

## DELMARVA PENINSULA FOX SQUIRREL STUDY

### BLACKWATER NATIONAL WILDLIFE REFUGE

#### 1st Report

PURPOSE. The purpose of studying the Delmarva Peninsula Fox squirrel is multifold. (1) To accurately determine the existing population of the Delmarva fox squirrel on one major type of Blackwater Refuge woodland, (2) To be able to determine the primary difference between high and low squirrel use areas, (3) To analyze the present squirrel censusing method consisting of the time area count and the leaf nest count system, (4) To determine the various timber harvest and stand improvement methods and their effects upon the Delmarva Peninsula fox squirrel.

CONTENT OF REPORT. This first report of a ten year study will deal primarily with the estimating of Delmarva Peninsula fox squirrels on the 52 acre block of woodlands known as Tract #3. An attempt will be made to show areas of both high and low fox squirrel use. The reliability of the time-area count will be cross checked against census results obtained in the 52 acre block via an intensive Lincoln index survey. This report will also show the various types of major vegetation (pine and hardwoods) found in the study plot and what preference the Delmarva squirrel may have.

PROCEDURE. Before any censusing or study work began in the 52 acre block, a grid system was laid out throughout the area. East Coast Forester Czuhai initially flagged out the area while making a vegetation survey. These flags were replaced by aluminum posts permanently marked with line number, point number and post number. The transect lines ran magnetic east to west

and totalled 7 lines. A post was placed every three chains along the transect lines. The transect lines were spaced 5 chains apart. Total grid points in the 52 acre block came to 29 (see exhibit #1).

The initial objective was to go into the 52 acre block, capture Delmarva fox squirrels via live traps, mark these squirrels with a bright colored dye and then survey the area by visual sightings using the Lincoln index system.

Trapping was started on November 25, 1970 and the entire block was evenly trapped. Two raccoon live traps (14" X 14" X 32") were placed at each grid point for five days making a total of 10 trap days at each point for the entire area. Shelled corn was used as bait for all traps. No prebaiting was undertaken because of the squirrel activity at this time of year. Trapping was completed by mid-December and 290 trap days yielded 15 Delmarva fox squirrels and six gray squirrels.

All of the Delmarva squirrels were color marked with picric acid dye, a bright yellow colored dye with lasting qualities. All parts of the squirrel were color marked from the shoulders to the tail (inclusive). The head of the fox squirrel was not dyed because of possible irritation to the eyes, ears, etc. After two to three weeks, the yellow colored picric acid dye had a tendency to become more brilliant and in some cases turn slightly orange in color. There was absolutely no difficulty at all in distinguishing a marked fox squirrel from a non-marked fox squirrel. In fact, an observation of a color marked Delmarva squirrel became an exciting psychedelic

experience in the field. If by chance a squirrel hunter would have noted one of these critters in the woods, he may have given up booze, hunting or both.

Data was taken on each fox squirrel prior to the time he was released after color marking. This data included weight, age, sex, date of capture, location of capture, and any distinguishing marks and the number of the squirrel. A numbered ear tag was placed in each ear to later identify the squirrel if he was captured again. Tags used were #1 fingerling tags available from National Band and Tag Company. A tag was used in each ear in the possibility that one of the tags may be pulled or scratched out.

Although the gray squirrels were not directly being studied, they were also tagged and data taken on each. The grays were caught regardless of intent and were thus incorporated into the total study with very little additional work. The tails were clipped on the six gray squirrels that were caught so they could be distinguished from other non-trapped squirrels. This tail clipping process consisted of trimming off all of the hair from half of the tail, that portion adjacent to the body. This clipping technique gave the squirrel a "whip like" look for the tail and made him readily distinguishable from normal gray squirrels.

After the 15 Delmarva Peninsula fox squirrels were marked and released, the process of observing the ratio of marked and unmarked squirrels began. Both sitting and stalking methods were used but it was found that sitting yielded more observations so this was the primary method utilized. Different times of the day were used (morning, mid-day and evening).

Mid-day observations proved to be as fruitful as either morning or evening so this time was most frequently used. These field observations were started in mid-December and were terminated in mid-April. The summer moult of the squirrel begins about the middle of April thus the termination of observations at that time since observations after that date could not be absolutely confirmed.

In addition to determining the total number of Delmarva squirrels in the 52 acre block of woods by the Lincoln index method, a cross check method by means of retraps was conducted. The cross check was undertaken from February 10 through the first week of March. Primarily the same trapping procedure was undertaken for the retrap data gathering system as for the original marking procedure, that is an even, systematic and thorough trapping effort over the entire 52 acres. Squirrel traps (6" X 6" X 19") were also used in addition to raccoon traps at each grid marker. Approximately 600 trap days were initiated on the study area for the retrap program. This retrapping series yielded one additional fox squirrel and nine new gray squirrels.

A refuge wide census of squirrels was undertaken to determine if the sample taken of squirrel sightings and nest counts gave realistic results. This same survey was duplicated three times on the study area to give a better average and help eliminate any bias. The procedure followed for the census sample was that as described in Blackwater's Wildlife Inventory Plan, Procedure #2.

To make the refuge wide nest count more meaningful and realistic, an intensive and thorough nest count was made of the 52 acre block. Notations

were made as to whether these nests were limb nests or trunk nests and also whether they were constructed in pine trees or hardwoods. However, the most important factor noted was the total nests found in the 52 acre study area because this would give a reasonably accurate number of nests in a given block of woodland where the number of squirrels is known.

The trapping and retrapping data obtained during the two capturing operations gave a reasonably good indication as to the habitat preference of both fox and gray squirrels. Field observations also confirmed this same preference of the two squirrels. A visual reconnaissance through the area quickly revealed which squirrel preferred which type habitat.

In further determining what habitat preference the squirrels indicated, the East Coast Forester made an intensive woodland survey throughout the study area to type map, age, check diameter and condition, determine growth rate and distribution of species within the plot. Due to the overall poor condition of the woodland study area, suggested improvements and management techniques for upgrading of this woodland are mentioned.

RESULTS. Results of the initial trapping program to obtain fox squirrels for color marking purposes yielded 15 Delmarvas. Eight of these were females (sows) and seven were males (boars). Only two of the fifteen squirrels could positively be identified as young of the year or immatures. Average weight of the adult females was 2 pounds, four ounces. Average weight of the adult males was 2 pounds,  $3\frac{1}{2}$  ounces. Average weight of the two confirmed immatures was 1 pound,  $13\frac{1}{2}$  ounces.

All squirrels took the picric acid dye quite well. The dye was most visible on the feet and underparts of the body where the squirrels were normally white or extremely light colored. Only one fox squirrel (which showed strong signs of melanism) had fur which did not readily accept the dye. The tail of this particular melanistic fox squirrel was notched (a small portion of hair was clipped from the center of the tail) for future positive identification in the event that other melanistic squirrels were in the study area.

It was commonly assumed that since fox squirrels and gray squirrels were found in the same areas that they lived in a perfect symbiotic atmosphere with interplay of territories, etc. and little conflict with one another. Trapping data from the 52 acre study area certainly did not support this assumption. The distribution sheet (see Exhibit #2) of original captures for both fox squirrels and gray squirrels shows that fox squirrels definitely inhabit the eastern portion of the 52 acre tract and gray squirrels the western part. A dotted line on exhibit #2 shows the area where the two species meet but do not cross over. Both recaptures and field observations continued to bear out this strong attraction for either side of the woods.

There are several physical differences between the eastern portion of the woods and the western side. The eastern side (preferred by the fox squirrels) is definitely more open, has less understory, is more dominantly loblolly pine, has older and more productive mast producing pine and is situated adjacent to the marsh. The western side (preferred by the gray squirrels) is more dense in understory, has more hardwoods, is situated

adjacent to upland areas and has pine trees of a younger age than the eastern portion, (see exhibits #4,5 & 6).

Field observations to obtain raw data became the most frustrating portion of the study and the most time consuming. The study plan called for making observations by the stand method or by carefully creeping through the woods. The author took the philosophy of a squirrel hunter and attempted to locate squirrels in this manner, that is go to the areas where Delmarvas were known or thought to be and observe all possible.

Observations were amazingly few and far between. Different times of the day were used, warm weather, colder weather, various ground litter conditions, frontal periods, after storms, low tides, etc. - you name it and the period or weather condition was tried for observations. None seemed to be the complete answer but one general trend did arise. More observations were made during the middle of the day, with winds of less than 10 miles per hour and with the temperature above 45 degrees. Only the time of day violated customary squirrel hunting tradition in that normally it is expected that more squirrels are active in the early morning or late afternoon hours. Approximately 80 hours were spent in the field trying to obtain observations of the Delmarva fox squirrel. This is only a total of 19 squirrels (both fox and gray) observed in 80 hours in the woods or about one squirrel for every four hours. Really not too exciting for a squirrel hunter.

Results of the field observations to located Delmarva Peninsula fox squirrels and therefore obtain a ratio of marked squirrels to unmarked squirrels

gave a total of 14 observations. Of these field observations, 12 were marked and two were unmarked. This gives a ratio of 6:1 in favor of dye marked fox squirrels. It may seem difficult to understand, but apparently nearly all fox squirrels were captured and marked during the first sweep of trapping the study area.

Using the Lincoln index, the following results are obtained:

A = Dyed fox squirrels observed

B = Total fox squirrels color marked

C = Total fox squirrels observed

X = Total fox squirrel population

$$X = \frac{BC}{A} \quad \text{or} \quad \frac{14 \times 15}{12} = 17.5 \quad \text{or} \quad \underline{18} \text{ Delmarva fox squirrels}$$

This same Lincoln index can be used on the gray squirrels. However, considerably fewer observations of gray squirrels were made since they were not a direct target of the study. It was the object of the author to observe in locations where fox squirrels were most likely to be found and thus the one sided results.

A total of five gray squirrels were sighted during field observations. Of these five, only one was marked with a clipped tail. The applied Lincoln index gives the following results:

A = tail clipped gray squirrels observed

B = total tail clipped gray squirrels

C = Total gray squirrels observed

X = Total gray squirrel population



$$X = \frac{B C}{A} \quad \text{or} \quad \frac{6 \times 5}{1} = 30 \text{ Eastern gray squirrels.}$$

The second sweep of trapping effort (8 weeks later) yielded one additional fox squirrel and nine new gray squirrels. This brought the total to 16 Delmarva squirrels and 15 gray squirrels actually caught and known to be in the 52 acre study plot. A population cross check by retraps yielded the following results:

M = Number of Delmarva squirrels marked

m = Number of marked fox squirrels recaptured in the 2nd period.

n = Total number of fox squirrels recaptured in the 2nd period.

N = Total number of fox squirrels in the population

$$N = \frac{M n}{m} \quad \text{or} \quad \frac{15 \times 8}{7} = 17.1 \text{ (Delmarva fox squirrel population)}$$

It should be noted that the 17.1 squirrel estimate obtained from calculations via retrapping is almost identical to the 17.5 squirrels obtained by the visual Lincoln index method. The standard error as computed from retrapping is quite narrow with an S.E. of only  $\pm 3.9$ . Therefore, for all practical purposes of this study, the population estimate of the Delmarva Peninsula fox squirrel shall be 18.

The gray squirrels can also be estimated in this same manner.

M = Number of gray squirrels marked

m = Number of marked gray squirrels recaptured in the 2nd trapping period

n = Total number of gray squirrels recaptured in the 2nd trapping period

N = Total number of gray squirrels in the population

$$N = \frac{M n}{m} \quad \text{or} \quad \frac{6 \times 13}{4} = 19.5$$

Because few gray squirrels were originally marked, the standard error is quite broad. Also, the visual sighting of gray squirrels were not frequent. A ball park figure for gray squirrels is estimated to be 25, an average of both population estimation methods.

The results of the refuge woodland survey to determine fox squirrel and gray squirrel populations via observations and nest counts are as follows: Of 50 random plots sampled, a total of 65 acres was sampled which yielded only 36 nests, 4 gray squirrels and 1 fox squirrel. Since 65 acres is slightly less than 1/12 of the total refuge woodlands, this figure can be expanded to the entire refuge to yield 454 nests. By actual count, the 91 known nests in the study area make up 1/6 or 17% of the total estimated nest activity on the refuge. Although the 52 acres represents 6% of the total woodland, it appears somewhat awkward for it to have 17% of the nests (three time the refuge average) even though it is known that the study plot has slightly better habitat for squirrels. Observations of both fox and gray squirrels were so sparse in the refuge survey that they could not be expanded with any degree of accuracy.

The following is the result of three individual samples of the 52 acre study plot:

1st Sample

<u>Area</u>	<u>Size in Acres</u>	<u>Fox Squirrels</u>	<u>Gray Squirrels</u>	<u>Nests</u>
31	.50	0	0	0
32	.90	0	0	2
33	.70	0	0	1
34	.65	0	0	0
35	.65	1	0	1

2nd Sample

<u>Area</u>	<u>Size in Acres</u>	<u>Fox Squirrels</u>	<u>Gray Squirrels</u>	<u>Nests</u>
31	.65	0	0	0
32	1.00	0	0	2
33	.70	0	0	1
34	.65	0	0	0
35	.65	1	0	1

3rd Sample

31	.65	0	0	1
32	.90	0	0	1
33	.70	0	0	0
34	.70	0	0	1
35	.70	0	0	0

By averaging all three sample data figures, the following information can be extracted:

Total acreage sampled	-	10.70 acres
Fox squirrels seen	-	2
Gray squirrels seen	-	0
Nests observed	-	11

Expanding this raw data to the entire 52 acre study area produces the information below:

10 fox squirrels  
0 gray squirrels  
55 nests

It is readily visible that the estimation of fox squirrels is nearly 50% off, that the estimation of gray squirrels is 100% off (no data) and that the nest estimation is nearly 50% off. These results clearly show that estimation of fox squirrels, gray squirrels, and nests by the "time-area" count system falls short of what is actually in an area.

As stated previously, 91 actual nests were counted in the 52 acre study plot. These nests were closely examined to determine if they had any correlation to the previous theory that fox squirrels tended to build their nests out on a limb and gray squirrels built their nests more frequently nearer the trunk. A breakdown of the data produced the following:

Limb nests	In pine	- 32
	In hardwood	- $\frac{5}{37}$
Trunk nests	In pine	- 27
	In hardwood	- 26
	In cedar	- $\frac{1}{54}$

Grouping the forest types together, 59 of the nests were found in pine, 31 in hardwoods, and 1 in a red cedar. Limb nests ranged from 1' to 12' away from the trunk with the average distance being 7'.

Exhibit #2 showed that the fox squirrels tended to inhabit the eastern side of the study area and the gray squirrels the western side. If the "limb nest theory" were true for fox squirrels, then there should be a strong tendency for more limb nests to be on the eastern half of the study area and more trunk nests on the western half. A glance at the nest distribution data

sheet (see exhibit #3) clearly shows that there is very little or no data in the study area to back up the supposition that fox squirrels tend to build nests out on limbs. It should also be noted that the nests are quite evenly distributed one from the other suggesting a territorial factor, not only for the respective species but within individual species as well.

FORESTERS REPORT. The following narration and data with accompanying exhibits portray the condition of the study area as described by the East Coast Forester.

Location. This 52 acre woodlands tract lies north of refuge headquarters and is in Refuge Compartment No. 1. The tract is bounded on the east by the Little Blackwater River, on the west by Egypt Road, on the north by pointed refuge boundary line, and on the south by croplands (along Old Mill Road).

General. The woodlands are composed of about 46 acres of pine-hardwood or mixed type and about 6 acres of pine type. The pine type is in the eastern part of the tract. Marshlands border the woodlands along the east to the Little Blackwater River.

Topography. The area is generally flat with some areas of standing water with drainage to the east into the Little Blackwater River. A manmade ditch along the north boundary of the tract serves as a drainage also.

History. No timber harvest activities or cutting has been done since the Government acquired these lands in 1933. The pine type (eastern part of woodlands) evidenced furrows, suggesting this area may have been farmed some forty years ago. The pine-hardwood type evidenced what were probably old logging roads.

Forest Management. A five percent line-plot cruise was made on the woodlands in October of 1970, following the guidelines established in the Blackwater Forest Management Plan. Data from 26 one-tenth acre plots (3 chain intervals) and 7 lines (5 chain intervals) were collected and compiled (see exhibits #5 & 6). From the cruise and aerial interpretation, this woodland area consists of about 6 acres of pine type and 46 acres of pine-hardwood or mixed type for a total of 52 acres.

Pine type (P). This type consists of approximately six acres. Stand age was estimated to be forty years and showed signs of stagnation and need for thinning. Some trees were dead or dying, many suppressed, and the dominant and co-dominant trees were in need of growing space to develop proper crowns (See exhibit #7). The forest floor was deeply covered with pine straw with little to no wildlife browse species in the understory. Some sweet gum, maple myrtle, and a few eastern red cedar, black cherry and black gum were scattered about.

Pine-Hardwood type (P-H). Approximately 46 acres in this tract are a mixed pine-hardwood type. The hardwood species are chiefly red oak(30%), white oak (22%), maple (18%), sweet gum (15%), black gum and others (15%).

DISCUSSION. The following are some field observations and findings which the author feels worth mentioning in this report although not directly related to the results of the study:

It was felt prior to the study that melanism or various degrees of melanism was present in 5% or even upwards of 10% of fox squirrels located on Blackwater Refuge. Only one out of 16 Delmarvas trapped during the study, or

6% of the population, was found to be melanistic. This dark colored squirrel was noted in the close company of a normal colored fox squirrel and were thus thought by the observer to be mates.

Retraps of Delmarva squirrels showed that their movements did not stray far from one central location. They evidently utilize the territorial system as most mammals do. Most of the Delmarva squirrels did not move outside of an area with a radius of 5 chains or 110 yards. However, one fox squirrel was noted to move from the southern portion of the woods to the north side, a distance estimated at 470 yards or more than a quarter of a mile.

All fox squirrels captured were taken to the garage at Quarters #2 to be worked up, data collected and dye applied. This was done because of lessening the chance of escape if one would happen to get loose. Even with all precautions, one fox squirrel did escape during the dying process. It was sighted two days later near the headquarters office and then retrapped shortly thereafter in the study area at the exact spot of his original capture. Distance from the Quarters #2 garage back to the squirrels original capture location is slightly more than  $\frac{1}{4}$  mile. The fox squirrels evidently have fairly accurate sense of "homing".

Because only two fox squirrels out of the 16 could positively be identified as juveniles, it would appear that production is off considerably in this woodlot from what could be expected in ideal habitat. Some TSI work in this study area could lend some interesting information on habitat improvement.

First appearance tells us that since the gray squirrel is more prevalent in this area and that the fox squirrel is on the decline that the gray may be more domineering even though he lacks size. The author noted only one personal encounter between a fox and gray squirrel. On this occasion, the fox squirrel barged into a nest occupied by a gray squirrel, a brief scuffle ensued, and the gray squirrel was quickly evicted and put on the run. The fox squirrel went upon his way unbothered. Evidently, the success of the gray squirrel has been his adaptability to the habitat in this area. The fox squirrel on the other hand may not be able to cope with a changing environment.

Many corn cobs were found throughout the study area on the forest floor. In recent years, fox squirrels have been observed carrying whole ears of corn from corn fields into the woods. This procedure has apparently also been done in the study area. Both agricultural fields to the north of and to the south of the study area are normally planted in corn.

The Delmarva squirrels held true to their reputation as pine cone feeders. On two occasions they were observed feeding on pine cones while in the canopy of a loblolly pine. Occasionally cuttings were found on the forest floor where a squirrel had completely torn apart a pine cone.

The fox squirrel has some very distinctive body characteristics which make him physically different from the gray squirrel besides nearly a 40% advantage in body size. The head of the fox squirrel is quite blocky and appears to be larger in proportion to his body than the gray. Also the ears



of the fox squirrel are often quite "fuzzy" and opaque and not translucent like the gray. Most Delmarvas are a light gray in color with some being nearly white. The faces of the older squirrels tended to be lighter in color, typical of many mammalian creatures.

Fox squirrels often sun themselves on a limb for an hour or more without movement. When they move from tree to tree, they do not have the lightning like appearance of speed as the gray but they do move with positive agility.

Knowing that the Delmarva squirrel is endangered makes an observation of this elusive squirrel that much more "impressive". It was quite gratifying for the author to observe this seldom seen animal of decreasing populations. His size and character was always impressive.

One unique factor brought out in trapping operations was the difference in activity between the fox and gray squirrel during the fall and winter months. Fox squirrels were easily trapped in November and December (fall) but gray squirrels were more elusive at this time. The opposite was true for trapping during the months of February and March (winter). A breakdown of results is as follow:

	Total Number Caught	
	<u>Fall</u>	<u>Winter</u>
Fox Squirrels	15	8
Gray Squirrels	6	13

This same characteristic was brought to light when fox squirrel trapping was undertaken for the Chincoteague Refuge transplant. Trapping was undertaken in February in an area known to have fox squirrels but only grays were captured.

PROBLEMS. Shock to the squirrels handled proved to be one problem in gathering data and dying the squirrels. All fox squirrels were handled by using welders gloves because this proved to be the easiest method of color marking the individuals with picric acid. Two individuals were noted to go into this "shock" situation but were able to climb when released back into the study area. One of these squirrels that exhibited shock symptoms was later recaptured so it is believed that both recovered.

Original intentions were to double mark the fox squirrels, that is number them with a metal tag in their ear plus an ear tattoo for extra insurance. The hairy ear of the fox squirrel made the tattoo impractical because it was not distinguishable after impression. After this was discovered, a metal tag was placed in each ear instead of just one single metal tag.

One major problem of the study was that it was initiated at least six weeks too late in the season. The study should have started in mid-October instead of late November. Both trapping and field observations should have been more productive because of the fox squirrels increased activity during the months of October and November.

It has since been learned that more information can be gained via retrapping rather than field observations in determining squirrel populations

in a given area. The problem of obtaining sightings and the time with getting these observations in this study proved that there should be an easier way. The retrap method should be seriously considered if intensive population estimates of this type are to be undertaken in the future.

SUMMARY. Population estimates for the Delmarva Peninsula fox squirrel (Sciurus niger cenereus) on the 52 acre study plot (Tract #3) by the Lincoln index method of observing the ratio of marked to unmarked individuals is 18. This figure was confirmed by a cross check using retrap data.

Population estimates on the eastern gray squirrel (Sciurus carolinensis) was calculated to be 25. The gray squirrel population figure was obtained by using both the visual and retrap data information. Population density of the study plot is .83 squirrels per acre.

The primary difference between high and low use fox squirrel use areas became rather evident. Delmarva squirrels preferred woodlands that is generally open, has a higher percentage of pine, has older mast producing pine trees, and has less understory. The gray squirrels inhabit the portion of the study area which contained a higher percentage of hardwoods, where the topstory was more dense, where the pine trees were of a younger age, and where the understory was more dense.

The legacy that Delmarva fox squirrel tend to build their nests out on a limb whereas gray squirrels tend to build their nest near the trunk was generally disproven. A study of the 91 nests in the study area showed no correlation in this matter.

A check of the present squirrel population census method (Wildlife Inventory Plan, Procedure #2) showed that samples obtained the time-area count were

approximately 50% of the actual number in a known population. This held true for both the fox and the gray squirrels and also the nests.

A survey of the 52 acres study area revealed that 46 acres were mixed pine-hardwood and 6 acres were loblolly pine type. The hardwood species are chiefly 30% red oak, 22% white oak, 18% maple, 15% sweet gum, and 15% black gum and other species.

ACKNOWLEDGEMENTS. I wish to thank the following people for their help and assistance in setting up and conducting the study for the Delmarva Peninsula fox squirrel: --- Thanks to East Coast Biologist Otto Florschutz for the major contribution in constructing the rough draft of the study plan and technical assistance throughout the study period, to East Coast Forester Eugene Czuhai for all data gathered concerning forest type and composition, to Dr. Vagn Flyger for assistance in color marking and tagging techniques, to Dr. Robert E. Jones and Mr. John H. Eiferman for help in trapping methods, trap selection, and retrap data compilation, to Franklin A. Hughes for assistance in trapping and nest counts, to Mr. Guy Willey for aid in time-area count surveys, and to Mr. Peter Irvin for assistance in retrap data collection.

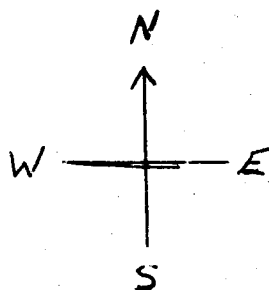
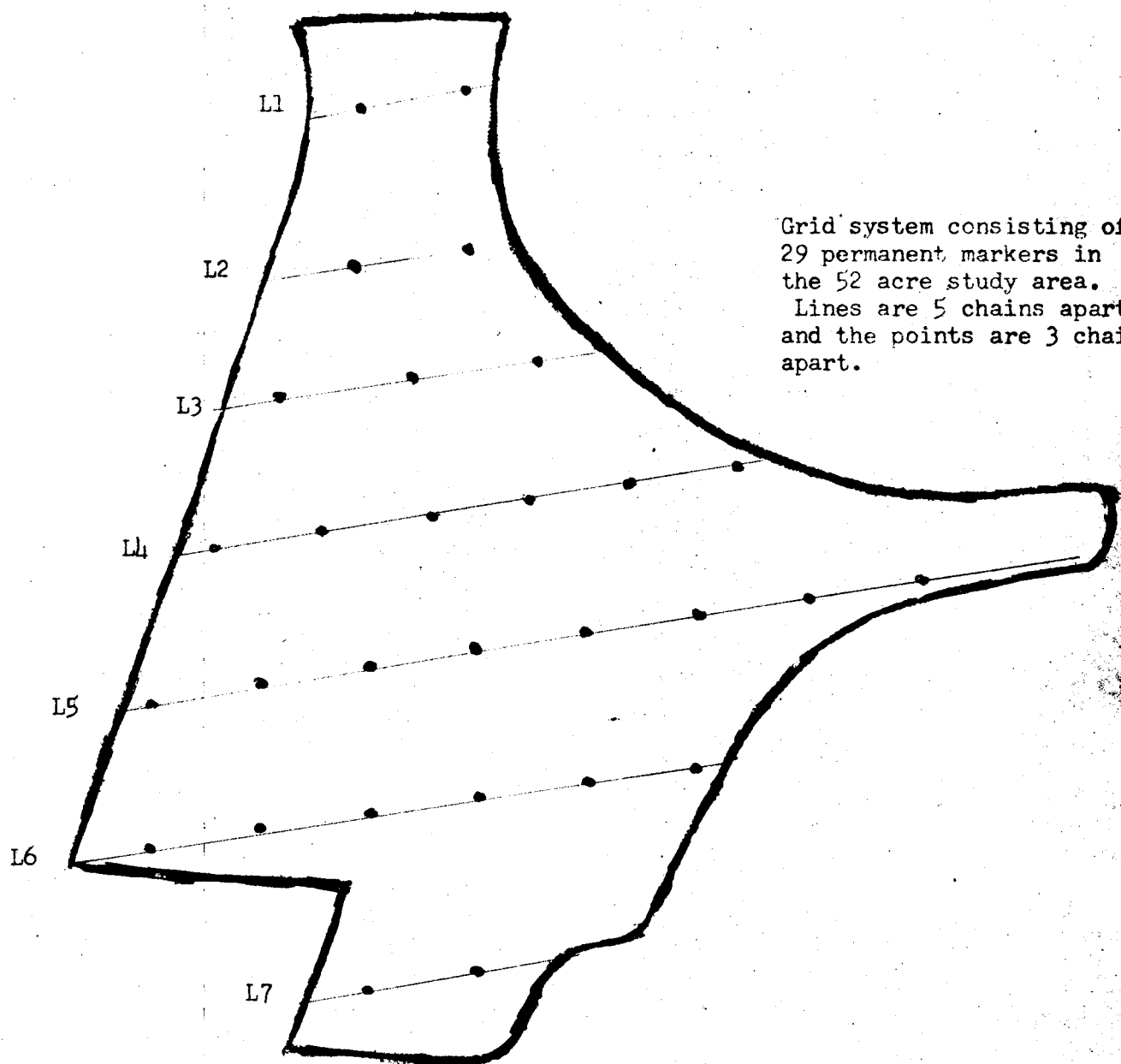
PHOTOGRAPHS. Attached.

Respectfully submitted,



Leon I. Rhodes  
Assistant Refuge Manager  
April 23, 1971

## SQUIRREL STUDY PLOT



# SQUIRREL STUDY PLOT

Exhibit #2

52 acres



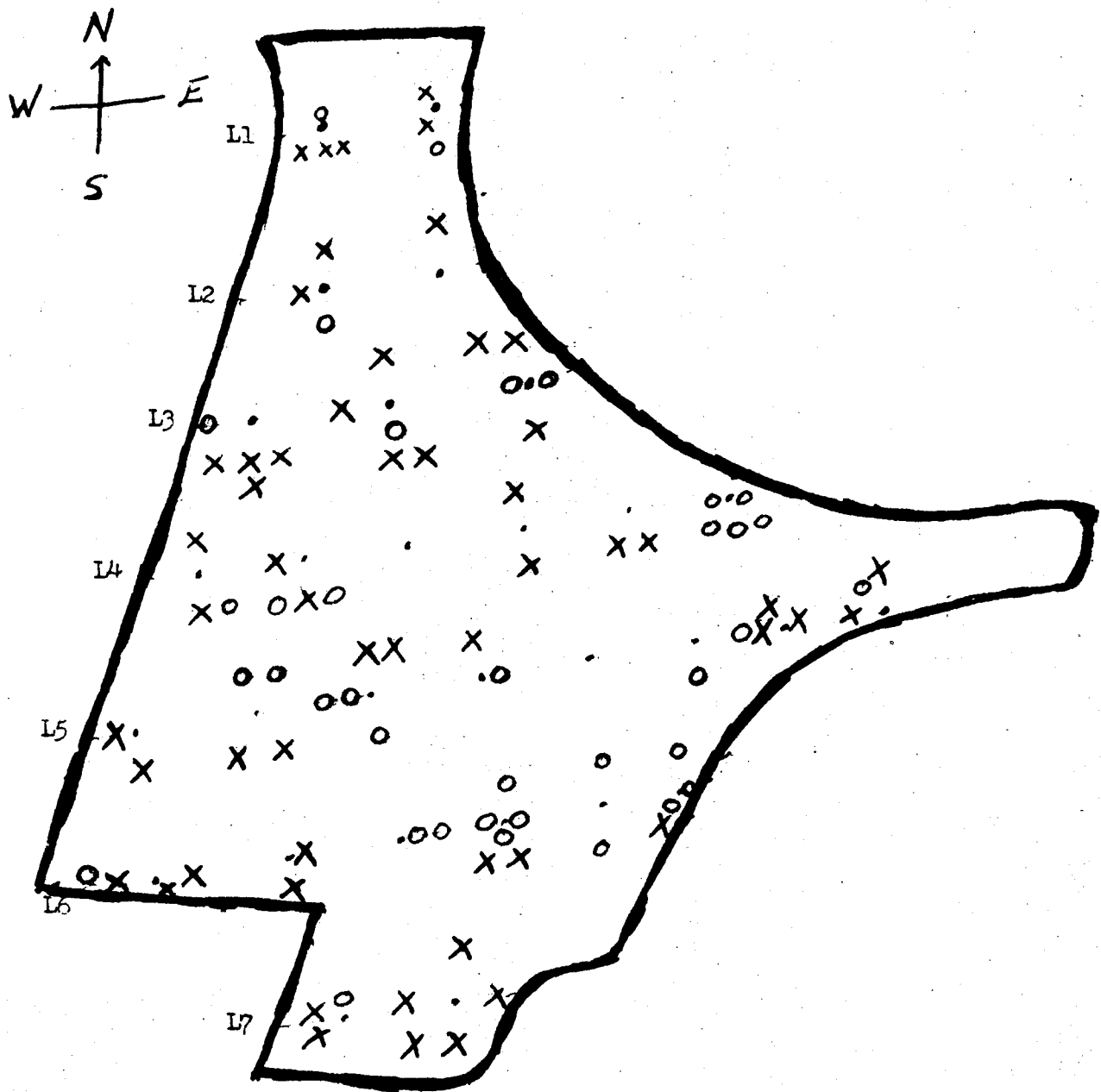
● DELMARVA PENINSULA FOX SQUIRREL -  
First time capture locations.  
16 squirrels

\* Gray Squirrel - First time capture  
locations. 15 squirrels

# SQUIRREL STUDY PLOT

Exhibit #3

## Nest Distribution data

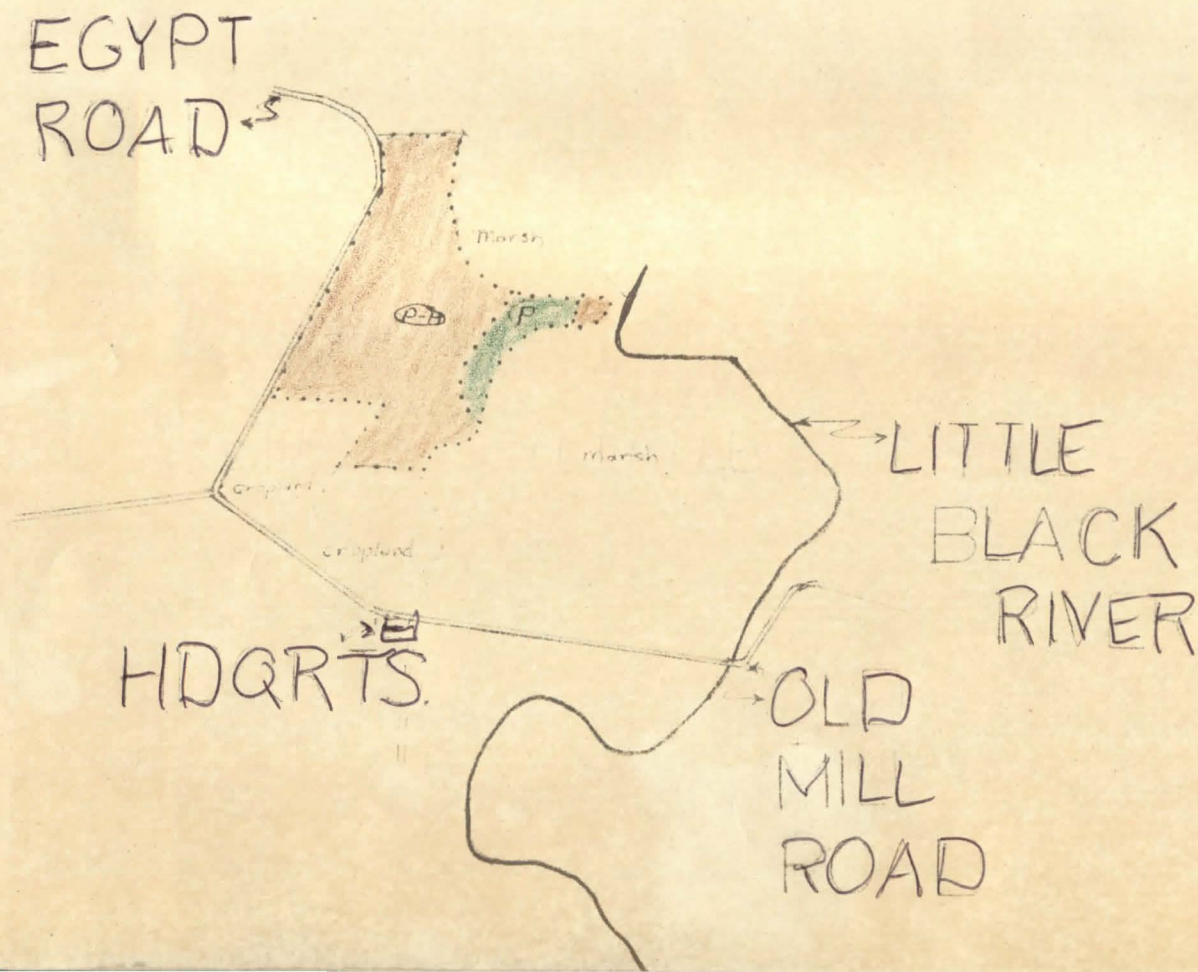


O - Limb Nests. 32 found in pine trees, 5 found in hardwoods. 37 total limb nests.

X - Trunk Nests. 27 found in pine, 26 found in hardwoods, and one found in a cedar. 54 total trunk nests.



# BLACKWATER-NWR



LEGEND:  
- PINE  
- PINE-HWD



**BLACKWATER NATIONAL WILDLIFE REFUGE  
EGYPT ROAD TRACT**

Table 1

Acres by Types

Compartment (1)	Pine Type	Pine Hardwood Type	Total
Egypt Road Tract	6	46	52
Percent	12	88	100

Table 2

Average Volume Per Acre by Types

Timber Type	Cords		Board Feet	
	Pine	Hardwood	Pine	Hardwood
Pine	7	1.6	14,833	—
Pine Hardwood	3.7	4.6	6,800	3,868

Table 3

Total Acres and Volume Summary

Species	Acres	Cords	. B. F.
Pine	6	212	401,798
Hardwood	46	222	177,928
Total	52	434	579,726

Blackwater National Wildlife Refuge Fox Squirrel Study  
Stock and Stand Analysis

Type: PineStudy Area: Egypt RoadDate: 2/5/71Line No. 1 - 7Plot No.: 14 (see attachment)

Species	D. B. H. (Inches)										Total		Averages		
	6	8	10	12	14	16	18	20	22		Trees	B.A.	Age	Height	S. I.
Pine	13	43	70	43	43	10					222	149	45	76	80
Hardwood	10	10	3								23	7	50*	74	70*
Total	23	53	73	43	43	10					245				
B. A.	4.5	18.5	39.8	33.8	45.9	13.9						156			

\* Estimated

Type: Pine-hardwood

Species	D.B.H. (In.)										Total	
	6	8	10	12	14	16	18	20	22	24	Trees	B. A.
Pine	23	20	19	11	6	5	4	3	-	.4	91	59
★ <del>Hardwood</del>	21	19	13	7	10	4	4	2	-	-	80	51
Total	44	39	32	18	16	9	8	5		.4	171	
B. A.	8.6	13.6	17.4	14.1	17.1	12.6	14.1	10.9	-	1.3		110

★ The hardwood species are chiefly red oak (30%), white oak (22%), maple (18%), sweet gum (15%), black gum and others (15%).

Blackwater National Wildlife Refuge Fox Squirrel Study  
Loblolly Pine Growth Data, 1971

Line	Plot	(in.) D.B.H.	Rings last 10 years (in.)	Growth Factor	Total (in.) Dia. Growth	Dia. at beginning of period (inches)
1	1	10.0	.9	2.19	2.0	8.0
1	2	18.8	.6	"	1.3	17.5
1	2	23.9	1.0	"	2.2	21.7
1	2	11.9	.6	"	1.3	10.6
1	2	12.1	.5	"	1.1	11.0
1	2	12.0	.7	"	1.5	10.5
1	2	16.8	.5	"	1.1	15.7
1	2	13.0	.3	"	.7	12.3
2	1	15.8	1.2	"	2.6	13.2
2	1	11.5	1.2	"	2.6	8.9
2	1	10.5	1.1	"	2.4	8.1
2	1	10.9	1.5	"	3.3	7.6
3	1	8.5	1.0	"	2.2	6.3
3	1	9.6	1.2	"	2.6	7.0
3	1	11.2	1.2	"	2.6	8.6
3	1	10.8	.7	"	1.5	9.3
4	2	9.6	.7	"	1.5	8.1
4	2	11.7	1.0	"	2.2	9.5
4	2	8.7	.6	"	1.3	7.4
4	2	12.0	1.0	"	2.2	9.8
4	4	14.4	1.1	"	2.4	12.0
4	4	19.0	1.3	"	2.8	16.2
4	4	10.3	.7	"	1.5	8.8
4	4	12.5	.9	"	2.0	10.5
4	6	14.1	1.2	"	2.6	11.5
5	8	13.2	.8	"	1.8	11.4
5	8	12.9	1.0	"	2.2	10.7
5	8	11.4	.7	"	1.5	9.9
5	8	10.9	.9	"	2.0	8.9
5	6	17.8	.6	"	1.3	16.5
5	6	20.8	.6	"	1.3	19.5
5	6	16.1	.5	"	1.1	15.0
5	4	12.2	.4	"	.9	11.3
5	4	18.8	1.2	"	2.6	16.2
5	4	13.7	.5	"	1.1	12.6
5	4	12.2	.5	"	1.3	10.9
5	2	12.6	1.2	"	2.6	10.0
5	2	9.8	1.0	"	2.2	7.6
6	2	15.9	.6	"	1.3	14.6
6	2	19.3	.5	"	1.1	18.2
6	2	14.2	.7	"	1.5	12.7
7	1	15.2	1.3	"	2.8	12.4
7	1	16.5	.8	"	1.8	14.7
7	1	16.0	.7	"	1.5	14.5
7	1	12.5	.9	"	2.0	10.5
7	2	13.2	.5	"	1.1	12.1
7	2	11.8	.7	"	1.5	10.3
7	2	13.7	.5	"	1.1	12.6
7	2	11.6	.8	"	1.8	9.8
Total		661.9	40.7		88.9	573.0
Average		13.5	.8		1.8	11.7





3. The picric acid dye had a tendency to become brighter and sometimes slightly orange after several weeks on the squirrel. Note the metal ear tag.







5. The squirrels were generally handled with the use of welders gloves. The animals needed to be hand held in order to apply the picric acid dye.



6. Gray squirrels were also captured in the study area and ear tagged. A wire cone was often used when color marking was not involved.

UNITED STATES GOVERNMENT

# Memorandum

TO : Refuge Manager, Blackwater NWR

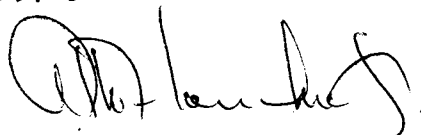
DATE: July 12, 1971

FROM : East Coast Biologist and Atlantic Coast District Forester, Washington, N. C.

SUBJECT: Delmarva Fox Squirrel Study

Bill, in reviewing the Delmarva Fox Squirrel Study Progress Report #1, (page 12), we have noted that approximately one third of the 91 squirrel nests observed on the 52-acre Egypt Road study area occurred in hardwoods. Unfortunately we do not know what species of hardwoods were utilized for nests. We feel this is very important and may even indicate a preferred nest tree species which could tie into future TSI work on the Refuge. In fact, some of Gene's plot data regarding nests show high use of a minor hardwood species. Using the Exhibit #3 map of the study area, which shows all nest locations, would you please have your personnel run a nest tree species composition of the 31 hardwood tree nests.

These data will be especially useful when compared to available hardwood composition in the 52 acres and also in near future years following the proposed experimental thinning which will be taking place in 1971 or 1972.



Otto Florschutz, Jr.  
East Coast Biologist



Eugene Czuhai  
Atlantic Coast District Forester

cc: Regional Office

Arrive Alive



East Coast Biologist & Atlantic Coast  
Forester, Washington, North Carolina

July 16, 1971

Refuge Manager, Blackwater N. W. Refuge

Delmarva Fox Squirrel Study (Your memo of July 12, 1971)

It is believed by some Blackwater staff members that the species composition of hardwood trees containing squirrel nests was recorded during the first phase of the Delmarva Squirrel Study. However, if this was done we fail to find any evidence of the fact now. Since it would be virtually impossible to find many of the original nests now, we devised and implemented the following procedure in an effort to determine squirrel preference (if any) of hardwood species for nest trees.

On the morning of July 15, 1971 Forester Czuhai and four refuge personnel systematically transected the entire 52-acre study plot which lies just north of the refuge office and immediately east of Egypt road (see attached map). Using a compass, Czuhai slowly walked the original and permanent transect lines. Two additional men walked abreast and on either side of him at 55 foot intervals. All squirrel nests observed were recorded on study plot maps, both as to physical location and to tree species in which located.

In addition to 34 squirrel nests located in loblolly pines, the following table shows the squirrel nests observed in hardwood species.

Tree Species	Number of Nests	Percent Occurrence
Red Maple	6	21
White Oak	6	21
Willow Oak	6	21
Black Gum	5	17
Southern Red Oak	3	10
Sweet Gum	1	03
Wild Black Cherry	1	03
Persimmon	1	03
Totals	29	99

In summary, it appears that the first four above listed species are preferred, and about equally preferred, tree species for squirrel nesting in this study plot. The southern red oak is probably an equally good nesting species, but it is of limited occurrence in this plot. The sweet gum is definitely a low preference species; it is a major tree in the hardwood species composition of the study area, but the nests were not in them. The two nests found respectively in the wild black cherry and the persimmon could probably be termed "incidentals," having no real significance in the overall nesting picture.



While possibly not as good as original data, we feel that these results are valid and adequate for the purpose of TSI considerations. Moreover, the trees presently marked for TSI removal need not be altered because of these findings.

William H. Julian

attach.

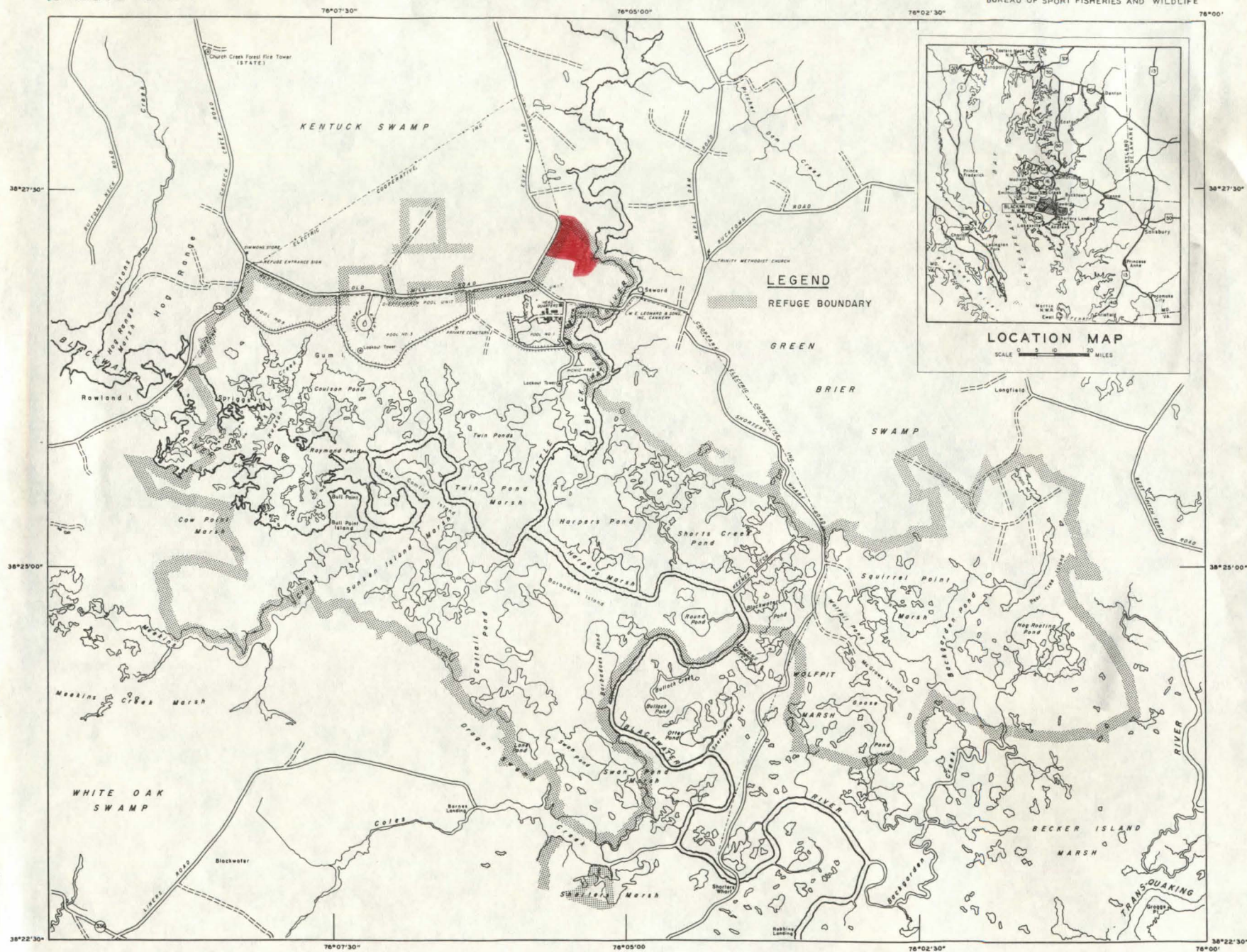
cc: Regional Office

# BLACKWATER NATIONAL WILDLIFE REFUGE

DORCHESTER COUNTY, MARYLAND

FISH AND WILDLIFE SERVICE  
BUREAU OF SPORT FISHERIES AND WILDLIFE

UNITED STATES  
DEPARTMENT OF THE INTERIOR



COMPILED IN THE BRANCH OF ENGINEERING  
FROM SURVEYS BY U.S. ARMY

ATLANTA, GEORGIA

JULY, 1964

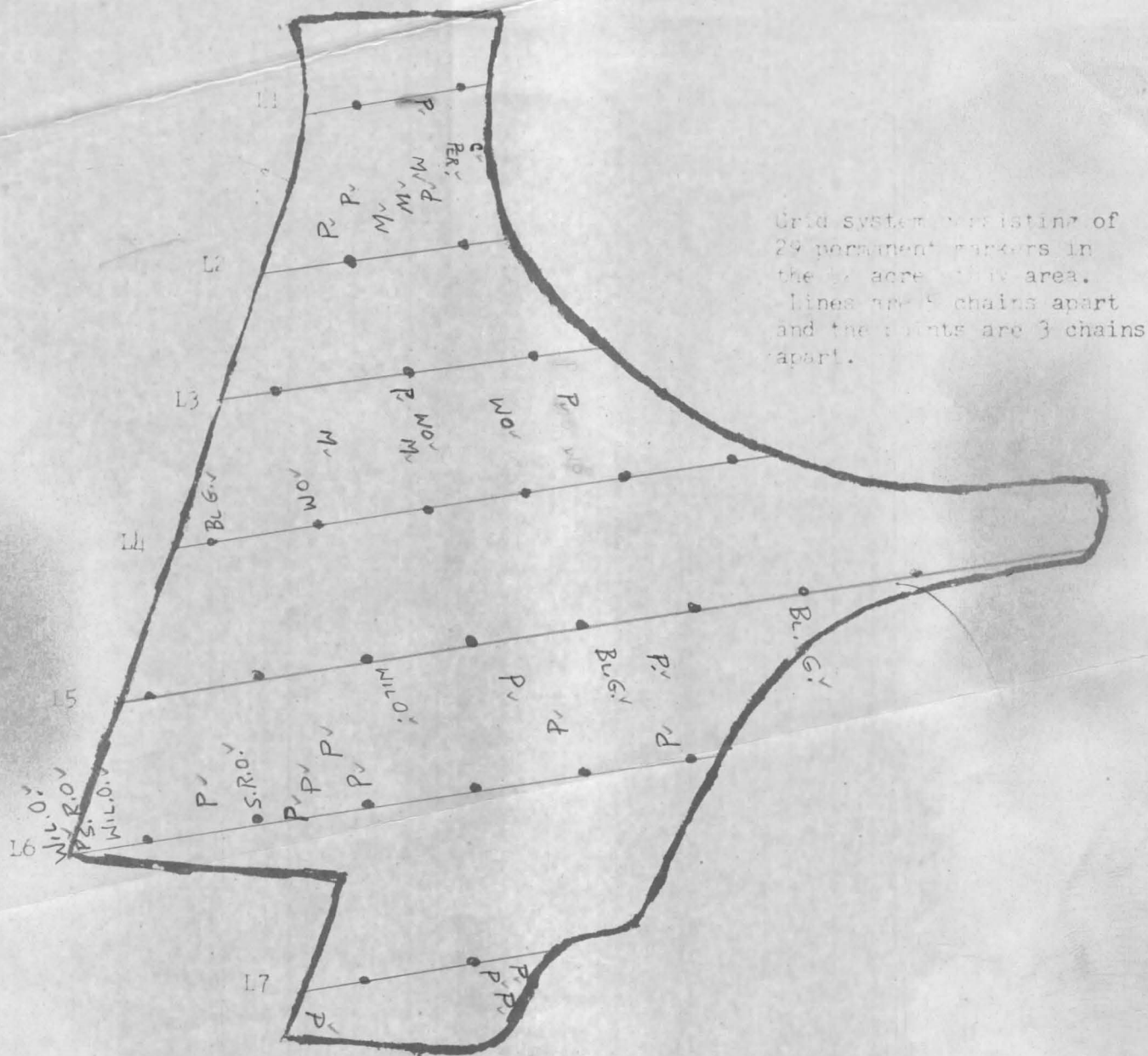
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0 1/4 1/2 2 MILES

MEAN  
DECLINATION  
1964

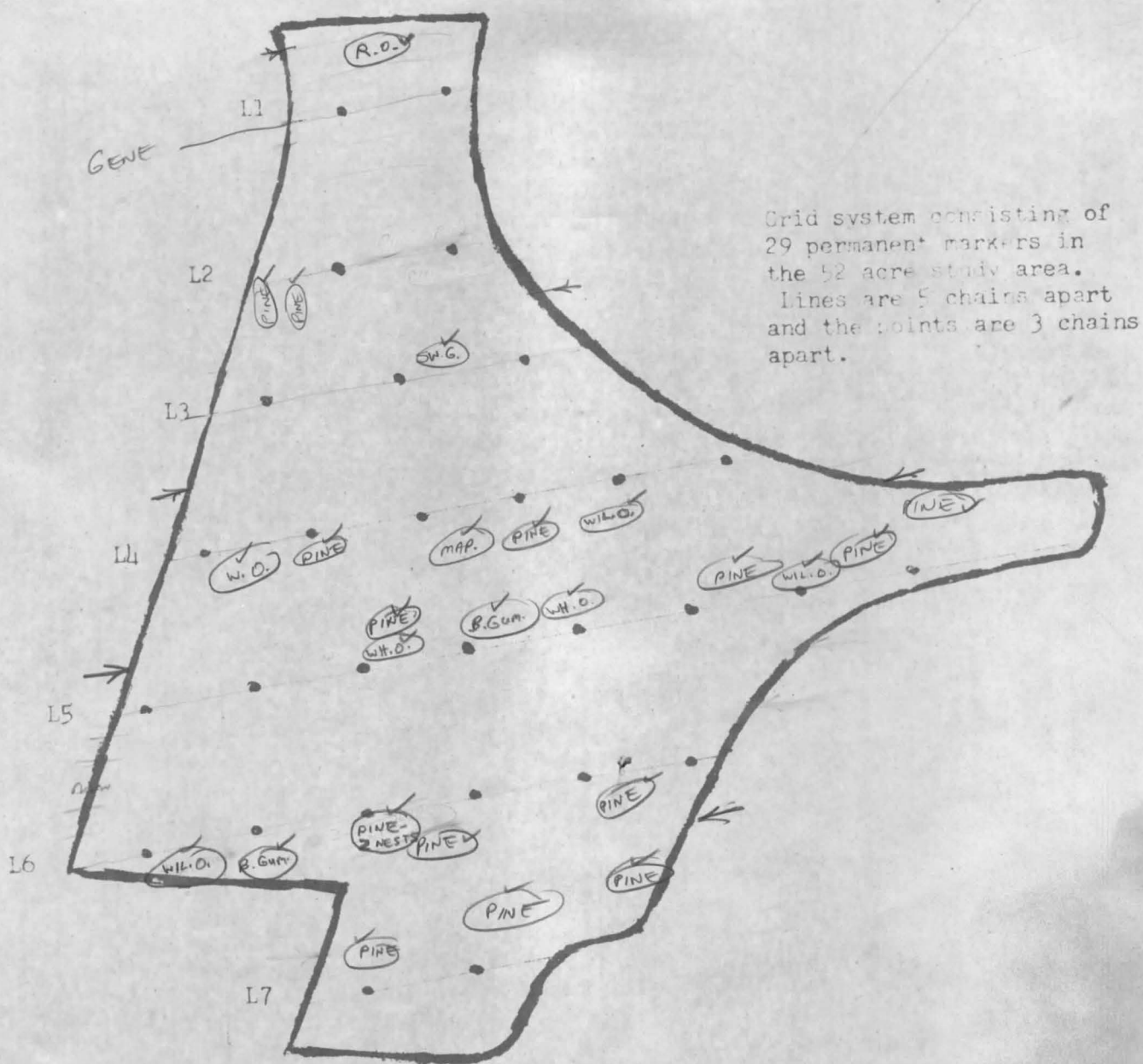
4R-MD-148-403



## SQUIRREL STUDY PLOT



## SQUIRREL STUDY PLOT



R.O. - red oak

pine

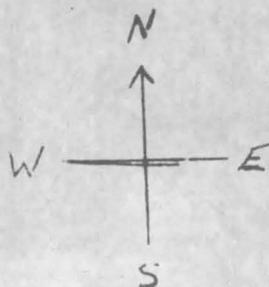
SW.G. - sweet gum

W.O. - white oak

MAP. - maple

WIL.O. - willow oak

B.Gum - black gum



UNITED STATES GOVERNMENT

# Memorandum

TO : Refuge Manager, Blackwater NWR

DATE: August 6, 1971

FROM : East Coast Biologist, Washington, North Carolina

SUBJECT: Squirrel Nest Tree Data

*WJH* MANAGER \_\_\_\_\_ CLERK  
*WJH* ASST. #1 \_\_\_\_\_  
*WJH* ASST. #2 \_\_\_\_\_ HUGHES  
*WJH* PUBLIC USE \_\_\_\_\_ STEWART  
*WJH* BIOL. TECH. \_\_\_\_\_

The following table is self-explanatory and was compiled from data submitted by you in your July 16 memo and from Forester Czuhai's cruise data. Of importance, I think, is the fact that little use was made of sweet gum for squirrel nests despite its major occurrence in the 52-acre tract. There seems also to be a preference for black gums and willow oaks. For comparison, pine are included and, as can be seen, there appears to be a preference for them also. We realize, of course, that tree sizes above six inches could be instrumental also but have not attempted categorizing this factor.

The value of these data will be more evident in future years following the proposed 1971-72 selective cut and comparisons with other study blocks on the Refuge. Please keep us posted on the progress of the timber sale.

Nest Tree\* Preferences by Squirrels on 52-Acre Egypt  
Road Tract, Blackwater NWR - 1970

Tree Species	Percent Composition	Number of Nests	Number of Trees	Trees per Nest
Sweet Gum	20.5	1	800	800
Red Oaks**	20.0	3	778	259
White Oaks***	20.0	6	780	130
Red Maple	19.5	6	761	127
Willow Oak	11.3	6	440	73
Black Gum	8.2	5	320	64
Black Cherry	0.5	1	20	20
Persimmon	Trace	1	1	1
All Hardwoods	100.0	29	3,900	134
Pines	100.0	59	5,540	94
All Trees	100.0	88	9,440	107

\*\*\* Includes white and post oaks

\* Trees six inches or larger only

\*\* Includes Northern & Southern Oaks, pin oaks and black oaks

*Otto Florschütz, Jr.*  
Otto Florschütz, Jr.

cc: Regional Office  
Forester Czuhai

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