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SECOND ANNUAL REPORT OF THE PRAIRIE GROUSE COMMITTEE
ILLINOIS CHAPTER - THE NATURE CONSERVANCY

June 1, 1969

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INTRODUCTION

Two groups, the Prairie Chicken Foundation of Illinois (PCFI) and the Prairie Grouse Committee (PGC), Illinois Chapter - The Nature Conservancy, are continuing their efforts to preserve and perpetuate our native prairie chickens by the acquisition and management of an adequate system of sanctuaries. Biologists of the Illinois Natural History Survey (INHS), with the cooperation of the Illinois Department of Conservation (IDC), are also participating in this joint effort by conducting censuses of prairie chickens, studying their ecology and response to management, and generally serving as consultants on land acquisition and management to all agencies involved. The purpose of this report is to summarize all these efforts and accomplishments, with special emphasis on last year's activities and a look to the future.

In the past century, prairie chicken numbers in Illinois have dwindled from millions to an estimated 280 birds in 10 remnant flocks in nine south-central counties in the spring of 1969. Our problem is to preserve this native species on range from which the native vegetative communities have been eliminated by agriculture. Donations have made possible the acquisition of 1,107.3 acres for sanctuaries since 1962, far less than the amount considered essential to save the chicken in Illinois. As shown by Figures 1 and 2, the Prairie Grouse Committee of the Illinois Chapter - The Nature Conservancy controls 390.3 acres at Bogota in Jasper County and 420 acres near Kinmundy in Marion County; the Prairie Chicken Foundation of Illinois controls 297 acres, all at Bogota. In addition, the Department of Conservation is now leasing 88 acres of grass and legumes as a holding action until an adequate refuge system can be established in Marion County near Farina and in southwest Effingham County near Loogootee.

The population decline of prairie chickens at Bogota has, temporarily at least, been halted. Although a 38 percent increase occurred between the springs of 1968 and 1969, the number of birds comprising the Bogota flock must still be regarded as precariously endangered. Research on nesting ecology now indicates that inherent behavioral patterns of prairie chickens must be considered in the acquisition and management of nesting sanctuaries. The optimum spacing between booming grounds appears to be not less than 600 yards; the distance between the center of a booming ground and the preferred zone for nesting is about 200-300 yards; and the optimum distance between nests appears to be about 120 yards. The conclusion is that we should create conditions, favorable for booming, at specific sites on individual sanctuaries and maintain suitable nesting cover surrounding these sites. Research is also revealing the importance of periodic disturbance in favoring the diverse community of grasses and forbs to which prairie chickens are adapted. Stands of domestic grasses such as timothy and redtop provide acceptable nesting and brood

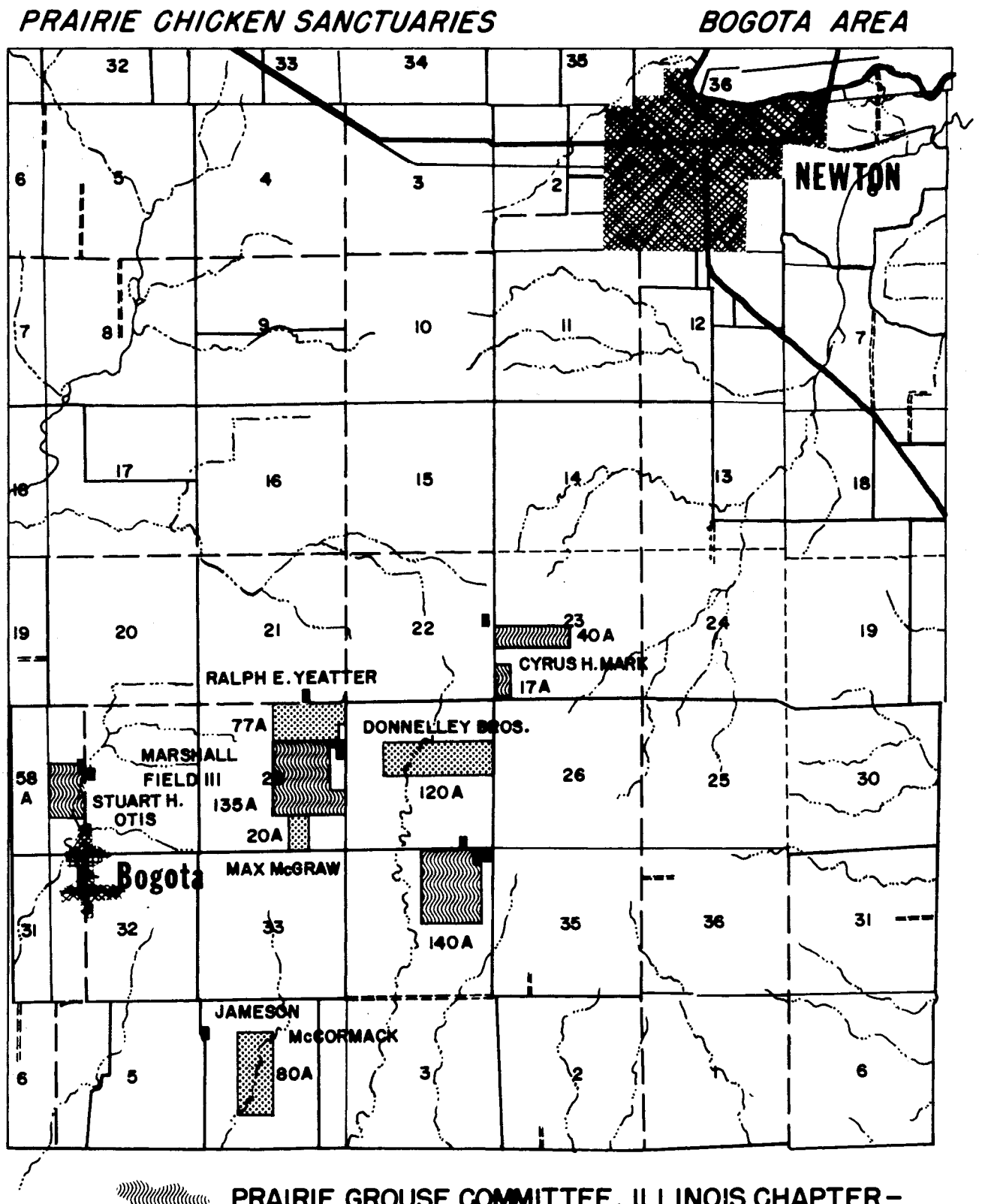
PRAIRIE CHICKEN SANCTUARIES
BOGOTA AREA
NEWTON
RALPH E. YEATTER
77A
MARSHALL FIELD III
STUART H. OTIS
135A
20A
58 A
Bogota
DONNELLEY BROS.
120A
CYRUS H. MARK
17A
40A
MAX McGRAW
140A
JAMESON
McCORMACK
80A
PRAIRIE GROUSE COMMITTEE, ILLINOIS CHAPTER - THE NATURE CONSERVANCY
PRAIRIE CHICKEN FOUNDATION OF ILLINOIS

Figure 1

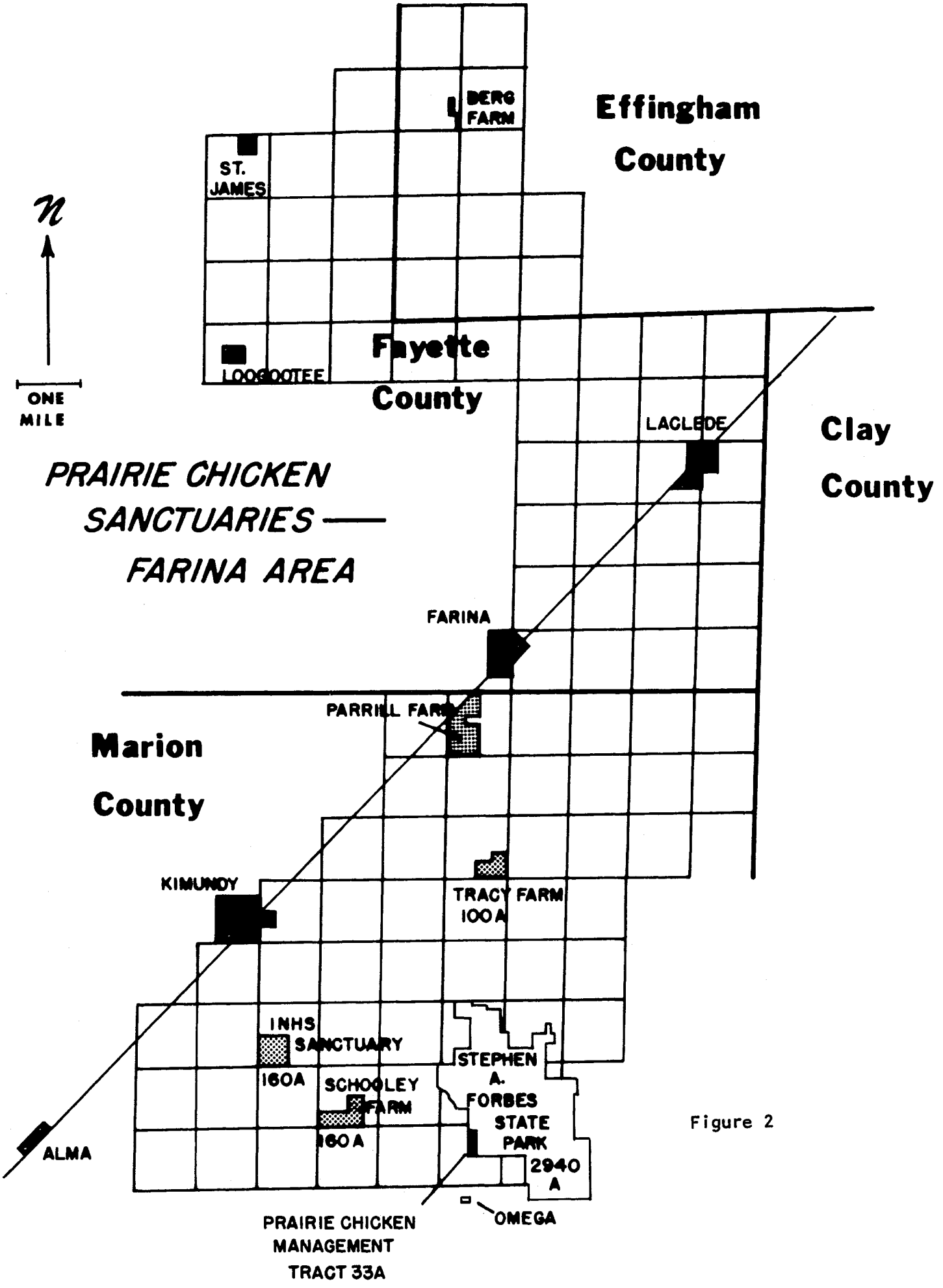
BERG FARM
Effingham County
ST. JAMES
N
ONE MILE
LOOGOOTEE
Fayette County
LACLEDE
Clay County
PRAIRIE CHICKEN SANCTUARIES —— FARINA AREA
FARINA
PARRILL FARM
Marion County
KIMUNDY
TRACY FARM 100A
INHS SANCTUARY
160A
SCHOOLEY FARM
160A
STEPHEN A. FORBES STATE PARK
2940 A
ALMA
OMEGA
PRAIRIE CHICKEN MANAGEMENT TRACT 33A

Figure 2

cover for only 2-3 years after establishment. Preliminary work indicates that prescribed burning can be an economical and effective tool in vegetation management for prairie chickens.

Our native chickens can be saved. Sanctuary systems of 1,500-2,000 acres in scattered tracts of 40-160 acres should be completed and developed in the immediate future to save our largest remnant flocks near Bogota, Farina, and Loogootee. We believe that the State as well as private individuals should participate in land acquisition. We recommend the creation of a prairie state park in south-central Illinois, with the objective of recreating a native prairie community as part of our Illinois heritage. At present, however, the major responsibility for saving the prairie chickens in Illinois remains in the hands of private citizens working through private groups such as the PGC and PCFI.

LAND ACQUISITION

Prairie Chicken Foundation of Illinois (PCFI) -- At a meeting of the Illinois Natural Resources Council in the fall of 1958 the necessity of forming an organization to preserve Illinois' native prairie chickens was expressed. A year later, on September 25, 1959, bylaws were adopted and the PCFI became the first group, public or private, in this state, organized with the single objective "to preserve and perpetuate the prairie chicken."

The history of the PCFI has shown that acquisition of sanctuaries has been slow; after more than 9 years the PCFI has control of only 297 acres (Table 1). The abundance of prairie chickens at Bogota continued to decline because of a continuing deterioration of habitat conditions over the area as a whole, at least through 1965.

The PCFI worked hard to interest others in the plight of the prairie chicken, to raise funds, and to acquire land, but it was obvious that additional efforts were needed to compensate for the rapid loss of nesting habitat and to assure the saving of the prairie chicken flock at Bogota.

Prairie Grouse Committee (PGC) -- After the January 1965 Board Meeting of the PCFI, the staff of the Illinois Natural History Survey became convinced that something more must be done if the prairie chicken was to be saved. Through the late Mr. A. B. McDonald and Mr. Stuart Otis it was proposed that the Illinois Chapter - The Nature Conservancy create a special project and form a group to be known as the Prairie Grouse Committee. Mr. Cyrus Mark and others were enthusiastic about the project and carried the ball in getting official approval of the project. Thus, the Illinois Chapter - The Nature Conservancy in the fall of 1965 formed the PGC, with the stated purpose of raising $125,000 to purchase 300 additional acres of sanctuaries for prairie chickens. This committee made its first land purchase, a 17-acre tract, at public auction, on October 2, 1965. Land acquisition by the PGC has proceeded as rapidly as suitable tracts became available and finances permitted. Each time a desirable tract has been offered for sale some dedicated conservationist has given a contribution making acquisition possible. At this writing the PGC has acquired 390.3 acres near Bogota and 320 acres near Farina (Table 2) and is in the process of acquiring another 100 acres near Farina. Thus, in less than 4 years, 810.3 acres of prairie chicken sanctuaries will be controlled and managed by the PGC.

Table 1. Land acquisitions by the PCFI.

Name of Sanctuary	Date Obtained	Acreage	Cost per Acre[1]	Type of Purchase	Total Cost of Sanctuary
Ralph E. Yeatter	5-15-62	77	$225	Cash	$17,325
Max McGraw	2-17-64	20	275	Cash	5,500
Donnelley	7-64	60	300	Contract[2]	18,000
Jameson McCormack	11-1-65	80	312.50	Lease[3]	25,000
Donsback Tract[4]	Summer 67	60	525	Contract[5]	31,500
Totals or Average		297	$327.69		$97,325

[1] This figure does not include interest charges, if paid.

[2] Paid $1,500 down and the balance on a 10-year contract at 5% interest.

[3] Title is held by purchaser who plans to donate the land to the PCFI.

[4] Adjoins the original Donnelley 60 and the entire 120 acres is now so named.

[5] Paid $8,000 down, with $5,000 to be paid in 1968 and the remainder to be paid at the rate of $3,000 per year; rate of interest is 6%.

We cannot emphasize enough the interest and dedication shown by the group on the Steering Committee of the PGC. When the original 17 acres came up for sale at public auction, on a 2-day notice so far as we were concerned, one member of the committee gave a certified check for $2,500 to pay down and then contributed most or all of the $6,800 for the land. Another member of the committee gave $8,500 as a down payment on the Charles Woods' farm. This same member was responsible for the purchase of the 160-acre Westfall property near Kinmundy. He, and one or more others, bought this land after he visited the booming grounds in the spring of 1967 and was shown the Westfall property, but was informed that the PGC was overcommitted and that the PCFI was not interested in the land.

This past year donations of $10,000 and $2,000 from foundations have made possible the purchase of the 160-acre Schooley farm. Other donations have allowed for the meeting of obligations for interest and principal due on previously acquired tracts.

Table 2. Land acquisitions by the PGC.

Name of Sanctuary	Date Obtained	Acreage	Cost per Acre[1]	Type of Purchase	Total Cost of Sanctuary
Cyrus H. Mark	10-18-65	17	$400	Public Auction	$ 6,800
Zimmerman Tract	3-1-66	140	428.57	Contract[2]	60,000[3]
Cyrus H. Mark	4-18-66	40	435	Public Auction	17,400
Stuart H. Otis	7-1-66	58.3[4]	266.14	Cash	15,250[5]
Illinois Natural History Survey[6]	4-17-67	160	280	Lease[7]	44,800
Marshall Field III	3-1-68	135[8]	472.22	Cash[9]	63,750[6]
Schooley Tract	3-20-69	160	285	Contract[10]	45,600
Subtotal		710.3			$253,600
Louis J. Lacey	(1969)	100	336[11]	Contract	33,600
Totals or Average		810.3	354.43		$287,200

[1] This figure does not include interest charges, if paid, and is figured on the final acreage in the sanctuary.

[2] Paid $6,000 down and the balance on a 9-year contract at 6% interest.

[3] Not including interest.

[4] 60 acres purchased but buildings and 1.7-acre lot sold on 4-7-67.

[5] Cost after subtracting sale price of land and buildings.

[6] Formerly known as the Westfall tract.

[7] Title is held by two purchasers who eventually plan to donate the land to the PGC.

[8] 160 acres purchased but buildings and 25 acres sold on 5-16-68.

[9] Entire original purchase cost of $85,000 borrowed at 6.5% interest.

[10] Five-year contract at 6% interest on balance of $34,200.

[11] 20 acres to be donated by present owner, 80 acres to be purchased at $420 per acre and leased to the PGC.

The Steering Committee is composed of the following individuals:

ILLINOIS CHAPTER - THE NATURE CONSERVANCY

Governor Richard B. Ogilvie, Honorary Chairman
Charles C. Haffner III, Chairman of the PGC
Cyrus Mark, Chairman of the Illinois Chapter - The Nature Conservancy
Elliott Donnelley, Treasurer
Dr. William J. Beecher, Chicago Academy of Science
Gaylord Donnelley
Stuart H. Otis
Frederick C. Pullman
Marshall Field
W. A. Elkins, The Nature Conservancy

ILLINOIS NATURAL HISTORY SURVEY

Dr. Glen C. Sanderson, Head, Section of Wildlife Research
Dr. L. J. Stannard, Taxonomist, Faunistic Surveys
F. C. Bellrose, Wildlife Specialist, Section of Wildlife Research
W. R. Edwards, Assoc. Wildlife Specialist, Section of Wildlife Research
R. L. Westemeier, Asst. Wildlife Specialist, Section of Wildlife Research

STATUS OF PRAIRIE CHICKEN FLOCKS IN ILLINOIS

Statewide Census Areas -- During the period of late March to mid-April, 1969, 15 areas in nine counties in south-central Illinois were systematically cruised in search of booming prairie chickens and an effort was made to determine the maximum number of cocks for each area. Censuses were discontinued on five areas where either no prairie chickens, or only one cock, had been found in the spring of 1968.

This spring (1969) a total of 140 prairie chicken cocks were counted on 10 of the 15 areas censused (Table 3), an overall decrease of 6 percent since the spring of 1968. However, by excluding the Bogota Area, on which a 38 percent increase occurred between 1968 and 1969, the decline amounts to 21 percent. A similar loss (19 percent) was recorded between 1967 and 1968 on the statewide census areas. No chickens were found on three of the areas censused in 1969, bringing the total of defunct census areas to 10 since 1963 (Fig. 3)

Table 3. High counts of prairie chickens on booming grounds on census areas in south-central Illinois, 1963-69.

Census Area	♂♂ & ♀♀	Cocks Only					
	1963	1964	1965	1966	1967	1968	1969
Jasper Co.							
Bogota	89	65	42	41	43	37	51[f]
West Liberty	10	5	7	5	1	0	CD[f]
Hunt	4	17[a]	9	1	1	1	CD[f]
Shamrock	NC	NC	NC	2	2	0	CD[f]
Hidalgo	NC	NC	NC	NC	NC[d]	0	CD
Marion Co.							
Farina	53	33[a]	40	33	39	25	28
Forbes Park	NC	17	7	7	16	16	14
Fairman[b]	NC	NC	NC	NC	10	13	4
Brubaker	NC	NC	NC	NC[d]	0	CD	
Fayette Co.							
La Clede	NC	20	10	9	7	4	4
Effingham Co.							
Dieterich	14	10	2	0	0	CD	
Loogootee[c]	NC	24	29[a]	24	16	26	24
Altamont	NC	NC	NC	NC[d]	0	CD	
Wayne Co.							
Mt. Erie	45	48	31	18	10	6	5
Cisne	23	24[a]	15	9	7	4	0[f]
Johnsonville	NC	NC	7	1	0	0	0
Geff	NC	NC	NC	6	3	1	1
Sims	NC	NC	NC	NC	7	3	1

Table 3. (Cont.)

Clay Co.							
Xenia	25	16	2	0	0	CD	
Sailor Springs	NC	NC	10	10	3	3	0
Clay City	NC	NC	NC	3	0	0	CD
Clark Co.							
Martinsville	29	29[a]	17	8	11	4	0
Bond Co.							
Hookdale	18	16	13	5	1	0	0
Washington Co.							
Hoyleton	NC	NC	NC	NC	NC	6[e]	8
ALL AREA TOTALS	310	324	241	182	177	149	140

[a] Census area enlarged.

[b] Area overlaps into Clinton Co.

[c] Area overlaps into Fayette Co.

[d] Prairie chickens reported in area.

[e] Estimate by local farmer.

[f] Prairie chickens still believed to be present in area.

NC Not Censused.

CD Census Discontinued.

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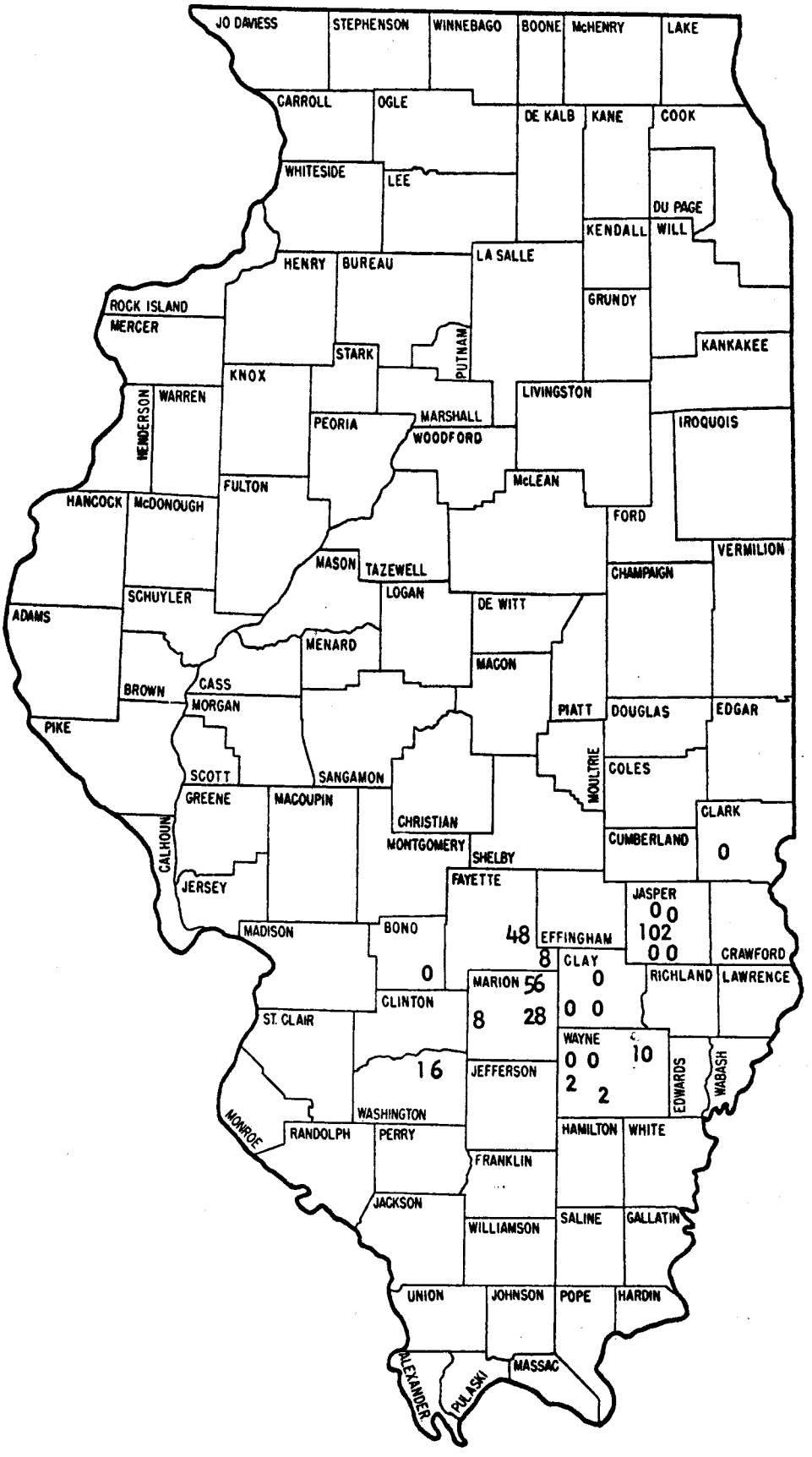

Figure 3. Estimated numbers of prairie chickens (both sexes) on 21 census areas in the spring of 1969.

Thus, assuming a 50:50 sex ratio, the statewide population numbered about 280 prairie chickens in the spring of 1969. The Bogota flock presently accounts for 36 percent of the statewide population. Four other flocks, in Effingham, Fayette, and Marion counties, which are distributed roughly 10 miles both north and south of Farina (Fig. 2) now comprise 50 percent of Illinois' remaining prairie chickens.

The Bogota Flock -- A marked change in the distribution of booming grounds and prairie chicken hens indicates that the prairie chicken sanctuaries are now starting to play a major role in supporting the flock(s) at Bogota. Of the six booming grounds established at Bogota in 1968, three were located on sanctuaries and two were within 100 yards of sanctuaries. Only one was as far as 900 yards from the nearest sanctuary. The latter ground (Kellog), one of the traditional booming grounds on the area, was occupied by seven cocks as early as January 1968 but declined to three cocks during the main courtship season of mid-March to mid-April. Only one hen was seen visiting the Kellog booming ground. By contrast, the highest counts of hens on the other five grounds were: Zimmerman, 10; J. Woods, 10; Donnelley East, 8; Yeatter, 5; and Donnelley North, 3. These counts, totaling 37 hens, were made by observers in blinds, on different mornings, and possibly involve duplications. The highest total counts of individual birds made on one morning were 18 hens and 37 cocks. The amount of shuttling between booming grounds by individual birds remains unknown. However, the highest winter count of 72 birds (both sexes), made January 10, 1968, is in close agreement with the estimate of 74 based on a 50:50 sex ratio and 37 individual prairie chicken cocks seen during the booming season.

Two of six booming grounds used during the spring of 1968 were active during the fall of 1968. The J. Woods ground was the focal point of fall booming activity; up to 54 of the 60 cocks observed in the Bogota Area were seen on this ground (Table 4). The peak count of 110 prairie chickens, made both on and off booming grounds on December 17, 1968, was 53 percent higher than the count for the previous fall and winter and 33 percent higher than the count of 83 prairie chickens made on October 20, 1966 (Westemeier 1967: Table 6). The counts for the fall of 1968 strongly suggested a significant increase from the declining or relatively stable population levels present at Bogota during the springs of 1963 through 1968.

In the spring of 1969 all booming was on or within 200 yards of the sanctuaries. The increase from 37 cocks at Bogota in 1968 to 51 (38 percent) in 1969 was encouraging and indicates that the prairie chicken can be preserved. However, the actual number of birds must still be regarded as low and we must for the present continue to consider the Bogota flock as critically endangered. The increased number of chickens present at Bogota in 1969 likely resulted from successful nesting in 1968, made possible by (1) a substantial acreage of sanctuaries located in strategic areas and (2) relatively early spring plowing, which gave nesting hens few alternatives but to nest on the sanctuaries. Only 2 nests were reportedly destroyed by plowing in 1968, in contrast to 18 nests destroyed by farming activities in 1964. Fourteen (78 percent) of the 18 nests found on the sanctuaries during the summer of 1968 had successfully hatched.

Table 4. Counts of prairie chickens on the Bogota Study Area in the fall of 1968 on booming grounds used the previous spring and in non-booming ground areas.

	Booming Grounds				Non-booming Ground Observations			Totals			
	J. Woods		Donnelley East								
Date	♂♂	♀♀	♂♂	♀♀	♂♂	♀♀	Unsexed	♂♂	♀♀	Unsexed	All
9/27	26	0	0	0	--	--	24	26	--	24	50
10/4	46	0	0	0	2	--	30	48	--	30	78
10/10	52	0	2	0	--	--	23	54	--	23	77
10/15	47	0	13	0	--	--	20	60	--	20	80
20/21	45	0	2	0	4	--	24	51	--	24	75
10/29	35	0	8	0	4	--	1	47	--	1	48
11/5	54	6	0	0	--	--	19	54	6	19	79
11/12	49	6	0	0	5	3	--	54	9	--	63
11/21	48	21	5	0	--	--	17	53	21	17	91
12/6	53	5	5	0	--	--	--	58	5	--	63
12/17	51	3	0	0	1	10	45	52	13	45	110

ECOLOGY AND BEHAVIOR

Dispersion of Booming Grounds -- Nearest neighbor distances between booming grounds of the greater prairie chicken were evaluated using data collected on the Bogota Area, in Wisconsin (Grange 1948:46, Hamerstrom et al. 1957:49), and in Missouri (Schwartz 1945:42; Arthaud 1967, unpublished data).

On the 16-square-mile study area at Bogota during the 6-year period of 1963-68, distances between 42 booming grounds ranged from 0.3 mile to 1.6 miles, with a mean distance of 0.8 mile. The mean density of prairie chicken cocks ranged from 2.3 to 4.9 per square mile during this period.

Grange (1948) reported that the density on a "prairie chicken tract" in central Wisconsin was also less than 5 cocks per square mile. Distances between 25 booming grounds ranged from 0.5 mile to 1.9 miles. The distance was 0.9 mile on Grange's area. Hamerstrom et al. (1957) reported the locations of 49 booming grounds on the Buena Vista Marsh in Wisconsin, which had a density of 8 cocks per square mile. Booming grounds were categorized into "regularly used" and "uncertain status." Regularly used booming grounds were located from 0.4 to 1.3 miles of each other. Booming grounds of uncertain status were found as close as 0.3 mile. Mean distance between adjacent booming grounds of either category was 0.7 mile.

Population levels of prairie chickens on the two study areas in Missouri were higher than the densities in Wisconsin or Illinois. Schwartz (1945) recorded 34 cocks per square mile on a 5.5-square-mile area in northern Missouri. Arthaud (1967) reported 74 cocks per square mile on the Taberville Prairie, a 2.6-square-mile tract in southwestern Missouri. Distances between booming grounds in northern Missouri ranged from 0.3 to 0.9 mile; the mean was about 0.5 mile. In 1966, 13 booming grounds on the Taberville Prairie were located from 0.2 to 0.9 mile of their nearest neighbor. Mean spacing for the Taberville grounds was 0.4 mile.

A combination of the data collected from Illinois, Wisconsin, and Missouri indicates that the mean distance between nearest neighbors on all booming grounds was 0.7 mile, or approximately 1,200 yards, for the 145 grounds. Eighty percent of inter-booming ground distances were less than 1 mile. More important, just 8 of 99 were less than 0.30 mile, with only 2 of these less than 0.25 mile apart. The data suggest that there was a minimum critical distance of about 600 yards in the spacing of regularly used booming grounds. At high densities this distance may be reduced to roughly 400 yards.

Nests in Relation to Booming Grounds -- At Bogota during the period of 1963-68, distances between 85 prairie chicken nests and the estimated centers of the nearest booming grounds have ranged from 117 to 1,700 yards (Table 5), with respective mean and median distances of 436±296 and 360 yards and a mode of about 240 yards. However, when five nests which we could not relate to established booming grounds were dropped from the sample, the mean distance was reduced to 375±159 yards. Thus, we conclude that few nests can be expected to occur within 100 yards of, or farther than 700 yards from, centers of established booming grounds; most nests would be expected from 215 to 535 yards from the center of a booming ground. On this basis, management must attempt to accommodate prairie chicken hens (1) developing suitable, safe nesting cover within 500 to 600 yards of centers of established booming grounds; (2) developing suitable booming grounds on or in the vicinity of existing sanctuaries; or (3) both.

Table 5. Distances from prairie chicken nests to nearest booming grounds, and related population changes, Bogota Study Area, 1963-68.

	1963	1964	1965	1966	1967	1968
Number of Nests	14	21	12	8	12	18
Distance (yards) to Booming Grounds						
Range	198-1,350	193-1,700	117-715	232-674	234-572	118-580
Mean	512	569	393	420	384	293
Population Change						
Percent	-17	-35	-2	+5	-14	+38
Cocks	-13	-22	-1	+2	-5	+14

A new booming ground became established on a 140-acre sanctuary (the Zimmerman tract) in 1968 and presented the only instance during the 6-year period where nesting cover completely encircled a booming ground (Fig. 4). Although prairie chicken hens could have nested up to 660 yards from the estimated center of the Zimmerman booming ground (located on a 10-acre field that was burned on February 28, 1968), six nests were found in a radial pattern at distances ranging from 210 yards to 254 yards, an average of 234 yards. A seventh nest was 323 yards from the booming ground. In several other instances, involving booming grounds not completely surrounded by nesting cover, nests tended to be located in the closest tract of suitable cover. Thus, when all available data are considered, the distance between the center of a booming ground and the preferred zone for nesting appears to be about 200-300 yards.

A consideration of proportionate changes in numbers of booming cocks at Bogota in relation to average nest-to-booming-ground distances suggested a population advantage favoring years when hens nested relatively closer to booming grounds. Regression analysis verified this observation ($F_{1,4} = 14.9$) and suggested that declining populations occurred when average distances exceed about 400 yards. This indicates that hens not only prefer to nest in the proximity of booming grounds--it is to the population's advantage that they do so.

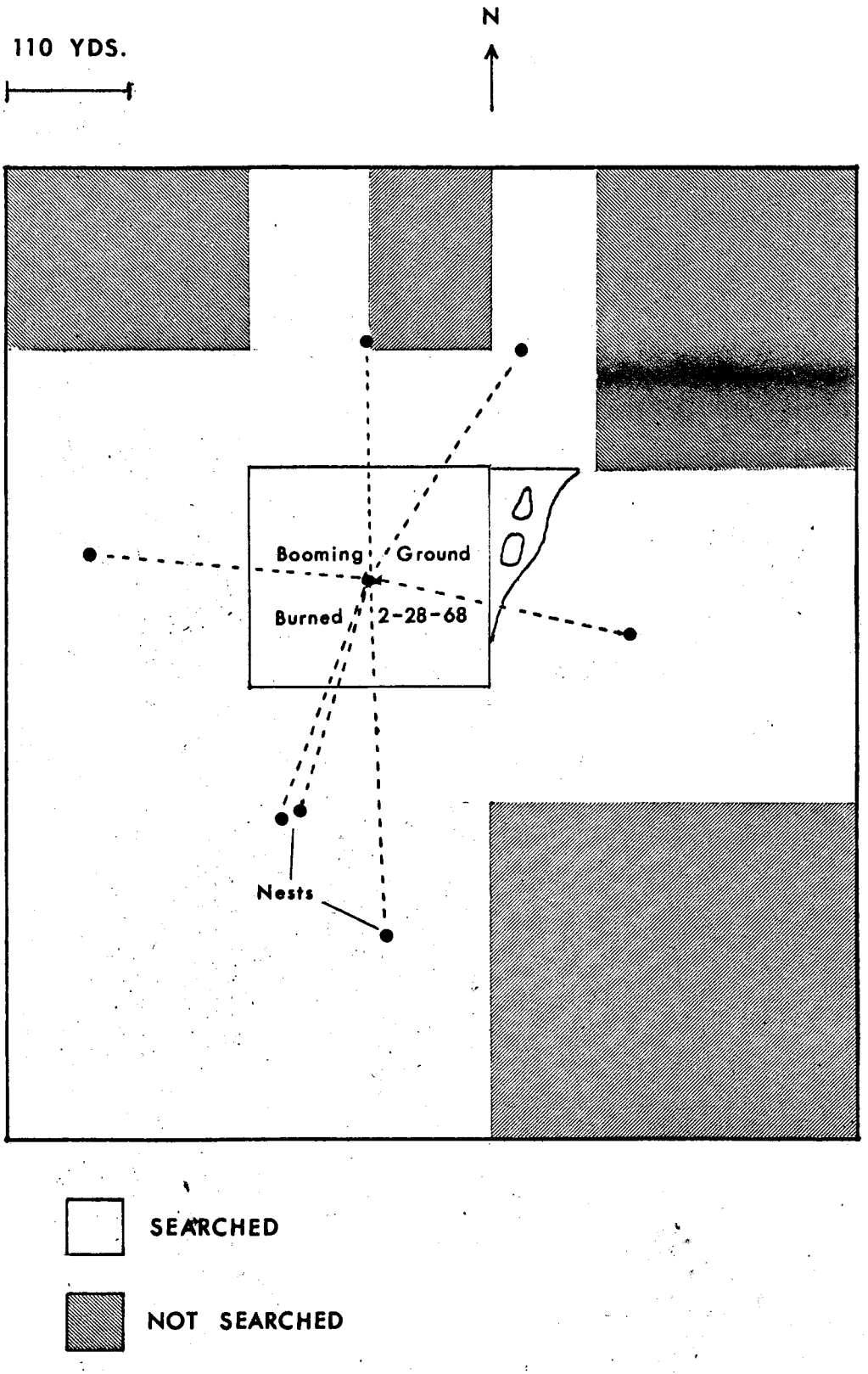

Figure 4. Dispersion of seven prairie chicken nests on the 140-acre Zimmerman tract at Bogota, 1968.

Distances Between Nests -- Distances between nests were examined for a possible spacing mechanism. Although 75 nests were found at Bogota during 1963-68 on 2,111 acres searched on foot and 590 acres searched using a tractor-mounted flushing bar, plus 49 nests reported by farmers, the problem in this analysis was to select those nests for which the data had a high probability of reflecting true "nearest-neighbor" distances. In this analysis, we somewhat arbitrarily used distances for 63 nests located in fields of contiguous, "high quality" nesting cover. Nearest neighbor distances ranged from 17 to 336 yards, with little apparent differences in the spacing of successfully hatched nests as compared with all nests located. The respective mean and median nearest neighbor distances were 129±91 and 96 yards for all nests with 142±87 and 129 yards for the hatched nests. These standard error terms suggest that most prairie chicken hens tend to place their nests relatively close together, i.e., less than 300 yards from another hen. These observations raise the question as to whether or not there is a minimum critical distance among nesting hens. At first glance, the data suggest that there may not be, or if so, that it is not well defined.

Although the success of nests with a median nearest-neighbor distance of 96 yards or less was not significantly different from that of nests more than 96 yards apart in our sample of 63 nests, we consider it important that half of the 20 unsuccessful nests occurred only 67 yards, or less, apart. Also, nine additional nests whose nearest-neighbor distances were not known, yet which could not have had nearest distances of less than 96 yards, were all successful. On this basis, it appears that a mechanism for spacing and some minimum critical distance among nests would be advantageous for a prairie chicken population.

The spacing between nests in relation to the clutch size of nests further suggests that nesting prairie chickens require a certain amount of space for maximum efficiency in production. Clutch sizes of 15 nests increased as the nearest-neighbor spacing between nests approached 120 yards; 23 nests separated by greater distances showed no apparent differences in clutch size. Interpretation of these data is complicated by insufficient information on (1) the time when the nests were initiated and (2) by the possibility of renesting. However, the prairie chicken is essentially a "one-shot" nester with limited renesting ability, so the effect of these possible sources of bias may be minimal.

Possible evidence for a mechanism of nest spacing was observed among seven nests located adjacent to the booming ground established on the 140-acre Zimmerman tract in 1968 (Fig. 4); five of the seven hatched. These nests were dispersed in a more or less radial fashion completely surrounding the booming ground. Except for two nests located 17 yards apart, nearest-neighbor distances ranged from 135 to 289 yards. The average nearest-neighbor distance for these seven nests was 144 yards. The largest concentration of nests observed thus far at Bogota was 15 on the 77-acre Yeatter Sanctuary in 1964, 9 of which hatched; the average nearest-neighbor distance there was 78 yards. Thus, the limited data on clutch size, nest-success and spatial relationships, suggest that optimum nest spacing is probably about 120 yards; however, this conclusion must be regarded as preliminary.

Our examination of spatial relationships suggests that (1) prairie chicken cocks will not establish well-defined booming grounds closer than 400-600 yards from other such grounds; (2) when suitable cover exists, hens apparently prefer

to nest between 200 and 300 yards from the center of booming grounds; (3) median nearest-neighbor distance for nesting hens was 96 yards; (4) half of the nests abandoned or destroyed had nearest neighbors only 67 yards or less away; (5) clutch size appeared maximum at nearest-neighboring nest distances of about 120 yards; and (6) in at least one instance, nests were placed in an approximate radial pattern surrounding a booming ground and suggested a spacing mechanism.

While no conclusive evidence of the existence of a spacing mechanism for nesting prairie chicken hens has yet been obtained, the available data strongly suggest that such a mechanism would be advantageous if maximum reproductive efficiency is to be attained by our Illinois flocks of prairie chickens. In our management programs we must recognize both the advantages of such a mechanism and its possible existence. We can endeavor to create on our sanctuaries attractive booming grounds of about 10 acres, surrounded by suitable nesting cover, at a ratio of about one per 60 acres of sanctuary. We can also attempt to acquire and develop suitable nesting cover around or in the vicinity of traditional booming grounds of surviving remnant flocks.

MANAGEMENT RECOMMENDATIONS

On the basis of our observations on the ecology and spatial relationships of prairie chickens we offer the following management recommendations; they will be changed and refined as our knowledge grows:

1. We must continue our efforts to increase our knowledge of the ecology and behavior of the prairie chicken in Illinois.

2. Our goal in management must continue to be the rapid acquisition of 1,500 to 2,000 acres in each of three sanctuary-complexes comprised of tracts of grassland 40-160 acres in size to save the remnant prairie chicken flocks near Bogota, Farina, and Loogootee, Illinois.

3. Once acquired, we should strive to establish a complex of native grasses and forbs on these sanctuary tracts. However, because of the time involved in establishing native species of vegetation, domestic grasses and legumes should continue to be seeded to provide interim emergency nesting cover.

4. Unless stands of domestic grasses and legumes are periodically rejuvenated, their use by prairie chickens will in a few years decline to a low level. Thus, some form of periodic management of sanctuaries appears essential if suitable cover is to be maintained. Properly timed prescribed burning, restricted haying, and limited grazing offer feasible alternatives to plowing and reseeding. Some form of management now appears desirable at least every second year in established sods.

5. Data on nest placement suggest that we should strive to develop a booming ground of roughly 10 acres in size for about every 60 acres of sanctuary. Booming grounds should be surrounded by acceptable nesting cover. It appears that booming grounds used in the fall are on areas of bare ground or on exceedingly short, sparse vegetation in the vicinity of good roosting (and subsequently nesting) cover. Fall

booming grounds are also used in the spring and are determining factors in nest placement. Three possible methods of creating booming grounds offer possibilities: (1) late-summer plowing for winter wheat, oats, or soybeans by sharecroppers; (2) heavy grazing by sharecroppers; (3) late-summer prescribed burning. The first technique seems the easier and more economical but the two latter methods may have the greater evolutionary basis. Each should be tried.

6. There are booming grounds established where we do not yet own sanctuaries, and periodically booming grounds will be established near our sanctuaries, yet not adjacent to them. Data on nest placement indicate that where such booming grounds occur, we can expect nesting on the nearest suitable nesting cover, usually within 200-500 yards of the booming ground, which has a high probability of being destroyed by plowing. In these situations every consideration should be given to leasing of nesting cover on an annual basis. However, leasing of acreage farther than 500 to 600 yards from a booming ground is not recommended.

7. We believe that the State as well as private individuals should participate in land acquisition to save our native prairie chickens. We recommend creation of a prairie State park in south-central Illinois, with the objective of recreating a prairie community comprised of a wide variety of native flowering plants and native animals, in addition to prairie chickens, as part of our Illinois heritage.

SANCTUARY AND COVER MANAGEMENT ACCOMPLISHED

The various activities associated with the management of PGC sanctuaries during the summer of 1968 through the spring of 1969 are listed in the appendix. This information shows our concern with providing a diverse grassland vegetation based largely on domestic grasses and legumes until we know more about the nesting ecology of prairie chickens and until more desirable cover types are defined and established. We are striving to achieve diversity by (1) prairie restoration; (2) prescribed burning at various seasons; (3) seeding a variety of domestic grasses and legumes; (4) combining of grass seed; (5) fallowing; (6) limited grazing; (7) delayed mowing for hay, firelanes, booming grounds, and to comply with Federal cropping programs; and (8) seeding of corn in strips that will be left undisturbed for 2-3 years. Much of this management is being achieved using local sharecroppers. However, a substantial amount of the management, particularly where prairie seedings are involved, remains to be done by biologists of the INHS and the IDC.

Of 687.3 acres (PGC and PCFI combined) comprising the present sanctuary system at Bogota, approximately 600 (87 percent) can be considered as nesting cover in 1969. Of the remainder, 19 acres of wheat, 28 acres of oats, and 20 acres of a new redtop seeding (all first-year sods) also may be used to a limited extent by nesting prairie chickens.

Prescribed burning has been accomplished on 34 plots totaling 171 acres at Bogota; 36 acres were burned in March 1968, 61 acres in August 1968, and 74 acres in March 1969. Delayed mowing for hay was accomplished on 7 plots totaling 23 acres in 1968. Limited grazing is planned for at least 20 acres in 1969. Our evaluation in 1969 of the nesting cover developed on these areas will help determine whether attractiveness of sanctuaries to nesting hens can be improved and maintained

by the use of prescribed burning and delayed haying as management techniques, thus eliminating the need to plow and reseed old, unused sods.

INCOME AND EXPENSES

Operating expenses for PGC sanctuaries for the period 7-1-68 to 6-30-69 were $11,947.99 (Table 6). Of this, 63 percent went for interest, 17 percent for taxes, and only 20 percent for habitat development and miscellaneous expenses. During this period, income from the sanctuaries was $4,501.81 even though our primary concern was cover for the prairie chickens (Table 7). Thus, except for interest charges, income as a byproduct of management exceeded the cost of management. Sharecropping using local farmers has proven both an effective and an economical means of establishing and maintaining cover on the sanctuaries.

Table 8 shows the cash position of the PGC as of June 30, 1969, and summarizes the income and expenses for the fiscal year ending June 30, 1969. Table 9 is a balance sheet for the PGC as of June 30, 1969. This table shows an equity of $144,895 and liabilities totaling $112,472 which give total assets of $257,367.

Table 10 summarizes the estimated financial obligations of the PGC from July 1, 1969, through 1970 and shows an estimated total of $103,636.33 owed after 1970. This post-1970 total does not include operating expenses, but it does assume that a $10,000 payment will be made on the Field Sanctuary each year until the note is paid. There is no commitment to pay a specific amount annually on this loan as is true for the Zimmerman and Schooley tracts. However, at the rate shown this loan would not be paid until 1974.

A LOOK TO THE FUTURE

The 1,107.3 acres managed for the prairie chicken in Illinois to date is an excellent start toward their ultimate preservation. The 687.3 acres now comprising the sanctuary system at Bogota make possible a degree of security that this flock has not had for perhaps 20 or 30 years, i.e., since the days of redtop farming. Likewise, the two sanctuaries (INHS Sanctuary & Schooley tract) now being developed between Forbes Park and Kinmundy should contribute substantially to the welfare of this flock. The Louis J. Lacey Sanctuary can probably be developed starting in the spring of 1970; however, there is still much to be accomplished if we are to save flocks in three other areas.

The ecology of the prairie chicken under present conditions in south-central Illinois involves cover types found off the sanctuaries as well as on them. There is no guarantee that the non-sanctuary habitat will remain as favorable to the chickens in the future as it is today. Small grain fields (mainly wheat) are used by chickens for booming grounds and as a source of greens during fall, winter, and spring, and small grain stubble is used extensively by broods, both night and day, and by full-grown birds for winter roosting cover. Also, corn and soybean stubble fields are intensively utilized for winter feeding. Intertilled crops are likely to remain part of the Illinois landscape, indefinitely, but small grains may not be grown in the future. The large acreage of wheat near Hoyleton in Washington County

appears to be the primary factor supporting the remnant flock of chickens still found there. Certainly, the beneficial effect of acres diverted from crop production as with the Federal Feed Grain Program, will become a thing of the past as the demand for food increases along with an increasing human population.

Although the acreage in sanctuaries at Bogota appears adequate for the minimum threshold of security now, there is no guarantee that this acreage will be adequate 10 years from now if cropping patterns change. There is, indeed, every reason to believe that farming will become increasingly intensive. Hence, we believe that a more realistic, long-term objective would be the development of a 600- to 1,000-acre sanctuary surrounded by 10 to 20 satellite sanctuaries, each 40 to 160 acres in size, distributed over a 10- to 15-square-mile area. We would like to see at least three such sanctuary systems developed as insurance against such events as increased use of pesticides, disease, or a weather disaster in one area. Additional acquisition should be immediately forthcoming in the flock range just south of Farina and in or near extreme southwestern Effingham County near Loogootee in Fayette County. The Farina flock is close enough to the flock west of Forbes Park to envision a chain of sanctuaries that would connect the two flocks. Thus, Sanctuary System No. 2 can be two connected groups of sanctuaries elongated over an 8-mile range extending from the Parrill farm south of Farina to about 1 mile south of the Schooley tract (Fig. 1). Table 3 shows that both the Loogootee and Farina flocks have demonstrated some degree of relative stability in their population level since 1963 or 1964. The status of these flocks is in direct contrast to the Wayne County flocks, for example, which may be judged as beyond the point of no return.

In addition to providing habitat for prairie chickens, sanctuaries on prairie farmland are also directly beneficial to many other species of wildlife. Although hunting cannot be justified on the present sanctuaries, hunters gain by their presence. Sanctuary lands serve as production areas for quail, mourning doves, and rabbits that can be hunted when such game species move to fall and winter habitat (woods and brush) generally found off the sanctuaries. Also, such grassland nesting species as upland plovers, Henslow's sparrows, grasshopper sparrows, short-billed marsh wrens, and perhaps even meadowlarks and redwings will be found in numbers only on sanctuaries in the future. Raptors such as short-eared owls, harriers, rough-legged hawks, red-tailed hawks, and sparrow hawks may be present in increasing numbers at Bogota during winter. Likewise, such foraging species as the hummingbird, chimney swift, barn swallow, purple martin, bluebird, mockingbird, Bell's vireo, yellow-breasted chat, orchard oriole, grackle, cardinal, field sparrow, song sparrow, and others benefit from the presence of the sanctuaries.

Each spring the sanctuary system at Bogota serves as a living outdoor laboratory for students and interested individuals. They assist with our research and observe the courtship performance of the prairie chicken. The prairie restoration now being emphasized on the sanctuaries will also serve as a living example of the vegetation from which the "bread basket" soils of our nation were derived.

Table 6. Summary of expenses for PGC sanctuaries -- 7-1-68 to 6-30-69.

Year	Sanctuary	Item	Amount	Total
1965	All	--	--	$ 69.00
1966	All	--	--	1,146.66
1967	All	--	--	7,333.09
1968 (to 5/30)	All	--	--	4,861.85
1969	Mark 17	Taxes	71.06	
	Mark 40	Taxes	167.20	
	Zimmerman	Taxes	592.46	
		Interest	2,520.00	
	Otis	Taxes	238.22	
	Field	Taxes	551.60	
		Interest	4,948.26	
	Survey	Soil Tests	16.80	
		Bulldozing	136.00	
		Limestone	463.55	
		Fertilizer	489.98	
		Taxes	382.58	
		Rent	1.00	
	Schooley	Legal Fees	54.00	
		Insurance	11.00	
		Timothy seed	15.75	
	Ditch repairs on several sanctuaries			
		Rye and fescue seed	30.60	
		Fertilizer	27.60	
	Domestic grass and legume seed used on Field & Survey sanctuaries		153.20	
		Prairie grass seed		
		Little bluestem	168.00	
		Sideoats grama	126.00	
		Big bluestem	75.00	

Table 6. (Cont.)

	Indiangrass	55.50
	Switchgrass	33.00
	Shipping charges	20.80
	Subtotal	478.30
Posts and bolts for new signs for Mark 17, Mark 40, Field, Otis, and Survey Sanctuaries		41.02
	Telephone	3.85
	Heater	27.95
	Lumber for blinds	140.03
	Meeting costs	95.48
	Legal fees	290.50
		$11,947.99

Table 7. Summary of income from PGC sanctuaries--7-1-68 to 6-30-69.

Year	Sanctuary	Item	Amount	Total
1966	All			$1,154.36
1967	All			3,577.74
1968 (to 5/31)	All			409.59
1969	Jasper Co.	Fed. Govt.		
		Feed Grain Prog. (1968)	1,232.26	
		Feed Grain Prog. (1969) 1st ½ payment	640.33	
	Marion Co.	Fed. Govt.		
		Feed Grain Prog. (1968) 2nd ½ payment	409.59	
		Feed Grain Prog. (1969) 1st ½ payment	426.57	
	Survey	Cost sharing on lime applied in 1968	210.90	
	Zimmerman, Mark 17, & Mark 40	Redtop & timothy seed	407.45	
	Field & Otis	Redtop & timothy seed	336.64	
	Field	Sweet clover seed	141.00	
	Field	Soybeans	262.95	
	Survey	Hay harvest	434.12	
				$4,501.81

Table 8. Cash position; income and expenses for fiscal year ending 6-30-69.

	Amount	
Cash Balance 7/1/68		$ 7,508.90
Income		
From govt. programs	$ 2,919.65	
" sale of crops	1,582.16	
" donations for land	28,728.50	
" other donations	3,149.73	
TOTAL INCOME		$36,380.04
TOTAL (cash balance & income)		$43,888.94
Expenses		
For habitat management	$ 1,811.88	
" taxes	2,003.12	
" misc.	664.83	
" land	28,174.05	
" interest	7,468.26	
TOTAL EXPENSES		$40,122.14
Cash Balance 6/30/69		$ 3,766.80

Table 9. Balance sheet for fiscal year ending 6-30-69.

			Amount	
Assets				
Cash				$ 3,767
Land at cost				
Mark Sanctuary I	(1965)	17 A.	$ 6,800	
Zimmerman Sanctuary	(1966)	140 A.	60,000	
Mark Sanctuary II	(1966)	40 A.	17,400	
Otis Sanctuary	(1966)	58 A.	15,250	
Survey Sanctuary	(1967)	160 A.	44,800	
Field Sanctuary	(1968)	135 A.	63,750	
Schooley Sanctuary	(1969)	160 A.	45,600	
				253,600
TOTAL ASSETS				$257,367
Liabilities				
Obligations on land				
Zimmerman Contract			36,000	
Field Bank Loan			42,272	
Schooley Contract			34,200	
TOTAL LIABILITIES				112,472
EQUITY				144,895
TOTAL				$257,367

Table 10. Summary of financial obligations from July 1, 1969 through 1970.

	Estimated Expenses		
	1969	1970	Total Owed After 1970
Zimmerman Tract			
Payment	paid	$ 6,000	$ 30,000.00
Interest	paid	2,160	5,400.00
Marshall Field III Sanctuary			
Payment	paid	10,000[1]	32,272.33
Interest	paid	1,800	4,500.00[2]
Schooley Tract			
Payment	paid	6,840	27,360.00
Interest	---	2,052	4,104.00
Operating Expenses			
Taxes	paid	2,500	---
Seed	paid	200	---
Lime & Fertilizer	$1,200	1,200	---
Misc.	500	1,000	---
TOTALS	$1,700	$33,752	$103,636.33

[1] There is no obligation to pay a specific amount on this loan; however, at this rate, the loan will not be repaid until 1974.

[2] If $10,000 is paid each February 15, until note is paid.

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APPENDIX A

Status of vegetation on the PGC sanctuaries at Bogota, spring 1969.

Sanctuary and Cover Types			Acreage Subtotals	Acreage Total
Marshall Field III Sanctuary				135
Timothy, 6th yr, combined 7/29/68			20	
Burned	8/21/68		5	
Burned	3/18/69		5	
To be burned	8/?/69		5	
To be burned	3/?/70		5	
Mixed redtop & timothy, 4th yr, combined 7/24/68			20	
Burned	3/18/68		5	
Burned	8/20/68		5	
Burned	3/18/69		5	
To be burned	8/?/69		5	
Weedy sweet clover & straw bales, 3rd yr, ½ combined 7/16/68			20	
Burned	8/20/68	To be plowed for wheat 8/1/69	5	
Burned	3/18/69		5	
To be burned	8/?/69		5	
To be burned	3/?/70		5	
Mixed redtop, lespedeza, & red clover, 2nd yr; to be combined for seed in 1969			20	
Hayed (oat stubble)	8/12-28/68		10	
Combined for lespedeza	12/1?/68		8	
Undisturbed since oats harvest	7/5/68		2	

Appendix A (Cont.)

		Subtotals	Total
Mixed grasses & legumes, 2nd yr, to be lightly grazed in 1969			20
Undisturbed since oats harvest	7/5/68	18	
Hayed (oat stubble)	8/28/68	2	
Wheat: to be harvested on 70:30 percent basis and clipped for weed control in 1969. Alfalfa, lespedeza, and timothy added 2/?/69.			12
Oats: two fields to be harvested in 1969 and clipped for weed control in trade for other work done. Oats seeded 3/18-20/69, prairie grasses seeded 4/3,16, & 21/69.			17
Weedy corn stubble seeded to prairie grass			5
Burned	3/18/69	2.5	
To be burned	8/?/69	2.5	
Corn: three unharvested strips seeded in 1968			2
Corn: to be seeded in 1969 & followed by prairie grass seeding after last cultivation			1
Bare strip to be seeded to prairie grass after third discing 6/15/69			1
Zimmerman Tract			140
Timothy, 4th yr			14
Undisturbed; to be burned 8/?/69		7	
Burned	8/26/68	3.5	
Burned	2/26/69	3.5	
Redtop & red clover mixed, 4th yr			10
Combined for seed; to be burned 8/?/69		5	
Burned	8/26/68	2.5	
Burned	2/26/69	2.5	

Appendix A (Cont.)

	Subtotals	Total
Redtop, 4th yr		10
Burned 2/28/68 & combined 7/23-25/68	5	
Burned 8/22/68	5	
Timothy & prairie grasses mixed, 4th yr		10
Burned 2/28/68	5	
Burned 8/22/68	5	
Weedy grasses & legumes, 5th yr		27
Mowed for weed control 7/25-29, 8/22/69; to be burned 8/?/69	20	
Burned 3/6/68	7	
Redtop, 10 yr +, oil well, hedge complex		8
Undisturbed	8	
Redtop & red clover mixed, 4th yr		10
Burned 8/19/68	5	
Combined for seed; to be burned 8/?/69	5	
Timothy & red clover mixed, 4th yr		9
Mowed for hay 6/20/68	6	
Mowed for hay & later for bmg. grd. (10/4/68)	3	
Redtop & red clover mixed, 4th yr		10
Combined for seed 7/23-25/68; to be burned 8/?/69	5	
Burned 3/18/69	5	
Timothy, 4th yr		10
Undisturbed; to be burned 8/?/69	5	
Burned 2/26/69	5	

Appendix A (Cont.)

	Subtotals	Total
Redtop, 4th yr	10	
Undisturbed; to be burned 8?/?69	5	
Burned 3/18/69	5	
Oats and prairie grass seeding: two small fields and seven narrow strips. Strips intersect all fields and are not subtracted from field acreages.	11	
Farmstead, ponds, and misc.	6	
Cyrus Mark 17		17
Redtop, 4th yr	17	
Burned 3/18/68, combined 7/24/68	5	
Burned 8/27/68	5	
Burned 3/6/69 (including 3-acre old cemetery prairie not owned as sanctuary)	5	
Combined 7/24/68; to be burned 8/?/69	5	
Cyrus Mark 40		40
Redtop	13.2	
Combined for seed	9.8	
Burned 8/29/68	4.4	
Timothy	15.5	
Combined for seed	2.0	
Undisturbed	10.7	
Burned 8/29/68	2.8	
Weedy grasses & forbs	7.3	
Undisturbed	5.5	
Burned 3/14/69	1.8	
Grass forb waterway burned 8/29/68	2.0	
Woodlot	2.0	

Appendix A (Cont.)

		Subtotals	Total
Stuart H. Otis 58			58.3
Mixed grasses, forbs, and shrubs, 10th yr ±		19.5	
Burned	3/30/68	16.0	
Burned	3/30/68 & 3/18/69	3.5	
Redtop, 3rd yr		19.3	
Combined	7/22-23/68	14.2	
Burned	3/18/69	5.1	
Redtop & broomsedge mixed, 10th yr ±		1.8	
Burned	3/18/69	1.5	
Undisturbed		0.3	
Timothy, 3rd yr		11.2	
Undisturbed		7.5	
Burned	3/18/69	3.7	
Old grass-forb pasture, undisturbed		5.4	
Roadside		1.1	

APPENDIX B

List of management activities accomplished on PGC sanctuaries in Jasper and Marion counties, summer 1968 through spring 1969.

Zimmerman 140-Acre Tract

5/21/68	Mowed field lanes to facilitate brood observations.
6/20/68	Mowed 11 acres of timothy-red clover for hay after a careful search for active nests and broods.
7/23-25/68	Redtop combined on 38 acres.
7/25-29, 8/22/68	Mowed 27 diverted acres for weed control in compliance with Feed Grain Program.
8/12/68	Mowed firelanes in preparation for prescribed burning.
8/19/68	Plowed several firelanes.
8/19/68	Burned 5 acres of a 10-acre redtop seed meadow.
8/22/68	Burned 10 acres (5 acres of undisturbed timothy-prairie grass and 5 acres of redtop seed meadow) Disced, harrowed, and seeded plowed firelanes.
8/26/68	Plowed 11 acres of small fields and strips in preparation for oats-prairie grass seedings in 1969. Eroded ditches graded in.
8/27/68	Burned 6.3 acres (3.8 acres of a 15-acre field of undisturbed timothy and 2.5 acres of a 10-acre field of redtop seed meadow).
8/30, 9/3/69	Disced graded-in ditches and spread 200 lbs of 5-20-20 fertilizer, 1 bu rye, 35 lbs fescue on repaired ditch areas totaling about 1 acre in size.
10/4/68	Mowed 3 acres for a booming ground.
2/26/69	Burned 6 acres for a booming ground (2.5 acres of redtop seed meadow and 3.5 acres of undisturbed timothy). Burned 5 acres of a 10-acre field of undisturbed timothy.
3/6/69	Burned 9 acres of a weedy grass-forb mixture.
3/18/69	Burned 5 acres of a 10-acre stand of undisturbed redtop. Burned 5 acres of a 10-acre redtop seed meadow.

Appendix B (Cont.)

3/18-20/69	Oats seeded on 11 acres of small fields and strips -- 200 lbs/ acre of 7-28-14 fertilizer applied.
3/29, 4/2, 3, & 10/69	Prairie grass broadcast by hand on 11 acres of new oats seeding.

Marshall Field III 135-Acre Sanctuary (possession 3/1/68)

6/7/68	Soybeans planted on 18 acres previously in corn stubble.
6/7/68	Corn planted on 2 acres (3 strips previously in soybean stubble) and left unharvested.
6/17, 7/1/68	Mowed field lanes to facilitate brood observations.
7/5/68	Oats combined on 37 acres.
7/16-22/68	Sweet clover combined on 15 acres of a 31-acre field.
7/24/68	Redtop-timothy mixture combined on 20 acres.
7/29/68	Timothy combined on 20 acres.
8/9/68	Mowed 11 acres of weedy sweet clover and straw bales in preparation for plowing.
8/12/68	Mowed firelanes in preparation for prescribed burning.
8/12-28/68	Mowed 12 acres for oat stubble-legume hay.
8/19/68	Plowed 11-acre field and two 1-acre strips in preparation for oats-prairie grass seedings in 1969.
8/20/68	Burned 5 acres of a 20-acre redtop-timothy seed meadow.
8/21/68	Burned 5 acres of a 20-acre timothy seed meadow.
8/28/68	Burned 5 acres of a 20-acre field of weedy sweet clover with straw bales.
9/24/68	Soybeans combined on 18 acres.
10/5/68	Wheat (2 bu/acre) seeded on 12 acres previously in soybeans; 150 lbs/acre 5-20-20 applied.
12/17/68	Lespedeza combined on 8 acres.
2/?/69	Alfalfa (1 bu), timothy (30 lbs), and lespedeza (50 lbs) seeded on 12-acre wheat seeding; 100 lbs/acre 33-0-0 applied.

Appendix B (Cont.)

3/18/69	Burned 5 acres of a 20-acre field of weedy sweet clover with straw bales. Burned 5 acres of a 20-acre redtop-timothy seed meadow. Burned 5 acres of a 20-acre timothy seed meadow. Burned 2.5 acres of a 5-acre field of weedy corn stubble seeded to prairie grass in 1968.
3/18-20/69	Oats (2 bu/acre) seeded on 17 acres (10-acre and 6-acre fields and a 1-acre strip); 100 lbs/acre of 5-20-20 applied.
3/27/69	New sign installed.
4/3, 16, & 21/69	Prairie grass broadcast by hand on 17 acres of new oats seeding.
6/?/69	Prairie grass to be seeded on a 1-acre strip of corn after last cultivation. Prairie grass to be seeded on a 1-acre bare strip after last discing.

Cyrus Mark 40-Acre Sanctuary

7/25/68	Redtop (13 acres) and timothy (2 acres) combined on 15 acres.
8/28/68	Firelanes mowed.
8/29/68	Burned 8.2 acres (3.4 acres of redtop, 2.8 acres of timothy seed meadow, 2.0 acres of waterway.
3/14/69	Burned 2 acres of weedy grass forbs.
4/3/69	New sign installed.

Cyrus Mark 17-Acre Sanctuary

7/24/68	Redtop combined on 17 acres.
8/27/68	Burned 5 acres of 17 acres of redtop seed meadow.
10/21/68	Mowed firelanes and field edges for multiflora rose control.
3/6/69	Burned 5 acres (including 3-acre old cemetery prairie not owned as a sanctuary).
3/27/69	New sign installed.

Appendix B

Stuart H. Otis 58.3-Acre Sanctuary

7/22-23/68	Redtop combined on 28 acres.
9/12/68	Mowed firelanes and 1 acre of pasture near farmstead.
3/18/69	Burned 15 acres of redtop seed meadow (7 acres), undisturbed timothy (4 acres), and mixed grass-forbs with invading shrubs (4 acres).
3/27/69	New sign installed.

Survey (I.N.H.S.) 160-Acre Sanctuary

7/1/68	Cattle (20 head) turned into 37-acre pasture.
7/1-11/68	Legumes mowed for hay on 43 acres.
7/26/68	Diverted acres mowed for weed control on 25 acres in compliance with Feed Grain Program.
8/6/68	Soil samples (24) taken on west 80 acres. Pond dam in pasture repaired, seeded, and fenced.
9/10/68	Legumes mowed for second crop of hay on 43 acres.
9/17/68	Plowed 30 acres of 43-acre hay meadow.
9/29-25/68	Limestone (127 tons), rock phosphate (14.1 tons), and potash (3.525 tons) applied to 30 acres.
9/27/68	Wheat seeded to 30 acres. Nature Conservancy one-third share to be traded for a lease in 1969 on a 20-acre stand of grass and legumes on private farmland near the main booming ground in this area.
9/25, 30, 10/8/68	Disced ditches, firelanes, and a 1-acre pilot plot in pasture. Limestone (6 tons), rock phosphate (1,200 lbs), and potash (300 lbs) applied to pasture plot.
9/30/68	Burned 4 acres of a 6-acre field of undisturbed timothy.
2/19/69	Burned 6 acres for a booming ground in the southeast portion of the sanctuary.
3/7/69	Alfalfa (6 lbs/acre), timothy 3 lbs/acre), and lespedeza (5 lbs/acre) broadcast on new 30-acre wheat seeding.

Appendix B (Cont.)

3/6/69	Burned 4 acres of 37-acre pasture (for a booming ground) and 5 acres of a 10-acre field of undisturbed grass forbs.
3/26/69	Broadcast alfalfa (5 lbs) and Ladino clover (0.5 lb) on 1-acre disced strip in pasture.
4/4, 20, 30/69	Burned old house and three old sheds, and cleaned up farmstead.
4/4/69	New sign installed.

Schooley 160-Acre Tract (possession 3/20/69 but subject to rights of the tenant until 3/1/70).

3/?/69	4 lbs/acre lespedeza, 4 lbs/acre redtop, 2 lbs/acre timothy broadcast on 20-acre oat seeding.
	2 lbs/acre timothy broadcast on 20-acre wheat seeding (10 lbs/acre red clover already broadcast on this field).
	22 acres of red clover to remain unplowed, but lightly pastured and perhaps combined for seed in 1969.
	25 acres of pasture to be lightly pastured in 1969.
	30 acres to be seeded to soybeans, followed by wheat, grass, and legumes in 1969.
	36 acres to be planted to corn in 1969.