ing dove, because a high percentage of their hunting kill is composed of locally reared or "home grown" doves.

The recent appointment of a Dove Committee by the International Association of Game, Fish, and Conservation Commissioners should be an important step in stimulating research leading toward a sound management program for mourning doves.

SUMMARY

Management of the mourning dove is a responsibility of the Bureau of Sport Fisheries and Wildlife. Suggestions for a management program have been published by Foote (1953, 1957) and others. Research and management projects were curtailed after the conclusion of the Cooperative Mourning Dove Study in 1953.

Progress and needs for three projects are discussed: nestling banding, reorganization of the call-count survey, and survey of hunting kill.

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CHOCCOLOCCO DEER RANGE ANALYSIS AND MANAGEMENT IMPLICATIONS *

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The productivity and management implications of a deer range were studied on the 40,000-acre Choccolocco Wildlife Management Area of the Talladega National Forest located in Cleburne County in northeastern Alabama (Figure 1). Field investigations were initiated in September, 1956, and completed in May, 1959. The results were submitted in partial fulfillment of degree requirements at the Alabama Polytechnic Institute.

During the course of this study, a technique for rapid evaluation of existing conditions on the Choccolocco deer range was developed and tested. The design and purpose of this technique should make it applicable to most other southeastern deer ranges. In addition, information gathered during the study indicated that our present deer populations can be managed best by determining the *trend* of prevailing range conditions. It is these two aspects of the Choccolocco study that will be presented at this time.

* A contribution of the Alabama Cooperative Wildlife Research Unit, the Auburn University, the Alabama Department of Conservation, the Wildlife Management Institute and the U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, cooperating.

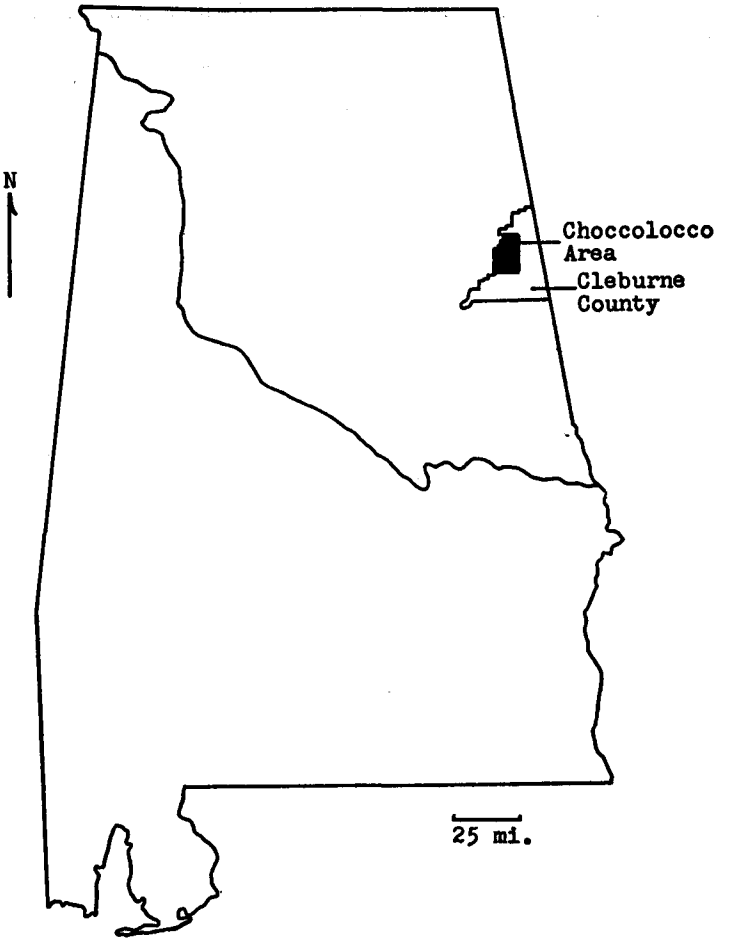


Figure 1. Map of Alabama with location of Choccolocco Area.

METHODS

Vegetation is the major source of energy for any deer population within a natural community. For this reason, it was considered necessary to survey the vegetation on the Choccolocco range in order to determine its carrying capacity. In addition to speed and accuracy, the ultimate objective of the final survey method was to provide a means of detecting shifts in the ideal balance between deer and their habitat in sufficient time to prevent serious damage to either or both these factors. Several survey methods approximating these requirements were tested on the Choccolocco range in order to find a suitable technique.

Quadrats utilizing an unmodified Aldous (1944) method were originally selected for use. This method, designed for northern deer yards, was discarded after several applications proved it to be too tedious and generalized for adequate evaluation of an area as large as the Choccolocco range. In contrast, Brown (1956) found the unmodified Aldous method suitable for evaluating deer range conditions in the forests of West Virginia. He considered line-intercept

and line-point systems unadaptable to a forest possessing several strata of plants while the measurement of browse clippings was too tedious and time consuming to allow extensive sampling.

Krefting (*n.d.*) modified the original Aldous deer browse survey method for evaluation of summer browsing on the leaves and tips of terrestrial plants in addition to evaluation of winter browsing. The objective of this method was to determine whether the range was overstocked, properly stocked or understocked in so far as the food supply was concerned.

Canfield (1941) described a method for sampling range vegetation with line segments. According to Hormay (1949), this method could be used (in combination with other methods) to measure vegetation factors like density, composition, yield, utilization, vigor and reproduction, and soil factors like erosion, bare soil, rock and litter cover.

Final selection of a survey method incorporated Krefting's modification of the Aldous browse survey method and Canfield's line-interception method for sampling range vegetation. This combination of methods plus certain additions provided a system of range analysis applicable to southern pine-hardwood forests of the type occurring in the Choccolocco Area.

Following this period of methods evaluation and selection, the survey was accomplished during the summer of 1957 and winter of 1958 througn the use of line-intercepts employing a chain 100 feet in length. An ordinary hardware chain was utilized for the study since it was both kink- and snag-proof and light in weight This chain was subdivided into five-foot segments of alternating light blue and orange colors to facilitate recording and to provide greater accuracy.

Since line-intercepts have a two-dimensional aspect, it was also necessary to establish a ceiling on browse height along the length of the chain. Goodrum (1954) used a height of 5½ feet in his studies on the relation of white-tailed deer to their browse within the longleaf pine belt of the Gulf Coastal Plain. Lindzey (1952) in his Oklahoma white-tailed deer studies considered browse as any plant with green twigs within five feet of the ground After observing the feeding habits of deer in both the field and captivity, it was concluded that both these heights were in excess of normal browsing levels on ranges where forage is still abundant and within easy reach And since proper deer management attempts to prevent overbrowsing and crowding, it seemed advisable to use a more conservative browse height when surveying the Choccolocco range, regardless of its condition at the time. With this objective in mind, height of the line was limited to 4½ feet, a figure derived by measuring the maximum, *unstrained* browsing height of captive deer.

Range analysis was limited to the 16,000-acre Shoal Creek drainage because it was considered representative of the total management area. One hundred sample lines were located at random throughout the drainage area along compass lines perpendicular to a center line at each point where the center line intersected section and half-section lines (Figure 2). Sample lines were placed 900 feet apart along these compass lines which extended to the drainage boundary. Roads, creeks, and other landmarks were used to locate compass lines in the field along which the predetermined sample lines were found by pacing and use of a compass.

Field data were recorded on forms especially designed for this type of survey (Figure 3). In addition to bare spaces, plant species were recorded under five major classifications: grasses, forbs, vines, shrubs and trees. The extent of coverage within each five-foot segment was visually estimated and recorded as the nearest inch or foot. In cases of observable deer browse, percentage removal of current annual growth was recorded as a denominator. Vegetation in excess of the 4½-foot ceiling was recorded as understory and canopy. This information was used to compute the distribution of forest types by site and the availability and degree of utilization of important food items.

One-quart stomach samples were obtained for food habits analysis according to the method described by Martin (1949). Samples collected during the 1956 hunting season were dried with unsatisfactory results. Therefore, subsequent one-quart samples were stored wet in a formalin solution until they were

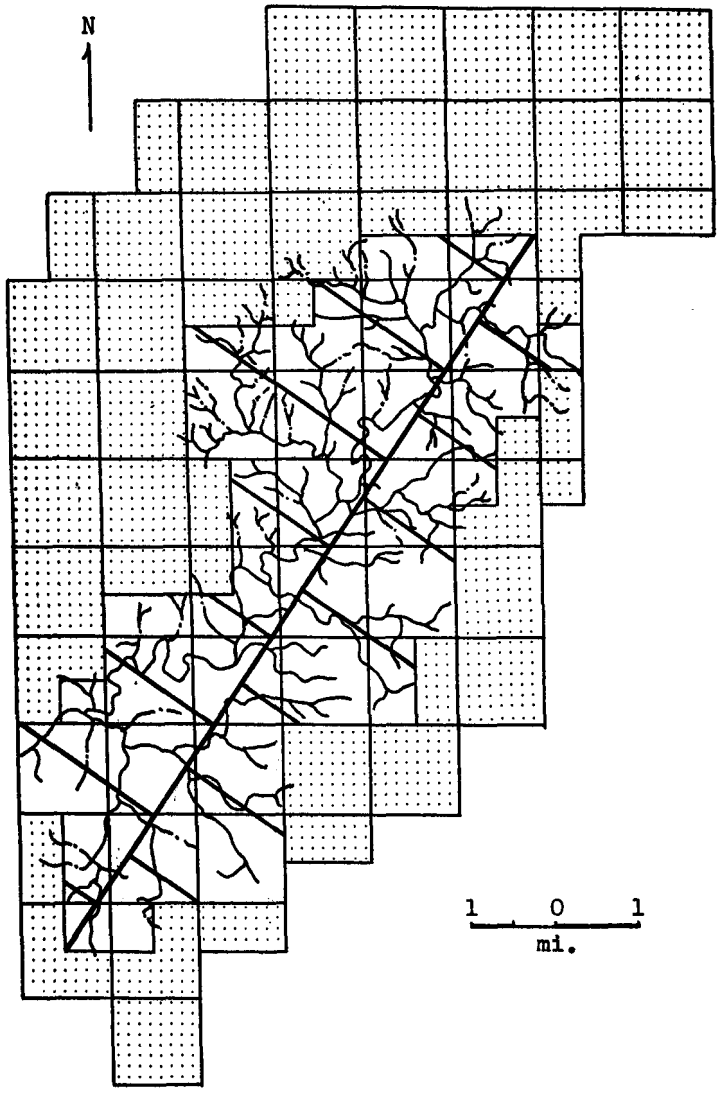


Figure 2. Map of Choccolocco Area with location of Shoal Creek and placement of range survey line-intercepts within the drainage.

examined. Food items were initially separated into the broad categories of grasses and grass-like plants, forbs, browse or woody species including vines, and a miscellaneous group. Specific identification was then made of food items within each group. Frequency of occurrence, volume and average utilization of all food items were determined by season

FIGURE 3

(Sample form used for recording of data during range survey of Choccolocco Area)

COVER ANALYSIS AND DEER BROWSING PRESSURE ON FOLIAGE IN LINE TRANSECTS

Sheet____of____Sheets

Name of Forest_____County_____Area_____Date_____

Location: Sec.____T__R__Transect No.__Tape No.____Direction____

Habitat: Type_____Surface_____Elevation_____Investigator_____

Intervals (Each represents a 5-ft. segment)

Species	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	Ave.
Bare Ground (%)																						

RESULTS

Composition of Available Food Plants. Results of the summer and winter range surveys were summarized by cover types applicable to deer usage. They were plotted on semi-logarithmic paper so small differences would be readily discernable (Figure 4). The difference between the summer and winter bare types represented the cumulative difference between the vegetation types during these seasons. Less than one-half the total Choccolocco Area was occupied by vegetation below 4 1/2 feet during any season of the year. In addition, not all this vegetation was acceptable deer food. These two factors imposed severe limitations on the number of deer this area could carry, even under optimum conditions.

Among the herbaceous types, grass coverage differed least from summer to winter because the dominant species were perennials and their dormant clumps remained after the leaves had died and withered away. Forbs suffered the greatest coverage reduction of all vegetation types from summer to winter because the majority of the species were annuals or non-rosette-forming biennials or perennials Widely scattered, composite rosettes accounted for the high frequency of forbs over grasses in contrast to their reduced coverage during the winter months.

Percentage coverage of vines did not decrease at all from summer to winter. The reduced coverage of shrubs and trees during this period may be attributed to the deciduous members of these types. The preponderance of ericaceous shrubs in that group accounted for the slight loss of leaves during the winter in contrast to the tree group.

Forest Types. The distribution of forest types in the Choccolocco Area was determined by analysis of canopy composition (Table I). Forest stands were placed in one of three general site categories dependent upon their location on a ridge slope. In essence, the three categories of lower, mid- and upper-ridge position represented decreasing soil moisture.

Utilization as Indicated by Range Surveys. Although every effort was made to accurately record the extent of feeding by deer on all plants, the growth form of woody plants retained and displayed browse marks longer and more clearly than herbaceous plants. For this reason, emphasis will be placed on woody browse plants during a discussion of range survey results since the utilization of herbaceous plants can be more accurately evaluated by an examination of stomach contents.

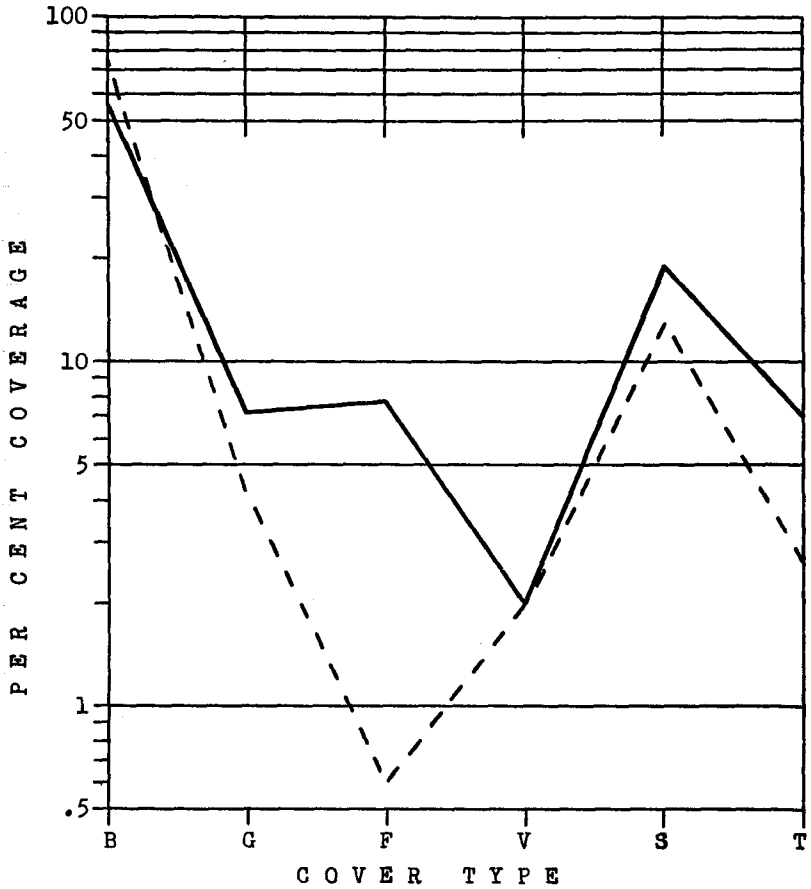


Figure 4. Seasonal comparison of Choccolocco cover types (B) bare, (G) grasses, (F) forbs, (V) vines, (S) shrubs and (T) trees.

——— Summer — — — Winter

TABLE I

DISTRIBUTION OF FOREST TYPES IN THE CHOCCOLOCCO AREA BY SITE AND IMPLIED MOISTURE RELATIONSHIPS

Forest Type	*Percent Distribution*		
	Lower Ridge	*Mid-Ridge*	*Upper Ridge*
PINE DOMINANT	30.3	26.7	47.1
Pine	21.7	9.3	24.3
Pine-Hardwood	8.6	17.4	22.8
HARDWOOD DOMINANT	69.7	73.3	52.9
Hardwood-Pine	18.5	25.5	25.8
Hardwood Complex	44.1	27.7	17.4
Oak	7.1	20.1	9.7
TOTAL	100.0	100.0	100.0

Since the availability and utilization of any particular plant species varied from one season to the next, results of the summer and winter surveys were compiled separately. An availability index was established by multiplying percent frequency of occurrence by average density in feet. This index presented a clear picture of availability on any particular group or species of plants since it moderated any plant (such as sawbrier) that occurred in several lines but with little coverage or any plant (such as alder) that occurred infrequently but with extensive coverage.

Average extent of browsing was expressed as percentage removal of current annual growth and evaluated by using a ratio derived from Krefting's (*n.d*) Index of Browsing where

$$\text{I. B.} = \frac{\text{C}}{(\text{T. P.})\ (\text{N})} \times 100.$$

Explanation of the formula is as follows:

C = Total actual browsing recorded in all lines of occurrence.

T. P. = Tolerance point, expressed as a percentage, represents the degree of deer browsing beyond which the plant can not tolerate continued browsing without undergoing permanent damage or death A tolerance point of 40 percent was used except for a few plants whose tentative tolerance points had been established by Goodrum and Reid (1954).

N = Number of lines in which the particular browse species occurred.

The ratio of actual browsing in relation to tolerance point was obtained by eliminating the multiplication factor of 100. According to this method, if the ratio is 1.00 or above, the plant is heavily browsed; if the ratio is between .75 and 1.00, the plant is moderately browsed; and if the ratio is under .75, the plant is lightly browsed.

As an example of this method, the summer range survey indicated that alder was browsed for a total of 90 percent in 10 lines. The tolerance point of alder has been established as 50 percent. Therefore,

$$\text{I. B.} = \frac{\text{C}}{(\text{T. P.})\ (\text{N})} = \frac{.90}{(.50)\ (10)} = \frac{.90}{5.0} = .18,$$

a ratio considered indicative of light browsing. On the other hand, alder had an availability index of .04 and can not be considered a very important deer food in the Choccolocco Area even though it may be a good indicator of prevailing range condition.

The summer survey indicated that a wide variety of shrubs and trees were browsed by deer during this period (Table II). By far the most important browse species was lowbush blueberry, which comprised 72 percent of all shrubs and was heavily browsed with 54 percent of its annual growth removed. Later field work and examination of stomach contents indicated, however, that lowbush blueberry actually sustained this heavy browsing during the months of April and May when fresh, tender leaves were most abundant. Other heavily utilized browse plants included greenbrier, hydrangea, strawberry-bush, mountain laurel, and viburnum. Herbeceous plants that exhibited consistent forage signs or were fed on in excess of 40 percent included cinnamon-fern, senna, milk-vetch, tick-clover, bush-clover, butterfly-pea, New Jersey tea, black snakeroot, mint, ruellia, partridge-berry, elephant's foot, goldenrod, ragweed, rosinweed, sunflower and tickseed.

As anticipated, the winter survey indicated that deer had less browse available on fewer species of shrubs and trees during this period than during the summer (Table III). Lowbush blueberry, which was only moderately browsed, displayed this condition of reduced availability because it had little to offer except previously browsed twigs, leaf buds, and early flowers. Bullbrier, hydrangea and mountain laurel continued to be heavily browsed while browsing increased from light to heavy on sweetleaf and black gum and from moderate to heavy on sawbrier and horsebrier. Dwarf sumac, especially seed heads and stems of the previous year's growing season, made its entry as a major source of browse.

The only herbaceous plant available and consumed in any quantity was Christmas fern, which sustained average utilization of 48 percent.

TABLE II

OCCURRENCE, COVERAGE AND DEGREE OF UTILIZATION OF BROWSE PLANTS IN THE CHOCCOLOCCO AREA BASED ON THE SUMMER RANGE SURVEY OF 1957

Browse Species	*Frequency of Occur. Percent*	*Average Density Feet*	*Availability Index Col. I x II*	*Average Browsing Percent*	*Krefting's Index of Browsing Ratio*	*Condition*
Bullbrier	45	1.01	.45	75.3	1.26	Heavy
Sawbrier	58	.33	.19	56.4	.94	Moderate
Horsebrier	11	.08	.01	53.4	.89	Moderate
Honeysuckle	2	Trace	..	37.0	.93	Moderate
Alder	10	.39	.04	9.0	.18	Light
Hydrangea	12	.18	.02	65.5	1.64	Heavy
Dwarf Sumac	27	.42	.11	5.8	.12	Light
Strawberry-Bush	5	.01	..	70.0	1.40	Heavy
Azalea	20	.32	.06	16.4	.41	Light
Mountain Laurel	2	.20	..	88.0	1.76	Heavy
Lowbush Blueberry	87	14.21	12.36	53.8	1.08	Heavy
Sweetleaf	8	.08	.01	24.8	.50	Light
Viburnum	1	Trace	..	74.3	2.23	Heavy
Yellowpoplar	8	.02	..	36.7	1.10	Heavy
Black Gum	58	.84	.49	25.4	.63	Light

TABLE III

OCCURRENCE, COVERAGE AND DEGREE OF UTILIZATION OF BROWSE PLANTS IN THE CHOCCOLOCCO AREA BASED ON THE WINTER RANGE SURVEY OF 1958

Browse Species	*Frequency of Occur. Percent*	*Average Density Feet*	*Availability Index Col. I x II*	*Average Browsing Percent*	*Krefting's Index of Browsing Ratio*	*Condition*
Bullbrier	32	1.00	.32	88.3	1.47	Heavy
Sawbrier	44	.36	.16	67.0	1.12	Heavy
Horsebrier	14	.30	.04	68.0	1.13	Heavy
Honeysuckle	2	.03	..	71.3	1.78	Heavy
Alder	14	.20	.03	12.0	.24	Light
Hydrangea	20	.28	.06	78.9	1.97	Heavy
Dwarf Sumac	24	.28	.07	92.3	1.85	Heavy
Strawberry-Bush	2	Trace	..	..	..	.....
Azalea	16	.32	.05	14.3	.36	Light
Mountain Laurel	8	.41	.03	93.7	1.87	Heavy
Lowbush Blueberry	86	10.91	9.38	41.2	.82	Moderate
Sweetleaf	6	.03	..	72.9	1.46	Heavy
Black Gum	6	.03	..	37.0	.93	Heavy

Utilization Based on Stomach Contents. One-quart stomach samples were taken from nineteen collected specimens in addition to thirty-nine ungutted animals brought to the deer checking station by hunters during 1956-57-58. In general, the contents of these stomach samples supported the range survey findings with four exceptions beyond the limitations of the survey methods employed. These were acorns, which constituted an important food item during the fall when available; fungi, which were consumed all year but most intensively during the fall and spring; lichens, which were ingested primarily during the winter, and litter composed of dead plant material which appeared in inverse ratio to the amount of live forage available. Information from these examinations was compiled by season as percent frequency of occurrence and volume multiplied together to yield a utilization factor.

Stomach samples obtained during late fall hunting seasons over a three-year period were compared with each other (Table IV). Perhaps the most important group from the standpoint of management was listed as miscellaneous. Within this group, acorns (primarily well-sprouted chestnut oak acorns) were moderately utilized in 1956, a year of bumper acorn crops; absent in 1957, a

year of acorn failure; and very heavily utilized in 1958, a year of abundant acorns in the black oak group. When these acorn utilization ratings were compared with those of litter, it became apparent that they were almost in inverse ratio to each other. This limiting effect of acorn consumption on the consumption of nearly nutritionless litter may be of paramount importance as a conditioning factor for deer about to enter a period of seasonal stress.

TABLE IV

LATE FALL FOOD ANALYSIS BASED ON THE CONTENTS OF SIXTEEN (1956), THIRTEEN (1957) AND TEN (1958) STOMACHS

	Percent						*Utilization Rating*		
	Frequency			*Volume*					
Food Item	'56	'57	'58	'56	'57	'58	'56	'57	'58
GRASSES	31	23	20	1.0	6.7	.7	.03	.15	0.1
FORBS	88	77	30	3.2	2.8	1.7	.28	.22	.05
Christmas Fern	19	46	20	.7	1.2	1.2	.01	.06	.02
BROWSE	94	100	90	42.2	35.8	10.1	3.97	3.58	.91
Greenbrier	56	23	70	2.0	2.2	3.2	.11	.05	.22
Dwarf Sumac	13	62	10	5.2	9.2	1.6	.07	.58	.02
Mountain Laurel	44	38	..	20.4	12.5	..	.90	.48	..
Blueberry	56	62	60	13.4	9.3	2.6	.75	.58	.16
Sweetleaf	13	23	30	.8	.5	.6	.01	.01	.02
Pine	19	38	..	.3	1.8	..	.01	.07	..
MISCELLANEOUS	100	100	100	53.6	54.7	85.5	5.36	5.47	8.55
Acorns	31	..	90	21.7	..	64.2	.67	..	5.78
Fungi	31	92	60	.9	9.0	5.6	.02	.83	.34
Lichens	19	54	10	.4	1.7	.3	.01	.09	..
Litter	100	92	80	30.6	44.0	15.4	3.06	4.05	1.23

Winter food analysis was based on the contents of eight stomachs (Table V). Lowbush blueberry continued to be heavily browsed as was mountain laurel. Litter still comprised an important part of the diet during this period of food scarcity but in lesser amounts than that of late fall samples. Forbs and grasses were utilized in increasing amounts.

TABLE V

WINTER FOOD ANALYSIS BASED ON THE CONTENTS OF EIGHT STOMACHS COLLECTED IN 1958 AND 1959

	Percent		*Utilization Rating*
Food Item	*Frequency*	*Volume*	
GRASSES	88	23.0	2.02
FORBS	50	6.4	.32
Christmas Fern	25	1.0	.03
BROWSE	100	53.5	5.35
Greenbrier	13	1.2	.02
Mountain Laurel	50	14.5	.73
Blueberry	100	36.9	3.69
Sweetleaf	13	.6	.01
MISCELLANEOUS	100	17.1	1.71
Acorns	13	Trace	..
Fungi	38	.8	.03
Lichens	25	5.8	.15
Litter	88	10.5	.92

Eleven stomachs were obtained for analysis of spring food habits (Table VI). Browse increased in importance and lowbush blueberry continued to be heavily utilized. Adding to this increased browse utilization was the inclusion of such items as new growth or greenbrier vines, red maple fruit, and the flowers of yellow poplar and sweetgum. The appearance of fresh pine in the stomach samples can be construed as another strong indication of overbrowsed conditions.

Grasses declined in importance while forbs increased slightly reflecting the emergence of new and succulent growth.

TABLE VI

SPRING FOOD ANALYSIS BASED ON THE CONTENTS OF ELEVEN STOMACHS COLLECTED IN 1957, 1958 AND 1959

Food Item	*Percent*		*Utilization Rating*
	Frequency	*Volume*	
GRASSES	64	14.0	.90
FORBS	82	4.7	.39
Christmas Fern	9	Trace	..
BROWSE	100	68.4	6.84
Greenbrier	45	10.1	.45
Mountain Laurel	27	4.2	.11
Blueberry	91	36.2	3.29
Sweetleaf	18	.8	.01
Pine	27	5.8	.16
Yellowpoplar, Flower	18	7.5	.13
Sweetgum, Flower	27	.5	.01
Red Maple, Fruit	18	2.7	.05
MISCELLANEOUS	91	12.9	1.17
Acorns	18	Trace	..
Fungi	73	7.3	.53
Litchens	45	1.1	.05
Litter	27	.7	.02

Insight into seasonal variation was gained by comparing major food items on the basis of average percent volume and by plotting utilization ratings on semi-logarithmic paper (Figure 5). The almost complete absence of litter in spring and the importance of acorns in late fall were clearly indicated.

MANAGEMENT IMPLICATIONS AND CONCLUSIONS

In retrospect, the Choccolocco deer range has undergone the following sequence of events: (1) extermination of native deer, (2) restocking, (3) complete control via closed seasons and law enforcement, (4) hunting under a buck law restricted to the removal of branch-antlered-deer only, and (5) improved harvest by permitting the removal of male deer with visible antlers without regard to branching. Despite this sequence of events and management practices, the annual rate of increase has always exceeded the harvest. Failure to remove these surplus deer has subsequently resulted in heavy utilization of food plants and a reduction in numbers and coverage of more palatable food plants. This condition is especially manifest during the "critical period" in late March and early April.

In support of this conclusion, the Choccolocco range surveys clearly indicated that the trend is towards rapid deterioration as suitable deer habitat. Honeysuckle, hydrangea, mountain laurel, sweetleaf and red cedar displayed distinct browse lines in many localities. Reproduction was severely hampered or prevented entirely on strawberry-bush and yellowpoplar in many stream bottom sites. Also indicative of this trend was the initial and limited utilization of generally regarded low quality food plants such as pine and alder.

How can this method of range appraisal be applied to other areas in the Southeast? First, it provides a rapid evaluation of prevailing range condition in time to invoke remedial action. Second, it can serve as a basis for deer management without regard to the difficult question of exactly how many deer are on a particular range. Third, it can be readily consolidated with the current rate of reproduction obtained from checking station data (assuming either sex hunting). Fourth, on newly stocked areas, it can be permanently established (in conjunction with the erection of adequate exclosures) as a standard to compare with similar ranges in various stages of occupancy and condition.

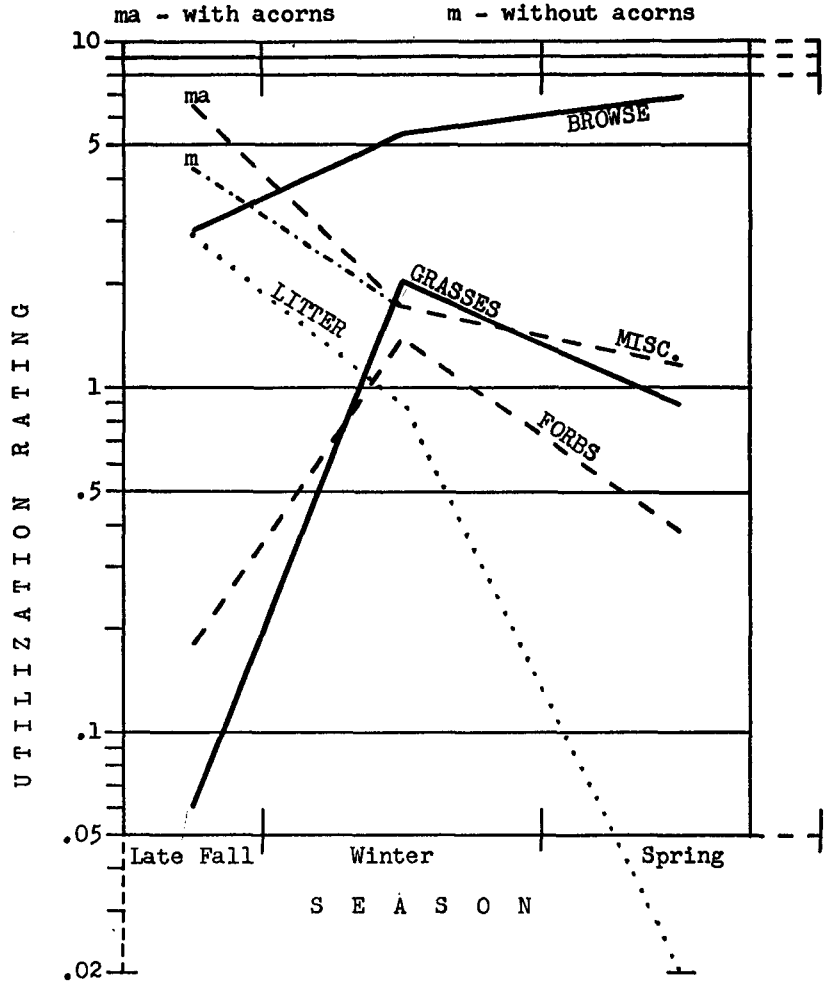


Figure 5. Utilization rating of food items eaten by deer in the Choccolocco Area during the three seasons of collection from 1957 through 1959. Data derived from frequency of occurrence times volume of stomach contents.

This method of range appraisal is especially valuable since our knowledge of deer population and range interrelationships is still too meager to permit hard-fast and unwavering management conclusions. For this reason, it is now more practical to manage deer on a *trend-concept* basis. This concept is proposed as a replacement for the oft-encountered supposition that deer can be properly managed only by knowing every facet of their life history. Complete knowledge will require many years of basic research and may, even then, always remain an ideal never attained. Until this gap in knowledge is narrowed, trend-concept management is recommended for present-day management of deer in the Southeast.

In order to prevent crowding and range deterioration, the management of any deer range should be based on its hunting capacity, i. e., the known *minimum* number of deer that will definitely be removed by hunting during any particular season. Thus, if any population does not have sufficient hunting pressure to insure removal of animals in excess of the carrying capacity, the population should be maintained at a level below this carrying capacity. This can be accomplished by initiating hunting within an expanding deer population early enough so the annual rate of increase will not exceed the hunting capacity. On long-established and overbrowsed areas, extended seasons and either sex hunting should remove excess deer. Once this is accomplished, hunting regulations can be modified as hunting pressure increases or decreases. A safety factor should be allowed to operate between carrying and hunting capacities.

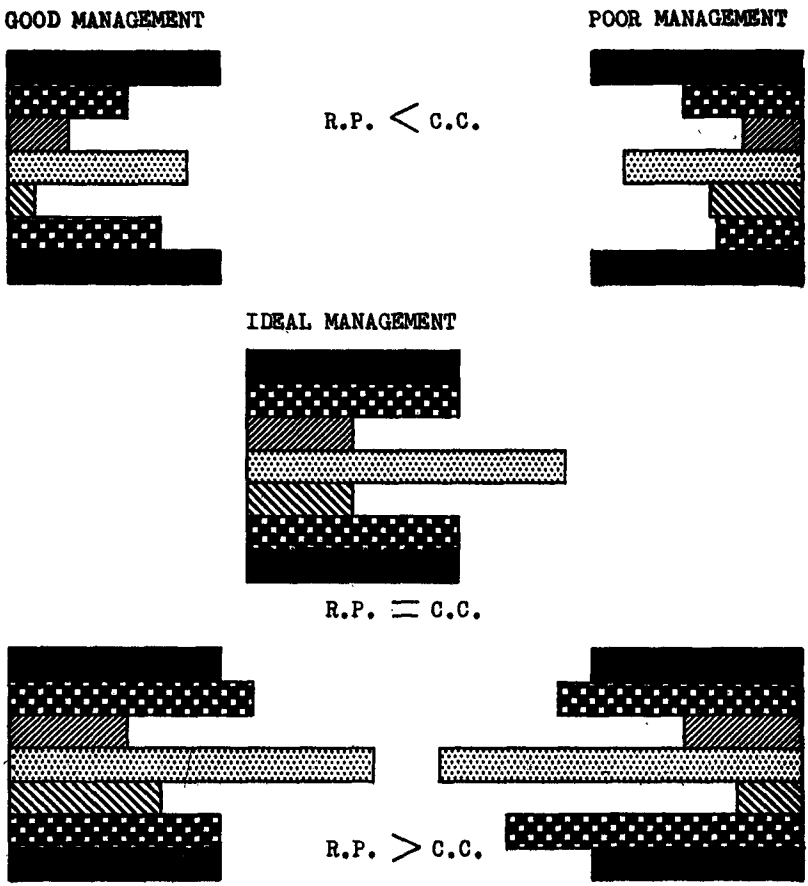
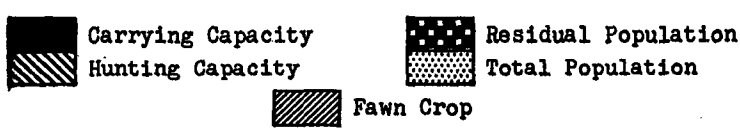


Figure 6. Relation of residual population (R.P.) to carrying capacity (C.C.) under varying conditions



The number of deer left after hunting may be referred to as the residual population. It is comprised of all age groups including the previous summer's fawn crop. Under ideal management conditions, hunting will remove annual deer surpluses in excess of the carrying capacity so the residual population will not exceed the maximum number of deer that may be consistently and safely carried overwinter with minimal deer mortality and damage to the range. Under these conditions, the residual population equals the carrying capacity of the range. Good management practices can be applied to residual populations above or below the carrying capacity in order to bring them under proper control (Figure 6).

In conclusion, information gathered during this study could be applied to good advantage on the Choccolocco range through more liberal hunting regulations. In the Southeast, information gathered in a similar manner could be used to eliminate further range abuse on overcrowded areas or to preclude habitat deterioration on recently stocked ranges.

APPENDIX

Common and Scientific Names of Forage Plants Mentioned in the Text

Forbs

Common Name	*Scientific Name*
Cinnamon-fern	*Osmunda cinnamomea*
Christmas fern	*Polystichium acrostichoides*
Senna	*Cassia* spp.
Milk-vetch	*Astragalus* spp.
Tick-clover	*Desmodium* spp.
Bush-clover	*Lespedeza* spp.
Butterfly-pea	*Clitoria mariana*
New Jersey tea	*Ceanothus americanus*
Black snakeroot	*Sanicula* sp.
Mint	*Mentha* sp.
Ruellia	*Ruellia* spp.
Partridge-berry	*Mitchella repens*
Elephant's foot	*Elephantopus* spp.
Goldenrod	*Solidago* spp.
Ragweed	*Ambrosia* spp.
Rosinweed	*Silphium* spp.
Sunflower	*Helianthus* spp.
Tickseed	*Coreopsis* spp.

Vines

Bullbrier	*Smilax Bona-nox*
Sawbrier	*S. glauca*
Horsebrier	*S. rotundifolia*
Honeysuckle	*Lonicera* spp

Shrubs

Alder	*Alnus* sp
Hydrangea	*Hydrangea* spp.
Dwarf sumac	*Rhus copallina*
Strawberry-bush	*Euonymus americanus*
Azalea	*Rhododendron* spp.
Mountain laurel	*Kalmia latifolia*
Lowbush blueberry	*Vaccinium vacillans*
Sweetleaf	*Symplocos tinctoria*
Viburnum	*Viburnum* spp.

Trees

Red cedar	*Juniperus virginiana*
Yellowpoplar	*Liriodendron Tulpifera*
Sweetgum	*Liquidambar Styraciflua*
Red maple	*Acer rubrum*
Black gum	*Nyssa sylvatica*

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TECHNIQUES INVOLVED IN THE USE OF CHEMICALS FOR ESTABLISHING WILDLIFE CLEARINGS [1]

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Wildlife clearings and/or food patches are essential management tools for a number of game bird and animal species. Such areas are valuable from several standpoints, i.e., attractiveness, simply as an open area or "playground," to provide more "edge" or shrubby growth, and those planted to agricultural crops as a source of supplementary foods.

Bulldozing and hand labor are the foremost methods of establishing and maintaining such wildlife clearings. Although these methods have been quite successful, they are also costly; the two main categories of cost are labor and equipment, with a number of factors contributing to each one.

A number of herbicides had been used successfuly in the past and were considered worthy for further experimental work in the establishment of wildlife clearings. After preliminary experiments at V. P. I. in 1956 and 1957, the use of new herbicides appeared to be economically feasible. Monuron pellets applied in June or October resulted in good control of woody plants. In June, an average kill of 81% was obtained on major tree species on three replications of a monuron treatment. The same experiment conducted in October showed a 70% kill. A December treatment applied at a rate of 5 gms./clump of brush showed good promise. There was no root sprouting in this experiment. Earlier work by Darrow [3] showed that large trees could be killed by as low as 10 lbs.

PROCEDURE

Two field experiments were set up on U. S. Forest Service and Virginia Commission of Game and Inland Fisheries lands to make the following evaluations:

1 Virginia Cooperative Wildlife Research Unit Release No. 60-4. These studies were supported in part by grants from the duPont Company and Amchem Products, Inc.

2 District Game Biologist, Virginia Commission of Game and Inland Fisheries; and Plant Physiologist, Virginia Agricultural Experiment Station, Research conducted with the senior author was graduate fellow with the Virginia Cooperative Wildlife Unit, V. P. I., Blacksburg, Virginia.

3 Darrow, Robert A. and Wayne G. McCully. Proceedings of the Tenth Annual Meeting of the Southern Weed Conference, pp. 24-28, 1957.

(active) monuron per acre.