I am sure many in this room will recall the impact of the early fire ant control program. This, more than anything else, triggered the explosion concerning the use of chemicals we have witnessed during the past couple of years.

Some with longer memories will recall the gypsy moth control program in New York when, in 1957, the court refused to issue an injunction to stop the program, and I expect there are persons here who remember the Dutch elm disease control program and the Japanese beetle eradications in the upper Midwest.

In all of these cases, the fish and wildlife interests protested *loud and long,* and *rightly so!*

But now let's examine the other side of the coin.

How many of us, who so vigorously protested the killing of a dozen or so sunfish in a pond, are pushing programs to deliberately kill thousands of fish under the role of fish management?

We have heard much protesting from game managers over the tightened restrictions of Amendment No. 2 to Section 164.6 of the Federal Aid Manual which required better planning and use of chemicals. Why?

I most sincerely urge you to consider all aspects of your roles as managers of the fish and wildlife resources and, above all, remember the Golden Rule and its application to this very complex problem.

This is a gigantic task we face. It's beset with difficulties and dangers.

But we can—yes, we "just gotta" win! I take heart when I think of big tasks and big jobs from an experience I had in Washington not too long ago.

A little tyke of a boy was struggling in an effort to move a large box-like table. After watching him make several unsuccessful attempts, I stepped up to him and said: "Sonny, you can't move that table. After all, it's as big as you are."

"Yes," the little fellow shot back without stopping his straining efefforts, "but *I'm as big* as it is, *too!*"

We are as big as this problem.

Let's keep everlastingly at it!

THE SYLAMORE DEER STUDY

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ABSTRACT

A study of the effects of forest management systems on deer carrying capacity in the Arkansas Ozarks has been established in two enclosures of 600 and 670 acres. Preliminary analysis indicated that cedar and pine-hardwood types produce more available forage than oak-hickory stands. Forage utilization appeared inversely related to size of the mast crop. Deer in the enclosures were estimated by driving, removed by trapping and hunting, and replaced with known numbers of deer. Hunter success was affected by weather and hunter ability but not by number of deer.

Since 1958 the Arkansas Game and Fish Commission and the Southern Forest Experiment Station of the U. S. Forest Service have been cooperating in a comprehensive long-term deer and deer habitat study in the Ozark Mountains of north Arkansas. Two large enclosures have been built, cleared of all deer, and restocked with known numbers of deer.

This paper describes the aims of the study and summarizes the experience and information gained in establishing it.

1 Southern Forest Experiment Station, Forest Service, U. S. Department of Agriculture.
2 Arkansas Game and Fish Commission. The Commission's share of the work is financed in part by a Federal Aid Project under the Pittman-Robertson Act.

The general objective of the investigation is to determine the effects on deer carrying capacity of three kinds of forest management: the present system of extensive management, intensive management for timber, and special treatments to improve wildlife habitat. Though deer and their habitat are of prime interest, observations will be made on squirrel and turkey also.

STUDY AREAS

The enclosures are on the Southern Forest Experiment Station's Sylamore Experimental Forest in Stone County, Arkansas. One, the Caney, comprises 600 acres; the other, Big Spring, 670 acres.

Topography is similar to that in much of the Ozarks—narrow ridges and valleys separated by steep slopes. Except for a faulted area, the soils from the ridge tops at 1,100 to 1,200 feet elevation down to approximately the 800-foot contour are derived from limestone; those between 700 and 500 feet are from sandstone. Between 700 and 800 feet, cedar glades occur on shallow soils on convex slopes. The stands vary from a few scattered trees in grassy openings to dense thickets with little understory.

Over most of the area oak-hickory forests dominate the north and east slopes, pine and mixed hardwoods the south and west slopes. Some of the over-mature trees and large culls were removed several years ago. After a long early history of fire and high-grading—common to much of the Ozarks—the age-class structure is unbalanced. The forest is overstocked with small trees but lacks stems between 8 to 12 inches d.b.h.

Management at present consists chiefly of removing culls and correcting the imbalance in stand-size classes by stimulating the growth of small trees and accelerating regeneration. The land has been under fire protection for more than three decades.

Deer populations on the Sylamore have had their highs and lows. They were very low in the 1920's. In 1926, refuges were established and hunting with dogs outlawed. From 1935 to 1937, an extensive program of release and thinning, aimed at speeding the growth of crop trees, created many openings in which forage increased. Deer multiplied rapidly, legal kill of bucks reaching a high point in 1943-1945. Overbrowsing began to be noticed in 1943. By this time the timber stands had increased in size and density, until most of the understory was shaded out. The range became severely overbrowsed (Donaldson et al., 1951), legal kill declined greatly, and die-off was noted (Alexander, 1954). Deer numbers were again low in the 1950's, and the range began a slow recovery. Today it still has a lower proportion of desirable browse plants than ranges that have not experienced an irruption (Halls and Crawford, 1960). Similar patterns have been observed on many abused deer ranges (Leopold et al., 1947).

FORAGE AND MAST INVENTORIES

Forage weights and utilization were inventoried in September 1959, after the enclosure boundaries were delineated but before fencing was started.

Forage yields were measured again in March 1962, and utilization estimates taken late in the winters of 1960 through 1962. The data were collected at 250 permanently marked points on quadrats 6.2 feet square and 5 feet high. Plots were stratified by soil and forest type.

The pine-hardwood and cedar glade types have the most available forage (table 1). Generally these types are more open, allow more light in the understory, and have less leaf-litter on the forest floor than do the dense oak-hickory stands. About half of the available yield is desirable deer forage. Available forage in winter is 10 to 15 percent of that in summer.

Mast yields have been sampled yearly since 1959 by placing a 50-gallon barrel near each of the 250 permanent forage sampling points and allowing the barrels to become partly filled with rain water. After mast-fall is complete, the barrels are emptied into hardware cloth bas-

Table 1.—*Available browse and forbs in Sylamore deer enclosures (oven-dry pounds per acre)*

CANEY

Season	Oak-hickory		Pine-hardwood		Cedar glade
	Limestone	Sandy	Limestone	Sandy	
Sept. 1959	105	[1]	191	[1]	231
March 1962	8	16	16	[1]	33
		BIG SPRING			
Sept. 1959	163	155	254	224	198
March 1962	10	19	42	29	48

kets and the catch is counted by species and converted to pounds of sound fruit per acre.

Observations taken before the enclosure fences were completed show an inverse relationship between mast yield and forage utilization. The 1959 yield of white oak (*Quercus alba*) acorns was light. Except for dogwood (*Cornus florida*), few other species produced fruit. Deer browsing on blueberry (*Vaccinium stamineum* and *vacillans*), dogwood, greenbrier (*Smilax bona-nox*), and eastern redcedar (*Juniperus virginiana*) was easily detected and in some cases intense. By comparison, the 1960 crop of white oak acorns was approximately three times that of the previous year. Additionally, dogwood fruit yields were good, black and red oaks (*Q. velutina* and *rubra*) produced fairly well, and grape (*Vitis* spp.) had a bumper crop. Mast was still left on the ground by spring, and there was little evidence of any winter browsing of forage.

DEER CENSUS AND REMOVAL

Enclosure fences were built by the Arkansas Game and Fish Commission which completed them in January 1962. Line poles spaced 10 feet apart carry two spans of woven wire topped by five strands of barbed wire. Total height is nine feet.

The fence appears high enough to prevent ordinary deer movement, although deer undoubtedly could jump it if unduly excited. Some have been seen trying to jump the fence but only one reportedly has cleared it. Special care will be taken in deer-census drives so as not to crowd deer into fences.

Some deer were left within the enclosures when the fences were completed. These had to be removed so that the study could start with a known number of animals.

Drives to estimate the number of deer were made on March 1, 1962. Drivers were spaced one chain apart and every fifth man followed a flagged line. The line of drivers moved abreast across the enclosures.

On Caney enclosure (600 acres), 90 men were needed. This drive went smoothly and 32 deer were counted. Later, by December 1962, 29 adult or yearling deer were removed from this enclosure. Thus, the difference between drive and total removal numbers was three deer.

In Big Spring enclosure, 37 deer were counted by driving but it was evident that the drivers were too few. There was confusion in counting, and some drivers thought that a group of seven to 11 deer was counted twice. The later census by trapping and hunting revealed only 26 adults and yearlings.

The experience suggests that reasonably accurate censuses can be made if two or three drives are conducted each year.

Deer removal was first attempted by trapping. Four box-type traps made of wooden slats were placed over artificially established salt licks in each enclosure. Trapping was successful only when plants were making vigorous growth. Twenty-three deer (including one fawn) were caught. They were either tagged and released outside the enclosures or killed and autopsied.

All the remaining deer were shot between September and November 1962 except for two killed in early June and one doe that escaped between the woven-wire spans before they were fastened together.

It took 23 dog hunts, a total of 814 man-hours and 608 dog-hours, to kill 31 adult deer and nine fawns. A doe and a fawn were killed in one spotlight hunt. Four hunts without dogs were unsuccessful.

The number of deer did not influence hunting success. When deer were abundant the dogs often switched from one trail to another. When deer were scarce the dogs stayed on the trail of one animal and eventually brought it by a hunter or exhausted it. It might not have been possible to kill the last few deer without dogs.

Hunting was best in moist, cool weather with a light wind that favored scent reception and trailing. On hot, dry days scenting was difficult and the dogs tired quickly. In strong winds the hunter could not hear the deer approach and was scented before he could get a shot.

Deer usually ran into or across the wind when being chased. This observation plus a knowledge of deer movement patterns made it possible to select good shooting locations near the fence where the deer would be forced to turn and pass through a small area. The hunters stood with the wind to their backs and moved to intercept the deer when they heard it approach. Skilled men accustomed to hunting with dogs were most successful.

We feel reasonably sure that all deer were removed from the enclosures. Checks were made with dog packs, and by observations after fresh snow, at established salt licks, and in high-use browse areas.

The number of animals in the enclosures does not necessarily indicate the population of the general region. Deer were accustomed to moving freely in and out of the enclosures when the fences were under construction and we may have closed the gates at a time of atypical use.

PLANS

During the spring and summer of 1963 the enclosures were restocked with individually marked deer, one per 50 acres. The population will be held constant for two years and expanded at two-year intervals until the estimated carrying capacity is reached.

Several factors will be measured as indicators of balance between stocking and habitat: (1) degree of browse utilization; (2) vegetation yields under browsing pressure; (3) animal productivity as determined from censuses, fawn-to-doe ratios, and embryo counts; and (4) animal condition as determined by bone marrow fat content, internal and external body fat indices, and general physiological and pathological conditions. Yearly variations in mast yields will be taken into account.

We think the herds will increase to carrying capacity under the present forest management system in two to four years. After that, both enclosures will be put under intensive timber management. The management plan will be written cooperatively with timber management personnel; it will incorporate the newest timber management systems; and wildlife considerations will not be disregarded. After carrying capacity under intensive timber management has been determined, special wildlife habitat improvement measures will be applied and carrying capacity evaluated once more.

The enclosures were expensive to establish, but we feel that their potentialities are immense. In addition to accomplishing the major objectives, they will provide the opportunity to check various census techniques, determine movement and use patterns, conduct animal behavior studies, determine forage preference under varying population densities, establish objective indicators—plant and animal—of carrying capacity, and study hunter success during harvest operations. Many other studies are possible; the number is determined by financial limits, not biological.

ACKNOWLEDGMENTS

Many individuals and agencies have assisted in this study. The Forest Game Committee of the Southeast Section of the Wildlife Society, U. S. Fish and Wildlife Service, Wildlife Management Institute, and Region 8 of the U. S. Forest Service all assisted in the planning. The Arkansas Forestry Commission, Arkansas Polytechnic College, and many individuals of the Arkansas Game and Fish Commission and Ozark National Forest assisted in the deer drives. Animal condition factors are being evaluated cooperatively with the Southeastern Co-

operative Deer Disease Unit. The Missouri Conservation Commission provided advice and assisted with the deer restocking program. Many individuals have offered their ideas and have actively helped.

LITERATURE CITED

1. Alexander, Harold E.
   1954. Deer problems. New to Arkansas. An old tale elsewhere. Fed. Aid Pub., Ark. Game and Fish Comm., 24 pp.
2. Donaldson, David, Carl Hunter, and T. H. Holder.
   1951. Arkansas' deer herd. Fed. Aid Pub., Ark. Game and Fish Comm., 72 pp.
3. Halls, L. K., and H. S. Crawford, Jr.
   1960. Deer-forest habitat relationships in north Arkansas. J. Wildl. Mgmt. 24: 387-395.
4. Leopold, A., L. K. Sowls and D. L. Spencer.
   1947. A survey of over-populated deer ranges in the United States. J. Wildl. Mgmt. 11: 162-167.

ELEVEN YEARS OF RUFFED GROUSE CENSUSING IN WESTERN NORTH CAROLINA*

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INTRODUCTION

Fluctuations in ruffed grouse (*Bonasa umbellus umbellus* L.) populations have been the subject of much study. Hickey (1955) notes evidence of three to four-year periodic fluctuations of gallinaceous birds in the North that gradually change into a ten-year cycle toward the South, disappearing below 40° north latitude. Rowan (1954), Hickey (1954), and Marshall (1954) present population data indicating periodic oscillations of grouse populations in the lake states and southern Canada. With minor differences these authors depict periods of maximum abundance as 1933, 1942, and 1951 and the periods of maximum scarcity as 1937, 1944 and 1955.

ACKNOWLEDGMENTS

This is a contribution from Federal Aid in Wildlife Restoration Project W-44-R. The data contained in this paper are the result of eleven years of work by various biologists and refuge personnel of the North Carolina Wildlife Resources Commission under the supervision of the junior author. The data were compiled and analyzed by the senior author.

DESCRIPTION OF THE AREA

The Flat Top Wildlife Management Area is located in Yancey County of North Carolina, adjacent to the Tennessee state line. Elevations on the area range from 2,800 feet to 4,716 feet above sea level. In this portion of the Appalachian Mountain Range there are numerous cross chains of ridges extending at right angles to the general line of the mountain system, however, there are no broad and well-defined valleys. The terrain is steep and covered with dense vegetation, mostly mountain hardwoods ranging from moist coves dominated by yellow poplar and sweet birch to oak ridges with a mixture of red, black, white, chestnut and scarlet oaks and occasional red maples, hemlock and yellow pine. Lesser vegetation of importance to the grouse includes dense rhododendron "slicks" in moist locations and equally dense mountain laurel on dry slopes. Characteristic fruit-producing species include

* Presented at the Seventeenth Annual Conference of the Southeastern Association of Game and Fish Commissioners, Hot Springs, Arkansas, September 30 to October 2, 1963.