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HISTORY AND DEVELOPMENT OF AN EXPERIMENTAL BOB-WHITE
MANAGEMENT AREA IN SOUTHERN IOWA

by

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A Thesis Submitted to the Graduate Faculty
for the Degree of

DOCTOR OF PHILOSOPHY

Major Subject Zoology

Approved:

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1940

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II. INTRODUCTION

Although Iowa has been an agricultural state since it was settled by the white man, not until recently have the problems of wildlife management and conservation as related to agricultural practices become generally recognized in the state.

The clearing of timber and tilling of the soil brought about radical changes in natural food supplies and other ecological conditions affecting native wildlife which the early white settlers found in this state. As more people came, more and more land was placed in cultivation. The ever increasing number of people and the changes which they brought about resulted in greater and greater changes in the natural habitat of all wildlife. The environment of some wildlife species, especially of the Eastern Bob-white (Colinus virginianus virginianus (Linnaeus))¹ was definitely improved by these early agricultural practices. However, as Iowa land became increasingly valuable and almost every tillable acre was cultivated the food supply and suitable cover for this bird were decreased so that it found conditions no longer favorable for maintaining its numbers.

The state legislature recognized the quail emergency and closed the hunting season on them in the spring of 1917. By 1932, The State Fish and Game Commission realized that merely closing the season had not accomplished the desired results. It is evident from their report for the

1. The scientific names of birds were taken from the American Ornithologists' Union Check-list of North American Birds, fourth edition, 1931.

biennium ending June 30, 1932, that much discussion and planning had occurred during this period about ways and means of procedure for maintaining and increasing the game species of the state. The statement is made in this report (p. 13-14): "The Fish and Game Department is now establishing an administrative force to establish and manage demonstration areas to determine to what extent the supply of pheasants can be increased. The Commission has also assisted in the establishment of a research department at Iowa State College to study the conditions under which game can establish and maintain itself under our agricultural methods. Demonstration areas for quail in the southern half of the state are also being established to determine, if possible, to what extent our supply of these native birds can be increased, and whether or not a shootable surplus can be maintained."

The first game management area in Iowa was a combination quail and pheasant area in Benton County, organized in 1932, and known in the files of the Commission as a pheasant demonstration area. The first quail demonstration area was located in Davis County and contained 841 acres. This area was set up in March, 1932, by John Ball of the American Game Association field staff, now of the United States Bureau of Biological Survey, who was assisting Aldo Leopold in making a game survey of Iowa to formulate recommendations for the conservation of wildlife. These were incorporated in the Report on the Iowa Twenty-five Year Conservation Plan (1933).

The need of more definite information on management of the State's game species led to the establishment of a wildlife research program July 1, 1932, by the cooperation of the Iowa Fish and Game Commission,

Jay N. Darling and Iowa State College to expand and extend the work of Charles E. Bessey, Herbert Osborn, William T. Hornaday, F. E. L. Beal, Louis H. Pammel and Joseph E. Guthrie. The work of this three-year program under the direction of Dr. Carl J. Drake, Dr. Paul L. Errington, and the late Prof. Joseph E. Guthrie, all of Iowa State College, was so satisfactory that it was further expanded and placed on a five-year plan. The Iowa State College Cooperative Wildlife Research Unit was established at Ames July 1, 1935, through a cooperative arrangement of Iowa State College, Iowa State Conservation Commission, the United States Bureau of Biological Survey and the American Wildlife Institute. This Research Unit was under the direction of Dr. Carl J. Drake, Iowa State College, Fred Schwob, Iowa State Conservation Commission, and Logan J. Bennett, Associate Biologist of the United States Bureau of Biological Survey who was succeeded by Thos. G. Scott, Agent of the United States Bureau of Biological Survey, March, 1938.

One of the initial projects of this expanded program was research on the bob-white on two Experimental Bob-white Management Areas located in Decatur and Wayne Counties (Figs. 1 and 2). In November, 1935, Watson E. Beed was appointed as graduate assistant in the Entomology and Economic Zoology Section of the Agricultural Experiment Station, Iowa State College, to begin this research. In June, 1936, he accepted other duties and on July 1, 1936, the writer was appointed to continue this work. After the writer had spent some time living on the area and studying its problems it became obvious that in addition to bob-white management research work, an investigation would have to be made of as many of the agricultural, economic and social factors as possible which are related

to the production and harvest of a shootable surplus of bob-white year after year. The results of this investigation from July, 1936, to February, 1940, are included in this thesis.

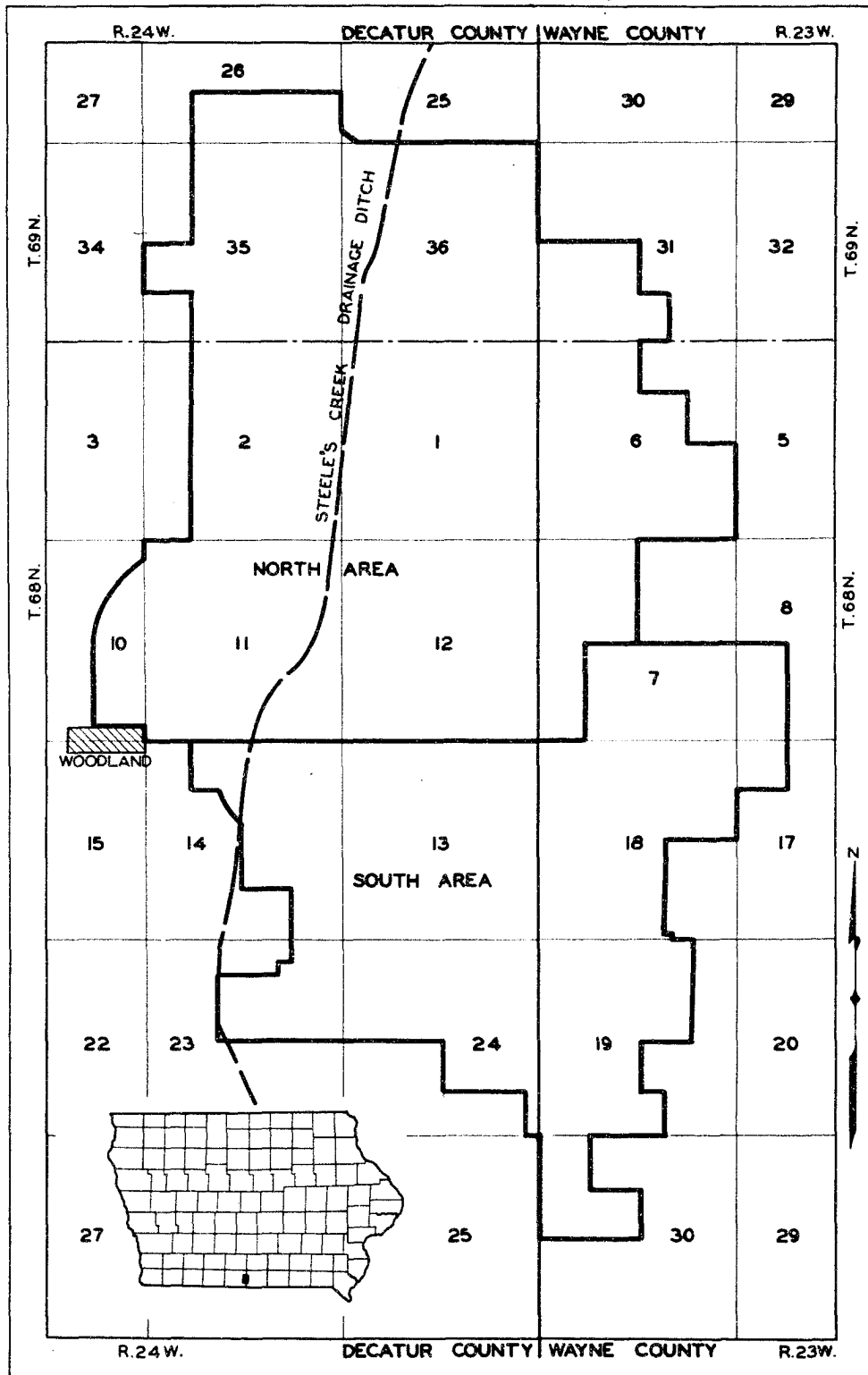
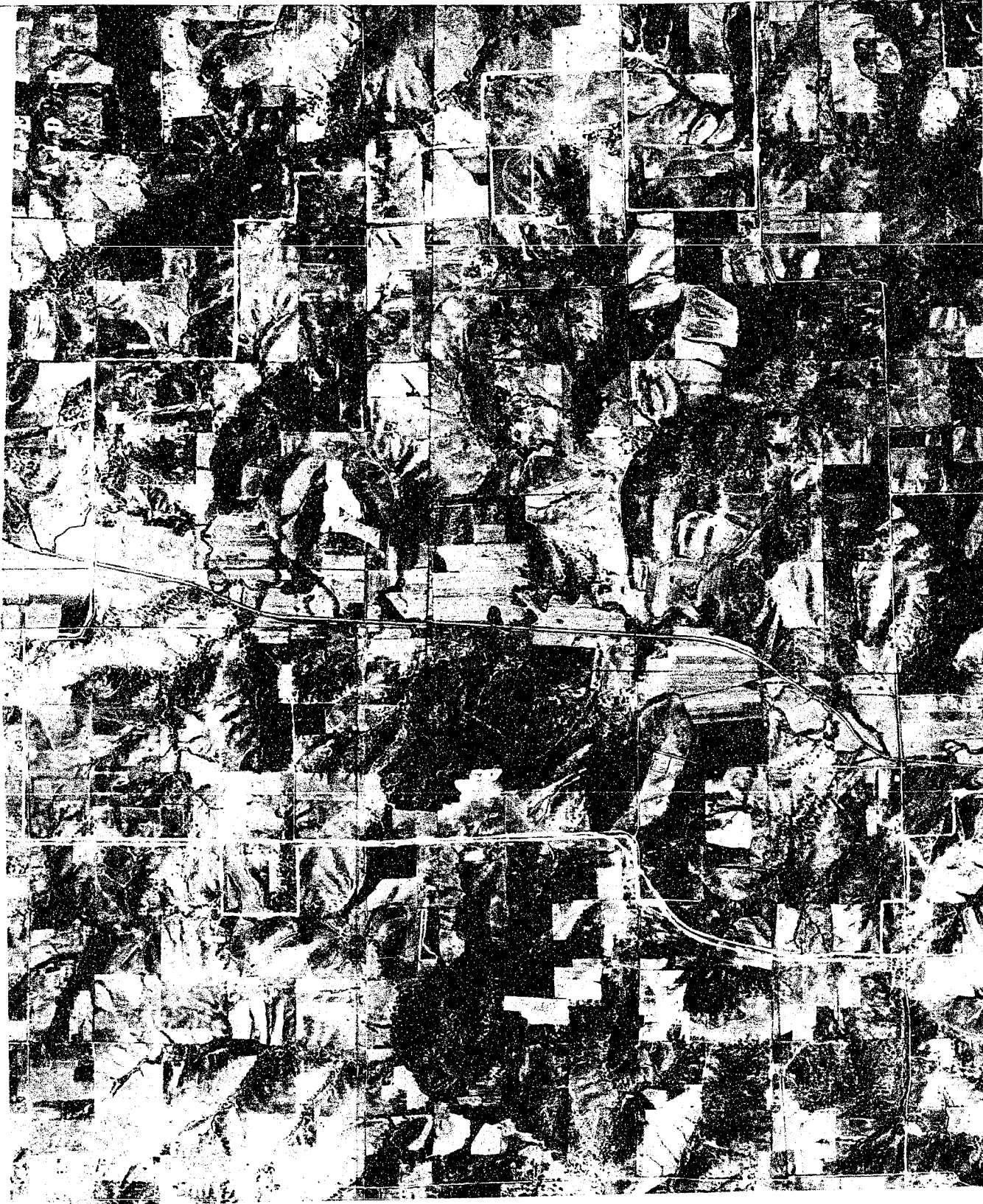


Fig. 1. Experimental bob-white game management area, Iowa.



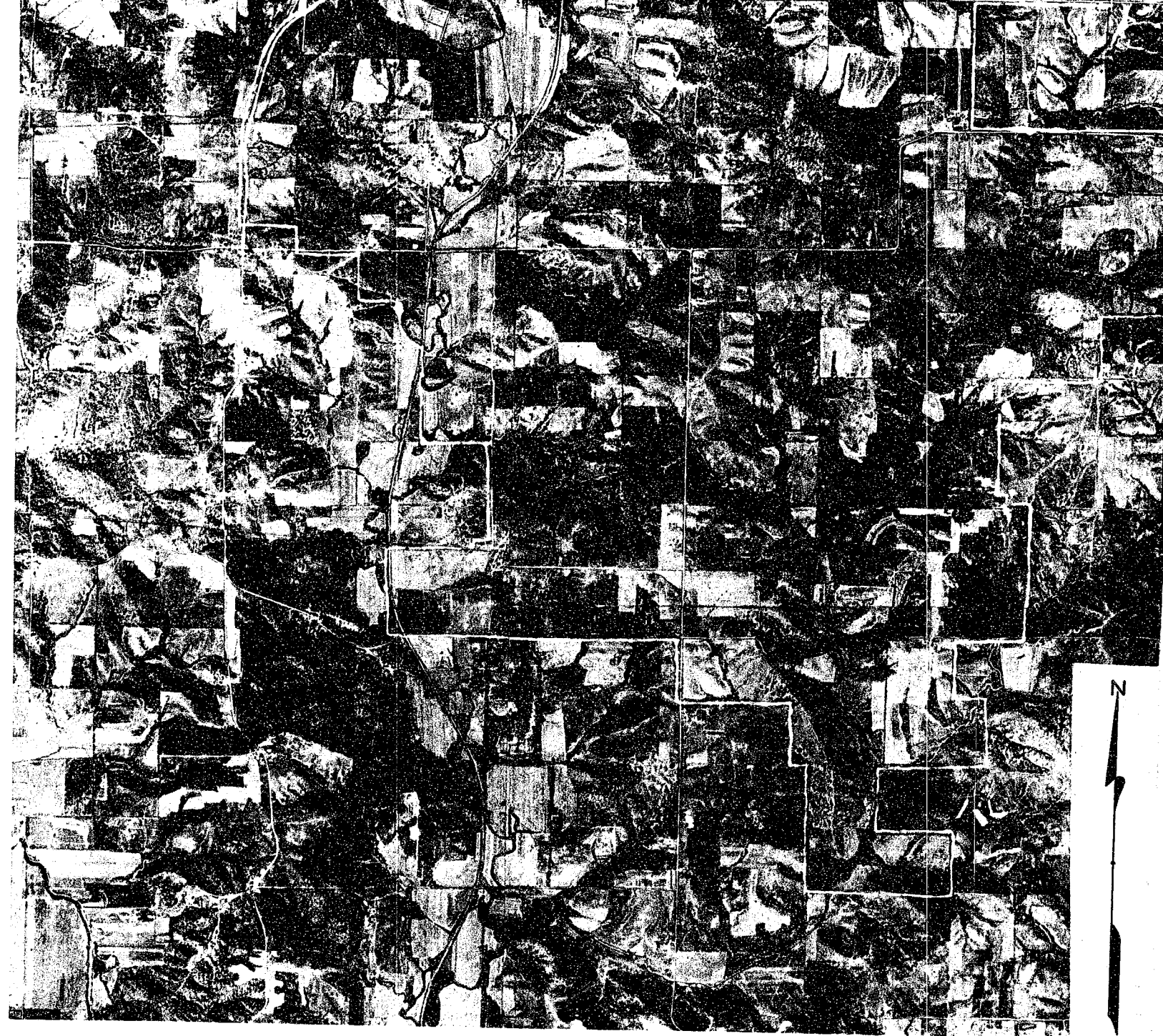


Fig. 2. Aerial photograph of experimental bob-white game management area, Iowa. (Taken October, 1937).

III. HISTORY OF THE ORGANIZATION OF THE BOB-WHITE EXPERIMENTAL GAME MANAGEMENT AREA

A group of farmers, October 25, 1933, assisted by Deputy Game Warden H. A. Holgren of the State Fish and Game Commission organized Game Management Area No. 27-93-1. This game area contained 4,289 acres and included part or all of sections 1, 2, 10, 11, 12 and 13, Range 24 W., Township 68 N., Woodland Township, sections 26, 35 and 36 Range 24 W., Township 69 N., of Highpoint Township in Decatur County and sections 6 and 7 Range 23 W., Township 68 N., Jefferson Township in Wayne County. Floyd Fleming was selected as Key Farmer for this area. A similar area No. 93-27-1 was organized January 21, 1934, in the same manner as the first. This area contained 2,171 acres, adjoined the first on the south and included part or all of sections 13, 14, 23 and 24 Range 24 W., Township 68 N. of Woodland Township, Decatur County and sections 17, 18, 19 and 30 Range 23 W., Township 68 N. of Jefferson Township, Wayne County. Eben Carver was selected Key Farmer for this area.

The objects of the organization of Game Management areas as stated by the State Fish and Game Commission (1934, p. 19) were, "(1) to build environments so that when adequate seed stock of game exists or is placed it will have a reasonable chance of producing annually surplus crops which may be harvested by the man who likes to hunt; (2) to gain some measure of control over the take so that adequate breeding stocks remain on the land; (3) to build a favorable relationship between the hunter and the land owner so that adequate areas may be kept available to

the hunter." The specific purpose on the part of the State Fish and Game Commission for the organization of the described areas was to manage better the production of bob-white. The object on the part of most of the farmers of the two areas was to secure the benefit of legislation in controlling trespassing and providing protection against unauthorized hunting as provided in Section 1709- el, Chapter 86 of the Code of Iowa, 1935.

Metal signs (fig. 3) were provided the farmers for fifty cents each by the State Fish and Game Commission for marking the boundaries of the farms and areas.



Fig. 3. Area boundary marker.

On May 17, 1935, the State Fish and Game Commission and the State Board of Conservation were merged to form the present State Conservation Commission.

Early in November, 1935, the farmers in Game Management Areas Nos. 27-93-1 and 93-27-1 were invited to attend a meeting at which plans were presented by representatives of the Iowa State College Cooperative Wildlife Research Unit and the State Conservation Commission for organizing the areas as Experimental Bob-white Game Management Areas to be operated for five years. The north area, No. 27-93-1, was to be known as a pay-shooting area and the farmers were to be permitted to charge for hunting privileges. The south area, No. 93-27-1, was to be known as a free-shooting area and the farmers were to be paid ten cents an acre. Designated bob-white management practices were to be carried on by the farmers on both areas. Hunters were to secure permission from the operator of each farm on which they hunted and the farmer was to provide the hunter with a written permit to hunt on his land. The Conservation Commission was to provide seed for small food patches and wire to fence some eroding ditches to provide cover and shelter for the game.

The Iowa State College Cooperative Wildlife Research Unit wished to carry on research work on the management of bob-white on these areas and if the program were acceptable to the farmers to place a research worker in charge who would be a resident on the area for part of the time. After a discussion the farmers voted to accept the plans which were presented to them.

After research work by the Iowa State College Cooperative Wildlife Research Unit was begun on the Experimental bob-white Game Management

Areas, the boundaries were changed to those as shown in Fig. 1. The north area was increased 450 acres making a total of 4,739 acres and the south area 803 acres making a total of 2,974 acres or a total of 7,713 acres in the two areas. The total acreage will be known throughout this thesis as the Game Area and when either of the two separate divisions of the Game Area is referred to it will be known as the North Area or the South Area.

IV. TECHNIQUES OF RESEARCH

The writer began his resident research work on the Game Area August 24, 1936 and lived in the home of a farmer in the northern part of the South Area. This period of residence continued until December 16, 1936.

The work on the Area during this period consisted of two phases, each widely divergent from the other yet closely related to the welfare and management of the bob-white. These were: (1) the investigation and observation of bob-white and its relation to other wildlife; and (2) making the acquaintance of the farmers and becoming familiar with their agricultural problems as related to wildlife in general and especially to the bob-white. Daily field notes and records were kept of all important observations in the field.

The writer was in the field daily an average of eight hours except for a few days. The time was divided about equally between studying the bob-white and its environment and becoming acquainted with the farmers in order to secure desired information and discuss and encourage game management practices. It was found by experience that the most favorable place to see the farmers was to meet them in their fields. There were 37 farm units on the Area at the beginning of the investigation and each of the farmers was seen on six different occasions. All of the data concerning the farmers and their agricultural practices was secured from interviews with them.

A great deal of time was spent becoming familiar with the topography

of the whole Area and in locating the suitable bob-white covey ranges. Thereafter repeated careful searches of the cover and feeding areas were made for bob-white which were counted when found. This work was done on foot and only on very few occasions was a bird dog used. Because of the large size of the Area and the time spent working with the farmers only about four sections of the most favorable bob-white range were studied intensively.

After the fall shuffle early morning field trips were made on about three mornings each week. By experience it was found that it was necessary to be at the selected locations before the beginning of light in order to hear the calls of the birds and their flight from their roosting places. At this time 15 bob-white coveys were selected for winter survival studies.

The writer returned to the Area March 28, 1937, and lived in the southern part of the South Area until May 8. The rest of this period until June 12, 1937, was spent living in the home of a farmer in the north part of the North Area. Living in both the South and North Areas made possible a better acquaintance with the people and their problems.

During the first five weeks of this period about 100 hours were spent in intensive field work and observations in an endeavor to check the 15 coveys selected for winter survival research. The rest of the time was spent in carrying on the work with the farmers, using the same methods as during the previous autumn. Each farmer was interviewed at least three times during this period.

Since June, 1937, a total of 76 days have been spent on the Area. The periods of work have varied in length from a few days to three weeks and the same methods and techniques were used as during the longer resident periods.

V. PHYSIOGRAPHICAL DESCRIPTION OF THE AREA

This Bob-white Management Area is located in central southern Iowa at 40°, 41.16' N. Latitude and 93°, 34.2' W. Longitude. It is of an irregular shape approximately six miles long and three miles wide lying on both sides of Steele's Creek which runs throughout most of the Area.

The topography of the land is very uneven. The irregular terrain of the Kansan and Nebraskan or pre-Kansan Drifts left by the last and next to the last glacial invasions was covered by a layer of loess of the Grundy Series, Brown (1936). On the tops of the few nearly level uplands it is only about two feet thick. It has eroded on the steepest slopes whereas on the more gentle slopes and in the valleys an eroded mixture of loess and drift has accumulated. The elevation is about 1,100 feet.

The average mean temperature which was determined by taking the average of the U. S. Weather Bureau records at Lamoni and near Corydon, Iowa, is about 49.8 F. and the average annual rainfall determined in the same manner is 34.33 inches. The records from these places were used because they are almost equidistant from and in opposite directions from the Area.

When the first permanent settler, Allen Scott, a U. S. Government Indian Agent for the Fox and Sac Indians, arrived from Indiana in 1838, he settled near the present village of Woodland. He found the land which is now included in the bob-white management area to be an almost unbroken expanse of timber except along a part of the east edge in Wayne County and the northwest part near the village of Highpoint in Decatur County. These parts were covered with the typical prairie vegetation.

Within the memory of people still living on the area, the only land cleared around the little village of Woodland in 1871 was the place where the church is located at the southeast corner of the intersection of the cross roads. The uplands were covered by the typical *Quercus-Hicoria* Association and the *Ulmus-Fraxinus-Juglans* Associes was found on the gentle slopes and in the bottoms. The more important trees were: red oak (*Quercus rubra*), white oak (*Quercus alba*), burr oak (*Quercus macrocarpa*), black oak (*Quercus velutina*), blackjack or jack oak (*Quercus marilandica*), post oak (*Quercus stellata*), laurel or shingle oak (*Quercus imbricaria*), American or white elm (*Ulmus americana*), red elm (*Ulmus fulva*), rock elm (*Ulmus racemosa*), hackberry (*Celtis occidentalis*), white ash (*Fraxinus americana*), black ash (*Fraxinus nigra*), box elder (*Acer Negundo*), buckeye (*Aeaculus glabra*), black walnut (*Juglans nigra*), white hickory (*Carya alba*), shell-bark or shag-bark hickory, (*Carya ovata*), birch (*Betula* sp.), black willow (*Salix nigra*), cottonwood (*Populus deltoides*), soft maple (*Acer rubrum*), hard maple (*Acer saccharum*), black locust (*Robinia pseudoacacia*), honey locust (*Gleditsia triacanthos*).

The wild fruits which were found were wild plum (*Prunus* spp.), wild grape (*Vitis* spp.), crab apples (*Malus* spp.), blackberries (*Rubus* spp.), raspberries (*Rubus* spp.), strawberries (*Fragaria* spp.), wild cherries (*Prunus* spp.), mulberry (*Morus rubra*), red haws (*Crataegus* spp.), and black haws (*Crataegus* spp.).

The principal shrubs were the smooth sumach (*Rhus glabra*), rough sumach (*Rhus typhina*), wild gooseberry (*Ribes* spp.), black elder (*Sambucus canadensis*), hazel nut (*Corylus americana*), prickly ash (*Zanthoxylum americanum*), buckbrush or coral berry (*Symphoricarpos* spp.), and swamp dog-

wood (Cornus amomum).

At the present time the principal trees are: red elm, soft maple, cotton wood, white oak, post oak, laurel oak, black oak, white ash, black ash, white hickory, and willow. A few walnut, boxelder, sycamore, hackberry and black walnut trees still remain.

The more important native wild fruits found now are: blackberry, gooseberry, strawberry, plum, grape, mulberry, crab apple, red and black haws, and cherry, but none of these are abundant. Shrubs which are present but are found in much less abundance than formerly are: sumach, buckbrush, black elder, and hazel nut.

This decrease of trees, shrubs and wild fruits is very pertinent in the comparison of wildlife habitat of an earlier period with that of the present.

When the Iowa territory was opened for settlement in 1840 the pioneers began to come into this country in large numbers from the states of Indiana, Ohio, and Kentucky. The removal of the forests began with their arrival. They built their houses of logs and cleared a few acres on which to raise food for their own use. Extensive clearing did not begin until the coming of the railroad in 1871 provided a means to market crops and livestock. This was also the time when the prairie began to be settled. The people living on the prairie depended upon wood for fuel and it was a common practice for a wood lot in good timber to be purchased for this purpose. These tracts varied in size from 11-40 acres. One of these 11 acre wood lots is still in use on the Area. A common practice was to build a brush fence around these wood lots. The brush was secured from the trimmings of cut timber and piled in a row. Many rail fences were built and frequently they were made of walnut. The Biographical and Historical Record of Ring-

gold and Decatur Counties, Iowa (1887) states that a great many walnut logs were shipped to England from this Area.

Very little of the original forests is left. Probably about 10 per cent of the land on the Area is in timber, most of which is second growth.

With the clearing of the woodland and the removal of the protective covering most of the humus eroded exposing the loess and the Kansan Drift. This eroding has caused many gullies to be cut through the fields ranging from a few feet to 25 feet in depth.

The rapid run-off of rainfall resulting carried large volumes of the humus, loess, and drift onto the lowlands and caused flooding of the meandering Steele's Creek. Before the removal of this protective covering the run-off was regulated so there were not great fluctuations of the level of the creek. To remedy this flooding a drainage ditch was dug in the autumn of 1930. It was financed by the Steele's Creek Drainage District which was organized August 18, 1930, and \$12,000 worth of bonds were voted and were sold at par September 10, 1930. The bonds were to run for 10 years. The acreage of the district is 3,307 acres. The dimensions of the ditch were 12 feet wide at the top, 8 feet wide at the bottom, and 8 feet deep. Its length was 7.48 miles which shortened the creek bed 4.02 miles. About a fourth of the Area is effected by this drainage ditch. The approximate dimensions of the ditch December 1, 1939 were 70 feet wide at the top, about 65 feet wide at the bottom and 12 feet deep.

This drainage project was possibly one of the contributing factors in the lowering of the water table of the flood plain. Many springs have ceased to flow and many wells have had to be deepened several times.

The importance of the relationship of the different factors related to

wildlife is well expressed in the quotation by Dr. Carl J. Drake in the Iowa Year Book of Agriculture (1937 p. 112), "Broadly speaking, wildlife restoration, reforestation, land utilization, water utilization, flood control, insect control, disease control, soil improvement, plant production, animal production, and other activities are all an integrant part of the unity of conservation and perpetuation of natural resources."

VI. EARLY AND PRESENT NATIVE GAME MAMMALS AND UPLAND GAME BIRDS

When the white man came to this part of the country we presume that he found a fairly stably balanced biotic community in which the Indian had been living. With this assumption an endeavor has been made to trace the important changes in game mammals and birds from the time of the arrival of the first settlers to the present. Old residents living on the Area, one of whom came there in 1858, only 20 years after the first permanent settlement in the county, have supplied much of the information concerning the game animals and birds found there in early times. These records have been verified in many cases by Scott (1937) and by Du Mont (1933). Only mammals and birds have been included which seemed to be more closely related to the investigation and development of the country.

Game Mammals¹

The Virginia opossum (Didelphis virginiana virginiana) was present at the time of the arrival of the first pioneers. Since some of its more serious predators, the wolf (Canis nubilus) and the wildcat (Lynx rufus) are no longer found here and very few coyotes (Canis latrans) are left, the opossums have been increasing gradually and at present quite a number are taken for their fur.

The Eastern raccoon (Procyon lotor lotor) was present at the time of

1. The scientific vertebrate names other than those of birds were taken from Pratt's Manual of land and fresh water vertebrate animals of the United States, second edition, 1935.

the early settlers but no information is available indicating their numbers. Only a few of them are on the Area now.

Weasel (Mustela longicauda subsp.), thought to be the Minnesota weasel (Mustela longicauda spadix) was found in early times. No records of weasel on the area were secured during this research and only two were known to have been taken near it. This scarcity may have been largely brought about by the farmers' killing them whenever possible because of their presumed predation on poultry.

Mink (Mustela vison) have been present since early times but their specific classification has not been determined for this early period. Early settlers on the area report that formerly two sizes and colors of mink were here, one being much larger than those found now and almost black in color, the other smaller and light brown in color. The few found now are the Mississippi Valley mink (Mustela vison letifera). During the memory of those now living here their numbers have decreased greatly; this decrease has been especially rapid during the last fifteen years. No doubt it has been caused very largely by the construction of the Steele's Creek drainage ditch. No permanent body of water is found anywhere along this creek at present.

The Canada otter (Lutra canadensis canadensis) is no longer found in this locality. The last known otter was taken by Everett Petty, an old trapper who has lived in this vicinity over 60 years. This animal was treed by dogs in the winter of 1911-1912 in an old drift of weeds, leaves, sticks, and other debris on Steele's Creek east of the village of Woodland, and was shot as it ran out of the drift.

Spurrell (1917) wrote that early settlers in Sac county reported that

they took the prairie spotted skunk (*Spilogale interrupta*) first in 1858. Since this is a more southern species which has extended its range north and northwestward it was probably present in small numbers on the area when the first settlers arrived. While it is not numerous its numbers seem to be increasing.

The Illinois skunk (*Mephitis mesomelas avia*) according to available records, was present during early times and is found in varying numbers from year to year at present.

At the beginning of this investigation no badgers (*Taxidea taxus*) were on this area. In the autumn, 1938, at least two dens were found on the east central part of the area. A few more scattered dens were found in the fall of 1939. The old trapper, Everett Petty, said he had never seen one in this part of the country before 1938. Since this was mostly a wooded country when the settlers came, it is probable that badgers were not present. If so, it is an indication that environmental factors favorable to the badger have been established.

According to Scott this area had the largest population density of the northern plains red fox (*Vulpes regalis*) of any place in the state in November 1939, 1.34 fox per square mile. The literature as reviewed by Scott (1937) indicates that its range has been extended south and eastward from its ancient range in the northern part of the state. It seems to have come in with the removal of the timber since older settlers remember when none were here. An old fox hunter reported that he had first encountered one about 1900.

A grey fox, possibly the Wisconsin grey fox (*Urocyon cinereoargenteus ocythous*) is said to have been plentiful when the pioneers came. Older

people in the community remember when it existed in considerable numbers. Only an occasional one strays into the area now.

During this research a few northern coyote (Canis latrans) were taken in or near the area. The early settlers found the coyote plentiful and it was a great menace to their livestock especially sheep, pigs and poultry. Although only an occasional coyote is found now, one was killed on a highway in November, 1936, by a farmer deliberately running over it with his car when it became confused by the head lights.

No timber wolves (Canis nubilus) have been heard of during this investigation. Often, when one is reported, upon inquiry it is found to be a northern coyote. Sheep could not be raised profitably in this part of the country until the pioneers reduced the numbers of timber wolves and coyotes which were here.

No positive records of the occurrence of the Rocky mountain cougar (Felis oregonensis hippelestes) have been found for this locality. Since white-tailed deer (Odocoileus virginianus) were plentiful in early times it is very likely that the cougar was present because the deer is one of its principal foods. Different literature on its distribution includes this part of the country.

The wildcat (Lynx rufus) was probably present in considerable numbers in early times but none are found at present. Since they prey upon lambs, pigs, and poultry the pioneers endeavored to reduce their numbers. The decrease in their natural wild foods also assisted in their extermination from this locality.

The southern woodchuck (Marmota monax monax) is included because of its digging proclivities. Its abandoned burrows provide dens for opossum,

skunk, fox, and cottontails (Sylvilagus floridanus). It is doubtful if numbers of this mammal were present when the settlers arrived. Its enemies, as listed by Anthony (1928) include eagles (Haliaeetus leucocephalus ssp.), and (Aquila chrysaetos canadensis), wildcats, cougars or mountain lions, coyotes, and wolves, all of which were formerly present and probably killed them if any ventured into the country. With the extermination of most of these enemies it has come in and is now present in large numbers.

The Franklin's ground squirrel (Citellus franklini) is included because it may become a factor in the nesting and rearing of the young of ground-nesting birds, (Bennett 1938). The first specimen known in this area was observed in the summer of 1936.

Arboreal squirrels are quite numerous on the area. Specimens have been taken for determination of species. All of those observed during this research seemed to have the characteristics of the western fox squirrel (Sciurus niger rufiventer). With the former abundance of the hazel nut, mast, hickory nut, and walnut crops food conditions were favorable for large numbers of squirrels before and during the early settlements.

Beaver (Castor canadensis) were present when the pioneers arrived. The last known report of beaver in or near the area was on the Weldon River in the winter of 1898-1899 by the trapper, Everett Petty. The subspecific classification of this beaver is not known. Pratt (1935) and Anthony (1928) in the distribution of the beaver, state that the Canada beaver (Castor canadensis canadensis) was known as far south as about 35 degrees in the Central and Eastern states. Both state that the Missouri river beaver (Castor canadensis missouriensis) was found along the Missouri River from

Kansas north and west to Montana. Scott (1937) lists the Missouri River beaver as occurring in the northwestern part of the state and states that it is possible that the Canada beaver occurs in the extreme northeastern part of the state. In view of the limitations set by Anthony and Pratt on the Missouri River beaver from Nebraska north and west and their statement that the southern limit of the Canada beaver is about 35 degrees along the Mississippi River classification of this animal is really doubtful. The drainage from this area flows into the Missouri River about a hundred miles east of Kansas City. This is much nearer the reported occurrence of the Canada beaver along the Mississippi River than the occurrence of the Missouri River beaver in Nebraska.

The common muskrat (Ondatra zibethica zibethica) was present along water courses and in marshes when the pioneers came. Large numbers of them were along Steele's Creek until the drainage ditch was dug in the autumn of 1930. Not one was ever observed or reported during this investigation.

The first records of the presence of the white-tailed jack rabbit (Lepus townsendii campanius) on the area were during the winter of 1937-1938 when only a few were reported seen.

The Mearns cottontail (Sylvilagus floridanus mearnsii) was probably present when the country was first settled. The presence of its enemies and a woods environment before the arrival of the white man may have limited the population. With the introduction of agriculture and the reduction of many of its enemies, the cottontail has become numerous.

No records of the use of the American elk (Cervus canadensis canadensis) for food by the early settlers were found although the area

is within its early distribution range according to Pratt (1935) and Anthony (1928).

The white-tailed deer was one of the principal foods of the pioneer. Howell and Smith (1915 p. 14) quote this paragraph from the Leon paper printed in 1872, "Last week a Ringgold County man brought to town 12 deer which he had killed within a few days. The venison sold readily at 9 to 10 cents a pound." People still living in the community remember when the deer was used for food. According to Anthony's species distribution, this is the range occupied by the plains white-tailed deer (Odocoileus virginianus macrourus).

No records of the presence of the plains bison (Bison bison bison) in this area have been found. If they occurred here they were only casuals from the main migration routes.

Game Birds

The Eastern Ruffed Grouse (Bonasa umbellus umbellus) was known locally as the "Timber or Woods Pheasant". They were plentiful when the early settlers arrived. Several living residents remember when they were present and their final disappearance which was caused by the removal of much timber, reduction of food supply, destruction of cover and unfavorable hunting practices.

The Greater Prairie Chicken (Tympanuchus cupido americanus) was abundant in early times. During times of severe winter blizzards they sought protection in the shelter of the timber. "The Prairie Chickens have the epizootic", is a statement copied from a Leon paper printed in 1872 which is

found in Howell and Smith (1915 p. 14). During the period from about 1908 to 1939 they had completely disappeared from this locality. In the summer of 1939 a farmer reported seeing a prairie chicken with four or five young that ranged along the north edge of the area. Since repeated but unverified reports have been received of their nesting not more than ten miles from the area in 1939, it is quite possible that this report was correct.

The presence of the Eastern Bob-white (Colinus virginianus virginianus) when the pioneers came in is doubtful. It is difficult in the light of present day observations and experiences to understand how this bird which depends so much upon agricultural practices now could have survived the severe winters when totally dependent upon natural wild foods. If it were present it must have been in small numbers. The bob-white was most abundant before agricultural methods became so intensified. Errington and Hamerstrom (1936) state that it was most plentiful in Iowa about 1880.

The Ring-necked Pheasant (Phasianus colchicus torquatus) was first introduced about 1923. It has made a good increase since this introduction in spite of unwise hunting practices.

The Eastern Wild Turkey (Meleagris gallopavo silvestris) was present when the early settlers came to this locality. The large amount of mast would have supplied food for a large population. The last known wild turkey in this locality was a hen, killed in the summer of 1886.

While game mammals and birds played an important role in the early economic life of the people, conditions have become unfavorable for them so that the numbers of many species have decreased very much and some have disappeared from this locality.

VII. EFFECT OF WEATHER CONDITIONS UPON VEGETATION

Upon arrival on the area, August 24, 1936, the writer found this part of the state to be suffering from a very severe drought and a very severe grasshopper epidemic. The condition of all vegetation and the landscape was such that it was almost impossible to describe. Bare, bladeless stalks from which the tassels had been eaten were all that could be found in most of the corn fields. No green forage of any kind was in the fields of harvested small grain, pastures or meadows. All small growth that was not seared brown by the hot dry winds had been eaten by the ravenous grasshoppers. In many cases it was necessary for farmers to feed their livestock just as they do in midwinter. Almost all of the springs and many wells were dry. The water shortage on many farms was serious.

Bob-white cover and covey ranges were very poor because the grasshoppers had eaten the leaves from almost all of the different species of plants, leaving cover with no sheltering leaves. The buckbrush or coral berry, black elder, smooth sumach, rough sumach, wild gooseberry, wild rose (Rosa spp.), hazelbrush, wild plum, sweet clover (Melilotus alba), lesser ragweed (Ambrosia artemisiifolia), greater ragweed (Ambrosia trifida), fleabanes (Erigeron spp.), and golden rods (Solidago spp.) were only bare stems which afforded no concealment from birds of prey or shelter from cold. The barrenness of the vegetation and ground are shown in Figs. 4-8.

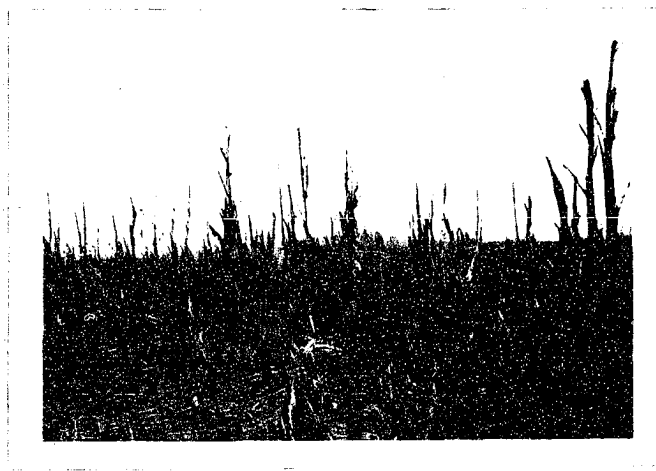


Fig. 4. Cornfield



Fig. 5. Buckbrush

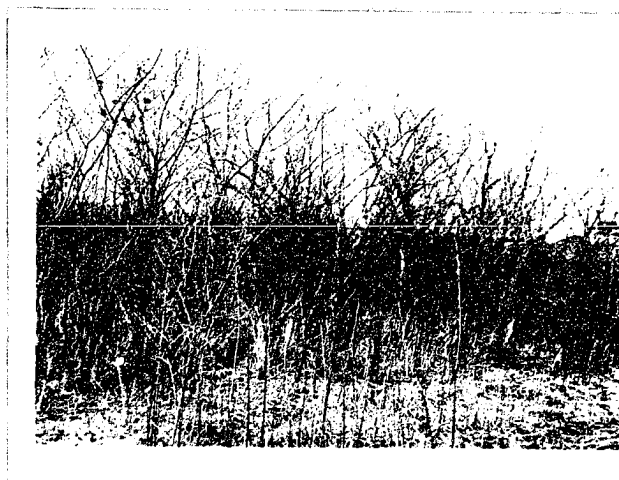


Fig. 6. Thicket



Fig. 7. Fence row

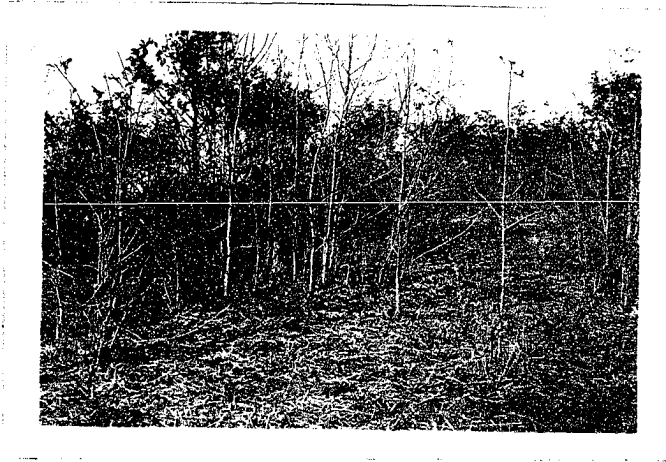


Fig. 8. Second growth brush pasture

A great variety of native food plants of the bob-white are found in abundance in normal seasons on the Area. The fruit of the wild cherry, wild plum, wild grape, poison ivy (Rhus toxicodendron), sumachs, and hawthorne (Crataegus spp.) did not develop during the season of 1936 because of the drought. The greater ragweed, lesser ragweed, smartweed (Polygonum spp.), partridge pea (Cassia chamaecrista), foxtail or pigeon grass (Setaria spp.), and panic grass (Panicum spp.) developed a small quantity of poor quality seed.

The cultivated food plants of the bob-white grown on the area corn (Zea mays var.), wheat (Triticum aestivum var.), oats (Avena sativa var.), cowpeas (Vigna catjang var.), soy-beans (Soja max var.), millet (Setaria italica var.), and different varieties of sorghum (Sorghum vulgare).

The relatively small amount of corn which is grown in this part of Iowa

was practically destroyed by the drought and grasshoppers. Some of the fields did not produce as much corn as was planted.

The cowpeas and soy-beans sowed for hay made such little growth and matured so few seed that they were not cut for hay but were left in the fields. This was fortunate for the bob-white.

The sorghums withstood the drought the best of any of the agricultural crops (Fig. 9) but did not produce much seed during this period. A period of warm rains began September 13, and continued for five weeks. During this time the various sorghums made a rapid growth and matured much seed. The shattered wheat and oats which were not eaten by the birds during the summer began to sprout when these rains came and in a few weeks the fields looked as they do in spring.



Fig. 9. Showing how sorghum withstood drought and grasshoppers

The Korean lespedeza (Lespedeza stipulacea) did well in the early part of the growing season but most of it was killed by the drought.

The small amount that lived reseeded and provided some food for the bob-white.

When winter came vegetative conditions had been changed very little because the abundant rains in the autumn came too late to be of any material benefit to most game foods and cover. The early part of the 1936-1937 winter was very mild and open. Early in January a rather heavy non-drifting snow fell. Almost immediately between one and two inches of sleet fell on the snow and this was followed at once by a rain while the temperature was at the freezing point. Just as this rain ceased the wind changed to the north and the temperature dropped to near zero. After this the entire landscape was covered with snow and ice to a depth of six to eight inches. This icy crust was so solid that livestock and even trucks did not break through. This ice remained from January 5 to March 3, 1937. The ice had partially melted on some of the south slopes by March 6. On this date the writer spent 14 hours on the area walking over 18 miles because the roads were so muddy it was impossible to use a car.

When the writer returned to the area March 28, 1937, the landscape was so barren that scarcely any kind of vegetative cover was visible. Even most of the small, leafless stems were lying flat on the ground. The few leaves which had been on the shrubbery and thickets after the severe drought and grasshopper epidemic had fallen to the ground from the pressure of the snow. The stems of the greater ragweed and the shrubbery remained standing but were so barren of leaves that they offered very little concealment for game. Much snow and ice were to be seen on the north slopes and in the timber and ditches. Remains of many old snow drifts were still visible.

The spring rains began April 1, but weather continued very cold with

the ground freezing each night. By April 11, the days were becoming a little warmer and by April 20, the first grass shoots had begun to appear through the ground. The growth was very rapid and in three days at a distance the ground appeared green. The apricot trees were in bloom by April 22. The wild grape vine began to put forth their buds by April 26 and were in bloom by May 27. In general the arrival of spring was delayed between three and four weeks for this locality. However, when warm weather did arrive conditions were so favorable that all vegetation had made up the delay in beginning growth by June 10.

The summer of 1937 was a very favorable growing season. Farmers reported agricultural crops were the best in this locality that they had been for five years. Grasshoppers, which had caused such serious destruction in 1936 did little damage this year in spite of the fact that the concentration of grasshopper eggs per unit area in Decatur County was reported to be among the highest in the state during the winter of 1936-1937, Dr. Carl J. Drake and George C. Decker (Unpublished data). A number of factors assisted in reducing the millions of grasshoppers that hatched. Two periods of heavy, cold, beating rains came in May just at a time when large numbers of newly hatched hoppers were emerging from the ground. Countless little grasshoppers were observed in the fields just previous to each of these periods and after the rains very few could be found. Late in May and early in June, a period of very humid weather occurred which made conditions favorable for parasites and fungus to kill many hoppers. A very complete county wide organization was formed for the distribution and use of poison bran which was of material assistance where needed. Grasshoppers that survived this series of adverse conditions found an abundance of tender wild plant growth

which kept them from migrating to the agricultural fields in search of food.

September 8, 1937, the contrast in the vegetation with that of 1936 was almost unbelievable. All plant life which had been stunted and dwarfed in 1936 had made a most luxuriant growth in 1937. Large areas of greater ragweed were found along fence rows, ditches and on fallow ground, growing to exceptional heights in the low places (Figs. 10-13). The lesser ragweed reached an unusual height in almost every suitable place (Figs. 14 and 15). The smartweed (Fig. 16) was just as luxuriant as the ragweeds but did not grow in such abundance. Slough grass (Spartina michauxiana) made an exceptional rank growth in the few marshy places (Fig. 17).



Fig. 10. Greater ragweed at the edge
of an upland field



Fig. 11. Greater ragweed along a road



Fig. 12. Greater ragweed on low ground



Fig. 13. Greater ragweed along a
road

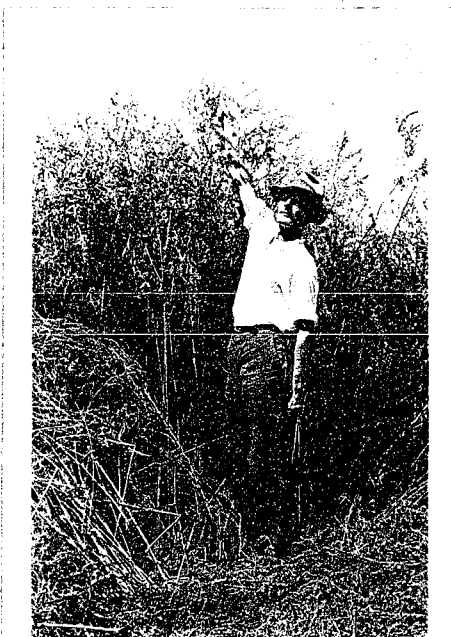


Fig. 14. Lesser ragweed on
fallow ground



Fig. 15. Lesser ragweed on upland ground



Fig. 16. Showing height of smartweed



Fig. 17. Slough grass on a marshy
upland meadow

All agricultural crops were above average especially the corn (Figs. 18-20). The different varieties of sorghum made an excellent growth and matured large amounts of high quality seeds (Figs. 21-23).

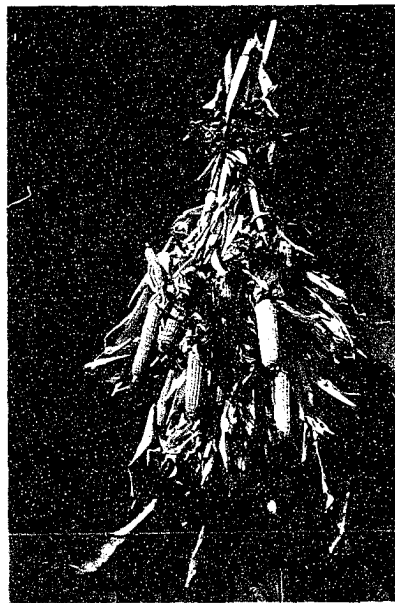


Fig. 18. Eight stalks with 16 ears
of corn



Fig. 19. Showing corn standing in field



Fig. 20. Shocked corn

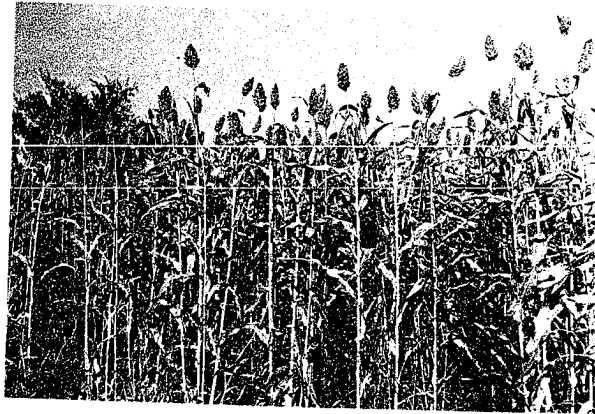


Fig. 21. Grohoma variety of sorghum

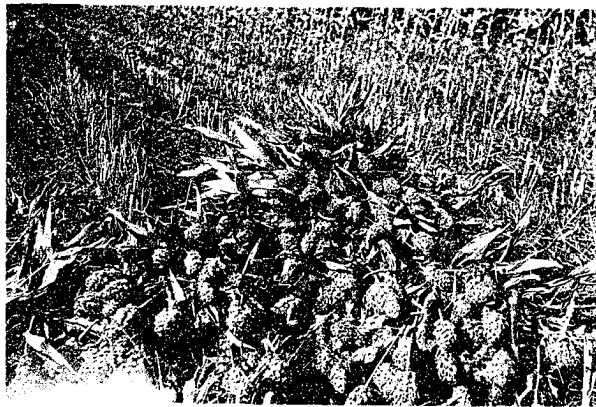


Fig. 22. Cut grohoma showing large, abundant
seed heads



Fig. 23. Grohoma showing height of shocks

With the large amounts of native wild foods and agricultural crops, game and seed eating birds had an abundance of food throughout the winter of 1937-1938. Good cover of all types was provided for them during the very mild and open winter.

In March 1938, when the farmers began to prepare the ground for spring crops the appearance of the rank weeds after the winter are shown in Figs. 24-27.

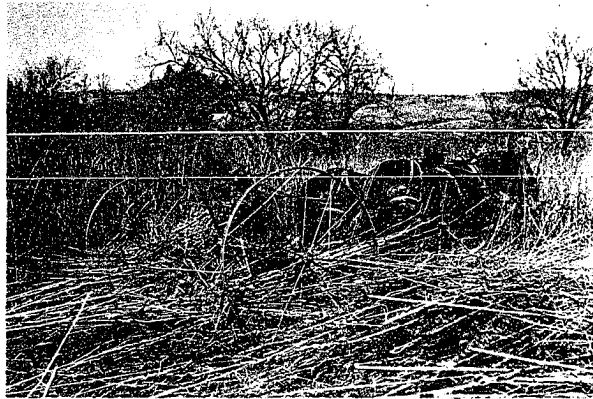


Fig. 24. Greater ragweed



Fig. 25. Lesser ragweed

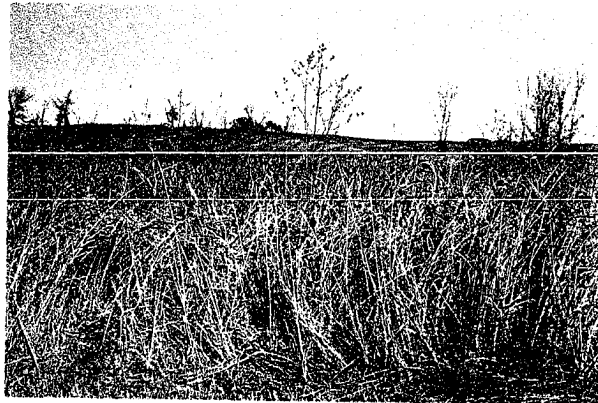


Fig. 26. Slough grass



Fig. 27. Weed and grass mixture

In June, 1938, the native plant growths seemed to compare favorably with those of the previous year, but after the crops were harvested the yield of corn for Decatur County averaged one-third less than in 1937, oats one-fifth less and wheat the same (Iowa Year Books of Agriculture, 1937 and 1938). The decrease was probably caused by insufficient moisture at critical periods and by insect injury, principally chinch bugs.

Although the native foods and cover for game had not made the rank growth of the previous summer, an abundance of both had developed and matured.

The winter of 1938-1939 was even more mild than that of 1937-1938. This locality received very little moisture from December to March which was an unusually wet month with a rainfall of 4.14 inches. When the farmers put in their crops during May, 1939, it was very dry but June was so wet that much of the low ground could not be properly cultivated. The agricultural crops were equal to those of 1938 except in the fields that had received an excess of moisture. Native game food and cover were as plentiful as in 1938 and equally as good.

Wildlife on the area began the winter of 1939-1940 with an abundance of good food and cover but during January and February it was buried under deep snow.

VIII. AGRICULTURAL CROPS AND BOB-WHITE MANAGEMENT

During the crop seasons of 1937, 1938, and 1939 a crop inventory was obtained in the autumn by means of a personal interview with each of the farmers on the area. Each farmer reported the total number of acres of land which he was farming and the manner and extent in which the land was divided among the different crops which he had grown the current season. The average size of the individual fenced fields was estimated by the writer to be about 40 acres. Sometimes this plot of ground would be seeded to two or more different kinds of crops. The larger enclosures were usually pastures which contained 40, 80, or even 120 acres. The smaller plots were usually planted with sorghum, millet, soybeans or some other similar crop which was beneficial to the bob-white when properly managed.

Corn

The first agricultural crop in importance from a monetary standpoint was corn (Table 1). The differences in the percentages between the north and the south area and also between owner and tenant operators may be explained by a personal knowledge of the economic condition of some of the owner operators in the south area. The higher percentages of their ground were seeded by owner operators in the south area than in the north in an effort on the part of some farmers to realize the greatest possible cash return from the soil in the shortest time with little consideration for the welfare of the land in order to try to pay off debt obligations in an effort to keep from losing their farms. No particular reason is known for the larger percentage of corn planted by tenant operators in the

Table 1.

Usage Distribution of Land

Crop	Year	Owner Operators								Tenant
		North Area		South Area		Total Area		North Area		South
		No. of	Per	No. of	Per	No. of	Per	No. of	Per	No. of
		Acres	Cent	Acres	Cent	Acres	Cent	Acres	Cent	Acres
Corn	1937	249	10.24	173	21.57	422	13.05	359	19.12	261
	1938	305	11.75	157	19.58	462	13.60	365	18.04	261
	1939	287	10.60	95	18.20	382	11.83	335	17.53	338
Oats	1937	179	7.36	33	4.11	212	6.56	123	6.55	157
	1938	266	10.24	90	11.22	356	10.48	194	9.59	175
	1939	169	6.24	36	6.90	205	6.35	189	9.89	187
Wheat	1937	134	5.52	0	0.00	134	4.14	0	0.00	12
	1938	121	4.66	0	0.00	121	3.56	0	0.00	0
	1939	79	2.92	0	0.00	79	2.45	0	0.00	8
Rye	1937	101	4.16	0	0.00	101	3.12	0	0.00	25
	1938	22	.85	4	.50	26	.77	10	.49	0
	1939	10	.37	0	0.00	10	.31	0	0.00	17
Meadow	1937	356	14.64	144	17.96	500	15.47	256	13.63	405
	1938	295	11.36	142	17.70	437	12.86	259	12.80	316
	1939	349	12.89	105	20.11	454	14.06	356	18.63	347
Pasture	1937	1339	55.08	420	52.37	1759	54.41	1116	59.42	1025
	1938	1502	57.86	393	49.00	1895	55.77	1112	54.97	1273
	1939	1612	59.53	257	49.23	1879	58.17	936	48.98	1403
Sorghum	1937	16	.66	15	1.87	31	.96	24	1.28	23
	1938	23	.89	2	.25	25	.74	30	1.48	46
	1939	13	.48	0	0.00	13	.40	19	1.00	10
Millet	1937	11	.45	5	.62	16	.49	0	0.00	0
	1938	0	0.00	0	0.00	0	0.00	5	.25	0
	1939	0	0.00	0	0.00	0	0.00	0	0.00	0
Legumes	1937	36	1.48	4	.50	40	1.24	0	0.00	2
	1938	62	2.39	2	.25	64	1.88	11	.54	22
	1939	132	4.87	19	3.64	151	4.67	66	3.45	76
Fallow	1937	10	.41	8	1.00	18	.56	0	0.00	127
	1938	0	0.00	12	1.50	12	.35	37	1.83	0
	1939	57	2.10	10	1.92	67	2.07	10	.52	36

Table 1.

tribution of Land

Tenant Operators						Total Operators					
North Area		South Area		Total Area		North Area		South Area		Total Area	
No. of	Per	No. of	Per	No. of	Per	No. of	Per	No. of	Per	No. of	Per
Acres	Cent	Acres	Cent	Acres	Cent	Acres	Cent	Acres	Cent	Acres	Cent
19.12	261	12.97	620	15.94	608	14.11	434	15.42	1042	14.63	
18.04	261	12.48	626	15.21	670	14.51	418	14.44	1088	14.48	
17.53	338	14.01	673	15.57	622	13.47	433	14.76	1055	13.97	
6.55	157	7.80	280	7.20	302	7.01	190	6.75	492	6.91	
9.59	175	8.36	369	8.97	460	9.96	265	9.16	725	9.65	
9.89	187	7.75	376	8.70	358	7.25	223	7.60	581	7.69	
0.00	12	.60	12	.31	134	3.11	12	.43	146	2.05	
0.00	0	0.00	0	0.00	121	2.62	0	0.00	121	1.61	
0.00	8	.33	8	.18	79	1.71	8	.27	87	1.15	
0.00	25	1.24	25	.64	101	2.34	25	.89	126	1.77	
.49	0	0.00	10	.24	32	.69	4	.14	36	.48	
0.00	17	.71	17	.39	10	.22	17	.58	27	.36	
13.63	405	20.13	661	16.99	612	14.20	549	19.51	1161	16.30	
12.80	316	15.06	574	13.95	554	11.99	457	15.79	1011	13.46	
18.63	347	14.39	703	16.26	705	15.26	452	15.41	1157	15.32	
59.42	1025	50.95	2141	55.03	2455	56.97	1445	51.35	3900	54.75	
54.97	1273	60.85	2385	57.96	2614	56.59	1666	57.57	4280	56.97	
48.98	1403	58.17	2339	54.11	2548	55.16	1660	56.58	4208	55.71	
1.28	23	1.14	47	1.21	40	.93	38	1.35	78	1.09	
1.48	46	2.20	76	1.85	53	1.15	48	1.66	101	1.34	
1.00	10	.41	29	.67	32	.69	10	.34	42	.56	
0.00	0	0.00	0	0.00	11	.26	5	.18	16	.22	
.25	0	0.00	5	.12	5	.11	0	0.00	5	.07	
0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	
0.00	2	.10	2	.05	36	.84	6	.15	42	.59	
.54	22	1.05	33	.80	73	1.58	24	.83	97	1.29	
3.45	76	3.15	142	3.28	198	4.29	95	3.24	293	3.88	
0.00	127	6.31	127	3.26	10	.23	135	4.80	145	2.03	
1.83	0	0.00	37	.90	37	.80	12	.41	49	.65	
.52	36	1.08	46	.83	67	1.45	46	1.57	113	1.50	

north area than in the south. However, when the total percentages of land planted to corn in the areas were compared little difference was found.

The growing of corn on the area was a beneficial practice in bob-white management. The larger amount of corn was husked in the fields and hauled to the farmsteads where it was cribbed for later use. This method of harvesting was of direct benefit to the quail until livestock which were turned into the fields had eaten all of the missed corn or had tramped down the vegetation until no cover remained for the birds. The practice of pasturing the husked fields by livestock of any kind was very detrimental to quail carrying capacity of the fields both from a standpoint of cover and of available food. If it were possible to leave some part of the fields best suited to sheltering the quail during the most adverse conditions, the untrampled vegetation and a little corn left as food would be of incalculable value in times of emergencies. From conversations with hunters, farmers and others interested in bob-white management practices it was found that little attention has been given to this particular phase of management.

A small amount of corn was cut and shocked and left standing in the fields. In some instances these shocks were very beneficial to the quail because they were located near shelter cover. In emergencies of deep snows they served as an excellent food supply.

Very little quantity of the corn was cut for ensilage for stock and this method of harvesting corn is of little direct benefit to bob-white.

Oats

Oats are the most important crop of the three small grains grown on the area (Table 1). These data show surprisingly little variation between owner operators of the two areas, between tenant operators of the two areas and total operators of both areas. The three-year average for the total of the two areas was 7.77 per cent. The two extremes of departure from this average were by the owner operators in the south area when in 1937 they were 3.66 per cent below and in 1938, 3.45 per cent above the three-year average. All other comparisons varied little from this average. Oats were seeded in the spring and usually matured about June 15.

During the harvest of oats some grain is lost by shattering and small amounts may be missed in cutting. This leaves some food for the bob-white but at this season of the year so much natural food is available that it is doubtful how much of these shatterings is used.

Wheat

Wheat as an agricultural crop is of minor importance, as shown by its data in Table 1. All of the wheat seeded during the investigation was winter wheat which is planted in the fall and is usually harvested about the middle of June. The owner operators in the north area during the three years seeded a total of only 334 acres while those in the south area planted none. The tenant operators in the north area during this time planted no wheat while those in the south area seeded only 20 acres. The writer is of the opinion that aside from the small number of acres planted,

wheat crops were of little importance in the management of quail.

Rye

Rye (Secale cereale), also as an agricultural crop was of little importance (Table 1). The owner operators in the north area seeded a total of 133 acres during the three-year period and four acres were seeded by those in the south area. The tenant operators in the north area seeded a total of 10 acres while those in the south area seeded 52 acres. Rye is sown in the autumn in this locality, matures and is cut about the same time that wheat is harvested. In 1939, for the first time combines were used to any extent in this area for the harvesting of small grains. More shatterings of each of the three grains were left in the fields than when the grain was bound, shocked, and threshed. Usually livestock was turned upon the stubble to glean any scattered stalks or fallen grain in the same manner as was done with the corn fields.

These small grains are frequently used as a nurse crop for clover and timothy whose young plants are delicate and need some measure of protection during their early growth. The three-year average for the whole area seeded to the three grains of oats, wheat, and rye was 10.12 per cent.

Meadow

Meadow is the term used to designate fields on which a hay crop of timothy (Phleum pratense) in pure or mixed stands is harvested (Table 1). Varying amounts of other forage plants may be present but the most important and principal plant is timothy. The three-year average of meadow

was 14.39 per cent for the whole area, 16.34 per cent for the south area and 13.16 per cent for the north area. Just why there is approximately one half more meadow in the south area than in the north area is not known. It may be because of greater susceptibility of the south area to erosion than the north area. Owner operators in the south area during each of the three years had a larger percentage of their ground in meadow than those in the north area. Tenant operators in the south area during the first two years had much more of their land in meadow than those in the north area but during the third year these operators in the north area had more of their land in meadow than those in the south area. This may have been the result of more meadow being plowed under and put in cultivation for a year or two in order that the ground might be seeded back to purer stands of desirable forages. The land when used as meadow for a number of years has a tendency to become fouled with undesirable plants and so has to be cultivated for a year or two before reseeding again.

The importance of the meadow in the life of the bob-white in this area is not known. The hay is usually cut the latter part of June, part is threshed for seed, part stacked in the fields and part placed in hay lofts in barns. When sufficient fresh growth has been made after cutting the hay, the meadows are pastured by livestock.

In the spring some of the farmers burn the dried grass remaining from the previous year. Those who practice this claim that an earlier growth is secured by exposing the ground to the direct rays of the sun. This burning renders the fields useless to the bob-whites until after sufficient growth has been made to conceal them.

Pasture

More land is used for pasture than for all other purposes combined (Table 1). The three-year average for the whole area was 53.65 per cent. The owner operators in the north area had 3.08, 8.86 and 10.30 per cent more of the total area of their land for each year in pasture than the owner operators in the south area. The tenant operators in 1937 in the north area had 9.43 per cent more of the total area of their land in pasture than those in the south area, while in 1938 and 1939 they had 5.88 and 9.19 less in pasture than the tenant operators in the south area. The owner operators in the north area in 1937 had 4.93 per cent less in pasture than the tenants in the north area. During 1938 and 1939 the owner operators had 2.89 and 10.55 per cent more of their land in pasture than the tenants. In the south area the owner operators had 1.42 per cent more of their land in pasture than the tenant operators and during 1938 and 1939 they had 11.85 and 8.94 per cent less of their land in pasture than the tenants. The three-year average annual percentage of the north and south areas in pasture was 53.77 and 53.47 respectively, a difference of only 0.30 per cent in favor of the north area which is not of material importance.

The land classed as pasture includes timber or woods pasture, open pasture, timber and waste. The largest percentage of pasture land was included in what has been termed timber or woods pasture. These pastures have from a few to many trees but are lacking in underbrush and in its place have varying amounts of grass, more generally blue grass (Poa sp.) growing under the trees. The United States Department of Agriculture

Census (1935) states Decatur County had 12.07 per cent of woodland pasture and Wayne County had 6.86 per cent. It was estimated by the writer that about 20 per cent of the land in the area was timber pasture.

The term open pasture refers to that pasture which had a few scattered trees on it which provided shade for livestock. There were only a few 40 acre plots which had no trees. It was estimated that the area contained about 20 per cent of this type of pasture.

Timber is the term used to define tree growth enclosures in which little if any grass was growing. Only one 11-acre fenced plot which was given over exclusively to the growing of timber and was not pastured by livestock at some time during the year was found on the area. The trees in this plot were making a good growth and numbers of young trees were in the stand.

About 275 acres of the woods pasture distributed in both areas contained sufficiently good stands of tree growths of different ages that it is the opinion of the writer they could profitably be fenced off and set aside for timber crops.

Waste land is the term used to include gullies, ditches and thickets which produced very little if any grass. The writer's estimate of the amount of waste on the area was between 2.5 to 5 per cent of the total area.

This land which was included under pasture was important to the management of bob-white for two reasons, first, 53.65 per cent of the total area was included in this classification and second, almost all of the permanent cover other than that found along fence rows was in these enclosures. Part or most of each covey range in which birds were found was in a pasture adjoining a grain field.

Over half the fence rows in all the fields as well as in the pastures

contained varying amounts of weed, shrub and tree growths which provided good quail environment.

Some of the gullies and eroding ditches contained weedy and shrub growths with intermixtures of grass which provided excellent shelter for bob-white. Other gullies were entirely useless because of their barrenness caused by continued erosion.

The few thickets found in the area designated as pasture provided a high quality of shelter and cover for quail because they were located near other favorable environment.

Borders refer to a strip of land on which the plant growths ranging from low forbs along the outer edge of the woods to stands of large trees which have shut out the lower level of forest plant growths. Such strips may vary from a few yards to as many as 75 yards in width. These strips constitute the really usable part of a forest or woods to the bob-white. These borders were found around the one 11 acre tract of timber and around the pastures making up the 275 acres of land which may be referred to as timber.

Sorghum, Millet, Legumes and Fallow

The remaining types of land usage practiced in this area during the period of investigation were the growing of varieties of sorghum, millet (Setaria italica) and legumes. The legumes which were grown were alfalfa (Medicago sativa), lespedeza, soy beans and sweet clover (Melilotus sp.). The land listed as fallow was not placed in any crop or used as pasture.

Tenant and owner operators for each of the three years used 294 acres

or 4.12 per cent, 252 acres or 3.35 per cent, 447 acres or 5.92 per cent for the growing of these crops and in fallow. While these percentages were relatively small when compared to the total area, yet they are of importance and may be the determining factor which makes it possible for bob-white to survive in this locality during periods of adverse climatic conditions. Of course these four methods of land use were not all practiced for the specific purpose to benefit the quail but in many instances were of material assistance to them. Because of the importance of these four methods of land usage to the bob-white, a more thorough analysis of these crops was made and will be presented in Section X, Game Management Practiced by the Farmers.

IX. LIVESTOCK AND BOB-WHITE MANAGEMENT ON THE AREA

Stoddard (1931, p. 351-352) writes, "In general it may be stated without fear of successful contradiction that the smaller the number of domestic animals at large over the quail ranges, the better for the quail, for under present methods of handling, hooved animals destroy many nests in summer, and seriously damage the birds' food supply mainly because certain native leguminous plants that furnish an important portion of their winter food cannot stand trampling and grazing during the growing months." This statement was made concerning the effect of domestic stock upon quail production in southern Georgia and northern Florida but may be applied in many ways to their production in any part of their range. The important difference is the fact that this reference refers to lands which are managed for the production of quail and crops and livestock are secondary. Since the greatest financial return on the area investigated was from field crops and livestock, the bob-white production was secondary. The topography of the terrain and nature of the soil are such that the primary use of the land should be the production of livestock. In spite of this fact, the type of livestock best suited to the area may be managed in such a manner so as not to seriously interfere with bob-white production. An inventory of the different kinds of livestock was secured by the interviews with the farmers in June, 1937, June, 1938, and November, 1939. These data are presented in tables in this section.

Horses

The small number of horses and colts on the two areas (Tables 2 and 3) and the methods of pasturing them probably had no detrimental influence on the bob-white. Most of the horses on all of the farms with one exception were used as work animals for the seeding and cultivation of the crops. When not in use, these horses were kept in stables or turned out in small pastures near the farmsteads.

The tables show a small increase of horses and colts for each successive year. Owner operators have almost twice as many horses on an acre basis for the total area as tenant operators in both north and south areas.

Cattle

During the investigation not enough cattle and calves were on the area to seriously damage the bob-white environment except perhaps on three farms (Tables 2 and 3). In 1939 six of the 24 farms in the north area contained 58 per cent of all the cattle and two of the 14 farms in the south area 52 per cent. Almost all of these cattle were of the meat producing type. Most of the cattle on the rest of the farms in both areas were of the dairy type. It was a general practice not to sell the calves of the beef cattle for veal as was done with the calves of the dairy stock. The presence of the beef cattle and calves in the pastures on a few farms probably did some damage to the bob-white and their environment.

Table 2.

Number of Adult Livestock on Area and Acres Per Animal

Stock	Year	North Area				South Area				Both Areas				Total Area	
		Owner		Tenant		Owner		Tenant		North		South			
		Operators		Operators		Operators		Operators		Area		Area			
		Acres		Acres		Acres		Acres		Acres		Acres		Acres	
		per		per		per		per		per		per		per	
		No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal
Horses															
June 1937		54	45	28	67	21	38	28	72	82	53	49	57	131	54
June 1938		64	40	24	84	26	31	29	72	88	52	55	53	143	53
Nov. 1939		71	38	23	93	15	35	38	63	94	49	53	55	147	51
Cattle															
June 1937		268	9	80	23	43	19	126	16	348	12	169	17	517	14
June 1938		187	14	106	19	30	27	154	14	293	16	184	16	477	16
Nov. 1939		328	8	162	12	34	15	126	19	490	9	160	18	650	12
Hogs															
June 1937		65	37	47	40	15	53	43	47	112	38	58	48	170	42
June 1938		90	29	51	40	19	42	28	75	141	33	47	62	188	40
Nov. 1939		416	6	175	11	58	9	168	14	591	8	226	13	817	9
Sheep															
June 1937		123	20	27	70	81	10	26	77	150	29	107	26	257	28
June 1938		118	22	32	63	21	38	210	10	150	31	231	13	381	20
Nov. 1939		193	14	37	52	0	0	261	9	230	20	261	11	491	15

Table 3.

Number of Young Livestock on Area and Acres Per Animal

Stock	Year	North Area				South Area				Both Areas				Total Area	
		Owner		Tenant		Owner		Tenant		North		South			
		Operators		Operators		Operators		Operators		Area		Area			
		Acres		Acres		Acres		Acres		Acres		Acres		Acres	
		per		per		per		per		per		per		per	
		No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal	No.	Animal
Colts															
June 1937:		7	347	0	0	1	802	2	1010	7	615	3	941	10	713
June 1938:		9	288	1	2023	2	401	0	0	10	462	2	1447	12	626
Nov. 1939:		3	903	3	637	1	522	7	344	6	770	8	367	14	54
Calves															
June 1937:		47	52	41	46	14	57	41	49	88	49	55	51	143	50
June 1938:		83	31	37	55	18	40	26	80	120	38	44	66	164	46
Nov. 1939:		50	54	36	53	5	104	25	96	86	54	30	98	116	65
Pigs															
June 1937:		155	16	154	12	27	30	67	30	309	14	94	30	403	18
June 1938:		191	14	229	9	47	17	64	33	420	11	111	26	531	14
Nov. 1939:		210	13	125	15	0	0	79	30	335	14	79	37	414	19
Lambs															
June 1937:		108	22	34	55	75	11	16	126	142	30	91	31	233	31
June 1938:		112	20	17	119	23	35	201	10	129	36	224	13	353	21
Nov. 1939:		1	2708	0	0	0	0	0	0	1	4619	0	0	1	7553

Hogs

The breeds of hogs kept in this locality are highly specialized quick meat-producing animals (Fig. 28). They are kept in small pastures as young pigs and are finished for market in small feed lots or pens. Seldom do they have access to large areas on the farms. Under this method of handling they are not a menace to bob-white production except in these small pastures. This eliminates the hogs versus bob-white problems which are found in some parts of the United States.



Fig. 28. Type of hog on the area

The difference in the number of hogs in June, 1937 and in November, 1939 (Table 2) of 647 may be partly explained by the fact that the 1939 inventory was taken near the time of the principal market season instead of in June. However, a part of this difference represents an increase in the number of breeding stock. The number of pigs in June, 1938 was 32 per cent more than in June, 1937. The number of pigs in November cannot be fairly compared with those in June because farmers prefer to raise spring and summer pigs (Table 3). The raising of hogs was the quickest and most economical way to increase the stock on the farms after the reduction necessitated by the grasshopper epidemic and drought of 1936. The farmers are able to produce a hog weighing between 180 and 250 pounds at the age of five to eight months which when sold usually brings a greater cash return for the corn consumed than if this corn had been sold.

Sheep

In June, 1937, 257 sheep were on the area (Table 2) and in November, 1939, 491 which is an increase of 234 sheep or 91 per cent. All of this increase was in adult stock which was kept for the production of lambs and wool. There were 10 or more sheep on each of eight farms in the north area and on four farms in the south area in 1939.

In the south area, one farm containing 208 acres had no sheep in 1936 or 1937. This farm had excellent bob-white cover and more coveys of birds than the average farm on the area. In 1938, 194 sheep were placed on this farm and in 1939, 173 sheep. The pasture land of about 125 acres was cropped closely and little cover of any type remained that was

suitable for bob-white. A farm in the north area which had no sheep in either 1936 or 1937 had 24 in 1939 which grazed on a 25 acre pasture. Two coveys of bob-white used this pasture as part of their range in 1936. In November, 1939, it was entirely unsuited for them. The number of lambs on the area (Table 3) was 233 in June, 1937, and 353 in June, 1938, an increase of 51 per cent. The inventory taken November, 1939, was after the lambs had been sold is the reason for only one lamb being listed. Stoddard (1931, p. 354) states, "Neither sheep nor goats, however, should be tolerated on lands held primarily for quail shooting, for sheep pasture, next to cotton land, is about the worst quail habitat known."

The total grazing pressure of horses, cattle, and sheep in terms of animal units has been calculated and is presented in Table 4 for the entire area, exclusive of unrented land. The owner operators in both areas for each year had a smaller number of acres per animal unit than the tenants with one exception. The tenants on the south area in 1938 had 3.21 acres less per animal unit than the owners. In 1937 and 1939 the north area had more animal units per acre than the south area but in 1938 the south area had more animal units per acre than the north area.

The same data are presented in Table 5 as in Table 4 except the acres per animal unit are calculated using the number of acres of pasture exclusive of unrented land instead of the total acreage, not including unrented land. The same animal unit relationship between owner and tenant operators is found in Table 5 as in Table 4. The true grazing pressure of livestock is shown in Table 5. Since owner operated land with the one exception, shows a greater grazing pressure than tenant operated land, quail environment should have been better on the tenant operated land.

Table 4.

Number of Animal Units¹ and Acres to Animal Unit Based on
Total Acreage Operated in Area².

North Area				South Area				Both Areas				Total			
Owner		Tenant		Owner		Tenant		North		South		All			
Operators		Operators		Operators		Operators		Area		Area		Operators			
:Acres :		:Acres :		:Acres :		:Acres :		:Acres :		:Acres :		:Acres :			
:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per			
:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:			
Year:	Units	:Unit	:	Units	:Unit	:	:	Units	:Unit	:	:	Units	:Unit		
June:	:	:	:	:	:	:	:	:	:	:	:	:	:		
1937:	358	: 6.79	:	124	: 15.14:	85	: 9.43	: 170	: 11.89:	482	: 8.94:	255	: 11.07:	737	: 9.68:
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
June:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1938:	299	: 8.68	:	145	: 13.95:	66	: 12.15:	234	: 8.94:	444	: 10.40:	300	: 9.65:	744	: 10.10:
:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
Nov.:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1939:	440	: 6.15	:	200	: 9.55:	50	: 10.44:	209	: 11.54:	640	: 7.22:	259	: 11.33:	899	: 8.40:

1. An animal unit is equal to: one horse, one cow, four colts or four calves under one year, seven sheep, or 14 lambs as stated by Schickele (1937 p. 358).

2. Hogs and pigs were not included.

Table 5.

Number of Animal Units¹ and Acres to Animal Unit Based on
Total Acreage of Pasture Operated on Area².

	North Area				South Area				Both Areas				Total	
	Owner		Tenant		Owner		Tenant		North		South		All	
	Operators		Operators		Operators		Operators		Area		Area		Operators	
	:Acres:		:Acres:		:Acres:		:Acres:		:Acres:		:Acres:		:Acres:	
	:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per		:No. of:per	
	:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:		:Animal:Animal:	
Year:	Units	Unit	Units	Unit	Units	Unit	Units	Unit	Units	Unit	Units	Unit	Units	Unit
June:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1937:	358	3.74	124	9.00	85	4.94	170	6.03	482	5.09	255	5.67	737	5.29
June:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1938:	299	5.02	145	7.67	66	5.95	234	5.44	444	5.89	300	5.55	744	5.75
Nov.:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
1939:	440	3.66	200	4.68	50	5.14	209	6.71	640	3.98	259	6.41	899	4.68

1. An animal unit is equal to: one horse, one cow, four colts or four calves under one year, seven sheep, or 14 lambs as stated by Schickele (1937 p. 358).

2. Hogs and pigs were not included.

The average number of acres for an animal unit on the area was 5.29 in 1937, 5.75 in 1938 and 4.68 in 1939. These data show that the grazing increased 0.61 acres per animal unit from 1937 to 1939. Hurd and Thomas (1934) published data of a survey made in 1930 in which they found that the number of acres used per animal unit in this part of the state was from two to five acres. If hogs and pigs had been included in Table 5, the number of acres per animal unit in 1939 would have been 3.5 which is the average number of acres found in the 1930 survey. This would seem to indicate that any increased grazing pressure might be detrimental to the welfare of the pasture and eventually to quail environment.

X. GAME MANAGEMENT PRACTICED BY THE FARMERS

Late in November, 1935, Watson E. Beed began game management work on the area where he and his wife lived as members of the community until June 10, 1936. During this period he endeavored to secure the cooperation of the farmers, distributed seed and materials to them for use in game management practices, and studied bob-white environment.

Season of 1936.

During the spring of 1936, sorghum seed, Korean lespedeza (Lespedeza stipulacea) seed, trees, and barbed wire were furnished without cost to the farmers to be used to perform designated game management practices. The farmers on the south area were paid ten cents an acre at this time to put these practices into operation during the crop year of 1936.

The writer and his wife became members of the community late in August of 1936. One of the first things which was done after becoming acquainted with the farmers was to secure a record of the definite bob-white management practices that had been performed by each farmer.

In preparing the data for the tables in this section six farm operators who had land in both areas were placed in the area in which most of their land was located. This placed four in the north area and two in the south area and so eliminated any duplication in the treatment of the data. During the discussion of the data in this section it is important to remember that the farmers in the south area were paid ten

cents an acre for the years 1936 and 1937 for practicing game management but were not permitted to charge for hunting, while those in the north area were not paid an acreage fee but were permitted to charge for hunting.

The two varieties of sorghum given to the farmers were black amber cane which may have been Minnesota amber sorgo, Dakota amber sorgo, or Waconia amber sorgo, and grohoma. Ten pounds of either variety were supplied to each farmer who desired it which is the amount of seed recommended to plant one acre in rows. An examination of the percentages of the different groups in Table 6 shows little difference of like groups accepting seed. All of the tenants in both areas accepted seed while 87 per cent of the owner operators in the north area, four per cent more than those in the south area, accepted seed. Some farmers disliked growing sorghum on their land because it is a soil depleting crop. The percentage of owner operators in the north area planting seed was 69 which was only two per cent more than that of each of the other three groups. The important part of this table from a game management viewpoint is that the seed was planted by almost identical percentages of each of the four groups of farm operators and the little difference of two per cent more for the owner operator group was on the north area where the farmers were not paid an acreage fee for game management practices on the land. After June 15, the 1936 growing season became very unfavorable for the growing and maturing of crops because of the hot dry weather and the severe grasshopper epidemic. Sorghums withstood these adverse conditions the best of any crop but one third of the tenants in each area planted no seed. The owner operators on the north area who planted no seed were 19 per cent, two more than those in the south. Nearly equal percentages of like groups

that received seed did not plant it. It may have been that some of the operators who waited until late in the season to plant the seed decided not to plant it because it was so dry that they knew there was not enough top soil moisture to germinate the seed.

Table 6.

Results of Distribution and Use of Sorghum Seed Given Farmers
for Game Management Practices in 1936

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operator		Operator		Operator		Operator	
	Per		Per		Per		Per	
	No.	Cent	No.	cent	No.	cent	No.	cent
Farmers								
Receiving Seed	14	87	9	100	5	83	6	100
Farmers								
Receiving No Seed	2	13	0	0	1	17	0	0
Farmers								
Planting Seed	11	69	6	67	4	67	4	67
Farmers								
Planting No Seed	3	19	3	33	1	17	2	33
Fields								
Matured Seed	7	42	3	33	3	50	3	50
Fields								
Partly Matured Seed	3	19	0	0	0	0	0	0
Fields								
Maturing No Seed	1	6	3	33	1	17	1	17

The adverse conditions prevented the sorghums from maturing the usual quantities of good quality seed although they developed moderate amounts of forage. Since some livestock losses resulted from eating the sorghum while the hydrocyanic acid content was high, some farmers cut the sorghum for

fodder when only a little seed had matured. Since this was practically the only food for livestock this season, only the shattered heads were left in the fields. Only a very few farmers left even small quantities of seed accessible to the bob-white.

The cost of the seed planted and not planted by the four groups of land operators is analyzed in Table 7.

Table 7.

Cost of Sorghum Seed Given Farmers for Game Management Practices in 1936

	North Area		South Area	
	Owner	Tenant	Owner	Tenant
	Operator	Operator	Operator	Operator
Ave. Cost of 10 lbs. of Seed Per Farmer	\$.39	\$.39	\$.39	\$.39
Cost of Seed Planted by Farmers	4.29	2.34	1.56	1.56
Cost of Seed Not Planted by Farmers	1.17	1.17	.39	.78
Total Cost of Seed	5.46	3.51	1.95	2.34

Korean Lespedeza was the variety of legume selected as the best for this locality. One bushel was supplied each farmer who desired it which would seed from two to twenty acres depending upon the method and purpose of seeding as recommended by Pieters (1939). Lespedeza seed was secured by 81 per cent of owner operators in the north area while 100 per cent of each of the other three groups secured seed (Table 8). The percentage of owner operators in the north area planting seed was 69 and of tenants was

only two per cent less. The percentage of owner operators in the south area was 83 but all of the tenants planted seed.

Table 8.

Results of Distribution and Use of Lespedeza Seed Given Farmers
for Game Management Practices in 1936

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operator		Operator		Operator		Operator	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Farmers								
Receiving Seed	13	81	9	100	6	100	6	100
Farmers								
Receiving No Seed	3	19	0	0	0	0	0	0
Farmers								
Planting Seed	11	69	6	67	5	83	6	100
Farmers								
Planting No Seed	2	13	3	33	1	17	0	0
Fields								
Matured Seed	3	19	3	33	0	0	1	17
Fields								
Partly Matured Seed	2	13	1	11	2	33	2	33
Fields								
Maturing No Seed	6	38	2	22	3	50	3	50

Apparently the success of the lespedeza in maturing seed was materially influenced by the time at which it was planted, by climatic conditions and by the grasshopper epidemic because so much of the seed did not mature. Since this legume is an annual, the maturing of seed by any individual plant makes it possible for each plant to be the center of further spread

of this introduced species which is considered with such favor by soil conservationists and game managers.

The number of farms on which lespedeza matured seed was small and as a result the first year's introduction of this plant was of little practical benefit to the bob-white.

The cost of lespedeza seed planted and not planted has been analyzed in Table 9.

Table 9.

Cost of Lespedeza Seed Given Farmers for Game Management Practices in 1936

	North Area		South Area	
	Owner	Tenant	Owner	Tenant
	Operator	Operator	Operator	Operator
Cost of 1 Bushel of Seed per Farmer	\$ 2.50	\$ 2.50	\$ 2.50	\$ 2.50
Cost of Seed Planted by Farmers	27.50	15.00	12.50	15.00
Cost of Seed Not Planted by Farmers	5.00	7.50	2.50	0.00
Total Cost of Seed	32.50	22.50	15.00	15.00

The Clark-McNary Cooperative Nursery operated by the Department of Forestry, Iowa State College and the Conservation Commission donated 5,175 trees which were trucked to the area May 5, 1936. The species and number of trees were: red pine (Pinus resinosa) 2275, western yellow pine (Pinus ponderosa) 1500, Scotch pine (Pinus sylvestris) 950, jack pine (Pinus banksiana) 250, Chinese elm (Ulmus pumila) 100, and osage orange (Maclura pomifera) 100. They ranged from 12 to 20 inches in height. The trees were

well taken care of and were distributed to the farmers who set most of them out in the next few days. As far as is known no special instructions were given for the setting of these trees, except that they were to be placed along gullies, ditches and hillsides to assist in controlling rapidly eroding places and to provide cover for game. Some of the farmers were very careful in their care of the young trees. They dug rather large holes for the trees and used water when setting them. Generally speaking, the season was quite moist during April, May, and June but the last of June the temperature became abnormally high accompanied by hot dry southwest winds. The trees were not affected by the grasshopper epidemic but only three trees of all those planted survived the long continued high temperatures and dry winds during the last half of June, July, August, and the first half of September. These three had died by spring, 1937. The percentage of owner operators in the north area setting trees was 62, 18 more than the tenants (Table 10). In the south area 50 per cent of both owner and tenant operators planted trees. Even with these adverse results the farm operators in December, 1936, expressing their desire to attempt growing trees on their lands in 1937 showed an increase of approximately 20 per cent in each group of operators except the owners in the south area, only 50 per cent of whom, the same as in 1936 indicated they wished to try again.

Since the trees were donated, the only cost was for the transportation, \$19.60.

Table 10.

Trees Given Farmers for Game Management Practices in
1936 and Trees Desired by Farmers in 1937

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operators		Operators		Operators		Operators	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Season 1936								
Farmers								
Receiving Trees	10	62	4	44	3	50	3	50
Farmers								
Receiving no Trees	6	38	5	56	3	50	3	50
Farmers								
Setting out Trees	10	62	4	44	3	50	3	50
Farms on which Trees Lived ¹	0	0	0	0	0	0	0	0
Spring 1937								
Farmers								
Desiring Trees	13	81	6	67	3	50	4	67
Farmers								
Desiring no Trees	3	19	3	33	3	50	2	33

1. Only three trees on one farm lived through the summer and these were dead by spring 1937.

Livestock on the area were partially responsible for the continued active erosion and spread of ditches and gullies. The stock in the pastures which contained gullies made paths very close to their edges. After rains the stock walked along these paths, their weight frequently pushed parts of these softened edges into the eroded part. This prevented these edges from becoming securely anchored by vegetation and thus stopping further spread of the eroding area. More soil was pushed towards ditch and gully bottoms as stock trampled their sides and many plants growing in the

loose soil of their sides were pulled up by the roots when they were cropped. This not only exposed the soil to continued erosion but destroyed protective plants which had become partially established and made it necessary for others to grow and become established before they could begin to replace the protection begun earlier.

In an attempt to control this cause of erosion and to hasten the establishment of a protective cover which would also benefit quail, barbed wire was provided each farmer who wished to enclose a part of some ditch or gully. They were also asked to fence one winter feeding station for bob-white against stock. The percentage of different operator groups who received wire ranged from a low of 22 for tenants on the north area to a high of 83 for tenants on the south area (Table 11). Less than one third of those receiving wire used it for the designated purposes, and very little was used in any other way. Tenants on the north area used none of it while 50 per cent of those in the south area made some use of it. Only 12 per cent of the owners on the north area made any use of it while 17 per cent of those on the south area made some use of it.

Table 11.

Results of Distribution and Use of Wire Given Farmers
for Game Management Practices in 1936

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operator		Operator		Operator		Operator	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Farmers Receiving Wire	8	50	2	22	4	67	5	83
Farmers Receiving no Wire	8	50	7	78	2	33	1	17
Spools of Wire Received	21		8		8		11	
Farmers Using Wire	2	12	0	0	1	17	3	50
Farmers Using No Wire	6	38	2	22	3	50	2	33
Spools of Wire Used	2		0		1		3	
Spools of Wire Not Used	19		8		7		8	

The cost of barbed wire used and not used by the farmers has been analyzed in Table 12.

Table 12.

Cost of Wire Given Farmers for Game Management
Practices in 1936

	North Area		South Area	
	Owner	Tenant	Owner	Tenant
	Operators	Operators	Operators	Operators
Cost of Wire per Spool	\$ 3.05	\$ 3.05	\$ 3.05	\$ 3.05
Cost of Wire Used per Farmer	3.05	0.00	3.05	3.05
Cost of Wire Not Used per Farmer	9.66	12.20	7.12	12.20
Cost of Wire Used by Farmers	6.10	0.00	3.05	9.15
Cost of Wire Not Used by Farmers	57.95	24.40	21.35	24.40
Total Cost OF Wire	64.05	24.40	24.40	33.55

A summary of each of the game management practices performed by the farmers is presented in Table 13. Several farmers are counted more than once since they practiced two or more types of game management. Each of two tenants on the south area performed four different types of game management. They planted lespedeza, sorghum, fenced a feeding station or eroding ditch, and constructed a feeding station. Each of several owners and tenants on both areas performed three practices, the most frequent combination being, the setting of trees, sowing lepedeza, and planting

sorghum.

Table 13.

Summary of Game Management Practices Performed by
Farmers in 1936

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operators		Operators		Operators		Operators	
	Per		Per		Per		Per	
	No.	cent	No.	cent	No.	cent	No.	cent
Planted Sorghum	11	69	6	67	4	67	4	67
Planted Lespedeza	11	69	6	67	5	83	6	100
Set out Trees	10	62	4	44	3	50	3	50
Fenced Ditch or								
Feeding Station	2	13	0	0	1	17	3	50
Constructed								
Feeding Station	1	6	0	0	2	33	2	33

The owner operators on both areas were equally cooperative in planting sorghum, lespedeza, and trees in that an average of 67 per cent of them performed these practices. These same practices were performed by an average of 59 per cent of the tenant operators on the north area and 72 per cent on the south area, a difference of 13 per cent in favor of the tenants on the south area. Comparing the average percentage of owner operators on the two areas with the average percentage of the tenant operators they were 67 to 65.5 or a difference of only 1.5 per cent in favor of the owners which because of this slight difference is not considered significant. Comparing the average percentage of all operators on the north area with those on the south they were 63 to 69.5 or a difference of 6.5 in favor of the south area.

The payment of an acreage fee for the performance of management

practices apparently made no difference with the owner operators as to the amount of game management practiced. The receiving of an acreage fee did seem to influence 13 per cent more of the tenant operators in the south area to practice game management than those in the north area. The payment of an acreage fee did seem to influence an average of 6.5 more of all the operators on the south area to perform these practices.

The practices of fencing a ditch or feeding station and constructing a feeding station were done by only seven different farm operators of the 37 on both areas. Two of the seven were owner operators on the north area, two were owner operators on the south area and three were tenant operators on the south area. Averaging the percentages of those performing these practices, 9.5 per cent of the owner operators performed them while no tenants did them. In the south area the average of the percentage of owner operators who performed these practices was 25 per cent while it was 41.5 for the tenants. Comparing the average percentages of owner operators on the two areas with the average percentages of tenant operators they were 17.5 per cent to 20.75 or a difference of 3.5 in favor of the tenants. Comparing the average percentages of all operators on the north area with those on the south area they were 4.75 per cent to 33.25 or a difference of 28.5 per cent in favor of the operators on the south area. The payment of an acreage fee did seem to influence an average of 28.5 per cent more of the operators on the south area than on the north area to perform these practices.

Part or all of the agricultural practices of planting sorghum, lespedeza, and trees were performed by 30 of the 37 operators on both areas while fencing ditches or feeding stations and building a feeding

station were performed by only seven of the 37 operators.

A summary of the farmers performing game management practices is presented in Table 14. No farmer, either owner or tenant operator, on either the north area or south area performed all the designated game management practices. In the north area 75 per cent of the owner operators and 8 per cent less of the tenants performed part of the game management practices. In the south area 100 per cent of both owner and tenant operators performed part of the practices. In the south area 100 per cent of both owner and tenant operators performed part of the practices. No game management practices were reported by four owner and three tenant operators on the north area.

Table 14.

Summary of Farmers Performing Game Management Practices
in 1936

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operators		Operators		Operators		Operators	
	Per		Per		Per		Per	
	No.	cent	No.	cent	No.	cent	No.	cent
Farmers Performing:								
All Practices	0	0	0	0	0	0	0	0
Farmers Performing:								
Part of Practices	12	75	6	67	6	100	6	100
Farmers Performing:								
No Practices	4	25	3	33	0	0	0	0
Total	16	100	9	100	6	100	6	100

A comparison of the average percentages of all operators performing part of the practices shows 71 per cent for the operators on the north area to 100 per cent for those on the south, or a difference of 29 per cent in favor of the latter. Apparently the operators on the south area who were paid an acreage fee were influenced to perform more of the game management practices than those on the north area, who were not paid.

The game management practices performed by the four groups of operators in 1936, may be summarized thus: apparently the payment of an acreage fee secured a partial cooperation by 100 per cent of both owner and tenant operators in the south area, on which an acreage fee was paid, against a cooperation of 75 per cent of owner operators and 67 per cent of tenant operators in the north area, on which no acreage fee was paid.

The costs for 1936 of all game management practices including the acreage fee of ten cents per acre paid the operators in the south area have been summarized in Table 15. When the sum of the amount expended on each type of land operation in each area is reduced to an acre basis fair comparisons are possible. In the south area owner and tenant operators received an average of 13.34 cents an acre to perform recommended game management practices while in the north area the same operators received an average of 3.47 cents an acre, a difference of 9.87 cents an acre in favor of the south area operators. As shown in Tables 13 and 14, a larger percentage of operators on the south area than those on the north area cooperated in game management but the difference was far from proportionate to the difference in the amount of payment per acre.

Table 15.

Summary of Costs of Game Management Practices

	North Area			South Area			Total	
	Owner	Tenant	Owner and	Owner	Tenant	Owner and	All	
	Operator	Operator	Tenant Operators	Operator	Operator	Tenant Operators	Operators	
Cost of Sorghum	\$ 5.46	\$ 3.51	\$ 8.97	\$ 1.95	\$ 2.34	\$ 4.29	\$ 13.26	
Cost of Lespedeza	32.50	22.50	55.00	15.00	15.00	30.00	85.00	
Cost of Wire	64.05	24.40	88.45	24.40	33.55	57.95	146.40	
Cost of Land Rental	0.00	0.00	0.00	109.00	188.40	297.40	297.40	
Cost of Trees	6.07	5.97	12.04	2.77	4.79	7.56	19.60	
Total Cost of Items	102.01	50.41	152.42	150.35	239.29	389.64	561.66	
Cost per Acre	.0445	.0262	.0347	.1404	.1295	.1334		

Game management was continued by some farmers during the severe winter of 1936-1937. Two farmers reported taking feed to the field for the quail and one of these was sure that the quail used the feed left in thickets for them. Five other farmers reported they threw out feed to the quail when they came to the farmsteads. One farmer left shocked grohoma standing in the field and two farmers had shocked corn in the field. One farmer stored his corn fodder in a woodlot in which quail were known to be wintering. Four other farmers put up five shelter stations of sorghum.

Season of 1937

When the writer returned to the area, March 29, 1937, plans for the specific game management practices for this year were explained to each farmer. Since the farmers on the north area had often requested that they be paid an acreage fee the same as those on the south area, the plans for this year included the north area. Both areas were to be operated the same as during 1936 except the farmers in the north area as well as those in the south area were to be paid ten cents an acre for practicing game management. In order to qualify for this fee each farmer was to do the following:

1. Grow some game food crop of at least one-fourth acre in a location near good cover, the food patch to be fenced against stock and left for game.

2. To fence one eroding ditch against stock.

The farmers were told that their farms would be checked in October to see if they had complied with the requirements before they would be paid the

acreage fee.

As the writer called on each farmer he satisfied himself that each one understood the game management practices that he was expected to do. Afterwards the writer did not in any direct manner order or request that the promises to fulfil the two requirements be met. But as he went around the area and observed that a farmer was slow in complying with the promises, he tactfully entered into conversation with him and called his attention to the fine food patch a farmer was planting or the fencing of a gully by another farmer. At no time was any farmer vexed about the situation or argumentative about the problem. Some excuse was given for delaying the fulfilment of the requirement. The writer was always received courteously and the partings were always friendly.

The year 1937 was more favorable to the farmers on the area than the two previous years in that increased rainfall at the proper time aided in developing an abundance of forage and good crops of cereals. Consequently it might be expected that a larger number than during either of the two previous years would be in an economic condition as well as a favorable frame of mind to carry out more of the practices recommended for game management.

Late in the summer the farmers in the north area were told that no funds were available to pay them the acreage fee which they had been promised. It is impossible to determine the effect that this promise had upon the game management practices in the north area.

On the entire area (Table 16) only two of the 37 operators performed all of the practices and 21 did not carry out any of the recommended practices. The two who carried out all of the practices were

tenant operators on the south area. In the north area 47 per cent of the owner operators and 10 per cent less of the tenants performed part of the game management practices. In the south area 20 per cent of the owner operators and 8.5 per cent more of the tenant operators performed part of the designated game management practices.

Of the owner operators in the north area, 47 per cent performed part of the practices, as compared with 20 per cent of those in the south area, a difference of 27 per cent in favor of the north area. Likewise, of the tenant operators in the north area, 37 per cent performed part of the practices, as compared with 28.5 per cent of those in the south area, a difference of 8.5 per cent in favor of the north area.

Table 16.

Summary of Farmers Performing Game Management Practices in 1937

	North Area				South Area			
	Owner		Tenant		Owner		Tenant	
	Operators		Operators		Operators		Operators	
	No.	Per cent	No.	Per cent	No.	Per cent	No.	Per cent
Farmers Performing All Practices	0	0	0	0	0	0	2	28.5
Farmers Performing Part of Practices	8	47	3	37	1	20	2	28.5
Farmers Performing No Practices	9	53	5	63	4	80	3	43.0
Total	17	100	8	100	5	100	7	100.0

Comparing the average percentages of all operators performing all or part of the game management practices on the north area with those on the south area they were 42 per cent to 38.5 or a difference of 3.5 per cent in favor of the operators on the north area.

When the data in Tables 14 and 16 are compared, they show a decided decrease in the percentages of the four groups of operators performing part or all of the designated game management practices for the year 1937. But this is not a reliable comparison because only one of the designated practices was the same 1936 as in 1937, that was the fencing of an eroding ditch or gulley.

The food patches planted in 1937 matured an abundance of food (Fig. 29) and three owner operators and three tenants on the north area and one owner operator and three tenants on the south area left them standing in the fields for quail food. Most of the food patches were protected from the stock by not permitting them to graze in the fields in which the patches were located. One field of soy beans (Fig. 30) was fenced to protect it from livestock. When sorghum stalks froze sufficiently, they bent or broke over about 1.5 to 2.5 feet above the ground (Fig. 31) and fell in various directions forming almost a solid mat or roof. It would seem that these mats might act as a possible shelter and food supply for quail. Only two eroding ditches were fenced (Figs. 32 and 33) during 1937. Later when tenants were changed, March, 1938, both fences were removed.

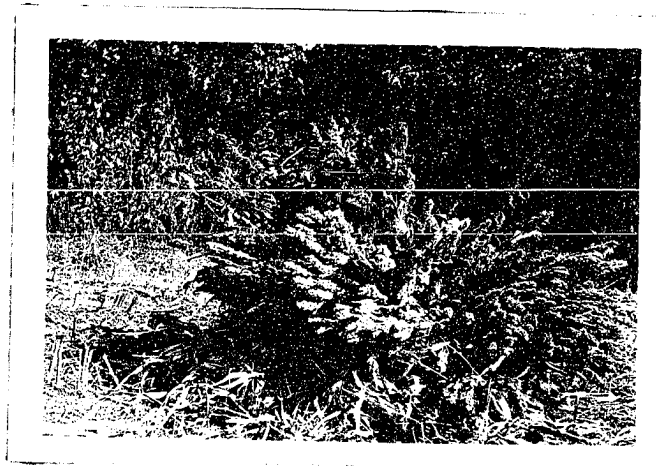


Fig. 29. Sorghum food patch



Fig. 30. Soy bean food patch



Fig. 31. Frozen sorghum stalks

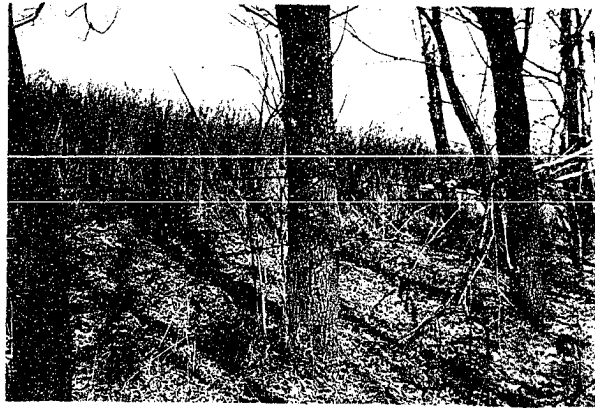


Fig. 32. Fenced ditch



Fig. 33. Fenced ditch

Data of other small fields of agricultural crops which were planted during 1937 and might have been of some benefit to quail are presented in Table 17. This table includes the food patches planted especially for quail. In some of the 21 fields not planted specifically for quail some food was left in the fields for them. Some soy beans and sorghum were left shocked in the fields and some millet (Fig. 34) and sorghum were left standing to provide food for the bob-white.



Fig. 34. Field of Millet

Table 17.

Owner Operator									
Crop	Year	North Area			South Area			No. of Fields	S
		No. of	Size Range of Fields	Total No. of Acres	No. of	Size Range of Fields	Total No. of Acres		
		Fields	in Acres	Acres	Fields	in Acres	Acres		
Sorghum	1937	7	$\frac{1}{4}$ - 6	17 $\frac{1}{2}$	2	5 - 10	15	7	
	1938	5	1 - 10	23	2	1	2	6	
	1939	4	1 - 9	13	0	0	0	3	
Millet	1937	2	5 - 6	11	1	5	5	0	
	1938	0	0	0	0	0	0	1	
	1939	0	0	0	0	0	0	0	
Alfalfa	1937	2	5 - 15	20	1	4	4	0	
	1938	1	15	15	1	2	2	0	
	1939	2	10 - 15	25	1	3	3	1	
Lespedeza	1937	0	0	0	0	0	0	0	
	1938	0	0	0	0	0	0	0	
	1939	4	5 - 16	35	1	10	10	4	
Soy beans	1937	3	4 - 8	16	0	0	0	0	
	1938	6	1 - 10	27	0	0	0	1	
	1939	5	2 - 10	23	1	4	4	0	
Sweet clover	1937	0	0	0	0	0	0	0	
	1938	2	6 - 14	20	0	0	0	2	
	1939	7	4 - 12	49	1	2	2	1	
Fallow	1937	1	10	10	1	8	8	0	
	1938	0	0	0	1	12	12	2	
	1939	3	5 - 34	57	1	10	10	2	

Table 17. Analysis of Sorghum, Millet, Legumes and Fallow Fields

Tenant Operator											Total	Operator
North Area						South Area						
No.	Size Range	Total	No.	Size Range	Total	No.	Size Range	Total	No.	Size Range	Total	
of	of Fields	No. of	of	of Fields	No. of	of	of Fields	No. of	of	of Fields	No. of	
Fields	in Acres	Acres	Fields	in Acres	Acres	Fields	in Acres	Acres	Fields	in Acres	Acres	Fields
15	7	$\frac{1}{4}$ - 7	25	7	$\frac{1}{4}$ - 10	33 $\frac{3}{4}$	14	$\frac{1}{4}$ - 7	42 $\frac{1}{2}$			
2	6	$\frac{1}{4}$ - 10	30	5	1 - 20	46	7	1 - 10	25			
0	3	3 - 10	19	3	1 - 5	9	4	1 - 9	13			
5	0	0	0	0	0	0	2	5 - 6	11			
0	1	5	5	0	0	0	1	5	5			
0	0	0	0	0	0	0	0	0	0			
4	0	0	0	0	0	0	2	5 - 15	20			
2	0	0	0	1	2	2	1	15	15			
3	1	10	10	2	4 - 26	30	3	10 - 15	35			
0	0	0	0	0	0	0	0	0	0			
0	0	0	0	0	0	0	0	0	0			
10	4	3 - 30	46	3	2 - 10	19	8	3 - 30	81			
0	0	0	0	1	2	2	3	4 - 8	16			
0	1	4	4	1	20	20	7	1 - 10	31			
4	0	0	0	1	9	9	5	2 - 10	23			
0	0	0	0	0	0	0	0	0	0			
0	2	3 - 4	7	0	0	0	4	3 - 14	27			
2	1	10	10	1	18	18	8	4 - 12	59			
8	0	0	0	3	22 - 80	127	1	10	10			
12	2	12 - 25	37	0	0	0	2	12 - 25	37			
10	2	5	10	3	6 - 20	36	5	5 - 34	67			

m, Millet, Legumes and Fallow Fields

Operator			Total			Operators		
South Area			North Area			South Area		
No. of Fields	Size Range	Total	No. of Fields	Size Range	Total	No. of Fields	Size Range	Total
Fields	in Acres	Acres	Fields	in Acres	Acres	Fields	in Acres	Acres
7	1/4 - 10	33 3/4	14	1/4 - 7	42 1/2	9	1/4 - 10	48 3/4
5	1 - 20	46	7	1 - 10	25	11	1/4 - 20	76
3	1 - 5	9	4	1 - 9	13	6	1 - 10	28
0	0	0	2	5 - 6	11	1	5	5
0	0	0	1	5	5	0	0	0
0	0	0	0	0	0	0	0	0
0	0	0	2	5 - 15	20	1	4	4
1	2	2	1	15	15	2	2	4
2	4 - 26	30	3	10 - 15	35	3	3 - 26	33
0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0
3	2 - 10	19	8	3 - 30	81	4	2 - 10	29
1	2	2	3	4 - 8	16	1	2	2
1	20	20	7	1 - 10	31	1	20	20
1	9	9	5	2 - 10	23	2	4 - 9	13
0	0	0	0	0	0	0	0	0
0	0	0	4	3 - 14	27	0	0	0
1	18	18	8	4 - 12	59	2	2 - 18	20
3	22 - 80	127	1	10	10	4	8 - 80	135
0	0	0	2	12 - 25	37	1	12	12
3	6 - 20	36	5	5 - 34	67	4	10 - 20	46

The winter of 1937-1938 was so open and mild and native foods and cultivated grains were so plentiful that feeding of quail was not necessary.

Seasons of 1938 and 1939

Notice of the discontinuance of the acre fee was given early in 1938, although the two areas were to continue as experimental bob-white areas. Observations and collection of data on game management practices by the farmers continued through February, 1940 although less intensively. The fields of crops for 1937, 1938 and 1939 which might be favorable to the bob-white were presented in Table 17. A summary of this table is presented in Table 18. The combined total number of fields of sorghum, lespedeza, soy beans and millet for these years are 30, 27, and 29. The number of sorghum fields dropped from 23 in 1937 to 10 in 1939. This decrease may be attributed directly to the lack of its continued emphasis for game food purposes. The first lespedeza fields reported were 12 in 1939 containing 110 acres of this desirable plant which is recommended for soil building, erosion control and quail food. The discontinuance of the growing of millet and the increase of soy beans may be due to chance selection on the part of the farmer for some crop to meet the qualifications to receive soil benefit payments under the provisions of the United States Agricultural Adjustment Administration. The use of alfalfa increased especially in 1939. It is the writer's

opinion that the farmers were not fully informed of the game food possibilities of certain plants which may at the same time possess all the food possibilities which he desires for his livestock and restore soil fertility and control soil erosion.

Table 18. Summary of Sorghum, Millet, Legumes, and Fallow Fields

	Fields			Acres		
	1937	1938	1939	1937	1938	1939
Sorghum	23	18	10	91	101	41
Alfalfa	3	3	6	24	19	68
Lespedeza	0	0	12	0	0	110
Soy beans	4	8	7	18	51	36
Sweet clover	0	4	10	0	27	79
Millet	3	1	0	16	5	0
Fallow	5	3	9	145	49	113
Total	38	33	54	294	252	447

The winter of 1938-1939 was even more mild and open than that of 1937-1938 so that the bob-white did not need to be fed.

During the severe part of the winter of 1939-1940, 20 farmers fed 26 coveys of quail around their farmsteads. This may be taken as an

indication of an increased interest of the farmers in the welfare of this upland game bird.

XI. INSECTIVOROUS AND SEED-EATING BIRDS AND BOB-WHITE MANAGEMENT

Early in the autumn of 1936, seed-eating and insectivorous birds were observed actively competing with quail for food. In an endeavor to try to find out the extent and seriousness of this competition for food a daily record was kept of the various species of birds observed during the two long periods of residence upon the area. The extent of this food shortage and the seriousness of this competition were not apparent until winter began, although it was recognized that an emergency existed.

Errington and Hamerstrom (1936 p.381) make this statement, "Where there isn't enough winter food for any population, it does not make a great deal of difference if a dozen birds or twice as many try to exist there..... If the ecological scales are set so fine that there is no more than exactly enough for the wintering bob-white population, they may be thrown out of balance at almost any time, anyway, as by a chance visitation of a numerous flock of sparrows or other small birds."

The 1936 season, as has been stated previously, was unfavorable for both native and cultivated foods and most insect populations were low except that of grasshoppers. Late in August and early in September, Eastern Robins (Turdus migratorius migratorius), Eastern Cardinals (Richmondia cardinalis cardinalis), Catbirds (Dumetella carolinensis), Red-headed Woodpeckers (Melanerpes erythrocephalus), Northern Flickers (Colaptes auratus luteus), Red-bellied Woodpeckers (Centurus carolinus), Brown Thrashers (Toxostoma rufum), Red-eyed Towhees (Pipilo erythrophthalmus erythrophthalmus), Blue Jays (Cyanocitta cristata cristata), and

various species of sparrows were feeding with the bob-whites on the sorghum seeds. During the period of mild temperatures and warm rains in the last half of September and the first half of October this competition was negligible. After killing frosts and the arrival of below freezing temperatures the competition became more acute. Late in November and early in December, Slate-Colored Juncos (Junco hyemalis hyemalis) and Black-capped Chickadees (Penthestes atricapillus atricapillus) that winter in this locality were present by the thousands and the English Sparrows (Passer domesticus domesticus) were found in lesser numbers. A few other sparrows were present in small numbers. On several occasions these birds and bob-whites were seen feeding together on weed seeds. It is not known when the supply of these seeds became exhausted. When on the area early in March very few seed-eating birds were seen and they were not observed in numbers again until late in summer or early in autumn of 1937. It is possible that the seed-eating birds migrated after using a large part of the available native and cultivated foods and when ice had made inaccessible most of that which remained. The non-migratory bob-white was not so fortunate as to be able to leave to seek a more favorable food supply but had to remain and endeavor to subsist upon what was left.

At no other time during the investigation were any insectivorous or seed-eating birds observed competing with the bob-white for food. Abundant supplies of both native and cultivated foods were produced in each of the three successive seasons of 1937, 1938 and 1939. The winters of 1937-1938 and 1938-1939 were so very mild and open that abundant food supplies were available for all the birds that wintered here. However, the winter of 1939-1940 caused another food emergency for the quail.

When on the area the third week in January, 1940, when the temperature was dropping several degrees below zero each night and the ground was covered with several inches of snow, large numbers of seed-eating birds were seen seeking shelter in protected ditches and gullies. It was possible for these birds to secure foods above the snow because of their ability to grasp the stem of a weed and remove the seeds. Since these seeds were inaccessible to the quail they were not competing with them for food. The seeds that fell on the very soft, fine snow were soon buried and so provided no food for the bob-white. It is the opinion of the writer that the seed-eating and insectivorous birds competed with the bob-white for food only during the late summer, autumn and early winter of 1936.

XII. BIRDS OF PREY AND BOB-WHITE MANAGEMENT

Hawks

The hawks seen on the area during the fall of 1936 and the spring of 1937 were: Sharp-shinned Hawk (Accipiter velox velox), Cooper's Hawk (Accipiter cooperi), Eastern Red-tailed Hawk (Buteo borealis borealis), Northern Red-shouldered Hawk (Buteo lineatus lineatus), American Rough-legged Hawk (Buteo lagopus s. johannis), Marsh Hawk (Circus hudsonius), and the Eastern Sparrow Hawk (Falco sparverius sparverius).

The Eastern Red-tailed Hawk was most frequently observed of all the hawks. This no doubt was because of its conspicuous soaring habits and its large size.

Cooper's hawk was the second most frequently observed. Because of this hawk's habits and shy nature, this might indicate that there were more of these hawks than of the Red-tailed Hawk.

The Marsh Hawk was the next most frequently seen but was not at all plentiful except in 1939 when different farmers reported these hawks nested on their farms.

The Northern Red-shouldered Hawk, the American Rough-legged Hawk, and the Sharp-shinned Hawk were observed only a few times during the investigation.

The Sparrow Hawk was observed very frequently because of its tendency to perch in conspicuous places.

As is generally the case, the farmers did not distinguish between

beneficial and injurious hawks. An effort was made to try to encourage them to protect the beneficial species, especially the Red-tailed and the Marsh Hawks.

The only two hawks that have been found to be serious predators of the bob-white under certain conditions are Cooper's Hawk and the Sharp-shinned Hawk. The predatory activities of these hawks are blamed on all other species.

All species of hawks seemed to be more plentiful in the fall of 1936 than in the spring of 1937. More hawks were observed in November, 1939, than at any other time during the investigation.

Owls

The two most numerous owls on the area in the autumn of 1936 and the spring of 1937 were the Great Horned Owl (Bubo virginianus virginianus), and the Eastern Screech Owl (Otus asio naevius). They were most frequently identified by their calls. Many Great Horned Owls were heard in the autumn of 1936 almost all over the area while in the spring of 1937 there was only one locality where they were heard frequently. In March, 1938, the writer stood at one place on the south area and heard 10 Great Horned Owls calling. Five groups of two each were heard from five different directions.

In November, 1939, many Northern Barred Owl (Strix varia varia) were seen on the area. Several of their pellets were examined and were found to contain mostly fur and bones of different mice.

Of these owls only the Great Horned Owl may have been a serious

predator on quail. It is the opinion of the writer that the period of their most serious predation upon the bob-white occurs between the time when the snow begins melting and the spring vegetation has grown large enough to conceal the quail.

XIII. OTHER MAMMALS RELATED TO BOB-WHITE MANAGEMENT

Fur-Bearers

Skulls of each of the fur-bearers, except the badger, found on or near the area were collected during the investigation and identified for their specific classification. Very good cooperation was given the writer by the trappers during the trapping seasons, November 10 to January 10, inclusive, of the years 1936-1937 and 1937-1938, who saved the skulls and also fur-bearers' stomachs. Each trapper was provided with labels and a jar of formaldehyde solution for preserving the stomachs. The trapper wrote the date, sex, method of capture, and the name of the animal on a tag prepared for him and tied it to each stomach. A summary of these data is presented in Table 19. All of these fur-bearers except the northern coyote and the northern plains red fox were on the protected list during the investigation. Only the fox stomachs have been analyzed for data on bob-white predation.

The Illinois skunk was the most numerous and valuable fur-bearer on the area. The highest price received for a skunk pelt in 1936-1937 was \$2.50, the lowest was 50 cents, and the average was \$1.36. In the fall of 1936, the trappers reported this skunk was the most numerous in ten years. In 1936-1937 many people who seldom do trapped because of financial necessity. These skunks were trapped in large numbers this season and a few were found dead in the fields. For some reason the skunk population was much smaller in 1937. In the fall of 1939, few

Table 19. Summary of Fur-Bearers' Stomachs and Skulls Collected on or near the Area,
Locality Records Decatur County, Leon, Iowa.

Name	Trapping Season	No. of Skulls ¹	Stomachs Collected							
			No. Trapped		No. Hunted		Total No. Taken		Total No. of	
			Males	Females	Males	Females	Males	Females	Males & Females	
Virginia	:1936-1937:	1	3	4	6	8	9	12	21	
opossum	:1937-1938:	-	2	2	2	3	4	5	9	
Eastern	:1936-1937:	2	1	1	0	2	1	3	4	
Raccoon	:1937-1938:	-	2	0	2	1	4	1	5	
Mississippi	:1936-1937:	6	5	4	1	5	6	9	15	
Valley Mink	:1937-1938:	-	3	1	1	0	4	1	5	
Prairie	:1936-1937:	2	9	6	0	1	9	7	16	
Spotted Skunk	:1937-1938:	-	4	0	1	0	5	0	5	
Illinois	:1936-1937:	1	37	23	6	5	43	28	71	
Skunk	:1937-1938:	-	18	8	2	1	20	9	29	
Northern Plains	:1936-1937:	28	15	12	0	0	15	12	27	
Red Fox	:1937-1938:	-	16	11	3	1	19	12	31	
Northern	:1936-1937:	2	0	1	0	1	0	2	2	
Coyote	:1937-1938:	-	1	1	0	0	1	1	2	

1. The specific names used for these animals in this thesis are those determined from these skulls by Iowa State College and United States Bureau of Biological Survey.

skunks were seen and very few were being trapped. Trappers reported that a similar period of scarcity of these skunks occurred in 1926. No records were secured of skunk predation on the bob-white.

The northern plains fox was the second most valuable fur-bearer in this locality (Fig. 35). The trappers received an average of \$5.10 for each pelt in 1936-1937; the highest price was \$6.00, the lowest was \$2.50. A total of 58 stomachs, 34 males and 24 females were examined for signs of bob-white predation. The only evidence found was three small feathers in the stomach of one male.

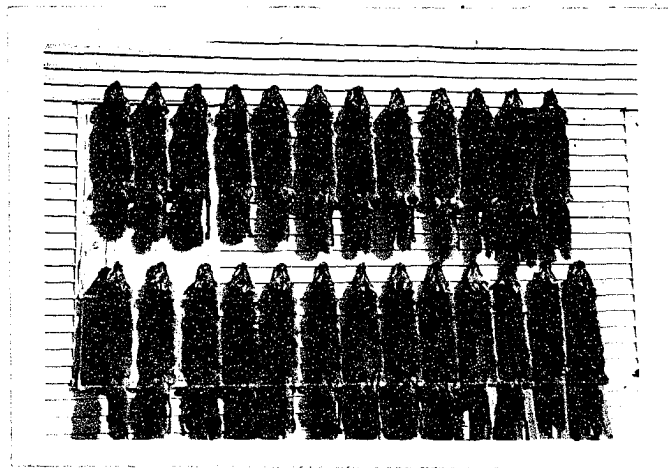


Fig. 35. Red fox pelts taken on or near the area

The virginia opossum was not so plentiful and neither was it so valuable since the average price received in 1936-1937 was only 33 cents for a pelt; the highest price was 60 cents and the lowest was 5 cents.

The eastern raccoon was not so valuable because of the paucity of

its numbers. The average price of the few pelts sold in 1936-1937 was \$6.43, the highest price was \$7.00, and the lowest was \$5.00. Because of the few raccoons on the area, they would exert very little predation pressure.

The prairie spotted skunk was not so valuable because of the low price received for its pelt, the average was 28 cents, the highest was 40 cents, and the lowest was 15 cents.

The Mississippi valley mink was not valuable as a fur-bearer because the only ones known to have been on the area during this investigation were casuals. The average price received for the 28 pelts taken near the area was \$10.02, the highest price was \$14.00, and the lowest was \$5.00.

Fur Income Per Acre

As few of the trappers confined their activities to only one farm, it was very difficult to secure information on the fur income per acre. These data were secured for seven farms on the area and four adjacent to the area and are presented in Table 20.

Most of this trapping was done by boys and one girl whose ages were 9 to 18 years. The three fur bearers most frequently taken by this group were the Illinois skunk, prairie spotted skunk, and the Virginia opossum because they were the most abundant and were the most easily trapped. An average of one Illinois skunk on 24.65 acres, of one Virginia opossum on 66.53 acres, and of one prairie spotted skunk on 90.72 acres were trapped on these farms.

Table 20. Fur Take and Income Per Acre on Individual Farms for 1936-1937 Season.

Trapper	Illinois	Virginia	Prairie: Spotted	Mississippi: Valley	Eastern: Raccoon	Northern: Plains	Northern: Coyote	Total	No. Acres	Income per Acre
	Skunk	Opossum	Skunk	Mink		Red Fox		Income	in Farm	in cents
A*	18	6	2	0	0	0	0	\$ 25.00	120	20.08
B	5	1	2	0	0	0	0	8.20	126	6.51
C	2	1	3	0	0	0	0	3.55	134	2.65
D	2	0	0	0	0	0	0	3.00	200	1.50
E*	8	0	0	0	0	1	0	11.50	155	7.66
F	10	12	7	0	0	0	1	29.25	480	6.08
G*	7	0	1	1	0	0	0	17.60	116	14.31
H	8	4	2	0	1	0	0	16.40	270	6.09
I	6	0	1	0	0	0	0	6.65	80	8.31
J*	8	1	1	0	0	0	0	12.10	120	10.08
K	7	5	3	0	0	0	0	13.20	200	6.60
Total	81	30	22	1	1	1	1	146.45	1996	7.33

*Adjacent to area.

The amounts received by the trappers on an individual farm ranged from \$3.00 to \$29.25. The acre income ranged from a low of 1.50 cents to a high of 20.08 cents. The average for the 1996 acres was 7.33 cents an acre. These data indicate the financial possibilities which may be realized by farm youths by trapping only on their own farms.

Rodents

Cottontail rabbits decreased somewhat during the icy winter of 1936-1937 but have increased rapidly since that time. Dr. George O. Hendrickson found a concentration of 6.4 rabbits an acre on parts of the area in 1939. His estimate was about 800-1000 rabbits a section over the entire area. Seton (1929) gives the average weight of the Mearns cottontail to be about 2.5 pounds. This information was used with that of Vorhies and Taylor (1933) to convert the consumption of green food of these rabbits into animal units. It was found that 800-1000 cottontails per section are equal to 6.61-8.26 animal units. This represents a grazing pressure of 82.62-103.25 animal units for the entire area.

Field mice (Microtus sp.) and wood mice or white-footed mice (Peromyscus sp.) were very plentiful in the fall of 1936. Farmers reported extensive mice damage to shocked grain and timothy under almost each shock in 1936. In 1937, this damage was observed very seldom but was more noticeable in 1938, and was heavy again in 1939.

A trapper, J. H. Surbaugh, living a few miles from the area, reported in December, 1937, some interesting observations of field and wood mice populations. He stated there were not more than one-tenth as many field

mice in November and December, 1937 as in the same months 1936, and not more than one-third as many wood mice. While the ground was covered with ice during January and February, 1937, he saw large numbers of these mice dead on top of the ice. It was his opinion that because of food scarcity, they were driven out of their burrows to the top of the ice in search of food where they were frozen. Mice runways were conspicuous in pastures in 1936, and were again noticeable in 1939. Just what the exact influence of the mice population was upon the hawk and owl populations is not known but the frequency and scarcity of these populations coincided exactly during the investigation.

The rat (Rattus norvegicus) population was the largest on the area November, 1939, that the oldest resident could remember. Farmers reported that most of their gardens were destroyed in the summer of 1939 by rats and rabbits. Many farmers stated that rats destroyed one to three acres of corn. This destruction began as soon as the formation of the kernels and continued as long as the corn was in the field. (Figs. 36 and 37). This damage based on the average yield for this year ranged from about 35 to possibly 150 bushels.



Fig. 36. Cobs stripped of corn by rats



Fig. 37. Corn field damaged by rats

Cats and Dogs

Since most of the dogs (Canis familiaris) stayed at home and since in March, 1938, only one of 38 was a bird dog, they were considered to have exerted no influence on the bob-white population. In six months the number had increased only three dogs.

March 20, 1938, the farmers reported 103 cats (Felis libyca domestica) which was an average of one to each 74.9 acres. By October 1, 1938 this number had increased to 187 cats or one cat to each 41.2 acres. Just what the influence of cats was upon bob-white population is not known. However apparently the cat population was too high for its continuance since between September, 1938, and November, 1939, most of the cats had died of a disease which the farmers said was similar to distemper.

XIV. SOCIAL AND ECONOMIC CONDITIONS AS THEY INFLUENCE
BOB-WHITE MANAGEMENT

Although comparatively few investigators have been aware of the relationship of farm game management to the social and economic status of the people, some have considered its importance. This has been well expressed by Taylor (1937 p. 48), "One cannot grow timber by studying trees alone neither can one produce wildlife by studying game species alone. One must give careful and critical attention to the soils, waters, vegetation, cultural conditions, including such features as burning, plowing, grazing, fallowing, timber cutting, and even social and economic conditions."

The Federal Forest Service has recognized the importance of the human element in forest conservation (Shea, 1940).

The people who settled this community were mostly of English, Irish, and Scotch descent. Since many had been tenant farmers in their native states they wished to find land that they could homestead or buy cheaply. A resident over 70 years of age remarked to the writer one day that he was afraid his forefathers had made a mistake when they settled on timberland instead of on the prairie. In the part of the country where these settlers had formerly lived, the best land was timbered which may have influenced their choice of land in their new home.

Farmers as well as others are sometimes described by the term "rugged individualists". This term applies very well to the people living on the area. Until very recently they have been isolated during the winter months

because the roads are often impassable. When the investigation began, no hard surface roads of any kind were found on the area. In 1938, one graveled road was constructed which runs along the west side of the area for about three and one-fourth miles. The little village of Woodland containing a store and filling station combined, two churches, a schoolhouse, and a few houses was the only town within the area. A larger trading center for the community was Leon, county seat of Decatur county, which is nine to sixteen miles, depending on the part of the area on which they live.

One way to increase farm game is by cooperation with the young people and children. In the spring of 1939, 79 adults lived on the area and only 17 children and young people under 20 years of age. One of the three schools on the area has been closed during the entire period of the investigation. A second one at times has had just enough children to continue.

In 1939, out of the 37 farm units, six of them were operated by bachelors who did both the farm and housework. Very little social or educational organization existed to help to unify the group.

During this investigation it has been difficult, indeed, to determine whether owner or tenant operators practiced more and better bob-white management. For example, during the winter of 1939-1940, of the 20 farm operators who fed quail, 10 were owners and 10 were tenants.

In the north area the percentage of owner operated land ranged from a low of 51.31 per cent in 1937 to a high of 57.14 in 1939 (Table 21). The tenant operated land ranged from a low of 37.63 per cent in 1937 to a high of 42.69 in 1938. The unrented land ranged from a low of 2.53 per

Table 21. Number of Acres and Percentage of Land Distribution on the Area

Year	North Area						South Area					
	4,739 Acres						2,974 Acres					
	Owner		Tenant		Unrented		Owner		Tenant		Unrented	
	Operators		Operators		Land		Operators		Operators		Land	
	No. of	Per	No. of	Per	No. of	Per	No. of	Per	No. of	Per	No. of	Per
	Acres	cent	Acres	cent	Acres	cent	Acres	cent	Acres	cent	Acres	cent
1936	2620	55.29	1964	41.44	155	3.27	1090	36.65	1884	63.35	0	0
1937	2431	51.30	1878	39.63	430	9.07	802	26.97	2021	67.96	151	5.07
1938	2596	54.78	2023	42.69	120	2.53	802	26.97	2092	70.34	80	2.69
1939	2708	57.14	1911	40.33	120	2.53	522	17.55	2412	81.10	40	1.35

cent in both 1938 and 1939 to a high of 9.07 in 1937.

In the south area the owner operated land dropped from a high of 36.65 per cent in 1936 to a low of 17.55 in 1939 which represented a loss of title by the owners of 19.10 per cent. The tenant operated land increased from a low of 63.35 per cent in 1936 to a high of 81.10 in 1939 which was an increase of 17.75 per cent. Unrented land ranged from a low of zero per cent in 1936 to a high of 5.07 in 1937. One farm of 208 acres in this area is now being operated on a sub-tenancy level since the landlord lives elsewhere and employs a man by the month to operate it.

Adverse financial conditions caused some farm buildings to be in desperate need of repair as is shown in Fig. 38 which is a picture taken in 1936 of buildings on an unrented farm. The people who had owned this farm became so involved in debt that they left it in the winter of 1935.



Fig. 38. Buildings in need of repair

Because of previous financial reverses and the almost total crop failure of 1936, 15 farmers secured work on the roads under the United States Works Progress Administration during the fall of that year. At this time it was necessary for some farmers to secure government feed loans to enable them to keep the small amount of stock after being forced to sell most of it.

The assessed valuation of land in Woodland Township may be used as a basis for the area. This was \$28.00 an acre and the average tax rate was 26 cents an acre in 1936.

In 1930 when Steele's Creek Drainage District was formed the land within this district was appraised at \$97.00 an acre. During this investigation 80 acres were sold for \$6.00 an acre and 123 acres for \$8.00 an acre. The average farm unit was 208 acres in 1937. From the crop year of 1936 to 1937, farmers on the area lost title to 792 acres of land or 10.2 per cent, 504 acres in the north and 288 acres in the south area.

There seems to be little question that bob-white practices in this community were influenced very materially by the social and economic welfare of the people. Were all ecological factors favorable to the bob-white the attitudes of the people toward this game species as determined by customs, education, and financial necessity seem to be the deciding factors in its continuation and increase in this area.

XV. POPULATION FLUCTUATIONS OF BOB-WHITE ON THE AREA

Census and Population Estimates

During the writer's first resident period one of the methods for securing the farmer's cooperation was to inquire how many coveys of quail he had on his farm and the number in each covey. Careful records were kept of these data. The writer was well aware of the opinion of different investigators that a farmer's estimate of the number of quail on his farm was thought to be unreliable. A further reason for this procedure was to arouse the farmer's interest in the quail so that he would learn of the covey locations and be prepared to feed the birds during the winter of 1936-1937. Since a decided food shortage existed as a result of the drought and grasshopper epidemic it was obvious that it would be necessary to feed most of the quail if they were to survive the winter whether mild or severe. These estimates of the quail population were secured from the farmers four times during the investigation (Table 22).

Table 22. Estimates by Farmers of Bob-white Population on their Land

Season	: No. of	: No. of	: Birds	: Acres	:
Year	: Coveys	: Birds	: per Covey	: per Bird	:
Autumn	:	:	:	:	:
1936	: 52	: 879	: 16.9	: 8.8	:
Spring	:	:	:	:	:
1938	: 32	: 562	: 17.5	: 13.7	:
Autumn	:	:	:	:	:
1938	: 99	: 1593	: 16.0	: 4.8	:
Autumn	:	:	:	:	:
1939	: 169	: 2766	: 16.4	: 2.8	:

In Table 23 the census figures for December, 1935, and March 1, 1936, were secured from the publication of Green and Beed (1936). During the fall of 1936, the writer located 27 coveys containing 419 birds. As previously stated time did not permit a complete census of the whole area. Plans were made to keep 15 of these 27 coveys under observation for winter survival studies. These coveys containing 238 birds were widely distributed over the area and were as representative as could be selected. Their coverts ranged from the poorest to the best on the area.

When the writer left the area December 16, the 15 coveys selected for survival study contained an average of 15.9 birds. During the first five weeks after the writer returned to the area, March 28, 1937, intensive field work was done in an endeavor to check the 15 coveys under observation and to locate any other coveys. At the end of the five weeks period birds were actually found in only three places. All were coveys selected for winter survival studies. Two coveys were on the north area. One, of 21 birds, had wintered near a farmstead where they frequently

Table 23. Bob-white Census Data on Game Management Area in Southern Iowa.

	Autumn				Winter				Early Spring			
	Before Nov. 15				After Dec. 15							
	No.	No.	Birds	Acres	No.	No.	Birds	Acres	No.	No.	Per cent	Acres
	of	of	per	per	of	of	per	per	of	of	of Birds	per
	Coveys	Birds	Covey	Bird	Coveys	Birds	Covey	Bird	Coveys	Birds	Lost	Bird
1935-1936 ¹	-	-	-	-	-	395	-	15.2	-	177	55.2	33.9
1936-1937 ²	-	-	-	-	15	238	15.8	-	3	29	87.8	-
1939-1940 ³	-	2268	-	3.4	-	2057	-	3.7	41	534	74.9	14.4

1. Data by Beed.

2. Data by Writer. Winter data includes only coveys used for winter survival observation.

3. Data for Autumn and Winter by Moorman, for Early Spring by Moorman and Writer.

sought the shelter of farm buildings but only four birds were found, three hens and one cock. The second covey of 26 birds also wintered near a farmstead and came through the winter with 20 birds in excellent condition. This covey fared the best of any of the 15 coveys under observation. Their range included the edge of very brushy woods near shocked sorghum and an unused building. It was reported by a farmer that this covey frequently spent the night in this building. The third covey was on the south area and it is possible it was composed of the survivors of two coveys containing a total of 20 birds. Their headquarters centered in a very brushy woodlot near a farmstead. The surviving covey contained four cocks and one hen. Evidences of the presence of a few quail were found in a few thickets on the north area but careful searching did not reveal them. Only these three coveys containing 29 birds were actually seen during this spring observation (Table 23)*. No quail were heard by the writer calling in other places. The farmers except for those located near these three coveys reported hearing no quail during the spring of 1937.

When an effort was made in September, 1937, to get an approximate census of the quail, the vegetation was so high and dense that time did not permit any accurate count. The winter of 1937-1938 was mild and open but no census work was done during this period. Each farmer was asked to estimate the number of quail on his farm on March 20, 1938, and again in October, 1938 (Table 22). The winter of 1938-1939 began with abundant

*This represents a loss of 87.8 per cent of the 238 birds under winter survival observation studies.

food and cover for the bob-white and the winter was even more mild than the previous one. No winter census work was done.

After two successive mild winters the fourth annual estimate of the number of quail on their farms was secured from the farmers in November, 1939 (Table 22).

When the farmers were asked to give their estimate of the number of quail on their farms the writer did not influence their replies in any way. No suggestions were given to assist them to give their estimate. Almost always they also gave the location of each covey. This information in the autumn of 1936 enabled the writer to check most of their estimates and covey locations with his data. From these data covey and bird duplications of eight coveys containing 143 birds were checked. This duplication amounted to 15.38 per cent of the coveys and 16.27 per cent of the birds. When these deductions were made for 1936 this gave a total of 44 coveys containing 736 birds or an average of 16.7 birds per covey which is an average of one bird per 10.48 acres. These percentages of duplications have been used as correction factors for each of the succeeding estimates by the farmers.

These estimates could not be checked against known census data until the fall of 1939. When these corrections were applied to the farmers' estimates for this year the resulting figures were 2.1 per cent above the census figures determined by Moorman. His census gave 2,268 birds for the area against 2,316 by the farmers. It is possible this may be merely a coincidence but it is at least interesting.

The writer and Robert Moorman made a census of the area February 16

to 18, 1940, at which time 41 coveys of 534 birds were located (Table 23). Twenty farmers were feeding 26 of the 41 coveys at their homesteads. Twelve coveys were feeding around shocked corn and sorghum, a soy bean stack, two cribs of corn, and at one feed lot located quite a distance from a farmstead. Three coveys containing three, five, and nine birds were found at considerable distance from any concentration of agricultural food. It is believed that the five and nine bird coveys were parts of two large coveys which farmers reported having been around their farmsteads.

Bob-white Population Fluctuations and Weather Data

An examination of Table 24 which was compiled by using the correction percentages on the farmers' population estimates in Table 22 with the census data in Table 23, shows the three winters of 1935-1936, 1936-1937, and 1939-1940 to be the winters of heaviest bob-white mortality. The heaviest percentage of loss was 87.8 per cent in the winter of 1936-1937, the second highest percentage was 74.6 per cent in the winter of 1939-1940, and the third highest loss was in the winter of 1935-1936 when the loss was 55.2 per cent.

Table 24. Summary of Bob-white Population Data on Game Management Area of 7,713 Acres in Southern Iowa

Year	Spring			Autumn				Winter	
	Population			Population				Mortality	
	No.	Acres	No.	No.	Ave. No.	Acres	Per cent		
	of	per	of	of	of Birds	per	rate of		
	Birds	Bird	Coveys	Birds	per Covey	Bird	Increase	No.	Per cent
1935*	-	-	-	395	-	15.2	-	218	55.2
1936	177	33.9	44	736	16.7	10.48	315.8	646	87.8
1937	90	85.7	29	501	17.3	15.39	456.5	30**	6.0**
1938	471	16.4	84	1334	15.9	5.78	183.2	80**	6.0**
1939	1254	6.1	143	2316	16.2	3.33	84.5	1571	74.6
1940	534	14.4							

* Data on about 6000 acres.

** Estimated winter predation mortality loss for 90 day period Errington and Hamerstrom (1936, p. 438).

The weather data graph (Fig. 39) shows the number of degrees F. departure of the monthly mean temperature from the average for each month during the investigation and the number of inches departure of the monthly precipitation from the monthly average for each month. This graph was constructed from data contained in Tables 25 and 26. The weather data for the area found in these tables were the average of the Lamoni and Millerton weather observation stations, the later being located in the country near Corydon and the percentage of sunshine was taken from the nearest record, Des Moines, (Reed, 1935-1940).

This graph shows the marked similarity of the below normal average monthly mean temperature for the winters of 1935-1936 and 1939-1940. The total precipitation during December, January, and February of these winters averaged slightly below normal but the exceptionally low temperatures especially during the month of January, which may be termed the critical month for the winter survival of the bob-white in this locality, kept most of the precipitation on the ground in the form of snow. During these winters the deep snows covered most of the natural foods as well as some of the agricultural foods. The drifting of the snow buried most of the natural escape and protective cover so that shelter was most difficult for the bob-white to find as is shown in Figs. 40-43, taken in January, 1940. Some of the cover that remained was often trampled by livestock as is shown in Figs. 44 and 45. The deep snow combined with low temperatures was the determining factor in the heavy mortality of the quail for the winters of 1935-1936 and 1939-1940.

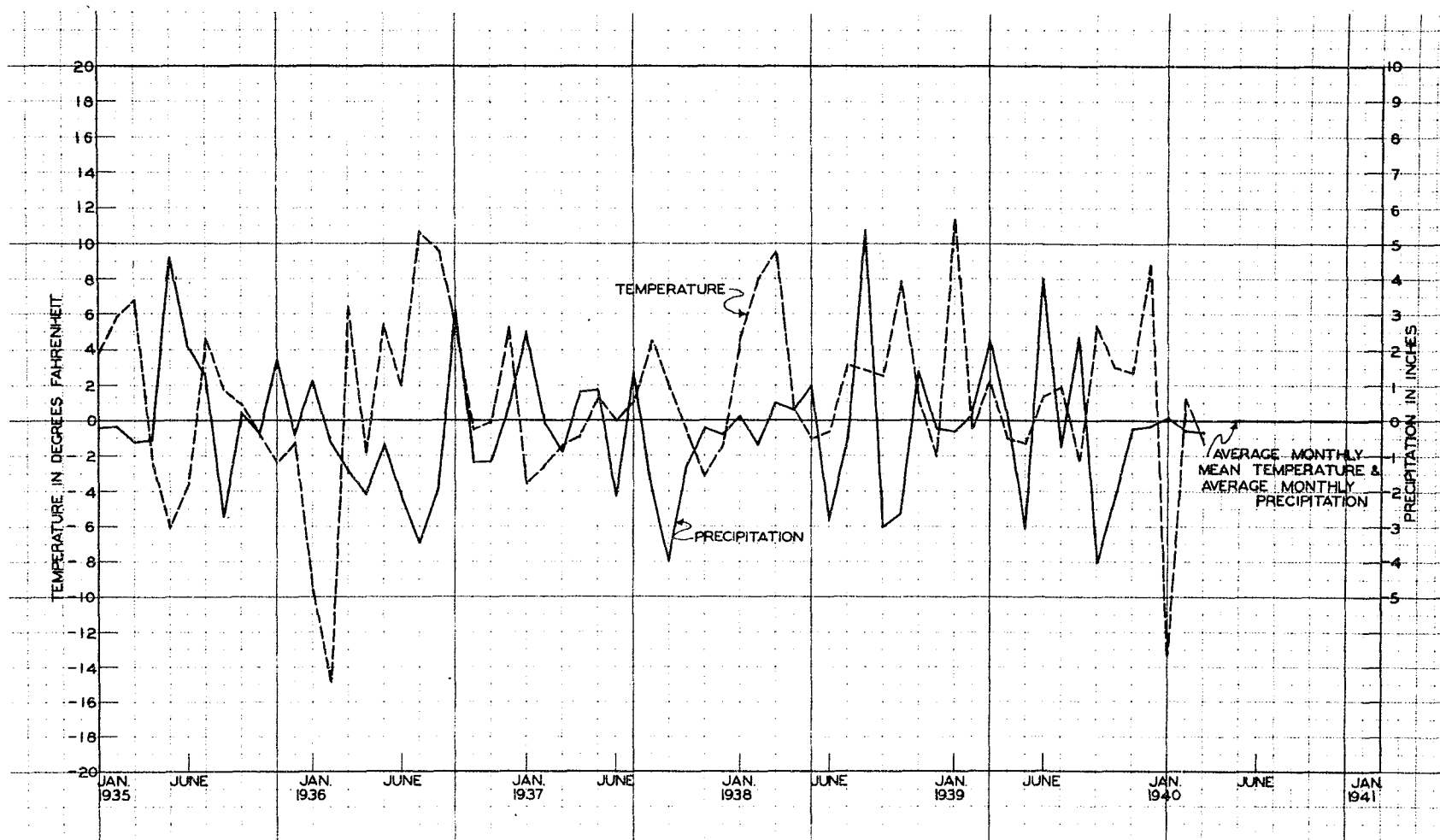


Fig. 39. Departure of monthly mean temperature and of monthly precipitation from the average.

Table 25. Minimum, Maximum, and Average Temperature and Precipitation for the Area

Month	: Highest : Temperature	: Lowest : Temperature	: Average : Mean : Temperature	: Highest : Precipitation	: Lowest : Precipitation	: Average : Monthly : Precipitation
Jan.	: 64.5	: - 29.5	: 21.3	: 4.60	: 0.01	: 0.98
Feb.	: 78.0	: - 27.5	: 25.3	: 4.18	: 0.04	: 1.27
March	: 68.0	: - 14.5	: 36.8	: 5.00	: 0.01	: 1.90
April	: 91.5	: 7.0	: 50.5	: 7.34	: 0.79	: 3.15
May	: 101.5	: 23.0	: 61.4	: 10.18	: 0.76	: 4.12
June	: 107.5	: 38.5	: 70.0	: 11.65	: 0.68	: 4.81
July	: 111.5	: 46.5	: 74.6	: 12.32	: 0.23	: 3.98
Aug.	: 112.0	: 38.0	: 73.1	: 13.03	: 0.36	: 3.77
Sept.	: 104.0	: 23.5	: 65.3	: 16.60	: 0.38	: 4.52
Oct.	: 93.5	: - 1.0	: 53.7	: 8.06	: 0.20	: 2.88
Nov.	: 82.0	: - 8.0	: 38.7	: 7.76	: 0.02	: 1.34
Dec.	: 68.0	: - 25.5	: 26.8	: 3.30	: 0.13	: 1.14

Table 26. Monthly Climatological Data for the Area

Year & Month	Minimum Temperature	Maximum Temperature	Average Mean Temperature	Departure from Normal	Total Precipitation	Departure from Normal	Percentage of Sunshine
1935							
Jan.	- 12.5	49.0	25.1	+ 3.8	0.75	- 0.23	47
Feb.	1.5	53.5	31.1	+ 5.7	1.10	- 0.17	46
March	9.0	77.0	43.6	+ 6.8	1.24	- 0.66	57
April	23.0	78.0	48.0	- 2.5	2.58	- 0.57	49
May	31.0	78.5	55.3	- 6.1	8.67	+ 4.55	40
June	40.5	86.0	66.3	- 3.7	6.89	+ 2.08	61
July	60.0	98.5	79.2	+ 4.6	5.18	+ 1.20	83
Aug.	43.5	100.0	74.9	+ 1.8	1.05	- 2.72	75
Sept.	34.5	92.0	66.2	+ 0.9	4.83	+ 0.21	69
Oct.	23.0	83.5	52.9	- 0.8	2.50	- 0.38	60
Nov.	10.0	66.5	36.3	- 2.4	3.08	+ 1.74	32
Dec.	- 8.5	55.0	25.5	- 1.3	0.68	- 0.46	39
1936							
Jan.	- 22.0	42.5	12.0	- 9.3	2.07	+ 1.09	45
Feb.	- 22.0	56.0	10.5	- 14.8	0.61	- 0.66	52
March	14.5	76.5	43.2	+ 6.4	0.48	- 1.42	71
April	8.0	90.0	48.6	- 1.9	1.06	- 2.09	72
May	39.5	89.5	66.8	+ 5.4	3.47	- 0.65	70
June	43.5	102.5	72.0	+ 2.0	2.64	- 2.17	79
July	55.0	111.5	85.2	+ 10.6	0.50	- 3.48	94
Aug.	55.0	110.0	82.8	+ 9.7	1.83	- 1.94	74
Sept.	44.5	100.0	70.7	+ 5.4	7.60	+ 3.08	62
Oct.	19.5	80.0	53.2	- 0.5	1.69	- 1.19	61
Nov.	12.0	72.5	38.6	- 0.1	0.18	- 1.16	65
Dec.	- 9.5	59.0	32.0	+ 5.2	1.57	+ 0.43	48

1. Des Moines, Iowa, Record.

Table 26. Monthly Climatological Data for the Area (continued)

Year & Month	: Minimum : Temper- : ature	: Maximum : Temper- : ature	: Average : Mean : Temperature	: Departure : from : Normal	: Total : Precipitation	: Departure : from : Normal	: Percentage : of : Sunshine
1937	:	:	:	:	:	:	:
Jan.	: - 5.0	: 43.0	: 17.7	: - 3.6	: 3.43	: + 2.45	: 60
Feb.	: - 1.5	: 46.0	: 22.7	: - 2.6	: 1.19	: - 0.08	: 59
March	: 14.0	: 67.0	: 35.3	: - 1.5	: 1.01	: - 0.89	: 53
April	: 25.0	: 79.0	: 49.6	: - 0.9	: 3.95	: + 0.80	: 47
May	: 42.0	: 90.5	: 62.6	: + 1.2	: 4.97	: + 0.85	: 65
June	: 46.0	: 97.0	: 70.0	: 0.0	: 2.65	: - 2.16	: 72
July	: 56.0	: 94.0	: 75.6	: + 1.0	: 5.32	: + 1.34	: 76
Aug.	: 58.5	: 97.5	: 77.5	: + 4.4	: 1.95	: - 1.82	: 82
Sept.	: 55.0	: 97.5	: 67.3	: + 2.0	: 0.54	: - 3.98	: 84
Oct.	: 17.0	: 89.5	: 53.1	: - 0.6	: 1.61	: - 1.27	: 61
Nov.	: - 3.0	: 78.0	: 35.6	: - 3.1	: 1.12	: - 0.22	: 61
Dec.	: - 3.5	: 52.0	: 25.4	: - 1.4	: 0.72	: - 0.42	: 44
1938	:	:	:	:	:	:	:
Jan.	: - 8.0	: 56.5	: 25.9	: + 4.6	: 1.09	: + 0.11	: 51
Feb.	: 6.5	: 65.0	: 33.3	: + 8.0	: 0.59	: - 0.68	: 39
March	: 14.0	: 84.0	: 46.3	: + 9.5	: 2.40	: + 0.50	: 53
April	: 21.0	: 81.0	: 51.1	: + 0.6	: 3.44	: + 0.29	: 56
May	: 35.0	: 84.5	: 60.4	: - 1.0	: 5.11	: + 0.99	: 48
June	: 49.0	: 94.5	: 69.3	: - 0.7	: 1.92	: - 2.89	: 74
July	: 58.0	: 99.0	: 77.7	: + 3.1	: 3.42	: - 0.56	: 82
Aug.	: 56.5	: 98.0	: 76.0	: + 2.9	: 9.17	: + 5.40	: 78
Sept.	: 34.5	: 93.5	: 67.9	: + 2.6	: 1.49	: - 3.03	: 75
Oct.	: 26.0	: 92.0	: 61.5	: + 7.8	: 0.28	: - 2.60	: 77
Nov.	: 4.0	: 81.0	: 39.9	: + 1.2	: 2.71	: - 1.37	: 63
Dec.	: 0.0	: 51.0	: 28.8	: - 2.0	: 0.89	: - 0.25	: 61

1. Des Moines, Iowa, Record.

Table 26. Monthly Climatological Data for the Area (continued)

Year & Month	Minimum Temperature	Maximum Temperature	Average Mean Temperature	Departure from Normal	Total Precipitation	Departure from Normal	Percentage ¹ of Sunshine
1939							
Jan.	3.0	63.0	32.6	+ 11.3	0.65	- 0.33	50
Feb.	- 8.0	54.0	24.8	- 0.5	1.45	+ 0.18	68
March	0.0	83.5	39.0	+ 2.2	4.14	+ 2.24	70
April	17.5	84.0	49.5	- 1.0	3.23	+ 0.08	63
May	41.0	92.0	66.1	- 1.3	1.10	- 3.02	76
June	50.5	92.0	71.3	+ 1.3	8.84	+ 4.03	65
July	58.5	98.5	76.5	+ 1.9	3.23	- 0.75	86
Aug.	50.0	88.5	70.8	- 2.3	6.12	+ 2.35	71
Sept.	32.5	99.0	70.6	+ 5.3	0.50	- 4.02	89
Oct.	21.5	93.5	56.7	+ 3.0	0.65	- 2.18	76
Nov.	18.0	70.5	41.4	+ 2.7	1.08	- 0.26	66
Dec.	- 5.5	68.0	35.5	+ 8.7	0.96	- 0.18	62
1940							
Jan.	- 19.5	34.5	8.0	- 13.3	1.03	+ 0.05	65
Feb.	- 5.0	48.0	26.5	+ 1.2	0.96	- 0.31	41
Mar.	10.5	77.0	35.5	- 1.3	1.54	- 0.36	46

1. Des Moines, Iowa, Record.



Fig. 40. Drifted snow that buried roadside cover



Fig. 41. Thicket cover and shelter made useless by snow

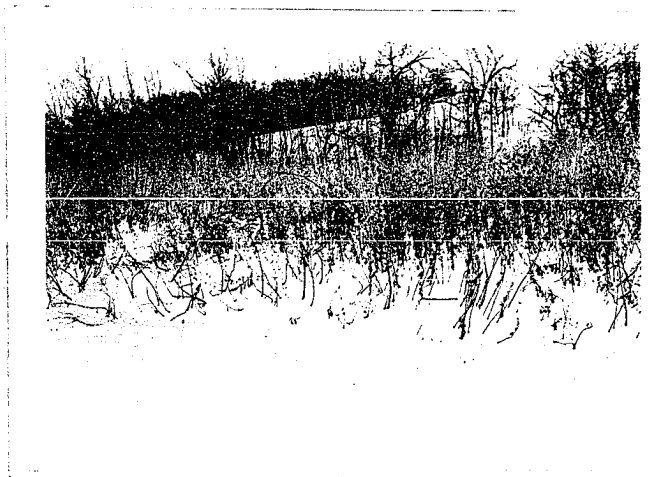


Fig. 42. Snow made food and shelter weeds
of little value to bob-white

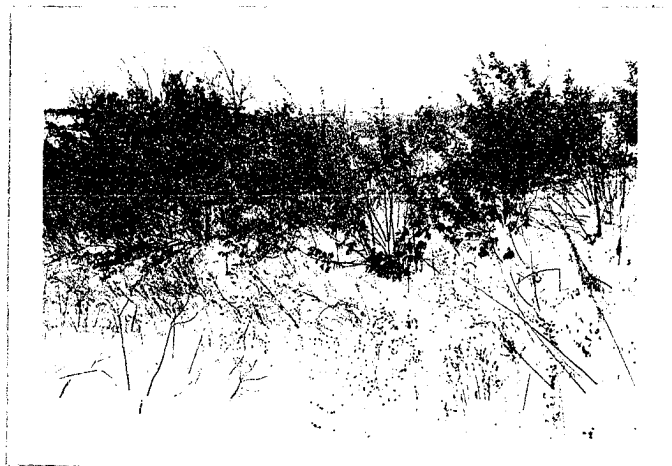


Fig. 43. Excellent protective cover
almost buried by snow



Fig. 44. Showing usefulness of smartweed
and lesser ragweed cover damaged by livestock



Fig. 45. Lesser ragweed trampled by
livestock

The third difficult winter for quail winter survival was 1936-1937. The graph (Fig. 39) shows that the average mean temperature was only one degree below normal, but the total precipitation during December, January, and February was 2.80 inches above normal. The critical month of January had an average mean temperature of 3.6 degrees below normal but the precipitation was 3.43 inches which is over three and one-half times the normal amount. The snow and sleet that fell early in the month was followed by a rain which packed the snow and sleet forming a heavy layer of ice which remained on the ground until the last of February. This made all food materials on the ground inaccessible to the bob-white. This period of about 46 days when the ground was sheathed in this heavy coating of ice was the most critical period for the bob-white during the investigation and the total population was considered to have suffered the same high mortality loss of 87.8 per cent as the 238 birds included in the winter survival observations.

At the beginning of the spring of 1937, following this severe winter, the quail population on the area was calculated to be 90 birds or one bird to 85.7 acres (Table 24). Apparently the rearing season of 1937 was an exceptionally favorable one since the rate of increase based on the available data was 456.7 per cent which gave a fall population of 501 birds or one bird to each 15.39 acres.

Since the winter temperature and precipitation of 1937-1938 were so favorable for the quail, the winter predation loss was placed at six per cent (Errington and Hamerstrom, 1936, p. 438). This loss of 30 birds left a 1938 spring population of 471 birds or one bird to 16.4 acres. The calculated rate of increase for 1938 was 183.2 per cent which gave a

calculated fall population of 1,334 birds or one bird for 5.78 acres. The winter temperature and precipitation of 1938-1939 were again very favorable for the winter survival of the bob-white (See Fig. 39) and the writer assumed that only predation losses of six per cent occurred as in 1937-1938. This estimated loss of 80 birds left a 1939 spring population of 1,250, or one bird to each 6.1 acres. The rate of increase for 1939 was calculated to have been 34.5 per cent which gave a fall population of one bird to each 3.33 acres. Deducting the known kill of 211 birds compiled by Moorman from the fall population gave a beginning winter population of 2,105 or one bird for 3.66 acres.

The winter of 1939-1940 was critical for the bob-white because January was the coldest since 1912. The average mean temperature of the area was 8.0 F. which was 13.3 below the January average of 21.3 F. Reed (1940) in Climatological Data for January says "There have been only five colder Januarys in the past 68 years than in 1940". The computed loss for the winter was 1,517 birds or 74.6 per cent which left on February 18, 534 birds or one bird for 14.4 acres.

The writer believes that the winter loss for 1939-1940 would have been as great or greater than in 1936-1937 if 20 farmers had not fed the quail in place of two as in 1936. Agricultural foods were much more plentiful and more were left available than in 1936-1937. It is not known just what the effect of the two feeding stations built on the south area by the United States Civilian Conservation Corps in 1936-1937 had upon the quail population. But during the winter of 1939-1940, on two different occasions residents of the area made the statement that it was fortunate for the quail that feeding stations similar to those built in 1936-1937 had not

been built this winter since these stations had really served as concentration centers where the birds were slaughtered. The recognition on the part of the farmers of the advisability of getting an adequate seed stock through the winter may have been a very important reason for 20 farmers feeding quail during the winter of 1939-1940.

Discussion of the Bob-white Breeding Potential

The high reproductive rate of 456.7 per cent for 1937 is not as high as the theoretical maximum breeding potential of 700 per cent which Leopold (1933, p.30, 36, and 37) worked out from data by Stoddard (1930, 1931). Various limiting factors prevent the attainment of this maximum breeding potential of quail in their natural environment. Few references were found containing definite percentages data of the increase of the fall population of upland game birds above the spring breeding stock.

Errington and Hamerstrom (1937, p.16) fully recognize the dangers in making comparisons of the recovery rates of breeding populations of different gallinaceous game bird species but feel that Ring-necked Pheasant may have "certain features in common" with bob-white. Similarly it may be that the British grouse recovery population percentages may indicate some of the possibilities of the recovery percentages of the bob-white. Leopold and Ball (1931) report data which give the annual grouse kill in England as 216 per cent above the spring breeding population. Game keepers in the British Isles make their principal census in the spring just previous to the beginning of the breeding season. In the management of this bird on the moors they expect an average increase of 216 per cent in shootable

birds calculated on their spring census data. In practice they state that a year is seldom so bad that the increase is as low as 175 per cent and in exceptionally favorable years it may be as high as 260 per cent.

A high population increase of the bob-white is reported by Errington (1933, p.122-132) in writing of nesting and the life equation of the bob-white on 1,920 acres of an area near Prairie du Sac, Wisconsin for the year 1930. He presents data that show an increase of 260 per cent for the fall population over the spring breeding stock.

Errington and Hamerstrom (1936, Table 75, p.422) report an even higher increase of 450 per cent in the fall population of quail above the spring seed stock on 896 acres of a 3,200 acre area near Prairie du Sac, Wisconsin in the rearing season of 1929. In the same table they calculate a spring breeding stock of one bird to 145 acres and a fall population of one bird to 26.4 acres. Apparently from these data the winter of 1929-1930 was a very favorable one for the survival of the quail since they report a total winter loss of only nine birds, or 7.44 per cent. This gave a spring breeding population density in 1930 of one bird to 28.5 acres. The increase in the fall population above the breeding population was 129 per cent, or one bird to 12.5 acres. The winter of 1930-1931 apparently was another very favorable one for quail survival since they report a total winter loss of 21 birds, or 8.17 per cent. This left a spring breeding population of 236 birds, or one to 13.6 acres. The rate of increase was not so high for the 1931 rearing season since it was 69 per cent which gave a total fall population of 400 birds, or one to eight acres. Since the fall population for this and the next four years averaged one bird to 7.76 acres, it is thought that this density

represents about the maximum carrying capacity for this part of the Prairie du Sac area during the investigation. If this population density represents the maximum carrying capacity of this Wisconsin area, this density was built up from a low of one bird to 145 acres to a high of one bird to eight acres in the course of three summers and two winters which were favorable for the bob-white.

An examination of the data in Table 24 for southern Iowa shows a parallel population increase from the spring of 1937 to the fall of 1939. The spring breeding population calculated for the area for 1937 was one bird to 85.7 acres and the fall population census data for 1939 was one bird to 3.33 acres.

Rearing Seasons of 1937, 1938 and 1939

An examination of Fig. 39 for the period from about April 25 to August 1, for each of the years, 1937, 1938, and 1939 shows a marked similarity for the average monthly mean temperature which was almost exactly normal. For May, June, and July, 1937 and 1938, the monthly precipitation was almost exactly the same. The precipitation in May for each of these two years was nearly one inch more than the average while June had over two inches less. May, 1939, had 3.02 inches deficiency in precipitation while June had an excess of 4.03 inches.

It is not known just what the influence of these temperature and precipitation fluctuations had upon the rearing of young bob-white but some relationships seem to exist. In the spring of 1937 the population density was one bird to 85.7 acres and indicates the space available for

each pair of nesting birds. The three known surviving coveys were widely separated and each was located in very desirable quail environment. This known low population of 29 vigorous birds with the additional 61 birds estimated to be present which had survived the preceding severe winter were not crowded for nesting and rearing space and had the further advantage of the factors of favorable temperature and precipitation which also provided excellent food and cover. All these and other factors contributed to the high reproductive rate of 456.7 per cent.

During the rearing season of 1938, the factors of temperature and precipitation were again favorable to the birds and provided an abundance of food and cover. But the population density had risen to one bird to 16.4 acres which resulted in greater competition for the more desirable nesting and rearing coverts. The percentage of increase for this season was 183.2 per cent.

Throughout the 1939 rearing season the factors of temperature and precipitation were not nearly as favorable as in the two previous seasons, and in addition the population density had increased to one bird to 6.1 acres which caused still greater competition for suitable nesting and rearing locations. The percentage rate of increase in 1939 decreased to 84.5 per cent.

These data for this area seem to show that the percentage rate of increase of quail was a product of the variable factors of the carrying capacity of the land, population density of the breeding birds, monthly mean temperature, and the monthly precipitation.

XVI. FARMER-SPORTSMAN RELATIONSHIPS

Farmer-sportsman relationships are perhaps the most trying problem in the national game management movement and the writer believes the most difficult to solve. Full recognition of this problem was taken when the Fifth North American Wildlife Conference (1940) appointed a permanent "Farmer-Sportsman Council."

A very important reason for the farmers wishing to organize Game Management Area No. 27-93-1 in 1933 was unsatisfactory hunter-farmer relationships which were climaxed by a trespassing urban hunter who had killed a farmer's cow.

When the season for shooting quail was opened in Decatur and Wayne counties in 1936, the first open season since the autumn of 1916, every farmer on the area was opposed to hunting on his land. They said there were not enough quail for any to be shot. Probably not more than 10 hunters were given permission to hunt quail during the season and very few birds were shot.

Unfortunate farmer-sportsman relationships were related to the writer from time to time. In every instance the hunters were trespassing and did not represent the higher type of hunter but most of these farmers place all strange hunters in the same class.

The season was closed on quail in these counties during 1937 and 1938 and opened in 1939 by legislative enactments. Since the data showed one quail to 3.33 acres (Table 24), when the farmers were interviewed in November, they were asked if they were going to permit quail shooting on

their lands. A summary of the answers was: 11 farmers replied they would not permit any hunting; 8 said they intended to hunt themselves; 6 would permit neighbors and friends to hunt; 10 replied that they wished to hunt themselves and to permit friends and neighbors also, to hunt; only 3 said they would permit strangers to hunt.

A meeting sponsored by a farmer, Floyd Fleming, was held in the Riddle School, Woodland Township, November 19, 1939. It was attended by 24 farmers from both areas and eight men who were representatives from the State Conservation Commission and the Iowa State Cooperative Wildlife Research Unit. A very friendly evening was enjoyed and many interesting things were discussed concerning bob-white management. When the farmers were asked if any one present would permit urban hunters on their farms to shoot quail at \$10.00 a day, no one was interested.

Throughout the season about 20 farmers permitted some hunting on their farms but as far as is known no hunter was charged for this privilege. Most of the hunting was done by the farmers and their friends. A few farmers permitted strangers to hunt (Fig. 46).

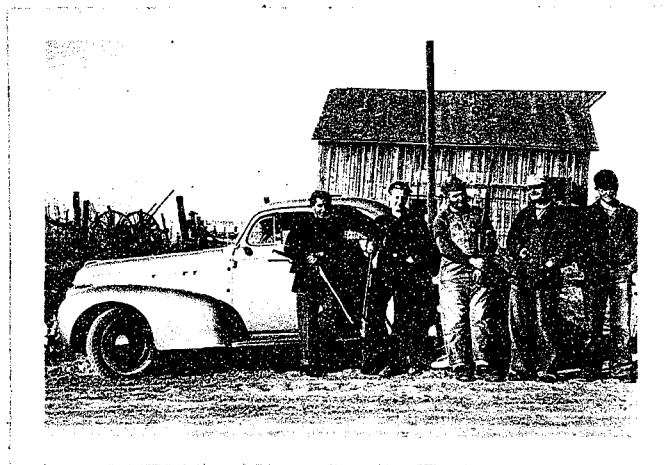


Fig. 46. Farmers and Urban Quail Hunters

Most of the farmers during this investigation had an aesthetic reason for desiring quail on their farms. They have frequently said they liked to see the bob-white on their lands and to hear their calls.

XVII. SUMMARY

This investigation continued from July, 1936 to March, 1940 and contains data collected on an experimental bob-white game management area in Southern Iowa. The area was divided into the north area containing 4,739 acres and the south area containing 2,974 acres. The north area was designated as the pay-shooting area because the farmers were permitted to charge \$1.00 a day per man for hunting privileges. The south area was designated as a free-shooting area because the farmers were not permitted to charge for hunting but instead were paid 10 cents an acre. Both areas were to carry out identical recommended game management practices.

These data contain information on many factors related to bob-white management. The inventories of agricultural crops and livestock, game management practiced by the farmers and method of land operation were organized and tabulated in such manner that comparisons could be made between the north and south area and between tenant operators and owner operators.

The three year average percentages for the agricultural crops grown were: corn, 14.36 per cent; oats, 8.08; wheat, 1.60; rye, 0.87; and sorghum, millet, and legumes 3.01. The average percentage of meadow for the three years was 15.03 per cent; of pasture, 55.81, and fallow 1.39. Comparison of the three year average percentages of agricultural land usage showed little variation between the two areas or between owner and tenant operators.

The livestock raised were: horses, cattle, hogs, and sheep. The

three-year average of acres of pasture per animal unit for owner operators in the north area was 4.14 acres, for tenants, 7.12 acres; for owners in the south area was 5.34 acres and for tenants, 6.06 acres; the average of acres of pasture per animal unit for all operators in the north area was 4.99 and in the south area, 5.88 acres.

Part of the designated game management practices were performed in 1936 by 100 per cent of both owner and tenant operators in the south area and by 75 per cent of the owner operators and 67 per cent of the tenant operators in the north area. The payment of 10 cents an acre to the operators in the south area did seem to influence slightly the performing of the designated practices for this year. The cost in 1936 for performing designated game management practices including materials and the acreage fee was 13.34 cents for the south area and 3.47 cents an acre for the north area. On the whole there seemed to be little difference between the amount and effectiveness of game management practiced by owner and tenant operators. The interest of the farmers in bob-white game management showed an increase since in 1939-1940 when no acreage fee had been paid for two years, 20 farmers, 10 owners and 10 tenants fed quail during the winter and only two had fed them during the winter of 1936-1937.

Seed-eating birds were observed competing with bob-white for food only during the late summer, fall, and early winter of 1936.

Cooper's hawk and the Great-horned owl were the only birds of prey present in sufficient numbers that might have been predators of quail.

The fur-bearers were: opossum, raccoon, mink, prairie spotted skunk, Illinois skunk, and red fox. A total of 58 fox stomachs were examined and only one contained any evidence of quail. A total income of \$146.45 was

received during the season of 1936-1937 for fur bearers' pelts taken on 11 farms of 1,996 acres which was an average of 7.33 cents an acre. The three most frequently taken fur-bearers on these farms were the Illinois skunk, one to 24.65 acres, the opossum one to 66.53 acres, and the prairie spotted skunk one to 90.72 acres.

Cottontail rabbit population in 1939 was estimated to be 800-1000 on a section which represented a grazing pressure of 82.62-103.25 animal units on 7,713 acres.

Norway rats were so numerous in 1939 that they destroyed from one to three acres of corn for many farmers.

An average of one domestic oat for each 41.2 acres was on the area in 1938.

The average percentage of owner operated land in the north area for four years was 54.63 per cent, of tenant operated land 41.02; owner operated land in the south area was 27.04 per cent and tenant operated land was 70.69. The average percentage of unrented land for the same years was 4.35 per cent in the north area and 2.28 in the south area. Social and economic conditions of the people were important factors in bob-white management.

During the period of the investigation three winters and one summer of adverse weather conditions for bob-white survival and production were experienced. In contrast to these unfavorable seasons two consecutive summers and two winters of exceptionally favorable conditions for the bob-white occurred. These severe winters caused calculated losses of 87.8, 74.6, and 55.2 per cent of the quail.

The lowest calculated population density for the area was one bird

to 85.7 acres and the highest was one bird to 3.33 which was built up during three consecutive rearing seasons. The highest calculated percentage rate of recovery was 456.7 per cent which occurred during the season when the breeding population was the lowest and the lowest percentage rate of recovery was 84.5 per cent when the breeding population was the highest.

Hunting of quail was permitted in the season of 1936 and closed until the season of 1939. The farmers allowed very little hunting in 1936 and 211 birds were reported taken by hunters in 1939. As far as is known no hunter on either area was charged for the privilege of hunting.

The farmer-sportsmen relationships did not progress to the stage of successful pay hunting which the writer believes will ultimately prove to be the satisfactory solution of hunting privileges on privately owned lands.

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