

ILLINOIS STATE NATURAL HISTORY SURVEY
Reprint Series No. R383

Acquisition and Management of Prairie Chicken Sanctuaries in Illinois

GLEN C. SANDERSON, RONALD L. WESTEMEIER,
and WILLIAM R. EDWARDS

*Section of Wildlife Research, Illinois Natural History Survey,
Urbana 61801*

Reprinted from
The Prairie Chicken in Minnesota
W. Daniel Svedarsky and Terrance Wolfe, Editors
University of Minnesota, Crookston
28 April 1973

ACQUISITION AND MANAGEMENT OF PRAIRIE CHICKEN SANCTUARIES IN ILLINOIS¹

Glen C. Sanderson, Ronald L. Westemeier, and William R. Edwards

When the first European settlers arrived in North America, prairie fauna and flora occupied about 40,000 square miles, or 60 percent, of what is now Illinois. Today the Grand Prairie is gone, and only vestiges remain in old cemeteries, along a few railroads, little-traveled country roads, and in a few small fields too sandy or rocky to farm or impossible to drain.

Some, but not much, of the wildlife of the prairies has benefited from the 150 years of changes induced by European man--the redwinged blackbird (Agelaius phoeniceus) is one example. Others, such as the yellowthroat (Geothlypis trichas), have been less adaptable but have been able to maintain their populations at levels similar to those that probably prevailed in the virgin prairies. The bison (Bison bison) and the sharp-tailed grouse (Pedioecetes phasianellus) are examples of species that were extirpated as free-living wild species in the state. The greater prairie chicken (Tympanuchus cupido pinnatus) and the upland plover (Bartramia longicauda) are examples of prairie species that still survive in the wild but whose populations are in precarious positions. Only 8 years ago the greater prairie chicken appeared headed for extirpation, but thanks to the efforts of dedicated conservationists, it now appears to have been saved on our primary management area near Bogota in Jasper County and is responding favorably to management at a second area near Kinmundy in Marion County. The purpose of this report is to discuss the acquisition of nest sanctuaries, the current status of the greater prairie chicken, aspects of its nest ecology, and its responses to management in Illinois.

Even though the native Illinois prairies have been essentially gone since the turn of the century, some of the remaining prairie fauna has been able to survive because of the ability of animals to utilize fields of hay, pastures, and grass seed meadows--the substitute prairie. However, even the substitute prairie is rapidly shrinking in Illinois. In 1970, there were approximately 5.2 million acres of hay and pasture in Illinois as compared with 7.5 million acres only 10 years previously. During the same decade, the acreage of soybeans (Glycine max) increased from 5.0 to 6.9 million acres; the acreage of corn (Zea mays) decreased only slightly from 10.3 million acres to 10.1 million acres. Wheat (Triticum aestivum), another important crop to many species of prairie wildlife, decreased from 1.6 to 1.0 million acres during this period, and the acreage of oats (Avena sativa) declined from 1.8 to 0.6 million acres.

Redtop (Agrostis alba) grown for seed in south-central and southeastern Illinois provided the substitute prairie for prairie chickens until the 1940's (Sanderson and Edwards 1966). After World War II, the development and availability of large

¹Partially supported by Illinois Federal Aid Project W-66-R, the Illinois Department of Conservation, the U. S. Bureau of Sport Fisheries and Wildlife, and the Illinois Natural History Survey, cooperating.

Sanderson et al.

tractors to work the heavy gray prairie soils, the increased use of agricultural limestone and fertilizers, the increased demand for corn and soybeans, and a reduced demand for redtop seed quickly brought a virtual end to the growing of redtop in Illinois. With the passing of the substitute prairie, the fate of the prairie chicken was sealed. The Federal Conservation Reserve Program initiated in 1958 provided some of the essential nest habitat until the mid-1960's, when most of the contracts expired. This program slowed the precipitous decline of the prairie chicken just long enough to enable private groups to begin to acquire the sanctuaries and for the cooperative research program to collect sufficient data on nest ecology to develop habitat suitable for saving the species.

We believe that there are two basic reasons for the success in managing and saving at least one remnant flock of native prairie chickens in Illinois. The first is the raising of money and the purchase of land for sanctuaries (Sanderson and Edwards 1966). We believe that these sanctuaries will long be monuments to the men and organizations whose names they bear. Second, but equally significant, are the results of the studies of the nest ecology, behavior, and population dynamics of the prairie chicken (Westemeier 1973).

For many years biologists of the Illinois Natural History Survey have studied the prairie chicken (Forbes 1912, Yeatter 1943, 1963, Westemeier 1973). Our present study was initiated in the summer of 1962 as a cooperative research project of the Illinois Department of Conservation, the U. S. Bureau of Sport Fisheries and Wildlife, and the Natural History Survey.

During the 1950's private individuals and groups became interested in the plight of the prairie chicken in Illinois. And, as reported by Sanderson and Edwards (1966:329): "At a meeting of the Illinois Natural Resource Council in the fall of 1958 the necessity of forming an organization to preserve Illinois' native prairie chickens was expressed. A year later . . . the Prairie Chicken Foundation of Illinois (PCFI) became the first group, public or private, in this state, organized with the single objective 'to preserve and perpetuate the prairie chicken.' " In the fall of 1965, the Illinois Chapter-The Nature Conservancy formed a special Prairie Grouse Committee (PGC) to raise additional funds to purchase land for sanctuaries for the prairie chicken.

POPULATION STATUS OF THE PRAIRIE CHICKEN IN ILLINOIS

Prior to the arrival of the white man, greater prairie chickens were widely distributed over about 60 percent of the state--the tallgrass prairies (Sanderson and Edwards 1966:326). As the forests were cleared, prairie chickens extended their range into these areas, and as the prairies were broken and planted to crops, prairie chickens increased in abundance (Yeatter 1943:378) and continued to do so until the 1860's. Since that date, as farming has increased in intensity, the prairie chicken population has suffered a fairly continuous decline even though there has been a continuous closed season on the hunting of prairie chickens in the state since 1933.

Beginning with the spring of 1963, biologists of the Natural History Survey, with the assistance of biologists from the Illinois Department of Conservation, have attempted to determine the number of prairie chicken cocks on booming grounds in Illinois each year (Table 1). Usually several counts are made on each booming

Table 1. Sanctuary acquisition and minimum counts of prairie chicken cocks in Illinois, 1963-73.

Year	Acres of Sanctuaries Owned 1 Year or Longer by March 1		NUMBER OF COCKS					
	Jasper County	Marion County	Jasper County	Marion County ^a	Nine Unmanaged Census Areas ^b	All Unmanaged Areas Censused	All Illinois Areas Censused	Number of Areas Censused
1963	0	0	78	12 ^c	232 ^d	232 ^d	310 ^d	10
1964	77	0	65	12	162	259	324	13
1965	77	0	42	4	101	199	241	15
1966	157	0	41	7	63	141	182	19
1967	394	0	43	16	52	124	177	22
1968	492.3	0	37	16	33	112	149	20
1969	687.3	160	51	14	23	89	140	15
1970	687.3	160	108	13	33	81	189	12
1971	687.3	420	159	6	30	61	222	9
1972	850.8	420	196	12	28	65	261	9 ^e
1973	850.8	460	203	22	28	64	267	14 ^e

^a Only those cocks in the immediate area where the Survey and Butler sanctuaries were later located.

^b The same nine areas were censused each year. They include one area in Marion County that was eventually managed (Lacey-Loy tract) but do not include those in Jasper County (the main managed area).

^c The count was partially reported by a farmer. The birds in this flock are not included in the nine unmanaged census areas.

^d Cocks and hens, but mostly cocks.

^e Birds were present on only eight areas.

Sanderson et al.

ground each year, and the maximum number of cocks counted on each area on one morning is considered the minimum count for that area. When several booming grounds are located in one general area, the counts are made as rapidly as possible, without flushing the birds, to avoid counting the same cocks on different booming grounds.

The counts made on the research area in Jasper County are made with the assistance of observers in blinds located on many of the booming grounds. Counts are made on many days during the booming season, and the time of each maximum count on each ground is recorded to avoid duplication. Biologists make counts on the booming grounds that do not have blinds on them while the observers are counting from the blinds.

In 1963, censuses were begun on nine privately owned areas in order to compare population trends on these unmanaged areas with population trends on the managed areas in Jasper County (Table 1). By 1973, only two of the nine original areas still had prairie chickens. One of these two areas is in Marion County, where the PGC began to acquire and manage sanctuaries in 1967. The management program in Marion County became sufficiently well established so that this area was classified as a management area in 1971.

Also shown in Table 1 are the numbers of cocks counted each spring on from nine to twenty-two census areas from 1963 through 1973. We began with ten census areas, but each year new areas were added as remnant flocks were located. Usually an area was no longer censused when no birds were located during two consecutive booming seasons. Thus, the figures in Table 1 are not comparable from one year to the next and do not represent the entire population of prairie chicken cocks in Illinois, but they indicate the minimum number of cocks present in an area each year. Hens usually visit the booming grounds as individuals or in small groups, so it is not possible to get complete counts of the hens. When we estimate the total numbers of prairie chickens, we assume one hen for each cock, an assumption that may not be valid.

Data in Table 1 document the dramatic decline in the prairie chicken population on the nine unmanaged areas--from 232 prairie chickens, most of which were cocks, in 1963 to 28 cocks on only two of the nine areas in 1973. The data show the equally dramatic population changes on the Bogota area in Jasper County and indicate the relationship of these changes to the acquisition of land for sanctuaries in the Bogota area.

From 78 cocks in 1963, the population declined to a low of 37 cocks in 1968. The first land was acquired for a prairie chicken sanctuary near Bogota on May 15, 1962 (Table 2). Most of the land acquired for prairie chicken sanctuaries was in soybeans, corn, or wheat when purchased, and it has usually required at least two to three years to develop good nest cover on the sanctuaries. As indicated in Table 1, less than 400 acres had been owned and managed as prairie chicken sanctuaries in this area for a year or longer by March 1, 1967, at which time the breeding flock responsible for the population in 1968 was present. The land in sanctuaries owned for one year or longer by March 1 had increased to 850.8 acres by 1972. The prairie chicken cocks increased from 37 in 1968 to 196 in 1972--an increase of 430 percent!

Table 2. Summary of land acquisition for prairie chickens in Illinois.

Name of Sanctuary	Date Obtained	Acreage	Total Cost of Sanctuary	Bought or Leased by
JASPER COUNTY				
Ralph E. Yeatter	5-15-62	77	\$17,325	PCFI ^a
Max McGraw	2-17-64	20	5,500	PCFI ^a
Donnelley Brothers (West)	7-64	60	18,000	PCFI ^a
Donnelley Brothers (East)	Summer 67	60	31,500	PCFI ^b
Jamerson McCormack	11-1-65	<u>80</u>	<u>25,000</u>	PCFI ^{b,c}
Subtotal		297	\$97,325	
Cyrus Mark	10-18-65	17	\$ 6,800	PGC ^d
Mr. & Mrs. Chauncey McCormick	3-1-66	140	60,000	PGC
Cyrus Mark	4-18-66	40	17,400	PGC ^d
Stuart H. Otis	7-1-66	58.3	15,250	PGC ^d
Marshall Field III	3-1-68	135	63,750	PGC ^d
Fuson Farm	8-29-70	163.5	47,999 ^e	PGC
Specht Farm	5-5-72	<u>110</u>	<u>27,500</u>	PGC
Subtotal		663.8	\$238,699	
Subtotal (Jasper County)		960.8	\$336,024	
MARION COUNTY				
Illinois Natural History Survey	4-17-67	160	\$56,500	PGC ^d
Burridge D. Butler	3-20-69	160	45,600	PGC
Louis J. Lacey	5-7-69	100 ^f	42,000	PGC
Loy Tract	5-28-71	<u>40</u>	<u>20,000</u>	PGC
Subtotal (Marion County)		<u>460</u>	<u>\$164,100</u>	
TOTAL		1,420.8	\$500,124 ^g	

^a The Prairie Chicken Foundation of Illinois (PCFI) gave this land to the Illinois Department of Conservation on March 29, 1973.

^b The PCFI consigned this land, and the payments due, to the Prairie Grouse Committee (PGC) in 1972.

^c PGC owns 40 acres and leases 40 acres.

^d Purchased by the State from the PGC in June 1970 for \$165,500.

^e Cost after subtracting sale price (\$10,001) of land (11.5 acres) and buildings sold on May 2, 1972.

^f PGC owns 20 acres and leases 80 acres.

^g Not including costs of land improvement.

Land acquisition in Marion County was begun much later than in Jasper County (Table 2). The flock between Kinmundy and Forbes Park, associated with the general area where the Survey and Butler sanctuaries were purchased in 1967 and 1969, respectively, declined from 12 cocks in 1963 and 1964 to only four cocks in 1965. However, this population increased to 16 cocks in 1967 and 1968, before there was any good nest cover on the sanctuaries. The Kinmundy-Forbes population again declined to only six cocks in 1971, but increased to 12 cocks in 1972 and to 22 cocks in 1973. We are encouraged by these recent increases because there are now more cocks in this area than in any year since counts were begun in 1963. Also, the first sanctuary acquired in this area, the 160-acre Illinois Natural History Survey sanctuary, was not within the traditional range of the Kinmundy-Forbes Park flock. In addition, use of this sanctuary by prairie chickens has been low because of roving packs of free-ranging dogs. Thus, a longer period was required to obtain good usage of this sanctuary than on most of the other sanctuaries. Only by the 1972 breeding season did we have a substantial acreage of good nest cover on the sanctuary system in Marion County.

The data for the Marion County area demonstrates the low levels to which prairie chickens can decline (four cocks) and still survive if the habitat is improved in time. So long as native prairie chickens are present on native range, it is probably never too late to save them from extinction if the proper management measures can be made quickly enough.

The responses of the prairie chickens to the management program on the Bogota area are extremely encouraging. They indicate that what we know about managing the chicken is sufficient to cause dramatic increases in the population. We believe that as we obtain additional information on the needs of this species, we can increase the population level above the approximately 400 birds (including hens) now present on the 960.8 acres of sanctuaries scattered over an area of approximately ten square miles (Fig. 1). In 1972, except for two minor booming grounds involving only one or two cocks each, all booming was located on or within 200 yards of the sanctuaries. Virtually all the nesting is now on the sanctuaries as there is little other safe nest cover in the area. The traditional central core of the Bogota area contained the phenomenal density of 135 cocks in 1972--a half-section area containing the Yeatter, Field, and McGraw sanctuaries (232 acres).

We believe that the interspersed corn, wheat, and soybean fields is important to our sanctuary system. We do not believe that we would have as many prairie chickens on 960.8 acres in one block as are now present on the scattered tracts if the birds had to obtain all their life requirements within the boundaries of a 960.8-acre sanctuary.

LAND ACQUISITION

Because funds were extremely limited for land acquisition, it was our policy to purchase only tracts that were being used by chickens or were within one mile of such areas and that had a history of use by chickens. Thus, our opportunities for land acquisition were severely restricted but even with these limitations, until 1970 we usually found as much or more suitable land than we had funds to purchase, even with minimum down payments and purchase contracts.

It was also the policy to purchase land in scattered tracts, preferably areas of from 40 to 160 acres, instead of attempting to buy land in one block for a sanctuary. We believe, given limited funds for land acquisition, that we can provide for more prairie chickens with a sanctuary system in scattered tracts than we can with the same amount of land in one block. Thus, our plan is similar to the "ecological pattern" proposed by Hamerstrom et al. (1957:59-63). With the present farming practices in this section of Illinois (primarily soybeans--40 percent, corn--26 percent, and wheat--10 percent, in 1972), the chickens use the intervening farmland for booming, feeding, rearing broods, roosting, and perhaps other activities.

Prairie Chicken Foundation of Illinois

The PCFI purchased five sanctuaries totaling 297 acres at a cost of \$97,325 between 1962 and 1967 (Table 2). All land acquired by the PCFI, except for the east 60 acres of the Donnelley Brothers Prairie Chicken Sanctuary (Fig. 1), was described by Sanderson and Edwards (1966:329-330).

Donnelley Brothers Prairie Chicken Sanctuary--The east 60 acres of the Donnelley sanctuary was purchased in the summer of 1967 for \$525 per acre (total cost = \$31,500). Terms of the purchase were \$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; the rate of interest was six percent.

Prairie Grouse Committee

The PGC has acquired by purchase or lease 11 sanctuaries totaling 1,123.8 acres at a cost of \$402,799 (Table 2, Figs. 1,2). The first three sanctuaries acquired by the PGC were described by Sanderson and Edwards (1966:331).

The Stuart H. Otis Prairie Chicken Sanctuary--This sanctuary was purchased on July 1, 1966. The initial purchase was 60 acres, but the buildings and a 1.7-acre lot were sold on April 7, 1967. A lot in Newton, Illinois, was taken as partial payment for the buildings and lot on the Otis sanctuary. The lot in Newton was sold to a real estate dealer. The farm house on the Mr. and Mrs. Chauncey McCormick sanctuary was sold to the same dealer, who moved the house to the lot in Newton. After all fees for selling the buildings and the two lots were paid, the Stuart H. Otis sanctuary of 58.3 acres cost \$266.14 per acre (total cost = \$15,250).

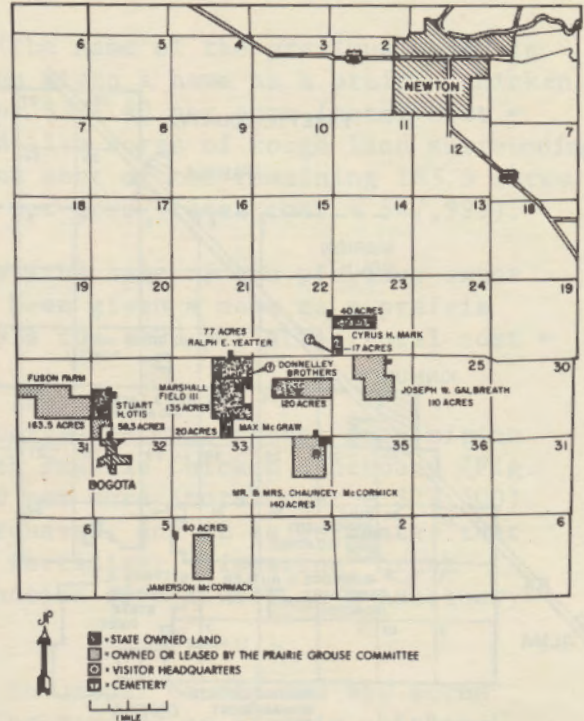


Fig. 1. Distribution of prairie chicken sanctuaries in Jasper County, Illinois.

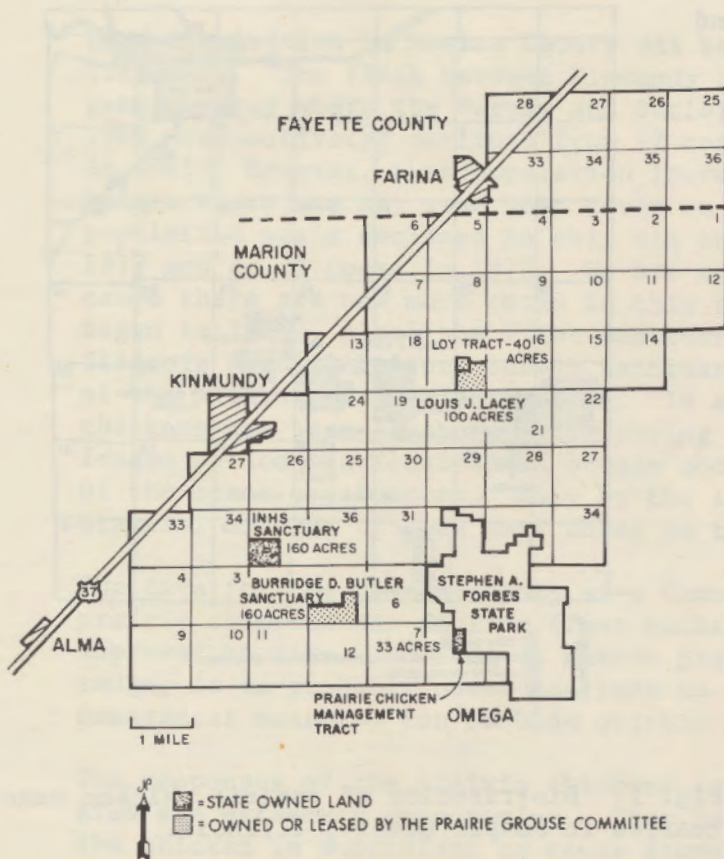


Fig. 2. Distribution of prairie chicken sanctuaries in Marion County, Illinois.

than one occupied dwelling could be on each property at any one time. The deed for the 25 acres sold from the Field sanctuary also specified that the owner of the 25 acres must maintain all line fences at his expense.

The Burridge D. Butler Prairie Chicken Sanctuary--This 160-acre sanctuary (Fig. 2) was purchased on March 20, 1969 on a five-year purchase contract at a cost of \$285 per acre (total cost = \$45,600) with six percent interest on the unpaid balance of \$34,200.

The Louis J. Lacey Prairie Chicken Sanctuary--This 100-acre sanctuary was obtained on May 7, 1969. The previous owner of this tract indicated that she was interested in selling the land only if it were used for a prairie chicken sanctuary; she was asking \$420 per acre for the land. In accordance with this information, the proposal was made that she donate 20 acres of the land to the PGC (The Nature Conservancy) and that the remaining 80 acres be purchased at \$420 per acre. If this proposal was accepted, the previous owner was to be given the opportunity to name the sanctuary. As an alternative, she was offered \$400 per acre for the land with no privilege to name the sanctuary. She accepted the first alternative, and a single donor purchased the remaining 80 acres and leased it to the PGC for management as a prairie chicken sanctuary. At some future date the 80 acres may be donated to the PGC.

The Illinois Natural History Survey Prairie Chicken Sanctuary--This 160-acre sanctuary (Fig. 2) was purchased by a group of donors on April 17, 1967 for \$280 per acre (total cost = \$44,800). The PGC improved the land by fertilizing and controlling erosion and planted it to nest cover for the prairie chicken, and in the fall of 1969 the land was donated to the PGC (The Nature Conservancy).

The Marshall Field III Prairie Chicken Sanctuary--This 135-acre sanctuary (Fig. 1) was purchased as a 160-acre tract with buildings on March 1, 1968 for a total cost of \$85,000. The entire purchase price was borrowed from a bank in Urbana, Illinois, by the PGC with The Nature Conservancy as cosignatory of the note. The rate of interest was 6.5 percent. After the buildings and 25 acres were sold on May 16, 1968, the 135 acres remaining in the sanctuary cost \$472.22 per acre (total cost = \$63,730).

In the case of the lot and house sold from the Field sanctuary and from the Fuson Farm (described on page 67), each deed specified that the property was not to be subdivided and that no more

The Fuson Farm (Fig. 1)--This 175-acre tract (the name of the previous owner is used to identify this property; it has not been given a name as a prairie chicken sanctuary) was purchased on August 29, 1970 for \$331.43 per acre (total cost = \$58,000). On May 2, 1972, the buildings and 11.5 acres of rough land surrounding the buildings were sold for \$10,001. Thus, the cost of the remaining 163.5 acres for the prairie chicken sanctuary was \$293.57 per acre (total cost = \$47,999).

The Loy Tract (Fig. 2)--This 40-acre sanctuary (the name of the previous owner is used to identify this property; it has not been given a name as a prairie chicken sanctuary) was purchased on May 28, 1971 for \$500 per acre (total cost = \$20,000).

The Joseph W. Galbreath Prairie Chicken Sanctuary--The most recent acquisition by the PGC was the 110-acre Joseph W. Galbreath Prairie Chicken Sanctuary (Fig. 1) purchased on May 5, 1972, at a cost of \$250 per acre (total cost = \$27,500). This piece of land was badly run down when purchased, and it is estimated that it will cost at least \$100 per acre for seed, fertilizer, limestone, brush control, and erosion control before it can function effectively as a sanctuary for prairie chickens.

General--As indicated in Table 2, 960.8 acres in Jasper County and 460 acres in Marion County--1,420.8 total acres--are being managed as prairie chicken sanctuaries. These lands had an initial purchase price of \$500,124; however, many thousands of dollars over and above the purchase price have been spent to increase the fertility levels of some tracts, to control erosion, and to establish grass nest cover. A total of 120 of these acres are being leased on an annual basis, with the prospect that they may eventually be donated to the PGC (The Nature Conservancy); 940.8 acres are paid for; and 360 acres are being bought on purchase contracts, with a total of \$25,340 as of April 1, 1973 still owed on them--\$6,500 on the east 60 acres of the Donnelley sanctuary, \$12,000 on the Mr. and Mrs. Chauncey McCormick sanctuary, and \$6,840 on the Burrige D. Butler sanctuary.

State of Illinois

Since 1967, the Natural History Survey has maintained 33 acres on Forbes State Park (Fig. 2) in redtop and timothy (Phleum pratense) to provide nest cover for the prairie chicken. In April 1964 the 80-acre tract just west of the 33 acres on Forbes was plowed and at least three prairie chicken nests were plowed under. When plowed, the 80 acres had been in the Federal Conservation Reserve Program and had a cover of fescue (Festuca sp.), timothy, dewberries (Rubus flagellaris), and various weeds. Apparently, one hen whose nest was destroyed on this tract attempted to re-nest on Forbes Park, but her second nest was destroyed when the Illinois Department of Conservation established a food patch for wildlife on the area. Although no chickens are known to have nested on the area since 1964, a booming ground is located (1973) only about two miles from the tract, and in 1972 quail hunters reported one or more chickens on the area. As the Marion County flocks increase in abundance, we believe that this area will be used by chickens but that it is desirable to have at least one additional sanctuary between this area on Forbes Park and the Butler sanctuary located 1.5 miles to the west.

Sanderson et al.

In June of 1970 the Illinois Department of Conservation, through the Nature Preserves Commission, purchased from The Nature Conservancy five prairie chicken sanctuaries totaling 410.3 acres. These were the 17-acre and 40-acre Cyrus Mark sanctuaries, the 58.3-acre Otis sanctuary, and the 135-acre Field sanctuary near Bogota, Jasper County (Fig. 1), and the 160-acre Natural History Survey sanctuary in Marion County (Fig. 2). These tracts were sold to the state at the purchase price plus capital improvements (a figure somewhat lower than the actual market value), with the written understanding between The Nature Conservancy and the Illinois Department of Conservation that the money received for the land would be spent by The Nature Conservancy to acquire additional land for sanctuaries for prairie chickens. The total sale price was \$165,500.

On January 24, 1972 these five tracts of land were officially dedicated as a nature preserve. This official act of dedication means that, under Illinois law, the highest and best use of these properties is as a prairie chicken sanctuary. Uses other than as specified in the Master Plan accepted by the Nature Preserves Commission are not permitted on these properties unless approved in writing by the Governor, the Director of the Illinois Department of Conservation, and by the Nature Preserves Commission. Thus, these areas have the best protection possible under state law to prevent them being used for roads, power lines, pipelines, reservoirs, and similar uses. Under terms of the management plan, "Responsibility for habitat development and management during the acquisition phase of the development of the system will be vested in the State Natural History Survey." Thus, the Natural History Survey at present has the management responsibility for all prairie chicken sanctuaries in Illinois.

At a meeting of the Board of Directors of the PCFI held on April 16, 1971, the following motion was passed unanimously: "As of January 1, 1972, the land which is fully paid for will be given to the State of Illinois, and the remaining assets and liabilities will be transferred to The Nature Conservancy." On March 29, 1973, the deed was signed transferring the 77-acre Yeatter sanctuary, the 20-acre Max McGraw sanctuary, and the west 60 acres of the Donnelley Brothers sanctuary to the State of Illinois.

The other assets and the responsibility for the 80-acre Jamerson McCormack sanctuary and the east half of the Donnelley Brothers sanctuary were given to the PGC between October 27, 1971 and June 28, 1972. As soon as the final paper work has been accomplished (probably before July 1, 1973), the PCFI will be officially disbanded.

The Natural History Survey, a state-supported research agency in the Illinois Department of Registration and Education, will continue to work with both the State of Illinois and the PGC in the acquisition of additional land for the prairie chicken, will continue to manage all prairie chicken sanctuaries for the immediate future, and will continue to conduct research on the prairie chicken on these sanctuaries.

MANAGEMENT OF THE SANCTUARIES FOR PRAIRIE CHICKENS

In Illinois, the limiting factor for the remaining populations of prairie chickens is enough suitable grassy vegetation for nesting. Thus, providing attractive and safe nest cover is the primary objective of the sanctuary system

for prairie chickens in our state. As mentioned earlier, crops such as corn, wheat, soybeans, and oats on the intervening farmland have an important role in providing for the needs of prairie chickens, and hence we must consider the presence of agricultural crops on adjacent private farmland as we develop the management plans for the sanctuaries.

The single most important finding of our continuing study of the ecology of prairie chickens has been that the age of a seeding, or the interval since a field was last disturbed, is very important in the acceptance of that field by hens for nesting (Westemeier 1973). In general, grasses and grass-legume mixtures are most readily accepted the second year after seeding and become progressively less acceptable thereafter. In the absence of some form of management, grasslands are relatively unacceptable for nesting after the fourth growing season. We have also found it highly desirable to provide bare, open areas five to ten acres in size for booming grounds adjacent to prime nest cover.

In order to provide attractive nest cover on our sanctuaries, it is necessary to maintain a program of annual management to establish new seedings, rejuvenate old ones, and provide booming grounds. Thus, it is necessary to treat a substantial proportion of our acreage in some manner each year. The key to our program, which we feel is ecologically sound and economically practical, is a combination of sharecropping and prescribed burning (Westemeier 1973).

Sharecropping

Redtop--Redtop is the basic species we use on the sanctuaries. This species appears to be most attractive to nesting hens when harvested by combine for seed; however, we occasionally find good densities of nests in undisturbed thin stands that contain a heavy admixture of dewberries and weedy forbs such as yarrow (Achillea millefolium). Harvesting redtop with a combine reduces the redtop from a height of about 28 inches to a 10- to 14-inch open stubble that withstands winter weather and is erect for the next nest season. Such stubble permits visibility for prairie chickens and provides sufficient concealment for nesting, and the wheel tracks of a self-propelled combine serve as travel lanes. The stems, seed heads, and leaves provide the necessary duff for nest material. Combining creates a desirable patchwork of openings in an otherwise too-thick stand of redtop by leaving wads of chaff and stems throughout the stubble. The openings caused by these wads of duff are usually one to two square feet and are often found within one yard of nest sites (Westemeier 1973).

The accumulation of residual cover is desirable for a two- to four-year period after an initial seeding of redtop, but the data (Westemeier 1973) indicates that it is most attractive to nesting prairie chicken hens the second growing season after seeding and becomes increasingly less attractive thereafter. We attribute this decline in attractiveness to the buildup of dense stands of matted dead vegetation that promote cold wet soil conditions; impede movements and decrease the availability of food for prairie chickens, especially young chicks; delay the phenology of new plant growth; and otherwise alter the ecology of grass stands as they grow older. Old sods can be fall-plowed, fertilized, and seeded to soybeans for one or two years--using a herbicide if necessary--and then reseeded to a redtop-timothy-legume mixture, using a small grain, prefer-

Sanderson et al.

ably oats, as a nurse crop. This entire renovation is accomplished under sharecropping agreements with local farmers. Soybean stubble provides an excellent site for booming grounds. New seedings of a combination of small grain, grass, and legumes also provide suitable sites for booming and provide excellent brood cover. Thus, about 20 percent of each sanctuary is scheduled for planting to row crops and small grains each year.

It is neither feasible nor necessary to leave the landowner's share of crops in the field for winter food as is usually done on areas managed for upland wildlife and waterfowl. Winter food has not been a problem for prairie chickens in Illinois. It is desirable that the landowner's share of crops be harvested and that any income be used to pay for other management practices on the sanctuaries, including the payment of local taxes. Long-term treatments with limestone and rock phosphate are costly but are essential in the development and maintenance of quality nest cover for prairie chickens. Fence building, selective basal spraying, mowing for weed and brush control, native prairie restoration, maintenance of firelanes, and prescribed burning are other management activities that involve some expense but must be done annually. Income from grass and legume seed, grazing, and haying (crops in which a permittee has no investment) help minimize the cost of management on the sanctuaries.

Redtop seed has been harvested on a 50:50 basis by local farmers. Income from redtop seed typically exceeds \$20.00 per acre. In 1972, the income from this source went as high as \$60.00 per acre (to be divided 50:50 between landowner and sharecropper). Fields believed to be capable of producing less than \$8.00 per acre of seed are scheduled for rejuvenation and are not harvested. Sharecroppers are guaranteed a minimum income of \$8.00 per acre to cover their expenses for combining, hauling, and marketing.

Timothy--On several occasions timothy was even more attractive to nesting hens than was redtop. The 14- to 18-inch stubble that results from a seed harvest has been exceptionally attractive at Bogota. The main difficulty with timothy is the low commercial value of its seed, making it difficult to interest local farmers in timothy management.

Undisturbed timothy has generally been poor for nesting but good for roosting, especially where old sods are involved. The regrowth of timothy after a late-June mowing for hay also provides about the right height and density of cover for nesting the next spring. However, mowing even as late as June 20 to July 1 may result in the destruction of late nests and is especially dangerous to chicks. Timothy mowed later than July 1 is almost worthless as hay, and in a dry summer the regrowth is not adequate to provide the residual cover so necessary for attracting nesting hens the next spring. The gradual soil depletion that results from prolonged annual haying is also a problem.

Legumes--Even though we have not found high densities of nests in legumes (Westemeier, unpublished data), farmers have reported, for example, five nests in seven acres of red clover (Trifolium pratense), twelve nests in 40 acres of red clover, and 13 nests in 36 acres of red clover-alfalfa (Medicago sativa), all of which were destroyed by plowing or mowing. In areas with declining populations, prairie chicken hens generally have no alternative but to nest in a wheat stubble-legume type of cover. Thus, some credence must be given to such

reports. Our experience has shown that when both a legume field and a field dominated by grasses are available near a booming ground, the grasses are preferred.

We usually seed legumes such as red clover, alsike clover (Trifolium hybridum), Korean lespedeza (Lespedeza stipulacea), and alfalfa at a rate of one pound per acre of each legume along with a new grass seeding. A legume admixture is desirable in a new grass seeding because clumps of clover are often found at nest sites, as are clumps of dewberries, goldenrod (Solidago sp.), yarrow, and similar plants. Also, legumes help maintain the grass through nitrification of the soil, and they increase the number and kinds of insects that are essential to growing chicks. Legumes disappear by about the third year after seeding, but they reappear after a March burn and thus help rejuvenate old sods.

Native Vegetation--Although prairie chickens have accepted various exotic grasses, we would prefer to emphasize the establishment and maintenance of native grasses for the management of prairie chickens. Seed for five species of native grass, including big bluestem (Andropogon gerardi), little bluestem (Andropogon scoparius), switchgrass (Panicum virgatum), side-oats grama (Bouteloua curtipendula), and Indian grass (Sorghastrum nutans) is available and has been purchased from dealers in Nebraska. We have tried several approaches to establish these grasses and various prairie forbs on the sanctuaries. Disking a plowed field, or a soybean stubble, three or four times in spring and early summer appears to be an excellent means of minimizing weed competition prior to a seeding of prairie grasses. Three species--big bluestem, Indian grass, and switchgrass--are responding well to this approach. Because of the height and rankness of these three species, haying, grazing, or prescribed burning appears essential for these grasses on the sanctuaries. If left undisturbed, these grasses, especially big bluestem, develop impenetrable stands of cane-like stems and residual cover. We have not found prairie chicken nests in this rank vegetation, and it is unlikely that young broods make use of it. By contrast, an encouraging amount of nesting and of use by broods has been observed in the more open stands of switchgrass on the Yeatter sanctuary during recent years (Westemeier, unpublished data). On this sanctuary, the rankness has been controlled by annual combining for seed (redtop and timothy), by mowing for weed control, and by burning or haying.

The advantage of working with native grasses is that they mature late and can be mowed late (late July or early August) for hay with no danger to nests and little danger to broods. Also, the subsequent regrowth is sufficient to produce suitable nest cover for the next spring. Unlike timothy or other cold season domestic grasses and legumes that are dry, unpalatable, and lacking in nutritive content after mid-July, native grasses are green, palatable, and nutritious at this time. Applications of limestone, rock phosphate, and potash should precede a prairie seeding because (1) basic fertility is typically low in the soils of this area, (2) haying is a soil-depleting form of management, (3) the best time to apply minerals to the soil is before seeding, and (4) once satisfactory stands of prairie grass are established on the sanctuaries they should not be plowed, considering the difficulty and expense involved in their establishment.

Seeding Mixtures--One mixture (per acre) that has shown promise for nesting prairie chickens in Illinois is four to six pounds of redtop, one pound of timothy, and one pound each of red clover, Korean lespedeza, and alsike clover. One pound of alfalfa per acre is added if the soil pH is suitable. The timothy

Sanderson et al.

and legumes help diversify the cover, but the stand is composed of enough redtop to make management (combining of seed) practical. For still greater diversity, one pound of switchgrass has been added to this mixture in several recent seedings. One important advantage of seeding switchgrass is that a sharecropper can easily handle, mix, and broadcast this seed along with the other types of seed mentioned, using oats as a nurse crop. The seed for big bluestem, little bluestem, Indian grass, and side-oats grama comes from a seed dealer as a chaffy, low-purity mass that is difficult to handle; the seeding of these native grasses has been limited to broadcasting by hand by project personnel.

All five prairie grasses may be added to a mixture containing redtop, timothy, and legumes if the subsequent management is to consist of haying or grazing, or both. The easily established redtop and timothy help control competition by Eurasian weeds and provide fuel for prescribed burning that can dramatically stimulate the development of prairie grasses. This approach was particularly successful on the McCormick Sanctuary.

Some success has been achieved with brome (Bromus inermis) and orchard grass (Dactylis glomerata) as nest cover, but, like timothy, they have limitations where haying is used as a form of management. Brome and orchard grass are difficult to combine and to seed, and they have little to offer us in the management of our sanctuaries.

Prescribed Burning

Westemeier (1973) discussed prescribed burning as a management tool for prairie chicken sanctuaries. Thus, in this report we only briefly summarize the relationships between prescribed burning and management of the sanctuaries for prairie chickens.

Redtop sods can be rejuvenated by prescribed burning in either August or March. Seed production is excellent the first year after a light burn; however, good densities of nests are not attained until after one full growing season (during the second growing season) after a burn. Timothy was especially attractive as nest cover during the second full growing season after a burn in March or August. In sods over two years of age that were composed primarily of redtop and timothy and fields in which prairie restoration is being attempted, no nests were found during the first nest season after a March burn and only a few nests have been found during the first nest season after an August burn. Excellent densities have been found the second nest season (one full growing season) after prescribed burning in either March or August. Limited nesting is possible during the first nest season after an August burn, in contrast to no nesting after a March burn.

The good densities of nests we find two or three years after seeding or after rejuvenation of sod usually occur when the fields are within one-quarter mile of an active booming ground. When new seedings or rejuvenated sods were one-half mile or more from active booming grounds, three or four years were often required for the hens to make extensive use of them for nesting. Thus, by the time hens would be making good use of seedings a half mile or more from active booming grounds, renovation of about 20 percent of the total area of such seedings should be initiated. The pattern of use just described provides strong support for our recommendation that an attractive booming ground of

five to ten acres be provided on or near each nest sanctuary.

The conclusion from our observations is that one full growing season after a prescribed burn in either March or August, hens apparently find the postburn vegetation more attractive than similar but unburned cover types. Nesting hens also appear to be more attracted to the vegetation that develops after an August burn than to the vegetative growth after a burn made in March. However, because prairie restoration is also a prime objective in the development of a sanctuary system, burning during March should continue. Burning in March appears better for encouraging the development of native prairie vegetation and for stimulating legumes, but burning in August appears better for such domestic sods as redbud and timothy, which have matured and are essentially dormant in August. The rule of thumb here seems to be to burn cool season grasses in late summer (warm season) and warm season grasses in late winter (cool season).

Prescribed burning, haying and light grazing, appear essential to maintain native grasses such as big bluestem, little bluestem, Indian grass, switchgrass, and side-oats grama in an attractive condition for nesting prairie chicken hens in Illinois.

Other Management Factors

We continue to find (Westemeier, unpublished data) most prairie chicken nests within about 25 yards of sharp edges or breaks in the nest cover--such as plowed, disked, or mowed edges. Thus, it is important that the size of fields be held to 20, 10, or even 5 acres to provide a maximum of edge.

During a typical wet spring in southern Illinois, about 95 percent of the nests are located on well-drained sites. Drainage is therefore a factor to consider when acquiring new land, and it is important to promote good surface drainage on sanctuaries. However, a few wet spots may provide desirable brood cover and diversity of habitat during midsummer, particularly during dry years.

Management of Booming Grounds

We find that the requirements for booming grounds may be summarized as five- to ten-acre well-drained tracts (the large size is preferred) of bare ground or very low, sparse vegetation, available from late summer through the next spring.

Sharecropping, with local farmers, is an effective method for producing suitable booming grounds. The basic rotation we use is soybeans followed by wheat or oats and red clover and then back to soybeans. The red clover is clipped for hay in late summer the year it is seeded and again for hay and for seed the second year.

New grass seedings, recently burned sods, close mowing, and heavy grazing have produced suitable booming grounds. We believe that the goal of management should be the maintenance of one booming ground for each 40 to 60 acres of sanctuary land. The optimum spacing between booming grounds on our sanctuaries is about 600 yards (Westemeier, unpublished data). Also, the booming ground should be surrounded by attractive and safe nest cover, because we have noted that 85 percent of the 319 nests located at Bogota (Westemeier, unpublished data) were

Sanderson et al.

between 100 and 450 yards from the nearest booming ground. Thus, we consider it important to establish one or more booming grounds on each sanctuary--even a 40-acre sanctuary should have a centrally located tract managed as a booming ground, although 60 to 80 acres are more feasible units for employing this concept.

FUTURE NEEDS FOR THE SANCTUARY SYSTEM IN ILLINOIS

On the basis of the remarkable recovery of the prairie chicken flock at Bogota, we are now confident that the species can be saved and perpetuated in Illinois using a system of properly managed sanctuaries. The question may now be logically asked: What are the future needs for the prairie chicken sanctuary system in Illinois? How many sanctuaries should be acquired, how large need they be, where should they be located? There are no simple answers to these questions. Some of the answers will depend on how future changes in land use and agriculture affect the ecology of the prairie chicken. But more important, what are our objectives for the species?

Our original objective was to perpetuate two remnant flocks, each consisting of 500 native prairie chickens. We believe we have saved the flock at Bogota and are encouraged by the recent results in Marion County (Table 1). The acquisition of as few as 1,000 additional acres in Marion County should suffice to assure perpetuation of that flock. But perpetuating two remnant flocks in Illinois is now a minimum objective.

During the past ten years, it has become increasingly clear that our remnant prairie chicken flocks represent a valuable resource. In 1973, over 400 persons spent a morning in the blinds at Bogota watching and listening to the sunrise serenade. A morning in the blind represents both a unique form of outdoor recreation and a valuable learning experience. We know of no better place than the booming ground to demonstrate territoriality, dominance, and breeding behavior. Our findings on the ecology and sociology of nest placement are classic (Westemeier, unpublished data). In 1972, 186 students representing 11 schools, colleges, and universities visited the sanctuaries. In 1973, 247 students representing 15 schools, colleges, and universities spent a morning in the blinds. The numbers of visitors and students who have come to Bogota represent only a small fraction of those who would come if adequate facilities were available. Even limited hunting, possibly with primitive weapons, is not out of the question if the Illinois Department of Conservation is willing to fund prairie chicken management on a scale comparable to the funding of waterfowl management or game farms.

It is our view that the prairie chicken sanctuary system should ultimately be expanded to permit large-scale public visitation and serve as an outdoor laboratory for all teachers and students who could make use of it. The potential demand for such use far exceeds the possibilities of the current projection for the sanctuary system. However, expanding the system to provide large-scale use by the public and students goes beyond the objectives of such groups as the PGC and the PCFI, who have funded most of the acquisition to date. Although we can help evaluate the potential role of the prairie chicken sanctuary system for recreation and education, it is the Department of Conservation, preferably in conjunction with one or more of our universities, that must ultimately plan

for and support such use. For now, however, large-scale public use will be regarded as a future possibility, and we will continue to concern ourselves with the needs of the prairie chicken sanctuary system in terms of assuring preservation of at least two remnant flocks, our original objective.

As indicated earlier in this paper, a shift in the agriculture of southern Illinois from redtop to increasing acreages of grains, particularly corn and soybeans, was responsible for the critical plight of the prairie chicken. The recent price of \$7.00 per bushel for soybeans and the advent of the soyburger must be regarded as omens of changes yet to come.

In recent years, wheat has been an important agricultural crop in Illinois and has played an important role in the ecology and welfare of the prairie chicken. In the spring, new wheat seedings are typically used as booming grounds. In summer, wheat stubbles with their new legume seedings make excellent brood-rearing cover. In fall, winter, and spring, at which time it is plowed, wheat stubble is used for roosting.

One of the results of the recent high demand for soybeans will undoubtedly be a drop in the acreage planted to wheat in Illinois. Land that will grow soybeans at \$7.00 per bushel will not long be used to grow wheat at \$2.00 per bushel. In terms of prairie chicken management, the shift to less wheat and more soybeans will require us to provide more and better brood cover on our sanctuaries in the future. We will probably need to plant more wheat or provide more land in early successional stages. The acreage of wheat or early successional stages on sanctuaries will be, in part at least, at the expense of nest cover. The net result will be that in the future more acres of sanctuary will be needed to support a given number of prairie chickens. A sanctuary system that is adequate today will undoubtedly be too small when the wheat is gone. We saw the redtop, the hay, and the oats virtually disappear in south-central Illinois. In 1963-65, the acreage of wheat amounted to about 14 percent of the 16-square-mile study area at Bogota. In 1972, wheat occupied ten percent of the land area (Westemeier and Vance, unpublished data). We can expect wheat to virtually disappear in a very few years and must plan accordingly.

Another important result of soybeans at \$7.00 per bushel will be a rapid inflation of land values. Land that sold for \$200-\$300 per acre in 1963 was selling for \$400-\$500 in 1970 and will soon be selling for more than \$600 per acre.

The rapid inflation of land values creates several problems. First, people are holding land as an investment. We have had few opportunities to buy favorably located land in the last two years. Our acquisition of sanctuaries in the Kinmundy area has been disappointing, not because of a particular shortage of money, but because suitable tracts were not available at a reasonable price. There is also the problem of being forced either to raise more money than anticipated for land if and when it becomes available, or to compromise by trying to manage with fewer acres.

In 1965, the PGC was formed with the objective of saving two remnant flocks each of about 500 prairie chickens (spring breeding populations), one flock near Bogota, Jasper County, and the other near Kinmundy, Marion County. At that time, we felt that a flock of 500 chickens could be maintained on a properly

Sanderson et al.

managed, well-situated system of sanctuaries, totaling about 1,000 acres, as long as farming practices in these areas remained relatively unchanged. To allow for possible changes in farming practices, such as the disappearance of set-aside acres under federal farm programs and the disappearance of wheat, we set as our goal the acquisition of 1,500 acres at Bogota and 1,500 acres at Kinmundy. Initial priority was given the flock at Bogota because we believed that we had the best chance of success in that area as a result of the land already acquired by the PCFI.

We have a spring population of about 400 prairie chickens (Table 1) on the 960.8 acres of sanctuaries at Bogota (Table 2). We believe that this flock will exceed 500 birds by 1975 or 1976, by which time suitable cover will have been developed on our most recent acquisitions. For the present, we believe that the flock at Bogota is relatively secure. In the long run, however, we would like to see an additional 500 to 600 acres, acquired in tracts of 40 to 80 acres, located in the sections south, north, northwest, and northeast of the primary concentration. The acquisition of these additional acres would offset the probable loss of wheat and provide greater opportunity for visitation by the public and by students.

Recently, the Central Illinois Public Service Company began acquisition of 8,000 acres just west of Bogota, where they will construct a plant for generating electricity. Much of the upland on this tract is gray prairie soil potentially suited to prairie chicken management. We hope that we can come to an agreement with CIPS regarding the management of some of this land for prairie chickens. If an agreement is reached, there will be less need for additional sanctuaries at Bogota. If we cannot reach an agreement, we can only expect their land acquisition to further inflate land prices in our purchase area.

We have not owned enough land long enough to develop the requisite cover that will enable us to observe a response in the Kinmundy flock similar to that of the Bogota flock. However, prairie chickens are now using both 160-acre sanctuaries in the Kinmundy-Forbes area and there was an increase from six cocks in 1971 to 12 cocks in 1972 to 22 cocks in 1973. Also, the remnants (22 cocks) of the once widespread flock immediately south of Farina are now anchored to the 140-acre Lacey-Loy tract.

The 460 acres now acquired in Marion County is, at best, less than half of what is needed to assure a flock of 500 prairie chickens. An additional 160 acres should be acquired as soon as possible in fairly close proximity to each of the three sanctuaries in Marion County. The long-term goal should remain a system of sanctuaries totaling 1,500 acres. Land in Marion County is even less available and is higher priced than land in Jasper County. In Marion County, recent intensive geodetic surveys and some leasing of mineral rights (oil) have caused land prices to be even more inflated.

For the past two years we have concentrated our efforts for land acquisition in the vicinity of sanctuaries in Marion County. We have met with little success but will continue to place high priority on saving these flocks.

SUMMARY

1. After the arrival of the white man in what is now Illinois, prairie chickens increased in abundance with the increase in farming until about the 1860's, when

farming became too intensive for the best interests of the prairie chicken. The populations in Illinois have suffered a fairly continuous decline from that time to the present; hunting has been closed in the state since 1933.

2. Population counts made each year beginning in 1963 indicate that prairie chickens have virtually disappeared from the state except for two managed areas--one near Bogota in Jasper County and one near Kinmundy in Marion County.

3. In Jasper County, where the first sanctuary for prairie chickens in Illinois was acquired in 1962, the population reached a low level of 37 cocks in 1968. By 1972, when 960.8 acres were in sanctuaries in this area, the population had increased by 430 percent--to 196 cocks.

4. In Marion County, one flock reached a low of four cocks in 1965 but had increased to 22 cocks by 1973.

5. Safe nest cover is the critical requirement for prairie chickens in Illinois at present, and virtually all nesting in the Bogota area is on sanctuaries. The sanctuaries are in scattered tracts of land, and it is believed that the interspersed farm crops is important to the success of the sanctuary system.

6. Most of the land acquired for prairie chicken sanctuaries has been purchased by two private organizations--the Prairie Chicken Foundation of Illinois and The Prairie Grouse Committee of The Illinois Chapter-The Nature Conservancy. In 1970, the Illinois Department of Conservation purchased five sanctuaries totaling 410.3 acres from the PGC.

7. Sanctuaries owned by the state have been dedicated as Nature Preserves, affording the sanctuaries maximum protection from other land uses.

8. The cost of acquisition, excluding interest and costs of land improvement, for the 1,420.8 acres now in prairie chicken sanctuaries was \$500,124. A total of \$25,340 (plus interest) is owed on three sanctuaries totaling 360 acres that are being acquired under purchase contract.

9. The PCFI will be officially disbanded sometime during 1973. The Natural History Survey plans to continue working with the PGC and the Illinois Department of Conservation to acquire a minimum of 1,500 acres in each of the two counties, Jasper and Marion. It is believed that a 1,500-acre sanctuary in scattered tracts will support a spring breeding flock of at least 500 chickens.

10. Management of prairie chicken sanctuaries is based on continuing intensive studies of nest ecology initiated in 1963. Two highly significant facts have emerged from this study. First, if left undisturbed, domestic grasslands are most attractive the second or third year after seeding and less attractive thereafter. As a result, we must manage on an annual basis, making new seedings and rejuvenating old ones. Second, the booming ground is the focal point of year-round prairie chicken activity and hens prefer to nest within 400 yards of a booming ground. Thus, one goal of management is to provide attractive booming grounds on or adjacent to prime nest cover.

11. The key to economically and ecologically sound programs for developing

Sanderson et al.

and maintaining suitable habitat for prairie chickens has been a combination of sharecropping, utilizing local farmers to produce or harvest specific crops in designated fields, and prescribed burning. Prescribed burning is an effective tool to rejuvenate stands of domestic and native grasses and to manage vegetation on the booming grounds.

12. Redtop is the principal species used on the sanctuaries. Combining redtop for seed under sharecropping agreements with local farmers provides cover that is attractive to nesting hens and income to help defray other management costs and local taxes.

13. Timothy provides an attractive nest cover for prairie chickens, but the low monetary value of its seed makes it difficult to persuade local farmers to manage it.

14. Various legumes including red clover, alfalfa, alsike clover, and Korean lespedeza provide a desirable diversity of habitat and help maintain the grass through nitrification of the soil.

15. We consider it desirable to establish and maintain native prairie grasses on the prairie chicken sanctuaries; however, for the most part, native grasses are more difficult to establish than the exotic grasses. Also, because of the height and rank growth of species such as big bluestem, Indian grass, and switchgrass, haying, light grazing, or prescribed burning appear essential to maintain these species in a form acceptable to the prairie chicken.

16. A seeding per acre of a mixture of four to six pounds of redtop, one pound of timothy and one pound each of red clover, Korean lespedeza, and alsike clover, plus one pound of alfalfa when the pH of the soil is suitable, has provided attractive nest cover on the sanctuaries.

17. Most nests have been found near sharp edges or breaks in the cover. Thus, we believe that fields of 20 or 10, or even 5, acres provide maximum benefits for nesting prairie chickens.

18. We recommend for booming grounds five- to ten-acre (preferably the larger) well-drained sites of bare ground or low sparse vegetation from late summer through spring. Sharecropping can be used effectively to provide attractive sites for booming grounds. Soybeans followed by wheat or oats and red clover and back to soybeans is one successful rotation for maintaining booming grounds in Illinois. New grass seedings, recently burned sod, close mowing, and heavy grazing can also provide attractive sites for booming grounds.

19. We recommend that the two sanctuary systems of 1,500 acres each in scattered tracts be completed as soon as possible. The recent increase in the price of soybeans will make it even more difficult to purchase land for prairie chickens in Illinois. Also, we anticipate that most of the present wheat acreage will be planted to soybeans. In the past, wheat grown on private land between the sanctuaries has provided booming grounds, brood-rearing cover, and roosting cover in fall, winter, and spring. In the future, it may be necessary to seed wheat on the sanctuaries if it virtually disappears as a crop in Illinois.

ACKNOWLEDGMENT

Ralph J. Ellis collected data during the period from 1963 through 1965 while serving as leader of the field research. D. Russel Vance assisted with most of the field work. John H. Slachter, Illinois Department of Conservation, assisted with the censuses, in the search for nests, and with the prescribed burning, and managed the sanctuaries belonging to the PCFI through 1971. Jack A. Ellis assisted with all the spring censuses. Stephen P. Havera tabulated the data of the acreages of corn and soybeans in Illinois. Financial assistance for some of the summer field work was provided by special grants from The Nature Conservancy, the Max McGraw Wildlife Foundation, and Mr. Henry W. Meers of Chicago. Helen C. Schultz provided editorial assistance.

LITERATURE CITED

- Forbes, Stephen A. 1912. The native animal resources of the state. Illinois State Academy of Science Transactions 5:37-48.
- Hamerstrom, F. N., Jr., Oswald E. Mattson, and Frances Hamerstrom. 1957. A guide to prairie chicken management. Wisconsin Conservation Department Technical Wildlife Bulletin 15. 128pp.
- Illinois Cooperative Crop Reporting Service. 1961. Illinois agricultural statistics. Annual summary. Illinois Department of Agriculture * U.S. Department of Agriculture Bulletin 61-1. 80pp.
- _____. 1971. Illinois agricultural statistics. Assessors' annual farm census. Illinois Department of Agriculture * U.S. Department of Agriculture S.F.C. 34. 31pp.
- Sanderson, Glen C., and William R. Edwards. 1966. Efforts to prevent the extinction of the prairie chicken in Illinois. Illinois State Academy of Science Transactions 59(4):326-333.
- Westemeier, Ronald L. 1973 (1972). Prescribed burning in grassland management for prairie chickens in Illinois. Annual Proceedings of the Tall Timbers Fire Ecology Conference 12:317-338.
- Yeatter, Ralph E. 1943. The prairie chicken in Illinois. Illinois Natural History Survey Bulletin 22(4):377-416.
- _____. 1963. Population responses of prairie chickens to land-use changes in Illinois. Journal of Wildlife Management 27(4):739-757.