8	20.0	1.8	67.0	24.0
Pieris nitida	0	0	0	.38	0	4.0
Mitchella repens	0	0	0	1.0	3.7	16.0
Smilax sp.	6.6	91.0	56.0	6.5	69.0	56.0
Ampelopsis arboreus	0	0	0	1.9	20.7	28.0
Gelsimium sempervirens	6.0	63.0	12.0	3.7	15.0	8.0
Parthenocissus quinquefolia	0	0	0	.02	0	4.0
Vitis sp.	7.0	6.6	12.0	.60	20.0	4.0
TOTAL	88.75	53.2	...	49.41	39.3	...
Forbes						
Hydrocotyle sp.	0	0	0	.04	0	12.0
Lycopus sp.	0	0	0	.19	0	4.0
Ascyrum sp.	0	0	0	.32	0	4.0
Miscellaneous herbs	.40	10.0	4.0	5.0	7.7	68.0
Dyschoriste sp.	0	0	0	4.1	45.0	40.0
TOTAL	.40	10.0	...	9.65	26.3	...
Grasses						
Broadbladed grasses	38.0	27.0	80.0	4.2	30.0	56.0
COMBINED TOTALS	127.15	30.0	...	63.25	31.8	...

The total quantity of small trees, shrubs and vines available in the hardwood hammock indicates the deer enclosure has nearly twice as much available vegetation as the management area generally. This is due entirely to the shrub *Myrica cerifera* which is not utilized in sufficient quantities by either deer or cattle to justify placing it in a preferred food category. When this plant is eliminated from the list then the management area shows a total of 43.41 pounds of shrubs per acre present to 37.75 for the deer enclosure. The management area includes 20 dicerent shrub species available to only 9 for the enclosure. Excessive browsing pressure on vegetation brought about by artificial confinement of deer and cattle may account for only 9 shrub species being found available in this habitat in the enclosure. Greater utilization of small trees, shrubs and vines occurs in the deer enclosure.

This habitat is used nearly year round by deer because of the variety of broadbladed trees and shrubs present. Only a small quantity of forbes existed on the deer enclosure while broadbladed grasses were fairly abundant. In the management area the reverse was true with forbes more abundant than grasses. The value of a management area for deer in the flatwoods country may possibly be determined by the extent coverage of hardwood hammock habitat present and the existing stage of ecological development.

Based on a review of the above figures the hardwood hammock in the deer enclosure is in bad shape and very little browse is available. The hammock outside the enclosure is somewhat better but still does not provide very much browse.

TABLE V

COMPARISON OF AMOUNTS OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION BY DEER AND CATTLE ON THE LAKE BUTLER DEER ENCLOSURE AND MANAGEMENT AREA IN THE SOFTWOOD SWAMP TYPE. STUDIES CONDUCTED 8 NOVEMBER, 1954

	Lake Butler Deer Enclosure 25 Plots (Deer and Cattle)			*L. Butler W'life Mgt. Area 26 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Magnolia virginiana	0	0	0	.60	10.0	3.8
Taxodium ascendens	.72	65.0	8.0	2.0	0	7.6
Nyssa sylvatica	.03	95.0	4.0	10.0	6.8	61.5
Vibernum nudum	10.0	10.0	4.0	0	0	0
Pieris nitida	41.0	2.5	16.0	100.0	4.4	69.2
Itea virginica	0	0	0	11.7	18.5	26.9
Ilex vomitoria	0	0	0	4.6	15.0	15.3
Aronia arbutifolia	0	0	0	.17	40.0	3.8
Hypericum fasciculatum	0	0	0	25.0	3.7	30.7
Arsenococcus sp.	.07	0	4.0	0	0	0
Myrica cerifera	51.0	0	28.0	0	0	0
Gaylussacia hirtella	0	0	0	1.3	11.6	23.1
Gelsimium sempervirons	.20	0	4.0	0	0	0
Smilax sp.	.52	60.0	12.0	1.0	99.0	3.8
TOTAL	103.54	46.5	...	156.37	23.2	...
Forbes						
Polygonum sp.	2.9	0	16.0	0	0	0
Saururus cernuus	4.2	5.7	28.0	0	0	0
Pteridium sp.	.22	0	8.0	0	0	0
Miscellaneous herbs	7.1	4.0	20.0	.80	0	7.6
Rynchospora sp.	5.0	35.0	8.0	0	0	0
Vacopa sp.	4.1	62.0	8.0	0	0	0
Dryopteris sp.	0	0	0	6.0	0	23.1
Pluchea sp.	1.1	0	4.0	0	0	0
Mariscus jamaicensis	79.0	0	8.0	.50	20.0	3.8
Lycopis sp.	0	0	0	3.6	23.0	11.5
Ascyrum sp.	0	0	0	.40	0	3.8
Chrysopsis sp.	0	0	0	2.2	0	3.8
TOTAL	103.62	26.6	...	13.50	21.5	...
Grasses						
Broadbladed grasses	106.0	14.7	68.0	4.1	8.0	42.3
Wiregrasses	0	0	0	.03	0	3.8
TOTAL	106.0	14.7	...	4.13	8.0	...
COMBINED TOTAL	313.16	29.2	...	174.00	17.5	...

In number of plant species present and quantity of available browse, shrubs, small trees, and vines were more abundant in the softwood swamp habitat of the management area than in the enclosure.

The most important deer foods on the management area, in this habitat, are *Magnolia virginiana, Nyssa sylvatica, Itea virginica, Ilex vomitoria, Aronia arbutifolia* and *Smilax* sp. Together they total 29.37 pounds per acre. In the deer enclosure the important deer foods were *Nyssa sylvatica, Vibernum nudum* and *Smilax* sp., totaling 10.55 pounds per acre of which 10 pounds was *Vibernum nudum. Vibernum nudum* only occurred in one plot but constituted the major portion of the vegetation present. Because it is not an abundant shrub a greater number of plots would probably decrease the number of pounds per acre presently indicated.

The sedge *Mariscus jamaicensis* constituted 79 pounds of the 103.62 pounds of forbes present in the enclosure. When 79 pounds are eliminated from the total, 24.20 pounds of forbes are present, bringing the amount much closer to the 13.50 pounds per acre of forbes found on the management area. *Mariscus* occurred in only two of the 25 plots taken and heavily in only one of the two. Again a greater number of plots might have decreased the amount presently indicated.

A much greater quantity of broadbladed grasses was present in the enclosure which would tend to make it more desirable for livestock. The management area, based on the variety and quantity of shrubs sampled would appear to be more suitable for deer.

Greater utilization of all plant classes is noticeable in the deer enclosure. Ten different species of shrubs were available to deer on the management area to eight in the enclosure in this habitat. A greater number of acres per deer exists on the management area contributing to the lower utilization figure and the greater number of shrub species available.

Based on frequency of occurrence, the most common plants were *Myrica cerifera* in the deer enclosure and *Pieris nitrida* in the management area. Neither of these species has been established as preferred deer foods.

The available vegetation in the softwood swamp of the deer enclosure consists primarily of *Myrica cerifera* and *Pieris nitida.* When these two species are eliminated from the total only 11.45 pounds per acre of vegetation remain. Neither one of these species is preferred foods and when taken may be from necessity rather than choice. Based on the census, this habitat is in poor condition.

TABLE VI

COMPARISON OF BLACKWATER DEER ENCLOSURE AND HOLT FISH HATCHERY ON AMOUNTS OF VEGETATION AVAILABLE TO DEER AND LIVESTOCK AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE LONGLEAF PINE-TURKEY OAK HABITAT TYPE.
STUDY CONDUCTED OCTOBER 13, 14, 15, 1954

	Blackwater Deer Enclosure 28 Plots (Deer)			*Holt Fish Hatchery 28 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Quercus stellata	34.0	0	7.1	47.0	0	14.0
Quercus cinerea	15.8	3.0	10.7	57.0	5.0	35.0
Quercus pumila	8.3	10.0	3.5	34.0	0	7.1
Gaylussacia dumosa	23.0	0	57.0	16.0	1.3	57.0
Vaccinium myrsinites	.31	10.0	7.1	.08	20.0	3.5
Myrica pumila	7.0	0	7.1	12.0	2.0	17.8
Geobalanus oblongifolius	4.1	0	10.7	17.8	0	14.0
Diospyrus virginiana	6.0	3	10.7	1.4	0	7.1
Kalmiella hirsuita	.03	50.0	3.5	.04	0	7.1
Symplocos tinctoria	7.0	0	3.5	9.0	30.0	3.5
Rubus sp.	.09	50.0	3.5	2.7	24.0	17.8

TABLE VI—*Continued*

COMPARISON OF BLACKWATER DEER ENCLOSURE AND HOLT FISH HATCHERY ON AMOUNTS OF VEGETATION AVAILABLE TO DEER AND LIVESTOCK AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE LONGLEAF PINE-TURKEY OAK HABITAT TYPE.
STUDY CONDUCTED OCTOBER 13, 14, 15, 1954

	Blackwater Deer Enclosure 28 Plots (Deer)			*Holt Fish Hatchery 28 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Quercus laevis	0	0	0	11.5	0	3.5
Polycodium floridanum	0	0	0	8.0	0	7.1
Smilax sp.	0	0	0	1.0	15.0	7.1
TOTAL	105.63	21.0	...	217.52	13.7	...
Forbes						
Solidago odora	14.0	0	53.5	15.0	7.1	85.7
Legumes	13.0	18.7	85.7	19.0	28.5	100.0
Chrysopsis aspera	102.0	0	78.5	81.0	1.2	89.2
Miscellaneous herbs	59.0	.71	100.0	36.0	10.1	100.0
Stillingia sp.	1.2	5.0	7.1	0	0	0
Ascyrum sp.	.30	0	25.0	.40	5.0	7.1
Ferns	.02	0	3.5	.03	0	7.1
Eupatorium sp.	12.0	0	7.1	7.0	0	3.5
Diodia teres	.02	0	3.5	.80	15.0	7.1
Clethra tomentosa	0	0	0	.80	20.0	3.5
Elephantopus tomentosus	0	0	0	19.2	12.8	25.0
Trilissa odoratissma	0	0	0	.29	10.0	3.5
TOTAL	201.54	8.13	...	179.52	12.2	...
Grasses						
Wiregrasses	176.0	0	92.8	108.0	0	85.7
Broadbladed grasses	271.0	.35	100.0	70.0	23.0	96.4
TOTAL	447.0	.35	...	178.0	23.0	...
COMBINED TOTALS	754.17	9.82	...	575.04	16.3	...

The browse census in the longleaf pine-turkey oak habitat (also referred to as longleaf pine-scrub oak and high pine flatwoods) was carried out during October when foliage of deciduous vegetation was still present. This accounts in part for the much greater variety of plant species sampled than was found in similar habitat in Citrus and Hernando Counties. Forbes and grasses formed 86% of the vegetation present in the deer enclosure and 62% on the fish hatchery grounds. Average utilization was more severe on the hatchery grounds in both of these vegetative classes, reflecting cattle pressure.

Based on available pounds per acre, small trees, shrubs and vines were nearly twice as abundant on these plots taken in the fish hatchery than were those taken in the deer enclosures. Evidently a sufficient variety and quantity of forbes and grasses prevented any heavy browsing by livestock. The high deer population which has been present in the enclosure (10 acres/deer 1951 census) plus the cattle pressure which was present until 1952 would probably account in part for the low quantity of shrubs available. Average utilization for all shrubs browsed was greater in the deer enclosure. The graded banks of the fish ponds in the hatchery grounds which are seeded to broadbladed grasses provide excellent forage during all but the winter months. Browsing by cattle on live oak and willow oak sprouts was noticed during the winter study.

In the deer enclosure there is approximately one deer per 10 acres, while on the hatchery grounds, although a deer population estimation is difficult, sign

would indicate that the population is very light. The hatchery contained 50.12 pounds per acre of shrubs known to be fed on by deer and the deer enclosure 11.53 pounds per acre. Based on acreage, this habitat type is by far the most predominant in the study area.

TABLE VII

COMPARISON OF BLACKWATER DEER ENCLOSURE AND HOLT FISH HATCHERY ON AMOUNTS OF VEGETATION AVAILABLE TO DEER AND LIVESTOCK AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE HARDWOOD HAMMOCK HABITAT. STUDY CONDEUCTED FEBRUARY 10, 16, AND 17, 1955

	Blackwater Deer Enclosure 30 Plots (Deer)			*Holt Fish Hatchery 25 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Juniperus silicicola	.80	37.5	13.3	1.2	46.0	12.0
Chamaecyparis thyoides	0	0	0	7.3	0	4.0
Quercus nigra	0	0	0	1.9	0	8.0
Ilex coriacea	13.0	57.0	16.6	81.0	3.0	16.0
Ilex glabra	10.0	18.0	13.3	30.0	0	32.0
Ilex vomitoria	2.4	80.0	3.3	15.0	26.2	16.0
Ilex opaca	9.0	17.0	26.6	68.0	4.2	28.0
Pieris nitida	105.0	3.4	76.6	107.0	1.5	40.0
Cliftonia monophylla	13.0	53.0	50.0	26.0	15.0	52.0
Itea virginica	0	0	0	.80	68.3	12.0
Myrica cerifera	1.6	0	3.3	0	0	0
Magnolia virginiana	11.0	62.0	30.0	50.0	14.0	48.0
Mitchella repens	0	0	0	.20	0	4.0
Myrica inodora	9.0	10.0	13.3	0	0	0
Gelsimium sempervirous	1.6	27.0	30.0	5.7	2.5	32.0
Smilax sp.	4.2	69.0	66.6	6.0	22.5	40.0
Vibernum cassanoides	1.6	69.0	36.6	10.0	47.0	48.0
Rubus sp.	0	0	0	.40	43.0	12.0
TOTAL	176.40	41.9	...	410.50	24.1	..
Forbes						
Hypericum sp.	.03	0	6.6	0	0	0
Miscellaneous herbs	.20	0	6.6	0	0	0
TOTAL	.23	0	...	0	0	0
Grasses and Sedges						
Broadbladed	5.3	0	46.6	6.5	4.2	52.0
Carex sp.	**3.4**	**0**	**53.3**	**.70**	**0**	**12.0**
TOTAL	8.7	0	...	7.20	4.2	...
COMBINED TOTALS	185.10	41.9	...	417.70	14.1	..

The hardwood hammock habitat type contains many shrubs which are considered good deer foods in the southeast. Those found on the Blackwater Management Area falling in to that category are *Juniperous silicicola, Ilex coriacea, Ilex vomitoria, Cliftonia monophylla, Itea virginica, Magnolia virginiana, Smilax* sp., *Vibernum cassanoides* and *Rubus* sp., *Pieris nitida, Ilex glabra, Myrica cerifera, Myrica inodora* and *Mitchella repens* have also been found present in the stomachs of Florida deer in very small quantities.

Small trees, shrubs and vines make up 95% of the vegetation found present in this habitat in the deer enclosure and 98% in the hatchery. A total of 234.10 more pounds per acre of shrubs was found present in the hatchery grounds in this habitat than in the deer enclosure indicating that cattle are having little

effect upon the vegetation and that there is plenty of browse available for the present deer herd to increase. Inside the deer enclosure in this habitat food conditions can be considered rather poor. This is more apparent when *Pieris nitida* (a little utilized shrub) is excluded from the total bringing the amount of browse available per acre to 71.40 pounds. Deer confined to a limited range as they are in this enclosure decrease the availability of browse plants considerably, and average utilization of browse plants in the deer enclosure was nearly twice as severe as average utilization of plants in the fish hatchery.

Overstory conditions are about the same for both areas. Herbaceous material and grasses would appear to be a minor consideration in this habitat during the winter except where cattle are concerned. Practically the same amount of ground vegetation was present in both areas.

TABLE VIII

COMPARISON OF BLACKWATER DEER ENCLOSURE AND HOLT FISH HATCHERY ON AMOUNTS OF VEGETATION AVAILABLE TO DEER AND LIVESTOCK AND THE UTILIZATION AND OCCURRENCE OF THE VEGETATION IN THE HARDWOOD SWAMP HABITAT. FIELD WORK DONE FEBRUARY 10, 16, AND 17, 1955

	Blackwater Deer Enclosure 5 Plots (Deer)			*Holt Fish Hatchery 5 Plots (Deer and Cattle)*		
Species	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*	*Ave. Lbs./Ac.*	*Ave. % Utilization*	*% Frequency Occur.*
Small trees, shrubs and vines						
Cliftonia monophylla	22.0	10.0	60.0	100.0	13.0	100.0
Magnolia virginiana	5.1	5.0	20.0	4.6	10.0	40.0
Pieris nitida	302.0	0	100.0	419.0	2.0	100.0
Ilex coriacea	153.0	15.0	100.0	163.0	14.0	100.0
Myrica inodora	177.0	0	80.0	101.0	0	100.0
Aronia arbutifolia	1.8	0	40.0	9.0	0	20.0
Smilax sp.	1.3	40.0	20.0	1.1	0	20.0
Rubus sp.	0	0	0	.30	90.0	20.0
TOTAL	662.2	17.0	...	798.0	25.8	...

Dense vegetation in the hardwood swamp habitat made quadrat sampling difficult. Deer and cattle browsing appeared heavy around the edges of the swamp.

Both areas were controlled burned four years ago. Before burning the dense overstory prevented understory cover from developing. Since the burn, understory vegetation has become dense. Ground cover is nearly non-existent. *Pieris nitida* and *Myrica inodora* are the two most abundant shrubs in each area, totaling 72% of the vegetation in the Blackwater enclosure and 65% on the fish hatchery grounds. These two shrubs are not considered to be deer foods although traces of them have been found in deer stomachs.

Perhaps clearings in the swamp would make the better browse plants more accessible to deer. Average utilization of all plants present was greater on the fish hatchery than in the deer enclosure, but the limited number of plots taken probably give an inadequate utilization figure due to the sporadic pattern of browsing exemplified by deer and cattle.

TABLE IX

COMPARISON OF AMOUNT OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION ON THREE AREAS OF DIFFERENT DEER POPULATION DENSITIES AT EGLIN AIR FORCE BASE IN THE LONGLEAF PINE-TURKEY OAK HABITAT. STUDY CONDUCTED MARCH 9, 10, AND 11, 1955

	Area of Low Deer Concentration, 0.625 Per 100 Ac., 25 Plots			*Area of Med. Deer Concentration, 2.083 Per 100 Ac., 25 Plots*			*Area of High Deer Concentration, 5.000 Per 100 Ac., 25 Plots*		
Species	*Ave. Lbs./ Acre*	*Ave.% Utili- zation*	*% Fre- quency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utili- zation*	*% Fre- quency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utili- zation*	*% Fre- quency Occur.*
Small trees, shrubs, and vines									
Quercus virginiana	0	0	0	.30	0	4.0	8.5	10.0	8.0
Quercus laurifolia	0	0	0	.07	0	12.0	0	0	0
Gaylussacia dumosa	.06	0	4.0	.64	0	16.0	0	0	0
Kalmiella hirsuita	.04	62.0	8.0	0	0	0	0	0	0
Smilax sp.	0	0	0	1.8	34.8	20.0	0	0	0
TOTAL	.10	62.0	. . .	2.8	34.8	. . .	8.5	10.0	. . .
Forbes									
Berlandiera pumila	.07	97.0	8.0	.02	50.0	4.0	.05	15.0	8.0
Ascyrum sp.	0	0	0	.40	0	4.0	0	0	0
Chrysopsis aspera	.32	15.0	32.0	.16	11.0	20.0	.29	8.7	32.0
TOTAL	.39	56.0	. . .	.58	30.0	. . .	.34	11.8	. . .
Grasses									
Wiregrasses	1.5	0	88.0	1.2	0	52.0	.86	.65	92.0
Broadbladed grasses	1.0	8.5	96.0	1.2	3.7	80.0	1.6	6.00	96.0
TOTAL	2.5	8.5	. . .	2.4	3.7	. . .	2.4	3.32	. . .
COMBINED TOTALS	2.99	42.1	. . .	5.78	22.8	. . .	11.2	8.0	. . .

In analyzing the vegetational associations in the three habitats studied at the Eglin Air Force Base Reservation, two conditions exist that are somewhat unusual in that similar conditions are hard to duplicate anywhere else in Florida. One, no burning has been allowed for at least 20 years and two, the deer population estimations are probably as accurate as any census figures to date.

Military personnel from the air force base were used to drive the three areas and count the number of deer they saw. As a check a track count census was also run and both sets of figures compared. Both types of censusing have in the past resulted in very close agreement.

The longleaf pine-turkey oak (also referred to as scrub oak) habitat in all three drive areas had very small quantities of available vegetation. The area of low deer population had the least amount of plants available with the area of medium population next in quantity and the area of highest concentration had the greatest quantity. Grasses and forbes were about equal in quantity available in all three areas with the major difference showing up in the shrub association. Average utilization in this habitat was heaviest in the area of low concentration and lightest in the area of heavy deer concentration.

Although the area of high deer concentration had *Quercus virginiana* as the only shrub sampled, *Crataegus* sp. was also abundant but being in a defoliated condition was not counted. Palmetto was also most abundant in the most heavily populated area but was not counted because of its lack of palatability and negative utilization.

This habitat type, based on the present study, has very little quantity or choice of browse available to deer during the winter months. Probably its most important period is during the fall before defoliation sets in and acorn and palmetto berries are present.

As in the case of the longleaf pine-turkey oak in Citrus and Hernando Counties, this habitat has seasonal importance. The predominant soil type is in the Lakeland series, a poorer quality soil than most of those found on the Chinsegut and Inverness areas or the Blackwater area.

TABLE X

COMPARISON OF AMOUNT OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION ON THREE AREAS OF DIFFERENT DEER POPULATION DENSITIES AT EGLIN AIR FORCE BASE IN THE UPLAND HAMMOCK HABITAT. FIELD WORK DONE MARCH 9, 10, AND 11, 1955

	Area of Low Deer Concentration, 0.625 Per 100 Ac., 15 Plots			*Area of Med. Deer Concentration, 2.083 Per 100 Ac., 15 Plots*			*Area of High Deer Concentration, 5.000 Per 100 Ac., 15 Plots*		
Species	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*
Small trees, shrubs, and vines									
Quercus virginiana	8.0	10.0	6.6	0	0	0	103.0	4.5	80.0
Quercus laurifolia	17.0	10.0	33.3	15.0	25.0	13.3	12.1	0	40.0
Quercus nigra	.70	0	13.3	0	0	0	0	0	0
Quercus myrtifolia	0	0	0	0	0	0	69.0	2.5	26.6
Symplocos tinctoria	0	0	0	1.3	0	6.6	0	0	0
Osmanthus americanus	0	0	0	.14	50.0	6.6	0	0	0
Cyrilla racemiflora	0	0	0	3.3	57.0	13.3	0	0	0
Chrysoma pausciflosculosa	0	0	0	0	0	0	6.0	0	6.6
Chiogenes virginianus	0	0	0	0	0	0	.54	45.0	13.3
Ilex vomitoria	0	0	0	0	0	0	.58	40.0	6.6
Ilex coriacea	0	0	0	9.1	0	6.6	0	0	0
Ilex glabra	36.0	0.7	46.6	50.0	3.7	53.3	0	0	0
Vaccinium mrysinites	.34	0	6.6	0	0	0	0	0	0
Gaylussacia sp.	0	0	0	.50	90.0	6.6	0	0	0
Smilax sp.	0	0	0	.10	0	13.3	.07	0	13.3
Pieris nitida	0	0	0	1.4	0	6.6	0	0	0
TOTAL	62.04	6.9	. . .	80.84	45.1	. . .	191.29	22.5	. . .
Forbes									
Berlandiera pumila	0	0	0	.11	0	1	0	0	0
TOTAL	0	0	. . .	.11	0	. . .	0	0	. . .
Grasses									
Wiregrasses	.23	0	20.0	.18	23.0	20.0	0	0	0
Broadbladed	1.50	0	60.0	.60	1.1	60.0	.80	0	40.0
TOTAL	1.73	0	. . .	.78	12.1	. . .	.80	0	. . .
COMBINED TOTALS	63.77	6.9	. . .	81.73	28.6	. . .	192.09	22.5	. . .

The upland hammock habitat is small in acreage, surrounding the fluvial swamps and situated between the swamps and the longleaf pine-turkey oak. The swamps are lowest in elevation with the hammocks on higher ground and the longleaf pine-turkey oak highest. The soil types tend to become progressively less well drained as elevation drops but become higher in organic content.

Similar to the longleaf pine-turkey oak, the upland hammock habitat showed the same pattern with the vegetation and deer populations increasing together. Small trees, shrubs and vines constituted 97% of the available vegetation in all three areas and the total number of browse plants present was 16 compared to only 5 found in the longleaf pine-turkey oak. Forbes and grasses were few in number of species present and small in quantity on all three drive areas. Average utilization was highest in the area of medium concentration and lowest in the area of low deer concentration.

TABLE XI

COMPARISON OF AMOUNT OF AVAILABLE VEGETATION, ITS OCCURRENCE AND UTILIZATION ON THREE AREAS OF DIFFERENT DEER POPULATION DENSITIES AT EGLIN AIR FORCE BASE IN THE FLUVIAL SWAMP HABITAT. FIELD WORK DONE MARCH 9, 10, AND 11, 1955

	Area of Low Deer Concentration, 0.625 Per 100 Ac., 25 Plots			*Area of Med. Deer Concentration, 2.083 Per 100 Ac., 10 Plots*			*Area of High Deer Concentration, 5.000 Per 100 Ac., 10 Plots*		
Species	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*	*Ave. Lbs./ Acre*	*Ave.% Utilization*	*% Frequency Occur.*
Small trees, shrubs, and vines									
Quercus laurifolia	.10	0	4.0	0	0	0	0	0	0
Cliftonia monophylla	20.2	4.4	64.0	116.0	0	70.0	169.0	2.5	80.0
Andromeda sp.	19.9	2.7	41.2	0	0	0	0	0	0
Pieris nitida	131.0	1.0	60.0	352.0	5.0	100.0	344.0	3.0	100.0
Ilex coreacea	14.0	5.7	28.0	148.0	3.5	70.0	334.0	4.4	90.0
Ilex opaca	.11	0	4.0	0	0	0	0	0	0
Ilex cassine	.43	0	4.0	0	0	0	0	0	0
Ilex glabra	17.7	0	16.0	0	0	0	0	0	0
Persea sp.	.65	10.0	16.0	.33	3.0	30.0	4.6	0	10.0
Gaylussacia sp.	7.7	0	32.0	15.6	0	70.0	0	0	0
Myrica inodora	6.9	0	8.0	0	0	0	52.0	0	50.0
Myrica cerifera	0	0	0	0	0	0	35.0	0	40.0
Magnolia virginiana	.19	0	8.0	0	0	0	20.3	15.0	30.0
Smilax sp.	.11	0	16.0	10.	80.0	10.0	.42	0	10.0
Ilicium floridanum	39.0	0	4.0	0	0	0	13.0	0	10.0
Arundanaria leucothia	2.1	0	4.0	0	0	0	.60	50.0	10.0
Vibernum sp.	.90	6.6	12.0	.14	10.0	10.0	.40	0	10.0
Vaccinium sp.	0	0	0	0	0	0	2.6	10.0	10.0
Osmanthus americanus	0	0	0	.40	0	30.0	0	0	0
TOTAL	260.99	5.0	...	632.57	20.3	...	975.92	14.1	...
Grasses and sedges									
Broadbladed	.70	0	4.0	0	0	0	0	0	0
Carex sp.	.20	0	4.0	0	0	0	0	0	0
TOTAL	.90	0	...	0	0	...	0	0	...
COMBINED TOTALS	262.79	5.0	...	632.57	20.3	...	975.92	14.1	...

The fluvial swamps contained dense understories typical of the hardwood swamp on the Blackwater Management Area. In the area of low deer population, 25 plots were taken because accessability was fairly easy. In the other two areas only 10 plots were attempted but this was believed to be adequate by the field technicians and will give a fairly accurate coverage of the vegetation present.

A total of 20 different shrubs, small trees and vines were sampled in this habitat, four more than were present in the upland hammock and 15 more than were found in the longleaf pine-turkey oak. No forbes were found in the sampling plots and only a trace of broadbladed grasses in the area of lowest deer concentration.

This habitat type, when judged on quantity and variety of deer foods available, was superior to the other two types and undoubtedly plays an important role in maintaining the present deer herd, particularly during the winter months.

As in the case of the other two habitats, vegetation and deer population increased together with the area of highest deer population having the greatest amount of available browse, the area of medium concentration next in amount, and the area of lowest concentration having the least amount available. Utilization followed the same pattern found on the upland hammock habitat. The preferred browse species *Ilex coriacea, Cliftonia monophylla* and *Magnolia virginiana* occurred most frequently on the area of high deer concentration. Average percent utilization was heaviest on the area of medium concentration primarily because of the species Smilax.

HABITAT EVALUATION

With the exception of the live oak hammock habitat in the Chinsegut deer enclosure, the average pounds per acre of vegetation on open range greatly exceeded the quantity of vegetation in the enclosures. In the enclosures the upper limits of the carrying capacity of the area is usually reached and the resultant browsing pressure extended any length of time will show up by the vegetation being more heavily utilized and the quantity available becoming less.

Although the flatwoods habitat possessed a large quantity of plant life, utilization and number of different species present are low.

On the Inverness area, where a three-year burning program is in effect and cattle grazing is allowed, plants have been kept in a state of secondary succession. The small coverage of live oak hammock habitat and the large population of deer and cattle had resulted in a heavy utilization of browse plants and a decrease in available vegetation.

Six skeletal remains of deer have been found in the Chinsegut enclosure during the past two years. Cause of death in most cases was definitely identified as lead poisoning. This indicates that poaching is not uncommon. Where a small deer population exists in a small area, poaching seriously affects the herd growth. Percent utilization of vegetation in the live oak hammock on the enclosure is conderably below that of the Inverness area, while average pounds per acre of available browse plants is considerably greater. This indicates the deer herd is not increasing in accordance with the amount of available vegetation.

TABLE XII

AVERAGE POUNDS PER ACRE OF SMALL TREES, SHRUBS AND VINES, AND THEIR AVERAGE PER CENT UTILIZATION IN THE VARIOUS HABITATS

	Deer Enclosure		*Open Range*	
Habitat Type	*Average Lbs./Acre of Small Trees, Shrubs and Vines*	*Average % Utilization of Small Trees, Shrubs and Vines*	*Average Lbs./Acre of Small Trees, Shrubs and Vines*	*Average % Utilization of Small Trees, Shrubs and Vines*
Flatwoods	324.7	4.9	469.8	4.3
Longleaf pine-turkey oak	76.0	17.0	149.5	15.0
Hardwood hammock	132.5	47.5	229.9	31.7
Live oak hammock	185.3	26.7	43.8	50.7
Hardwood swamp	662.2	17.0	798.0	25.8
Softwood swamp	103.5	46.5	156.3	23.2

A greater variety of plants exists in the different habitats on open range. In those deer enclosures where burning and pulpwood cutting were discontinued for any length of time natural plant succession progressed with some plants disappearing. Also, heavy utilization of some browse plants encouraged competing species to take over.

Hammocks and swamps provide the greatest variety of browse plants and the greatest number of preferred foods. The extent coverage of these two habitat types within an area and the ecological stage they are in has considerable effect upon the size of the deer herd.

The small variety of browse plants available during winter months on the longleaf pine-turkey oak and flatwoods habitats and their low utilization would indicate these types are not utilized much during winter months. Season of heaviest use would probably be during the fall when acorns and saw palmetto berries have ripened.

TABLE XIII

VARIETY OF SMALL TREES, SHRUBS AND VINES AVAILABLE TO DEER IN THE DIFFERENT HABITATS

	Enclosure	*Open Range*
Habitat Type	*Ave. No. Different Plant Species Available to Deer*	*Ave. No. Different Plant Species Available to Deer*
Flatwoods	6.0	6.0
Longleaf pine-turkey oak	7.5	8.0
Hardwood hammock	11.0	16.5
Live Oak hammock	10.0	13.0
Hardwood swamp	7.0	8.0
Softwood swamp	8.0	10.0

Absence of fire in the longleaf pine-turkey oak habitat at Eglin Air Force Reserve for over 20 years has resulted in a more advanced stage of plant succession than is found in the other areas. It has reduced the average pounds per acre of evergreen shrubs, trees and vines available to deer.

TABLE XIV

AVERAGE POUNDS PER ACRE OF SMALL TREES, VINES AND SHRUBS IN THE LONGLEAF PINE-TURKEY OAK HABITAT OF VARIOUS AREAS

Area	*Quantity*
Eglin Air Force Base	3.46 pounds per acre
Chinsegut and Inverness Areas	64.0 pounds per acre
Blackwater Management Area	161.5 pounds per acre

If controlled burning had taken place at Eglin, plant succession would have been continually set back and plant competition stimulated, resulting in greater quantity and variety of plants. The cleared bombing ranges indicate how vegetation will increase in longleaf pine-turkey oak after disturbance.

The Blackwater Management Area (Holt Fish Hatchery), where a three-year burning program is in effect, possesses a higher quality soil than Eglin. The burning program and the better quality soil have resulted in an abundance of plants. The Blackwater Area, when considering the quantity of available vegetation present in the various habitats, should possess one of the highest deer populations in the state. In the enclosure where adequate protection is more easily maintained, the herd reached a high of 1 deer to 10 acres. Outside the enclosure the annual track count census indicates that the population is one of the lowest in the management areas.

On those areas studied where deer and cattle ranged together, small trees, shrubs and vines were more abundant in most cases than in those areas where only deer were present. These two conditions during this study were not easily compared, as deer confined to enclosures will through necessity exert more browsing pressure within a smaller area. Also, most deer enclosures have had controlled burning discontinued, the exception being the Blackwater enclosure. The only large area where deer ranged alone and controlled burning was absent over a long period of time was the Eglin Air Force Reserve.

TABLE XV

QUANTITY OF VEGETATION IN THOSE AREAS WHERE ONLY DEER ARE PRESENT AND IN THOSE AREAS WHERE DEER AND CATTLE RANGE

		Deer	*Deer and Cattle*
Habitat Type	*Area*	*Ave. No. Lbs./Acre of Small Trees, Shrubs and Vines*	*Ave. No. Lbs./Acre of Small Trees, Shrubs and Vines*
Longleaf Pine-Turkey Oak	Eglin	3.80	....
	Inverness and Blackwater	....	149.5
Upland and Live Oak Hammond	Eglin	111.3	....
	Inverness	....	43.8
Hardwood Swamp	Eglin	623.7	....
	Blackwater	....	730.1
Hardwood Hammock	Blackwater and Lake Butler Enclosures	....	229.1
	Blackwater and Lake Butler Management Area	132.5	....
Softwood Swamp	Lake Butler Enclosure	103.5	....
	Lake Butler Management Area	....	156.3

The live oak hammock habitat in the Inverness Area is the only type where the average number of pounds per acre of vegetation is less where deer and cattle range together. The Inverness Area has had excellent protection over a period of at least five years. It has one of the largest deer herds in the state along with a fairly large cattle population. The vegetation in the live oak hammocks is presently being utilized quite heavily.

RESULTS

1. The longleaf pine-turkey oak habitats censused in late October and early November had a greater quantity and variety of plants available than the same type habitats censused during February and March. Deciduous foliage had not as yet all dropped and annual herbaceous material had not entirely died back.

2. All swamps and hammocks in the deer enclosures (except for the live oak hammock of the Chinesegut enclosure) had a lesser quantity of small trees, shrubs, and vines available than the same habitat types on open range. This resulted from the following influences: (a) Enclosures had a smaller number of acres per animal; (b) land use practices such as controlled burning and pulpwood cutting had been discontinued (except for the Blackwater deer enclosure).

3. Only a small variety of browse plants were available to deer during the winter months on longleaf pine-turkey oak habitat and flatwoods.

4. Swamps and hammocks had a much greater variety of deer browse plants present than the more extensive longleaf pine-turkey oak and flatwoods.

5. In the longleaf pine-turkey oak habitat of Eglin Air Force Reservation the quantity of vegetation available to deer was nearly non-existent. This is due principally to the absence of fire for 20 years.

6. In the three drive areas of different deer population densities on Eglin the area of low population had the smallest amount of upland hammock and fluvial swamp present.

7. The Blackwater Management Area, which had the greatest quantity and variety of plants available to deer, has the lowest deer population.

8. The Lake Butler Wildlife Management Area had very little available browse in those swamps and hammocks censused both inside the enclosure and outside. The cattle population was rather high and the deer population low.

9. The Inverness area had both a high deer and cattle population, and the amount of available browse in the live oak hammock when compared to the Chinsegut enclosure was low.

10. On the three drive areas at Eglin the area of low deer population had the least amount of available browse in all three habitat types sampled and the area of highest deer concentration had the greatest quantity of available browse in the three habitats.

11. Browse studies should be continued and the number of plots taken in each habitat increased, especially on the Eglin Air Force Reservation where cattle grazing and controlled burning are absent. The absence of these two influences have left this area in a more stabilized condition than is found elsewhere in the state and therefore furnishes a good check area.

12. Browse studies should be run between December and March when annual herbaceous material has died back and deciduous foliage dropped.

SUMMARY

At adaptation of the Forage Weight Method of Range Inventory (100% clipping method) developed by R. S. Campbell and J. T. Cassidy of the U. S. Forest Service in 1951 was used in making a browse survey. In using the 100% clipping method, the quantity of vegetation available to deer is based on the average number of pounds per acre.

A total of 597 plots was taken in the following habitat types: longleaf pine-turkey oak (186 plots), flatwoods (50 plots), hammock (255 plots, and swamp (106 plots).

The browse census was conducted during the late fall and winter months when annual growth had stopped and deciduous vegetation had shed its foliage.

The Lake Butler Wildlife Management Area, located in the flatwoods country of northeast Florida, the Blackwater Wildlife Management Area, located in the longleaf pine-turkey oak country of northwest Florida, and the Chinsegut-Inverness Areas located in the longleaf pine-turkey oak country of west central Florida were chosen for the browse census study because each possessed a deer enclosure.

In those enclosures where only deer were allowed (Chinsegut and Blackwater) an effort was made to compare habitat where deer and cattle ranged together with habitat where only deer ranged. Habitats where burning had been discontinued were compared with similar habitats where controlled burning was still a practice.

The Eglin Air Force Reservation located in the longleaf pine-turkey oak country of northwest Florida was selected for study because of the absence of fire for 20 years and because of population estimates based on deer drives of three areas of different population densities.

Records on deer populations, as estimated by the deer track count census method, and number of cattle present as obtained by lessee records were kept on all study areas.

Descriptions of the prevailing soil types in the different habitats were obtained on all management areas from Bulletin No. 42 *Soils of Florida and Their Utilization* by O. C. Bryan and Ralph Stoutamire, 1946.

Extent coverage of habitats in the study areas was determined by aerial photos obtained at the county P. M. A. office.